Symposium on Challenges and Opportunities: Management of Plant Diseases under Weather Change

December 14-15, 2017

ABSTRACTS

Organised by

Department of Plant Pathology, College of Agriculture
Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur
and
Indian Phytopathological Society (Central Zone)

Jawaharlal Nehru Krishi Vishwa Vidyalaya
Jabalpur 482004 (MP), India

Symposium

on

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Jabalpur (MP) 482004

Abstracts

Symposium
on
Challenges and Opportunities: Management of Plant Diseases under Weather Change

December 14-15, 2017

Chief Patron

Dr. Pradeep Kumar Bisen
Vice Chancellor
JNKVV, Jabalpur

Patron

Dr. Dhirendra Khare
Director
Directorate of Research Services
JNKVV, Jabalpur

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Dean, College of Agriculture, Jabalpur

Co-Organizing Secretary

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Vice Chancellor

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कृषि नगर, आधारताल, जबलपुर ४८२ ००४ (म.प्र.)
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Message

I am happy to know that Indian Phytopathological Society (Central Zone Chapter) is organizing a National Symposium on "Challenges and Opportunities: Management of Plant Diseases under weather change" during December 14-15, 2017 at College of Agriculture, JNKVV, Jabalpur.

Tremendous challenges are being put forth by biotic stresses before the agricultural scientists to meet the ever-growing demands of food and nutritional security with a climate change scenario. Plant diseases are posing a major threat to agricultural crops in several parts of the country. Development of sustainable plant disease management strategies offers one of the best option to enhance the production, as land water and other natural resources are depleting.

I understand that the major constraint in effective disease management are the quick development of new races and strains of pathogens that leads altered host pathogen interactions with climate changes.

I am confident that interactions among scientists during the symposium will provide useful recommendations.

I congratulate Dr. Om Gupta, President (Central Zone) and Dr. Pramod Gupta, Zonal Councilor for taking initiation and leadership.

I wish the symposium a great success.

(P.K. Bisen)

Dr. Dhirendra Khare
Director Research Services

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Message

It gives me immense pleasure to learn that Central Zone Chapter, Indian Phytopathological Society and College of Agriculture, JNKVV, Jabalpur are jointly organizing a national symposium on "Challenges and Opportunities: Management of Plant Diseases under Weather Change" at JNKVV, Jabalpur during December 14-15, 2017.

The symposium themes chosen like Role of Green Technologies, Post Harvest Management, Disease Management under Organic Farming situation under changing weather conditions, challenges in agricultural extension education for plant health and solution for adoption of effective plant disease management. Molecular approaches in disease diagnosis, Integrated Disease Management and Epidemiology & Forecasting of diseases aspects will certainly stimulate effective discussion. Hopefully, these shall lead to pragmatic and relevant recommendations.

In recent year under the changing climate patterns and cropping system, host pathogen and favorable environment interactions are leading to out break of diseases. Rapid dissemination of Mungbean yellow mesaic desease in Soybean, root sets in oilseed and pulses and wilt disease in pulse crops are the examples. Vector-bone disease are becoming a major threat. Lock of internal quarantine system and weak interest in phytosanitony measures for several objectionable pathogens is of a great concern. Under these circumstances, we need constantly keep searching for some innovative approaches with consideration of environment and profitability.

I extend my heartiest greetings to participants and wish the event a success.

(Dhirendra Khare)

Dr. S.K. Rao
Vice Chancellor

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Message

I am happy to note that Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur and Indian Phytopathological Society (Central Zone Chapter) are organizing a National Symposium on "Challenges and Opportunities: Management of Plant Diseases under weather change" at Jabalpur during December 14-15, 2017.

This is an important aspect to be dealt in depth. The concern shown by Dr. Om Gupta, Zonal President and Dr. Pramod Gupta, Zonal Councilor of the Society is appreciable. I consider that in relation to human welfare and food security the scientific discussion on these aspects would be significant.

I am confident that the fruitful recommendations will emerge out for the benefit of agriculture under changing weather parameters.

I wish the symposium a great success.

(S.K. Rao)

Dr. Dinesh Singh
Secretary

Indian Phytopathological Society

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No. IPS/Sec/2017/00376
Dated: November 30, 2017

Message

It is a matter of great pleasure that College of Agriculture, JNKVV, Jabalpur, Madhya Pradesh is organizing National Symposium on "Challenges and opportunities: Management of plant diseases under weather changes" in collaboration with Indian Phytopathological Society (Central Zone), New Delhi during Dec. 14-15, 2017.

Weather change influences the dynamics of occurrence, prevalence, severity of plant diseases and emergence of new diseases. Improved understanding of the plant diseases and management strategies make a major contribution under climate-change for sustainable crop production systems to ensure global food security.

I am confident that the symposium will lead to some fruitful and actionable recommendations which will help policy maker to implement it for the benefit of plant health across India, particularly in central India.

Best wishes for success of the symposium.

(Dinesh Singh)

डॉ. पी.के. सिंह
निदेशक (का.)
Dr. P.K. Singh
Director

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ISO 9001 : 2015 Certified

F.No. 9-129/PME/2017-18
Dated : 11/12/2017

Message

I am delighted to know that the Department of Plant Pathology, College of Agriculture, JNKVV, Jabalpur and Indian Phytopathological Society (Central Zone) is organizing Symposium on "Challenges and Opportunities: Management of Plant Diseases under weather change" during October 14-15, 2017 at College of Agriculture JNKVV, Jabalpur (MP).

The responsibility of protecting food crops from diseases and pests in the changing environment is rising with increase in human population and its need. The crop yield fosses, on field and during post harvest period, caused by pest's viz., weeds, diseases, insects etc. are of paramount importance. It has been noticed that crop loss due to pests ranges between 10-30% of crop production. Hence, eco-friendly based management strategies needs to be formulated to tackle such pests. This includes cultural, physical, biological and chemical approaches, It is also important to give more emphais to use molecular techniques for pathogen detection, resistance identification and cloning of genes for resistance and use of feasible and effective formulations of bio-control agents in order to achieve the goal,

I firmly believe that this symposium will provide an interactive platform to come out with useful recommendation to manage the plant disease and adverse weather abnormalities and will be certainly helpful to achieve the goal of sustainable and nutritional food production even under changing weather.

The deliberations of the symposium will come out in a road map in support of present status and future priority along with policy framing in managing plant disease under changing weather.

I am happy to know that a souvenir is being published on this occasion. I complement and congratulate the organizing teams for taking this initiative and I convey my best wish for grand success of the symposium,

(P.K. Singh)

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CONTENTS

Symposium on
Challenges & Opportunities: Management of Plant Diseases under Weather Change

December 14-15, 2017

Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur &
Indian Phytopathological Society (Central Zone)

Technical Programme

December 14, 2017, Thursday (Day 1)		
09.00-10.00	**Registration**	
10.00-11.00	**Inauguration Ceremony**	Venue: Vivekanand Hall College of Agriculture, JNKVV, Jabalpur
11.00-11.30	High Tea	Venue: Vivekanand Hall
11.30-12.00	**Keynote Address:** Strengthening of Teaching, Research and Extension Activities in Plant Pathology	Dr. M.N. Khare, Ex-Dean, Emeritus Professor (Pl Path), JNKVV, Jabalpur
12.00-12.45	**Session-01 Strategies for Plant Disease Management under Changing Climate** Chairman : Dr. M.N. Khare Rapporteur: Dr. Vijay Yadav	Venue: Vivekanand Hall
12.00-12.15	**Lead Lecture** 01 : Plant disease management and future strategies for climate change adaptation	Dr. Mamta Sharma, ICRISAT, Hyderabad
	Lead Lecture 02: Emerging disease scenario in pulses under climate change	Dr. Om Gupta, JNKVV, Jabalpur
	Oral Presentation	
12.15-12.25	OP.01. Status of agriculture and plant pathology in the changing world scenario	Dr. Vijay Kumar Yadav GanjBasoda
12.25-12.35	OP.02. Management of *Strigaasiatica* (l.) Kuntze in kodo millet using organic fertilizers and microbes	Dr. Ruchi Chaurasia, A.K. Jain, S.K. Tripathi and Ashish Kumar, COA, Rewa
12.35-12.45	OP.03. Impact of climate change on plant diseases in India	Dr. Ramesh Kumar, B. Chaudhary and S. Kumar
	OP.04.Evaluation of bitter gourd varieties against leaf curl and downy mildew diseases	Vijay Kumar, K. Koshale, Amrotin & C.P. Khare, Raipur

12.45-01.30	**Session-02 Role of Green Technologies and Biotechnological Interventions** Chairman : Dr. M.N. Khare Rapporteur: Dr. Vijay Yadav	Venue : Vivekanand Hall
12.45-01.00	**Lead Lecture** : Cloning and characterization of different genes from *Trichoderma* spp.	Dr. Pratibha Sharma, ICAR-Emeritus Scientist
	Oral Presentation	
01.00-01.10	OP.01. Marker assisted introgression of BLB and blast resistance gene(s) in rice cv. safri-17 and dubraj	Shinde U. Dnyaneshwar, Toshy Agrawal, Tanvi Kadu, Ashish Pradhan, A.S. Kotasthane and Satish B. Verulkar, Raipur
01.10-01.20	OP.02. Evaluation of fluorescent pseudomonas and *Trichoderma* against *Fusarium oxysporum*f.sp. udum inciting wilt in pigeonpea	Dr. Santram Sahu, Kamalnarayan Koshale and R.K.S. Tiwari, Bilaspur
01.20-01.30	OP.03. Identification of siderophore producing and cynogenic fluorescent pseudomonas and a simple confrontation assay technique to evaluate potential bio-control agent	Dr. Anil S. Kotasthane, Toshy Agrawal, Najam Waris Zaidi and U.S. Singh
1.30-1.40	OP.04. Feasibility of solar panel enabled production units for cultivation of white button mushroom *Agaricusbisporus* (lange) imbach, in tropical areas of Chhattisgarh	Harvinder Kumar Singh, C.S. Shukla and A.S. Kotasthane, Raipur
01.40-02.30	Lunch	
02.30-03.15	**Session-03. Post Harvest Management of Diseases and Agricultural Commodities including Mushrooms** Chairman : Dr. O.K. Sinha Rapporteur: Dr. Vibha Pandey	Venue : Vivekanand Hall
02.30-02.45	**Lead Lecture** : Management of diseases in post harvest horticultural crops: a brief review	Dr. C.P. Khare, IGKVV, Raipur
	Oral Presentation	
02.45-02.55	OP.01. Management of onion crop to overcome storage disease and increased shelf life in Sagar district of MP	Dr. K.S. Yadav and Ashish Kumar Tripathi, KVK, Sagar
02.55-03.05	OP.02. Development of diagnostic technique for seed health assessment in pulses	Dr. Shekhar Hirwani, N. Lakpale ,N. Khare and A. Pradhan, Raipur
03.05-03.15	OP.03. Cultural, physiological characteristics and yield attributes of milky mushroom (*Calocybeindica* P & C.)	Dr. Anurag Kerketta, H.K. Singh and C.S. Shukla, Raipur

	OP.04. Electrolyte leakage from pigeonpea seeds incited by seed- borne mycoflora	Ashish Pradhan, N. Lakpale and A.S. Kotasthane, Raipur
03.15-04.00	**Session-04. Agricultural Extension Education: Challenges and Solutions for Adoption of Effective Management** Chairman : Dr. O.K. Sinha Rapporteur: Dr. Vibha Pandey	Venue : Vivekanand Hall
03.15-03.30	**Lead Lecture** : Agricultural Extension Education: Challenges and Solutions for Adoption of Effective Management	Dr. M.P. Thakur
	Oral Presentation	
03.30-03.40	OP.01. New extension paradigm for transfer of technologies including plant diseases and insect-pests management	Dr. Sarvesh Kumar and R.C. Sharma, KVK, Harda
03.40-03.50	OP.02.Evaluation of antimicrobial activity of antibiotics, fungicides and plant growth promoting activity of fluorescent pseudomonads isolate against *Xanthomonasaxonopodis*pv. glycines causing bacterial pustule in soybean	Dr. Girija Shankar, Ashish Pradhan and R.K. Dantre, Raipur
03.50-04.00	OP.03. Assessment of different management modules for leaf curl disease of tomato in kymore plateau and Satpura hills Agroclimatic zone of Madhya Pradesh	Dr. Jai Singh, A.K. Gupta; A.K. Chaubey, A.K. Singh and M.S. Baghel, KVK, Sidhi
	OP.04. Viable options of artificial intelligence, robotics and the internet of things in agriculture with special reference to plant pathology	Siddarth Nayak, Anay Rawat, P.K. Gupta, P. Shrivastava and S.K. Jain
04.00-04.15	Tea	
04.15-05.00	**Session-05. Plant Disease management Strategies under Organic Farming Situations** Chairman : Dr. M.P. Thakur Rapporteur: Dr. Sushma Nema	Venue : Vivekanand Hall
04.15-04.30	**Lead Lecture** : Plant disease management strategies under organic farming situations	Dr. O.K. Sinha**,** ICAR-IISR, Lucknow
	Oral Presentation	
04.30-04.40	OP.01. Insect and disease management in organic crop cultivation for sustainable agriculture	Dr. MK Bankoliya, Sarvesh Kumar
04.40-04.50	OP.02. Various treatment of bottle gourd (*Lagenarisiceraria*) against downy mildew under field conditions	Dr. Vivekanand Uraiha, C.P. Khare,Raipur

04.50-05.00	OP. 3. Studies on native isolates of fungal and bacterial bio-agents against collar rot of chickpea	Jhumshree Meher and coworkers
	OP.04.Impact of organic farming on system based high value crops and dynamics of nematode community structures	Dr. S.P. Tiwari, Jayant Bhatt and G.P. Tiwari
05.00-05.45	**Session-06. Molecular Approaches in Disease Diagnosis and Management** Chairman : Dr. M.P. Thakur Rapporteur: Dr. Sushma Nema	Venue: Vivekanand Hall
05.00-05.15	**Lead Lecture** : Molecular approaches in disease diagnosis and management	Dr. Sharad Tiwari, JNKVV, Jabalpur
	Oral Presentation	
05.15-05.25	OP.01. Molecular approaches for diagnosis of fungal pathogens	Dr. Yogendra Singh, S. Tiwari, and G.K.Koutu
05.25-05.35	OP.02. Effect of silicon on disease resistance, morpho-physiological and yield attributing traits in rice	Dr. Radha Singh, S.K. Tripathi, R.K. Tiwari and S.K. Pandey, Rewa
05.35-05.45	OP.03. Molecular characterization of yellow mosaic disease of soybean and their collateral and alternate host	Dr. R.K. Singh, Indore
	OP.04.Molecular characterization of *Alternaria alternata* causing fruit rot of chilli through RAPD marker	Kajal D. Jankar, Ekta D. Bagde, S, Mane, Akola
December 15, 2017, Friday (Day 2)		
09.30-10.15	**Session-07. Integrated Disease Management** Chairman : Dr. Pratibha Sharma Rapporteur: Dr. A.K. Jain	Venue: Vivekanand Hall
09.30-09.45	**Lead Lecture** : Beyond Present Approaches of Integrated Disease Management	Dr. Robin Gogoi, IARI, New Delhi
	Oral Presentation	
09.45-09.55	OP.01. Root exudates associated with the resistance of four chickpea cultivars to different races/ pathotypes of *fusarium oxysporum*f. sp. *ciceris*	Dr. Minakshi Patil and Om Gupta
09.55-10.05	OP.02. Management of anthracnose disease of safedmusli (*Chlorophytumborivilianum*) caused by *C. chlorophyti*	Dr. G.N. Pandey, B.K. Patidar, D.K. Patidar and R.P. Patel
10.05-10.15	OP.03.*Integrated management of root rot of mungbean caused by Macrophomina phaseolina (tassi) goid through soil and*	Dr. Rajesh Kumar Pandey and Pramod Kumar Gupta

	seed dressing formulations to avoid the yield loss	
10.20-10.30	OP.04.Studies of *aphelenchoidesbesseyi* (christie, 1942) on proso millet (*P.*) and foxtail millet (*Setariaitalica*) germplasm	R.L. Sharma, S.P. Tiwari, Jayant Bhatt and Dilip Kumar
10.30-1045	OP.05.Abundance of whitefly (B*emisia tabaci*genn.) and incidence of mungbean yellow mosaic India virus in mungbean	R.S. Marabi S.B. Das and A.K. Bhowmick, K. Chaukikar
10.45-11.00	OP.06.Integrated management strategies on *Meloidogyneincognta* in tomato nursery through organic cakes	S.P. Tiwari, Jayant Bhatt and B. Gowda
	OP.07.Morphological variability in *Alternaria Burnsii*	G.P. Tiwari, S.P. Tiwari, S. Nema, Om Gupta and S.N. Singh
11.00-11.20	**Session-08. Epidemiology and Disease Management** Chairman : Dr. Pratibha Sharma Rapporteur: Dr. A.K. Jain	Venue : Vivekanand Hall
11.00-11.20	**Lead Lecture** : Epidemiology and forecasting in effective disease management	Dr. Yogita Ghard, DWR, JBP
	Oral Presentation	
11.20-11.30	OP.01. Changing scenario of small millet diseases in relation to climate change in Madhya Pradesh	Dr. A.K. Jain , R.P. Joshi and S.K. Pandey
11.30-11.40	OP.02. Rational approaches for leaf blast management of rice in Madhya Pradesh.	Dr. S.K. Tripathi, Radha Singh, R.K. Tiwari
11.40-11.50	OP.03. Pythium sp. an emerging disease of blight on tomato	Dr. Rakesh Kumar, Priyanka Gupta and S.R. Palicherla
11.50-12.00	OP.04.Variability among isolates of *alternaria porri*causing alternaria blight of niger from different geographical regions of India	Shikha Sharma and R.S. Ratnoo
12.00-12.15	Tea	
12.15-1.15	**Prof. MJ Narasimhan Academic Merit Award Competition** Chairman : Dr. Pratibha Sharma Co-Chairman : Dr. Robin Gogoi Rapporteur: Dr. C.P. Khare	Venue: Vivekanand Hall
	Simulation of Cyclic adenosine monophosphate (cAMP) dependent Protein Kinase A (PKA) activity in relation to appresorium formation in *Magnaportheoryzae* under temperature influence	L.S. Rajput, Taru Sharma, P. Madhusudhan and P. Sinha

	In-silico analysis of BLB resistance gene(s) *Xa4, Xa7, Xa21* provides the basis for fine mapping of introgressed gene(s) in Karma Mahsuri	Aafreen Khan, Toshy Agrawal, Anil Kotasthane and S.N. Singh, JNKVV, Jabalpur
	Introgression of multiple Genesconferring resistance against BLB and Blastin Rice through MAS Strategy	Shinde Umesh Dnyaneshwar, Toshy, Raipur
	Genetic variations among *alternaria*spp collected from different host plants	G.P. Tiwari, S.P. Tiwari, S. Nema, Om Gupta and S.N. Singh, JNKVV, Jabalpur
	Lunch	
03.00-04.00	**Plenary Session Discussion and Closing Ceremony**	Presentation of Reports by concerned Rapporteurs
04.00	**Vote of Thanks**	Dr. Pramod Gupta Councilor, IPSCZ

Keynote lecture

Strengthening of teaching, research and extension activities in plant pathology

M.N. Khare
Ex-Dean, Emeritus Professor (Plant Pathology)
JNKVV, Jabalpur, M.P.

Plant Pathology is an important discipline in agricultural education. The crops suffer due to biotic and abiotic stresses at various stages of crop growth. The climate temperature and humidity play decisive role in their severity. The pathogenic fungi, bacteria and nematodes, viruses and abiotic factors like high or low temperature and humidity, macro and micro elements play most important role in damaging the crops leading to heavy losses in quantity and quality of produce. It is essential to manage the destruction through improvement of crop varieties to possess resistance to pathogens and abiotic stresses. Cultural practices like crop rotation, soil solarization, adjustment of planting date, inter and mixed cropping, irrigation schedule, removal of diseased plant refuge, seed priming, physical seed treatment etc. are a must to be followed. Botanicals and antagonistic microorganisms are tried as they have exhibited great potential in destruction of pathogens and saving the crops from diseases. Under utmost need fungicides nonsystemic and systemic are used at least effective dose as seed, plant and soil treatment. It is essential to impart basic and applied knowledge to the student.

People talk of explosion of population but there is explosion of knowledge too. The ICAR New Delhi has research institutes on various crops, Bureau of Agriculturally Important Microbes at Mau U.P., Central Agricultural Universities besides State Agricultural Universities and several Private Universities. Plant Pathology is also taught in department of Botany in traditional universities.

Teaching at Undergraduate level

In B.Sc. (Agri.) curriculum the following courses are taught in Plant Pathology as per Dean's Committees recommendation.

1.	Fundamentals of Plant Pathology	II Sem	(3+1) 4 Credit
2.	Principles of integrated pest and disease management	V Sem	(2+1) 3 Credit
3.	Diseases of field and horticultural crops and their management I	V Sem	(2+1) 3 Credit
4.	Diseases of field and horticultural crops and their management II	VI Sem	(2+1) 3 Credit
5.	Plant Clinic	VII Sem	(2) Credit
6.	Mushroom Cultivation Technology	VIII Sem	(0+1) 1 Credit

In some institutions Agricultural Microbiology course of (1+1) 2 credits is taught in second semester by Plant Pathology Department. Staff should have basic and applied knowledge about the contents of each course. Collection of diseased material, concerned fungi, bacteria, nematodes should be made to provide to students in practicals.

Teaching at M.Sc. (Ag.) Level

The following courses are recommended by the Fifth Dean's Committee in Plant Pathology for M.Sc. Ag. Programme:

1.	Mycology	2+1
2.	Plant Virology	2+1
3.	Plant Bacteriology	2+1
4.	Principles of plant pathology	3+0
5.	Detection and diagnosis of plant diseases	0+2
6.	Diseases of field and medicinal crops	2+1
7.	Disease of fruits, plantation and ornamental crops	2+1
8.	Diseases of vegetable and spice crops	2+1
9.	Post harvest diseases	2+1
10.	Insect vectors of plant viruses and other pathogens	1+1
11.	Ecology of soilborne pathogen	2+1
12.	Epidemiology and forecasting of plant diseases	2+1
13.	Principles of plant disease management	2+1
14.	Disease resistance in plants	2+0
15.	Chemicals in plant disease management	2+1
16.	Biological control of plant diseases	2+1
17.	Integrated disease management	2+1
18.	Plant quarantine	2+0
19.	Seed Health Technology	2+1
20.	Mushroom Production Technology	2+1

At Ph.D. level

1.	Advanced Mycology	2+1
2.	Advanced Virology	2+1
3.	Advanced Bacteriology	2+1
4.	Molecular basis of host-pathogen interaction	2+1
5.	Principles and procedures of certification	1+0
6.	Plant bio security and bio safety	2+0
7.	Seminars M.Sc. Agriculture	1+0
8.	Ph.D.	1+0, 1+0.
9.	Thesis research M.Sc. Ag.	20 credits
10.	Ph.D.	45 credits

Facilities

The Agricultural Education Division, ICAR, New Delhi has recommended the minimum requirements for establishment of new college in agriculture and allied disciplines in 2016. Twenty departments are formed and Plant Pathology is one of them in which one Associate Professor and two Assistant Professors are provided in a unit of sixty students at UG level and 0.4 ha land has been allocated. The office and laboratory space and equipments are listed. For

laboratory one Assistant, two lab Assistants and one Field Assistant are recommended. Similarly provisions are made for facilities at post-graduate level.

I. Strengthening of Teaching

At under-graduate courses fundaments should be made very clear. Symptoms and signs, disease and life cycle, crop disease management should be known to students on crop diseases.

At Post graduate level both basic and applied aspects should be cleared. Assignments should be given to students so that they may review the literature and understand citation and listing of references. In seminars the topics of current need should be assigned.

II. Research

For curricular research problems of local or regional importance should be selected. Both horizontal and vertical approaches are possible looking to the available facilities in the department, institute and other organizations local and other places. The data must be well tabulated, analyzed and discussed. The photographs, graphs, histograms etc. should be very clear and only publishable material should be included. The write up should be very carefully checked. The cited references must be included in the list of publication.

III. Extension

The extension plant pathology is of great importance. One should know identification of diseases through symptoms and signs, their recurrence and spread, climate factors, epidemiology, their management with recent trends. Good knowledge is essential.

Conclusion

Presently the competition is very tough hence proper knowledge is a must. Students should be encouraged to use each and every minute in learning and understanding the subject.

Need of training to working staff was recognized very early days and scientists from various Agricultural Universities were sent for advanced training to other countries like USA. Time has come when such trainings are required for 6 to 12 months on various specializations. Fellowships are available in different countries, they should be approached by the university and the concerned staff to get them. The university should allow duty leave to such candidates who get success in getting fellowships on such important fields like mycology, bacteriology, virology, nematology, disease resistance, management, seed pathology, molecular plant pathology etc. This will help in improvement of standards.

Centers of excellence should be established in different institutions in Plant Pathology on various aspects in the country to impart training to the staff. Ace out efforts are needed to improve the quality of teaching, research and extension activities in Plant Pathology.

TS-01 (Lead lecture 01)

Plant disease management and future strategies for climate change adaptation

Mamta Sharma* and Raju Ghosh
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Climate change and annual climate variability will exacerbate existing vulnerabilities of resource-constrained farmers who depend on agriculture for a living. On average, 30–50% of the yield losses from agricultural crops are caused by diseases and insect-pests. Increase in the frequency of climate extremes, especially temperature and rainfall, are likely to influence the distribution, establishment, epidemiology and management of plant diseases and insect-pests and fuel the losses manifold. Climate change will probably influence the occurrence, prevalence and severity of plant diseases. This will also affect disease management with regard to timing, preference and efficacy of chemical, physical and biological measures of control and their utilization within integrated pest management (IPM) strategies. Prediction of future requirements in disease management is of great interest for agro-industries, extension services and practical farmers. A comprehensive analysis of potential climate-change effects on disease control is difficult because current knowledge is limited and fragmented. This study reveals that certain existing preventive plant protection measures, such as use of a diversity of crop species in cropping systems, adjustment of sowing or planting dates, use of crop cultivars with superior resistance and/or tolerance to diseases and abiotic stress, use of reliable tools to forecast disease epidemics, application of IPM strategies, and effective forecasting systems, may become particularly important in the future. Effective crop protection technologies are available and will provide appropriate tools to adapt to altered climatic conditions, although the complexity of future risks for plant disease management may be considerable, particularly if new crops are introduced in an area. Overall, the challenge of adapting disease control measures to climate change is not likely to be fundamentally different from the adjustments to technological innovations or changes in the economic framework already required in current crop protection. Potential beneficial effects of climate change, such as longer growing seasons, fewer frosts and shifted precipitation patterns, must not be neglected, as they could counteract the presumed enhancement of particular diseases.

TS-01 (Lead lecture 02)

Emerging disease scenario in pulses under climate change

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Chickpea and Pigeonpea are the two largest cultivated pulses in India. These are largely grown in rain-fed environments that are most vulnerable to climate change. Increasing temperature, increasing atmospheric CO_2, altered precipitation patterns and increase in the frequency of climate extremes are likely to influence the distribution, establishment, survival and spread of pathogens. Changes in the disease spectrum of chickpea and Pigeonpea have been monitored through extensive surveys. Further, analysis of long-term disease and weather data sets indicated emergence of new diseases and shift in the occurrence and distribution of diseases of chickpea and pigeonpea. In chickpea, frequent out-breaks of diseases such as dry root rot (*Rhizoctonia bataticola*) and collar rot (*Sclerotium rolfsii*) and in Pigeonpea Phytophthora blight (*Phytophthora cajani*) and Alternaria blight have been observed. With increased temperature and more frequent moisture stress, Rhizoctonia blight is becoming more intense in typically tropical-humid areas, while viruses and rusts dominate in warm but dry zones. Data collected in India during the preceding years showed higher incidence of dry root rot in chickpea varieties that are resistant to Fusarium wilt in years when temperatures exceed 32°C. This is consistent with greenhouse experiments where different soil moisture levels and temperatures were manipulated, showing that *R. bataticola* infected chickpea plants and caused dry root rot faster at 35°C coupled with soil moisture levels less than or equal to 60%. By contrast, cooler temperatures and wetter conditions are associated with increased incidence of stem rot on soybean (*Sclerotinia sclerotiorum*), blights in Chickpea, Lentil, Pigeonpea, and Pea, and anthracnose (*Colletotrichum spp*.) in Lentil and Chickpea. Recent studied indicated increased incidence and frequent outbreaks of Phytophthora blight of Pigeonpea (*Phytophthora cajani*) in India over the last decade and can be attributed to high intermittent rainfall during the crop season.

The impact of elevated CO_2 levels (550 and 700 ppm) in comparison to ambient level (350-380ppm) was studied on disease development in chickpea and Pigeonpea under specifically designed facilities such as Open top chambers (OTC) and Free Air CO_2 Enrichment (FACE) and CO_2 controlled incubators at ICRISAT. Advancement in the incubation period and increased incidence of diseases such as Phytophthora blight and sterility mosaic disease in Pigeonpea and dry root rot in chickpea was observed. However, no significant difference was found in wilt disease of Chickpea and Pigeonpea. It is established fact that temperature, moisture and greenhouse gases are the major elements of climate change. Current estimates indicate an increase in global mean annual temperatures of 1ºC by 2025 and 3ºC by the 2100. The carbon dioxide (CO_2) concentration is rising @ of 1.5 to 1.8 ppm/year and is likely to be doubled by the end of 21st century. Variability in rainfall pattern and intensity is expected to be high. Greenhouse gases (CO_2 and O_3) would result in increase in global precipitation of 2 ±

0.5ºC per 1ºC warming. Overall, changes in these elements will result in: i) warmer and more frequent hot days and nights, ii) erratic rainfall distribution pattern leading to drought or high precipitation and iii) drying of rain fed semi-arid tropics in Asia and Africa.

Soils host a huge diversity of microbes for which our knowledge of function and diversity remains very limited. The number of soil microorganisms varies with the season more in spring and fewer in winter and summer. The top layer of soil have more microorganisms then do the lower layers and are abundant in the root zone of plants (rhizosphere). Climate variability and changing climate patterns are alarming the equilibrium of host-pathogen interactions resulting in either increased epidemic outbreaks or emergence of new pathogens or less known pathogens causing severe yield losses. Climate variables (temperature, humidity, and greenhouse gases) are the key factors for these changes. The plant pathogens are among the first organisms to experience the climate change for its population dynamics i.e. multiplication, virulence, survival, dispersal. Thus, these key indicators must be evaluated for the impact of nature and magnitude. Global climate change responsible for the emergence of new disease or existing minor once becoming as major. Efforts are being made to discuss the different climate variables on diseases , pathosystems and the mitigation strategies for their management. Detailed investigations to understand the effect of CO_2 on plant defensive responses in chickpea against these diseases is underway. Further, analysis of plant diseases in pulses in climate change scenario will have several uses for long-term planning particularly to prioritize research activities to address future needs.

Effect of climate change on plant pathosystems

Climate change may affect plant pathosystems at various levels viz. from genes to populations, from ecosystem to distributional ranges; from environmental conditions to host vigour/susceptibility; and from pathogen virulence to infection rates These changes may show positive, negative and neutral impacts on host-pathogen interactions which could result: a) extension of geographical range; b) increased over-wintering and over summering; c) changes in population growth rates; d) increased number of generations; (e) loss of resistance in cultivars containing temperature-sensitive genes (f) extension of crop development season; (g) changes in crop diseases synchrony; h) changes in inter-specific interactions; i) increased risk of invasion by migrant pathogens; and j) introduction of alternative hosts and ‘green bridges’ or over-wintering hosts.

Microbial response to global climate change

Climate change will affect plant disease directly or indirectly because changes in environmental conditions are strongly associated with differences in the level of losses caused by a disease because the environment significantly influences plants, pathogen and their antagonists. The changes associated with global warming (increased temp. changes in the quantity and pattern of precipitation, increased CO_2 and Ozone levels, drought) may affect the incidence and severity of plant disease. The increase in mean winter temperature, the shift in precipitation from summer to winter and the tendency toward heavy rain favors the infection of Phytophthora sp. Climate change have multiple effect on the epidemiology of plant diseases including the survival of primary inoculum, the rate of disease progress during a growing

season. It has also impact on the duration of epidemics, stage and rate of development of the pathogen, effect on host resistance, change in the physiology of host-pathogen interactions.

Coping with the effects of climate change on plant diseases

- Disease development is the cumulative effect of various factors that affect the host and pathogen. A slight change in microclimatic conditions can affect the outcome of the plant pathogen interaction.
- The plant pathogen relationship can also be affected by microbial populations or control agents. The effects of climate change differ in different plant pathogen systems.
- Under worst case scenario, several crops may require more fungicides spray treatments or higher application rates thus increasing costs for farmers, prices for consumers and the likelihood of the development of fungicide resistance.
- By evaluating the efficacy of current physical, chemical and biological control methods under changing climatic conditions and research convening new tools and strategies (Plant breeding) for coping with the predicted charges will be of great importance.
- Fungicide may continue to serve as common disease suppression agents although alternative measures such as cultural methods and biological control should be developed
- The persistence of plant protection chemicals in the phyllosphere is highly dependent on weather conditions. Changes in duration intensity and frequency of precipitation will affect the efficacy of chemical pesticides
- Temperature can directly influence the degradation of chemicals and other plant physiology and morphology, indirectly affecting the penetration, translocation, persistence and modes of action of many systemic fungicides.

Conclusion

The disease is the result of interaction among a susceptible plant, a virulent pathogen and suitable environment, and both plant and pathogen are influenced by environment. Exposure to altered atmospheric conditions can modify fungal disease expression. Temperature is one of the main factors in ecosystem with the rain to determine the incidence and severity of disease, but effect may be positive or negative (change in the environment). This require us to anticipate what might happen in the future. By anticipating the future, we can prepare ourselves for problems caused by climate change especially those related to agricultural activities, which generate the greatest amount of food consumed by humans.

TS-02 (Lead lecture)

Cloning and characterization of different genes from *Trichoderma* spp.

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Biological control implies the use of beneficial microorganisms *viz.* bacteria, fungi and actinomycetes for reducing/arresting the growth of the various plant pathogens in nature-friendly and ecologically safer manner. Among these biocontrol agents (BCAs) fungal group serves a successful one in managing many of the plant diseases. Amongst the fungal BCAs, *Trichoderma* spp. are widely used against many of the destructive plant pathogens. *Trichoderma* spp. emerged as one of the most momentous microbes with enormous biotechnological applications like, development of transgenic plants against plant diseases, improvement of strains through protoplast fusion and GFP tagging in the 21st century. Also, this fungal group produces superfluous amounts of bioactive secondary metabolites which may be useful. Over expression of the mycoparasitic genes from different *Trichoderma* species resulted in successful management of various biotic and abiotic stresses in diverse host systems. The mycoparasitic chitinases genes were artificially transferred into plant system, it had shown tolerance to various biotic as well as abiotic stresses. Among the endo chitinases, *Ech42* is the most extensively studied and successfully used in many transgenic programmes. Cellulases(E.C.3.2.1.4) are industrially important enzymes produced by various *Trichoderma* spp. specially *T.harzianum, T. viride* and *T. reesei*. The other biotechnology tool like protoplast fusion have been developed to enhance its biocontrol potential. In order to develop a unique effective strain as a single source of vital enzyme, it was intended to integrate two biocontrol species for high production of mycoparasitic enzymes by fusing their protoplasts.The fusantswere used to enhance biocontrol potential intraspecifically as well as interspecifically.

