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IMPACT OF TECHNOLOGY APPLICATION PROGRAMME (FLD) ON MANAGEMENT OF CHICKPEA POD BORER (*HELICOVERPA ARMIGERA* HUBNER) UNDER CLIMATIC SCENARIO OF BUNDELKHAND INDIA

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ABSTRACT

Chickpea is an important pulse crop of Bundelkhand region, its productivity is hampered due to various abiotic and biotic stresses, encountered during the period of crop growth as well as at the time of storage. The management of these factors individually, may become uneconomical as well as time and resource consuming. Therefore, a frontline demonstration on integrated pest management (IPM) module for chickpea in rainfed situation of bundelkhand was carried out at twenty farmer's field during two consecutive cropping seasons of *Rabi*, 2021-22 and 2022-23 to minimize the cost of cultivation and ensure higher monetary returns from chickpea. The observations documented revealed that IPM module was found significantly superior over practices followed by farmers. The lower average pod damage (8.40%), higher average incremental yield advantage over existing practices of farmers (6.64q/h), net return (Rs. 61532.0) and B:C Ratio (2.15) were recorded from plots having IPM module in chickpea crop.

Keywords: Bundelkhand, Chickpea, Climatic, IPM module and Pod borer. FLD (Frontline Demonstrations)

Introduction

Globally, chickpea is cultivated on 15 million hectares, produced over 18.1 million tons during 2022-23 (Anonymous, 2023). India is the largest producer of this crop, followed by Australia, Turkey and Ethiopia. In 2022-23, India produces about 13.5 million tons of chickpea, contributing approximately 74.6 per cent of the global production. Chickpeas contribute nearly 50 per cent of India's pulse production. The major producing states are Maharashtra (2.631 million hectares), Madhya Pradesh (2.346 million hectares), Rajasthan (1.938 million hectares), Uttar Pradesh (0.682 million hectares), Karnataka (0.962 million hectares) and Gujarat (0.631 million hectares) Anonymous, 2024. Traditional methods of cultivation, heavy prevalence of insect-pests and diseases as well

as semi-arid farming situations are major regulating factors in the chickpea productivity. The most economically important pests are chickpea pod borer, cutworms, pulse beetle, dry root rot, wilt and weeds. The severe problems of cutworms, dry root rot and weeds occurred during vegetative phase of crop growth. Whereas, pod borer and wilt infest the crop heavily during its reproductive phase. The chickpea pod borer remains active from germination till harvest of the crop, while pulse beetle infests the crop in storage. With these backgrounds, a frontline demonstration on management of chickpea pod borer in rainfed situation of Bundelkhand was carried out at farmer's field with the objective to establish the production potential of chickpea.

Material and Methods

The frontline demonstrations on management of chickpea pod borer in rainfed situation of bundelkhand were carried out at the field of 20 farmers during *Rabi*, 2021-22 and 2022-2023. The farmers were selected on the basis of participatory rural appraisal (PRA), farmer's interest to participate as well as site uniformity. The frontline demonstration includes several activities as capacity development of farmers participated, method demonstrations, scientist visit to farmer's field and field day. The management module for chickpea pod borer had following components as selection of suitable site (field) and variety + summer ploughing + seed dressing/treatment + soil health management + timely sowing + intercropping with mustard/linseed + de-topping/ nipping + weed management + water management + monitoring of key insect-pest through pheromone traps + facilitation of natural predation of insects through erection of bird perches + need based and judicious use of safer pesticides. The impact of IPM module was observed with respect to existing practice of farmers for

chickpea cultivation. The chickpea var. JG-36 was grown at farmer's fields by following recommended agronomic practices, which includes above mentioned components of IPM module. The amount of insecticides required (ml or gram per liter of water) was calculated by using formula:

$$\text{Amount of insecticides (ml or gram/liter water)} = \frac{\text{Per cent concentration required (\%)} \times 1000}{\text{Per cent active ingredient (\%)}}$$

The effect of management (IPM) module for key insect-pest (pod borer) in terms of per cent pod damage was calculated by using the formula given below:

$$\text{Percent pod damage} = \frac{\text{Number of damaged pods}}{\text{Total number of pods}} \times 100$$

The yield of crop was recorded from each farmer's field and calculated treatment wise mean yield. The benefit: cost (B: C) ratio was also computed by the total cost of cultivation and net return obtained from each plot. It was calculated by using the formula:

$$\text{Benefit : cost ratio} = \frac{\text{Net return (Rs./ha)}}{\text{Cost of cultivation (Rs./ha)}}$$

Table 1: Practices followed in plots of IPM Module and existing practices of farmers

