Management of gram pod borer, *Helicoverpa armigera* Hub. in chickpea in Saran District, Bihar, India

Abstract:

Field experiment was conducted for management of gram pod borer in chickpea during *rabi* season in 2019/20 and 2020/21. Two technologies, namely two times spray of profenophose 50 EC, and the use pheromone trap at flowering time and spray of spinosad 45 SC @ 50% practices of spraying quinalphos in eight farmers' field using variety "BG-372". The results of two years pooled data revealed that the use pheromone trap at flowering time and spraying of spinosad 45 SC @ 50% pod formation were the most effective against gram pod borer management. The least per cent pod infestation (1.75%) was recorded in these technologies followed by the per cent pod infestation recorded (2.74%) in two times spray of profenophos 50 EC at 50% flowering and pod formation stage. The highest pod infestation was recorded (7.82%) in farmers' practices. Similarly, maximum grain yield (14.84 q/ha) was recorded in using pheromone trap at flowering and spraying spinosad 45 SC @ 50% pod formation stages followed by the yield record in spraying profenophos 50 EC (12.26 q/ha) and the yield record in farmers' practices (9.42 q/ha). The cost benefit analysis showed that the net return and benefit cost ratio was also higher in using pheromone trap and spraying spinosad 45 SC (₹ 52763/ha and 2.48:1) than the net return and benefit cost ratio in the farmers' practices (₹ 28544/ha and 1.55:1), respectively.

Key word: Pheromone trap, spinosad, Benefit cost ratio

Introduction:

Gram commonly known as "Chickpea' or Bengal gram is the most important pulses crop of India. In India, chickpea accounts for about 45% of total pulses production. Similar to the case of other pulses, India is the major chickpea producing country and contributing for over 75% of total world chickpea production. The chickpea production in the country has gone up from 3.65 to 9.53 million tons between 1950/51 and 2013/14, registering a modest growth. During the period, while the area has also gone up from 7.57 to 9.93 million ha, the yield has steadily increased from 482 Kg/ha to 960 Kg/ha (Maurya and Kumar, 2018). There is steady decline in the area, production and productivity of the crop. The farmers are losing the ground due to heavy

losses from pests and disease. Gram pod borer, *Helicoverpa armigera* (Hub.), is the most damaging pest in most of areas where chickpea is grown. *H. armigera* is a charismatic and one of the most dominant insect pests in agriculture. This pest damages the chickpea plants from seedling stage to crop maturity stage and its larvae can thrive on leaves, tender twigs, flowers and pods. After pod formation, the larvae bore into the pods and feed on the seed inside and cause considerable loss to seed yield. Its larvae feed on young pods by making holes and eat the developing seeds by inserting the half portion of their body inside the pod. Chickpea is attacked by more than 250 species of insect of which pod borer *Helicoverpa armigera* Hubner is the major pest in most parts of the country (Shanower *et al.*, 1999). Excessive and indiscriminate use of pesticides to control this pest has resulted in undesirable ecological changes (Mahappatro and Gupta, 1998). Productivity losses range from 20 to 90 per cent depending upon severity of insect attack (Tripathi, *et al.*, 2023). In view of the above, management of gram pod borer through different chemicals in holistic manner incorporating judicious use of newly introduced modern pesticides seem to be best alternative. Hence, the present investigation was carried out to Management of gram pod borer, *H. armigera* Hub. on chickpea in Saran District,Bihar.

MATERIALS AND METHODS

The on farm trails were conducted at eight farmer's field of Saran District (Bihar) for two consecutive years of 2019/20 and 2020/21. The trials were laid out in randomized block design with eight replications. Chickpea crop was sown in last week of October 2019 and 2020. All the agronomical practices recommended for the crop were followed. Two technologies, namely two spray of profenophos 50 EC @ 1.5 ml/liter of water at 50% flowering time and 50% pod formation time, and the use of pheromone trap @ 20/ha at flowering time and spray of sponosad 45 SC @ 0.3ml/liter of water at time of 50% pod formation were compared with farmers' practice of spraying quinalphos @ 2ml/liter of water at time of pod formation in eight farmers' field using the chickpea variety 'BG-372'. After treatments application, observations were made and data on numbers of infested pod/m^2, per cent pod infestation, weight (g) of harvested grain/m^2 and calculate total yield/ha were recorded. Gross return ₹ /ha, net return ₹ /ha and cost-benefit ratios were also calculated. Data analysis was carried out on the two years data, and per cent pod infestation was transformed to Arc Sine.

Pod damage (%) $= \frac{No.of\ afected\ \ pods}{Total\ \ no.\ of\ pods} \text{x}\ 100$

Benefit Cost Ratio

Gross return was calculated by multiplying total yield with the market price of the produce. Cost of cultivation and cost of treatment imposition was deducted from the gross returns, to calculate net returns and cost benefit ratio by the following formula:

$$\text{B : C} = \frac{Net\ returns}{Total\ cost\ of\ cultivation}$$

Results and Discussion:

The results showed that the number of infected pod/m^2 and per cent pod infestation by *H. armigera* on chickpea for management of this pest through different technology during 2019/20 and 2020/21 in presented in table 1 and 2. The data revealed that use of technology were significantly superior in comparison to farmers' practices. The number of infected pods and per cent pod infestation range from 47.12/m^2 to 153.50/m^2 and 2.01% to 9.38% pod infestation in 2019/20 and 62.63/m^2 to 137.77/m^2 and 1.49% to 6.26% pod infestation in 2020/21, respectively. Significantly minimum pod infestation (54.88/m^2) was recorded in the use of pheromone trap @ 20/ha at flowering time and spray of sponosad 45 SC @ 0.3ml/liter of water at time of 50% pod formation followed by 81.37//m^2 two times spray of profenophos 50 EC @ 1.5 ml/liter of water at 50% flowering time and 50% pod formation time as compared to farmers' practice of spraying quinalphos @ 2 ml/liter of water at time of pod formation (145.64/m^2). Similarly, significantly minimum per cent pod infestation showed in use of pheromone trap @ 20/ha at flowering time and spray of sponosad 45 SC @ 0.3ml/liter of water followed by two times spray of profenophos 50 EC @ 1.5 ml/liter of water at 50% flowering time and 50% pod formation time compared with farmers' practice in both year i.e. 2.01% 3.33% and 9.38% during 2019/20 and 1.49%, 2.14% and 6.26% during 2020/21, respectively.

