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# Validation of integrated pest management module against insect pests of pigeonpea, *Cajanus cajan* in Tarai region of Uttarakhand

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**Abstract:** Experiments on validation of integrated pest management (IPM) module against insect pest of pigeonpea in comparison with the Non-IPM (farmer's practices) were conducted at N.E.B. Crop Research Centre, G. B. Pant University of Agriculture & Technology, Pantnagar during Kharif 2014 and 2015. Adopted IPM module contained Seed treatment with *Trichoderma* spp. @10g/kg of seed, Sole crop, Bird perches @ 50/ha, need based insecticides spray (Chlorantraniliprole 18.5SC @ 30 g a. i./ha; Neem soap@10g/lit; Acetamiprid 20SP @ 20 g a. i./ha). The results indicated that minimum population of pod borers *(Helicoverpa armigera, Maruca vitrata* and podfly) and sucking insects (aphids, jassids, pod bug) was reported in IPM plots and maximum population of insects was observed in Non-IPM plots. Percent insect control over non-IPM was 50.98 % for *H. armigera*, 44.69 % for *M. vitrata* and 19.17 % for *Maruca* webbing were recorded. While, for sucking pest complex, insect control over non-IPM was 51.59 %, 40.36 % and 36.17 % against jassids, aphids and tur pod bug, respectively. Similarly, minimum pod borer damage (6.48 and 7.71 %) was recorded in IPM plots as compared to maximum pod borer damage (8.37 and 8.22 %) in non -IPM plots, respectively during 2014 and 2015. Whereas, pooled grain yield for IPM plots was 1286.5 kg/ha for both seasons as against 888 kg/ha in non-IPM plots with 1:2.89 benefit cost ratio. Hence, It is apparent that studied IPM module was able to increase the yield of pigeonepea with lower cost of production as against non-IPM thus it would be benefiting the farmers.

**Keywords:** Insect pests, IPM, Non-IPM, Pigeon pea, Validation.

## INTROUCATION

Pigeon pea is a second important legume crop mostly cultivated in tropical and semi arid tropic region of India. India is major pigeon pea producing country with 63.75 % of global production followed by Myanmar (18.9 %) production (FAOSTAT, 2015). In India pigeon pea was cultivated on 3.55 M ha with total production of 2.78 MT and yield of 783 kg/ha (Anonymous, 2016). The annual demand for pulses in Uttarakhand is 0.3 million tons, but the present production is only 0.06 million tons, leading to a huge protein deficit among the poor of this state (ICRISAT, 2008). Uttarakhand has more than 55 per cent area under rain fed hill agriculture and has tremendous scope for pigeon pea cultivation. As per the land statistics of Uttarakhand, about 34 thousand ha is fallow which can be brought for pigeon pea cultivation. Many factors responsible for low yields of pigeonpea in India, insect pests are the major ones. Though the pest spectrum of pigeonpea crop includes 200 insects and mites, in which gram pod borer (*Helicoverpa armigera*) (Puri and Saxena, 2003), spotted pod borer (*Maruca vitrata*), pod fly (*Melanogromyza obtusa*) has been the major pest as they reduces yield by feeding the reproductive parts and pods of plants. Wadaskar *et al.* (2013) recorded 15.9 % pod damage due to lepidopteron borers and Sujithra and Subhash, (2014) reported 2.6 %, 9.7 % and 5.3 % per cent pod damage by *H. armigera, M. vitrata* and *M. obtusa,* respectively. A number of insecticides have been found reported to be effective for controlling insect pests on pigeonpea (Ujagir, 2000). However, in the wake of widespread resistance and cross resistance to chemical insecticides (Kranthi *et al.*, 2002) the need of integrated pest management (IPM) is increasingly felt. In recent time integrated pest management (IPM) is possible way to reduce the yield losses due to insect pest complex and it will also eliminate other ill effects of pesticides in pigeon pea. Most of the farmers are not aware about the benefit of IPM technology, in this regard, the present study was conducted to validate the IPM technology for the management of major insect pests of pigeonpea in *Tarai* region of Uttarakhand.

