Comparison of efficacy of a new insecticide for the management of gram pod borer (*Helicoverpa armigera* Hubner) in chickpea

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ABSTRACT

Gram pod borer (*Helicoverpa armigera)* is a very destructive and serious pest of gram and causes serious damage to the crop. Krishi Vigyan Kendra, Samba, Jammu and Kashmir conducted on-farm trials (OFTs) during rabi 2021-22 and 2022-23 at farmers' fields to assess the efficacy of a new insecticide for the management of gram pod borer in gram. Treatments used were chloropyriphos 20EC @ 2 ml per litre of water (farmers' practice), cypermethrin 25EC @ 1.5 ml per litre of water (recommended) and emamectin benzoate (Missile 5SG) @ 0.4 g per litre of water (intervention). During 2021-22, in case of emamectin benzoate (Missile 5SG) @ 0.4 g per litre of water, 76.34 per cent reduction in damage to pods was observed over farmers' practice (chlorpyriphos). The yield of gram was 92.31 per cent higher due to the emamectin benzoate over farmers' practice. During 2022-23, emamectin benzoate caused 78.26 per cent less damage to gram over farmers' practice. There was an increase of 82.14 per cent in yield due to emamectin benzoate application over farmers' practice. In 2021-22, emamectin benzoate resulted in B-C ratio of 4.51 as against 2.52 in cypermethrin and 1.86 in chlorpyriphos treatments. In 2022-23, emamectin benzoate gave a B-C ratio of 4.62 in comparison to 2.63 and 2.08 in cypermethrin and chlorpyriphos treatments respectively. Therefore, the use of emamectin benzoate (Missile 5SG) @ 0.4 g per litre of water can be recommended for the control of pod borer in gram crop under rainfed conditions of Samba, Jammu and Kashmir.

Keywords: Gram pod borer; on-farm trials; emamectin benzoate; cypermethrin; chloropyriphos

INTRODUCTION

Pulses are an important group among the food crops which occupy a unique position in agriculture by virtue of their high protein content. Chickpea (*Cicer arietinum* L), commonly known as Bengal gram, gram or Chana, originated from southwestern Asia, is an important rabi pulse crop of India, which has been considered as King of Pulses (Bhatt and Patel 2001).

Chickpea is characterized by high content of protein and fat and is a good source of soluble fiber and micronutrients. Additionally, chickpea plays a key role in the crop rotation system with cereals to improve soil fertility. Over the last several years, India has been the top producer of chickpea worldwide. In 2021, the production volume of chickpeas in India amounted to almost 12 million metric tonnes. Australia came in second at an estimated 876.5 thousand metric tonnes. Around 15.97 million metric tonnes of chickpeas were produced worldwide (Shahbandeh 2023).

Among biotic factors, chickpea is infested by nearly 60 insect species in which cutworm, *Agrotis ipsilon* (Ratt), gram pod borer (*Helicoverpa armigera* Hub), semilooper (*Autographa nigrisigna* Walk) and aphid (*Aphis craccivora* Koch) are the pests of major importance (Acharjee and Sarmah 2013). Among these, the major damage is caused by gram pod borer which is polyphagous in nature. It is one of the serious pests of chickpea which feeds on more than 150 crops throughout the world (Vinutha et al 2013).

H armigera Hubner is considered to be the most serious insect pest (Anwar and Shafique 1993) causing on average 30-40 per cent damage to pods (Metcalf and Luckmann 1975, Saleem and Yunus 1982, Rahman 1990, Hashmi 1994) which may increase to 80-90 per cent in conducive environments (Sehgal and Ujagir 1990, Sachan and Katti 1994).

It is estimated that *H armigera* alone is responsible for losses over Rs 3,500 million annually in India despite heavy application of pesticidal inputs (Kumar and Kapur 2003). *H armigera* alone accounts for the consumption of half of the total pesticides used in India for the protection of different crops (Suryavanshi et al 2008).

MATERIAL and METHODS

The experiment was conducted at farmers' fields during rabi 2021-22 and 2022-23 with an objective to assess the efficacy of a new insecticide for the management of gram pod borer in gram. During 2021-22 and 2022-23, five farmers were selected and a trials on chickpea were laid out in 0.4 ha of each of farmers' fields.

The recommended agronomical practices were followed to raise a good crop. The details of treatments are given in Table 1.

The three treatments used were chloropyriphos 20EC @ 2 ml per litre of water (farmers' practice), cypermethrin 25EC @ 1.5 per litre of water (recommended) and emamectin benzoate (Missile 5SG) @ 0.4 g per litre of water (new intervention).

