# JUNAGADH AGRICULTURAL UNIVERSITY

## RESEARCH RECOMMENDATIONS FOR FARMERS COMMUNITY

## III. PLANT PROTECTION

Total 157 Farmers' recommendations/ new technologies developed by plant protection disciplines are described below:

**Year: 2004-05**

**Entomology**

### 1. Management of *Halicoverpa armigera* through different antifeedants in chickpea

For the eco-friendly management of *Halicoverpa armigera* in chickpea in South Saurashtra Agro-climatic Zone, two spraying of kadvi mehadi leaf extract (ICBR 1:5.12) or mamejva leaf extract (ICBR 1:4.67) or Jatropha leaf extract (ICBR 1:4.41) or five per cent neem leaf extract (ICBR 1:4.12) at 15 days interval from the date of pest infestation is recommended.

### 2. Integrated pest management in coriander

Integrated pest management module for coriander aphid comprising of sowing of coriander in 1$^{st}$ week of October and releasing coccinellid predators @ 400 adults/ha (ICBR 1:8.10) at ETL of 1.0 aphid index / plant (ICBR 1:5.00) is recommended for South Saurashtra Agro-climatic Zone.

### 3. Chemical control of sucking pests of summer okra through seed treatment

For the control of sucking pests (jassid and aphid) in summer okra, seed treatment of thiamethoxam @ 2.8 g/kg seeds (ICBR 1:12.28) or imidacloprid @ 5 g/kg seed (ICBR 1:11.51) is recommended for South Saurashtra Agro-climatic Zone.

### 4. Fenugreek

Not included, as recommendation does not confirm the guideline of CIB.

### 5. Bio efficacy of some synthetic and botanical insecticides against fruit borer of pomegranate

Not included as recommendation does not confirm the guideline of CIB.

### 6. Groundnut

The farmers of North Saurashtra Agro-climatic Zone are advised to apply karanj cake (ICBR 1:6.86) or castor cake (ICBR 1:5.62) @ 250 kg/ha in furrow at the time of sowing for the management of pod borer (*Penthicoides seriatoporus* Fairmaire) in groundnut under dry farming condition.

(*Department of Entomology, CoA, JAU, Junagadh*)

### 7. Pigeon pea

The farmers of North Saurashtra Agro-climatic Zone are advised to adopt the bio-intensive module consisting of the first spray of HaNPV @ 250 LE/ha at ETL of 10 larvae/20 plants followed by second spray of neem seed kernel extract 5 per cent after 15 days of first spray (ICBR 1:1.95).

(*Main Dry Farming Research Station, JAU, Targhadia*)

### 8. Cotton

For the control of pink bollworm in cotton, farmers of Saurashtra region are advised to spray spinosad 45 SC @ 50 g a.i./ha (ICBR 1:3.10) as and when pest crosses the ETL (10 male moths/ pheromone trap/day).

### 9. IPM – Cotton

For the management of insect pests of cotton, the following IPM strategies are recommended for farmers of South Saurashtra Agro-climatic Zone (ICBR 1:5.70).

1. Seed treatment with imidacloprid @ 10 g/kg seeds.
2. Collection of infested shoots of spotted bollworm in the early stage.
3. Installation of pheromone trap @ 5/ha one week after germination.
4. Early three releases of *Chrysoperla* @ 10,000 eggs/1st instar larvae/ha.
5. Spraying of neem formulation (Azadirachtin 0.0035 %) or NSKE 5 per cent.
6. Four times releases of *Trichogramma* @ 1.5 lakh/ha with the initiation of egg laying of the pest.
7. Spraying of HaN PV @ 450 LE/ha for *Helicoverpa armigera*.
8. Hand collection of eggs and larvae of *Helicoverpa armigera*.
9. Planting of maize as intercrop (10:1), marigold and castor as trap crops in and around the cotton field.
10. Need based application of insecticides for sucking pests and bollworms based on ETL.

(*Cotton Research Station, JAU, Junagadh*)

### 10. Chemical control of mustard aphid (*Lipaphis berysimi* Kalt.)

The farmers of South Saurashtra Agro-climatic Zone growing mustard crop are advised to apply first spray of insecticide imidacloprid 17.8 SL 0.005 per cent (ICBR 1:7.68) or methyl-o-demeton 25 EC 0.03 per cent (ICBR 1:5.92) at appearance of aphids and second spray after 15 days of first spray.

(*Main Oilseeds Research Station, JAU, Junagadh*)

## Plant Pathology

### 11. Pearl millet

Not included, as recommendation does not confirm the guideline of CIB.

(*Main Pearl Millet Research Station, JAU, Jamnagar*)

### 12. Groundnut

The farmers of South Saurashtra Agro-climatic Zone are advised to use tebuconazole @ 1.25 g/kg as seed treatment (ICBR 1:51.12) to reduce the collar rot disease of groundnut.

(*Main Oilseed Research Station, JAU, Junagadh*)

### 13. Management of early blight disease in tomato

For the management of early blight of tomato in South Saurashtra Agro-climatic Zone, seed treatment with captan @ 3 g/kg seeds, application of carbofuran @ 1 kg a.i./ha in seed bed and covering of nursery with nylon net (400 mesh) after sowing and after transplanting four sprays of mancozeb @ 0.3 per cent (ICBR 1:7.09) during *rabi* season at 15 days interval starting from initiation of early blight disease are recommended.

(*Vegetable Research Station, JAU, Junagadh*)

## Year: 2005-06

## Entomology

### 14. Sesame

Due to ban in Endosulfan, this recommendation was removed.

### 15. Chickpea

Due to ban in Endosulfan, this recommendation was removed.

### 16. Coriander seeds

The farmers of South Saurashtra Agro-climatic Zone are advised to store the well dried coriander seeds in plastic coated jute bag (ICBR 1:11.57) or high density polyethylene (HDPE) bag 35 micron (ICBR 1:7.23) to protect from the infestation of cigarette beetle (*Lasioderma serricorne* Fab.) up to 10 months of storage after harvesting.

(*Department of Processing & Food Engineering, CAET, JAU, Junagadh*)

## Year: 2006-07

## Entomology

### 17. Coriander

Not included, as recommendation does not confirm the guideline of CIB.

### 18. Fenugreek

Not included, as recommendation does not confirm the guideline of CIB.

(*Department of Entomology, CoA, JAU, Junagadh*)

### 19. Sesame

The farmers of North Saurashtra Agro-climatic Zone growing sesame are advised to take plant protection measures from 28 days after sowing (DAS) for the control if leaf roller and 42 DAS for gall fly. Moreover, the farmers are further advised to take care that the leaf roller infestation is found more when there is more rainfall/rainy days and gall fly infection is more when there is low rain/dry period.

(*Main Pearl millet Research Station, JAU, Jamnagar*)

### 20. Chickpea

Due to ban in Endosulfan, this recommendation was removed.

### 21. Chickpea

Not included, as recommendation does not confirm the guideline of CIB.

(*Pulses Research Station, JAU, Junagadh*)

## Plant Pathology

### 22. Effect of phosphate solubilizing microorganisms on growth and yield in chickpea

The farmers of South Saurashtra Agro-climatic Zone are advised to apply phosphate solubilizing microorganism cultures either PBA-13 (*Bacillus coagulans*) (CBR 1:28.79) or PBA-20 *(Aspergillus* spp.*)* (CBR 1:22.95) or PBA-10 (*B.coagulans*) (CBR 1:21.60) ($10^8$ viable cells/g) as seed treatment @ 30 g/kg seed in gram crop in place of phosphatic fertilizer.

(*Department of Plant Pathology, CoA, JAU, Junagadh*)

**23. Groundnut-Castor relay crop**

The farmers of South Saurashtra Agro-climatic Zone are advised to sow groundnut with castor as relay crop (Row ratio of 2:1) along with soil application of carbofuran 3 G @ 1 kg a.i./ha (Furadan 3G @ 33 kg/ha) to reduce the root knot nematode disease (*Meloidogyne arenaria*)and to get higher yield (CBR 1: 2.35).

(*Main Oilseeds Research Station, JAU, Junagadh*)

**24. Garlic**

Not included, as recommendation does not confirm the guideline of CIB.

(*Vegetable Research Station, JAU, Junagadh*)

**Year: 2007-08**

**Entomology**

**25. Dillseed**

Not included, as recommendation does not confirm the guideline of CIB.

**26. Cumin**

Not included, as recommendation does not confirm the guideline of CIB.

**27. Tomato**

Seed treatment with thiamethoxam 70 % WS @ 4.2 g/kg seed is recommended under South Saurashtra region for effective management of whitefly and leaf miner attacking tomato nursery and thereby to obtain higher numbers of transplantable seedlings.

**28. Groundnut (*kharif*)**

For effective and economical management of white grubs in *kharif* groundnut, seed treatment with chlorpyriphos 20EC @ 25 ml/kg seed (CBR1:11.00) or furrow application of phorate 10G @ 25 kg/ha (CBR 1:7.69) at the time of sowing or drenching of chlorpyriphos 20EC (0.1 %) (50 ml/10 lit water) in plant row after 15 days of germination (CBR 1:4.67) is recommended under South Saurashtra region.

**Note:** General treatments of spraying of carbaryl 0.2 % on host trees *viz*., babul, neem and ber trees surrounding the field within three to four days of pre-monsoon rain, spraying of crop with monocrotophos 0.05 % and installation of light trap are to be followed.

(*Department of Entomology, CoA, JAU, Junagadh*)

**29. Custard Apple**

Not included, as recommendation does not confirm the guideline of CIB.

**30. Castor**

Not included, as recommendation does not confirm the guideline of CIB.

**31. Castor**

For effective and economical management of thrips in castor, spraying of dimethoate, 0.03 %, (CBR 1:14.01) at appearance of pest is recommended.

(*Main Oilseeds Research Station, JAU, Junagadh*)

**32. Castor**

The farmers of North Saurashtra Agro-climatic Zone cultivating castor under rainfed condition are advised to apply granulosis virus @ 300 LE/ha at ETL (4 larvae/plant) for control of semi looper. The spray should be done in late evening hours and wetting agent (Sandovit) @ 10 ml and UV protectant (Ranipal) 1 g should be mixed in 10 lit of spray solution.

(*Main Dry Farming Research Station, JAU, Targhadia*)

**Plant Pathology**

**33. Fenugreek**

The farmers of South Saurashtra Agro-climatic Zone are advised to sow fenugreek in third or fourth week of October for maximum yield and minimum powdery mildew disease incidence.

(*Department of Plant Pathology, CoA, JAU, Junagadh*)

**34. Green gram**

Not included, as recommendation does not confirm the guideline of CIB.

**35. Black gram**

Not included, as recommendation does not confirm the guideline of CIB.

(*Main Dry Farming Research Station, JAU, Targhadia*)

**36. Onion (*kharif*)**

Not included, as recommendation does not confirm the guideline of CIB.

(*Vegetable Research Station, JAU, Junagadh*)

**Year: 2008-09**

**Entomology**

**37. Management of thrips in onion (bulb purpose) through newer insecticides**

Not included, as recommendation does not confirm the guideline of CIB.

(*Department of Entomology, CoA, JAU, Junagadh*)

**38. Okra**

Due to ban in Endosulfan, this recommendation was removed.

**39. Chemical control of stem borer *Chilo partellus* (S) of pearl millet**

Not included, as recommendation does not confirm the guideline of CIB.

(*Main Pearl Millet Research Station, JAU, Jamnagar*)

**Plant Pathology**

**40. Chemical control of powdery mildew of coriander**

Not included, as recommendation does not confirm the guideline of CIB.

**41. Efficacy of fungicides for the control of powdery mildew of cumin**

The farmers of South Saurashtra Agro-climatic Zone are advised to apply three sprays of difenoconazole 25 EC 0.025 per cent (10 ml/10 lit) at 15 days interval starting from initiation of disease for effective and economical control of powdery mildew of cumin.

**42. Effect of sowing period on the occurrence of powdery mildew of cumin**

The farmers of South Saurashtra Agro-climatic Zone are advised to sow cumin in third or fourth week of October for keeping low incidence of powdery mildew disease and better seed yield.

