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Theme 1: Pathogens Detection, Diversity and its Characterization

T1OP1: Pathogens Detection, Diversity and its Characterization Variability among the Isolates of *Pythium aphanidermatum*

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Damping-off is the most serious disease of tobacco in nursery conditions caused by *Pythium aphanidermatum.* A total fifteen isolates of *P. aphanidermatum* were recovered from infested soil samples of *bidi* tobacco growing areas of middle Gujarat which are designated as Pa1 to Pa15. The isolates show incredible variability in cultural and morphological characters on oat meal agar media. The isolates show white to light white types of colony appearance whereas, the aerial, moderately aerial, flat, fluffy, fluffy and dense and fluffy aerial types of topography and margin were observed in the fifteen different isolates. Evident differences in size of mycelium, oospore and number of oospores were observed among the isolates even when the same medium was used for the growth. The pathogenic variability among the different isolates revealed that maximum mortality due to damped-off was recorded in Pa4 (98%), followed by Pa14, Pa8, Pa3, Pa7, Pa11, Pa12, Pa2, Pa13, Pa9, Pa15, Pa10, Pa1, Pa6 and Pa5isolates. All the seedlings were healthy in uninoculated, which proved that all the fifteen isolates were pathogenic and isolate Pa4 and Pa14 were found highly virulent.

T1OP2: Detection, Diversity and Characterization of *Curvularia lunata* Causing Curvularia Leaf Spot Disease of Maize in Gujarat

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Curvularia lunata (Wakker) Boedijn is one of the leading restrictions in challenging the cultivation of *Zea mays* Linn. (maize) which caused leaf spot or Curvularia leaf spot disease. In India, several species of Curvularia like as *Curvularia indica, Curvularia clavata, Curvularia lunata* and *Curvularia andropogonis* have been reported to cause Leaf spot disease of maize. This disease is frequent, wide-ranging, severely damaging and economically vital showing severity extended from 20.50 to 63.60 per cent. So, the present investigation was carried out to study the behavior of the pathogen (*Curvularia lunata*)/disease (Curvularia leaf spot), cultural, morphological and molecular characterization among the isolates of the pathogen. A total of fifteen isolates were isolated from diseased samples collected from different maize growing areas of Gujarat and screened against different culture media for diversity and characterization. The result exhibited tremendous variability in cultural and morphological characteristics of various isolates of the *C. lunata*. The molecular identification of fungal isolate [Anand (Mp13)] was performed via PCR amplification and sequencing the ITS region of fungal DNA (rDNA) with universal primer ITS1 and ITS4. A high level of genetic variability among the fifteen isolates of *C. lunata* collected from different regions of Gujarat was observed while screening different RAPD primers. The highest polymorphism (100%) was recorded by the primer OPA-3, OPA- 18 and OPB-5. The lowest polymorphism was observed in the primer OPB-9 and OPE-3.

T1OP3: Occurrence and Diagnosis of Foliar Diseases in Cotton Growing Regions of Bharuch

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Cotton is one of the most important commercial crops and it is one of the backbone of national economy of our country. In India, thirty diseases have been reported for cotton crop. Cotton suffers from several diseases *viz.*, soil-borne and foliar diseases. Several researchers explore the foliar pathogens causing considerable losses in cotton across the country. Hence the present study has been carried out to know the status of foliar diseases under cotton growing regions of Bharuch district. During the survey it has been observed through visual examination and symptomatology, cotton crop is affected by foliar diseases like Alternaria leaf spot caused by *Alternaria* spp., Curvularia leaf spot caused by *Curvularia* sp. and Angular leaf spot disease caused by *Xanthomonas* sp. Among them, severity of Alternaria leaf spot and Curvularia leaf spot were found in notable proportion. It has been also observed that the intensity of diseases also varies in relation to Desi cotton and Bt cotton. Therefore, the present investigation needs more attention to explore the disease diagnosis and their management.

T1OP4: Biochemical Characterization of Different Isolates of *Xanthomonas campestris* pv. *campestris* causing Black Rot of Cabbage

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Bacteria have a complex biochemical structure which play significant role in determining its aggressiveness and identifying such characteristics helps in defining which cell nutrients it uses, its metabolism products in response to specific chemicals and presence of enzymes which further allows decision-making for antibiotics selection in managing bacterial infection in plants. In present study, total of seven different biochemical tests were performed with 15 different *Xanthomonas campestris* pv. *campestris* isolates *i.e.*, Gram's staining, tween-80 hydrolysis, Kovac's oxidase, gelatin hydrolysis, starch hydrolysis, catalase test and KOH solubility test and their reaction were recorded. All the isolates showed positive results in tween-80 hydrolysis, gelatin hydrolysis, starch hydrolysis, catalase activity and KOH solubility while negative for Gram's staining and Kovac's oxidation, confirming their Gram -ve nature.

T1OP5: Symptomatology, Characterization and Management of Twig Blight of Chilli caused by *Choanephora cucurbitarum*

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Choanephora cucurbitarum is a facultative saprobe that belonging to the sub division: Zygomycotina, class: Zygomycetes, order: Mucorales, and family: *Choanephoraceae* and is responsible for causing twig blight in chilli. Initially, the symptoms were observed in the field during mid to late monsoon season *i.e.,* August and September months. Initially, symptoms appeared as a black necrotic lesion or streak on the twig. The disease started at the distal end of the infected leaves. The appearance of a stiff silvery mass of whisker-like or hairy strands of the fungus growing out of the affected chilli plant tissue, topped with a black ball made of great numbers of spores which appeared as minute black headed pin-like structures around the stem, giving 'lamb's tail' like appearance. The pathogen produced creamishwhite colored culture. The mycelium was hyaline, unbranched, and without any septations. Based on cultural and morphological characters, the pathogen was identified as the *Choanephora cucurbitarum* (Berk & Ravenel) Thaxt. which was further confirmed by ITS sequencing. The ITS - rDNA region of the isolate was amplified using the primers ITS 1 and ITS 4 and gave an amplicon of approximately 600 bp. On sequencing 594 bp long sequence was obtained. The obtained sequence was analyzed by Blastn of the NCBI. The isolated and sequenced fungi aligned in a clad having other *C. cucurbitarum*. Therefore, it was considered as an isolate of *C. cucurbitarum* and named *Choanephora cucurbitarum* NAU LN-1. Three different systemic fungicides *viz*., Azoxystrobin 23% SC, Carbendazim 50% WP, and Hexaconazole 5% EC were screened at two concentrations *viz.,* 250 and 500ppm. They significantly reduced the mycelial growth of *C. cucurbitarum*. However, none of the test fungicides showed 100% inhibition at both the tested concentrations. Among all, hexaconazole found most effective for *C. cucurbitarum*. The non-systemic fungicides copper oxychloride at 250 ppm and 500 ppm and mancozeb at 500 ppm concentration recorded cent per cent growth inhibition of *C. cucurbitarum*. Among the combi products, the efficacy of a carbendazim 12% + mancozeb 63% WP was the best with cent per cent growth inhibition of *C. cucurbitarum.*

T1OP6: Morphological and Biochemical Characterization of *Dickeya zeae* causing Bacterial Stalk Rot of Maize and Standardization of their Inoculum Concentration by Growth Curve

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A great yield loss occurs in corn due to interrupted nutrient flow from root to leaves as a result of tissue disintegration caused by Bacterial stalk rot of maize earlier known as *Erwinia chrysanthemi* pv *zeae* which is further classified based on rRNA sequence under soft rot causing bacterium *Dickeyazeae*. Losses vary from region to region. On the basis of climatic conditions, it causes 21 to 98 per cent grain yield losses in maize. As economic losses are very high effective management strategies needs to be identified based on the nature of pathogen and its morphological, biochemical characterization and molecular characterization. *In vitro* evaluation of isolated bacteria for colony characters on different culture media and several biochemical tests including KOH string, catalase and gelatinase liquification were carried out for characterization of pathogen. Molecular identification of the isolates by 16s ribosomal RNA (rRNA) sequencing for further confirmation of it as a stalk rot bacterium. Development of growth curve for standardization of inoculum concentration which creates higher disease under field conditions for germplasm screening. Adequate amount of inoculum ensures the maximum contact between host and pathogen or delivery of the pathogen inoculum at particular targeted place *viz*. pith tissue of stem, internal spaces of leaf, sheath region of plant, internodal region and root tissue *etc*. Hence biochemical, pathological and molecular characteristics can be the basis for pathogen identification and for resistance breeding through germplasm screening.

T1OP7: Detection, Characterization and Confirmation of Seed-borne Nature of *Macrophomina phaseolina* from Sesame Seeds: First Report in Gujarat

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Sesame (*Sesamum indicum* L.) known as the 'Queen of the Oilseeds' is primarily grown for its seeds and edible oil, which are rich in antioxidants, proteins, vitamins and minerals, making them highly valuable for human consumption. Sesame cultivation faces challenges due to various biotic agents, with diseases caused by *Macrophomina phaseolina* being a major threat. *Macrophomina phaseolina*, a soil-borne fungus, causes root rot, wilt, and other complex diseases, leading to severe

yield losses. It can survive in seed, soil and crop residues for extended periods, making it difficult to control. The devastating seed-borne nature of *M. phaseolina* is still unexplored particularly in Gujarat, so the present study was conducted to prove and examine seed-borne nature and characterization of the fungus in sesame seeds. Visual examinations under a stereo binocular microscope revealed the presence of microsclerotia on infected sesame seeds. The pathogen was isolated and primarily identified as *M. phaseolina* based on cultural and morphological characteristics. Molecular identification using PCR amplification and sequencing of the Internal Transcribe Spacer (ITS) region of fungal DNA (rDNA) with universal primers ITS1 and ITS4 of fungal DNA confirmed the presence of *M. phaseolina* (Gene Bank Accession No. OR144351) and produced an amplicon of 550 bp. NCBI database via BLAST search revealed significant similarities of 93.35 to 95.37 per cent with other *M. phaseolina* sequence worldwide. The histopathological studies revealed the location of microsclerotia in the seed coat as well as cotyledons. Sesame seeds carrying microsclerotia on their surface were proven to transmit the pathogen, *M. phaseolina* from seed to seedlings, plants and seeds also. Based on these detection, transmission and characterization study, first time in Gujarat, the seed-borne nature of *M. phaseolina* from sesame seeds has been proved.

T1OP8: Morphological, Cultural and Biochemical Characterization of *Xanthomonas axonopodis* pv. *citri*

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The productivity of acid lime is still below the potential. Diseases are the major constraints for citrus production, which impedes fruit yield and quality. Citrus suffers from a number of diseases caused by fungi, bacteria, viruses and viroids. Citrus canker is an important disease affecting citrus species. In India citrus canker was first reported from Punjab (Luthra and Sattar, 1942; Bedi, 1961). The causal agent of citrus canker was earlier identified as bacterium *Pseudomonas citri* by Hasse (1915) but later Dye *et al*. (1978) proposed the name *Xanthomonas campestris* pv. *citri* which was again reclassified as *Xanthomonas axonopodis* pv. *citri* (Hasse) by Vauterin *et al*. (1995). The bacterium (*Xanthomonas axonopodis* pv. *citri)* is rod-shaped, Gram negative with single polar flagellum. It is obligately aerobic, non-spore former, and produces yellow colonies on nutrient agar medium and it can withstand the higher temperature of 35 to 39ºC (Whiteside *et al*., 1998). The morphological and cultural characteristics of isolated bacterium were studied on nutrient agar medium for identification and characterization. The bacterial pathogen was found Gram negative, rod shaped, showed positive reaction to catalase test, starch hydrolysis, KOH test, sulphide indole motility, casein hydrolysis, indole production, H2S production and negative for urease test. The *Xanthomonas axonopodis* pv. *citri* was isolated and it showed a typical yellow coloured, raised, and mucoid colony on nutrient agar medium. The seven days old colony showed angulated or zig-zag margins.

T1OP9: Pokkah Boeng Disease of Sugarcane: Detection and Characterization of Pathogenic Agent

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Pokkah boeng disease is an airborne fungal disease caused by *Fusarium fujikuroi* species complex. It is majorly reported from *Gramineae* family like sugarcane, sorghum, and maize. Globally, Sugarcane (*Saccharum officinale* L.) is one of the most important cash crops and India is the second largest producer of sugarcane after Brazil. The crop suffers from various biotic and abiotic factors leading to severe economic losses. Among the diseases, Pokkah boeng is emerging as a major disease associated with *Fusarium* species complex. To detect and characterize the pathogen, a roving survey was conducted during *Kharif* 2020 in seven major sugarcane growing mandals of Visakhapatnam district of Andhra Pradesh (India) *viz*., Anakapalle, Chodavaram, Kasimkota, Butchayapeta, Chidikada, Munagapaka and Makavarapalem. Peculiar symptoms of the disease noticed were initial chlorotic or whitish areas at the base of the foliage followed by pronounced twisting, yellowing, bending of spindle leaves, shot holes, malformed top and knife cut symptoms. A total of twenty Fusarium isolates were recovered from the diseased samples using standard tissue isolation method on potato dextrose agar. Carnation leaf agar was used for morphological characterization. The microconidia were 0-1 septate, ovoid to fusiform shape with 2.49-3.03 × 0.62-0.99µm to 12.9-15.9 × 1.09-2.96µm dimensions. Macroconidia were 3-4 septate with straight to falcate and fusiform shape having size ranging from 6.14-8.25 × 2.49-3.03µm to 45.16-49.12 × 1.12-1.85µm. Cultural characterization on PDA revealed variation in among the Fusarium isolates with respect to colony colour (white, greyish violet, pale violet, pinkish white to pale violet, brownish to dark purple and pale brown to brick red), growth rate (56-90 mm), growth pattern (aerial to submerged) and colony texture (floccose, fibrous, dusty fibrous, downy, fluffy). Molecular characterization of DNA (extracted using standard CTAB method) amplified using ITS 1 and ITS 4 primers sequenced and subjected to BLAST and phylogenetic analyses revealed prevalence of *Fusarium sacchari* and *Fusarium andiyazi* in the surveyed district of Andhra Pradesh. Confirmation of *Fusarium andiyazi* associated with sugarcane Pokkah boeng in Andhra Pradesh, India was further confirmed with TEF- á and beta tubulin primers. A present investigation for the first time revealed *Fusarium andiyazi* as cause of sugarcane Pokkah boeng in India besides *Fusarium sacchari*.

T1OP10: Status on Occurrence and Pathogenic Variability of *Fusarium oxysporum* f.sp. *radicis-cucumerinum* causing Root and Stem rot of Cucumber in Southern Rajasthan

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Cucumber cultivation is vulnerable to attack of several diseases that interrupt the normal physiological process of this crop. Root and stem rot caused by *Fusarium oxysporum* f.sp. *radicis-cucumerinum*, is one of them which hamper successful cultivation and causes significant yield losses globally including India. An intensive roving survey was carried out to know disease occurrence and distribution of root and stem rot of cucumber was conducted in cucumber growing 10 villages of each five districts of Southern Rajasthan *viz*., Udaipur, Rajsamand, Chittorgarh, Banswara, and Dungarpur. The disease incidence was ranged from 17.00 to 27.60 per cent during 2022 and 21.40 to 33.00 per cent during 2023. During *Kharif* season 2022, maximum disease incidence (25.04%) was recorded from Udaipur district followed by 22.16, 20.32 and 19.52 per cent disease incidence from Chittorgarh, Banswara and Dungarpur districts, respectively. However, minimum disease incidence (18.86%) was from Rajsamand district. During *Kharif* season 2023, maximum disease incidence (30.44%) was recorded from Udaipur district followed by 27.56, 26.12 and 22.92 per cent disease incidence from Chittorgarh, Banswara and Dungarpur districts, respectively. However, the minimum disease incidence (24.26%) was from Rajsamand district. Pooled data revealed the highest disease incidence in Udaipur (27.74%) and the lowest in Dungarpur (21.22%) district. The pathogenic variability of ten isolates of *Fusarium oxysporum* f. sp. *radiciscucumerinum* of different five districts of Rajasthan was tested on cucumber susceptible variety S-82 through soil inoculation method in pot conditions. After 35-45 days of sowing disease incidence was recorded. According to the results maximum mortality was showed by isolate FORC-U1 (93.33%) followed by isolate FORC-C2 (86.67%). Isolate FORC-D1 showed per cent mortality of 80.00%.

T1OP11: First Report of *Fusarium falciforme* causing Wilt of Chilli

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Chilli is infected by various diseases caused by fungi, bacteria, nematodes and virus, among them, fusarium wilt caused by *Fusarium falciforme* is the major one. The present study was undertaken at Navsari Agricultural University, Navsari, Gujarat at department of plant pathology. Chilli plants showing typical wilt symptoms were collected from Valsad region of Gujarat and brought to laboratory for further studies. Isolation of pathogen was done on PDA medium. Microscopic studies revealed that mycelium was hyaline, septate and highly branched. *Fusarium falciforme* produced pure white aerial mycelium and a fluffy whitish to pink cottony growth on PDA media. The macroconidia were having 3-4 septa and ranged in size from 33.70 to 38.60 µm X 4.50 to 5.20 µm in length and width, respectively. The length of microconidia ranges from 10.17 to 17.26 µm, and the width ranges from 4.67 to 5.47 µm with 0-1 septa. The chlamydospores measured 9 to 11 µm along the periphery were round, globose to oval-shaped, intercalary to terminally hyaline and single or in chains formed on hyphae. The molecular identification using ITS primers confirmed that the pathogen associated with wilt of chilli is *F. falciforme* having gene bank accession number OR177843. The spectrophotometric analysis of DNA showed an average concentration of DNA was 448.30 ng/µl with an O.D. value 1.80 nm. The pathogenicity of the pathogen was successfully proved.

T1PP1: Effect of Different Solid and Liquid Media on *Colletotricum lindemuthianum in vitro* Condition

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The black gram [*Vigna mungo* (L.) Hepper], commonly known as urdbean, is an annual, semi-erect spreading herb belonging to the family *Leguminosae*. Numerous biotic and abiotic stresses contribute to significant yield reduction in black gram, with several diseases caused by fungi, bacteria, and viruses impacting production. Prominent diseases include anthracnose, powdery mildew, Cercospora leaf spot, root rot, stem canker, bacterial leaf blight, yellow mosaic, and leaf crinkle, collectively causing substantial yield losses. Anthracnose disease is particularly prevalent in black gram cultivation areas, manifesting foliar symptoms that develop under cool and humid conditions. Plant samples displaying typical anthracnose symptoms were collected from the Pulses Research Station. The mycelial growth observed on and around the infected plants was transferred to slant, and pure cultures were maintained on Potato Dextrose Agar (PDA) slants and sterilized sorghum grains for further investigation. *In vitro* experiments assessing the impact of different solid and liquid media revealed that Potato Dextrose Agar was the most effective, followed by Richard's Agar, for promoting growth and sporulation. Among the liquid media tested, Richard's Broth exhibited the maximum dry mycelial weight and excellent sporulation, followed by Czapeck's Broth. These findings underscore the importance of media selection in studying and managing anthracnose in black gram, providing valuable insights into optimal conditions for fungal growth and sporulation. Addressing these diseases is crucial for sustaining and improving black gram yields, contributing to food and agriculture sustainability.

T1PP2: Physiological Studies on *Colletotrichum capsici* [(Syd.) Butler and Bisby] A Causal Agent of Anthracnose (Leaf Spot) of Betelvine

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Betelvine (*Piper betle* L.) is a perennial rooted climber which belongs to the family *Piperaceae* and mostly planted in tropical and subtropical areas for its leaves. The productivity of betelvine is affected by different fungal and bacterial diseases, among them anthracnose is one of the important fungal diseases caused by *Colletotrichum capsici* [(Syd.) Butler and Bisby]. The present research work was conducted at the Department of Plant Pathology, JNKVV, Jabalpur, M. P. during 2022-2023. The physiological studies were taken up to know the best physiological conditions required for the growth and sporulation of the fungus. In physiological studies, among the different temperatures and media tested for optimum growth and sporulation of the fungus, 25°C temperature (75.33 mm for growth) and oat meal agar media was found superior (79.66 mm for growth) and excellent sporulation. Similarly, among different pH ranges, pH 7.5 was found best for growth (74.33 mm) and pH 7.0 and 6.5 for excellent sporulation. Likewise, among different relative humidity studied, 100 per cent was found best for growth (88.33 mm) and 95 and 100 per cent both for excellent sporulation.

T1PP3: Status of Root Rot of Okra [*Abelmoschus esculentus* (L.)] Incited by *Rhizoctonia solani* in Zone-lll A of Rajasthan

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Okra or lady's finger [*Abelmoschus esculentus* (L.) Moench] which is known as “Bhindi” in Hindi, is one of the most important summer vegetables of Rajasthan as well as India and belongs to the family *Malvaceae*. Earlier, its botanical name was *Hibiscus esculentus* (L.) under the section *Abelmoschus* of *Hibischus*, established by Linnaeus (1737). This crop suffers severely from the vagary of diseases caused by fungi and an important one is root rot incited by *Rhizoctonia solani*, which not only reduces the potency of seed; but also degrades the health-beneficial and nutritional quality components of the crop. To know the status of disease incidence, a roving survey was conducted during Zaid 2022 in major okra growing districts (*viz*., Jaipur, Ajmer, Dausa and Tonk) covering Zone III-A of Rajasthan. A total of 48 fields of okra crop were surveyed covering 16 villages in 8 tehsils. Every surveyed field revealed the presence of root rot and it was ranged from 17.00 to 40.74 per cent with an overall mean of 26.71 per cent. The highest mean disease incidence was observed in Jaipur district (31.64%) followed by Tonk (26.69%), Ajmer (24.81%) and lowest was in Dausa district (23.73%). Conclusively, this disease is gaining importance in okra growing areas and may be alarming situation in coming years. Therefore, growers and researchers may take care of, so that it can be managed in time.

T1PP4: Diversity of Rhizospheric Mycobiome Associated with *Dipsacus inermis* Wall. Growing in Kashmir Himalayas

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The microbiome in the rhizosphere of a plant plays a crucial role in the survival and growth of plants by offering tolerance and resistance to abiotic stress and greatly boosting the synthesis of bioactive compounds. *Dipsacus inermis* Wall., growing in Kashmir Himalayas, is very valuable medicinally since it contains several bioactive chemicals. The relationship between fungi and medicinal plants that occur in this region of Himalayas has not received much focus. So the current study was undertaken to characterize the diversity of rhizospheric fungi associated with *Dipsacus inermis*. We identified twelve fungal species from the rhizospheric soil samples collected from various locations in the Kashmir Valley. The most frequently isolated fungi were *Aspergillus niger* with an isolation frequency (IF) of 39.92%, followed by *Trichoderma harzianum* (IF, 17.71%), *Alternaria alternate* (IF, 10.02%), and *Pencillum expansum* (IF, 3.45%).

T1PP5: Study of Collar Rot (*Sclerotium rolfsii* Sacc.) Disease of Indian Bean (*Dolichos lablab* L.)

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Indian bean (*Dolichos lablab* L.) is an important and most ancient cultivated member of *Fabaceae* family which is commonly grown in tropical regions in Asia, Africa and America. It is also known as lablab bean, sem bean and wal-papdi. Indian bean is affected by several biotic and abiotic stresses. Collar rot of Indian bean caused by *Sclerotium rolfsii* Sacc. is a major threat for Indian bean growers of Gujarat, particularly in the areas where humidity is very high. The majority of Indian bean growers using their own seed of local variety for growing next-generation crops along with traditional practices and flood irrigations which might be vulnerable to the collar rot. A survey was carried out during November, 2022 to April, 2023 of the selected farmers of Vadali and Idar Taluka of Sabarkantha District of Gujarat. The initiation of the collar rot was first started 20-25 DAS. For control of this farmers are extensively use the fungicides. Incidence of disease accelerated with increase in humidity. The correlation coefficient between weather parameters and disease incidence indicated that all the parameters jointly played an important role in the development of such disease. Predictable model shows high R2 value indicating a strong association between percent disease incidences to weather parameters.

T1PP6: Eriophytid Mite Interaction on Leaves of *Pongamia pinnata* - A Histological Study

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Galls are irregular growth of cells formed as a result of stimulation from Insects Eriophytid mite *Aceriapon gamiae* on leaves of *Pongamia pinnata*. In the present study, different stages of leaf galls were cut and their internal study was carried out. Pouched galls were found both on adaxial and abaxial surfaces of the leaves which represented neoplastic growth. In this study, different days old leaf galls were cut and undifferentiated mesophyll tissue was seen which was absent in the results of anatomical study of non-galled leaves.

T1PP7: Assessment of Macrofungal Diversity in the District Anantnag of Jammu and Kashmir

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Macrofungi are eukaryotic, achlorophyllous, macroscopic spore-bearing organisms belonging to the kingdom of fungi that digest food externally and absorb nutrients directly through their cell membrane. They have huge economic importance in terms of their various biological, nutritional, and medicinal roles. They form ectomycorrhizal associations with the roots of higher plants; fungal mycelium also improves soil particle adhesion thereby stabilizing the soil; and they are the main agents of degradation processes in terrestrial ecosystems. Information and studies regarding mushroom diversity in the Kashmir Himalayas are still scanty and have remained neglected. In this backdrop, a survey was conducted across different study sites in Anantnag district. During the study, 16 species of wild macrofungi, *viz*., *Macrolepiota procera, Xerocomus rubellus, Coprinus atramentaria, Flammulina velutipes, Fomes fomentarius, Rusulla turci*, *Lentinus tigrinus, Pleurotus ostreatus, Schizophyllum commune, Scleroderma citrinum, Agrocybe praecox, Laetiporus sulphureus, Tricholoma sulphureum, Coprinus plicatus, Coprinellus micaceus,* and *C. disseminates* were identified on the basis of macro- and micro-morphological characteristics. Among the identified species, *Coprinellus* spp. was the dominant in the study area.

T1PP8: Survivability Study of *Exserohilum turcicum* Causing Turcicum Leaf Blight in Maize at Different Storage Conditions

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Turcicum Leaf Blight (TLB) caused by *Exserohilum turcicum* is a major foliar disease of maize that affects nearly every production region. In humid areas with mild temperatures, the disease is more common. It causes severe leaf damage and defoliation throughout the grain-filling cycle, as well as yield losses. It is a polycyclic disease in which secondary inoculations are needed for disease progression. Thus, this study aimed to study the effect of different storage conditions *viz*., Open, Lab and Refrigerated at different intervals *viz*., December (2020) to July (2021). The infected maize leaves were brought to the laboratory and kept at three different storage conditions. Periodical isolations at monthly interval till the pathogen lost its viability taken on selective media. The pathogen survived for a period of 8 months under all the three conditions. Mycelial growth in culture isolated from infected plant debris stored at different conditions revealed that thick growth was observed for five months (December to April), whereas, thin mycelial growth was recorded during May to July. High sporulation was observed in cultures isolated from laboratory and open field conditions. Sporulation varied from low to high in cultures obtained from infected plant debris stored under refrigerated condition. Variation in spore germination was observed with respect to storage time. Higher spore viability as indicated from germination per cent (88.1%) was recorded in cultures isolated from open field conditions during June. It indicated the possibility of secondary inoculum infecting the successive maize crop; Therefore, needs to be investigated or standardized to manage the disease to avoid the economic loss to growers.

T1PP9: Characterization of Elite Soybean Genotypes against *Rhizoctonia* Aerial Blight

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Soybean (*Glycine max* (L.) Merrill) is commonly referred to as the "Golden bean". Recent years due to climate changes in India, soybean production is facing several biotic challenges among them *Rhizoctonia* root rot or *Rhizoctonia* aerial blight (RAB) stands out as a prevalent and widespread soil-borne disease affecting soybean production. Growing of resistance/tolerant cultivar is best management practice for RAB disease. A total of 107 soybean genotypes were evaluated under the prevailing epiphytotic field conditions, aiming to identify genotypes with resistance or tolerance to RAB. The genotype VPSM 1096A exhibited the lowest area under disease progress curve value at 79.02, indicating a notable resistance to the disease. When compared, this genotype did not revealed a significant difference in disease expression when compared to genotypes IC 415047, VPSM 117, and UPSL 63. However, it displayed a significantly lower susceptibility to the disease when compared to the remaining genotypes. The genotypes VPSM 1096A IC 415047, VPSM 117, and UPSL 63 showed excellent agronomical characters also such as yield/plant, pod weight, test weight, number of pods per plant, pod insertion height, stem girth and plant height. Multi-trait

genotype-ideotype distance index (MGIDI) revealed that these genotypes VPSM 1096A IC 415047, VPSM 117, and UPSL 63 are highly useful for sources of breeding. Apart from this, these genotypes of soybean were screened against three more diseases in 0-9 scale such as anthracnose, bacterial pustules, yellow mosaic virus. Among the evaluated genotypes, specifically EC 390981 A, EC 39376, UPSL 390, IC 415047, IC 073710, TGX 722-110E, VPSM 117, EC 457052, and EC 100778 demonstrated a resistance reaction against soybean anthracnose. Furthermore, these genotypes also exhibited highly resistant reaction against bacterial pustules and yellow mosaic virus disease of soybean. This suggests that these genotypes possess a robust and comprehensive resistance profile against multiple diseases, making them potentially valuable for cultivation in areas where these diseases are prevalent or act as a resistance donor for multiple diseases of soybean.

T1PP10: Symptomatology and Transmission of *Zucchini yellow mosaic virus* Infecting Muskmelon

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Cucurbits belong to the family *Cucurbitaceae* and form an important and a large group of vegetables. They are grown mainly in summer and rainy seasons in India and even in winter in some parts of southern and western India as both annual and perennial crops. It includes cucumbers, pumpkins, summer/winter squash, watermelons, muskmelons, Gourds. Among them, muskmelon is one of the major consumed cucurbits fresh as a desert. Muskmelon (*Cucumis melo* L.), known for truck as well as home garden vegetable crop and suitable for well drained loamy soil and requires optimum temperature for germination about 23-25°C. Sowing is done in late February. It is infected by downy mildew, anthracnose, viruses *etc.* but among them viral disease like *Zucchini Mosaic Virus* (ZYMV) causes enormous losses in term of quality point of view. The main of symptoms are leaf become severely distorted. mosaic, yellowing as well as "shoestring" symptoms also observed. The fruits are reduced in size, develop dark green blisters, serrated edges and other deformations as well as poorly formed surface netting. Host for this virus are Zucchini and other cucurbits, including melon, pumpkin, watermelon and the species of *Luffa* and *Momordica*. It is transmitted through seed, mechanically and is vectored by aphids. This disease can be managed by sowing resistant varieties, collection and destruction of virus affected leaves, use plastic mulches (transparent or silver) as they have been shown to repel aphids and delay virus spread.

T1PP11: Diversity of Fungi Causing Fruit Rot of Cucurbits (Pumpkin, Cucumber and Watermelon) in Kashmir Valley

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A preliminary investigation on the diversity of fungi causing fruit rot in cucurbits (pumpkin, cucumber and watermelon) was conducted in 2021-2022, at different locations in Kashmir Valley. The results revealed that eight different species of fungi were causing fruit rot in cucurbits (pumpkin, cucumber and watermelon) in Kashmir Valley. These fungi include *Alternaria alternate*, *Fusarium solani*, *Aspergillus niger*, *A. flavus*, *Curvularia lunata*, *Penicillium* sp., *Fusarium* sp., and *Rhizopus* sp. The most frequent isolated pathogenic fungi was *Fusarium* spp. which accounted for 80–90% of all rots.

T1PP12: Evaluation of Chickpea Germplasm for Yield and Yield Attributing Characters

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Chickpea (*Cicer arietinum* L.) is an important legume crop which accounts for a substantial proportion of human dietary nitrogen intake and plays a crucial role in food security. Chickpea crop is affected by various plant diseases, among them; dry root rot caused by a fungal pathogen *Rhizoctonia bataticola* is an economical disease particularly in Rajasthan. The disease generally appears around ? owering and podding. Drooping of petioles and lea? ets, lower portion of the tap root usually remains in the soil when plants are up-rooted; taproot is dark and is devoid of most of its lateral and ? ner roots. The aim of study was to evaluate 1488 germplasm of chickpea against dry root rot along with yield performing traits grown in arid and semi-arid region of Rajasthan during 2021-22 in artificial created sick field. The significant results were recorded for root length (8.80 cm to 21.66 cm), shoot length (25.00 cm to 64.80 cm), number of branches (7.20 to 23.20), number of pods (13.60 to 127.00), seed index (3.50 g to 35.40 g) and yield (133.30 of ICC-9368 to 2532.70kg/ha of ICC-11689 & ICC-14383) attributing characters whereas under disease reaction categories, 941 germplasm were categorized as resistant to moderately resistant (PDI=10.1-20%) while remaining were susceptible to highly susceptible to the pathogen.

T1PP13: Distribution and Prevalence of Bacterial Blight of Rice in Major Rice Growing Areas of Karnataka

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Rice (*Oryza sativa* L.) is the staple food for about one-half of the world's population. It occupied one-third of the total cultivated area and is the major food crop of Indian population. The crop is known to attack by various diseases like blast, sheath blight false smut, tungro and bacterial blight. Among all these diseases, bacterial blight caused by *Xanthomonas oryzae* pv. *oryzae*is the most common in occurrence globally from Asia to Africa and Americas with varying degrees of disease

intensities. The disease is known to cause severe yield losses up to 80% depending on the level of resistance of a cultivar, stage of the crop and environmental conditions. Further increased nitrogenous fertilizers tend to increase the disease. A random roving survey was conducted in major rice growing areas of Karnataka covering different ecosystems *viz.,* Irrigated ecosystems of TBP and UKP command area, Hilly upland, Irrigated Bhadra and Irrigated Kaveri during *kharif* 2022 to know the distribution and severity of the disease. In each ecosystem different talukas were selected and in each taluka, two villages were selected and in each village two fields were selected to record the severity of the disease. Maximum per cent disease index of 33.93 was observed in Sirwar taluka of Raichur followed by T. Narsipura taluka (18.00 %) of Mandya and Devadurga taluka (11.32 %) of Raichur. The least disease severity of 1.00 % was observed in Channagiri taluka of Davanagere. Practice of monoculture, high nitrogenous fertilizer application and cultivation of susceptible varieties like Sona Mahsurrie were found to be the primary reasons for the high disease incidence. The stage of the crop as well as the environmental factors also played very important role in the disease development.

T1PP14: Morpho-molecular Characterization of Pathogens Associated with Seedling Diseases of Chilli

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Chilli is an important commercial and universal spice crop affected by many pathogens causing pre-emergence and post-emergence damping off, dieback and wilt to an extent of 62 per cent in seedling stage**.** Pathogens associated with seedling diseases were characterized and identified as *Fusarium, Macrophomina, Phomopsis* causing damping- off and white rot fungi *viz., Schizophyllum and Phanerochete* causing rotting and post-emergence damping off in chilli, while *Alternaria* produced black lesions on stem and *Phoma* was associated with dieback. Further pathogenicity was confirmed by proving the Koch's postulates. Cultural and morphological characterisation revealed that all pathogens were septate and *Fusarium, Phanerochete*, *Phomopsis* and *Schizophyllum* showed white coloured colony growth with zonations in the isolates BS-1 and BS-2, whereas *Macrophomina, Phoma, Alternaria* showed charcoal black, olive green and grey coloured colony growth respectively with zonations in the isolates RP-1, RP-2 and sectoring in BA-1 isolate. Compound microscopy examination revealed that all pathogens were septate and spore size of *Alternaria* ranged from 20.47×4.14 µm to 36.33 × 3.85 µm and *Fusarium* from 8.70×3.66 µm to 13.17 ×1.52 µm (macroconidia), 3.27 ×2.43 µm to 6.92 ×1.79 µm (microconidia). Sclerotial size of *Macrophomina* and pycnidial size of *Phoma* varied from 70.05 x 56.88 µm to 86.61 x 74.42 µm and 54.78 ×37.61 µm to 69.51× 44.56 µm respectively**.** Molecular identification of all isolated pathogens were confirmed through ITS, universal and TEF1-á, species-specific primers. Further NCBI-BLAST analysis showed 91-99 per cent identity with *Alternaria alternata*, *Fusarium oxysporum*, *Macrophomina phaseolina, Phanerochaete* sp., *Phoma* sp., *Phomopsis* sp. and *Schizophyllum commune*.

T1PP15: Identification of *Pseudomonas fluorescens* Isolates Using Different Biochemical Tests

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Potential of antagonistic rhizobacteria *Pseudomonas fluorescens* is a common Gram-negative, rod-shaped bacterium which is used for the biological management of different diseases. *P. fluorescens* not only enhances the plant growth but also controls the fungal pathogens by production of anti-fungal metabolites. The objective of this experiment was to identify different isolates as P. fluorescens using different biochemical tests. A total thirty (30) *P. fluorescens* isolates were collected from different rhizospheric soils of different villages of Navsari district by serial dilution method and their characterization was done. The isolates produced fluorescents yellow green or bluish green diffusible pigment of variable intensities on King's B medium under UV light. The result of this experiment indicated that most of the isolates gave positive result for catalase test, methyl red, citrate utilization, casein hydrolysis, IAA production, nitrate reduction and negative for H2S production, acid and gas production, starch hydrolysis, Voges-Proskauer test. All the isolates were produced siderophore. As per the results obtained by these characterizations the isolates were confirmed as *P. fluorescens*.

T1PP16: Blast of Pearl Millet in India. Present Status and Future Prospects

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Numerous biotic and abiotic stressors negatively impact pearl millet's growth and yield. One of them is blast, which significantly reduces India's pearl millet yield. In India, blast, often referred to as leaf spot, is a devastating disease that affects the production of grain and fodder in pearl millet. It is caused by *Pyricularia grisea* (teleomorph: *Magnaporthe grisea*). In 1953, a small number of pearl millet cultivars in India were initially reported to have blast disease. Later, in the 1980s, reports of the illness on several hybrids and varieties were made on occasion. Since 2000, the disease has expanded throughout the Indian states that produce pearl millet, and numerous hybrids and cultivars have showed signs of susceptibility to the illness. Pearl millet hybrids and cultivars are responding to the blast disease in a variety of ways, ranging from sensitive to resistant. A review has been conducted of the pathogen's biology, current status, geographic distribution, host range, epidemiology, and disease management strategies encompassing chemical, biological, and host resistance control measures. In addition to the presentation of breeding tactics and molecular breeding procedures, screening techniques and a

disease grading system in host genotyping are also covered. There is a dearth of scientific data on pearl millet blast. A thorough explanation of the biology and treatment of pearl millet blast disease will inspire new directions for future study and help to improve the state of the disease in India. Finding hotspots for genotype screening of pearl millet.

T1PP17: A Review on the False Smut of Rice

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Rice (*Oryza sativa*) belongs to the *poaceae* family, serving as a primary crop and staple food for over half of the world's population. It is infected by a variety of organisms such as fungi, bacteria, viruses, nematodes, *etc*. Among fungal diseases false smut caused by *Ustilaginoidea virens* appear to be one of major emerging disease infecting rice. The disease has been recorded in all rice growing countries worldwide. False smut is now very prone in almost all the rice grown areas of the world due to climate change, cultivation of high yielding varieties, over use of nitrogenous fertilizer and more frequent irrigation, it has emerged as the most devastating rice grain disease in major rice-growing regions in India. The infection of the pathogen transforms individual grains of the panicle into a yellowish smut ball, which changes to yellowish orange, green, olive green and finally to greenish black. Besides rice, maize and several weeds common to rice fields, serve as alternative host for *U. virens.* It was reported that *U. virens* also attacks *Digitaria marginata*, a common rice weed which occurs in 85% of the rice fields. To mitigate the disease, it is advised to use moderate rates of nitrogenous fertilizers, reduce humidity levels through alternate wetting and drying rather than permanently flooding the fields, and treat seeds with biological control agents such as *Trichoderma viride*, *T. virens*, *T. harzianum* and *T. reesei* against *U. virens,* which has proven to be more effective. The application of tebuconazole 50% + trifloxystrobin 25% WG at 0.8 g/L or picoxystrobin + propiconazole 11.7% SC at 2.0 m/L at 50 and 100 per cent flowering stage found to be most effective in reducing per cent infected panicles/sq m and per cent infected spikelets/panicle.

T1PP18: Identification of Diseases in Date Palm

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The date palm (*Phoenix dactylifera*) stands as one of the earliest cultivated fruit plants from ancient times. Belonging to the Palmaceae family, this plant is believed to be indigenous to regions surrounding the Persian Gulf. Several fungi are associated with the decline of the growth and production of date palm. Of them pathogenic soil-borne fungi, including *Fusarium oxysporum*, *F. solani*, *Macrophomina phaseolina*, *Thielaviopsis paradox*, and *Diplodia phoenicum*, has been identified as detrimental to date palm roots. Simultaneously, fungi like *Thielaviopsis paradoxa* (Black scorch), *Helminthosporium* sp., *Alternaria* sp. (causing leaf spots), and *Botrydiplodia theobromae* (inducing Basal rot) affecting date palm foliage. To decipher this complex, date palm infected samples were collected from the field of Date palm Research Station, Mundra, Horticulture instructional Farm, and Agroforestry Research Station of Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar. The isolation process of revealed the presence of *Fusarium sp*. and *Macrophomina phaseolina* in the infected root region, while *Alternaria* sp. and *Helminthosporium* sp. was identified in the affected leaf tissues. Purification and identification of these fungal isolates involved a comprehensive examination of *in vitro* culture characteristics and microscopic analysis of morphology of culture, encompassing micro and macro conidia, chlamydospores, and spore shape and size. Pathogenicity assessments, and overall biological Performance, *Fusarium* sp., *Alternaria alternata, Helminthosporium* sp., and *Macrophomina phaseolina* were identified as the causative agents responsible for infections in both leaves and roots of date palm seedlings.

Theme 2: Disease and Pest Management in Natural Farming

T2OP1: Management of Collar Rot of Chickpea caused by *Sclerotium rolfsii* Using Organic Inputs

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The collar rot is an important disease of chickpea which causes reduction in plant population resulting in significant yield losses. The management of collar rot of chickpea is very crucial in organic farming. The research work for the management of collar rot of chickpea using organic input was conducted during Rabi 2020-21 and 2021-22. The efficacy of different organic inputs against collar rot of chickpea disease was tested by seed treatment under field experiment. All organic inputs showed a significant increase in seed germination, decrease in collar rot incidence and an increase in the seed yield of chickpea as compared to untreated control. Two-year pooled data revealed that maximum percent germination of chickpea was observed when seeds were treated with Beejamrit (93.89%) followed by seed treatment with *T. viride* @ 6g/kg (92.78%) as compared to control (80.00%). The minimum collar rot incidence 11.46% was observed when seeds were treated with *Trichoderma viride* followed Beejamrit seed treatment for 5 hours with a collar rot incidence 12.47% as compared to collar rot incidence 27.24% in untreated control. The maximum seed yield of chickpea (22.52 q/ha) was observed under seed treated with *Trichoderma viride* followed by seed treatment with Beejamrit (21.71 q/ha) which was significantly higher over untreated control (17.82 q/ha).

T2OP2: Management of American Serpentine Leaf Miner, *Liriomyza trifoli* (Burgess) in Tomato Under Protected Cultivation

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In the nineteenth century one of the devastating invasive pest introduce in India from American sub-continent that was serpentine leaf miner, *Liriomyza trifolii. For the eco-friendly* management of *L. trifolii* the experiment was conducted at horticulture farm, College of Horticulture, S. D. Agricultural University, Jagudan (Mehsana), Gujarat using a completely randomized design with three replications and ten treatments in the *Rabi* season of 2020-21 and 2021-22. Nine botanical insecticides were tested and among that neem seed kernel extract at 5% significantly outperformed other treatments by recording the lowest damage percentage (9.80%) which was statistically at par with tobacco decoction at 2% (10.52%) and azadirachtin at 1500 ppm (11.13%). Similarly, based on the number of mines per three compound leaves neem seed kernel extract at 5% demonstrated superior efficacy by recording the lowest damage (10.59 mines/3 compound leaves). Tomato fruit yield was maximized in plots treated with neem seed kernel extract at 5%, harvesting 449.16 q/ha found at par with azadirachtin 1500 ppm (445.83 q/ha) and tobacco decoction 2% (436.00 q/ha). Ultimately, the integration of biopesticides into the management paradigm offers a pathway towards sustainable and eco-friendly tomato production under protected cultivation.

T2OP3: Evaluation of Different Organic Inputs for the Management of *Sclerotium* Rot in Groundnut (*Arachis hypogea* L.)

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Groundnut (*Arachis hypogaea* L.) is an important oil seed crop in India. Several factors are responsible for low productivity among which diseases such as leaf spot, collar rot, stem rot, bud necrosis, etc., are very important. Stem rot is a major soil-borne disease of groundnut causing serious pod loss at harvest resulting great economic losses in groundnut. For its management, pesticides application is a routine practice among the farming community but pesticides may affect groundwater by a process known as leeching. Not only pesticides dangerous to the environment, but they are also hazardous to a person's health. Indigenous agricultural practices which are based on natural and organic methods of farming offer several effective, feasible and cost-effective solutions to most of the basic problems being faced in conventional farming systems. To manage the sclerotium rot in groundnut, eleven different treatment combinations were evaluated during 2021-22, 2022-23 and 2023-24. Treatment of (seed soaking with *Beejamrutha*@ 300 ml per kg seeds + seed treatment with *Trichoderma harzianum*1 WP (1 X 108cfu/g) @ 10g/kg seeds + soil application of vermicompost (dose: 1 ton/ha) enriched with *T. harzianum*1 WP (1 X 108cfu/g) (10 g *T. harzianum* per kg vermicompost)}gave minimum Sclerotium rot incidence for all three years which was found at par with the treatment of {(Seed soaking with Beejamrutha @ 300 ml per kg seeds + seed treatment with *T. harzianum* 1 WP (1×108cfu/g) @ 10g/kg seeds+soil application of vermicompost (dose: 1 ton/ha) enriched with *Pseudomonas fluorescens* 1.75 WP(2×106cfu/ml) (10 ml *P. fluorescens* per kg vermicompost)} as compared to control.

T2OP4: Effective and Eco-friendly Tactic to Combat Mango Post-harvest Diseases

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Mango *(Mangifera indica* L.) is considered one of the most popular fruits among millions of people. Symptomatological and taxonomical observations revealed the occurrence of major post harvest fungal diseases *viz*., anthracnose, stem end rot, black rot and rhizopus rot. Pathogenicity and diagnosis revealed the incitants of anthracnose stem end rot, black rot and rhizopus rot confirmed as *Colletotrichum gloeosporioides*, *Botryodiplodia theobromae, Aspergillus niger* and *Rhizopus stolonifer,* respectively. Effect of pre-cooling results revealed that the fruits treated with force air pre-cooling at 15ºC for 8 hours proved to be the most effective with respect to per cent disease incidence of anthracnose and stem end rot in Kesar variety. With a view to find out ecofriendly management tactic in Kesar variety the results revealed that the fruits treated with neem leaf extract significantly proved most effective followed by hot water treatment 52ºC for 10 minutes with respect to per cent disease incidence of anthracnose and stem end rot. The minimum per cent disease incidence of stem end rot was found in 2 gl-1KCl (28.78%) treatment followed by 0.5 gl-1KCl (43.07%) while in case of anthracnose, significantly least per cent disease incidence (10.00%) and its highest per cent disease reduction (75.00%) were recorded in fruit treated with 2.5 g l-1KCl. Among different treatments the fruits packed with neem leaves show minimum stem end rot (39.23%) and anthracnose (30.00%) disease incidence. So from the management studies it is obvious that the force air pre-cooling at 15ºC for 8 hours, neem leaf extract, KCl and leaf packing treatment were found effective for the management of anthracnose and stem end rot diseases incidence and increases shelf life in Kesar variety of mango.

T2OP5: Eco-friendly Management of Chilli Leaf Curl Disease Complex under Field Condition

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Chilli (*Capsicum annuum* L.) is popularly known as "wonder spice" and is an important cash crop and remunerative vegetable crop of India and is grown both for the home market and export. Chilli leaf curl complex disease is one of the major limiting factors in chilli production. In our present investigation attempt was taken to manage the chilli leaf curl by eco-friendly approaches. Foliar application of Imidacloprid was found most effective as this treatment give minimum PDI (36.29) followed by Raw cow milk @ 25% (49.62%), NSKE @ 10% (54.07%), Cow urine @10% (54.80%), Potassium PDI (59.25%),Two week butter milk @ 20%, (59.25 %), Neem leaf extract @ 20% (62.21 %), and Cow dung +Jaggery @ 2% (76.28%), while the maximum PDI was recorded in control. Imidacloprid was significantly superior over all other treatments. Next to Imidacloprid foliar application of Cow milk @ 25% + Turmeric powder @ 2% was found effective and it was superior to cow dung, Neem leaf extract and control but it was statistically at far with cow urine 10%, NSKE@10%, potassium@1.5% and buttermilk @ 20%. Foliar application of cow urine @10% also shows increasing result and it was superior over cow dung +Jaggery and control. While it was statistically at par with NSKE, Potassium, Raw cow milk, buttermilk and neem leaf extract. The maximum percentage disease is controlled by Imidacloprid (57.39%) followed by Raw cow milk @ 25% + turmericurine @ 10% PDC (35.65%), Potassium @ 1.5% PDC (30.43%), Two week butter milk @ 20% (30.43%) and Cowdung+Jaggery @ 2% (10.43%).

T2OP6: Eco-friendly Management of Leaf Miner (*Aproaerema modicella* Deventer) in *Kharif* Groundnut

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Leaf miner is considered as the most important insect pest of groundnut in India and particularly in rain fed situations. The pest initially appears as a leaf miner causing short blister like mines. Older larvae fold the leaflet and feed within. To overcome this problem, an experiment was conducted on the field efficacy of different botanical and biopesticide against leaf miner (*Aproaerema modicella* Deventer) in *Kharif* groundnut during the year 2020, 2021 and 2022 at Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar in randomized block design and replicated thrice with eight treatments. Based on three year data, pooled over year data showed that the minimum leaf damage (6.32%) was recorded in the treatment of azadirachtin 1500 ppm @ 0.0006 per cent followed by next best treatment with NSKE @ 5 per cent which recorded 8.03% leaf damage. In pooled over year, maximum haulm yield was recorded in the treatment of azadirachtin 1500 ppm @ 0.0006 per cent (3240.20 kg/ha) and it was at par with NSKE @ 5 per cent with 3115.81 kg/ha. Also, the highest pod yield was recorded in the treatment of azadirachtin 1500 ppm @ 0.0006 per cent (1717.82 kg/ha) and it was at par with NSKE @ 5 per cent (1613.59 kg/ha). So, it is concluded that Azadirachtin 1500 ppm @ 0.0006 per cent applied at 40 ml/ 10 L of water as spray recorded minimum leaf damage (%), highest pod yield, haulm yield and were proved to be the most effective treatment to least affected by leaf miner.

T2OP7: Bio-efficacy of Different Leaf Extract Against Mustard Aphid (*Lipaphis erysimi*) in North Gujarat

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The investigation on the bio-efficacy of different leaf extracts against Mustard aphid (*Lipaphis erysimi*) in North Gujarat were carried out on maize sub-research station, Khedbrahma. SDAU, Sardarkrushinagar during *Kharif*, 2018- 19, 2019-20 and 2020-21. Bio-efficacy shows that among different leaf extract the lowest (1.30/plant) aphid index on treated with neem leaves (*Azadirachta indica*) @ 5% and it was followed by castor leaves (*Ricinus communis*) @ 5% spray (1.51 /plant) and Garlic bulb (*Allium sativum*) @ 1% (1.58 /plant). Remaining treatments showed more or less similar trend of effectiveness in pooled over year. Thus, spraying of Neem leaves (*Azadirachta indica*) @ 5% or castor leaves (*Ricinus communis*) @ 5% were found effective botanical not only in terms of control of aphid but increase the yield of mustard also.

T2OP8: Response of Plant Extracts and Enzymes Activities as a Defense Mechanism Against Wilt and Root-knot Nematode in Cucumber

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Cucumber (*Cucumis sativus*) popularly known as *khira* is one of the important cucurbitaceous vegetables from nutritional as well as economic point of view. It is said to be a native of Northern India. It is one of the most important host for wilt and Root-knot nematode. So an experiment was conducted to assess the effect of plant extracts (*viz.*, parthenium, wild sunflower, wild amaranthus, datura and *Achyranthus aspera)* on accumulation of polyphenol oxidase (PPO), peroxidase

(PO) and phenol in cucumber roots infected with wilt complex disease and management of disease complex. The observations on enzymatic activity were assayed after 14 days of sowing using spectrophotometer while observation on plant growth parameter, disease incidence and nematode reproduction were recorded 60 days after sowing. Result showed that maximum PPO, PO and Phenol activity was recorded in plant treated with parhenium @ 10% concentration, while minimum PPO, PO and Phenol activity was observed in nematode+ fungus infected plant roots. The data also indicated that all plant extracts significantly increased cucumber plant growth parameters compared to control plant. Maximum plant growth parameters were recorded with parthenium followed by wild sunflower and *Achyranthus aspera.* However minimum plant growth parameters were recorded with untreated control (nematode+fungus). Data on nematode reproduction showed that all the plant-extracts significantly reduced the nematode reproduction as compared to untreated check. Among the plant-extract, the *parthenium* was recorded most effective treatment with minimum nematode reproduction followed by wild sunflower and *Achyranthus aspera* @ 10% concentration. However, untreated check nematode alone was observed as least effective with maximum nematode reproduction. While, the maximum per cent disease incidence was recorded with untreated check nematode + fungus.