## MATERIALS AND METHODS

Investigation was undertaken on pigeonpea to evaluation of IPM components during Kharif season of 2014 and 2015 at N. E. B. Crop Research Centre of G.B. Pant University of Agriculture and Technology, Pant-

  

**Table 1.** Effect of IPM module on the incidence of major Lepidopteron insect pests of pigeon pea.

| Treatment | Insect population per plant | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | *Helicoverpa armigra* | | | *Maruca vitrata* | | | Webbing | | |
| | IPM | Non IPM | Insect control over Non IPM (%) | IPM | Non IPM | Insect control over Non IPM (%) | IPM | Non IPM | Webbing control over Non IPM (%) |
| 2014 | 1.00 | 2.00 | 50.98 | 1.48 | 2.45 | 44.69 | 3.88 | 4.63 | 19.17 |
| 2015 | 1.45 | 3.00 | - | 1.67 | 3.34 | - | 3.89 | 5.00 | - |
| Mean | 1.25 | 2.5 | | 1.57 | 2.89 | | 3.88 | 4.81 | |
| P (0.05%) | 0.067 | | | 0.086 | | | 0.060 | | |

**Table 2.** Effect of IPM module on the incidence of major sucking insect pests of pigeon pea.

| Treatment | Jassid/5 trifoliate/plant | | | Aphid/50 shoots | | | Tur Pod Bug/plant | | |
|---|---|---|---|---|---|---|---|---|---|
| | IPM | Non IPM | Insect control over Non IPM (%) | IPM | Non IPM | Insect control over Non IPM (%) | IPM | Non IPM | Insect control over Non IPM (%) |
| 2014 | 5.00 | 9.87 | 51.59 | 6.55 | 15.56 | 40.36 | 3.45 | 5.00 | 36.17 |
| 2015 | 6.00 | 13.00 | - | 12.35 | 16.00 | - | 3.22 | 5.50 | - |
| Mean | 5.50 | 11.43 | | 9.45 | 15.78 | | 3.33 | 5.25 | |
| P (0.05%) | 0.056 | | | 0.127 | | | 0.059 | | |

nagar and at farmer's field with the following treatments:

Treatment I- IPM package consist of Seed treatment with *Trichoderma* spp. @10 g/kg of seed, Sole crop, Bird perches @ 50 perches/ha, need based insecticides spray (I Spray at bud initiation stage of crop: Chlorantraniliprole 18.5SC @ 30g a.i./ha; II Spray: Neem soap @ 10g/lit ; III Spray: Acetamiprid 20 SP @ 20 g a.i./ha).

Treatment II- farmers practices (Non IPM) consist of I Spray: Profenophos @ 30g a.i./acre; I Spray: Chloropyriphos 20 EC @ 1.5 lit /acre; I Spray: Acephate 75 SP @ 800 g a.i./acre (Srinivasan and Philip Sridhar, 2008).

The cultivar, Manak was raised in accordance with recommended agronomic practices in three replications. Ten randomly selected plants from the field were tagged for recording the observations of lepidopteron insects. Larvae of spotted pod borer were observed on leaves, flower buds and pods along with webbing. Similarly, the larva of gram pod borer was counted on pods of all the tagged plants. Sucking pest complex was recorded on five randomly selected plants but Jassids were observed from 5 trifoliate leaves/plant and aphids are counted from 50 terminal shoots per plot. The data on incidence of *Helicoverpa armigera, Maruca vitrata* larva and webbing, jassid, aphid and tur pod bug were recorded in IPM and Non IPM fields and used to work out per cent insect control using the following formula:

Percent insect control= Population of insect in Non IPM – Population of insect in IPM X 100 / Population of insect Non IPM

Besides these, 50-100 pods of were harvested across the field to ascertain the pod damage. Pod damage due to individual pod borer species was assessed based on their damage symptoms. At the time of harvesting yield was recorded both In IMP and Non IPM and cost benefit ratios were worked out using the following formula (Pandey *et al.*, 2016):

C : B= Additional income over Non IPM / Additional cost over Non IPM.