(*Department of Plant Pathology, CoA, JAU, Junagadh*)

**43. Management of stem rot of groundnut through oil cakes**

The farmers of North Saurashtra Agro-climatic Zone are advised to apply castor cake @ 750 kg/ha in furrow before sowing for effective and economical management of stem rot of groundnut.

**44. Management of powdery mildew of sesamum through triazole fungicides**

Not included, as recommendation does not confirm the guideline of CIB.

*(Main Dry Farming Research Station, JAU, Targhadia)*

**Year: 2009-10**

**Entomology**

**45. Field efficacy of bio-pesticides against thrips in onion (bulb purpose)**

Not included, as recommendation does not confirm the guideline of CIB.

(*Department of Entomology, CoA, JAU, Junagadh*)

**46. Management of pest in brinjal through bio-pesticides**

Due to ban in Endosulfan, this recommendation was removed.

**47. Management of shoot fly and stem borer in *bajra* crop**

Not included, as recommendation does not confirm the guideline of CIB.

(*Main Pearl Millet Research Station, JAU, Jamnagar*)

**48. Development of low cost protection technology for sorghum shoot fly (*Atherigona soccata)***

The farmers of North Saurashtra Agro-climatic Zone growing sorghum for fodder purpose in *kharif* season are advised to give seed treatment with imidacloprid 70 WS @ 5 g/kg seeds and two sprays of Neem Seed Kernel Extract 5 % at 7 and 14 days after germination for the management of shoot fly.

(*Grassland Research Station, JAU, Dhari*)

**49. Management of sesame leaf webber/ capsule borer through insecticides**

Due to ban in Endosulfan, this recommendation was removed.

**50. Testing of newer molecules of pesticides against sucking insect pests in groundnut**

The farmers of North Saurashtra Agro-climatic Zone cultivating groundnut under rainfed condition are advised to apply imidacloprid 17.8 SL 0.007 % (4 ml/10 l) at ETL of aphid (1.5 aphid index/plant) and jassid (3 nymphs/3 top leaves) for effective and economical control of these pests.

### 51. Integrated management of insect pests and diseases of groundnut under rainfed condition

The farmers of North Saurashtra Agro-climatic Zone cultivating groundnut under rainfed condition are advised to spray the tank mixture of insecticides and fungicides in schedule i.e. thiamethoxam 25 WG @ 4 g + hexaconazole 5 EC @10 ml/10 l at 35 DAS, acetamiprid 20 SP@ 2 g + chlorothalonil 75 WP @ 25 g/10 l at 50 DAS and imidacloprid 17.8 SL@ 4ml + carbendazim 50 WP @ 5 g + mancozeb 75 WP@ 26 g/10 l at 65 DAS for effective and integrated management of the sucking insect pests i.e. aphid, jassid and thrips and diseases i.e. tikka and rust.

(*Main Dry Farming Research Station, JAU, Targhadia*)

### 52. Testing of new insecticides against sucking pests in groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are advised to give seed treatment with imidacloprid 600 FS @ 3 g/kg seed **or** thiamethoxam 70 WS @ 1 g/kg seed for effective and economical management of thrips and jassid.

### 53. Bio-efficacy of insecticides against thrips in groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are advised to spray imidacloprid 17.8 SL 0.005 % (2.8 ml/10 l) **or** methyl-o-demeton 25 EC 0.025 % (10 ml/10 l) at the initiation of the pest for effective and economical management of thrips.

(*Main Oilseeds Research Station, JAU, Junagadh*)

## Plant Pathology

### 54. Chemical control of powdery mildew of mango

The farmers of South Saurashtra Agro-climatic Zone cultivating mango are advised to apply three sprays of hexaconazole 5 EC 0.005 % (10 ml/10 l) at 20 days intervals from initiation of flowering for effective and economical management of powdery mildew.

### 55. Chemical control of colletotrichum and cercospora leaf spots of urdbean

Not included, as recommendation does not confirm the guideline of CIB.

### 57. Evaluation of fungicides for the control of downy mildew disease of bitter gourd

Not included, as recommendation does not confirm the guideline of CIB.

(*Department of Plant Pathology, CoA, JAU, Junagadh*)

### 56. Management of stem rot of groundnut (*Sclerotium rolfsii*) by different methods of application of *Trichoderma sp*.

The farmers of South Saurashtra Agro-climatic Zone cultivating groundnut are advised to treat the seed with talc based *Trichoderma viride* @ 10 g/kg seeds **or** apply T. *viride* @ 2.5 kg/ha as soil drenching at 30 days after sowing **or** *T. viride* @ 2.5 kg along with either castor cake **or** FYM @100 kg /ha in furrow at the time of sowing to reduce stem rot incidence.

### 58. Management of *Meloidogyne arenaria* and *Sclerotium rolfsii* complex in groundnut

The farmers of South Saurashtra Agro-climatic Zone cultivating groundnut are advised to treat the seed with talc based *Pseudomonas fluorescens* @ 20 g/kg seeds followed by the application of *Pseudomonas fluorescens* in furrow @ 2.5 kg/ha for effective management of root knot nematode and stem rot diseases.

(*Main Oilseeds Research Station, JAU, Junagadh*)

### 59. Biological control of angular leaf spot disease of cotton

Not included, as recommendation does not confirm the guideline of CIB.

(*Cotton Research Station, JAU, Junagadh*)

### 60. Chemical control of Alternaria leaf spot of sesame

Not included, as recommendation does not confirm the guideline of CIB.

(*Main Dry Farming Research Station, JAU, Targhadia*)

## Year: 2010-11

## Entomology

### 61. Efficacy of newer insecticides against sucking pests of coriander

Not included, as recommendation does not confirm the guideline of CIB.

(*Department of Entomology, CoA, JAU, Junagadh*)

### 62. Management of eriophyid in coconut cv. T x D (Mahuva)

For effective and economical management of eriophyid mite in coconut, root feeding application of azadiracatin 2.5 % @ 15 ml with equal water quantity per palm at two months interval throughout the year is recommended under South Saurashtra Agro-climatic Zone.

(*Agricultural Research Station (Fruit Crops), JAU, Mahuva*)

### 63. Testing efficacy of bio-pesticides for the control of sesame leaf webber/capsule borer (*Antigastra catalaunalis*)

Not included, as recommendation does not confirm the guideline of CIB.

(*Agricultural Research Station (Ag. Botany), JAU, Amreli*)

## Plant Pathology

### 64. Integrated Management of downy mildew of cucurbit (Ridge gourd)

Not included, as recommendation does not confirm the guideline of CIB.

(*Vegetable Research Station, JAU, Junagadh*)

### 65. Chemical control of leaf/stem/capsule spots (Alternaria alternata) of sesame

Not included, as recommendation does not confirm the guideline of CIB.

(*Agricultural Research Station, JAU, Amreli*)

## Year: 2011-12

## Entomology

### 66. Efficacy of newer insecticides against cabbage aphid

For effective and economical management of cabbage aphids under South Saurashtra Agro-climatic Zone, two spray of acetamiprid 20 SP 0.004 % (2 g/10 liter water) at 15 day interval starting from aphid infestation are recommended. The waiting period of acetamiprid 20 % SP (15 g. a.i./ha) should be maintained 7 days between last spray and harvesting of the crop.

(*Department of Entomology, CoA, JAU, Junagadh*)

### 67. Monitoring of bajra worm *Helicoverp aarmigera* (Hubner) through sex pheromones during *kharif*

The farmers of North Saurashtra Agro-climatic Zone growing *kharif bajra* are advised to install sex pheromone traps for monitoring of adult male moths of ear head worm (*Helicoverpa armigera* Hubner) @ 5 traps/ha at 1 ft height above ear head after the formation of ear head.

(*Main Pearl millet Research Station, JAU, Jamnagar*)

### 68. Management of eriophyid mites in coconut cv. D x T with nutrient and fertilizers

For the effective and economical management of eriophyid mite in hybrid coconut (D x T Mahuva), application of half dose of recommended chemical fertilizers (NPK-0.750: 0.375: 0.750 kg/palm/year) with 50 kg FYM, 1.5 kg gypsum and 0.075 kg borax/palm/year in June and remaining half dose of recommended chemical fertilizers (NPK 0.750:0.375:0.750 kg/palm/year) in October is recommended under South Saurashtra Agro-climatic Zone.

(*Agricultural Research Station (Fruit Corps), JAU, Mahuva*)

## Plant Pathology

### 69. Integrated management of major diseases of groundnut

The farmers of South Saurashtra Agro-climatic Zone growing groundnut are advised to treat the seeds with tebuconazole 2 % DS @1.5 g/kg and spray tebuconazole 25 EC @ 10 ml/ 10 l water at 45 and 60 days after sowing.

OR

Apply talc based *Trichoderma* @ 10 g/kg seed and @ 4 kg/ha with 250 kg castor cake in furrow at the time of sowing and spray hexaconazole 5 EC @ 10 ml/10 l water twice at 45 and 60 days after sowing for economic and effective control of soil borne (collar rot & stem rot) and foliar (tikka & rust) diseases. The waiting period of tebuconazole 25 EC (125 g a.i./ha) and hexaconazole 5 EC (100 g a.i./ha) should be maintained 49 and 30 days, respectively between last spray and harvesting of the crop.

(*Main Oilseed Research Station, JAU, Junagadh*)

**70. Wilt management in chickpea**

The farmers of the South Saurashtra Agro-climatic Zone growing irrigated chickpea during *rabi* season are advised to adopt seed treatment of carbendazim 1 g + thiram 2 g/kg seed along with soil application of *Trichoderma viride* ($10^6$ cfu/g) @ 2.5 kg mixed in 250 kg either castor cake or FYM/ha at the time of sowing in furrow for management of wilt and to get higher seed yield.

*(Pulses Research Station, JAU, Junagadh)*

**Year: 2012-13**

**Entomology**

**71. Field efficacy of newer acaricides for the management of mites in garlic**

Not included, as recommendation does not confirm the guideline of CIB.

**72. Field efficacy of bio-pesticides against pest complex of okra**

Not included, as recommendation does not confirm the guideline of CIB.

**73. Bio efficacy of newer miticides against mites in cluster bean**

Not included, as recommendation does not confirm the guideline of CIB.

**74. Field efficacy of bio-pesticides against inflorescence pests of mango**

Not included, as recommendation does not confirm the guideline of CIB.

**75. Field efficacy of different insecticides against the leaf webber of mango**

Not included, as recommendation does not confirm the guideline of CIB.

(*Department of Entomology, CoA, JAU, Junagadh*)

**76. Ecofriendly management of sesame leaf webber, *Antigastra catalaunalis* Duponchel under rainfed condition**

The farmers of North Saurashtra Agro-climatic Zone, cultivating sesame under rainfed condition are advised to give two sprays of Neem Seed Kernel Extract 3 % (300 g / 10 lit water) for effective and economic control of the leaf webber. The first spray should be applied when the pest population reach at 5 larvae / 20 plants (ETL) and second spray at 15 days after the first spray.

(*Main Dry Farming Research Station, JAU, Targhadia*)

**77. Chemical control of sucking pests through foliar application of new insecticides in cotton**

Farmers of South Saurashtra Agro-climatic Zone, growing cotton are advised to apply three sprays of imidacloprid 200 SL @ 40 g a.i. /ha (4 ml/10 litre water) or thiamethoxam 25 WG @ 25 g

a.i./ha (2 g/ 10 litre water) or acephate 75 SP @ 750 g a.i./ha (20 g / 10 litre water) for effective and economic control of sucking pests (jassids and whitefly) at 15 days interval starting from the pest infestation. The waiting period of thiamethoxam 25 WG @ 25 g a. i/ha should be maintained 21 days between last spray and harvesting of the crop. The residue of imidacloprid 200 SL @ 40 g a.i. /ha and acephate 75 SP @ 750 g a.i./ha after first and second picking was found below detection level in the cotton lint and seeds.

The pre-harvest interval of 104 days is recommended for imidacloprid, thiamethoxam and acephate.

(*Cotton Research Station, JAU, Junagadh*)

## Plant Pathology

### 78. Management of root knot nematode, *Meloidogyne arenaria* in groundnut

Not included, as recommendation does not confirm the guideline of CIB.

(*Main Oilseed Research Station, JAU, Junagadh*)

### 79. Management of leaf blight disease in tomato

Not included, as recommendation does not confirm the guideline of CIB.