T2OP9: Management of *Fusarium solani* and *Meloidogyne javanica* in Fennel through Bio-agents and Botanicals

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Fennel *(Foeniculum vulgare* Mill.) popularly known as *"Saunf"* is one of the important and highly valued spice crops grown in India. *Fusarium solani* is the most common pathogen in causing root rot of fennel with qualitatively and quantitatively losses. Development of root rot disease in fennel crop depends on the complex interaction between nematode and fungus. An experiment was conducted on the management of *Fusarium solani* and *Meloidogyne javanica* in fennel through bio-agents and botanicals. The bio-agents were used as soil application (2.5 kg/ha) while botanicals were used as seed soaking (@10 per cent concentration for 30 minutes). Bio-agents (*Pseudomonas fluorescens* and *Trichoderma harzianum*) and botanical (garlic clove and parthenium leaves extract) were used alone as well as in combination. Plants were uprooted 60 days after sowing and observations were recorded on plant growth characters, per cent root rot incidence and nematode reproduction. Results showed that maximum plant growth characters were recorded in *Trichoderma harzianum*+ garlic treated plants followed by parthenium and garlic, while lowest per cent root rot incidence and reduced nematode reproduction were recorded in *Trichoderma harzianum*+garlic treated plants followed by *Trichoderma harzianum*+ parthenium and parthenium as compared to untreated control plant.

T2OP10: Holistic Plant Health Management in Natural Farming Addressing Challenges and Seizing Opportunities

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Natural farming stands as a chemical-free agricultural system deeply rooted in Indian tradition, augmented by a contemporary comprehension of ecology, resource recycling, and on-farm resource optimization. It is recognized as an agro ecology-based diversified farming approach that seamlessly integrates crops, trees, and livestock, fostering functional biodiversity. Notably, synthetic chemicals find no place in natural farming, as they are strictly prohibited for pest and disease management. Instead, a range of organic inputs such as neem, cow urine, fermented curd water, dashparni extract, neem-cow urine extract, leaves extract, chili-garlic extract, etc., are employed. Cultural, agronomic, mechanical, and biological practices are common place in natural farming, alongside Indigenous Traditional Knowledge (ITKs), careful seed selection, adoption of disease-resistant varieties, strategic sowing times, and the incorporation of border crops and intercrops. Additionally, practices like the application of Khatti lassi, Jungle ki Kandi, Sontha aster, and the regular use of Drava Jeevamruth on mulch material contribute to enhancing microbial diversity and promoting immunity in plants, thereby preventing the spread of diseases. Our collective knowledge, enriched by centuries of research conducted by erudite scholars and sages, offers effective strategies for managing pests and diseases while increasing crop productivity. Ancient texts such as the Vedas, Buddhist literature, Kautilya's Artha-sastra, Krishi-Parashara, Tamils' Sangam literature, Agni Purana, Varahamihira's BrhatSamhita, Surapala's Vrikshayurveda, Chakrapani Misra's Viswavallabha, and more constitute a vast repository of wisdom on disease and pest management without disrupting the natural harmony of ecosystems. In the face of imminent threats such as climate change, pollution, and soil erosion, we find ourselves on the precipice of potential annihilation. This critical juncture necessitates a retrospective examination of time-tested practices to achieve the crucial goal of food security through sustainable agriculture. Natural farming emerges as a powerful solution, capable of promoting soil health, encouraging crop diversity, supporting natural predators, fostering beneficial insects, and enhancing crop resilience against disease outbreaks. This eco-friendly and spiritually aligned approach aligns with the laws of nature, safeguarding the Panchmahaboota or Panchtatva (Earth, Fire, Water, Air, and Ether).

T2OP11: Eco-friendly Management of Pulse Beetle (*Callosobruchus maculates* Fabricius) in Blackgram

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A laboratory study was carried out in Department of Entomology, Pulses Research Station, S. D. Agricultural University, Sardarkrushinagar during 2021-22, to evaluate the effect of grain protectants against pulse beetle in black gram. Among different grain protectants such as neem oil, karanja oil, mohua oil, castor oil, nilgiri oil, cotton oil, sunflower oil, sesame oil, groundnut oil, cotton oil and mustard oil, the lowest (0.45 %) seed damage, minimum (0.65%) weight loss, highest (89.41) germination percentage and highest (93.44 %) feeding index was observed in the seeds treated with neem oil. Castor oil was significantly less effective among non-edible oils while in the case of edible oil significantly most effective oil was coconut oil due to minimum seed damage, while significantly maximum seed damage was observed in cotton oils. Hence, these botanicals can be used as safer alternatives to chemical insecticides for long term storage of blackgram seeds.

T2OP12: Management of Root-knot Nematodes (*Meloidogyne incognita)* in Cucumber Using Different Organic Amendments in Pots

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A pot trial experiment was conducted to find out effective management practices of root-knot nematode in cucumber cv. GCU-1. The experiment was arranged in completely randomized block design with three replications and seven treatments *i.e.,* T1= Poultry manure @3.0 t/ha, T2= Mustard cake @ 2.0 t/ha, T3= Tobacco dust @2.0 t/ha, T4=Castor cake@ 2.0 t/ha, T5= Neem cake @ 2.0 t/ha, T6= FYM @10 t/ha, T7=Control. All the treatments were significantly superior over untreated control in reducing root-knot nematode population in cucumber. However, soil application of the treatment, T1= Poultry manure 3.0 t/ha was found most effective with the lowest root-knot index and soil nematode populations. This treatment was also found most effective in promoting vine length, fresh shoot and root weight and fresh shoot and root length.

T2OP13: Eco-friendly Management of Bihar Hairy Caterpillar, *Spilosama oblique* Walker in Castor

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A study on eco-friendly management of *Spilosama obliqua* Walker was carried out at Cotton Research Station, SDAU, Sardarkrushinagar during 2021-22. The results on the efficacy of different botanical and microbial pesticides revealed that all the treatments were found significantly superior over the control. Significantly least larval population (8.00 larvae/plant) of hairy caterpillars were recorded in *Beauveria bassiana* 1.15 WP (1x108cfu/ml) @ 0.0069% which is at par with Agniastra 10% (8.40 larvae/plant), Brahmastra 10% (8.75 larvae/plant), Azadirachtin 1500ppm @ 0.00075% (9.60 larvae/plant) and *Beauveria bassiana* 1.15 WP (1x108cfu/ml) @ 0.0046 % (11.50 larvae/plant), respectively. Significantly highest yield (2332 and 2300 kg/ha) was recorded in the treatments *Beauveria bassiana* 1.15 WP (1x108cfu/ml) @0.0069% and Azadirachtin 1500ppm @ 0.00075% which are at par with Brahmastra 10% (2156 kg/ha) and Agniastra 10% (2140 kg/ha).

T2OP14: Effectiveness of Panchgavya Formulations against *Rhizoctonia solani* Kuhn Causing Sheath Blight of Rice

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The mainly rice grown crop was found severely affected by sheath blight under the South Gujarat region. Sheath blight of rice symptoms were noticed on leaf blades and sheath just above the water level. The isolation was done from infected parts and purified by hypal tip method on PDA and that maintained at 4ºC. The seven different panchagavya formulations of five cow products such as cow urine, dung, curd, ghee and milk and that designed as PG1, PG2, PG3, PG4, PG5, PG6 and PG7. The PG against test pathogen *Rhizoctonia solani in vitro* condition by the poisoned food technique and that tested at 2, 4, 6, 8 and 10 per cent concentrations. It was observed that panchagavya were able to suppress the growth of *R. solani*. Among the different formulations, PG1 was significantly effective at all concentrations as compare to other PG formulations against *R. solani*.

T2OP15: Evaluation of Phytoextracts against *Colletotrichum gloeosporioides* Caused Leaf and Fruit Spot Disease of Custard apple

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The Custard apple or sugar apple (*Annona squmosa* L.) is one of India's oldest dryland fruit crops belonging to the family *Annonaceae* and genus Annona. The crop is found to be badly infected with diseases resulted with lower yield and quality of fruits. Among the various diseases, leaf and fruit spot caused by *Colletotrichum gloeosporioides* has become a severe melody to this crop. The extracts of ten plants part *viz.,* Neem (*Azadirachta indica* Juss), Ashoka (*Polyanthia longifolia*

Sonn), Nilgiri (*Eucalyptus globules* Labill), Ardusi *(Adhatoda vasica* Ness.) Lantana (*Lantana camera* L.), Simarouba (*Simarouba glauca* DC), Subabul (*Leucaena leucocephala* Lam.), Bougainvillea (*Bougainvillea spectabilis* Willd.), Garlic (*Allium sativum* L.), Onion (*Allium cepa* L.) were evaluated *in vitro* against *C. gloeosporioides* at 10, 20 and 30 per cent concentrations through poisoned food technique against leaf and fruit spots of custard apple under *in vitro*. Among them, extract of lantana leaves (81.91%) was proved excellent in inhibiting the mean mycelial growth of the pathogen. Next best in order of merit was bougainvillea leaves extract (58.60%), neem leaves extracts (58.01%), subabul leaves extract (57.68%), garlic clove extracts (55.20), ashoka leaves extract (54.99%) and Simarouba leaves extract (54.78%).

T2OP16: Eco-friendly Management of Blast in Pearl Millet

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Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is an important cereal and forage crop of arid and subtropical regions of the Indian subcontinent as well as several African regions. Among the various diseases of bajra, blast also referred as leaf spot caused by *Pyricularia grisea* (Cooke) Sacc. [Teleomorph: *Magnaporthe grisea* (Herbert) Barr.] has emerged as a serious disease affecting both forage and grain production in pearl millet, resulting economic loss. Recently intensity of blast increased at alarming rate in commercial hybrids cultivation. In view of these, chemical control is taken to manage this disease. A field trial was conducted at Pearl Millet Research Station, JAU, Jamnagar during *Kharif* 2023 to find out the effectiveness of different ecofriendly products against blast of pearl millet. Total ten ecofriendly components were used for treatments. All the treatments was significant over control in respect to disease intensity. Among the treatments *jivamrut* recorded minimum blast intensity (23.33%), while *Bacillus subtilis*1.0% WP recorded maximum grain yield (2903 kg/ha) and fodder yield (6021 kg/ha).

T2PP1: Eco-friendly Management of Powdery Mildew of Pea Incited by *Erysiphe polygoni* DC.

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Pea (*Pisum sativum* L.) is a valuable crop all over the world, is also known as "Matar". It belongs to family *Leguminosae* and sub family *Papilionaceae*. It's affected by various fungal, bacterial and viral diseases. Powdery mildew of pea is one of the major diseases of pea incited by *Erysiphe polygoni* DC. Major symptoms of powdery mildew disease are the presence of white floury patches appeared on the leaves as well as stems, tendrils, pods and in the severe condition its cover whole plant parts except root region and finally plant become older and later stage of the crop whole plant become comparatively greyish brown and the infected parts convey dull appearance. In extreme condition infected pods and leaves fall down from the plant. An experiment was conducted at farm of SKNCOA, Jobner during the *Rabi* season 2021. Six natural products with one control *viz*. Panchgavya (10%), butter milk (10%), neem seed kernel extract (NSKE 10%), Durant (10%), Parthenium (10%)and Mehandi(10%) were applied as two foliar spray. During evaluation, all the treatments were found effective against powdery mildew of pea but Neem Seed Kernel Extract (NSKE 10%) and Panchgavya (10%) were found as best treatment to control powdery mildew disease of pea.

T2PP2: Organic amendments: Eco-friendly Approach for Management of Root Rots in Cowpea

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Cowpea [*Vigna unguiculata* (L.) Walp.] is one of the important vegetable and pulse crops of India. Cowpea plant is an excellent source of cattle fodder. It has also an ability to fix atmospheric nitrogen in the soil. Root rot disease of cowpea has become a major constraint in recent years for successful and profitable cultivation of cowpea in Gujarat. Looking to the seriousness of the disease the research was conducted on the efficacy of different organic amendments against *Macrophomina phaseolina* of cowpea under laboratory condition at Department of Plant Pathology, S. D. Agricultural University Sardarkrushinagar, Gujarat. The six organic amendments at three different concentrations (5, 10 and 20%) were tested against *M. phaseolina* by poisoned food technique *in vitro*. Significantly least growth of mycelium was recorded in the extract of neem cake @ 20% (59.54%) followed by mustard cake @ 20% (56.57%). Vermicompost @ 5% (33.08%) and FYM @ 5% (33.96%) were found less effective against *M. phaseolina*.

T2PP3: The Status and Occurrence of Alternaria Leaf Spot in *Coriandrum sativum* and Its Eco-friendly Management

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The present investigation was done in Department of Plant Pathology, SKNCOA, Jobner during *Rabi* season 2021, against Alternaria leaf spot of coriander incited by *Alternaria alternata*. This disease is emerging as a major and widespread problem in India as well as in Rajasthan. A major disease of the Alternaria genus is the blight disease, which causes yield losses

ranging from 32-57 per cent on average. The pathogenicity tests demonstrated that this seed borne *Alternaria alternata* was pathogenic on coriander and symptoms on leaves first appeared as small, dark brown to black, circular lesions (≤5 mm diameter) that enlarged and coalesced to form dark brown blotches as time progressed. Occasionally, dark spots can also be seen on tender stems and pods. Leaf spot disease was most severe (64%) on wounded leaves inoculated with *Alternaria alternata*. The bioagents and phyto extracts were used to manage the disease, among bioagents, *Trichoderma harzianum* was found most effective and resulted in reduction in disease intensity (38.30%) as compared to untreated control. When plant leave extracts tested as the foliar application under field conditions, neem was found most effective with the maximum disease control (50.94 at 10%) followed by garlic leave extract.

T2PP4: Efficacy of Different Organic Inputs and Phytoextracts against *Colletotricum lindemuthianum* by Poisoned Food Technique and in Pot Condition

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The black gram (*Vigna mungo* L. Hepper) commonly known as urdbean is an annual semi-erect to spreading herb belonging to the family *Leguminosae*. It has high nutritional value containing fat, protein, carbohydrate, calcium, phosphorus, iron, thiamine, riboflavin, niacin, and beta-carotene. Many biotic and abiotic stresses cause significant yield reduction in black gram. The production is affected by several diseases caused by fungi, bacteria and virus. The major diseases are anthracnose, powdery mildew, Cercospora leaf spot, root rot, stem canker, bacterial leaf blight, yellow mosaic and leaf crinkle causing significant yield losses. Among the various fungal diseases, the occurrence of anthracnose disease in black gram is commonly observed in most of the cultivated areas. The infected plant exhibits mostly foliar disease symptoms which become severe under cool and humid atmosphere. For the management, farmers using very high amounts of fungicides without knowing the nature of the pathogen. It results in certain level of toxicity in plant system and thus health hazardous and disturb ecology of soil and microbial diversity of the ecosystem. Therefore, need to be awareness of farmers for implementing organic inputs and phytoextracts rather than chemical application for disease control with concern to recent environmental problem and health hazards. Among eight organic inputs and phytoextracts tested *in vitro*, the highest mean growth inhibition was recorded with panchagavya which was followed by *jivamrutha* whereas in pot condition vermiwash at 10 per cent gave highest per cent disease control followed by garlic bulb extract at 10 per cent.

T2PP5: Management of Ascochyta Blight of Pea through Botanicals

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Pea (*Pisum sativum* L.) is an annual, self-pollinated cool-season legume native to northwest to southwest Asia. It is one of the most important legume crops in the temperate climate of the world. The crop occupies a position of considerable importance in the agriculture economy and being a leguminous crop, it plays a significant role in the eco- buildup of agriculture. Pea crops attacked by several diseases in which Ascochyta blight (*Ascochyta pisi)* causes considerable losses. Blight symptoms are characterized by discrete brown to black flecks and undefined lesions on leaves, petioles, stems and pods that later coalesce to form dark black large lesions and blighted foliage of the crop. An experiment was conducted at farm of SKNCOA, Jobner during *Rabi* season 2021.Total six botanicals with one control *viz*. Neem (*Azadirachta indica*), Aak (*Calotropis procera*), Garlic (*Allium sativum*), Datura (*Datura stramonium*), Parthenium (*Parthenium hysterophorus*), Giloy (*Tinospora cordifolia*) tested under *in vitro* and *in vivo* conditions. Among these botanicals, neem leaves extract was found superior with mycelial growth inhibition of 88.89 and 100 per cent at 5 and 10 per cent concentrations respectively, under *in vitro* condition and maximum disease control 54.31 per cent as compare to control plot under field condition.

T2PP6: Application of Botanicals: An eco-friendly Approach for Management of Collar Rot of Lentil caused by *Sclerotium rolfsii*

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Lentil (*Lens culinaris* Medik.) is an important pulse crop. Lentil suffered with most destructive disease in lentil growing areas of the Madhya Pradesh, collar rot of lentil caused by *Sclerotium rolfsii*. The fungi can attack the crop during any time from seedling to flowering stage and are comparatively more destructive at the seedling stage.In Chemical control the impact of plant diseases could reduce, but field application of synthetic fungicides may creating problems on the environment, human health and may lead to the development of resistance in pathogenic fungi to common fungicides. The natural plant products, have been used to control microorganisms causing plant diseases. So in the present work nine plant species extracts were tested *in vitro* to know their inhibitory effect on the growth of *S. rolfsii*. The effect of phyto extracts significantly minimum mycelium growth was recorded in *Curcuma longa* (39.25 mm) while maximum mycelium growth was observed in *Ricinus communis* (90.00 mm). The field experiments of botanicals against collar rot of lentil has been carried out at the field of Department of Plant Pathology, R.V.S.K.V.V. College of Agriculture, Gwalior (M.P.) during *Rabi* 2019-20. Nine botanicals were evaluated against the

incidence of collar rot of lentil caused by *S. rolfsii*. Among the treatments, *M. champaca*, *S. asoca* and *C. longa* were found most effective to reduce collar rot incidence of lentil.

T2PP7: Disease and Pest Management in Natural Farming Prevention and Control of Plant Disease in Organic Agriculture

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Organic farming has significantly increased in importance in recent decades. Disease management in organic farming is largely based on the maintenance of biological diversity and soil health by balanced crop rotations, including nitrogen-fixing and cover crops, intercrops, additions of manure and compost, and reductions in soil tillage. Most soil- borne diseases are naturally suppressed, while foliar diseases can sometimes be problematic. Only when a severe disease outbreak is expected are pesticides used that are approved for organic farming a detailed overview is given of cultural and biological control measures. Attention is also given to regulated pesticides. We conclude that a systems approach to disease management is required and that interdisciplinary research is needed to solve lingering disease problems, especially for organic farming in the tropics. Some of the organic regulations need revision in close collaboration with various stakeholders.

T2PP8: Investigate the *in-vitro* Efficacy of Organic Inputs against *Alternaria alternata* Causing Blight Disease in Fennel

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Fennel (*Foeniculum vulgare* Mill.) is a medicinal plant belonging to the *Umbelliferae* (*Apiaceae*) family, known and used by humans since antiquity, due to its flavour. The fennel crop is affected by many fungal and bacterial pathogens. *Alternaria alternata* is the most predominant fungal genera causing blight disease in fennel. The bio- efficacy of various organic inputs *viz*., *panchgavya*, *beejamrit* and cow urine were evaluated at 3 and 5% concentrations against *A. alternata* under *In-vitro* conditions using the poisoned food technique. The results revealed that minimum mycelial growth was found in *panchagavya*, 5 per cent (55.75 mm) with 38.06 per cent growth inhibition of *A. alternata*. Minimum mycelial growth (55.75 mm) was found in *panchagavya* @ 5 per cent with 38.06 per cent growth inhibition followed by cow urine @ 5 per cent (67.75 mm) with 24.72 per cent growth inhibition. The maximum mycelial growth was recorded in beejamrit, 3 per cent (86.25 mm) with 4.17 per cent growth inhibition which was found statistically at par with cow urine, 3 per cent (84.75 mm) with 5.83 per cent growth inhibition. Among all the organic inputs, *panchagavya* showed the highest antifungal activity against *A. Alternata* causing blight disease in fennel.

T2PP9: Effect of Botanicals against *Stemphylium vesicarium* of Onion under *in vivo* and *in vitro* Condition

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Onion (*Allium cepa*) is a biennial, cool-season crop but usually grown as annual crop and it is native to central Asia. India is the second largest onion growing country in the world which occupies a position of considerable importance in the agriculture economy. It is important condiments widely used in all households and highly rich in nutrients like calcium, phosphorus, sulphur and carbohydrates, manganese, biotin, vit C, vit B6. Disease was characterised by oval-shaped, tan to brown lesions on leaf blades. Yellow streaks which later turn brown extended along the blade in both directions from lesion. It also exhibit multiple small lesions, which coalesce and cause blighted leaves. During this study, 6 botanicals (Neem, Aak, Marigold, Datura, Parthenium, Aloe vera) were evaluated under *in vivo* and *in vitro* conditions. Among these, aloe vera leaves extract was reported most effective for inhibition of mycelial growth 60.81, 68.01 and 71.62 per cent at 5, 10 and 15 per cent against *Stemphylium vesicarium* of onion followed by neem under *in vitro* condition. Six botanicals were evaluated by foliar application under field conditions. Among these aloe vera leaf extract was most effective with 30.89 per cent disease intensity and with a reduction over control of 50.97 per cent followed by neem. The result of this study indicates that the application of aloe vera has great potential to manage disease effectively and eco-friendly. These are considered safer for human health, as they often have lower toxicity levels.

T2PP10: *In vitro* Bio-efficacy of Biochars against Root and Stem Rot of Cucumber

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In vitro evaluation of bio-efficacy of different three biochar's *viz.,* Greenhouse waste (GHW), Eucalyptus wood (EW) and Citrus wood (CW) were evaluated at different three concentrations (each @ 1, 2, and 3%) against *F. oxysporum* f.sp. *radicis-cucumerinum* causing root and stem rot of cucumber by using poison food technique. Among the three different biochars, Greenhouse waste (GHW) was found most effective by showing minimum mycelial growth of 50.78, 40.10 and 29.88 mm and 43.58, 55.44 and 66.80% growth inhibition at 1, 2 and 3% concentrations, followed by eucalyptus wood (EW) with 59.68, 50.18, 38.66 mm mycelial growth and 33.69, 44.24 and 44.99% growth inhibition 1, 2 and 3% concentrations. Whereas, Citrus wood (CW) depicted highest mycelial growth 66.26, 55.88, 44.30 mm with 26.38, 37.91 and 50.78% lowest per cent growth inhibition of the pathogen at same above concentrations, respectively.

T2PP11: Management of Wheat Aphid (*Rhopalosiphum maidis* F.)

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Wheat is grown as a major cereal crop in the state. High yielding wheat varieties were endorsed for North Gujarat agro climatic zone is highly susceptible to wheat aphid *Rhopalosiphum maidis* F. at booting stage of the crop. It harbors in leafwhorl and suck sap from the leaf there by affecting the yield of the crop. The increasing concern for environmental awareness of pesticides hazards has evoked a worldwide interest in pest control agents of biopesticides. These biopesticides are safer to be in pest control programme and may prevent several adverse effects caused due to synthetic insecticidal application. Therefore, the present investigation was proposed to determine the efficacy of biopesticides as an alternative to insecticides in the management of aphid in wheat crop. A field experiment was conducted at Wheat Research Station, S. D. Agricultural University, Vijapur during 2018-19, 2019-20, 2020-21 and 2021-22 for evaluation of efficacy of different insecticides and bio-pesticides against aphid in wheat. The eight different treatments were evaluated. Based on pooled data of four years, the result revealed that minimum mean aphid population (1.76) was observed with foliar sprays of Thiamethoxam 25 WG @ 0.01% which was at par with all the other treatments except *Beauveria bassiana* @ (1x109cfu/g) and untreated check. The grain yield (49.25q/ha) was also recorded higher with Thiamethoxam 25 WG @ 0.01% compared to control.

T2PP12: *Panchagavya*: An eco-friendly Tool for Plant Disease Management

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Panchagavya is an organic product produced by using five different by-products of cow like cow dung, cow urine, cow milk, cow ghee, cow curd and other ingredients. It has the potential to play the role of promoting growth and providing immunity in plant system. Micro and macronutrients are important for the growth and development of plants. It is made up of several minerals, amino acids, and growth regulators like auxins and gibberellins as well as beneficial microbes including azotobacter, pseudomonas, phosphorus solubilizing microbes. Apart from essential plant nutrients, it also contains plant growth hormones including IAA and Gibberellic acid. It possesses antimicrobial properties against many phytopathogens (*Rhizoctonia solani, Sclerotia rolfsii*, *Pythium aphanidermatum, Sclerotia sclerotiorum*, *Fusarium oxysporum*, *Alternaria solani* and *Colletotrichum* spp.) and are used singly or in combination with cow urine, neem cake. As a cost-effective and eco-friendly solution, it emerges as a promising avenue for farmers seeking sustainable alternatives to chemical inputs. This research aims to shed light on the practical implementation and efficacy to advocating for its integration into mainstream agricultural practices for a more environmentally conscious and resilient farming future.

T2PP13: Role of Bio-indicators in Plant Disease Management under Natural Farming

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Plant diseases pose significant threats to global agricultural productivity, necessitating effective and sustainable management strategies. Traditional approaches often rely on chemical interventions that may have adverse environmental impacts. In this context, the utilization of bioindicators in plant disease management has emerged as a promising and eco-friendly alternative. Bioindicators, which include various organisms such as fungi, bacteria, insects, and plants, serve as sensitive indicators of environmental changes and can play a pivotal role in monitoring and mitigating plant diseases in natural ecosystems. Bioindicators offer valuable insights into the health of ecosystems by responding to subtle changes in biotic and abiotic factors. In the context of plant diseases, certain bioindicator species demonstrate specific relationships with pathogens, providing early warnings of potential outbreaks. These indicators can be harnessed for disease surveillance, enabling timely and targeted interventions to prevent the escalation of epidemics. Moreover, bioindicators contribute to the development of sustainable agricultural practices by promoting biological control mechanisms. Some bioindicators exhibit antagonistic interactions with plant pathogens, acting as natural enemies that suppress disease incidence. Harnessing the ecological functions of these bioindicators can lead to the development of integrated pest management strategies, reducing reliance on synthetic chemicals and minimizing environmental impact. Furthermore, the study explores the potential of bioindicator-assisted diagnostics in detecting and identifying plant diseases. The use of molecular techniques and advanced technologies allows for the rapid and accurate identification of pathogens through the analysis of bioindicator responses. This not only aids in early disease detection but also facilitates the implementation of targeted and precise disease management measures. In conclusion, the integration of bioindicators into plant disease management strategies offers a sustainable and ecologically friendly approach. By leveraging the diverse roles of bioindicator organisms in natural ecosystems, we can enhance our understanding of plant-pathogen interactions, improve disease surveillance, and develop effective and environmentally conscious strategies for disease control in agriculture. This abstract underscores the importance of embracing bioindicator-based approaches as key components of integrated plant health management systems.

T2PP14: Eco-friendly Management of Leaf Miner, *Aproaerema modicella* (Deventer) in Groundnut

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Experiments on "Eco-friendly management of leaf miner, *Aproaerema modicella* (Deventer) in groundnut." were carried out at Agronomy Instructional Farm, S. D. Agricultural University, Sardarkrushinagar during *Kharif*, 2020. In order to evaluate the efficacy of various botanicals and microbial pesticides against leaf miner in groundnut, an experiment was laid out in a Randomized Block Design with three replications having gross and net plot area 4.00 m × 3.15 m and 3.60 m × 2.25 m, respectively during *Kharif* season of 2020. Groundnut cultivar, GG 2 was grown at a spacing of 45 cm between two rows and 10 cm within the rows. Among various eco-friendly pesticides, azadirachtin 10000 ppm 0.003 per cent was the most effective treatment as it recorded the lowest number of leaf miner (2.17 larvae/plant) and leaf damage (12.93%) without interferring spider and also recorded with highest pod yield (2224.30 kg/ha), increase in yield over control (25.98%) and the highest gross realization (₹116775.80/ha) followed by *Lecanicillium lecanii*1.15 WP 0.004 per cent.

T2PP15: Eco-friendly Approaches in Management of *Alternaria alternata* of Stevia (*Stevia rebaudiana*)

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A field experiment was conducted at Central Research Field, SHUATS, Prayagraj to evaluate the effect of organic manure (FYM@ 4.5 kg/m2*), Neem cake @ 40 g/m2, bioagent (Pseudomonas fluorescens @ 2 g/m2) and Biomix (40 g/m2) at two intervals against Alternaria leaf spot (Alternaria alternata) of stevia (Stevia rebaudiana)* during *Rabi* season 2022-23. All the treatments significantly reduced the disease intensity as compared to untreated plants. The study revealed that organic manures were much more effective for Stevia when they were applied in combination rather than sole application. The minimum percent disease intensity was recorded in combination treatment of bio-resources *i.e.* T7 - *FYM + Neem cake + P. fluorescens + Biomix* (18.56%), followed by T6 - *Neem cake + P. fluorescens + Biomix* (21.85%). Maximum plant height (61.88 cm), highest number of suckers (66.03), and maximum fresh (69.91 gm/m2) and dry (50.28 gm/m2) weight of leaves were recorded in T7 - *FYM + Neem cake + P. fluorescens + Biomix*as compared to other treatments.

T2PP16: Plant Disease Management Strategies for Organic Farming

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In recent years, increasing consciousness about environmental pollution due to use of chemical pesticides and the development of fungicide resistance in plant pathogens has challenged to search disease management using eco- friendly strategies. Organic farming aim to conserve ecosystems, promote biodiversity and produce safe produce without compromising environmental sustainability. Organic farming focus on the use of sustainable and environment friendly practices, relying on natural processes to maintain soil fertility by balanced crop rotations including nitrogen- fixing crops, winter cover crops, intercrops and additions of manure. Mulching and cover cropping contribute to soil health and microbial diversity, fostering a balanced ecosystem that could suppress soilborne pathogens. Moreover, the incorporation of beneficial microorganisms which encouraged to establish biological control and promotion of plant growth. In organic agriculture, effective plant disease management through natural substances is a critical aspect to minimize or eliminate synthetic chemicals /pollutants. Nowadays, plant disease management in organic farming involves a holistic and integrated approach that combines use of preventive measures, cultural practices, natural substances and biological control agents. When severe disease outbreak is occurred under organic farming, it causes huge losses in yield and quality of produce. Hence, there is need of hour to devise effective disease management strategies which could provide effective disease management in time.

T2PP17: Role of Indigenous Traditional Knowledge in Plant Disease Management

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Most of the farmers in our country mainly depend on chemical pesticides and fungicides to control diseases and pests in agriculture and horticultural crops. Abundant usage of these pesticides in crop fields causes harmful effects to human beings as well as to other living organisms. This noxious effect of chemicals brings the urgent need for eco- friendly and health hazard-free sustainable agriculture. Indigenous Traditional Knowledge (ITK) is particularly important in the disease management of crops. ITK is the actual knowledge of a community, local and rural in origin, and plays a vital role in organic agriculture more a given population that reflects the experiences based on tradition and includes more recent experiences with modern technologies. ITK provides valuable inputs to make efficient use of natural resources and extends relevant support for sustainable development. Indigenous techniques used in different components of farming systems are mostly organic, eco-friendly, sustainable, viable, and cost-effective. Indigenous Traditional Knowledge is the knowledge of the indigenous people inhabiting different geographical regions of the world with their own language, culture, tradition, belief, folklore, rites, and rituals. India is the heartland of indigenous groups of people and a treasure house of ITKs applicable in the agricultural sector. Due to rapid urbanization, the indigenous groups are losing concentration in the conservation of these long-earned ITKs which brings the

importance of collection, documentation, and scientific validation of ITKs. It is cheap, easy to adopt, locally available, reduces the inputs, useful in organic farming, and useful in doubling the farmers' income.

T2PP18: Evaluation of Bioagents, Botanicals and Elicitors on Alternaria Blight of Mustard (*Brassica juncea* L.) caused by *Alternaria brassica* (Berk.) Sacc.

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Brassica juncea (L.) belongs to the family Brassicaceae (Crucifereae) and is commonly known as Indian mustard and globally used as oilseed, vegetable, and condiment. This research investigates environmentally sustainable methods for managing the Alternaria blight on mustard. The field experiment was conducted at the research plot in the Central Research Field, SHUATS, Prayagraj, U.P. during *Rabi* season 2022-2023 to test the effect of bioagents, botanicals, and elicitors on Alternaria blight of mustard (*Brassica juncea* L.) caused by *Alternaria brassica* (Berk.) Sacc**.** Among the treatments, *Trichoderma viride*@ 10 g/l was the most effective. The seed treatment and foliar spray of *T. viride* @ 10g/l thrice at 15-day intervals significantly reduced disease intensity on leaves and pods, AUDPC, and significantly increased the yield and cost-benefit ratio. The current experiment proved that, without using any chemicals, the management of Alternaria blight disease in mustard can be profoundly possible through the use of different bio-agents, essential oils, botanicals, and elicitors.

T2PP19: *In vitro* Evaluation of Botanical Agents for Controlling *Aspergillus flavus* Growth: A Comparative Study

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Groundnut (*Arachis hypogaea* L.) is an annual legume cultivated in the tropical and subtropical regions of the world. Afla rot caused by *Aspergillus flavus* is an important disease in this region as well as in the world. Botanicals can indeed be used as natural alternatives to synthetic fungicides for controlling fungal infections in plants. It is important to note that while botanical fungicides are considered more environmentally friendly and may have lower environmental impact compared to synthetic alternatives, their efficacy can vary depending on the specific plant pathogen and conditions. A total of five botanicals *viz*., neem (leaves), garlic (clove), onion (bulb), ginger (rhizome) and tulsi (leaves) extract with suitable control were evaluated at 5, 10 and 15 per cent concentrations by poison food technique *in vitro* to know their inhibitory effects on the growth of most aflatoxigenic isolates of *A. flavus* (AF-6). The results revealed that all the plant extracts were inhibitory to the growth of *A. flavus in vitro*. The highest mean growth inhibition of 69.41 per cent was recorded with garlic clove extract, followed by neem leaves (64.86%) and onion bulb (60.24%) extract, whereas lowest in ginger rhizome (11.83%). The most effective botanical of garlic clove extract, which inhibited fungal growth by 53.88, 74.16 and 80.19 per cent at 5, 10 and 15 per cent concentrations, respectively.

T2PP20: Natural Farming in Cowpea

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Cowpea is one of the most commonly produced legume crops. It is one of the most versatile crop: that feeds people, and their livestock. It is a high protein food, and very popular. The plant itself can be dried and stored until needed as fodder for livestock. As a nitrogen-fixing legume, cowpea improves soil fertility and consequently helps to increase the yields of cereal crops when grown in rotation. In the Green Revolution era, synthetic insecticides were used comprehensively to shield crops from various insect-pests. The justification behind using pesticides is that with intensive agriculture, the problems of insect-pests are taking complex shape and posing serious challenges. Scientific surveys and evidences indicate a number of risks associated with the use of such chemicals. Their over use lead to resistance in pests, killing of various beneficial organisms like fishes, birds, wildlife, honey bees, pollinators and microbes, poisoning to agricultural farms and contamination of soil, air, surface and groundwater, biomagnification of toxicants in food chains, residues in food and feed stuff and much more. To conquer the deleterious effects of chemical- based farming, a more sustainable system of natural farming was adapted. In natural farming, insect pests on plants are managed by the farmers with natural products prepared easily by them from local resources at almost negligible cost. The major elements of this strategy include host plant resistance, use of beneficial organisms, agronomic practices, and some organic slurry or natural fertilizer like *Jivamrut* that improves the immunity of plants against disease and pest attack.

T2PP21: Development of an Ecological Safe Strategy for the Control of Downy Mildew (*Pseudoperonospora cubensis*) in Cucumber Cultivation (*Cucumis sativus* L.)

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Downy mildew caused by *Pseudoperonospora cubensis* is a most devastating disease of cucurbits. The disease was more prevalent in Western plain zones with incidence and severity of

36.41 and 20.42 per cent followed by central plain zone *i.e.* 26.92 and 15.62 per cent, respectively, the infection spreads rapidly, causing significant loss of yield and fruit quality. The objective of the research was to develop an ecological strategy for the control of downy mildew in cucumber. The treatments were arranged in a completely randomized experimental design with an alternation of chemical and biological fungicides. The treatments were: T1: Sodium bicarbonate @ 1%, T2: Full creamed milk @ 10%, T3: Jivamrut @ 10%, T4: *Panchgavya* @ 10%, T5: Salicylic acid @ 1%, and T6: Isonicotinic acid @ 1%, T7: Buttermilk@10% and T8: Control (No spray). The following variables were evaluated: percent disease intensity, percent disease control, plant height, number and weight of fruits, yield and economic analysis of each treatment. The results showed that the best treatments were T5 and T1, with percent disease control of 72.89% and 70.12%, respectively while, T7 and T2 showed the least percent disease control among all the 8 treatments with an average of 37.18% and 39.71%. Treatments T5 and T1 showed the best yield, as well. The profitability analysis showed that all the alternatives were profitable with a Benefit/Cost>1 ratio. However, the treatments T5 and T1 were the most useful. We recommend this control strategy to reduce the use of chemical fungicides and, at the same time, obtain an efficient control of the disease, which guarantees a significant yield of high-quality fruit.

Theme 3: Policies for the Seed Health and Prevention of Transboundary Spread of Pathogens

T3OP1: Histopathological Studies Confirming the Seed Borne Nature of *Macrophomina phaseolina* in Sesame Seeds

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Sesame, renowned for its rich oil and protein content, faces a formidable challenge from the seed-borne fungus *Macrophomina phaseolina*, causing seed rot and yield losses. This study investigates the fungus's seed-borne traits, emphasizing pathogen's histopathological studies in seed parts. Different twelve isolates of *M. phaseolina* were obtained from various twelve genotypes/cultivars showing different morphological characters. Seeds showing microsclerotia on its surface was used for this study through component plating method and the cleared whole mount method. The study revealed that *M. phaseolina* is not only the soil-borne pathogen but also a notorious seed-borne pathogen. Location studies discovered that the pathogen is mainly externally seed-borne and more or less present in cotyledon and embryonic axis also in profoundly infected seeds. In some heavily infected seeds of genotypes/cultivars AT-364, AT-288, AKT-101, AT-390, GT 3 and RT-366 pathogen was also moved into the cotyledons (including embryonal axis). The regaining of the pathogen from seed components showed that the pathogen was invariably present in the seed coat of all the infected seeds of all the genotypes/cultivars. Based on these findings, *M. phaseolina* was confirmed as an externally seed-borne pathogen of sesame seeds.

T9OP2: Studies on Rate of Degeneration of Potato Varieties Due to Virus Incidence

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The physiological causes and viral disease infections are the two main reasons for potato degeneration. The seed potato diseased with viral diseases degenerated in the following successive generation therefore the investigation was carried out to evaluate the potato varieties of Gujarat *i.e.* K. Khyati, K. Pukhraj and K. Chipsona-3 against viruses and their subsequent degenerative effects on yield with comparison to fresh breeder seed for four consecutive years. The per cent incidence of viral diseases at 80 DAP was recorded highest (mild mosaic: 17.69%, severe mosaic: 12.31 and PLRV 30.93 in last year) in T3 *i.e.* Previous seed produce without seed plot techniques. Comparatively lower per cent incidence of viral diseases (mild mosaic: 9.26%, severe mosaic: 6.94 and PLRV 8.61 in last year) was recorded in T2 *i.e.* Previous seed produce using seed plot techniques and the least incidence of viral diseases (Mild mosaic: 2.22%, Severe mosaic: 2.13 and PLRV 2.03 in last year) was recorded in T1 *i.e.* Fresh breeder seed every year. Similarly, the total tuber was recorded significantly higher in T1 *i.e.* Fresh breeder seed every year and was found at par with T2 *i.e.* previous seed produce using seed plot techniques up to three consecutive years. So, the seed producer of North Gujarat growing seed potato varieties Kufri Khyati or Kufri Pukhraj or Kufri Chipsona-3 are recommended to multiply the seed tubers up to three consecutive years, starting from breeder seed and then by adopting seed plot technique. The crop raised using these seed tubers produced higher tuber yield with low viral disease incidence.

T3OP3: Detection of Seed-borne *Soybean mosaic virus* and *Bean common mosaic virus* Infecting Soybean through DAS-ELISA

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The soybean crop is susceptible to various viruses. Still, some seed-borne viruses such as *Soybean mosaic virus* (SMV) and *Bean common mosaic virus* (BCMV) have a high economic impact on its production. The indexing of soybean seed and leaf samples to confirm the presence of seed-borne *Soybean mosaic virus* (SMV) and *Bean common mosaic virus* (BCMV) was done using DAS-ELISA. The SMV and BCMV-infected leaf and seed samples from Rahuri, Pune, Sangali and Parbhani were assessed through DAS-ELISA for the presence of SMV and BCMV. The different parts of each seed sample *viz*., seed coat, embryo and cotyledon and two leaf samples were used to confirm the location of SMV and BCMV. The DAS-ELISA of samples showing virus-like symptoms gave positive reactions with SMV and BCMV antiserum. The O.D. values in SMV-infected samples ranged between 2.15 to 2.37 as compared to

0.91 and 1.76 in negative and positive control, respectively. SMV was absent in the seed coat of seed samples from the Rahuri and Sangli locations. The optical density (O.D.) values in BCMV-infected samples ranged between 1.78 to 2.40 as compared to 0.29 and 1.69 in negative and positive control, respectively. BCMV was absent in leaf samples of Parbhani. Among the different parts of the seed, the maximum O.D. value was recorded in the embryo, while the minimum was in the seed coat. From this study, we can confirm the seed-borne nature of SMV and BCMV.

T3OP4: Elucidating Histopathological and Biochemical Alterations in Fennel Seeds Infected by *Ramularia foeniculi*

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Ramularia blight, caused by *Ramularia foeniculi* is a highly destructive disease of fennel, in field conditions, the disease development initiates on lower leaves, resulting in the yellowing premature defoliation; then gradually spreads to upper leaves, inflorescences, and seeds. It results in a significant yield loss. Besides quantitive loss, the impact of Ramularia blight on seed quality was never explored. To assess this impact on fennel seed quality, an experiment was conducted to explore histopathological and biochemical alterations of Ramularia infected fennel seeds. The histopathology of Ramularia infected fennel seeds depicts a clear change in the seed physiology. Especially resulting in the damage of the seed epidermal layer. Further, the estimation of total soluble sugars, protein, and antioxidant was done in healthy and diseased seeds at the green stage. Diseased seeds show a relatively lower amount of total soluble sugars, protein, total phenol, and antioxidants in comparison to their normal counterparts. This physiological and biochemical change may result in the reduction in both oils and other phytochemical constituents in fennel seed which may lead to some extent decreases in its flavor and aromatic properties as well as medicinal values.

T3PP1: Impact of Seed Mycoflora on Seed Quality Parameters of Chickpea

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Chickpea (*Cicer arietinum* L.), a vital pulse crop, is grown in dry areas of India and Europe. Seed-borne mycoflora significantly impact germination, nutritional quality, and seedling vigour of chickpea seeds. Six mycoflora were identified, including *Aspergillus niger*, *A. flavus* Link., *Fusarium oxysporum* f. sp. *ciceri*, *Rhizopus stolonifer*, *Macrophomina phaseolina* (Tassi), and *Penicillium* spp. When inoculated separately, *Aspergillus niger* inoculated seeds showed minimum seed germination (10.67%), while *Penicillium* spp. showed maximum seed germination (44%). After control (1118 and 105.20), *Penicillium* spp. (277.73 and 34.43) treated seeds showed the highest seedling vigour index I and II, while *Aspergillus niger* (23.07 and 3.63) treated seeds showed the lowest. *Fusarium oxysporum* caused the most protein content reduction (39.89%) in chickpea seeds, while *Aspergillus niger* caused the most carbohydrate content reduction (26.45%).

T3PP2: Bio Alternative to Enhance Seed Germination and Antagonistic Against Fungal Pathogen

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In present research fifteen bacterial colonies of endophytic bacteria from different plant parts of castor plant were isolated by pure culture technique and endophytes were tested for their *in vitro* seed germination of wheat seeds to enhance shoot length, root length, fresh weight, and dry weight of seedling. All the fifteen isolates were named Erc1 to Erc15. Co-inoculation of plant growth promoting rhizobacterial endophytic isolates and wilt causing fungal pathogen in castor *Fussarium oxysporum* f. sp. *ricini* showed differential level of inhibition due to the antagonistic interaction between the two organisms. Among them Erc7 proved the most efficient and showed 71.11 percent inhibition whereas Erc1 showed the least inhibition 37.78 per cent of fungal pathogen. The DNA of all the bacteria was isolated and PCR amplification of *16S r*RNA genes of all the isolates were done. The best antagonistic isolate Erc7 was gene sequenced for 16S *r*RNA gene. Upon BlastN, the sequence was submitted to the NCBI Genbank (Accession number ON514555). It showed maximum similarity to *Bacillus cereus*. In microscopic examination, the isolates Erc7 showed diplobacilli and the presence of endospores which is also a typical characteristic of Bacillus cereus.

T3PP3: Preserving Global Agriculture Diversity: Significance of Seed Health in International Seed Exchange

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Agricultural biodiversity is essential for ensuring food security, adapting to climate change, and sustaining ecosystems. International seed exchange is a fundamental practice that

enables the sharing of genetic resources among countries and regions. This exchange facilitates the introduction of new varieties with desirable traits, contributing to the enhancement of agricultural biodiversity. Seed health is a highly significant aspect of agricultural production, with both domestic and foreign implications including genetic resource scientists involved in the collection, evaluation, and conservation of plant germplasm. Seed health relates to the potential hazards and risks of introducing pests and pathogens of quarantine importance along with imported seed. Seed health is the basis for seed certification conducted by the seed industry in the production of seed for domestic or export purposes and in the issuance of phytosanitary certificates by government agencies. The role of plant quarantine in the international transfer of plant germplasm, the review begins with the concepts of hazards, risks, pathways, safeguards, pest risk analysis, and risk/benefit considerations used by quarantine officers in determining the entry status of high-risk plant germplasm and in setting safeguards. Preserving global agricultural diversity through international seed exchange is a shared responsibility that necessitates a focus on seed health. By recognizing the significance of seed health, implementing rigorous quality control measures, and fostering international cooperation, we can ensure the continued exchange of seeds that contribute to resilient and diverse agricultural systems worldwide. This commitment is essential for addressing future challenges and building a sustainable foundation for global food security.

T3PP4: Management of Seed Mycoflora of Blackgram under *in-vitro* Conditions

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Black gram is one of the principle, important and extensively used pulse crops in India. Major seed-borne fungi include *Macrophomina phaseolina, Curvularia lunata, Fusarium oxysporum, Colletotrichum lindemuthianum, Aspergillus niger, Aspergillus flavus* and *Aspergillus terreus* were found associated with black gram. These seed-borne fungi cause major yield loss as well as it affects the quality of seeds. Therefore, present investigation was taken up to manage seed mycoflora associated with black gram. Phytoextracts, organic inputs, bio-agents and fungicides were used for the management of seed-borne fungi. Among the phytoextracts garlic clove extracts showed least seed mycoflora (66.5%). In organic inputs, *panchagavya* showed least seed mycoflora (28.34%) as compared to control (94.45%). Seed treatment with *Trichoderma viride* Pers. (2×108 cfu/ml) found effective for reducing seed mycoflora (22.92%) in black gram as compared to other treatments. The minimum number of fungal species and minimum per cent of total seed mycoflora (1.2%) was achieved through seed treatment of mancozeb 75 WP, 3g/kg under *in-vitro* conditions.

T3PP5: Transboundary Spread of Seed-borne Pathogens: A Global Concern

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More than 1,300 pests and pathogens threaten crops globally, with an estimated economic impact of around $540 billion annually. The movement of seeds across borders can introduce new pathogens that may pose a potential risk to the agriculture of the importing country with potentially devastating consequences. FAO estimates that these pathogens are responsible for the loss of up to 40% of global food crops, and for trade losses in agricultural products exceeding $220 billion each year. Transboundary spread of seed-borne pathogens is a significant concern for global agriculture. With old and new pests and diseases causing devastation across the world, it is becoming increasingly important to consider plant health. The severe damage inflicted by introduced pests and pathogens represents a serious threat to food systems and biodiversity. Unregulated germplasm transfers and exchanges have been recognized as an essential pathway for spreading pests and pathogens through human collection and distribution activities. The spread of pests has increased dramatically in recent years through the agricultural trade and unintentional movement of infected living materials (*e.g.* infected seed, tissue culture materials), climatic factors (e.g. wind, rainfall), and insect or other vectors. Therefore, extreme care is required to ensure that the exchanged germplasm is pest-free. The Consortium of International Agricultural Research Centers (CGIAR) have established Germplasm Health Units (GHUs) to guarantee the safe movement of plant materials, along with compliance with the International Plant Protection Convention (IPPC) procedures and the International Standards for Phytosanitary Measures (ISPMs) applied by National Plant Protection Organizations (NPPOs) to prevent the introduction and control the spread of pests along with plants or plant products and also to eradicate those that have entered and are still confined. In India, the Directorate of Plant Protection, Quarantine and Storage under the Ministry of Agriculture and Farmers' Welfare is responsible for enforcing quarantine regulations and for inspection and disinfection/disinfestation of agricultural commodities meant for commercial purpose. The imported germplasm material, including transgenics, is quarantined at the ICAR-National Bureau of Plant Genetic Resources, New Delhi. The strategies for biosecurity for plant viruses include stringent quarantine measures for the imported material, domestic quarantine, and use of certified disease-free seed and other planting material within the country. In the case of detecting new emerging pests, it is the farmer's responsibility to notify NPPOs of any unusual symptoms or signs in the field, and they should follow the instructions of NPPOs, especially in case of eradication. Moreover, trading infected seed and keeping them as planting material for the next season should be prohibited. The farmer is the connector between the plant and NPPOs to identify any unknown symptoms or signs in the field, conduct regular field visits to observe the plant health

status, and take action in case of any invasive new pest. To ensure reports from farmers on pest outbreaks are as timely, honest and transparent as possible, proper communication channels and support mechanisms need to be put in place, establishing a sense of collaboration."

T3PP6: Impact of Storage on the Seed Health of Clusterbean (*Cyamopsis tetragonoloba*)

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Clusterbean is one of the most important cash crops in the semi-arid region of India. Its storage as seed become a common practice by the local farmers. However, its storage for more than one year is an issue, especially in the presence of high atmospheric moisture during rainy weather. The impact of long-time storage of clustrebean seed under ambient conditions always affects the quality. Thus, to assess the long-term storage consequence on the seed health of clusterbean, an experiment was conducted by storing the seeds of clusterbean variety GG-2 in polypropylene bags for 0, 12, and 24 months. For that, the healthy seeds were collected directly from the field during *Kharif* 2021, 2022, and 2023 and stored at room temperature. After the prescribed time of storage, the seed lot was taken to the laboratory for examination of the seed health. The results revealed that significant variation was observed among all the seed lots in all the seed quality parameters. Interestingly, the seeds stored for more than two years in normal conditions were infected seed lots. 100 percent of seed germination was observed in the healthy seed lot. Whereas, 0 percent of seed germination was observed in storage for one and two years. Maximum seedling length (8.8cm), maximum seedling dry weight (0.12154 g), vigour index-I (461.2), and vigour index-II (7.76) were also recorded in the healthy seeds. The storage and infected seeds do not germinate at all to observe seedling length, seedling dry weight, vigour index-I, and vigour index-II. Different fungi, *viz*., *Alternaria* spp., *Aspergillus* spp., *Rhizopus* spp., *Fusarium* spp. were detected from the infected seeds. Further, bacterial infection was observed in storage and infected seeds. Further biochemical analysis indicates the deterioration of seed quality. Maximum guar gum content (28.63%) was recorded in healthy seeds, while only 25.63% and 23.60% guar gum content was recorded in storage seed and infected seed of clusterbean, respectively. The long-term storage for more than 24 months showed phytochemical changes in clusterbean seeds which may lead to a decrease in gum content as well as other economic values.