## RESULTS AND DISCUSSION

Table 1 and 2 reveals the effect of IPM and non-IPM module on the population of lepidopteran and sucking insects on pigeonpea. During 2014, the mean larval population of *Helicoverpa armigera* in different management modules ranged from 1.00 per plant to 2.00 per plant (Table 1). Minimum mean larval population (1.00 per plant) was recorded in the plot treated with IPM module and maximum mean larval population (2.00 per plant) in the plot in which IPM module was not applied. In case of *Maruca vitrata* minimum mean larval population (1.48 per plant) and minimum number of webs (3.88 per plant) was recorded in the plot treated with IPM practices, whereas, maximum in mean larval population (2.45 larvae / plant) and maximum number of webs (4.63 per plant) was recorded in non-IPM plot. During 2014, for sucking insect complex, minimum mean jassid population (5.00 per plant) was observed in IPM plot as compared with non IPM module (9.87 jassids per plant) (Table 2). In case of aphids, minimum mean population of 6.55 per 50 shoots was recorded for plot in which IPM module was applied as compared with 15.56 aphids/50 shoots in non-IPM module. Tur pod bug population was ranged from 3.45/plant in IPM plots to 5.00 bugs/plant in non-IPM plots.

During 2015, the mean larval population of *H. armigera* and *M. vitrata* in both management modules ranges from 1.45 per plant to 3.00 per plant and 1.67 per plant

**Table 3.** Evaluation of IPM module on bases of percent pod damage in Pigeonpea (Kharif, 2014 - 2015).

| Pod Borers | Pod damage (%) | | | |
|---|---|---|---|---|
| | 2014 | | 2015 | |
| | IPM | Non IPM | IPM | Non IPM |
| *M. vitrata* | 4.93 | 5.46 | 3.56 | 5.76 |
| *H. armigera* | 2.34 | 3.67 | 1.56 | 2.98 |
| *M. obtuse* | 15.87 | 15.98 | 14.32 | 15.98 |
| Mean | 7.71 | 8.37 | 6.48 | 8.22 |
| P (0.05 %) | 0.103 | | 0.009 | |

**Table 4.** Economic analysis of IPM module Pigeonpea (Kharif, 2014 - 2015) at Pantnagar.

| Treatments | Yield 2014 (kg/ha) | Yield 2015 (kg/ha) | Pooled yield (kg/ha ) | Increase in yield (%) | Additional yield (Rs/ ha ) | Additional Income (Rs/ ha ) | Additional cost (Rs/ha ) | Net return (Rs/ ha) | C:B ratio |
|---|---|---|---|---|---|---|---|---|---|
| IPM | 1275 | 1298 | 1286.5 | 30.97 | 398.5 | 23910 | 8245 | 15665 | 1: 2.89 |
| NON IPM | 987 | 789 | 888 | - | - | - | - | - | - |

*Market price 60kg/ha, IPM Practices: Chlorantraniliprole 18.5 SC = Rs 2919.00, Neem soap@10g/lit= Rs250.00, *Trichoderma* spp. @10g/kg of seed = Rs 100, Bird perches @ 50/ha= Rs500, Acetamiprid 20SP=Rs 1676, Labour = Rs 1000

to 3.34 per plant, respectively. Minimum mean *H. armigera* larval population (1.45 per plant) was recorded in the plot treated with IPM module and maximum mean larval population (3.00 larvae per plant) in the plot in which IPM module was not applied. In case of *M. vitrata* minimum 1.67 larvae per plant and 3.89 webs per plant was recorded in the plot treated with IPM practices whereas, maximum mean larval population 3.34 larvae per plant and 5.00 webs per plant was recorded in non-IPM plot (Table 1). The result was accordance of Bhede *et al.* (2015) who reported mean number of webbings by larvae was less in IPM (0.09/ plant) as compared to Non IPM fields (0.16/ plant) in pigeon pea. For jassids, minimum mean population (6.00 jassids/plant) was recorded in IPM as compared with non IPM module in which 13.00 mean population was recorded. Similar trend was recorded in case of aphids and tur pod bug with minimum mean population 12.35 aphids/plant and 3.22 bugs/plant, respectively in IPM, whereas, 16.00 aphids/plant and 5.50 bugs/plant was observed in non IPM module. Results showed that insect pests of pigeonpea were effectively managed by IPM practices over non-IPM. Hence, the IPM program successfully served as an effective way to replace the traditional use of insecticides being used earlier in pigeon pea (Chandrakar and Shrivastava 2002, Mittal and Ujagir 2005, Meena *et al.* 2006, Srinivasan and Durairaj, 2007, Dodia *et al.* 2009, Sharma *et al.* 2015) and in chickpea crop (Singh *et al.* 2009). The IPM program was provided 50.98 %, 44.69 %, 19.17 %, 51.59 %, 40.36 % and 36.17 % pooled control of *H. armigera, M. vitrata,* webbings, jassids, aphids and tur pod bug, respectively in 2014-2015 (Tables 1 and 2). Pandey *et al.* (2016) also reported more than 50 percent control of lepidopteran and sucking insects of cabbage in IPM plots over Non IPM.

