Proceedings of the XXIII Biocontrol Workers' Group Meeting and Technical Programme for 2014-15

27-28th June, 2014
Orissa University of Agriculture and Technology
Bhubaneswar

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AICRP on Biological Control of Crop Pests and Weeds

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Proceedings of the twenty third workshop of the AICRP on Biological Control of crop pests held at Orissa University of Agriculture & Technology, Bhubaneswar on 27-28 June, 2014

The twenty third annual Meeting of the AICRP on Biological Control of Crop Pests was held at Orissa University of Agriculture & Technology, Bhubaneswar on 27-28 June, 2014. The Programme appended in **Annexure-I.** Dr. J.M. L. Gulati, Vice Chancellor I/C, Dr. P.K. Chakrabarty, ADG (PP) ICAR, Dr. C.A. Viraktamath, RAC Chairman, NBAII, Dr. Abraham Vergese, Director, NBAII, Dr. C. Chattopadhyay, Director, NCIPM, Dr. P. K. Das, Dean Research, OUAT, Dr. B. Mishra, Dean, OUAT, Project Coordinators of White grubs, Honeybees, Orniothology and 80 scientists of AICRP on Biocontrol and NBAII and representatives from Biocontrol Industry attended the workshop.

The meeting was inaugurated by Dr. J.M. L. Gulati, Vice Chancellor I/C OUAT, Bhubaneswar on the forenoon of 27th June 2014. Dr. B. Mishra, Dean, College of Agriculture, OUAT Bhubaneswar welcomed the delegates. Dr. P. K. Chakrabarty, ADG (PP), ICAR in his address emphasized the importance of popularization and increase in uptake of biocontrol technologies among the farming community and suggested to take up Eco-specific niche based biocontrol programmes under AICRP Biocontrol. Ten publications (Folders/Pamphlets) from AICRP centres & NBAII were released as given below.

NBAII:

1. Biological Control of Pests of tomato, brinjal cotton, sugarcane & rice using stress tolerant natural enemies

AAU-A:

2. *Trichogramma* wasp - A success story (in Gujarati)

AAU-J:

3. Biological control of papaya mealy bug (in Assamese)
4. Role of biopesticides in organic farming (in Assamese)

MPKV:

5 & 6. MISSION P3 (Conservation of Predators, Parasitoids & Pollinators) (in Marathi & English)

7. Plant protection principles for higher production of tomato (in Marathi)

SKUAST:

8. Mass rearing technique of predatory *Chilocorus infernalis* for biological control of San Jose Scale

KAU:

9. Classical biocontrol of papaya mealy bug in Kerala and Lakshadweep islands
10. AICRP on biological control of crop pests and weeds (Brochure)

Dr. Abraham Verghese, Director, NBAII, and Project Coordinator Bangalore presented the salient achievements of the AICRP-BC for the year 2013-14. Dr. J.M. L. Gulati, Vice Chancellor I/C, in his presidential address suggested that the biocontrol technologies should be important components in IPM/ Organic farming systems for management of crop pests and stressed the importance of improving biodiversity and conservation of biocontrol agents in nature. The formal sessions began after a brief inauguration.

The results of the experiments from each centre were presented in four sessions. The progress of research on biological control of insect pests, plant diseases and nematodes of

various crops using parasites, predators, pathogens and antagonists was thoroughly reviewed by Dr. Abraham Vergese. In the session on Institute-industry/Public private partnership, J.P Singh from FARMER presented his experience with the use of EPN for management of sugarcane white grubs. Research needs and problems faced by the Biocontrol industry were discussed. Dr. B. Ramanujam, AICRP PC Cell I/C reviewed the Tribal Sub Plan proposals with reference to biocontrol technologies from eleven centres encompassing 120 tribal villages. In the plenary session, a panel of experts reviewed the technical programme for the 2014-15 and was finalized after thorough discussion.

The Significant Achievements and recommendations of the various sessions are as follows

Session I - Basic research on biodiversity and natural enemies of insect pests at NBAII and biological control of plant diseases

Chairperson: Dr. P. K. Chakrabarty, ADG (PP), ICAR, New Delhi
Co- Chairpersons: Dr. Swaroop Singh, Project Coordinator, AINP on Whitegrubs, RAU, Udaipur & Dr. B. Ramanujam, AICRP- PC Cell I/C, NBAII, Bangalore

Rapporteurs: Dr. Chandrika Mohan, CPCRI, Kayangulam & Dr. Harsha N Shelat, AAU-Anand

Speakers and Topics :

Dr. S.K. Jalali, NBAII, Bangalore: Biodiversity of insect pests & natural Enemies including EPN.

Dr. Chandish Ballal, NBAII, Bangalore: Parasitoids, Predators, Pathogens & Endophytes

Dr. A.K. Tiwari GBPUAT, Pantnagar: Biological Control of Plant diseases using antagonists

Significant Achievements

1. Basic research work at NBAII, Bangalore

- Described 5 new Indian species of parasitic wasps belonging to the subfamily Microgastrinae.
- A new species of gregarious endoparasitoid, *Parapanteles echeriae* (Lepidoptera: Riodinidae) was described and illustrated. This is the first ever record of a parasitic wasp associated with *Abisara*. A key to the Indian species of Parapanteles was also published.
- Two new species of *Orius* (*Orius* sp. nov. and *Orius* sp. nr. *O. pallidicornis*) were collected from *Hibiscus* and *Butea* respectively. *Orius amnesius* Ghauri collected on rose and *Buchananiella pacificus* Herring are first records for India.
- Survey for invasive insects in south India revealed the occurrence of invasive Jack Beardsley mealybug, *Pseudococcus jackbeardsleyi* in Tamil Nadu, and Karnataka. Papaya, custard apple, purple martin (*Streptocarpus* sp.), *Cordyline terminalis*, Jasmine, tapioca, chrysanthemum, Indian spinach, parthenium and chrysanthemum were found to horbour this mealybug.
- Erythrina gall wasp, *Quadrastichus erythrinae* was severe in Mandya and Chamarajnagar districts in *Erythrina indica*. *Aprostocetus gala* was found to be the

major parasitoid of *Q. erythrinae* and 25-46% parasitization was observed. It was clearly established that *Aprostocetus gala* is not a gall former in *Erythrina* plants but a very good parasitoid of *Q. erythrinae. A. gala* was unable to parasitize *L. invasa* both in net house and field release studies.

- Demonstrated whitegrub control in redgram and fodder grass using EPN.
- Seven *Bt* isolates expressing the coleopteran specific *cry3A* gene were tested against the coleopteran pest *Sitophilus oryzae* along with the *Bt* standard strain (4AA1). The isolate *Bt*AN4 was the most toxic among the indigenous isolates tested and showed LC_{50} value of 89.65µg/ml.
- *Leucanicellium lecanii* (Vl-8 isolate) and *Beauveria bassiana* (Bb-9 isolate) showed significantly lower whitefly (*Bemisia tabaci*) population in polyhouse grown tomato (15.29 & 17.21 whiteflies/plant respectively) as compared to untreated control (48.24 whiteflies/plant in tomato) indicating reduction of 68.30 & 64.32% in tomato.
- Entomofungal isolates of Bb-5a, Ma-6 and Vl-8 showed significantly low cabbage aphid (*Brevicoryne brassicae*) population/leaf (4.62, 5.82 & 5.06 respectively) with a significant reduction of 60.0-68.25% over control.

2. Biological suppression of diseases

- *Trichoderma* isolates TCMS 5, TCMS 14a, & Th 14 reduced the intensity of brown spot disease of rice ignificantly with an incidence of 17-19% as compared to 48% in control (GBPUAT)
- In chickpea, soil application TCMS-5 isolate of *Trichoderma* (1kg talc based formulation of /100 kg vermicompost/acre), seed treatment (@ 10 g/kg seeds) and two foliar sprays (@10 g/lit at 45 & 90 days after sowing) showed least mortality (5.9%) as compared to control (15.4%) after 90 DAS (GBPUAT).
- In lentil, seed treatment, soil application and foliar spray with Th-17 or TCMS-5 isolates of Trichoderma indicated higher germination and plant stand (GBPUAT).
- Bio-efficacy of CHF *Pf*-1 was evaluated for the management of bacterial wilt of brinjal caused by *Ralstonia solanacearum* in Pasighat, Arunachal Pradesh. Application of CHF *Pf*-1 as seedling dip @25g / liter for 30 minutes before transplanting + soil drenching @ 2.5g / litre at 20 days after transplanting (DAT) recorded lowest wilt incidence of 14.75% and it was better than soil drenching with streptomycine/bleaching powder (19.8% and 21.0% incidence respectively). The highest yield of 244.55q/ha was also recorded in CHF *Pf*-1 seedling dip + soil drench treatment (CAU).

Recommendations:

1) Identification of biocontrol agents especially insects should be strengthened based on molecular basis to protect IPR.
2) All the AICRP centres should deposit the biocontrol agents especially insects at NBAII, Bangalore with passport data to get the registration number and this should be used while publishing research papers.
3) Molecular identification should be precise with more repetitions to overcome machine error.
4) Duplication of work especially basic research on pollinators, *Trichoderma* etc. may be avoided

5) An appeal / suggestion from NGO was to simplify the registration procedure for microbial biopesticides at CIBRC to promote the low input eco-friendly technologies to benefit farming community. This will be taken up appropriately.

Session II- Biological Suppression of Pests of Sugarcane, Cotton, Rice, Maize & Sorghum

Chairperson : Dr. Abrahan Vergese, Director, NBAII, Bengaluru
Co- Chairpersons : Dr. B.K. Mishra, Dean, OUAT, Bhubaneswar & Dr. K.C.Sahu, HOD, Pl. Pathology OUAT ,Bhubaneswar

Rapporteurs : Dr.Vidhya, KAU, Trissur & Dr. P.H. Godhani, AAU-A, Anand

Speakers and Topics:

Dr. Jaspal Singh Virk, PAU, Ludhiana: Sugarcane and Cotton
Dr. K.R. Lyla, KAU, Trissur : Rice, Maize & Sorghum

Significant Achievements

Sugarcane:

- Incidence of sugarcane woolly aphid and occurrence of natural enemies viz., *Dipha aphidivora, Micromus igorotus and Encarsis flavoscutellus* were assessed in Maharastra, Karnataka, Tamil Nadu. The population of natural enemies were found established in all places, especially *Encarsia* with the increase in the population of woolly aphid and as a result the incidence of SWA was found to be very low in these areas.
- Percentage parasitism of *T. chilonis* reared Erisilk worm eggs against early shoot borer of sugarcane were on par with *T.chilonis* reared on *Corcyra* eggs. Prolonged emergence of adults from cards made by ESW eggs enabled continuous availability of parasitoid in the field .
- In Maharastra large-scale demonstrations with eight releases of *T. chilonis* TTS @ 50,000 parasitoids/ha at weekly interval starting from 45 days after shoot emergence was found effective in reducing the infestation of early shoot borer (6.8%) and increased tillers as well as cane yield (144.3 MT/ha).
- In Odisha, regular release of *T.chilonis* against early shoot borer and inter-node borer resulted in lower incidence of early shoot borer (7.2 to 8.7%) as compared to 27.4 to 35.8% in farmers practice. Similarly, internode borer incidence was least in parasitoid released plots (11.84-14.38%) as compared to 27.45% and 33.33% in farmers practice. Top shoot borer incidence was also least in parasitoid released fields (2.8-4.2%) as compared to 7.3-9.1% incidence in Farmers practice. The yield was higher (144.7-155.2 t/ha) in parasitoid released plots whereas it was 109.5-111.6 t/ha in farmers practice.
- Biocontrol technologies for management of sugarcane borers were implemented in large-scale (2200ha) in Punjab leading to a reduction of 50-60% of pest incidence and the yield were on par with Chemical pesticide treated plots.

Rice

- The successful management of rice pests and diseases through the bio-intensive IPM (BIPM) strategy was demonstrated and dissipated in Kerala (100ha), Assam (60 ha) Odisha (60 ha) and Punjab (10ha) in comparison with chemical insecticide pest management practice (farmers practice).
- In Assam, the incidence of dead heart and white ear were less (2.77% and 2.7%) in BIPM package as compared to farmers practice (3.9%). Maximum mean yield was contributed by BIPM package with 4757.0 kg/ha, significantly superior to the farmers practice (3875.0 kg/ha) (AAU-J).
- In Kerala in BIPM plots, Coccinellid population was significantly high compared to the plots of Farmer's practice (KAU).
- In Punjab, BIPM practice in Basmati Rice indicated a net return of Rs. 1, 01,775/- in BIPM package as compared to Rs. 1, 07,070/- in farmer's practice (PAU).
- In Uttarakhand, by adopting biocontrol technologies, an average yield of 45q/ha was obtained as compared to conventional farmer's practices (38 q/h) (GBPUAT).

Maize

- Four releases of *T. chilonis* @ 150000 parasitoids/ha in maize at 10 days intervals starting 25th days after germination was found most effective against maize stem borer in Rajasthan (MPUAT).
- Biological control of maize stem borer was demonstrated in Punjab (10ha) in comparison with chemical pesticide management practice. The % leaf damage & dead hearts and yield were par in both practices

Sorghum

- Application of *M. anisopliae* (Ma 36 @ 5ml/l) at 20, 45 DAE resulted in 18.0% reduction in dead hearts over control and was on par with whorl application of carbofuran granules @ 8 kg/ha at 20 DAE. However there were no significant differences among the fungal formulation in reducing the leaf damage (DSR).

Recommendations

1. While monitoring the population of natural enemies of cotton mealybugs, the populations of parasitoids should also be recorded.
2. Temperature tolerant strains of *T. chilonis* should be tested in Western U.P for sugarcane borer. PAU may provide the technology and NCIPM take up the work.
3. Private industry may be encouraged to take part in *Corcyra* production on PPP mode.

Session III- Biological Suppression of Pests of Pulses, Oilseeds, Tobacco and Coconut

Chairperson : Dr. C.A. Viraktamath, Chairman, RAC, NBAII
Co- Chairperson : Dr. S. K. Jalali, HOD, NBAII, Bangalore

Rapporteurs : Dr. S. M. Galande, MPKV, Pune & Dr P.S. Shera, PAU, Ludhiana

Speakers and Topics:

Dr. R.V. Nakat, MPKV, Pune : Pulses and Oilseeds
Dr. S. K. Jalali, NBAII, Bangalore : Tobacco
Dr. Chandrika Mohan, CPCRI, Kayangulam: Coconut

Salient Achievements

Pigeonpea

- In Maharastra, spraying of *Bt* strain NBAII-BTG4 @ 2% thrice at fortnightly interval was statistically comparable with chlorpyriphos 0.05% in reducing pod damage (11.8%) of *H. armigera* and *Maruca testulalis* and increased the yield (14.8 q/ha) of pigeon pea (MPKV).
- In Gujarat, PDBC-BT1 @ 2% showed minimum damaged pods (6.79%) followed by PDBC-BT1 @ 1% (7.06%). Maximum yield (1841 kg/ha) was observed in plots treated with chemical insecticide followed by NBAII-BT G4 2% (1761 kg/ha) (AAU-A).
- In Karnataka, NBAII BTG 4 *Bt* @ 2g/lit was found effective against pigeon pea pod borer (*H. armigera*) which recorded 10.84 per cent pod damage and it was statistically superior over rest of the bioagents. This treatment recorded significantly higher grain yield of 14.88 q/ha than other treatments (UAS-R).

