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# Relevance of Bio-intensive IPM for Upland Crops in Andhra Pradesh

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**ABSTRACT**

The biointensive IPM demonstrations conducted in Guntur district of Andhra Pradesh on cotton, pigeonpea, chickpea and blackgram during three cropping seasons from 1999 – 2002 revealed that the IPM plots recorded less boll damage/pod damage, received less number of sprays and registered high yields and net returns compared to non-IPM plots. The activity of natural enemies population in cotton IPM fields were higher than non- IPM fields. The input cost on plant protection was substantially reduced in IPM demonstrations. The cost- benefit ratio of cotton (1:2.87), pigeonpea (1:3.01), chickpea (1:2.92) and black-gram (1:5.58) were higher in IPM plots compared to non-IPM plots.

**Key words :** Blackgram, Chickpea, Cotton, IPM, Pigeonpea

In Andhra Pradesh upland crops like cotton, pigeonpea, chickpea and blackgram are intensively cultivated under high input management. As a result the pest problems have assumed serious proportions more than any thing else. Among the pests of common occurrence, *Helicoverpa armigera* Hub. is most predominant and persistent throughout the year on array of crops like cotton, chillies, greengram, blackgram, sunflower, pigeonpea, tobacco and tomato due to its wide host range and inflicting yield loss of around 50-60%. The unilateral reliance on chemical insecticides resulted in the total elimination of native bio-control agents, resurgence of minor pests and development of resistance to insecticides besides causing environmental pollution and human hazards. The abuse of insecticides resulted in the outbreak of *H.armigera* since 1987 and culminated in total failure of cops in certain years and many fold increase in cost of cultivation rendering cultivation risky and uneconomical. To overcome the present crisis, it is highly essential to identify eco-friendly and cost effective alternate technologies. In this direction bio-control approach utilizing predators, parasitoids and entomopathogenic fungi under different situations needs to be exploited profitably by integrating available eco-friendly technologies with IPM for sustainable agriculture.

## MATERIAL AND METHODS

The field demonstrations of bio-intensive IPM were organized in farmers' fields through farmers' participatory approach in Guntur District, Andhra Pradesh for three seasons from 1999-2002 to demonstrate IPM module in comparison with chemical protection practices in cotton, pigeonpea, chickpea and blackgram. The farmers involved in the IPM demonstrations were given adequate training before implementing the project. Bio-intensive IPM package adopted for management of pest complex of cotton includes seed treatment with imidacloprid @ 5g per kg seed or carbosulfan @ 30 g/ seed, castor as trap crop for *Spodoptera litura* Fab., maize and marigold as trap crops for *H. armigera*, monitoring of bollworm with pheromone traps @ 10/ha, bird perches @ 20/ha, utilization of two biocontrol agents *Trichogramma chilonis* Ishii. @ 1,50,000/ha and Helio NPV @500 LE/ha, *Bracon hebetor* Say. @25,000/ha depending on the threshold levels of egg and larval stages of *H. armigera*. The above bioagents were used along with other IPM components like use of neem formulations to act as feeding and oviposition deterrants, topping the plant at 15-16 sympodial stage to prevent egg laying of *H. armigera*, use of chemical insecticides like chlorpyriphos, quinolphos and acephate on need basis when the pest population crossed ETL . IPM packages adopted for the management of *H.armigera* on pigeonpea is sowing intercrops like soyabean/ greengram/blackgram, monitoring the *H.armigera* activity with pheromone traps @ 10/ha, keeping bird perches @ 20/ha, use of Helio NPV @ 500 LE/ha, use of neem formulations to act as feeding and oviposition deterrents, using insecticides on need basis.