The results of Table 3 established that during 2014, the pod damage by lepidopteran borers pests viz., *H. armigera* and *M. vitrata* were 2.34 % and 4.93 % in IPM as compared to 3.67 % and 5.46 % pod damage, respectively in non IPM module. Similar trend was recorded during 2015 with 1.56 % and 3.56 % pod damage by *H. armigera* and *M. vitrata* as compared to 2.98 % and 5.76 % pod damage, respectively by both insects in non IPM module. Gajendran *et al.*, 2006 also recorded minumu pod damage (3.8 % and 2.4 %) by *Maruca* and *H. armigera*, in IPM treated plot for blackgram. For pod fly, minimum percent pod damage was recorded 15.87 % in plot treated with IPM and maximum 15.98 per cent pod damage were observed in non IPM plot during 2014. Similarly, in 2015, the minimum 14.32 % pod fly damage was recorded in plot treated with IPM with 15.98 % pod fly damage in non IPM. Visalakshmi *et al.*, 2005 found IPM component best in reducing the pod damage (10.4 %) with highest grain yield (1264.4 kg/ha). Similarly, Samiayyan and Gajendran (2009) have successfully demonstrated a viable and workable IPM module for pod borer, *H. armigera* management in pigeonpea in Tamil Nadu.

In IPM demonstration field higher pooled grain yield (1286.5 kg/ha) was recorded in IPM field against non IPM (888 kg/ha) which resulted benefit cost ratio of 1:2.89 (Table 4). This finding is supported by Srinivasan and Philip Sridhar (2008) recorded higher grain yields (728 kg/ha) from the IPM modules in pigeonpea and Cost: Benefit of 1:2. Similarly Singh *et al.* (2003), Srinivasa Rao and Dharma Reddy (2003) observed more CB ratio in IPM fields for pigeon pea than in farmers' practices. Whereas, Gajendran *et al.* (2006) observed more C: B ratio in IPM fields for blackgram than in farmers' practices.

## Conclusion

It was concluded that new generation insecticides like Chlorantraniliprole 18.5SC @ 30 g a.i./ha; Neem soap @ 10 g/lit and Acetamiprid 20 SP @ 20 g a.i./ha coupled with seed treatment *Trichoderma* spp. @ 10 g/ kg of seed, Sole, bird perches @ 50/ha were quite effective against Lepidoptera and sucking pest insect pests without adverse effect to the environment and also reduced the cost of production by reducing number of sprays representing IPM as more profitable than chemical pesticidal spray with highest benefit cost ratio in pigeonpea. Hence, adoption of studied IPM module could increase the yield of pigeon pea with lower cost of production would be benefiting the farmers.

## REFERENCES

Anonymous (2016). Annual Report. All India Co-ordinated Research Project on Pigeonpea. IIPR, Kanpur.

Bhede, B. V., Sharma, O. P., Badgujar, A. G., Bhagat, S., Bhosle, B. B. and Khullar, M. (2015). Impact of area-wide integrated pest management strategies on pests of pigeonpea and yield in Marathwada region of Maharashtra, India. *Legume Research,* 38 (1): 101-108

Chandrakar, H. K., Shrivastava S. K. *(*2002). Evaluation of some combinations of match (Lufenuron) against pod damaging pests in pigeonpea. *Journal of Applied Zoological Research,* 13*:* 206–207

Dodia D. A., Prajapathi B. G. and Asharya S. (2009). Efficacy of insecticides against stem borer, *H. armigera*, infesting Pigeonpea*. Journal of Food Legumes,* 22*:*144–145

FAOSTAT (2015). Compared data of pigeonpea production of India with other countries retrieved July, 10 2016 from http://faostat.fao.org/site/339/default.aspx.