Theme 4: Emerging Trends in Biological Control

T4OP1: Antimycotic Efficacy of Culture Filtrate of Indigenous *Trichoderma* Isolates for the Management of Anthracnose Rot causing Pathogens of Chilli

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Chilli is a major spice and vegetable crop in India. The production of chilli is mainly affected by anthracnose rot diseases caused by *Colletotrichum truncatum* and *C. jasminigenum* in Kashmir Valley, India. Various chemicals are available for the control of anthracnose diseases. The present study was conducted to develop a novel biocontrol strategy for the management of chilli anthracnose in a sustainable and eco-friendly manner. Two local isolates of *Trichoderma* species, *T. harzianum* and *T. viride,* were tested at different concentrations for their fungitoxic activity. The results revealed thatthe culture filtrates of both the *Trichoderma* isolates (*T. harzianum*-Th and *T. viride*-Tv) at all the concentrations (5%, 10%, 15% and 20%) caused a significant reduction in the mycelial growth of *Colletotrichum truncatum* and *C. jasminegenum*. *Trichoderma viride* isolate (Tv) proved more effective than *T. harzianum* (Th) isolate. The mycelial growth inhibition percentage by *Trichoderma* isolate Tv was highest (92.16%) against *Colletotrichum jasminigenum* at 15% and lowest (34.78%) at 5% concentration. However, the *Trichoderma harzianum* (Th) isolate caused the highest percent inhibition of mycelial growth (92.16%) against *Colletotrichum truncatum* at 20% and the lowest (59.36%) at 5%. The analysis of the mycelial growth inhibition test by the selected two specific *Trichoderma* isolates suggests their use as novel biocontrol agents and additional research is required to fully explore their potential.

T4OP2: *Trichoderma* Encouraged with Vermicompost in Clampdown of Early Blight and Boosts Potato Tuber Yield

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A field experiment was conducted to assess the effect of *Trichoderma viride* as seed treatment, foliar spray and enriched vermicompost in suppression of early blight in potato variety of K. Bahar at Agricultural Research Station, Kota during the year *rabi* 2021-22 and 2022-23. Early blight of potato (*Alternaria solani* (Ell. and Mart.) Jones and Grout is one of the most serious diseases of potatoes. Trichoderma comes in the category of the most useful bioagents in agriculture. The study revealed that application of *Trichoderma viride* @ 8 g/kg tuber, *T. viride* spore suspension (2x106cfu) @ 8 ml/lit/20kg potato tuber than dry in shade 30 minutes at the time of planting and *T. viride* enriched with vermicompost (1kg: 100 vermicompost) as broadcast at time of planting showed maximum growth of potato plants, minimum disease incidence of early blight, highest total tuber and marketable yield over untreated control. Comparatively, the recommended fungicide Mancozeb 75WP @ 0.25% also provided good disease control but the tuber yield per plot was inferior to *T. viride* treatments. The soil microbial population was carried out in laboratory conditions through serial dilution methods and revealed that

minimum plant pathogens colony was recorded in using *T. viride* treatments and maximum in untreated control.

T4OP3: Assessment of Bacterial Endophytes for Managing Pod Rot of French Bean Caused by *Sclerotium rolfsi* Sacc.

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French bean (*Phaseolus vulgaris* L.) is the most important pulse crop grown for export in India. It suffers heavily from pod rot disease which is incited by *Sclerotium rolfsi* Sacc. The efficient bacterial endophytes *viz*., BS80, BS178, and BS118 revealed significant per cent inhibition of fungal mycelial growth 65.18, 62.59 and 57.03, respectively. All three bacterial endophytes were found compatible and formulated four microbial consortia (MC1, MC2, MC3 and MC4). The endophytes alone and in microbial consortia were evaluated for PGP properties *in-vitro* and revealed the highest seed germination percentage of 88.67 and vigour index 2470.33 when treated with MC4 followed by MC1 showed per cent seed germination and vigour index 86.67 and 2007.33, respectively. All the microbial consortia showed superior to the individual endophytes. Under field condition, Seed treatment + soil application with MC4 showed PDI of 15.87±0.43 followed by MC1 (24.97±0.65) as compared to control (37.30±1.26). The PGP traits revealed that maximum plant height (43.12 cm), no. of branches (5.67), no. of pods/plant (23.43) and weight of 10 pods (94.70 g) were found in the plots treated with MC4 followed by MC1 (37.88 cm, 4.57, 19.53, 85.23 g) but found very low in control as 24.80 cm, 3.87, 12.30 and 62.37g, respectively.

T4OP4: Eco-friendly Guardians: Unleashing Biological Agents against Plant Diseases

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Biological control, a sustainable and environment-friendly approach to pest and disease management, has witnessed significant advancements in recent years. One notable trend is the integration of precision technologies with biological control methods. Advances in sensor technologies, remote sensing, and data analytics allow for a more targeted and efficient deployment of biological control agents. This integration not only enhances the effectiveness of control measures but also minimizes the environmental impact, providing a nuanced and sustainable solution. In addition, the exploration of microbial resources for disease and pest control has gained momentum. The identification and utilization of specific microbes with antagonistic properties against pathogens and pests offer a promising avenue. Researchers are delving into the microbiome of plants and insects to discover novel strains with the potential to enhance biological control efficacy. Furthermore, there is a growing emphasis on understanding the intricate ecological relationships within agroecosystems. This involves studying the interactions between natural enemies, hosts, and the environment to optimize the release and persistence of biological control agents. The holistic approach considers the entire ecosystem, promoting long-term stability and resilience against pests and diseases. Biotechnological tools, including genetic engineering and gene editing, are playing a transformative role in biological control. Researchers are developing genetically modified organisms with enhanced traits for pest and disease resistance. This approach holds promise for creating resilient crops and beneficial organisms that can withstand evolving challenges in the dynamic biological landscape. Lastly, the integration of biological control into integrated pest management (IPM) programs is becoming more widespread. The combined use of biological, cultural, and chemical control methods provides a comprehensive and sustainable approach to pest and disease management. These trends collectively contribute to a more sustainable, effective, and environmentally conscious paradigm for managing pests and diseases in agriculture and public health.

T4OP5: Unveiling the Power of Fungal Antagonists in Sandalwood Wilt Management

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Sandalwood seedlings and trees are confronted with a substantial menace stemming from diseases originating in the soil. Various soil-borne fungi like *Fusarium* sp., *Phytophthora* sp., *Rhizoctonia* sp., *Sclerotium* sp., and *Verticillium* sp., have been found associated with the wilt and mortality in sandalwood seedlings and mature trees. In Himachal Pradesh, the most imminent threat is from *Fusarium* sp. followed by *Phytophthora* sp., accounting for nearly 100 per cent of seedling mortality. The efficacy of fungal antagonists, namely *Trichoderma harzianum, T. viride*, and *T. koningii* (JA and MA strains) for the management of sandalwood wilt was examined. Results obtained under controlled conditions indicated that *T. harzianum* significantly hinders the radial mycelial growth of the *Fusarium* sp. by 76.6 per cent followed by *T. viride* exhibiting inhibition of 57.0 per cent. *In vivo* investigations demonstrated that the application of *T. harzianum* leads to the lowest disease incidence at 22.2 per cent, followed by *T. viride* with a disease incidence of 33.33 per cent in sick pots of *Fusarium* sp. Moreover, sandalwood seedlings subjected to *T. harzianum* treatment demonstrate noteworthy enhancements in root weights, showing increases of 31.46 per cent with respect to the untreated healthy control. In comparison to the diseased control, the root weight of seedlings treated with the same regimen exhibited a substantial increase of 78.69 per cent. However, a maximum inhibition of 55.42 per cent in mycelia of *Phytophthora* sp. was recorded with *T. koningii* (strain JA)

in dual culture. Furthermore, in pot experimentation, a notable enhancement in root weight (83.89%) was observed in Sandal seedlings. These findings suggest a potential biocontrol efficacy of *T. koningii* (Strain JA) against *Phytophthora* sp., highlighting its positive impact on the root development. Hence, the application of *T. harzianum* and *T. koningii* emerges as the most promising bio-control agent against Sandalwood wilt.

T4OP6: Antagonistic Activity of *Trichoderma viride* and *Trichoderma harzianum* against Leaf Spot Fungus *Diaporthe ukurunduensis* Y H Gao & L Cai on *Morus alba*

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Leaf spot disease of mulberry is a severe and protuberant foliar disease in Kashmir Valley. It reduces the quality as well as quantity of mulberry leaf and silk production. A study was carried out to investigate the antagonistic activity of *Trichoderma harzianum* and *Trichoderma viride* isolates against *Diaporthe ukurunduens* is causing leaf spot disease on mulberry. The results revealed that the *Trichoderma harzianum* (Th1) caused maximum inhibition of mycelial growth (68.46%) as compared to *Trichoderma viride* (Tv1) (66.33%), after 7 days of incubation. Both the test isolates of *Trichoderma* significantly reduced the mycelial growth of the *Diaporthe ukurunduensis***.** The application of biocontrol agents, *Trichoderma harzianum* (Th1) and *Trichoderma viride* (Tv1) can be a promising approach and serve as an alternative to fungicides in reducing the leafspot disease of mulberry.

T4OP7: Seed Biopriming: A Novel Biocontrol Approach for Managing Wilt-root Rot Complex in Chickpea (*Cicer arietinum* L.)

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Chickpea (*Cicer arietinum* L.) popularly known as Bengal gram or chana is one of the important pulse crops grown in temperate, sub-tropical, and tropical climate throughout the world. Among the different diseases of chickpea, the wilt and root rot complex are one of the chief constrain and also become a major limiting factor in successful cultivation of chickpea crops in Gujarat state. Nine different biocontrol agents were tested for their antagonistic activity against wilt-root rot pathogens under *in vitro* study by dual culture method. Out of nine antagonistic agents evaluated, the bioagents *T. Harzianum* and *B. subtilis* showed strong antagonistic activity against *F. oxysporum* f. sp. *ciceri* and *F. solani,* while the fungal antagonists *T. virens* and *T. hamatum* were recorded the best antagonists against *M. phaseolina.* In field conditions, seed biopriming treatment for 10 hrs with the suspension of talc-based formulation of *B. subtilis* (1x108 CFU/g) or *T. harzianum* (2x106 CFU/g) successfully managed the wilt and root rot complex disease and also created the positive impact on the seed germination, root and shoot growth and vigour index which are the key factors for better production.

T4OP8: Biological Management of Common Scab of Potato

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Potato is heavily infested by a number of tuber borne diseases. Among the tuber borne diseases nowadays the common scab of potato becoming very serious problem. Common scab causes superficial lesions on the surface of potato tubers and affects the quality of the produce. The affected tubers fetch low prices in the market due to poor appearance and also because deeper peeling is required before consumption. Economic losses due to common scab are primarily due to skin blemishes. By keeping in mind the economic losses due to common scab of potato the experiment was conducted for the biological management of common scab of potato. The five different treatments *viz.,* T1: Seed treatment with *Trichoderma viride* @ 1 liter/ ha seed and soil application with *Trichoderma viride* (1 kg mixed in 100 kg FYM, incubated for a week and applied at the time of planting), T2: Seed treatment with *Pseudomonas fluorescens* @ 1 kg/ha seed and soil application with *Pseudomonas fluorescens* (1 kg mixed in 100 kg FYM, incubate for a week and applied at the time of planting), T3: Seed treatment with *Bacillus subtilis*@ 1 kg/ ha seed and soil application with *Bacillus subtilis* (1 kg mixed in 100 kg FYM, incubate for a week and applied at the time of planting) T4: Seed treatment with 3% boric acid solution + soil application of boric acid @ 4kg/ha and T5: Control. The study was conducted for three years on a fixed plot. The pooled result revealed that the minimum disease incidence and severity (33.95% & 38.67%) was recorded in T4 *i.e.*seed treatment and soil application boric acid which was at par with T3 (39.06% & 44.40%) seed treatment and soil application with *Bacillus subtilis.* The next best treatment in sequence was T2 (47.04% & 46.93%) *i.e.* seed treatment and soil application with *Pseudomonas fluorescens.*

T4OP9: *In-vitro* Evaluation of Bio-active Components from *Brevundimonas diminuta* against *Colletotrichum capsici* Causing Chilli Fruit Rot

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Fruit rot, the fungal disease of chilli caused by *Colletotrichum capsici* (Syd.) Butler and Bisby is the most devastating disease, which cause serious losses in yield and quality. The antagonistic microorganisms are known to secrete enough secondary metabolites (SMs), which possess antimicrobial properties. The cell-free supernatant (CFS) obtained from antagonistic microorganisms contains toxic secondary metabolites, which have antifungal properties. The main

objective of the investigation is to find out the antifungal activity of soil-borne microorganisms. Hence, a total of eight different bacterial isolates were obtained from chilli ecosystem. The cell free supernatant from all the eight bacterial isolates was extracted and tested against *C. capsici* at 2.5, 5.0, 7.5 and 10.0 per cent concentrations. Among the eight different isolates, *Brevundimonas diminuta* and *Bacillus subtilis* were found to be superior in inhibiting the pathogen. The minimum inhibitory concentration value of crude extract from these two bacteria was found to be at >500 ìg/ml. These beneficial bacteria were further identified through different biochemical properties and molecular diagnosis using 16SrDNA universal primers. The antagonistic effect of these organisms against pathogen was found to be clustering of mycelium, hyphal and protoplasm disintegration and also inhibition of appressorium formation.

T4OP10: Biological Control of Rice Blast (*Pyricularia oryzae*) by Using of *Streptomyces* spp. Isolate MK121 in Malwa Region of Punjab, India

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Soil has number of microorganisms like algae, protozoa, fungus and actinomycetes, particularly *Streptomyces* spp. and has antagonistic activity against wide range of plant pathogens. In the recent decennium the popularity of bio-control agents is raised day by day. In present research, for the finding of such principles, *in vitro* suppression of *Pyricularia oryzae* the causal agent of rice blast disease was studied by using of *Streptomyces* spp. isolate *MK121*. The rice seedling-leaves is sprayed with mixed spore suspension of the pathogen and *S*. Isolate *MK121,* resulted shows strong inhibition of the pathogen and suppression of leaf blast symptoms on the plant. The antagonist crude sap of *Streptomyces* isolate MK121 was performed in aqueous cultures and bioactivity was monitored in shaked cultures. The goals of this research including isolation, characterization and identification of the active metabolites of soil microorganisms and future goals include the identification of active genes for use in the development of recombinant DNAs against infection caused *P. oryzae*.

T4OP11: Harnessing Fungal Endophytes from *Vitis vinifera* as Biocontrol Agents against Rot Causing Pathogen *Geotrichum candidum*

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Endophytic fungi are abundant sources of bioactive natural compounds and do not cause symptoms in the plants in which they reside. Endophytic fungi possess many biological activities and have proven to be good biocontrol agents against deadly pathogens. Therefore, it can serve as a great substitute for chemical fungicides. The present study aimed to evaluate the antagonistic effect of some endophytic fungi isolated from the fruits of *Vitis vinifera* L. against *Geotrichum candidum*, a post-harvest rot-causing fungal pathogen. A total of 14 endophytic fungi, *viz*., *Epicoccum vitcis, Nigrospora sphaerica, Arthrinium arundinis, Talaromyces purpurogenus, Trichoderma viride, Trichoderma asperellum, Trichoderma reesi, Alternaria tennuisima, Rhizopus stolonifer, Fusarium oxysporum, Curvularia lunata, Bipolaris spicifera, Fusarium proliferatum, and Chaetomium globosum,* were isolated from fruit samples of *Vitis vinifera.* It was observed from the results that the endophytic fungus *Trichoderma asperellum* showed maximum inhibition against rot causing pathogen *Geotrichum candidum*, followed by *Trichoderma viride.* and *Bipolaris spicifera* exhibited minimum inhibition against the pathogen.

T4OP12: Fungicidal Efficacy of Culturable Phyllosphere Endophytic Bacteria in Suppression of *Bipolaris maydis* causing Maydis Leaf Blight Disease in Maize

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The global human population is on a rapid trajectory of growth, projected to reach 9.7 billion by 2050. Addressing the growing demand for food and nutrition for this population presents a significant challenge. To ensure an adequate food supply, the use of chemical pesticides, including fungicides, becomes inevitable. However, these chemical pesticides have various drawbacks and can have substantial adverse effects on non-target organisms and the broader environment. This is largely due to their elevated toxicity, long residual activity, and resistance to biodegradation. Hence, there is a critical necessity to explore alternative approaches for managing phytopathogens. Biological control of maydis leaf blight (MLB) disease, by harnessing the naturally occurring endophytic bacterial community that shares the common ecological niche *i.e.*, phyllosphere is among the most attractive options which are not explored. The phyllosphere is home to diverse microbial communities that are collectively called a microbiome or phyllomicrobiome. In this study, the culturable endophytic phyllosphere bacterial communities were explored and identified by using 16S rRNA gene sequencing-based molecular identification. The molecular identification revealed a total of 10 bacterial species belonging to *Alcaligenes* (2)*, Brevundimonas* (2), *Pseudomonas* (3), *Microbacterium* (1), *Proteus* (1) and *Stenotrophomonas* (1). Over 50% of the bacterial isolates were able to suppress the mycelial growth of *Bipolaris maydis* either by secretory or volatile metabolites. In planta pathogen challenged evaluation trial revealed the biocontrol potential of *Pseudomonas putida, Brevundimonas olei* and *Stenotrophomonas maltophila* that showed over 60% MLB suppression on maize leaf. The most effective pathogen controlling bacterial isolates were again evaluated for their multi-trait plant growth promoting features where

Stenotrophomonas, Brevundimonas and *Pseudomonas* showed the highest utilization of phosphate, potassium, zinc, etc.

T4OP13: Antagonistic Activity of Soil Bacterial Isolates against Castor Wilt Pathogen *Fusarium oxysporum* f. sp. *ricini*

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Fusarium wilt disease is one of the most widely distributed and destructive diseases causing huge yield loss in castor (*Ricinus communis* L.). The present study was conducted to isolate bacteria from soil and screen their antagonistic property against castor wilt pathogen *Fusarium oxysporum* f. sp. *ricini*. A total of 189 bacterial cultures were isolated from 47 rhizospheric soil samples. The *in vitro* antifungal activity of bacterial isolates was evaluated using dual culture technique. The two isolates SK4-3-3 and SK5-1-3 displayed maximum fungal inhibition with 78.36 and 81.66% antagonistic activity, respectively. The morphological, cultural, biochemical, and molecular studies identified the isolate SK4-3-3 as *Pseudomonas aeruginosa* strain YPAB1 and SK5-1-3 as *Bacillus paralicheniformis* strain YPAB2 having GenBank accession number MK511844 and MK511846, respectively. The *in vivo* inhibition of castor pathogen by talk-based preparations of bacteria was evaluated by pot experiments using wilt susceptible castor genotype JI 35. The bacteria and pathogen were applied alternatively by soil application and root dip inoculation methods. The root dip inoculation of bacteria displayed reduction in wilt incidence; 85% with *Pseudomonas aeruginosa* strain YPAB1 and 76.5% with *Bacillus paralicheniformis* strain YPAB2. The wilt incident decreased significantly upon soil inoculation of bacteria exhibiting 38.3% with *Pseudomonas aeruginosa* strain YPAB1 and 61.7% with *Bacillus paralicheniformis* strain YPAB2. Moreover, the use of *Pseudomonas aeruginosa* strain YPAB1 *via* soil application significantly increased root length of castor plant. Maximum chlorophyll content was observed when *Bacillus paralicheniformis* strain YPAB2 was applied by root dip inoculation.

T4OP14: Field Evaluation of Entomopathogenic Fungi Enriched with Organic Amendments against White Grub, *Holotrichia consanguinea* Blanchard Infesting Groundnut

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White grub, *Holotrichia consanguinea* Blanch (Scarabaeidae: Coleoptera) is polyphagous and the most destructive soil pest inflicting damage to a groundnut crop and causes economic yield losses in India. In this study, the potentiality of the two entomopathogenic fungi (EPF) *viz*., *Metarhizium anisopliae* (Metchnikoff) Sorokin and *Beauveria bassiana* (Balsamo) Vuillemin enriched with organic amendments like neem cake, castor cake, vermicompost, and poultry manure was evaluated to manage population buildup of white grub in groundnut crop. Results showed that the plot treated with soil application of vermicompost @ 1 ton/ha + *M. anisopliae*1.15 WP (1 × 108cfu/g) @ 2 kg/ha showed the least amount of plant mortality due to white grub which was at par with castor cake @ 1 ton/ha + *M. anisopliae*1.15 WP (1 × 108cfu/g) @ 2 kg/ha and neem cake @ 1 ton/ha + *M. anisopliae*1.15 WP (1 × 108cfu/g) @ 2 kg/ha which showed only 1.74, 2.00 and 2.24% plant damage, respectively. Plots treated with vermicompost @ 1 ton/ha + *M. anisopliae*1.15 WP (1 × 108cfu/g) @ 2 kg/ha had the fewest (0.19) white grubs per one meter row length. Based on highest pod yield, net realization and net gain, the treatment with soil application of vermicompost @ 1 ton/ha + *M. anisopliae*1.15 WP (1 × 108cfu/g) @ 2 kg/ha was found most effective treatment for the management of white grub in groundnut. Hence, *M. anisopliae* enriched with various organic amendments, such as vermicompost, castor cake, and neem cake can be used as a healthy alternative to minimize load of synthetic pesticides in groundnut crops for white grub management.

T4OP15: Management of Root-knot Nematode in Pomegranate by Natural Agents

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An on-farm trial (OFT) was conducted to test the efficacy of *Paecilomyces lilacinus* against root-knot nematode in Pomegranate during *Kharif* 2021 and 2022 at farmers' fields in Jalore district. The study revealed that the application of *Paecilomyces lilacinus* @ 20g mixed with neem cake (2 kg) per plant near the root zone (20 cm depth) was significantly superior to the farmer's practices. *Paecilomyces lilacinus* with neem cake reduced the nematode infestation from 25 per cent to 30 per cent while maximum nematode intensity was observed in farmers' practices. Economic yield (25 kg/plant) was also observed in T2 while 10.20 kg/plant was observed in T1.

T4OP16: Evaluation of Biocontrol Potential of Plant Growth Promoting Bacterial Cultures against Anthracnose Disease Pathogen *Colletotrichum*

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Vigna radiata (L.) R. Wilczek is commonly known as green gram or mung bean. It is the third most important pulse next to chickpea and pigeon pea. Its yield is reduced on large scale because of biotic and abiotic stresses. Fungal disease is one of the important biotic stresses. Major fungal diseases of a green gram are anthracnose, macrophomina blight, powdery mildew, and Cercospora leaf spot, which cause up to 40-60% yield loss. The green gram yield loss is up to 20-70% owing to anthracnose caused by seed and soil-borne fungal pathogen *Colletotrichum* sp. In the present study, the *Colletotrichum* sp. was isolated from infected green gram samples collected from Pulses Research Station, S.D.A.U. The fungal isolate was purified after several passages on Potato Dextrose Agar (PDA) medium. The growth characteristics revealed whitish mycelia at initial phase, and later became dark brown in colour after maturity. Microscopic observation showed hyaline, single celled, smooth walled, oblong and rod-shaped conidia characteristic of *Colletotrichum* sp. The plant growth promoting bacteria (PGPB) namely *Bacillus velezensis, Bacillus halotolerance*, *Bacillus cereus* and *Pantoea alhagi* were validated for various plant growth promoting activities. All the four bacterial cultures were positive for nitrogen fixation and ammonia production under *In vitro* condition. *P. alhagi* showed clear zone on Alek sand row agar medium indicating *K solubilization* with *K solubilizing* index (KSI) 2.8 ± 0.02. Further, these PGPB were evaluated for their in vitro biocontrol activity against Colletotrichum sp. by dual culture technique using PDA medium. *B. velezensis* showed maximum fungal growth inhibition (63.33± 2%), followed by *B. halotolerance* (60 ± 2%), *B. cereus* (59.44 ± 2%) and *P. alhagi* (55.56 ± 2%). The results indicated plant growth promoting as well as biocontrol potential of bacterial cultures, which can be further explored as agriculturally important bacterial formulations.

T4OP17: Compatibility of *Trichoderma harzianum* Rifai with Fungicides against Soil Borne Pathogens of Chickpea

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Chickpea wilt and chickpea root rot are considered the most important, devastating and challenging diseases. To overcome such issues, biological is one of the best, low cost and sustainable methods for managing these soil-borne diseases. *Trichoderma harzianum* was isolated from the rhizosphere of disease infected plant. Total of 10 isolates were collected from the middle Gujarat regions and were designated as Th1 to Th10. Dual culture technique was used for the selection of an effective isolate of *T. harzianum* against *Fusarium oxysporum*, *Macrophomina phaseolina* and *Rhizoctonia solani*. Among the 10 isolates of *T. harzianum*, Arnej isolate designated as Th1 found most effective against all three fungus inhibits the mycelial growth of *F. oxysporum* (69.25%), *M. paseolina* (62.59%) and *R. solani* (90%). Ten fungicides with recommended dose and half of the recommended dose were used for the compatibility study of *T. harzianum.* Among ten fungicides four fungicides with recommended and half of the recommended dose were found compatible, whereas, six fungicides found incompatible. Among four fungicides metiram 55% + pyraclostrobin 5% WG was found most compatible recorded 89.33 and 90.00 mm growth, highest spore load/ml 47.67 and 50.00 of *T. harzianum* at recommended and half of the recommended dose, respectively. However, mancozeb 75 % WP was found second most compatible fungicide in regards to mycelial growth, sporulation and spore germination of *T. harzianum* at recommended dose and half of the recommended dose.

T4OP18: *Chaetomium globosum* the Silent Warrior in Biocontrol against Phytopathogens

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Chaetomium globosum is a filamentous fungus that has gained attention for its potential as a biocontrol agent. *C. globosum* shows promise as a biocontrol agent due to its antagonistic properties, production of bioactive compounds, and environmentally friendly nature. *C. globosum* exhibits antagonistic properties against various plant pathogens, including certain fungi and bacteria. It can compete with and inhibit the growth of pathogenic organisms through mechanisms such as competition for nutrients and space. The fungus is known to produce secondary metabolites, such as chaetoglobosins and other bioactive compounds, that have antifungal and antibacterial properties. These metabolites play a role in the biocontrol activity of *C. globosum*. *C. globosum* may act through multiple modes to control plant pathogens. It can parasitize other fungi, produce enzymes that degrade the cell walls of pathogens, and release antifungal compounds that inhibit the growth of target organisms. *Chaetomium globosum* is generally considered safe and environmentally friendly. It has been explored as an alternative to chemical pesticides, providing a sustainable approach to disease management without causing harm to the environment or non-target organisms. Research has been conducted to evaluate the efficacy of *C. globosum* as a biocontrol agent in agriculture. This includes its potential use in controlling diseases in various crops, such as fruits, vegetables, and cereals. The potential of *C. globosum* and its bioactive compounds has led to interest in the development of biopesticides. Biopesticides derived from *C. globosum* can be used as alternatives to chemical pesticides, particularly in integrated pest management strategies. While there is promise in the use of *C. globosum* as a biocontrol agent, further research is needed to understand its interactions with different plant pathogens, optimize application methods, and assess its long-term effects on soil ecosystems. Research suggests that *C. globosum* may have a broad spectrum of activity against various plant pathogens, making it versatile for the management of different plant diseases. This versatility is a valuable characteristic of biocontrol agents. Continued research and development efforts will contribute to unlocking the full

potential of *C. globosum* and expanding its use as a sustainable and effective biocontrol agent in agriculture.

T4PP1: Evaluation of Different Biocontrol Species of *Trichoderma* and PGPR against *Fusarium oxysporum* f. sp. *fragariae* under Laboratory and Field Conditions

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Strawberry (*Fragaria* x *ananassa)* is an important soft fruit crop and grows well under temperate climates. Strawberry production is hampered by various soil borne diseases. Soil borne pathogens such as *Phytophthora, Mycosphaerella, Fusarium, Verticillium, Pythium* cause huge losses in production of strawberry. Fusarium wilt is one of the major soil borne disease of strawberry and causes yield losses throughout the world. To control the outbreak of this disease systemic chemical fungicides are applied at regular intervals during the crop growth. Due to high residual effect of chemical fungicides and direct consumption of fruit biological disease management is useful for the control of disease effectively. Therefore, the present work was envisaged with the objectives to record *in vitro and in vivo* evaluation of different species of *Trichoderma* and Plant Growth Promoting Rhizobacteria (PGPR) in singly or in combination against *Fusarium oxysporum* f. sp. *fragariae*. All the microbial antagonists evaluated *in vitro* and *in vivo*, inhibited the growth of *Fusarium oxysporum* f. sp. *fragariae*. Out of the biocontrol agents *Trichoderma harzianum* significantly arrested the mycelial development *in vitro.* Whereas in field condition consortium of *Pseudomonas chlororaphis* and *Trichoderma harzianum* gave better result to control wilt incidence and also enhance the growth parameters. Therefore, it can be concluded that biocontrol agents specially PGPR not only helps in improving the plant growth parameters but also help in mitigating the loss due to soil borne diseases.

T4PP2: Aptness of Entomopathogenic Fungi, *Beauveria bassiana* (Balsamo) Vuillemin with Insecticides

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Entomopathogenic fungus, *Beauveria bassiana* (Balsamo) Vuillemin is prime facie to combat the notorious sucking pests as well as chewing pests. The farmers only rely on chemical pesticides to combat the insect pests population, which creates problems like resistance, resurgence, residues and adverse impact on health of all animals. To overcome these fatality, compatibility of *B. bassiana* with chemical insecticides is necessitate to retard the insect pests. Hence, *In vitro* study on compatibility of *B. bassiana* with chemical insecticides has been conducted at department of Entomology, CPCA, SDAU, Sardarkrushinagar during year 2023. Total nine insecticides (profenophos 50 EC, chlorantraniliprole 18.5 SC, emamectin benzoate 5 SG, fipronil 5 SC, novaluron 10 EC, lambda cyhalothrin 5 EC, flubendiamide 39.35 SC, spinosad 45 SC, indoxacarb 15.8 EC) were evaluated with *B. bassiana.* The results showed that the insecticide fipronil 5 SC was found to be the most compatible with *B. bassiana,* as it was categorized as harmless (Grade 1). However, novaluron 10 EC, chlorantraniliprole 18.5 SC, flubendiamide 39.35 SC, indoxacarb 15.8 EC and emamectin benzoate 5 SG were relatively harmless (Grade 1) to these fungi while lambda-cyhalothrin 5 EC and spinosad 45 SC were found slightly harmful (Grade 2). Profenophos 50 EC was categorized as harmful (Grade 4).

T4PP3: Influence of Root and Leaf Leachates of Cassava on Rhizosphere Colonizing Fluorescent *Pseudomonas aeruginosa* of Sesamum (*Sesame orientale* L.) Cultivated Land

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The plant–microbe interactions are largely influenced by different allele-chemicals of plant origin. The changing climate and pollutants influence higher plant allocations and plants secondary metabolites (PSM). Our study focused on particular allelopathic soil condition of Chettikulangara village of Onattukara* region in Alappuzha district. Onattukara is well known for the sesame cultivation. A total of 81 bacterial strains were isolated from the soil of sesamum cultivated field which is pre-cultivated with cassava. The best 3 bacterial strains were selected and are morphologically and biochemically identified as *Pseudomonas aeruginosa* by 16 s RNA partial gene sequencing. These strains were deposited in the GenBank P2L3(ON329827), N3D3(ON329826), KMND3(ON329825). All these three strains show antagonistic activity against 5 different fungal strains isolated from the sesamum field. *In vitro* studies to know the interaction between root and leaf leachates of cassava with isolated bacterial strains can confirm the positive influence in the bacterial colony. Cassava variety "Sree Vijaya" is developed by ICAR-Central Tuber Crops Research Institute, Trivandrum, and used as the pre-cultivated crop and for the study. The study focuses on the modes operandi of cassava root and leaf leachates interacting with *Pseudomonas aeruginosa* and how they influence the growth of sesamum. The transcriptome profiling of KMNB3 done in RGCB Trivandrum, after 24 hrs of inoculation in root exudates of cassava also shows the changes in genetic modification within the bacterial strain. The findings will have a direct impact on the remoulding of the present agricultural practices in sesamum cultivation particularly in allelopathic soil condition of Onattukara, which will be a positive thrust to organic farming.

T4PP4: To Evaluate the Efficacy of Selected Bio-agents with Different Combinations against the Early Blight Disease of Tomato Caused by *Alternaria solani* (Ellis and Martin) Jones and Grout

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A field experiment was conducted at the research plot of the Department of Plant Pathology, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, Uttar Pradesh in *Rabi* season of 2021-22 to evaluate different combinations of bio-agents for the management of early blight of tomato caused by *Alternaria solani.* A total of eight treatments namely *Trichoderma viride* + *Bacillius subtilis* + *Pseudomonas fluorescens* (1.6% +1.6% +1.6%), *T. viride* +*P. fluorescens* + Neem seed kernel extract (1.6% +1.6% + 1.6%), *T. viride* + *P. fluorescens* (2.5% + 2.5%), *P. fluorescens* + *B. subtilis* (2.5% + 2.5%), *P. fluorescens* + NSKE (2.5% + 2.5%), *B. subtilis* + NSKE (2.5% + 2.5%), *T. viride* + NSKE (2.5% + 2.5%) including control were replicated three times. During evaluation, all the seven treatments were found significantly superior over control in managing early blight and yield. Among all the tested treatments, *T. viride* +*P. fluorescens* +NSKE (1.6% +1.6% +1.6%) was found significantly superior over control along with all other treatments which recorded minimum disease intensity and maximum fruit yield followed by *T. viride* + *B. subtilis* + *P. fluorescens* (1.6% +1.6% +1.6%). Plant disease intensity decreases with the application of different treatments over untreated control.

T4PP5: Management of Dry Root of Chickpea by Fungal Endophytes Isolated from Selected Medicinal Plants

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A total of 286 strains of fungal endophytes belonging to 19 different genera were isolated from four selected medicinal plants, *viz., Vitex negundo, Ocimum basilicum, Bacopa monnieri* and *Plumbago zeylinica.* The isolated endophytes were tested for their antagonism against dry root rot pathogen, *i.e., Macrophomina phaseolina* by dual culture technique. All the endophytes showed certain degree of antagonism against the pathogen. Best results were shown by *Fusarium falciforme, Chaetomium globosum, Colletotrichum siamense, Trichoderma viride* and *Trichoderma* sp. In-planta screening of the potent endophytes was performed using sick pot technique. Maximum per cent disease inhibition (PDI) was shown by treatments having *Trichoderma* sp. (73.09%) followed by *Trichoderma viride* (69.28%) and *Chaetomium globosum* (65.01%). The treated and untreated plants were also tested for production of defence enzymes *i.e.*, peroxidase, polyphenol oxidase and phenylalanine ammonia lyase. It was observed that the plants treated with potent fungal endophytes showed higher concentration of defence enzymes in the infected areas as compared to untreated plants. This study shows that fungal endophytes have a role in plant growth promotion and disease inhibition and can be used as potential biocontrol agents in future.

T4PP6: *In vitro* Evaluation of Different Bio-agents for their Bio-efficacy against *Sclerotium rolfsii* Sacc.

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Groundnut (*Arachis hypogaea* L.) is an annual legume native to South America. Groundnut plant belongs to family *Fabaceae*. The groundnut is attacked by several fungal diseases. Among them stem rot caused by *Sclerotium rolfsii* Sacc. is the most serious and common disease of groundnut as it is prevalent in almost all the groundnut growing areas of the world, where temperature is sufficiently high to permit the growth and survival of the fungus. The disease symptoms initially appeared in field condition on groundnut crop with dark brown water soaked lesions on stem at collar region and plant gave characteristic yellowing of lower leaves followed by loss of vigour and gradually wilting of whole plant and dried. Wilted plants were easily pulled out from the soil. There was whitish mycelial growth found creeping around the collar region of plants. Such infected plants also gave white to brown coloured, round to spherical sclerotial bodies. The hazardous effects of chemicals used in plant disease management have forced the plant pathologists of the world to find out the use of antagonistic micro-organisms little or no adverse effect on environment. In the present study, five different known *Trichoderma* spp. along with *Pseudomonas fluorescens and Bacillus subtilis* were evaluated for their antagonistic efficacy against *S. rolfsii* by dual culture method. Out of seven antagonists tested, *Trichoderma harzianum* gave significantly the maximum growth inhibition followed by *Trichoderma viride*. The least growth inhibition was recorded by *Bacillus subtilis* and *Trichoderma longibrachyatum.* Although, all the antagonists were found effective in inhibiting the growth of the fungus as compare to control.

T4PP7: *Pseudomonas* Isolates as Emerging Biocontrol Agent

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The ecofriendly way to increase agricultural production involve the biological agents already present in the soil which can enhance plant growth and reduce the pathogenic microbes. Crops are threatened by soil-borne diseases and are often difficult to control, because of the “hidden” status of the pathogens and also because of the absence, noxiousness or lack of efficacy of chemical treatments. In this context twenty *Pseudomonas* isolates (PsEc1 to PsEc20), obtained from the

rhizosphere of desi thor (*Euphorbia caducifolia* Haines) plants, were characterized for their PGPR activity and antagonism against the fungus *Fusarium oxysporum* f. sp. *cumini*, the causal agent of cumin wilt. Morphology of the isolates shows rod shaped, gram negative, oxidase positive and appeared yellowish green, light green to greenish blue or dull white. These isolates were screened for their plant growth promoting ability by testing their influence on seed germination of green gram, production of ammonia, production of IAA, phosphate solubilization, nitrogen fixation and HCN production. Their 16S *r*RNA gene was PCR amplified and these gene sequence data were submitted to the NCBI GenBank with accession numbers respectively, MT775484 to MT775503. BLAST analysis revealed their resemblance with *P. fluorescens* (11), *P. aeruginosa* (3), *P. putida* (3), *P. stutzeri* (2) and *P. syringae* (1). Among these isolates, PsEc17 proved most efficient PGPR and improve the soil health through 69.5 per cent inhibition of *Fusarium oxysporum* f. sp. *cumini* also produced highest, IAA production, seed germination test, phosphate solubilization and HCN production. *Pseudomonas fluorescens* (PsEc17) is proved as best plant growth promoting isolate and can be developed as bioinoculant.

T4PP8: Comparative Efficacy of Seed Treatment with *Trichoderma* spp. for Management of Lentil Wilt Incitant by *Fusarium oxysporum* f. sp. *lentis*

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The present study was undertaken in order to find out the comparative efficacy of seed treatment with four *Trichoderma* species *viz., Trichoderma viride, Trichoderma harzianum, Trichoderma virens* and *Trichoderma azospirillum* against *Fusarium oxysporum* f. sp. *lentis* incited wilt in lentil. Four antagonistic were tested as seed treatment under pot experiment for their comparative efficacy against seed germination and wilt disease incidence due to *F. oxysporum* f. sp. *lentis* in lentil crop under sick soil. Lentil grain yield was also recorded. Seed treatment with spore suspension of *Trichoderma viride* containing the approximate spore concentrations 1x108 spores/ml, @ 0.6% /kg of seeds was found most effective with maximum seed germination (97.33%) and lowest disease incidence (36.99%) also recorded disease control (55.78%) over control followed by *Trichoderma harzianum*. Among treated pots highest grain yield recorded (23.00 g/pot) in *Trichoderma viride* followed by *Trichoderma harzianum* (20.00 g/pot) applied through seed treatment.

T4PP9: Host Range of *Metarhizium anisopliae* (Metchnikoff) Sorokin

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Entomopathogenic fungi were the first to be identified as disease-causing microorganisms in insects and are important insect population regulators. They are used as a bio-pesticide in agriculture against a variety of insect pests, including lepidopterous larvae, aphids and thrips. Microbial control agents are believed to be an effective, environment friendly, economical and alternative to chemical pesticides for the management of insect pest. One appealing feature of these fungi is that their virulence is caused by contact and their action is carried out through penetration. *Metarhizium* causes a disease known as 'green muscardine' in insects because of the green colour of its conidial cells. *M. anisopliae is* a widely used entomopathogenic fungus for the biocontrol of incest pests. Species within the genus *Metarhizium* are pathogenic having broad host ranges. It has been demonstrated to control over 200 different insect pests from several orders, including Lepidoptera, Orthoptera, Hemiptera, Coleoptera, Dermoptera, etc. It is extensively recognized as a biocontrol agent for a wide range of insect pests such as termites, whiteflies, corn borers, locusts, aphids, mealy bugs and thrips. It is widely distributed in soil and has very broad range of crop pests including elm bark beetle, plant hoppers, coconut leaf beetle, rhinoceros beetle, onion thrips, storage cowpea, white grub, cattle tick and also termite species. The striking feature of this fungus is that it infects through contact and acts either through penetration.

T4PP10: An *in-vitro* Evaluation of Different Bioagents against *Xanthomonas campestris* pv. *campestris* Causing Black Rot of Cabbage

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The effective application of antagonistic bacteria and fungi to suppress the pathogenic microorganisms has been found an alternative to chemicals as well as safe for the environment. Such biocontrol agents also play vast role in promoting overall healthy plant growth (PGPRs) and have huge potential to assist the human being in fighting the plant diseases in an eco-safe way. In this direction, the effect of five biocontrol agents *viz. Trichoderma viride, T. harzianum, T. asperellum, Pseudomonas fluorescens* and *Bacillus subtilis* were evaluated for their antagonistic activity against *Xanthomonas campestris* pv. *campestris* (*Xcc*) by agar diffusion method (dual inoculation) and the results indicated that the *Trichoderma harzianum* was highly antagonistic to *Xcc* with (70.39%) highest per cent inhibition followed by *T. asperellum* (64.95%) and *P. fluorescens.*

T4PP11: Bio-efficacy of Biopesticides Evaluated against Corn Leaf Aphid, *Rhopalosiphum maidis* (Fitch) Infesting Maize

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For the control of maize aphid, *Rhopalosiphum maidis* (Fitch) in field condition on maize crop was carried out at entomology

farm, Anand Agricultural University, Anand during 2021-22. Among the seven biopesticides studied against aphid, on tassel *Lecanicillium lecanii* 1.15% WP conclude most effective followed by *Metarhizium anisopliae* 1.15% WP and *Beauveria bassiana* 5% WP and similarly, on cob *L. lecanii* 1.15% WP found most effective followed by *M. anisopliae* 1.15% WP and *B. bassiana* 5% WP. Minimum aphid reduction observed in garlic bulb extract 5% and neem seed kernel extract 5%. Further, Plot treated with *L. lecanii* 1.15% WP*, M. anisopliae* 1.15% WP and *B. bassiana* 5% WP gave highest grain yield 5523, 5503, 5462 kg/ha., green fodder yield 7491, 7443 and 7244 kg/ha., dry fodder yield 5977, 5921 and 5705 kg/ha, respectively. For natural enemies; *L. lecanii* 1.15% WP observed toxic to LBB adults on tassel and on cob which was at par with *M. anisopliae* 1.15% WP and *B. bassiana* 5% WP. While, neem oil 1% and neem seed kernel extract 5% found less toxic compared to other treated bio-pesticides. Looking to grub, on tassel neem oil 1% found most toxic which was at par with *L. lecanii* 1.15% WP*, M. anisopliae* 1.15% WP and *B. bassiana* 5% WP. While, neem seed kernel extract 5%, azadirachtin 0.15% EC and garlic bulb extract 5% noticed less toxic to grubs. On cob *L. lecanii* 1.15% WP observed toxic to grub followed by *M. anisopliae* 1.15% WP, neem oil 1% and *B. bassiana* 5% WP and azadirachtin 0.15% EC found less toxic compared to other treatments.

T4PP12: High Throughput Screening Technique for Evaluation of Cell Free Supernatant of Antagonistic Bacteria against *Colletotrichum capsici* Causing Chilli Fruit Rot

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Chilli fruit rot is a devastating disease causing severe losses in yield as well as quality. The biological management of the disease using antagonistic microorganisms is of major concern as the disease causes post-harvest losses. The antagonistic microorganisms especially bacteria known to secrete plenty of toxic secondary metabolites having antimicrobial properties. Products in the form of microbe-produced metabolites are currently gaining popularity among researchers, although they are less well known among farmers, in comparison to microbial cell inoculants, packaged as either single microbial strains or consortia, which have been commercialized for quite some time. The laborious and time-consuming secondary metabolites screening methods require significantly large quantities of test material. High throughput screening (HTS) technologies are important procedures utilized for the screening and inhibitor identification to minimize and optimize the time required for lead identification from the large number of bioactive secondary metabolites to the very specific, potential and target oriented discovery. Resazurin is a redox dye that shows colorimetric and fluorometric changes related to cellular metabolic activity. For cell viability test, the sterile 96 wells microplate was labeled and used. The colour change from blue to pink or colourless was recorded as metabolically active cells and colour change to pink was recorded as metabolically inactive cells.

T4PP13: Extraction and Characterization of Fumonisin Produced by *Fusarium verticillioides* Incitant of Ear Rot of Maize and its Bio-degradation by *Lactobacillus penetrans* MYSN-23

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Fumonisin, a mycotoxin produced by *Fusarium verticillioides* (Sacc.), frequently contaminate maize and its products worldwide. It is a diester of propane-1, 2, 3-tricarboxylic acid (TCA) and 2-amino, 12, 16-dimethyl, 3, 5, 10, 14, 15-penta hydroxylcosane with empirical formula of C H NO (relative molecular mass: 721g mol-1). Fumonisin contamination is associated with most important diseases such as leukoencephalomalacia in horses, pulmonary edema in swine and esophageal cancer in human beings. Hence it is inevitable to produce the concentration of fumonisin below the maximum tolerable daily intake limit. The physical and chemical methods employed to prevent the mycotoxin contamination are not fruitful when public health has been taken into consideration. There present investigation focused on the utility of probiotic *i.e. Lactobacillus penetrans* MYSN-23 which completely degraded the fumonisin (100%) by adsorption or binding with the toxin, over an incubation period of 120 min and safe guard the maiz against *F. verticillioides* by production of antifungal compounds. Hence *Lactobacillus penetrans* MYSN-23 can be used as natural preservative as well as a promising tool in poultry and animal maize based feed to minimize the mycotoxin contamination.

T4PP14: Efficacy of Phytoextracts, Bioagents and Fungicides against Sclerotinia Sclerotiorum *in vitro*

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The investigation was carried out to estimate phytoextracts, bioagents and fungicides against *Sclerotinia sclerotiorum in vitro* in mustard**.** Crop were sown in randomized block design with three replications during *Rabi*, 2022, at Research Farm of Swami Keshwanand Rajasthan Agriculture University, Bikaner. The efficacy of nine plant extracts were tested against *S. sclerotiorum* on PDA by Poisoned Food Technique. Among nine plant extracts, extract of garlic cloves was found most effective in inhibiting mycelial growth (50.48, 64.04 and 83.51%) of *S. sclerotiorum* at 5, 10 and 15 per cent. Extracts of giloy, tumbakheep and tulsi were found least effective in inhibiting mycelial growth of *S. sclerotiorum* over control. The antagonistic action of two fungal bioagents *viz., Trichoderma viride* and *Trichoderma harzianum* and two bacterial bioagents *viz., Pseudomonas flurosence* and *Bacillus subtilis* were evaluated against test pathogen by dual culture and paper disc method respectively. The result observed that mycelial growth

was least in the prescence of *T. harzianum* (28.34mm). The efficacy of eleven fungicides was evaluated against *S. sclerotiorum*on PDA by poisoned food technique. Among these, carbendazim + mencozeb and propiconazole were found cent per cent inhibitory at 100, 200 and 500 ppm. Least effective at all concentration copper oxychloride against *S. sclerotioum* was found.

T4PP15: Evaluation of Organic Inputs against *Colletotrichum truncatum* Under *in-vitro* Conditions

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The black gram (*Vigna mungo* L. Hepper) commonly known as urdbean, belonging to the family Leguminosae is an important pulse crop grown in India and Gujarat. The black gram field is mainly affected by biotic and abiotic stresses, among biotic stresses diseases are major ones. The major diseases infecting black gram are anthracnose, powdery mildew, Cercospora leaf spot, stem canker, bacterial leaf blight, yellow mosaic and leaf crinkle. Among them occurrence of anthracnose is common caused by *Colletotrichum* spp. is major ones. The efficacy of different organic inputs (*Panchagavya*, *Jeevamrutha*, *Beejamrutha*, cow urine and vermiwash) were tested *in-vitro* by using poisoned food technique to know their inhibitory effect on the growth of *Colletotrichum truncatum*. Among them, vermiwash was found superior with 66.48 per cent growth inhibition and 30.16 per cent least mycelial growth at 3 per cent concentration, while *Panchagavya* was found superior with 80.22 per cent growth inhibition and 30.16 per cent least mycelial growth at 5 per cent concentration. Lowest growth inhibition 34.22 per cent was recorded in *Panchagavya* and 33.04 per cent in cow urine at 3 and 5 per cent concentration, respectively. The present study showed that all the organic inputs were effective in reducing mycelial growth of *C. truncatum*. The effectiveness of antifungal activity of organic inputs found significantly increased with increase in their concentration except in cow urine and *Beejamrutha*.

T4PP16: Plant Growth Promoting Activity of *Bacillus* Bacteria from Banas River

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Total of fifteen rod shaped gram positive *Bacillus* isolates from Banas river. The cells of three isolates Bbr11, Bbr12 and Bbr13 appeared in chains (streptobacilli) whereas the rest isolates were diplobacilli in nature. The isolates produced irregular, undulate and creamish dull colonies with ground glass appearance on Nutrient agar medium and all the isolates produced endospore. The isolates were studied for their plant growth promoting activities for plants as Indole acetic acid production, phosphate solubilization, seed germination and nitrogen fixation. Inoculation of green gram seeds with the isolate Bbr5 showed maximum increase of root length and seedling fresh weight which were respectively 41.17% and 9.80% higher over control. Whereas the isolate Bbr4 resulted in increased shoot growth over control by 43.85 percent. IAA production by various isolates ranged from 21.23 ìg/ml (Bbr8) to 68.17 ìg/ml (Bbr5). Thus, Bbr5 was most efficient in IAA production which was followed closely by Bbr4 (63.74ìg/ml) and Bbr11 (53.06ìg/ml). phosphate solubilization by the various isolates of Bacillus bacteria from Banas River has been presented. Phosphate solubilization by the isolates ranged from 10.71ìg/ml (Bbr2) to 52.02ìg/ml (Bbr5). Thus, Bbr5 was most capable of solubilizing tricalcium phosphate. However, it was followed by the isolates Bbr10 and Bbr4, which respectively showed phosphate solubilization of 39.33 ìg/ml and 37.84 ìg/ml after an incubation of 48 h. In the present investigation, nitrogen-fixing ability of the isolates were identified by growing them on nitrogen free medium followed by sub-culturing them repeatedly on such N-free medium. If the bacterium showed pellicle formation in the subsurface layer and retained its ability to grow on N free medium even after several subculturing cycles, the bacteria was supposed to possess the ability of nitrogen fixation. The observation revealed that only two isolates Bbr4 and Bbr5 showed positive result for nitrogen fixation.

T4PP17: Mitigation of Wilt Disease of Tomato (*Fusarium oxysporum* f. sp. *lycopersici*) with Solid-state Fermentation Formulation of *Trichoderma* Species

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The present investigation was undertaken to develop an effective bio-management module to combat the *Fusarium* wilt disease of tomato caused by *Fusarium oxysporum* f.sp. *lycopersici* (FOL). Initially, the studies were conducted to evaluate six multi-facial biocontrol isolates of *Trichoderma* species *viz*., *Trichoderma harzianum AMUTH-1, T. harzianum AMUTH-2, T. harzianum AMUTH-3, T. asperellum (= T. viride) AMUTV-1, T. asperellum AMUTV-3 and T. virens (= Gliocladium virens) AMUTS-1* against FOL *in vitro.* Among these antagonists, *T. harzianum* AMUTH-1 and *T. asperellum* AMUTV-3 exhibited the maximum inhibitory effect while *T. virens* AMUTS-1 was recorded as the least effective *Trichoderma* isolate against FOL *in vitro*. Interestingly, *T. harzianum* AMUTH-1 and *T. asperellum* AMUTV-3 were found to produce indole acetic acid, siderophore and possess high enzymatic activities (cellulase, chitinase, ligninase and protease) *in vitro.* Further, pot trials were conducted and the chemical fungicide, carbendazim was used to compare the effectiveness of *Trichoderma* isolates. Pot trials also verified the efficacy of *T. harzianum* AMUTH-1 with 9-28% enhancement in the plant-growth parameters and 15-21% biomass production, and 88% decrease in the soil population of

FOL. The effect of *T. harzianum* AMUTH-1 was also at par with fungicides, carbendazim.