Chickpea

- The per cent pod damage in chickpea was significantly lower with two sprays of HaNPV @ 250 LE/ha (MPAUT)

Soybean

- In Maharastra, spraying of *Sl*NPV @ 250 LE/ha (1.5 x 10^{12} POBs/ha) thrice at fortnightly interval was statistically superior in suppressing the infestation of *Spodoptera litura* (4.76 larvae/m row) with 78.0 per cent larval mortality and gave maximum yield of soybean (21.95 q/ha) (MPKV).

Safflower

- Three sprays of *Metarhizium anisopliae* @ 10^{13} conidia/ha at fortnightly interval was next best treatment to dimethoate@ 0.05% in suppressing the aphid population (*Uroleucon compositae*) on non-spiny variety of safflower and increased the yield in Maharastra (10.9 q/ha) (MPKV).
- In Andhra Pradesh, bio suppression of safflower aphid, *U. compositae* was achieved through two sprays of *Verticillium lecanii* 1.0 % WP in non spiny safflower. (ANGRAU)

Coconut

- Outbreak of coconut leaf eating caterpillar, *Opisina arenosella* was observed in Trivandrum during April 2013 with 74.4 percent leaf damage. It was brought down to 16.7 per cent with the release of larval parasitoids, *Goniozus nephantidis Bracon brevicornis* (CPCRI)
- Biointensive integrated management of *Opisina arenosella* along with nutritional management was demonstrated at Jajur village in Arasikere area of Karnataka (CPCRI)
- Biocontrol technology was demonstrated for the management of rhinoceros beetle, *Orycetes rhinoceros* over an area of 1500 ha in Southern Kerala on coconut (CPCRI)

Recommendations:

- While recording incidence of biocontrol agents and their diversity, emphasis is laid only on predators. Special efforts need to be made to record data on parasitoids also.
- The NBAII *Bt* formulations proved consistently effective for three years against pigeon pea pod bores in different centres may be may be taken up for large-scale demonstrations in Farmers fields and included in the package of practices.
- Nomenclature of stain/biotype of biocontrol agents should be consistent and not to be frequently changed.
- Current valid scientific names of the insects and biocontrol agents need to be used.

Session IV- Biological Suppression of Pests of Fruit and Vegetable Crops, Polyhouse Crop Pests, Storage Pests and Weeds

Chairperson : Dr. C. Chattopadhayay, Director, NCIPM, New Delhi

Co- Chairpersons : Dr. Chandish Ballal, HOD, NBAII, Bangalore & Dr. S.N.Mohapatra, HOD, Nematology, OUAT, Bhubaneswar

Rapporteurs : Dr. A.A. Khan, SKUAST & Dr. Anjumoni Devee, AAU-A

Speakers and Topics:

Dr. Karupuchami, TNAU, Coimbatore: Tropical and Temperate Fruits, Mealybugs & Tea Mosquito bug
Dr. A. Saravanan, TNAU, Coimbatore: Vegetables
Dr. P. N. Ganga Visalakashi, IIHR, Bangalore: Polyhouse crop pests, Storage pests & Weed Biocontrol

Salient Achievements

Mango

- In Maharastra, spraying of *Metarhizium anisopliae* @ 1 x 10^9 spores/ml with adjuvant (sunflower oil 1 ml/l + Triton X 100 @ 0.1 ml/l) during offseason in December followed by four sprays of the entomopathogenic fungi at weekly interval during flowering (January-February) found significantly effective in suppressing the hopper population (10.6 hoppers/inflorescence) and increased fruit set (11.8 fruits/inflorescence) in mango (MPKV).

- In Tamil nadu, talc formulation of *Metarhizium anisopliae* of IIHR strain @ 1kg/100L recorded 77.1 per cent mortality of mango hoppers which was significantly superior to other formulations *viz*., liquid and oil formulations which recorded 71.13 and 63.73 per cent mortality of adult mango hoppers over untreated control respectively (TNAU).
- In Karnataka, the efficacy of oil, water and talc based formulations of *M. ansiopliae* in addition to chemical control were tested against mango inflorescence hopper *Idioscopus nitidulus*. Significant reduction in hopper population was found in Imidacloprid @ 0.3ml/l sprayed trees followed by Nimbicidin @0.3 % spray. Liquid

and talc formulations of *M. anisopliae* were on par in reducing the hopper population (IIHR).

- In Kerala, oil formulation of *M. anisopliae* was found superior than the talc and liquid formulations of *M. anisopliae* against mango hopper and it was on par with Nimbicidin. There was no significant difference between treatments in fruit set (KAU).

Custard apple

- Release of *Scymnus coccivora* @ 10 grubs per tree twice at monthly interval was found effective in reducing the mealy bugs *Maconellicoccus hirsutus. hirsutus* and *Ferrisia virgata* and increased the yield of marketable custard apples (34.9 kg/tree). It was at par with *Cryptolaemus montrouzieri* @ 5 grubs per tree (MPKV).

Papaya

- Papaya mealy bug incidence was noticed 12.8 to 21.0% with 2.1 to 2.8 pest intensity rating in five districts of Maharashtra. Besides eight predators, the parasitoid *Acerophagus papayae* and *Pseudleptomastix mexicana* were observed in the mealy bug colonies. The pest incidence was recorded from April to December 2013 with peak (14.6-25.0%) in June (MPKV).

Citrus

- Field evaluation on bio-efficacy of EPNs through stem injection @50 ijs/ml of water and as cadaver application against citrus trunk borer, *Anoplophora versteegi* were carried out at two locations *viz.* Pasighat and Ringging of Arunachal Pradesh. CAU-1 stem injection (37.22 and 36.43% reduction at Pasighat and Rengging respectively) and CAUH-1 stem injection (33.90 and 36.75% reduction at Pasighat and Rengging respectively) were observed as the best treatments. However, EPNs were found inferior to stem injection with dichlorvos 0.05 per cent.

Pineapple

- *Beauveria bassiana* and *Metarhizium anisopliae* and *Lecanicillium leacanii* were evaluated against pineapple mealybug, *Dysmicoccus brevipes* (Cockerell). Mycosis to the mealybugs was noticed only in treatments with *L. leacanii* @ 10^8 spores/ml & 10^9 spores/ml (KAU)

Banana

- *B. bassiana* (10^8 spores/ml) and *M. anisopliae* (10^8 spores/ml) were found causing good mycosis on grubs of banana pseudostem weevil (KAU).

Apple

- *Metarhizium anisopliae* (10^6 conidia/cm^2) was found to be the most effective in controlling apple root borer, *Dorysthenes hugelii* resulting in 82.6 per cent mortality of the larvae and was on par with chlorpyriphos (0.06%) which killed 87.5 per cent of the grubs (YSPUHF).

- Field releases of *Trichograma embryophagum* + *T. cacoeciae* @ 100,000/ha against codling moth *(Cydia pomonella*) in apple orchards of Kargil recorded 23.5 % reduction of fruit damage. However, the combined effect of *Trichograma embryophagum, T. cacoeciae* and pheromone trap revealed 27.66% reduction of fruit damage at Kargil.

Tomato

- In the biointensive IPM field, the population of sucking pests *viz.*, aphids, thrips, leafhoppers and whiteflies and fruit borer *viz*., *Helicoverpa armigera* incidence were significantly lower when compared to farmers practice. The incidence of fruit borer was 6.4 to 8.6% in BIPM as compared to 14.2 to 15.8% in farmers practice at 75 to 105 DAT. The fruit yield (36.80t/ha) was significantly higher in BIPM plot as compared to farmers practice (32.45t/ha) with a cost benefit ratio of 1:3.2 (TNAU).

Brinjal

- Two sprays of NSKE and six release of *Trichogramma chilonis* in brinjal significantly reduced the fruit and shoot damage and sucking pest incidence in Rajasthan (MPUAT).
- The biointensive IPM practice produced net return over the farmers practice in the range of ₹1,06,830 to ₹ 1,24,800 indicating the superiority of IPM package over the farmers' practice (OUAT).
- Among the biocontrol agents, *Brumus suturoides* @ 1500/ha, *Scymnus*@ 1500/ha and *Cryptolaemus* @ 1500/ha significantly reduced the population of mealybug over control. (TNAU).
- The BIPM module was found to be significantly effectively over other modules in suppressing the shoot (10.6%) and fruit (15.3%) borer infestation and increased the marketable fruit yield of brinjal (217.8 q/ha) (MPKV).

Cauliflower:

- Bt formulations *viz.*, PDBC BT 1 and NBAII BTG 4 @ 1 and 2% were significantly superior in reducing the larval population of diamondback moth by 85.48 to 90.88% over control. Highest yield of 17.8 t/ha was recorded in NBAII BTG 4 @ 2% spray which was on a par with other Bt formulations and chlorpyriphos treatment (TNAU).

Tapioca

- BIPM module evaluated against *Aleurodicus dispersus* on cassava recorded a lower population of *A. dispersus* (76.93 per 5 plants) as compared to farmer's practice (226.11 per 5 plants) and untreated check (320.96 per 5 plants). Maximum yield was recorded from BIPM module (36.79 t/ha) as compared to untreated check (21.60 t/ha). The net profit and benefit cost ratio (BCR) were also higher in BIPM module (1 : 3.34) than the farmer's practice (1: 2.41) (TNAU)

Polyhouse crop pests

- Release of predatory mite, *Neoseiulus longispinosus* at 1:10 predator: prey ratio in carnation resulted in 91.2 per cent reduction of phytophagous mite population over

untreated control and was also on par with fenazaquin (0.0025%) which caused 92.1 per cent reduction (YSPUHF).

- Release of *Blaptostethus pallescens* @ 30 nymphs/m row along with chemical control (Omite 300 ml/ acre) was found effective in managing two-spotted spider mite, *Tetranichus urticae* on okra under net house condition (PAU).

- The treatment of *Paecilomyces lilacinus* @ 20 kg/ha found to be the most effective in reducing the root-knot nematode population (64.3 %) and gall index (52%) which was at par with the treatment of *Arthrobotrys oligospora* @ 20 kg/ha in reducing the root knot nematode population (60%) and gall index (38 %) (MPKV).

Storage pests in rice

- Release of anthocorid predator, *Xylocoris flavipes* @ 30 nymphs per kg of corcyra infested stored rice (12.75 moths/jar) was significantly superior to all other treatments in reducing the emergence of *Corcyra* moths (AAU-J).

- Release of anthocorid bugs in rice bins could effectively control the *Corcyra cephalonica* larvae. Nymphs of the bug *Xylocoris flavipes* performed better than those of *Blaptostethus pallescens* in minimizing the moths. (ANGRAU).

Recommendations

1. Damage of PMB before release and emergence of parasite should be recorded by all centres dealing with PMB (MPKV, KAU, TNAU, IIHR, NBAII, AAU-J, OUAT)
2. Appropriate statistical analysis has to be used while analyzing the field data (All AICRP centres)

Session V- Institute – Industry Partnership

Chairperson: Dr. J. Kumar, Dean, GBPUAT, Pantnagar

Co-chairpersons: Dr. Vasudeava Rao, PC , Agri. Ornithology, ANGRAU, Hyderabad
Dr. A. Krishnamoorthy, Principal Scientist, IIHR, Bengaluru.

Rapporteurs : Dr. Neelam Joshi, PAU & Dr. Sajad, SKUAST

There was a talk by J.P Singh from FARMER on the efficacy of EPN against sugarcane pests The important decisions/ recommendations that emerged from the session were:.

Recommendations:

1. Biopesticides should be exempted from Registration under Insecticide Act and should be treated like biofertilizers.
2. Quality control laboratories should be identified among centres working on biocontrol for quality assurance of biopesticides.
3. Govt. Should extend subsidies to industries on biocontrol to promote them and also to the farmers to adopt.

Session VI: Presentation of Tribal Sub Plan Proposals from AICRP centres during XII plan

Dr. Abraham Verghese, Director and Dr. B. Ramanujam, AICRP Pc Cell I/C reviewed the Tribal Sub Plan proposals from eleven centres (AAU-A, AAU-J, CAU, GBPUAT, MPKV, MPUAT, OUAT, SKUAST, TNAU, YSPUHF & UAS-R) and accepted for implementation from 2014-15 year onwards. The details of the TSP programmes of these centres are included in the Technical programme of 2014-15.

Session VII: Plenary Session & Formulation of Technical Programme

A panel of Experts comprising Dr. C.A. Viraktamath, Chairman, RAC, NBAII, Dr. Abraham Verghese, Director, NBAII, Bangalore, Dr. C. Chattopadhyay, Director, NCIPM, New Delhi, Dr. P.K. Das, Dean of Research, OUAT, Bhubaneswar, Dr. J. Kumar, Dean, GBPUAT, Pantnagar, Dr. B.K. Mishra, Dean, OUAT, discussed the details of the on-going programmes and the final technical programme for the years 2014-15 were finalized.

Recommendations:

1. The field experiments which have been completed for three years may be closed the data may be analyzed and the recommendations may be included in the package of practices. The cost benefit ratio should be worked out for all closed field experiments (AAU-A)
3. *Trichoderma viride* culture from GBPUAT centre may be sent to NBAII for confirmation of the species whether it is *viride* or *asperellum* (GBPUAT)
4. Standard protocols should be followed while naming the different strains used in the biocontrol experiments (GBPUAT)
5. Effective strain of *Trichoderma* on rice may be sent for testing on at KAU (GBPUAT)
6. Protocols for sending the specimens for barcoding should be sent to centres (NBAII)
7. IIHR centre should provide the details of formulations of *Metarhizium ansipliae* for the mango hopper experiments (IIHR)
8. The specimens of mango hoppers may be sent Dr. CA Virakthamat for identification (MPKV, KAU, IIHR)
9. MPKV centre should discuss with Dr. A. Krishnamoorthy, PS, IIHR to finalize the treatments for brinjal fruit & shoot borer experiment (MPKV)
10. PAU should provide the package of recommendations to NCIPM for taking up of sugarcane borer control in Uttar Pradesh (PAU & NCIPM)
11. EPN should be tested on pupal stage of codling moth of apple (SKUAST)
12. PAU centre may also take up observations on other sucking pests in the polyhouse experiment on mites (PAU)
13. The polyhouse experiment on chrysantemum leaf miner at TNAU centre may be modified to take up work on pest intensity & natural enemies on chrysanthemum under polyhouse conditions (TNAU)
14. NCIPM centre should propose a programme on sugarcane white grub control using EPN in Uttar Pradesh (NCIPM)

Technical Programme for different centers of AICRP on Biological Control of Crop Pests & for the year 2014-15 is given as Annexure-II.

