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Original Research Article

Efficacy of Some Newer Insecticides in Comparison with Botanicals against Pod Borer Complex in Pigeon Pea

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A B S T R A C T

The field experiment was conducted to study the effective botanicals and chemicals insecticides against Pod borer complex on pigeon pea at field of Entomology section, College of Agriculture, Nagpur during *kharif* season of 2016-17, in randomized block design with three replications. Total eight treatments viz., NSE 5%, Neem oil 2% Chlorantraniliprol 18.5 SC, Spinosad 45 SC, Indoxacarb14.5 SC, Emamectin benzoate 5 SG, Flubendiamide 20 WDG, and control (water spray) were studied. The observations on per cent fruiting body damage (on green pod), per cent pod damage at harvest, per cent grain damage at harvest. Flubendiamide 20 WDG emerged out as the most superior one against pigeon pea pod borer complex in reducing per cent fruiting body damage (on green pod) per cent pod damage at harvest, per cent grain damage at harvest. Another treatment Viz., Chlorantraniliprol 18.5 SC, Emamectin benzoate 5 SG and Spinosad 45 SC also perform better and emerged as next effective treatments against pod borer complex and recorded significant per cent fruiting body damage (on green pod), per cent pod damage at harvest, per cent grain damage at harvest. The treatment Indoxacarb 14.5 SC performs better for pod borer complex compared to other treatments including control (water spray). The treatment NSE 5% and neem oil 2 % observed medium, as compared all other treatments except control (water spray). The treatment Flubendiamide 20 WDG recorded as better.

Keywords

Pigeon pea, Pod borer complex, Botanicals, Insecticides

Introduction

Pigeon pea [*Cajanus cajan* (L.) Millsp.] also known as red gram, arhar and tur is second most pulse crop of India next to gram and in Maharashtra 32.37% of area is covered under the pigeon pea crop, generally grown in *kharif* season.

In India, pigeon pea occupies about 3.90 million hectare of area with an annual production of 3.17 M tones and productivity of 813 kg/ha (Anonymous 2015-16). An insect pests specially pod borer complex are major limiting factor in getting higher yield of pigeon pea, and hence become the vital important to study tactics dealing with management of pod borer complex. In the present experiment it was focused on impact of different insecticidal treatments in comparison with botanicals on per cent fruiting body damage, pod damage, and grain damage by pod borer complex (on green pod).

Materials and Methods

The present field experiment was carried out on Tur crop, variety PKV-TARA during *kharif* season 2016-17 on the insectary field of Entomology section, College of Agriculture Nagpur (Dr. PDKV, Akola, M.S. India), the experiment was laid out in a randomized block design with eight treatments consisting NSE 5% @ 50g/l, Neem oil 2% @ 20ml/l, Chlorantraniliprole 18.5 SC @ 0.25 ml/l, Spinosad 45 SC @ 0.3 ml/l, Indoxacarb 14.5 SC @ 0.55ml/l, Emamectin benzoate 5 SG @ 0.2 g/l, Flubendiamide 20 WDG @ 0.5 g/l, including control (water spray) were evaluated against pigeon pea pod borer complex and observed the per cent pod damaged by pod borer complex at harvest, per cent fruiting body damage by pod borer complex (on green pod), per cent grain damage. The plot size was kept 18.48 m^2 with a spacing of 60 x 30 cm between rows and plants respectively and recommended agronomical practices were followed.

Results and Discussion

The data obtain was subjected to statistical analysis after appropriate transformations and are presented in Table 1 and fig1 and described below under the respective headings. The results obtained are discussed below in the light of relevant, literature available under respective headings.

Effect of different treatments on per cent fruiting body damage by pod borer complex (on green pod)

Damage by lepidopteran pest (on green pod)

The data presented in table 1 and fig 1 revealed that the (T_7) Flubendiamide 20 WDG 0.02 per cent was most effective in recording minimum pod damage i.e (10.56%) by Lepidopteran pest on green pod followed by (T_3) Chlorantraniliprole 18.5 SC 0.01 per cent recorded 13.66 % pod damage (on green pod) and both were significantly superior over all other treatment, whereas the (T_4) Spinosad 45 SC 0.027per cent was next effective and recorded 14.33% pod damage by Lepidopteran pest (on green pod).

Next treatment in order of efficacy was (T_6) Emamectin benzoate 5 SG 0.002 per cent was recorded 16.03% pod damage followed by (T_5) Indoxacarb 14.5 SC 0.015 per cent was recorded 16.30% pod damage and (T_2) Neem oil 2% was recorded 17.68% pod damage (on green pod). However the application of (T_1) i.e. NSE 5% was least effective and recorded 18.96% pod damage whereas highest pod damage by Lepidopteran pest (on green pod) was recorded 27.32% in control (water spray).