IPM package adopted for the management of *H. armigera* on chickpea is monitoring *H. armigera* activity with pheromone traps, keeping bird perches @20/ha, use of neem formulations to act as feeding and oviposition deterrants, use of Helio

NPV @ 500 LE/ha, use of insecticides on need basis. IPM package adopted for the management of *H. armigera* on blackgram is seed treatment with carbosulfan @30 kg/ seed, spraying 5% Neem seed kernel extract, use of Helio NPV at weekly intervals, need based insecticide application. In non- IPM plots management of pests is purely dependent on chemical insecticides. The observations for bollworm/pod borer incidence were made on 50 randomly selected plants at weekly intervals commencing from initial infestation till maturity of the crop both on IPM and non-IPM plots. The infestation of sucking pests was also recorded as per the standard methodology.

**RESULTS AND DISCUSSION**

The results of the demonstrations conducted for three seasons from 1999 -2002 on the management of pest complex on cotton revealed that the cost of plant protection was less in IPM plots (Rs 3,171/ha) with less number of sprays (7.93) compared to non- IPM plots (Rs 5,429/ha) with14.25 sprays. Besides the bollworm incidence in squares (9.23%) and bolls (7.35%), jassids (2.19/3 leaves), aphids (8.76/3 leaves) and whitefly (5.0/3 leaves) were less in IPM plots compared to non-IPM plots (16.91%, 13.39% and 4.45/3 leaves,11.39/3leaves 9.6/3 leaves, respectively) (Table 1). This culminated in higher CB ratio of 1:2.87 in IPM plots compared to 1:1.9 realized on non-IPM plots. The activity of natural enemies like coccinellids (4.12/10 plants), chrysopids (5.36/10 plants), spiders (7.09/10plants), syrphids (3.36/10 plants) were high in IPM plots when compared to non-IPM plots recording 0.68, 1.02, 1.49 and 1.25/10 plants, respectively (Table 1).Venugopala Rao *et al.* (1994) has reported economic returns in cotton by integration of some of the identified strategies. Deware (1996) reported an increase of yield in cotton with IPM practices compared to recommended plant protection with chemical pesticides. Due to adoption of IPM practices, IPM plot executed lower *H. armigera* damage with incremental cost- benefit ratio of 3.85 (Anonymus, 2002).

The pooled data of the demonstrations in respect of pigeonpea revealed that the IPM plots recorded less pod damage (14.91%) and received less number of sprays (5.56) compared to non-IPM plots with 28.28% pod damage and 8.7 sprays. The yield (10.52 q/ha) net returns (Rs. 17,870/ha) and CB ratio (1:3.01) were higher in IPM plots compared to 9.0 q/ha, Rs. 10,220 q/ha and 1:1.91, respectively recorded in non-IPM plots (Table 2). Gowda *et al.* (2002) validated the IPM of pigeonpea pod borer and recorded lower plant protection cost (Rs 1400 vs. 2140/ha) and higher net return (Rs 13745 vs. 3620/ ha) for IPM than non-IPM fields. Similarly, Rao *et al.* (2002) observed the higher activity of coccinellids and spiders in IPM plots with highest grain yields (12.77 to 14.17 q/ha) and CB ratio.

The IPM demonstrations conducted for the management of *H. armigera* on chickpea recorded less pod damage (15.39%) with less number of sprays (4.7) leading to higher yields (15.2 q/ha) and net returns (Rs 13,887/ha) with high CB ratio of 1:2.92 compared to non- IPM plots which registered more number of sprays(6.43), high pod damage(25.32%), lower yields(12.68) and net returns (8,411) with low CB ratio(1:1.59) (Table 2). Similar results of less pod damage and increased seed yield compared with the untreated control were obtained in IPM plots, with the pesticide-based IPM module recording better values for these parameters. However, considering the disastrous effects of chemicals, the biointensive IPM module is considered as a more ecological-friendly option to control pod borer infestation in chick pea (Gowda *et al.*, 2004). Ranga Rao *et al.,* (2003) recognized IPM as the best treatment for controlling pod borer on chick pea with least pod damage of 9.4%, maximum yield of 1.17 t/ha and highest cost benefit ratio of 1:6.3.