The various types of biological control agents such as bacteria and fungi are involved in biocontrol activity. Among them, fungal genus *Trichoderma* plays a major role in controlling the plant diseases and also induce the defense response in the plant system against pathogens. The species of *Trichoderma* are known to produce different kinds of enzymes which have a significant role in biocontrol activity like cell wall degradation, biotic and abiotic stress tolerance, hyphal growth, antagonistic activity against plant pathogens. By the advance techniques laid in the molecular biology, we can easily isolate, characterize, clone, sequence and express the functions of these genes and can study their functions and role in the biocontrol mechanism. The role, and functions of some major biocontrol genes present in the *Trichoderma* species viz*., Trichoderma harzianum, Trichoderma viride, Trichoderma atroviride, Trichoderma reesei,*

Trichoderma hamatum and *Trichoderma longibrachiatum* have been well studied by various workers.

Species specific primers from different genes have been developed for some of the important species. Protoplast fusion can be used as a tool in strain improvement for bringing genetic recombination and developing hybrid strains in filamentous fungi. Isolation, fusion and regeneration of protoplasts have been carried out in Trichoderma mainly for improving the biocontrol potential. To develop a unique effective strain as a single source of vital enzyme, it was intended to integrate two biocontrol species for high chitinase production by fusing their protoplasts. The fusants can be used to enhance biocontrol potential intraspecifically as well as interspecifically. There is a wide scope of working with different genes of Trichoderma.

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TS-03 (Lead lecture)

Management of diseases in post harvest horticultural crops: a brief review

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India is the second largest producer of fruits and vegetables next to China contributing 10.9 and 11.9 % of the total world production respectively with the production of 299853 thousand metric tonne of horticultural crops with 1,76,177 and 93,707 thousand metric tons of vegetables and fruits. The per capita consumption of fruits has increased from 40 to 85 g/day and that of vegetables from 96 to 175 g/day within the last one decade. It has been estimated that about 30 to 35 per cent (one-third) of fresh horticultural produce is lost after harvest and these losses can assume considerable economic and social importance in which post harvest diseases destroy 10 to 30 per cent of the total yield of the saleable volume of crops, and in some perishable crops, especially in developing countries, they destroy more than 30 per cent of the crop yields. In India nearly 20-50 % of perishable are lost due to post harvest diseases. Post harvest diseases usually cause great losses of fresh fruits and vegetables by reducing their quality, quantity, or both. The development of postharvest disease is intimately associated with the physiological status of the host tissue. The losses involve parasitic diseases caused by fungi, bacteria and viruses, environmental factors, physiological and mechanical factors. A wide variety of fungal and bacterial pathogens cause post harvest diseases in fruit and vegetables. Some of these infect produce before harvest and then remain quiescent until conditions are more favourable for disease development after the harvest. Other pathogens infect produce during and after harvest through surface injuries. Fungi which cause post harvest diseases belong to the group ascomycota and associated fungi anamorphic. Important genera of anamorphic post harvest fungal pathogens include *Penicillium*, *Aspergillus*, *Geotrichum*, *Botrytis*, *Fusarium*, *Alternaria*, *Colletotrichum*, *Dothiorella*, *Lasidiodiplodia* and *Phomopsis*. Also in the phylum Oomycota genera *Phytophthora* and *Pythium* are important post harvest pathogen. *Rhizopus* and *Mucor* are important genera of Zygomycota. *Sclerotium rolfsii* and *Rhizoctonia solani* also cause significant post harvest losses in vegetable crops. while *Erwinia*, *Pseudomonas*, *Bacillus*, *Lactobacillus* and *Xanthomonas* are the important bacterial genera that cause many diseases in fruits and vegetables. Many pre harvest factors directly and indirectly influence the development of post harvest disease, even in the case of infections initiated after harvest. Information of mechanism of infection is essential for the development of an effective programme for the management of postharvest diseases. Harvesting at perfect stage with improved method, cleaning, selection of healthy fruits, washing, grading disinfection and storage at low temperature and humidity retard the growth and development of pathogens cause postharvest diseases. Traditionally fungicides have played a central role in post harvest disease control. However, It may also be possible to use essential oils as an alternative to some synthetic fungicides and may provide ''greener'' alternative. Since the loss of earned money is more painful than any other and so is the pain of postharvest loss of a crop. Therefore there is an urgent need to make efforts minimizing these losses due to diseases.

TS-04 (Lead lecture)

Agricultural extension education: Challenges and solutions for adoption of effective management

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The term extension was first used in USA in the first decade of this century to connote the extension of knowledge from the Land Grant Colleges to the farmers through the process of informal education. Extension also called rural advisory services, as consisting of all the different activities that provide the information and services needed and demanded by farmers and other actors in rural settings to assist them in developing their own technical, organizational and management skills and practices so as to improve their livelihoods and well-being (GFRAS, 2010). Extension may include services within three areas: Technology and information sharing, Advice related to farm, organizational and business management and Facilitation and brokerage in rural development and value chains. Agricultural Extension Education is an applied behavioural science, the knowledge of which is applied to bring about desirable changes in the behavioural complex of human beings usually through various strategies & programmes of change & by applying the latest scientific & technological innovations. It is a full-fledged discipline, having its own philosophy, objectives, principles, methods & techniques which must be understood by every extension worker & others connected with the rural development. Agricultural extension in our country is primarily concerned with the dissemination of useful & practical information relating to agriculture, including improved seeds, fertilizers, implements, pesticides, improved cultural practices, dairying, poultry, nutrition, etc.; the practical application of useful knowledge to farm & home; and thereby ultimately to improve all aspects of the life of the rural people within the framework of the national, economic & social policies involving the population as a whole. Agricultural extension services need to assume new challenges and reform itself in terms of content, approach, structure and processes. Extension in this context includes all those agencies in the public, private and civil society that provide a range of agricultural advisory services and facilitate application of new knowledge. A strong, vibrant and responsive extension with an expanded mandate is a pre-requisite for achieving a faster, sustainable and more inclusive growth through agriculture. Extension in today's Indian context, includes all those agencies in the public, private, NGO and community based initiatives that provide a range of agricultural advisory services and facilitate technology application, transfer and management.

The challenges that most agricultural extension services face are mostly of a technical and logistic nature such as insect pest invasions, outbreaks of serious diseases, locust attacks, severe climatic effects, natural disasters, or intensive campaigns for an increase in agricultural production. Farmers currently need a wider range of support, including organisational, marketing, technological, financial and entrepreneurial. To be successful, farmers require a

wide range of knowledge from different sources and support to integrate these different bits of knowledge in their production context. These challenges for effective management may be achieved through 1. input agencies (dealing with seeds, fertilisers, pesticides, equipments), 2. large agri-business firms (involved in manufacture and sale of inputs and purchase of farm produce), 3. farmer organisations and producer co-operatives, 4. non-governmental organisations (NGOs), 5. media (print, radio and television) and web based knowledge providers , 6. financial agencies involved in rural credit delivery, and 7. consultancy services. The solutions for effective crop protection management (ECPM) may be as under:

- ECPM is a decision-based process involving coordinated use of multiple tactics for optimizing the control of pathogen in an ecologically and economically.
- There is a very strong need of a **National Plant Protection Policy**.
- Like human health and animal health being taken care of by the State Deptt. of Health, and Veterinary respectively, the Plant Health must be taken care of either by the State Deptt. of Agriculture being the Agriculture as a State Matter or by an Independent Agency.
- There should be **Plant Protection Centres** at the village and Panchayat levels who should be made responsible for crop protection and be linked with SAUs, ICAR institutes for technological backstopping.
- There should be trained Agril. Officers for identification and diagnosis of insect pests and diseases and who should visit the field twice in a week.
- If they fail to go to the field, they should inform the framers in writing.
- Plant protection should be the responsibility of PPO rather than the farmers who are illiterate and have no idea of pesticides, sprayers etc. Farmers should be charged less.
- All the plant protection measures should be regularly and timely followed based on the appearance of the insect pests and diseases.
- These centres should work like Deptt. of Electricity, Water Resources, Telecom who provide regular services to their clients.

TS-05 (Lead lecture)

Plant disease management strategies under organic farming situations

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In our country, during 2016-17 around 11.8 lakh ha area has been occupied under certified management for organic farming (OF) and the country has the largest number of organic producers in the world. Madhya Pradesh State has the largest area under OF. With impressive progress in OF, plant disease management becomes imperative to sustain crop productivity which is generally low than the conventional farming. Use of synthetic pesticides is not allowed in OF. Hence, plant protection strategy is not directed at killing the pests, but focuses on keeping the diseases and pest population as low as possible.

The disease management in OF is based on the following four strategies:

I. Prevention of pathogen's entry into the field at pre-planting stage

It mainly involves field sanitation, inactivation of pathogen by soil solarization, anaerobic soil disinfestations and bio-fumigation.

II. Limiting pathogen's entry by reducing initial inoculum at planting stage and thereafter

It is achieved through use of healthy seed of a recommended variety obtained from organically produced crop, temporal and spatial isolation, crop rotation and control of insect-vectors.

III. Restricting establishment of pathogen in the host and minimizing dispersal of inoculum

(a) **Soil and crop management :** A healthy and well nourished plant is generally less vulnerable to the attack by the pathogens. Major emphasis is given on balanced supply of nutrients through organic amendments and cover crops along with higher water-use efficiency. Drip irrigation is preferred over sprinkler or flood irrigation in order to contain diseases. High plant density is avoided as it builds humid microclimate that predisposes plants to diseases.

(b) **Inducing plant resistance:** A variety may not be resistant to all the major diseases. Therefore, plant growth promoting rhizo-bacteria (PGPR) or fungi which are known to induce systemic resistance in plants may be applied to impart resistance in above-ground plant parts.

(c) **Bio-control:** Wide variety of microbial antagonists are prevalent in organically managed soil. Such antagonists act against the pathogen and reduce the soil-borne inoculum. These may be applied as seed inoculant or soil drench. Besides, natural enemies of insect –vectors may be released in the crop.

IV. Curative methods of disease management

Pesticides from natural sources, e.g., water-based plant extracts, toxins produced by bacteria and mined products are allowed in OF for disease management. Copper and sulphur fungicides are subjected to regulated use due to accumulation of their toxic residues in plant parts and in natural enemies of insect-vectors. Some mineral or vegetable oils are permitted for use as spreader-sticker. Microbial extracts are also allowed against diseases. Since natural pesticides are less effective than synthetic ones, the pesticide application efficacy becomes important.

Wayforward: OF is in its infancy in India and many developing countries as well. Conversion of conventional farming into organic farming takes several years to establish chemical and microbial equilibria. During the transition period, disease outbreaks may occur. For effective management of diseases in OF, research efforts require a systems approach in which scientists from different disciplines should work together on the aspects of improving soil fertility through organics and cover crops. Potential sources of organics that promote bio-control and induced systemic resistance in plants should be searched and effective curative methods of disease management using natural sources need to be devised.

In recent years, demand of organic products is increasing due to public awareness on the hazards of agro-chemicals. Growers are therefore attracted towards OF as high priced organic products make farming very remunerative.

TS-06 (Lead lecture)

Molecular approaches in disease diagnosis and management

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Plant diseases cause major economic losses to crops worldwide. Detecting pathogen at early stages is essential to control disease spread and facilitate effective management practices. Although serological methods have revolutionized plant disease detection, they are not very reliable in predicting systemic diseases at early stages and they also require at least 1–2 days for sample collection, experimentation and analysis.

The emergence of advanced biotechnological tools has revolutionized the field of plant pathology. Various methods based on the properties of bio-molecules like DNA, RNA and proteins are being used for rapid and accurate detection of diseases. These highly sensitive

techniques include PCR based methods, real time quantification and metagenomics approaches.DNA microarray technology is a new and accurate diagnostic technology for plant pathogens. Advances in molecular plant pathology and biotechnology have made the development of some disease diagnostic kits. These kits are designed to detect plant pathogen itself or proteins produced by either the pathogen or the plant during infection. Disease management using modern biotechnological tools broadly divided in two groups; genetic engineering of crops with one or more genes and molecular breeding using DNA markers for identification and transfer of resistant gene/s. Genetic engineering techniques allow the detection, isolation, modification, transfer and expression of single gene or groups of related genes, from one organism to another. Genetic engineering of crops for disease resistance includes RNAi approaches, gene stacking and genome editing. Molecular breeding is adapted for identification and tagging of useful genes during plant breeding programs. Molecular breeding includes marker assisted selection (MAS) and quantitative trait loci (QTL) mapping and is now considered an essential component of current crop improvement efforts for major crops.

While serological and PCR-based methods are mostly used for effective disease diagnosis, biosensors may provide instantaneous results and maybe used to identify infections at early asymptomatic stages. Remote sensing technologies may be extremely helpful to confirm diagnostic results. These innovative techniques represent unprecedented tools to render agriculture more sustainable and safe, avoiding expensive use of pesticides in crop protection.

TS-07 (Lead lecture)

Beyond present approaches of integrated disease management

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Plant diseases are consequential effects of mainly the biotic factors like fungi, bacteria, viruses and other sub-microscopic pathogens although some abiotic factors cause disorders in the crops. They pose threat to the crop health as well as the loss of produce, ultimately impact on the society and overall economy. Investigations are on to find out a sustainable strategic solution of this ever existing problem of the crop culture. Various disease management practices like cultural, physical, genetical (resistant varieties), biocontrol and chemical have long been applied conventionally. But the integration of these practices has been most emphasized to achieve eco-friendly management of crop diseases up to the desired level. Various IDM modules specific to crops and different agro-climatic situations have been developed. However, technological advancement in the recent times supplements the IDM technology with newer tactics of plant disease management. Novel technologies such as improvement of biocontrol potentiality, use of biosurfactants, phytochemicals, disease resistant transgenic plants, induced resistance, nanoparticle based chemical and gene delivery

systems, RNA interference etc. are the examples that can pyramid the conventional IDM methods for effective management of the crop diseases. We present here about the integration of known preventive cum corrective measures and promising recent technologies to keep away the pathogens from causing significant problems, with minimum risk or hazard to human and desirable components of their environment.

TS-08 (Lead lecture)

Conidial dispersal of *Alternaria solani* causing early blight in tomato: Impact of mulches to alter climatic and microclimatic variables

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Changes in environmental conditions are strongly associated with the crop losses caused by a disease because the environment directly or indirectly influences growth, survival and dissemination, and hence the incidence of seed-borne fungi and the disease severity. The climatic factors include rainfall, temperature, relative humidity and wind. These parameters, as they apply in air, soil or both media, also modify the transmission of disease causing conidia. Careful observations on the initiation and development of early blight disease on tomato crop in the field reveal that the conidial inoculum reaches the leaf from the soil through mechanical or wind dispersal. The experimental study was conducted with the objective to modify microclimatic conditions of tomato crop canopy which may hamper conidial dispersal and reduce severity of early blight of tomato caused by *Alternaria solani*. The conidial spores survive on rhizosphere and old dry lower leaves of the plant and spread when suitable climatic conditions are available. We evaluated effect of marigold intercropping, plastic mulching singly and in consortia on *A. solani* conidial density, tomato leaf damage and microclimatic parameters compared to tomato crop alone. Study reveals Tomato-marigold intercropping–plastic mulching treatment (T+M+P) significant reduction in disease intensity by 35 to 38 % as compare to tomato alone. Marigold serves as barrier to conidial movement and plastic mulching prevents evapotranspiration and reduces the canopy RH that results in less germination of *A. solani* spores. Macroclimatic study reveals that occurrence of highest inoculum concentration was favoured by high minimum, maximum and mean air temperature, low relative humidity (RH) and high wind speed. Organic mulches like cotton boll shell, sedge grass, wood chips along with marigold intercropping and plastic mulch were also tested to hinder dispersal of *A. solani* conidia. The results were not encouraging for organic mulches. The plastic mulch is very effective to reduce conidial dispersal and improving plant vigour by reducing disease severity.

TS-09 (Lead Lecture)

Epidemiology and forecasting in effective disease management

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Forecasting of plant diseases means predicting for the occurrence of plant disease in a specified area ahead of time, so that suitable control measures can be undertaken in advance to avoid losses. The principles of disease forecasting based on (a) The nature of the pathogen, (b)effects of the environment on stages ofpathogen development, (c) The response of the host to infection and (d) activities of the growers that affect the pathogenor the host. Among the first, spray warning services to be established for growers, were the grapevine downy mildew forecasting schemes in France, Germany and Italy in the 1920s. Disease forecasting methods are available for many plant diseases worldwide. In 1911, one of the first attempts at predicting Late Blightwas madeby Lutman who concluded that epidemics were favoured in wet and coldconditions. Similarly, in 1926, Van Everdingenin Holland proposed the first 'model' based on four climatic conditions necessary forLate Blight development.

Presently, there are many examples of forecasting models for e.g. models for *Sclerotinia Stem* Rot, Potato late blight, Potato early blight, *Botrytis* rot in basil etc. Advanced methods are also being used in disease forecasting. They are, surveillance & monitoring methods, use of GIS tools, Remote sensing technology. Example of some existing simulation models are EPIPRE (EPidemicsPREdiction and PREvention), RustDEp etc. Further, the success of a forecasting system depends on need tointervene, the accuracy of predictions, timelyprediction and the ability to implement a control tactic. In Indian conditions also, many models have been developed for disease forecasting viz. by Chattopadhyay *et al.* (2005) to forecast the *Alternaria*blight of oilseed *Brassica*and Kumar and Bhar (2005) for forecasting yield of mustard (*Brassica juncea*) in India.

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MJ Narshimhan Academic Award (01)

Simulation of Cyclic adenosine monophosphate (cAMP) dependent Protein Kinase A (PKA) activity in relation to appresorium formation in *Magnaporthe oryzae* under temperature influence

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Temperature rise due to climate change is expected to affect pathogenicity of the pathogens. Temperature has a significant influence on growth and sporulation of rice leaf blast pathogen (*M. oryzae*). Various components of rice blast infection process observed maximum at 27°C (optimal temperature) as compared to suboptimal (22°C) and supra-optimal (32°C) i.e., spore germination, appressoria formation, germ tube growth. This is an indirect indication that *M. oryzae* is not capable to cause infection at higher temperature.

Temperature has significant influence on cAMP dependent PKA activity. The PKA activity is higher at optimal temperature as compared to both suboptimal and supra-optimal temperatures. The PKA activity increases during appresoria formation and later on it decreases due to dephosphrylation that indicated change in enzymatic activities in the appresoria, leading to change in pathogen aggressiveness. The cAMP dependent PKA activity was fitted to kinetic models. However model could not explain the steady state behaviour that occurs 8 h onwards. May be there for, *M. oryzae* needs additional kinetics parameters in the models. Total proteins and phosphorylated protein are also found to be higher at optimal temperature. Total protein oscillation is an indication of transfer to fill the need of new protein in particular time. Total phosphorylated protein is highest at the appressoria formation indicated the demand of many biochemical processes where phosphorylation is required. The cAMP dependent PKA activity influence on components of pathogen infection process is an important study to understand pathogen biology that may help in development of new target fungicide.

MJ Narshimhan Academic Award (02)

In-silico analysis of BLB resistance gene(s) *Xa4, Xa7, Xa21* provides the basis for fine mapping of introgressed gene(s) in Karma Mahsuri

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Bacterial leaf blight (BLB) of rice caused by *Xanthomonas oryzae* pv. *oryzae* (*Xoo*) is one of the most serious production constraints of rice worldwide. Chhattisgarh one of the leading rice producing state in India has 37.73 lakh hectare area under rice cultivation with the production of 60.28 lakh tones. One of the major production constraints of Karma Mahsuri is its susceptibility to bacterial leaf blight which can only be managed through host plant resistance. We report herein in phenotyped resistant genotypes the MAS based introgression of two (*Xa7+Xa21*) and three (*Xa4+Xa7+Xa21*) gene pyramids.

Foreground selection markers are required for precise placement of gene(s) of interest and also quickly and reliably select desirable material, and eliminates individuals that contain deleterious alleles is critical to the success of a plant breeding program. By identifying BAC or PAC clones that simultaneously contained a hit from the marker *in silico*, it has been reported herein a high resolution molecular marker map for *Xa4, Xa7* and *Xa21*. Map generated from a targeted region will help us to select appropriate combinations of markers for foreground selection, precise placement of a gene(s) of interest and analysis of regional and sub-regional rates of recombination.

MJ Narshimhan Academic Award (03)

Introgression of multiple Genesconferring resistance against BLB and Blastin Rice through MAS Strategy

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Rice is a monocot, is normally grown as an annual plant, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia. Bacterial Leaf blight (BLB) and Blast are the most devastating diseases affecting entire rice acreages and cause severe yield losses up to 80%. Development of resistant cultivars has

been proved to be the most effective and eco-friendly way to control these diseases. Till date, numerous resistance (R) genes have been identified in a diverse range of rice germplasm and at least 23 genes for blast (*Magnaporthe grisea*) and 34 (23 dominant and 11 recessive) resistance genes against BLB. But the cultivar containing single resistance gene proved susceptible due to horizontal resistance developed. To overcome this problem and to deliver durable resistance against the pathogen, researchers have identified that pyramiding of more than one resistance gene can be beneficial. For this, Marker Assisted Selection (MAS) can be employed to develop rice cultivars with multiple resistance genes to surmount this problem.In the present work, the authors tried to introgress multiple resistance genes responsible for BLB (*xa5, xa13, Xa21 and Xa4*) and blast (*Pi1* and *Pi2*) resistance in local cultivar Safri-17 and Dubraj. They screened the host plants for resistance against BLB by inoculating the leaf at Raipur through clip inoculation and blast screening was done at Ambikapur in Chhattisgarh. Genotyping with SSR primers was also done which allowed authors to select lines which possess multiple resistance genes for BLB as well as blast. The Population obtained consists of resistance genes for both BLB and blast which includes 115 lines of F2 generation, 250 and 626 lines of F5 and F6 respectively.

MJ Narshimhan Academic Award (04)

Genetic variations among *alternaria* spp collected from different host plants

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The genus *Alternaria* is indigenous and pathogenic to economically important agricultural crops causes early blight symptoms. Growth and colonization varied with duration and exposure in a suitable natural and synthetic growth media. The studied isolates were collected from cumin, sesame, tomato brinjal, onion, cauliflower, chilli, datura and potato.

Variations among different *Alternaria* species were identified on the basis of protein and Random Amplified Polymorphic DNA (RAPD) banding pattern. Molecular characters were varied to some extent when they were grown on PDB and compared with protein pattern in different *Alternaria* species. A total of 80 protein bands were observed with different molecular weight ranged from 3.0 KD – 29.0 KD. Highest (17) bands were found in *Alternaria burnsii*, *Alternaria alternata* and *Alternaria solani* with higher variation in proteins, whereas minimum (one) was found in *Alternaria brassicae* followed by two bands in *Alternaria tenuissima.* A total of 20 RAPD primers were used to analyze genetic variability among *Alternaria* species. Out of them only eight were found to be suitable for amplification. Primers OPH-02 and OPH-04 amplified the highest six bands with all samples, while, OPH-06 and OPH-09 amplified five bands with two polymorphic (60%) each. Among all primers only OPH-02,

OPH-06 and OPH-09 were able to amplify polymorphic banding pattern. *Alternaria* spp isolates were grouped into two clusters i.e. one major and one minor when dendrogram generated based on Jaccard's similarity coefficient using UPGMA cluster analysis. The major cluster consisted eight isolates while minor cluster contained only one isolate.

TS-01 (OP-01)

Status of agriculture and plant pathology in the changing world scenario

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By 2050, global grain demand will double as a result of population growth. There will be limited arable land available, particularly in areas most affected by population growth, because different sectors are competing for land use. Thus, increasing crop productivity is a major challenge. However, neither planting more productive crops nor cultivating more land area where possible can solely meet the need for more food. Agriculture is the backbone of Indian economy which in turn relies on the monsoon season. Rising global temperature is not only causing climate change but also contributing to the irregular rainfall patterns. Uneven rainfall patterns, increased temperature, elevated CO_2 content in the atmosphere are important climatic parameters which affects the crop production. Indian agriculture system is based upon south-west and north-east monsoon. Almost 80% of the total precipitation comes from south-west monsoon in India. Any fluctuations and uncertainties in long range rainfall pattern may affect the agriculture sector and also lead to increase the frequency of droughts and floods at regional scale. Shifts in climatic seasonality may result in alterations of the synchrony between crop phenology and disease or pest patterns. Such changes will have a drastic effect on the growth and cultivation of the different crops on the earth. Simultaneously, these changes will also affect the reproduction, spread, severity of many plant pathogens and development of different dormant pathogens, which could induce an epidemic. Increase in temperature with sufficient soil moisture may increase evapo-transpiration resulting in humid microclimate in crops and may lead to incidence of diseases favoured under these conditions, in most of the case of insect vectored diseases, warmer temperatures also helps additional insect generations, which increases transmission rates of the invasive pathogen, thus posing a threat to our food security. If yield losses from diseases remain at current levels or even further increase. Then improvements in plant disease management needed in order to reduce both pre and post harvest yield losses.

TS-01 (OP-02)

Management of *Striga asiatica* (l.) Kuntze in kodo millet using organic fertilizers and microbes

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Kodo millet (*Paspalum scrobiculatum* L.) indigenous to India is an important coarse cereal crop grown by tribal and poor farmers in low fertile lands with fewer inputs for their own consumption under rainfed conditions. The grains of kodo millet are nutritionally rich as well as posses a number of medicinal properties. *Striga asiatica* (L.) Kuntze, a partial root parasitic flowering plant popularly known as witch weed is a serious threat to subsistence kodo millet production particularly in light and low fertile soils. In the present study, two organic manures namely farm yard manure (FYM) and vermin-compost (VC) augmented with three microbes namely *Trichoderma viride*, *Azospirillum* spp. and *Glomus intraradices* (VAM) in various combinations were evaluated for the management of *S. asiatica* in kodo millet using a susceptible variety GPUK 3 during Kharif 2015. The use of organic fertilizers enriched with microbes was recorded to reduce the Striga related parameters in kodo millet. Soil application of FYM and VC enriched with *T. Viride, Azospirillum* spp. and *G. Intraradices* significantly reduced the emerged Striga count plot^{-1} (60.2 to 79.5%), Striga vigour ratings, Striga severity (70.6 to 92.2%) and value of area under Striga number progress curve (ASNPC). Soil application of FYM (2.5 t ha^{-1}) + VC (1.25 t ha^{-1}) enriched with *T. Viride* + *Azospirillum* spp.@ 2kg t^{-1} of manure and Soil application of FYM (2.5 t ha^{-1}) + VC (1.25 t ha^{-1}) enriched with *T. viride* @ 2kg t^{-1} before sowing were at par and found best for minimizing the Striga severity 92.2% and 87.0%, respectively and obtaining maximum grain yield. Lowest values of ANSPC i.e. 147 and 154.2 , respectively were also found in the same treatments. The study indicates that organic manures and microbes may be utilized to minimize the incidence of *S. asiatica* in kodo millet.

TS-01 (OP-03)

Impact of climate change on plant diseases in India

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Climate changes are in reaction to changes in the, biosphere, hydrosphere and other atmospheric and interacting factors. Human activities driven by demographic, economic, technological and social changes have a major impact on climate change. The climate

influences the incidence and distribution of plant diseases. The key factors that control growth and development of diseases are temperature, light and moisture. The climate change affects the survival, vigor, rate of multiplication, sporulation, direction, and distance of dispersal of inoculums, rate of spore germination and penetration of pathogens. Climate affects all life stages of the pathogen and host and clearly poses a challenge to many pathosystems. The environmental change, especially when combined with pathogen and host introductions, may result in unprecedented effects. Understanding the potential effects of climate change on agriculture in terms of its impacts on severity and incidence of pests and diseases is an important issue. Climate changes will affect diseases, yield and quality of our crops. Our knowledge is inadequate on how multifactor climate changes may affect plant health. Climate change can have positive, negative, or neutral impact on individual pathosystems because of the specific nature of the interactions of host and pathogen. Climate change operates at a global scale; a lack of understanding of epidemic processes at relevant environmental and spatial scales has hampered progress. From a disease management perspective, information is normally required for a specific disease at a field scale; thus, data on potential impacts of climate change need to be assessed and evaluated at a detailed level to capture important mechanisms and dynamics that drive epidemics.

TS-01 (OP-04)

Evaluation of bitter gourd varieties against leaf curl and downy mildew diseases

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Bitter gourd, *Momordica charantia* L. is one of the most popular vegetable of India. Bitter gourd is usually infected with number of diseases throughout the period of crop. Among them leaf curl and downy mildew are commonly infecting diseases that cause considerable loss to the crop. Nineteen varieties of bitter gourd viz. VNR-28, VNR Kanhaiya, Vivek, Sagar (AG-811), No. 4003, Nanha, Ankur Tillu, Sunil Karela, Indra Karela, Bujji, Raman, Unnat Kathi Gaurav, Selection 05, Kathi Selection (Cham Cham-7), Meghana-2, NS-1018, Katahi, Uchha Bolder, Local cultivar were evaluated against leaf curl and downy mildew diseases at Horticultural Research Farm, College of Agriculture, IGKV, Raipur during Rabi 2015-16. Among the nineteen varieties of bitter gourd not a single variety too showed resistant or moderately resistant reaction against leaf curl disease. One variety (Meghana-2) was moderately susceptible, fifteen viz. VNR-28, VNR Kanhaiya, Sagar (AG-811), No. 4003, Nanha, Ankur Tillu, Sunil Karela, Indra Karela, Bujji, Raman, Unnat Kathi Gaurav, Selection 05, Kathi Selection (Cham Cham-7), NS-1018, Uchha Bolder were susceptible. However three varieties viz. Vivek, Katahi, Local Cultivar were highly susceptible against leaf curl disease. However among the nineteen varieties of bitter gourd two (Unnat Kathi Gaurav, Kathi Selection) were highly resistant, three (No. 4003, Bujji, Meghanaa-2) were moderately resistant, thirteen viz. VNR-28, VNR Kanhaiya, Vivek,

Sagar (AG-811), Nanha, Ankur Tillu, Sunil Karela, Indra Karela, Raman, Selection 05, NS1018, Katahi, Uchha Bolder were moderately susceptible and only one variety i.e. VNR-22 was susceptible against downy mildew disease.

TS-01 (PS-01)

Assessment of different management modules for leaf curl disease of tomato in Kymore plateau and Satpura hills agroclimatic zone of Madhya Pradesh

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In order to assess the efficacy of four different management modules including farmers practice for leaf curl disease of tomato, a three years of On Farm Trial (OFT) was conducted on 20 farmers field of Chorgarhi, Mankesher and Upani village of Sidhi district in Madhya Pradesh during 2014-15 to 2016-17.The experimental findings revealed that all the management modules were found superior over farmer's practice. The module T4 having tolerant variety (Avinash-1)+ seed treatment with Thiomethoxam-75 WG@5 gram / kg seed + Nursery raised in nylon net of 40 gauge mesh for leaf curl management + before transplanting root dip in Imidachloprid -17.8SL(@ 3ml/10 lit. of water) for 30 minute + rouging out and burning of infected plants + two spray of Thiomethoxam-25WG@125 gram/ha before flowering at 25 and 45 DAT was found effective in reducing disease as well as total no.of white fly/plant , Tomato yield (qt./ha) and cost benefit ratio followed by module T3 (Seed treatment with Imidachloprid -17.8SL @ 3ml/ 10 lit. of water + spray of Neem oil @ 1 per cent in nursery and 25DAT+ need based spray of Imidachloprid -17.8SL @125 ml/ ha before flowering) and T2 (Seed treatment with Imidachloprid- 17.8SL @ 3ml/ 10 lit. + Two spray of Neem oil @ 1 per cent at 25 and 45 DAT). Thus, on the basis of the data, it is considered that module T4 and T3 may be considered for improving sustainable management of leaf curl disease in tomato.

TS-01 (PS-02)

Combination of azoxystrobin+ difenocanazole for effective management of sheath blight of rice

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Rice sheath blight, caused by the fungal pathogen *Rhizoctonia solani* Kuhn [Sexual stage: *Thanetophorus cucumeris* (Frank) Donk] is one of the major production constraints in

rice-growing countries of the world. Under conditions favoring disease, up to 50% of grain yield may be lost (Marchetti and Bollich 1991). Use of Short-stature well-tillering susceptible semi-dwarf cultivars planted at high densities, leading to dense canopies with moist microclimates, promote disease spread. Both seedlings and adult plants are equally affected but loss is much more when the disease appears in seedlings. The infection and spread of disease before the flag leaf stage revealed 20% grain loss. A trial was conducted to test the efficacy of different combination(s) of fungicide against sheath blight of rice. We report herein Azoxystrobin 18.2 % w/w + 11.4 w/w SC (Amister) effectively reduced the sheath blight severity (11.11%) and also increased the grain yield as compared to other treatments and control. This study also demonstrated that rice producers can reduce sheath blight losses by planting moderately susceptible to moderately resistant cultivars and improve rice grain yield by applying Azoxystrobin 18.2 % w/w + 11.4 w/w SC(Amister).

TS-01 (PS-03)

Plant growth promoting atoxigenic fungus aspergillus flavus confers protection against charcoal rot of soybean

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Madhya Pradesh is leading state of soybean and shares 53 percent area and 58percent of total production of soybean in country. In Madhya Pradesh, 6.02 million tons soybean is produced from 5.54 million ha land with productivity of 1086 Kg/ha. Charcoal rot caused by the fungus, *Macrophomina phaseolina* (Tassi) Goidanich, has emerged as serious concern for cultivation of soybean as it can infect over 500 plant species in more than 100 plant families around the world. It can survive as microsclerotia (masses of fungal tissue) for two or more years in dry soil. The biological control of *M. phaseolina* by atoxigenic *Aspergillus flavus* was evaluated under in-vitro and in-vivo conditions. Poison food and dual culture techniques were used to test the potentiality of *A. flavus* against *M. phaseolina* under in-vitro conditions. A measurement of RWC (relative water content) was performed through Barrs and Weatherly method whereas Chlorophyll Content Index was estimated through the portable chlorophyll meter. The six isolates of atoxigenic *A. flavus* were found significantly suppressive towards the mycelial growth of *M. phaseolina* under dual culture method. The highest reduction in radial growth was recorded with isolate 4. Under poison food technique, the significantly growth inhibition was recorded with isolate 2 at 48 and 72 hours. However the inhibitory effect of isolate 1 was markedly higher than other isolates and was followed by isolate 2 at 96 hours. The highest RWC was recorded with isolate 1 treated plants followed by isolate 2. Similarly, the lowest disease incidence was recorded in isolate 1. The highest chlorophyll content was recorded in isolate 2 in *M. phaseolina* inoculated plants.

