Technology developed and Recommended

Sr. No.	Recommendation
1	**Influence of habitat manipulation on incidence and severity of pest damage in cabbage (2023)** Farmers of Gujarat growing cabbage are recommended to grow cabbage with vegetable cowpea as intercrop (5:1 rows) and one row of fodder oats as border crop or cabbage with oats as border crop to manage the population of aphids and diamond back moth (DBM), which enhances the natural enemies (*Coccinellids* and *Chrysoperla*) of insect pests infesting cabbage.
2	**Development of biointensive pest management (BIPM) module for the management of shoot and fruit borer, *Leucinodes orbonalis* (Guenee) in brinjal (2023)** The following components of bio-intensive pest management (BIPM) module found effective for the management of shoot and fruit borer, *Leucinodes orbonalis* infesting brinjal. • Intercropping of brinjal with coriander (seed purpose) (2:1 rows) • Clipping of damaged shoots • Installation of pheromone trap for *L. orbonalis* @40/ha at 30 DATP (Change lure at 21 days interval) • Three sprays of azadirachtin 10000 ppm (20 ml/10 litre water) at 30, 75, 105 DATP, two sprays of *Bacillus thuringiensis* AAU-Bt1 ($2x10^8$ cfu/g) 1% WP (50 g/10 litre water) at 45, 90 DATP and one spray of entomopathogenic nematode (EPN) *Steinernema carpocapsae* 1% WP (80 g/10 litre water) at 60 DATP
3	**Isolation, characterization and bioassay studies of *Spodoptera frugiperda* nuclear polyhedrosis virus (*Sf*NPV) (2023)** The maximum number of NPV infected larvae of fall armyworm, *Spodoptera frugiperda* found during cob formation stage of maize. The native isolate of *Sf*NPV found to possess tetrahedral to hexagonal shaped POBs. The median lethal concentration (LC50) was 5.1 x 10^6 POBs/ml and there was no cross infectivity of native isolate of *Sf*NPV against *Spodoptera litura*.
4	**Bio-efficacy of different bioagents against early blight of tomato (2023)** The application of *Trichoderma harzianum* (AAUBC-Th1)-1% WP (min. 2 x 10^6 cfu/g) and *Pseudomonas fluorescens* (NBAIR PfDWD)-1% WP (min. 2 x 10^8 cfu/g) through any of the following methods found effective for the management of early blight disease of tomato. 1. Soil application of enriched vermicompost (1.25 kg of each formulation/250 kg vermicompost/ha) before transplanting, seedling root dip (5 g of each formulation/litre of water) for 30 min just before transplanting and two foliar sprays (2.5 g of each formulation/litre of water), first spray starting with the initiation of the disease and second at 10 days after first spray. 2. Soil application of enriched vermicompost (2.5 kg of *P. fluorescens*/250 kg vermicompost/ha) before transplanting, seedling root dip (10 g of *P. fluorescens*/litre of water) for 30 min just before transplanting and two foliar sprays (5 g of *P. fluorescens*/litre of water), first spray starting with the initiation of the disease and second at 10 days after first spray.

5	**Biological suppression of fall armyworm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) in maize (2022)** Three releases of *Trichogramma pretiosum* (50,000 eggs per ha) at weekly interval and spray of *Bacillus thuringiensis* NBAIR *Bt*G4 1% WP @ 50 g/ 10 lit. of water for three times at ten days interval with the initiation of pest found effective for the management of fall armyworm, *Spodoptera frugiperda* (J. E. Smith) in maize.
6	**Evaluation of different bio-pesticides against fall armyworm, *Spodoptera frugiperda* (J. E. Smith) (Lepidoptera: Noctuidae) in maize (2021)** Application of *Bacillus thuringiensis* NBAIR strain – *Bt* G4 (1% WP - $2x10^8$ cfu/g) @ 50 g/10 litre water **or** *Bacillus thuringiensis* AAU strain -AAU *Bt*1 (1% WP - $2x10^8$ cfu/g) @ 50g/10 litre for three times at ten days interval with the initiation of the pest found effective for the management of fall armyworm *Spodoptera frugiperda* in maize
7	**Management of shoot and fruit borer, *Earias vittella* through biocontrol agents in okra (2020)** The spraying of *Bacillus thuringiensis* var. *kurstaki* 1% WP @ 50 g/10 lit. water or NSKE 5% (500 g/10 litre water) at fifteen days interval for three times **or** six releases of *Trichogramma chilonis* @ 50,000/ha at weekly interval starting from the initiation of shoot and fruit borer (*Earias vittella*) is advised for the effective control of the pest in okra.