Annexure-I

ANNUAL GROUP MEET OF ALL INDIA CO-ORDINATED RESEARCH PROJECT ON BIOLOGICAL CONTROL OF CROP PESTS

Venue**: Orissa University of Agriculture and Technology, Bhubaneswar**
Date **: 27 - 28th June, 2014**

PROGRAMME: June 27, 2014 (Friday) 9.30 to 11.45 am

0930-1030	**REGISTRATION**
1030-1130	**INAUGURATION**
Invocation	ICAR Song
Welcome	**Dr. B.K. Mishra,** Dean, College of Agriculture, OUAT, Bhubaneswar
Project Co-ordinator's Report	**Dr. Abraham Verghese** Project Co-ordinator, AICRP on Biological Control of Crop Pests and Director, NBAII, Bangalore
Release of AICRP Publications	**1. NBAII :** Biological Control of Pests of tomato, brinjal cotton, sugarcane & rice using stress tolerant natural enemies **2. AAU-A:** *Trichogramma* wasp - A success story (in Gujarathi) **3. AAU-J:** 1. Biological control of papaya mealy bug (in Assamese) Role of biopesticides in organic farming (in Assamese) **4. MPKV:** 1. MISSION P3 (Conservation of Predators, Parasitoids & Pollinators) (in Marathi & English) 2. Plant protection principles for higher production of tomato (in Marathi) **5. SKUAST:** Mass rearing technique of predatory *Chilocorus infernalis* for biological control of San Jose Scale **6. KAU:** 1. Classical biocontrol of papaya mealy bug in Kerala and Lakshadweep islands 2. AICRP on biological control of crop pests and weeds (Brochure)
Address by Chief Guest	**Dr. P. K. Chakrabarty,** ADG (PP), ICAR, New Delhi
Address by President	**Dr. J. M. L. Gulati,** Vice Chancellor I/C, OUAT, Bhubaneswar
Vote of thanks	**Dr. H. P. Patnaik,** HOD, Entomology, College of Agriculture, OUAT, Bhubaneswar
1130-1145	**TEA**

PRESENTATION OF PROGRESS REPORTS	
June 27, 2014; 1145-1330 hrs	**SESSION I: BASIC RESEARCH ON BIODIVERSITY AND NATURAL ENEMIES OF INESECT PESTS AT NBAII AND BIOLOGICAL CONTROL OF PLANT DISEASES**
Chairman Co-Chairmen	Dr. P. K. Chakrabarty, ADG (PP), ICAR, New Delhi Dr. Swaroop Singh, Project Coordinator, AINP on Whitegrubs Dr. B. Ramanujam, P.S, NBAII, Bangalore
Rapporteurs	Dr. Chandrika Mohan, CPCRI, Kayangulam Dr. Harsha N Shelat, AAU- Anand
Speakers	
Biodiversity of insect pests & natural Enemies including EPN	Dr. S.K. Jalali, NBAII, Bangalore
Parasitoids, Predators, Pathogens & Endophytes	Dr. Chandish Ballal, NBAII, Bangalore
Biological Control of Plant diseases using antagonists	Dr. A.K. Tiwari GBPUAT, Pantnagar
1330-1400 hrs	**LUNCH**
June 27, 2014; 1400-1530 hrs	**SESSION II: BIOLOGICAL SUPPRESSION OF PESTS OF SUGARCANE, COTTON, RICE, MAIZE AND SORGHUM**
Chairman Co-Chairmen	Dr. Abraham Verghese, Director, NBAII, Bangalore Dr. B.K. Mishra, Dean, OUAT, Bhubaneswar Dr. K.C.Sahu, HOD, Pl. Pathology OUAT ,Bhubaneswar
Rapporteurs	Dr.Vidhya, KAU, Trissur Dr. P.H. Godhani, AAU-A, Anand
Speakers	
Sugarcane & Cotton	Dr. Jaspal Singh Virk, PAU, Ludhiana
Rice, Maize & Sorghum	Dr. K.R. Lyla, KAU, Trissur
1530-1700 hrs	**SESSION III: BIOLOGICAL SUPPRESSION OF PESTS OF PULSES, OILSEEDS, TOBACCO AND COCONUT**
Chairman Co-Chairmen	Dr. C.A. Viraktamath, Chairman, RAC, NBAII Dr. S. K. Jalali, HOD, NBAII, Bangalore
Rapporteurs	Dr. S. M. Galande, MPKV, Pune Dr P.S. Shera, PAU, Ludhiana
Speakers	
Pulses & Oilseeds	Dr. R.V. Nakat, MPKV, Pune
Tobacco	Dr. S. K. Jalali, NBAII, Bangalore
Coconut	Dr. Chandrika Mohan, CPCRI, Kayangulam

June 28, 2014 (Saturday) **0915-11.30 hrs**	**SESSION IV: BIOLOGICAL SUPPRESSION OF PESTS OF FRUIT AND VEGETABLE CROPS, POLYHOUSE CROP PESTS, STORAGE PESTS AND WEEDS**
Chairman Co-Chairmen	Dr. C. Chattopadhayay, Director, NCIPM, New Delhi Dr. Chandish Ballal, HOD, NBAII, Bangalore Dr. S.N.Mohapatra, HOD, Nematology, OUAT, Bhubaneswar
Rapporteurs	Dr. A.A. Khan, SKUAST Dr. Anjumoni Devee, AAU-A
Speakers	
Tropical and Temperate Fruits, Mealy bugs & Tea Mosquito	Dr. Karupuchami, TNAU, Coimbatore
Vegetables	Dr. A. Saravanan, TNAU, Coimbatore
Polyhouse Crop Pests, Storage pests & Weed Biocontrol	Dr. P. N. Ganga Visalakashi, IIHR, Bangalore
1130-11.45 hrs	**TEA**
June 28, 2014 (Saturday) **1145-1230 hrs**	**SESSION V:** **INSTITUTE–INDUSTRY PARTNERSHIP**
Chairman Co-Chairmen	Dr. J. Kumar, Dean, GBPUAT, Pantnagar Dr. A. Krishnamoorthy, P.S, IIHR, Bangalore Dr. Vasudeva Rao, Project Coordinator, AINP on Ornithology
Rapporteurs	Dr. Neelam Joshi, PAU, Ludhiana Dr. Sajad Mohi-ud-din, SKUAST
Interaction on Institute–Industry Partnership	Mr. Mohan Das, Agi-Biocare, Kottayam J.P. Singh, FARMER, New Delhi
12.30-13.30	**Tribal Sub Plan programme proposals**
Presentation of Tribal Sub Plan programme proposals by AICRP Centres (AAU-A, AAU-J, GBPUAT, MPKV, SKUAST, TNAU, YSPUHF, CAU, OUAT, MPUAT & UAS-R)	Chairman Dr. Abraham Vergese, Director, NBAII, Bangalore Co-Chairman: Dr. B. Ramanujam, NBAII, Bangalore
1400-1700 hrs	**SESSION VI (Plenary): Presentation of Recommendations and Finalization of Technical Programme for the year 2014-15**
Panel of Experts	Dr. C.A. Viraktamath, Chairman, RAC, NBAII Dr. Abraham Verghese, Director, NBAII, Bangalore Dr. C. Chattopadhyay, Director, NCIPM, New Delhi Dr. P.K. Das, Dean of Research, OUAT, Bhubaneswar Dr. J. Kumar, Dean, GBPUAT, Pantnagar
Rapporteurs	Dr. B. Ramanujam, NBAII, Bangalore Dr. Chandish Ballal, NBAII, Bangalore
Speakers	Presentations of Recommendations & Plan of Work by Chairmen of different technical sessions. Remarks by Panel of Experts
Vote of Thanks	Dr. Chandish Ballal**,** HOD, NBAII, Bangalore
1530-1545 hrs.	**TEA**

Annexure-II

Centre-wise Technical Programme-2014-15

Centre	Projects									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
AAU-A	Biodiversity-Spiders & EPN mapping	Biological control of chilli anthracnose **(New)**	Bio-efficacy of microbial insecticides against sucking pest in *Bt* cotton **(New)**	Bio-efficacy of microbial insecticides against *Spodoptera litura* in cauliflower **(New)**	Large scale demonstration of BIPM technology for management of *Helicoverpa armigera* in tomato	Survey and monitoring of papaya mealybug *Paracoccus marginatus*	Large scale demonstration of NBAII liquid formulations (PDBC-BT1 and NBAII-BTG4) against pigeon pea pod borer (*Helicoverpa armigera*) **(New)**	TSP on Biocontrol Technologies for Management of *Fusarium* wilt in chick pea/ pigeon pea **(New)**		
AAU-J	Biodiversity *Trichogramma Chrysoperla Coccinellids*	Evaluation of EPF against sucking pests of chillies	Evaluation of EPF against soil insects of potato	Evaluation of *B. bassiana* against tea mosquito bug	Large scale demonstration of proven biocontrol technologies in rice	Demonstration of bio intensive package for the pest of tomato **(New)**	TSP on BIPM Technologies for rice, sugarcane & vegetables **(New)**			
ANGRAU	Biodiversity *Trichogramma Chrysoperla*	Monitoring of SWA & Impact assessment of Natural enemies	Monitoring of Cotton Invasive Mealy Bugs including sap sucking insects, mirids	Evaluation of *Trichogramma chilonis* against Maize stem borer *Chilo partellus* **(New)**	Evaluation of Bt Formulations against Pulses borers	Bio suppression of Safflower Aphid	Biological control of Groundnut pest complex **(New)**	Large scale demonstration against sugarcane Borers (ESB & INB) **(New)**		
GBPUAT	Biological control of chilli anthracnose **(New)**	Field evaluation .of promising Trichoderma /Pseudomonas for management of soil-borne diseases of rice, chickpea & wheat	Large scale demonstration of Biocontrol technologies in rice & pea	TSP on Promoting BIPM amongst *buksa* tribe in district Udhamsingh nagar **(New)**						

Centre	1	2	3	4	5	6	7	8	9	10
KAU	Biodiversity Natural enemies of Banana Weevil & Aphid, root mealy bugs of pepper	Field evaluation of EPF against Rice Gundhi bug	Evaluation of *M. anisopliae* formulations against Mango Hoppers (Oil formulations)	Monitoring of Papaya Mealy bug & natural enemies on alternate hosts	Field evaluation of EPF against banana Pseudostem weevil	Field evaluation of EPF against pineapple Mealy bugs	Laboratory evaluation of entomopathogens against banana root mealybug- *Geococcus citrinus* **(New)**	Large scale demonstration of proven biocontrol technologies in rice		
MPKV	Biodiversity- *Trichogramma Chrysoperla, Cryptolaemus*	Monitoring of SWA & Impact assessment of Natural enemies	Monitoring biodiversity and outbreaks of invasive mealy bugs on cotton	Monitoring biodiversity and outbreaks of sap sucking pests including, mirids and their natural enemies in *Bt* cotton	Monitoring of Papaya Mealy bug & natural enemies on alternate hosts	Evaluation of *M. anisopliae* formulations against mango hoppers	Biological suppression of onion Thrips	Biological suppression of shoot and fruit borer, *Leucinodes orbonalis* in brinjal (**New)**	Biological suppression of fruit borer, *Earis vitella* in okra (**New)**	Biological suppression of mustard aphid, *Lipaphis erysimi*. **(New)**
MPKV	Demonstration of biological control of *Spodoptera litura* soybean **(New)**	Biological management of red spider mite *Tetranychus urticae* in rose in polyhouse conditions **(New)**	TSP on Management of insect pests and diseases in horticulturalplantation in tribal area **(New)**							
PAU	Biodiversity of Natural enemies Rice yellow stem borer & Cotton pests & EPN mapping	Monitoring biodiversity and outbreaks of invasive mealy bugs on cotton	Monitoring biodiversity and outbreaks of sap sucking pests including, mirids and their natural enemies in *Bt* cotton **(New)**	Seasonal abundance of Rice - Predatory Spiders **(New)**	Microbial control of Lepidopteran pests of moong bean	Validation of different BIPM modules against shoot and fruit borer, *Leucinodes orbonalis* in brinjal **(New)**	Field evaluation of IPM Module for cauliflower/ cabbage pests	Evaluation of Commercial Formulations of Bt & microbial agents against Cabbage Butterfly	Evaluation of anthocorid predator. *Blaptostethus* against spider mites in Poly houses (brinjal, chilli, okra).	Evaluation of EPF against spider mite, *T. urticae* on capsicum /bell pepper under protected condition

Centre	1	2	3	4	5	6	7	8	9	10
PAU	Large scale demonstration of proven biocontrol technologies in basamati rice	Large scale demonstration against Sugarcane Borers with tts *T. Chilonis*	Large scale demonstration against maize stem borer with *T. Chilonis* & *Cotesia flavites*							
SKUAST	Biodiversity of Natural enemies of pests of apple apricot, plum, pear, peach, cherry, walnut & almonds	Survey for natural enemies of apple codling Moth	Bio intensive management of codling moth, *Cydia pomonella* on apple in Laddakh	Evaluation of predatory mite, *Blaptostethus pallescens* against European Red mite *Panonychus ulmi* on apple **(New)**	Evaluation of predatory mite, *Blaptostethus pallescens* against saffron thrips on saffron **(New)**	Polyhouse evaluation of predators against Cabbage Aphids	TSP on Bio-intensive IPM of Codling moth in Ladakh **(New)**			
TNAU	Biodiversity- *Trichogramma Chrysoperla, Cryptolaemus*	Monitoring of SWA & Impact assessment of Natural enemies	Monitoring of Cotton - Invasive mealybugs	Monitoring of Papaya Mealy bug & natural enemies on alternate hosts	Large scale field demonstration of BIPM package for the management of key pests of tomato	Biocontrol of Brinjal Mealy bugs	Efficacy of Bt strains against DBM in Cauliflower	Evaluation of BIPM module against Cassava Whitefly *Aleurodicus dispersus*	Monitoring & Biodiversity of outbreaks of invasive Mealy bugs in major horticultural crops	Monitoring the diversity of pests and natural enemies in chrysanthemum in Poly house conditions **(New)**
TNAU	TSP on Biocontrol technologies for horticultural crops **(New)**									

Centre	1	2	3	4	5	6	7	8	9	10
YSPUHF	Biodiversity-*Trichogramma Chrysoperla, Coccinellids*	Evaluation of EPF & EPN against Apple Root Borer	Biointensive management of insect pests of tomato under field conditions **(New)**	Development of bio-intensive IPM package for the suppression of insect pests of capsicum under field conditions **(New)**	Polyhouse evaluation of predatory mite *Neoseiulus longispinosu s*against rose mites	Polyhouse evaluation of management of sap sucking pests capsicum & rose	TSP on Use of ecofriendly methods of pest management for apple and vegetable crop pests **(New)**			
CAU	Biodiversity-*Trichogramma, Chrysoperla, Cryptolaemus*	Management of bacterial wilt of brinjal with *P. fluorescens*	Bioefficacy of EPN against Citrus trunk borer	TSP on Management of insect pests of cabbage with bio control based IPM **(New)**						
OUAT	Biodiversity-*Trichogramma, Chrysoperla,* spiders	Bio control of pests of Gingelly	Monitoring of Papaya Mealy bug & natural enemies on alternate hosts	BIPM in Okra	Large scale demonstration of proven biocontrol technologies in Rice	Large scale demonstration of BIPM in Sugarcane	Large scale demonstration of biocontrol of coconut caterpillar	Large scale demonstration of BIPM in Brinjal	TSP on Demonstration of BIPM in Arhar and Paddy in tribal villages. **(New)**	
MPUAT	Biodiversity-*Trichogramma, Chrysoperla, Cryptolaemus*	Validation of IPM module in Soybean	Validation of HaNPV against *H. armigera i*n tomato **(New)**	TSP on Popularization of biointensive IPM modules in maize in Udaipur district**.** (**New)**						
UAS-R	Biodiversity-*Trichogramma, Chrysoperla, Coccinellids*	Incidence of natural enemies of cotton mealy bugs and to work out the species richness of natural enemies	Large scale demonstration of NBAII BTG 4 Bt against pigeon pea pod borer	Identification and evaluation of predatory mites on *Tetranychus spp* in tomato under greenhouse condition	TSP on BIPM technologies for groundnut & chickpea **(New)**					