T4PP18: Non-pathogenic *Fusarium* Strains as a Biocontrol Agent

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Fusarium oxysporum is a significant fungal group within the soilborne microflora, recognized for its ability to induce wilt or root rots in various agricultural crops worldwide. While some strains act as saprophytes in the rhizosphere of plants, others exhibit pathogenic behaviour, posing threats to crop health. Interestingly, certain non- pathogenic strains of *F. oxysporum* have been identified and these play a crucial role in protecting plants from their pathogenic counterparts. Phenotypic and genetic studies have revealed considerable diversity among *F. oxysporum* populations. The non-pathogenic strains, initially isolated from suppressive soils, exhibit multiple modes of action against pathogenic strains, positioning them as promising biocontrol agents. These strains compete for nutrients in the soil, inhibit chlamydospore germination of pathogens, via through infection sites on the root, and induce systemic resistance in host plant species. The practical application involves formulating non-pathogenic *Fusarium* strains in talc and charcoal-based media, with commercial formulations readily available. Combining these strains with other biocontrol agents has proven effective in achieving comprehensive biocontrol of plant pathogens. This integrated approach holds great promise for sustainable agriculture by reducing reliance on chemical pesticides. These strains of *Fusarium* have been successfully combined with other biocontrol agents to obtain an effective biocontrol of plant pathogens. For the application of non-pathogenic *Fusarium* under field conditions some additional research is needed in several areas including field studies and integration into production systems; risk assessment; and genetic improvement of biocontrol agents.

T4PP19: Exploring the Potentiality of Rhizospheric Antagonistic Bacterial Isolates against *Macrophomina phaseolina* (Tassi) Goid. in Black Gram

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Black gram is an important pulse crop occupying a unique position in Indian agriculture and is a major source of protein (24%). *Macrophomina phaseolina*, causing root rot disease in black gram is a potential threat under Indian condition. The present study aimed at isolating bacteria from rhizospheric zone of higher trees and evaluate their antagonistic activity against *M. phaseolina* by dual- culture technique. Total of twelve bacterial isolates having different morphological characters were isolated and tested *in-vitro* against *M. phaseolina*. Among five bacterial isolates, three isolates from Anand, one is from Navsari and one is from Junagadh, Gujarat showed strong inhibition (?70%) against *M. phaseolina*. These potential isolates were further examined for their morphological and biochemical characteristic. Bacterial diversity is checked by ARDRA analysis and on the basis of 16S rDNA gene sequencing isolates were identified and named as *Bacillus licheniformis* AAU BCM 1 *Bacillus stratosphericus* AAU BCM 2, *Pseudomonas aeruginosa* AAU BCM 3, *Pseudomonas azotoformans* AAU BCM 4, *Stenotrophomonas* sp. AAU BCM 5. Under pot conditions, among all the treatments, treatment with *P. aeruginosa* was the best treatment which gave the highest seed germination, shoot length, root length, vigour index and the lowest per cent seedling mortality in black gram as compared to control. Treatment of black gram plants with bacterial isolates and subsequent inoculation with *M. phaseolina* led to increased phenol and peroxidase activity, peaking at 45 DAS, followed by 30 DAS and lowest at 15 DAS. Among all plant regions, the leaf exhibited the highest phenolic activity, followed by the collar region and root. Additionally, in root tissues, peroxidase activity was most prominent, followed by the leaf and collar region. Notably, the treatment with the antagonistic bacterial isolate *P. aeruginosa* (AF 4) combined with challenge inoculation of *M. phaseolina* showed the highest phenol and peroxidase activity. In view of these, the apparent bacterial biocontrol agents could provide a mean for reducing the disease incidence in addition to limiting the use of fungicides. Based on the above studies, it can be concluded that such biocontrol approach should be employed as a part of an integrated disease management system.

T4PP20: Evaluation of Inhibitory Effect of Biocontrol Agents against *Alternariaster helianthi* Causing Alternaria Leaf Blight of Sunflower under *in-vitro* Conditions

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Sunflower (*Helianthus annuus*) is the world's fourth largest oilseed crop and its seeds are used as food and its dried stalk as fuel. However, sunflower is invaded by many plant pathogens. Among them, Alternaria leaf blight caused by *Alternariaster helianthi* is one of the important foliar diseases. Continuous usage of chemical methods causes environmental, soil and water pollution. Whereas biological control of diseases is long-lasting, inexpensive, eco-friendly and harmless to target organisms. In this context, it is aimed to evaluate five bioagents namely (*Trichoderma viride, T. harzianum, T. asperellum, Pseudomonas fluorescens* and *Bacillus subtilis*) against *A. helianthi* by dual culture method. The result showed that *T. harzianum* showed maximum percentage inhibition of mycelial growth followed by *T. viride.*

T4PP21: Bio-efficacy of Different Bioagents against Alternaria Leaf Spot of Castor

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Alternaria leaf spot, caused by the fungus *Alternaria ricini*, poses a significant threat to castor (*Ricinus communis*) cultivation worldwide. Cultural practices played a pivotal role in disease management. Crop rotation with non-host crops exhibited a significant reduction in disease incidence. Sanitation practices, including the prompt removal and destruction of infected plant debris, were found to be crucial in preventing the overwintering of the pathogen. The evaluation of castor germplasm revealed promising results in the identification of resistant varieties. Breeding efforts focused on developing cultivars with inherent resistance to Alternaria leaf spot, offering a sustainable, long-term solution to farmers. Fungicide trials were conducted to assess the efficacy of various chemical formulations. Azoxystrobin, mancozeb, and chlorothalonil demonstrated effective control, and an integrated pest management (IPM) approach was recommended to minimize environmental impact and enhance the longevity of chemical control strategies. Biological control agents, including selected antagonistic fungi and bacteria, were tested for their ability to suppress *Alternaria ricini*. Initial findings suggest the potential of these biopesticides as environmentally friendly alternatives in disease management.

T4PP22: Deciphering of *Bacillus* spp. As a Potential Biological Control Agent for Spot Blotch of Wheat

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Spot blotch caused by *Bipolaris sorokiniana* is one of the most devastating diseases in the warm and humid wheat growing areas around the world including South Asia, Latin America and Africa. It can cause upto more than 80% yield loss under the presence of high temperature and high humidity environmental conditions. It can infect leaves, stem, roots, rachis and seeds and is able to produce toxins like helminthosporol and sorokinianin. However, with the changing climate, infection of wheat by *B. sorokiniana* is increasing and may be defined as the major pathogen in the major wheat growing areas of the world. Most of the commercially grown cultivars are moderately resistant to susceptible against spot blotch and are subjected to significant yield losses under conducive climatic conditions. Therefore, there is an urgent need to find sustainable and effective strategies for controlling this disease. So far, biocontrol approach has attracted huge scientific attention since they are environmentally friendly, sustainable, and effective approach. Among the several endophytic biocontrol agents reported so far, *Bacillus* spp. is widely used and developed in agriculture, which has the advantage over other biocontrol microorganisms because of producing various antifungal compounds and strong tolerance to extreme conditions changes. Moreover, several species of *Bacillus* such as *Bacillus subtilis* TE3 and *Bacillus amyloliquefaciens* XZ34-1 were verified to be highly effective against spot blotch pathogen. The underlying mechanisms of action included as apoptosis by disrupting the cell membrane integrity, decreasing mitochondrial membrane potential (MMP) and accumulation of reactive oxygen species (ROS) in the mycelia cell, thereby inhibiting the growth of pathogen, and producing of various growth promoting substances for the overall growth of wheat plant. Therefore, *Bacillus* spp. could be a promising biological control that can be used as a sustainable alternative to control spot blotch of wheat.

T4PP23: Bio-efficacy of Crude Extract of Different *Pleurotus* spp. against Plant Parasitic Nematodes

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Plant parasitic nematodes are a significant threat to agricultural productivity, causing substantial economic losses worldwide. In search of sustainable and eco-friendly alternatives to synthetic nematicides, the bio-efficacy of crude extracts derived from different *Pleurotus* spp. against plant parasitic nematodes. Crude extracts were obtained from five species of *Pleurotus* spp., including *Pleurotus ostreatus, Pleurotus sajor-caju, Pleurotus pulmonarius, Pleurotus djamor* and *Pleurotus columbines* through a standardized extraction process. These extracts were evaluated for their nematicidal potential against *Meloidogyne* spp., a widely distributed and economically important plant parasitic nematode. On water agar, all of the species tested produced tiny droplets of toxin. Filtrates of the tested fungi grown in potato dextrose broth were toxic on the nematodes but this toxicity varied between species. Culture filtrates of *Pleurotus ostreatus* showed the highest nematicidal activity toward *Meloidogyne* spp. and the lowest toxic effect was observed in filtrates of *Pleurotus columbinus*. The findings suggest that *Pleurotus* spp. extracts could serve as a potential eco-friendly and sustainable alternative for nematode management in agriculture, contributing to the development of novel bio-pesticides.

T4PP24: Endophytic Microorganism: Prospects in Pest Management

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Endophytic microorganisms are of great importance for protecting plants against pests including insects, nematodes,

plant pathogenic fungi, and bacteria. The word endophyte connotes "in the plant," and studies have established that endophytes emanate from the phyllosphere and rhizosphere. Among the endophyte, the large population is shared by fungi alone and others are bacteria and actinomycetes. They exhibit a symbiotic association with the tissues of most plants. Fungal endophytes isolated in vitro from *Artemisia annua* can suppress the growth of most phyto-pathogenic organisms by the production of antifungal compounds such as n-butanol and ethyl acetate. Lolines alkaloids produced by *Neotyphodium* sp. showed broad-spectrum insecticidal activity. The isolate of *Enterobacter cloacae* was observed to have control action against diamondback moth. Fengycin was found to be effective on *Botrytis cinerea*, causing the grey mold disease in many plants especially in apple. *Streptomyces* sp. is one of the dominant genera, which is most commonly isolated as endophytic actinomycetes. The nature of colonization in the internal tissue has made the endophytes a valuable tool for crop improvement performance in agriculture. They are widely distributed in the vascular bundles which aid in their distribution throughout the plant, fungal endophytes colonize asymptomatically in both inter and intracellular manner. The use of endophytes proves to be an alternative of great potential in the fields of biocontrol. Endophytes are an important component of sustainable agriculture in view of their ability to inhibit pest, produce phytohormones and promote plant growth. Endophytes as biological control agents produce potent bioactive secondary metabolites which offer a novel management avenue for the pest.

Theme 5: Diversified Approaches in Plant and Soil Health Management

T5OP1: Development of Technologies for the Management of Soil Borne Diseases of Groundnut

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A field experiment was conducted at the Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh (Gujarat) during *Kharif* for three consecutive seasons of the year 2017-18, 2018-19 and 2019-12 to evaluate the effect of deep summer ploughing, fungicide, and its combinations with biological control agents for minimizing soil borne diseases of groundnut. The highest income (Rs.55087) and net realization (Rs.48952) were obtained in the treatment T4 comprising of Deep summer ploughing with mould board plough + Soil application of *Trichoderma harzianum* @ 4 kg/ ha enriched in 250 kg FYM/ha + Seed treatment with Tebuconazole 2DS @ 1.5 g/ kg of seeds followed by seed treatment with PGPR @ 625 g / ha of seeds + Soil application of *T. harzianum* @ 4 kg/ ha enriched in 250 kg FYM/ha at 35 and 70 DAS was carried out with ICBR of 1: 8.98. This treatment also reduced collar rot (75%) and stems rot (74.64%) diseases of groundnut with increasing pod yield (76.47%) and haulm yield (67.87%) as compared to control.

T5OP2: Effect of Nutrients and Plant Extracts on Alternaria Blight of Tomato Caused by *Alternaria alternata*

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Studies with nutrients and phyto-extracts were performed *in vitro* and *in vivo* to assess their potential in controlling Alternaria blight of tomato (*Solanum lycopersicum* L., syn.= *Lycopersicon esculentum* Mill.) caused by *Alternaria alternata.* It has become a severe menace to the growers of Rajasthan in India and in general, causes economic losses under changing climatic scenarios. In the present study, seven nutritional elements (copper, calcium, zinc, magnesium, potassium, iron and boron) at 100, 300 and 500 ppm concentration and seven botanicals (*Calotropis gigantea, Alstonia scholaris, Gingiber ofcinale, Allium sativum, Azadirachta indica, Datura stramonium* and *Aloe barbadensis*) at 5, 10 and 15% concentrations were evaluated *in vitro* by poisoned food technique. In field experiments, further these nutrients (at 0.5% conc.) and plant extracts (at 10% conc.) were assessed by two foliar applications to control the disease. The results of *in vitro* studies with copper and zinc showed the most significant antifungal activity at all tested concentrations. In botanicals, the 100% inhibition of mycelial growth was obtained with garlic extract at 10% concentration. In field conditions, two foliar applications of copper sulphate (0.5%) were proved the most effective in reducing disease intensity (46.94%) and in increasing fruit yield (43.75%) followed by zinc sulphate. In plant extracts, garlic extract (10%) proved superior in reducing disease intensity (58.16%) and in increasing fruit yield (49.47%) followed by neem leaf extract. The results of this study indicate that foliar application garlic extract has great potential to be used to manage disease effectively and eco-friendly for the betterment of the end users. In lieu of consumer health, present findings may be helpful for growers to get extra benefits by producing organic tomato.

T5OP3: Arbuscular Mycorrhizal Fungi Impart Growth Promotion and Protection against Fungal Diseases in Yard Long Bean

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Arbuscular mycorrhizal fungi (AMF) have been reported to enhance plant growth and offer protection against fungal and bacterial diseases in crop plants. A study was undertaken to assess the individual effect of soil application of AMF at sowing as well as its combined effect with biofumigation using

bulbs of *Allium sativum* (garlic) on germination and seedling vigour of yard long bean plants (var. KAU Deepika). The highest germination percentage (83.67%) was observed when the major component of garlic essential oil *viz*., diallyl disulphide (0.30%) was drenched in soil followed by application of AMF @ 5g seed-1 atsowing. The next best treatment with the highest germination percentage was soil application of AMF @ 5g seed-1 atsowing (82.45%) when compared to untreated control (71.43%) at 2 weeks after sowing. Sowing of biofumigated seeds in soil applied with AMF @ 5g seed-1 recorded the highest seedling height (19.50 cm) and number of leaves (5.70). The maximum number of pods per plant (56.60), pod yield per plant (1.49 kg) and number of harvests (17.93) as well as the highest inhibition (PDI - 11.55) of powdery mildew disease were recorded in the plants applied with AMF (5g plant-1) in soil at the time of planting and foliar spray of sodium bicarbonate (0.5%) at 20, 40 and 60 days after planting compared to control (PDI - 50.17).

T5OP4: Plant Growth-promoting Potential of Multitrait Halotolerant Phosphate-solubilizing Bacteria Isolated from the Kutch Desert Soils

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Salinity stress is a major factor predisposing plants to diseases by weakening their natural defense mechanisms. This study evaluated the potential of plant growth promotion by three halotolerant phosphate solubilizing bacterial strains-*Enterobacter bugandensis* PH27, *Psychrobacter faecalis* PH28, and *Bacillus amyloliquefaciens* PH30-isolated from Kutch desert soils and identified through 16S rRNA sequencing. These strains demonstrated considerable phosphate and zinc solubilization capabilities and high salt tolerance, with phosphate solubilizing indices of 2.56, 2.86, and 1.37, respectively, and an ability to withstand salt concentrations up to 7.5% NaCl. Quantitative analysis revealed that isolate PH27 and PH28 had superior phosphate solubilization efficiency, with concentrations reaching 2.3 and 2.6 µmoles mL-1, respectively. Additionally, the enzymatic activity assessment demonstrated diverse trends in acid and alkaline phosphatase activities across the strains, with PH30 maintaining superior performance over the 96-hour study period. Furthermore, the research evaluated the influence of these strains on the growth of pea GDF-1, wheat GW-451, and mung bean GM-4. Notably, *B. amyloliquefaciens* PH30 consistently improved seed germination, plant height, dry weight, and leaf area, enhancing soil fertility through increased phosphorus availability. Healthier crops, better equipped to resist infections and pathogen attacks, enrich the soil with organic matter and nutrients, fostering a beneficial microenvironment. This effect is crucial in harsh environments like the Kutch desert, where conditions heighten plant disease vulnerability. Additionally, using these bacteria in agriculture may reduce reliance on chemical inputs like fertilizers and pesticides, often needed to counteract salinity and disease effects. This research underscores the transformative potential of halotolerant phosphate-solubilizing bacteria, particularly *B. amyloliquefaciens* PH30, as a cornerstone in developing resilient and sustainable agricultural systems.

T5OP5: Influence of Pendimethalin and Metsulfuron-methyl on Beneficial Soil Bacterial Population in Wheat

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The associated weeds of wheat crops act as a carrier of many plant pathogens. However, weedicides used for control of these weeds may influence native bacterial population. In this view effect of different concentrations of pendimethalin and metsulfuron-methyl on beneficial soil bacterial population were tested in wheat crop. The investigation consisted of nine treatments; T1-pendimethalin (@1.0 kg.ai.ha-1) pre-emergence, T2 - pendimethalin (@2.0 kg.ai.ha-1) pre-emergence, T3 - metsulfuron-methyl (@4.0 g.ai.ha-1) post-emergence (30DAS), T4 - metsulfuron-methyl (@8.0 g.ai.ha-1) post-emergence (30DAS), T5 - T1 + T3, T6 - T2 + T3, T7 - T1 + T4, T8 - T2 + T4 and T9 – control. The initial observation of soil population of various beneficial bacteria showed non-significant variation among the treatments. However, at 10, 20, 40, and 120 days-after-sowing, bacterial population showed significant variation among the treatments. The highest bacterial populations were observed in the control, where no weedicides were applied. The least soil population of *Azotobacter,* phosphate solubilizing bacteria, and actinomycetes. were observed in the treatment T8 at 40th day of incubation. In this treatment pendimethalin was applied as pre-emergence @ 2.0 kg.ai.ha^{-1} and metsulfuron-methyl as post-emergence at 30 DAS @4.0 g.ai.ha^{-1}. However, Application of pendimethalin @1.0 kg ai ha^{-1} (pre-emergence) and metsulfuron-methyl @4.0 g.ai. ha^{-1}(post-emergence) in wheat showed the least inhibitory effect on the soil population of N-fixing bacteria, phosphate- solubilizing bacteria, and actinomycetes.

T5OP6: Development of Agricultural Wastes Enriched Hydrogel Composites and Fungicidal Formulations for Evaluation in Mungbean

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Mungbean, a major pulse crop in India is grown as summer crop which predominantly suffers from water scarcity and attack of soil borne diseases like wet root rot or web blight (causal organism *Rizoctonia solani*) and dry root rot or Macrophomina blight (causal organism *Rizoctonia bataticola*). Out of these two damage due to *Rizoctonia solani* is more

prevalent. To combat this pathogen, it is therefore additionally emphasis on greener options i.e controlled release formulations as alternatives to synthetic options and as the integrated disease management (IDM) component necessitates development of quality products with enhanced shelf life and field viability. Excipients namely agriresidue-based hydrogel composites have been developed from agri-residue sources namely, sugarcane bagasse and corn cob. Two series of hydrogel composites with the water absorption capacity of the order of > 350 g/g – 690 g/g on dry weight basis have been synthesised using raw biomass and gel synthesizing materials. Prepared formulations and hydrogel composite samples have been characterized by TEM, SEM, XRD, FT-IR and solid state C13 NMR techniques. One of the developed materials was utilized as auxiliary to develop powder for seed treatment and that formulation was characterized and evaluated for their potential to control the web blight in mung bean under pot conditions. The biocontrol potential this powder formulation of carbendazim was found to be superior to that of normal formulation under pot conditions, although both expressed superior bio-efficacy as compared to Carbendazim 50% WP and the talc based (2% dust) formulation. The developed formulations need further validation under integrated disease management (IDM) programs in mungbean.

T5OP7: Evaluation of Organic Inputs and Biocontrol Agents Against Blackgram Anthracnose (*Colletotrichum truncatum*)

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The black gram (*Vigna mungo* L. Hepper) commonly known as urdbean, is an annual semi-erect to spreading herb belonging to the family *Leguminosae*. Black gram is usually cultivated during *Kharif* season and its productivity is mainly hampered by insect pest and diseases. Among diseases, powdery mildew (*Erysiphe polygoni*), leaf spots (*Cercospora* sp., *Alternaria* sp.), anthracnose (*Colletotrichum* spp.), mosaic and leaf crinkle are the major ones affecting black gram. The occurrence of anthracnose disease in black gram is commonly observed in most of the cultivated areas and it continues to be one of the major constraints in black gram cultivation. Anthracnose pathogen (*Colletotrichum* spp.) attacks all aerial parts of plants at all stages of crop development leading to heavy losses. Foliar spray with fungicides appears to be more effective for the management of anthracnose however the overreliance on chemicals has resulted in the problem of resistance, creation of environmental pollution and human health risk hence use of bio-agents and organic inputs would help to minimize ill effects of fungicides use. Thus the present study was carried out to evaluate the efficacy of organic inputs and biocontrol agents against anthracnose pathogen under in-vitro conditions. Five organic inputs *viz*., Panchagavya, Jivamrutha, Cow urine, Beejamrutha and Vermiwash were assayed at 3 and 5 per cent concentrations by following poisoned food technique, while five bio-agents viz., *Trichoderma viride*, *Trichoderma harzianum*, *Trichoderma asperellum*, *Pseudomonas fluorescens* and *Bacillus subtilis* were tested against anthracnose pathogen by using Dual culture technique. Among the five organic inputs, at the 3 per cent concentration. Vermiwash was effective with 66.48 per cent growth inhibition and at 5 per cent concentration, Panchgavya was found superior with 80.22 per cent growth inhibition. Among all the bio-agents tested, *T. harzianum* and *T. asperellum* recorded cent per cent mycelial growth inhibition while *T. viride* showed least growth inhibition of *C. truncatum.*

T5OP8: Value addition in Castor by Composting of Castor Shell and Stalk by Influence of Composting Microbes

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Composting comprising of four treatments namely, T1: Shredded castor shell /stalk+10% dung slurry; T2: T1 + 2% urea solution + 0.5% SSP (weight basis); T3: T1 +composting microbes @ 1 kg/t; and T4: T2 +composting microbes @ 1 kg/t was tested under field conditions for four consecutive years at the Oilseeds research station, S. D. Agricultural University, Sardarkrushinagar during 2018-21. The nutrient composition of composted castor shell and stalk before and after composting were analysed. The castor biomass waste *i.e.* shell and stem had ample quantity of essential plant nutrients. The results indicated that composted fresh castor shell or shredded stalk compost (approx. 1000 kg) treated with cow dung (100 kg) + urea solution (4 kg /200 L water) + SSP (5 kg) along with composting microbes @ 1 kg resulted in highest N, P, K content and micronutrient content (Fe, Mn, Zn and Cu). The final castor shell compost has an average N, P, K content (1.5, 0.9 and 1.6 %) while the castor shredded stalk compost has an average N, P, K content (1.2, 0.6 and 0.7 %) which could be used as a source of nutrients in raising the crops sustainably. The cost of production of compost was Rs. 6.81 per kg of shell and Rs. 6.76 per kg stalk respectively.

T5OP9: Management of Citrus Gummosis Caused by *Phytophthora* spp.

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Citrus is the most extensively produced tree fruit crop in the world. Citrus species are essentially diploid and were domesticated in Southeast Asia several thousand years ago and then spread throughout the world. *Citrus* sp. are susceptible to a number of destructive diseases that are continuously emerging and which can severely limit production or totally decimate the industries of the country. Among these *citrus gummosis* is one of the most important biotic constraints in the country. This study was conducted with the objective for management of *citrus gummosis* (*Phytophthora* spp.). The study of two year trial suggested that pasting the stem with

metalaxyl MZ 68% WP (50 g/litre) followed by drenching of fenamidone 10% + mancozeb 50% WG, 0.2% (10 litre/ tree) twice *i.e.* first at onset of monsoon and second at one month after first application found effective for management of citrus gummosis.

T5OP10: Smoke Water Characterization of *Cyamopsis tetragonoloba* and *Arachis hypogaea* Crop Residue and its Application in Plant Protection

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Crop residue incineration has threatened the air quality level and human health. Smoke water (SW) preparation and its application in agriculture will encourage the farmers to follow nonpolluting way of crop residue management. SW prepared from *C. tetragonoloba* and *A. hypogaea* crop residue was evaluated for its molecular profile, seed germinating activity and antimicrobial property. GC-MS QTOF analysis of reveled forty-one and twenty-three molecules in *C. tetragonoloba* and *A. hypogaea* crop residue, respectively. *C. tetragonoloba* SW showed anti- germinating activity in compared to control and *A. hypogaea* SW:DD/W (1:1). Antimicrobial activity of *C. tetragonoloba* SW against *Xanthomonas citrus, Xanthomonas* spp. and *A. niger* was found to be promising compared to *A. hypogaea* SW, this property supports the diversified range of molecular profile of both the SW as well as its application in customized agriculture practices. SW showed contradictorily results of seed dormancy and as a biocontrol agent.

T5OP11: Status on Prevalence and Distribution of Alternaria Blight of Tomato Caused by *Alternaria alternata* (Fr.) Keissler in Major Tomato Growing Districts of Rajasthan

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Tomato (*Solanum lycopersicum* L.) cultivation is vulnerable to the attack of several diseases that interrupt normal physiological process of this crop. Alternaria blight of tomato caused by *Alternaria alternata* (Fr.) Keissler is one of the major diseases and main constraints to produce tomato in Rajasthan causing considerable yield loss globally including India. An intensive roving survey was conducted to assess the severity of Alternaria blight of tomato caused by *Alternaria alternata* during *Kharif* 2022 and 2023 in major tomato growing areas of Rajasthan *viz.*, Jaipur, Bundi, Kota, Chittorgarh, Sirohi and Udaipur districts. Five village from each district and five fields from each village were randomly selected. A total of one fifty tomatoes farmer's fields were randomly surveyed to record for data on disease occurrence, intensity, total production and yield loss estimation was made over the previous year average yield of tomato in Rajasthan. The disease index was ranged from 21.10% - 33.95% per cent during 2022 and 19.78% - 30.35% per cent during 2023. During *Kharif* season 2022, maximum PDI was recorded from Udaipur district with PDI 33.95% followed by Bundi district where PDI was 31.48%. While, in Sirohi, Chittorgarh and Kota districts were recorded 31.37, 29.37 and 26.49% PDI of Alternaria blight in tomato respectively. Whereas, minimum disease severity of Alternaria blight in tomato was recorded in Jaipur district having PDI 21.10%. During *Kharif* season 2023, maximum mean per cent disease index was recorded in Udaipur district with PDI 30.35% followed by Sirohi district where PDI was recorded 29.04%. While, in Bundi, Chittorgarh and Kota districts were recorded 26.06, 25.53 and 22.92 % PDI of Alternaria blight in tomato respectively. Further, minimum disease severity of Alternaria blight was recorded in Jaipur District with PDI 19.78%. Pooled data revealed the highest disease index in Udaipur (32.15%) and lowest in Jaipur (20.44%) district. Yield loss estimation varies in 19.69%-10.38% in pooled analysis.

T5OP12: Comparative Study of Different Modules with Natural Farming in Pearl Millet + Greengram

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A field experiment was conducted during *Kharif* seasons of 2021 and 2022 at the Agronomy Instructional Farm, Chimanbhai Patel Collage of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar to compare three farming modules *viz*; low-cost natural farming (LCNF), organic farming (OF) and conventional farming (CF) modules in pearl millet + green gram cropping system. The results showed that conventional farming module (M3) recorded significantly higher pearl millet grain equivalent yield (2774.3 kg/ha) over organic farming module (M2) and low-cost natural farming module (M1) during first year (*Kharif* 2021). However, it remained statistically at par with low-cost natural farming module (M1) which recorded PGEY of 1739.3 kg/ha during second year (*Kharif* 2022). Further, results indicated that the LCNF and OF modules did not differ significantly between themselves. Looking to the economics, LCNF module (M3) fetched maximum gross and net returns as well as BCR.

T5OP13: Effect of Integrated Nutrient Management on Soil Properties under Papaya (*Carica papaya* L.) Cultivation

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The experiment was carried out on papaya cv. GJP 1 during the year 2019-20 and 2020-21 at College of Horticulture, SDAU, Jagudan. The experiment was laid out in RBD with three replications. Total ten treatments were evaluated in the present study *viz*., 100% RDF (200:200:250 g N-P2O5-K2O plant-1) through chemical fertilizers (**T1**), 50% RDN through urea + 50% RDN through Neem cake (NC) (**T2**), 50% RDN through urea + 50% RDN through Castor cake (CC) (**T3**), 50% RDN through urea + 25% RDN through NC + 25 % RDN through CC (**T4**), 40% RDN through urea + 40% RDN through NC + Biofertilizers (BF) (**T5**), 40% RDN through urea + 40% RDN through CC +BF (**T6**), 40% RDN through urea + 20% RDN through NC + 20% RDN through CC +BF (**T7**), 30% RDN through urea + 30% RDN through NC +BF (**T8**), 30% RDN through urea + 30% RDN through CC +BF (**T9**), 30% RDN through urea + 15% RDN through NC + 15% RDN through CC + BF (**T10**). The common dose of FYM @ 10 kg per plant were applied along with *Trichoderma* @ 5 g in all the treatments, whereas biofertilizers (*Azotobacter*, PSB and KSM) @ 10 ml each per plant were applied as per treatments at the time of planting. Nitrogen through urea was applied in four equal splits (at 60, 120, 180 and 240 days after planting) as per treatments, however, treatments of organic manures were applied in two equal splits (at the time of planting and 60 days after planting). experimental field soil was loamy sand in texture, mildly alkaline, non-saline in nature, low in organic carbon (OC) and available N, medium in available P and high in available K. The results based on pooled data revealed that majority of soil parameters *viz*. OC, available N, available S and exchangeable Ca & Mg were recorded significantly maximum in treatment T3, whereas significantly maximum available P and available K were observed under treatment T1 that was remained at par with treatment T3. Therefore, it could be concluded that the application of treatment T3 in papaya significantly influenced post-harvest soil parameters and increased nutrients availability in soil.

T5OP14: Effect of Drought Alleviating Microbes with Adequate and Deficit Irrigation in Mustard under North Gujarat Agro-climatic Region

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India is the fourth largest vegetable oil economy in the world next to USA, China and Brazil. Oilseeds are the second largest contributor in Indian agricultural economy after the cereals. The productivity levels of the rapeseed- mustard group of crops in India are about 2/3rd of the world level owing to large scale cultivation under rainfed conditions, where crop suffer biotic and abiotic stresses, and resources crunch. Moisture stress during growing season in rapeseed-mustard could reduce the production by 17 to 94%. Further, moisture stress at post flowering stages of the crop has led to a drastic reduction in growth and yields of mustard. Thus, there is need to improve the drought tolerance ability of the crop and retain moisture supply in the root zone throughout the crop growing period to meet the water requirements during the reproductive phase for achieving the higher yields. Hence, the present study was carried out to study the effect of drought alleviating microbes under adequate and deficit irrigation on performance of mustard. The field experiment was conducted during *Rabi* season of 2021-22 and 2022-23 at Centre for Oilseeds Research, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat, India. The experiment was laid out in split plot design consisting three irrigation treatments in main plot *viz*. No irrigation, 50% deficit of irrigation and normal irrigation, each main plot was further divided into six sub plots to accommodate drought alleviating microbe's treatments *viz*. MRD 17, MKS 6, Biophos and Biophos+, CRIDA MI-I, CRIDA MI-II and control (No culture) with replicated thrice. The microbial culture treatment was applied as seed treatments before sowing. The recommended dose of fertilizer for mustard (GM 3) was N50, P50, and S40 kg/ha was applied. Full dose of P, S and half dose of nitrogen fertilizers were drilled just before the sowing by manually as a basal application through urea, DAP and elemental sulphur and remaining half dose of nitrogen was applied at 30-40 DAS under moist condition. Remaining crop management practices were adopted as per package of practices. Various growth parameters, yield attributes and yield were recorded at harvest. Results revealed that the irrigation treatments had significant influenced on number of secondary branches/plants, number of siliquae/plants, 1000-seed weight, seed yield, stover yield and yield stability index of mustard, which was recorded significantly higher under normal level of irrigation to the tune of 18.1, 40.2, 12.3, 63.8, 51.0 and 62.6% higher over without irrigation based on two years pooled data. Application of normal level of irrigation fetched Rs 48220 and 44430/- higher gross and net returns in comparison to no irrigation treatment and it was also recorded significantly higher B:C ratio (3.15) as compared to no irrigation and 50% deficit irrigation.

T5PP1: Soil Health and Sustainable Agriculture

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Soil health is defined as the continued capacity of soil to function as a vital living ecosystem that sustain plants, animals, and humans. Healthy soil gives us clear air and water, bountiful crops and forests, productive grazing lands, diverse wildlife, and beautiful landscapes. A healthy soil acts as a dynamic living system that delivers multiple ecosystem services, such as sustaining water quality, plant productivity, controlling soil nutrient recycling decomposition, and removing greenhouse gases from the atmosphere. Soil health is closely associated with sustainable agriculture, because soil microorganism diversity and activity are the main components of soil health. Agricultural sustainability is defined as the ability of a crop production system to continuously produce food without environmental degradation. Its goal is to provide food for growing human populations while taking the welfare of the

surrounding ecosystem into account. The basic goals of sustainable agriculture are environmental health, economic profitability, and social and economic equity. Arbuscular mycorrhizal fungi (AMF), cyanobacteria, and beneficial nematodes enhance water use efficiency and nutrient availability to plants, phytohormones production, soil nutrient cycling, and plant resistance to environmental stresses. Farming practices have shown that organic farming and tillage improve soil health by increasing the abundance, diversity, and activity of microorganisms. Conservation tillage can potentially increase grower's profitability by reducing inputs and labor costs as compared to conventional tillage while organic farming might add extra management costs due to high labor demands for weeding and pest control, and for fertilizer inputs (particularly N-based), which typically have less consistent uniformity and stability than synthetic fertilizers. This review will discuss the external factors controlling the abundance of rhizosphere microbiota and the impact of crop management practices on soil health and their role in sustainable crop production.

T5PP2: Crop Diversification: An Effective Strategy for Sustainable Agriculture Development

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Sustainable agricultural practices involve a variety of approaches. The most important approach for sustainable agriculture development is crop diversification. It allows the farmers to employ biological cycles to minimize inputs, conserve the resource base, maximize yields and also reduce the risk due to ecological and environmental factors. It serves as an important opportunity to augment income and employment generation for rural communities. Crop diversification promotes the interaction of beneficial soil bacteria, interrupts the disease cycle, and reduces the quantity of weeds. Crop diversification boosts land-use efficiency and crop output by improving the physical and chemical qualities of soil. Crop diversification shows a lot of scope to alleviate problems such as the resurgence of insect-pests and weeds, soil degradation, environmental pollution, soil salinity, decline in farm profit and climate change. Crop diversification through a crop intensification system enhanced the net returns, B:C ratio, and overall system productivity of a farm. In order to achieve the benefits of crop diversification farmers are shifting from low value low yielding crops to high value high yielding crops. Thus, crop diversification has the sound capacity for achieving the goal of nutritional security, income growth, food security, employment generation, and sustainable agriculture development.

T5PP3: Effect of Various Carbon and Nitrogen Sources on the Growth of *Sclerotium rolfsii* Causing Collar Rot of Lentil

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Collar rot of lentil caused by *Sclerotium rolfsii,* a polyphagous pathogenic fungus causing substantial losses in the quality and productivity of lentil in major lentil growing areas of Madhya Pradesh. *In vitro* studies were conducted where five different carbon and nitrogen source-based culture media were selected to observe the most suitable culture media for the growth of the pathogen *S. rolfsii* respectively. The result showed that among carbon sources best mycelial growth of *S. rolfsii* was observed in sucrose (90 mm) and the least mycelial growth was observed in Maltose (81.67 mm). Similarly, among nitrogen sources, the best mycelial growth was observed in Ammonium bromide (89.33 mm), and the least mycelial growth was observed in peptone (66.67 mm).

T5PP4: *Rustica mosaic virus*: A threat to Culcutti Tobacco

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Nicotiana rustica L. known as vilayati, calcutti or rustica tobacco has a short plant stature with round puckered leaves and yellow flowers. It is grown in a major part of North Gujarat and some part of middle Gujarat. About 80 per cent of the total production of *rustica* tobacco in the country is confined to the tobacco growing areas of North India namely Haryana, Punjab and Uttar Pradesh. Further, it is also cultivated in West Bengal, Karnataka, Tripura, Tamil Nadu and Gujarat. *Rustica* tobacco is infected by a variety of pathogens such as fungi, bacteria, viruses, nematodes, flowering plant parasites, *etc*. Among viral diseases, “mosaic” appears to be one of the most destructive quantitatively as well as qualitatively. Unlike the most popular mosaic disease of *N. tabacum* due attention has not been given to “mosaic” of *N. rustica*. Mosaic disease of rustica tobacco characterized by general chlorosis of the leaves with dark green blisters. The virus is readily transmitted mechanically and by aphid, *Myzus persicae* suiz. It is also transmitted through grafting but not through the seed. The virus is inactivated at 60 for 10 minutes exposure and at the dilution of 10. It remains infective in crude sap up to 48 hrs. at room temperature (30-40) and 12 days at 5. Maximum disease incidence was recorded in GC1 and the average incidence ranged from 25.00 to 61.66 %. Eco-friendly measures were attempted to manage *rustica* mosaic. Leaf extracts of *Clerodendrum inerme* and *Prosopis julifora* were found to have potential inimical effects on mosaic disease. Maize is a barrier crop recorded minimum incidence of *rustica* mosaic. Phytosanitary measures, barrier crops (maize) and antiviral principles containing resources have the potential to vitiate the *rustica* mosaic and they are non-treacherous to nature too.

T5PP5: Integrated Crop Disease Management of Minor Millets in Arid Rajasthan

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Millets are coarse cereals from the *Poaceae* family that have been cultivated since the dawn of civilization. The most important cultivated species of small millets are finger millet, Foxtail millet, proso millet, barnyard millet, kodo millet, and little millet. Minor millets contain micronutrients such as Mg, Ca, Mn, Fe, K, Zn, tryptophan, phosphorous, fibre, and B vitamins. Small or minor millets are considered neglected crops due to their low yield potential in comparison to major millets (sorghum and pearl millet) and fine cereals (rice, wheat, and maize). Small millets are the traditional crops that are better suited to less fertile soils. There are several methods for controlling the disease of minor millets, including cultural, chemical, and the use of resistant varieties. The usefulness of any method is determined by the farmers' economic and social circumstances. The use of resistant varieties is the most basic and cost-effective control method, and it can be combined with cultural and chemical control methods. Careful agronomic practices can help reduce their occurrence. Seed treatment, plant spacing, and regulating the amount of nitrogenous fertilizer applied to the crop are all important preventative measures. One farmer-inspired indigenous practice of using raw cow milk as seed treatment has been experimentally validated in farmers' fields and at C. R. Farm of the Central Arid Zone Research Institute, Jodhpur, by integrating with *Trichoderma* spp. (the farmer-friendly fungus and biocontrol agent). Smut disease appears on common millet earheads and can be controlled by treating the seed with copper fungicide.

T5PP6: Impact of Diverse Treatments on Cercospora Leaf Spot (*Cercospora capsici* Heald and F.A. Wolf) and Yield in Chilli (*Capsicum annuum* L.) Plants

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This study investigated the impact of various treatments on the disease intensity (%) of Cercospora leaf spot in chilli plants at different time intervals after transplanting (DAT). The treatments included Mancozeb 75WP @0.2%, Ginger rhizome extract @10%, Garlic clove extract @10%, Onion bulb extract @10%, Neem leaf extract @10% and untreated control (T0). Disease intensity was assessed at 45 DAT, 60 DAT and 75 DAT. Results revealed that at 45 DAT Mancozeb 75WP @ 0.2% demonstrated the most significant reduction in disease intensity (10.91%) followed by Ginger rhizome extract (16.57%). Similarly, at 60 DAT and 75 DAT, Mancozeb 75WP consistently exhibited the lowest disease intensity (17.22% and 19.33%, respectively). The findings suggest the efficacy of Mancozeb in mitigating Cercospora leaf spot in chilli plants emphasizing its potential as a practical treatment option for disease management in agricultural practices. Additionally, the study explores the effect of these treatments on chilli yield with Mancozeb 75WP leading to the maximum yield (1.18 t/ha) followed by Ginger rhizome extract @10% (1.13 t/ha), Garlic clove extract @10% (1.05 t/ha), Onion bulb extract @10% (0.99 t/ha) and Neem leaf extract (0.88 t/ha) in comparison to the untreated control (T0) at 0.60 t/ha.

T5PP7: Diversified Cropping Practices: Impacts on Soil Health, Sustainability, and Disease Management

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Diversified cropping practices, characterized by cultivating a variety of crops within an agricultural system, have gained prominence for their potential to enhance soil health and contribute to sustainable agriculture. This paper comprehensively reviews the multifaceted impacts of diversified cropping on soil health and sustainability. Positive effects encompass increased soil organic matter, improved nutrient cycling, enhanced disease and pest management, improved soil structure, and the promotion of biodiversity. However, challenges such as soil erosion risk, weed competition, and disease spread necessitate careful management for optimal benefits. The concept of soil health, defined as the soil's capacity to function as a vital living system supporting biological productivity, environmental quality, and plant, animal, and human health, is crucial for agricultural sustainability and ecosystem function. Management practices promoting soil health, such as crop rotations, cover crops, green manures, organic amendments, and conservation tillage, exhibit generally positive effects on soil borne disease management. These practices enhance soil microbial biomass, activity, and diversity, leading to biological suppression of pathogens. Nevertheless, specific disease issues may be associated with certain soil health management practices. The paper synthesizes two decades of research progress on soil health, sustainability, and management practices, emphasizing their implications for plant disease and disease management strategies. The discussion addresses long-term sustainability, resilience to climate change, and economic and social benefits in the context of diversified cropping. The findings underscore the necessity for strategic management practices to harness the full potential of diversified cropping, promoting resilient and sustainable agricultural systems.

T5PP8: From Tradition to Innovation: Exploring the Evolution of Diversified Approaches in Plant and Soil Health Management

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Amidst the ongoing transition from traditional to innovative approaches in plant and soil health management, the agricultural panorama is undergoing a profound and transformative shift. This exhaustive review critically analyses the evolutionary path of diversified approaches, navigating through historical roots, current trends and anticipated future possibilities within the sphere of sustainable agriculture. By amalgamating a varied spectrum of methodologies implemented worldwide, spanning from age-old agricultural traditions to state-of-the-art innovations, the analysis provides an encompassing perspective of the intricate journey. The exploration surpasses a mere documentation of changes, striving to illuminate the nuanced interplay between tradition and innovation. The insights gleaned from this exploration are intended as a guiding force for sustainable agriculture practices in the forthcoming years, presenting a detailed understanding of the challenges and opportunities ahead. This narrative transcends mere observation, standing as a valuable asset for a broad spectrum of stakeholders, including farmers, researchers, policymakers and industry leaders. It furnishes strategic insights that not only contribute to a nuanced comprehension of the diverse journey of agricultural practices but also furnish a pathway to nurture sustainable agriculture in the future. As we navigate the intricacies of the evolving agricultural paradigm, this narrative stands as a guiding instrument, directing the path toward a resilient, adaptive and sustainable future for global agriculture.

T5PP9: Conservation Tillage Techniques: Assessing their Effects on Soil Structure and Crop Productivity

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Conservation tillage, encompassing reduced or minimal soil disturbance, has gained prominence as a sustainable agricultural practice. This study examines the impact of conservation tillage techniques on soil structure and crop productivity. By synthesizing findings from diverse studies, the paper aims to provide a comprehensive analysis of the effects of conservation tillage on soil physical properties, nutrient dynamics, water retention and overall crop performance. The assessment will consider various conservation tillage methods, including no-till, strip-till, and reduced tillage, highlighting both the advantages and potential challenges associated with these techniques. Insights from this review contribute to a nuanced understanding of the role of conservation tillage in promoting soil health and sustainable agriculture. In the exploration of soil structure, the paper will scrutinize alterations in soil aggregation, porosity and compaction resulting from different conservation tillage methods. By synthesizing data from diverse studies, the review aims to offer a nuanced perspective on how these changes influence the overall physical properties of the soil. Additionally, the impact of conservation tillage on soil organic matter content and microbial activity will be thoroughly examined, shedding light on the intricate dynamics that contribute to a healthier soil ecosystem. Nutrient dynamics represent a pivotal aspect of the review, encompassing an in-depth analysis of how conservation tillage practices influence nutrient cycling, availability and soil fertility. By elucidating the intricate relationships between soil structure and nutrient management, the paper aims to provide valuable insights into optimizing agricultural productivity while maintaining soil health.

Theme 6: Mushroom: Commercial Production and Agripreneurship

T6OP1: Evaluation of Different Spawn Doses and Local Substrates for the Cultivation of Various *Pleurotus* spp.

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Present study was conducted in Department of Plant Pathology, COHF, Neri during 2021-22. During the study, five different spawn doses of standard wheat grain spawn were evaluated for the cultivation of five *Pleurotus* species *viz., P. eous, P. flabellatus, P. ostreatus, P. eryngii* and *p. cornucopiae*. In addition to this, five different substrates including paddy straw, maize straw, sawdust, *lantana* leaves along with standard check wheat straw were also evaluated for the cultivation of said five species. Among the five spawn doses evaluated, minimum time for spawn run (12.33 days) as well as first flush (21.07 days) was recorded when the substrate was spawned @ 3.0 per cent followed by that at @ 2.5 per cent (13.60 and 22.07 days, respectively). As far as yield of different species of *Pleurotus* at different spawn doses was concerned, maximum average yield was recorded when the substrate was spawned @3.0 per cent (3.68 Kg/ 4kg dry substrate) which was followed significantly @ 2.5 per cent (3.45 Kg/ 4kg dry substrate). Among different *Pleurotus* species, *P. eous* exhibited maximum yield (2.88 Kg/ 4kg dry substrate) which was statistically at par with that of *P. eryngii* (2.84 kg / 4kg dry substrate) and *P. flabellatus* (2.81 kg / 4kg dry substrate), while *P. cornucopiae* yielded minimum fruit bodies (2.61Kg/ 4 kg dry substrate). Among different substrates evaluated, time taken for spawn run and first flush was minimum and statistically at par when these species were raised on paddy straw (12.46 and 22.33 days, respectively) and wheat straw (12.86 and 21.87 days, respectively). However, average fruit body yield was found to be maximum (3.75 kg/ 4kg dry substrate) in paddy straw followed by that in wheat straw (3.59 /4kg dry substrate). Out of five species evaluated, *P. eous* yielded maximum fruit bodies (3.07k/4kg dry substrate) followed by *P. flabellatus* (3.05 kg/4kg dry substrate).

T6OP2: Cultivation of Oyster Mushroom [*Pleurotus ostreatus* (Jacq.) P. Kumm.] Through Substrate Enriched With Tea Waste

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A study was conducted to assess yield with biological efficiency and nutritional contents of *Pleurotus ostreatus* for different formulations of wheat straw, sugarcane bagasse, coconut green husk, banana pseudo stem and waste paper mixed with tea waste, lime, gypsum and sucrose at various proportion (70:27:1:1:1). The data showed a progressive yield of *Pleurotus ostreatus* was obtained from wheat straw + tea waste + lime + gypsum + sucrose (711.6 g/kg substrates) and sugarcane bagasse + tea waste + lime + gypsum + sucrose (702.3 g/kg substrates. The work of this experiment also highlights the positive correlation of yield and biological efficiency. The nutritional contents of the mushroom grown on mixed substrates were comparatively higher as compared to control. Mix substrates gave the maximum protein content (27.316 mg/g), total sugar (27.670 mg/g), phenol (1.952 mg/g), moisture (91.6 %) in supplemented wheat straw.

T6OP3: Evaluation of Spent Mushroom Substrate for the Management of Rhizome Rot of Ginger

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Present study was conducted in Department of Plant Pathology, COHF, Neri during 2019-2021. During the study, it was found that *Fuasrium solani* was associated with rhizome rot of ginger. Among eight leachates of four different mushroom species, leachate of *Pleurotus sajor-caju* spent substrate colonized with *Trichoderma viride* (46.29% inhibition) was found superior to all other leachates. Out of different aqueous extracts of four mushroom spent substrates under study, spent substrate colonized with *T. Viride*-leached of *Agaricus bisporus* (51.02% inhibition,) *P. sajor-caju* (51.66 % inhibition), *P. florida* (48.80 % inhibition) and *P. ostreatus* (73.80% inhibition) proved better than their respective counterparts. Among the four different ethanol extracts of *A. bisporus* spent substrate, ethanol extract of *A. bisporus* spent substrate colonized with *T. viride*-leached (58.51% inhibition) was found best to inhibit the pathogen. Out of four different ethanol extracts of *P. sajor-caju* spent substrate, ethanol extract of *P. sajor-caju* spent substrate (86.29% inhibition) colonized with *T. viride*-leached used at 4 per cent concentration was found best in which cent per cent inhibition of pathogen was recorded. Among the four different ethanol extracts of *P. florida* spent substrate, ethanol extract of *P. florida* spent substrate colonized with *T. viride*-leached (93.06% mean inhibition) followed by *P. florida* spent substrate colonized with *T. viride* (89.63% mean inhibition) both used at 4 per cent concentration were found to completely inhibit the pathogen (100% inhibition). Out of four different ethanol extracts of *P. ostreatus* spent substrate, ethanol extract of *P. ostreatus* spent substrate colonized with *T. viride*-leached (79.45 % inhibition) used at 4 per cent concentration was found to completely inhibit the pathogen. Among the different spent mushroom substrates evaluated under pot culture conditions, spent mushroom substrate colonized with *T. viride* and leached for 10 days of all substrates resulted in cent per cent reduction of pre emergence rot in both naturally infected and artificially inoculated ginger. Among the four species, spent substrate of *P. sajor-caju* substrate (88.11%) was found to be best in disease management. Spent mushroom substrate colonized with *T. viride* of all substrates and leached for 10 days treatment proved best in managing the post emergence rot in both naturally infected (88.93%) and artificially inoculated ginger (91.38%) and was found to be best in disease management.

T6OP4: Standardization of Nutrient Medium Protocol for the Mycelial Growth of *Cordyceps militaris* L.

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Cordyceps militaris is one of the highly prized medicinal mushrooms being used in various traditional medicine systems across the globe. Cordycepin is one of the important biological compounds known for its therapeutic properties. It is present not only in mature fruiting bodies but also in fungal mycelium when grown on culture media. The cultivation period of this fungus to the mature stage (fruiting body stage) is around 3 months. In the present study, modifications to the nutrient medium were assessed for their potential to rapidly increase the biomass of this fungus. The results revealed that the best agar culture media composition for its growth was standardized during. It was found that among the different agar media, PDA produced the largest mycelial growth, followed by CMA, SDA and RSA. In order to reduce the time duration for maximum mycelial growth, the agar media was optimized with supplements, *viz.*, Malt extract (ME) and Yeast extract (YE). The results revealed that maximum mycelial diameter was observed after 17 days of cultivation with the media composition of PDA, 6g/L ME and 6g/LYE.

T6OP5: Evaluation of Agricultural Residues as Substrates for Growth and Yield of Oyster Mushroom (*Pleurotus florida*)

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The oyster mushroom (*Pleurotus florida*) is one of the cultivated edible mushrooms and has certain medicinal properties as well as economic and ecological values. Every year, massive amounts of lignocellulosic agricultural crop residues are produced worldwide, and not all of them are properly utilized. There are many ways of managing agricultural waste, one of which is mushroom cultivation. This study was conducted to compare the influence of selected consortiums of agricultural residues on the growth of *P. florida*.

This species was cultivated on different substrates, *viz.*, wheat straw, maize straw, bajara straw, sorghum straw, mustard straw, groundnut shell and castor shell were evaluated for detecting the growth and yield parameters of oyster mushroom (*P. florida*). Among them, mustard straw was found to be the superior substrate recorded the minimum days for spawn run (12.33 days), pinhead formation (15.33 days), first harvest (17.33 days), second harvest (29.33 days) and third harvest (42.33 days), respectively. But significantly highest yield (2063.00 g/3 kg), biological efficacy (68.77 %), in terms of weight first harvest (1030.00 g/3 kg), second harvest (645.00 g/3 kg) and third harvest (388.00 g/3 kg) recorded in castor shell.