8	**Microbial insecticides against sucking pests infesting *Bt* cotton (2017)** The spray of microbial insecticides *Lecanicillium lecanii* (2×10^8 cfu/g -1% WP) **or** *Beauveria bassiana* (2×10^8 cfu/g - 1% WP) @ 40 g /10 litre water at fortnightly interval for three times starting from initiation of sucking pests is advised for the effective biological control of sucking pests infesting *Bt* cotton.
9	**Bio-intensive module for pod borer and wilt disease in chickpea (2013)** For the management of pod borer and wilt in chickpea, following Bio-Intensive Pest Management module can be adopted. 1. Seed treatment with *Trichoderma viride* (2×10^6 cfu /g) @ 8 g /kg seed at the time of sowing against wilt disease. 2. Use of FYM @ 1 ton/ha enriched with *T. viride* (2×10^6 cfu /g) (2 kg/ ton of FYM) for wilt disease. 3. Planting marigold (*Tagetes erecta*) on the borders of chickpea field as trap crop for *Helicoverpa armigera.* 4. Installation of pheromone traps @ 40 traps/ha at 15 days after sowing for trapping of *H. armigera* male moths. 5. Installation of "T" shaped bird perches @ 100 /ha at 15 days after germination. 6. Alternate spray of *Ha*NPV @ 250 LE /ha and Neem Seed Kernel Extract @ 5% during vegetative stage, at flowering stage and at pod formation stage for the suppression of *H. armigera.*
10	**Bio-Intensive Pest Management module for pests of okra (2013)** Below mentioned Bio Intensive Pest Management module is advised for the management of insect-pests of okra. • Sowing of the crop during first week of May. • Soil application of *Paecilomyces lilacinus* (2×10^6 cfu /g) @ 25 kg /ha (Talc based formulation) • Seed treatment with thiamethoxam 70 WS @ 2.8 g /kg seed (2 g a.i./kg seed). • Installation of pheromone traps @ 60 /ha for mass trapping the moths each of *Helicoverpa armigera* and *Earias vittella*. • Regular clipping of the shoots infested by spotted bollworm.

	• Need based alternate spray of NSKE @ 5% (500 g/10 litre water), *Bt* (5 x 10^7 spores /mg) @ 30 g/10 litre water and *Beauveria bassiana* (2x10^8 cfu /g) @ 30 g /10 litre water.
11	**Microbial insecticides against leaf defoliators infesting paddy (2012)** Spraying of *Bacillus thuringiensis* (5 x 10^7 spores/mg) @ 1.0 kg/ha (20 g/ 10 litre water) or *Beauveria bassiana* (2 x 10^6 cfu/g) @ 1.0 kg/ha (20 g/ 10 litre water) or *Lecanicillium* (*Verticillium*) *lecanii* (2 x 10^6 cfu/g) @ 1.0 kg/ha (20 g/ 10 litre water) is advised at initiation of leaf folder damage in paddy.
12	**Integrated Pest Management module for leaf folder in paddy (2012)** The paddy growers are advised to use resistant paddy cultivar (Gurjari), transplanting of paddy seedlings during first fortnight of July and application of NSKE 5% (500 g/ 10 litre water) to suppress the incidence of leaf folder and maintain the population of predatory spiders.
13	**Management of sucking pests and shoot & fruit borer through organic insecticides in brinjal (2012)** Spraying of cow urine 20% fortified with leaf extract of either neem, custard apple, lantana or jatropha 10% (1 kg/10 litre water) for suppression of sucking pests (aphid, leaf hopper and whitefly) as well as shoot and fruit borer in organically cultivating brinjal.
14	**Management of fruit borer, *Helicoverpa armigera* through microbial insecticides in tomato (2012)** Spraying of *Ha*NPV (1.0x10^9 POB/ml) @ 250 ml/ha (5 ml/ 10 litre water) **or** *Beauveria bassiana* (1x 10^8 cfu/g) @ 1.0 kg/ha (20 g/10 litre water) **or** *Metarhizium anisopliae* (1 x 10^8 cfu/g) @ 1.0 kg/ha (20 g/10 litre water) at 85 days after transplanting suppress fruit borer, *Helicoverpa armigera* infesting tomato.