Sr. No.	Particulars	IPM module	Existing practices of farmers
1.	Farming situation	Rainfed	Rainfed
2.	Type of soil	Black Cotton (clayey rich)	Black Cotton (clayey rich)
3.	Summer ploughing	Done	Not done
4.	Name of crop	Chickpea	Chickpea
5.	Name of variety	RVG-236	RVG-236
6.	Seed rate	100 kg/ha	125kg/ha
7.	Seed dressing/treatment	Carbendazim 12% + Mancozeb 63WP @ 2.0 gram/kg seed	NA
8.	Dose of fertilizers	24:64:32 :: N:P:K	21.6:55.2:00 N:P:K
9.	Sowing Method	Seed drill	Seed drill
10.	Intercropping with	Mustard/linseed	NA
11.	Monitoring	Pheromone trap @ 5 per ha	NA
12.	De-topping/ Nipping	25-30 days after sowing	40-50 days after sowing
13.	Weed management	Manual	NA
14.	Water management	Sprinkler	Flood
15.	Bird perch	Erected @ 25 per ha	NA
16.	Application of Insecticide	Economic Threshold Level (ETL)	Pod formation

Statistical analysis

The observations recorded were subjected to transformed and analyzed statistically by appropriate software. Critical difference for technology options were computed at 5% level of significance using one-way analysis of variance (ANOVA).

Result and Discussion

The influence of frontline demonstration on management of chickpea pod borer was analyzed on

the basis of changes in knowledge, skills and attitudes among farmers due to their participation in capacity development as well as method demonstrations programmes conducted during the period of demonstration, per cent pod damage at the time of maturity, crop productivity and economic analysis of technology options taken into consideration.

Effect of IPM module on chickpea pod damage

The observations recorded on per cent pod damage at time of maturity indicated that the lowest

average pod damage (10.4 & 6.8%) was recorded from plots having IPM module followed by existing practices of farmers (22.8 & 20.6%) during *Rabi*, 2022-23 & 2023-24 respectively. The influence of IPM module on minimizing the per cent pod damage differed significantly between each other (Table-1). These results are supported with the findings of Vikram *et al.* (2000); Sanap *et al.* (2001); Singh, *et al.* (2002) and Parmar *et al.* (2015), who reported that the crop sown later suffered most from pod borer infestation as compared with which was sown earlier. Early sowing of chickpea resulted in low larval population of pod borer and pod damage per cent in Indian condition. In general, the larval population of pod borer was less in the crop sown in October in comparison to the crop sown in November under Indian condition (Anonymous, 2013). Likewise, Mahmudunnabi *et al.* (2014) reported that the sowing of chickpea at optimum time reduced pod damage caused by chickpea pod borer. As per the report of Ahmad (2003), the intercropping of chickpea with linseed and mustard has been reported to significantly lower the pod damage as compared to chickpea sole crop. Borah *et al.* (2010) observed that the intercropping of chickpea with linseed generally delayed the appearance of major pests and reduced their incidence. According to a report published by Lal *et al.* (2002) and Tripathi *et al.*, (2008), minimum pod damage and larval population were found in Chickpea + Mustard Followed by Chickpea + barley and Chickpea + Wheat. Several species of insectivorous birds have been found to feed on insect-pests of different crops, including pod borer (Chakravarthy, 1988), which have been known to reduce the larval population to the extent of 84% in Punjab, India. The beneficial role of insectivorous birds in insect-pest management has not received much recognition beyond faunistic documentation. This is mainly due to over dominance of broad spectrum insecticides in plant protection scenario (Gopali *et al.*, 2008). The minimum pod damage was recorded from plots of IPM module due to comparatively lesser infestation of pod borer. The IPM practices followed in chickpea plots affected the population buildup of targeted insects due adverse micro environments created in agro-ecosystem of chickpea.

Chickpea productivity and economic analysis module

The crop productivity and economics of module revealed that the plots had IPM module produced the maximum yield per unit area as 15.68 and 17.42 q/ha, however existing practices of farmers gave the minimum productivity of 9.16 and 10.67 q/ha during

both the cropping season of *Rabi*, 2022-23 & 2023-24, respectively (Table- 2). Mahmudunnabi *et al.* (2014) supported the finding and reported that the IPM package provided the highest yield. According to Singh *et al.* (2002) and Borah (19998), the grain yield of chickpea was decreased as sowing was delayed, indicating a direct correlation with pest incidence. Tripathi *et al.*, (2008), highest grain yield was observed in Chickpea + Mustard Followed by Chickpea + barley and Chickpea + Wheat. The highest average gross returns of Rs. 90032.0/ha was obtained from plots having management module. Correspondingly, cost of production as well as net returns (Rs. 28500/ha & Rs. 61532/ha) was found higher from fields, where management module was implemented as compared to farmer's practices (Rs. 22350.0/ha & 43619.8/ha). The benefit: cost ratio of management module (2.15) was computed higher as compared to farmer's practices (1.41) (Fig.-1). In line of above observations, Chavan *et al.* (2003) reported higher return per rupees investment with the IPM module than farmer's practices. These observations were also supported by Bhosale *et al.*, (2009) and Bajia and Srivastava (2022). Lal *et al.* (2002) and Borah *et al.*, (2010), intercropping in chickpea with mustard/ linseed showed increased net return. Regular monitoring of insect-pests is a vital component for any IPM module, which helps to make decision on pest management actions to be initiated. An effective management strategy always depends on accurate monitoring of damaging stages of the insects. Pheromone trap can be used as a monitoring tool for chickpea pod borer because moth catch is positively correlated with the larval count (Prabhakar *et al.*, 1998). The management (IPM) module created the favorable environment to produce better yield, minimized the risk of biotic and abiotic stresses and augmented the activities of natural enemies in chickpea agro-ecosystem. Thus, it had recorded lowest per cent plant/pod damage; highest yield and B: C ratio.