TS-01 (PS-04)

Screening of soybean germplasm lines for identification of multiple disease resistance

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Fifty soybean germplasm lines received from IISR, Indore namely CAT 1328, CAT 1477, CAT 1483, CAT 1539, CAT 1847, CAT 1857, CAT 1878, CAT 1927, CAT 1935 B, CAT 1995, CAT 2026, CAT 2034 B, CAT 2071, CAT 2082, CAT 2083 A, CAT 2090, CAT 2091, CAT 2144 A, CAT 233, CAT 248, CAT 292, CAT 313 A, CAT 349, CAT 377, CAT 400, CAT 407, CAT 408, CAT 410, CAT 411 A, CAT 411 B, CAT 418, CAT 460 B, CAT 473 B, CAT 483, CAT 488, CAT 606, CAT 992, DSb 1, JS 20-37, JS 20-42, KB 70, MAUS 176, NRC 67, NRC 71, NRC 78, NRC 84, PS 1347, SQL 89, PB 1165, CAT 326 along with five checks (JS 335, TAMS 38, JS 93-05, NRC 7 and PUNJAB 1) were evaluated to find multiple resistance against Charcoal rot, Yellow Mosaic Viruses, Aerial blight and bacterial pustules diseases in augmented plot during *Kharif* 2017-18. Amongst, only fourteen genotypes i.e., CAT 1328, CAT 1483, CAT 1847, CAT 1857, CAT 1927, CAT 349, CAT 411 B, CAT 418, CAT 488, JS 20-37, NRC 67, NRC 78, SQL 89, CAT 326 were found to be absolute resistant against charcoal rot disease whereas per cent mortality lies between 2.5 to 80.0 in remaining genotypes. Yellow mosaic disease incidence were recorded on eleven lines (CAT 1878, CAT 2082, CAT 292, CAT 349, CAT 483, CAT 488, CAT 606, JS 20-42, KB 70, NRC 67 and SQL 89) with the per cent disease index up to 9.0 whereas remaining were found to resistant. Similarly, twenty and twelve genotypes were found to be affected with aerial blight disease and bacterial pustules disease with the severity of up to 6.8 and 18.5 per cent, respectively. Altogether, only four genotypes i.e. CAT 1483, CAT 1847, CAT 1927 and CAT 418 were showed multiple resistant against all the four diseases where as CAT 418 and CAT 1847 also yielded good as compare to other lines.

TS-01 (PS-05)

Studies on variability in *Rhizoctonia solani* isolated from different rice growing areas of Chhattisgarh plain and its virulence on rice crop

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Rhizoctonia solani Kühn is most widely distributed plant pathogen and can cause disease on at least 200 different plant species. Due to variation in the distribution of *R. solani* across environments, it is important to know which isolate is most virulent within a given

species especially to identify genetic resistance to highly virulent isolates. Keeping in view, the importance of the crop, severity of the disease and advantages of biological control, present investigation was taken up to study. The cultural and morphological features of *Rhizoctonia solani* were studied on growing them on PDA medium which was isolated from different rice growing locations of Chhattisgarh plain viz., Raipur, Bilaspur, Bhilai, Durg, Anjora, Rajnandgoan and Mungeli. The isolates varied with respect to growth, colony characteristics and sclerotial morphology. The radial growth of mycelium was significantly highest in Rajnandgoan isolate and lowest in Anjora isolate. Sclerotia production was highest in Raipur isolate while least no. of sclerotia was produced from isolates of Bhilai. Virulence potential of seven different field isolates of *Rhizoctonia solani* was studied on susceptible variety (Swarna) of rice crop and it was found that Raipur isolate was significantly superior in producing the lesion length (65.00 mm) followed by Bilaspur isolate while the least relative lesion length was observed in Anjora isolate.

TS-01 (PS-06)

Studies on interaction of *Meloidogyne incognita* and *Fusarium oxysporum* in black gram

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The root knot nematode (*Meloidogyne incognita*) caused significant reduction in plant height, root length fresh and dry weights of shoots and roots. Root galls and final nematode population increased with the increasing levels of nematode inoculum. Highest level of nematode inoculum indicated inhibitory and damaging potential on plant growth parameters on blackgram. Two second stage larvae of M. incognita were found to the damaging level on blackgram (Cv TU 98-14).The root knot nematode continues to penetrate at all the growth stages of plant. However, seven days old plant were observed to be most susceptible to root knot. Significant reduction in plant growth parameters during plant growth was noticed on seven days old plants. The treatments receiving the nematode inoculation prior to fungus resulted in higher reduction and plant growth than the fungus alone and concoment N+F treatments. When nematode inoculation was done seven days prior to fungal inoculation, it showed maximum synergistic effect followed by treatment parasite and pathogens inoculated simultaneously. Presence of nematodes not only predisposed the host lealth but also shortened the incubation period for disease expression. *Paecilomyces lilacinus* significantly increased the growth parameters of the black gram viz., plant height, root length, fresh and dry weight of shoot and roots with significant decrease in the number of galls and final nematode population. *Pochionia chlamydosporia* was also noted to be superior and took second rank in improving the plant growth and reduced nematode population.

TS-01 (PS-07)

Role of NPK plus sulphur fertilizers in the management of black spot disease (Alternaria drassicae) of mustard

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Effect of Soil Application of NPK and Sulphur as nutrients on the Severity of black spot disease (BSD) caused by *Alternaria brassicae* and yield attributes of mustard were investigated in 2013-14 and 201-15 at Krishi Vigyan Kendra, Katni. The severely of BSD was significantly minimum (20.4%) in plot grown in ground treated with N:P:K:S @ 90:40:50:25 than on plot from without sulphur applied control plots (36.2 to 40.3%) on leaf. However, 18.5% disease severity was recorded on those plots which treated with 25 kg/ha sulphur plus NPK @ 90:40:50 followed by N:P:K:S 90:40:50:40 in comparison to 120:50:40:50 kg per hectare N:P:K:S on pods. The severity of BSD in both combinations of NPKS increased with increase the dose of sulphur but was significantly lower than without sulphur fertilized plots. Significantly higher yield (20.5 q/ha) obtained in 90 kg N, 40 kg P_2O_5, 50 kg K_2O + 40 kg sulphur per hectare applied plot and it was 36% more than control treatment. Seed obtained from sulphur treated plot had more oil content. Sulphur at lower doses of Nitrogen and phosphorous showed increased resistant to lodging.

TS-01 (PS-08)

Evaluation of resistance in different varieties of bottle gourd (*Lagenaria siceraria*) against downy mildew under field conditions

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Pseudoperonospora cubensis is one of the important pathogen that incites cucurbit downy mildew. It is responsible for devastating losses in bottle gourd and also in bitter gourd, cucumber, cantaloupe, pumpkin, watermelon and squash. Although downy mildew has been a major issue in India, downy mildew on bottle gourd has been successfully controlled for many years through host resistance. The occurrence of downy mildew were first observed from last week of August and gradually increased during the crop period. Disease severity and incidence reached at maximum in September. Cultivation of resistant or tolerant cultivars is one of the best options to minimize the losses due to diseases. Nine varieties of bottle gourd (Amrit, Ankit, Anmol, Anurag, Latto, Mahima, Manya, Naveen and NS-443) were evaluated for resistance against downy mildew (*Pseudoperonospora cubensis*). Among the nine varieties of bottle gourd evaluated three (Amrit, Anmol and NS-443) were resistant, two (Ankit and Naveen) were moderately resistant and remaining four (Anurag, Latto, Mahima and Manya) were moderately susceptible.

TS-01 (PS-09)

Evaluation of newly evolved fungicides for the management of leaf blast of rice

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Rice (*Oryza sativa* L.) is one of the most important cereal crop grown in 44ha in various diverse ecosystem in India. The crop is severely affected by fungal diseases and causing heavy economic losses every year. Among the biotic stresses, leaf blast caused by *Pyricularia grisea* is causing significant losses in various crop stages in rain fed and irrigated ecosystem.

Keeping these facts in view, the present research work was carried out at All India Coordinated Rice Improvement Project Rewa during *Kharif* season against highly susceptible variety PS5 for the management of disease by using Randomized Block Design in three replications .

Among the tested fungicides Tricyclazole @0.6g/l was found significantly superior for controlling the leaf blast of rice (45.6%) and increasing the grain yield over untreated check. Application of Difeconazole 25EC and Thifluzamide 24% were found at par for controlling the disease severity under natural conditions.

TS-01 (PS-10)

Outbreak of mungbean yellow mosaic virus disease of soybean under changing climatic conditions of Jabalpur, Madhya Pradesh

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On account of its ability to fix biological nitrogen 270 kg/ha as compared to 150 kg/ha by other pulses and due to high quality protein (40-42%) and oil content (18-20%), Soybean [*Glycine max* (L.) Merrill], is the most popular grain legume grown on 55.5 lakh ha with a production of 51.6 lakh metric tons and productivity of 930 kg/ha in Madhya Pradesh.

In the first week of August 2015, an outbreak of Mungbean Yellow Mosaic Virus (MYMV) disease was noticed with 43% plant population infection at V3-R2 stage. During that period average temperature 27.7 C and relative humidity 76.5% prevailed. Within a short period (10-12 days) more than 70 % crop plant population was infected in Research Fields, Seed Production Units and Farmers Fields. It was observed that in 31st week (July, 2015), the rainfall

was 145.40 mm and the average temperature was 26.7^{0}C with the relative humidity of 80% which favored the outbreak. In the 3rd week of August the incidence of MYMV increased up to 60% in JS 335 while it was 30, 50 and 0% in JS 20-34, JS 20-69 and PS 1225 respectively. Previous reports suggest that MYMV is not seed borne and transmitted through white fly (*Bemisia tabaci*) in a persistent manner.

TS-01 (PS-11)

Screening of varieties/ breeding materials for resistance to different diseases in natural condition under south Gujarat region

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Cotton is one of the principal commercial crop and it is the back bone of national economy of our country. Cotton remains the most miraculous fiber and is still nature's wonder fiber. Cotton is grown all around the globe, and is traded internationally as well. The production is influenced by the repeated out breaks of pest and diseases and these are the major factors responsible for lower yield of cotton in India. A field trial was conducted at Main Cotton Research Station (MCRS), NAU, Surat in the year 2015 for a season to determine the influence of different diseases in respect to different varieties/ entries. During the season, entries were evaluated for their reaction against the different diseases in cotton crop. Total thirty nine entries including the checks were evaluated for their reaction against the different diseases. Out of these entries, twenty five entries were observed disease free whereas, six entries as resistant, six entries as moderately resistant and two entries i.e. GBHV-170 and GSHV-185 observed in the Grade 3 against the bacterial leaf blight disease with 12.5 and 11.5 % per cent disease intensity (PDI). Whereas, for Alternaria leaf spot disease, twenty one entries as disease free, sixteen entries as resistant and two entries as moderately resistant against the disease.

TS-01 (PS-12)

Agroterrorism a threat for Indian Agriculture

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Agroterrorism is a type of bioterrorism in which pathogens (fungi, bacteria, viruses, insects and other pest etc.) are used to attack agriculture food chain, it is a new type of bio-warfare mechanism where physical and mechanical objects/structures are relatively untouched

where as the biotic life forms particularly agricultural crops and veterinary are under extremely high risk of destruction. The main goal under such type of warfare is to minimize the food supply of target nation so as to starve its population to death or create severe unrest among the population. The results of such agroterror attack in a highly populous country like India could be devastating and disastrous. Although Indian agriculture is highly diverse, enormously scattered sufficed with variable crop type and dissimilar weather conditions but still threat is there and biosecurity and biosafety are essential to protect our farmers from such sudden bioweapon hazards. Indian agriculture may present itself as a weak opponent and become a possible victim of agro terrorism if we are not aware of such threats. It is essential to identify possible threats, create biosurveillance and biodefence mechanism and develop quick responses towards agroterrorism. Apart from creating awareness among Indian farmers, quarantine, prevention, prophylactic measures and preparedness are essential to counter such agroterror attacks.

TS-01 (PS-13)

Effect of dominant rhizosphere fungi on *Macrophomina phaseolina* causing charcoal rot of soybean

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Soybean (*Glycine max*) has been grown for centuries in India for its immense nutritive values. India is also a largest producer of this crop. Over the years, its production is stagnant or declining owing to change in climate and also due to ever changing pathogenic behaviour of pathogen. Mostly, the soil borne pathogens are controlled by the application of systemic fungicides that are not effectively controlling the pathogen. Besides, chemical methods are not economical in the long run because they pollute the atmosphere, damage the environment, leave harmful residues, and can lead to the development of resistant strains among the target organisms with repeated use. In addition, to their target effect on beneficial root zone microflora. Depending upon the strain, the use of root mycoflora in agriculture can provide numerous advantages: (i) Colonization of the rhizosphere by the BCA (‘‘rhizosphere competence’’) allowing rapid establishment within the stable microbial communities in the rhizosphere (ii) Control of pathogenic and competitive/deleterious microflora by using a variety of mechanisms thereby improvement of the plant health and (iii) Stimulation of root growth. Hence, the present investigation was undertaken to utilize the dominant resident mycoflora of crop that are capable of adjusting to changing environment and have ability to combat the menace of its co-partner (pathogenic group). Out of 157 fungal species isolated from plant rhizosphere of soybean, forty three dominant rhizosphere fungi viz, ten isolates of Aspergillus niger, ten isolates of *Trichoderma asperellum*, six isolates of *Aspergillus flavus*, nine isolates of Aspergillus terreus and eight isolates of *Penicillium citrinum* were utilized for suppressing *Macrophomina phaseolina*. The rhizosphere fungi were isolated through dilution plate technique

and their efficacy against the pathogen was established through dual culture and poison food technique. The physiological parameters and disease incidence of plant were observed under in-vivo conditions. The five dominant rhizosphere fungi viz. *Trichoderma asperellum*, *Aspergillus niger, Aspergillus terreus, Aspergillus flavus and Penicillium citrinum* and their isolates have been evaluated for their bio control potential under in-vitro and in-vivo conditions. The isolates with higher mycelia growth suppressing ability under dual culture technique had not found inhibitory towards the test pathogen under poison food technique except *A. terreus* isolate 1. The tested in-vitro beneficial fungi showed their varying potential against pathogenic fungi under in-vivo conditions.

Among the rhizosphere fungi, the suppression of *M. phaseolina* was in order of *T. asperellum , A. flavus , A. niger , P. citrum , A. terreus* in dual culture technique. Under poison food technique, the sequence was in order of *A. terreus* > *A. niger* > *T. asperellum* > *P. citrinum* > *A. flavus* in inhibiting the test pathogen. Although, all the tested rhizosphere fungi were found suppressive but few isolates like *T. asperellum* isolate 6 and 1 (35.0 and 35.7 mm), *A. flavus* isolate 4 (50.0 mm), *A. niger* isolate 7 (55.7 mm*), P. citrinum* isolate 7 (58.3 mm) and *A. terreus* isolate 1 (62.7 mm) markedly reduced the mycelia growth of the test pathogen under dual culture technique. Under poison food technique, AT1 (41.3 mm), AN9 (42.3 mm), TA6 (50.3 mm), PC2 (51.7 mm) and AF1 (52.7 mm) significantly inhibited the radial growth of the pathogen. The results obtained from pot experiments revealed that the minimum disease incidence was recorded in plants treated with culture filtrate of isolates AF1 (15.38%), TA9 (16.66%), AN5 (16.66%), AT1 (18.18%) and PC8 (21.42%) and also recorded the maximum percent of RWC in their leaves. The most effective bioagents tested against pathogen under in-vitro conditions were TA1 and 6, AN9, AF4, AT1 and PC2 while AF1, TA9, AN5, AT1 and PC 8 under in-vivo conditions. The *A. terreus* isolate 1 was the only isolate that was found suppressive against the test pathogen under both in-vitro and in-vivo conditions. The disease suppressing ability of *T. asperellum* isolate 8 and *A. niger* isolate 5 was the highest and similar in comparison to other isolates and were next best to AF1.

TS-01 (PS-14)

Evaluation of different rice establishment methods with improved varieties, for their suitability and enhancement of the productivity

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For Evaluation of different rice establishment methods with improved varieties, for their suitability and Enhancement of the productivity, trial was laid out in split plot design at All India Coordinated Rice Improvement Project, Rewa Centre with 4 crop establishment methods as main plots and 8 cultivars (V1- Mandya Vijaya, V2- Dhanrashi, V3- PA 6444, V4- KRH-2, V5- RP BIO 226, V6- IIRR Dhan 44, V7- Tulshi, V8- JGL 17004) as subplots with 4 replications. The

main plot treatments were 4 crop establishment methods (M1: Dry direct seeds rice in puddle of unpuddled, M2 Aerobic rice unpuddled condition M3: Transplanted and M4: Optional method location specific) and 8 cultivars (two varieties of each-promising HYVS, hybrids, hybrids from IIRR, drought cultures, basmati culture and location specific standard checks) as sub plot treatments. Over all mean grain yield revealed that transplanted method of rice cultivation was best method for higher yield of rice (5.45 t/ha) followed by dry direct seeded rice (5.20 t/ha).Similarly, both HYVs performed better than those of all other hybrids.

TS-01 (PS-15)

Plant growth promoting response of fluorescent pseudomonas on chickpea

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Chickpea (*Cicer arietinum* L.) is the most important pulse crop of India. PGPR (rhizo biofertilizers) are a group of bacteria that actively colonize plant roots and enhance plant growth and help in sustainable crop production. The rhizospheric soil contains diverse types of PGPR communities, which exhibit beneficial effects on crop productivity. The beneficial plant-microbes interactions in the rhizosphere are determinant of plant health and soil fertility. Flourescent Pseudomonas is one of the important plant growth promoting rhizobacteria that colonize roots and enhance plant growth in chickpea plant. A pot experiment was conducted to investigate the effect of five isolates of fluorescent Pseudomonas *viz.* P66, P141, P200, P229, P260 on the growth of chickpea. Efficacy of different isolates of Pseudomonas for chickpea plants varied to induce root and shoot length ranging from 21.8 to 41.78 cm and 17.85 to 24.083 cm respectively. Maximum root length (41.78 cm) and shoot length (24.083 cm) were recorded when seeds were treated with P229, and P66 respectively. Seed treated with isolate P260 has 19.98 cm (47.82%) more root length and isolate P260 has 6.23 cm (25.86%) shoot length as compared to control. Significant increase in root length was observed with isolates P229> P260>P141>P200>P66 in respective order. Similarly significant increase in shoot length was observed with isolate P66> P141>P229>P200>P260.

TS-01 (PS-16)

In vitro evaluation of different fungicides against wilt of pigeonpea incited by Fusarium udum butler

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Pigeonpea (*Cajanus cajan*) is one of the important leguminous crop of the tropics and subtropics and is infected by the wilt pathogen *Fusarium udum*. Plants get infected at an early stage, symptoms; however, appear at different growth stages depending on the severity of infection. Generally, wilt symptoms appear 4-6 weeks after sowing but become common and pronounced at reproductive stage. The wilt incidence may range 69-99% and 31-63% in susceptible and moderately susceptible cultivars, respectively. Therefore, the present study was conducted to assess the ability of eight fungicide viz., Captan (0.1g), Blue copper (0.3g), Carbendazim (0.1g), Carbendazim + Mancozeb (0.25g), Mancozeb (0.25g), Fipronil (0.1ml), Thiophanate Methyl (0.1g) and Pyraclostrobin (0.02g) along with control against *Fusarium udum* by following the poisoned food technique under in vitro condition. All the fungicides inhibited the radial growth of *Fusarium udum* in vitro after 168 hrs of incubation. Thiophanate Methyl, Carbendazim and Carbendazim + Mancozeb were found most effective fungicides which completely inhibited the radial growth and sporualtion of *Fusarium udum*. Pyraclostrobin, Captan, Mancozeb and Blue copper were second next in order of toxicity resulting, respectively 87.18, 81.90, 70.02 and 58.70 percent inhibition of radial growth. Least inhibition was recorded in Fipronil (38.97%).

TS-01 (PS-17)

Efficacy of different foliar fungicides against early blight (*Alternaria solani* ellis and martin) of tomato under field conditions

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Early blight of tomato is the most important disease in tropical and subtropical areas. Early blight is strongly influenced by different environmental conditions causing the leaf blight, stem blight and apical fruit rot. A field trial was conducted at the experimental field of Krishi Vigyan Kendra Majhgawan, Satna, Madhya Pradesh during Rabi season of 2015-16 to find out the effective fungicidal application for its management. In vitro evaluation of six different fungicides namely, hexaconazole + captan (Taqat 75 % WP) @ 0.2 % (T1), metiram + pyraclostrobin (Cabrio Top 60 % WG) @ 0.3 % (T2), metalaxyl + mancozeb (Ridomil Gold 68 %

WP) @ 0.2% (T3), hexaconazole (Contaf 5% EC) @ 0.2% (T4), chlorothalonil (Kavach 75 % WP) @ 0.2% (T5) and propineb (Antracol 70% WP) @ 0.3% (T6) were applied at the first initiation of disease symptoms. Observations were recorded at 10 and 20 days after spray. All fungicides significantly reduced the disease severity but Cabrio Top (T2) was the most effective fungicide against early blight of tomato. Analysis of the data showed that, the lowest per cent disease intensity (PDI) was observed in metiram + pyraclostrobin @ 0.3 % (T2) (16.34 %) followed by hexaconazole + captan @ 0.2% (T1) (23.62%). Similarly, the highest yield of tomato fruits were recorded with metiram + pyraclostrobin @ 0.3 % (T2) (248.30 q/ha) followed by hexaconazole + captan @ 0.2% (T1) (226.55 q/ha), respectively.

TS-01 (PS-18)

Chickpea survivability after endophytic seed bacterization and soil application of fe3+edta in green house condition

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Endophytic bacteria (EB) were isolated from surviving chickpea plant at Bangalore where wilt in epidemic and evaluated as potential bio-control agent. A green house experiment was conducted to study the suppression of Fusarium wilt in suppression and conductive soils. The soils were rendered suppressive by addition of antagonists through seed inoculation. Conductive soil was made by soil inoculation *Fusarium oxysporum f. sp. ciceri* (FOC). An average of 64.9% to 96.4% of Plant germinated in all the ten treatments where seeds bacterization with endophytic Bacteria was done. In case of control (only FOC) only 26% of Plant germinated and in normal control (without any treatment) 60% of the Plant survived Pseudomonas florescence (EN-1) treated post amended with 100µMFe 3+Edta showed maximum (96.4%) germination in conductive soil .The next highest (88.0%.) was observed in *Bacillus substilis* (EN-3) treated with 50µMFe 3+Edta amended conductive soils. The number of plant surviving after 40 days was recorded in all the treatments. None of the plant survived. In pathogen treated FOC but in normal soil 35.2% of plant survived.

TS-01 (PS-19)

In vitro efficacy of fungicides against phytophthora stem blight (PSB) disease of pigeonpea caused by Phytophthora drechsleri f. sp. cajani

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Pigeonpea is one of the food legumes rainy session pulse crop of India, mainly used as dhal throughout the county in vegetarian diet. The Phytophthora Stem Blight (PSB) disease of pigeonpea caused by *Phytophthora drechsleri pv cajani* is one of the dreaded disease affecting the field stand from initial crop growth stage. Most of the pigeonpea varieties are susceptible to Phytophthora Stem Blight (PSB) disease and can be controlled by the use of fungicides. In-vitro evaluation of fungicides against *P. drechsleri f. sp. cajani* was carried out by poison food technique using eight fungicides. Data of radial growth of *P. drechsleri f. sp. cajani* was recorded at seven days after inoculation. Among fungicides, completely mycelium inhibition was recorded in Trifloxystrobin, Chlorothalonil, Pyrachlostrobin, Fosetyl Al, Mancozeb + Mefenoxam and Copper Oxychloride (0.00 mm) at 200, 1500, 2000, 1000, 2500 and 2500 ppm concentraction respectively, while the growth reduction was less in Azoxystrobin (79.33 mm) followed by Metalaxyl+Mancozeb (27.67 mm).

TS-01 (PS-20)

Evaluation of little millet cultivars for resistance against banded leaf and sheath blight caused by *Rhizoctonia solani* kuhn

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Little millet (*Panicum sumatrense*) locally known as Kutki is an important small seeded hardy cereal crop grown by the tribal and poor farmers in low fertile lands for their own consumption with low inputs. In India, the crop is grown in an area of 291 thousand hectares with annual production of 102 thousand tonnes and 349 kg ha-1 productivity. Madhya Pradesh ranks second in area of little millet after kodo millet. The grains of little millet are rich in fibre, protein, minerals and has low glycemic index, which helps to manage diabetes, blood pressure, constipation and obesity. Among the biotic stresses, banded leaf and sheath blight (BLSB) caused by *Rhizoctonia solani* Kuhn) is becoming a major constraint for little millet cultivation. Use of resistant cultivars is the cheapest and feasible measure to combat with the disease problem in such poor crop. In the present study, 27 little millet cultivars were screened against BLSB under artificial inoculations. The fungus was isolated in potato dextrose medium and

cottony regular and fast growing colony of *R. solani* was recorded. Significant differences were recorded among the cultivars in relative lesion height and apparent infection rate. Relative lesion height (RLH) varied from 17.8 to 51.1% was recorded. Cultivars were grouped into different categories of reaction against BLSB. Two cultivars namely TNAU 176 and TNAU 178 were found resistant to BLSB, where as eleven cultivars namely TNPSu 202, 205, BL 6, 8, GPUL 3, RLM 208, 224, Acc. No. 115, 148, DLM 103 and OLM 203 were shown moderately resistant reaction. Eight cultivars namely TNPSu 203, 204, 208, BL 150, DHLM 28-4, RLM 209, DLM 95 and JK 8 were moderately susceptible and six namely TNPSu 201, 206, 207, 209, Acc. No. 60 and JK 36 were susceptible to BLSB. These cultivars may be utilized in breeding programme for the development of high yielding and BLSB resistant varieties of little millet.

TS-01 (PS-21)

Management of Alternaria blight of ashwagandha through fungicides, organic manure and biofertilzer

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The management of Alternaria blight of Ashwagandha through fungicides, organic manure and biofertilzer. An experiment was conducted under lab and field condition during the year 2008-09 and 2009-10. *In vitro* Maximum growth inhibition occurred in Carbendazim and Chlorothalonil after eight days (0.0mm) at 500ppm concentration. In Vivo Minimum PDI of 5.0 and 5.4 was observed in Vitavax Power and Mancozeb. And Maximum yield was recorded in Vitavax Power (7.48 q/ha) and Mancozeb (6.77 q/ha) followed by Chlorothalonil (5.75 q/ha) out of seven fungicides. Evaluation of seven amendments of biofertilizes for the management of disease under field condition revealed that Minimum PDI of 5.5 and 6.8 was observed in FYM and RDF+FYM. Similarly all the treatments significantly increased the yield as compared to control. Maximum increase in yield was recorded in FYM followed by RDF+FYM.

TS-01 (PS-22)

Study on extent of knowledge of rice growers about identification and control of insect pests and diseases of rice in Panna District

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Rice (*Oryza sativa* L.) is an important staple crop in India occupying 43.38 million hectare area with production of 104.3 million tonnes. Rice is one of the major *kharif* crop grown about 65210 hectare area in Panna district. The average productivity of rice is of 27.7 q/ha

which is very low due to several constrains. It is dominated by vast forest and mineral with 73% marginal and small farmers. Therefore the present study was conducted in Ajaygarh and Panna block of Panna district during 2016-17 to the extent of knowledge regarding identification and control measures of insect pests and diseases of rice growing farmers. A total 80 randomly respondents were constituted as a sample for the present study. The study revealed that majority of farmers were aware of Leaf folder (72%) followed by Case worm (67%), Stem borer (64%), Gandhi bug (58%), Gall midge (52%), Swarming caterpillar (47%) and Brown plant hopper (37%) and aware of diseases like Blast (57%), Bacterial leaf blight (39%), False smut (36%), and Sheath blight (27%). Least number of respondents knew about the suitable insecticides and fungicides for the control of Stem borer (36%) and Leaf folder (34%) and similarly control of Blast (34%) and Bacterial Leaf Blight (21%) with optimum dose of insecticide and fungicide application. Farmers were also not aware about use of optimum volume of insecticides and fungicides along with type of nozzle.

TS-02 (OP-01)

Marker assisted introgression of BLB and blast resistance gene(s) in rice cv. safri-17 and dubraj

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Rice a monocot, is normally grown as an annual plant, it is the most widely consumed staple food for a large part of the world's human population, especially in Asia. Two diseases viz., Bacterial Leaf blight (BLB) and Blast are the most devastating diseases affecting entire rice acreages and cause severe yield losses up to 80%. Development of resistant cultivars has been proved to be the most effective and eco-friendly way to control these diseases. To date, more than 39 R-genes conferring host resistance to various strains of Xoo have been identified and some of those have been characterized (Verdier *et al*. 2012; Wang et al. 2014a; Zhang et al. 2014). Approximately 96 rice blast resistance genes have been identified and among these 74 have been mapped and 9 blast resistance genes have been cloned. We report herein marker assisted introgression of blb (xa5, xa13, Xa21 and Xa4)and blast (Pi1 and Pi2) resistance gene(s) in rice cv. Safri-17 and Dubraj The Population obtained consists of resistance genes for both BLB and blast which includes 115 lines of F2 generation, 250 and 626 lines of F5 and F6 respectively.

TS-02 (OP-02)

Evaluation of fluorescent pseudomonas and *Trichoderma* against *Fusarium udum* inciting wilt in pigeonpea

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Pigeonpea, *Cajanus cajan* (L.) *Millsp*. is the fifth prominent pulse crop in the world and second most important pulse crop after chickpea in India. Diseases are the one of the major biotic factor which hampers pigeonpea production. Among the diseases *Fusarium wilt* caused by *Fusarium oxysporum f. sp. udum* is one of the most important soil borne disease of pigeonpea. The pathogen is both seed and soil borne in nature hence management of the disease is very difficult. Therefore twenty four isolates of Fluorescent pseudomonas and two isolates of *Trichoderma harzianum* and one isolate of *Trichoderma viride* were evaluated against one and five isolates of *Fusarium oxysporum f. sp. udum* respectively to find out their efficacy against the pathogen. Among the twenty four isolates of Fluorescent pseudomonas evaluated maximum inhibition was found in case of isolate P151 with 45.30 per cent inhibition

followed by P67 (41.88%) and P99 (41.88%) and least inhibition was observed in case of P126 (20.51%) followed by P176 and P205 (21.37%). Among the three isolates of Trichoderma tested against the *Fusarium udum, T. harzianum* isolate Kanpur 1 and Kanpur 2 were found to be best against pathogen isolate of DFU and BeFU respectively while T. viride Bilaspur isolate was most effective against KFU.

TS-02 (OP-03)

Identification of siderophore producing and cynogenic fluorescent pseudomonas and a simple confrontation assay technique to evaluate potential bio-control agent

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In soil, plant roots normally coexist with bacteria and fungi which may produce siderophores capable of sequestering the available soluble iron. Microbial cyanogenesis has been demonstrated in many species of fungi, and in a few species of bacteria (Chromobacterium and Pseudomonas). Fluorescent Pseudomonas isolates # P29, P59, P144, P166, P174, P187, P191, P192 were cynogenic and produced siderophore (includes a non-cynogenic #207) in the presence of strong chelater 8-Hydroxyquinoline (50mg/L). Fluorescent Pseudomonas isolates # P66, P141, P144, P166, P174 were antagonistic against both R. solani and S. rolfsii. Finding effective bio-control and PGPR strains for fundamental research or practical applications requires a technique. Vigorous plants growth was observed following seed bacterization with P141, P200, P240 on chickpea. In plots where the plants were derived following seed bacterization showed reduced collor rot incidence. A simple confrontation assay technique (which makes use of funnel edge for inoculation) is proposed to identify potential bio-control agent and is suitable for standardization.

TS-02 (OP-04)

Feasibility of solar panel enabled production units for cultivation of white button mushroom *Agaricus bisporus* (lange) imbach, in tropical areas of Chhattisgarh

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The aim of this pilot scale investigation was to explore possibilities of solar panel enabled eco-friendly production units (10'x8'x8') with flexibility to handle various combinations of temperature and humidity control on an as-needed for cultivation of white button mushroom

(spawn and case run 22-240C, pinhead initiation and button formation 15-17°C and humidity 85-90%) in Raipur, Chhattisgarh. Strain S-11 was selected as a potential strain from a repertoire of cultivated strains of A. bisporus and evaluated for yield and cultivation prospects round the year in these units. It was found that eight crops of S-11 strain of button mushroom can be taken if cultivated round the year with 15-20% biological efficiency (B.E.) on long method prepared paddy straw or wheat straw compost. Production units (10'x8'x8') could accommodate 200 bags each containing 5kg of compost and with a cropping period of 45-50 days, production of 1.5 to 2.0 quintals of button mushroom was achieved. It was also recorded that though there was less no of button mushrooms per bag, the weight of individual unopened buttons were on a higher side with maximum being 230 gm of a single harvested button mushroom. This opens up novel avenues for cultivation of an otherwise temperate mushroom in tropical and subtropical areas successfully or as a profitable livelihood option without bearing the cost of huge electricity charges and danger of crop failure due to lack of power backing facilities.

TS-02 (PS-01)

Association of bacterial leaf blight disease of cotton with different weather parameters under south Gujarat condition of India

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Main objective of present study is to study the progress of the Bacterial blight disease of cotton (BLB), caused by Xanthomonas campestris pv. malvacearum (Smith) Dye, with relation to the environmental parameters. This is a common disease affecting the growth, development and yield of cotton. A field trial was conducted to determine the influence of environmental factors viz., rainfall periods, temperature, sun shine hours and humidity on the development of disease. Bacterial blight disease was recorded with its appearance and subsequently at weekly interval till it prevailed on G. Cot. Hy. 12 (Non Bt). The incidence of bacterial blight disease (BLB) was noticed during 28 to 49th standard week with the maximum disease intensity in third week of September (23.5% PDI). None of the abiotic factors had significant influence on bacterial blight disease progress and development.

TS-02 (PS-02)

Screening of varieties/ breeding materials for resistance to different diseases in natural condition under south Gujarat region

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Cotton is one of the principal commercial crop and it is the back bone of national economy of our country. Cotton remains the most miraculous fiber and is still nature's wonder fiber. Cotton is grown all around the globe, and is traded internationally as well. The production is influenced by the repeated out breaks of pest and diseases and these are the major factors responsible for lower yield of cotton in India. A field trial was conducted at Main Cotton Research Station (MCRS), NAU, Surat in the year 2015 for a season to determine the influence of different diseases in respect to different varieties/ entries. During the season, entries were evaluated for their reaction against the different diseases in cotton crop. Total thirty nine entries including the checks were evaluated for their reaction against the different diseases. Out of these entries, twenty five entries were observed disease free whereas, six entries as resistant, six entries as moderately resistant and two entries i.e. GBHV-170 and GSHV-185 observed in the Grade 3 against the bacterial leaf blight disease with 12.5 and 11.5 % per cent disease intensity (PDI). Whereas, for Alternaria leaf spot disease, twenty one entries as disease free, sixteen entries as resistant and two entries as moderately resistant against the disease.

TS-02 (PS-03)

Field screening of arthrobacter isolated from different crop rhizospheres on soybean in a vertisol of central India

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Thirteen isolates of Arthrobacter were short listed under field conditions at Research Field of Department of Soil Science and Agricultural Chemistry, JNKVV, Jabalpur during Kharif 2015 to evaluate the efficiency on plant growth, yield attributing characters, seed yield of soybean and availability of nutrients in soil. The experiment was conducted using Randomized Block Design with three replications. Soybean seeds were inoculated with Arthrobacter isolates along with recommended dose of fertilizers with two controls i.e. fertilized uninoculated and unfertilized uninoculated.