T6OP6: Utilization of Different Wastes on the Yield of Oyster Mushroom (*Pleurotus sajor- caju*)

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Oyster mushroom is probably most suitable fungus for producing protein rich food from cellulolytic wastes with simple cultivation technology. Moreover its capacity of growing on any type of ligno cellulosic substrate without any prior treatment of base materials gives it an advantage over other cultivated mushroom, where aerobic fermentation of substrate is pre-requisite. Nutritions provided by the substrate is the single most important factor affecting the nutritional and biochemical properties of mushrooms. Considering this in the proposed experiment, effect of different seven wastes as substrate for mushroom cultivation will be evaluated for its direct or indirect effect on nutritional and biochemical properties of oyster mushroom (*Pleurotus sajor- caju*). The five per cent spawn rate and three kg sugarcane substrate gave higher sporophore production (1065.11 g) and biological efficiency (35.50%) of oyster mushroom (*Pleurotus sajor-caju*) compare to the other waste product used as a substrate. Sporophore produced with sugarcane bagasse substarate contain higher amount of Total soluble sugar (9.54%), total protein (7.75%) and crude fiber (0.75%) compare to the other treatments. Therefore, for the higher sporophore production (biological efficiency) with better nutritional and biochemical properties of oyster mushroom (*Pleurotus sajor-caju*) use the sugarcane bagasse as substrate with 5 per cent spawn rate.

T6OP7: Cultivation of White Button Mushroom (*Agaricus bisporus*-NBS-5AB) in Natural Environmental Condition at North Gujarat

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The white button mushroom (*Agaricus bisporus*) - a temperate mushroom variety grows at low temperature (16- 18 °C) and high relative humidity (RH) (80-90%) during its fruiting and cropping stages. On the contrary, most of the regions in India witness a higher temperature and lower RH, making it difficult to grow the button mushroom under natural climatic conditions. But in North Gujarat condition, temperature was low during the period of winter hence, cultivation of button mushroom (*Agaricus bisporus*-NBS-5AB) was carried out at Polytechnic in Agriculture, S. D. Agriculture University, Deesa during Nov. 2022 to Feb. 2023 under natural environmental condition. Fresh culture of *Agaricus bisporus* (NBS-5AB) was maintained on potato dextrose agar. Using wheat straw as substate compost was prepared by long method of composting and cultivation of *Agaricus bisporus* (NBS-5A) was carried out in a closed room. The relative humidity inside the cropping rooms was maintained to 80-90%. Compost preparation took 27 days and spawn run completed in 18 days and required 12-15 days more for case run. The pinheads developed into solid button sized mushrooms in another 6-8 days. Morphological characteristics recorded for this mushroom revealed an average stipe length of 2.96 cm having girth of 1.6 cm. While the average pileus length and width was 2.0 cm and 3.36 cm respectively. Mushroom yield of 12.09 kg/100 Kg compost was recorded.

T6OP8: Strain-specific Evaluation of *Pleurotus* Cultivation on Wheat Straw: Yield Variances and Morphological Diversity

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The research investigation entitled “Strain-Specific Evaluation of *Pleurotus* Cultivation on Wheat Straw: Yield Variances and Morphological Diversity” was carried out at AICRP on Mushroom, College of Agriculture, Pune. The objectives of the research experiment was to evaluate the yield potential of selected accessions of *Pleurotus* spp. on wheat straw. This study evaluated the performance of ten strains of *Pleurotus* species, coded as PL-18-01 to PL-18-10, cultivated on wheat straw substrate using standardized cultivation methods. The experimental procedure encompassed subjecting the substrate to hot water treatment at 65°C for one hour, along with pH adjustment to 7.5 utilizing CaCO3. Employing a Randomized Block Design (RBD) with three replications per strain, the investigation assessed yield, growth parameters and consumer acceptability. The findings unveiled significant strain-specific variations in yield performance. Notably, strain PL-18-10 exhibited the highest yield of 109.02 kg/100 kg dry wheat straw, attributed to larger fruit size (7.87 cm diameter) and increased fruit numbers (438.42). Additionally, strains PL-18-05 and PL-18-06 demonstrated commendable yields of 97.86 and 91.66 kg/100 kg dry wheat straw, respectively. Conversely, strain PL- 18-07 displayed the lowest yield of 66.43 kg/100 kg dry wheat straw. Spawn run and harvest period's demonstrated variability among strains. PL-18-05 displayed the shortest

durations for both spawn run (13.23 days) and first harvest (23.0 days), while strain PL-18-09 necessitated the longest time for spawn run (19.07 days) and first harvest (28.0 days). Fruit body weights ranged from 3.55 to 7.46 g/fruit, with PL-18-02 recording the highest average weight. Observations on stipe length, stipe diameter, pileus diameter, and fruit colour highlighted significant differences among strains, showcasing their diverse morphological characteristics. In conclusion, strain PL-18-10 emerged as a promising strain due to its superior yield, larger fruit size and quantity indicating its potential suitability for commercial cultivation of *Pleurotus* spp. on wheat straw substrates.

T6OP9: Enhancing Commercial Production of Mushroom: A Farmer-centric Approach

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Mushroom cultivation has emerged as a lucrative venture, offering farmers an alternative and sustainable source of income. This abstract presents a comprehensive overview of mushroom commercial production at the farmer's field, emphasizing a holistic and farmer-centric approach. The cultivation of mushrooms, particularly species like *Agaricus bisporus* (button mushrooms), *Pleurotus ostreatus* (oyster mushrooms), and *Lentinula edodes* (shiitake mushrooms), has gained popularity due to their nutritional value, rapid growth, and adaptability to diverse climatic conditions. The success of mushroom cultivation lies in the integration of scientific knowledge with practical, on-the-ground expertise. Farmers are introduced to advanced cultivation techniques, substrate preparation, and environmental control methods, ensuring optimal conditions for mushroom growth. The use of locally available materials for substrate formulation minimizes costs and enhances sustainability. Furthermore, the incorporation of organic farming practices contributes to environmentally friendly production. Due to low land holding and undulating land we at Sirohi district have explored the economic benefits for farmers engage in mushroom cultivation, providing insights into market demand, pricing dynamics, and potential profit margins. Additionally, community-based models for mushroom farming are discussed, promoting collective efforts for increased production and market access. The challenges associated with mushroom cultivation, such as disease management and post-harvest handling, are addressed by us with practical solutions. Training programs and extension services provided by KVKs are vital components of this farmer-centric model, empowering individuals with the necessary skills and knowledge for successful mushroom production. Our study advocates for the promotion of mushroom commercial production at the farmer's field, emphasizing sustainable practices, economic viability, and community engagement. By fostering a farmer-centric approach, stakeholders can contribute to the growth of this emerging sector, ensuring a resilient and inclusive agricultural landscape.

T6OP10: Entrepreneurship in Mushroom Spawn Production: Scope and Challenges in India

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Consumption of mushrooms has been increased by human being as nutritious, delicious and medicinal food since recent past. It was accepted as a valuable healthy food throughout the world after the Aryans, the Greeks, the Romans and the Chinese people. The edible mushrooms are reported not only to combat numbers of severe diseases such as diabetes, hypertension, high risk strokes, white Parkinson's disease, Alzheimer's disease and even numbers of types of cancers but also approved to be having antibacterial, antiviral, antioxidant, cosmetic, anti-aging and immunobooster properties. Among the cultivated edible mushroom species, button mushroom: *Agaricus* spp., oyster mushroom: *Pleurotus* spp., milky mushroom: *Calocybe* spp., shiitake mushroom: *Lentinulla* spp. and paddy straw mushroom: *Volvariella* spp. were grown and produced in huge amount in India. As like other crops, mushroom seed or spawn have gained unique importance in mushroom farming forgetting high quality mushroom production over the globe and India. China, Japan, USA, Poland and Netherlands are the top five leading producers of edible mushrooms in the world. India ranks 11th position with only 0.38 % share in mushroom production. In India per capita consumption is about 90 g, which is very less compared to other countries including USA 1.49 kg and China 1.16 kg. India is producing 620 million ton of Agro waste every year and thus have wider scope to convert the unused agro waste of about 500 million tons in mushroom production. Researchers have assumed the target mushroom production of India to be about 300 million tons in near future. Among the various constraints availability of demandable quality mushroom spawn is a great constraint faced by numbers of local and small scale mushroom growers in India. To cultivate unused available agro wastes there is demand of at least 100 million ton quality mushroom spawn in India in near future. There is wider scope of production of different types of cheap spawn such as sawdust spawn, plug/dowel spawn, wood chip spawn, liquid spawn along with commonly used cereal grain spawn in India. Good quality spawn conform to high yield potential, absence of contaminants and better economic benefit. Agricultural or microbiological graduates can easily establish spawn production laboratories and become a successful entrepreneur along with creating employability in near future of India. Mushroom spawn production is a technology and it needs expertise in laboratorial technical skills. Negligible numbers of spawn production trainings to teach laboratory skill were organized by few institutions of India as compared to mushroom cultivation trainings. As the growth of mushroom spawn production is directly proportional to the growth of mushroom production in India, the trainings on spawn production should also be organized in equal number to produce and supply the demandable quality mushroom spawn. Only few Government institutes were working on mushroom breeding and have developed quality and productive mushroom

strains of button mushroom, Paddy straw mushroom, milky mushrooms and shiitake mushroom. But to combat world mushroom production there is need to establish more numbers of mushroom breeding institutes and mushroom spawn production laboratories throughout the India. Thus mushroom spawn production technology has a bright scope as a successful enterprise in mushroom production of India in near future.

T6OP11: Effect of Different Agricultural Substrates and their Combination on Growth and Yield of Blue Oyster Mushroom [*Pleurotus ostreatus* (Jacq.: Fr.) Kummer)] under South Gujarat Conditions

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The present study on effect of different agricultural substrates and their combination on growth and yield of blue oyster mushroom under south Gujarat condition was carried out during the four years 2020-21 to 2023-24 at the Centre of Excellence on Mushroom Research, Department of Plant Pathology, College of Agriculture, Navsari Agricultural University, Waghai. Nine different substrates or their combinations *viz.*, T1: Finger millet straw: paddy straw (50:50), T2: Finger millet straw: little millet straw (50:50), T4:Finger millet straw: paddy straw (70:30), T4:Finger millet straw: little millet straw (70:30), T5: Finger millet straw: paddy straw: little millet straw(33:33:33), T6: Finger millet straw (100%), T7: Paddy straw (100%), T8: Little millet straw (100%) and T9: Wheat straw (100%) were evaluated for the cultivation and production of blue oyster mushroom. These straws were cut down to 8-10 cm small pieces and subjected to sterilization, bag filling, inoculation, and casing as per standardized protocol developed by DMR, Solan. Observation on various growth and yield parameters were taken. The pooled year data revealed that the treatment T7: paddy straw (100%) exhibited highest total yield (2706.57g) which was found at par with T1: Finger millet straw: paddy straw (50:50) (2657.31 g) followed by T3: Finger millet straw: paddy straw (70:30) (2575.27g), T9: wheat straw (100%) (2566.23 g), T6: finger millet straw (100%) (2558.71g) along with maximum net return. Thus the farmers of South Gujarat are advised to use paddy straw (100%) or finger millet straw: paddy straw (50:50) for effective and economic cultivation of blue oyster mushroom.

T6PP1: Morphological and Genetic Diversity Analysis of the Fifteen Strains of *Lentinula edodes* Led to the Identification of three High Yielding Strains

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Lentinula edodes is commonly referred as shiitake mushroom and well known for its nutritional, medicinal and therapeutic value. Besides its worldwide production rank at second position, there are limited number of genetic diversity studies and commercially available strains. Therefore, the present study deals with the morpho-molecular characterization of the fifteen strains along with two control strains. The results of the morphological evaluation and yield analysis identified three strains as high yielding strains then control. The highest yield was recorded in DMRO- 412 (78.57%) followed by DMRO-702 (77.30%) and DMRO-701 (74.30%). Moreover, genetic diversity analysis using the simple sequence repeats (SSR), sequence characterized amplified region (SCAR), and sequence-related amplified polymorphism (SRAP) markers categorized these strains into four clusters. The combined diversity analysis using these markers also categorized fifteen strains into four clusters and cluster III possesses all the high yielding strains (DMRO-412, DMRO-701 and DMRO-702) including two control. The results of the proximate analysis of these strains indicate maximum DPPH activity (71.73%) in DMRO-725. Notably, DMRO-702, a high yielding strain contains highest protein (29.13%) and phenol content (2.46 mg GAE/100g) as compared with other strains. The findings of this study will be helpful to the different breeding programmes based on the *L. edodes* as well as to various mushroom growers.

T6PP2: Impact of Culture Media on Oyster Mushroom Mycelial Growth

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Oyster mushroom is an edible, saprophytic, and lignocellulolytic fungus. Nowadays, people enjoy eating mushrooms more and more because of their many health benefits and ability to treat a wide range of disorders. The oyster mushrooms are cultivated all over the world. In this study, oyster mushrooms (*Pleurotus florida*) were grown with various media to determine their mycelial growth. We ran tests to know how different media affected the growth of mushrooms. In making oyster mushroom growing media, one of the stages that must pass is the composting of growing media (bag log). At this stage, it takes a week or more to compile the media, so that media is ready to be inoculated by the fungus. Five culture media *viz*., potato dextrose agar, malt extract agar, compost extract agar, wheat extract agar, nutrient agar media and bajara agar media were tested for mycelial growth of *P. florida*. Among them, the significantly highest mycelial growth of *P. florida* was recorded on malt extract agar at 3rd, 5th and 8th days after initiation which was 28.00, 31.00 and 90.00 mm, respectively.

T6PP3: Mushroom: Commercial Production and Agri-preneurship Extraction of Material from Mushroom Residue for 3D Printing

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Globally, only 9% of plastic by mass is recycled. Allowing consumers to directly convert mushroom residue waste into 3D filament can increase the recycling rate by reducing contamination and costs from traditional large-scale recycling methods. The 3D Printing global market is growing at a very fast pace and is projected to expand even further in next few years. 3D Printing using mushroom residue is a promising new technology that has the potential to reduce waste by using it in making new product. By using agricultural residue as a substrate, researchers are able to up cycle materials that would otherwise be discarded. It can help to reduce environment impact of agriculture & food production. Mushroom residue is the byproduct of the mushroom cultivation process. It is made up of the substrate that the mushroom have grown on, as well as remaining mycelium & mushroom caps & stems. Wheat straw is a by-product obtained after harvesting of wheat grains. About 529 million tons wheat straw is generated every year in all over the world. A good wheat crop can yield about 2.5 to 2.8 tons of straw per acre. However, yields can vary depending on the quality of the wheat and how high the stubble is cut. China is the world's largest producer of straw, accounting for about one-fifth of global straw resources. In India, at (year 2010-11) 112 million tonnes of wheat straw was expected to be available in the country and in next 10 years (year 2020) this quantity increased up to 140 million tonnes. As per the projections, the share of UP in total wheat straw pool will be the highest (33%), followed by Punjab (19%), Haryana (15%), Rajasthan (11%), MP (10%) and Bihar (6%). The straw availability from other wheat producing states is expected to be 6 percent. Mushroom cultivation waste can be a potential alternative. Efficient use of agricultural waste. Printing involves successful extraction of suitable bio-based material from mushroom waste, showcasing potential for sustainable & eco-friendly 3D printing applications. This material could have promising applications in eco-friendly 3D printing & contribute to sustainable manufacturing practices. Further research & optimization are needed to enhance its printing properties & potential commercial viability.

T6PP4: Evaluation of Different Grain Spawn on Different Agroforestry Wastes for Cultivation of *Pleurotus membranaceus* Massee

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An experiment was conducted at College of Horticulture and Forestry, Neri to evaluate different grain spawn on different agroforestry wastes for cultivation of *Pleurotus membranaceus*. Six different grain spawn *viz.,* wheat, paddy, sorghum, oats, bajra and barley were evaluated on four different agroforestry wastes such as wheat straw, paddy straw, maize straw and pine needles for the cultivation of *Pleurotus membranaceus*. The linear growth of the fungus was measured at 3 days interval for 12 days in the master culture bottles filled with different grains. Maximum linear growth and growth rate was observed in paddy grains (89.25 mm and 12.76 mm/day, respectively) whereas minimum (65.33 mm and 9.54 mm/day, respectively) was recorded in barley grains. All the grain spawn substrates were further evaluated on four different agroforestry wastes, the substrates were steam sterilized in autoclave for 30 minutes and spawned with different grain spawn @ 2.5% and filled in polypropylene bags of 5kg capacity under aseptic conditions. The bags were incubated under natural conditions in the bamboo hut and observations were recorded in terms of days to spawn run as well as first flush and yield. Biological efficiency (%) was further calculated as fresh weight of fruit bodies harvested in relation to dry weight of substrate. As far as time taken for complete mycelium run and first flush was concerned, it was found to be least (6.67 days and 10.33 days, respectively) were recorded in paddy grain spawn on paddy straw substrate. Maximum biological efficiency of *P. membranaceus* (96.5 %) was observed on paddy straw spawned with paddy grain.

T6PP5: Evaluation of Different Grain and Production Substrates for Cultivation of *Pleurotus eous* (Berk.)

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An experiment was conducted at College of Horticulture and Forestry, Neri to evaluate different grain spawn substrates on wheat straw and the best grain spawn substrate on different production substrates for cultivation of *Pleurotus eous*. Out of six different grain spawn substrates *viz*., wheat, paddy, maize, jowar, bajra and kodo grain evaluated on standard production substrate (wheat straw), minimum time (12.67 days) for spawn run and first flush (19.00 days) were recorded with wheat grain spawn. However, maximum yield (2134.00 g/kg dry substrate) exhibiting maximum (213.40 %) biological efficiency was recorded with maize grain spawn. Further, out of six production substrates *viz*., wheat straw, paddy straw, maize straw, lantana leaves, pine needles and saw dust evaluated, minimum time (8.33 days) for spawn run was recorded on paddy straw while, time taken for first flush (18.33 days) was recorded on wheat straw. However, maximum yield (2803.00 g/kg dry substrate) with highest (280.30 %) biological efficiency was again recorded on paddy straw substrate. Moreover, longest stipe length was recorded on paddy straw (15.47 mm) substrate and maximum (98.33 mm) cap diameter was recorded on wheat straw substrate.

T6PP6: Effect of Different Substrates on Yield and Biological Efficiency of Pink Oyster Mushroom (*Pleurotus djamor*)

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Effect of different substrates on yield and biological efficacy of pink oyster mushroom (*Pleurotus djamor*) were evaluated to know the best substrate for getting higher yield of pink oyster mushroom during the year 2022-23 in North Gujarat condition. Among the selected seven substrates namely wheat straw, maize straw, bajra straw, sorghum straw, mustard straw, groundnut shell and castor shell, the maximum yield in first, second and third harvesting was found in wheat straw as substrate with 880.80 g, 411.04 g and 176.16 g of yield respectively. The total yield 1468.00 g and biological efficiency was 48.93 per cent with wheat straw. In ground nut shell 1386.67 g total yield and 46.22 per cent biological efficiency was found as compared to other substrate. While the lowest total yield was found in castor shell which was 901.67 g and biological efficiency was 30.06.

T6PP7: A Medicinal Caterpillar Mushroom: *Ophiocordyceps sinensis*

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Ophiocordyceps sinensis B. is an entomophagous mushroom. It is a fungus that parasitizes larvae of ghost moths and produce fruiting body which possess most valuable medicinal properties but it is poorly defined species because the fungus is endemic. It is known as “fungal gold” or “soft gold” in China and Japan. It is a combined life form of fungus and caterpillar. It belongs to Ascomycetes and is reported to have more than 400 species. *O. militaris* was successfully cultivated under in vitro conditions using modified Malt Extract Medium. For induction of fruiting a temperature range of 18-22°C along with 8 hrs light period was provided. Fungus is considered as medicinal mushroom because of its multiple utility in wide range of human diseases. Many *in vitro* and *in vivo* studies support *O. sinensis* having diverse biological activities and pharmacological potential. The world is now awakening to the importance of this fungus and its price is shooting up drastically. Due to the herb's rarity and high prices associated with the wild collected variety, different attempts have been made to cultivate both the *Ophiocordyceps spp.* Among them *O. militaris* have been successfully cultivated in *in-vitro* condition.

T6PP8: Effect of Different Agricultural Substrates on Growth and Yield of Milky Mushroom [*Calocybe indica* (Purkayastha & Chandra)] Under South Gujarat Condition

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The present investigation on effect of different substrates on growth and yield of milky mushroom under South Gujarat condition was carried out during the year 2022-23 at Centre of Excellence on Mushroom Research, Department of Plant Pathology, College of Agriculture, Navsari Agricultural University, Waghai. Seven different substrates *viz.*, paddy straw, nagli straw, vari straw, sugarcane straw, wheat straw, sorghum straw and banana straw were evaluated for the cultivation and production of milky mushroom. These straws were cut down to 2-3 cm small pieces and subjected to sterilization, bag filling, inoculation and casing as per standardized protocol developed by DMR, Solan. Observation on various growth and morphological parameters and yield parameters were taken. Paddy straw was found superior substrate by recording minimum duration for spawn run (17.33 days), pinhead formation (28.33 days) and first harvest (33.67 days) with highest number of fruiting bodies (17.33), pileus diameter (9.37 cm), length of stalk (9.83 cm), maximum yield (1156.00 g) and biological efficiency (115 %) followed by all the other substrates used.

T6PP9: Effect of Different Casing Materials on Growth of Milky Mushroom [*Calocybe indica* (Purkayastha & Chandra)] under South Gujarat Condition

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The present investigation on effect of different substrates on growth and yield of milky mushroom under South Gujarat condition was carried out during the year 2022-23 at Centre of Excellence on Mushroom Research, Department of Plant Pathology, College of Agriculture, Navsari Agricultural University, Waghai. Six different casing materials *viz.*, soil, FYM, vermicompost, soil + sand (1:1), soil + FYM (1:1) and soil + vermicompost (1:1) were evaluated for cultivation and production of milky mushroom. Paddy straw was cut down to 2-3 cm small pieces and subjected to sterilization, bag filling, inoculation and casing as per standardized protocol developed by DMR, Solan. Among all the casing material tested, soil + vermicompost (1:1) was obtained superior casing material by recording minimum time for spawn run (16.67 days), pinhead formation (27.00 days) and first harvest (32.67 days) with highest number of fruiting bodies (19.67), pileus diameter (10.90 cm), length of stalk (9.97 cm), maximum yield (1366.67 g) and biological efficiency (136.67 %) followed by all the other casing material tested.

Theme 7: Advances in Nano and Molecular Approaches

T7OP1: Bioinformatics in Deciphering Host Pathogen Interactions: A Review

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The success of next-generation sequencing data for host-pathogen interactions in public repositories provides a unique opportunity to understand disease systems biologically. Genome data in popular depositories supports the retrieval, annotation and analysis of functional elements at gene and genome levels for application development. Bioinformatics, coined by Hogeweg and Hesper in 1970, aims to enhance biological process understanding through sequence pattern recognition, data mining and machine learning algorithms. The areas include databases, software development, genome analysis, applications in drug design, gene expression analysis and crop improvement. Bioinformatics tools are crucial for identifying genes, target proteins and harvesting biological information from plant genomes. In plant breeding, bioinformatics facilitates genetic selection, expediting the isolation of desired varieties and aiding in the collection and processing of plant phenotypes. Modern plant pathology relies on bioinformatics for innovative disease diagnostic tools, leveraging extensive biological data from genomics and molecular biology advancements. Sequencing agriculturally important crops enhances understanding of plant–pathogen interactions and resistance. Bioinformatics tools identify and characterize genetic variations, enabling the development of disease resistance through exploiting desirable mutations. CRISPR/Cas9 genome editing offers efficient strategies for durable resistance. Finding the genetic basis of pathogen resistance is crucial for plant geneticists aiming to overcome limitations on crop success. Disease-resistance genes (R genes) activate a plant's immune system, with NBS-LRR (nucleotide-binding sites (NBS) and leucine-rich repeat (LRR) domains being the largest family encoding functional immune receptors. Establishing host resistance is vital for plant growth, crop yield and reducing pesticide use. Pyramiding R genes is considered an ecologically friendly method to enhance resistance durability. Recent efforts focus on developing new methods, leading to a proliferation of reports on cloned genes. A review of recent literature shall be presented.

T7OP2: Molecular Variability among *Colletotrichum* spp. Isolates Causing Tomato Anthracnose

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Anthracnose of tomato, caused by *Colletotrichum* spp., is considered as one of the most important post-harvest diseases hampering the marketability and causing a great economic loss to the producer. In the present study, ten different isolates of *Colletotrichum* spp. were collected from tomato and chilli from different locations and cultural, morphological, and molecular variability was studied. The PCR amplification of genomic DNA of ten isolates for *actin* gene followed by gel electrophoresis showed the presence of a single band at 400 bp. Similarly, PCR amplification of genomic DNA of the isolates for *â-tubulin* gene and gel electrophoresis revealed the presence of a single band at 850 bp in all ten isolates of *Colletotrichum* spp. The evolutionary phylogenetic analysis of obtained sequences identified A1, A2 and A5 as *Colletotrichum gloeosporioides,* A3 and A4 as *Colletotrichum cliviicola*, N1 and N2 as *Colletotrichum truncatum* and N3, N4 and N5 as *Colletotrichum coccodes*. The variability among isolates of *Colletotrichum* spp. was analyzed using RAPD primers and ISSR primers. Total of 14 RAPD primers were screened out of which 8 produced scorable bands and total of 29 scorable bands were produced. The size of amplified bands ranged from 100 bp to 900 bp. The dendogram produced using the data of RAPD primers produced two clades in which A1, A2, A5 and A4 grouped together and N3, N4 and N5 grouped together. In case of screening with ISSR primers, a total of 12 ISSR primers were screened out of which 7 produced scorable bands and a total of 25 scorable bands were produced. The size of amplified bands ranged from 100 bp to 2000 bp. All bands produced were polymorphic bands. The dendogram produced using the data of ISSR primers produced two clades in which A3, A4 and A5 grouped together and N1, N3, N4 and N5 grouped together. Combined data of RAPD primers and ISSR primers produced dendogram in which 3 clades were produced with A1 and A2 grouped together, A3, A4, and A5 grouped together and N1, N3, N4 and N5 were grouped together.

T7OP3: Cultural, Morphological and Molecular Characterization of *Sclerotium rolfsii* (Teleomorph: *Athelia rolfsii*) Associated with Stem and Pod Rot of Groundnut in Gujarat

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Groundnut is an important oilseed crop in India which occupies first position in terms of area and second position in terms of production. Gujarat stood first in area coverage, production and productivity. This crop is annually affected by many soil-borne diseases; among them stem and pod rot cause significant yield loss. In this study, we aimed to characterize the cultural, morphological, and molecular character of fifteen isolates of *S. rolfsii* collected from various localities of groundnut growing areas of Gujarat. Colony morphology (flat/fluffy), colony diameter (11.20 to 19.50 mm), days to sclerotia initiation (5 to 9), size of sclerotia (0.80 to 1.95 mm), sclerotial shape (round/irregular), sclerotial colour (dark brown to light brown), sclerotial arrangement (scattered/central/peripheral) and number of sclerotia (250 to 46) varied among isolates on PDA and CzDA. The molecular study revealed that the cent per cent polymorphism was recorded by the primer OPA-3 and OPE-1. Whereas, the lowest polymorphism was observed in the primer

OPA-20, OPA 18 and OPA 2 (62.50, 70.00 and 83.33) out of 40 primers.

T7OP4: Molecular Characterization of Resistant Wheat Genotypes against Leaf Rust of Wheat

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Leaf rust or brown rust of wheat caused by *Puccinia triticina* Eriks. is the most widely prevalent rust in all the wheat growing areas of India leading to 50-80% loss of grain yield. The present study was based on consecutive three years field data of multilocational screening under epiphytotic condition. Among fifty genotypes tested, 10 genotypes showed complete no infection at all with zero value of AUDPC while 12 genotypes with AUDPC value ranged from 1 to 100 were identified as phenotypically resistant. Another 14 genotypes having AUDPC value ranging from 101 to 400 and remaining 14 genotypes with AUDPC value ranging from 401 to 600 above were identified as moderately susceptible and highly susceptible to leaf rust, respectively. The results of epidemiological studies have depicted that two parameters *i.e.* maximum and minimum temperature were significantly positive correlation with disease severity. Among, four tested statistical prediction models, two models *viz*. Logistic and Gompertz were best fitted model with equation of y = 100/(1+(100/b-1)*exp(-a*time)) for maximum temperature and y = 100*exp (-b*exp (-a*x)) for minimum temperature against disease severity. Moreover, the results of molecular characterization of 12 wheat genotypes has resulted that 6 genotypes were characterized with presence of *Lr68* gene (385bp) by SSR marker csGs, 5 genotypes were identified with presence of *Lr28* gene (320bp) by SSR marker Xwmc313 and 12 genotypes were identified with presence of *Lr9* gene (550bp) as detected by SCAR marker SCS5. Moreover, another highly durable adult plant resistant (APR) gene *i.e. Lr34* gene (150bp) was detected in 7 genotypes by STS marker CsLV34. Therefore, the application of molecular markers provides a more reliable tool to identify resistance genes at the genetic level and also to speed up the work of resistance breeding, thus these identified resistant wheat genotypes could be a promising source in wheat resistance breeding for combating leaf rust of wheat.

T7OP5: Bio-protection of Sheath Rot Disease of Rice and Insight into the Molecular Basis of Interaction between *Oryza sativa*, *Sarocladium oryzae* and *Bacillus cereus*

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Sheath rot of rice caused by *Sarocladium oryzae* is one of the major biotic factors reducing the potential yield of rice up to 85%. Sheath rot isolate number seven (shR7) proved highly virulent with PDI of 80.3% out of 10 isolates collected from different rice growing areas in Odisha. Eighty three *Bacillus* spp. isolated from various rice rhizosphere regions of Odisha. *Bacillus* isolate RBS-57 proved more efficacious in inhibiting radial growth of *S. oryzae* (shR7) with highest 74.44% growth inhibition out of all eighty four *Bacillus* isolates. Similar trends were also found by *Bacillus* isolates RBS-57 with highest 27.85 cm mean root length and other growth promoting characters among all eighty four *Bacillus* isolates. *B. cereus* (RBS-57) was found to have maximum six number of antibiotic genes like iturin, Bacillysin, fengycin etc. Seed treatment at the rate of 10ml/kg seed, seedling root dip at the rate of 10ml/l with foliar spray 10ml/l at 30 and 60 DAT with liquid formulation of *B. cereus* (RBS-57) recorded highest disease reduction of 74.51%. *B. cereus* (RBS-57) also recorded higher growth promoting activity among all *Bacillus* spp. tested and found at par with chemical treated plants in pot as well as two field trials. 2D-PAGE analysis were conducted for protein expression in healthy, pathogen inoculated, pathogen with bio agent RBS-57 liquid formulation and only bio agent. Eighteen differentially expressed proteins were identified by MALDI-TOF mass spectrometry (MS) analysis *viz*., BTB/POZ domain protein NPR1, peroxiredoxin, L-ascorbate peroxidase, catalase, indole-3- pyruvate, transcription factor MYB56, WUSCHEL- related homeobox 4, hypersensitive-induced response protein, Ribulose bisphosphate carboxylase in four different types of treatments. The relative expression levels of all the genes in real time PCR showed positive correlation with protein fold change value. This study proves the efficacy of RBS-57 liquid formulation against sheath rot disease of rice in both pot and field conditions.

T7OP6: High Throughput Sequencing Unravels Castor-Macrophomina Interactions Towards a Sustainable Plant Breeding

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Castor (*Ricinus communis*) is one of the most economically important cash crops throughout the world. Castor has been used for many purposes such as in medicine, lubricants, laxatives, cosmetics, etc. The main constraint in the production of castor is stress especially biotic stress which reduces the production, yield and effect product quality. So, all together it alleviate production and could not able to fulfill the demand of industries. The study of castor as a plant- pathogen system helps to accelerate the understanding of the molecular mechanisms underlying disease resistance and offers the opportunity of improving the yield and quality of the crop. The use of functional genomics has contributed to this purpose through both traditional and recently developed techniques that allow the identification of plant key functional genes in susceptible and resistant responses and the understanding of the molecular basis of compatible interactions during pathogen

attack. Next generation sequencing technologies (NGS), which produce massive quantities of sequencing data, have greatly accelerated research in biological sciences and offer great opportunities to better understand the molecular networks of plant-pathogen interactions. In this research, we tried to summarize important research that used high-throughput RNA-seq technology to obtain transcriptome changes in castor plants in response to a *Macrophomina phaseolina* pathogens. These findings will facilitate genetic engineering, genome editing, Genomic selection, GWAS etc to incorporate new sources of resistance, molecular markers in castor for increase the defence against pathogens and are of major importance for sustainable plant-disease management, in terms of plant's innate immune mechanisms in view of plant breeding.

T7OP7: Silicon: A Wonder Metalloid for Plant Resistance Mechanisms against Tomato Leaf Miner

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Silicon is a wonder metalloid for inducing resistance in plants against insect pests as it helps to culminate the over reliance on pesticides resulting in various harmful consequences paved the way for eco-holistic approach. *Tuta absoluta* (Meyrick) (Lepidoptera: Gelechiidae) is a significant insect pest in India. Some *T. absoluta* populations have been observed to have insecticide resistance, leading in control failure. The application of alternative control based on silicon, which is clean and sustainable, can minimize pesticide use, boosting fruit quality, and conserving the environment. This study looked at how feeding silicon-containing compounds changed the shape of *T. absoluta* larvae's midgut and mandibles. The foliar application of silicon-containing compounds in tomato plants was effective against the attack of *T. absoluta* caterpillars causing detachment of midgut cells from the basal membrane, which may result in digestion difficulties and larval mortality.

T7OP8: Response of Genomic Locations against Fusarium Wilt in Castor

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Castor is most adversely affected by wilt (caused by *Fusarium oxysporum* f. sp. *ricini*) causing heavy yield loss up to 85 percent, based on inoculums of fungal pathogen and environmental conditions. To overcome this limitation to achieve future demand, many resistant lines have been characterized. However, less information is available regarding QTLs associated with wilt resistance which is pre requisite for molecular breeding. In the present study, genomic locations associated with the response of fusarium wilt were identified using a bi-parental F2 mapping population. F2 population was developed using contrasting line VP1 (Wilt susceptible) × (SKI336 Wilt resistance). F2 population (182 individual) was screened in the sick plot of wilt for the evaluation of individual plant's response to the wilt disease. Data for disease reaction of each plant was recorded. Genotyping of 182 individuals of the mapping population was completed with 50 SSR markers. Phenotypic and genotypic data was utilized to identify QTLs using Ici software. QTLs were detected in the chromosome number 3, 4, 6, 7, 8 and 10 with the LOD cut of score 2.5. Further, markers present in the near to QTLs position were validated in the susceptible and resistant genotypes. Resistant alleles of markers namely Castor_SSR_ 22, Castor_SSR_65, Castor_SSR_46 and Castor_SSR_ 244 located on qWilt 4.1, qWilt 6.1, and qWilt 7.1/7.2 and qWilt 10.1/2 found prominent in the set of resistant genotypes as compared to susceptible is indicating that identified Wilt QTLs positions are useful for fine mapping of genes and screening of genotypes for susceptible and resistant against wilt in castor.

T7OP9: Formulation, Characterization and Evaluation of Chitosan nano Particles on Fall Armyworm, *Spodoptera frugiperda* under Laboratory Condition

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The formulation and characterization of different nano-biopesticides against fall armyworm, *S. frugiperda* under laboratory conditions was carried out from June, 2021 to July, 2022 at the Department of Nanotechnology, Centre for Advanced Research in Plant Tissue Culture, Department of Agricultural Biotechnology, AAU, Anand, while its evaluation was carried out during July, 2022 at Department of Entomology, BACA, AAU, Anand. Chitosan (Ch) and ChNPs + NSKE nano-formulations were synthesized by standardizing the methodology. The formulated ChNPs and ChNPs + NSKE nano-formulations depicted characteristic average size distribution of 189.40 ± 7.50 and 192.20 ± 7.89 nm; PDI of 0.38 ± 0.02 and 0.72 ± 0.03; KCPS of 115.05 ± 0.90 and 164.90 ± 7.50 as well as zeta potential of 34.70 ± 3.69 and 32.50 ± 6.38 mV, respectively. Ultra-visible (UV) spectra depicted peaks at 250 and 254 nm for ChNPs and ChNPs + NSKE, respectively. Formulated NPs represented a characteristic Fourier transform infrared spectroscopy (FTIR) peaks at 3323.04, 2751.80, 1633.44, 1402.52, 1316.62, 1274.75, 1196.20, 1022.70, 985.14 and 857.93 cm-1 for ChNPs and 3334.01 as well as 1635.55 cm-1 for ChNPs + NSKE, respectively. Characterization of nano-biopesticides revealed that the average size in nanometre scale with PDI indicated uniform distribution alongside optimum particle counts as per KCPS and a stable charge distribution as indicated by the zeta potential for the synthesized nano-

formulations. UV and FTIR spectra confirmed the elemental presence of silver, chitosan and NSKE in the nano-formulations synthesized. The synthesized nano-biopesticides exhibited that the ChNPs + NSKE (2.5%) recorded significantly the highest larval mortality (83.64%) of fall armyworm. Whereas, the remaining nano-biopesticides exhibited larval mortality against *Spodoptera frugiperda* in the following descending order: NSKE, 2.5% (79.99%) > ChNPs + NSKE 0.675% (53.35%) > ChNPs 25% (26.53%).

T7PP1: Molecular Approaches for High Throughput Detection and Quantification of Genetically Modified Crops

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The number of genetically modified crops is gaining attention globally, because of the regulation of cultivation and trade of GMOs in several countries. There is pressure for their accurate detection and quantification. These diagnostic techniques are mainly divided into two major groups, *i.e.*, identification of transgenic (1) DNA and (2) proteins from GMOs and their products. Today, DNA-based approaches are more popular for this purpose than protein- based methods. Conventional methods such as PCR (polymerase chain reaction) and enzyme-linked immunosorbent assay (ELISA) were routinely employed for DNA and protein based quantification respectively. Although these techniques (PCR and ELISA) are considered as significantly convenient and productive, there is a need for more advanced technologies that allow for high throughput detection and the quantification of GM events as the production of more complex GMOs is increasing day by day. Therefore, recent approaches like microarray, capillary gel electrophoresis, digital PCR and next-generation sequencing are more promising due to their accuracy and precise detection of transgenic contents. These detection techniques are based on their advent, feasibility, accuracy, and cost effectiveness. However, these emerging technologies have a lot to do with the detection of a specific event, contamination of different events, and determination of fusion as well as stacked gene protein are the critical issues to be addressed in the future.

T7PP2: Plant Molecular Farming

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Plant molecular farming is the practice of producing recombinant proteins, secondary metabolites, and other non-naive proteins in plants that have commercial, biological, and therapeutic value. The basis of this technology is the genetic modification of plants, which can be achieved using both stable gene transfer techniques (gene transfer to nuclei and chloroplasts) and unstable transfer techniques (viral vectors). The manufacturing of biomedicine is limited by its high cost and inefficient production methods. However, transgenic plants have drawn a lot of attention as bioreactors of the new generation due to its benefits, including the safety of recombinants (antibodies, enzymes, vaccines, growth factors, etc.) and their potential for large-scale low-cost production. Amplification and spread of the transgene, the buildup of recombinant protein toxicity in the environment, contamination of the food chain, and the expenses of further processing are some alarming problems associated with the use of transgenic plants. To produce useful products like enzymes, pharmaceutical proteins, and biomedicines via the safest, cheapest, and most effective means, plants are appropriate by expressing functional proteins that are identical to those found in mammals. Additionally, from interleukins to recombinant antibodies, plants can produce therapeutic proteins in huge quantities. Plant suspension cell culture in fermenters or field multiplication of plant lines undergone stable transformation can enhance the amount of protein and biomass generated by plants.

T7PP3: Zinc Nanoparticles: An Innovative Approach in Plant Disease Management

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Nanotechnology is an innovative and emerging discipline in the field of science and technology. With its broad application, it is now becoming a key part of life sciences, including approaches to target phytopathogens for disease management. Most in vitro assays have found that nano-Zn inhibits bacteria, a range of fungal pathogens, including *Alternaria alternata*, *Botrytis cinerea*, *Fusarium oxysporum*, *Mucor plumbeus*, *Penicillium expansum*, *Rhizoctonia solani*, *Rhizopus stolonifer* and *Sclerotinia sclerotiorum* as well as the nematode *Meloidogyne incognita*. Antifungal activity of zinc oxide (ZnO) and ZnO nanoparticles (ZnO NPs) was evaluated on the control of *Fusarium oxysporum* Schltdl. (Nectriaceae) under laboratory and greenhouse conditions. *In vitro* evaluation, poisoned culture media was prepared and an explant was placed in the centre of solid medium. ZnO NPs showed antifungal activity inhibiting *in vitro* mycelial growth and sporulation of *Fusarium oxysporum*. Foliar application of ZnO NPs decreased the incidence and severity of the disease caused by *F. oxysporum*, allowing the growth of tomato plants. ZnO NPs have the potential as a biostimulant to promote plant growth and to be used in the prevention and control of plant deterioration by phytopathogenic microorganisms.

T7PP4: Integrated Molecular and Bioinformatics Approaches for Disease-related Genes in Plants

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Phytopathogens have greatly threatened livelihoods and societal growth because they affect quality crop production. Plant diseases caused by pathogenic bacteria, fungi, and viruses account for nearly 20–40% of losses in agricultural crop yields worldwide. The molecular basis of the host–pathogen interaction is better understood due to the advancements in molecular and bioinformatics technologies. Modern plant pathology relies on bioinformatics approaches to create novel plant disease diagnostic tools. In recent years, a significant amount of biological data has been generated due to rapid developments in genomics and molecular biology techniques. The progress in the sequencing of agriculturally important crops has made it possible to develop a better understanding of plant–pathogen interactions and plant resistance. Molecular techniques offer precision in identifying genomic regions and specific genes associated with disease resistance. The identified disease-related genes serve as valuable targets for genetic engineering and breeding programs. The availability of host–pathogen genome data offers effective assistance in retrieving, annotating, analyzing, and identifying the functional aspects for characterization at the gene and genome levels. Physical mapping facilitates the identification and isolation of several candidate resistance (R) genes from diverse plant species. A large number of genetic variations, such as disease-causing mutations in the genome, have been identified and characterized using bioinformatics tools, and these desirable mutations were exploited to develop disease resistance.

T7PP5: Major QTL's Conferring the Resistance to Diseases in Rice Diseases Alongwith their Associated Genetic Markers

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Rice is a significant contributor to India's grain production. India is the world's second-largest producer of rice and the largest exporter of rice in the world. The highest intensity of rice cultivation is in the Eastern region of the country. Rice disease has serious negative effects on crop yield, and the correct diagnosis of rice diseases is the key to avoid these effects. Over the past decade, advancements in molecular genetics have resulted in highly saturated molecular linkage maps of rice. These maps identify genes and quantitative trait loci (QTLs) associated with disease resistance, abiotic stress tolerance, and yield potential. Primary investigations have revealed QTLs linked to various traits in different habitats. Map-based genetic analyses have become crucial in crop research, enabling the identification and manipulation of genes related to quantitatively inherited characters. This approach has sparked progress in DNA markers and molecular linkage maps, opening avenues for understanding and improving rice production. QTL mapping has proven successful in exploring complex forms of plant disease resistance, allowing scientists to characterize specific resistance loci, analyze race-specificity of partial resistance genes, and investigate relationships between resistance genes, crop growth, and the environment.

T7PP6: Advancements in Molecular Breeding for Biotic Stress Tolerance in Oilseed Crops

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Oilseed crops are high-value agricultural commodities for use in edible oil products. They contribute 40% of the total calorie intake in the diet and also act as a source of condiments. Several biotic and abiotic stresses are affecting oilseed productivity. Biotic stress may occur due to pathogenic bacteria, fungi, or viruses as well as nematodes, insects, animals, and plants. They directly deprive their host of its nutrients leading to reduced plant vigour and in extreme cases, death of the host plant. The major cause of pre- and postharvest losses. There is a need to undertake stress management practices. Since, the application of fungicides, pesticides such labour intensive, increases the financial burden on farmers. There is a need to develop resistant or tolerant cultivars. Conventional plant breeding methods develop new plant varieties by the process of selection and seeks to achieve expression of genetic material that is already present within the species. However, it is time-consuming which makes it difficult to react adequately to the evolution of new virulent pathogens or insects. The modern molecular techniques make it possible to use markers and probes to track the introgression of several R-genes into a single cultivar from various sources during a crossing programme. MAS is a method of selecting desirable individuals in a breeding scheme based on DNA molecular markers patterns instead of, or in addition to, their trait values. It is a tool so that it can help plant breeders select more efficiently for desirable crop traits. It incorporates a plethora of plant genomic resources into the process of breeding disease-resistant crops. Using molecular markers is most likely to increase the efficiency of the breeding process in cases where pest and disease resistance is controlled by one or a few genes, and those genes have a large effect on the resistance phenotype. QTL mapping is a powerful tool for identifying genes that are associated with disease resistance in plants. Association mapping is also a high-resolution method for mapping quantitative trait loci based on the principle of linkage disequilibrium that holds a great promise for the dissection of complex genetic traits. It is an efficient and effective tool for the dissection of complex traits and for the identification of alleles that can contribute to the enhancement of a target trait. Another step involving biotechnological tools for gene editing like CRISPR-Cas system, which became popular due to its faculty to perform double stranded cuts at specific target sites in various genomes, thereby opening up possibilities to edit genes and influence traits in a more controlled and simplified manner compared to prior genome editing techniques to control gene expression without causing any damage to the organisms. Molecular techniques led to the development of highly stable and durable resistance to major pests and diseases. MAB can

be efficiently used in germplasm characterization, QTL mapping, Gene pyramiding, genetic diversity and evolutionary and phylogenetic studies for biotic stress tolerance in oilseed crops. By effective exploitation of various molecular breeding techniques, it is possible to increase oilseed production by minimizing biotic stresses.

T7PP7: Marker–driven Characterization of Wheat Genotypes: A Genomic Approach

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Wheat (*Triticum aestivum* L.) is the most important cereal crop. It belongs to the genus Triticum of the family Poaceae. The most prevalent pathogens on wheat are the three rusts *viz.*, black/stem rust (*Puccinia graminis* Pers. *tritici* Erikss. and Henn.), leaf/brown rust (*Puccinia recondita* Rob. Ex. Desm. f. sp. *tritici*) and yellow/stripe rust (*Puccinia striiformis* West), which pose serious threat on its production. Among all three rusts, black or stem rust caused by *Puccinia graminis tritici* is the most feared disease of wheat inflicting severe yield losses due to its wide distribution and tendency to form new races. It is potentially most dreadful when the variety is susceptible and conditions are favourable for their development hence, known as 'killer' disease of wheat because it kills wheat plant. Developing resistance against pathogens is a very difficult task. Here, we used twelve SSR primers for screening of twenty-five wheat genotypes to identify the presence of rust resistance genes *i.e.*, Sr2, Sr22, Sr24, Sr25, Sr26, Sr31, and Sr38. Out of twelve SSR primers, four primer pairs representing the gene Sr2, Sr22 and Sr24 were amplified. The resistant allele of Sr24 has appeared in 60 percent of screened genotypes. In the 58 per cent of genotype, Sr2, Sr22 and Sr24 resistance allele were present. However, no strong correlation was observed between resistance and susceptible genotypes with the markers may be due to the involvement of multiple genes in the resistance mechanism.

T7PP8: Formulation, Characterization and Evaluation of Silver Nano Particles on Fall Armyworm, *Spodoptera frugiperda* under Laboratory Condition

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The formulation and characterization of different nano-biopesticides against fall armyworm, *S. frugiperda* under laboratory conditions was carried out from June, 2021 to July, 2022 at the Department of Nanotechnology, Centre for Advanced Research in Plant Tissue Culture, Department of Agricultural Biotechnology, AAU, Anand, while its evaluation was carried out during July 2022 at the Department of Entomology, BACA, AAU, Anand. Silver (Ag) and AgNPs + Neem seed kernel extract (NSKE) nano-formulations were synthesized by standardizing the methodology. The formulated AgNPs and AgNPs + NSKE nano-formulations depicted characteristic average size distribution of 50.87 ± 0.69 and 125.20 ± 4.01 nm; PDI of 0.34 ± 0.06 and 0.37 ± 0.06; KCPS of 224.10 ± 1.40 and 161.90 ± 1.70 as well as zeta potential of -20.00 ± 4.05 and -18.6 ± 8.46 mV, respectively. Ultra-visible (UV) spectra depicted peaks at 422 and 434 nm for AgNPs, AgNPs + NSKE, ChNPs and ChNPs + NSKE, respectively. Formulated NPs represented characteristic fourier transform infrared spectroscopy (FTIR) peaks at 3415.00, 1578.00 and 1384.00 cm-1 for AgNPs and 3334.06 and 1635.55 cm-1 for AgNPs + NSKE, respectively. Characterization of nano-biopesticides revealed that the average size in nanometre scale with PDI indicating uniform distribution alongside optimum particle counts as per KCPS and a stable charge distribution as indicated by the zeta potential for the synthesized nano-formulations. UV and FTIR spectra confirmed the elemental presence of silver, chitosan, and NSKE in the nano-formulations synthesized. The synthesized nano-biopesticides exhibited that the AgNPs-NSKE (2.5 g) recorded significantly the highest larval mortality (98.71%) of fall armyworm. Whereas, the remaining nano- biopesticides exhibited larval mortality against *Spodoptera frugiperda* in the following descending order: NSKE, 2.5% (79.99%) > AgNPs + NSKE 1.25% (73.47%) > AgNPs + NSKE 1.25% (66.74%) > AgNPs + NSKE 0.675% (56.70%) and AgNPs 25% (36.59%).

T7PP9: Computational Insights into Fungicide Binding Sites on RNA Polymerase of *Fusarium udum*

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Pigeonpea (*Cajanus cajan*) is a vital food legume in semi-arid tropical and sub-tropical farming systems, susceptible to the devastating Fusarium wilt caused by *Fusarium udum*. Molecular docking is to understand the interactions between the ligand and the target at the atomic or molecular level. The ligand molecules of ten different fungicides were docked with RNA polymerase protein molecule of *Fusarium udum*. AutoDock Vina was used for the docking simulations. The binding affinity of the fungicides with RNA Polymerase protein of *F. udum* ranged between - 3.4 to -6.6 kcal/mol. The highest binding affinity was found in Difenoconazole (-6.6) and Metiram showed the lowest binding affinity (-3.4). The zone of common amino acid binding sites between fungicides and fungus protein was TRP34, ALA217, and GLU215. The *in silico* results were confirmed with the *in vitro* fungicidal bioassay against *F. udum*. The wet lab results were corroborated with the *in silico* results.

T7PP10: Molecular Variability Check through RAPD among the Isolates of Seed-borne *Macrophomina phaseolina* Infecting Sesame Seeds

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Sesame (*Sesamum indicum* L.) is an ancient oilseed crop originating from India, widely cultivated across different climates worldwide known as the "Queen of the Oilseeds". Seeds are the economically significant part of the crop and it contains high oil and protein concentrations, making it highly valued for its nutritional content and delightful flavour. Sesame cultivation faces challenges, particularly concerning biotic agents with diseases caused by *Macrophomina phaseolina* being a major threat. Moreover, this pathogen's seed-borne nature poses a direct threat to human health when infected seeds are consumed. Twelve *M. phaseolina* isolates from different genotypes/cultivars showed distinct cultural, morphological and molecular variability. The RAPD study using 40 primers revealed cent per cent polymorphism with OPA 2, OPE 1 and OPE 3, while OPA 3 and OPA 18 exhibited the lowest polymorphism (85.71% and 83.33%). Most isolates belonged to cluster B, indicating genetic similarity, while cluster A included only four isolates. Molecular variability amongst the isolates of *M. phaseolina* infecting sesame seeds were analyzed using molecular marker RAPD.