Centre	Projects				
1	**2**	**3**	**4**	**5**	**6**
CISH	Survey and collection of natural enemies of mango pests	Survey, Collection, Identification and Mass Culturing of Trichogrammatids and Entomopathogenic Nematodes from Mango Ecosystem in Uttar Pradesh and Uttarakhand for evaluation against mango leaf webber (*Orthaga euadrusalis*)	-	-	-
CPCRI	Survey and collection of natural enemies of coconut black headed caterpillar, eriophid mite, red palm weevil	Surveillance and need-based control of coconut leaf caterpillar, *Opisina arenosella* in Kerala -	Scaling up utilization of *M. anisopliae* through technology transfer -	Entomopathogenic nematodes for management of Red palm weevil (*Rhynchophorus ferrugineus*) -	Large area field validation of integrated biocontrol technology against *Oryctes rhinoceros*
CTRI	Field Evaluation of *Pochania Chlamydosporia* against root knot nematodes in FCV tobacco		-	-	-
Dir. Rice Res.	Survey and collection of natural enemies of rice pests	-	-	-	-
Dir. Seed Res.	Survey and collection of natural enemies of sorghum pests	Evaluation of *Uscana* sp. Trichogrammatidae) against *Callosobruchus* sp. on storability of pigeonpea seed.	-	-	-
Dir. Sorghum Res.	Field evaluation of NBAII entomopathogenic strains against sugarcane stem borer, *Chilo artellus*(Swinhoe) in Kharif sorghum	-	-	-	-
Dir. Soybean Res.	Survey and collection of natural enemies of soybean pests	Field Evaluation of entomofungal pathogens against Soybean defoliators	-	-	-

Centre	Projects				
1	2	3	4	5	6
Dir Weed Science Res.	Biocontrol of *Chromolaena odorata* in forest area & waste lands of Chattishgarsh utilizing *Cecidochares connexa* by inoculative release	-	-	-	-
IARI	*Trichogramma* strains from different agroclimatic zone of India	Collection, evaluation of *Trichogramma chilonis* strains on cole crop insect pests (viz., cauliflower and cabbage)	-	-	-
IIHR	Monitor and record of incidence of papaya mealy bug and its natural enemies on papaya and other alternate hosts	Validation of BIPM of thrips on onion	Validation of BIPM of thrips on capsicum under polyhouse	-	-
IIVR	Survey, collection and identification of mealy bug infesting major vegetable crops and its natural enemies	-	-	-	-
NBAII	Field evaluation of *Trichogramma chilonis* produced using Eri-silk worm eggs as factitious host	Monitor and record of incidence of papaya mealy bug and its natural enemies on papaya and other alternate hosts	-	-	-
NCIPM	IPM in Groundut in Rajasthan and Haryana	Management of Greenhouse Mites using Biocontrol Agents	-	-	-

Protocols for the new experiments initiated during 2014-15

1. Biological control of chilli anthracnose disease (GBPUAT, PAU, AAU-A)

Varieties : Centre can choose a suitable variety
Area : 500 m^2 per variety
Treatments : 5

T1: *Pichia guilliermondii* (Y12) Seed treatment, Seedling dip & Foliar spray ($2x10^8$cfu ml^{-1})
T2: *Hanseniaspora uvarum* (Y73) Seed treatment, Seedling dip & Foliar spray($2x10^8$cfuml^{-1})
T3:*Trichoderma harzianum* (Th-3) Seed treatment, Seedling dip & Foliar spray($2x10^8$cfu g^{-1})
T-4: Recommended fungicidal control Seed treatment, Seedling dip & Foliar spray
T-5: Untreated control

Method of application

a) Seed treatment: The seeds will be treated with formulations before sowing into nursery. Mix 10ml or grams of concentrated formulation with 100ml with water. This can be used to treat 1 kg of seeds. The seeds will be soaked in formulation for 5 minutes with constant shaking and then the treated seeds can be shade dried for 1 hour and used for sowing.

b) Seedling dip: Chilli seedlings raised in plastic trays or nursery beds can be treated with antagonist formulation just before transplantation. Twenty ml or 20gm of formulation can be mixed in 1litre water to obtain antagonist suspension for seedling treatment. Seedlings should be uprooted carefully from plastic trays or nursery beds and roots should be dipped in antagonist suspension for 5-10 minutes and transplanted to main field.

c) Foliar/fruit spray: Foliar spray of antagonist formulation can be given at the rate of 10g or 10ml per litre of water using a high volume sprayer with a spray fluid volume of 500L ha^{-1}. First spray should be given at initiation of fruit ripening and later 3-4 sprays can be given at monthly intervals or until the last harvest.

Seasons: Kharif/Rabi

Number of plants and replications: RBD design with three replications.

No. of plants/ treatment = 75 (25 plants x 3 replications)

Total number of plants for 5 treatments = 375 (75 x 5 treatments)

Spacing: 2 x 3 feet (Between plants 2 feet, between rows 3 feet)

Observations

a) Disease intensity –Total numbers of healthy and diseased fruits in each plant should be counted and percent fruit rot incidence in each replication can be calculated using formula

$$\text{Fruit rot incidence (\%)} = \frac{\text{Number of infected fruits per replication}}{\text{Total number of fruits per replication}} \text{ X } 100$$

b) Yield of each treatment can be taken
c) Weather parameters like, Temp., RH, Rain fall
d) Data statistically analysed (ANOVA, CD,)

2. Bio-efficacy of microbial insecticides against sucking pest in *Bt* cotton (AAU-A)

Objective : To evaluate the microbial insecticides against *Bt* cotton sucking pest

Season and year : *Kharif* 2014
Experimental details :

1. Treatments : 10
2. Replication : 03
3. Design : Randomized Block Design (RBD)
4. Crop / variety : *Bt* cotton
5. Spacing : 90X60 cm

Details of treatments

T_1 : *Beauveria bassiana* (2×10^8 cfu) @ 30 g /10 litres water
T_2 : *Beauveria bassiana* (2×10^8 cfu) @ 40 g /10 litres water
T_3 : *Verticillium lecanii* (2×10^8 cfu) @ 30 g /10 litres water
T_4 : *Verticilium lecanii* (2×10^8 cfu) @ 40 g /10 litres water
T_5 : *Metarhizium anisopliae* (2×10^8 cfu) @ 30 g /10 litres water
T_6 *Metarhizium anisopliae* (2×10^8 cfu) @ 40 g /10 litres water
T_7 *Nomurea rileyi* (2×10^8 cfu) @ 30 g /10 litres water
T_8 *Nomurea rileyi* (2×10^8 cfu) @ 40 g /10 litres water
T_9 Recommended insecticide
T_{10} Control (water spray)

Observation recorded:

The bio-efficacy microbial insecticides will be evaluated against aphid, *A. gossypii*, jassid, *A. biguttula biguttula*, whitefly, *B. tabaci* and thrips, *T. tabaci* based on pest population. Considering the pest population in experimental area, two sprays were applied on need basis.

Evaluation based on pest population

The observations on population of sucking pests [Aphid, *A. gosypii*; Jassid, *A. bigutulla bigutulla*; Whitefly, *B. tabaci* and Thrips, *T. tabaci*] will be made on five plants selected randomly in each plot. On each plant, three leaves will be selected randomly from top, middle and bottom canopy and population counts will be made before the first spray as well as 3, and 7 days after each spray. The periodical data on pest population will be subjected to ANOVA after transforming them to square root. The data were also pooled over periods, sprays and years.

Effect on seed cotton yield

To see the effect of different treatment on seed cotton yield in kilograms was recorded plot-wise and picking-wise. The yield data will be summed-up plotwise, converted to quintal/ha and subjected to ANOVA.

3. Bio-efficacy of microbial insecticides against *Spodoptera litura* in cabbage (AAU-A)

Objective : To evaluate the commercially available microbial insecticides for their efficacy against S. *litura* infesting cabbage
Agro-climatic sub region: Middle Gujarat Zone 3
Year of commencement : 2014-15
Crop and Variety : Local

Season and Year **:** *Rabi* 2014

Experimental details: Treatments : 10
Design : RBD
Replications : 03
Spacing : 45 x 45

Details of treatments:

T_1 : *Bacillus thuringiensis* 1.0 kg/ha
T_2 : *Bacillus thuringiensis* 2.0 kg/ha
T_3 : *Beauveria bassiana* (2 x 10^8 cfu) @ 30 g /10 litres water
T_4 : *Metarhizium anisopliae* (2 x 10^8 cfu) @ 30 g /10 litres water
T_5 : *Metarhizium anisopliae* (2 x 10^8 cfu) @ 40 g /10 litres water
T_6 *Nomurea rileyi* (2 x 10^8 cfu) @ 30 g /10 litres water
T_7 *Nomurea rileyi* (2 x 10^8 cfu) @ 40 g /10 litres water
T_8 *SI* NPV 1 x 10^{10} POB/ha
T_9 Recommended insecticide
T_{10} Control (water spray)

Methodology:

Standard agronomical practices were followed for raising the crop. The first spray of respective microbial insecticides will be applied as per the treatments on appearance of spodoptera and subsequently two sprays will be given at 15 days interval. For recording the observation Larval count (No./plant) was recorded from 5 randomly selected and tagged plants from each net plot area. The observations will be recorded before 3 and 7 days after spray. Similarly, per cent cabbage head damage by *S. litura* was assessed by counting the healthy and damaged cabbage head during each picking. Treatment wise fruit yield was recorded separately.

4. Large scale demonstration of NBAII liquid formulations (PDBC-BT1 and NBAII BTG4) against pigeon pea pod borer *(Helicoverpa armigera*) (AAU-A)

Objective: To demonstrate the NBAII liquid formulations for the suppression of pod borer infesting pigeon pea

Treatments:

1. PDBC-BT1 @ 2% spray
2. NBAII-BTG4 @ 2% spray
3. Farmers practices

Methodology (in detail):

Whole pigeon pea field was divided into 3 equal plots each of nearly 0.25 ha area. Each plot was further divided into 5 equal sectors. In order to record larval population and pod borer damage due to *H. armigera*, 50 plants were randomly selected from each quadrate. The observations were recorded at weekly interval with starting the activity of the pest. Healthy and damaged pods due to *H. armigera* were recorded during each picking. Treatment wise marketable fruit yield was recorded separately.

Spray schedule: Three sprays (pre flowering, post flowering and pod emergence)

5. Demonstration of bio intensive package for the pest of tomato (AAU-J)

Experimental details:

Location: Farmers field (Uttar garumara, Jorhat)
Target pest: Tomato fruit borer, *Helicoverpa armigera*
Area : 0.5 hectare/ treatment
Year of commencement:2014-15 (**New**)
Tratments : 3
T1= BIPM Package

- Seedling root dip with *Pseudomonas* 2% solution
- Installation of yellow sticky trap @50 no./ha
- Installation of bird perches @10/ha
- Spray of NSKE@5% against sucking pest
- Raising of African marigold as trap crop (planting a row of marigold after 14 rows of tomato)
- Use of sex pheromone traps @ 5/ha for each *Helicoverpa armigera, Spodoptera litura*
- Six release of *Trichogramma chilonis* @ 1,00,000/ha from flower initiation stage at weekly intervals
- Spray of NSKE@5% against sucking pest
- Rouging of leaf curl disease affected plants
- Regular collection and destruction of damage fruits
- Need based spray of HaNPV

T2= Chemical control
T3= Untreated Control
Observations:

- Population of aphids, whiteflies, thrips, per cent damage of leafminer and fruit borer will be recorded.
- Natural enemies population will be recorded.
- Yield will be recorded at each picking
- Per cent yield loss, increase in yield over control will be worked out

6. Field evaluation of entomopathogens against banana Pseudostem weevil, *Odoiporus longicollis* (KAU)

Design: RBD
Replication: 3
Treatments: 6 (From 5^{th} or 6^{th} month after planting.)
T1: Leaf axil filling *Metarhizium anisopliae* (10^8 spores/ml)
T2: Spraying on pseudostem *M.anisopliae* (10^8 spores/ml)
T3: Leaf axil filling *Beauveria bassiana* (10^8 spores/ml)
T4: Spraying on pseudostem *B.bassiana* (10^8 spores/ml)
T5: Chemical control
T6: Control

7. Field evaluation of entomopathogens against pineapple mealybug, *Dysmicoccus brevipes* (KAU)

Design: RBD
Replications: 4
Treatments: 5
T1: *Lecanicillium lecanii* (10^7 spores/ml

T2: *L. lecanii* 10^8 spores/ml
T3: *L. lecanii* 10^9 spores/ml
T4: Chemical control
T5: Control

8. Field evaluation of fungal pathogens on gundhi bug, *Leptocorisa* sp. (KAU)

Design: RBD
Replications: 4
Treatments: 5

T1: *Metarhizium anisopliae* 2 x 10^7 spores/ml
T2: *M. anisopliae* 2 x 10^8 spores/ml
T3: *M. anisopliae* 2 x 10^9 spores/ml
T4: Chemical control
T5: Control

9. Laboratory evaluation of entomopathogens against banana root mealybug- *Geococcus citrinus* (KAU)

Design: CRD
Replications: 3
Treatments: 7

T1: *Lecanicillium lecanii* @ 10^7 spores/ml
T2: *L. lecanii* @ 10^8 spores/ml
T3: *B. bassiana* @ 10^7 spores/ml
T4: *B. bassiana* @ 10^8 spores/ml
T5: *M. anisopliae* @ 10^7 spores/ml
T6: *M. anisopliae* @ 10^8 spores/ml
T7: Control

10. Biological suppression of shoot and fruit borer, *Leucinodes orbonalis* in brinjal (MPKV)

Treatments:

T1: *Nomuraea rileyi* @ 10^8 conidia/ ml
T2: *Metarhizium anisopliae* @ 10^8 conidia/ ml
T3: *Beauveria bassiana* @ 10^8 conidia/ ml
T4: *Trichogramma chilonis* @ 60,000 parasitoids/ha, 15 releases
T5: *B. thuringiensis* @ 1 kg/ha
T6: NSKE 5%
T7: Chlorpyriphos @ 0.04% spray
T8: Untreated control

Methodology: Plot size: 3 x 2 m.

- Monitoring the incidence of *L. orbonalis* using pheromone traps.
- Releases of parasitoids and sprays of entomopathogens, *Bt* and NSKE will be followed at weekly interval starting from 50% flowering stage of the crop.