The experiment revealed that most of the isolates stimulated early seed germination at 4th and 6th DAS. Maximum germination was recorded with the isolate AR2 (42%) and overall average of all isolates by 25% over FUI while at 6 DAS the highest germination of soybean seed was recorded with AR2 isolate (59%) and the overall average performance of all isolates by 10% more to FUI. Maximum chlorophyll content was recorded with isolate AR2 (2.25 mg/g fresh leaf) which was 25% higher to FUI (1.80 mg/g fresh leaf), shoot length by 23% and plant biomass by 19% all at 45 DAS. Similarly, maximum number of nodules (33%) and nodule biomass (10%) were formed by isolate AR2 followed by AR4, AR9 and AR1. While the highest nitrogen content in nodules was also recorded with the isolate AR2 (3.69%) followed by AR8 (3.55%). With regard to contents of nutrients in plant and grain at 45 DAS, isolate AR2 possessed the top rank in increasing N (2.39%) and P2O5 (0.18%). In context of grain and straw yields at harvest, only three isolates AR2, AR4, and AR7 contributed significantly. Soil pH, OC, and EC remained unaffected due to inoculation with different isolates.

Amongst the 13 isolates, AR2 exhibited the best overall performancefollowed by AR4, AR7 and AR8.

TS-02 (PS-04)

Integrated management of cercospora leaf spots and yellow mosaic disease of mungbean (*Vigna vadiata*) and their impact on yield

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Before going to conducted the experiment an extensive survey was conducted during the kharif 2016 for the record of natural susceptibility in different varieties against cercospora and yellow mosaic disease incidence sown in the six Block of the Narsinghpur district and found that the variety K851 was most susceptible (35.56%) followed by PDM11and TM3. However, variety PDM 139 had less disease incidence (1.69%). On the basis of survey, PDM 11 was taken under demonstration during the summer season of 2017. A set of fungicides,bioesticides and insecticides were tested for seed treatment as well as foliar application and found that seed treated with thiomethaxam(3g) + carbendazim (2g)/kg seed gave highest seed germination (93.9%) than imidacloprid+carbendazim (87.6%) followed by carbendazim+ *T. viride* (82.3%). There ware only 72% germination in untreated control. The combination of seed soaking in 0.1% imidacloprid and dry seed treated with carbendazim+ *T. viride* followed by foliar sprays of 0.1% imidacloprid and 1.5% carbendazim at 30 and 45 days after sowing respectively was the best treatment to minimized the intensity of cercospora leaf spot (5.5%) and yellow mosaic (8.5%). Effect of thiomethazam (0.1%) and carbendazim (0.1%) was at par. All the treatment ware significantly effective than control plot. Amongst the treatments, seed treated with thiamethoxam (cruiser 3.5g/kg seed) and sprayed with 0.1% imidacloprid +1.5% carbendazim at 30 and 45 days, respectively produced the highest grain yield (1395 kg/ha). Whitefly population was minimum in thamethaxam (0.2%)+ carbendazim

(0.15% sprayed plot in comparison to imidacloprid (0.1%)+carbendazim (01.5%). Minimum grain yield (587kg/ha) was obtained in control plot.

TS-02 (PS-05)

Influence of biocontrol agent *Basillus subtilis* for the management of brown spot of rice

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Rice (*Oryza sativa* L) Brown spot caused by *Helminthosporium oryzae* is prevalent throughout the rice growing tracts of the country in soils of low pH, low available Potassium and under poor fertilizer and water management in upland ecosystem. The disease affects the leaves and glumes of the host plant, seedling, sheaths, stems and grains quality and causes significant yield losses .

Keeping these facts in view, the study was carried out to evaluate the different concentrations of various newly evolved fungicides In vitro as well as the efficacy of exogenous application of various biocontrol agent Bacillus subtilis combinations in different mode of applications in the field against highly susceptible variety PS 4 for controlling rice brown spot disease .

Among the tested fungicides at different concentrations, Hexaconazole 5% EC at 750ppm was found to be highly effective to check the mycelial growth of H.oryzae (11.3mm) followed by Merger (Tricyclazole 18%+ Mancozeb 62% WP (13.6mm) over untreated check (87mm) after 5days of incubation .

In regard to application of Bio control agent Bacillus subtilis in different mode of application Seedling dip+2nd at 15 Days after transplanting and 3rd application @500 g/ha gave optimum percent disease control 14.56% followed by seed treatment+2nd at 15 Days after transplanting and 3rd application @250 g/ha (29.57%) over untreated check

Thus, it may be concluded that biocontrol agent Bacillus subtilis as seed dressing and its foliar application may be recommended to the growers for effective management under rain fed and irrigated ecosystem to combat the economic losses.

TS-02 (PS-06)

Induced systemic resistance (ISR) by beneficial microbes (a novel strategy for plant protection)

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Plants are central players in a complex food web in which numerous members profusely take advantage of the plant's resources. The plant microbiota are predominantly hosted by the root system, which deposits up to 40% of the plant's photosynthetically fixed carbon into rhizosphere. Several genera of the rhizosphere microbiota, which are referred to as plant growth-promoting rhizobacteria (PGPR) and fungi (PGPF) can enhance plant growth and induces resistance system. The term induced is a generic term for the induced state of resistance in plants triggered by biological or chemical inducers, which protects non exposed plant parts against future attack by pathogenic microbes and herbivores. Induced systemic resistance (ISR) is triggered by certain strains of non pathogenic root colonizing bacteria and fungi, its signaling requires Jasmonic acid and Ethylene which prime the whole plant body for enhanced defense against a broad range of pathogens and insect herbivores. Induced systemic resistance (ISR) emerged as an important mechanism by which a wide variety of root-associated mutualists, including Pseudomonas, Bacillus, Trichoderma, and Mycorrhiza species sensitize the plant immune system for enhanced defense without directly activating costly defences. As a response of ISR, the activities of defense related enzymes viz., phenylalanine ammonia lyase (PAL), peroxidase (PO), polyphenol oxidase (PPO), chitinases and β-1-3-glucanase are enhanced and start the accumulation of phenolic substances. Induced systemic resistance is more sustainable strategy for crop protection, which is systemic, long lasting, having broad spectrum effectiveness and minimizes environmental pollution by reduction in pesticides consumption. Consequently, plants treated with beneficial microbes are larger, healthier and have better yields than plants without them.

TS-02 (PS-07)

Management of lesion nematodes *Pratylenchus* spp. in chickpea by biological means

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The approach of nematode management with bio-control agents will provide an environmental sustainable and suitable for plant and animal health. The lesion nematodes

Pratylenchus spp. is described as one to the major limiting factor in crop production especially in chickpea. Fifteen soil inhibiting fungi were isolated from the Pratylenchus prone soils of different localities and isolated fungi were identified and attempts were made to find out their antagonistic behavior against *Pratylenchus thornei*. Out of 15 fungi, P. pinophilum, *T. harzianum Crisosparium, T. viride,* sp. (T), *Crisosporium sp.* (R), *F. moniliforme, Cladosporium sp.* and *A. alternata* were exhibited positive correlation against the existing population of *P. thornei* and their antagonistic behaviour was tested against *P. thornei*. Reduction in population of *P. thornei* was 90 per cent in the presence of *T. viride.* However, *T. harzianum*, *Crisosporium sp.* (T) and (R), *Cladosporium sp.* were also drastically declined the nematode population. Nematode population was drastically declined in the presence of *T. viride* within 72 hours and further reached minimum after 168 hours, similar trend were shown by other test antagonistic fungi.

TS-02 (PS-08)

Combinations of *Bacillus subtilis* for effective management of sheath blight disease of rice

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Sheath blight disease of rice caused by *Rhizoctonia solani* Kuhn has gained the status of a major disease of rice in Chhattisgarh and yield losses varies from 5.5-20%. Under conditions favoring disease, up to 50% of grain yield may be lost. Soil-borne pathogens are notoriously difficult to control. Crop rotation, breeding for resistant plant varieties and the application of pesticides are insufficient to control root diseases of important crop plants. Since the earliest observations of antagonistic disease suppressing soil microorganisms more than 70 years ago, plant pathologists have been fascinated by the idea that such microorganisms could be used as environmentally friendly biocontrol agents, both in the field and in greenhouses. Sustainable biological control of plant pathogens depends on efficient exploitation of naturally occurring micro-organisms. In an ideal crop ecosystem, interactions between plant pathogens and their antagonists in the infection court would suppress the initiation of infection of the host plant. In a comprehensive study on evaluation of *Bacillus subtilis* for the management of rice sheath blight under field condition revealed two treatment combinations involving two different strains of *B. subtilis* (1) *B. subtilis* ZB87-1/2, 25DAT @ 1.5 gm/lit + *B. subtilis* ZB87- 1/2, 50 DAT @ 2.5 gm/lit; 2) *B. subtilis* ZB87-1/2, 25DAT @ 2.5 gm/lit + *B. subtilis* ZB87-1/2, 50DAT @ 1.5 gm/lit+ Hexaconazole 75%) effective for sheath blight management of rice.

TS-02 (PS-09)

Xoo-NIL's incompatible interaction a positive functions encoded by avirulence genes forms the basis for analyzing diversity in bacterial blight population and r gene deployment

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Bacterial populations are notoriously "shifty enemies" and often circumvent disease management strategies. Deployment of rice varieties has been subject to boom-and-bust cycles and effective resistance to the bacterial blight pathogen, (*Xanthomonas oryzae* pv. *oryzae*), is often short lived, owing to the shift in the pathogen population towards virulent races. Race specific interactions such as those observed between *Xanthomonas oryzae* pv. *oryzae* and rice are thought to follow the gene for gene model which predicts that incompatible interaction are the consequence of positive functions encoded by avirulence genes in the pathogen and corresponding resistance gene in the host. The rice-Xoo is a good model system to investigate the avr gene. The present investigation was therefore carried out by speculating the avr genes in the pathogen based on the phenotypic responses of NILs carrying gene and gene combinations.

In the present investigation the host specific nature/incompatible interactions of the isolates on the near isogenic lines indicated that responses are clearly the result of the molecular cross talk between avirulence gene product(s) and corresponding R gene product(s). The presence of avr genes were speculated corresponding to the complementary R gene(s) present in the NILs carrying gene and gene combinations. Current leads forms the basis for concerted future research particularly on avr gene mapping using molecular markers and formulating gene deployment strategies.

TS-02 (PS-10)

Beneficial microorganisms alleviate abiotic stress conditions

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Abiotic stresses are the foremost limiting factors in agriculture. It is affects plants in different ways and are causes of reduction in crop productivity. In order to increase crop productivity it becomes necessary to evolve efficient technologies for abiotic stress management. Microorganisms could play a significant role in this respect, if we can exploit their unique properties of tolerance to extremities, their ubiquity, genetic diversity, their interaction

with crop plants. Soil microorganisms, if exploited can serve in agriculture for increasing and maintaining crop productivity. Beneficial soil microorganisms can promote growth and increase productivity through mechanisms such as nutrient mobilization, hormone secretion and disease suppression. Besides influencing the physico-chemical properties of rhizospheric soil through production of exo polysaccharides and formation of biofilm, microorganisms can also influence higher plants response to abiotic stresses like drought, chilling injury, salinity, metal toxicity and high temperature, through different mechanisms like induction of osmo-protectants and heat shock proteins etc. in plant cells. Many soil microorganisms such as *Trichoderma harzianum, Pseudomonas syringae, P. fluorescens* and *Bacillus sp.* (tolerance to salinity and drought), *Bacillus polymyxa, Pseudomonas alacaligenes* (tolerance to nutrient deficiency), Arbuscular mycorrhizal fungi i.e. *Glomus mosseae, G. etunicatum, G. intraradices, G. fasciculatum, G. macrocarpum, G. coronatum* etc. (enhancing nutrient uptake) help in alleviating abiotic stresses.

TS-02 (PS-11)

Utilization of PGPF for management of alternaria leaf blight of asalio (*Lepidium sativum* l.) caused by *Alternaria alternata*

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Asalio, an important medicinal plant with significant pharmacological properties has been observed to be generally affected by many fungal pathogens in India. Among them, A. alternata causes severe leaf spot in the northern Indian plains. Phosphate-solublizing Fungi (PSF) functions in soil phosphorus cycle by increasing the bioavailability of soil phosphorus for plants and root associated fungi have been known to benefit plants and are hence referred to as plant growth promoting fungi (PGPF). Five isolates of Aspergillus awamori namely Zinger-Z, Parthenium-P, Red gram-G, Rice leaf sheath-R, Field bean-B different rhizosphere and phylloplane were tested In-vitro and in-vivo conditions. The results showed that Aspergillus awamori isolates were IAA, Phosphorus solublizing activity, Ammonia producing activity, solublizing index in Pikovskaya's medium, Biomass determination and efficacy tests were performed against Alternaria alternata and it is also showed significant results of physiological parameters Relative water content, Chlorophyll content, Membrane stability index and disease index in In-vivo conditions. The IAA activity of all *Aspergillus awamori* isolates were minimum. .However, the phosphorous solublizing and Ammonia producing activity of *A. awamori*-R, *A. awamori*-B and *A. awamori*-Z was higher and medium among the tested isolates.The solublizing index and Phosphate-solublizing activity of all *Aspergillus awamori* isolates was found significant. *A. awamori*-R showed highest halo zone formation. Out of five isolates of *A.awamori*, the highest mycelia growth suppressing ability was recorded by *A. awamori* -Z while least *A. awamori*-B. However, the highest inhibition was recorded in *A. awamori*-G isolates that corresponds to 23.24 percent reduction in mycelia growth when growth medium was amended with ZnSO4. All isolates of *A. awamori* were highly and equally suppressive towards A.

alternata. *A.awamori* culture filtrates of *Aspergillus awamori* amended with $ZnSO_4$ amended culture, exhibited comparatively lower mycelial growth inhibition in comparison to $ZnSO_4$ non amended culture filtrate. The highest biomass production of *A.awamori*-B was recorded in both $ZnSO_4$ amended medium and without $ZnSO_4$ amended medium. The *A.awamori*-P was found highly effective in promoting the physiological activity of the plant In-vitro reducing the Alternaria leaf blight disease incidence.

TS-02 (PS-12)

Evaluation of bio-pesticides for the management of root-knot in tomato nursery beds

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An experiment to manage root-knot nematode (*Meloidogyne incognita*) was conducted consecutively for five years, in tomato nursery bed measuring 1m x 1m with initial population 2-2.5 nematodes per g soil. The biocontrol agents *Paecilomyces lilacinus, Pseudomonas fluorescence, trichoderma harzianum* and *Pochonia chlamydospora* were incorporated in the soil @ 2.5 Kg/ha prior to sowing of tomato seeds. Application of Carbofuran @ 0.3g a.i. /m2 served as positive control.

The result findings revealed that there was a progressive reduction in the population of *Meloidogyne incognita* (79.04) and root gall index (2.50) with 146.0 q/ha yield and maximum ICBR (1:9.16) of tomato in the treatment where carbonfuran was applied @ $10g/m^2$. This was followed by *Trichoderma harzianum* (ICBR, 1:7.46) where final population was noted to be 93.14 N/$200cm^3$ soil with 2.92 root gall index 4.17 at nursery level. Yield was significantly increased (138 q/ha) when compared to control and rest of the treatments. *Psuedomonas fluorescens* stood next in order of efficacy with 95.96 N/ $200cm^3$, 3.29 gall index and 135.67 q/ha yield.

TS-02 (PS-13)

Combined application of fungal and bacterial bioagents, together with fungicide for integrated management of collar rot of chickpea

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Collar rot of chickpea is caused by the soil-borne pathogen Sclerotium rolfsii and management of this ubiquitous pathogen is not possible through a single approach. An integrated approach was adopted by using fungal (*Trichoderma spp*.) and bacterial (*Fluorescent Pseudomonas* and *Bacillus spp.*) antagonist and a fungicide (Propineb 70% WP) for the management of collar rot of chickpea. The highly effective isolate of Trichoderma spp. (Tricho-12), *Fluorescent Pseudomonas* (Pf-17), Bacillus spp. (Bs-6), and fungicide (Propineb 70% WP) was compatible among themselves and caused the highest mycelial growth inhibition of *S. rolfsii* under in vitro condition. The seed dressing talc powder formulation developed form biocontrol agents (Tricho-12, Pf-17 and Bs-6) and fungicide (Propineb 70% WP) was evaluated alone and in combinations as seed treatment against pathogen. All the treatments significantly enhanced the seed germination and reduced the collar rot incidence. The seed treated with a combination of Propineb + Pf-17 + Bs-6 provided the highest seed germination and lowest collar rot incidence.

TS-02 (PS-14)

Studies on efficacy of indigenous biocontrol agents on root-knot disease of tomato caused by *Meloidogyne incognita*

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Root-knot nematode is one of the major pest of tomato parasitizing root system of the plant at every stage of crop growth. One thousand second stage juveniles / 500 gm soil were found to be the damaging threshold level on tomato.

All the biocontrol agents inhibited hatching of eggs and caused mortality of second stage juveniles at all the concentrations under invitro studies.

Soil incorporation of *T. viride, P. fluorescens* and *Bacillus spp.* at different levels produced better plant stand with reduced multiplication of root-knot nematode.

Reduction in number of galls/plant and egg masses/gall due to *M. incognita* with increased plant growth parameters were also noted when the roots of seedlings were exposed

to various concentrations of biocontrol agents. The maximum concentration (9x108) was observed to be most effective among the concentrations of boicontrol agents tested.

TS-02 (PS-15)

Role of root colonizing Trichoderma species in management of alternaria leaf blight of asalio (*Lepidium sativum* l.) caused by *Alternaria alternate*

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Lepidium sativum an important medicinal plant with immense pharmacological properties has been observed to be generally affected by many fungal pathogens in India particularly Alternaria alternata characterized by the appearance of brown necrotic spots on the leaf margin affecting the herb yield. Root colonizing PGPF (plant growth promoting fungi) have been reported to produce substances such as plant hormones to allow plants to utilize decomposing organic matter through mineral solubilization and to suppress plant pathogens in the rhizosphere by antagonistic mechanisms, such as the production of hydrolytic enzymes, aggressive mycoparasitism, competition for saprophytic colonization, and the induction of plant systemic resistance. The effect of six species of Trichoderma isolated from different crops of rhizosphere and their efficacy was assessed under in vitro and in vivo conditions. Under in-vitro conditions, they were screened for their qualitative traits viz., IAA production, phosphorus solublizing activity and ammonia producing activity. Biomass determination and bioefficacy tests were performed against Alternaria alternata. The six Trichoderma species viz., *T. koningii, T.ressei-1* and *T.longibrachiatum* produced higher quantity of IAA. The tri-calcium phosphate solublization activity was recorded only with *T. asperellum* and *T. harzianum*. The *T. koningii* and T.ressi-2 medium ammonium producer while rest four Trichoderma species were minimum ammonium producer. Out of six species of Trichoderma highest suppression was recorded with T.ressei-2 towards the Alternaria alternata. However, the highest inhibition was recorded by metabolite of T. asperellum isolates that corresponds to 38.75 percent reduction in mycelia growth when growth medium was non-amended with znso4. Similarly, the highest inhibition was recorded in metabolite of *T.ressei*-2 isolates when growth medium was amended with znso4. The highest biomass production of *T. ressei*-2 was recorded with $ZnSo_4$ amended medium while the highest biomass of *T. ressei*-1 was recorded with non $ZnSo_4$ amended growth medium. The effect of inoculation of fungal bioagent along with FYM and $ZnSo_4$ was found significant on relative water content (RWC), chlorophyll content, membrane stability index (MSI) and disease index under in-vivo conditions. The minimum disease incidence of Alternaria leaf blight was recorded with the soil application of either *T.ressei*-2+FYM + $ZnsO_4$ or *T.ressei*-1+FYM + $ZnsO_4$.

TS-02 (PS-16)

Genetic variability assessment of *Fusarium oxysporum* f. sp. ciceris using molecular markers

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Fusarium wilt of chickpea caused by *Fusarium oxysporum f. sp. ciceris* (Foc) is a major constraint to chickpea production world-wide. The disease is widespread in the chickpea growing areas of the world and is reported from at least 33 countries, causing 10-15% annual losses. It is more important between the latitudes 30°N and 30°S where the chickpea-growing season is dry and warm (Sharma et al., 2009). Chickpea wilt is gradually prevailing in India as a result of the increased drought condition since last few years. Therefore, the issue needs great attention to enhance the yield (Lines *et al.,* 2008). The disease is soil or seed born (Jamil *et al.,* 2010), which is difficult to control by the use of chemicals or fungicides. The cultivation of resistant varieties is one of the most durable and economical practice for the management of this disease. However, performance of varieties differs from place to place owing to existence of physiological races among the Foc isolates. The identification of pathogenic races of Foc is important for disease resistance breeding and for the efficient use of available Fusarium wilt resistant cultivars in chickpea. Monitoring pathogenic variability of fungus based on DNA markers will greatly help in understanding pathogen diversity and their pathogenicity.

Based on electrophoretic banding pattern of SSR primers, pair wise genetic similarity among different races for genetic diversity was estimated and dendogram was generated using Unweighted Pair Group method with “UPGMA” sub programme of “NTSYS”-pc.

Three dimensions scaling of seven isolates of foc races showed similarity according to principle components analysis. In this accessions divided in to two groups, first group contain only three isolates namely I-9, I-4 and I-80 were divers from other accessions. Group B contained four isolates namely I-28, I-20, I-13 and I-1. Similarity according to principle components analysis race 5 and 4 were placed closely and race 6 was diverse from other races. The similarity co-efficient of the seven isolates of foc based on SSR markers ranged from 0.7 to 0.3 among all the genotypes. Accessions 4 and 5 showed the highest similarity index (0.7), while the lowest (0.3) between 6 and 7.

TS-02 (PS-17)

Eevaluation of biocontrol agents for the management of banded leaf and sheath blight in kodo millet

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Kodo millet (*Paspalum scrobiculatum* L.) is a climate resilient small millet crop and rank third in India under cultivated area after finger millet and little millet. Madhya Pradesh ranks first in area of kodo millet , where the crop is cultivated in 143.37 thousand hectares with average yield of 525.5 kg ha^{-1} (www.mplandrecords.mp.gov.in). The grains of kodo millet are rich in nutritional as well as medicinal properties and can be stored for several years without fear of store grain pests. Earlier, banded leaf and sheath blight (BLSB) caused by *Rhizoctonia solani* was considered to be of minor importance, but during recent surveys, it has emerged as a major limiting factor in kodo millet growing areas of the state. Several rhizospheric fungi and bacteria have been found antagonistic potential for biological control of *R. solani*. In the present study, antagonistic effect of *Trichoderma viride, Pseudomonas fluorescens* and *Bacillus subtilis* was studied as seed treatment and soil application to control BLSB in kodo millet. All the biocontrol agents were found to reduce the relative lesion height (19.1 to 51.4%) and percent disease index (14.8 to 40.3%) of BLSB in kodo millet. Soil application of value added T. Viride @ 1 kg formulation mixed in 25 kg FYM, incubated for 15 days and applied an area of 1 acre at the time of sowing was found best and soil application of *P. fluorescens* + *T. viride* + *B. subtilis* @ 335 g each was at par with the application of *T. viride* to reduce the BLSB incidence in kodo millet. Lowest apparent infection rate (r) of BLSB (0.012 and 0.019 percent per day) and highest grain yield i.e. 2100 kg ha^{-1} and 1992.6 kg ha^{-1}, respectively was also recorded in the same treatments.

TS-02 (PS-18)

Identification of potential flurescent pseudomonas isolates inducing drought tolerance in rice

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Beneficial microorganisms colonize the rhizosohere/endorhizosphere of plants and promote growth of the plants through various direct and indirect mechanisms. The role of microbes in management of biotic and abiotic stresses is gaining importance. These organisms

could include rhizoplane and endophytic bacteria and symbiotic fungi and operate through a variety of mechanisms like triggering osmotic response and induction of novel genes in plants. The development of stress tolerant crop varieties through genetic engineering and plant breeding is essential but a long drawn process, whereas microbial inoculation to alleviate stresses in plants could be a more cost effective environmental friendly option which could be available in a shorter time frame. In order to identify potential fluorescent isolate inducing drought tolerance, seedlings of three rice varieties (IR-64, Sahbhagi Dhan and DRR-42) were raised following biopriming with different fluorescent pseudomonas. Rice seedlings derived from seed treatment with isolates P1, P2, P5, P7, P8, P10, P11, P17, P19, P28, P141, T14 were able to sustain water stress water stress. Current leads forms the basis for concerted future research particularly on field evaluation and application of potential organisms.

TS-02 (PS-19)

Management of collar rot (*Sclerotium rolfsii*) of chickpea through biopesticides

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Seeds of Chickpea (*Cicer areitinum* L.) are valued for human and animal consumption. It contains quality protein (20-23%), carbohydrate (60%) and dietary fibers (7%). Apart from the major source of vegetable protein, the chickpea plant has a unique ability to fix atmospheric nitrogen through root-nodule bacteria. Thus plays a very important role in enriching the soil health and soil fertility.

Among the diseases, collar rot caused by *Sclerotium rolfsii Sacc*. (*Teliomorph: Corticium rolfsii* (Curzi) is a devastating disease problem. Disease was noticed at seedling stage, particularly in wet-soil conditions. The affected plant turned yellow and exhibited sign of rotting at collar region. White mycelium strands were noticed on dried tap root .Presence of white-brown, irregular shaped sclerotia mingled with mycelial was the chief identification symptom at field level.

Efficacy of four biopesticides (*Trichoderma viride, Trichoderma harzianum, Bacillus subtilis* and *Pseudomonas fluorescence*) obtained from TNAU, Coimbatore, PAU, Ludhiana, AAU, Anand and JNKVV Jabalpur was evaluated through seed dressing @10g/kg seed sown under natural sick soil. Seed treated with *Trichoderma viride* resulted in 95% emergence as compared to untreated 82%. Seed treated with *Trichoderma viride* exhibited only 3% infection by *Sclerotium rolfsii* as compared to 17% in untreated seeds. Least (64.7%) disease control was recorded when bacterial bioagent were used.

TS-03 (OP-01)

Management of onion crop to overcome storage disease and increased shelf life in Sagar district of Madhya Pradesh

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Onion (*Allium cepa*) is good source of minerals, vitamins, Polyphenol and a number of phytonutrients. India ranks first in terms of the area under onion cultivation in the world and second largest producer of onions after China, producing 1.6 million MT annually. The onion producing states in India includes mainly, Maharashtra, Karnataka, Gujrat, Bihar and Madhya Pradesh. The onion stored for long period and bulb suffers heavily due to *Aspergillus* spp, *Penicillium* spp, *Alternaria* spp*, Fusarium* spp*, Rhizopus* spp., C*olletotrichum* spp., and *Botrytis spp.* during storage and causing about 35-40 % onion damaged.

Onion is a commercial crop which is grown in 21000 ha area in the Sagar district. Due to poor management and imbalance fertiliser application *i.e.* application of excess nitrogen in standing crop resulting high infestation of fungal diseases in storage. To overcome the problem, KVK Sagar conducted on farm trails on integrated approaches to increase shelf-life of Onion during storage with two treatment i.e. T-1 No use of excessive nitrogen (only 100 kg/ha, in 2-3 split doses within 60 DAT). Seedling treatment of onion with *Trichoderma viride*, spray of 0.1 % Carbendazim before 20 days of harvesting, T-2 as farmers practice (After harvesting curring of Onion). The data on incidence of storage disease were recorded in the storage of demonstration plot as well as farmers practice. The net monetary return and benefit cost (B:C) ratio were calculated based on current market price. Results showed 52.1 per cent control of fungal infection and increased shelf life of Onion in storage, due to this net return increased from Rs. 63000 to 10100 per hectare and B:C ratio 3.62 to 4.54.

TS-03 (OP-02)

Development of diagnostic technique for seed health assessment in pulses

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Seed health refers primarily to the presence or absence of the microorganisms of various kinds. Leguminous crops generally contain more protein commonly carry seed born mycoflora which is a major factor affecting seed health. Concentration of electrolytes leachates were increased in seed leachate may be due to altered permeability of cell membrane caused

by seed borne mycoflora as the storage period increases. Neutral to slightly acidic nature of seed leachate were observed as the pH values shows decreasing trend over the storage period. These seed leachate when titrated with strong alkali solution (NaOH and KOH), the consumption of alkali solution shows increasing trend with the increase in storage period. Staining of seed leachate with basic stain Methylene blue, shows some promising results toward the development of colour chart of varying colour intensities for reference. Both titration method and staining could be further developed as diagnostic technique(s) for seed health assessment of seed lots before sowing.

TS-03 (OP-03)

Cultural, physiological characteristics and yield attributes of milky mushroom (*Calocybe indica* P&C.)

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Present study entitled “Cultural, physiological characteristics and yield attributes of milky mushroom (Calocybe indica P&C.)” was carried out in the Mushroom Research Laboratory, Department of Plant Pathology, College of Agriculture, IGKV, Raipur. Present experiment was conducted to know the physiological requirements for milky mushroom production. Cultural characteristics and radial growth of different strain of Calocybe indica was studied on different media and temperature to know the suitable medium and temperature for its growth and development. Among the tested media and temperatures, the maximum radial growth was observed in strain CI-522 on potato dextrose agar medium and both strain CI-522 and strain CI-524 at temperature 30°C was found to be superior for radial growth with cottony white mycelial growth and entire margin. Spawn development of different strain of Calocybe indica on different cereal grain was also studied. Among cereal grains, sorghum grains took significantly less time for spawn development with strain CI-524 followed by strain CI-4. The minimum time required for spawn run and primordial initiation in both strain CI-522 and strain CI-524 with wheat grains raised spawn and different grain raised spawn also in wheat straw. Higher yield and biological efficiency (%) was recorded in strain CI-524 in sorghum grains raised spawn followed by wheat grains raised spawn. In strain comparison for yield and yield attribute, strain CI-524 was recorded as superior strain followed by strain CI-4, whereas strain CI-1was found as lowest performer. The combination of compost + vermicompost found to be best as casing materials and in combination of wheat + lathyrus found to be suitable straw substrates for cultivation of C. indica.

TS-03 (OP-04)

Electrolyte leakage from pigeonpea seeds incited by seed- borne mycoflora

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Pigeonpea, a very important member of pulses, its seeds also harbours variety of mycoflora which deteriorates the quality of seed during storage. Good and healthy seeds are not only essential requirement but also an important component for any successful production programme. The fungi associated with crop seeds play an important role in seed deterioration during storage. Seed deterioration either due to mechanical damage caused by tissue colonization or production of different type of toxin by the associated seed borne mycoflora which leads to increased leakage of various substances from pigeonpea seeds during the imbibitions stage of seed germination. In this context, electrolyte leakage of seeds from three stored pigeonpea varieties (Rajeev Lochan, ICPL-87119 and Farmer's variety) incited by seed borne mycoflora was studied. The amount of electrolyte leakage as revealed by EC reading of seed leachates was influenced by the type of associated fungal species, type of seed variety and storage periods. The maximum electrolyte leakages (7.00 ds m^{-1}) was induced by *Aspergillus flavus* in variety Rajeev Lochan, by Aspergillus niger and Fusarium udum in variety ICPL-87119 (6.89 ds m^{-1}) and by A. flavus in Farmer's variety (8.74 ds m^{-1}) after 60 days of storage. An increasing trend in Electrolyte leakage was also recorded when the storage period of fungal treated pigeonpea seeds increased from 0-60 days at an interval of 15 days.

TS-03 (PS-01)

Management of seed associated mycoflora of tomato

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Tomato (*Solanum lycopersicon* L.) is a rich source of Vitamin A and C with antioxidants like lycopene and beta-carotene. The important vegetable crop suffers from number of biotic stress of which several are seedborne in nature. In a previous investigation early blight, late blight, wilt, leaf curl was recorded on standing crop grown at farmers back yard field, commercial field and research experimentation during 2016-17.In 12 seed sample from the farmers field nurseries and 18 samples from commercial nurseries analysed by Standard Blotter Method (ISTA, 1996): obtained from 6 villages. Association of Fusarium oxysporum was observed in the range of 1.0-19.0%, *Alternaria alternata* (2.0-12.0%), *Aspergillus niger* (6.0-19.0), *Aspergillus flavus* (6.0-14.8%). Influence of seed treatment with 3 bio-pesticide and 6 chemical fungicides was determined on the association of mycoflora using a pre-tested seed

sample with maximum natural infection (19%) of *Fusarium oxysporum, Alternaria alternata* (12.0%). Efficacy of Carboxin + Thirum (0.2%), Carbendazim + Mancozeb (0.25%) and Copper oxychloride (0.25%) was recorded among the chemical fungicide. Seed treatment with chemical fungicides and bio-pesticides enhanced tomato seed germination.

TS-03 (PS-02)

Study of seed mycoflora in different samples of okra

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Health status of okra seed samples collected from six different locations (Raipur, Kawardha, Bilaspur, Ambikapur, Jashpur and Dhamtari) of Chhattisgarh was studied. By incubation methods (standard blotter, agar plate and 2, 4-D), in total 14 mycoflora (*Alternaria sp., Aspergillus flavus, Aspergillus fumigatus, Aspergillus niger, Chaetomium sp., Colletotrichum sp., Curvularia sp., Fusarium sp., Memnoniella sp., Nigrospora sp., Penicillium sp., Rhizopus sp., Sterile mycelium, Trichoderma sp.*) were detected with varying frequencies in different samples and methods. Frequency of mycoflora was highest 82.5 % in standard blotter method, 81.84% in agar plate method and lowest 78.83% was in 2, 4-D method. Overall mycoflora detected by three incubation methods revealed that seed sample of Dhamtari harbour maximum mean frequency of mycoflora (87.67%) followed by Ambikapur (85.00%), Kawardha (81.33%), Bilaspur (80.67%), Jashpur (78.33%) and minimum in seed sample of Raipur (73.33%).

TS-03 (PS-03)

Growth and yield performance of oyster mushroom (*Pleurotus ostreatus)* on different substrates

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Mushroom is a popular nutrient and protein-rich food of the world. Oyster mushroom is the second most popular mushroom after button mushroom all over the world. Growing medium of the mushroom is generally known as substrate. Substrate is the base of mushroom cultivation same as soil for crops. The present study was conducted with the aim to find out the most suitable substrate for the cultivation of Oyster mushroom (*Pleurotus ostreatus*). In the present experiment Wheat straw, Paddy straw, Mustard Straw and Chickpea straw were used alone and also in a combination of each other with 1:1 ratio(w/w) for the cultivation of Pleurotus ostreatus. The results obtained during the present experiment, maximum yield (460.00 g/kg of dry substrate with 46.00% B.E.), minimum days for spawn run (24.00 days), minimum days for first harvesting (32.00 days), maximum days for cropping period (63.00 days), highest pileus

length and width (9.5 cm and 9.88 cm) were observed at wheat straw while highest number of fruiting body (18.00) and highest number of lob (48.00) was observed in wheat straw + paddy straw. Based on the results obtained, Wheat straw would be recommended as most suitable substrate for the cultivation of Pleurotus ostreatus.

TS-03 (PS-04)

Control of post harvest losses of perishable fruit and vegetable crops

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Losses of fruit and vegetable crops are a major problem in the post-harvest chain. Post harvest losses may be caused by a wide variety of factors, ranging from growing conditions to handling at retail level. Ministry of Agriculture reported that 25-30 per cent of fruits and vegetables in India are wasted. Many practices can be adopted to control postharvest losses. Postharvest handling operations at initial stage such as pre-cooling, sorting, grading, pre-treatment etc. are very important. Dehydration of fruit and vegetables is one of the oldest forms of food preservation and till today it is widely adopted. Dehydration of fruits and vegetables also lowers the cost of packaging, storing, and transportation by reducing both the weight and volume of the final product. Nowadays technology of postharvest management is growing up day-by-day and many advances are made in storage as well as packaging of fruits and vegetables. Modified atmospheric storage, controlled atmospheric storage, vacuum storage etc. are very helpful to extend shelf life. Many advanced technologies have introduced to minimize postharvest losses. A cold chain is a temperature-controlled supply chain. An unbroken cold chain is an uninterrupted series of storage and distribution activities which maintain a temperature range to extend storage life.