Theme 8: Market Intelligence, Business Incubation and Extension in Plant Pathology

T8OP1: Role of Crop Protection Solutions in Doubling Farmers' Income in India

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Pest infestations cause crop losses of 20-25% in India each year. According to the Ministry of Agriculture, pests, weeds, and plant diseases cost India INR 1.48 billion in agricultural production per year. There might be a 78% loss in fruit production, a 54% loss in vegetable production, and a 32% loss in cereal production if crop protection methods are not used. Climate change is an important development that has affected the national population and agriculture. Crop protection solutions play a vital role in two ways; protecting the crop and produce from pests and increasing the farm productivity. When judiciously applied, the damage of the crop is reduced, and the output increases which directly impacts the income generated per hectare. Hence, the crop protection solution will play a principal part in the government's aspiration to double farmer's income by 2023. There is no singular approach to crop protection. Farmers today have a diverse toolbox at their disposal to minimize damage from pests, of late, much of modern research in plant pathology aims at finding other environmentally friendly means of controlling plant diseases. The most promising approaches include conventional breeding and genetic engineering of disease-resistant plants, application of disease-suppressing cultural practices, RNA and gene-silencing techniques of plant defense promoting nontoxic substances, and to some extent, use of biological agents antagonistic to the microorganisms that cause plant disease. Plant disease prediction is an underutilized area in India. Pests and diseases are highly dependent on weather variables, and many models have been developed to predict disease outbreaks. However, in conventional agriculture,these models are rarely used. However, in the next few years, model-based forecasting will gain momentum in plant pathology. Biopesticides and biocontrol agents represent another aspect of crop protection. This is becoming all the more important given the determination of many Indian states to go fully organic. Indian biopesticide market is expected to deliver $778 million by 2025 at a CAGR of 25.4%. The share of biopesticides in India is about 4.5% of total pesticide sales. The Indian biopesticides market is projected to witness a CAGR of 7.3% during the forecast period (2022-2027). Nanotechnology is a fascinating and rapidly evolving science that is used in plant protection. Agrochemicals have already been classified by the government as one of the 12 champion industries to focus on. , and the agrochemicals market is expected to reach a value of around $7.4 billion by 2026. The use of agrochemicals can increase crop productivity by 25-50%, by mitigating crop loss due to pest attacks at present, only 294 molecules are registered in India and about 75 molecules and their combinations are being used to protect 140 million hectare of diverse Indian agricultural crops. Commenting on the affordability of CPP, Dr Dalwai Committee report, on “Doubling Farmers Income” mentions that the cost of pesticides is only 0.4% of the total cost incurred by the farmers. The share of pesticides in the cost of cultivation was 3 per cent in cotton, 1.9 per cent in paddy, and further lower in wheat (0.7%) and sugarcane (0.3%). A joint consultation mechanism of the farmers, industrialists, and the government is vital to check the indiscriminate use of agro-chemicals for crop protection and also be mindful of their side effects. Expert advice should be taken before deciding on a pesticide option. Farmers must quantify the damage caused by a particular pest after determining the ETL and apply pesticides accordingly. The solution is not in shunning chemical pesticides but in educating farmers about proper use and consistently spending on research to come out with safer and more efficient products. Indian farmers need far greater range of newer molecules to fight the battle against pests, diseases, weeds and other attacks. It is indeed a ray of hope. Digital tools are one of the most innovative crop protection tools of modern agriculture. Technologies like mobile application, artificial intelligence (AI), the internet of things (IoT), big data, robot, and predictive analysis among others have streamlined the supply chain system. With internet and mobile penetration at the level of 50% and 79% respectively, providing digitally enabled One Stop Solution to the farmers Overall, digitisation could help farmers in getting technology at their doorsteps. Crop protection measures are only available towards the end of each package of practices they ultimately determine crop health and quantity. Investing in proper plant health management is therefore a very smart and sensible way to sustainable agriculture. Public and private sectors will be

keen on investing in better delivery techniques and products that leave very little impact on the plant and the soil. Hence, Crop Protection Solutions will play a principal part in the government's aspiration to double farmer's income by 2023. These advances will be discussed during the presentation along with threats and promises.

T8OP2: Artificial Neural Network as Market Intelligence System in Forecasting of Market Price of Cumin in Jodhpur District of Rajasthan

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Price forecasting is an integral part of commodity trading and price analysis. Short-term market price forecasting has been a difficult problem for a long time because of the involvement of too many factors that cannot be accurately predicted. However, time series analysis has been conventionally used in the modelling of short-term price forecasts. In recent years, a new technique of artificial neural network (ANN) has been proposed as an efficient tool for modelling and forecasting of market price. The present study analyzes the forecasting of market price of cumin in selected markets of Jodhpur, Rajasthan. The daily time series data from 6th Jan 2020 to 15th Dec 2023 were collected from Agricultural Marketing Information System (AGMARKNET). Different Neural Networks and Auto Regressive Integrated Moving Average (ARIMA) model were carried out to know the best forecasting model during study the period. The results revealed that the maximum R2 value (0.989), minimum MAE (1213.367) and RSME (1790.054) value were found in the NN8 model. In case of the ARIMA model, maximum R2 (0.980), minimum MAE (1365.304) and RSME (2354) was found in ARIMA (2, 1, 1). The results showed that ANN model evidently outperformed the time series model in forecasting the market price of cumin before one day or one week. A good correlation between the model and the real price was also observed in NN8 model with an average relative error less than 9.28%. Therefore, ANN being flexible functional form and universal functional approximator leads to self-adaptive statistical method. So, it provides an effort towards designing a market intelligence system for providing accurate and timely price forecasts along with decision support system well in advance to individual farmers in view of their local conditions.

T8OP3: Production and Marketing of Mushrooms: India v/s World

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The mushroom industry is one of the booming industries in the agriculture sector in the present era. There is a wide gap between the production and demand of mushrooms all over the world. Marketing is the process and procedures involved in moving the product from the point of production to the consumer's hands. But, the marketing of fresh mushrooms in India as well as in the world is not well organised. Producers bring fresh mushrooms to the market and other market intermediaries like wholesalers, brokers *etc.* is not functioning in this market. China, Japan, United States, Netherlands, India *etc.* are the leading producers of mushrooms in the world. The major problem faced by the mushroom producers in our country is that of distress sales during the winter months, especially in the North Indian region of the country. The future of the mushroom industry in India is determined by how efficiently the marketing of fresh mushrooms takes place in our country. For efficient and effective marketing, it is essential to understand the global and national scenario of the production and marketing of mushrooms. This paper addresses the world scenario and Indian scenario of production and marketing of mushrooms, demand, and consumption levels of this industry.

T8OP4: Dealers Outlook and Marketing Status of Various Insecticide Brand Used by Onion Growers in Amreli District

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Onion (*Allium cepa* L.; Family: Amaryllidaceae) is one of the most important commercial vegetable crops. Onion is a cool season crop. India stands at second position in onion production after China in the world. In India, Gujarat stands at second position in onion cultivation after Maharashtra state. The present study has been undertaken in Rajula, Savar Kundla, Khambha, and Dhari talukas of Amreli district, as all four talukas have higher area under onion cultivation. Multistage sampling technique was adopted to select the districts, talukas, and villages. The study was mainly based on primary data and total of 120 growers and 20 dealers were selected for the research study. The study revealed that majority of the onion dealers had business experience of 11 to 15 years and across different insecticides company's dealer's margin varied from 10 to 17 per cent. The most important factor considered by dealers for selling onion insecticides was reported price and followed by other factors *i.e.* quality, brand image and demand. Onion dealer`s major expectations from insecticide companies were reported as increasing margin, farmer satisfaction, easy and timely availability of insecticides. It was observed that highest market share was captured by United Phosphorus Limited company followed by Dhanuka Agritech Ltd. and Dharmaj Crop Guard Ltd. company. For the purchasing of insecticides from retail shops mostly credit mode was followed by growers. The onion growers exhibited more interest for choosing same brand same quantity even the price were increased, while in the absence of particular preferred brand growers shifted to another brand. Generally, most of the growers preferred to purchase insecticides by dealer's recommendation. The majority of onion growers responded

that insecticide companies have leveraged field demonstrations followed by farmer meeting platform and the farmer's fair as key promotional activities.

T8OP5: Marketing Status and Brand Preferences of Chilli Growers towards Various Insecticide Brands in Rajkot District

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Chilli *(Capsicum annuum L.)* is considered as one of the most important commercial spice crop. It is widely used as universal spice, named as wonder spice. Different varieties are cultivated for varied uses like vegetable, pickles, spice and condiments. India is the world's largest chilli producer and consumer. The present study had been undertaken in Gondal, Jamkandorna, Upleta and Dhoraji talukas of Rajkot district, as all the four talukas have higher area under chilli cultivation. Multistage sampling technique was adopted to select the districts, talukas and villages. The study was mainly based on primary data and total 120 growers and 20 dealers were selected for the study. The result revealed that highest market share was captured by Nagarjuna Agrichem Ltd. company followed by Bayer Crop Science and United Insecticides Pvt. Ltd. company. The factors influencing chilli grower's brand preference towards insecticides found to be highest with price and quality of insecticides. Among the most popular insecticide brands, the first preference was given to Profex super of Nagarjuna Agrichem Limited. Majority of chilli growers were loyal towards dealer (80.83%) and brand (85.00%) of insecticides. Credit availability was the most important factor affecting dealer loyalty and efficiency was found the important factor affecting the brand loyalty of chilli growers. The insecticide companies should supply good quality insecticide at affordable price which may attract both dealers and growers to become brand loyal.

T8OP6: Market Intelligence – The Need, Development and Relevance to Policy Analysis

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Proficient market intelligence is essential for the development of agriculture economy as a whole. It would help in providing outlets and incentives to increase agricultural production. Market intelligence plays an important role in the commercialization of subsistence farmers. The unavailability of market information would nullify most of the government's efforts to increase agricultural production. It would further help in building effective linkages of production systems with supply chains and value-added activities, which would play an important role in agricultural diversification. The development of farmers and the agricultural sector as a whole enables the use of market intelligence in agriculture. Agricultural market information helps ensure that products go to markets where they are in demand. It condenses marketing channels, reduces transportation costs, and helps ensure that every marketing transaction is fair and that all participants share the risks and benefits. Agricultural prices are of enormous importance in the Indian economy and have a significant influence on the decision-making patterns of farmers and other stakeholders in terms of crop area and marketing. Future agricultural growth is expected to achieve largely from improved productivity of diversified agricultural systems with regional specialization and sustainable management of natural resources, especially land and water.

T8PP1: Market Intelligence, Business Incubation and Extension in Plant Pathology

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Growing global demand for infectious disease diagnostics is paving the way for novel methods of detection for plant disease pathogens, thus propelling market growth. Worldwide revenue from the plant disease diagnostics market was about US$ 96.5Mn in 2022. Business incubation is very important in plant pathology incubator provides a range of support services like technology mentoring, networking, access to laboratories, office space, and developing forward and backward linkages for business promotion. Extension plant pathologists have been the face of our science to farmers, horticulturalists, homeowners, and agribusiness since the passage of the Smith-lever Act in 1914. The job of an extension specialist has changed over this time, but the need to be knowledgeable about all facets of our science and to have the ability to apply and effectively teach this knowledge to a diverse clientele has remained constant. Extension work in plant pathology was first undertaken by state land grant university or college faculty in the context of county fairs, farmer institutes, short courses, field demonstrations, farm trains, and other efforts to deliver information to clientele.

T8PP2: Advancing Agricultural Outreach: Next-generation Extension and Market Intelligence Strategies in Plant Pathology

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As agriculture undergoes rapid technological transformations, the integration of innovative approaches becomes imperative to address contemporary challenges and optimize productivity. The study delves into the development and application of next-generation extension strategies designed to disseminate critical information efficiently. Leveraging technological tools and digital platforms, these strategies aim to empower farmers and extension workers with real- time insights on disease

management and sustainable agricultural practices. The abstract highlights the significance of bridging the communication gap between researchers, extension services, and agricultural communities to ensure the effective transfer of knowledge. Simultaneously, the research investigates advanced market intelligence strategies tailored specifically for plant pathology. Recognizing the importance of timely and accurate market information, the study explores the integration of state-of-the-art technologies, including artificial intelligence and data analytics, to analyze market trends, predict disease outbreaks, and identify opportunities for innovation. By combining efficient extension services with robust market intelligence, the research aims to create a holistic framework that not only equips farmers with the latest insights but also enables stakeholders to make informed decisions in a dynamic agricultural landscape. Ultimately, this research contributes to the discourse on the future of agricultural outreach by proposing a comprehensive model that synergizes next-generation extension and market intelligence strategies. The findings of this study hold the potential to revolutionize the way information is disseminated and utilized in the field of plant pathology, thereby fostering a more sustainable and resilient agricultural future.

T8PP3: Scope of Mushroom Marketing in Gujarat in the Post-pandemic Era

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This essay aims to draw attention to the growing business prospects in rural Gujarat that have resulted from the post-pandemic spike in demand for mushrooms. Since there are no open loops in the mushroom industry, it differs from the linear economy in that it is simpler, less expensive, and more profitable. This study aims to evaluate the potential of mushroom enterprise in Gujarat. A survey of 1000 households across Gujarat suggests a positive outlook for the mushroom industry in the state. Following the COVID-19 pandemic, mushrooms are now more widely accepted. They are regarded by many locals as a comparatively inexpensive source of protein. Approximately 70% of participants anticipated a rise in their family's mushroom consumption in the future. Mushroom cultivation is finding pace in states like Gujarat where people will frequently eat vegetables instead of nonvegetables. Many mushroom enterprises were established across Gujarat in the recent past. In Gujarat, the mushroom industry is expanding mainly because consumers are becoming more health-conscious and are looking for highly nutritious foods. In 2022, Gujarat produced around 14,600 tons of mushrooms annually, with a sharp increase in rishi mushroom production and oyster mushrooms. Nowadays, cordyceps are commercially grown in Gujarat. Furthermore, value-added products of mushrooms could be a good way to introduce it to the population who does not appreciate the raw product. Supply chain strengthening will certainly lead to better reach of products to potential consumers.

Theme 9: Advances in Chemicals and Drone Technologies for Plant Disease Management

T9OP1: Integrated Pest and Disease Management in Coriander

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Coriander is an important seed spices crop grown in India. It is widely cultivated in Gujarat, Rajasthan and some adjoining states. The crop suffers from several pests and diseases. Hence, an experiment was planned to find out the integrated management of pests and diseases in coriander. A field experiment was conducted in a randomized block design with three replications during *Rabi* 2018-19, 2019-20 and 2020-21 at Seed Spices Research Station, Jagudan (Gujarat). Coriander cv. Gujarat coriander 2 (G.Cor 2) was sown in November at a distance of 30 cm row spacing by using 15 kg seed rate per hectare. Different nine treatments of fungicides, insecticides and bio-pesticides applied with their prefixed concentrations and were compared with untreated control. Among all the treatments two sprays of propiconazole 25 EC @ 0.025% (10 ml/10 L) + two sprays of acetamiprid 20 SP (0.004%) was found superior and it was at par with two sprays of wettable sulphur 0.2% (25 g/10 L water) + two sprays of acetamiprid 20SP (0.004%) and two sprays of propiconazole 25 EC @ 0.025% (10 ml/10 L) + two foliar sprays of *Lecanicillium lecanii* 1.15WP (1x109cfu/g) (40 g/10 L) for the economical and effective management of powdery mildew and aphids in coriander.

T9OP2: Exploring Potential of New Generation Fungicides in Combating Foliar Diseases in Bt Cotton

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Among the foliar diseases of *Bt* cotton, Alternaria leaf spot caused by *Alternaria alternata* (Fr.) Keissler and bacterial blight caused by *Xanthomonas citri* pv. *malvacearum* (Smith) Dye is widely distributed and highly destructive. The Alternaria leaf spot and bacterial blight diseases are now becoming major foliar diseases in *Bt* cotton- growing regions of Gujarat and damaging the foliage to a greater extent. The pathogens *A. alternata* (Accession No. MW035008), *X. citri* pv. *malvacearum* strain Xcm1 (Accession No. MW867239) was identified based on ITS rDNA. The current study aimed to explore the potentiality of new molecules in minimizing the early infection of foliar pathogens in Bt cotton. In preliminary *in-vitro* testing, the poisoned food technique was followed to evaluate the ready- mix fungicides against *A. alternata* at two different concentrations. Out of tested fungicides, azoxystrobin 18.2% + difenoconazole 11.4% SC and tebuconazole 50% + trifloxystrobin 25% WG were found significantly superior at both the concentrations (500 and 1000 ppm) with mycelial growth inhibition of 96.55, 97.63 and 93.19, 97.52 per cent,

respectively. The lowest mycelial growth inhibition was recorded at both the concentrations (100 and 200 ppm) in streptomycin sulphate 90% + tetracycline hydrochloride 10% SP (1.24 and 3.06%). It was noted that as the concentration of the fungicides were increased, the growth inhibition of *A. alternata* increased. The agar well diffusion method was used to determine the zone of inhibition against *X. citri* pv. *malvacearum*. Streptomycin sulphate 90% + tetracycline hydrochloride 10% SP was the most effective at both concentrations in inhibiting the bacteria among the fungicides tested. At both concentrations, 100 and 200 ppm, the inhibition zone measured 19.91 and 21.44 mm, respectively. The field experiment was conducted during *Kharif* 2019-20 and *Kharif* 2020- 21 to manage Alternaria leaf spot and bacterial blight diseases in *Bt* cotton through the application of different ready-mix fungicides. First foliar spray of respective fungicides was given at the appearance of the diseases and a subsequent spray was given after 15 days of the first spray. The pooled results of the two seasons indicated that the application of azoxystrobin 18.2% + difenoconazole 11.4% SC recorded the highest disease control of 81.84 per cent with 11.56 per cent disease intensity. The control treatment recorded the highest disease intensity (63.67%) against Alternaria leaf spot. Application of streptomycin sulphate 90% + tetracycline hydrochloride 10% SP recorded the highest disease control of 85.41 per cent with lower disease intensity (7.34). The treatment metiram 55% + pyraclostrobin 5% WG recorded 15.77 per cent disease intensity with good disease control (68.65%). The highest disease intensity (50.30%) was recorded in the control treatment against bacterial blight. The highest seed cotton yield was recorded in the treatment of azoxystrobin 18.2% + difenoconazole 11.4% SC (1792 kg/ha) and streptomycin sulphate 90% + tetracycline hydrochloride 10% SP (1606 kg/ha) as compared to control (903 kg/ha) treatment. This effective treatment can be employed as a chemical component in foliar disease management in Bt cotton.

T9OP3: Management of Major Foliar Diseases of Groundnut

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A field experiment was conducted at the Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh (Gujarat) during *Kharif* for three consecutive seasons of the year 2017-18, 2018-19, and 2019-20 to find out the most effective and economical fungicide for controlling the foliar disease of groundnut. Looking at the three years data it was revealed that the treatment comprising of seed treatment of Tebuconazole 2DS @ 1.5 g/kg seeds+ foliar spray of Tebuconazole 50% +Trifloxystrobin 25% WG @ 1.32 g/L (0.035%) at 40 and 65 DAS (T4) significantly reduced early leaf spot (55.87%), late leaf spot (55.09%), Alternaria leaf blight (57.92%) and rust (47.21%) diseases of groundnut with increased pod yield (45.62%) and haulm yield (60.40%) as compared to control. The highest income of Rs. 41637 was also obtained in the same treatment followed by T7 with additional income and net realization of Rs. 35700 and 32925, respectively with ICBR 1:12.86.

T9OP4: *In vitro* Evaluation of Fungicides against *Fusarium oxysporum* f. sp. *capsici* (Sacc.) Causing Wilt of Chilli

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The investigation was conducted at the Department of Plant Pathology, JNKVV- Jabalpur (M.P.) during 2020-21 to test the efficacy of fungicides under *in vitro* conditions. The fungus was isolated from the diseased chilli plants collected from the research field of the University. The pathogen was identified *Fusarium oxysporum* f. sp. *capsici* based us on cultural and morphological characteristics. Seven fungicides, *viz*., Copper oxychloride (Blue Copper) (0.3%), Chlorothalonil (Kavach) (0.2%), Tebuconazole (Folicure) (0.1%), Probineb (Antracoal) (0.2%), Fluopyram (Luna) (0.1%), Thiram (Seed Cap) (0.25%), Hexaconazole (Contaf) (0.1%) and Nine combination fungicides, *viz*., Carbendazium + mancozeb (Safal) (0.2%), Fluopyram + Tebuconazole (Luna) (0.1%), Azoxystobin + tebuconazole (Azexy sulphur) (0.1%), Azoxystrobin + difenconazole (Azoxy Top) (0.1%), Metalaxyl + Mancozeb (Master) (0.25%), Carboxin + thiarum (Vitavex Powder) (0.25%), Tebuconazole+Trifloxystrobin (Vatio) (0.1%), Captan + Hexaconazole (Taqat) (0.2%), Hexaconazole + Carbendazium (Sofia) (0.2%), were evaluated against *Fusarium oxysporum* under *in vitro* condition. Among solo fungicides, Tebuconazole was discovered to be the most effective fungicide inhibiting the radial growth of *Fusarium oxysporum* f. sp. *capsici* to the tune of 100% followed by Fluopyram (68.13%) after 168 hours of incubation. Hexaconazole, Thiram, Probineb, Chlorothalonil, and Copper oxychloride suppressed the growth of the test pathogen by 63.37, 62.63, 56.0, 26.66, and 21.11 percent, respectively. Copper oxychloride inhibited the least (21.11%). Carbendazium + Mancozeb was found most effective fungicide which inhibited the mean radial growth of *Fusarium oxysporum* f. sp. *capsici* to the tune of 93.22 per cent followed by Azoxystrobin + Difenoconazole (89.83%) after 168 hrs of incubation. Tebuconazole + Trifloxystrobin, Hexaconazole + Carbendazium, Carboxin + Thiarum, Azoxystobin + Tebuconazole, and Captan + Hexaconazole inhibited the growth of test pathogen, respectively by 86.44, 86.44, 84.74, 79.66, 77.96 and 64.40 per cent. The least inhibition was noted in Metalaxyl + Mancozeb (32.20%).

T9OP5: Integrated Management of Sclerotinia Stem Rot in Chickpea

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Chickpea (*Cicer arietinum* L.) is the most important pulse crop grown all over the India. The various diseases cause serious losses in chickpea production. Stem rot of chickpea caused by *Sclerotinia sclerotiorum* is a serious problem in chickpea which causes an economic yield loss. Stem rot disease in chickpea can appear at any stage of the crop and is caused by fungi and Sclerotia in soil. Sclerotia may survive for 5 to 8 years in the soil. Excessive vegetative growth, high soil moisture, and cooler weather (20° C) conditions favor disease development. To combat this disease an integrated management approach was framed and an experiment was conducted at a research farm, ARS (SKRAU), Srganganagar from *Rabi* 2019-20 to 2021-22. The experimental results show that minimum disease incidence (5.50%) was observed in treatment combination *i.e.* ST with carboxin 37.5% + thiram 37.5% (75 WP) @ 2g kg^{-1} seed and one foliar spray with propiconazole 25EC @ 0.1 per cent at 60-65 DAS along with no irrigation during 25th December to 15 January. The next best treatment with a disease incidence of 5.75 per cent was in another treatment combination *i.e.* ST with carboxin 37.5% + thiram 37.5% (75 WP) @ 2g kg^{-1} seed and one foliar spray with carbendazim 12% + mancozeb 63% (75 WP) @ 0.2 per cent at 60-65 DAS along with no irrigation during 25th December to 15th January.

T9OP6: Evaluation of Most Effective Fungicide against Major Seed-borne Mycoflora of Maize through Seed Priming Technique

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Seed health evaluation was attempted for seed samples of maize collected from farmers saved seeds from eight districts of the Marathwada region of Maharashtra state. Dry seed examination revealed a distinct variation in healthy seeds, damaged, discoloured, shrivelled and inert matter in seed samples of different locations of maize. Eight seed- borne mycoflora *viz*., *Aspergillus flavus, Aspergillus niger, Fusarium moniliforme, Rhizoctonia bataticola, Curvularia lunata, Alternaria alternata, Rhizopus stolonifer* and *Fusarium oxysporium* were detected and identified by using the Standard blotter, Agar plate and Towel paper method. The associated seed borne mycoflora were found to reduce the germination and thereby seedling vigour index. Overall mycoflora detected by all three incubation methods revealed that maize seed samples of Jalna and Aurangabad district harbour maximum mycoflora resulting in less germination percentage. The standardized seed priming for 12 hrs was found most effective among all other hydropriming based on seed quality characters. Among all different fungicides tested against *Fusarium moniliforme* by employing the poisoned food technique. Carbendazim 12% + Mancozeb 63%WS and Azoxystrobin 18.2% + Difenoconazole 11.4% SC @ 2500 ppm respectively were found most effective fungicides over all other treatments, which were found to be the most effective fungicides by arresting 100% radial mycelial growth of *Fusarium moniliforme*.

T9OP7: Management of Bacterial Blight of Rice (*Xanthomonas oryzae* pv. *oryzae*)

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Rice (*Oryza sativa* L.) is cultivated in highly diverse climatic and agroecological conditions in India. About 60- 65% of the Indian population depends on rice as the primary source of nutrition. Every year 40% of rice crop is lost worldwide due to biotic stresses including insects, pathogens and weeds. Among the biotic stresses, diseases took a heavy toll in reducing the yield and quality of rice as such various diseases *viz*., bacterial leaf blight, paddy blast, sheath blight, brown leaf spot, false smut, and rice tungro disease are reported to cause severe yield losses. Most importantly rice crop was found susceptible to many bacterial pathogens. One of them is bacterial leaf blight (BLB) caused by *Xanthomonas oryzae* pv. *oryzae* that is regarded as the oldest rice disease in Asia and which exerts severe yield losses in different rice growing regions across the globe. Hence it is very important to manage this disease effectively. To reduce the BLB intensity efforts were made using antibiotics, antibacterial chemicals, biological control agents and organic products during *Kharif*, 2023. Among the antibiotics and antibacterial chemicals tested, all of them were found significantly superior over control, however, seed treatment with streptocycline+ copper sulphate @ 0.1g/lit each accompanied with 2 foliar sprays of bacterinashak @ 0.5 g/lit showed the least per cent disease index of 13.11 and 19.41 after the first and second sprays respectively. Among the biocontrol agents and organic products, seed treatment with *Pseudomonas fluorescence*@ 10g/l+ seedling dip with *P. fluorescence*@ 10 g/l + 2 foliar sprays with *Bacillus subtilis*@ 10 g/l showed the minimum disease intensity of 15.63% and 19.78% after first and second sprays respectively. The highest bacterial blight intensity was recorded in untreated check plots.

T9OP8: Bio-efficacy of Different Fungicides Against *Lasiodiplodia theobromae* (Pat.) Griffon & Maubl Causing Mango Dieback *in vitro*

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Mango (*Mangifera indica L.)* is one of the most important fruit crops, and belongs to the family Anacardiaceae. Mango is a tropical fruit but grows in a wide range of climatic conditions. Due to that, it is infected by a number of diseases at all stages of its development, among them dieback caused by *Lasiodiplodia theobromae* (Pat.) Griffon & Maubl. is considered to be the most destructive disease, leading to significant yield loss and low fruit quality of mango due to slowly wilting of trees. The present investigation was carried out to evaluate the inhibitory activity of different fungicides against *L. theobromae*. Different eleven fungicides *viz.,*

Azoxystrobin 23 SC, Carbendazim 50 WP, Copper oxychloride 50 WG, Hexaconazole 5 EC, Propiconazole 25 EC, Sulphur 80 WP, Carbendazim 12% + Mancozeb 63% WP, Tebuconazole 50% + Trifloxystrobin 25% WG, Azoxystrobin 18.2%+ Difenconazole 11.4% SC, Carbendazim 25% + Flusilazole 12.5% SE and Fluopyram 17.7% + Tebuconazole 17.7% were tested at three different concentrations *i.e.*, 1000, 1500 and 2000 ppm by poisoned food technique. Among them, cent per cent growth inhibition was found in Carbendazim 50 WP, Propiconazole 25 EC, Carbendazim 12% + Mancozeb 63% WP and Carbendazim 25% + Flusilazole 12.5% SE at all three concentrations. The results indicated that almost all fungicides are effective against *L. Theobromae* at the preliminary level. Hence, they can be explored further *in vivo* conditions for the management of mango dieback.

T9OP9: Morpho-cultural Characteristics and *in vitro* Management of *Colletotrichum gloeosporioides* (Penz.) Penz and Sacc. Causing Anthracnose of Dragon Fruit (*Hylocereus* spp.)

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Dragon fruit or "Kamalam" (*Hylocereus* spp.) is emerging as super crop owing to its health and medicinal benefits worldwide. It is a climbing cactus vine that belongs to the family Cactaceace. Dragon fruit can be damaged by some abiotic disorders and by the infestation of pests and diseases. Out of many diseases, anthracnose, which is caused by *Colletotrichum gloeosporioides* is frequently reported and is relatively the most destructive and emerging fungal disease in India as well as in Gujarat. Notable symptoms of anthracnose appear either on the fruit or on the stem, showing as reddish-brown irregular or round spots that later merge, enlarge, and turn into dark brown sunken lesions. Diversity in cultural and morphological characteristics of *Colletotrichum gloeosporioides* were studied in eight different media at room temperature (27±1°C). Among them, Czapek's dox agar (84.00mm) and potato dextrose agar (83.67mm) were significantly higher in maximum mycelial growth; while, the least mycelial growth was observed on water agar (67.67mm) and soybean meal agar (64.67mm) after 168h of incubation. *In vitro* efficacy of ten fungicides (systemic and non-systemic), ten botanicals, and five bio-agents were tested against causal agents by adopting the poisoned food technique. The investigation revealed that, among fungicides, the maximum growth inhibition was observed in COC 50 WP propineb 25 EC, propiconazole 25 EC, and carbendazim 50 WP (99.99%) whereas, in plant extracts, maximum growth inhibition was found in garlic (64.78%) followed by neem (62.75%) at 15 per cent concentration. Among bio-agents, the maximum mycelial growth was recorded in *Bacillus subtilis* (88.11%) followed by in *Trichoderma viride* (65.70%).

T9OP10: Development of Agricultural Wastes Enriched Hydrogel Composites and Fungicidal Formulations for Evaluation in Mungbean

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Mungbean, a major pulse crop in India is grown as a summer crop that predominantly suffers from water scarcity and attack of soil-borne diseases like wet root rot or web blight (*Rizoctonia solani*) and dry root rot or Macrophomina blight (*Rizoctonia bataticola*). Out of these two damage due to *Rizoctonia solani* is more prevalent. To combat this pathogen, it is therefore additionally emphasis on greener options *i.e.*, controlled release formulations as alternatives to synthetic options and as the integrated disease management (IDM) component necessitates the development of quality products with enhanced shelf life and field viability. Excipients namely agriresidue based hydrogel composites have been developed from agri-residue sources namely, sugarcane bagasse and corn cob. Two series of hydrogel composites with a water absorption capacity of the order of > 350 g/g – 690 g/g on a dry weight basis have been synthesised using raw biomass and gel synthesizing materials. Prepared formulations and hydrogel composite samples have been characterized by TEM, SEM, XRD, FT-IR and solid state C13 NMR techniques. One of the developed materials was utilized as an auxiliary to develop powder for seed treatment and that formulation was characterized and evaluated for their potential to control the web blight in mung bean under pot conditions. The biocontrol potential of this powder formulation of carbendazim was found to be superior to that of normal formulation under pot conditions, although both expressed superior bio-efficacy as compared to Carbendazim 50% WP and the talc-based (2% dust) formulation. The developed formulations need further validation under integrated disease management (IDM) programs in mungbean.

T9OP11: Evaluation of Fungicides for the Management of Pearl Millet [*Pennisetum glaucum* (L.)] Blast Caused by *Pyricularia grisea* under Field Condition

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Blast disease caused by *Pyricularia grisea* is a major problem and a serious threat to pearl millet productivity. Most of the hybrids being grown in India are susceptible to blast, as not much effort has been made to breed for blast resistance in pearl millet. In the absence of host plant resistance, the disease can be effectively managed with chemical fungicides. Therefore, seven fungicides (Tricyclazole 75% WP, Edifenphos 50% EC, Carbendazim 50% WP, Tricyclazole 18% + Mancozeb 62% WP, Tricyclazole 45% + Hexaconazole 10% WG,

Propiconazole 10.7% + Tricyclazole 34.2% SE, Carbendazim 12% +Mancozeb 63% WP) were tested for their efficacy to manage blast disease on a blast susceptible pearl millet line (ICMB 9544). Results of this study clearly demonstrated that the disease can be effectively managed with two sprays of Tricyclazole + Hexaconazole @ 0.05% recorded lowest PDI (19.22%) and AUDPC value (824.58 units) while the highest grain and fodder yields of 1857.50 kg/ha and maximum disease intensity of 67.92% recorded in the control (without spray).

T9OP12: Twister Disease of Onion - A Recent Challenge in Production and its Management

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Onion belonging to the genus Allium in Alliaceae family is the oldest cultivated vegetable in the world. It is the second only after tomatoes, both of which are extensively used not only for culinary purposes all over the world. It is a multi-use vegetable that is consumed fresh as salad as well as in the form of several processed products. The leading onion-growing countries are China, India, USA, USSR, Japan, Spain, Turkey, Brazil, Italy, Egypt, Pakistan, Iran, and Brazil. In India, it occupies an area of 14, 34,000ha with production of 2, 67, 38,000MT as recorded in the year 2019-20 (NHB). India ranks first in area with 14, 34,000 ha and accounting to 2, 67, 38,000 MT tolling second in production. The major onion-producing states are Maharashtra, Madhya Pradesh, Karnataka, Gujarat, Bihar, Haryana, Andhra Pradesh, Tamil Nadu, Uttar Pradesh, and West Bengal. These states account for almost 90 per cent of the total onion production of the country. Of late, in Karnataka and Maharashtra, the onion production is being hampered by twister disease. The disease is usually aggravated if rains coincide with the vegetative stage of the crops. The yield losses toll up to cent per cent in a few areas. The disease incidence in major growing pockets of Karnataka has been assessed through a rowing survey in the year 2022. The pathogens associated with the disease were isolated and characterized as *Colletotrichum* sp., *Fusarium* sp. and *Sclerotium* sp. through morphological and molecular means. A total of 80 *Colletotrichum*, 35 *Fusarium* and 20 Sclerotium isolates were isolated and their diversity with respect to morphology, cultural, and genetic makeup was studied. To manage the disease, endophytic bacterial isolates were isolated and screened through paired culture method. Among the 45 isolates, the isolate 112 proved to be potent in arresting the growth of all three pathogens *in vitro*. Further, fungicides were also screened through the poisoned food technique against three pathogens and it was observed that Propiconazole 25% EC, Azoxystrobin 11%+ Tebuconazole 18.3% SC, Tricyclazole 18%+ mancozeb 62% WP, and Tebuconazole 25%+ Trifloxystrobin 50%WG were found to be potent in arresting the growth of all the pathogens. Further, the compatibility among the fungicides and bacterial isolate was tested and the formulation of the endophytic bacterial isolate was also developed. The field evaluation of bacteria and fungicides revealed that the bacterial isolate 112 @10g per liter (Talc based) in combination with fungicides, *viz*., Azoxystrobin 11% + Tebuconazole 18.3% SC@ 1 ml per liter when applied as foliar spray three times starting from one month of the crop at 15 days interval could reduce the disease incidence by 76.20%. The residue analysis of the fungicide Azoxystrobin 11% + Tebuconazole 18.3% SC was assessed on onion and was found to have no residual effect post 15 days of spray. To understand the physiology of twisting, the LCMS analysis of infected and healthy onion plants was carried out, and was observed that, in the twisted plants there was a multifold increase in the GA4 hormone suggesting the role of this hormone in twisting.

T9OP13: Effect of Fungicide Application on Tikka Disease Development in Groundnut

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The leaf spot or tikka disease (*Cercospora arachidicola* and *Cercosporidium personatum*) of groundnut (*Arachis hypogea* L.) is a predominant, devastating, and economically important foliar disease and leading to a major yield loss of groundnut in India as well as the entire world. Field experiment was conducted during *Kharif* 2018, 2019 and 2020 for the evaluation of fungicides (Tebuconazole 50% + Trifloxystrobin 25% WG; 0.05%, Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.075%, Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.1% and Pyraclostrobin 13.3% + Epoxiconazole 5% SE @ 0.025%) against the tikka disease of groundnut. The yield data revealed that a significantly higher pod yield (1655 kg/ha) was recorded in the treatment *i.e.* Tebuconazole 50% + Trifloxystrobin 25%, 0.075%, and the same was found at par with all other treatments. Significantly minimum pod yield was found in the control plot (915 kg/ha). Maximum Benefit-Cost Ratio (BCR) 1:5.50 was found in Tebuconazole 50% + Trifloxystrobin 25% WG, 0.05 followed by Pyraclostrobin 13.3% + Epoxiconazole 5%; 0.025% (1:5.05).

T9OP14: Phytoremediation of Fipronil and Metalaxyl by Mungbean (*Vigna radiata*) and Indian Mustard (*Brassica juncea*)

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About 40% of the world's potential agricultural output is lost each year due to the breakout of weeds, pests, and diseases. If pesticides were not used, this loss would easily double up. Food crop production is not an easy task since there are multifarious species of weeds and worms, plant-eating insects worldwide. Fipronil is a broad-spectrum phenylpyrazole insecticide and veterinary medication that is widely used across the world, whereas, Metalaxyl is a fungicide mostly used in fungal diseases. Keeping in view the above scenario, the present studies were carried out to remediate by *Vigna radiata*

and *Brassica juncea*. The experiment was laid out with five treatments of Fipronil and Metalaxyl (T1: Untreated check, T2: Fipronil 5% SC @ 200 g a.i. ha-1, T3: Fipronil 5% SC @ 600 g a.i. ha-1, T4: Metalaxyl 35% WS @ 200 g a.i. ha-1, T5: Metalaxyl 35% WS @ 600 g a.i. ha-1). The study was conducted in two parts, the first session was carried out to assess the persistence of Fipronil and Metalaxyl in sandy loam soil before the phytoremediation investigation and the second section was carried out to evaluate the phytoremediation efficacy of *Vigna radiata,* and *Brassica juncea*. The pooled results indicated that *Vigna radiata* remediates Fipronil and Metalaxyl as significantly reduced half-life from 84 days to 45 days and from 67 days to 36 days, respectively. Interestingly, *Brassica juncea* remediates Fipronil and Metalaxyl more efficiently as the significantly reduced half-life of 3.7 days and 4.8 days, respectively. However, bioaccumulation of Fipronil and Metalaxyl was observed in the whole plant of *Vigna radiata* on the 30th day of harvesting, while the residues of Fipronil and Metalaxyl were below the determination limit from the whole plant of *Brassica juncea* at harvest. Therefore, *Brassica juncea* is an ideal crop for Phytoremediation.

T9OP15: Bio-efficacy of Fungicides against Cercospora Leaf Spot Diseases of Mothbean

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Mothbean is a good source of dietary carbohydrates and proteins for the largely vegetarian people of arid and semi-arid areas of the country. Cercospora leaf spot (CLS) is the most serious foliar disease of mothbean in our growing region. The disease occurs on other legumes, including closely related plants such as mung bean, 'true' beans (*Phaseolus*), and soybean. It causes leaves to fall off and serious yield losses of up to 40 per cent. The experiment bio- efficacy of fungicides against Cercospora leaf spot diseases of mothbean was conducted during *Kharif*, 2020 & 2021. The crop was sown in the first week of July in both the sessions in randomized blocked design and replicated thrice. The experiment consisted ten treatments along with control *viz*., spray with thiram 37.5% + carboxin 37.5 + @ 2 ml /l, spray with hexaconazole @ 1 ml/l, spray with trifloxystrobin 25% + tebuconazole 50% @ 0.5 g / l, spray with azoxystrobin 23% SC @1 ml/l, spray of difenoconazole @ 0.5 ml/l, spray with carbendazim 50% WP @ 2g/ l, spray with myclobutanil @ 1 g/l, spray with kresoxim methyl @ 1 g/l, spray with pyraclostrobin 133G/L + epoxiconazole 50 G/L SE @1.5ml/l. The foliar spray was done twice at an interval of 15 days starting from the initial appearance of the disease. The percent diseases intensity was recorded prior to first & second spray and after 15 days of last spray by examining 20 leaves from 10 randomly selected plants in each treatment. Two years pooled results were indicated that minimum per cent disease intensity (7.60%) of cercospora leaf spot was recorded in two foliar spray with pyraclostrobin 133G/L + epoxiconazole 50 G/L SE @1.5 ml/l with maximum seed yield (438 kg/ha) and it was statistically at par with difenoconazole @ 0.5ml/l (9.40% PDI). Maximum Cercospora leaf spot (31.00%) was recorded in control with minimum seed yield.

T9OP16: Management of Powdery Mildew Disease in Ber (*Zizyphus mauritina* Lamarcke.)

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Ber, *Ziziphus mauritiana* Lamk. is an important arid and semi-arid fruit crop indigenous to an area under India to China. In Gujarat, ber is cultivated on an area of about 11,190 hectares with production of 1, 13, 901 metric tonnes and productivity of 9.40 metric tons (Anon. 2019). Powdery mildew incited by *Oidium erysiphoides* f. sp. *ziziphi,* Yan and Wang is the most important biotic stress which resulted in heavy loss in yield and quality of the fruits. An experiment was conducted at Agroforestry Research Station, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat during the year 2016-17 to 2020-21. Three sprays of fungicides were applied first at the initiation of the disease and subsequent sprays applied at fifteen days interval. Eight fungicides *viz.* potassium bicarbonate (0.5%); difenconazole 25% EC(0.05%); myclobutanil 10% WP(0.04%); penconazole 10% EC(0.05%); hexaconazole 5% EC(0.1%); flusilazole 40% EC (0.01%); dinocap 48 EC(0.1% & 0.05%) and wettable sulphur 80% WP (0.2%) were evaluated against powdery mildew disease. The treatment of myclobutanil 10% WP @ 0.04% revealed minimum powdery mildew incidence (9.09 % PDI) with highest fruit yield (8613.00kg/ha.) which was at par with dinocap 48 EC @ 0.1%.

T9OP17: Management of Cumin Blight (*Alternaria brunsii*) by Novel Fungicides

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A field experiment on the efficacy of tebuconazole 25.9 EC against cumin blight was conducted at farmers' fields as well as the instructional farm of Krishi Vigyan Kendra, Jalore (Agriculture University, Jodhpur) to find out the bio- efficacy of fungicides @ 1ml/lit. The experiment was conducted with two treatments T1: Carbendazim 12 + Mancozeb 63% @ 2g/litre and T2: Tebuconazole 25.9 EC @ 1ml/litre of water. The incidence of blight appeared in the last week of January and reached its peak in the second week of February. The minimum disease intensity of cumin blight was found in the T2 (Tebuconazole 25.9 EC @ 1ml/litre of water) with 6.00 per cent, while 39.00 per cent disease intensity was observed in T1 (Carbendazim 12 + Mancozeb 63% @ 2g/litre). The economic yield of cumin was maximum increased in T2 with 8.90 q/ha which is higher as compared to T1.

T9OP18: Evaluation of Different Fungicides and Plant Products against Powdery Mildew of Fenugreek

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Fenugreek holds a significant role as a seed spice in the Indian cooking system and is mainly cultivated in North India. Not only valued for its culinary uses, but fenugreek also possesses notable medicinal properties. These challenges affecting crop production in this region include poor soil fertility, the prevalence of diseases and pests, and the impact of abiotic factors. Renowned for its culinary contributions, fenugreek also boasts commendable medicinal properties. These factors collectively contribute to the relatively low production of fenugreek in North India. Powdery mildew, caused by *Erysiphe polygoni* DC, is a significant hindrance to fenugreek production. A field study evaluating various fungicides and plant products against powdery mildew of fenugreek was conducted at the Research Farm of the College of Agriculture, Sumerpur during the Rabi season of 2022-23. The research findings indicated that all treatments were significantly more effective than the control in managing powdery mildew. The lowest PDI (7.63%) and the highest yield (13.19 q ha-1) were observed in the foliar spray treatment using Hexaconazole 5 EC @ 1 ml/liter, followed by the foliar spray of Tebuconazole 25.9 EC @ 1 ml/liter

T9OP19: Application of Drone for Disease Detection in Precision Agriculture

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Plant diseases affect the quality and quantity of agricultural products and have an impact on food safety. These effects result in a loss of income in the production sectors which are particularly critical for developing countries. Visual inspection by subject matter experts is time-consuming, expensive and not scalable for large farms. As such, the automation of plant disease detection is a feasible solution to prevent losses in yield. Nowadays, one of the most popular approaches for this automation is to use drones. Drones have been used for diverse application purposes in precision agriculture and new ways of using them are being explored. Many drone applications have been developed for different purposes such as pest detection, crop yield prediction, crop spraying, yield estimation, water stress detection, land mapping, identifying nutrient deficiency in plants, weed detection, livestock control, protection of agricultural products and soil analysis. Different disease types were covered by different researchers. As per reviewed literature fungus accounts for 64% of the diseases for which drones were used while virus, nematode and abiotic studies only in 10%. Most of the studies (58%) utilized field images and very few studies used leaf images (14%) or plant images (28%). Mainly CIR (color infrared) images were generated by drones to support decision-making Five different drone types are fixed-wing, single-rotor helicopter, quadcopter, hexacopter, octocopter. Among them, quadcopter is the dominant drone type used in disease detection.

T9OP20: Evaluation of Insecticides against Fall Army Worm (*Spodoptera frugiperda* J. E. Smith) in Maize

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The investigation on "Evaluation of insecticides against fall army worm (*Spodoptera frugiperda* J. E. Smith) in maize" was carried out on maize sub-research station, SDAU Khedbrahma during *kharif*, 2019-20, 2020-21, and 2021-22. The occurrence of this pest has also been reported from Anthiyur, Bhavani, and Ammapettai and has also found in Maharastra and Gujarat. The larvae feed on the growing points by remaining inside the leaf whorl. The symptoms of damage are scrapping of leaves, pinholes, small to medium elongated holes, parallel shot holes, irregular shaped holes on leaves, loss of top portion of leaves, presence of chewed up frass material, and fecal pellets in the leaf whorl, drooping of leave portion above the feeding area, and feeding on tassel. In this investigation, the lowest (0.59 larvae/ plant) was found in plot treated with emamectin benzoate 5 SG @ 0.0031% and it was followed by chlorantraniliprole 18.5 SC @ 0.0069% (0.80 larvae/ plant), emamectin benzoate 5 SG @ 0.0025% (0.94 larvae/ plant) and spinosad *45 SC* @ 0.0168% (1.03 larvae/ plant). The remaining treatments showed a more or less similar trend of effectiveness in pooled over the year.

T9OP21: Efficacy of Different Concentrations of Insecticides against Leaf Webber, *Antigastra catalaunalis* (Duponchel) in Sesame

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Sesame leaf roller and capsule borer (*Antigastra catalaunalis*) have been identified as one of the most detrimental pests responsible for significant damage to sesame crops in India. The onset of the crop attack occurs during the early stages of seed germination and persists until the crop reaches maturity, whereby nearly all plant components, including the shoot, leaf, flower and pod, are subject to substantial damage. Hence, the bio-efficacy of three insecticides with their different doses was evaluated on Gujarat Til 4 variety of sesame crop in randomized block design with three replications and eight treatments at Agronomy Instructional Farm, C. P. College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during *Kharif*, 2019-20 and 2021-22. The first spray was given at the appearance of pests and subsequent spray were given at 15 days after first spraying. During the year 2020 & 2021, the results pertaining to no. of leaf web per plant, during the entire period of first and second sprays indicated that respectively minimum no. of leafweb per plant (0.71/plant) & (0.60/plant) were observed in the treatment chlorantraniliprole 18.5 SC @ 0.0069 per cent and it remained significantly superior over rest of all treatments. Pooled data of

two consecutive years shows that treatment chlorantraniliprole 18.5 SC @ 0.0069 percent was found most effective and registered with minimum no. of leaf web/plant (0.64/plant) and also remained significantly superior over rest of the treatments. However, pooled data of two year show that, maximum yield (806.06 kg/ha) was also recorded in the treatment of chlorantraniliprole 18.5 SC @ 0.0069 per cent and remained significantly superior over the rest of the treatments.

T9OP22: Evaluation of Bioefficacy and Phytotoxicity of Kasugamycin 3% SL against Early Blight of Potato

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Effect Kasugamycin 3% SL on early blight of potato indicates that disease incidence was started before 1st application and it ranged between 2.09 to 2.49% and was non-significant. Further, the data recorded before 2nd application revealed that Kasugamycin 3%SL @ 1500ml/ha was found most effective in controlling early blight and found significantly superior over all the treatments (PDI 6.44 %) and was significantly on par with Kasugamycin 3% SL@ 1000ml/ha (PDI 7.20%). Among the standard checks Kresoxim methyl 44.3% SC @ 500ml/ha recorded PDI 11.68 % and treatment (Copper Oxychloride 50% WP @ 2500 gm/ha) recorded PDI 13.06 %. Maximum disease incidence recorded in the untreated control (PDI 23.51%). The data recorded 14 days after 2nd application also showed similar trends in controlling early blight disease. Kasugamycin 3% SL@ 1500ml/ha was most effective with the lowest PDI 9.77 %, and on par with treatment Kasugamycin 3% SL@ 1000 ml/ha (PDI 10.89 %). These two treatments were significantly superior to all other treatments. Next better treatment among the standard checks was Kresoxim methyl 44.3% SC @ 500ml/ha (PDI 17.05%) followed by Copper Oxychloride 50%WP @ 2500 gm/ha (PDI 22.69%). Maximum disease incidence recorded in the untreated control (PDI 39.14 %). The tuber yield recorded was highest from the treatment of Kasugamycin 3% SL @1500 ml/ha 128.8 Q/ha) which was significantly superior over all other treatments but on par with the treatment of Kasugamycin 3%SL@1000 ml/ha yielded 125.5 Q /ha. The other treatments significantly superior over untreated control were Kresoxim methyl 44.3% SC @500 ml/ha (109.5 Q/ha) and Copper Oxychloride 50% WP @ 2500 g/ha (104.1 Q/ha). Untreated control treatment yielded the lowest potato tubers (83.8 Q/ha). Studies revealed that Kasugamycin 3% SL did not have any phytotoxic effects on potato crops. The plants were healthy at different growth stages after the 0, 1,3,5,7, and 10 days after each spraying. The treatments was not caused phyto-toxicity and were found safe for potato crops up to 90 g a.i. /ha (3000 ml/ha).

T9OP23: Management of Pearl Millet Blast by Using Chemical and Bio Agents

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The pearl millet leaf spot known as blast (*Pyricularia grisea* (Cooke) Sacc. [teleomorph- *Magnaporthe grisea* (Herbert) Barr] disease is more important in pearl millet forage cultivar. Recently, it has emerged as a serious disease of dual purpose *(Pennisetum glacum* (L.) R. Br.); reducing the grain and fodder production in India (Lucos *et al.* 2007; Anonymous 2009). Through the resistance, cultivars have been brought out under field conditions, but after a few years, it become susceptible in the field. So, it is necessary to manage the disease in the field by means of spraying using fungicides. A field trial was conducted at Pearl Millet Research Station, JAU, Jamnagar during *Kharif* 2021, 2022, and 2023 to find out the effectiveness of different chemicals and bioagents against the blast of pearl millet. A total of six components were used for treatments. All the treatments were significant over control with respect to disease intensity. In results of blast intensity on 60 DAS pooled results, treatment spray Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.04% at 20 and 35 DAS (22.96%) found superior over treatment and sprays of *Pseudomonas fluorescens* @ 10g/l at 20 DAS and Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.04% at 35 DAS (26.75%), found statistically at par. Maximum blast intensity (47.72%) recorded in control. Three year pooled results for grain yield indicated that the highest grain yield found in treatment spray Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.04% at 20 and 35 DAS (2472 kg/ha) and which was at par with treatment sprays of *Pseudomonas fluorescens* @ 10g/l at 20 DAS and Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.04% at 35 DAS (2377 kg/ha). In fodder yield indicated that the highest fodder yield was also found in treatment spray Tebuconazole 50% + Trifloxystrobin 25% WG @ 0.04% at 20 and 35 DAS (46.80 q/ha) Minimum grain yield (1755 kg/ha) and fodder yield (36.41 q/ha) recorded in control.

T9OP24: Detection of Plant Diseases through Drone Technology: Smart Way to Manage Agriculture in Future

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The quality and quantity of agricultural production is significantly impacted by plant diseases. These diseases cause a decrease in income in the production sectors, which are crucial for developing countries. Performing visual inspections by subject matter experts can be time-consuming, expensive, and not scalable for large farms. Hence, atomization is the feasible solution to detect plant disease and prevent losses in yield. In the present scenario, one of the most popular and effective approaches for this automation is to use drone technology which plays a pivotal role in the monitoring of plant pathogen spread, detection, and diagnosis to ensure crops' health status. The advantages of drone technology include high spatial resolution, high efficiency, and more significantly, quick detection of plant diseases across a large area with low cost,

reliability, and provision of high-resolution data. Drone technology employs an automated procedure that begins with gathering images of diseased plants using various sensors and cameras. After extracting features, image processing approaches use the appropriate traditional machine learning or deep learning algorithms. Drones have many potential uses in agriculture, including reducing manual labor and increasing productivity. Drones may be able to provide early warning of plant diseases, allowing farmers to prevent costly crop failures.