Observations: The observations will be recorded on five randomly selected plants/ plot.

1. Pre-treatment incidence on shoot infestation and catches from pheromone traps.
2. Post-counts of shoot and fruit infestation at weekly interval.
4. Yield of healthy marketable fruits at each picking.

11. Biological suppression of fruit borer, *Earis vitella* in okra (MPKV)

Treatments:

T1: *Lacanicillium lecanni* @ 10^8 conidia/ ml
T2: *Metarhizium anisopliae* @ 10^8 conidia/ ml
T3: *Beauveria bassiana* @ 10^8 conidia/ ml
T4: *Trichogramma chilonis* @ 60,000 parasitoids/ha, 15 releases
T5: *B. thuringiensis* @ 1 kg/ha
T6: NSKE 5%
T7: Chlorpyriphos @ 0.04% spray
T8: Untreated control

Methodology: Plot size: 3 x 2 m.

- Releases of parasitoids and sprays of entomopathogens, *Bt* and NSKE will be followed at fortnightly interval.

Observations: The observations will be recorded on five randomly selected plants/ plot.

1. Pre and post- treatment counts on fruit infestation at weekly interval.
2. Yield of healthy marketable fruits at each picking.

12. Biological suppression of mustard aphid, *Lipaphis erysimi* (MPKV)

Treatments:

T1: *Metarhizium anisopliae* @ 10^8 conidia/ ml
T2: *Lecanicillum lecanii* @ 10^8 conidia/ ml
T3: *Beauveria bassiana* @ 10^8 conidia/ ml
T4: NSKE @ 5% suspension
T5: *L. lecanii*+ *M. anisopliae* @ 10^8 conidia/ ml each
T6: Dimethoate @ 0.06% spray
T7: Control

Methodology and observations: The trial will be laid out in RBD with 3 replications. Plot size: 2 x 1 m; Treatment applications will be started at initial occurrence of aphid colonies. In all, three sprays will be given during evening hours at fortnightly interval.

Observations:

1. Aphid population before treatment as pre-count and post count 5, 7 and 10 days after each spray (Aphid population will be recorded on 5 cm apical twig per plant from 5 randomly selected plants per plot)
2. Record seed yield per plot.

13. Biological management of red spider mite *Tetranychus urticae* infesting rose in polyhouse conditions (MPKV)

Treatments:

T1: *Lecanicilliumlecanii*@ 10^8 cfu/ml
T2: *Hirsutellathompsonii*@ 10^8 cfu/ml
T3: *Beauveriabassiana*@ 10^8 cfu/ml
T4: *Metarhiziumanisopliae*@ 10^8 cfu/ml
T5: Predatory mite
T6: Abamectin 0.3 ml/litT7: Untreated control

Observations:

- Initial mite population per plant on 3 leaves from 10 plants.
- Mite population 7 days after each spray.
- Yield parameters.

Methodology: Micro-plot/pot size: 1.5 x 1.0 m; Replications: Three

1. Planting of seedlings in raised beds/plastic pots.
2. Apply organic manure as per recommendations.

14. Demonstration of biological control of *Spodoptera litura* soybean (MPKV)

Treatments:

T1: *Sl* NPV @ 250 LE/ha (1.5 x 10^{12} POBs/ha)
T2: MPKV strain of *N. rileyi* @ 10^8 conidia/ ml
T2: Untreated control

Plot size : 1 ha per treatment to be divided into 10 equal blocks as replicates

Observations:

1. Pre-treatment larval population in 1 m row at 5 spots from each plot.
2. Post-treatment surviving larval population will be recorded a week after each spray.
3. Record grain yield per plot.

15. Evaluation of predatory mite, *Blaptostethus pallescens* against European Red mite *Panonychus ulmi* on apple (SKUAST)

i. Collection of ERM infested apple leaves
ii. Release of nymphs and adults on infested leaves
iii. To study the response of *B. pallescens* against eggs of ERM in laboratory conditions

Observations to be recorded:

- Predatory potential of nymphs and adults of *B. pallescens*
- Per cent reduction of ERM eggs
- Determination of prey : predator ratio

16. Evaluation of predatory mite, *Blaptostethus pallescens* against saffron thrips on saffron (SKUAST)

- Collection of saffron thrips during flowering period of saffron
- To study the response of *B. pallescens* against saffron thrips in laboratory conditions

Observations to be recorded:

- Predatory potential of nymphs and adults of *B. pallescens*

17. Large scale field demonstration of BIPM package for the management of key pests of Tomato (TNAU)

T_1 BIPM package

- Spraying of *Pseudomonas* 2% solution on protray/seed bed one day before pulling out of seedlings
- African Marigold as trap crop
- Installation of yellow sticky trap @ 50 No's /ha.
- Installation of bird perches @ 10/ha.
- Need based application of *B.t* and NPV based on pheromone monitoring
- Sucking pests management through NSKE/ Neem oil emulsion /Azadirachtin spray
- Release of *Trichogramma pretiosum* @ 50,000 No's /ha.
- Release of *Chrysopa* grubs @ 50,000 No's /ha.
-

T_2 Farmer's practice

Plot size : One acre/treatment

Observations

- Population of aphids, thrips, leafhoppers, whiteflies and fruit borer will be recorded at 15 days interval
- Natural enemy activity will be recorded
- Yield will be recorded at harvest

18. Monitoring the diversity of pests and natural enemies in chrysanthemum in Poly house conditions (TNAU)

a. Survey will be conducted monthly intervals in polyhouses for the incidence of major pests and their natural enemies. Infested plant parts will be collected and observed for the emergence of natural enemies.
b. Alternate host plants, if any will be recorded

19. Development of bio-intensive IPM package for the suppression of insect pests of capsicum under field conditions (YSPUHF)

Treatments:

For aphids:

i) Release of *Chrysoperlla* larve @ 5/plant
ii) Release of *Chrysoperlla* larve @10/plant
iii) *Verticillium lecanii*@ 10^6 conidia/ml
iv) *Verticillium lecanii @ 10^7 conidia/ml*
v) Neem pesticide @ 2-5 ml/l of 1500ppm azadirachtin
vi) Chemical control (methyl demeton @0.025%)
vii) Untreated control

For *Spodoptera litura:*

i) Neem pesticide @ 2-5 ml/l of 1500ppm azadirachtin

ii) NPV of *S. litura* @ 250LE/ha
iii) Bt formulation @1.0Kg/ha
iv) Chemical control (malathion @ 0.05%))
v) Untreated control

Design: RBD, replications: 5, plot size 2x5m

Observations to be recorded:

i) Population of aphids before and 7 days after application on 3 leaves/plant from 5 plants per replication
ii) Population of *S. litura* before and 7 days after application on 5 plants per replication

20. Biointensive management of insect pests of tomato under field conditions (YSPUHF)

Treatments:

For *Helicoverpa armigera:*

i) *Trichgrammachilonis*@100000/ha
ii) Neem pesticide @ 2-5 ml/l of 1500ppm azadirachtin
iii) NPV of*H.armigera*@ 250LE/ha
iv) *Bt formulation* @1.0Kg/ha
v) Chemical control (deltamethrin @ 0.05%)
vi) Untreated control

For greenhouse whitefly, *Trialeurodes vaporariorum:*

i) Release of *Chrysoperlla* larve@ 5/plant
ii) Release of *Chrysoperl la*larve @10/plant
iii) *Verticillium lecanii* @ 10^6 conidia/ml
iv) *Verticillium lecanii* @ 10^7 conidia/ml
v) Neem pesticide @ 2-5 ml/l of 1500ppm azadirachtin
vi) Chemical control (methyl demeton @0.025% or triazophos @ 0.08%)
vii) Untreated control

For phytophagous mites:

i) Release of *Neoseiulus longispinosus* @ 10 mites/plant
ii) Release of *Neoseiulus longispinosus* @ 20 mites/plant
iii) Neem 1500ppm azadirachtin @ 2-5 ml/l
iv) Chemical control (fenazaquin @0.0025%)
v) Untreated control
vi)

Design: RBD, Replication: 5, plot size: 2x5m

Observations to be recorded:

1. Number of larvae of *H armigera* per plant from 5 plants per replication before and 7 days after application
2. Population of whitefly nymphs before and 7 days after application on 3 leaves/plant from 5 plants per replication
3. Population of mites before and 7 days after application on 3 leaves/plant from 5 plants per replication

21. Evaluation of *Uscana* sp. (Trichogrammatidae) against *Callosobruchus* sp. on storability of pigeonpea seed (Dir. Seed Res. Mau)

Objectives:

1. To evaluate *Uscana* sp. against *Callosobruchus* sp damaging pigeonpea seed
2. To assess parasitisation effect of *Uscana* sp. on the eggs of *Callosobruchus* sp. under ambient condition
3. To find out longevity of *Uscana* sp. on the eggs of *Callosobruchus* sp. in pigeonpea seed under storage
4. To monitor the effect of *Uscana* sp. release on seed quality attributes particularly seed viability during storage

Treatments:

1. Release of 10 *Uscana* sp. + 50 eggs of *Callosobruchus* sp.
2. Release of 20 *Uscana* sp. + 50 eggs of *Callosobruchus* sp.
3. Release of 30 *Uscana* sp. + 50 eggs of *Callosobruchus* sp.
4. Release of 40 *Uscana* sp. + 50 eggs of *Callosobruchus* sp.
5. Control: 50 eggs of *Callosobruchus* sp.

Methodology:

Certified seeds of pigeonpea with very high percentage of germination and low moisture content (about 10%) should be taken for the experiment. Prepare cards by pasting pigeonpea seeds (12-15 no.) with gum and keep it in test tubes. Allow freshly emerged bruchids into test tubes for egg laying on the seeds pasted on cards. Remove the bruchids after egg laying from test tubes. Transfer cards with egg into new test tube and maintain equal no. of eggs on each card (50 no.). Release required no. of freshly emerged *Uscana* sp. into test tubes containing eggs. Test tubes will be closed with cotton plug and keep it in room under ambient condition. The temperature and relative humidity of the room will be recorded on standard weekly basis.

Observation to be recorded:

1. No. of eggs parasitized
2. No. of adult parasitoids emerged
3. Insect infestation (% seed damage)
4. No. of adult insects emerged
5. Seed germination and seed moisture
   At every 12-15 days for a total period of 6 months or loss of germination below Indian minimum seed certification standard (IMSCS) whichever is early.

22. IPM in Groundut in Rajasthan and Haryana (NCIPM)

Biological control agent introduction – Entomopathogenic nematode (*Heterorhabditis* sp. Strain IARI) based treatments in groundnut.

Crop: Groundnut

Location 1: ARS, Durgapura (Collaborating Principal Investigator –Dr VK Aggarwal)
Location 2: Village Phogat, Dist. Jhajjhar, Haryana (Farmer's Field)
Collaborators: NCIPM, New Delhi (Investigators: Dr N. Sabir, Dr J. Singh, Dr A. Birah)**;** **ARS Durgapura (**Dr VK Aggarwal**); NGO- FARMER, Ghaziabad** (Dr JP Singh)
Area: approx. 1 Acre
Start: July, 2014
Preliminary IPM Module to be tested-

- Soil treatment – mulching and enriched organic amendments
- Seed treatment with *Metarhizium anisopliae*
- Application of EPN – (through *Galleria melonella* cadavers -@ 4000/acre)
- Application of fungicide Chlorothalonil for *Cercospora* leaf spots and *anthracnose*
- Application of Mancozeb for the control of *Cercospora* leaf spots
- Maintenance of crop hygiene for preventive pest management

Experimental/Statistical Design: RBD

23. Management of Greenhouse Mites using Biocontrol Agents(NCIPM)

Crop: Parthenocarpic Cucumber

Location 1: **NCIPM, New Delhi** (Investigators: Dr N. Sabir, Dr J Singh, Dr A. Birah)

NBAIR, Bangalore (Dr Chandish Ballal)
Location 2: Farmers' greenhouse (optional)

Area: approx. 200 sq.m.

Start: Oct, 2014

Treatment: Biological control agent, Anthocorid Bug, *Blaptostethus pallescens* (NBAII strain)
Treatment/Dose: 30 bugs/plant or per sq.m.

Replications: 20
Design: Paired t-test

24. Evaluation of *Trichogramma chilonis* against Maize stem borer *Chilo partellus* on Maize (ANGRAU)

Treatments:

1. *Trichogramma chilonis* @ 250000 parasitoids/ha. Two times at weekly intervals, starting first round 10 days after germination.
2. Farmers practice

Plot size: 1 acre. The farmers plot will be isolated from the experimental field with a minimum distance of 500 metres.
Observations:

i. Divide the plot of 1 ha. into 10 segments of equal size to serve as 10 replications. Observations will be recorded in each segment as detailed below.
ii. Per cent egg parasitism by collecting 10 egg masses from field at random, keeping in glass vials, observe for emergence under laboratory condition to confirm the parasitism.
iii. Record dead hearts from 50 randomly selected plants.
iv. Grain yield from plots
v. The data will be analyzed using't' test.

25. Biological control of Groundnut pest Complex (Rabi, 2014-15) (ANGRAU)

Treatments:
1. Release of *Trichogramma chilonis* @ 1,00,000/ha, 3-4 times
2. Spray of *Bt*. @ 1 kg/ha twice at 15 day interval
3. Spray of NSKE 5% 3-4 times
4. Spray of *Beauveria bassiana* 2 kg/ha twice at 15 days interval
5. Insecticidal check
6. Control

Plot size: 5mx4m
Replications: 4
Observations:
a) No. of different pests like *Spodoptera*, Leaf miner, Hairy caterpillars from 10 plants before spraying and after 5 and 7 days of spraying.
b) Yield at harvest
c) *Sl*NPV should be used if *Spodoptera* infestation occurs.

26. Field Evaluation of *Pochania Chlamydosporia* against root knot nematodes in FCV tobacco (CTRI)

Objective: To evaluate nematode antagonistic fungi *Pochania Chlamydosporia* against root knot nemaotes under field conditions

T1. *Pochania Chlamydosporia* treated tray seedling+ *P .Chlamydosporia* at planting+ *P . Chlamydosporia* at 30 DAP
T2. *Pochania Chlamydosporia* treated tray seedling+ *P .Chlamydosporia* at planting
T3. *Pochania Chlamydosporia* treated tray seedling
T4. Untreated tray seedling + *P .Chlamydosporia* at planting+ *P . Chlamydosporia* at 30 DAP
T5. Untreated tray seedling + *P .Chlamydosporia* at planting
T6. Untreated tray seedling
T7. Untreated tray seedling+ Carbofuron @ 1g /plant
T8. Conventional seedlings + Carbofuron
T9. Check (Conventional seedlings)

Observations to be recorded
1. Plant growth parameters
2. Initial soil nematode population
3. Final soil nematode population
4. Root knot disease observations
5. FCV tobacco yield parameters

Tribal Sub plan programme Centre-wise (2014-15 onwards)

1. AAU, Anand Centre (Gujarat)

Tribal Groups Present

Panchmahal is the tribal district of Gujarat located in western India. Godhra (22°46'38"N 73°37'13"E) falls in Panchmahal District with a population of 1,21,852 (2001), IST (UTC+05:30) and elevation 73 metres (240 ft.) 74% of the total population comprises of tribals.