TS-03 (PS-05)

Containing *Aspergillus niger* the cause of post harvest black mould disease of Nagpur mandarins

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Nagpur mandarin is an important fruit crop of Central India that faces huge losses due to post harvest rot caused by black mould *Aspergillus niger*. Disease turns devastating when fruits are injured by hail storm. It is required to develop consumer friendly strategies with less environmental risks to reduce the losses. There are some registered fungicides with restricted

use for postharvest decay control in fruits. Some fungicides like benzimidazole and dicarboximide are still available for use but are losing their effectiveness due to resistance developed in pathogens. The promising methods investigated so far are alone not as effective as fungicides. It is necessary to combine these alternatives with chemicals to improve effect of fungicides at lower doses to have reduced environmental hazards. Use of edible wax in combination with antagonists and chemicals is a promising alternative. Thus, this experiment was conducted to test newer fungicides, wax and bioagent in combination against Aspergillus rot of Nagpur mandarin under ambient storage condition. It is observed that these fungicides are effective in controlling Black mould to an extent, but, bioagent Saccharomyces cerevisiae was absolutely ineffective. It is found that on 3rd day Propiconazole 0.1% + Citracine Wax 6% was the most effective in controlling Aspergillus rot/black mould followed by Benomyl 0.1% + Citracine Wax 6%. On 6th day Propiconazole 0.1% + Citracine Wax 6% and Propiconazole 0.1% + Vegetable Wax 6% were at par. On 9th day Propiconazole 0.1% + Citracine Wax 6%, Propiconazole 0.1% + Vegetable Wax 6%, Benomyl 0.1% + Vegetable Wax 6% were the most effective. On 12th day Propiconazole 0.1% + Citracine Wax 6%, Benomyl 0.1% + Vegetable Wax 6% and on 15th day Propiconazole 0.1% + Citracine Wax 6%, Benomyl 0.1% + Vegetable Wax 6% and Propiconazole 0.1% + Vegetable Wax 6%, were at par. Incremental Cost Benefit Ratio shows that the treatment Propiconazole 0.1% + Citracine Wax 6% is more economical with highest Incremental Benefit of 1:2.22 followed by Benomyl 0.1% + Vegetable Wax 6% (1:1.55). Pesticide Residue Analysis of recommended dose of Propiconazole by HPLC technique indicates that this treatment had around 20 times less residues than Maximum Residue Limits set by Europe, Codex Alimentarius Commission, Canada and USA. It is concluded that dipping of Nagpur mandarin (Mrig Bahar) fruits in 1ml/litre solution of Propiconazole followed by coating with 6% Citracine or Vegetable Wax or dipping in 1ml/litre solution of Benomyl followed by coating with 6% Vegetable Wax can protect the fruits from Black mould or Aspergillus fruit rot upto 15 days of harvesting under ambient storage conditions.

TS-03 (PS-06)

Containing *Colletotrichum gloeosporioides* a post harvest pathogen of Nagpur mandarins

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An important fruit crop of Central India, Nagpur mandarin faces losses due to post harvest rot caused by fungus *Colletotrichum gloeosporioides*. It is required to develop user, consumer and environment friendly strategies to reduce the losses. Some fungicides with restricted use are registered for post harvest application to fruits. Fungicides like benzimidazole and dicarboximide, are still in use but are losing effectiveness due to resistance developed in pathogens. Many promising methods are investigated so far but none is found as effective as fungicides. It is required to develop a method that combines such alternatives with chemicals to

improve the effectiveness of fungicides at lower doses for reducing environmental hazards. Use of edible wax in combination with antagonists and chemicals is a promising alternative. This experiment was framed to test newer fungicides, wax and bioagent in combination against Colletotrichum rot of Nagpur mandarin under ambient storage condition. It is found that chemicals are effective in controlling Colletotrichum rot to an extent but bioagent Saccharomyces cerevisiae was ineffective. For controlling Colletotrichum rot upto 12th day Propiconazole 0.1% + Vegetable Wax 6% was most effective with 80.71% disease control on 3rd day, 38.55 % on 6th day, 15.37% on 9th day and 14.29% on 12th day followed by Propiconazole 0.1% + Citracine Wax 6%. On day 15th Propiconazole 0.1% + Citracine Wax 6% was most effective with 11.90% disease control followed by Propiconazole 0.1% + Vegetable Wax 6% with 7.14% disease control. Incremental Cost Benefit Ratio showed that the treatment Propiconazole 0.1% + Citracine Wax 6% is more economical with highest incremental benefit of 1: 3.44. Pesticide residue analysis of recommended dose of Propiconazole by HPLC technique indicated that this treatment had around 20 times less residue than Maximum Residue Limits set by Europe, Codex Alimentarius Commission, Canada and USA. It is concluded that dipping of Nagpur mandarin (Mrig Bahar) fruits in 1ml/litre solution of Propiconazole followed by coating with 6% Citracine or Vegetable Wax can protect the fruits from Colletotrichum fruit rot upto 15 days of harvesting under ambient storage conditions.

TS-03 (PS-07)

Containing post harvest pathogen *Geotrichum candidum* the cause of sour rot of Nagpur mandarins

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Nagpur mandarins are a major fruit crop of Central India. This commercial crop faces heavy losses due to post harvest decay of fruits. Sour rot is caused by a devastating fungal pathogen Geotrichum candidum. This fast growing fungus once attack fruit does not allow it to stand even for a day. Situation gets worse if fruits are injured due to hail storm and atmosphere gets filled with the strong sour smell emitting out of decayed lot. No management practice is suggested for this devastating pathogen so far. In general various methods have been evaluated against post harvest pathogens, and although they show promise, none alone has been found to be as effective as fungicides. Therefore, to manage *G. candidum* it is necessary to develop such strategy which combines these alternatives with chemicals to improve the effectiveness of fungicides at lower doses for reduced environmental risks. Use of edible wax in combination with the antagonists and chemicals may be a promising alternative. Thus, this experiment was conducted to test newer fungicides, wax and bioagent in combination against Geotrichum rot of Nagpur mandarin under ambient storage condition. It is observed that chemicals were effective in controlling Geotrichum rot to an extent, but, bioagent Saccharomyces cerevisiae was synergistic to the pathogen. Here, Propiconazole 0.1% +

Vegetable Wax 6% was found the most effective on 3rd and 6th day followed by Propiconazole 0.1% + Citracine Wax 6% against *G. candidum*,. After 6th day no treatment was found effective. It appears from Incremental Cost Benefit Ratio that the treatment of Propiconazole 0.1% + Vegetable Wax 6% is more economical with the highest Incremental Benefit of 1: 8.03 followed by treatment Propiconazole 0.1% + Citracine Wax 6% (1: 7.54) and Benomyl 0.1% + Vegetable Wax 6% (1: 1.99). Pesticide residue analysis of recommended dose of Propiconazole done by HPLC technique indicate that the treatment had around 20 times less residues than Maximum Residue Limits set by Europe, Codex Alimentarius Commission, Canada and USA. Hence, it is concluded that dipping of Nagpur mandarin (Mrig Bahar) fruits in 1ml/litre solution of Propiconazole followed by coating with 6% Vegetable or Citracine Wax can protect the fruits from Geotrichum fruit rot upto 6 days of harvesting under ambient storage conditions.

TS-03 (PS-08)

A possible agro-forest and herbal wastes utilization approach for the cultivation of oyster mushroom

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In the present study high yielding strain of Pleurotussajor – cajuhave beenselected for screening of suitable agro-forest and herbal waste *viz.*, leaves of sisam, Karanj, mahua, neem, eyculyptus, bamboo and herbal wastes *viz.* straw of ashwaghandha, isabgol, chandrashur compared with wheat straw to find their bio-efficiency and production. Among these substrate, standard wheat straw found to the best growth and substract and give highest biological efficiency (25.50%) followed by combination of ashwaghandha + wheat straw (1:2) gave 20.63 bio-efficacy 21.20% and least (14.31%) bio-efficacy were found in karanjsubstract alone with 429.53 g/kg sporophore.

TS-03 (PS-09)

Effect of weather parameters on the incidence of major insect pests of okra

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A trial was conducted to observe the “Effect of abiotic factor (weather parameter) on the incidence of major insect pests of okra (*Abelmoschus esculentus* L. *Moench*)” during kharif season of 2014 at Entomological experimental field, college of agriculture, JNKVV Jabalpur

(M.P.). Major activity period of jassid (Amrasca biguttula biguttula) was observed from August to October with two distinct peaks during 36th and 37th SW (Standard Week) (131.50 and 136.00 jassid/ per 30 leaves) and Aphid (Aphis gossypii) was observed from August to 1st week October with two distinct peak 36th and 37th SW (46.50 and 44.50 Aphid/ per 30 leaves) respectively while whiteflies (*Bemisia tabaci*) was appeared first week of August to last week of September with two distinct peak 34th and 35th SW (3.83 and 3.33 whitefly/ per 30 leaves). Shoot and Fruit borer, Earias vittella observed from last week of August up to crop maturity 43rd SW with three distinct peak 36th, 40th, & 41st SW (42.00, 41.33 and 41.67 % fruit infestation). Analysis of correlation regression between weather (abiotic) factors and the major insect pests of okra showed that population of *A. biguttula biguttula* had a significant positive correlation with maximum temperature (r=0.58) and (byx=18.15) while *B. tabaci* had a significant positive correlation with minimum temperature (r=0.67) and (byx0.34). While *A. gossypii* and *E. vittella* showed that non significant relationship with abiotic factor.

TS-03 (PS-10)

Composition of macro and micro nutrients in leaves of shoots bearing healthy and malformed panicles as influence by different sources of organic nutrients

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A field investigation was conducted to study the effect of organic and inorganic sources of nutrients on physico-chemical properties of soil under high density mango orchard (*Mangifera indica* L.) cv. Amrapali at Horticulture Complex, Maharajpur, Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.) during 2012-13 and 2013-14. A total of twenty four treatment combinations of inorganic and organic sources on nutrient were tested in factorial randomized block design with three replications. The results of study revealed that higher level of nutrient either in the form of chemical fertilizer or organic sources enhanced the concentration of macro and micro nutrient in leaves. Application 520: 160: 450 NPK g plant^{-1} and Vermicompost (25 kg) + Oil cake (2.5 kg) + Azotobacter + VAM + TV + PSB (100 g each) registered higher concentration of N (2.59 and 2.78%), K (62.90 and 77.82 mg kg^{-1}), Zn (27.33 and 30.03 mg kg^{-1}), Cu (9.53 and 10.51 mg kg^{-1}), Fe (196.93 and 213.10 mg kg^{-1}) and Mn (88.57 and 98.03 mg kg^{-1}) was in leaves of shoot bearing malformed panicle than healthy once. Whereas, higher concentration of P (0.37 and 0.34%) was in leaves of shoots bearing healthy panicle. Similarly, higher dry accumulation was with malformed panicles over healthy one. The minimum severity and intensity (1.8 m2 and 9.42%) of malformed panicle was noted when plant nourished with 100% RDF of chemical fertilizer (415: 130: 360 NPK g plant-1) or (2.2m^2 and 12.15%) organic sources of nutrient (Vermicompost (25 kg) + Oil cake (2.5 kg) + Azotobacter + VAM + TV + PSB (100g each) or its combination registered (1.2 m^2 and 5.56%). The inorganic and organic sources of nutrient increased the organic carbon, available nitrogen, phosphorous and potassium in post harvest form the base value. Further, it was noted that

these sources significantly decreased the bulk density. The soil pH and electric conductivity of soil did not differed significantly when plant received nutrient either in the form of chemical fertilizer or organic sources. The interaction of different sources of nutrient in post harvest soil of high density orchard did not showed any significant effect on physic-chemical property of soil.

TS-03 (PS-11)

Low cost nutritional security through mushroom

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Pleasing flavour, adequate protein content and health values, mushrooms unquestionably represent one of the world's greatest relatively untapped source of nutritious and palatable food. In spite of problems that exist in the cultivation of mushrooms, there is definitely a possibility of using mushrooms in a more important role as a source of protein to enrich human diets and it has also medicinal value mushroom is a natural source of the statin drug Lovastatin, a drug used to lower cholesterol. Research has also shown the oyster mushroom has anti-cancer properties an in vivo experiment showed a beta-glucan isolated from the mushroom reduced colon cancer growths and increased antioxidant activities in rats. More than 50 varieties of mushroom are consumed in India but only three, namely, button mushroom (*Agaricus biosporus*), Oyster mushroom (*Pleurotus ostreatus*) and paddy straw (*Volvariella volvacea*) mushroom are commercially cultivated. Among these, oyster mushroom is very easy to cultivate at low cost. Species of Pleurotus are characterized by rapid growth under wide range of temperature, ability to colonise substrate in short duration and potential to tolerant higher concentration of CO_2 which act as protein cover against competitor moulds. Cultivation of Oyster mushroom represents one of the major current economically profitable biochemical processes for the conversion of waste plant residues into a protein rich food which will help in overcoming protein malnutrition problem in developing countries like India. Nearly 60 kg mushroom is produced in 100 kg of straw. Some disease like dry bubble, wet bubble, green mould, false truffle etc are serious but can be diagnosed controlled easily. Frontline demonstration were conducted by krishi vigyan kendra, Jabalpur the study was conducted during kharif 2015-16 in 5 villages.

TS-04 (OP-01)

New extension paradigm for transfer of technologies including plant diseases and insect-pests management

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A big part of our crop production is being damaged by crop pests in agriculture economy. The importance of agriculture as a viable driver for economic development and sustainable livelihood security. Therefore the effective transformation of technologies for plant diseases and insect-pests management is high need of the hour to save food which may helpful to feed the mounting population of country. Effective extension in agricultural development requires a change of extension approach as a sole strategy in achieving effective and competitive agricultural development. Extension, in the current faces challenges of tackling objectives like promoting environmentally sustainable agricultural practices and efficiently linking of farmers to local and international markets including non-farm employment and enterprise expansion pairing technology transfer with other services relating to both input and output markets. Extension should play the key role to transfer of technical knowledge among the different entities to improve the overall performance of the innovation system. The recent advances in ICT can be used effectively in extension education for transfer to technologies by using digital extension paradigm for transfer of technology. The technology transfer involves a top–town approach that delivers specific recommendations to farmers about the practices they should adopt by 1. Mobile access for audio interaction and messaging 2. Television (audio-video) 3. Interactive video chat through android mobile phones 4. Tele-conferencing 5. E-mail 6. Face book 7. Whats app 6. Computer etc. In the present scientific era the technology, which is profitable, demonstrable, compatible and its dissemination should be quick. The Internet and other forms of computer networking can be of much useful for exchange of markets and other kinds of technical information targeting plant diseases and insect-pests management with the farmers.

TS-04 (OP-02)

Evaluation of antimicrobial activity of antibiotics, fungicides and plant growth promoting activity of fluorescent pseudomonads isolate against *Xanthomonas axonopodis pv. glycines* causing bacterial pustule in soybean

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Bacterial pustule caused by the bacterium *Xanthomonas axonopodis pv. glycines* is a major constraint of soybean. In the present investigation seven antibiotics at five different

concentrations (100, 200, 300, 500 and 1000 ppm) and five fungicides at three different concentrations (0.1, 0.2 and 0.3%) were evaluated in vitro by “disc diffusion method”. Among the antibiotics Tetracyclin found to be most effective for inhibiting the growth of the pathogen almost at all the level of concentrations (12.75 mm, 20 mm, 27.50 mm, 34.25 mm and 40 mm) followed by Chloramphenicol and Streptomycin. Copper oxychloride (23.25 mm and 27.25 mm) and Dithane M-45 (21.75 mm and 27.50 mm) found to be most effective for inhibiting the growth of the test pathogen at 0.1 and 0.2 per cent concentrations followed by Copper sulphate with 15.25 and 21.25 mm zone of inhibition respectively. At 0.3 per cent concentration the performance of Copper sulphate was best with mean inhibition zone of 41.00 mm followed by Copper oxychloride (30.25 mm) and Dithane M-45 (29.25 mm). Among the sixteen isolates of fluorescent Pseudomonads evaluated to find out their effect on seed germination and plant growth promoting activity isolates Pf 33 and Pf 39 found to be most effective for enhancing seed germination and vigour index followed by Pf 35.

TS-04 (OP-03)

Assessment of different management modules for leaf curl disease of tomato in kymore plateau and Satpura hills Agroclimatic zone of Madhya Pradesh

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In order to assess the efficacy of four different management modules including farmers practice for leaf curl disease of tomato, a three years of On Farm Trial (OFT) was conducted on 20 farmers field of Chorgarhi, Mankesher and Upani village of Sidhi district in Madhya Pradesh during 2014-15 to 2016-17. The experimental findings revealed that all the management modules were found superior over farmer’s practice. The module T4 having tolerant variety (Avinash-1)+ seed treatment with Thiomethoxam-75 WG@5 gram / kg seed + Nursery raised in nylon net of 40 gauge mesh for leaf curl management + before transplanting root dip in Imidachloprid -17.8SL (@ 3ml/10 lit. of water) for 30 minute + rouging out and burning of infected plants + two spray of Thiomethoxam-25WG @125 gram/ha before flowering at 25 and 45 DAT was found effective in reducing disease as well as total no. of white fly/plant , Tomato yield (qt/ha) and cost benefit ratio followed by module T3 (Seed treatment with Imidachloprid -17.8SL @ 3ml/10 lit. of water + spray of Neem oil @ 1 per cent in nursery and 25DAT+ need based spray of Imidachloprid -17.8SL @125 ml/ ha before flowering) and T2 (Seed treatment with Imidachloprid -17.8SL @ 3ml/ 10 lit.+ Two spray of Neem oil @ 1 per cent at 25 and 45 DAT). Thus, on the basis of the data, it is considered that module T4 and T3 may be considered for improving sustainable management of leaf curl disease in tomato.

TS-04 (OP-04)

Viable options of artificial intelligence, robotics and the internet of things in agriculture with special reference to plant pathology

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The paper braces the importance of artificial intelligence (AI), robotics and the internet of things in agriculture. The global population is growing at an alarming rate and is burdened with worsening effect of climate change and shrinking resources. To feed this ever growing population the food production must be increased substantially and sustainably. The production of food is resource exhaustive and creates imbalances and stress for natural environment. All this has paved way for development of artificial intelligence based systems and robots connected through internet of things for future agriculture applications. Many AI based solutions for agriculture and farming are available across the globe and many more are in trial phase, robots specifically designed for agriculture have started doing many tasks which actually farmers used to do. The systems thus developed are technically sound, economically viable, easily accessible, user friendly, interactive and are able to take self decision.

TS-04 (PS-01)

Study on technological gap in adoption of system of rice intensification (SRI) by practicing farmers of Mandla District, M.P.

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Rice is the staple food crop of India, providing 43 per cent of caloric requirement for more than 73 per cent of Indian population. The demand can only be met by maintaining the increase in productivity under decreasing trend of land availability and total factor productivity and has to meet the demands for sustainability and preservation of environment quality.Assembly of the practices that culminated in SRI began in the 1960s based on Fr. de Laulanie's observation of 'positive-deviant' farmer practices, starting with planting single seedlings instead of multiple seedlings in a clump, and not keeping irrigated paddy fields flooded during the rice plants' vegetative growth stage. Keeping this in view the study was designed to find out the extent of adoption of recommended practices of SRI technology of paddy cultivation and relationship of the characteristics of paddy growers with their level of adoption. The study was conducted in Mandla district of Madhya Pradesh during the year 2015 to 2016. Total 120 respondents were selected on random basis.

TS-04 (PS-02)

Demonstration of bio-agent and bio-fertilizer against wilt complex of chickpea through seed and soil treatment under natural field condition

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Chickpea (*Cicer arietinum* L.) is an important pulse crop in India and Chhattisagrh, considering rank first in few districts of state, know a day's area under chickpea cultivation is increasing year by year in plain area of Chhattisgarh and specially in Bilaspur district. Among various soil borne diseases, wilt (*Fusarium oxysporum f. sp. ciceris*), dry root rot (*Rhizocotonia bataticola*), collar rot (*Sclerotium rolfsii*) appear every year in the district and state, that reduces the crops yields in considering extend. Since long time the disease appear in the complex form and challenged the cultivation of chickpea in Paddy-Chickpea-Paddy cropping system. In present time, due to the use of harmful potential and conventional systemic and non systemic fungicides, managing soil diseases are inadequate, uneconomical and cause ecological problem due to residues in soil and crops. Keeping in the view, investigation and large scale demonstration were taken at village Nawgaon block Bilha dist Bilaspur in Rabi season of years 2012-13, 2013-14 and 2014-15 to minimize the incidence of wilt complex pathogen by seed and soil treatment with Trichoderma harzianum & Rhizobium and dibbling by seed cum fertilizer drill. The seed treated with Trichoderma harzianum + Rhizobium along with soil application of T. harzianum enriched FYM were found most effective to reduce the incidence of wilt complex of chickpea (70.66%) and recorded the number of root nodulation (35.90), fresh wet (45.93 g), dry wet (27.25 g) of chickpea plants and obtained maximum yield 8.80 q/ha compared to farmers practices (20.28% mortality/sq., number of root nodulation (30.25), fresh wet (38.62g), dry wet (18.31g), yield 6.78 q/ha) without inoculation of bioagents and biofertilizer in avg. of three years.

TS-04 (PS-03)

Indiscriminate use of insecticides leads to resistance development in pests in soybean

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Now a day, the greatest challenges are indiscriminate use of pesticides that leads to resistance development in pests were studied through randomly survey in Harda district of Madhya Pradesh during kharif 2017-18. Resistance is a genetically based characteristic that allows an organism to survive exposure to a pesticide dose that would normally have killed it. They spread due to process of selection brought by repeated pesticide use in crop. The

discriminate use of pesticides have posed many environmental and health problems. The soybean crop benefit ratio was affected by many factors viz., dose of pesticides, recommended quantity of water, frequently use of pesticides, wetting period of pesticides and pest stage. Out of them, increases in dose of pesticide and decreases in water quantity per ha directly affected the pesticide resistance, these factors simultaneously low down the net profit to farmers. The average diseases incidence and infestation, Arial blight (5.88%), Yellow mosaic (5.42%), Collar rot (1.00%), white fly 4.12% and stem fly (3.28%), where, the average yield 8.12 qtls per ha were recorded in Harda district.

The correlation coefficient (r) between average diseases incidence percent and yield of soybean (Arial blight -0.728**, Yellow mosaic -0.680*, Collar rot -0.360, white fly -0.409* and stem fly -0.484* was observed. This indicates that the average soybean yield was gradually decreased at the maximum disease incidence / infestation.

The regression equations between average disease incidence/ infestation and average yield were studied. The regression equation Y1= 14.50-0.959 X1 reveals that the maximum average disease incidence percent should not be more than 15.11 % for the given average yield and thereafter with 1% disease incidence, it decrease in average yield by 0.959 qlt per ha. The low benefit cost ratio (1.43:1) has been low down which is due to farmer get very less net profit in soybean crop during kharif 2017-18. Hence, It is concluded that the implementation of integrated disease/ pest/ nutrient management would be better option to break out the development of resistance in pest and increase of benefit cost ratio.

TS-04 (PS-04)

Containing post harvest Trichoderma rot of Nagpur mandarins

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Nagpur mandarin is a major fruit crop of Central India that faces huge losses due to post harvest fungal pathogens including a minor pathogen Trichoderma spp. that contributes to losses to an extent. Due to continuous focused efforts taken for managing major pathogens it is possible that this minor pathogen may turn as a major pathogen. Therefore, it is required to develop a line of action that covers the minor pathogen as well. Some fungicides with restricted use have been registered for post harvest decay control in fruits. But development of resistance in post harvest pathogens is observed for fungicides such as benzimidazole and dicarboximide that are still in use. To raise consumer confidence it is necessary to find alternatives with reduced environmental risks. Some promising methods are reported but none alone are as effective as fungicides. Hence, it is necessary to devise a strategy for combining these alternatives with chemicals for improved effectiveness of fungicides at lower doses to reduce environmental risks. Use of edible wax in combination with antagonists and chemicals is one of such methods. Therefore, in this experiment newer fungicides, wax and bioagent were

evaluated for management of Trichoderma rot of Nagpur mandarin under ambient storage condition. In this experiment chemicals were found effective to certain extant but bioagent Saccharomyces cerevisiae was ineffective. Among the treatments on 3rd day Propiconazole 0.1% + Citracine Wax 6% was most effective followed by Imazalil 0.1% + Vegetable Wax 6%. On 6th day Imazalil 0.1% + Citracine Wax 6%, Imazalil 0.1% + Vegetable Wax 6% and Propiconazole 0.1% + Vegetable Wax 6% were at par. On 9th day Imazalil 0.1% + Vegetable Wax 6% was the most effective followed by Propiconazole 0.1% + Vegetable Wax 6% and Imazalil 0.1% + Citracine Wax 6%. On 12th day Propiconazole 0.1% + Vegetable Wax 6%, Imazalil 0.1% + Vegetable Wax 6%, Imazalil 0.1% + Citracine Wax 6% were at par. On 15th day Propiconazole 0.1% + Vegetable Wax 6%, Imazalil 0.1% + Citracine Wax 6% and Imazalil 0.1% + Vegetable Wax 6% were at par. Incremental Cost Benefit Ratio indicates that the treatment of Propiconazole 0.1% + Vegetable Wax 6% is more economical with highest Incremental Benefit of 1:17.10 followed by Propiconazole 0.1% + Citracine Wax 6% (1:12.07) and Benomyl 0.1% + Vegetable Wax (1:10.12). Pesticide residue analysis of recommended dose of Propiconazole done by HPLC technique indicate that this treatment had around 20 times less residues than Maximum Residue Limits set by Europe, Codex Alimentarius Commission, Canada and USA. It is concluded that dipping of Nagpur mandarin (Mrig Bahar) fruits in 1ml/litre solution of Propiconazole followed by coating with 6% Vegetable or Citracine Wax or dipping in 1ml/litre solution of Imazalil followed by coating with 6% Vegetable or Citracine Wax or dipping in 1ml/litre solution of Benomyl followed by coating with 6% Vegetable Wax can protect the fruits from Trichoderma fruit rot upto 15 days of harvesting under ambient conditions.

TS-04 (PS-05)

Biotic invasions and biodeterioration of reading material in libraries

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Preservation and conservation of reading material present in the library from biological attacks is one of the most crucial tasks to enhance the usable life of precious reading material and to preserve and conserve it for future generation. Reading material is vulnerable for infection, growth and proliferation from many organisms. The activity of these organisms can cause damage, cracking, loosening, bratticing discolouration, staining, yellowing, deterioration, weakening of paper, decreasing life of reading material and many more ill, disastrous and irreversible consequences. The major constraint in the problem is to make the reading material available to the readers all the time and to simultaneously kill or remove the infectious infestation from the reading material without damaging it. Multiple strategies have been adopted to prevent biotic invasions and prevent biodeterioration of library reading material but still lot more has to be done due to the fact that numbers of paper based reading materials are increasing in libraries at an exponential rate. Suitable preservation policies need to be framed and seriously implemented to safeguard his resource.

TS-04 (PS-06)

Farmers awareness about seed treatment in chickpea in Narsinghpur district of MP

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Narsinghpur district in MP is growing Gram 80-90 000 ha. Area in last two years, it is observed through a study conducted with the help of RAWE students 2017. 125 farmers were surveyed by purposively selecting KVK adopted Villages for the purpose of study about awareness of seed treatment in Gram by Fungicide (Carbendazim) @1.5-2 gm followed by Rhizobium, PSB and Trichoderma, 5 gm each were studied, it is observed that 80 per cent selected farmers know the benefits of Seed treatment as per guided by Krishi Vigyan Kendra Narsinghpur Scientists. But out of that only 20 per cent adopted seed treatment as mendatory activity in Gram and these selected also know that after Wilt and root rot no remedy is to Control these diseases in Gram. This shows the impact of Krishi Vigyan Kendra Narsinghpur trainings about Gram cultivation. It is revealed in this study that farmers awareness is good about seed treatment and adoption is less due to lake of their interest in seed treatment in Gram because of hurry in sowing, non availability of Seed treatment fungicide, Biofertilizers in time and near to their village as observed during this study.

TS-04 (PS-07)

Study the prevalence of grain smut of little millet (*Panicum sumatrense*) in farmers field

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The status and prevalence of grain smut was recorded in farmers field covering 24 villages in 9 blocks of 6 districts of Madhya Pradesh. During field survey only early maturing cultivars locally known as Mejhari were found to be infected with grain smut causing pathogen. Late maturing cultivars locally known as Medo were free from infection. Grain smut incidence 0.0 to 31.7% with a mean of 11.9% was recorded in 6 villages belonging to 2 blocks of Rewa district. Average grain smut severity was recorded 1.2%, which was highest in Khatkari village of Hanumana block. Out of six surveyed villages, grain smut incidence in little millet was not observed in Khairao Mauganj block, Pidaria and Deora of Hanumana block of Rewa district. In Satna district, grain smut incidence and severity varied from 0.0 to 27.5%and 0.0 to 2.1% with a mean of 1.2%, respectively were recorded in 3 villages of Majhagavan block. Maximum grain smut incidence with highest smut severity was recorded in Madwa village, whereas, grain smut incidence was not observed in Saraundha village.

TS-04 (PS-08)

Major crop diseases and thier control measures for kharif crops of Narsinghpur district Madhya Pradesh

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The major diseases and pests found for soybean crop in Narsingpur district of Madhya Pradesh were Bacterial leaf blight (*Xanthomonas campestris*), Leaf spot (*Colletotrichum dematium, C.Lindemuthianum*), Rust (*Phakospora sp*.), Yellow mosaic disease (virus), Tobacco caterpillar (*Spodoptera litura*), White flies (*Bemisia tabaci*), Girdle beetle (*Oberiopsis brevis*). For girdle beetle control spraying of Chloropyriphos/Quinolphos (25 EC .05% or Triazophos 1% spray), for control of Borer and caterpillar- Imamectin benzoate (5 SG 40gm Rynxypyre 30ml per 200 lit. water), for sucking pest control - neem oil (5ml per lit. water), Imidachloprid (0.5ml per lit. water or in 250 lit.), for control of disease leaf spots- Tricyclazole (2.5gm per lit. water), for control fungal disease- DM 45 Dithane M45 (2gm per lit.), Bavistin (.02% or other copper fungicide) were found very effective. The major Sugarcane diseases found were Sugarcane red rot (*Colletotrichum falcatum*), Grassy shoot (*Micoplasma*), Leaf spot (*Helminthosporium sacchari*), Mosaic (virus), Insects shoot borer (*Chilo infuscatallus*) and pyrrila (*P. purpusilla*) and their control measures are same as described above. The major diseases and pests found for Pigeonpea (tuar, arhar) are wilt (*Fusarium oxysporum*), sterility mosaic (virus), leaf spot (*Cercospora indica*) insects like pod borer (Heliothis armigera), leaf webber (*Maruca vitrata*), tur plum moth (*Exelastis atmosa*).For wilt Trichoderma viridae 5kg per/100kg.FYM/hectare for soil treatment before sowing and pests control measures are same as described above. Diseases and pests found in black gram and green gram were Alternaria leaf spot, (*Alernaria sp*.), leaf spot (*Cercospora sp*.), powdery mildew (*Erysiphae sp*.), Sulpher fungicide (0.2% or dust), bacterial leaf blight (Xanthomonas sp.), Yellow mosaic (Virus). Insects like pod borer (*Spodoptera litura*), jassids (*Empoasca sp*.), white flies (*Bemisia tabaci*), thrips (*Caliothrips indicus*) and control measures are same. The major diseases and pests found in Rice crop are brown spot (*Helminthosporium oryzae*), leaf spot (*Cercospora sp*.), false smut (*Ustilagenoidea sp.*), bacterial leaf blight (*Xanthomonas sp*.) can be controlled by spraying of streptomycin sulphate 800-1000 ppm), khaira disease (control-soil application of zinc sulphate 25 kg per hectare). The major insects in rice crop are stemborer (*Scripophoga incertulus*), gallmidge (*Orseolia oryzae*), brown plant hopper (*Nilapervata lugens*). Deep summer ploughing, use of resistant varities, chemical seed treatment (fungicide like Bavistin, thirum, vitavax 2gm per kg seed and insecticide Thiomithaxam, Imidachloprid 5gm per kg) rizobium, PSB, Trichoderma viridae, blue green algae etc.), integrated weed management, crop rotation, use of light trap (2 per hectare) and pheromone trap were other control measure which found very effective for kharif crops during 2013-17 for Narsingpur district.

TS-04 (PS-09)

Assessment of improved technology on productivity and profitability of chickpea crop

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Chickpea (*Cicer arietinum* Linn) is the most important pulse crop of Chhattishgarh state in rabi season and soil borne root infecting fungi are limiting factor to reduce plant population, growth and development of crop and ultimately yield potential. Trichoderma is a biological control agent and it has antifungal, antinematode, plant growth promoting and plant defense inducing activities. Rajnandgaon district is situated in southern part of Chhattisgarh State and lies at 19.57o N to 21.42o N latitude and from 80.23o to 81.31o E longitude. Krishi Vigyan Kendra Rajnandgaon CG conducted Frontline Demonstration on Farmers Field Kharif 2016 under NMOOP Programme. During this demonstration, an area of 40 ha was covered with plot size of 0.80 ha under each demonstration with active participation of 50 Farmers. Improved technology of soil health card based fertilizer application including seed treatment of mancozeb and carbendazim @ 3gm per kg seed, Rhizobium + PSB + Trichoderma @ 10 gm respectively per kg seed. Existing farmer practices as control were taken for the comparison. Chickpea variety JAKI 9218 showed significant yield achievement 13.7 q per ha under improved technology while in farmer practice 8.5 q per ha and it was 61.17 % higher than farmer practice. Application of Trichoderma @10 gm per kg of seed including Rhizobium + PSB, chemical fungicide and use of balance fertilizer improved root nodulation, yield, net return and B:C ratio. Therefore, it is suggested that for achieving sustainable higher production, productivity and management of soil borne disease of chickpea, improved technology of seed treatment with chemical fungicide including Rhizobium, PSB and Trichoderma inoculation adoption is necessary.

TS-05 (OP-01)

Insect and disease management in organic crop cultivation for sustainable agriculture

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Organic crop cultivation is way to save the health of the soil and human both. The farmers dependency on agri-business companies for seeds, fertilizers and pesticides will be reduced which may save their cost of cultivation also. Our land will keep giving us returns for extended periods of time. The general approach in organic agriculture to deal with the causes of a problem rather than treating the symptoms also applies for pest and diseases. Therefore, management is of a much higher priority than control. The control of insect pest and diseases under organic cultivation needs to be protecting our crops by using practices like biological, mechanical control and natural pesticides. The chemical control measures not accepted for plant protection strategies. Knowledge about plant health and pest and disease ecology helps the farmer to choose effective preventive crop protection measures. As many factors influence the development of pest and disease in crops. This can be accomplished through the right timing of management practices, a suitable combination of different methods, or the choice of a selective method. Some important preventive crop protection measures are the following as selection of adapted and resistant varieties, suitable cropping systems, use of balanced nutrient management, use of good water management practices, conservation and promotion of natural enemies, use of proper sanitation measures and use of organic based insecticide pesticides including with cultural and mechanical practices in crop cultivation are major interventions for insect and disease management in organic crop cultivation for sustainable agriculture production.

