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Rathwa MG
College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

Patel VN
College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

Makwana AB
College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

Correspondence
Rathwa MG
College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat, India

Estimation of yield losses due to spotted pod borer, *Maruca testulalis* in cowpea

Rathwa MG, Patel VN and Makwana AB

Abstract
Investigations were carried out to evaluate the yield losses caused by spotted pod borer, *Maruca testulalis* on cowpea during *kharif*, 2015 at College Farm, Junagadh Agricultural University, Junagadh. The results revealed that lower larval population of pod borers was observed in protected plots than unprotected plots. Significantly minimum pod damage (15.10 %) were recorded from protected plots by providing protection with the Spinosad 45 SC 0.009 per cent and Profenophos 50 EC 0.05 per cent alternative at 10 days interval intervals starting from flowering initiation to the pod maturity stage of the crop, 339.93 kg/ha yield loss can be saved. Total avoidable yield loss could be worked out as 41.14 per cent.

Keywords: yield losses, cowpea, *Maruca testulalis* (Geyer), spotted pod borer

Introduction
Cowpea, (*Vigna unguiculata* (L.) Walper) is nutritionally important pulse crop grown in the semiarid and sub-humid tropics of Asia. In India, cowpea is also known as *chola* or *choli, lobia, chavli,* Southern pea and black-eyed bean. It is believed to have been originated in Central Africa. In India, cowpea is cultivated in about 1.5 million hectare with an annual production of 0.5 million tones and average productivity 608 kg/ha (Swaminathan, 2007) [10]. In Gujarat, cowpea (grain legume) is cultivated in about 30470 ha area with an annual production of 322084 tones and average productivity of 845 kg/ha (Anon., 2014-15) [2] whereas, vegetable purpose cowpea occupies an area of 760 ha with an annual production of 6460 (M.T.) average productivity of 8.50 (M.T. /ha). (Mission for Integrated Development of Horticulture (MIDH). Among the various insect-pests, the spotted pod borer *M. testulalis* was reported as a major and the potential pest in Saurashtra region of Gujarat causing considerable damage to cowpea crop by attacking on various parts *viz*., buds, flowers, pods and seeds (Anon, 2015-16) [3]. About 17.37 per cent pod damage was estimated due to *M. testulalis* (Anon., 1989) [1]. The larval stage of the pest can destroyed the flower and tender pods to an extent of 66 per cent in tropics and sub-tropics (Singh and Emden, 1992) [9]. A preliminary survey around Junagadh revealed that the spotted pod borer, *M. testulalis* is key pest of cowpea in this area. The present investigation was carried out to evaluate the population dynamics of spotted pod borer, *M. testulalis* in cowpea.

Material and Methods
The investigations on population dynamics of spotted pod borer, *Maruca testulalis* (Geyer) infesting cowpea was carried out at the college farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *Kharif* 2015. The crop was grown in plot size of 20 m x 10 m and keeping 45 cm x 10 cm spacing between row to row and plant to plant.
The two treatments *viz*., unprotected and protected plots were replicated fifteen times in Sampling Design. Unprotected plots were kept free from insecticides and subjected to the natural infestation of the pests. Whereas, protected plots were kept free from pests' damage through application of pesticides *viz*., Spinosad 45 SC 0.009 % and Profenophos 50 EC 0.05 % alternatively at 10 days intervals starting from flowering initiation to the pod maturity stage of the crop.
The pest population was recorded in both protected and unprotected plots. Total 15 quadrates (100 cm X 90 m) were drawn from protected and 15 quadrates were drown from unprotected plots. From each quadrates randomly five plants were selected and tagged on which observation were recorded.

The yield data of cowpea pods of 15 quadrates from protected and from 15 quadrates from unprotected plots were recorded. The yield difference in protected plots over unprotected was recorded and avoidable loss was worked out by using the following formula (Pradhan 1969).

$$\text{Yield increased (\%)} = \frac{T - C}{C} \text{ X } 100$$

$$\text{Avoidable yield loss (\%)} = \frac{T - C}{T} \text{ X } 100$$

Where, T = Yield of respective treatment (kg/ha)
C = Yield of control (kg/ha)

Results and Discussion

Population of spotted pod borer in protected and unprotected plots of cowpea

The data presented in Table 1 indicated that the larval population of spotted pod borer, *M. testulalis* was non-significantly distributed randomly in treated and untreated plants before first spray and recorded 2.39 and 2.66 larvae per plant. While after first spray pest's population were reduced (0.60 larvae/plant) in the plots receiving insecticidal treatment as compared to untreated plots (2.81 larvae/plant). The similar trend in respect of treated and untreated plots was observed, after second and third spray pests population were reduced (0.65 and 0.35 larvae/plant) in the plots receiving insecticidal treatment as compared to untreated plots (2.43 and 2.18 larvae/plant), respectively.

The similar observation was also noticed by Pachani (2000) [8] showed the larval population of *M. testulalis*, the first peak (3.40 larvae per plant) during 3rd week of August and (1.94 larvae per plant) during 1st week of September in untreated plot. Umbarkar *et al*. (2011) [11] reported that the after first spray pests population were reduced (1.07 to 1.09 larvae/plant) in the protected plots receiving insecticidal treatment as compared to untreated plots (1.53 to 2.62 larvae/plant).

Estimation yield losses caused by the spotted pod borer, *M. testulalis* in cowpea

The study was carried out by using large plot technique. There were two treatments. In one set of treatments, the crop was protected against *M. testulalis* by spraying the recommended insecticide i.e. Spinosad 45 SC 0.009 per cent and Profenophos 50 EC 0.05 per cent alternative at 10 days interval starting from the initiation of flowering. Whereas, in another set the crop was allowed to attack by the *M. testulalis*. The yield of cowpea grain was recorded from protected and unprotected plots are given in Table 2 and depicted in Fig. 1.