(*Vegetable Research Station, JAU, Junagadh*)

## Year: 2013-14

## Entomology

### 80. Testing Bio-efficacy of insecticides against sucking pest in summer groundnut

The farmers of South Saurashtra Agro-climatic Zone growing summer groundnut are advised to spray imidacloprid 17.8 SL 0.005 % (3 ml/ 10 litre water; 25 g a.i./ha) twice at 15 days interval starting after initiation of pest for effective and economical management of sucking pests in groundnut. The pre harvest Interval (PHI) of this insecticide is 40 days.

(*Main Oilseeds Research Station, JAU, Junagadh*)

### 81. Management of shoot fly and stem borer in *bajra* crop

Not included, as recommendation does not confirm the guideline of CIB.

(*Main Pearl millet Research Station, JAU, Jamnagar*)

### 82. Chemical control of thrips (*Thrips tabaci* L.) in onion through newer insecticides

Not included, as recommendation does not confirm the guideline of CIB.

### 83. Management of sucking pests of *kharif* groundnut through newer insecticides

Not included, as recommendation does not confirm the guideline of CIB.

(*Grassland Research Station, JAU, Dhari*)

### 84. Efficacy of new molecules against *Helicoverpa armigera* in chickpea

For effective and economic control of pod borer *(Helicoverpa armigera*) in chickpea crop, farmers of South Saurashtra Agro-climatic Zone are advised to apply two sprays of chlorantraniliprole 20 SC 0.003 % (1.5 ml/ 10 liter water; 15 g a.i./ha) or emamectin benzoate 5 SG 0.001 % (2 g/ 10 liter water; 5 g a.i./ha). First spray should be applied at 50 % flowering and second at 15 days after first spray. The PHI for these insecticides is 27 days.

(*Pulses Research Station, JAU, Junagadh*)

### 85. Testing bio-efficacy of certain insecticides against pod borer complex on pigeon pea

The farmers of South Saurashtra Agro-climatic Zone are advised to apply two sprays of spinosad 45 SC 0.009 % (2 ml/ 10 litre water; 45 g a.i/ha) or thiodicarb 75 WP 0.075 % (10 g/ 10 litre water; 375 g a.i/ha) or flubendiamide 48 SC 0.0096 % (2 ml/ 10 litre water; 48 g a.i/ha) or chlorantraniliprole 20 SC 0.003 % (1.5 ml/ 10 liter water; 15 g a.i./ha) starting from 50 per cent flowering and second spray at 15 days after first spray for the control of pod borer complex in pigeon pea. The PHI for these insecticides is 30 days.

(*Pulses Research Station, JAU, Junagadh*)

**Year: 2014-15**

**Entomology**

**86. Management of sucking pests through insecticides in brinjal**

For effective and economical control of brinjal whitefly, three sprays of chlorantraniliprole 18.5 SC, 0.002 %, 1.08 ml/10 litre water at 15 days interval starting from the pest infestation are recommended under South Saurashtra Agro-climatic Zone. The PHI for chlorantraniliprole 18.5 SC, 0.002 % is one day.

**87. Storage potential of bio-agent under refrigerator conditions**

Farmers are advised to store the field collected ladybird beetles (*Coccinella septempunctata* (L.)) in jar containing folded papers under domestic refrigerator conditions (6.0 to 7.5 $^{0}$C) up to 120 days with the survival rate of 84 per cent without hampering their longevity and fecundity. These stored predatory beetles can be released in field crops for biological control of insect pests.

**88. Storability of HaNPV and SNPV under refrigerator condition**

Farmers are advised for biological control of *Helicoverpa armigera* and *Spodoptera litura* through Nuclear Polyhedrosis Virus (NPV) to store the field collected NPV infected larvae under domestic refrigerator conditions (6.0 to 7.5$^{0}$C). These NPV infected larvae can be stored up to 8 months of storage period with 100 per cent virulence, which can be utilized for the biologicalmanagement of respective pest.

**89. Studies on effect of drip v/s flood irrigation on the incidence of important mango pests**

Mango growers of South Saurashtra Agro-climatic Zone are informed that the lower incidence of gall midge, hopper and thrips is found in drip irrigated orchard as compared to flood irrigated orchard.

(*Department of Entomology, CoA, JAU, Junagadh*)

**90. Testing of efficacy of different newer insecticides against shoot fly and stem borer in pearl millet**

Farmers of North Saurashtra Agro-climatic Zone growing *kharif* pearl millet are advised to treat the seeds with imidacloprid 600 FS, 8.75 ml/kg seeds, 4.20 g a.i./kg seeds at the time of sowing followed by spray with imidacloprid 17.8 SL, 0.009 % (5.0 ml/10 liter water, 45.39 g a.i./ha) at 35 days after germination of the crop for effective management of shoot fly and stem borer. The PHI for these insecticides is 42 days.

*(Main Pearl millet Research Station, JAU, Jamnagar)*

**91. Storage study of wheat harvested by combine harvester**

The farmers storing wheat are advised that wheat harvested by combine harvester (up to 6 % mechanically damaged grain) to be stored with the treatment of castor oil (15 ml/1.0 kg grain) and

can be kept in GI bin container to keep safe against lesser grain borer up to eight months of storage as it reduces pest population, grain damage, weight loss as compared to untreated wheat kept in jute bags.

*(Department of Processing & Food Engg., CAET, JAU, Junagadh)*

**92. Testing bio-efficacy of certain insecticides against pod borer complex on urdbean**

Farmers of South Saurashtra Agro-climatic zone are advised to apply two sprays of chlorantraniliprole 18.5 SC, 0.006 % (3 ml/ 10 litre water) or flubendiamide 48 SC, 0.0096 % (2 ml/ 10 litre water), first spray at 50 per cent flowering and second at 15 days interval for the control of pod borer complex in urdbean.

The PHI for chlorantraniliprole 18.5 SC is 20 days, whereas 11 days for flubendiamide 48 SC.

*(Pulses Research Station, JAU, Junagadh)*

**Plant Pathology**

**93. Assessment of *Trichoderma* population in the field under groundnut cultivation**

Farmers of North and South Saurashtra Agro-climatic Zone are advised to apply *Trichoderma* every year for the management of stem/pod rot disease in groundnut.

**94. Standardization of method and time of application of bio-controlagents for management of stem and pod rot of groundnut caused by *Sclerotium rolfsii***

Not included, as recommendation does not confirm the guideline of CIB.

**95. Compatibility of *Trichoderma* with different seed dressing agrochemicals used for the management of diseases and pest in groundnut**

Farmers of South Saurashtra Agro-climatic Zone are advised that the agrochemicals used for seed treatment in groundnut *viz.*, carbendazim 12 % + mancozeb 63 % - 75 WP @ 3.0 g/kg seed or mancozeb 75 WP @ 4.0 g/kg seed or carboxin 37.5 % + thirum 37.5 % - 75 WP @ 3.0 g/kg seed or tebuconazole 2 DS @ 2.0 g/kg seed or imidacloprid 600 FS @ 3.0 ml/kg seed against seed and soil borne diseases/sucking pests do not reduce the soil population of *Trichoderma*, hence they are compatible with *Trichoderma harzianum*.

**96. Effect of spawn rates on sporophore production of Oyster mushroom (*Pleurotus sajor-caju*)**

Mushroom growers are advised to use 3.0 per cent spawn rate in polyethylene bags (18 × 24 inch) of oyster mushroom (*Pleurotus sajor-caju*) to get the optimum sporophore production with higher biological efficiency.

**97. Effect of substrate rates on sporophore production of Oyster mushroom (*Pleurotus sajor-caju*)**

Mushroom growers are advised to use 3 kg wheat straw substrate with 3 per cent spawn rate in polyethylene bags (18 × 24 inch) for the optimum sporophore production with higher biological efficiency of oyster mushroom (*Pleurotus sajor-caju*).

**98. Management of cumin wilt (*Fusarium oxysporum f. sp. cumini*)**

Not included, as recommendation does not confirm the guideline of CIB.

**99. Efficacy of different bio-control agents against cumin wilt caused by *Fusarium oxysporum f. sp. cumini***

Not included, as recommendation does not confirm the guideline of CIB.

**100. Effect of foliar application of insecticides in cumin on *Trichoderma* applied in soil**

Not included, as recommendation does not confirm the guideline of CIB.

**101. Effect of foliar application of herbicides in cumin on *Trichoderma* applied in soil**

Not included, as recommendation does not confirm the guideline of CIB.

(*Department of Plant Pathology, CoA, JAU, Junagadh*)

**Year: 2015-16**

**Plant Pathology**

**102. Management of alternaria leaf blight of groundnut**

The farmers of south Saurashtra growing summer groundnut are advised to apply three sprays of mancozeb 75 WP 0.2 % (27 g/10 litre of water) at 35, 50 and 65 days after sowing for effective and economical management of alternaria leaf blight of groundnut.

**103. Refining integrated disease management in groundnut**

The farmers of south Saurashtra growing *kharif* groundnut are advised to apply seed treatment with tebuconazole 25 WG @1.5 g/kg seed or seed treatment with *Trichoderma viride* 1 % WP10

g/kg seed, furrow application of *T. viride* at the time of sowing and broadcasting at 40 DAS @4 kg enriched in 50 kg FYM and two sprays of tebuconazole 25.9 SC @10 ml/ 10 lit at 15 days interval from initiation of foliar disease for effective and economical management of collor rot, stem rot, tikka and rust disease.

*(Main Oilseeds Research Station, JAU, Junagadh)*

### 104. Efficacy of seed dressing chemicals against wilt and root rot complex of cotton

The farmers of south Saurashtra are advised to treat the cotton seeds with a ready mixture of carboxin 37.5 % + thiram 37.5 % DS @ 3.5 g/kg seeds before sowing for economical and effective control of wilt and root rot complex and to improve seed cotton yield.

*(Cotton Research Station, JAU, Junagadh)*

## Year: 2016-17

## Entomology

### 105. Field efficacy of different insecticides against citrus pests

The farmers of South Saurashtra Agro-climatic Zone growing citrus are advised to apply two sprays of imidacloprid 17.8 SL 0.0072 % (4 ml/10 lit water), first spray at starting of pests' infestation and second15 days after the first spray for effective management of leaf miner and black fly.

(*Department of Entomology, CoA, JAU, Junagadh*)

### 106. Evaluation of botanicals, bio-pesticides and insecticides against gram pod borer

The farmers of South Saurashtra Agro-climatic Zone growing chickpea are advised to apply alternate spray of *HaNPV* 2 x $10^9$ POBs/ml (5 ml/10 lit. water) and chlorantraniliprole 18.5 SC 0.004 % (2 ml/10 lit. water) for effective and economic control of pod borer (*Helicoverpa armigera*) in chickpea crop. First spray to be started at 50% flowering and second at 15 days after first spray.

The PHI for Chlorantraniliprole 18.5 SC is 11 days.

*(Pulses Research Station, JAU, Junagadh)*

### 107. Integrated cotton crop management with emphasis on biotic stress

The farmers of South Saurashtra Agro-climatic Zone growing cotton are advised to apply the following Integrated Pest Management module for control of mealy bug and conservation of lady bird beetle. However, IPM module also reduced the population of aphids, jassid, thrips, whitefly, mite, mirid bug and maintain population of predators i.e. chrysopa and spider as compared to CFP module but they were non-significant.

1. Seed treatment with *Pseudomonas fluorescens* @ 10 g / kg of seed
2. Sowing of castor as a trap and maize as a border crop (10:1)
3. Sowing of black gram as intercrop
4. Fertilizer application of FYM 10 t/ha + 180-37.50-112.50 NPK kg/ha in three split at basal, 30 DAS and 60 DAS
5. Need based application of insecticides in sequence *viz.*, acephate 75 SP (0.113 %) 750g a.i/ha (20 g /10 lit. water), flonicamid 50 WG (0.015 %) 75g a.i/ha (3g /10 lit. water), fipronil 5 SC (0.008 %) 40g a.i/ ha (16 ml /10 lit. water) and buprofezin 25 SC (0.05 %) 250 g a.i/ha (20 ml /10 lit. water).
6. Pre-emergence application of pendimethalin 30 EC (0.20 %) @ 1000 g a. i./ha (67 ml/10 lit. water) and quizalofop ethyl 5 EC (0.01 %) @ 50 g a. i./ha (20 ml/10 lit. water) 30 DAS for weed control.