TS-05 (OP-02)

Management of downy mildew of bottle gourd (*Lagenari siceraria*) under field conditions

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Pseudoperonospora cubensis, the causal agent of bottle gourd downy mildew. Downy mildew was appeared during the course of investigation. The occurrence of downy mildew were first observed from second fortnight of December 2017 gradually increased during the crop period.The seeds treated with chemical i.e. carbendazim 12% + mancozeb 63% (3g/kg seed) considerably increased germination percentage (93.33%), root length (9.14cm), shoots length (13.11 cm), fresh weight (5.67 g), dry weight (0.66 g) and vigour index (2183.65). The minimum days to first flowering (40 DAS), fifty per cent flowering (45 DAS) and first fruiting (43 DAS).and maximum days to fruit length (37.87 cm) and girth (15.43 cm), Seed treatment with seed pro @

25g/kg + drenchig at first true leaf stage with seed pro @ 5% + spray of (imidacloprid 17.8 SL @ 7.5 ml/15L + neem oil 0.2%) + (tebuconazole 50% + trifloxistrobin 25% WG @ 1g/l) + Fosetyl-Al @ 0.1% + (tebuconazole 50% + trifloxistrobin 25% WG @ 1g/l) + (imidacloprid 17.8 SL @ 7.5 ml/15L + neem oil 0.2%) + Fosetyl-Al @ 0.1%.

TS-05 (OP-03)

Studies on native isolates of fungal and bacterial bio-agents against collar rot of chickpea

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Collar rot of chickpea caused by *Sclerotium rolfsii* Sacc., [teleomorph: *Athelia rolfsii* (Curzi)] is a devastating soil-borne disease of fungal origin, causing heavy economic losses (Kokub *et al.,* 2007). It is reported almost all over the world wherever chickpea is grown, due to which 10 to 30% yield loss is recorded annually according to severity of the disease. It is more serious at seedling stage causing plant mortality ranged from 54.7 to 95%. The present investigation was undertaken to find out bio-efficacy of twenty native isolates of *Trichoderma spp.* isolated from rhizospheric zone of eight different crops from different locations of Jabalpur by using serial dilution method against *Sclerotium rolfsii* and their effects on growth parameters of chickpea plant. In vitro screening of Isolates (20) of *Trichoderma spp.* against *Sclerotium rolfsii* was done by dual culture technique with 87.41 and 39.78% of maximum and minimum per cent zone inhibition recorded with T-20 and T-7 isolate. On the basis of cultural and morphological characters best eight isolates; one from each host were selected for further studies in polyhouse. Tr-7 was found to be most effective with minimum seedling mortality of 6.67%. Soil inoculation was found more effective as compared to seed treatment in controlling seed rotting as well as seedling mortality. Whereas, seed treatment of bio-agents found to be more effective on growth promotion as compared to soil inoculation. In combination treatments some isolates of *Trichoderma spp.* were found to be synergistic (Tr-2, Tr-4, Tr-6, Tr-7 and Tr-8) whereas, some exhibiting antagonistic effect (Tr-1, Tr-3 and Tr-5) with Pseudomonas fluorescence.

TS-05 (OP-04)

Impact of organic farming on system based high value crops and dynamics of nematode community structures

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Under the micronutrient and organic supply system in paddy, population of Hirschmanniella oryzae declined in neem cake with vermicopost and intercropping in the plots where 50 per cent N was supplied as FYM + rock phosphate and bio fertilizers. Application of FYM, neem cake and vermicompost and combination of neem cake + vermicopost + organic practices stood subsequently in order of efficacy against dummy plots where maximum population of rice root nematode was encountered. Root infestation was poor in these treatments. Cent percent NPK and micronutrient combinations did not found significantly effective on nematode multiplication. However, the treatment was superior over dummy plots. Population of *Helicotylenchus dihystera* declined in neem cake, vermicompost whereas, intercropping combination population remained at par with FYM, neem cake and vermocompost, FYM + rock phosphate + biofertilizer combinations. Very low population of Hoplolaimus indicus was recorded in few blocks. Study suggests that parasitism of *H. indicus* remained low in rainfed paddy. Although, very low population of *Tylenchorhynchus brevilineatus* was noticed. Non-significant effect of nutrients was noticed on *T. brevilineatus.* Fifty percent NPK and 50 per cent N combination favored multiplication of beneficial nematodes. However, sharp decline in beneficial nematodes was recorded in presence of neem cake.

TS-05 (PS-01)

Evaluation of different plant extracts as seed treatment to manage seed mycoflora of okra

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Four plant extracts viz. neem, garlic, Cassia tora and ginger extract (10 %, 20 %, 30 % and 40 % for different soaking period 0, ½, 1, 2, 3, 4, 5 hours) were used for testing the efficacy of plant extract against seed mycoflora of okra. In case of treatment with neem extract germination was recorded highest (81.40%) followed by 75.70%, 62.80% and lowest was 49.28 % in the concentration of 40%, 30%, 20% and 10 % respectively, in garlic extract seed germination was highest 82.80% in 40 % concentration followed by 68.50%, 60% and lowest germination was 45% in 30%, 10% and 20% of concentration. The seed treated with different plant extract neem extract was recorded with minimum (29.61%) frequency of mycoflora followed by Cassia tora extract (32.08%), ginger extract (32.28%) and maximum frequency was

found in garlic extract (33.53%). In case of soaking period average highest germination was observed in five hours of soaking period (74.69%) followed by four hours (73.13%), three hours (69.69%), two hours (61.56%), one hours (55.94%), half hours (50%) and lowest germination was observed in zero hours of soaking period (48.44%).

TS-05 (PS-02)

Use of sacred basil for organic plant disease management

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Sacred basil (*Ocimum sactum*) plant has many antimicrobial properties. Its extract and essential oil show antifungul activity against a wide range of fungi. Now-a-days development of bio-pesticides have been focused as a viable disease management strategy for organic agriculture. Therefore, in present investigation different forms of sacred basil viz. powdered, crude and , boiled extract were evaluated against ten fungal pathogens viz. *Rhizoctonia solani, R. bataticola, Phoma sorghina, Colletotrichum gloeosporioides, Fusarium pallidorosem*, *F. oxysporium f.sp. ciceri, Sclerotium rolfsii, Sclerotinia sclerotiorum*, *Alternaria solani* and *A. alternata* by poisoned food technique. The effective forms were tested against fungal pathogens under four concentrations (5, 10, 15 and 20%) for standardization. The results showed that leaf extract in the crude form @15% and 20% concentrations significantly inhibited the growth of *F. oxysporium f.sp. ciceri*. Among all forms leaf extract in powder form (@20% concentration) was found significantly superior and inhibited the growth of *Sclerotinia sclerotiorum* (77%). All forms of plants extracts effectively and significantly inhibited the growth of *F. oxysporium f.sp. pallidoroseum*. The leaf extract is more effective at higher concentration (20%).

TS-05 (PS-03)

Evaluation of Aspergillus terreus for management of charcoal rot of soybean

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India produces 10.43 million tons of soybean from 10.83 million hectare with productivity of 959 Kg/ha. Madhya Pradesh shares 53% in area and 58% in total production. Soybean suffers from several biotic factors but charcoal rot caused by the fungus *Macrophomina phaseolina* (Tassi) Goidanich is among the five top most important soybean diseases, causing huge annual losses. The antagonistic potentials of, *Aspergillus terreus* was evaluated against *M. phaseolina* through dual culture technique. However, the effect of culture filtrate of Aspergillus terreus on growth of test pathogen was studied by the poison food technique. The physiological parameter of crop and disease incidence was recorded through standard

methods. The tested nine isolates of A. terreus significantly suppressed the mycelia growth of *M. phaseolina* under dual culture method. The highest reduction in radial growth of test pathogen was recorded with isolate 3 followed by isolate 9 after 48 hours. All the isolates markedly reduced the growth of *M. phaseolina* at 72 hours. Under poison food technique, the significantly growth inhibition was recorded with isolate 1 followed by isolate 2 and isolate 3 at 48 hours. The highest growth inhibiting ability of isolate 1 followed by isolate 3 and isolate 2 was recorded at 96 hours. The isolate 1was was found inhibitory towards test pathogen throughout the studied period. The highest relative water content (RWC) of soybean leaves was recorded in isolate 1 treated plant under in-vivo condition. Similarly, the lowest disease incidence was also recorded with the same isolate (isolate 1). Treatment effect of culture filtrate of different bioagents on chlorophyll content of the plants was not much pronounced, with or without inoculation of *M. phaseolina*. The chlorophyll content of the plant was not much affected with the inoculation of test pathogen as the highest chlorophyll content (31.4%) was recorded in isolate 7 in pathogen inoculated and un-inoculated conditions.

TS-05 (PS-04)

Upright distribution of root lesion nematodes (*Pratylenchus thornei*) under chickpea – maize crop alternation

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Root-lesion nematode (*Pratylenchus thornei* Sher and Allen) is a migratory, endoparasitic nematode commonly fed and reproduced in the cortical tissue of host. *Pratylenchus thornei* is a threat to the legume and cereal cultivation. Lesions are developed when they are severe infesting in host. To determine the vertical distribution of *P. thornei* in chickpea-maize crop rotations, the samples were collected from different level of soil depth separately during rabi-2016 and kharif-2017 respectively. The size of sample was 1 kg/depth and replicated thrice. The samples were processed with Whitehead tray extraction method and *P. thornei* populations were examined. Distribution of *P. thornei* in chickpea field was enormous and they were between four to 22 inch of the soil depth and nematode encountered from 600 to 5000 N/ 200 cm^3 soil and 100 to 1700 N/ 5g of root from chickpea. The samples collected from rhizospheric soils of maize and examined for their distribution from the previous crop soil and were examined for their distribution pattern, *P. thornei* was maximum (1000-1200 N/ 200 cm^3) between 12 to 18 inch soil depth when Maize was grown-2017. However 10 inch soil depth was found ambient for extraction of nematodes and the soil below the depth 16 inch was scarcity of *P. thornei* populations in maize soils. Simultaneously extraction of the maize root samples their ware *P. thornei* free zone fails to sustain the nematode populations.

TS-05 (PS-05)

Plant disease management in organic farming

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In the recent decades importance of organic farming has significantly increased. Most of horticultural crops are eaten fresh or used for health care and hence any contamination in the form of pesticide may lead to major health problems. During organic forming, most soil born diseases can be naturally suppressed by the soil tillage, intercrops and crop rotation. To control diseases, insects, weeds and other pests, organic farming relies on crop rotation, crop residues, animal manures, legumes, green manures, off-farming wastes, cultural practices and mineral bearing rocks. Continuous use of chemical pesticide leads the development of resistant strains, environmental pollutions and adverse effect on the beneficial micro-organisms and this is a greater concern of global food safety and security. Recently, many botanicals are used to spray crops to keep free from diseases and transmitting vectors. Bio-control agents such as Trichoderma, Pseudomonas, Bacillus and Paecilomyces are available in different formulations and used to manage various types of diseases in organic production system.

TS-05 (PS-06)

Organic storage of green gram in pro super bag in the demonstration on field of farmer

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Green gram (*Vigna radiata* L.) grown by Hoshangabad farmers in zaid season as a cash crop. After harvesting of green gram at the end of June and the first week of July. The storage problems occur due to high level of humidity and onset of monsoon. In the present study we have introduced pro super bag based on hermetic storage system in the demonstration year 2015-2016. After six month the stored green gram it has been observed that in green gram there is pest infestation, moisture content and the germination percentage. The results showed that stored in gunny bag for six months the pest infestation is 20% and the moisture content increase 10 to 20%. In case of stored in pro super bag no pest infestation occurs whereas germination percentage is found more than 95%, and the market price of green gram is increased 40% in comparisons to green gram stored in gunny bags.

TS-06 (OP-01)

Molecular approaches for diagnosis of fungal pathogens

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The trend for globalization in agriculture creates even higher demands in various aspects of plant protection. With the advancement of international commerce that practically cancelled the geographic boarders between countries, requires more strict legislation to check the movement of plants and plant materials. Phytosanitary inspections and quarantine regulations became more stringent demanding increased control measures not only between countries but also within the territories of a certain country. Selection of healthy and disease free propagation materials to the prevention of spread of a pathogen to another country, screening of mother plants for certain pathogens, monitoring of resistance phenotypes of a fungus to certain agro chemicals are among challenges encountered on a routine base.

Fungal pathogen incites very serious diseases in plants and responsible for considerable yield losses. All disease management programmes need a simple, safe and rapid and cost effective method of pathogen detection. Though visual identification of plant disease is the most rapid and cost effective method of disease diagnosis, but it is difficult for inexperienced personal and is also limited particularly to disease affecting aerial parts of the plants. Other method of pathogen identification is based on observed morphological characteristics by microscopic examinations of the diseased tissue, this method also require highly specialized taxonomists, which are now rarely available. Various problems associated with micro scopical detection of plant pathogens can be overcome by protein/ Nucleic acid based detections. These methods are very robust and repeatable. Protein based assay ELISA may be very useful in fungal pathogen diagnosis**.** The nucleic acid based detections can be used at any developmental stage of plant since all living cells contain entire set of genome and not affected by environment. A wide range of Molecular markers can be explored for quick and reliable diagnosis.

The application of these technologies in plant pathology has greatly improved our ability to detect plant pathogens and is increasing our understanding of their ecology and epidemiology. Although molecular methods, such as polymerase chain reaction (PCR) and molecular hybridization, are routinely used in the diagnosis of human diseases, they are not yet widely used to detect and identify plant pathogens because of cost and other constraints. The presents review presents some of the diagnostic tools currently used for fungal plant pathogens and describe some novel applications.

TS-06 (OP-02)

Effect of silicon on disease resistance, morpho-physiological and yield attributing traits in rice

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Silicon (Si) is considered as a beneficial element and play a vital role for enhancing the growth and development as well as creating disease resistance in the plant system. It is excluded from any formulations of nutrient solutions but exhibits higher uptake in rice crop resulting the development of disease resistance particularly against leaf blast, brown spot, sheath blight and grain discoloration.

Keeping these facts in view, ,the present study was undertaken to evaluate five rice hybrids and one high yielding rice variety (BPT5204) to understand the role of silicon under irrigated ecosystem. The experiment was layout in RBD with three replications. Control plot (T1) was maintained without the solublizer or silixol application but were sprayed with water at the four growth stages viz; at active tillering, panicle initiation, 50% flowering and milky grain stages whereas, silicon solubilizers Imidazole (T2) @ 1g/ l water is solublized and sprayed and T3 Silixol @ 400 ml in 200 liters/acre were used in all the four growth stages in the tested varieties under irrigated ecosystem

Among the tested silicon solublizer, Silixol treatment enhanced the germination percentage, plant height, leaf area, total dry matter (TDM), harvest index (HI), grain yield and disease resistance (leaf blast, brown spot and sheath blight) in all the tested hybrids and variety BPT 5204 as compared to other treatments over untreated check.

TS-06 (OP-03)

Molecular characterization of yellow mosaic disease of soybean and their collateral and alternate host

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Total 216 yellow mosaic disease samples were collected during 2012-2015 from 24 districts i.e. AshokNagar, Barwani, Bhopal, Damoh, Dewas, Dhar, Guna, Gwalior, Indore, Jabalpur, Jhabua, Katni, Khargone, Mandsaur, Narsinghpur, Raisen, Rajgarh , Ratlam, Sagar, Satna, Sehore, Sajapur, Ujjain and Vidishaof Madhya Pradesh from different crops *viz. Abelmoschus esculentus*, Bean, *Cajanus cajan, Capsium annum, Ficus benghalensis, Glycine max, Gossipium sp., Laurel sp., Luffa cylindrical, Phaseolus vulgaris* (bean), *Phaseolus vulgaris*

(french bean), *Sesamum indicum, Solanum melongena, Vigna mungo, Vigna radiate* and weeds. 45 weed samples from 13 districts namely Barwani, Damoh, Dhar, Indore , Jabalpur, Jhabua, Katni, Khargone, Narsinghpur, Raisen, Sagar, Satna, Ujjain were also collected.

The weeds and other crop plants showed the yellow mosaic disease symptom were collected and extracted the DNA for amplification of MYMIV gene. Three weeds viz. Sidasp, Carcorus sp. and Desmodium rotundifolium were showing amplification with AV1, AC2 and AC3 primer of MYMIV. Similarly many crop plants also selected for amplification of such gene. Out of these *Vigna radiate* (Mungbean), *Solanum melongena* (Brinjal) Frenchbean, chilli (*Capsicum anum*), sesamum (*Sesamum indicum*), bhindi, (*Abelmuschusisculentus*) urdbean, (*Vigna mungo*) beans (*Phaseolus vulgaris*) and *Cajanus cajan* (Arhar) also showed amplification with AV1, AC2 and AC3 primer of MYMIV. To confirm the infectivity of MYMIV virus on different crop plants and weeds sequencing of amplified product also undertaken and blast result showed the identity with MYMIV. Hence brinjal, French bean, arhar, mungbean, beans, chilli, sesamum, urdbean could be exist as collateral host for survival and perpetuation of particle of MYMIV virus. Some of the annual weed viz.Carchorus sp. also served as reservoir of MYMIV virus.There is no significant difference between MYMIV strains isolated from soybean, weed and other legumes. Phylogenetic tree indicates that there is no crop and geographical specificity within the strains of MYMIV. The sequences of 11 districts Indore, Jhabua, Mandsaur, Sagar, Ujjain, Dhar, Narsinghpur, Sehore, Bhopal, Katni, Jabalpur were used to make phylogenetic tree. In all 38 MYMIV strains of M.P fall in one major cluster along with 5 standard strains of MYMIV. Two standard MYMV DNA A forms separate cluster and it does not contain any M.P MYMV strains.

TS-06 (OP-04)

Molecular characterization of *Alternaria alternata* causing fruit rot of chilli through RAPD marker

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Molecular variation in chilli fruit rot pathogen (*Alternaria alternata*) was analyzed by using six isolates collected from major chilli growing region of Maharashtra. The genomic DNA extracted from each isolate of *A. alternata* was subjected to polymerase chain reaction using 15 primers of OPA and OPB series off which 10 primers produced 83 scorable bands with size ranging from among the RAPD primer 83 bands 80 bands were polymorphic and level of polymorphism was 96.38%. Molecular diversity using RAPD marker showed that the Aa2 (Satara) having higher similarity index with Aa4 (Akola). Dendrogram generated by pooled molecular data of 10 RAPD primers formed two clusters namely ‘A’ and ‘B’. cluster A include Aa1 and cluster B include Aa2, Aa4, Aa3, Aa5 and Aa6. Thus, the molecular characterization of six isolates of A. alternata by RAPD revealed existence of variations.

TS-06 (PS-01)

Pathotype delineation in *Rhizoctonia solani* Ag-1 causing foliar blight in soybean

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Soybean is an important oilseed crop in Madhya Pradesh. Among the several factors attributed to low productivity of soybean, damage of crop due to Rhizoctonia foliar blight is substantially important in Kymore Plateau and Satpura Hills Agroclimatic Zone of Madhya Pradesh. The present study was aimed to ascertain the status and pathotype dynamics in Rhizoctonia solani (Kühn) causing foliar blight of soybean. Twenty randomly selected locations were surveyed in three districts *viz.*, Rewa, Satna and Sidhi in two consecutive years. Foliar blight caused is by Rhizoctonia solani anastomosis group-1 (AG-1), intraspecific group AG-1IA and AG-1IB., in which intraspecific group IB was observed as major pathotype in Kymore Plateau and Satpura Hills Agroclimatic Zone of Madhya Pradesh. Aerial blight which were initially thought to be misnomer, Isolates of AG-1IB could be differentiated from AG-1IA on the basis of anastomosis grouping and cultural characteristics on water agar. Maximum production of microsclerotia developed from second week of August to last week of August.

TS-06 (PS-02)

A simple method for isolation of high quality DNA from plant pathogen Alternaria spp.

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Alternaria species are known as major plant pathogens. A simple and easy protocol for isolation of DNA from Alternaria spp. was developed for their genetic studies. For PCR based analysis, pure genomic DNA of high molecular weight is basic requirement. In this method, DNA extraction from fresh mycelium of pure fungal colonies was used. 200 mg of fresh and crushed fungal mycelium was transferred to a sterilized 1.5 mL micro centrifuge tube with the help of sterilized scalpel and added with 800 mL of DNA extraction buffer. The mixture was vortexed at high speed for 5 minutes. The samples were placed in a water-bath at 65^0C for 30 minutes. The samples were then centrifuged at 10000 g for 10 minutes at room temperature. Supernatant was collected and equal volume of phenol-chloroform-isoamylalcohol (25:24:1) was added and mixed. The samples were again centrifuged at 10000 g for 10 minutes at room

temperature. Supernatant was again collected and mixed with equal volume of chloroform-isoamylalcohol (24:1). Samples were again centrifuged at 10000 g for 10 minutes at room temperature. Supernatant was collected and 500 µL of prechilled isopropanol was added. Samples were incubated at -20^{0}C for 1 hour. After that the samples were centrifuged for 15 minutes at 13000 g to pellet the DNA. Supernatant was decanted and DNA pellet was washed with 200 µL of 70% ethanol and kept at -20^{0}C for overnight. DNA pellet was air dried and dissolved in 200 µL of TE buffer, thereafter 5 µL of RNase was added to DNA Samples, mixed and incubated at 37^{0}C for 1 hour. After incubation, samples were washed with chloroform-isoamylalcohol (24:1) and centrifuged at 10000 g for 10 minutes. Supernatant was collected and 500 µL of prechilled isopropanol was added. Samples were incubated at -20^{0}C for 1 hour. Then the samples were centrifuged for 15 minutes at 13000 g to pellet the DNA. DNA pellet was air-dried and 20 µL of TE buffer was added and tapped with finger and stored at -20^{0}C till further use.

The purity of DNA was estimated by measuring absorbance at 260 nm using spectrophotometer. A variety of PCR – based assays were done to check the suitability of extracted DNA for downstream analysis. Molecular marker, Inter-simple sequence repeats (ISSRs) amplification reaction was carried out using 20 µL of reaction volume containing 2 µL of DNA. Isolated fungal DNA resulted good amplification with ISSRs. Extracted high quality DNA can be used to study other molecular markers.

TS-06 (PS-03)

Identification of quantitative trait loci's associated with sheath blight tolerance in rice

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Sheath blight, caused by the pathogen *Rhizoctonia solani* Ku¨hn, is one of the most serious diseases of rice and leads to severe yield loss worldwide. A recombinant inbred line (RIL) population consisting of 122 lines was constructed from a cross between Danteshwari (high yielding popular rice cultivar but moderately susceptible to water stress, susceptible to sheath blight) and Dagad Deshi (tall deep rooted poor yielder and tolerant to water stress and sheath blight). Five traits were used to evaluate sheath blight resistance, namely infected tillers per hill, lesion size (total (coalescing lesions) and individual lesion (one spot) lesion length and width). Using the RIL population and 162 molecular markers, we identified 11 quantitative trait loci (QTLs) for the five traits. Identification of map position was accomplished by identifying BAC or PAC clones that simultaneously contained a hit from the microsatellite / HvSSR marker further helped us to generate a high resolution molecular marker map of the identified QTL region. Identified QTLs were located on seven chromosomes. A major QTL for infected tillers per hill on chromosome 1 was identified with phenotypic variance of 18.02%. Six QTLs were

with positive additive effect and one QTL with negative additive effects was identified indicating that alleles at these loci are being contributed by either of the parents respectively.

TS-06 (PS-04)

Identification of multiple resistant genotypes against major diseases of soybean

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Soybean ranks first, among oilseed crops in the world and India both. It is a predominant rainy season crop of the rainfed agro-ecosystem of India. Yellow vein mosaic, Charcoal rot and Rhizoctonia aerial blight are some of the major diseases in soybean causing drastic losses in the yield of soybean all over the country. Due to abiotic stresses, disease outbreak occurs in alternate years leads to 80 % yield loss in severe cases. Chemical or cultural control of theses above disease is neither economical nor environment-friendly. Deployment of genetic resistance is considered to be the effective way to control it. Present study was conducted for two seasons during Kharif 2014 and 2015 with 50 advance breeding genotypes of soybean in RBD with three replications at Seed Breeding Farm, JNKVV, Jabalpur under AICRP on Soybean. Soybean genotypes comprising of breeding lines, varieties and mutant lines were screened for YMV, RAB and CR disease reaction for two years. No genotypes were exhibited absolute resistant reaction, however 24 genotypes viz., JS 20-98, JS 20-24, JS 20-29, JS 20-34, JS 20-69, JS 20-05, JS 20-41, JS 20-87, JS 20-50, JS 20-53, JS 20-64, JS 20-65, JS 20-71, JS 20-73, JS 20-74, JS 20-76, JS 20-82, JS 20-90, JS 20-95, JS 20-96, JSM 127, JSM 230, JSM 283 and JSM 302 revealed multiple resistance reaction. Similarly, 9 genotypes viz., JS 20-79, JS 20-80, JS 20-85, JS 20-89, JS 20-94, JS 20-91, JS 20-99, JSM 127 and JSM 207 showed moderately resistant reaction. The rest genotypes showed moderately susceptible (03) susceptible (08) and highly susceptible (06) reactions.

TS-07 (OP-01)

Root exudates associated with the resistance of four chickpea cultivars to different races/pathotypes of *Fusarium oxysporum* f. sp. *ciceris*

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Plant roots serve a multitude of functions in the plant including anchorage, provision of nutrients and water, and production of exudates with growth regulaory properties. In context to this an *in vitro* experiment was conducted to study the effect of root exudates of four chickpea cultivars on spore germination and hyphal growth of different races / pathotypes of *Fusarium oxysporum* f.sp. *ciceris* (FOC) at JNKVV, Jabalpur M.P. The root exudates of the susceptible cv. JG 62 and late wilting cv. K 850 did not inhibit colony growth and spore germination of all isolates of FOC whereas, hyphal growth and spore germination were strongly inhibited by root exudates of JG 315 except in isolate I-4 (Race 3) where the colony growth was 29.5 mm at 9th day with 22.0 per cent spore germination at 48 hrs which was higher than other races / pathotypes. On the contrary, the root exudates of JG 74 resulted higher colony growth 82.0 mm and spore germination 75.5 per cent by isolate I-4 representating Race 2 whereas, in isolate I-20 i.e Race 4 had significantly less colony growth i.e. 19.5 mm with spore germination 26.0 per cent. The results led to conclusion that the resistance of chickpea to vascular wilt depends upon the antifungal activity of the root exudates clearly indicating that the resistant cultivar had a negative influence on fungal growth and spore germination whereas, the susceptible cultivar stimulated the fungal growth and germination.

TS-07 (OP-02)

Management of anthracnose disease of safed musli (*Chlorophytum borivilianum*) caused by *Colletotrichum chlorophyti*

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Safed Musli (*Chlorophytum borivilianum*) is a medicinal crops belonging to the family Liliaceae. Because of its medicinal property, safed musli is known as divya aushadhi. The fasciculated roots of safed musli is reported to contain 2-15% saponin, which has the medicinal property of enhancing vitality and immunity to human beings. It also helps in correcting gynaecological disorders. There are many other therapeutic uses of safed musli where dried fasciculated roots are used as a curative for pre-natal and post-natal illness, arthritis, restorative and a health tonic etc. Safed musli is commercially grown in the Gujarat, Rajasthan and Madhya Pradesh. Anthracnose is most important disease of safed musli caused

by Colletotrichum chlorophyti, which determined our study. In Malwa region these disease was causes considerable damage to the crop every year and sometimes becomes more severe in almost growing areas, which may result in total loss of fasculated root yield and quality. The study were conduct for management of anthracnose disease of safed musli in consecutive three year experimental trails during 2014-15 to 2016-17 at research field, College of Horticulture, Mandsaur. The result from mean of three years data revealed that the treatment Carbendazim + Mancozeb @ 0.15 % recorded minimum disease incidence (17.08%) and maximum fasciculated root yield (3358.26 kg/ha) followed by Carbendazim @ 0.15 %(20.60 % and 2667.14 kg/ha). Whereas maximum disease incidence (43.26 %) and minimum fasciculated root yield ((1387.49 kg/ha) was recorded in control.

TS-07 (OP-03)

Integrated management of root rot of mungbean caused by *Macrophomina phaseolina* (tassi) goid through soil and seed dressing formulations to avoid the yield loss

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Bundelkhand (BKD) region in central plains of India comprises of 13 districts covering a total area of 7.08 m ha, out of which six districts with 4.12 m ha area are in Madhya Pradesh (MP) and seven districts with 2.94 m ha area in Uttar Pradesh (UP). The districts are: Sagar, Damoh, Datia, Panna, Chhatarpur, and Tikamgarh in MP and Jhansi, Lalitpur, Jalaun, Hamirpur, Banda, Mahoba and Chitrakoot in UP. These districts lag behind in terms of development but hold tremendous potential for pulses in terms of area expansion and productivity improvement. Rainfed agriculture is the main livelihood occupation of the farmers in BKD region. Among crops, pulses contribute 32.4% to the food grain production under normal rainfall years. However, in drought years, contribution of pulses to the food grain output increases substantially as farmers allocate more area to plant pulses as a contingency plan. Vast area under pulses and prevalent agro-climatic conditions offer scope to turn this region into a pulse bowl of India. However, BKD remains a low productivity zone compared to other parts of pulse growing region of the country. Among all pulses, mungbean [*Vigna radiata* (L.) *Wilczek*] is an important pulse crop of India. To overcome with major constraints which are known to limit the productivity, the field experiments were conducted during the summer seasons of 2014–2015 and 2016–2017 in a split plot factorial design. Soil treatments constituted the main plots and seed treatments the sub plots. All treatments were replicated 3 times in an experiment. Each sub plot experimental unit was 6.0 m2 with 5 rows. Forty seeds per row were sown 10 cm apart at 30 cm row spacing. Twenty-six treatments consisting of two different factors for soil application and seed treatment were evaluated. Four soil application formulations, namely *Acaulospora scrobioculata, Glomus intraradices*, and compost were evaluated as the main treatment factors. The Trichoderma spp (*Trichoderma harzianum*-Indian Type Culture Collection No.-6797, T.viride ITCC No.-2109, T.virens ITCC No.-4177) considered

as compatible with other soil microbes; therefore, clay soil based seed dressing formulations developed from these isolates were evaluated for seed treatment along with one commercial biocontrol based formulation Bash-Bacillus subtilis and Rhizobium. Untreated soil and seeds served as controls. Factors were randomized at each level. The experiment was conducted in a field inoculated with fungal pathogen *Macrophomina phaseolina* by incorporating a 15-days old inoculum multiplied on sorghum grains, at the rate of 13g sub plot-1 (2x109 cfu g^{-1}). Susceptible Mungbean cv. Virat was sown on 14 April 2015 and 18 April 2016 at 5 cm depth in furrows. Fertilizers (N 25 kg ha^{-1} and P_2O_5 50 kg ha^{-1}) were applied. 100g Vesicular Arbuscular Mycorrhiza and prescribed dose (5kg/m^2) of compost were applied 4-5 inches below the treated seeds at the time of sowing in furrows. The seeds were treated separately with Kalisena-AN 27, Rhizobium at 8g kg^{-1} of seed and clay soil based formulation of *T. harzianum, T.viride* and *T.virens* at 4g kg^{-1} of seed (108 cfu g^{-1}), used for alone and in integration. Among all the treatments, a combination of Glomus intraradices and compost for soil application and clay based T. virens for seed treatment together, provided the highest seed germination, shoot and root lengths and grain yield with the lowest incidence of root rot in Mungbean under field conditions. Individually, soil application of *Acaulospora scrobioculata, Glomus intraradices*, and compost and seed treatment with clay soil based *T. harzianum, T.viride, T.virens*, commercial biocontrol based formulation *B.subtilis* and Rhizobium were effective in reducing the incidence of root rot and increasing the grain yield of Mungbean, but their effectiveness was greater when applied as a combination. Thus, combined application of Glomus intraradices, and compost as soil treatment along with clay soil based *T. virens* and Rhizobium as seed treatments in two modes of application is recommended for the management of root rot of Mungbean.

TS-07 (OP-04)

Studies of *Aphelenchoides besseyi* (christie, 1942) on proso millet (P*anicum miliaceum*) and foxtail millet (*Setaria italica*) germplasm

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The nematodes are roundworms which live in the soil and fresh water. They are the only plant parasites belonging to the animal kingdom that are studied in Plant Pathology. Foliar nematodes (*Aphelenchoides spp*.) are emerging serious wide spread pathogens of ornamental plants and mushroom grown in greenhouses, nurseries, and landscapes. Studies on population dynamics of *Aphelenchoides besseyi* in different germplasm of proso and foxtail millet with coloured seed coat revealed significant relationship between nematode and seed colour. Looking to the appearance of the seeds, the visual observations indicated that bold seeds have high nematode number. The investigations on number of nematodes and seed coat colour seem to be the first study of its own kind and may require further studies for conformation. Among nineteen proso millet and 46 foxtail millet germplasm all 19 proso millet germplasm were found infested with *Aphelenchoides besseyi*, where as 30 out of 46 foxtail millet germplasm were examined harboured with *Aphelenchoides besseyi*. Range of nematode

population/250 seeds were 50-456 and 0-528 for proso and foxtail millet germplasm respectively. During diapauses period females of *Aphelenchoides besseyi* were encountered tightly coiled compared to males with loose coiled below the hull. Morphometrical attributes suggested that all the population of *Aphelenchoides besseyi* varied in variations in different hosts viz. rice, proso and foxtail millet. Sterility, distortion, scattered panicles, chaffy and bended glum were typical symptoms. Populations of *Aphelenchoides besseyi* in proso and foxtail millet are different than the common one on the basis of morphometrical attributes. New biotypes or races may be encoded from this study.

TS-07 (OP-05)

Abundance of whitefly (B*emisia tabaci* genn.) and incidence of mungbean yellow mosaic India virus in mungbean

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Whiteflies plays an important role in the transmission of different plant viruses belonging to the genus Begomovirus and family Geminiviridae in vegetable and field crops which are severely affected in terms of qualitatively and quantitatively. Mungbean yellow mosaic India virus (MYMIV) is a bipartite virus consists of DNA-A and DNA-B genome and which is reported to be the causative agent of the disease in central India. In this concern an experimental trial was conducted to determine the effect of weather factors on the abundance of whitefly and incidence of mungbean yellow mosaic India virus disease in mungbean during the Kharif season 2015. The first appearance of whitefly population was started from 28th standard week (SW) on six days old crop which was swiftly increased and reached at peak (25.60 whiteflies/cage/plant) at 32nd standard week on thirty four days old crop. During this period the temperature was ranged from 24.2-31.2^{0}C, relative humidity 69-91%, wind speed 3.70 km/hr, sunshine 4.60 hours and rainfall 14.00 mm, respectively. After that its population was started decline as the crop become old and reached its maturity. The incidence of yellow mosaic disease was recorded weekly as percent disease incidence (PDI) in mungbean crop which was first observed from 30th SW on twenty days old crop (1.10%) and it was acquired peak at 36th SW on sixty two days old plants (95.5%). During this peak period the temperature was ranged from 24.2-32.2^{0}C, relative humidity 57-87%, wind speed 3.50 km/hr, sunshine 6.70 hours and rainfall 8.20 mm, respectively. Correlation studies between maximum temperature and yellow mosaic disease was expressed significantly positive correlation whereas, evening relative humidity was exhibited significantly negative association. Results revealed that the abundance of whitefly and incidence of disease was highly influenced by weather factors during Kharif season 2015 which occurred severely and caused maximum yield loss to this crop.