Gajendran ,G., Chandrasekaran, M. and Jebaraj, S. (2006). Evalution of Integrated Pest Management Module against major insect pest of Blackgram in Rainfed Ecosystem. *Legume Research.,* 29 (1): 53 – 56

ICRISAT (2008). Pigeonpea climbs the mountains of Uttarakhand. retrieved July, 10 2016 from http://www.icrisat.org/newsroom/news-releases/icrisat-pr2008 -media19.htm

Kranthi, K. R., Jadhav, D. R., Kranthi, S., Wanjari, R. R., Ali, S. S. and Russell, D. A. (2002). Insecticides resistance in five major insect pest of cotton in India. *Crop Protection,* 21: 449-460

Meena, R. S., Srivastava, C. P. and Joshi, N. (2006). Bioefficacy of some newer insecticides against the major insect pests of short duration pigeonpea. *Pestology,* 30: 13–16

Mittal, V. and Ujagir, R. (2005). Evaluation of naturalize Spinosad 45 SC against pod borer complex in early pigeonpea*. Indian Journal of Plant Protection,* 33: 211–215

Pandey, A. K., Kumar, Bijendra and Dev, C. (2016). Validation of IPM module against major insect – pest and diseases of cabbage in mid-hills of Uttarakhand. *Journal of Hill Agriculture*, 7 (1): 96-101

Puri, S. N. and Hem, Saxena.( 2003). Menace of *Helicoverpa* on pulse crops- a continuing challenge. In National Symposium on Pulses for Crop Diversification and Natural Resource Management, December, 20-22, 2003, IIPR, Kanpur. P.14-15

Samiayyan, K. and Gajendran, G. (2009). Evaluation and demonstration of pigeonpea IPM module for pod borer management. *The Madras Agricultural Journal*, 96 (7-12): 401-403

Sharma, O. P.. Bantewad, S. D, Patange, N. R., Bhede, B. V., . Badgujar, A. G., Ghante, P. H., Kadam, M., Bhagat, S.and Kumari, A. (2015). Implementation of Integrated Pest Management in Pigeonpea and Chickpea Pests in Major Pulse-Growing Areas of Maharashtra. *Journal of Integrated Pest Management,* 15(1):12

Singh H. R., Singh R. N., Yadav K. G., Yadav A. (2009). Efficacy and economics of some bio-pesticide in management of Helicoverpa armigera (Hub) on chickpea. *Pestology,* 33: 36–37

Singh, H. M., Ali, S., Singh, R. A., Chakraborti, D. K., Singh, V. K., Rajput, S. K. S. and Srivastava, D, K. (2003). Integrated pest management in pigeonpea. *Annals of Plant Protection Sciences,* 11(1): 145-146

Srinivasa Rao, M., Dharma Reddy, K., 2003. IPM of Pod borers in Long Duration Pigeonpea. *Annals of Plant Protection Sciences,* 11 (1): 26-30

Srinivasan T., Durairaj C. (2007). Newer insecticides against pod borer complex of pigeonpea with special reference to Helicoverpa armigera and Melanagromyza obtusa. *Indian Journal of Plant Protection,* 35: (1) 47–49

Srinivasan, G. and Philip Sridhar, R. N. (2008). Evalution of Integrated Pest Management Module against majoe insect pest of rainfed pigeon pea. *Legume Res.,* 31(1): 60 – 62

Sujithra, M. and Subhash, C. (2014). Seasonal incidence and damage of major insect pest of Pigeo pea *Cajanus cajan* ( L.). *Indian Journal of Entomology*, 76 (3): 202-206

Ujagir, R. (2000). Field efficacy of insecticides against pod borer complex in early pigeonpea (*Cajanuscajan* (L.) Millsp. at Pantnagar, North India. *Annals of Plant Protection Sciences,* 71: 19-25

Visalakshmi, V., Ranga Rao, G. V. and Arjuna, P. R. (2005). Integrated pest management againt *Helicoverpa armigera* Hubner in chickpea*. Indian Journal of Plant Protection,* 33 (1): 17-22

Wadaskar, R. M., Bhalkare, S. K. and Patil, A. N. (2013). Field efficacy of newer insecticides against pod borer complex of pigeonpea, *Journal of Food Legumes*, 26