15	**Microbial insecticides against aphid and head borer in cabbage (2012)** Two sprays of *Beauveria bassiana* (2 x 10^6 cfu/g) **or** *Lecanicillium* (*Verticillium*) *lecanii (*2 x 10^6 cfu/g) @ 30 g/10 litre water at the initiation of pest incidence for suppression of aphid and head borer (*Helicoverpa armigera*).
16	**Cyst nematode management in pigeonpea (2011)** Application of talc-based mixture of *Trichoderma harzianum* (10^8 spores / g) @ 5 kg/ha + *Pochonia chlamydosporia* (10^8 spores/ g) @ 20 kg/ ha in furrows at the time of sowing for effective management of cyst nematode, *Heterodera cajani* in pigeonpea.
17	**Habitat manipulation for natural enemies in *Bt* cotton (2010)** Raising of 10 per cent maize plants randomly or one row of cowpea in-between two rows of cotton is advised to reduce the population of jassid and whitefly and increase the population of biocontrol agents in *Bt* cotton.
18	**Enhancement of natural enemies in Hybrid cotton (2008)** Adopt following measures to enhance the activity of natural enemies and thereby to suppress the incidence of insect pests in cotton Hybrid-10. Interspersing of one row of *Cassia occidentalis* L. after every six rows of cotton and sowing of maize and planting of Zinnia (*Zinnia elegans*) @ 10% of total population of cotton plants **OR** Interspersing of one row of *Cassia occidentalis* L. after every six rows of cotton, sowing of maize and planting of Zinnia (*Zinnia elegans* Jacq.) @ 10% of total plant population of cotton plants and one release of *Trichogramma chilonis* @ 1.5 lakh/ha + *Chrysoperla carnea* @ 5000 larvae (2-3 days old)/ha, coinciding with the appearance of pests. Note: *Cassia occidentalis* should be harvested before ripening of the pods.

19	**Conservation of entomophage diversity in Hybrid cotton-10 (2004)** For the management of pest complex and to conserve entomophage diversity in cotton Hybrid-10, adopt the following IPM package. 1. Hand picking of different stages of pests and putting them in 60 mesh wire screen cages twice during peak incidence. 2. Interspersing of 10% maize plants with cotton crop, sowing of cotton and maize should be done simultaneously. 3. One release of *Chrysoperla carnea* @ 14,000 larvae (2-3 days old) synchronizing with the appearance of the pests. 4. Release of *Trichogramma chilonis* @ 1,50,000 per hectare per week (5 releases), first release should be synchronized with the appearance of the bollworms.
20	**Management of sucking pests in Hybrid cotton (1994)** Sucking pests of cotton hybrid-6 can be economically (ICBR 1:4.07) and effectively managed and natural biological control agents are conserved by implementing following Integrated Pest Management module in middle Gujarat. • Application of phorate 10 G 1 kg a.i./ha in soil at 7 days after germination. • Planting of two rows of maize and sorghum on the periphery of cotton (These plants should be kept free from insecticides). • Five releases of *Trichogramma chilonis* **@** 2, 00,000/ha and *Chrysoperla scelestes* and 1,00,000/ha at weekly interval alternatively synchronizing with the appearance of bollworms. • Spraying monocrotophos 0.04% only on the aphid infested plants which should be synchronized with the appearance of aphid. • Need based spraying of triazophos 0.05% for sucking pests particularly aphid and whitefly.
21	**Management of cotton bollworms through biocontrol agents (1988)** Cotton bollworms *i.e. Earias vittella* and *Heliothis armigera* can be satisfactorily controlled by supplementary release of *Trichogramma chilonis* and *T. achaeae* (Both @ 10,000/acre). Release of *Chelonus blackburni* @ 5000/acre, *Chrysoperla carnea* 100 adults per acre and *Rogas aligarhensis* 150 adults/acre at fortnightly interval and by spraying purified suspension of indigenous NPV of *Heliothis armigera* @ 10^9 PIB/ml at 3 days interval. Since *Spodoptera litura* Fab. often infest cotton, spraying of purified suspension of NPV of *S. litura* in the evening immediately after the occurrence of the pest is recommended.
22	**Management of pod borer (*H. armigera*) through *Ha*NPV in chickpea (1982)** Spraying crude suspension of an indigenous NPV of *H. armigera* @ 100 L.U. in 350-400 litres of water/acre/week effectively control the *H. armigera* infesting chickpea.
23	**Management of fruit borer, *H. armigera* through *Ha*NPV in tomato (1982)** Spraying crude suspension of an indigenous NPV of *H. armigera* @ 100 L.U. in 350-400 litres of water/acre/week effectively controls the *H. armigera* infesting tomato.