TS-07 (OP-06)

Integrated management strategies on *Meloidogyne incognta* in tomato nursery through organic cakes

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An experiment to manage root-knot nematode (*Meloidogyne incognita*) was conducted consecutively for five years, in tomato nursery bed measuring 1m x 1m with initial population 2-2.5 nematodes per g soil. The organic cakes viz., Neem, Jatropha and Castor @ 1 Kg/m^2 were incorporated 20 days before sowing of seeds in solarized and non solarized nursery soils. Application of Carbofuran @ 0.3g a.i./m^2 served as positive control. The results indicated that there was significant reduction of root gall index (RKI) and number of egg masses/gall in Neem cakes followed by Jatropha. However, there was drastic reduction (1.53) of RKI in Carbofuran treated nursery which was statically at par with Neem cake (1.78) in solarized nursery soil with an ICBR ratio 1:3.32. While, in Neem cake treated bed it was 1: 0.98 followed by Jatropha (1:0.49).

Under non-solarized nursery soil the RKI was minimum (3.08) in Neem cakes followed by Jatropha (3.43). The interrelationship between solarized vs. non-solarized was significant in reduction of RKI and final (242/200 cm3) root knot population in bed soil. During the investigations the per cent coefficient of variance was less than one when calculated RKI was considered.

TS-07 (OP-07)

Morphological variability in *Alternaria Burnsii*

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Alternaria blight of cumin, as the disease is quite destructive in all the cumin growing areas. The studies was aimed to work out assessment of losses Morphological variability in *Alternaria burnsii*. Alternaria genus belongs to the Phylum Ascomycota, Class Othideomycetes, Order Pleosporales and family Pleosporaceae (Simmons, 2007). Alternaria burnsii causeses leaf blight of cumin. The mycelium of *Alternaria burnsii* consists of septate, branched, light brown hyphae which turned darker with age. The pathogens exhibited variation in radial growth, colony colour, margin and sporulation on different media when allowed for 48, 96, 144 and 192 h. The radial growth of *Alternaria burnsii* was significantly different on all the media tested timeof incubation on both the media. Maximum growth, 87.50 mm of the fungus *A. burnsii* was noted on potato dextrose agar with moderate sporulation followed by 83.17mm and 76.33 mm on oat meal agar and carrot agar medium respectively however sporulation was

good on both the media. However the sporulation was scanty on the later Minimum 39.5 mm fungal growth was observed on Asthana & Hawker's agar; however sporulation was scanty on synthetic media viz. Asthana & Hawker's agar, Richard's agar and Czapek's Dox agar medium Mycelial growth increased significantly as time of incubation increased. Maximum growth rate was recorded between 144 to 192 h of incubation on Czapek's Dox agar. Maximum growth rate was recorded between 48 to 96 hrs. On potato dextrose agar. Colony characters also varied on different media tested; margins of the colony were smooth in all the media except potato dextrose agar and Richard's agar.

TS-07 (PS-01)

Integrated approach for the management of wilt disease of pigeonpea using SPI technique

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Pigeonpea (*Cajanus cajan L*.) is the second most important pulse crop in the country which accounts for about 11.8% of the total pulse area and 17% of total pulse production of the country. It is a good source of protein (22%), dietary fibre and various vitamins viz. thiamine, magnesium, phosphorus, potassium, copper and manganese and also essential amino acids like lysine, tyrosine, cystine and arginine. However, wilt disease of pigeonpea caused by Fusarium. udum Butler is a major constraint to reduce the production and productivity of pigeon pea crop. The disease occurs in most of the pigeonpea growing countries of Asia, Africa, Europe and America and causes considerable yield loss to the crop particularly in India. The annual yield loss to pigeon pea due to wilt disease in India has been estimated worth of US$ 36 million. The main symptom of the disease is characterized by gradual, sometimes sudden, yellowing, withering and drying of leaves followed by drying of entire plant or some of its branches. If an infected plant is split open below the purple band, browning of the stem and brown to black discoloration of xylem vessels is visible. The disease is soil and seed borne and the fungus is host specific which survives in off season on plant trashes in the soil. The area and productivity of pigeon pea crop in Panna district is 17500 ha and 1240 kg/ha respectively. The major constraint for low productivity of pigeon pea crop is due to high incidence of wilt disease. Therefore, in order to curb the negative impact of the disease, integrated disease management module was assessed for the management of wilt disease of pigeonpea at farmer's field using System of Pigeonpea Intensification (SPI) technique during 2016-17. The module was comprised of deep summer ploughing, soil treatment with Trichoderma @ 5 kg/ha, selection of wilt resistant variety (TJT-501), seed treatment with Rhizobium + PSB cultures @ 5 g each/kg seed followed by Trichoderma @ 5 g/kg seed. Higher production (23.1 Qt/ha) was obtained from the assessed fieldas compared to control plot (14.0 Qt/ha). Higher disease incidence (35-40%) was also recorded from the control plot as compared to assessed plot (5-10%). Higher net income (Rs. 98655/ha) and benefit cost ratio (1:6.5) was also obtained from the assessed field as compared to control plot (Rs. 54200/ha) and (1:4.3) respectively. Thus,

this technology must be disseminated among farmers through various extension activities for successful management of wilt disease of pigeon pea.

TS-07 (PS-02)

Effect of integrated disease management (IDM) modules for the management of cotton diseases in natural condition under south Gujarat region

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Cotton is a vital commercial crop in the world and plays an important role for fibre, fuel and edible oil in the community and to industry. Cotton is a white fibrous agricultural product that has a wide variety of uses, from textile production, to creating paper, to producing oil and food products. Cotton is grown all around the globe, and is traded internationally as well. The cotton diseases scenario has shown a continuous change during the past sixty four years. Several diseases have been reported for the cotton crop. In this experiment, total seven modules including the control was tested in this experiment from which, module 6 (6.50 % PDI) followed by module 5 (8.50 % PDI) significantly recorded minimum bacterial leaf blight infection in comparison to the module 7 i.e. control (18.50 % PDI) in RCH 2 BG II hybrid.

For Alternaria leaf spot disease, module 6 (2.50 % PDI) were recorded significantly minimum Alternaria leaf spot disease in RCH 2 BG II hybrid as compared to the control (10.50 % PDI) followed by module 5 (4.50 % PDI) and module 4 (5.50 % PDI).

The highest seed cotton yield was recorded in module 6 (2690.00 kg/ ha), followed by module 5 (2430.67 kg/ ha) and module 4 (2311.00 kg/ ha).

TS-07 (PS-03)

Integrated disease management of sesame phyllody

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Sesame, (*Sesame indicum L*.) is the indigenous oil seed crop of the world and also a major oilseed crop of India. It is grown in an area of 19.47 lakh hectares with a production of 8.66 lakh tones and the world with productivity of 445 kg/ ha during 2015-2016. The major sesame growing states are Uttar Pradesh, Rajasthan, Madhya Pradesh Chhattisgarh, Andhra Pradesh, Maharashtra, Gujarat, Tamil Nadu, West wangal and Orissa. However, a distressing feature is that the productivity of sesame in these states is very low. The main reason for low productivity of this crop is due to the attack of various biotic and a biotic stresses. Sesame

phyllody is an important disease caused by a phytoplasma and is transmitted by a leaf hopper called Orosius albinctus. The affected plants become stunted and floral parts are modified in to leafy structures bearing no fruits and seeds causing yield loss up to 33.9 per cent. Keeping this in view, a field experiment was conducted during 2014 at research area of AICRP on Sesame and Niger for the effective management of phyllody in sesame (variety-JTS-8). The object of study was to find out the efficacy of seed treatment of Imidacloprid followed by two spray of insecticide and botanical along with the standard check and untreated check. The experiment comprising eight treatments was laid out in Randomized Block Design with three replications. Among the eight treatments tested a positive and significant response was found with the seed treatment of Imidachloprid at 5ml/kg followed by spray of Thiamethoxam @ 0.25g/l which had the disease incidence of 4.0% and seed yield of 495 kg/ha. This was followed by two sprays of Acetamiorid 0.3g/l (disease incidence 5% and yield of 463 kg/ha). The seed treatment with Imidachloprid at 5ml/kg and two sprays of Azadirachtin 0.03% with disease incidence of 5.3% and seed yield of 398 q/ha were at par to the above treatments.

TS-07 (PS-04)

Studies on *Macrophomina phaseolina* (tassi) goid causing dry root rot disease of chickpea

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Chickpea is one of the major grain legume crop widely grown in the Indian sub continent, which accounts for almost 75 per cent of world's production. Chickpea dry root rot caused by *Macrophomina phaseolina* is the most important soil borne disease and main constraint in boosting the yield. Keeping in view, dry root rot pathogen was isolated by standard tissue isolation method and was identified as *Macrophomina phaseolina*. Pathogenecity was proved by blotter paper technique and sick pot method and the culture was compared with original culture. Among the eight media used, Potato dextrose agar and Czapek's agar showed maximum radial growth with mean colony diameter of 90 mm. PDA and carrot media supported good mycelial growth and sclerotia production. Maximum dry mycelial weight was recorded eighth day of incubation (150 mg). Among chickpea genotypes screened for dry root rot, thirteen genotypes showed resistant reaction under field condition. Whereas, none of the genotypes were found resistant in blotter paper method. Among the systemic fungicides evaluated, hexaconazole, carbendazim, difenoconazole and propiconazole recorded cent per cent inhibition of mycelial growth at all concentrations tested. Cent per cent inhibition was recorded by thiophanate methyl at 500 ppm. Among contact and combi-product fungicides evaluated, mancozeb, carboxin 37.5+thiram 37.5 and carbendazim 12% +mancozeb 63% WP showed cent per cent mycelial inhibition at all concentrations. Among bioagents tested, maximum inhibition was recorded in *Trichoderma harzianum* (Th-55) (81.48%) followed by *Bacillus subtilis* (75.85%). Among ten botanicals tested, NSKE recorded maximum mycelial inhibition of 85.18, 92.58 and 97.40 per cent at 5, 10 and 15 per cent respectively.

TS-07 (PS-05)

Interaction between plant parasitic nematode with micro organism

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The term interaction is used qualitatively and quantatively in involved In plant diseases. Synergism and antagonism are best describing the interrelationship between two or more factors considered terms describing quantitative plant disease interaction combined effect of a phytoparasitic nematode and another plant disease organism is better either greater· or less than' the sum of the effects of the individual organisms. Parasitic nematodes are capable of producing diseases in their hosts on their own. However, the interactions of nematodes with Fungi, bacteria and viruses are well established. The synergistic Interaction 1st most common and constantly degrade plant health. In a natural or crop ecosystem, plants are exposed to many different kinds of plant pathogens, both animate and inanimate. Therefore, three kinds of relationships exist (Neutralism: where the associated plant pathogens are not affected by each other; Synergism: where Interacting pathogens either mutually help each other or the benefit Is conferred on either of the pathogen alone and antagonism : where Interacting pathogen Inhibit each other or only one of the pathogens is Inhibited.). Associations between nematodes and fungi results in three different types of synergism that can result in plant damage (Back, Haydock et al. 2002). It can be summarized as being positive when an association between nematode and pathogen resulting in plant damage exceeding the sum of individual damage by both pathogens (1 + 1 >2); Antagonistic when an association between nematode and fungus result in plant damage less than that expected from the sum of the individual pathogens (1 + 1< 2); and neutral when nematodes and fungi cause plant damage that equates to the sum of individual damage by both pathogens (1 + 1 = 2).

TS-07 (PS-06)

Integrated management of the collar rot of soybean caused by *Sclerotium rolfsii* sacc

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Soybean (*Glycine max* L.) occupied first rank in world edible oil production. India ranks third in respect of area and production. In India annual yield due to various disease are estimated as 12% of total production. Over hundred pathogen are known to affect soybean, of which 66 fungi, six bacteria and eight viruses have reported to be associated with soybean seed. Among these, soil borne disease like root rot, collar rot or charcoal rot caused by *Fusarium sp., Sclerotium rolfsii* and *Rhizoctonia sp.* are more important as they reduce the plant population in the field resulting in the heavy yield losses. Collar rot caused by *Sclerotium*

rolfsii Sacc. appears during seedling stage and take heavy losses resulting in uneven stand of crop. The fungus can overwinter as mycelium in infected tissues or plant debris or as sclerotia near soil surface or buried in soil which serve as a major source of primary infection by germinating in response to alcohols and other volatile compounds released from decomposing plant material. Sclerotia disseminate by cultural practices with infected soil and contaminated tools, infected seedlings, water, wind and possibly as concomitant contaminants along with seeds. The pathogen being soil-borne, polyphagous in nature and longer persistence in soil, due to which its control with chemicals alone seems to be ineffective and uneconomical. So, an investigation was conducted to diminish collar rot of soybean by use of integrated disease management. Integration of different component was evaluated in the field for controlling collar rot and increasing seed yield of soybean. The highest percentage (28.76%) of collar rot was observed in control plots where untreated soybean seeds were sown in field. The lowest percentage of collar rot plant (8.56%) was observed in the treatment T5 *viz.* T2 (ST with Carbendazim + Mancozeb @ 2g/kg seed) + spray with Thiophanate Methyl @ 0.1% at 55 and 75 DAS. The next lowest percent incidence (12.93%) was observed in T4 where T1 (Seed Treatment (ST) with Carboxin + Thiram (combination product) @ 2 g/kg seed) + foliar spray with Thiophanate Methyl @ 0.1% at 55 and 75 DAS. Similarly, the highest yield was recorded in T5 (16.88 q/ha), which was followed by T4 Treatment (15.21 q/ha). The seed treatment with bioagents and integration of bioagents and fungicides were also found effective against collar rot in present studies, the treatment T3 (ST with Trichoderma viride @ 5g/kg seed) and T6 (T3 + spray with Thiophanate Methyl @ 0.1% at 55 and 75 DAS), reduces the collar rot incidence 15.25% and 16.98% respectively, significantly over the control but they were at par with each other. Foliar spray with Trichoderma viride @ 5 g/l (T8) was not found effective in reducing the collar rot incidence.

TS-07 (PS-07)

Effect of different temperatures and carbon sources on growth and sporulation of Trichoderma isolates of Bilaspur and Sarguja divisions

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Among the all promising biocontrol agents Trichoderma spp. has provided one of the first economical antagonistic against soil borne pathogen like Fusarium, Sclerotium, Rhizoctonia, Phytophthora and Pythium etc. Indigenous isolates of *Trichoderma spp.* has great potential for management of different diseases hence, different isolates of Trichoderma spp. were collected from Bilaspur and Sarguja divisions of Chhattisgarh. 10 isolates of *Trichoderma harzinum* and two isolates of *Trichoderma viride* were isolated and tested for their growth and sporulation at different temperatures i.e. 20^0C, 25^0C, 30^0C, 35^0C and carbon sources (xylose, sucrose and dextrose). Amongst carbon sources, dextrose was found to be uniformly favorable for the growth and sporulation of all isolates. However, T4 isolate (*Trichoderma harzianum*) was found to be the most efficient in utilizing all three carbon sources and had maximum growth of

87.67mm, 71.67mm and 88.80 mm respectively in xylose, sucrose and dextrose amended media followed by T8 isolate (*Trichoderma harzianum*), T5 isolate (*Trichoderma harzianum*) and T6 isolate (*Trichoderma harzianum*). Whereas, xylose and sucrose were not supportive for the growth of Trichoderma strain number T3 (*Trichoderma harzianum*) and T 18 (*Trichoderma* viride). Data on the effect of different temperatures indicate that growth and sporulation of Trichoderma isolates i.e. T1, T4, T7 ,T8 (*Trichoderma harzianum*) were not affected at different temperature i.e. 20^0C, 25^0C, 30^0C and 35^0C whereas, isolates i.e. T2 ,T5, T28 (*Trichoderma harzianum*) and T18 (*Trichoderma viride*) where found to be sensitive at low (20^0C) and high temperature(35^0C).

TS-07 (PS-08)

Effect of seed treatments on seedling parameters of bitter gourd

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Bitter gourd, *Momordica charantia* L. is one of the most popular vegetable of Cucurbitaceae family in the tropical and subtropical countries. It is widely grown throughout South-east Asian countries including India, China and Nepal. The seedling parameters viz. germination percentage, root and shoot length, fresh weight, dry weight and vigour index should be better for getting good crop yield. These parameters are influenced by numerous factors among them effect of seed and soil borne pathogens are important. The effect of these kinds of diseases can be minimized with seed treatment. Therefore an experiment was conducted to test the effect of bio control and chemical methods of seed treatment at Horticultural Research Farm, College of Agriculture, Raipur during Rabi 2015-16. Effect of various seed treatments on seedling attributes viz. germination percentage, root and shoot length, fresh weight, dry weight and vigour index of bitter gourd seedlings were evaluated during 2015-16. Among all the treatments chemical treatment provided best result in comparison to untreated (control). The highest germination percentage (99.00%), root length (10.77 cm), shoots length (17.97 cm), fresh weight (60.29 mg), dry weight (0.72 mg) and vigour index (1789.30) were observed when seeds were treated with chemical i.e. carbendazim 12% + mancozeb 63% (3 g/kg seed). This was followed by bio control (seed pro 25 g/kg seed). Poor seedling attributes *viz.* germination percentage, root and shoot length, fresh weight, dry weight and vigour index of bitter gourd were obtained when seeds were not treated with any chemical or bio control substance.

TS-07 (PS-09)

Occurrences of phytophthora fruit rot in Madhya Pradesh and in vitro evaluation of fungicides

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Guava (*Psidium guajava*) crop is found to be badly infected by several diseases. However, fruit rot caused by *Phytophthora nicotianae* var. parasitica is becoming severe problem to guava orchard. The disease severity varies according to climatic conditions. it is severe mostly during the rainy season when there is high humidity and moderate temperature. Then young green fruits are severely infected by the disease, which show irregular water soaked to brown coloured lesions that enlarge in size and white cottony growth appeared on the lesions. Infected fruits drop down. The fungus was isolated and studied. The disease was noticed in guava orchards around Jabalpur during monsoon season of the year 2000 and again from 2011 to 2015. The disease was observed and identified first time from the state. Further attempts were also made to evaluate the efficacy of different fungicides against the pathogen under in vitro condition. seven fungicides viz., Bordeaux mixture, copper oxychloride, mancozeb, chlorothalonil, ridomil,aliette and propineb were evaluated by poisoned food technique and disc suspension method. The results indicated that ridomil, mancozeb, chlorothalonil completely inhibited the mycelial growth of *Phytophthora nicotianae var. parasitica* and thus showed their best effectiveness. Similarly ridomil, mancozeb and aliette were best effective for inhibition of sporangia formation as well as for zoosporangiosis.

TS-07 (PS-10)

Effect of fungicides on leaf blast and grain yield of basmati rice in Raisen district of Madhya Pradesh

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Rice blast caused by *Magnaperthe grisea Barr* (*Pyricularia oryzaca*) is the most destructive pathogen of rice worldwide causing signified yield losses ranging up to even 100%. The cultivation of resistant variety and use of fungicides have been advocated by several works for rice blast management. The present study was conducted at farmers' fields with farmers participating mode in Kharif season from 2014 to 2017 in Raisen district. Each demonstration was conducted as on area of 0.4 ha and the same area adjacent to the demonstration plot was kept as farmer practices. The technologies demonstrated for blast management are Tricyclazole 18%, Tricyclazole 18% + Mancozeb 62% and Farmer practice.

The data on incidence of blast disease were recorded from vegetative to crop harvest stage in demonstration plot as well as farmer plot. The fungicide show effective management of the diseases over farmer practices. Application of Tricyclazole 18% + Mancozeb 62% recorded less occurrence of blast diseases (4.29%) followed by Tricyclazole (6.67%) and farmer practice (13.75%).Seed yield of Rice was found 45 percent more in applicant of Tricyclazole 18% + Mancozeb 62% (36.12 q/ha) as compared to Farmer practice (24.8 q/ha).

Application of Tricyclazole 18% + Mancozeb 62% gave highest net return Rs. 49231/ha over Farmer practice (25041 Rs./ha) and high benefit cost ration 2.42 as compare to 1.73 under Farmer practice in the corresponding year. Number of tillers/plant, No. of spikelet/panicle and 1000 seed weight was noticed in plot sprayed with Tricyclazole 18% + Mancozeb 62%.

TS-07 (PS-11)

Studies on races of *P*yricularia oryzae (cav.) infecting paddy

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Rice (*Oryza sativa* L.) is an important cereal crop. Among the diseases of rice, blast disease caused by *Magnaporthe grisea* (Hebert) Barr. (Anamorphic: *Pyricularia oryzae* Cav.) is exerting the major threat in rice cultivation. Roving survey was carried out in rice growing area of southern Karnataka which revealed that the maximum leaf blast severity (38.92%) was recorded in Krishnarajpet taluk. The colony character of all the seven isolates of *P.oryzae* on different solid media revealed that the radial growth of all isolates ranged from 2.1 cm of isolate 7 (potato carrot agar) to 9.0 cm of isolate 1 (kirchoff's, richard's and rice leaf extract medium), after 14 days of incubation. The dry mycelial weight of all isolates in different liquid media ranged from 120.22 mg of isolate 2 (sabourad's broth) to 284.6 mg of isolate 4 (richard's medium) after 14 days of incubation. Systemic fungicides, tebuconozole and combi product, tebuconazole 50% + trifloxystrobin 25% (nativo) showed complete inhibition of the *P. oryzae* at all the concentrations (50, 100 and 150 ppm) tested. Among five bio-agents, Trichoderma virens showed maximum inhibition of mycelium (67%), among seven botanicals, garlic clove extract showed 95.52 per cent inhibition at all the concentrations (5, 10 and 15 per cent). Among five animal products, cow ghee showed 97.24 per cent inhibition at all the concentrations (10, 20 and 30 per cent). 25 host differential lines screened against *P. oryzae*, 7 host differential lines (2, 3, 4, 10, 12, 13 and 22) showed resistant reaction.

TS-07 (PS-12)

Management of wilt disease in chilli in Sagar District of Madhya Pradesh

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Chilli, *Capsicum annuum* L., is mainly cultivated for its vegetable green fruits and for the dry chilli as the spice of commerce. It is a rich source of Vitamin C, A and B. In India it is an important cash crop, which is grown for the both domestic and export market. India is the largest producer of chillies in the world (8.5 lakh tones). Chilli crop suffers with many fungal, bacterial and viral diseases resulting in huge yield losses. Technology demonstration is the most effective way to show how a thing works, how to do the work, principles involved in an operation and to show the end results of the technology/methodology adopted. The present studies were conducted at farmer's field with farmers participatory mode in summer season from 2013 to 2016 in Sagar districts. Each demonstration was conducted on an area of 0.20 ha and the same area adjacent to the demonstration plot was kept as farmer's practices. The package of improved production technologies included variety VNR 145, balance fertilizer (80:60:40 NPK/ha) applied as basal, Seeds were treated with different treatment i.e. Trichoderma viride @ 10 g kg^{-1} seed for prevention of seed-borne diseases and inoculated with azotobactor and PSB @ 10 g kg^{-1} seed for increasing the availability of nitrogen and phosphorus to crop roots. Enrich Trichoderma viride were also applied in the soil in another treatment. Seed sowing was done in raised bed nursery in the month of February than planted in the fields. One hand weeding was done at 25 DAS for effective control of weed. Yellow sticky trap (50 No.), Blue sticky trap (50 No.) and Pheroman trap (20 No.) were installed for monitoring and management of sucking pest and pod borer. Foliar spray of Insecticide was done at 15 days interval for management of insect- pest. The data on incidence of wilt disease and green chilli yield were recorded from vegetative to crop harvest stage in demonstration plot as well as farmers practice. The cost of cultivation, gross monetary return and benefit cost (B:C) ratio were calculated based on current market price. The average occurrence of wilt disease in various treatment were 4.3, 7.6 and 14.0 per cent. This may be due to precautionary use of Trichoderma viride with FYM as basal application. Green yield of chilli was found 34.2 per more in organic production system (87.5 q/ha) as compared to farmers practice (65.2 q/ha). The economic viability of organic production technologies over traditional farmer's practices was calculated depending on prevailing prices of inputs and output costs. It was found that average cost of production of chilli under organic production technologies was 64600 per ha in both the years over farmers practice (local check) which was 52125 per ha. Cultivation of chilli under organic production technologies gave higher net return as Rs 1,10,400 per ha as compared to farmer's practices which recorded Rs. 78,375 per ha. The use of organic inputs technologies also gave higher benefit cost ratio 2.71 as compared to 2.48 under farmers practice in the corresponding years.

TS-07 (PS-13)

Role of silicon (si) in biotic and abiotic plant stresses

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Silicon (Si) is the second most abundant element of the earth`s crust and is regarded as mineral substrate for the growth and development of most plants. It is rapidly gaining attention in agriculture because of its many beneficial effects for plants. The lower values of Si in the soil can be justified due to severe and frequent soil erosion and sediment transportation. Si plays a pivotal role in the nutritional status of a wide variety of monocot and dicot plant species and it is very effective in controlling pest and diseases caused by both fungi and bacteria. Usually plants absorbs Si almost equal to the concentration of most of macro nutrients. Silicon also exerts alleviate effects on various abiotic stresses including salt stress, metal toxicity, drought stress, radiation damage, nutrient imbalance, high temperature and freezing so on. The most remarkable effect of Si is the reduction in the intensities of a number of seed borne, soil borne, foliar, especially powdery mildew diseases and many economically important crops. The reduction in disease symptom expression is due to the effect of Si on host resistance, incubation period, size and lesion number. Photosynthesis and the antioxidant system are also improved for Si supplied plants.

TS-07 (PS-14)

Stem rot incited by *Sclerotinia sclerotiorum* in mustard

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Stem rot disease has emerged as a potential threat in most mustard growing area at globally. It is being continuously serious and devastative disease year after year.. Earlier, it was considered as a minor disease and now, it has become a serious problem in recent years. Northern region of Madhya Pradesh jointly contributes >60% production of the rapeseed mustard. However, successfully establishment of the infection within 5-8 days after inoculation in the favorable environmental condition in 45-65 days old plants. In search of the new botanicals, biological agents, animal byproducts and chemicals may lead to integrated management of the disease with no fluctuation of the environment. With view of resistance, there was no proven resistance in the brassica genotypes against the disease. Stem rot is a polyphagous and soil born nature, hence, the sclerotia can survival upto 5 years in the soil. The identified of the new genes in rapeseed mustard against this disease through advanced biotechnological approaches. With the view of the above points more need to do work in future on the mustard crop against Stem rot.

TS-07 (PS-15)

In vitro studies on interaction of *Trichoderma viride* and *T. harzianum* with different fungicides

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The test organism Trichoderma was isolated from the soil using Trichoderma selective medium, observations for radial growth, colony characters and pigmentation were recorded on potato dextrose agar medium. For assessing the compatibility of Trichoderma species, eight fungicides (carbendazim, carboxin, triadimefon, thiophanate methyl, chlorothalonil, copper- oxychloride, mancozeb, and wettable sulphur) were used each at three concentrations 500, 1000 & 1500 ppm, respectively in addition to control and Poisoned food techniques was followed in vitro. All the fungicides significantly reduce the radial growth of *T. viride* and *T. harzianum* except wettable sulphur and mancozeb. There was no radial growth of *T. viride* and *T. harzianum* in carbendazim, carboxin and thiophanate methyl, while maximum mean radial growth of T. viride (85.22 mm) and *T. harzianum* (79.77 mm) were recorded in wettable sulphur and mancozeb. All the three concentrations significantly reduced the radial growth of 41.15 mm in *T. viride* and 34.66 mm in *T. harzianum* being maximum in 1500 ppm. The significant interaction component clearly revealed that with increasing concentration of each fungicide, there was a significant reduction in radial growth.

TS-07 (PS-16)

Effect of soil amendments on white blister development of *Amaranthus bicolor* incited by *Albugo bliti*

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The field experiments was conducted in the plant pathology field, Indira Gandhi Krishi Vishwavidyalaya, Raipur Chhattisgarh in the year 2014-2015 to study the effect of soil amendments on white blister (*Albugo bliti*) development of Amaranthus bicolor. In all, 11 different organic amendment i.e., Lantana (*Lantana camara*), Ipomoea (*Ipomoea purpurea*), Karanj (*Pongamia pinnata*), Xanthium (*Xanthium strumarium*), Oil cakes like Mustard cake , Neem cake, Karanj cake and manures like Vermicompost , FYM , Vermicompost+Trichoderma, FYM + Trichoderma were incorporated in soil 15 days prior to sowing.

Disease severity was recorded on 20 randomly selected plants twice - first 15 days after sowing and second before harvest (30 days after sowing). All the experiments were repeated thrice on same plots in same season. Disease severity in three dates of sowing was ranging

from 8.05 to 12.80% and first date significantly lower than that of second and third date of sowing. Overall, it seems that Neem cake or FYM or FYM + Trichoderma may be amended as per availability to reduce the white blister diseases severity in Amaranthus.

TS-07 (PS-17)

Management of white tip disease of rice

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Aphelenchoides besseyi is one of the important nematode pests of paddy and responsible for 24 per cent losses in yield. Six or more nematodes per seed are the threshold level of damage. The nematode remained viable under the seed coat in anhydrobiotc conditions for four consecutive seasons. Field experiment was conducted to manage Aphelenchoides besseyi incorporating hot water treatment, neem cake, seed soaking and foliar spray of carbosulfan at 45 days after transplanting. The results indicated that when seeds were exposed at 540C for 15 minutes in hot water followed by subsequent foliar spray of carbosulfan (25 EC) @ 0.01% at 45 DAT reduced nematodes to the tune of 45.28 in shoot and 59.96 percent in 100 seeds. The maximum (25.83 q/ha) yield was observed in above treatment with a cumulative increased yield of 27.87 percent over untreated check. However, seeds immersed only in hot water at 540C for 15 minutes alone eradicated the population below the threshold level of damage. Application of neem cake @ 50g/m2 nursery and when such seedlings were transplanted in to main field and same nursery when sprayed with one foliar spray of carbosulfan @ 0.01 percent 45 DAT did not encouraged effect of treatment either solely (neem cake raised nursery) or in combination towards reduction of nematode population in seed (208/N and 200/ 100 seed) as well as in shoot (13 and 16 N/50g shoot).However, one spray of carbosulfan (0.01%) at 45 DAT has emerged as feasible and economical method for management of A. besseyi in rice.

TS-07 (PS-18)

Assessment of improved technology on productivity and profitability of chickpea crop

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Chickpea is the most important pulse crop of Chhattishgarh state in rabi season and soil borne root infecting fungi are limiting factor to reduce plant population, growth and development of crop and ultimately yield potential. Trichoderma is a biological control agent and it has antifungal, antinematode, plant growth promoting and plant defense inducing activities.

Rajnandgaon district is situated in southern part of Chhattisgarh State and lies at 19.57°N to 21.42°N latitude and from 80.23° to 81.31°E longitude. Krishi Vigyan Kendra Rajnandgaon CG conducted Frontline Demonstration on Farmers Field Kharif 2016 under NMOOP Programme. During this demonstration, an area of 40 ha was covered with plot size of 0.80 ha under each demonstration with active participation of 50 Farmers. Improved technology of soil health card based fertilizer application including seed treatment of mancozeb and carbendazim @ 3gm per kg seed, Rhizobium + PSB + Trichoderma @ 10 gm respectively per kg seed. Existing farmer practices as control were taken for the comparison. Chickpea variety JAKI 9218 showed significant yield achievement 13.7 q per ha under improved technology while in farmer practice 8.5 q per ha and it was 61.17 % higher than farmer practice. Application of Trichoderma @10 gm per kg of seed including Rhizobium + PSB, chemical fungicide and use of balance fertilizer improved root nodulation, yield, net return and B:C ratio. Therefore, it is suggested that for achieving sustainable higher production, productivity and management of soil borne disease of chickpea, improved technology of seed treatment with chemical fungicide including Rhizobium, PSB and Trichoderma inoculation adoption is necessary.

TS-07 (PS-19)

Assessment of losses of leaf blight disease in chandrasur caused by *Alternaria alternata*

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Chandrasur (*Lepidium sativum* L) is known as Garden cress, is a important medicinal crops . The crop's seed, leaves and roots are economically and medically very important.. The leaf and seeds is used for secondary syphilis and tenesmus, antidiarrheal and antispasmodic, hypoglycaemic laxative, antibacterial, antioxidant, contraceptive effects and in inflammatory bowel disease and also for fracture-healing and diuretic activities. Chandrasur is under commercial cultivation in Madhya Pradesh having more than 25000 ha and it is increasing every year due to increasing demand. Several fungal diseases are recorded but leaf spot and blight is most severe diseases in Chandrasur caused by *Alternaria alternata* (Fr.) Keisser. In severe epidemic it can lead to complete leaf blight which is most damaging in Chandrasur. The disease symptoms are characterized by the appearance of brown necrotic spots on the leaf margin. These necrosis spreads towards the midrib and as a result the leaf curls up and dries, and these spot also found on stem of Chandrasur when relative humidity is found to be 50% minimum and 84% maximum an average 67%, temperature 22.05^{0}C minimum and 29.14^{0}C maximum an average 25.59^{0}C. An experiment was carried out to study on assessment on losses in yield at different level of disease severity caused by these disease, a susceptible local chandrasur variety was sown in experimental field KNK, College of Horticulture Mandsaur. The per cent diseases index (PDI) of alternaria blight was 44.80%, 37.7 % and 27.23% were observed in the unprotected plot whereas it was 26.40, 11.35 and 9.35 were

observed in the plot sprayed (protected plot) respectively, yield losses due to Alternaria blight infection was estimated 22.97%, 31.38% and 30.89% in three successive year (i.e. 2009-10,10-11 and 2011-12).

TS-07 (PS-20)

Growth and sporulation of *Alternaria* spp. under different nutrients

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Early blight incited by Alternaria is an economically important and widely distributed disease of Solanaceae, Apiaceae, Brassicae, Pedaliace, and Amaryllidace. Losses were estimated upto 80%. Variability is existing phenomenon of Alternaria vary with patho-types. PDA and carrot agar remained suitable for *A. burnsii, Alternaria porri* and *A. solani*. Oat meal agar favoured *A. alternata, Alternaria brassicae* and *A. melonganae*. Except Richard's agar and Czapek's Dox agar, evaluated nutrients significantly supported Alternaria tenuissima. Abundant sporulation of *A.sesami* on Richard's agar. Septate/branched dark hyphae, short and dark conidiophores, beaked muriform, 3-14 transverse and 0-8 longitudinal septa notivedin *A. solani*. Pale olivaceous, curved in *A.alternata*. Solitary, fasciculate, erect, light olive, septate, irregularly bent, with a single terminal scar, geniculate, 3-5 (-8) celled conidiophores of *Alternaria burnsii*, smoke grey, simple, seldom branched, wavy, prominent scar at each geniculation, 14-17 µ long and 6-11 µ wide in *Alternaria brassicae*, light brown, obpyriform, short conical beak at the tip/ beakless and smooth in *Alternaria melongenae*. 1.5-45 µ long, 2-4.5 µ wide beak, swollen terminally 2 or 3 scars, 0-8 transverse septa were noticed in *Alternaria tenuissima*. Conidia were slightly curved, obclavate, dark, 4-10 transverse and 1-4 longitudinal septa, long hyaline beak , branched in *Alternaria sesame*. Conidia smooth, obclavate to elongate-oval, with 3-14 transverse and 0-8 longitudinal septa, tappered, long, filiform, trifurcate beak was found *Alternaria porri*.