The data presented in Table 2 revealed that 15.10 per cent pod damage was recorded from treated (protected) plots, while in case of untreated plots significantly higher pod damage 32.91 per cent was recorded.

The data presented in Table 2 revealed that a significantly higher yield of cowpea grain 826.11 kg/ha was recorded from protected plots, while 486.18 kg/ha was recorded from unprotected plots. The yield increased in protected plots over unprotected plots was 339.93 kg/ha which was 69.91 per cent higher over control.

The result clearly indicated that by providing protection with the effective pesticides against spotted pod borer, *M. testulalis* in cowpea, 339.93 kg/ha yield loss can be saved. Total avoidable yield loss could be worked out as 41.14 per cent.

Very scanty review of literature was found on losses by *M. testulalis* in cowpea. However, Ogunwolu (1990) [6] reported that the yield reduced 72.1 per cent in 1985 and 48.1 per cent in 1986, due to *M. testulalis* on cowpea. Nabirye *et al.* (2003) [5] reported the highest yields of 791 kg/ha with a 51 per cent gain over the farmers' traditional practices by verifying integrated pest management (IPM) technologies for legume pod borer, *M. vitrata* in cowpea. Umbarkar *et al*. (2011) [11] reported 12.94 per cent pod damage by *M. testulalis* with 36.41 per cent avoidable yield loss on cowpea. Oyewale and Bamaiyi (2013) [7] stated that the damage by *Maruca sp*., in cowpea causes low yield and sometimes total yield losses. Maina *et al.* (2014) [4] reported 43 to 45 per cent grain yield loss was recorded in untreated cowpea crop due to legume pod borer, *M. vitrata* during 2008 and 2009 cropping seasons at Nigeria. Thus, the present findings are more or less in similar trends with previous workers, but varied from location to location as reported by above scientists.

Table 1: Population of spotted pod borer in protected and unprotected plots of cowpea

Sr. No.	Treatment	No. of larvae per plant before and after spraying					
		First spray		Second spray		Third spray	
		Before	After	Before	After	Before	After
1.	Protected	1.70*(2.39)	1.05(0.60)	1.45(1.61)	1.07(0.65)	1.17(0.88)	0.92(0.35)
2.	Unprotected	1.78(2.66)	1.82(2.81)	1.88(3.04)	1.71(2.43)	1.66(2.25)	1.64(2.18)
	S. Em.	0.04	0.03	0.03	0.03	0.04	0.03
	CD at 5%	NS	0.09	0.11	0.10	0.10	0.09
	C. V. %	8.08	8.96	9.21	9.70	9.78	9.73

Note: - 1. * $\sqrt{X + 0.5}$ transformation.
2. Figures in parentheses are retransformed values.
3. NS: Non-significant
4. Protected: Spinosad 45 SC 0.009 % and Profenophos 50 EC 0.05 %

Table 2: Loss in yield of cowpea grain due to spotted pod borer during *kharif* 2015

Sr. No.	Treatment	Pod damage (%)	Yield (Kg/ha)	Yield loss (Kg/ha)	Avoidable yield loss (%)	Yield increased over control (%)
1	Protected	22.86*(15.10)	826.11	339.93	41.14	69.91
2	Unprotected	35.00(32.91)	486.18			
	S. Em.±	0.52	16.10	-	-	-
	C. D. at 5%	1.50	46.65	-	-	-
	C. V.%	8.02	9.51	-	-	-

Note: - 1. *Arcsine transformation
2. Figures in parentheses are retransformed values.
3. Protected: Spinosad 45 SC 0.009 % and Profenophos 50 EC 0.05 %

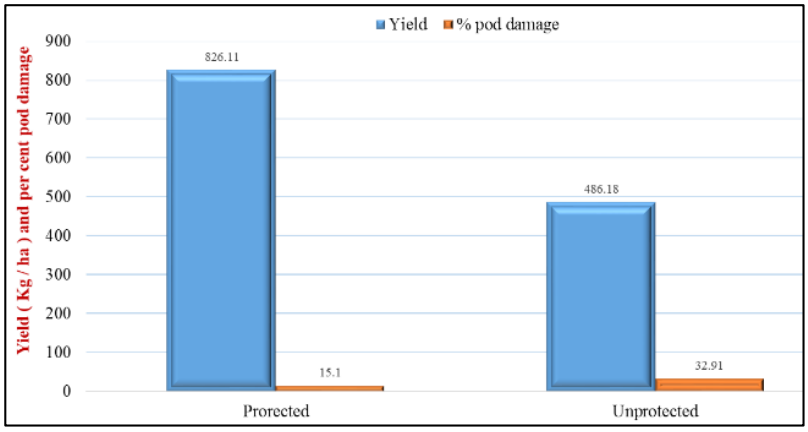

Fig 1: Yield loss and pod damage of cowpea due to spotted pod borer on cowpea during *kharif*, 2015

Conclusion

The result clearly indicated that the significant reduction was recorded in larval population of *M. testulalis* in protected plots as compared to unprotected plots after spraying of Spinosad 45 SC 0.009 per cent and Profenophos 50 EC 0.05 per cent, revealed that a significantly higher yield of cowpea grain 826.11 kg/ha was recorded from protected plots, while 486.18 kg/ha was recorded from unprotected plots. The yield increased in protected plots over unprotected plots was 339.93 kg/ha which was 69.91 per cent higher over control.

The result clearly indicated that by providing protection with the effective pesticides against spotted pod borer, *M. testulalis* in cowpea, 339.93 kg/ha yield loss can be saved. Total avoidable yield loss could be worked out as 41.14 per cent.

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