7. Installation of yellow sticky trap @ 5 traps/ha for monitoring of white fly.
8. Installation of pheromone traps @ 5 traps/ha for monitoring of all bollworms.
9. Need based application of copper oxychloride 50 % WP 0.2 % (40 g/10 lit. water) and carbendazim 50 % WP (0.05 %) (10 g /10 lit. water) for disease control.

*(Cotton Research Station, JAU, Junagadh)*

## Plant Pathology

### 108. Biological control of soil borne diseases of sesame

The farmers of North Saurashta Agro-climatic Zone growing sesame are advised to treat seed with *Trichoderma harzianum*1 % WP 5 g/kg seed or *Pseudomonas fluorescens* 1 % WP 5 g/kg along with soil application of *Trichoderma harzianum* 1 % WP 2.5 kg/ha with 300 kg FYM or castor cake at the time of sowing were found effective and economical for management of soil borne diseases (*Macrophomina* stem rot and *Phytophthora* blight) of sesame.

*(Agricultural Research Station, JAU, Amreli)*

## Year: 2017-18

## Entomology

### 109. Bio-efficacy of *Beauveria bassiana* in combination with different insecticides against sucking pests of Bt cotton (Bollgard-II)

For effective and economical management of aphid, jassid, whitefly and thrips in cotton, the farmers of South Saurashtra Agro-climatic Zone are recommended to apply five spray of any one of the following

1. Dinotefuran 20 SG 0.01 % (5.0 g/10 litre of water).
2. Diafenthiuron 50 WP 0.05 % (10.0 g/10 litre of water).
3. Flonicamid 50 WG 0.015 % (3.0 g/10 litre of water).
4. Spiromesifen 22.9 SC 0.011 % (5.0 ml/10 litre of water).
5. Spinosad 45 SC 0.018 % (4.0 ml/10 litre of water).

For ecofriendly management, apply *Beauveria bassiana* 1.15 WP (Min. 2 x $10^6$ cfu/g) 0.007 % (60 g/10 litre of water), first spray at pest initiation and subsequent four spray should be given at 10 days interval after first spray.

| Year | Crop | Pest | Pesticides with formulation | Dosage | | | | Total Quantity of Chemical suspension required/ha | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i./ ha | Quantity of formulation ml or kg/ha | Con (%) | Dilution in water (10 lit.) | | | |
| 2017-18 | Cotton | Aphid, Jassid, Thrips and White fly | Dinotefuran 20 SG | 50 | 0.250 kg | 0.01 | 5 g | 500 lit | First spray at pest appearance and subsequent four sprays at 10 days interval after first spray | 15 |
| | | | Diafenthiuron 50 WP | 250 | 0.500 kg | 0.05 | 10 g | 500 lit | | 21 |
| | | | Flonicamid 50 WG | 75 | 0.150 kg | 0.015 | 3 g | 500 lit | | 25 |
| | | | Spiromesifen 22.9 SC | 57.25 | 250 ml | 0.011 | 5 ml | 500 lit | | 10 |
| | | | *Beauveria bassiana* 1.15 WP | 2 x $10^6$ cfu/g | 3.0 kg | 0.007 (Min. 2x$10^6$ cfu/g) | 60 g | 500 lit | | -- |

### 110. Evaluation of new pheromone based mating disruption technology for pink bollworm in cotton

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton are recommended to give three application of Sawaj Pheromone based Mating Disruption Paste (Sawaj MDP) technology @ 400g paste per application per hectare (uniformly distributed in 1000 dots between two branches) against pink bollworm, first at initiation of pest infestation (flowering stage) and subsequent two applications at an interval of 30 days for effective, economical and ecofriendly management.

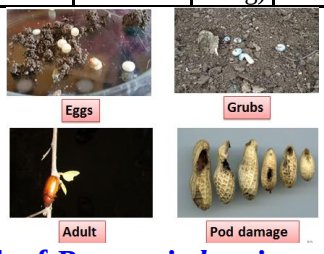
| Year | Crop | Pest | Pesticides with formulation | Dosage | | | | Total Qty. of water required/ ha | Application schedule |
|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i./ ha | Qty. of formulation g/ha | Conc (%) | Dilution in water (10 lit.) | | |
| 2018 | Cotton | Pink boll worm | Sawaj MDP technology | - | 1200 g/ha (400 g paste per application per hectare) | - | - | - | First application at pest infestation (flowering stage), while second and third at 30 days interval after first application. |


## 111. Microbial management of white grubs in groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are recommended to give seed treatment with chlorpyrifos 20 EC @ 25 ml/kg seed and soil application of *Beauveria bassiana* or *Metarizium anisopliae* 1.15 WP @ 5 kg/ha (Min. 2 x $10^6$ cfu/g) along with castor cake (300 kg/ha) before sowing and drenching in plant row after 30 days of germination.

For organic farming, soil application of *Beauveria bassiana* or *Metarizium anisopliae* 1.15 WP @ 5 kg/ha (Min. 2 x $10^6$ cfu/g) along with castor cake (300 kg/ha) before sowing and drenching in plant row after 30 days of germination for effective and economical management of white grub.

| Year | Crop | Pest | Pesticides with formu-lation | Dosage | | | | Total Quantity of Chemical suspension required/ ha | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i./ ha | Quantity of form-ulation ml, kg/ha | Con. (%) | Dilution in water (10 lit.) | | | |
| 2017-18 | Groundnut | White grub | Chlorpyrifos 20 % EC (ST) + *Beauveria bassiana* 1.15 WP (SA and drenching) **OR** Chlorpyrifos 20 % EC (ST) *Metarhizium anisopliae* 1.15 WP (SA and drenching) | 600 + 57.50 + 57.50 | 3.0 lit + 5.0 kg + 5.0 kg | 0.006 (Min. 2 x $10^6$ cfu/ g) | NA 50 g | -- 1000 lit (Drenching) | ST and soil application before sowing and drenching after 30 days of germination | - |
| | | | | 600 + 57.50 + 57.50 | 3.0 lit + 5.0 kg + 5.0 kg | 0.006 (Min. 2 x $10^6$ cfu/ g) | NA 50 g | | | |
| | | | *Beauveria bassiana* 1.15 WP (SA and drenching) **OR** *Metarhizium anisopliae* 1.15 WP (SA and drenching) | 57.50 + 57.50 | 5.0 kg + 5.0 kg | 0.006 (Min. 2 x $10^6$ cfu/ g) | 50 g | 1000 lit (Drenching) | Soil application before sowing and drenching after 30 days of germination | - |
| | | | | 57.50 + 57.50 | 5.0 kg + 5.0 kg | 0.006 (Min. 2 x $10^6$ cfu/ g) | 50 g | | | |




## 112. Effect of insecticides on growth of *Beauveria bassiana*

For mixing Sawaj Beauveria with different insecticides, farmers are advised to refer the following table (Yes/No).

| Sr. No. | Insecticide | At lower dose | | | At recommended dose | | | At higher dose | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Conc. (%) | Dose (ml/g) / 10 lit. | Farmer are advise to mix the insecticides with *B. bassiana* (Yes/No) | Conc. (%) | Dose (ml/g) / 10 lit. | Farmer are advise to mix insecticides with *B. bassiana* (Yes/No) | Conc. (%) | Dose (ml/g)/10 lit. | Farmer are advise to mix the insecticides with *B. bassiana* (Yes/No) |
| 1 | Methomyl 40 SP | 0.040 | 10.00 | Yes | 0.080 | 20.00 | Yes | 0.12 | 30.00 | Yes |
| 2 | Lambda cyhalothrin 5 EC | 0.00125 | 2.50 | Yes | 0.0025 | 5.00 | Yes | 0.00375 | 7.50 | Yes |
| 3 | Thiodicarb 75 WP | 0.075 | 10.00 | Yes | 0.15 | 20.00 | Yes | 0.225 | 30.00 | Yes |
| 4 | Chlorpyriphos 20 EC | 0.020 | 10.00 | Yes | 0.040 | 20.00 | Yes | 0.060 | 30 | No |
| 5 | Profenophos 50 EC | 0.037 | 7.50 | No | 0.075 | 15.00 | No | 0.112 | 22.50 | No |
| 6 | Quinalphos 25 EC | 0.025 | 10.00 | Yes | 0.050 | 20.00 | No | 0.075 | 30.00 | No |
| 7 | Spiromesifen 22.9 SC | 0.011 | 5.00 | Yes | 0.023 | 10.00 | Yes | 0.033 | 15.00 | Yes |
| 8 | Bifenthrin 10 EC | 0.0025 | 2.50 | Yes | 0.005 | 5.00 | Yes | 0.0075 | 7.50 | Yes |
| 9 | Diflubenzuron 25 WP | 0.012 | 5.00 | Yes | 0.025 | 10.00 | Yes | 0.037 | 15.00 | No |
| 10 | Novaluron 10 EC | 0.005 | 5.00 | Yes | 0.010 | 10.00 | Yes | 0.015 | 15.00 | Yes |
| 11 | Fipronil 5 SC | 0.005 | 10.00 | Yes | 0.010 | 20.00 | Yes | 0.015 | 30.00 | Yes |
| 12 | Indoxacarb 14.5 EC | 0.0036 | 2.50 | Yes | 0.007 | 5.00 | Yes | 0.0108 | 7.50 | Yes |
| 13 | Chlorantraniliprole 18.5 SC | 0.003 | 1.50 | Yes | 0.006 | 3.00 | Yes | 0.009 | 4.50 | Yes |
| 14 | Spinosad 45 SC | 0.007 | 1.50 | Yes | 0.014 | 3.00 | Yes | 0.021 | 4.50 | Yes |
| 15 | Imidacloprid 17.8 SL | 0.0026 | 1.50 | Yes | 0.005 | 3.00 | Yes | 0.008 | 4.50 | Yes |
| 16 | Acetamiprid 20 SP | 0.003 | 1.50 | Yes | 0.006 | 3.00 | Yes | 0.009 | 4.50 | No |
| 17 | Thiamethoxam 25 WG | 0.005 | 2.00 | Yes | 0.010 | 4.00 | Yes | 0.015 | 6.00 | Yes |
| 18 | Chlorfenpyr 10 EC | 0.0075 | 7.50 | Yes | 0.015 | 15.00 | Yes | 0.0225 | 22.50 | No |
| 19 | Diafenthiuron 50 WP | 0.025 | 5.00 | Yes | 0.050 | 10.00 | Yes | 0.075 | 15.00 | Yes |
| 20 | Flubeniamide 480 SC | 0.072 | 1.50 | Yes | 0.144 | 3.00 | Yes | 0.216 | 4.50 | Yes |
| 21 | Cartap hydrochloride 50 SP | 0.025 | 5.00 | Yes | 0.050 | 10.00 | Yes | 0.075 | 15.00 | No |
| 22 | Emamectin benzoate 5 SG | 0.00125 | 2.50 | Yes | 0.0025 | 5.00 | Yes | 0.00375 | 7.50 | Yes |
| 23 | Carbosulfan 25 EC | 0.025 | 10.00 | Yes | 0.050 | 20.00 | Yes | 0.075 | 30.00 | Yes |
| 24 | Buprofezin 25 EC | 0.025 | 10.00 | Yes | 0.050 | 20.00 | Yes | 0.075 | 30.00 | No |
| 25 | Polytrin 44 EC | 0.022 | 5.00 | Yes | 0.044 | 10.00 | Yes | 0.066 | 15.00 | Yes |
| 26 | Dinotefuran 20 SG | 0.005 | 2.50 | Yes | 0.010 | 5.00 | Yes | 0.0152 | 7.50 | Yes |
| 27 | Flonicamide 50 SG | 0.0075 | 1.50 | Yes | 0.015 | 3.00 | Yes | 0.0225 | 4.50 | No |
| 28 | Acephate 75 SP | 0.037 | 5.00 | Yes | 0.075 | 10.00 | Yes | 0.112 | 15.00 | No |
| 29 | Dimethoate 30 EC | 0.015 | 5.00 | Yes | 0.030 | 10.00 | Yes | 0.045 | 15.00 | Yes |
| 30 | Azadirachtin 0.15 EC | 0.0003 | 25.00 | Yes | 0.0007 | 50.00 | Yes | 0.0011 | 75.00 | Yes |