TS-08 (OP-01)

Changing scenario of small millet diseases in relation to climate change in Madhya Pradesh

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Small millets comprising kodo millet, little millet, barnyard millet, foxtail millet and finger millet are small seeded cereal crops usually grown by poor farmers in low fertile lands under rainfed conditions. These crops are low water demanding, requires less fertilizers, plant protection measures and can produce a reliable harvest under the extreme climatic conditions. Climatic factors particularly temperature, relative humidity and rainfall may change the host parasite relationship that may result in positive or negative impact on incidence and severity of different diseases. Indian agriculture is primarily weather dependent and rain fed crops like small millets are influenced by both low as well as excess rainfall. Earlier these crops were known for lesser incidence of diseases both in the field and storage. In the last few years, the disease scenario of small millets in Madhya Pradesh has changed drastically. Smuts, blast and leaf spots were the only major diseases in different small millets. Now, banded leaf and sheath blight (BLSB) caused by *Rhizoctonia solani* Kuhn in all the small millets have emerged as potential threat to the production of these crops in Madhya Pradesh. Partial root parasitic flowering plant (*Striga* spp.) is becoming a problem in low fertile soils under stress conditions in kodo millet. Use of resistant cultivars is the most viable and economical way to mitigate the losses caused by diseases. Cultivars of different small millets possessing resistance for different diseases or multiple disease resistance were identified. Late maturing cultivars were shown resistance against BLSB in little millet and foxtail millet. Elicitation of resistance in little millet due to foliar spray of salicylic acid and sodium fluoride at 100, 150 and 200 ppm significantly reduced the BLSB incidence from 21.2 to 45.7% and lower the infection rate. Weather based models to predict the development of major diseases in small millets should be the future strategy to mitigate the risks of climate change. Weather based models to predict the development of major diseases in small millets should be the future strategy to mitigate the risks of climate change.

TS-08 (OP-02)

Rational approaches for leaf blast management of rice in Madhya Pradesh

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Rice is an important food source grown in 42 Mha in India under upland, lowland, rain fed and deep water in diverse ecosystem. The crop is affected with biotic stresses every year with heavy economic losses. Among the diseases, blast is caused by Pyricularia grisea Cav. the most important disease concerning the rice crop in the world. It has been found in over 85 countries across the world and every year the amount of crop loss due to rice blast could feed 60 million people. Although, the damage is very much influenced by environmental factors, and the disease is recognized to be one of the most serious diseases of the rice plant worldwide particularly in India. Rice blast is a devastating disease commonly occurred in temperate regions and can be found in areas such as irrigated lowland and upland conditions which is conducive due to long periods of free moisture where leaf wetness is required for infection and high humidity for rice blast incidence.

Excessive use of nitrogen fertilization as well as drought stress increase rice susceptibility to the pathogen as the plant is placed in a weakened state and its defenses are low. Extended drain periods also favour infection as they aerate the soil, converting ammonium to nitrate and thus causing stress to rice crops, as well. The fungus is able to infect and produce lesions on all organs of the rice plant except the root. When the fungus attacks a young leaf, purple spots can be observed after an incubation period, changing into a spindle shape which has a gray centre with a purple-to-brown border and then surrounded by a yellow zone as time passes. Brown spots appear only on the older leaves or leaves of resistant cultivars. In young or susceptible leaves, lesions coalesce and cause withering of the leaves themselves, especially at the seedling and tillering stages. Exposure of the diseased plants to higher temperatures, e.g. around 32 ºC, causes lesions to expand rapidly in the first 8 days and level off shortly thereafter, then a swift cessation of lesion enlargement takes place. On the other hand, the rate of enlargement is slow and constant over the 20-day period at lower temperatures, eg.16ºC. Lesions expand slowly and cessation occurs gradually in the intermediate temperature regime, 20–25ºC. Severe outbreak of leaf blast causes stunting and the development of small panicles. Many fungicides are being used against blast disease, including benomyl, fthalide, edifenphos, iprobenfos, tricyclazole, isoprothiolane, probenazole, pyroquilon, felimzon, diclocymet, carpropamid, fenoxanil and metominostrobin, and antibiotics such as blasticidin and kasugamycin. Systemic fungicides are widely used to protect against leaf blast by seedling application and also to protect against panicle blast when applied more than 20 days before heading. The composition, amount, timing and application method of fungicide applied depends on the disease forecast or level of disease severity. Blast disease can be controlled by an integrated management system using a variety of methods viz;

resistant cultivars, cultural practices, bio control agent and chemical application based on the information from disease forecasting systems.

TS-08 (OP-03)

Pythium sp. an emerging disease of blight on tomato

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Tomato production is seriously getting affected by many emerging pathogens, such as tospovirus and blight. Blight in solanaceous crops is primarily caused by three fungal pathogens, *viz.*, Altenaria, Phytopthora and Pythium. Among them Altearia and Phytopthora are the most frequent and reported from many places but no report of Phythium incidence on tomato in India. Symptoms of blights are rapid and complete chlorosis, browning then death of plant tissues. This disease appears to most dominant in areas with high rainfall, humidity and temperature as well as in semiarid climates.

During roving survey of tomato fields found up to 100% disease incidence of blight on tomato in Medchal district of Telangana in August 2016. Ten infected leaf samples showing symptoms of blight were collected. The leaf tissue was mounted on wet tissue paper and incubated for 5 days. After that culture were transferred on selection media at 18ºC for 10 days. The full grown fungus was sampled from petri plates and transferred to liquid bean media and incubated for 48 hrs. DNA was isolated from all the cultures and amplified ITS region using universal primers in PCR. The amplified products were eluted and sent for sequencing. The BLAST results of sequenced DNA revealed the presence of two different types of fungus*, viz., Altenaria solani* and another one *Pythium sp.* The sequence data was submitted in NCBI gene bank (Accession Number KX430179 and KY393265). The same tomato fields were once again surveyed during August 2017 and found 60-100% blight disease incidence. All this information is emphasizing that it is extremely important to develop resistant verities, which is the only possible and sustainable way to fight against blight during this rapidly changing climatic conditions. This is a first report of *Phythium sps*. Infecting tomato in Hyderabad, India.

TS-08 (OP-04)

Variability among isolates of alternaria porri causing *alternaria blight* of niger from different geographical regions of India

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Alternaria blight is the major constraint for niger production. In these experiments five isolates of Alternaria porri from three different states were studied for cultural, morphological, pathogenic and Toxin variability. Among the isolates, maximum colony diameter was observed in Ap-1 of Udaipur (88.22 mm) and minimum diameter recorded in Ap-5 (79.22 mm) after 7 days of incubation. In case of sporulation the maximum number of conidia 14.68×103 conidia/ mm2, were recorded in Ap-1 and minimum sporulation 10.46 ×103 conidia / mm^2 was recorded in Ap-5 of Vanrasi. The colony character *i.e.,* margin/shape and colour of the culture of different isolates varied from cottony woolly growth, aerial at centre, concentric zonation, whitish margin white, dark greyish in color later turned dark black in Ap-1. While Ap-5 showed felty mycelial growth, with light grayish black with whitish margin and isolates also differed in the size of the conidia the largest conidia with beak was of Ap-1, 98-112 × 26-39 µm. Whereas, smallest size of conidia was of Ap-5, 75-100 × 19-25µm. Average numbers of horizontal and vertical septa were 3-9 and 0-5 in Ap-1 and minimum in Ap-5. Isolate Ap-1 was found to be most virulent with 49.51 % PDI whereas, minimum PDI 37.57 was recorded in the isolate Ap-5. JNC-6 and Gujarat niger-2 were found to be susceptible with isolate Ap-1 and other varieties showed moderately susceptible response with all the five isolates. In case of toxin variability Ap-1 isolate showed very severe toxic effect with 49.51 % PDI, where initial toxicity symptom expression was within 10 hours, leading to complete and severe necrosis of leaves with distinct black colouration. Whereas, least toxicity were observed in Ap-5 with 37.60% PDI which were expressing symptoms after 35 hrs.

TS-08 (PS-01)

Effect of weather parameters on foliar diseases of sesame

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Sesame (*Sesamum indicum* L.) is an ancient oilseed crop. It plays an important role in the oilseed economy throughout the world. The fungal foliar diseases viz., Alternaria leaf spot, Cercospora leaf spot and Powdery mildew of sesame are the most important in Jabalpur area, resulting in heavy yield losses. A field experiment was conducted during 2015 at research area of AICRP on Sesame and Niger for to find out the effect of climatic factors and management for foliar disease in sesame. In this experiment, three sesame varieties (JTS-8, TKG-21 and

GT-10) were sown with two treatments (protected and unprotected). Protected (Soil application of *Tricoderma viride* 2.5 kg/ha; seed treatment with Thiram 1g+Carbendazim, 2g/kg of seed and two spraying with Sulphex and Saaf (@ 3g/lit of water), at growth and flowering stages of the crop with unprotected (no spraying). The severity of powdery mildew, Alternaria and Cercospora was recorded at weekly intervals using 0 - 5 grade scale. The disease severity was correlated with the weather parameters. The weather parameters viz., Maximum temp., Minimum Temp., Relative humidity (morning & evening), wind speed and total rainfall prior to seven days of disease observation were used for correlation and regression analysis. Correlation of diseases with the weather parameters indicated that Alternaria, Cercospora leaf spot and powdery mildew were positively correlated with Relative humidity observed during morning and evening. The regression analysis also exhibited similar trends as observed in case of correlation.

TS-08 (PS-02)

Correlation studies between sheath blight disease of rice and weather variables in Chhattisgarh plains

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Chhattisgarh state (popularly known as Rice Bowl) is the most congenial for rice cultivation. Like other crops, rice crop is also known to suffer by many biotic and abiotic stresses and among biotic stresses, diseases are pivotal one. Correlation between sheath blight and weather variables was studied and it appears from the pooled correlation analysis between weather parameters and sheath blight disease severity that Tmax and SSH from 16 September to 30 October were found positively correlated in all three dates of sowing over four years kharif season under study. During this period of time, crop growth stage was in maximum tillering to panicle initiation stage coincide with the Tmax range (30.5-32.6^{o}C) and SSH range (4.2-9.6) which favours the maximum sheath blight disease progression. During 16 September to 15 October in first and second dates of sowing, RHm suppose to influence the development of sheath blight disease. Year wise correlation analysis between weather variables and sheath blight disease severity suggest that Tmax and SSH had positive effect in the development of sheath blight disease of rice during kharif season.

TS-08 (PS-03)

Natural infection of mungbean yellow mosaic India virus in weed plant and kharif cultivated pulses crop

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India is well known for its biodiversity of fauna and flora in across the world where different types of agricultural crops are grown. The number of wild species of plants is closely relatives of cultivated species which are play as host or reservoir of different kind of plant diseases. Among them virus disease is more prevalent to exploit their useful genome and spontaneously maintain survivability around the year. Of them the incidence of yellow mosaic disease (genus begomovirus) is severely occurs in pulses crop which is transmitted by whitefly (*Bemisia tabaci* Genn.) has been characterized through molecular studies and reported as mungbean yellow mosaic India virus (MYMIV) in Jabalpur, Madhya Pradesh, India. This disease is seriously cause pulses crop particularly in blackgram, greengram, soybean and other bean crops. In the year 2015, the incidence of MYMIV was recorded as epidemic form in soybean and blackgram. Whereas, many wild/weed plants are naturally grown on which viruliferous whiteflies and virus are survive simultaneously during the off season of agricultural crops and easily spread in next crop. Number of alternate weed host of virus viz; wild Vigna species (*V. hainiana* and *V. trilobata*), *Phaselus trilobus, Corchorus capsularis, Acalypha indica, Eclipta alba, Sida rhombifolia* and *Sida acuta* are found to be host of MYMIV. Other weed host plants are reported on the basis of YMD symptoms that *Ageratum conizoides*, *Corchorus olitorius, Alternanthera sessilis* and *Malvastrum coromandelianum* are also found to be host of MYMIV. Hence considering the wide host range of this disease timely management of weed plants and whitefly is very important to check the incidence of YMD.

TS-08 (PS-04)

Correlation between weather parameters and incidence of phytophthora stem blight of pigeonpea

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The word “pulses” is used in India to describe the seeds of leguminous crops that are usually dicotyledonous. Pulses are one of the important segments of Indian agriculture after cereals and oils. Pigeon pea or red gram [*Cajanus cajan* (L.) *Millspaugh*] is an important pulse crop of semi-arid tropics of Asia, Africa and Americas. The crop is a photoperiod sensitive plant with a typical short day requirement for induction of flowering and is one of the kharif crop of central zone of India. Pigeon pea cultivated as mono crop and as well as mixed cropping

almost entire area around Bhopal district of M.P. Pigeon pea cultivated area are lies at latitude of 23.12 N, longitude of 77.05 E and altitude of above 1667 MSL and situated in western part of Vindhyanchal plateau . Due to vast area of pigeon pea production in this region, formers face problems to manage the crop particularly in the aspect of disease management. Phytophthora stem blight of Pigeonpea caused by *Phytophthora drechsleri* var. cajani is one of the major problems faced by the farmers at early stages of plant. Present study was conducted to evaluate the effect of meteorological parameters and showing dates on the incidence of stem blight. The susceptible variety of pigeonpea ICP7119 was shown on first week of July in Phytophthora sick plot during 2009-10, 2010-11 and 2011-12 in kharif season. Completely randomized block design was followed in experiment and replicated three times. The observations of diseases progress were recorded as standard weeks. Findings indicates that the positive correlation present between the weather parameters and disease incidence. Disease progress of phytophthora blight is positively related to number of rainy days and rainfall.

TS-08 (PS-05)

Occurrence of purple blotch of onion and effect of chemical and biocontrol agent against alternaria porri causing purple blotch of onion

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Present study on “Occurrence of purple blotch of onion and effect of chemical and biocontrol agent against *Alternaria porri* causing purple blotch of onion” was carried out in the Laboratory of the Department of Plant Pathology J.N.K.V.V., Jabalpur and Survey to asses disease incidence in the districts covering major export zone of Madhya Pradesh such as Shajapur, Dewas, Ratlam, Mandsaur, Dhar, Neemuch and Jabalpur. Many fungal and bacterial diseases are major constraints in onion production, out of these; purple blotch caused by *Alternaria porri* (Ellis) Ciferri. is most destructive and a limiting factor causing a great threat for its higher productivity and export potential. *Alternaria sp.* is a major leaf spot and blight causing pathogen on various plant species including onion purple blotch caused by *Alternaria porri.* Disease incidence was maximum in Dewas district (18.00 per cent) followed by Jabalpur (17.00 per cent) and minimum in Shajapur district (1.00 per cent) among all the districts, surveyed. For disease development, the favorable temperature and relative humidity were found to be 250 C and 90 per cent respectively. Out of seven fungicides tested at different concentration, Captan + Hexaconazole (0.2 per cent) followed by Carbendazim (0.1 per cent) was most effective against *A. porri* under in vitro conditions. Among the Four bioagent tested, *Trichoderma viride* followed by *Trichoderma harzianum* was most effective against *A. porri* under *in vitro* condition.

TS-08 (PS-06)

Prevalence of tuber borne diseases of potato in Madhya Pradesh

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Potato (*Solanum tuberosum* L.), the most preferred crop food crop, suffers from number of biotic factors. In a study conducted in seven districts, 14 villages at 70 fields at farmer's field in Madhya Pradesh during 2016, six major seed borne diseases were recorded. Incidence of tuber rots by *Sclerotium rolfsii* (2-17%), *Phythophthora infestans* (5-14%), and *Ralstonia solanacearum* (6-14%), *Fusarium spp* (3-21%), *Streptomyces scabies* (2-6%), *Rhizoctonia solani* (3-19%) was noticed in Chhindwara, Seoni, Indore districts. Dry rot due to *Macrophomina phaseolina*, wet rot *Sclerotium rolfsii* was prevalent at all the locations. All these pathogen are responsible for tuber quality deterioration under field, storage and transit condition. None of these districts were found suitable for seed production of potato because of the tuber borne pathogens. As per Indian seed act (1966) these pathogens are objectionable to the tuber storage, however prophylactic measures, the incidence can be minimized coupled with seed treatment and plant-application of protectant chemicals.

TS-08 (PS-07)

Influence of weather parameters on bacterial blight of hirsutum varieties of cotton

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Among various diseases occurring on cotton, bacterial leaf blight caused by *Xanthomonas axonopodis* pv*. malvacearum* causing serious loss to cotton. Since many years, it has been occurring in an epiphytotic form on commercially grown cotton varieties, leading to severe defoliation and substantial yield losses. A field trial was conducted during Kharif, 2016 on the experimental field of Plant Pathology Section, College of Agriculture, Nagpur. Studies were conducted to assess progress of bacterial blight disease on 11 varieties of G. hirsutum groups, in relation to the environmental factors. Bacterial blight disease was recorded with its first appearance and subsequently at weekly interval till it prevailed on G. hirsutum cotton varieties and its incidence varied from 0.37 to 21.11 per cent. Disease was first appeared in 33th Met. Week (2nd week of August) on the test cotton varieties, of which intensity ranged from 0.37 to 1.85 per cent and further prevailed up to 1st Met. week (1st week of January). BLB initiation and development were influenced by weather parameters. Highest disease intensity (21.11%) was recorded during 43rd Met. week on AKH-10-10. The disease started declining after 48th Met. week i.e. during last week December, 2016.

The correlation studies revealed that during the year 2016-17 maximum temperature and bright sunshine hours of preceding week had positive and significant correlation with bacterial leaf blight disease intensity. While, total rainfall, total rainy days, relative humidity (evening and morning) mean relative humidity of preceding week showed negative and non-significant correlation with bacterial leaf blight disease intensity.

TS-08 (PS-08)

Temperature studies of *Colletotrichum gloeosporioides* (penz.) penz. and sacc. the causal agent of leaf and fruit spot of pomegranate

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Leaf and fruit spot caused by *C. gleosporioides* is second important disease of pomegranate. Temperature has a drastic effect on growth and development of the pathogen. The experiment was conducted to find out the temperature requirement of the various isolates of the pathogen. 16 isolates, namely PCg 1 to PCg 16 were collected and tested at different temperatures i.e. at 20^0C, 24^0C, 28^0C and 32^0C and on different days ie 5, 10 and 15 days after inoculation. Results suggested that the maximum was growth of all the PCg isolates was found at 28^0C and no growth was observed at 32^0C. All isolates showed statistical difference in temperature requirement between different isolates and different temperatures and in their interactions.

TS-08 (PS-09)

Variability in Colletotrichum and identification of resistance against soybean anthracnose

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The genus Colletotrichum comprises ~600 species attacking over 3,200 species of monocot and dicot plants. Colletotrichum species are fungal pathogens that devastate crop plants worldwide. The genus Colletotrichum includes a number of plant pathogens of major importance, causing diseases of a wide variety of woody and herbaceous plants. It has a primarily tropical and subtropical distribution, although there are some high-profile species affecting temperate crops. Only a small number of Colletotrichum species have been associated with the teleomorph, Glomerella, and generally these teleomorphs are rarely observed in nature (Sutton, 1992). In the present investigation single spore isolates were derived from different naturally infected hosts, which allowed us to demonstrate morphological variability in the fungus. Attempts were made to induce the teleomorph and to determine the

mating system in this fungus. Anthracnose occurs throughout the soybean production areas of the world. We also report here in ten entries (IVT-24, IVT-26, IVT-39, TMAS-38, RSC-10-52, IVT-04, RSC-10-70, IVT-13, NRS-125, RSC-10-71) resistant to anthracnose of soybean out of 138 screened.

TS-08 (PS-09)

Genetics and epidemiology of powdery mildew resistance in mungbean

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The Mungbean crop is very much prone to various diseases. Among them powdery mildew (*Erysiphe polygoni* DC) is an important disease causing large economic loss. Its epidemic form covers all parts of the plant with white powdery growth of fungus, thereby adversely affecting the photosynthetic activity if the plant; in turn, reducing yield as well as market price. Severe infection of powdery mildew occurs in cool and dry months and it can reduce yield by 20 and 40 per cent and 100 % when the disease occurs at the seedling stage. The maximum damage occurs when powdery mildew infects plants just before the flowering stage. The Chhattisgarh which is considered to be the hot spot of powdery mildew disease in Vigna crops the yield losses ranges from 20-40 per cent. Powdery mildew generally appears from early flowering to the pod maturity stage and its development depends upon the cultivars used. Several workers reported inheritance of resistance to powdery mildew as monogenic dominance, Digenic dominant and trigenic. Quantitative gene with additive and non-additive gene action has also been reported. Continuous efforts are being made to develop varieties resistant to powdery mildew disease and variety “Pragya” (RUM-1) developed from IGKV, Raipur was the first powdery mildew resistant variety but it is also succumbed to disease at later stages of crop growth particularly at podding stage. To study the inheritance of powdery mildew in mungbean four crosses *viz.*, Malviya Jyoti x TM 99-2, Malviya Jyoti x TM 2000-2, Pusa Vishal x TM 99-2, and Pusa Vishal X TM 2000-2 were made during Kharif 2004, using Pusa Vishal and Malviya Jyoti as agronomicaly established parents and TM 99-2 and TM 2000-2 as powdery mildew disease resistant donors. Generations of breeding material were advanced in consecutive seasons of kharif 2004 and rabi 2004-05. Fresh crosses were again made during rabi 2004-05 which were also advanced to F2 generation in consecutive seasons. To get the fresh F1 seeds crosses were further attempted during rabi 2005-06.Field experiment with parents, F1 and F2 was conducted for four crosses in Randomized Complete Block Design at research farm, AICRP on MULLaRP, Indira Gandhi Krishi Vishwavidyalaya, Raipur. The population size of F1 and parents 2 rows each and F2-15 rows with Row to Row spacing 30 cm. and Plant to Plant spacing 10 cm with fertilizer levels 20:40:20 NPK kg ha^{-1}. Observations recorded on disease infestation showed varying degree of disease infestation in different populations. The present finding revealed that in both resistant parents resistance to disease is present till the 70-75 days after sowing after which all plants showed susceptible reaction

indicating absence of another gene which may control disease resistance in later stages of crop growth. Results of the present study showed digenic control of powdery mildew disease and resistance being controlled by two recessive genes. Observations on periodical development of disease also showed that neither parents nor F2 segregants showed any resistance to powdery mildew after 75 days. This again showed that beside these two genes more genes may also be responsible for controlling disease resistance in mungbean.

TS-08 (PS-10)

Identification of multiple disease resistant genotypes in finger millet

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Finger millet (*Eleusine coracana* L. Gaertn.) popularly known as Ragi is a hardy traditional popular food crop widely grown on marginal soils. In India, the crop is cultivated in 1.6 m ha with a production of about 1.59 mt and productivity of 1428 kg ha^{-1}. The grains are rich source of protein, fibre, minerals and amino acids, which are crucial to human health and growth. The crop suffers with various biotic stresses at all the stages of crop growth resulted economic loss in quality and quantity of the produce. Growing resistant cultivars is the best and cheapest mean to combat with any biotic stress. In the present study, fifteen early and medium maturing finger millet genotypes including local susceptible REC 69 were evaluated against important diseases. Neck blast and finger blast (*Pyricularia grisea*) incidence ranging from 0.0 to 30.2% and 2.2 to 28.1%, respectively were recorded. Five genotypes namely VL 268, PR 10-30, PPR 2773 and GPU 45 were found resistant to both the blast infections showing less than 5% incidence. Foot rot (*Sclerotium rolfsii*) incidence ranged 0.0 to 6.1 % and sheath blight (*Rhizoctonia solani*) incidence ranged 0.0 to 51.6% in finger millet genotypes. Five genotypes namely TNEC 1234, VL 268, GPU 91, PPR 1040 and REC 69 were free from foot rot. Whereas eight genotypes were free from sheath blight. Three genotypes of finger millet namely VL 268, PR 10-30 and GPU 45 were shown resistance against neck blast, finger blast, foot rot and sheath blight. These genotypes may be utilized in breeding programme for the development of multiple disease resistant varieties.

TS-08 (PS-11)

Effect of date of sowing on intensity of alternaria blight and seed yield of mustard

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Alternaria blight of mustard caused by *Alternaria brassicae* (Berk) Sacc. is assuming importance as it has started becoming severe and resulting in heavy losses particularly during favorable weather condition. The disease attacks all areal parts of the plants including pods resulting in severe defoliation and blighted appearance of the plant. A field trial was conducted at College Research Farm of JNKVV, College of Agriculture, Tikamgarh with five mustard cv. Pusa Bold, Pusa Agrani, Pusa Jai Kisan , Kranti and Varuna during 2013-14 crop seasons. They were sown on different dates viz, 20st Oct. 4th Nov. and 19th Nov at fortnightly intervals in a split-plot design with three replications Alternaria blight was recorded on late sown (19th Nov.) crop irrespective of the highest intensity of Alternaria blight (32.4%) was recorded on late sown crop variety Pusa bold and Kranti. Severity of Alternaria blight was significantly influence by date of sowing in all the five cultivars the 20th Oct. sown crop showed significantly less disease index (13.7%) with higher seed yield (2145.1 kg/ha).

TS-08 (PS-12)

Interaction between *Meloidogyne incognita* and *Fusarium oxysporum* on black gram (*Vigna mungo* L.)

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Black gram (*Vigna mungo* L.), one of the pulses, is mostly produced in Asian countries as their tropical climate and soil type suits its cultivation. India occupies 31 lakh hectares of land with 14 lakh tones production and 451.61 kg/ha productivity. Madhya Pradesh alone contributes 4.72 lakh hectares of land with 1.66 tones production and 351.69 kg/ha productivity (Anon.2012).

The interaction between root knot nematode *Meloidogyne incognita* and the fungus *Fusarium oxysporum* was studied on Black gram cultivar TU 98-14.The results indicated that plant growth was adversely affected in all the cases where the plant was inoculated with *M. inocgnita* and *F. oxysporum* when compared with uninoculated control. The data revealed that significantly reduced (13.40) plant height was recorded in the treatment where nematode inoculated first and fungus seven days after followed by the inoculation by fungus first and

nematode seven days after. Simultaneous inoculation by both the organisms recorded 16.06 cm plant height which was at par with nematode inoculation only (15.36) cm). Fungus inoculated plants attained 16.56 cm plant height against 18.62 cm plant height in control. Minimum (11.52 cm) length of root was noticed in the treatment were nematode preceded fungus followed by the treatment where fungus inoculated first and nematode seven days after (12.98 cm). Reduced root length was also noted in nematode (14.28 cm) and fungal inoculation (13.06 cm) which were at par with each other. Significant increase in root length was also recorded in simultaneous inoculation by both the organisms. Uninoculated control recorded maximum (19.02 cm) root length.

TS-08 (PS-13)

In vitro efficacy of antagonists, botanicals and fungicides against *Alternaria porri* causing Alternaria blight of niger

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Experiment was conducted to test the efficacy of five antagonists by “dual culture method”, six botanicals and seven fungicides by “poisoned food technique” at different concentration under in vitro condition against Alternaria porri causing alternaria blight of niger. Out of five anatagonists *Trichoderma harzianum* showed maximum growth inhibition of 78.07% followed by *T. virens* 71.29 per cent growth inhibition against *A. porri*. Similarly, *Allium sativum* was found to be most effective showed 26.68, 25.33, and 24.50 per cent inhibition of *A. porri* at 1.0, 0.5 and 0.2% concentration respectively, followed by *A. cepa* (bulb) caused 24.41 per cent inhibition at 1.0%. Whereas, Occimum. sanctum recorded 15.35% inhibition at 0.5% and least 14.11 per cent inhibition recorded by *O. sanctum* at 0.1 concentration. Among the fungicides, nativo-75 WG- (trifloxystrobin 25% + tebuconazole 50%) and tebuconazole, 0.05 and 0.1 % concentration has completely inhibited the mycelial growth and sporulation of the pathogen followed by hexaconazole 5% + captan 70% WP recorded 76.63 and 75.21 per cent inhibition at 0.1 and 0.05% concentration, respectively. However, Minimum 46.67 per cent inhibition recorded by flint (trifloxystrobin) 50WG at 0.05%.

TS-08 (PS-14)

Influence of weather parameters on disease and pest incidence in pigeonpea and its effect on production in Vindhya plateau of Bundelkhand region

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Pigeonpea is a drought-tolerant legume grown mainly in the semi-arid tropics, especially in India. The crop represents about 5% of world legume production, with more than 70% being produced in India. Madhya Pradesh is a leading state of India in pulse production which contributes 10 per cent of the total pigeonpea production in the country. Bundelkhand region of the state is well known for cultivation of the pulses especially pigeon pea, however its production is usually affected by diseases and pest incidence due to change in climatic conditions i.e. certain weather parameters (Rainfall, temperature and relative humidity). Keeping in view the above, the relationship of disease and insect incidence in pigeon pea with meteorological parameters was studied in Sagar district of Bundelkhand region which falls in Vindhya Plateau agro-ecological zone. It was noticed that the phytophthora blight disease occurred in the Ist week of August after heavy rains where maximum temperature was 32.8 and relative humidity was 76.5 per cent and maximum mortality was observed during continuous drizzling which continued for 2 to 3 days. Wilt disease incidence was observed at flowering stage of pigeon pea during IInd fortnight of October and it gradually increased with the lack of moisture in the soil. The pod borer incidence of was found maximum in the second week of November when temperature was 31.7 and relative humidity was 60.7 per cent. The pigeonpea yield considerably affected due to occurrence of diseases and pests which largely attributed to variation in the above meteorological parameters.

TS-01 (OP05)

Development and characterization of a repository of *Trichoderma* spp. from Madhya Pradesh with special emphasis of antagonistic potential and plant growth promotion activity

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Fungal species belonging to the genus *Trichoderma* are worldwide in occurrence and easily isolated from soil, decaying wood and other forms of plant organic matter. In total, 14 districts of Madhya Pradesh were surveyed for collection of soil samples and 177 soil samples were collected from fields of different farmers from 62 blocks of 14 districts of Madhya Pradesh. Soil samples were collected either from rhizospheric region of plant from cultivated field or from non-cultivated field. Out of 177 soil samples 40 samples yielded *Trichoderma* isolates. The cultural characteristics of the isolates were significantly variable from each other. All the forty isolates showed fast growth covering the full petriplate growth (85mm) with in 3rd day of incubation at 25°C. Conidiation was predominantly effuse and conidial/colony colour change was observed of different shades like light green, dark green-white, light green-white, yellow green and white with aerial, sub-aerial and submerged-aerial type of growth pattern. Among 40 isolates of *Trichoderma*, one isolate of *Trichoderma* T_{23} was producing completely yellow colour in petriplate growth which was observed not only from back side of petriplate but also from the front side growth in petriplate. This shows its high capacity to produce antibiotics. The isolates showed host selectivity in their capacity to inhibit the different plant pathogens. It was observed that *Trichoderma* isolate T_{21} showed its maximum inhibition capacity against two plant pathogenic fungi namely *U. segatum* var*. segatum* and *R. bataticola*; and *Trichoderma* isolate T_6 showed its maximum inhibition capacity against a group of three plant pathogenic fungi namely *Sorosporium paspali thunbergii, Helminthosporium graminea* and *Alternaria solani.* This suggests that different isolates of *Trichoderma* have their differential rate of inhibition against different plant pathogenic fungi. Apart from the direct inhibition of plant pathogens by mycoparasitism on hyphae of the different plant pathogenic fungi, *Trichoderma* spp. also have capacity to parasitize and kill the hard resting structure, sclerotia perpetuating in soil with their differential activity. Further, it was interesting to note that a set of eight isolates effectively parasitized the 100 % sclerotia of *S. rolfsii*.

Use of Entomopathogens for biological control of insect - pests

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Indigenous strains entomopathogens i.e. *Bacillus thuringenesis*, *Beauveria bassiana*, *Metarhizium anisopliae* and *Aspergillus flavus* were isolated either from naturally infected insect- pest or through soil baiting method from different parts of Chhattisgarh. One strain of *Aspergillus flavus* was isolated from naturally infected Chiku moth (*Nephopteryx eugraphella* Ragonot) in 2013. Two strains of *Metarhizium anisopliae* and four strains of *Beauveria bassiana* were isolated from different parts of Chhattisgarh between 2014- 2017. One strain of *Bacillus thuringenesis* was isolated from soil of cabbage field. Pathogenecity test was performed by inoculating spore suspension (1.93×10^7) of entomopathogenic fungi on growing larvae. Freshly collected larvae were sprayed with spore suspension while, in case of uninoculated control, larvae were sprayed with distilled water. Four larvae were placed in petriplates under inoculated and uninoculated treatments with three replications. Observations on activities and mortality were recorded after 2 days, 3 days and 4 days of inoculation.

In vitro, pathogenecity test of *Aspergillus flavus* was performed on Chiku moth caterpillar as well as larvae of other insect hosts i.e. *Helicoverpa armigera* (Gram pod borer), *Spodoptera litura* (Tobacco caterpillar). Significant mortality was recorded on both insect hosts. There was significant effect of temperatures on bio-efficacy of *Aspergillus flavus*. It was more pathogenic at 30 ^{0}C and 35 ^{0}C and took less time to kill larvae of insect hosts compared to 20 ^{0}C and 25 ^{0}C. *In vitro*, two strains of *Metarhizium anisopliae* and two strains of *Beauveria bassiana* were screened for their pathogenecity test against caterpillar of rice grain moth (*Corcyra cephalonica*). Talc based formulations of different strains of *Metarhizium anisopliae* and *Beauveria bassiana* were prepared using various concentrations of spore biomass and tested against rice grain moth (*Corcyra cephalonica*) and gram pod borer (*Helicoverpa armigera*). Results indicate that formulations having higher percentage (10 %, 20 %) of biomass were found to be more pathogenic than 1% and 5 % talc based formulations. Results also indicated that increasing the doses from 0.5 % to 10 % resulted in higher larval mortality.

Isolation of region specific indigenous strains of entomopathogenic fungi from natural population, characterization for their bio control potential and large scale production at regional and local level should be encouraged. To take-up the commercial production of bio pesticides and to encourage the entrepreneurship, large number of pilot plants should be established at regional level involving self help groups of farmers, women farmers, landless labourers and trained them for the production of microbial biopesticides under the supervision of scientists from SAUs, ICAR . The scientist involved in the programme should provide help in technology transfer, consultancy, training and quality control.

Symposium on Challenges and Opportunities: Management of Plant Diseases under Weather Change

December 14-15, 2017

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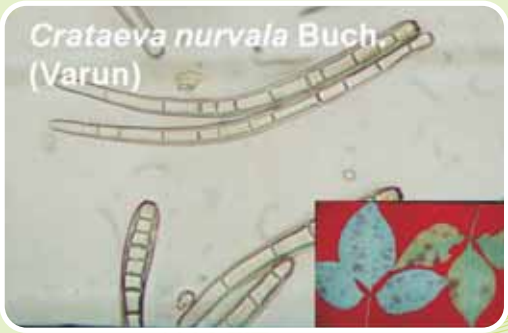

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