T9PP1: Effect of Seed Treatment and Soil Application of Insecticides on Incidence of Stem Fly, *Melanagromyza sojae* (Zehntner) Infesting Black Gram in *Kharif* Season

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The experiment was conducted at the Entomology Farm, B. A. College of Agriculture, Anand Agricultural University, Anand, using a randomized block design with three replications and ten treatments in the *Kharif* season. Out of seven insecticides tested as seed treatment and soil application, the treatment of imidacloprid 600 FS, thiamethoxam 30 FS applied @ 5.0 and 7.5 ml/kg seed, and fipronil 0.3 GR was found effective in managing stem fly, *M. sojae* infestation in black gram and it reflected on yields. Maximum net profit was realized in the treatment of imidacloprid 600 FS @ 7.5 ml/kg seeds (₹ 24858/ha) followed by thiamethoxam 30 FS @ 7.5 ml/kg seeds (₹ 23547/ha). With respect to ICBR, the treatment of thiamethoxam 30 FS @ 5 ml/kg seeds stood first by exhibiting ICBR 1:38.01 followed by thiamethoxam 30 FS @ 7.5 ml/kg seed (ICBR 1:36.50).

T9PP2: Comparative Efficacy of Tri-azole Group Fungicides on Stem Gall Disease of Coriander (*Coriandrum sativum* L.) Incitant by *Protomyces macrosporus* Unger Under Sick Plot

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The present investigations were carried out during *Rabi* 2021-2022 at Agricultural Research Station, Ummedganj-Kota, Agriculture University, Kota (Rajasthan) for testing the effectiveness of new generation chemicals of triazole group such as hexaconazole 5% SC, propiconazole 25% EC and tebuconazole 25.9% EC against *Protomyces macrosporus* Unger incited stem gall of coriander under sick plots with 21 treatments and 3 replications in Randomized Block Design (RBD). Seed treatment of hexaconazole was found with the highest germination of 83.00%. Seed treatment and foliar spray at 45, 60 and 75 days after sowing (DAS) by hexaconazole and tebuconazole were found most effective against stem gall disease with minimum incidence of 24.67 and 31.67 per cent respectively and with maximum per cent disease reduction (68.51% and 59.57%) under sick field conditions over control. Seed treatment and foliar spray of hexaconazole and tebuconazole were found most effective against with minimum stem gall disease intensity of 17.33 and 19.83 per cent at 45, 60 and 75 DAS, respectively, over stem gall intensity in control (50.17%). The yield was also higher in these treatments over other treatments. Maximum per cent seed deformation was found in T0 control (14.33%), while significantly minimum was found in seed treatment and foliar spray of hexaconazole (3.67%) at 45, 60 & 75 DAS. The highest total yield, marketable yield and per cent increase over control were obtained from hexaconazole 223.33 gram per plot, 215.19 gram per plot and 74.03, respectively, followed by tebuconazole 221.00 gram per plot, 210.67 gram per plot and 72.21, respectively. The highest B:C ratio was found in T18 seed treatment by tebuconazole @ 2 ml/kg seed and foliar spray of tebuconazole 25.9% EC (4.09) @ 0.5 ml/L at 45, 60 & 75 DAS followed by T16 seed treatment by hexaconazole @ 0.5 ml/kg seed foliar spray of hexaconazole 5 % SC (100.59) @ 0.5 ml/L at 45, 60 and 75 DAS.

T9PP3: Management of Blast Disease of Pearl Millet through Novel Combined Formulations of Fungicides

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The experiment was carried out at the Agricultural Research Station, Keshwana, Jalore functioning under the jurisdiction of Agriculture University, Jodhpur. Seven different fungicides were evaluated for the management of Blast disease of Pearl millet through spraying twice at 15 days intervals under field conditions. The results showed that the per cent disease intensity revealed that all the fungicides significantly effectively reduced the Blast disease of Pearl millet disease over control. The minimum disease intensity (6.25 %) was recorded with the application of Propiconazole 25% SC @ 0.1 % (1ml/l) with 84.43 per cent decreased disease intensity. However, Tebuconazole 50% + Trifloxystrobin25 % WG @ 0.04% (0.4g/l) were observed to be second best with 7.28 per cent disease intensity with 81.16 per cent decreased intensity. Carbendazim 12% WP + Mancozeb 63% @ 0.25% (2.5g/l) was found least effective with 24.20 per cent disease intensity and 39.72 per cent decreased intensity. The maximum yield (1860 kg/ha) was recorded in Propiconazole 25% SC @ 0.1 % (1ml/l) followed by Tebuconazole 50% + Trifloxystrobin25 % WG @ 0.04% (0.4g/l) with 1748 kg /ha and, respectively. Least yield was obtained with Carbendazim 12% WP+ Mancozeb 63% @ 0.25% (2.5g/l) (1350 kg/ha).

T9PP4: Effect of Different Fungicides against *Alternaria alternate* Causing Leaf and Fruit Spot of Pomegranate (*Punica granatum* L.) *in vitro*

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Pomegranate is one of the important commercial fruit crops of India. India ranks first in pomegranate production in the world. The botanical name of pomegranate *Punica granatum* L., belongs to the family *Lythraceae* with the chromosome number 2n=16. Pomegranate is a vital cash crop of India, commercially grown in many states *viz*., Maharashtra, Karnataka, Gujarat, Andhra Pradesh, Madhya Pradesh, Tamil Nadu, and Rajasthan. Six systemic, six non-systemic, and combined fungicides were evaluated against *Alternaria alternata* under *in vitro* by poison food technique. Among the systemic fungicides evaluated, Propiconazole at 500 ppm inhibited cent per cent mycelial growth of the fungus which was at par with Hexaconazole at the same concentration. Among the non-systemic fungicides evaluated, Mancozeb at 2000 ppm inhibited maximum mycelial growth of the fungus with 76.85 per cent. It was followed by Copper oxychloride and Captan at the same concentration inhibited the mycelial growth with 73.87 and 71.85 per cent, respectively. Among the combined fungicides evaluated Azoxystrobin + Difenoconazole at 500 ppm inhibited cent per cent mycelial growth and it was followed by Carbendazim + Iprodione at 2000 ppm (95.56%) concentration and Azoxystrobin + Mancozeb at same concentration (91.48%).

T9PP5: Effect of Different Fungicides against *Colletotrichum gloeosporioides* Causing Leaf and Fruit Spot of Custard Apple (*Annona Squamosa* L.) *in vitro*

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Custard apple (*Annona squmosa* L.) is one of India's oldest dry land fruit crops belonging to family *Annonaceae* and genus Annona. It is one of the finest fruits gifted to India by tropical America. Custard apple crop is found to be badly affected with several diseases. Among the various diseases leaf and fruit spot disease caused by *Colletotrichum gleosporioides* causing 60-70 per cent yield losses have been reported. Five systemic, five contact and five ready-mix fungicides were evaluated against *C. gloeosporioides* under *in vitro* by poison food technique. Among the systemic fungicides evaluated, carbendezim at 1000 ppm inhibited 98.51 per cent mycelial growth of the fungus and it was followed by tebuconazole at same concentration. Among the non-systemic fungicides evaluated, copper oxycloride at 2500 ppm inhibited maximum mycelial growth of the fungus with 98.51 per cent and it was at par with same fungicide at 2000 ppm. Among the ready-mix fungicides evaluated Tebuconazole + trifloxystrobin and carbendazim + mancozeb both at 2500 ppm inhibited 98.51 mycelial growth and it was at par with both same fungicides both at 2000 ppm.

T9PP6: Management of Anthracnose of Tomato through Fungicides

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Anthracnose of tomato caused by *Colletotrichum* spp. stands out as an important disease, especially a significant post-harvest concern. In this study, the management of tomato anthracnose was investigated through the evaluation of different fungicides. Among the seven fungicides tested, carbendazim displayed the highest mycelial growth inhibition of 96.63%, similar to the effectiveness of carbendazim + mancozeb at 95.89%. difenoconazole exhibited a significant mycelial growth inhibition of 93.87%, while propiconazole showed 92.85% inhibition. Hexaconazole achieved a moderate inhibition of 73.33%, tebuconazole + trifloxystrobin achieved 52.68% inhibition, and metiram + pyraclostrobin had the least efficacy with only 41.01% inhibition. In a field study aimed at managing anthracnose in tomatoes, seven different fungicides were applied at 15-day intervals after 25 days. Among the tested fungicides, carbendazim exhibited the highest efficacy, resulting in a disease incidence of 32.67% and a disease index of 20.00%. This remarkable 80% reduction in disease index indicates significant suppression of the disease on tomato plants. On the other hand, the combination of metiram and pyraclostrobin showed the highest disease index of 66.66%, resulting in a comparatively lower reduction in disease severity of 28.57%. These results suggest that the metiram and pyraclostrobin combination had limited efficacy in managing anthracnose, leading to a higher disease index and less effective disease control on tomato fruits. Interestingly, the highest yield of 3.46 kg per plant was achieved when using difenoconazole, while the lowest yield of 3.06 kg per plant was observed when using carbendazim. These findings provide valuable insights for farmers and researchers in selecting appropriate fungicides for effective anthracnose management and optimizing tomato crop yield.

T9PP7: Studies on Host Range of *Rhizoctonia solani* f. sp. *sasakii* and Fungicidal Management of Banded Leaf and Sheath Blight Disease in Maize

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Maize, a member of the grassy family Gramineae is the third most important cereal crop in the world after wheat and rice which is considered as the queen of cereals by virtue of contributing to about one-third of its production. Banded leaf and sheath blight (BLSB) caused by *Rhizoctonia solani* f. sp. *sasakii* is the most important and destructive foliar disease in

the maize-growing areas of Gujarat, causing considerable yield loss. Six plant species were inoculated with the pathogen to study the host range of *R. solani* f. sp. *sasakii*. Among them, rice, sorghum, chickpea and soybean showed symptoms of *R. solani* f. sp. *sasakii* infection whereas chilli and brinjal didn't show any susceptible reaction. The field evaluation of different fungicides against BLSB disease revealed that two foliar sprays of propiconazole 25% EC @ 0.025% (10 ml/10 litre of water) and carbendazim 50% WP @ 0.03% (3 g/10 litre of water) at an interval of 15 days, commencing from the initiation of disease was most effective and economical in managing BLSB.

T9PP8: Efficacy of Fungicides and Bio-agents Against *Alternaria alternata* Incitant of Linseed Blight

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Linseed (*Linum usitatissimum* L.) is an annual self-pollinated rabi oilseed crop belongs to Linaceae family. Edible linseed oil is used for human consumption and contains alpha linolenic acid, a polyunsaturated fatty acid that has nutritional and health benefits such as in reduction of cardiovascular disease, atherosclerosis, diabetes, cancer, arthritis, osteoporosis, autoimmune and neurological disorders. Flax protein helps in the prevention and treatment of heart disease and in supporting the immune system. The crop suffering with many diseases among which blight caused by *Alternaria alternata* is one of the most yield limiting factors in India. Eight fungicides and six bio-agents were tested against *A. alternata* causing blight of linseed. Among fungicides, hexaconazole 5% SC, hexaconazole 5% + captan 70% WP and zineb 68% + hexaconazole 4% WP were highly efficient in inhibiting the mycelial growth of *A. alternata* completely at all the concentration tested under *in vitro*. Out of six bio-agents evaluated, *T.harzianum* has shown maximum inhibition of the test pathogen (73.38%).

T9PP9: Microbial Cleanup of Chlorpyrifos Residues in Farm Soil

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Organophosphorous pesticides such as chlorpyrifos and its derivatives are most commonly used throughout the world as insecticide, acaricide and miticide used primarily to control foliage and soil-borne insect pests. An application of chlorpyrifos by drenching leads to chemical spoilage of the soil for organic farming and the environment. To eliminate such pesticide, an experiment has been conducted to dissipate chlorpyrifos from the soil by microbial treatments of *Pseudomonas aeruginosa* and *Bacillus paralicheniformis*. It was observed that there was significant variability of chlorpyrifos residue observed in both controls as well as bacterial-treated soil in pots during observation days. Among all treatments, natural soil showed a noticeable earlier and faster rate of chlorpyrifos residue reduction in initial days as compared with treatments of bacteria and absolute control. Chlorpyrifos residue reduction rate was mostly found same during the observation period among treatments of bacterial culture and absolute controls. There were not any effects of bacteria treatments observed on the reduction/degradation of chlorpyrifos residues in the soil as compared with both the controls, but natural soil showed the best performance toward residue reduction. Natural soil contains diverse, natural, and acquainted microbe's consortium, therefore, show faster dissipation of chlorpyrifos as compared with individual microorganisms. The rate of chlorpyrifos residue reduction was nearly 0.19 ppm per day recorded. Most of the amount of pesticide residues reduced up to 21th of incubation in all conditions of the experiment and reached to negligible residues level in soil.

T9PP10: *In-vitro* Efficacy of Various Fungicides and Botanicals against *Curvularia lunata*

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Maize (*Zea mays* L.) is the world's leading crop and is widely cultivated as cereal grain that was domesticated in Central America. It is one of the most versatile crops having wider adaptability. But productivity of maize in Gujarat remains low due to several diseases caused by fungi, bacteria, viruses, *etc*. Among, all the diseases of maize, Curvularia leaf spot disease caused by *Curvularia lunata* is a new emerging disease that is widely distributed and highly destructive in maize-growing regions. Looking to the seriousness of the disease and economic importance of the crop in Gujarat the present investigation was carried out to evaluate the efficacy of various fungicides and botanicals against *Curvularia lunata* using poisoned food technique. Nine phytoextracts were tested at 10 and 20% concentrations. Among them, maximum growth inhibition of *C. lunata* was recorded in tulsi leaf extract @ 20 per cent concentration with minimum colony diameter which was at par with turmeric and ginger rhizome extract. Among the different evaluated fungicides minimum mycelial growth and maximum growth inhibition of *C. lunata* were observed in Hexaconazole + Zineb ready-mix fungicide at 1000 and 2000 ppm concentrations, respectively.

T9PP11: Plant Disease Assessment through the Drone Technology

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Plant diseases are one of the major threats to global food production. Efficient detection of plant pathogens is instrumental in restricting and effectively managing the spread of the disease and reducing the cost of pesticides. Traditional, molecular, and serological methods that are widely used for plant disease detection are often ineffective if not applied during the initial stages of pathogenesis, when no or very weak symptoms appear. Classically, diseases were recognized based on traditional methods; these methods, often subjective, were strictly dependent on the observer and though time-consuming overall, were prone to inaccuracy. Additionally, human scouting is expensive and, in many cases, impractical due to human error and/or the occurrence of cryptic when not mild symptoms, making diagnosis at early stages impossible. Therefore, a technologically driven agricultural revolution is important to permanently solve the problems mentioned earlier at a reasonable cost with little environmental impact. With the continuous adoption of recent advanced technologies such as Internet of Things devices, intelligent algorithms, sophisticated sensors, and modern machines, agriculture has changed. Drones have many potential uses in agriculture, including reducing manual labour and increasing productivity. Drones are equipped with digital, multispectral, hyperspectral, thermal, and fluorescence sensors which offer finer resolution of plant diseases and assist in plant disease detection at earlier stages than is possible with satellite systems. Drones may be able to provide early warning of plant diseases, allowing farmers to prevent costly crop failures. The advantages of drone technology include high spatial resolution, high efficiency, usage flexibility, and more significantly, quick detection of plant diseases across a large area with low cost, reliability, and provision of high-resolution data.

T9PP12: Management of Powdery Mildew of Ber (*Oidium erysiphoides* f.sp. *ziziphi)* Through Noval Combined Formulations of Fungicides

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Ber (*Ziziphus mauritiana* Lamk.) is commercially grown in arid and semi-arid regions of India and other countries. The powdery mildew of ber incited by *Oidium erysiphoides* f. sp. *ziziphi* Yan and Wang (perfect stage: *Microsphaera alphitoides* f. sp. *ziziphi* Griffon and Maublance) is a major disease in India, and causing heavy loss in productivity and quality of fruits and mostly appeared in the last week of October and reaches at peak in the month of December. To manage the disease, five fungicides along with newer combined formulations (tebuconazole 50% + trifloxystrobin 25% WG, metiram 55% + pyraclostrobin 5% WG, fluxapyroxad 250g/l + pyraclostrobin 250 g/l, myclobutanil and azoxystrobin 23% SC) were sprayed twice under natural conditions in orchard. Among these tebuconazole 50% + trifloxystrobin 25% WG (@ 0.1%) was recorded highly effective with minimum disease intensity (6.47%). In conclusion, the use of noval fungicides in combined formulations may be the most powerful tools in combating this disease with economical return.

Theme 10: Epidemiology and Disease Forecasting in Relation to Climate Change

T10OP1: Impact of Climate Change on Downy Mildew Disease Dynamics in Ridge Gourd and Strategies for its Management

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Ridge gourd, which is popularly known as "*Kalitori*" belongs to the family *Cucurbitaceae* being cultivated throughout the world. The fruits are rich in essential nutrients and fibers. Several biotic stresses like fungi, bacteria, viruses, and nematodes are found responsible for lower productivity. Among these, foliar diseases like downy mildew caused by *Pseudoperonospora cubensis* are a major bottleneck for significant yield losses. A study was conducted to assess the impact of weather variables and the influence of climate change situations on disease dynamics of downy mildew under *in vitro* and *in vivo* conditions. The epidemiological studies revealed that the maximum sporangial germination was observed to be at the temperature ranging between 19-22 0C with 95 per cent relative humidity. Field observations revealed that the crop that was sown early recorded a maximum PDI of 91.80 per cent at 42nd SMW with highest AUDPC of 3289.44 during *Kharif* 2021. Similarly, the disease intensity of 93.80 percent was observed during *Kharif*, 2022 with the highest AUDPC of 3346.91. The pooled analysis of both years revealed that the cumulative effect of rainfall (0.963, 0.934, 0.939, and 0.845) was found significant and positively correlated with disease intensity in all the different dates of sowing. Further, stepwise regression excluded non-significant variables, and only rainfall (p=0.038) and cumulative rainfall (p=0.00) were found to contribute to disease development respectively. The studies on the effect of carbon dioxide and temperature on disease progress in open-top chambers revealed that, the treatment T1 (elevated CO2 at 550 ± 25 ppm with normal temperature), in which the disease severity was found to increase linearly from 10.70 to 52.30 PDI. However, the treatment T3 (ambient CO2 at 410 ± 25 ppm with 2 °C rise in temperature) showed a negative impact on disease progress with the least incidence of 19.66 per cent. Disease management involving different components revealed that downy mildew can be effectively managed through staking of plants with one foliar application of *Pseudomonas fluorescens* (5g/Lit) before the disease onset+ one spray with Benalaxyl M 4% + Mancozeb 65% WP after initial symptoms with one more foliar application of *P. fluorescens* (5g/Lit) at seven days interval

followed by a spray with Amisulbrom 20% SC (0.75 ml) at fortnight interval which resulted minimum disease incidence (23.55 %) and maximum fruit yield of 17.63 t/ha with benefit cost ratio of 2.47.

T10OP2: Computational Models to Assess Plant Diseases

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Crop diseases have the potential to cause devastating epidemics that threaten the world's food supply and vary widely in their dispersal pattern, prevalence, and severity. Plant disease modelling is an important field for assessing the intensity or severity of the disease. It is a management system enabled to forecast the occurrence and any change in severity or intensity of plant diseases. Forecasting the occurrence of diseases under a specific area and time; however, appropriate preventive and control measures can be taken in advance to obtain potential yield. Applying management practices at the appropriate time reduces the wastage of crops and chemicals by forecasting disease and making it cost- effective. Basic components of plant disease are needed to investigate disease forecasting schemes. There are seven basic requirements for successful disease prediction. Intensity, incidence, and severity are primary disease measuring terms used to study disease forecasting. Modelling involves field observations, disease measurements, and weather conditions favouring disease spread, mathematical formulas, and computer use. The mathematical and analytical relationship gives information about interaction among the host, pathogen, and weather variables in mathematical equations presented as simple statements, tables, or graphs. Disease prediction can be made based on parameters involved like inoculum, weather variables, and comparative information. Prediction model for chilli anthracnose disease was calculated and will be validated in the coming years. Computer simulation is beneficial for growers to understand the effect of components and subcomponents of the epidemic on yield loss.

T10OP3: Factor Affecting the Outbreak of Leaf Spot and Flower Blight Diseases of Marigold and its Management

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Marigold (*Tagetes* spp.) is one of the most popular traditional flower crops grown commercially in different parts of India. It is also an important commercial crop grown in the South Gujarat. The effect of different weather parameters on the percent disease intensity of leaf spot and flower blight incidence of marigold caused due to *Alternaria tenuissima* was studied using a simple correlation technique and regression coefficient to study the development of the disease. The maximum percent disease intensity of leaf spot and flower blight incidence was recorded when maximum temperature was in the range of 29.8 °C to 32.3 °C, minimum temperature in the range of 23.2 °C to 24.3 °C, rainfall in the range of 67 mm to 148 mm, evening relative humidity in the range of 81.2% to 85.1% and bright sunshine hours of 2.9 hrs/day to 4.5 hrs/day, as they were most favourable conditions for the rapid development of leaf spot and flower blight of marigold. This forecasting model can be used as an aid for farmers by forewarning them prior to disease development and hence managing the disease more efficiently. Different fungicides were evaluated under field conditions for the management of leaf and flower blight of marigold. The results revealed that three foliar sprays of either hexaconazole 4 + zineb 68 WP 0.07 per cent (10 g/ 10 l.) or Mancozeb 75WP, 0.02 per cent (30g/10 l.) or tebuconazole 50 + trifloxystrobin 25WG, 0.03 per cent (4g/ 10 l.) first at the initiation of the disease and subsequent two sprays at 15 days interval were found effective in managing leaf and flower blight disease in marigold which also reflected on flower yield as well. The treatment of hexaconazole 4 + zineb 68 WP registered the highest ICBR1: 4.73 followed by mancozeb 75WP registered ICBR1:4.32 while tebuconazole 50 + trifloxystrobin 25WG registered ICBR1:3.87.

T10OP4: Development of Disease Prediction Models and Geo-phytopathological Model for Forecasting of Stem Rust of Wheat in North Gujarat

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Stem rust caused by *Puccinia graminis* f.sp. *tritici*. is the most important rust mainly in wheat growing areas of the Central Zone of India leading to 60-80% yield loss. The agro-climatic condition of North Gujarat which comes under the Central Zone of India favors the development of stem rust with the predominant pathotypes like 11 and 40A. Field screening of various 40 entries including promising genotypes and released varieties was executed during three consecutive experimental years of 2019-2020, 2020-2021 and 2021-2022 *Rabi* seasons at Wheat Research Station, Vijapur, S.D.A.U. Four genotypes were found to have no infection at all. The result further states that the lowest and highest AUDPC value was found as 1.17 to 1610. The impact of different weather variables on the development of stem rust in North Gujarat was taken under investigation for its forecasting by the development of the best prediction model and geo-phytopathological model. Among the four prediction models studied, two models *i.e.* Logistic and Gompertz were identified to be the best fitted model with the given equations of y = 100/(1+(100/b-1)*exp(-a*time)) for maximum temperature and y = 100*exp (-b*exp (-a*x)) for minimum temperature against disease severity, respectively. The optimum maximum temperature ranges from 28-31°C and minimum temperature ranges from 12- 15°C were identified as the best congenial requirement for development and progress of disease. Moreover, a geo- phytopathological model was developed and validated from significant correlated weather variables based on all three experimental years. Weather is an

epigenetic factor which influences both host plant and pathogen interaction leading to development and progress of disease. HTR is also most conducive parameters to forecast the severity of any disease while validation of HTR model is a location specific. Therefore, researchers may capitalize data and its analysis to devise a new effective system to monitor the status of stem rust of wheat in North Gujarat.

T10OP5: Impact of Weather Variables on Development and Progress of Okra Powdery Mildew

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Development and progress of powdery mildew (*Erysiphe cichoracearum* DC) disease in relation to meteorological factors were studied in a natural/field condition. Out of twelve factors, maximum temperature, mean temperature, bright sunshine hours, GDD, AGDD and crop age were found significantly positive correlation while minimum temperature, morning relative humidity, afternoon relative humidity and mean relative humidity were showed significantly negative correlation with the powdery mildew intensity of okra, in *Kharif* season. The values of correlation coefficient value of *Rabi* season showed significantly positive relationship of PDI with minimum temperature, GDD, AGDD and crop age in the okra. Whereas, in summer among all the variables, afternoon relative humidity (0.845), mean relative humidity, AGDD and crop age were registered significantly positive correlation while maximum temperature, mean temperature, BSSH and GDD showed significantly negative correlation. The result of regression analysis showed afternoon relative humidity, mean relative humidity and crop age were the crucial factors for the development of powdery mildew during *Kharif* season. Variation accounted by this regression equation is 97.5 per cent. In *Rabi*, variation accounted by the regression equation is 96.8 per cent. So, morning relative humidity and crop age were identified as a crucial factors for the development of powdery mildew in *Rabi* season. In summer season variation accounted by regression equation is 99.7 per cent and the mean temperature, bright sun shine hours and crop age were found as most associative factors, which can predict the PDI of powdery mildew in natural conditions.

T10OP6: Influence of Environmental Factors on the Development of Downy Mildew (*Sclerospora graminicola*) in Pearl Millet

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The present study was undertaken during *Kharif,* 2022 to find out the effect of different weather variables on the development of downy mildew in pearl millet. The data of downy mildew incidence for consecutive one year revealed that the mean weekly disease incidence in 7042 S ranged from 5.45 to 81.82 per cent indicating the highly susceptible response. The second fortnight of August to the first fortnight of September can be considered as window period for downy mildew incidence. The disease incidence in cultivar 7042 S was correlated highly significantly and positive correlation with maximum temperature (r = 0.753**), highly significantly and negative correlation with total rainfall (r = -0.744**). Evening relative humidity (r = -0.602*), morning relative humidity (r = -0.625*) and rainy days (r =- 0.624*) was significant and negatively correlated with downy mildew incidence. The minimum temperature showed non-significant and negative correlation (-0.309) with downy mildew disease incidence. It has been observed that multiple correlation (R) value 0.941 indicates a strong association between per cent disease incidence and weather parameters. The co-efficient of determination (R2) of 0.886 proved the significance of overall regression model accuracy. Predict the occurrence of downy mildew with R2 = 0.886, indicating that all weather parameters contributed 88.6 per cent towards disease development.

T10OP7: Histopathological Response and Epidemiology of *Fusarium oxysporum* Under Elevated Conditions that Incites Wilt of Pea (*Pisum sativum* L.)

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Pea (*Pisum sativum* L.) a grain legume belongs to the family of Fabaceae. It is one of the oldest and most widely domesticated crops across the temperate regions of the globe. Pea possessing the nature of self-pollinating holds a chromosomal number of 2n=14 with a haploid genome size of 4.5 Gp. The production pea is prone to various biotic and abiotic stress among which Fusarium wilt induced by *Fusarium oxysporum* f. sp. *pisi* (Fop) is an important disease and a major constraint in pea production incurring losses to the growers. The major barricade faced by the 21st century is climate change, which is imposing serious threats on agricultural produce. The research was undertaken to study the survival and infectivity nature of the pathogen. At different temperatures and pH and Nitrogen doses, it is observed that isolates showed maximum growth and sporulation at temperature 25°C and pH 5. The combination

effect of Nitrogen doses and different pH exhibited that growth was increased when the pH levels were moving towards neutral levels at all the increasing doses of the Nitrogen source. A similar trend of results was observed in case of micro and micro conidial formation at each combination of different temperatures and different pH, and different Nitrogen doses. Maximal micro and macro conidial formation was observed at 25°C and pH 7, but there was high variation among conidial formation by supplementing the higher doses of nitrogen. In similar study, a combination effect was performed to analyse the fresh and dry weights of all the six isolates of Fop, which resulted in significant variation among the isolates with changes in temperature, pH and Nitrogen doses. Field Screening studies of sixty pea genotypes against 3 Fop was performed for during 2021-22 and 2022-23, the reaction results infectivity variation of 3 Fop isolates. Ambiguity was found among the infectivity nature of isolates against sixty pea genotypes screened. Based on the screening results, the genotypes were categorized to resistant, (FPT20-31, Makhyatmubi), tolerant (CAU-FP7), moderately tolerant (Makuchabi), susceptible (FPT 20-17) and highly susceptible (FPT-20-25 and FPT 20-35). Based on the screening results 8 genotypes were taken for histopathological studies. The tissues of each genotype were fixed according to the standard protocols. Later the tissues were hand sectioned and stained with TBO and Fast green:Safranin stains to observe the changes in the Fop inoculated plants. The observations on histopathological studies were taken after 7th and 14th day of inoculation. Significant changes on categorized hosts were observed. Formation of papillae, Lignification of wall cells, accumulation of phenols, accumulation of carbohydrates, unknown substances was revealed by different stains used and observations were analyzed that the tolerant genotypes CAU-FP7, Makuchabi have shown more defence structures when compared to susceptible genotypes, FPT-20-25 and FPT 20-35.

T10OP8: Effect of Weather Parameters on Anthracnose Disease of Cowpea Caused by *Colletotrichum lindemuthianum*

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Cowpea [*Vigna unguiculata* (L.) Walp] is locally known as chowli, lobiya, southern pea or black eye pea in India. It is considered to be native of Tropical Africa and grown extensively in West Africa, Brazil and India. Pulses are the integral part of Indian dietary system due to their richness in protein and other important nutrients. Cowpea seeds contain protein (23.4%). Fat (1.8%) and Carbohydrate (60.3%) as well as rich source of calcium and iron. Cowpea is relatively a major legume in India mainly grown as vegetable and fodder crop in Rajasthan, Karnataka, Tamil Nadu and Orrisa. Diseases are the major constraint in economic crop production as they inflict heavy losses. Anthracnose is one of the devastating fungal disease that affect all above ground parts, causing severe damage and loses under low temperature, high humidity and free moisture. Most of the promising cowpea cultivars are under a great threat for profitable cultivation due to the attack of several abiotic and biotic factors *viz*., Fungi, bacteria, viruses and nematodes. The major losses of cowpea are caused by *Colletotrichum lindemuthianum* fungi causing anthracnose in cowpea. Considering the severity and its destructive nature, the study was undertaken to find out the appropriate cause, epidemiology and its management. The observations on anthracnose intensity was recorded at weekly interval from susceptible cv. GC-3 grown at NAU, Navsari, during *Kharif* - 2016. The epidemiological studies showed that maximum temperature and wind speed were found significantly and negatively correlated. Minimum temperature, evening relative humidity and rainfall were significantly and positively correlated while, morning relative humidity was found non-significant and positively correlated with the anthracnose intensity. All these factors played an important role in the development of disease. But maximum temperature as well as rainfall found to play dominant role in the anthracnose development in cowpea.

T10PP1: Geographical Distribution of Downy Mildew Disease in Major Cucurbits across Agro Climatic Zones of Karnataka

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Among various vegetables, cucurbits are the largest group of summer vegetables being cultivated throughout the length and breadth of India. These cucurbits are well known for their high nutritional and medicinal properties. Cucurbits are more prone to insect pests and diseases mainly due to their tenderness and softness as compared to other crops and also the virtual absence of resistance traits because of intensive hybrid cultivation. Among biotic stresses, downy mildew disease caused by *Pseudoperonospora cubensis* is one of the major threat for the cultivation of cucurbits results in yield loss up to cent percent if unmanaged early. A roving survey was conducted to assess the spatio temporal distribution of downy mildew disease among major cucurbits like cucumber, ridge gourd, bitter gourd, bottle gourd and musk melon across eight agro-climatic zones of Karnataka during *Kharif* 2021 and 2022. Survey results highlighted that, all the major cucurbits were found infected irrespective of cultivars or hybrids and the disease was well distributed throughout the growing areas. The survey data also indicated that, there was significant positive correlation with crop stage and disease severity (r=0.859**). In case of ridge gourd, the disease severity was highest in Bengaluru rural (54.53 %), followed by Bagalkote (51.72 %), Chikkaballapura (49.52 %) and Belagavi (49.41 %). The least severity was recorded in Ramanagara district (32.78 %) followed by vijayanagara (38.18 %) district of Karnataka. The pooled data, among agro climatic zones indicated that, Northern dry zone was found maximum severity of 44.95 per cent followed by northern transition zone 44.67 per cent. Similar trend was noticed in case of cucumber crop where highest severity of 73.80 per cent was recorded at IIHR,

Hesaraghatta plots of Bengaluru rural followed by Chandrabanda village (70.51 %) of Raichur district. Least incidence was observed Yechagalli village (23.40 %) of Najangud taluk of Mysore followed by Gopanahalli village (23.94 %) of Holenarsipura taluk of Hassan district. The survey data also revealed that, the districts with annual rainfall ranging 807 to 1498mm recorded maximum disease intensity across the climatic zones.

T10PP2: Role of Environmental Factors in the Disease Development in Field Condition *Macrophomina phaseolina* in Clusterbean

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Clusterbean is one of the oldest domesticated crops, mainly grown under rainfed conditions of arid and semi-arid regions of tropical India during *Kharif* and *Zaid* seasons. It is affected by a number of phytopathogenic fungal and bacterial diseases *viz*., bacterial blight, Alternaria leaf spot, root rot, powdery mildew, etc. Of them, dry root rot of cluster bean caused by *Macrophomina phaseolina* is a serious problem in cluster bean cultivation resulting in up to 21- 60% losses at pre- and post-emergence stages. The root rot pathogen can attack a wide range of hosts which makes it highly destructive among other plant pathogens in the tropics and sub-tropics. The development of this disease is favored by high temperature (30-35°C), and moisture stress. Epidemiological studies showed that weather parameters play a crucial role in dry root rot development. However, in the crop seasons (*Kharif 2022*) the maximum disease occurrence was recorded during the 30th and 32nd meteorological weeks (23rd July to 12th Aug). The simple correlation analysis of disease incidence with weather variables indicates a strong linear relationship between disease incidence with soil temperature (°C) and soil moisture (%). Thus, it can be predicted that soil temperature (°C) and soil moisture (%) are the very critical factors for the development of root rot in clusterbean.

T10PP3: Study on Relationship between Weather Parameters and Disease Development of Alternaria Leaf Spot of Cotton

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Cotton is one of the most important fiber cash crops of the world as well as India. It belongs to the botanical family "Malvaceae". *Alternaria alternata* is an economically important pathogen on numerous crops worldwide. The experiments were conducted at Guru Kashi University, Talwandi sabo (Punjab) under the field and laboratory conditions to study the Alternaria leaf spot of cotton during the season 2019- 2020. A field experiment was undertaken to determine the effect of different weather parameters with four different varieties of cotton (F 2383, RCH 773, RCH 650, and FDK 124). Weather factors *viz.,* temperature, relative humidity and rainfall played an important role in the progression of *Alternaria alternata.* Temperature (maximum), and humidity (maximum and minimum) was found to have a significant positive correlation with Alternaria leaf spot while temperature (minimum) and rainfall (mm) was found to have a significant negative correlation with flourish of *A. alternata*.

T10PP4: Epidemiology of Fenugreek Powdery Mildew Disease under South Gujarat Condition

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Powdery mildew caused by *Erysiphe hyperici* Wallr. S Blumer is a serious disease affecting biomass and seed yield of fenugreek (*Trigonella foenum-graecum L.*) under agroclimatic conditions in Gujarat. One year study under varied south Gujarat agro-climatic conditions revealed the infection pattern and identified growth parameters for *Erysiphe* sp. In epidemiological studies, disease initiation was noticed after 52 DAS. Variety (Rmt-1) 2.78 per cent after that, the linear progress of the disease was observed up to crop maturity. PDI was found highest *i.e.* 82.22 at maturity (10th SMW) on local variety. The disease development was recorded higher during 3rd to 6th SMW. In local cultivars disease progress was found higher during 80 to 94 days of crop age *i.e.* pod formation period. The disease increased faster during the 3rd and 6th SMW in *Rabi* season. In the present study, the optimum maximum and minimum temperatures for maximization of powdery mildew severity on fenugreek leaves were 27.6°C to 35.1°C in *Rabi* under field conditions. The results of correlation study, the meteorological variable correlation coefficient reflect the extent of association between PDI of local cultivar with different meteorological factors and crop age. Out of nine factors, crop age (0.969) was found significantly positive correlation while maximum temperature (0.517), mean temperature (0.605) and minimum temperature (0.617), morning relative humidity (0.210), afternoon relative humidity (0.306) and mean relative humidity (0.255) were showed significantly negative correlation with the powdery mildew intensity of local cultivar in *Rabi* season. The result of regression analysis on an average meteorological factors with PDI during rabi season revealed that crop age (independent variable) with PDI (dependent variable) was identified as crucial role for the development of powdery mildew epidemics by accounting regression equation is 96.8 per cent (R2= 0.968) variation during *Rabi* season.

T10PP5: Influence of Climate Change Factors on Plant Diseases

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Climate change is affecting our agriculture due to 0.740C average global increase in temperature in the last 100 years and atmospheric CO_2 concentration increase from 280 ppm in 1750 to 4000 ppm in 2013. Worldwide losses due to diseases range from 9 to 16% in rice, wheat, barley, maize, potato, soybean, cotton and coffee. This range is increasing year by year this might be due to climate change, through a number of interactions, that take place among the host, pathogen, potential vectors and the environment. Epidemiological measures *viz.,* temperature, rainfall, relative humidity, wind, atmospheric pressure, sunshine, and Greenhouse gases, *viz*., CO_2 concentration, N_2O, and CH_4 are the major factors responsible for plant disease development. Changes in environmental conditions are strongly associated with differences in the level of losses caused by disease because the environment significantly (directly or indirectly) influences plants, pathogens and their antagonists. The changes associated with global warming (*i.e.*, increased temperatures, changes in the quantity and pattern of precipitation, increased CO_2 and ozone levels, drought, etc.) thus, may affect the incidence and severity of plant disease and influence the further co-evolution of plants and their pathogens. Fungal pathogens are often strongly dependent on humidity or dew for plant infection. Temperature can directly affect the multiplication of pathogenic bacteria, influencing the incidence of disease development and viruses may be present in hosts while symptom expression is dependent on temperature. These reviews prove that temperature; relative humidity; rainfall; sunshine; and elevated CO_2 are the major factors responsible for disease development as either they increase or decrease.

Theme 11: Host Resistance and Phenomics for Plant Protection

T11OP1: The Functional Mechanisms of Effector Genes to Induce Incompatible and Compatible Responses in *brassica* Host-pathosystem

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The applications of genomics and effectoromic approaches during *Brassica* host-pathogen interactions have allowed to understand the molecular mechanisms of effector genes for their expression and effects on the host by the pathogen. The genome sequences of *Brassica* host and pathogens have facilitated to reveal functional mechanisms of effector genes. The resistance conferred by effector genes products is of five major kinds: NTL (TIR-NBS-LRR), CNL (CC-NBS-LRR), RLK (receptor-like kinase), RLP (receptor-like proteins and Pto (a Ser/Thr kinase proteins). Molecular mechanisms of crucifers host resistance against biotrophs have been revealed in different *Brassica* species during host-pathogen interactions. The R-genes and QTLs have been identified, functionally characterized, and molecularly mapped on the chromosomes of *Brassica* species. The expression of defense-related genes plays a crucial role during pathogenesis and host resistance. A single gene (*Acr*) responsible for conferring resistance to *Albugo* was mapped on a densely populated *Brassica juncea* RFLP map. *WRR* 4 gene confers broad-spectrum white rust resistance to four races of *A. candida*. Three WRR (*WRR4BCol*-0, *WRR8Sf*-2, and *WRR9Hi*-0) genes against *Ac2V* and a gene *WRR12* (*SOC3*) conferring NHR to AiBoT have been identified. Host resistance in *Brassica* species to powdery mildew is multilayered and multicomponent at both pre- and post-penetration stages. Salicylic acid enhances the expression of RPW 8.1 and RPW 8.2, leading to HR or SHL and resistance. *BjNPRI* gene activates SAR to confer broad-spectrum resistance to powdery mildew of *B. juncea*. There is a role of WRKY transcription factors and overexpression of R-genes like PMR, MLO, PEN, EDR, MAPK, MAPK 65-3, NPR1, PAD3, PAD4, ED5, SNARE, RLKs and KDL (AtCEP1) to confer resistance to powdery mildew of crucifers.

T11OP2: Components of Chickpea Resistance to Blight Caused by Fungal Pathogen *Ascochyta rabiei*

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Blight caused by *Ascochyta rabiei* [(syn. *Phoma rabiei*), teleomorph *Didymella rabiei* (syn. *Mycosphaerella rabiei*)] is a major disease of chickpea in cool and humid regions of the world. *A. rabiei* is a heterothallic fungus that usually penetrates directly through epidermis. While sufficient information is available on *A. rabiei* factors causing blight in chickpea, the chickpea factors that govern resistance/susceptibility to *A. rabiei* are fairly unknown. To elucidate mechanisms governing chickpea resistance to blight, the pathogenesis related proteins (PRPs) and pathways for phenylpropanoid metabolites, abscisic acid (ABA), gibberellic acid (GA) and jasmonic acid (JA) were studied. The genes for anabolism and catabolism with respect to these pathways were retrieved from the *A. rabiei* genome. The genes and proteins were characterized; the gene-specific primers were synthesized and were used to study transcriptional changes in the genes following *A. rabiei* inoculations in a blight resistant (HC1) genotype and a blight susceptible (GPF2) genotype of chickpea. Gene expression studies revealed that following inoculations, chickpea activated its defences soon after the landing of spores on chickpea surface. The HC1 and GPF2 responded differently to pathogen inoculations. In resistant host, the JA, GA and phenylpropanoid pathway genes had maximum expression at 2 hours after inoculation whereas PRPs/defence genes had maximum expression at 24/36 h entailing that chickpea uses two-tier defence system against *A. rabiei i.e.* immediately after inoculation and just prior to host penetration. In contrast to this, the susceptible host either failed to activate its defences or had a delayed response. Another major difference between the resistant host and susceptible host was the up-regulation of ABA biosynthesis genes in GPF2 and downregulation in HC1. The study revealed that phenylpropanoids, PRPs, JA and its precursors, and methyl jasmonate governed resistance to *A. rabiei* in chickpea whereas ABA governed susceptibility.

T11OP3: Host Plants are the Key Contributors to the Genetic Diversity in *Papaya ringspot virus* (P & W) Populations

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Papaya ringspot virus (PRSV) infects papaya and cucurbits, causing significant damage throughout the world. The genetic diversity of PRSV is influenced by various factors, and the host plays a crucial role in shaping this. Understanding the interplay between the host and PRSV is essential for developing effective strategies for managing the disease. In this investigation, we examined the genetic diversity among PRSV-P and PRSV-W isolates originating from diverse cucurbit and papaya hosts. The evaluation was based on the nucleotide and amino acid coding sequences of coat protein (CP), nuclear inclusion protein-a (NIa-pro), and Helper component proteinase (HC-pro). A total of 28 isolates originated from different locations (Delhi, Gujarat, Karnataka, Odisha, Uttar Pradesh, Uttarakhand, and West Bengal), and various hosts (Bottle gourd, Cucumber, Papaya, Pumpkin, and Watermelon) were included in the analysis. The lengthwise variability was observed solely in the CP coding region. The CP of papaya-originated PRSV-P (P-P) isolates exhibited a range of 837-861 nucleotides (nt), whereas the CP of cucurbit originated PRSV-P and PRSV-W isolates ranged from 855-876 nt. The effect of host species was studied by serially inoculating the isolates in squash host (Laboratory host) and found substitution and in-del of amino acids in the PRSV isolates of squash host in the first passage itself, which remained the same in the subsequent passages (1st, 5th, and 10th passages). The changes were observed in the CP and Hc-pro gene sequences near the DAG and PTK motif of the proteins associated with the aphid transmissibility. Further, the comparative severity of different PRSV pathotypes was studied and observed that the PRSV-W were inducing severe symptoms as compared to PRSV-P. The response of different hosts to PRSV infection symptoms varies, some hosts exhibited mild symptoms to specific pathotype of the virus, while others have shown severe symptoms. This indicated that the selective pressure exerted by the host's immune system or resistance mechanisms may decide which viral variants or pathotypes are more successful in establishing infections. The findings of this study provide valuable insights into the evolution/adaptation of PRSV and the host's role in determining the genetic diversity of PRSV isolates.

T11OP4: Screening of Chickpea (*Cicer arietinum*) Germplasm for the Source of Resistance Against Root-Knot Nematode, *Meloidogyne incognita*

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Chickpea (*Cicer arietinum* L.) is the second most widely cultivated food legume crop after common bean worldwide. Chickpea is also an important source of dietary protein for human beings. Plant parasitic nematodes are one of the important biotic factors which affect the crop production and productivity worldwide. *Meloidogyne incognita* is a species of root-knot nematode that commonly infects Chickpea roots in most growing areas of the world. Root galls induced by *M. incognita* interfere with water and nutrient up-taking abilities of the roots and suppresses Rhizobium nodulation. Intensive root galling often results in premature defoliation, wilting, and eventually plant death. The nematode resistant cultivars/accessions are considered an eco-friendly and economically feasible means for the management of root-knot nematodes. Since the information regarding resistant chickpea against root-knot nematodes in India is meagre, therefore, the present study was undertaken to identify the source of resistance in chickpea germplasm to *M. incognita*. In the present work, 3000 accessions of chickpea germplasm were screened at ICAR- NBPGR, New Delhi during the years 2021-2023 to identify new sources of resistance in chickpea against *M. incognita*. Preliminary screening was conducted in pots filled with nematode-infected soil containing 2-3 infective stage juveniles (J2) per gram of soil. After 45 days of sowing, plants were uprooted, root galls per plant root system were counted and a gall index (GI) of 0-5 was assigned using standard methods, where 0=no gall, 1=1-2, 2=3-10, 3=11-30, 4= 31-100, 5=>100 galls per root system. Host response of chickpea germplasm was determined using GI and designated as resistant (GI≤2.0), moderately resistant (GI≤3.0) and susceptible (GI>3.0). Those accessions showing <10 root galls during preliminary screening were selected for rescreening with artificial inoculation (2 J2s per g of soil) under net house conditions at NBPGR, New Delhi to confirm their resistance consistency. Based on the number of root galls induced by *M. incognita*, one accessions and two accessions were found resistant and moderately resistant with 3-10 and 11-30 root

galls per root system, respectively. Whereas, in susceptible check accession (IC299195), >100 galls were recorded per root system. Nematodes penetration into roots decreased drastically while very few small and deformed egg masses were recorded on roots of resistant accessions. In conclusion, the drastic reduction in nematode penetration into the roots, reduction in root gall formation, and lower number of poorly developed egg masses suggest that resistance may be both pre-infectional as well as post-infectional in resistant chickpea accessions. These identified resistant accessions may be useful in chickpea breeding programs for root-knot nematode management.

T11OP5: Screening of *Bt* Cotton Hybrids for Resistance Source Against Foliar Diseases Under Field Conditions

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Foliar diseases of Bt cotton *viz*., Alternaria leaf spot caused by *Alternaria alternata* (Fr.) Keissler and bacterial blight caused by *Xanthomonas citri* pv. *malvacearum* (Smith) Dye are

widespread and highly destructive and become a major limiting factor for the production cotton. Twenty-seven Bt cotton hybrids were screened (each in two rows) to identify the resistant source against foliar diseases under field conditions during *Kharif* 2019-20 and *Kharif* 2020-21. The hybrids were grown following standard agronomical practices. The experimental area was kept unsprayed without any pesticide and micronutrient spray throughout the crop season. The seeds of different hybrids of Bt cotton were procured from GSSC as well as GEAC-approved hybrids of private companies. One susceptible check LRA 5166 (non-Bt) was procured from ICAR-CICR, Nagpur, and was sown as an infector row each after two rows of hybrids. The final disease reaction using the lowest rating scale based on two years of data showed that none of the hybrids was resistant to Alternaria leaf spot, while Solar 76 and G. Cot. Hy. 10 were expressed a resistant reaction to bacterial blight. Hybrids such as G. Cot. Hy. 12, Solar 76, Bhakti, Modiji, KCH 144, ATM, Surpass, Solar 77, Savaj 503, Solar total against Alternaria leaf spot, while RCH 659, Suraj, and Solar total against bacterial blight showed a moderately resistant reaction. Solar 60, Ajeet 155, RCH 2, NC 1125 and Neck 303 were susceptible to Alternaria leaf spot, while G. Cot. Hy. 8, GTTH 49, RCH 2, Ajeet 155, Ajeet 199, KCH 144, Surpass, NC 1125, Neck-303, Raja, 25D25, Mahasangram, Neck 2108 and Goldstar were susceptible to bacterial blight. The results may be varied due to disease pressure and environmental factors present in the respective area. The biochemical quantification indicated that moderately resistant (Bhakti, Savaj 503) and resistant (Solar 76, G. Cot. Hy. 10) hybrids to Alternaria leaf spot and bacterial blight recorded higher moisture content, phenol content, total soluble sugars, and total chlorophyll in both healthy and diseased leaves as compared to susceptible hybrids.

T11OP6: Screening of Chickpea Genotypes against Dry Root Rot Disease Incited by *Rhizoctonia bataticola*

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Chickpea (*Cicer arietinum* L.) is one of the most important pulse crops grown in Rajasthan as well as in India. It is the third most valuable grain legume crop in the world after common bean and pea. Dry root rot (DRR) of chickpea (*Cicer arietinum* L.) caused by *Rhizoctonia bataticola* is an important disease affecting chickpea production, especially in tropical and sub-tropical ecologies of the world. The root necrosis gradually increases with time without any apparent symptoms on the parts of the above ground till flowering and podding growth stages. *Rhizoctonia bataticola* is mainly a soil-borne pathogen with a wide host range and can survive under the soil as a saprophyte upto 15 years. It causes high yield losses in the oilseed, pulses, and vegetable crops and produces different symptoms like charcoal rot, stem and root rot, dry root rot, seedling blight, and ashy stem blight. During the present study, a total of 1488 germplasm were evaluated in Augmented Block Design in 6m x 2.5m plot size under the artificial created sick field. Susceptible check L-550 and resistant check CSJ-515 were included as standard checks. Out of 1488 germplasm screened, 531 germplasm were resistant (PDI=0.1-10%), 410 were moderately resistant (PDI=10.1-20%), 247 were moderately susceptible (PDI=20.1-30%), 219 were susceptible (PDI=30.1-50%) and 81 germplasm were found highly susceptible (PDI above 50%) against dry root rot disease.

T11OP7: Revolutionizing Plant Health: The Dynamic Duo of ISR and SAR in Sustainable Plant Disease Management

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As the global challenge of plant diseases continues to threaten agricultural productivity, a paradigm shift towards sustainable and eco-friendly disease management strategies is imperative. This abstract delves into the pivotal roles of Induced Systemic Resistance (ISR) and Systemic Acquired Resistance (SAR) in plant defense mechanisms and their significance in the effective management of plant diseases. Induced Systemic Resistance (ISR) is a sophisticated defense mechanism initiated by beneficial microbes in the rhizosphere, activating a systemic response in plants. Non- pathogenic microorganisms, such as certain bacteria and fungi, trigger ISR, leading to the priming of the plant's defense mechanisms. This priming effect enables a quicker and more robust response upon subsequent encounters with pathogenic organisms. ISR is associated with reduced disease severity and represents a promising avenue for sustainable disease management, particularly through the integration of beneficial microorganisms into agricultural practices. Systemic Acquired Resistance (SAR), a broad-spectrum defense response, is activated in plants following exposure to pathogens, their derivatives, or specific chemicals. SAR involves the systemic activation of defense- related genes, resulting in the accumulation of antimicrobial compounds such as pathogenesis-related proteins and phytoalexins. The enduring nature of SAR provides long-lasting protection, making it a valuable asset in the management of a diverse array of plant diseases. Understanding the molecular intricacies of SAR opens avenues for innovative strategies in crop protection. These defense mechanisms, ISR and SAR, can be integrated into diverse disease management strategies. The significance of ISR and SAR in plant disease management lies not only in their intrinsic capacity to bolster plant defenses but also in their potential to reduce reliance on chemical pesticides. Embracing these natural defense mechanisms represents a forward-looking approach to sustainable agriculture, promoting resilient crops and global food security. As research in this field advances, the integration of ISR and SAR into mainstream agricultural practices holds promise for shaping the future of effective and environmentally conscious plant disease management.

T11OP8: Identification of Novel Resistance Sources for Alternaria blight (*Alternaria burnsii*) in Cumin

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Cumin (*Cuminum cyminum* L.) is a significant seed spice crop belonging to the Apiaceae (Umbelliferae) family within the order Apiales. Originating from the Mediterranean and near Eastern regions, cumin holds global popularity in culinary applications, herbal medicine, and food flavoring, particularly enhancing the taste of soups, pickles, and vegetables. It holds a prominent position among seed spices worldwide. The production of cumin faces challenges primarily from seed and soil-borne pathogens, leading to issues such as poor germination and early seedling mortality. Among the various fungal diseases affecting cumin, wilt, blight, and powdery mildew stand out. Early signs of Alternaria infection manifest as minute, whitish necrotic areas that evolve from purple to brown and eventually black. Blight, in particular, has been reported to cause significant seed losses, reaching up to 83%. In a recent survey conducted in the Jodhpur region, the intensity and incidence of Alternaria blight were found to range from 40.2% to 60.16% and 42.83% to 70%, respectively. The investigation also revealed a correlation between weather conditions and Alternaria blight, with optimal temperatures (15°C to 30°C), high relative humidity, and cloud formation significantly promoting the disease during the 2021-2022 period. To identify the causative agent, infected cumin plants displaying typical blight symptoms were collected from farmers' fields. Through standard tissue isolation methods, the fungus was isolated and identified as *Alternaria burnsii* based on cultural and morphological characteristics. Koch's Postulates were followed to confirm the pathogenicity of the isolated fungus. Further, in an attempt to mitigate the impact of Alternaria blight, 30 cumin germplasms were screened under natural field conditions. However, none exhibited a highly resistant or resistant reaction. Only three germplasms were identified as moderately resistant to Alternaria blight. This information contributes to our understanding of the challenges faced by cumin cultivation and provides insights into potential resistance mechanisms for future breeding efforts.