## 113. Effect of fungicides on growth of *Beauveria bassiana*

For mixing Sawaj Beauveria with different fungicides, farmers are advised to refer the following table (Yes/No).

| Sr. No. | Insecticide | At lower dose | | | At recommended dose | | | At higher dose | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Conc. (%) | Dose (ml/g)/ 10 lit. | Farmer are advise to mix the | Conc. (%) | Dose (ml/g)/ 10 lit. | Farmer are advise to mix | Conc. (%) | Dose (ml/g)/ 10 lit. | Farmer are advise to mix the |

| | | | | fungicides with *B. bassiana* (Yes/No) | | | fungicides with *B. bassiana* (Yes/No) | | | fungicides with *B. bassiana* (Yes/No) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1 | Sulphur 80 WP | 0.100 | 12.50 | Yes | 0.200 | 25.00 | Yes | 0.300 | 37.50 | Yes |
| 2 | Copper oxychloride 50 WP | 0.100 | 20.00 | Yes | 0.200 | 40.00 | Yes | 0.300 | 60.00 | Yes |
| 3 | Dinocap 48 EC | 0.024 | 5.00 | Yes | 0.048 | 10.00 | Yes | 0.072 | 15.00 | Yes |
| 4 | Metalaxyl 4 + Mancozeb 64 WP | 0.102 | 15.00 | No | 0.204 | 30.00 | No | 0.306 | 45.00 | No |
| 5 | Zineb 75 WP | 0.100 | 13.30 | No | 0.200 | 26.60 | No | 0.300 | 40.00 | No |
| 6 | Fosetyl-Al 80 WP | 0.080 | 10.00 | Yes | 0.160 | 20.00 | Yes | 0.240 | 30.00 | No |
| 7 | Chlorothalonil 75 WP | 0.100 | 13.40 | Yes | 0.200 | 26.70 | Yes | 0.300 | 40.10 | Yes |
| 8 | Mancozeb 75 WP | 0.093 | 13.40 | No | 0.187 | 26.70 | No | 0.280 | 40.10 | No |
| 9 | Benomyl 50 WP | 0.025 | 5.00 | Yes | 0.050 | 10.00 | No | 0.075 | 15.00 | No |
| 10 | Hexaconazole 5 EC | 0.0025 | 5.00 | No | 0.005 | 10.00 | No | 0.0075 | 15.00 | No |
| 11 | Carbendazim 50 WP | 0.025 | 5.00 | No | 0.050 | 10.00 | No | 0.075 | 15.00 | No |
| 12 | Propiconazole 25 EC | 0.013 | 5.00 | No | 0.025 | 10.00 | No | 0.038 | 15.00 | No |
| 13 | Thiophanate methyl 70 WP | 0.035 | 5.00 | No | 0.070 | 10.00 | No | 0.105 | 15.00 | No |
| 14 | Thiram 75 SP | 0.100 | 13.40 | No | 0.200 | 26.70 | No | 0.300 | 40.10 | No |
| 15 | Carboxin 37.5 + Thiram 37.5 DS | 0.038 | 5.00 | No | 0.075 | 10.00 | No | 0.113 | 15.00 | No |
| 16 | Metalaxyl 8 + Mancozeb 64 WP | 0.0748 | 10.40 | No | 0.1497 | 20.80 | No | 0.2246 | 31.20 | No |
| 17 | Tabucanazole 25 EC | 0.013 | 5.00 | No | 0.025 | 10.00 | No | 0.038 | 15.00 | No |
| 18 | Propineb 70 WP | 0.070 | 10.00 | No | 0.140 | 20.00 | No | 0.210 | 30.00 | No |
| 19 | Tridimefon 25 WP | 0.013 | 5.00 | No | 0.025 | 10.00 | No | 0.038 | 15.00 | No |
| 20 | Mancozeb 63 + Carbendazim 12 WP | 0.075 | 10.00 | No | 0.15 | 20.00 | No | 0.225 | 30.00 | No |
| 21 | Azoxystrobin 23SC | 0.012 | 5.00 | No | 0.023 | 10.00 | No | 0.035 | 15.00 | No |

## 114. Bio-efficacy of different bio-pesticides and insecticides against pink bollworm in Bt cotton (Bollgard-II)

The farmers growing cotton are recommended to apply five spray of *Beauveria bassiana* 1.15 WP (Min. 2 x $10^6$ cfu/g) 0.009 % (80 g/10 litre of water), first spray at 5 % appearance of rosette flower and subsequent four spray at 10 days interval after first spray for effective and economical management of pink bollworm.

| Year | Crop | Pest | Pesticides with formu-lation | Dosage | | | | Total Quantity of Chemical suspension required/ ha | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i./ ha | Quantity of formu-lation ml, kg/ha | Con. (%) | Dilution in water (10 lit.) | | | |
| 2017-18 | Cotton | Pink boll worm | *Beauveria bassiana* 1.15 WP | 46.00 | 4.0 kg | 0.009 (Min. 2 x $10^6$ cfu/ g) | 80 g | 500 lit | First spray at 5 % rosette appearance of flower and subsequent four spray at 10 days interval after first spray | - |

*(Department of Entomology, CoA, JAU, Junagadh)*

## 115. Bio-efficacy of selected insecticides against pink bollworm in Bt cotton

The farmers of South Saurashtra Agro-climatic Zone growing *Bt* cotton are recommended to apply any one of the following insecticides, first spray at 75 days after sowing and second at 15 days of first spray for effective and economical management of pink bollworm.

1. Lamda cyhalothrin 2.5 EC, 0.0025% (10 ml/10 lit. of water) or
2. Deltamethrin 2.8 EC, 0.0028% (10 ml/10 lit. of water).

| Year | Crop | Pest | Pesticides with formulation | Dosage | | | | | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | g. a.i./ ha | Quantity of formulation ml/ha | Con. (%) | Dilution in water (10 lit.) | Total Quant. of water lit /ha | | |
| 2017 | Cotton | PBW | Lambda cyhalothrin 2.5 EC | 12.5 | 500 | 0.0025 | 10 ml | 500 | First spray at 75 days after sowing and second after 15 days of the first spray for effective control of pink bollworm. | 21 |
| | | | Deltamethrin 2.8 EC | 14 | 500 | 0.0028 | 10 ml | 500 | | - |

*(Cotton Research Station, JAU, Junagadh)*

## 116. Management of ear head worm, *Helicoverpa armigera* (Hub.) infesting *bajra* crop with bio-pesticides

Farmers of North Saurashtra Agro-climatic Zone growing *kharif* pearl millet are recommended to spray *Ha*NPV @ 450 LE/ha (10 ml/10 lit. water) **or** *Bacillus thuringiensis*5 WP (2 x $10^8$ cfu/g) @ 1.0 kg/ha (20 g/10 lit. water) or *Beauveria bassiana* 1.15 WP (2 x $10^6$ cfu/g) @ 2.0 kg/ha (40 g/10 lit. water) on appearance of *Helicoverpa armigera* at ear head stage for effective and economical management of pest.

| Year | Crop | Pest | Pesticides with Formulation | Dosage | | | | Total qty. of water required /ha | Application schedule | Waiting period / PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i. / ha | Qty. of formu g, ml, kg or l/ha | Conc. (%) | Dilution in water (10 lit.) | | | |
| 2018 | Pearl millet (bajra) | *Helicoverpa armigera* | *Ha*NPV 450 LE/ha | -- | 500 ml | 450 LE/ ha | 10 ml | 500 litre | Single spray at the appearance of *H. armigera* larva on ear head | -- |
| | | | *Bacillus thuringiensis* 5 WP | 50 | 1.0 kg | 0.01 ( 2 x $10^8$ cfu/g) | 20g | | | |
| | | | *Beauveria bassiana* 1.15 WP | 23 | 2.0 kg | 0.0046 ( 2 x$10^6$ cfu/g) | 40g | | | |

*(Main Pearl millet Research Station, JAU, Jamnagar)*

## 117. Effect of intercrop on the incidence of major insect pests of sesame

Farmers of North Saurashtra Agro-climatic Zone growing sesame in *kharif* are recommended to grow black gram as an intercrop (2 line sesame + 1 line black gram) at the spacing 60 x 10 cm to reduce pest infestation, increase predator activity and to get higher net realization.


*(Agricultural Research Station, JAU, Amreli)*

## 118. Testing bio-efficacy of insecticides against leaf webber (*Crocidolomia binotalis* Zell) of mustard

The farmers of South Saurashtra Agro-climatic Zone growing mustard in *rabi* season are recommended to apply two spray of chlorpyriphos 20 EC 0.05 % @ 250 g a.i./ha (25 ml/10 liter water) or quinalphos 25 EC 0.05 % @ 250 g a.i./ha (20 ml/10 litre water) at 7 days interval starting from the initiation of pest infestation for effective and economical management of mustard leaf webber.

| Year | Crop | Pest | Pesticides with formu-lation | Dosage | | | | Total Quantity of Chemical suspension required/ ha | Appli-cation schedule | Waiting period/ PHI (days) | Remark (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i g/ha | Qty. of formu-lation ml or kg/ha | Con. (%) | Dilution in water (10 lit.) | | | | |
| 2017 | Mustard | Leaf webber | Chlorpyriphos 20 EC | 250 | 1.25 lit | 0.05 | 25 | 500 lit | First spray at initiation of leaf webber damage and second at 7 days after first spray | -- | Regi Ster ed und er CIB App ro ved list |
| | | | Quinalphos 25 EC | 250 | 1.0 lit | 0.05 | 20 | 500 lit | | | |

## 119. Evaluation of different storage bags against the groundnut bruchid beetle (*Caryedon serratus*) in storage

The farmers of South Saurashtra Agro-climatic Zone are recommended to store fumigated groundnut pods in high density polythene (HDPE) bags or polythene layered gunny bags for effective and economical management of bruchid pest.

*(Main Oilseeds Research Station, JAU, Junagadh)*

# Plant Pathology

## 120. Management of fungal foliar diseases of cotton

The farmers growing cotton are recommended to apply three spray of pyraclostrobin 5WG + metiram 55WG 0.18 % @ 30 g/10liter of water, first spray at initiation of diseases and subsequent two spray at 15 days interval after first spray for effective and economical management of fungal foliar diseases.

The farmers those interested in organic cotton production are recommended to apply three spray of *Pseudomonas fluorescens* (2 x $10^8$ cfu/g) 50 ml/10 liter of water, first spray at initiation of diseases and subsequent two spray at 15 days interval after first spray for effective and economical management of fungal foliar and bacterial blight diseases.

| Year | Crop | Disease | Fungicide with formulation | Dosage | | | | Total Quantity of Chemical suspension required / ha | Appli-cation schedule | Waiting Period/PHI (days) | Remark |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i./ha | Quantity of formu-lation g, ml, kg or l/ha | Concen tration (%) | Dilution in water (10 lit) | | | | |
| 2018 | Cotton | Foliar diseases | Mancozeb 63WP + Carbendazim 12 WP | 750 | 1.0 kg | 0.15 | 20 g | 500 | First spray at initiation of | BDL | - |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Pyreclostobin 5 WG + Metiram 55WG | 900 | 1.5 kg | 0.18 | 30 g | 500 | diseases & next sprays at interval of 15days | 45 | Registered in CIB-RC |
| | | | *Pseudomonas fluorescens* | 25 $2x10^8$ cfu/ml | 2.5 l | 0.005 $2x10^8$ cfu/ml | 50 ml | 500 | | -- | -- |

*(Cotton Research Station, JAU, Junagadh)*

**Year: 2018-19**

## Agricultural Entomology

### 121. Effectiveness of *Beauveria bassiana* in combination with different insecticides against onion thrips

The farmers of South Saurashtra Agro-climatic Zone (VII) are advised to apply three sprays of dimethoate 30 EC 0.03 % (10 ml/10 l of water) OR *Beauveria bassiana* 1.15 WP 0.0035 % (Min. 2 x $10^6$ cfu/g) + dimethoate 30 EC 0.015 % (30 g + 5.0 ml/10 l of water) OR *Beauveria bassiana*1.15 WP 0.007 % (60 g/10 l of water) first at initiation of pest infestation and subsequent two sprays at ten days interval for effective and economical management of thrips, *Thripstabaci*in onion.