The incidence of *H armigera* was recorded on regular basis to apply different treatments at appropriate time. The treatments were applied as soon as the larval population reached the economic threshold level ie 1 larva per m linear row length. The required quantity of insecticides was calculated by using the formula as given below:

$$\text{Quantity of insecticide required} = \frac{\text{Volume of water (l/ha)} \times \text{Desired concentration (\%)}}{\text{Strength of insecticide formulation}}$$

Insecticides were sprayed with the help of hand sprayer. Proper care was taken to avoid drift of spray from one plot to another. The pre- and post-treatment observations on larval population of *H armigera* were made under each treatment at five places. The per cent reduction in larval population was determined for each treatment using following formula:

$$\text{Reduction in insect population (\%)} = \frac{\text{Population in treatment} - \text{Population in control}}{\text{Population in control}} \times 100$$

Seed yield of chickpea was recorded on the basis of individual plot. The increase in seed yield of chickpea over control was calculated for each treatment separately by using the following method given by Pradhan (1964):

$$\text{Increase in yield (\%)} = \frac{\text{Yield in treatment} - \text{Yield in control}}{\text{Yield in control}} \times 100$$

The benefit-cost ratio was determined by using the following formula:

$$\text{Benefit-cost ratio} = \frac{\text{Monetary gain over control (Rs/ha)}}{\text{Cost of cultivation/plant protection (Rs/ha)}}$$

On-farm trials were laid out on management of gram pod borer in fields of five farmers over an area of 2 ha.

RESULTS and DISCUSSION

Both emamectin benzoate and cypermethrin lowered and reduced the population of gram pod borer in comparison to farmers' practice (Table 2).

During 2021-22, in case of emamectin benzoate (Missile 5SG) @ 0.4 g per litre of water, 76.34 per cent reduction in damage to pods was observed, whereas, only 46.24 per cent reduction was noticed due to cypermethrin 25EC @ 1.5 ml per litre of water over farmers' practice (chlorpyriphos 20EC @ 2 ml/l of water). The yield of gram was 92.31 per cent higher due to the emamectin benzoate treatment in comparison to 23.08 per cent in cypermethrin over farmers' practice.

Table 1. Treatments applied for assessment/refinement

Treatment	Insecticide used
Treatment 1	Chloropyriphos 20EC @ 2 ml/l of water (farmers' practice)
Treatment 2	Cypermethrin 25EC @ 1.5 ml/l of water (recommended practice)
Treatment 3	Emamectin benzoate (Missile 5SG) @ 0.4 g/l of water (new intervention)

Table 2. Yield, damage caused and benefit-cost ratio due to application of insecticides against gram pod borer

Insecticide used	Yield (q/ha)	Damage (%)	B-C ratio
2021-22			
Chloropyriphos 20EC @ 2 ml/l of water (farmers' practice)	6.50	23.25	1.86
Cypermethrin 25EC @ 1.5 ml/l of water (recommended)	8.00 (23.08)	12.50 (– 46.24)	2.52
Emamectin benzoate (Missile 5SG) @ 0.4 g/l of water (new intervention)	12.50 (92.31)	5.50 (– 76.34)	4.51
2022-23			
Chloropyriphos 20EC @ 2 ml/l of water (farmers' practice)	7.00	23	2.08
Cypermethrin 25EC @ 1.5 ml/l of water (recommended)	8.25 (17.86)	12 (– 47.83)	2.63
Emamectin benzoate (Missile 5SG) @ 0.4 g/l of water (new intervention)	12.75 (82.14)	5 (– 78.26)	4.62

Figures given in parentheses are the per cent values over farmers' practice

During 2022-23, emamectin benzoate caused 78.26 per cent less damage to gram in comparison to 47.83 per cent in cypermethrin over farmers' practice. There was an increase of 82.14 per cent in yield due to emamectin benzoate application as against 17.86 per cent increase due to cypermethrin over farmers' practice.

In 2021-22, emamectin benzoate resulted in B-C ratio of 4.51 as against 2.52 in cypermethrin and 1.86 in chlorpyriphos treatments. Similarly, in 2022-23, emamectin benzoate gave a B-C ratio of 4.62 in comparison to 2.63 and 2.08 in cypermethrin and chlorpyriphos treatments respectively.

Therefore, the use of emamectin benzoate (Missile 5 SG) @ 0.4 g per litre of water can be recommended for the control of pod borer in gram crop under rainfed conditions of Samba, Jammu and Kashmir.

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