Tribes

1. Bhils
2. Nayaka
3. Naikada
4. Patelia
5. Rathwa
6. Koli

Bhils are considered to be amongst the oldest settlers in the country. They derive their name from the Dravidian word called Billu, which means bow. Bhils are, thus, seen with bow and arrow. They live in isolation, go for hunting, fishing, practice shifting cultivation and have escaped to a large extent the influence of Brahmania (upper caste) culture. This tribe was able to maintain political independence to a great extent (Robert, 1985) and it remained the most turbulent amongst all the tribes. The Bhils are fond of hard wine. Basically, they are lazy and so they are not very progressive in farming (Chitle, 1978).

Percentage Distribution of the tribal population

Tribe	Population (%)
Bhil	73.5
Koli, Dhor, Tokre Koli	2.6
Naika, Naikada	10.2
Patelia	7.0
Rathwa	5.8
Others	0.9
TOTAL	100.0

Anand Agricultural University has a farm at Derol in Panchmahal District. Wilt is a common disease of chick pea/ Pigeon pea occurring in the area leading to tremendous crop losses annually**.** A demonstration has been planned integrating different components of IPM for effective management of wilt in chick pea/ Pigeon pea.

Activities Envisaged under TSP in their Locality:

1. **Validation of Biocontrol Technologies for Management of *Fusarium* wilt in chick pea/ Pigeon pea**

   Crop/Variety: Chick Pea or Pigeon pea/ Local Suitable

   Treatments: 8 as follows.

T-l: Carbendazim seed treatment @ 2g/Kg of seeds + Carbendazim soil application @ lg/liter 60 days after sowing
T-2: Carbendazim seed treatment @ 2g/Kg of seeds + *Trichoderma viride* soil application @ 2.5 kg/hain FYM @ 50 kg / ha
T-3: Carbendazim seed treatment @ 2g/Kg of seeds + *Pseudomonas fluorescens* in soil application in FYM @ 50kg / ha
T-4: Carbendazim seed treatment @ 2g/Kg of seeds + [*T. viride* + *P. fluorescens*] soil application each @ 2.5 kg /ha in FYM @ 50 kg / ha
T-5: *T. viride* seed treatment @ 5g/kg of seeds + *T. viride* soil application @ 2.5 kg /ha in FYM @50 kg / ha
T-6: *P. fluorescens* seed treatment @ 5g/kg of seeds + *P. fluorescens* in soil application @ 2.5 kg /ha in FYM @ 50 kg/ha
T-7: Absolute Control

Replications: 4

Design: RBD

Observations to be recorded:

1. Wilt incidence (%)
2. Yield (kg/ha)

2. **Farmers Meet**

Farmers shall be invited during different crop developmental stages and educated on the technological developments for the effective management of chick pea/ Pigeon pea wilt.

Expenditure Incurred : NIL

Expenditure anticipated till March, 2015 : Rs. 2,00,000/-

2. AAU, Jorhat Center (Assam)

1. **Name of the Project Proposal**:
   Economic upliftment of **Ethnic Deory and Missing Tribes** areas of Jorhat and Golaghat District of Assam
2. **Details of the locations of Tribal areas/STs where TSP is going to be executed (As per TSP guidelines**
   One village dominated by the Deory community selected from Jorhat District and another village by the Missing Community from Golaghat district, respectively. Out of the total population, 95% comprised of tribal people in both the villages

   (a). **Name of the village**: Nam Deory, under Deory autonomous council
   Gram panchayat: 39 Uttar Baligaon Gaon panchayat
   Block: Dhekorgorha
   District : Jorhat
   Total population: 800
   Totla no. of household: 210
   (b). **Name of the village**: Dany Chapori under Missing autonomous council
   Gram panchayat: Madhya Brahmaputra Gaon Panchayat

Block: Golaghat North Development
District : Golaghat
Total population:1200
Total no. of household:340

3. **No. of village**: 2
   No. of Farmers: 150 (25 in each village, for 3years)
   Area: Total 14 ha (Rice: 10 ha, vegetables:3 ha and sugarcane:1 ha), to be covered 7 ha in each village (**for 2014-15**) and decide later for next two years

4. **Crops to be dealt:**
   Rice, sugarcane and major winter vegetables (cole crops, tomato, and brinjal) along with poultry, fishery and animal husbandry

5. **Biocontrol/IPM technologies to be implemented for pest and disease management**
   The BIPM technology validated under AICRP on biological control in respect of Rice, sugarcane and winter vegetables will be implemented for pest and disease management.

6. **Materials to be supplied to the TSP farmers with clear financial details 2014-15**

Crops

Materials to be supplied (A)	Rate	No. of beneficiary	Cost (Rs.)
1. Rice seeds (@ 45kg/ha)	Rs. 30/kg seed	20	13,500.00
2. Sugarcane sets (@75q/ha)	Rs. 300/q of set	4 6	22,500.00 7,000.00
3. Vegetable seeds (Hybrid)	-		30,000.00
4. Fertilizers (organic)	-		20,000.00
5. Crop protection (Biopesticides / bioagents)	-		
Total (A)=			93,000.00

Animal husbandry

Materials to be supplied (B)	Rate	No. of beneficiary	Cost (Rs.)
Poultry	Rs.260/kg chicks	10	5000.00
Goat (cross breed)	Rs. 3500/breed	2	20,000.00
Pig	Rs. 2500/pig	8	40,000.00
Total (B)=			65,000.00

2015-16

Crops

Materials to be supplied (A)	Rate	No. of beneficiary	Cost (Rs.)
1. Rice seeds (@ 45kg/ha)	Rs. 30/kg seed	20	13,500.00
2. Sugarcane sets (@75q/ha)	Rs. 300/q of set	8 6	45,000.00 7,000.00
3. Vegetable seeds (Hybrid)	-		35,000.00
4. Fertilizers (organic)	-		20,000.00
5. Crop protection (Biopesticides / bioagents)	-		
Total (A)=			1,20,500.00

Animal husbandry

Materials to be supplied (B)	Rate	No. of beneficiary	Cost (Rs.)
Poultry	Rs.260/kg sicks	10	5000.00
Goat (cross breed)	Rs. 3500/breed	2	20,000.00
Pig	Rs. 2500/pig	4	20,000.00
Total (B)=			45,000.00

For 2016-17

Crops

Materials to be supplied (A)	Rate	No. of beneficiary	Cost (Rs.)
1. Rice seeds (@ 45kg/ha)	Rs. 30/kg seed	25	20,250.00
2. Sugarcane sets (@75q/ha)	Rs. 300/q of set	4 6	22,500.00 7,000.00
3. Vegetable seeds (Hybrid)	-		35,000.00
4. Fertilizers (organic)	-		22,000.00
5. Crop protection (Biopesticides / bioagents)	-		
Total (A)=			1,06750.00 =1,07000.00

Animal husbandry

Materials to be supplied (B)	Rate	No. of beneficiary	Cost (Rs.)
Poultry	Rs.260/kg sicks	10	5000.00
Goat (cross breed)	Rs. 3500/breed	2	30,000.00
Pig	Rs. 2500/pig	5	25,000.00
Total (B)=			60.000.00

7. Training /demonstrations to be given to tribal farmers (C)
    - Training on Eco- friendly pest management/rearing technique, management and marketing of fish, poultry, goat and pig.
    - Organizing exhibition and field day.
8. Detailed financial requirements for execution of the project

2014-15

Particulars	Cost (Rs.)
A. Materials to be supplied (crop)	93,000.00
B. Materials to be supplied (animal husbandry)	65,000.00
C. Training / Exhibition/field day	20,000.00
D. P.O.L	10,000.00
E. Miscelleneous	2,000.00
Total (A+B+C+D+E)=	1,90,000.00

2015-16

Particulars	Cost (Rs.)
A.Materials to be supplied (crop)	1,20,500.00
B. Materials to be supplied (animal husbandry)	45,000.00
C. Training / Exhibition/field day	13,000.00
D. P.O.L	10,000.00
E. Miscelleneous	1500.00
Total (A+B+C+D+E)=	1,90,000.00

2016-17

Particulars	Cost (Rs.)
A. Materials to be supplied (crop)	1,07,000.00
B. Materials to be supplied (animal husbandry)	60,000.00
C. Field day	6,000.00
D. P.O.L	10,000.00
E. Miscelleneous	2,000.00
p. Result compilation & report preparation	5,000.00
Total (A+B+C+D+E)=	1,90,000.00

9. Targets proposed and Expected Achievements

The proposed programme will directly help to improve the economic status of those ethnic tribal peoples. The majority of the farmers under tribal areas are illiterate and they are easily influenced by the agent of pesticide dealers. They generally recommend the use of spurious materials as well as insecticides which have not been recommended by the university. This results in unwanted health hazards to the farmers as well as to the consumers, besides proving to be uneffective in many cases. Therefore, BIPM programme are to be implemented in these localities. Farmers participation in developing BIPM at their field, case study, indigenous knowledge and

training have immense scope to bridge the gap in farmer's knowledge on application of Biological control.

The tribal peoples are more interested to rear goat, poultry and piggery due to heavy demand of meat in the market and lower requirements of land and labours. Therefore, under TSP programme rearing of animals as well as their marketing certainly boost up the economy of tribal people within a limited span of time. It would provide better scope for employment and income generation at village level if technologies on agriculture and animal husbandry are adapted by unemployed educated rural youth

10. **Anticipated impact of TSP project on economic improvement of the Tribal people and wealth creation in Tribal areas.**

The direct beneficiaries of the project output will be small as well as large scale rice, sugarcane and vegetable growers. They will be economically benefited from the reduced use of pesticides, both in terms of material and application cost. Consumers, on the other hand will benefit from receiving pesticide free produce at lower prices.

It is expected that the project activities (crop and animal production) will help the farmers to generate a steady income initially which will increase in time with proper management of the components. Moreover, the inputs provided to the farmers and the benefits derived from them would significantly help the farmers in creation of wealth of the areas.

3. CAU, Pasighat (Arunachal Pradesh)

Proposal under tribal sub plan "Management of insect pests of cabbage with bio control based IPM" at CAU Centre, under AICRP on biological control of crop pests and weeds.

Technical Programme-

Location: Three locations viz. Jhampani, Ruksin and Pasighat.

Number of demonstration site: Seven sites in each locations.

Treatments: Three treatments in each demonstration site will be maintained. They are-

1. Bio-control based IPM:
   i. Soil application with *Trichoderma viride* @ 50g/sq. m mixing with FYM at the time of field preparation.
   ii. Sowing two rows of broad bean in the main field at the border and after every 10 row of cabbage. Sowing will be done 15 days before planting of the cabbage.
   iii. Installation of pheromone traps of *Spodoptera litura* @ 20 traps/ ha and replacing the lures at one month interval.
   iv. Spraying of *Bacillus thuringiensis* @ 500g/ha as and when required.
2. Farmers practice:
   i. Soil drenching with blitox 50 WP @ 0.25 per cent at 15 days after sowing at nursery.
   ii. Profenophos @ 0.05% was sprayed at 20, 35 and 50 days after transplanting.

3. Untreated control.

Plot size: About 500 sq. m for each treatment.

Total Area: Approximately 3.15 ha.

Expected outcome: The bio control based IPM will give an almost similar cost: benefit ratio with the use of chemical pesticides. Adopting the technology by the farmers will help in conserving the rich biodiversity of the region, producing pesticide residue free cabbage and earning almost similar net economic return with the use of chemical pesticides.

Budget Requirement:

Sl No.	Particulars	Amount (Rs)
1	Inputs like seeds, biopesticides, traps, lures, chemicals, etc.	Rs 40,000/-
2	Manpowers	Rs 60,000/-
3	TA	Rs 20,000/-
4	Training (one in each locations)	Rs 30,000/-
5	Miscellaneous(like posters, stationeries, etc)	Rs 10,000/-

4. . GBPUAT, Pantnagar (Uttarakhand)

1. Project Title: Promoting biointensive IPM through a Common Minimum Programme amongst *buksa* tribe in district Udhamsingh nagar in Uttarakhand state

2. Details of the location of the tribal areas/STs where TSP is going to be executed

Buksa Tribe in Uttarakhand The tribal population of Uttarakhand is concentrated in the remote/forest areas of Tarai and Bhabar and higher reaches of Pithoragarh, Chamoli, Uttarkashi districts, and Jaunsar-Bhabar area of Dehradun district. Among all 13 districts of the state, Udham Singh Nagar with a tribal population of 43.03% is at the top, followed by Dehradun (38.78%), Pithoragarh (7.53%) and Chamoli (4.09%). In fact these four districts of Uttarakhand contribute about 94% of total tribal population. The districts with lowest tribal population in the state are Rudraprayag, Tehri, Champawat, Almora, Pauri, Bageshwar, Uttarkashi, Hardwar and Nainital having respectively, 0.07, 0.27, 0.29, 0.34, 0.62, 0.76, 1.05 percent population. But their largest proportion to total population among all the districts is found in **U.S. Nagar (8.9%),** followed by Dehradun (7.7%), Pithoragarh (4.2%) and Chamoli (2.8%). Proportion of the tribal population to the total population of the remaining districts is found less than 1%.

The average household size of the tribal population in the state is found as 6.1 people per family, which is higher than that of the all castes population of the state (5.3) and India (5.1). Maximum tribal density about 38 people per km^2 is registered in U.S. Nagar followed by Dehradun with 32 people/km^2 in 2001. More than 93% of the total tribal population of the state is residing in the four districts- **U.S. Nagar,** Dehradun, Pithoragarh and Chamoli. Therefore these districts have more tribal density in comparison to the other districts in the

state. In U.S.Nagar, the literaccy rate amongst the ST population is 63.9% in total with 78.5% amongst male and 49% female population.