| Year | Crop | Pest | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | |
| 2018-19 | Onion | Thrips | Dimethoate 30 EC | 150 | 0.500 l | 0.03 | 10 ml | 500 l | First spray at pest initiation and subsequent two sprays at ten days interval after first spray | - |
| | | | *Beauveria bassiana* 1.15 WP + dimethoate 30 EC | 17 + 75 | 1.5 kg + 0.250 l | 0.0035 (Min 2 x $10^6$ cfu/ g) + 0.015 | 30 g + 5 ml | 500 l | | - |
| | | | *Beauveria bassiana* 1.15 WP | 35 | 3.0 kg | 0.007 (Min 2 x $10^6$ cfu/ g) | 60 g | 500 l | | - |



### 122. Effect of different schedule base insecticidal spray against garlic thrips

The farmers of South Saurashtra Agro-climatic Zone (VII) are advised to apply schedule spraying of *Beauveria bassiana* 1.15 WP (Min. 2 x $10^6$ cfu/g), first spray at initiation of pest infestation 0.0035 % (30 g/10 l of water). Subsequent second 0.007 % (60 g/10 l of water) and third 0.009 % (80 g/10 l of water) spray at ten days interval for effective and economical management of thrips, *Thripstabaci*in garlic.

| Year | Crop | Pest | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | |
| 2018-19 | Garlic | Thrips | *Beauveria bassiana* 1.15 WP | 17 | 1.50 kg | 0.0035 % (Min. 2 x $10^6$ cfu/g) | 30 g | 500 l | First spray at initiation of pest infestation and subsequent two sprays at ten days interval after first spray | - |
| | | | *Beauveria bassiana* 1.15 WP | 35 | 3.00 kg | 0.007 % (Min. 2 x $10^6$ cfu/g) | 60 g | | | |
| | | | *Beauveri bassiana* 1.15 WP | 46 | 4.00 kg | 0.009 % (Min. 2 x $10^6$ cfu/g) | 80 g | | | - |


## 123. Management of sucking pests in cumin

The farmers of South Saurashtra Agro-climatic Zone (VII) are advised to apply two sprays of *Beauveria bassiana* 1.15 WP (Min. $2x10^6$ cfu/g) 0.007 % (60 g/10 l of water), first at initiation of pest infestation and second at ten days interval for effective, economical and eco-friendly management of thrips, *Thripstabaci*in cumin.

| Year | Crop | Pest | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | |
| 2018-19 | Cumin | Thrips | *Beauveria bassiana* 1.15 WP | 35 | 3.0 kg | 0.007 (Min. $2x10^6$ cfu/g) | 60 g | 500 l | First spray at initiation of pest infestation and second spray at 10 days interval after first spray | - |

## 124. Evaluation of new pheromone based mating disruption technology for fruit fly in mango

The farmers of South Saurashtra Agro-climatic Zone (VII) growing mango are advised to give Sawaj MDP technology 400 g paste/ha uniformly distributed in 1000 dots on main and subsidiary branches of each tree against fruit fly, first application in the month of March, when fruit fly catches in the trap and successive two applications at 30 days interval for effective, economical and eco-friendly management.

| Year | Crop | Pest | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | |
| 2018-19 | Mango | Fruit fly | Sawaj MDP technology | - | 400 g Paste per application per ha | - | - | - | First application in the month of march, while second and third at 30 days interval after first application. | - |

## 125. Effectiveness of different bio-pesticides against mealybug in custard apple

The farmers of South Saurashtra Agro-climatic Zone (VII) are advised to apply two sprays of *Lecanicillium lecanii*1.15 WP (Min. $2x10^6$ cfu/g) 0.007 % (60 g/10 l of water) OR *Beauveria bassiana* 1.15 WP (Min. $2x10^6$ cfu/g) 0.007 % (60 g/10 l of water) along with sticker (3 ml/10 l of water), first at initiation of pest infestation and second at 20 days interval for effective, economical and eco-friendly management of mealybugin custard apple.

| Year | Crop | Pest | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | |
| 2018-19 | Custard apple | Mealy bug | *Lecanicillium lecanii*1.15 WP | 83 | 7.2 kg | 0.007 (Min. 2 x $10^6$ cfu/g) | 60 g | 1200 l | First spray at initiation of pest infestation and second spray at 20 days interval after first spray | - |
| | | | *Beauveria bassiana* 1.15 WP | 83 | 7.2 kg | 0.007 (Min. 2 x $10^6$ cfu/g) | 60 g | | | - |

*(Department of Entomology, JAU, Junagadh)*

## 126. Testing the bio-efficacy of newer insecticides against castor defoliators

The farmers of South Saurashtra Agro-climatic Zone (VII) growing castor are advised to apply two sprays of chlorantraniliprole 18.5 SC 0.006 % (3.0 ml/10 l of water) OR indoxacarb 14.5 SC 0.0073 % (5.0 ml/10 l of water) OR spinosad 45 SC 0.009 % (2.0 ml/10 l of water) OR emamectin benzoate 5 % WG 0.002 % (4.0 g/10 l of water) at 15 days interval starting from pest infestation for effective and economical management of defoliators (*Spodoptera* and Semilooper).

**Note: Castor being a nonedible crop, CIB recommendation for insecticides is not considered.**

| Year | Crop | Pest | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | | |
| 2018 | Castor | Defoliators | Chlorantraniliprole 18.5 SC | 27.8 | 0.150 l | 0.006 | 03 ml | 500 l | First spray at initiation of defoliators and second at 15 days after first spray | 112 | Result of residual analysis was found below detection limit. |
| | | | Indoxacarb 14.5 SC | 36.3 | 0.250 l | 0.0073 | 05 ml | 500 l | | | |
| | | | Spinosad 45 SC | 45 | 0.100 l | 0.009 | 02 ml | 500 l | | | |
| | | | Emamectin benzoate 5 WG | 10 | 0.200 l | 0.002 | 04 g | 500 l | | | |

## 127. Management of lepidopteron pests using botanicals in groundnut

The farmers of South Saurashtra Agro-climatic Zone (VII) growing groundnut in *kharif* season are advised to apply two sprays of pongamia oil (30 ml/10 l of water) OR ponneem (30 ml/10 l of water) at 15 days interval starting from pest infestation for effective and economical management of defoliators (*Helicoverpa* and *Spodoptera*). To prepare ponneem, mix 450 ml of neem oil + 450 ml of pongemia oil (karanj oil) + 100 ml of soap solution (wetting agent).

*(Main Oilseeds Research Station, JAU, Junagadh)*

## 128. Evaluation of egg parasitoid *Trichogramma bactrae* through inundative release for the management of cotton pink bollworm

The farmer of the South Saurashtra Agro-climatic Zone (VII) growing cotton are advised to apply *Trichogramma bactrae* 1.5 lakh parasitoid eggs per hector, two release at flowering stage (40-50 days) at weekly interval and three release at boll formation stage (60-75 days) at weekly interval for biological management of pink bollworm.

## 129. Evaluation of pheromone traps and lures against cotton pink bollworm through mass trapping

The farmers of the South Saurashtra Agro-climatic Zone (VII) growing cotton are advised to install the phero-sensor TM-BP-sleeve trap OR phero-sensor TM-SP-sleeve trap, 20 traps/ha after 30 days of germination. Change the sex pheromone trap lure thrice in a season at 45 days interval for effective management of pink bollworm.

| Year | Crop | Pest | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | |
| 2018 | Cotton | Pink bollworm | Phero-sensor TM-BP-sleeve trap | - | 20 traps/ha | - | - | - | Installation of traps at 30-35 days after germination and each trap lure changed after 45 days interval. | - |
| | | | Phero-sensor TM-SP-sleeve trap | - | 20 traps/ha | - | - | - | | |

## 130. Bio-efficacy of insecticides against major sucking pests in Bt cotton

The farmers of South Saurashtra Agro-climatic Zone (VII) growing *Bt* cotton are advised to apply three sprays of flonicamid 50 WG 0.02 % (4.0 g/10 l of water) OR diafenthiuron 50 WP 0.06 % (12.0 g/10 l of water) OR dinotefuran 20 SG 0.008 % (4.0 g/10 l of water), first at pest initiation and subsequent two sprays at 15 days interval for effective and economical management of aphid, jassid, whitefly and thrips.

| Year | Crop | Pest | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | |
| 2017-18 | Cotton | Aphid, Jassid, Thrips and Whitefly | Flonicamid 50 WG | 100 | 0.200 kg | 0.02 | 4 g | 500 l | First spray at pest appearance and subsequent two sprays at 15 days interval after first spray | 25 |
| | | | Diafenthiuron 50 WP | 300 | 0.600 kg | 0.06 | 12 g | | | 21 |
| | | | Dinotefuran 20 SG | 40 | 0.200 kg | 0.008 | 4 g | | | 15 |

***(****Cotton Research Station, JAU, Junagadh)*

## 131. Management of major insect pests infesting pearl millet under organic cultivation

The farmers of North Saurashtra Agro-climatic Zone (VI) growing organic pearl millet are advised to apply two sprays of *Beauveria bassiana* 1.15 WP (2 x $10^6$ cfu/g) 50 g/10 l of water at 30 and 60 days after sowing for the effective and economical management of shoot fly and stem borer, whereas for ear head worm, *Helicoverpa armigera* one spray of *Ha*NPV 250 LE/ha at anthesis stage to be carried out.

| Year | Crop | Pest | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | |
| 2019 | Pearl millet (bajra) | Shoot fly and stem borer | *Beauveria bassiana*1.15 WP ( 2 x $10^6$ cfu/g) | 28.75 | 2.500 kg | 5g/l | 50 g | 500 l | Two spray at 30 and 60 DAS | - |
| | | *Helicoverpa armigera* | *Ha*NPV @ 250 LE/ha | -- | 0.250 l | 250 LE/ha | 5 ml | 500 l | Single spray at anthesis stage | - |

***(****Main Pearl millet Research Station, JAU, Jamnagar)*

## Plant Pathology

## 132. Efficacy of bio-agents against *Aspergillus flavus* and aflatoxin production in groundnut

Farmers of South Saurashtra Agro-climatic Zone (VII) growing groundnut are advised furrow

application of *Trichoderma harzianum* 1 % WP (2 x $10^6$ cfu/g) 0.625 kg + *Pseudomonas fluorescens* 1% WP (1x$10^8$ cfu/g) 0.625 kg in 125 kg of castor cake/ha at the time of sowing and soil application (broadcasting at plant base) of same quantity at one month after sowing found effective for management of aflarot (*Aspergillus flavus)*.

| Year | Crop | Disease | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | | |
| 2019 | Groundnut | Aflarot disease | *Trichoderma harzianum* | - | 0.625 kg | 2 x $10^6$ cfu/ g | -- | 125 kg | At sowing and 30 DAS | Nil | These bio pesticides are not registered with CIB & RC for use in groundnut crop for management of this disease. |
| | | | *Pseudomons fluorescens* | - | 0.625 kg | 1 x $10^8$ cfu/ g | -- | 125 kg | At sowing and 30 DAS | NIl | |


*(Department of Plant Pathology, JAU, Junagadh)*

## 133. Management of groundnut diseases through organic amendments, bio products and biocontrol agents

Farmers interested in organic cultivation of groundnut are advised to apply *Trichoderma harzianum* 1 % WP (2 x $10^6$ cfu/g) as a seed treatment 10 g/kg seed along with its furrow application 4.0 kg/ha enriched in 300 kg FYM at the time of sowing for management of collar rot and stem rot diseases. Whereas, for leaf spot spray neem seed kernel extract 5 % (500 g/10 l of water) at 30, 45 and 60 DASOR to spray cow urine 10 % (1000 ml/10 l of water) at 20, 40, 60 and 80 days after sowing.

| Year | Crop | Disease | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | |
| 2019 | Groundnut | Collar rot, Stem tot & leaf spot disease | *Trichoderma harzianum* | -- | 10 g/ kg seed | 2 x $10^6$ cfu/g | -- | -- | As a seed treatment | Nil |
| | | | *Trichoderma harzianum* | -- | 4.0 kg | 2 x $10^6$ cfu/g | -- | 300 kg FYM | Furrow application at the time of sowing | Nil |
| | | | Neem seed kernel extract | - | 25 l | 5 % | 0.500 l | 500 l | Three sprays at 30, 45 and 60 DAS | Nil |
| | | | Cow urine | -- | 50 l | 10 % | 1.000 l | 500 l | Four sprays at 20, 40, 60 and 80 DAS | Nil |