The frontline demonstrations on management of chickpea pod borer under rainfed situation of Bundelkhand region carried out in participatory mode with interested farmers during two consecutive crop seasons and concluded as management (IPM) module was found significantly superior over existing practices of farmers. The lowest per cent pod damage, highest incremental yield advantage, better net return and favorable benefit: cost ratio was recorded from plots having IPM module for chickpea pod borer. Majority of the farmers perceived problem of seed dressing/treatment, weed management, water management and safe as well as judicious application of pesticides in agro-ecosystem of chickpea under the climatic scenario of Bundelkhand region. Instead of

that the significant changes in knowledge, skill and attitude of farming communities were perceived due to their capacity development, method demonstrations

scientist visit to farmer’s field and field day organized during the course of front line demonstration.

Table 2: Extent of pod damage in different technology options during cropping seasons

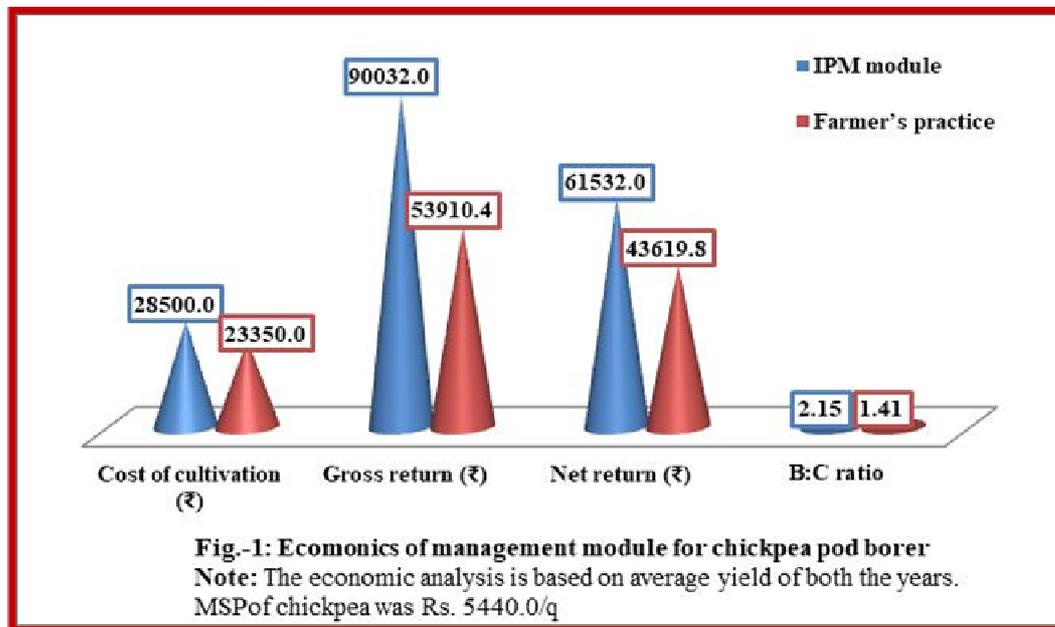
Technology	Extent of pod damage (%)			Pod damage reduced over control	Percent pod damage decrease over control
	2022-23	2023-24	Average		
IPM Module (Intervention)	10.4 ^a (3.30)	6.8 ^a (2.70)	8.6 ^a (3.02)	13.1 ^a (3.69)	60.36 ^a (51.27)
Farmer’s practices (Check)	22.8 ^c (4.83)	20.6 ^c (4.59)	21.7 ^{bc} (4.71)	0.0 (0.71)	0.00 (4.05)
SEm±	0.43	0.36	0.40	0.43	5.94
CD_(0.05)	1.38	1.15	1.27	1.38	19.01
F-test	**	**	**	**	**

Figure in parentheses are statistically transformed values

Table 3: Effect of management module on yield of chickpea during cropping seasons

Technology	Yield (q/ha)			Incremental yield over control (q/ha)	Percent increase in yield over control
	2022-23	2023-24	Average		
IPM Module (Intervention)	15.68 ^a	17.42 ^a	16.55 ^a	6.64 ^a (2.67)	67.00 ^a (55.24)
Farmer’s practices (Check)	9.16 ^c	10.67 ^c	9.91 ^c	0.00 (0.71)	0.00 (4.05)
SEm±	1.90	2.12	2.01	0.31	6.40
CD_(0.05)	6.08	6.77	6.43	1.01	20.47
F-test	**	**	**	**	**

Figure in parentheses are square root transformed values



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