T11OP9: Identification of New Sources of Resistant Entries against Black and Brown Rust of Wheat

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Disease is one of the major factors that restrict the increment in wheat production. Among several diseases of wheat, black and brown rust are more devastating as they evolve continuously through mutation and their wind-borne uredospore are spread over long distances, which has resulted in failure of resistance and led to severe losses in global wheat production. However, for the management of both the rusts, the most useful and economically effective measure is the utilization of resistant cultivars. The development of new cultivars with improved genetic resistance has a great impact on reducing production costs and risks of environmental pollution due to the heavy use of fungicides against wheat rust. For the successful implementation of resistant sources against black rust and brown rust, effective field screening of wheat lines is an important task. Therefore, screening of 194 entries of *T. aestivum* and 124 entries durum wheat were conducted during 2022-2023 *Rabi* season at Pathological block, Vijapur. For effective screening under field conditions, an artificially created epiphytotic condition was also created during the experimental season by injecting the inoculum suspension of black rust and for brown rust spraying of inoculum on susceptible varieties. It was found that 23 entries in aestivum and 24 entries in durum wheat were found resistant against black rust. Against the brown rust, 91 entries of aestivum and 93 entries of durum wheat were found resistant. Thus, these identified promising resistant entries could be a valuable source of wheat while combating black and brown rust in wheat cultivation.

T11OP10: Screening of Tomato Genotypes for Resistance against Damping-off (*P. aphanidermatum*) Disease

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Damping off is disease is typically seen in all Solanaceae family crops. But in tomato growing areas/nursery beds in all over India disease affects the cultivation and causes significant losses to farmers before transplanting of tomato crop. Concerning the elimination of chemical pesticide applications in agriculture, cultivation of disease resistant varieties as a preventive measure for control of this disease is highly desirable approach in plant disease management. Hence, the experiment was conducted during 2014-15 to know the varietal status in resistance against damping-off disease of tomato. Out of thirty-one genotypes screened against damping-off of tomato four genotype, NTNL-18, NTNL-19, NTNL-39 and NTNL-53 were found moderately resistance reaction against damping-off tomato. Twelve genotypes found moderately susceptible while, thirteen genotype were showed a susceptible reaction. Only two genotype NTNL-55 and GT-2 were showed highly susceptible reactions against damping-off tomato caused by P. *aphanidermatum.*

T11OP11: Enhancing Bread Wheat Resistance against Stripe Rust and Leaf Rust through Molecular Characterization of Exotic Germplasm of Bread Wheat and Nanotechnology Interventions

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Wheat (*Triticum aestivum* L.) stands as the predominant cereal crop in India, facing severe threats from stripe rust and leaf rust. This study assessed 164 exotic bread wheat germplasms for their resistance against these diseases under epiphytotic conditions. The evaluation involved molecular characterization and nanotechnological interventions to validate their resistance. Among these, sixty accessions displayed resistance to stripe rust, while eighteen showed leaf rust resistance in field conditions, exhibiting lower AUDPC values. Molecular marker characterization revealed that out of 18 leaf rust-resistant accessions that were phenotypically resistant, 13 accessions possessed *Lr19* gene and 8 accessions carried the adult plant resistance gene, *Lr67*. However, five germplasm accessions harbored both *Lr19* and *Lr67* genes. The current study has provided breeders with resistant wheat lines against leaf and stripe rust, allowing them to incorporate these lines into their breeding programs. The study employed two methods to monitor disease progression: foliar application of salicylic acid and the use of chitosan nanoparticles. We propose that the potential application of chitosan nanoparticles might prove to be a sustainable approach for enhancing wheat rust disease management.

T11OP12: AUDPC Values of Different Wheat Verities in Response to *Puccinia triticina* and their Severity

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Wheat is an important cereal crop in the world after corn and rice and it is also the second most important crop after rice in India but leaf rust, caused by *Puccinia triticina*, is the most common rust disease of wheat. The fungus is an obligate parasite capable of producing infectious urediniospores as long as infected leaf tissue remains alive. So, it is important to understand the pathological responses. Out of six varieties tested, three wheat varieties showed a resistance response, while the other three varieties showed a susceptible response against leaf rust of wheat. Disease severity and area under disease progressive curve (AUDPC) data of three susceptible varieties revealed that the highest AUDPC value (1218.70) was recorded in Agra local which showed the most susceptible response followed by Pisi Local (840.70) and Lalbahadur (837.90). There was no development of leaf rust symptoms on three varieties viz., GW 496, GW 366 and GW 463.

T11OP13: Unraveling the Foundation of Soybean's Defense Mechanism against Mungbean Yellow Mosaic India Virus

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Yellow mosaic, a debilitating disease impacting soybean production, poses a significant challenge to crop yield and quality. In this study, we employed Composite Interval Mapping to identify two key Quantitative Trait Loci (QTLs) associated with resistance on chromosomes 6 and 2 in the soybean genome. QTL annotation led to the identification of *RDR1* and *SGS3* as potential candidate genes, and their DNA sequences were examined for resistance genetics. To unravel the functional significance of these genes, we cloned and sequenced *RDR1* and *SGS3* from both yellow mosaic disease-resistant (SL-1024) and susceptible (JS-335) soybean cultivars. Pre- and post-inoculation expression levels of these genes were analyzed in a controlled environment, revealing substantial differences between resistant and susceptible genotypes. Sequencing efforts highlighted a key Single Nucleotide Polymorphism (SNP) at position 1747 in the *RDR1* gene, indicative of resistance. Similarly, two SNP variants in the *SGS3* gene defined the resistant genotype (SL-1074). Validation of these findings necessitates screening for resistance genotypes. Further investigations using quantitative Real-time PCR demonstrated elevated expression levels of *RDR1* and *SGS3* in resistant genotypes compared to susceptible ones, suggesting that SNP variants may enhance disease resistance gene expression. Functional significance was further assessed through RNA interference (RNAi) experiments, where knockdown of *RDR1* and *SGS3* genes resulted in higher viral loads in resistant genotypes compared to susceptible one's post- inoculation. These findings underscore the potential of genetic alterations in influencing plant breeding strategies and crop protection measures. In conclusion, this research sheds light on the genetic basis of soybean resistance to yellow mosaic, offering valuable insights for crop innovation and agriculture. Continued exploration of these genetic mechanisms holds promise for enhancing disease resistance in soybean and other crops, thereby contributing to sustainable agriculture practices.

T11OP14: Mechanism of Powdery Mildew Resistance by Differential Physio-morphic Characters of Okra Cultivars

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To investigate physio-morphic characters in resistant and susceptible cultivars of okra. 12 okra varieties were screened for powdery mildew resistance in field conditions for two years. Among 12 different varieties Sonakshi and Taj-042 showed moderately susceptible reaction. While, the varieties *viz*., R.K.-523, Okra-OH-102, Siri-19, Arka Anamika, Venus, GO-2 and Rani exhibited susceptible, whereas Gitanjali, GAO-5 and Pusa Sawani categorized highly susceptible reaction against powdery mildew of okra. None of the variety was found resistant during both the years. Among the physio-morphic characters of different varieties hair-length on midrib of middle and lower leaves, lamina of upper and lower leaves, hair density on the midrib of upper and lower leaves, veins of lower leaves and lamina of upper and middle leaves exhibited significantly negative correlation with the per cent disease intensity on okra. Similarly, stomatal area of upper, middle and lower leaf and leaf lamina thickness of lower leaves were also found significantly negative correlation with disease intensity. While, stomatal density on upper, middle and lower leaf and stomatal index of upper, middle and lower leaf showed significantly positive correlation with the disease intensity.

TP11OP15: Integrated Approaches for Enhancing Citrus Tristeza Virus Resistance: From Identifying Disease-resistant *khasi* Mandarin Mother Stock to *ab initio* Modeling and Docking Evaluation of Protective Strategies

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Citrus tristeza virus (CTV), a closterovirus-transmitted brown citrus aphid (*Toxoptera citricidus*), causes citrus decline globally. CTV comprises flexible filamentous particles (2000×11nm) and a 19.3-kb positive-sense ssRNA genome with 12 ORFs encoding 19 proteins. CTV has cut down over one million Indian citrus trees. Northeast India produces many citrus species, but Khasi mandarin (Citrus reticulata Blanco) is the most valuable. Serious CTV infection is the main reason for the fall in the Khasi mandarin crop. Various Khasi mandarin-growing locations of Assam were surveyed to determine CTV disease incidence and molecular status. Khasi Mandarin provided citrus samples. According to DAC-ELISA and PCR assays, the Kamrup Metro and Goalpara districts of Assam had 77-85% CTV incidence rates. Healthy-looking 50 Khasi mandarin twigs were grafted into a rough lemon to identify disease- free mother stocks and mild CTV strains. The PCR assay found 10 CTV-free and 40 CTV-positive samples. CTV-free trees were kept segregated as disease-free mother stocks for production planting. CTV CP genes from all infected isolates were amplified, sequenced, and analyzed. Present isolates shared 87-100% nt identity in pair-wise sequencing analysis. Six Gr I-VI groupings were formed via phylogenetic tree analysis. Genetically mild CTV strains were found. The reported isolates under Gr-II and Gr III were identified as possible mild CTV isolates based on nucleotide sequence and codon usage biases (CUB) analysis using CP gene sequence and comparison with recognized mild and severe CTV infections. Insilco did Molecular Docking of severe strain coat proteins with flavonoids and chemicals. Flavonoids (Diosmin) strongly bind to the Coat Protein of CTV. This study shows flavonoids have potential compared to other chemicals.

T11OP16: Bio-chemical Basis of Host Plant Resistant to *Maruca vitrata* (Fabricius) in Selected Genotypes/Varieties of Cowpea

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An experiment was conducted at the research farm of the Centre of Excellence for Research on Pulses, S. D. Agricultural University, Sardarkrushinagar during *Kharif* 2010. The experiment was laid in randomized block design with three replications. The biochemical constituents *viz*., total amino acid, total soluble sugar, protein, and nitrogen content in cowpea pods were found higher in genotype GC-12 and GC-601 than other genotypes. While, these biochemicals were very low in GC-706 and GC-203. The total amino acid, total soluble sugar, protein and nitrogen content in cowpea pods were significantly and positive correlated with per cent pod damage. Significant positive correlation indicated that, as with the increase in total amino acid, total soluble sugar, protein and nitrogen content in cowpea pods there was an increase in the incidence of *M. vitrata*. Due to higher amount of nutritional compounds the variety was more preferred by host. The biochemical constituents *viz.,* total phenol, tannin and flavonoid contents in cowpea were higher in GC-706 and GC-203 as against GC-12 and GC-601. All three above biochemical constituents in the pods of cowpea were significantly and negatively correlated with per cent pod damage. Hence, it indicated that the total phenol, tannin and flavonoid contents were increased, there was a decrease in the incidence of *M. vitrata.* So, it can be concluded that genotypes having lower content of nutritional compounds *viz*., total amino acid, total soluble sugar, protein and nitrogen and higher content of anti- nutritional compounds *viz*., total phenol, tannin and flavonoid contents will be least preferred by *M. vitrata* for feeding. Ultimately this will reflected to lower pod damage and higher yield.

T11OP17: Resistance Response of Custard Apple Cultivars to *Collectotrichum gloiosporioides* Penz. Causing Anthracnose

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Anthracnose, caused by *Colletotrichum gloeosporioides* Penz. is considered the most important disease of custard apple that

contributes significantly to preharvest and postharvest losses. The objective of this study was to identify the resistant response of the different cultivars against the pathogen *C. gloeosporioides*. Seven cultivars of custard apple were evaluated for anthracnose under natural field conditions continuously for five years at Jhalawar, Rajasthan, India. Disease intensity was recorded using 0-5 foliar disease rating scale and per cent disease index (PDI) was calculated. These genotypes were further categorized as resistant and susceptible groups based on per cent disease index. The result revealed that Custard apple cultivar Arka sahan was found resistant to anthracnose disease with minimum disease incidence (8.20%) followed by Atemoya 9.80% while a maximum disease incidence of 19.20% was observed in APK (Ca-1).

T11OP18: Screening of Ber Varieties/Germplasms against Powdery Mildew (*Oidium erysiphoides* f. sp. *ziziphi*) Disease

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Ber (*Zizyphus mauritina* Lamarcke.) is an important arid and semi-arid fruit crop indigenous to an area joined from India to China. In Gujarat, ber is being cultivated on an area of about 11,190 hectares with production of 1, 13, 901 metric tonnes and productivity of 9.40 metric tons (Anon. 2019). Powdery mildew incited by *Oidium erysiphoides* f. sp. *ziziphi,* Yan and Wang is the most important biotic stress which causes maximum reduction in yield and quality of ber fruits. Developing a varietal resistance to disease provides an early, cheaper, stable, and sustainable remedy for the management of the disease. In the present investigation, 65 cultivars/ germplasms were tested for resistance against *O. erysiphoides* f. sp. *ziziphi.* Among them the variety Apple ber is found highly resistant; Mehrun and Sukavani found moderately resistant; Mundia mehra, Kaithly, Vikas, Darakhi-1, Banarasi Pavandi, Seo and Manuki found susceptible and the rest of the cultivars/germplasms found highly susceptible with powdery mildew disease in ber.

T11OP19: Resistance Sources for *Fusarium* Wilt Disease of Castor

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Fusarium wilt disease is most destructive and widely distributed which causes huge yield losses. Losses in yield due to wilt disease were observed in most of the cultivated castor hybrids. The release and adoption of wilt resistance castor hybrids has managed *Fusarium* wilt disease effectively. A renowned wilt resistant castor hybrid GCH-4 eventually turned out to become wilt susceptible. Similarly, the wilt resistant variety DCS-9 exhibited up to 60 per cent wilt incidence indicating gradual breakdown of resistance. It is necessary to identify the newer potential sources for wilt resistance. Promising castor inbred and pistillate lines were screened against *Fusarium* wilt disease in wilt sick plot at the Centre for Oilseeds research, SDAU, Sardarkrushinagar. Wilt incidence (%) was recorded at 180 days after sowing and disease reaction was categorized. Wilt disease resistance was confirmed through artificial screening. Castor inbred lines *viz*., SKI-399, SKI-401, SKI-403, SKI-405, SKI-406, SKI-408, SKI-411, SKI-412, SKI-415, SKI-416, SKI-417, SKI-419 and SKI-420 are resistant (Less than 20% wilt incidence) to wilt disease. Castor pistillate lines *viz*., Geeta, JP- 96, SKP-106, SKP-121, SKP-123 and SKP-84 are resistant (Less than 20 % wilt incidence) to wilt disease. These parental lines could be used as wilt resistance source(s) in future breeding programme to develop wilt resistant hybrids/varieties.

T11OP20: Reaction of Pearl Millet Genotypes against Downy Mildew Disease in Hot Spot of Gujarat State: Current and Future Challenges

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Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is an important cereal and forage crop of arid and subtropical regions of the Indian subcontinent and several African regions. The major pearl millet cultivating states in India include Rajasthan, Gujarat, Maharashtra and Uttar Pradesh. Downy mildew (DM), caused by *Sclerospora graminicola*, continues to be a major biotic constraint to pearl millet production in India. The downy mildew (DM) of pearl millet constantly threatens sustainable pear millet production and food security. Pearl millet downy mildew was first reported by Butler (1907) in India and described it as the disease of ill-drained lands where it developed into epidemics of severity. In India, the pathogen is present in all the states where pearl millet is cultivated. The disease was considered with minor importance till 1970, as its incidence was sporadic on local cultivars. The first epiphytotics of DM occurred during the crop season of 1971 on the first popular hybrid HB 3 and caused substantial yield loss. *S. graminicola*, a type species of the genus Sclerospora, belongs to the group Chromista, phylum Oomycota, class Oomycetes, order Sclerosporales and family Sclerosporaceae. The pathogen is heterothallic, but homothallism also occurs. It produces both asexual (sporangia, zoospores) and sexual spores (oospores). The vegetative phase is in the form of mycelium colonizing the intercellular spaces in the host tissues like root, stem, leaf and panicle. The pathogen draws the nutrition from the host cell through a specialised structure called haustoria and haustorial mother cell. The hyphae are coenocytic, multinucleate, and grow profusely in the tissues. At later stages, they produce plenty of asexual spores on the lower leaf surfaces. After the exhaust of sporulation, the pathogen switches over to sexual

reproduction to produce oospores. Gupta and Singh (1996) estimated the losses on pearl millet cv. HB 3. They observed that severe and systemic infection reduced the fresh weight of the shoot along with the number of basal and nodal tillers. In North Gujarat, during the *Kharif* season, downy mildew causes heavy infestation which can cause yield losses up to 70% in favorable weather conditions, however, most damage is in the range of 10-70% depending on crop stage, disease severity, and cultivar susceptibility. Several new pathotypes of *Sclerospora graminicola* have evolved, and some promising ones have succumbed to DM (Thakur and Rao 1997; Thakur *et al*. 1999). Monitoring the DM resistance of pearl millet hybrids and virulence in the pathogen is critical for effectively utilising resistance genes. In this disease, two types of symptoms are produced *viz*: downy mildew and green ear. Symptoms often vary according to the host, time of expression, and ambient conditions (Kenneth, 1998). Changes in morphological characters in susceptible pearl millet due to downy mildew reduced grain and fodder yields. Therefore, in the present study, 11 inbred lines and their 28 crosses (F1) with an international susceptible check (7042 S) were assessed for downy mildew resistance under field conditions during the *Kharif Season* (2023-24) at the Centre for Millets Research, Sardarkrushinagar Dantiwada Agricultural University, Deesa. The disease was scored first at 30 days after emergence (pre-booting/flowering stage), second at 45 days after emergence and third at 60 days after emergence (soft-dough stage) of the crop. The finding of this investigation revealed that three crosses J2372 × JMSB20175, J2372× J2539 and J2372× J2532 showed resistant (R) reaction. J2372× JMSB20172 cross shows moderately resistant (MR) reaction. The 7042 S an international susceptible check showed 92.3% downy mildew disease incidence. In the remaining 24 crosses, 8 showed susceptible reactions, and 16 showed highly susceptible reactions. The resistant lines identified through this study could be used as a potential source for developing downy mildew-resistant varieties. The recorded data could also be used in the marker-trait association study for downy mildew in pearl millet.

T11OP21: Phenomics for Biotic Stress Resistance in Crop Plants

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Phenomics for biotic stress resistance is defined as the study of host plant resistance through automated trait analysis to generate phenotypic data. One of the greatest ways to control diseases is to use resistant cultivars that are both economically feasible and relevant over wide areas. In order to quantify phenotypic attributes using various sensors mounted on a platform, photos of an experimentally constructed field or a single plant must be taken. Additional image and data analysis is carried out using various software programmes. Plant resistance and pathogenicity or pathogen aggressiveness in a variety of genotypes analysed through phenomics can be linked genomically with the identification of genes or quantitative trait loci (QTLs) associated with resistance. Many automated tools that can be used for high throughput phenotyping to evaluate disease in field conditions have been developed and tested. This will help to meet the increasing demand for research into the development of disease-resistant cultivars that will support agricultural production in the future and ensure food security.

T11PP1: Screening for Disease Resistance Mutants of Cumin against Alternaria blight

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Cumin (*Cuminum cyminum* L.) popularly known as Jeera or Jiroo is the most important spice crop in India. Gujarat is the second largest producer next to Rajasthan with 50-55% of the total production of India. This crop suffers from blight disease caused by *Alternaria burnsii.* Forty-eight mutants of cumin along with susceptible check GC 4 were screened against Alternaria blight under field conditions, none was found highly resistant and resistant. Only two mutants C16.1 and C2.1 founds which showed susceptible reaction and rest of mutants showed highly susceptible diseases reaction at 75 DAS. Healthy leaves of moderately susceptible cumin mutants *viz.,* C16.1, C2.1 and C1.2 showed significantly higher levels of phenol content, phenylalanine ammonia-lyase (PAL), peroxidase (PO), polyphenol oxidase (PPO), superoxide dismutase (SOD) and chlorophyll content than the susceptible mutants at 60 DAS. The significantly increase in the phenol content, phenylalanine ammonia-lyase (PAL), peroxidase (PO), polyphenol oxidase (PPO) and superoxide dismutase (SOD) in the moderately susceptible and susceptible mutants were observed after the invasion of pathogen, whereas in the case of chlorophyll content, significantly decreased in the moderately susceptible and susceptible mutants were observed after invasion of pathogen. In moderately susceptible mutants higher amount of phenol content, PAL, PO, PPO, SOD and chlorophyll content were observed than the susceptible mutants after the invasion of pathogen. Genotypes *viz.,* C16.1, C2.1 and C1.2 can be used in future research work for developing Alternaria blight resistant genotypes through breeding and molecular approaches.

T11PP2: Screening of Green Gram [*Vigna radiata* (L.) Wilczek] Genotypes/Varieties against Cercospora Leaf Spot Disease

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Green gram (*Vigna radiata* L.) is one of the most important legume crops grown in India, since ancient times. It belongs to

the family *Fabaceae* and subfamily *Papilionaceae*. As a pulse crop, it is referred to as a soil fertility restorer due to its special capacity for biological nitrogen fixation. During *Kharif* season of the year 2022, total twenty-seven different green gram genotypes/varieties were tested under in vivo condition to determine their level of resistance against Cercospora leaf spot disease caused by *Cercospora canescens*. A significant variability among the genotypes/varieties was observed during disease reaction. It was found that three accessions showed resistance reaction, three genotypes were moderately resistant, sixteen as moderately susceptible, four as susceptible and one was highly susceptible against Cercospora leaf spot. The results of the present study indicate that genotypes/varieties that have been identified as resistant or moderately resistant to the CLS disease may be able to be employed in future breeding programmes to develop green gram varieties that are resistant to Cercospora leaf spot.

T11PP3: Transgressive Segregation in Mungbean (*Vigna radiata* (L.) Wilczek)

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The investigation was carried out to estimate transgressive segregants among nine genotypes (four crosses along with five parents) of mung bean for eleven morphological characters. These genotypes were sown in randomized block design with three replications during *Kharif*, 2022, at Research Farm of Sri Karan Narendra College of Agriculture, Jobner, Jaipur. The highest percentage of transgressive was observed for plant height (23.33%) in cross HUM 1 x ML 818, followed by seed yield per plant (19.17%) and seed yield per plant (20.00%) in cross HUM 1 x RMG 975. In general, in all four the highest proportion of transgressive segregants were recorded for seed yield per plant (92) followed by plant height (84), pods per plant (83), pod length (81), seeds pod per pod (76), 100-seed weight (67), clusters plant per plant (67) and pods per cluster (55). The dependency of grain yield on these characters and the production of individual segregants and simultaneous transgressants of seed yield in combination with 3 or 4 characters indicated the feasibility of funneling such ideotype in mungbean. If these segregants hold true in further generations, will be of high value in fixing characters, hence their further generations are under evaluation.

T11PP4: Comprehensive Assessment of Wilt Resistance in Pigeonpea (*Cajanus cajan* L.)

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Pigeonpea (*Cajanus cajan* L.) is the second most important pulse crop in the country after chickpea. India is the major pigeonpea producing country, contributing almost 80% of total production and area in the world. The pigeonpea crop suffers heavily due to wilt disease, caused by *Fusarium udum* Butler in the major growing areas resulting in huge production losses. Because of its soil-borne nature and long survival, growing resistant varieties is the best option for managing the disease. During *Kharif* 2021, a total of 68 entries of pigeonpea were evaluated against wilt disease in the wilt sick plot. The wilt incidence was varying from 0 to 76.66%. Out of 68 entries 32 entries showed free to resistant reaction, 24 entries showed moderately resistant reaction and 12 entries showed susceptible reaction against wilt disease. The entries showed resistant reaction and moderately resistant reaction can be used in further breeding programs aimed for wilt resistance.

T11PP5: Screening of Genotypes against Leaf Spot of Ashwagandha (*Withania somnifera* L. Dunal)

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Ashwagandha (*Withania somnifera*) is known as the "Queen of Ayurveda," and it is considered as a vital medicinal herb that was extensively used in ancient Indian medicine. Among the different diseases reported in *Ashwagandha*, the leaf spot disease is considered the most prominent one. The field experiment was carried out during the *Rabi* season 2020-21 and 2021-22 at Agronomy Instructional Farm, SDAU, Sardarkrushinagar, Gujarat. In a field setting with simulated epiphytotic circumstances, forty (40) genotypes of Ashwagandha along with a check (JA 134) were tested against leaf spots caused by *Alternaria alternata*. The results of the present study revealed that SKA 18 showed susceptible reaction (S), two genotypes, namely, IC 310620 and SKA 17 were showed moderately susceptible reaction (MS), and genotypes, *viz.,* SKA 4, SKA 5, SKA 15, SKA 16, SKA 19, SKA 20, SKA 21, SKA 25, SKA 27, SKA 28, SKA 32 exhibited moderately resistant (MR) reaction and genotypes especially, SKA 1, SKA 2, SKA 3, SKA 6, SKA 9, SKA 13, SKA 14, SKA 23, SKA 26, SKA 29, SKA 31, SKA 33, SKA 34, SKA 35, MWS 1, MWS-201, SKA 17-24-1 showed resistance (R) and genotypes specifically, SKA 7, SKA 8, SKA 10, SKA 11, SKA 12, SKA 22, SKA 24, SKA 36 showed highly resistant diseases reaction at 85 days after sowing.

T11PP6: Identification of Genetic Sources Conveying Root Rot Resistance in Cowpea (*Vigna unguiculata* L.)

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Cowpea cultivation is greatly threatened by cowpea root rot which is caused by *Macrophomina phaseolina* (Tassi) Goid. This disease not only infects seedlings and adult plants, leading to significant yield losses, but it also weakens the ability of cowpea plants to fix nitrogen. In turn, this allows the pathogen's population in the soil to increase. The most effective approach to managing cowpea root rot is through host plant resistance, as it is both cost-effective and environmentally beneficial. To identify genetic resistance to root rot caused by *M. phaseolina*, screening was conducted on 25 cowpea genotypes during the summer of 2022-23. This screening took place under sick plot conditions in the field Agronomy Instructional Farm, S. D. Agricultural University, Sardarkrushinagar. Among the 25 genotypes evaluated 5 genotypes displayed a moderately resistant response. Additionally, 12 genotypes were found to be moderately susceptible to the disease, and 6 genotypes were identified as susceptible and the remaining 2 genotypes are highly susceptible to *M. phaseolina*. These genotypes can serve as valuable sources of resistance in breeding programs aimed at developing root rot-resistant cultivars.

T11PP7: High Throughput Plant Phenotyping for Disease Resistance

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Disease resistance is a key to increasing crop yield and food security. Implementation of high throughput phenotyping for the screening of fields for disease detection is critical for accelerating crop improvement and making breeding strategies. Nowadays, various high-throughput sensors are available which used for high-throughput phenotyping. High-throughput technology can give a high-efficiency performance with less error as well as it is a very less time-consuming method. Phenotyping is used for getting information on quantitative traits of various diseases. High throughput phenotyping is non-invasive imaging and sensing for the evaluation of anatomical, physiological, and biochemical properties of plants. Sensing systems can used for the screening of disease in both controlled as well as field conditions for precision phenotyping. These techniques can help in the efficient detection of the QTL which is related to disease resistance.

T11PP8: Secondary Metabolite Mediated Biotic and Abiotic Stress Management

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Secondary plant products or metabolites are the compounds that are naturally synthesized in plants. Most of them are organic substances produced by the members of microbial, fungal and plant kingdoms, that carry out specific functions under certain conditions but are not directly involved in the growth and development of a plant. Secondary metabolites (SMs) play a major role in plant defense mechanisms against pathogens and other higher organisms. The plant's ability to survive over the long term is compromised by the lack of secondary metabolites. Typical examples of such substances include phenolics, pigments, and others. Plant phenolic compounds, including flavonoids and lignin precursors, are thought to be important defense chemicals that can scavenge damaging ROS. They are helpful for plants to react against stress. SMs play an important role in stopping infections, whether they are caused by biotic or abiotic factors. They come under biochemical defense mechanism of plants either pre-existing chemical defenses or post inflectional or induced defenses. Plant SMs are crucial for biotic stress management that arises from injury of an organism caused by other living organisms, such as cultivated or native plants, parasites, beneficial and harmful insects, fungi, bacteria, and viruses. Resistance to secondary infections by pathogens can also be brought on by a plant's interaction with microorganisms or molecular patterns linked to bacteria. Plantibodies that are produced in genetically engineered plants that express foreign genes that produce antibodies against plant pathogens. Phytoalexins such as pisatin, phaseolin, rishitin, etc., are the important plant metabolites produced by plants in response to injury or infection. They are toxic antimicrobial substances produced in appreciable amounts in plants only after stimulation by phytopathogenic micro-organisms or by chemical or mechanical injury.

T11PP9: A Promising Genotype of Pigeonpea for Wilt Resistance

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Pigeonpea (*Cajanus cajan* (L) Millsp.) is a major food legume grown in semi-arid tropical and subtropical farming systems with a variety of agro-ecological conditions. It provides humans high-quality vegetable protein and serves as a source of animal feed and firewood. Its cultivation is limited to poor countries, particularly in Asia and Africa. Pigeonpea is susceptible to a number of diseases, including Alternaria leaf spot, Phytophthora blight, sterility mosaic, and wilt. Developing different disease resistance genotypes in pigeonpea is a difficult undertaking in the field. In this study, we have developed a pigeonpea genotype called SKNP1715 that is resistant to wilt diseases in the field. The genotype was investigated for wilt screening during *Kharif* 2021 and *Kharif* 2022 at wilt sick plots of several locations (AICRP centres) as well as the Pulses Research Station, S.D. Agricultural University, Sardarkrushingar. Pigeonpea genotype SKNP1715

was shown to be resistant to wilt with 17.55% disease incidence during *Kharif* 2021 and that of 08.62% wilt incidence during *Kharif* 2022. Overall pigeonpea genotype SKNP1715 used as the promising wilt-resistant donor for future breeding programme.

T11PP10: Multiple Environments Evaluation of Wheat (*Triticum aestivum* L.) Germplasm for Stripe Rust Resistance in Western-Himalayan Region

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The rust diseases of wheat (*Triticum aestivum* L.) pose a constant threat to sustainable wheat production and food security in Asia. Wheat production in the Western-Himalayan region is affected by various biotic and abiotic stresses, of which yellow (or stripe) rust, caused by *Puccinia striiformis* f. sp. *tritici* is the most serious threat. Stripe rust can cause yield losses of up to 100% in favorable weather conditions, however, most damage is in the range of 10-70% depending on crop stage, disease severity, and cultivar susceptibility. Therefore, the present study was conducted for screening of wheat germplasm for stripe rust resistance at multiple locations in the western Himalayan region of Kashmir valley. we investigated the natural variation available for stripe rust resistance in 256 Indian wheat varieties at four different locations (Faculty of Agriculture, Wadura, Sopore, SKUAST-K; Dryland Agriculture Research Station (DARS), Budgam, SKUAST-K; Mountain Research Centre for Field Crop (MRCFC), Khudwani, Anantnag, SKUAST-K, Mountain Agriculture Research and Extension Station (MARES), Gurez, SKUAST-K. The selected varieties were released in India in the past 100 years (1906-2006) and represent all the six wheat-growing zones of India. The analysis of stripe rust data led to the identification of 123 resistant wheat varieties with various levels of resistance to stripe rust. Validation of already reported gene-linked markers on 48 contrasting wheat genotyping (24 highly resistant and 24 highly susceptible) was also attempted. Therefore, these 48 contrasting genotypes were characterized using gene- linked SSR markers. The Single Marker Analysis (SMA)/regression analysis of the genotypic data of 7 gene-linked SSR markers and trait data of 48 genotypes led to the identification of two markers *viz*., XWmc198 and XGwm6 associated with stripe rust resistance genes Yr32 and Yr25, respectively. The phenotypic variation explained by the marker "XWmc198" varied from 13.99% to 21.91%, while that explained by the marker "XGwm6" varied from 9.5% to 12.11%. The average number of alleles per locus detected by these gene-linked markers was 2.58. The resistant lines identified through this study could be used as a potential source for developing stripe rust-resistant varieties. The data recorded could be also used in the study of marker-trait association for stripe rust in wheat.

Theme 12: Post-harvest Management

T12OP1: Management of Post-harvest Rots of Papaya under Controlled Conditions

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During the present investigation in the year 2019-20, different fungi *viz*., *Colletotrichum fructicola, C. truncatum, Rhizopus stolonifer, Aspergillus flavus, Fusarium pallidoroseum* identified under NCFT Id No. 9013.20 and 9014.20 ITCC No. 11309.20, 11310.20 and 11308.20, respectively were found to be associated with post-harvest rots in papaya. Among six different chemicals *viz*., calcium chloride, pyroclostrobin 5% + metiram 55%, copper oxychloride, chlorothalonil, carbendazim, and mancozeb evaluated *in vitro* at four different concentrations, as well as pre and post- inoculation dip treatments against all the five test pathogens. Mancozeb at all the concentrations tested inhibited the growth of the five test pathogens except *A. flavus at 500 ppm.* Carbendazim at all concentrations tested inhibited the growth of all the test pathogens except *C. fructicola* at 125 and 250 ppm. In pre-inoculation dip treatment, the longest incubation period (90.13 h) and minimum mean (13.36 mm) lesion diameter was recorded in mancozeb treatment exhibiting 74.50 per cent disease control. In case of post inoculation dip treatments, no symptoms were observed in case of dip treatment with mancozeb at all durations *i.e.*, 30, 45 and 60 minutes in the case of *C. fructicola* and *C. truncatum*, carbendazim at all durations in *C. truncatum* and *Fusarium pallidoroseum*, while for 45 and 60 minutes could successfully control the rot resulting in no symptoms in case of *C. fructicola* and *A. flavus*. Significantly minimum mean (5.49 mm) lesion diameter was recorded in mancozeb treatment exhibiting 86.87 per cent disease control. Some dip treatments were able to completely control the rot caused by test pathogens, while others could successfully prolong the incubation period in comparison to the untreated control. So, these fungicides can be further evaluated as pre- harvest sprays and post-harvest dip treatments to reduce different post-harvest rots in papaya. Post-inoculation dip treatments were more found to be effective than pre-inoculation dip treatments.

T12OP2: Bio-management of Postharvest Rot of Tulip Bulbs Caused by Fungal Pathogen *Talaromyces purpureogenus* in Kashmir Valley

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Tulip bulbs are prone to various postharvest and storage rots

due to infestations caused by a variety of pathogens, particularly fungal pathogens. The present study was carried out to evaluate the in-vitro efficacy of three local *Trichoderma harzianum* isolates (TH796R1, TH796R2, and TH796R3) for the management of *Talaromyces purpureogenus,* a rot-causing pathogen of tulip bulbs. The study was carried out to develop an alternative approach that could minimize the use of chemical fungicides by being an eco-friendly, low-cost, and highly effective biocontrol strategy for disease management. The results revealed that *Trichoderma* isolates caused a significant reduction in the mycelial growth of *Talaromyces purpureogenus*. Among the three isolates of *Trichoderma harzianum*, TH796R3 was able to cause maximum inhibition of mycelium, followed by isolate TH796R1. The minimum inhibition of mycelial growth was caused by the TH796R2 isolate. It is evident from the results of the present study that various local isolates of *T. harzianum* demonstrated a remarkable effect against the isolated fungal pathogen and can be further assessed for their potential antifungal activity against other pathogenic fungi as well.

T12OP3: Unleashing Nature's Secret Weapon: *Anisopteromalus calandrae* and its Potential to Control *Tribolium castaneum*

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The well-known idiobiont ectoparasitoid wasp *Anisopteromalus calandrae* (Howard) (Hymenoptera: Pteromalidae) feed on the late-instar larvae and pupae of several species of coleopteran pests, developing internally or hidden inside the host substrate. Interestingly, *A. calandrae* may attack and feed on a variety of host species, such as *Rhyzopertha dominica*, *Sitophilus oryzae, Callosobruchus chinensis, Callosobruchus maculatus, Lasioderma serricorne* and *Tribolium castaneum.* The aim of this study was to investigate the preference of *A. calandrae* for parasitizing different stages of *T. castaneum* and the search ability *A. calandrae* at different depths in storage. Female *A. calandrae* could control 5 and 6-week-old mature larvae and pupae of *T. castaneum*. The number of *A. calandrae* offspring emerged from the 6-week-old mature larvae of *T. castaneum* was approximately 20% higher than that from the pupae. The parasitism rate of the *A. calandrae* against the *T. castaneum* larvae markedly increased with the increase of larval ages, with 15.00, 18.33, 30.00 and 83.33% of the parasitism rates against 3-, 4-, 5-, and 6-week-old larvae of *T. castaneum*, respectively. The parasitism level was up to 87.5 % in the 6-week-old larvae of *T. castaneum* placed closest to the surface, gradually decreasing as the depth increased. The female *A. calandrae* preferred to parasitizing mature larvae and pupae of *T. castaneum* and could control the *T. castaneum* and produce their offspring during their whole adult stage. According to the current research results, *A. calandrae* had great potential for controlling *T. castaneum*.

T12OP4: Post-harvest Management of Alternaria Fruit Rot of Tomato (*Lycopersicon esculentum* Mill.) Caused by *Alternaria tomato*

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Tomato fruits are affected by many fungal pathogens, but Alternaria fruit rot of tomato caused by Alternaria tomato (Cooke) G. F. Weber was the most destructive disease leading heavy losses in field as well as in the market. The fruit rot caused by *A. tomato*, which adversely affect the fruit quality, quantity and ultimately reduce the market value. The overdose of chemicals resulted resistance development in pathogens and have adverse effect on the consumer health. There is need to search alternative approaches to chemical control which have minimal deleterious effects and ecofriendly in nature. An antagonist, phytoextract and cow urine were used for ecofriendly management of the Alternaria fruit rot of tomato *in vitro* as well as *in vivo* by pre and post inoculation method. The *Trichoderma viride* was effective antagonist in inhibiting the mycelial growth of *A. tomato in vitro* by dual culture method with (85.02%) per cent growth inhibition as well as it was found most effective in reducing Alternaria fruit rot severity as both pre (10.63%) and post -inoculation (13.67 %) treatments. The garlic clove extract (10%) recorded lowest mycelia growth (17.00 mm) with highest percent mycelia growth inhibition. The similar results were also recorded in reducing Alternaria fruit rot severity in pre (8.36 %) and post -inoculation (10.46 %) methods.

T12OP5: Post-harvest Disease Management of Banana under Bharuch District

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Banana (*Musa paradisiaca* L.) is a tropical fruit known as "poor man's apple" and "apple of paradise". India holds first position in production and productivity in banana. It ranks third in area after mango and citrus. Banana grower faces significant post harvest loss due to post harvest diseases due to transportation, environmental effect, improper handling or care of banana fruit. It adversely affects the fruit quality, quantity and ultimately reduces the market value. Considering the seriousness of the disease, the present investigations were carried out to generate basic information for suitable management practices for reducing post harvest losses of

banana. Bioagent, phytoextracts and cow urine was tested against stem end rot (*Lasiodiplodia theobromae*) and Fusarium rot (*Fusarium verticillioides*) of banana *in vitro* and *in vivo* condition. *Trichoderma harzianum* was found the most efficient antagonist in inhibiting the mycelial growth (56.67% and 59.79%) of *L. theobromae* and *F. oxysporum in vitro* condition. The same pattern was observed under *in vivo* condition in reducing the crown rot severity (33.34% and 44.67%)) and Fusarium rot severity (40.85% and 42.97%) in pre-inoculation) and post-inoculation at 8th days after inoculation. Cow urine at 10 per cent concentration was recorded the maximum mycelial growth inhibition (31.85%) of *L. theobromae* and garlic clove extracts at same concentration (35%) against *F. oxysporum*. In vivo condition garlic clove extracts was recorded minimum severity of both diseases. Crown and Fusarium rot severity in pre-inoculation (46.21% and 26.32%) and post-inoculation (47.62% and 27.29%) was recorded at 8th day after inoculation.

T12OP6: Post-harvest Management Widening the Scope of Fennel Cultivation in Sirohi District

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Being cultivated in the southern corner of Aravalli hills, fennel reaches the farthest corner of Raisina hills. The journey so far was owned by its peculiar taste and flavor but for farmers, it was not profitable due to negligence at the time of harvesting as bad weather coincides with the peak harvesting season of fennel. Also, various diseases like Ramuaria blight caused by *Ramularia foeniculi Sybille* is still a big threat to fennel growers. With the interventions of KVK, Sirohi farmers were equipped with technology as well as inputs specifically to reduce post-harvest losses. This study focuses on the major factor and role of technological interventions in increasing the fennel area in the Sirohi district.

T12OP7: Assessing the Impact of Packaging Materials and Storage Duration on the Shelf Life and Post-harvest Preservation of Oyster Mushrooms

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For thousands of years, people have used the fruit bodies of mushrooms as a food source and to make a variety of goods, including pickles and vegetable salads. Because they breathe and transpire more quickly than other fresh foods, mushrooms are typically very perishable. However, the produce is only edible for a few hours because of its limited shelf life. Mushrooms have an extremely limited shelf life; under normal circumstances, they cannot be kept or transported for longer than 24 hours throughout the year. The three most frequent postharvest alterations in mushrooms are color change, weight loss, and microbiological spoiling. These occurrences frequently cause significant financial losses. Proper, sound, and appropriate postharvest practices of storage and processing are needed to sustain the budding mushroom farming and industry in the country. Hence, to increase the storage life of the mushroom, a study was carried out by using different packaging materials like Polypropylene, Polyethylene pouches, brown paper bags, Punnet boxes, and glass Petri dish stored under different storage conditions, *i.e.*, 30 °C (room temperature), 10 °C, and 40 °C. The results obtained from the above study have revealed that the shelf life of the mushrooms has increased upto 10 days under the refrigeration condition (40 °C) by using the Polypropylene followed by Punnet packaging material, and the quality analysis after the storage period showed that the colour, hardness, nutritional parameters and organoleptic score and microbial load, The statistical analysis has shown the significant difference between the packaging material and storage days with all the quality parameters analysed in the present study.

T12PP1: Post-harvest Management of Mango Anthracnose

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Mango (*Mangifera indica L.*) is one of the most popular fruit crops grown throughout the tropical and subtropical region belongs to 'Anacardiaceae' family having its origin in South East Asia, the Indo-Burma region, mainly in the foothills of the Himalayas. It is a drupe type of fruit and considered the 'National fruit' and 'King' of Indian fruits. Post- harvest losses of mango due to fungal diseases are of prime importance which deteriorates the quality and makes the fruits unsuitable for the market leads to heavy losses to sellers as well as consumers. Mango is the most popular due to its wide range of adaptability, high nutritive values and richness, delicious taste and excellent flavour. The fruit is an excellent source of vitamin A, vitamin C and iron. Mango has high energy about 250 KJ (60 kcal/100 g). Mango fruit consists of (15 g) carbohydrates, sugar content is about (13.7 g/100 g), fat (0.38 g), protein is about (0.82 g), respectively. Mango fruit is a good source of vitamins which consists of (7%) vitamin A, (2%) of thiamine, (3%) riboflavin, (4%) of pantothenic acid, (9%) of pyridoxin, (11%) of folate, choline is about (2%), (44%) vitamin C, (6%) of vitamin E and (4%) of vitamin K. Mango is an excellent source of minerals like calcium, iron, magnesium, phosphorus, sodium and zinc. Mango fruits is known to be affected by fungi. Major threat of mango production is due to the post-harvest decay or spoilage of fruits by microorganisms. Anthracnose is one of the most important post-harvest diseases of mango. It is one of the most severe diseases of mango. The present Investigation was carried out on the “Post Harvest Management of Anthracnose of Mango”, with a view to isolation and identification of the pathogen responsible for anthracnose disease of mango, pathogenicity, morphological and cultural characteristics of pathogen, biochemical changes in mango, different storage method, *in vitro* evaluation of mango.

T12PP2: Organic amendments: A Better Strategy for the Control of Post Flowering Stalk Rot Pathogen of Maize

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Maize being the queen of cereals has high productivity and wider adaptability to different agro-climatic situations. Post flowering stalk rot of maize evading several regions of India with its ability to reduce the yield and premature death of plant by wilting gained its importance to understand and analyse the disease with proper management practices. Fusarium stalk rot is one of the most destructive soil borne disease estimated to cause a total loss of 38 per cent in India. The disease causes vascular discoloration, pith disintegration and complete wilting of plants. Post flowering stalk rot of maize caused *by Fusarium verticillioides* is a highly destructible disease with its systemic nature. *In vitro* analysis of different concentrations of systemic fungicide exhibited significant inhibition on the growth of the fungus. Carbendazim, difenconazole and propiconazole demonstrated complete inhibition of the fungus at 500 ppm concentration. Subsequent reduction of 98.89, and 98.15 per cent in the 100 and 50 ppm of carbendazim and difenconazole. Complete inhibition in the radial growth of *F. verticillioides* was also exhibited by tebuconazole + trifloxystrobin and azoxystrobin + difenconazole at 500 ppm concentration. Organic amendment extract at different concentration levels exhibited growth inhibition in these treatments also varied from 20.00 to 97.78 per cent. Highest inhibition of 97.78 per cent was displayed in 30 per cent concentration of castor cake extract. Subsequently, 83.33 per cent inhibition was exhibited by mustard cake as well as neem cake extracts at 30 per cent concentration. Castor cake and neem cake at 30 per cent concentration effectively reduced the spore germination to 11.67 per cent. Oil cake extracts with a potential to nourish soil as well as plants moreover higher inhibition potential in controlling radial growth and spore germination of the fungus was considered an effective alternative for chemical fungicides.

T12PP3: Strategies for Mitigating Potato Dry Rot in Post-harvest Storage

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Potatoes are a staple food, providing essential nutrients, antioxidants, and resistant starch for health and energy, supplementing a country's food source. The potato crop is affected by numerous diseases in the field as well as in storage conditions. Of them potato dry rot disease caused by *Fusarium* species complex is a major threat to global potato production particularly in cold storage. Dry rot of tubers can leads to the rotting of potato reduce crop establishment by killing developing potato sprouts, and crop losses can be up to 25% more than 60% of tubers in storage. The present study aims to evaluate the effect of inorganic salts on *Fusarium* spp. through poison food technique in CRD. *In vitro* studies showed that salts (0.2 M) inhibited the mycelial growth and spore germination of *Fusarium* spp. Among these salts, sodium chloride, sodium carbonate, copper sulphate, potassium tetraborate, borax were fungi toxic. These findings suggest that the use of inorganic salts could be an effective method for controlling potato dry rot. Further research and testing should be conducted to determine the optimal concentration and application method for these salts in order to ensure their efficacy and safety for consumer consumption.

T12PP4: Cigarette beetle's *vs* Garlic: A Startling Discovery of Infestation in Domestic Garlic Storage

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The globally distributed stored pest *Lasioderma serricorne* (Fabricus) (Anobiidae: Coleoptera) seriously damages stored grains economically. The beetle's preferred food sources include dried tobacco, grains, dates, dried fish, ginger, pepper, grains, raisins, and medications. Adults are able to fly vast distances as well. They also have the power to contaminate additional food that is eaten. Garlic, *Allium sativum* a bulbous blooming plant originates in South Asia, Central Asia, and North-eastern Iran. Various diseases and insect pests damage garlic at different stages of the crop's growth. For the identifying pest destroying domestically kept garlic a roaming survey was carried out in Panch Pipalava village of Kodinar taluka, Dist. Gir-Somnath, India. Damaged garlic bulbs were gathered throughout the study, and *Lasioderma serricorne*, the cigarette beetle, was found to be the destructive pest. *L. serricorne* grubs caused damage to the garlic cloves near the bulb's proximal end. As grubs ate through the garlic clove, a brownish, powdery material appeared at the bulb's base. This pest was first found in Gujarat in garlic that was kept at home.

T12PP5: Maintenance of Post-harvest Life and Quality Aspects in Fruits Crops

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Post-harvest technologies play a crucial role in ensuring the quality and longevity of fruits from the point of harvest to consumption. This abstract explores various advancements and methodologies within the realm of post- harvest technologies in fruit. One significant aspect of post-harvest technologies is the

use of controlled atmosphere storage. This technology involves manipulating the storage environment, regulating temperature, humidity, and gas composition to slow down the physiological processes of fruits. By minimizing respiration rates and ethylene production, controlled atmosphere storage extends the shelf life of fruits, preserving their freshness and nutritional value.Additionally, cold storage and refrigeration have become indispensable in preserving fruit quality. These technologies inhibit microbial growth and enzymatic activities, preventing spoilage and maintaining the visual and nutritional attributes of fruits. Cold chain management, encompassing transportation and distribution under controlled temperature conditions, further ensures that fruits reach consumers in optimal condition.Emerging technologies, such as modified atmosphere packaging (MAP) and nanotechnology, contribute to enhancing post-harvest fruit quality. MAP involves modifying the atmosphere within packaging to slow down aging processes, while nanotechnology introduces nano-scale materials for coatings or packaging that inhibit microbial growth and moisture loss.Furthermore, post-harvest treatments, such as hot water treatment and irradiation, are employed to reduce pests and pathogens in fruits. These treatments are essential for meeting international phytosanitary standards, enabling the global trade of fruits while ensuring safety and quality.Post-harvest fruit technologies, like controlled atmosphere storage, cold chain management, innovative packaging, and advanced treatments, have advanced to enhance quality and extend shelf life. These methods collectively support the global fruit industry's demands. Ongoing research and development in novel technologies emphasize the importance of a sustainable and efficient post-harvest management system for fruits.

T12PP6: Post-harvest Management of Fruits and Vegetables to Minimize Loss

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Post-harvest science and technology facilitates the industries to deliver safe, nutritious and fresh horticultural commodities to consumers at the end of the supply chain from farm to mouth. Significant food wastage and losses, could be reduced by improved post-harvest research, advancement, training and education. At present, many advanced technologies and techniques are already being implemented to reduce the post-harvest losses at harvesting, during packing and transportation, in wholesale and retail markets, and at various levels of handling. Improvements are also required to minimize the losses effectively and keep the process cost low so that it could be applicable at commercial scale in a wide range of economic levels. Future studies should also be focused on incorporating various emerging technologies with post-harvest practices and appropriate improved practices should be adopted to an existing value chain and marketing system. India harvested 223.089 million tonnes of horticultural produce from 20.876 million hectares of land in the 11th five year plan. The major crops contributing to it are fruits and vegetables (approx. 204 million tonnes from 14.314 million hectares area). Horticulture sector contributing 30 percent to the India's agricultural GDP from 8.5 percent of cropped area. Therefore, there is a need for development of budget friendly technologies for the production of value-added products. Post harvest management of fruits and vegetables provide great opportunities for value addition and also provides wealth from waste. Its optimum utilization helps in reducing the cost of production of crops. There are several technologies used to utilize fruits and vegetables such as drying & dehydration, freezing, fermentation, extraction, etc., are some treatment examples that can be useful to recycling and upgrading waste of fruit and vegetable market.

T12PP7: Integrated Management of Post-harvest Diseases

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Food loss across the food supply chain, from crop harvesting to consumption, is referred to as postharvest loss. The weight loss from spoiling, nutritional loss, quality loss, seed viability loss, and commercial loss can all be roughly grouped together. These microbial deterioration, senescence, and disease invasion are the main causes of postharvest losses, which have a significant impact on the amount and quality of food. Numerous techniques are used to minimize the postharvest losses and diseases, these techniques include treating of products using a variety of physical, biochemical, and biological means, which directly manage pathogen infestation and increase product shelf life, but each has certain drawbacks. However, to decrease postharvest losses and improve shelf life, two or three postharvest treatment techniques might be combined to increase the effectiveness of these procedures. To prevent or minimize postharvest disease, various management techniques such as sanitation of storage facilities, temperature management, and use of resistant varieties, chemical treatments, and biological control are employed. Therefore, combining several treatment approaches may provide producers and stakeholders with a more reliable, long-lasting, workable, and sustainable post-harvest infection management strategy. This will emphasize how crucial both traditional and cutting- edge methods are for managing postharvest diseases and pathogen infestation in order to preserve crop quality.