## 134. Efficacy of *Trichoderma harzianum* on growth and stem rot disease management in groundnut

The farmers of South Saurashtra Agro-climatic Zone (VII) growing *kharif* groundnut are advised to apply *Trichoderma harzianum* 1 % WP (2x $10^6$ cfu/g) as furrow application 4 kg/ha in 250 kg of castor cake at the time of sowing and soil drenching 4 kg/ha in soil at 30 days after sowing for effective and economical management of stem rot disease and obtaining higher pod yield. The application of *Trichoderma harzianum* also resulted in growth promoting ability by increasing leaf dry weight, leaf area, plant height, number of branches, pods per plant and root length in groundnut.

| Year | Crop | Disease | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | |
| 2019 | Groundnut | Stem tot & Growth promoting Ability | *Trichoderma harzianum* | --- | 4.00 kg | 2 x $10^6$ cfu/g | -- | 250 kg castor cake | Furrow application at the time of sowing | NIL |
| | | | *Trichoderma harzianum* | -- | 4.0 kg | 2 x $10^6$ cfu/g | -- | 1000 l | As a soil drenching at 30 DAS | NIL |

## 135. Integrated management practices to minimize *Aspergillus flavus* infection and other diseases in groundnut

The farmers of South Saurashtra Agro climatic Zone (VII) growing *kharif* groundnut are advised seed treatment with mancozeb (75 % WP) 3g/kg of seed + furrow application of *Trichoderma harzianum* 1 % WP (2 x $10^6$cfu/g) 2.5 kg in 250 kg of castor cake/ha at the time of sowing for effective and economical management of aflarot and obtaining higher pod yield. It is also effective for management of stem rot and collar rot.

Farmers interested in nonchemical cultivation of groundnut are advised seed treatment with *Trichoderma harzianum* 1 % WP(2x $10^6$ cfu/g) 10g/kg of seed + furrow application of *Trichoderma harzianum* 2.5 kg enriched before one week in 250 kg of FYM/ha at the time of sowing for effective and economical management of aflarot and obtaining higher pod yield. It is also effective for management of stem rot and collar rot.

| Year | Crop | Disease | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | | |
| 2019 | Groundnut | Aflarot disease and collar and stem rots | Mancozeb 75 % WP | 0.36 | 3 g/kg seed | 0.2 % | --- | -- | As a seed treatment | --- | Registered product with CIB |
| | | | *Trichoderma harzianum* | --- | 2.5 kg | 2 x $10^6$ cfu/g | -- | 250 kg castor cake | Furrow application at the time of sowing | Nil | - |
| **OR** | | | | | | | | | | | |
| 2019 | Groundnut | Aflarot disease and collar and stem rots | *Trichoderma harzianum* | --- | 10 g /kg seed | 2 x $10^6$ cfu/g | -- | -- | As a seed treatment | Nil | - |
| | | | *Trichoderma harzianum* | -- | 2.5 kg | | -- | 250 kg FYM | Furrow application at the time of sowing | Nil | |

## 136. Biological control of root rot of castor

The farmers of South Saurashtra Agro climatic Zone (VII) growing castor during *kharif* season are advised to apply *Trichoderma harzianum* 1 % WP (2 x $10^6$ cfu/g) as seed treatment 4g/kg seed along with its soil application 2.5 kg enriched in 100 kg FYM/ha for a week and applied at the time of sowing for effective and economical management of root rot disease.

| Year | Crop | Disease | Pesticides/ Biopesticides formulation | Dosage | | | | Qty. of water/ soil amendments required ( kg or l/ha) | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ha) | Qty. of formulation g or ml/kg seed, kg or l/ha | Con. (%) | Qty. of formulation in 10 l of water (g or ml) | | | |
| 2019 | Castor | Root rot of castor | *Trichoderma harzianum* | --- | 4 g/kg seed | 2 x $10^6$ cfu/g | --- | -- | As a seed treatment | --- |
| | | | *Trichoderma harzianum* | --- | 2.5 kg | 2 x $10^6$ cfu/g | -- | 100 kg FYM | Furrow application at the time of sowing | --- |

*(Main Oilseeds Research Station, JAU, Junagadh)*

### 137. Standardization of numbers of pheromone traps for fall army worm in maize

For effective management of fall army worm in maize, the farmers are advised to install 50 sex pheromone traps per hectare. The lure to be changed after 40 days.

### 138. Evaluation of bio-agents and chemical insecticides against fall army worm in maize

For effective management of fall army worm in maize, the farmers are advised to apply three sprays of *Beauveria bassiana* 1.15 WP (2 x $10^6$ cfu/g) 0.009 % (80 g/10 l of water) OR *Nomuria rileyi* 1.15 WP (2 x $10^6$ cfu/g) 0.007 % (60 g/10 l of water) + *Sf*NPV 450 LE (10 ml/10 l of water) OR two sprays of emamectin benzoate 5 SG 0.0025 % (5g/10 l of water) OR thiodicarb 75 WP 0.075 % (10 g/10 l of water) OR spinetoram 11.7 EC 0.012 % (10ml/10 l of water), first at initiation of pest infestation and second at 15-day interval.

*(Dept. of Entomology, COA, JAU, Junagadh)*

## Year: 2019-20

## Entomology

### 139. Evaluation of new pheromone based mating disruption technology for shoot and fruit borer in brinjal

The farmers of South Saurashtra Agro-climatic Zone growing brinjal are advised to give three applications of Gir Sawaj Mating Disruption Paste @ 400 g per application per hectare (uniformly distributed in 1000 dots between two branches), first at initiation of pest infestation and successive two application at an interval of 30 days for effective, economical and ecofriendly management of brinjal shoot and fruit borer.

| Year | Crop | Pest | Pesticides with Formu-lation | Dosage | | | | Total Qty. of Chemical suspension required/ ha | Application schedule |
|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i ./ha | Qty. of formulation /ha | Conc. (%) | Dilution in water (10 lit.) | | |
| 2020 | Brinjal | Shoot and fruit borer | Gir Sawaj Mating Disruption Paste | - | 400 g paste per application per hectare | - | - | - | First application at pest infestation, while second and third at 30 days interval after first application. |

### 140. Impact of bio-pesticides and insecticides on foraging bee in mustard

The farmers of South Saurashtra Agro-climatic Zone are advised to apply two sprays of *Beauveria bassiana* 1.15 WP (Min. 1×$10^8$ cfu/g) 0.0069 % (60 g/10 l of water), first at initiation of aphid and second at 15 days after first spray. *Beauveria bassiana* 1.15 WP found safer for foraging activities of bees in mustard.

| Year | Crop | Target | Pesticides with formulation | Dosage | | | | Total Qty. of Chemical suspension required/ha | Application Schedule |
|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i./ ha | Qty. of formulation /ha | Conc. (%) | Dilution in water (10 lit.) | | |
| 2020 | Mustard | Foraging bees | *B. bassiana* 1.15 WP | 35 | 3.0 kg | 0.0069 (Min. 1x$10^8$ cfu/g) | 60 g | 500 lit. | First spray at initiation of aphid and second spray at 15 days after first spray |

## 141. Study on foraging activities of honeybees on seed spices

The farmers of South Saurashtra Agro-climatic Zone are advised to avoid the insecticidal spray during visiting time of honey bees from 12.00 to 16.00 hours on coriander, fennel and dill seed crops. Among the different honey bee species, *Apis florea* was the dominant forager.

## 142. Synergism of different plant oils with different insecticides against pod borer, *Helicoverpa armigera* infesting chickpea

| Year | Crop | Pest | Pesticides with formulation | Dosage | | | | Total Quantity of Chemical suspension required/ ha | Application schedule | Waiting period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i./ ha | Quantity of formulation/ha | Con. (%) | Dilution in water (10 lit.) | | | |
| 2020 | Chick pea | *Helicoverpa armigera* | Chlorantraniliprole 18.5 SC + Neem oil | 30 + 2500 | 162.5 ml + 2.5 lit | 0.006 % + 0.5 % | 3.25 ml + 50 ml | 500 lit. | First spray when pest crosses the economic threshold level (0.75 larvae/plant before flowering and 0.5 larvae /plant after flowering) and second spray at 20 days interval after first spray | 11 |

## 143. Standardization of number of pheromone trap for fall army worm *Spodoptera frugiperda* (J. E. Smith) in maize

The farmers of South Saurashtra Agro-climatic Zone are advised to install 50 sex pheromone traps per hectare (20 sex pheromone traps per acre) at 10 days after germination and replace lure at 40 days for effective management of fall army worm in maize.

## 144. Bio-efficacy of different biopesticides against fall army worm *Spodoptera frugiperda* (J. E. Smith) infesting maize

The farmers of South Saurashtra Agro-climatic Zone growing maize are advised to spray *Beauveria bassiana* 1.15 WP (1 x $10^8$ cfu/g) 0.009 % (80 g/10 l of water) OR *Nomuraea rileyi* 1.15 WP (1 x $10^8$ cfu/g) 0.009 % (80 g/10 l of water) OR *Beauveria bassiana* 1.15 WP (1 x $10^8$ cfu/g) 0.007 % (60 g/10 l of water) + *Sf*NPV 450 LE (10 ml/10 l of water), first spray at initiation of pest infestation and subsequent two sprays at 10 days interval for the effective and economical management of fall armyworm.

| Year | Crop | Pest | Pesticides with formulation | Dosage | | | | Total Quantity of Chemical suspension required/ ha | Application schedule |
|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i./ha | Quantity of formulation/ha | Con. (%) | Dilution in water (10 lit.) | | |
| 2020 | Maize | Fall armyworm | *Beauveria bassiana* 1.15 WP (1 x $10^8$cfu/g) | 46 | 4.0 Kg. | 0.009 % | 80 g | 500 lit. | First spray at initiation of pest infestation, subsequent second and third at 10 day interval |
| | | | *Nomuraea rileyi* 1.15 WP (1 x $10^8$cfu/g) | 46 | 4.0 Kg. | 0.009 % | 80 g | | |
| | | | *Beauveria bassiana* 1.15 WP (1 x $10^8$cfu/g) + *Sf*NPV | 35 + -- | 3.0 Kg. + 0.5 lit. | 0.007 + 450 | 60 g + 10 ml | | |

## 145. Bio-efficacy of different insecticides against fall army worm, *Spodoptera frugiperda* (J. E. Smith) infesting maize

The farmers of South Saurashtra Agro-climatic Zone growing maize are advised to spray spinetoram 11.7 EC 0.012 % (10 ml/10 l of water) OR emamectin benzoate 5 SG 0.0025 % (5 g/10

l of water) OR thiodicarb 75 WP 0.075 % (10 g/10 l of water), first at initiation of pest infestation and second after 15 days of first spray for effective and economical management of fall armyworm.


| Year | Crop | Pest | Pesticides with formulation | Dosage | | | | Total Quantity of Chemical suspension required/ha | Application schedule |
|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i./ ha | Quantity of formulation/ ha | Con. (%) | Dilution in water (10 lit.) | | |
| 2020 | Maize | Fall armyworm | Spinetoram 11.7 EC | 59.00 | 0.5 lit. | 0.012 | 10 ml | 500 lit. | First spray at initiation of pest infestation and second at 15 day interval |
| | | | Emamectin benzoate 5 SG | 13.00 | 0.250 lit. | 0.0025 | 5 g | | |
| | | | Thiodicarb 75 WP | 375 | 0.5 lit. | 0.075 | 10 g | | |

## 146. Area wide integrated management of white grub in groundnut

The farmers of South Saurashtra Agro-climatic Zone growing groundnut are advised to spray chlorpyrifos 20 EC 0.04 % (20 ml/10 l water) on surrounding host trees at onset of monsoon, seed treatment of chlorpyrifos 20 EC @ 25 ml/kg seed, soil application of *Metarhizium anisopliae* OR *Beauveria bassiana* 1.15 WP @ 5 kg/ha (Min. 1 x $10^8$ cfu/g) + castor cake (300 kg/ha) before sowing and drenching of *M. anisopliae* or *B. bassiana* @ 5 kg (1 x $10^8$ cfu/g) dissolved in 1000 l of water/ha in root zone of plant after 30 days of germination for the effective and economical management of white grub.