The results of IPM are encouraging on blackgram for the management of *H.armigera*. The pooled data clearly showed that with 5 sprays, it was possible to reduce the pod damage (12.4%) with less investment on plant protection (Rs.2400/ ha) compared to non-IPM with 7.25 sprays, 23.61% pod damage and higher investment on plant protection(Rs 3987/ha). The yield and net returns realized in IPM plots was higher (16.5 q/ha & Rs.26962/ha) compared to non-IPM plots (14.37 q/ ha and Rs. 20862.5/ha) (Table 2). With the implementation of IPM practices pod borer damage was less and grain yield was high in IPM practices compared to control (Anonymus, 2000).

The bio-intensive IPM demonstrations reduced reliance on chemical pesticides to control key pests of upland crops which lead to conservation of natural enemies besides saving in plant protection cost without reduction in yield paving the way for sustainable plant protection.

Table 1. Performance of IPM demonstrations for the management of pest complex on cotton with special reference to *H.armigera*

| S.No | Pest/Bioagent | Mean of three years (1999-2002) | |
|---|---|---|---|
| | | IPM | non-IPM |
| 1. | Jassids/3 leves | 2.19 | 4.45 |
| 2. | Aphids/3 leaves | 8.76 | 11.39 |
| 3. | Whitefly/3 leaves | 5.00 | 9.60 |
| 4. | *Helicoverpa eggs/10* plants | 1.92 | 3.06 |
| 5. | *Helicoverpa* larvae/10 plants | 1.62 | 2.97 |
| 6. | *Helicoverpa* damage | | |
| | Square(%) | 9.23 | 16.91 |
| | Bolls(%) | 7.65 | 13.39 |
| | Locules(%) | 5.16 | 7.16 |
| 1. | Coccinellids/10 plants | 4.12 | 0.68 |
| 2. | Chrysopids/10plants | 5.36 | 1.02 |
| 3. | Spiders/10 plants | 7.09 | 1.49 |
| 4. | Syrphids/10plants | 3.36 | 1.25 |

Table 2.Performance of IPM *vs* chemical control for the management of pest complex in upland crops

| S.No | Particulars | Mean of three years (1999-2002) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | Cotton | | Pigeonpea | | Chickpea | | Blackgram | |
| | | IPM | non-IPM | IPM | non-IPM | IPM | non-IPM | IPM | non-IPM |
| 1. | Cost of cultivation (-cost of plant protection) (Rs/ha) | 11476 | 12213 | 6275 | 6662 | 5974 | 6796 | 3475 | 3850 |
| 2. | Cost of plant protection(Rs/ha) | 3171 | 5429 | 2654 | 4730 | 1237 | 2370 | 2400 | 3987 |
| 3. | No.of sprays (including releases) | 7.93 | 14.25 | 5.56 | 8.70 | 4.70 | 6.43 | 5.00 | 7.25 |
| 4. | Pod damage(%) | - | - | 14.91 | 28.28 | 15.39 | 25.32 | 12.40 | 23.61 |
| | Yield(q/ha) | 21.75 | 20.00 | 10.52 | 9.00 | 15.20 | 12.68 | 16.50 | 14.37 |
| 5. | Inter crop (Soyabean / Blackgram) | 9.75 | - | 10.83 | 8.78 | - | - | - | - |
| 6. | Gross returns (Rs/ha) | 41270 | 33360 | 27165 | 21613 | 210 | 17577 | 32837 | 28700 |
| 7. | Net returns | 26622 | 15717 | 17870 | 10220 | 13887 | 8411 | 26962 | 20862 |
| 8. | CB ratio | 1:2.87 | 1:1.90 | 1:3.01 | 1:1.91 | 1:2.92 | 1:1.59 | 1:5.58 | 1:3.16 |

CB ratio = Cost - benefit ratio

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