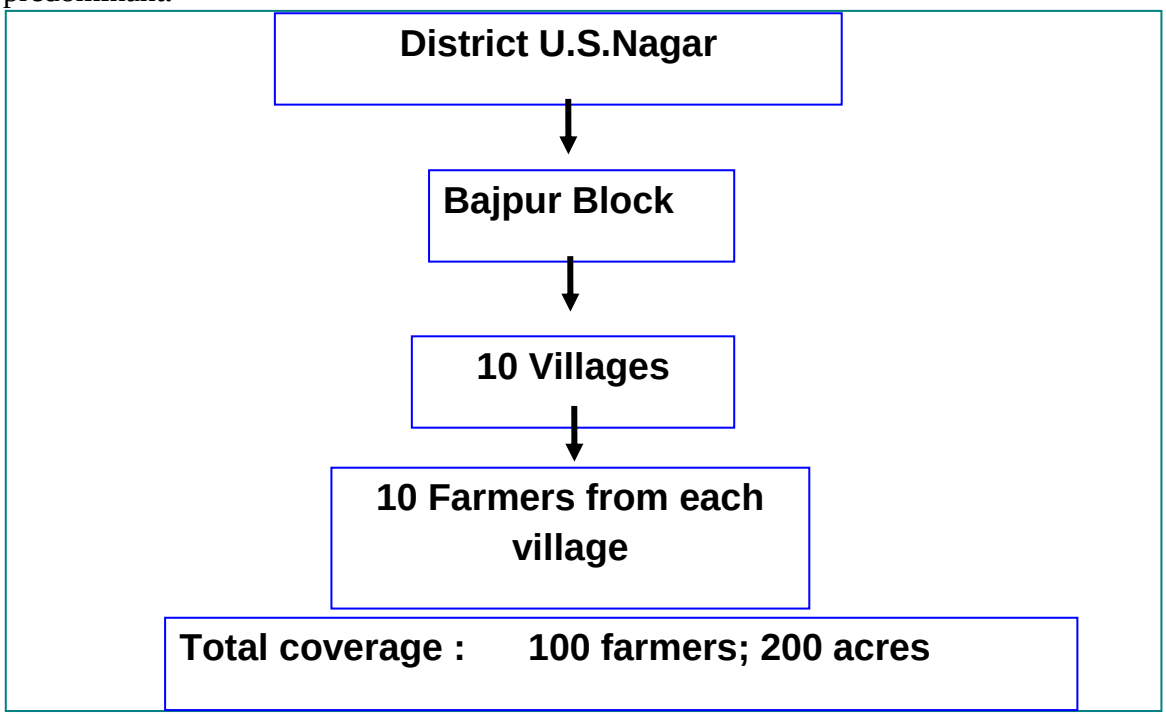
About 63% of the total tribal workers of the state are registered as cultivators, which are 10% and 18% more than the all castes and tribal cultivators of the state and country, respectively. The percentage of tribal cultivators in the state varies from 2.2% in Tehri to 71% in Dehradun district followed by 70% in U.S. Nagar.

Jaunsari tribe is the largest tribal group of Uttarakhand with more than 38.78 percent of the total population. The entire population of the state is scattered throughout the state with over 356 villages. Second largest tribal group of the state is the Tharu tribe. It accounts for around 32.50 percent of the total population of the state. They are scattered over 141 villages. Further, Bhotiyas also constitute a considerable portion of the state`s total population. They are mostly found in Almora district, Chamoli district, Pithoragarh district and Uttarkashi district of the state. That are scattered over 291 villages. Next prominent tribal group of Uttarakhand is Buksa tribe. This tribal group constitutes around 13.67 percent of the total population. They are spread over 173 villages of mainly Nainital and Dehradun districts. However, the main concentration of the Buksa tribe is found in Gadarpur, Ramnagar, Bajpur and Kashipur regions. Lastly, Raji tribe is the smallest tribal group of Uttarakhand. This tribal group constitutes around 0.27 percent of the total tribal population of the state. They are mostly confined in eight villages.

The population of STs in Bajpur block of Udham Singh Nagar district is around 5500 families and these are Buksa tribes. Their occupation status is farming, agriculture labour, animal husbandary, service, business and self employment. Average family size is 5-6 person, literacy rate is around 70%. Major crops are rice, wheat, sugar cane and agroforestary.

3. No. of villages, no. of farmers and area to be covered under the project:

This programme is going to be a community programme. A minimum size of unit would be 10 farmers from each village/ ten village/ block for delivering inputs and setting up demonstrations. Participatory methods will be used throughout the programme to ensure that proposed technologies and options meet the objectives of small farmers. The programme would be launched in Bajpur block of Udham Singh district where *Buksa* tribe is predominant**.**



4. Crops to be dealt : Rice, wheat and vegetables would be taken.

5. Biocontrol/IPM technologies to be implemented for pest and disease management:

The cost of soil borne pathogens and pests to society and the environment far exceeds the direct costs to growers and consumers. The use of chemical pesticides to control soil borne pathogens has caused significant changes in air and water quality, altered natural ecosystems resulting in direct and indirect effects on wild life, and caused human health problems. Long term chemical applications may permanently alter the microbial community structure to an extent that sustainable agriculture may be impossible.

The opportunity therefore exists to address the issues relating to IPM across ecosystems through a Common Minimum Programme. Other specific problems could be addressed through supplementary intervention(s). Key elements have been identified that provide the frame work for a regional approach and include:

a. Plastic mulching (soil solarization) of nursery beds and fields

Rationale: Soil solarization involves covering moist soil with clear plastic and allowing the soil to heat up. This practice reduces or eliminates many soil inhabiting pests by raisingtemperature in the top 5 to 7.5 cm. of soil lethal to many soil borne pathogens and pest organisms. Besides, it reducesweed population, improved physical and chemical properties of the soil and increases population of useful (friendly) micro flora in the soil. Since, plant pathogens are weakened through the effect of solarization; they are over powered by the bioagents.

b. Use of bioagents for seed treatment, seedling treatment, soil treatment and foliar application

Rationale: Use of bioagents, i). reduces cost of cultivation, ii). it is ecofriendly and does not affect the health of humans and animals, (iii) through its use pathogens do not develop resistance and (iv) use of bioagents promotes seed germination and plant growth.

c. Bio-composting including vermi composting

Rationale : Traditionally farmers use undecomoposed farm yard manure, which is deficient in nutrients and does more harm than good to the crop. Undecomposed FYM promotes diseases, insects and pests and weed populations in the soil. On the other hand, vermicompost is more nutritious and gets ready in lesser time.

d. Use of value-added vermicompost or FYM

Rationale : This increases the nutritive value of the compost as well as provides opportunity to the bioagant to grow faster in the compost so that it can compete well with plant pathogens in the soil. Further, it facilitates rapid spread of bioagents in the soil.

GBPUAT has long and accumulated experience in the development of technologies through client oriented research. The proposed programme has been developed on the basis of IPM research and development for small and marginal farmers in the region that has been underway for over the past 4-5 years.

6. Materials to be supplied to TSP farmers with clear financial details:

Individual inputs	Cost
Bioagents & Biopesticides	Rs 600.00
Plastic sheet	Rs 200.00
Earthworms	Rs 300.00
Total	Rs 1,000.00 per farmer

6. Trainings/ demonstrations to be given to tribal farmers:

Field Days

i). Field Days / Block : 2

ii). Total Field Days : 2 x 2 = 4

Trainings

i). On campus training/block : 2

ii). Total trainings : 2 x 2 = 4

8. Detailed financial requirements for execution of the project per year:

Item	Amount
i. Cost of inputs/100 farmers @ Rs 1000/farmer	100,000.00
ii. Cost of 4 Trainings @ Rs 10,000/ training including POL charges	40,000.00
iii. Cost of 4 Field Days@Rs10,000/field day including POL charges	40,000.00
iv. Input cost for bioagent production	10,000.00

9. Targets proposed and expected achievements:

It is targeted that a greater proportion of *Buksa* tribe receives and understands the benefits of adopting low cost technology so that input: output ratio decreases and farming becomes a remunerative enterprise. **With the availability of more funds, atleast 1000 farmers would be attached with the programme.** Following are expected to be the achievements:

- Increased efficiency of soil and on-farm resources for immediate benefits to the small land holders
- Enhanced confidence of farmers towards adoption of IPM technologies
- Low-cost technologies for improving the productivity of small farms
- Low-cost IPM technology under the framework of organic farming
- Enhanced cooperation among stakeholders
- Confidence building among small farmers towards making the farming remunerative

- Reduced pressure on the highly fragile Himalayan ecosystem due to restrained use of chemical inputs.
- Promoting farmers towards organic mode of farming.

10. Anticipated impact of TSP project on economic improvement of tribal people and wealth creation in tribal areas:

The major community benefits arising from the success of the project are two fold. Firstly, economic and social benefits would flow from the increased income of farmers as a result of improved yield and quality of the produce due to reduced direct and indirect impact of serious seed and soil borne diseases and pest problems. This is expected to generate growth and reduce drudgery levels at the end of small and marginal farmers. Secondly, there are a range of potential environmental benefits arising from the reduction in the reliance on synthetic pesticides in food production. These include reduced risk of health problems associated with the exposure during application, contamination in ground water and in the food chain.

5. MPKV, Pune Centre (Maharastra)

1. **Name of the project proposal**: Management of insect pests and diseases in horticultural plantation in tribal area

2. **Details of locations of tribal areas/STS where TSP is going to be extended:**
3. Tribal (ST) dominating areas of Akole and Sangamner Tahsil of Ahmednagar District in Maharashtra.

4. **No. of villages/ No. of farmers/area to be covered in TSP project :**

Sr. No.	Year	No. of Villages	No. of farmers	Area in Horticultural crops covered under TSP
1	2014-15	10	50	50 Acres.
2	2015-16	15	100	100 Acres.
3	2016-17	20	150	150 Acres.
Total	**3 years**	**45**	**300**	**300 Acres.**

5. **Crops to be dealt**

Sr. No	Horticultural crops	Major Insect pests
1	**Mango**	Mango hoppers, Thrips, White flies, Mealy bugs and Stem borer
2	**Sapota**	Chikoo moth, Scales, Mealy bugs
3	**Guava**	Mealy bugs, white flies, Nematodes and Canker disease on fruits
4	**Citrus**	Mealy bugs, Scales, White-black flies, Citrus canker
5	**Pomegranate**	Aphids, Jassids, Thrips, Whiteflies, Mealy bugs, Telya disease

6. Biocontrol/IPM technologies to be implemented for pest & disease management:

To increase the beneficial microbes fauna near the rootzone of fruit trees.

I. The application of 40 kg Neem cake enriched with *Trichoderma* + *Pacilomyces* + *Metarhizium anisopliae* + P. solublizing bactria + K. solublizing bacteria + *Pseudomonas fluorescence*. etc. 1 kg each will be mixed properly and water will be added to moist and covered with plastic or gunny bags for 5 days for enrichment and then will be applied @ 1 kg/tree near the root zone mixed in soil during monsoon. The population of beneficial microbes will be built-up in monsoon during high humidity.

II. For the control of pests and diseases, the preventive two sprays of NSKE + Biopesticides will be given during flowering at 10 days interval as details given below

i. Spraying of NSKE 5 % + *Verticillum lecanii* 5 gram + *Metarhizium anisopliae* 5 gram +*Pseudomonas fluorescence* 5 grams per liter of water

ii. Use of yellow sticky traps one trap per tree for control of sucking pests.

iii. For control of stem borers after cleaning the hole prepared by stem borer, the application of *Metarhizium anisopliae* 10 ml injection and plug the hole with wet soil/mud.

iv. Curative spraying on demand if infestation of pests or diseases occurred.

7. The material to be supplied to the TSP farmers with clear financial details:

Sr. No	Components	Price of component (Rs.)	Quantity	No. of farmers	Area covered (Acres)	Total expenditure (Rs.)
I st Year						
1	NSKE	500	50 kg.	50	50	25,000
2	Biopesticides + Growth promoter	120X5 600	5 kg.	50	50	30,000
3	Yellow sticky traps	20x 6 =120	6 No.	50	50	6,000
4	Biopesticides for spraying - *Verti, Meta, Pseudo*	120 x 5 Kg= 600	5 Kg	50	50	30000
I st Year				**Total (Rs.)**		**91,000 +**
Training inputs						**24,000**
IInd Year						
5	Above 1-4 components	500,750, 150,360	Double	100	100	**1,82,000**
III rd Year						
6	Above 1-4 components	500,750, 150,360	Triple	150	150	**2,73,000**
Total for 3 Years				**300 acres**		**5,70000**

8. Training/Demonstrations to be given to Tribal group – Three days practical training on **"Mass Production of Bioagents and Biopesticides"** will be given to Self Help Groups especially women at their location, which will help them to produce their requirement of bioagents and after training, they will continue the production and demonstration of natural enemies and biopesticides for the control of agriculturally important pests in

horticultural crops. Once the population of natural enemies built up in their areas then the pest load will be automatically reduced due to natural biological control.

9. Detailed financial requirements for execution of the project:

1st Year 2013-14 - Rs. 91,000/- +

Training inputs - Rs. 24, 000/-

2nd Year 2014-15 - Rs. 1,82,000/-

3rd Year 2015-16 - Rs. 2,73,000/-

Total Financial requirement Rs. 5,70,000/- (Rupees five lac seventy thousand only for three years)

10**. Target proposed and expected achievements**:

1. Pesticide use will be reduced by 50% from first year and 100 % from third year onwards.
2. Pest and diseases of horticultural crops will be effectively controlled.
3. Residue free production of fruits.
4. Tribal farmers will be able to identify the natural enemies of important horticultural crops.
5. They will learn the technique of mass production of bioagents and entomopathogenic based biopesticides.

11. Anticipated impact of TSP Project on economic improvement of the tribal people and wealth creation in tribal areas

1. TSP will help to reduce the cost of plant protection in horticulture crops.
2. Increase the beneficial fauna near the rhizosphere of the fruit tree to reduce the pest and diseases.
3. Ecofriendly pest management.
4. Tribal farmers will know the natural enemies.
5. They will learn the technique of mass production of bioagents and biopesticides.
6. Increase in yield therefore, income from agriculture will be increase.

6. MPUAT Udaipur Centre (Rajasthan)

Name of the Project proposal : Popularization of biointensive IPM modules in maize among Tribal's of Udaipur district.

Introduction:- Maize is major kharif crop of TSP area of Udaipur district and covered about 80% total sown area which is more than 140000 ha. The major pest is maize stem borer and generally tribal farmer are using local seed which is susceptible and not using control measure against this pest. Our objective is to increase maize yield by popularizing the biocontrol based control measures of maize stem borer. For this we want to demonstrate and supply following critical inputs to TSP farmers.

1. **Details of the location of Tribal areas/STs where TSP is going to be executed (as per TSP guidelines):**

Farmers of following TSP villages of Tehsil Girwa will be executed

1. Naya Guda

2. Dhar
3. Dudawali
4. Raiyata
5. Kaliwas

2. **No. of villages, No. of farmers, area (ha) to be covered under TSP Project (As per TSP guidelines):**
    a. Villages : 5
    b. No. of farmers : 15 per village
    c. Area of demonstration : 0.4 ha per demonstration
3. **Crops to be dealt**: Maize
4. **Biocontrol/IPM technologies to be implemented for pest and disease management:**
    a. Soil application of FYM enriched Trichoderma.
    b. Sowing of quality seed of high yielding varieties.
    c. Four releases of egg parasitoids @ 1.5 lakh/ha starting from one week after germination.
    d. Need base application of eco-friendly insecticides/NPV against sucking and defoliator insects.
5. **Materials to be supplied to the TSP farmers with clear financial details**: Quality seeds, critical inputs.
    a. Seed of high yielding hybrid varieties
    b. Trichoderma
    c. Trichogramma
    d. Need based pesticides
    e. NPV
6. **Training/Demonstrations to be given to tribal farmers**:
    a. Trainings : 02
    b. No. of farmers/training : 70
    c. Field day : 05 (one in each village)
7. Detailed financial requirements for execution of the Project (budget not more than Rs. 1.90 lakhs/year/centre):

Budget Allocation:

S. No.	Particulars	Quantity	Rate /kg	Amount (Rs.
1	Quality maize seed	600 Kg	80	48,000
2	Tricho cards	550 Nos.	35	19,250
3	Biopesticides (Trichoderma & NPV)			12,750
4	Farmers field schools	5	10,000	50,000
5.	Training	2	15,000	30,000
6	POL			30,000
	Total Rs.			**1,90,000**

8. **Targets proposed and Expected Achievements:** To create awareness and direct benefit to 75 families belongs to Scheduled Tribes of 5 TSP villages.
9. **Anticipated impact of TSP Project on economic improvement of the Tribal people and wealth creation in Tribal areas:**
    a. Seed replacement.
    b. Popularization of IPM Technology.
    c. Improvement in living status of farmers.
    d. Awareness about high yielding varieties in place of local variety.