| Year | Crop | Pest | Pesticides with formulation | Dosage | | | | Total Quantity of Chemical suspension required/ha | Application schedule |
|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i./ha | Quantity of formulation /ha | Con. (%) | Dilution in water (10 lit.) | | |
| 2020 | Groundnut | White grub | Chlorpyrifos 20 % EC (spray) + Chlorpyrifos 20 % EC (Seed treatment) + *Metarhizium anisopliae* 1.15 WP (Soil application and drenching) | 200.0 + 600.0 + 57.50 + 57.50 | 1.0 lit.+ 3.0 lit + 5.0 kg + 5.0 kg | 0.04 + -- + 0.006+ 0.006 | 20 ml + NA + NA+ 50.0 g | 1000 lit (Drenching) | Spraying on surrounding host trees at onset of monsoon, Seed treatment and soil application before sowing and drenching after 30 days of germination |
| | | | Chlorpyrifos 20 % EC (spray) + Chlorpyrifos 20 % EC (Seed treatment) + *Beauveria bassiana* 1.15 WP (Soil application and drenching) | 200.0 + 600.0 + 57.50 + 57.50 | 1.0 lit.+ 3.0 lit + 5.0 kg + 5.0 kg | 0.04 + -- + 0.006+ 0.006 | 20 ml + NA + NA+ 50.0 g | 1000 lit (Drenching) | |

*(Department of Entomology, JAU, Junagadh)*

## 147. Bio-efficacy of new insecticidal molecules against sucking pest of summer groundnut

The farmers of South Saurashtra Agro-climatic Zone growing summer groundnut are advised to apply two sprays of imidacloprid 17.8 SL 0.005 % (2.8 ml/10 l of water) at 10 days interval starting from pest infestation for effective and economical management of thrips. Pre-harvest interval (PHI) of 40 days should be kept.

| Year | Crop | Pest | Pesticides with formulation | Dosage | | | | Total Quantity of Chemical suspension required/ha | Application schedule | Waiting Period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i./ ha | Quantity of formulation/ ha | Concen-tration (%) | Dilution in water (10 lit) | | | |
| 2020 | Groundnut | Thrips | Imidacloprid 17.8 SL | 24.9 | 0.140 lit. | 0.005 | 2.80 ml | 500 lit. | First spray at initiation of pests and second at 10 days after first spray | 40 |

## 148. Bio-efficacy of biopesticides against sucking pest infesting groundnut

The farmers of South Saurashtra Agro-climatic Zone growing groundnut in *kharif* season are advised to apply two sprays of imidacloprid 17.8 SL 0.005 % (3.0 ml/10 l of water) at 10 days interval starting from pest infestation for effective and economical management of thrips. Pre-harvest interval (PHI) of 40 days should be kept.

| Year | Crop | Pest | Pesticides with formulation | Dosage | | | | Total* Quantity of Chemical suspension required/ ha | Application schedule | Waiting Period/ PHI (days) | Remark (s) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i./ ha | Quantity of formulation/ ha | Concentration (%) | Dilution in water (10 lit) | | | | |
| 2020 | Groundnut | Thrips | Imidacloprid 17.8 SL | 26.7 | 0.150 lit. | 0.005 | 3 ml | 500 lit. | Two sprays at 10 days interval starting from pest infestation | 40 | Registered under CIB approved list |

## 149. Management of white grub in groundnut

The farmers of South Saurashtra Agro-climatic Zone growing groundnut in *kharif* season are advised to apply seed treatment with imidacloprid 600 FS @ 4 ml OR chlorpyriphos 20 EC @ 25 ml per kg of seeds for effective and economical management of white grub.

| Year | Crop | Pest | Pesticides with formulation | Dosage | | | | Total* Quantity of Chemical suspension required/ha | Application schedule |
|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i./ ha | Quantity of formulation/ ha | Concen-tration (%) | Dilution in water (10 lit) | | |
| 2020 | Groundnut | Root feeders (White grub) | Chlorpyriphos 20 EC | -- | 3.000 lit.(ST) | 0.5 | 25 ml/ kg seed | -- | Seed treatment before sowing |
| | | | Imidacloprid 600 FS | -- | 0.480 lit.(ST) | 0.192 | 4 ml/ kg seed | -- | |

*(Main Oilseeds Research Station, JAU, Junagadh)*

## 150. Testing of IPM modules with farmers practice against pest complex of pearl millet

The farmers of North Saurashtra Agro-climatic Zone growing *kharif* pearl millet are advised to apply seed treatment of imidacloprid 600 FS @ 8.75 ml/kg at the time of sowing, removal of shoot fly dead hearts, installation of fish meal traps @ 10/ha at 7 days after germination (fish meal to be replaced once in a week) and spraying of dimethoate 30 EC 0.03 % (10 ml/10 l of water) at 35 days after germination for effective and economical management of shoot fly.

| Year | Crop | Pest | Pesticides with Formu-lation | Dosage | | | | Total qty. of chemical suspension required / ha | Application schedule | Waiting period / PHI (days) | Remarks |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i./ ha | Qty. of formu-lation/ ha | Concen-tration (%) | Dilution in water (10 lit.) | | | | |
| 2020 | Pearl millet (bajra) | Shoot fly | Imidacloprid 600 FS | 16.80 | 8.75 ml/kg seed | -- | -- | 35 ml | Seed treatment at the time of sowing | Nil | Reg. in CIB |
| | | | Dimethoate 30 EC | 150.00 | 0.5 L/ha | 0.03 | 10 ml | 500 ml | Single spray at 35 days after germination | Nil | Reg. In CIB |

*(Main Pearl millet Research Station, JAU, Junagadh)*

# Plant Pathology

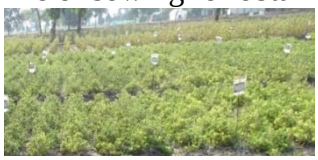
## 151. Biological control of root rot of coriander

The farmers of South Saurashtra Agro-climatic Zone growing coriander are advised to apply talc based *Trichoderma harzianum* 1 % WP (2 x $10^7$ cfu/g) @ 6.0 kg mixed in 500 kg of FYM per hectare at the time of sowing in furrows for effective and economical management of root rot.

| Year | Crop | Disease | Pesticides/ Biopesticides formulation | Dosage | | | | Quantity of water/ soil amendments require/ha | Application schedule |
|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i. /ha | Quantity of formulation / ha | Conc. (%) | Quantity of formu-lation in 10 l of water (g or ml) | | |
| 2020 | Coria -nder | Root rot | *Trichoderma harzianum* 1.0 % WP | -- | 6.0 kg/ha | 2 x $10^7$ cfu/g | -- | 500 kg FYM | Soil application in open furrow at the time of sowing |

## 152. Impact of Rhizobium isolates on groundnut under field condition

The farmers of South Saurashtra Agro-climatic Zone growing groundnut during *kharif* season are advised to give seed treatment of *Rhizobium leguminosarum* isolate-1 ($10^7$ cfu/ml) @ 10 ml/kg seeds along with soil application of recommended dose (RD) of $P_2O_5$ (25 kg/ha) & $K_2O$ (50 kg/ha) and 75 % RD of N (9.4 kg/ha) at the time of sowing for obtaining higher pod yield and net return.



## 153. Impact of Azotobacter isolates on cotton under field condition

The farmers of South Saurashtra Agro-climatic Zone growing *Bt* cotton are advised to give seed treatment of *Azotobacter chroococcum* isolate-1 ($10^7$cfu/ml) @ 10 ml/kg seeds along with soil application of recommended dose (RD) of $P_2O_5$ (50 kg/ha) and $K_2O$ (150 kg/ha) at the time of sowing in furrow and 75 % RD of N (180 kg/ha) [in equal four splits of 45 kg first at basal and remaining at 30, 60 and 90 days after sowing] for obtaining higher seed cotton yield and net return.

## 154. Impact of phosphate solubilizing microorganism on cotton under field condition

The farmers of South Saurashtra Agro-climatic Zone growing Bt cotton are advised to give seed treatment of *Bacillus subtilis* JAU isolate-1 ($10^7$ cfu/ml) @ 10 ml/kg seeds along with soil application of recommended dose (RD) of N (240 kg/ha) [in equal four splits of 60 kg first at basal and remaining at 30, 60 and 90 days after sowing] and $K_2O$ (150 kg/ha) and 75 % RD of $P_2O_5$ (37.5 kg/ha) at the time of sowing for obtaining higher seed cotton yield and net return**.**

## 155. Impact of phosphate solubilizing microorganism on groundnut under field condition

The farmers of South Saurashtra Agro-climatic Zone growing groundnut during *kharif* season are advised to give seed treatment of *Bacillus subtilis* JAU isolate-1 ($10^7$ cfu/ml) @ 10 ml/kg seeds along with soil application of recommended dose (RD) of N (12.50 kg/ha) and $K_2O$ (50.00 kg/ha) and 75 % RD of $P_2O_5$ (18.75 kg/ha) at the time of sowing for obtaining higher pod yield and net return.

## 156. Biological control of root rot (*Macrophomina phaseolina*) of groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are advise to apply talc based *Trichoderma harzianum* 1 % WP (2 x $10^7$ cfu/g) @ 1.5 kg/ha + *Trichoderma viride* 1 % WP (2 x $10^7$ cfu/g) @ 1.5 kg/ha OR *Trichoderma viride* 1 % WP (2 x $10^7$ cfu/g) @ 1.5 kg/ha + *Pseudomonas fluorescens* 1 % WP (1 x $10^8$ cfu/g) @ 1.5 kg/ha mixed in 500 kg/ha well decomposed farm yard manure in furrow at the time of sowing, for effective and economical management of root rot of groundnut.


| Year | Crop | Disease | Pesticides/ Biopeticides formulation | Dosage | | | | Quantity of water/soil amendments required/ha | Application schedule |
|---|---|---|---|---|---|---|---|---|---|
| | | | | a.i. (g/ha) | Quantity of formulation/ ha | Conc. (%) | Quantity of formulation in 10 l of water (g or ml) | | |
| 2020 | Ground nut | Root rot | *Trichoderma harzianum* 1 % WP + *Trichoderma viride* 1 % WP | -- | 1.5 kg/ha (1 % WP) + 1.5 kg/ha (1 % WP) | $2 \times 10^7$ cfu/g + $2 \times 10^7$ cfu/g | -- | 500 kg FYM | Furrow application at the time of sowing |
| | | | *Trichoderma viride* 1 % WP + *Pseudomonas fluorescens* 1% WP | -- | 1.5 kg/ha (1 % WP) + 1.5 kg/ha (1 % WP) | $2 \times 10^7$ cfu/g + $1 \times 10^8$ cfu/g | -- | 500 kg FYM | Furrow application at the time of sowing |

*(Action: Professor & Head, Department of Plant Pathology, JAU, Junagadh)*

## 157. Management of major foliar diseases of groundnut

The farmers of South Saurashtra Agro-climatic Zone growing *kharif* groundnut are advised to apply seed treatment of mancozeb 75 % WP @ 3 g/kg seeds follow by two sprays of hexaconazole 5 % SC, 0.005 % (10 ml/10 l of water) at 40 and 65 DAS for effective and economical management of early and late leaf spots (ELS & LLS) diseases of groundnut.

| Year | Crop | Pest | Pesticides with formulation | Dosage | | | | Total* Quantity of Chemical suspension required/ha | Application schedule | Waiting Period/ PHI (days) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | g.a.i./ ha | Quantity of formu-lation/ ha | Concen -tration (%) | Dilution in water (10 lit) | | | |
| 2020 | Groundnut | Foliar diseases of groundnut | Mancozeb 75 % WP | 0 | 3 g/kg seed | -- | -- | 0.36 kg | As a seed treatment | 58 |
| | | | Hexaconazole 5 % SC | 25 | 0.500 lit. | 0.005 | 10 ml | 500 lit. | Foliar spray at 40 and 65 DAS | 58 |

*(Main Oilseeds Research Station, JAU, Junagadh)*