Moreover, significantly maximum grain weight was observed in use of pheromone trap @ 20/ha at flowering time and spray of sponosad 45 SC @ 0.3ml/liter of water followed by by two times spray of profenophos 50 EC @ 1.5 ml/liter of water at 50% flowering time and 50% pod formation time compared with farmer's practices in both respective years i.e. 128.81 g/m^2, 105.29 g/m^2 and 89.48 g/m^2 and 168.57 g/m^2, 139.80 g/m^2 and 98.78 g/m^2 area during 2019/20

and 2020/21, respectively. The total yield per hectare was also calculated in technology option II (14.84 q/ha) followed by technology option I (12.26 q/ha) and farmer's practices (9.42q/ha). Overall, result farmer's practices was found less effective in checking pod and grain damage due to pod borer in comparison to new molecule insecticides. These results agree with the report of Prasad and Jha (2014) that minimum pod and grain damage and maximum yield produce was recorded in spray of spinosad 45 SC @0.33 ml/liter water. It was also reported that spinosad 45 SC @ 0.33 ml/liter water gave the highest percentage of reduction of pod borer Rashid *et al.* (2003), Ahmed *et al.* (2004), Tripathi *et al.* (2023) and Nitharwal *et al*. (2017).

While judging the utility of any technology in pest management programme, it is not only evaluated by its relative potency against the target pest and the period for which its application provides protection to the crop, but the economics of treatments also remained a major consideration. The data recorded that the technology option II gave maximum cost benefit ratio of 2.48:1 (Table -2). Followed by technology option I (1.90:1) and farmer's practices (1.55:1). Gowda *et al*. (2007) who reported that the spinosad 45 SC recorded the highest yield and maximum cost benefit ratio. Nitharwal *et al*. (2017) also recorded most economical treatment of spinosad 45 SC (3.40:1).

Conclusion :

The present finding clearly indicate that the new generation insecticides like spinosad was effective against gram pod borer, *H. armigera* with good yield return. Furthermore, the benefit cost ratio was also more with the use of pheromone trap @ 20/ha at flowering time and spray of sponosad 45 SC @ 0.3ml/liter of water at time of 50% pod formation. Hence, it is suggested that the effective use of pheromone trap @ 20/ha at flowering time and spray of sponosad 45 SC @ 0.3ml/liter of water at time of 50% pod formation may be avoid the development of resistance.

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Table 1: Incidence of gram pod borer, *Helicoverpa armigera* Hub. on chickpea crop during *rabi* 2019/20 and 2020/21

Treatments	No. of infected pod /m^2			Pod infestation (%)			Weight of grain/m^2 (g)			Yield q/ha		
	2019/20	2020/21	Pooled	2019/20	2020/21	Pooled	2019/20	2020/21	Pooled	2019/20	2020/21	Pooled
Farmers practice: spraying quinalphos @ 2 ml/liter of water at time of pod formation	153.50	137.77	145.64	9.38 (17.83)	6.26 (14.49)	7.82 (16.16)	89.48	98.79	94.14	8.95	9.88	9.42
Two times spray of profenophos 50 EC @ 1.5 ml/liter of water at 50% flowering time and 50% pod formation time	72.87	89.86	81.37	3.33 (10.51)	2.14 (8.41)	2.74 (9.46)	105.29	139.80	122.55	10.53	13.98	12.26
Use of pheromone trap @ 20/ha at flowering time and spray of sponosad 45 SC @ 0.3ml/liter of water at time of 50% pod formation	47.12	62.63	54.88	2.01 (8.16)	1.49 (7.00)	1.75 (7.58)	128.81	168.57	148.69	12.82	16.86	14.84
SEm±	12.66	13.18	12.92	1.49	0.55	1.02	9.35	10.69	10.02	0.90	1.07	0.99
CD at 5%	27.04	28.28	27.66	3.20	1.17	2.19	19.35	22.93	21.14	1.92	2.29	2.11

Figures in parenthesis are the Arc sine.

Table 2: Economic viability of different technology option in chickpea crop during *rabi* 2019/20 and 2020/21

Treatments	Gross return (₹ /ha)			Cost of cultivation (₹ /ha)			Net return (₹ /ha)			Benefit Cost Ratio		
	2019/20	2020/21	Pooled	2019/20	2020/21	Pooled	2019/20	2020/21	Pooled	2019/20	2020/21	Pooled
Farmers practice: spraying quinalphos @ 2 ml/liter of water at time of pod formation	43631	50388	46982	18859	18017	18438	24772	32371	28544	1.31	1.80	1.55
Two times spray of profenophos 50 EC @ 1.5 ml/liter of water at 50% flowering time and 50% pod formation time	51334	71298	61147	21368	20777	21072	29966	50521	40074	1.40	2.43	1.90
Use of pheromone trap @ 20/ha at flowering time and spray of sponosad 45 SC @ 0.3ml/liter of water at time of 50% pod formation	62498	85986	74015	21546	20957	21251	40952	65029	52763	1.90	3.10	2.48

Not : The sale price of grain was considered as Rs. 4875/q in 2019/20 and Rs. 5100/q in 2020/21.