7. OUAT, Bhubaneswar (Odisha)

Demonstration of Bio control based IPM in field crops like Arhar and Paddy in tribal villages.

Procedure to be followed

1.Villages to be selected with at least 50% tribal population

2.Bio control agents like *Trichogramma, Trichoderma, Pseudomonas* will be mass produced in the laboratory and will be used for control of insect pests and diseases in paddy and arhar.

3. At least 100 Acres of each crop will be covered.

Budget requirement's 2,00,000 (Rupees two lakhs)

8. SKUAST, Srinagar Centre (Jammu & Kashmir)

1.	Name of the Project Proposal	**Bio-intensive IPM of Codling moth in Ladakh**
2.	Details of locations of Tribal areas/STs where TSP is going to be executed	TSP will be conducted in Ladakh region (Kargil) of Jammu and Kashmir. Kargil is situated approximately 220 Km away from main campus of Agriculture University (SKUAST-Kashmir). The identified locations where TSP will be executed are (1) Shanigund (2) Mingy (3) Mangmore (4) Bagh-e-Khomini (5) Ali Abad. These areas are located within the radius of 50 Km around Kargil.
3.	a. No of Villages	05
	b. No of Farmers	15
	c. Area covered	05 ha
4.	Crops to be dealt	Apple
5.	Biocontrol/ IPM technologies to be implemented for pest and disease management	(a) Release of *Trichogramma embryophagum* and *T. cacoecae* @ 100,000/ha as bio-agents for the management of codling moth (b) Use of pheromone traps (4 trap/500 m^2) for mass trapping of codling moth

		(c) Two spray of Bt @ 2.0 gm/lit. (d) 2 spray of NSKE 5% @ 5.0 ml/Lit. (e) Burlapping and killing (f) Chorpyriphos/ dimethoate @1.0 ml/lit			
6.	Materials to be supplied to the TSP farmers with clear financial details.	Materials (per year)	No.	Rate (Rupees)	Total (Rupees)
		1.Trichocards	100	50	5000.00
		2.Pheromone traps	400	100	40,000.00
		3.Bt	-	-	5000.00
		4. Pesticides	10 lit.	800	8000.00
		5. Foot sprayer	10 Nos.	3000	30,000.0
		6. Spraying containers (Tubs)	10 Nos.	800	8000.00
		7. Gunny bags	1000 Nos.	20.00	20,000.00
		Total			1,16,000.00
7.	Training/ Demonstrations to be given to tribal farmers	Training regarding Management of Codling moth. (a) Training regarding identification of Codling moth. (b) Demonstration regarding release of Tricho-cards and Pheromone traps. (c) Timing of management			
8.	Financial Details	Items (per year)	No.	Rate (Rupees)	Total (Rupees)
		1.Trichocards	100	50	5000
		2.pheromone traps	400	100	40000
		3.Bt	-	-	5000
		4. NSKE	10 kg	500	5000
		5. pesticides	10 lit.	800	8000
		6. Foot sprayer	10 Nos.	3000	30,000.0
		7. Spraying containers (Tubs)	10 Nos.	800	8000.00
		8. Gunny bags	1000 Nos.	20.00	20,000.00
		9.Travel/DA	5visits	20000	100000
		10. Labour Charges (04)	30 days	250	30000
		Total			2,51,000.00
9.	Target proposed and expectedAchievements	1. Reduction in fruit infestation 2. Increase in yield			
10.	Anticipated impact of TSP Project on economic improvement of the tribal of the Tribal people and wealth creation in Tribal areas	The people living in tribal areas below poverty line and their livelihood mainly depend on agriculture and allied fields. Main source of income is from horticultural crop. By controlling the key pests (Codling moth) associated with these fruit crops, the yield can be increased which can boost the economy of the people living in the tribal areas.			

9. TNAU, Coimbatore Centre (Tamil Nadu)

Objectives:

i. To give awareness about the indiscriminate use of pesticides and their harmful effects
ii. To educate the importance of various non-chemical methods
iii. To give hands on training to tribal farmers about mass production of various biocontrol agents
iv. To distribute the bio-inputs to the selected tribal farmers in three different districts
v. To offer training on use of biocontrol agents and their conservation methods
vi. To monitor the implementation of various technical know-how and to record methodology for the impact of the project.

The following three tribal areas will be selected to implement the project.

Year	Village	Crop	District
1	Two villages	Mango, tapioca	Salem
2	One village	Coffee	Dindigul
3	One village	Vegetables	Nilgiris

One hundred tribal farmers covering from the three districts will be selected in consultation with nearby KVK's/extension officials/self help groups. The identified farmers will be offered one training alone with distribution of inputs and consultancy services for effective utilization of inputs. In the training, demonstration on the efficacy/ usefulness of biocontrol agents will be done in the farmers fields.

During three years a total of 300 farmers covering three districts will be benefitted out of the project. The utilization of bioinputs in their field, awareness of biocontrol agents, hands on training will bring remarkable change of their skill, knowledge, economy besides practicing eco-friendly insect pest management strategies.

The following inputs will be distributed at free of cost to the tribal farmers.

S.No	Biocontrol agents	Quantity
1	*Pseudomonas*	1kg
2	*Trichoderma*	1kg
3	*Beauveria/ Metarhizium*	1kg
4	*Chrysopa/coccinellid/ Bt*	Need based
5	Neem seed/ neem cake /Neem oil	5kg / 2lt
6	Tricho card	600 cc@6cc/farmer/year

Budget requirement

Details	2014-15 (Rs.)	2015-16 (Rs.)	2016-2017 (Rs.)
Bio inputs @Rs.1300/ farmer to 100 persons	1,30,000	1,30,000	1,30,000
Training expenditure including TA	60,000	60,000	60,000
Food, snacks and transport of farmers and inputs	30,000	30,000	30,000
Recurring contingency on banners, training kit and printouts	25,000	25,000	25,000
Total	2,45,000	2,45,000	2,45,000

10. UAS- Raichur Centre, Karnataka

Sl No.	Particulars	Details
1	Name of the project proposal	Tribal Sub Plan
2	Details of the locations of Tribal areas/STs where TSP is going to executed	Devdurga and Raichur
3	No. of villages, No. of farmers, area (ha) to be covered under TSP Project	Three villages and in a year one village will be selected to implement the TSP. 10 ha in each village
4	Crops to be dealt	Ground nut and Chick pea
5	Biocontrol/IPM technologies to be implemented for pest and disease management	1. Monitoring insect pests through Pheromone traps 2 Ha NPV and Sl NPV 3. Entompathogenic Fungi
6	Materials to be supplied to the TSP farmers with clear financial details	1.Pheromone traps 2. Ha NPV and Sl NPV 3. Knap sack Sprayers 4. Entomopathogenic Fungi 5. Vermibeds for production of vermicompost
7	Training/Demonstrations to be given to tribal farmers	Training programs on IPM of ground nut and Chick pea
8	Detailed financial requirements for execution of the Project (budget not more than Rs. 1.90 lakhs/year/centre)	5.70 lakhs 2014-17 (1.90lakhs/year)
9	Targets proposed and Expected Achievements	To demonstrate the IPM technology in Ground nut and chick pea Helps to overcome the injudicious use of pesticides Helps to conserve the natural enemies
10	Anticipated impact of TSP Project on economic improvement of the Tribal people and wealth creation in Tribal areas.	Production of vermicompost helps tribal youths to engage themselves in mitigating the purchase of fertilizers Awareness will be made to reduce cost of cultivation of ground nut and chick pea in tribal areas

Financial Requirement: 2014-15

Village		Particulars	Quantity	Amount	Total
Sasivegera Village	a	Pheromone traps 4 traps /acre	100 No.	150/trap	15000=00
Tq Devadurga ,	b	Sl NPV 100LE /acre	5000 LE	200/100 LE	10000=00
District Raichur	c	Entomopathogenic Fungi	50 Kg	200/Kg	10000=00
No. of farmers : 20,	d	Knap sack Sprayers	20 No.	2500/each	50000=00
Area: 10 ha	e	Vermibeds	20 No.	3200/each	64000=00
Crop: Groundnut	f	Training Programmes	3 No	10000/each	30000=00
	g	Field Days	1 No	10000/each	10000=00
Grand Total					**189000=00**
(One lakh eighty nine thousand only)					

Financial Requirement: 2015-16

Village		Particulars	Quantity	Amount	Total
Pilligundi Village	a	Pheromone traps 4 traps /acre	100 No.	150/trap	15000=00
Tq Devadurga ,	b	Sl NPV 100LE /acre	5000 LE	200/100 LE	10000=00
District Raichur	c	Entomopathogenic Fungi	50 Kg	200/Kg	10000=00
No. of farmers : 20,	d	Knap sack Sprayers	20 No.	2500/each	50000=00
	e	Vermibeds	20 No.	3200/each	64000=00
Area: 10 ha	f	Training Programmes	3 No	10000/each	30000=00
Crop: Groundnut	g	Field Days	1 No	10000/each	10000=00
Grand Total					**189000=00**
(One lakh eighty nine thousand only)					

Financial Requirement: 2016-17

Village		Particulars	Quantity	Amount	Total
Garaldinni Village	a	Pheromone traps 4 traps /acre	100 No.	150/trap	15000=00
Tq Raichur ,	b	Ha NPV 100LE /acre	5000 LE	200/100 LE	10000=00
District Raichur	c	Entomopathogenic Fungi	50 Kg	200/Kg	10000=00
No. of farmers : 20,	d	Knap sack Sprayers	20 No.	2500/each	50000=00
	e	Vermibeds	20 No.	3200/each	64000=00
Area: 10 ha	f	Training Programmes	3 No	10000/each	30000=00
Crop: Chickpea	g	Field Days	1 No	10000/each	10000=00
Grand Total					**189000=00**
(One lakh eighty nine thousand only)					

11. YSPUHF, Solan Centre, (Himachal Pradesh)

1- **Name of the Project proposal**: **Use of ecofriendly methods of pest management for apple and vegetable crop pests.**

2- **Details of the location of Tribal areas/STs where TSP is going to be executed (as per TSP guidelines** :

Location : District Kinnaur: It is situated 77°45' and 79°00'35'' East Longitudes and between 31°55'50" and 32°05'15" North Latitudes. Kinnaur shares its Eastern boundary with Tibet. On the South and South Eastern sides, it has Uttar Kashi district of Uttar Pradesh. On the Western side lies the Shimla district and on the North and North-West is situated Lahaul and Spiti.

Population is 61,639 out of which 74% is scheduled Tribes.

Headquarter is Recong Peo (altitude 2,760 meters) - former HQ. was Kalpa (altitude 2,770 meters)

Altitude varies from 2,550 metres to 6,791 meters.One can travel in a taxi or jeep on National Highway 22 for the entire journey from Kalka to Kinnaur. Some of the parts of journey can be done by long route buses run by HRTC. Distance from Shimla to Kalpa is 244 km., , Delhi 590 km., Kullu 267 km.

Nauni to Kalpa is 304Km

Area is 10,820 sq. km.

Three villages in Distt Kinnaur(H.P) will be selected. These are

1. Village- Kamroo
2. Village Kalpa
3. Village-Ribba

3- **No of villages, No of farmers, area (ha) to be covered under TSP Project (as per TSP guidelines**: 3 villages, 600 (ha) area, 300 farmers including self help groups and members of gram panchyats.

4- **Crops to be dealt**: Apple, Peas, cabbage, cauliflower & beans.(all Commercial crops)

5- **Biological/IPM technologies to be implemented for pest and disease management** : 1- use of light traps for monitoring apple root borer 2- use of entomophagus fungus & neem product for the control of apple stem and root borer,3- safe use of pesticide for the conservation of parasitoids of apple woolly aphid, 4-use of pheromone traps for DBM in cole crops,5- use of BT & Neem products for the control of catterpillar in cole crops, 6- use of yellow sticky traps for the control of white flies on beans, 7- use of predatory mite for the control of mites on beans,8- use of blue sticky trap for pea leaf minor.

6- **Material to be supplied to the TSP farmers with clear financial details** : 1- Predatory Mite, 2- Yellow Traps, 3- Blue sticky traps, 4- Light traps, 5- entomophagus fungus 6- neem product, 7- Pheromone traps, 8- BT. (as mentioned in the training budget)

7- **Training/demonstration to be given to tribal farmers** : Total six trainings in three villages will be organized (2 trainings in each village per year in the month of May & September)

a) **Detailed financial requirements for execution of the project**

Expenditure for one training:

Registration material (for 100 farmers)	5000/-
Working lunch and refreshment	10000/-
Honorarium for recourse persons	2500/-
Miscellaneous charges	2500/-
Total	20000
Number of trainings	6
Total expenditure for 6 trainings	120000/-
b) Travel charges:	40000/-
c) Literature and other material for farmers:	30000/-
Grand total: Rs.	190000/-

8- Targets proposed and Expected Achievements

Framers use chemical pesticides indiscriminately on crops like apple, peas and cole crops resulting in insecticide resistance in various pests. Through the proposed trainings the farmers will be demonstrated about the use of bio-pesticides and other eco-friendly techniques to manage these pests which will not only reduce the expenditure incurred on chemical pesticides but also reduce the impact on health and environment.

9- Anticipated impacts of TSP Project on economic improvement of the tribal people & wealth creation in tribal areas

The target areas are far away from the university and the people are not well aware of the technologies developed by the university. The training programmes to be organized in these areas will create awareness among the farmers regarding the ecofriendly approaches of pest management. Most of the crops grown by the farmers of these areas are cash crops and off season for rest of the country. Farmers mainly apply pesticide indiscriminately to control pests which is detrimental to their health and environment. The trainings will therefore be very helpful in uplifting the economy of the farmers as well as reducing the risks to their health and environment.

Crop wise coverage under tribal sub plan at Solan centre

Kinnaur district of Himachal Pradesh is a tribal district and the main occupation of the people is farming. Apple is the main crop grown by the farmers, however, vegetables namely peas, cabbage, cauliflower and beans are also grown as off season vegetables and are good source of income. In apple farmers encounter the attack of pests like apple root borer (*Dorysthenes hugelii)*, phytophagous mites and apple wooly aphid (*Eriosoma lanigerum)*. Among vegetable crops cole crops are mainly infested by diamondback moth (*Plutella xylostella*) and cabbage butterfly (*Pieris brassicae)*, peas and beans by leaf miners and whiteflies. Under this sub plan training will be imparted to the farmers of three villages namely Kamroo, Kalpa and Ribba covering about 600ha area for ecofriendly management of these pests. About 400 ha will be covered under apple which is the most important crop of the area and about 200ha (50ha each under peas, cabbage, cauliflower and beans) will be covered under vegetables.

(Abraham Verghese)

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