Damage by dipteran pest (on green pod)

The data in table 1 and figure 1 showed that the treatment of insecticide i.e. (T_7) Flubendiamide 20 WDG, 0.02 per cent was most effective in recording minimum pod damage i.e. 5.15% by Dipteran pest (on green pod). This treatments was at par with (T_3) Chlorantraniliprole 18.5 SG, 0.01 per cent (6.08% pod damage) and (T_4) Spinosad 45 SC, 0.027per cent (6.15% pod damage) and followed by (T_6) Emamectin benzoate 5 SG 0.002 per cent (7.66% pod damage), (T_5) Indoxacarb 14.5 SC 0.015per cent (7.34% pod damage) and (T_2) Neem oil 2% (7.86% pod damage) on green pod by Dipteran pest. However the application of (T_1) i.e. NSE 5% was least effective among all insecticidal treatments with 8.92% pod damage. Whereas highest pod damage of 10.57% by Dipteran pest on green pod was recorded in control (water spray).

Damage by pod borer complex (on green pod)

The data in table 1 and figure 1 showed that the treatment of insecticide i.e. (T_7) flubendiamide 20 WDG, 0.02 per cent was significantly effective recording minimum pod damage of 15.71% by pod borer complex (on green pod) and at par with (T_3) chlorantraniliprole 18.5 SC, 0.01 per cent (19.74% pod damage) and (T_4) spinosad 45 SC, 0.027 per cent (20.48% pod damage).

Next treatment in order of efficacy was (T_5) indoxacarb 14.5 SC, 0.015 per cent (23.64% pod damage), (T_6) emamectin benzoate 5 SG, 0.002 per cent (23.69% pod damage) and (T_2) Neem oil 2% (25.54% pod damage). However the application of (T_1) i.e. NSE 5% was exhibited least effective with 27.88% pod damage. Whereas, highest pod damage by pod borer complex (on green pod) was recorded (37.89%) in control (water spray). Bhoyar *et al.*, (2004) evaluated biointensive treatments for the management of pod borer complex of pigeonpea.

Treatment of spinosad 2.5 SC and endosulfan 35 EC 0.07 per cent were found most effective recording least mean pod damage of 11.85 and 17.80 per cent and grain damage of 13.51 and 20.41 per cent, respectively. The grain yield was also highest 14.43 and 22.88 q/ha in treatment of spinosad and endosulfan. Rao *et al.*, (2007) studied the efficacy of Spinosad 45 SC (0.4 ml/litre), Indoxacarb 14.5 SC (1.0 ml/litre), Monocrotophos 36 EC (1.5 ml/litre) and *Metarhizium* (1.0×10^8 spores/g) against spotted pod borer, *M. vitrata* infesting pigeon pea (cv. ICPL- 88034). They observed lowest pod damage in plants sprayed with Spinosad followed by Indoxacarb and both the treatments also registered the lowest seed damage and highest grain yield respectively. Chowdary *et al.*, (2010) revealed that significantly low per cent fruit damage was observed in the treatment Rynaxypyr @ 30 g.a.i/ha (7.80%) followed by its lower dosage (20 g. a.i/ha) which recorded 10.51 per cent fruit damage.

While the treatments Emamectin benzoate 15 g. a.i/ha, Flubendiamide @ 45 g. a.i/ha, Spinosad @ 56 g a.i/ha and Indoxacarb @ 75 g.a.i/ha recorded 18.70, 19.03, 19.35 and 22.81 per cent fruit damage, respectively. Highest per cent fruit damage was in untreated check. The results of the present investigation are partially agreed with the result of said workers and give support to the data.

Effect of different treatments on per cent pod damage at harvest

Pod damage by Lepidopteran pest at harvest

The data presented in table 2 and fig 2 revealed that the treatment of insecticide i.e. (T_7) Flubendiamide 20 WDG, 0.02 per cent was most effective recording minimum pod damage i.e. (15.57%) by Lepidopteran pest at harvest, followed by (T_3) Chlorantraniliprole 18.5 SC, 0.01 per cent (18.56%pod damage), (T_6) Emamectin benzoate 5 SG, 0.002 per cent (19.90% pod damage) and (T_4) Spinosad 45 SC, 0.027per cent was next effective treatment with (20.36% pod damage) by Lepidopteran pest at harvest. Next treatment in order of efficacy was (T_5) Indoxacarb 14.5 SC, 0.015 per cent (21.09% pod damage), (T_1) NSE 5% (22.66% pod damage) by Lepidopteran pest at harvest. However the application of (T_2) i.e. Neem oil 2% was least effective and recorded (23.20% pod damage). Whereas highest pod damage of 31.87% was recorded by Lepidopteran pest at harvest control (water spray).

Table.1 Effect of different treatments on per cent fruiting body damage by pod borer complex (On green pod)

Treatment no.	Treatment	Per cent fruiting body damage (on green pod)		
		Lepidopteran pest	Dipteran pest	Pod borer complex
T_1	NSE 5%	18.96 (25.34)	8.92 (17.37)	27.88 (31.87)
T_2	Neem oil 2%	17.68 (25.78)	7.86 (16.28)	25.54 (30.35)
T_3	Chlorantraniliprole18.5 SC	13.66 (21.16)	6.08 (14.27)	19.74 (26.37)
T_4	Spinosad 45 SC	14.33 (23.37)	6.15 (14.35)	20.48 (26.90)
T_5	Indoxacarb14.5 SC	16.30 (23.96)	7.34 (15.71)	23.64 (29.09)
T_6	Emamectin benzoate 5 SG	16.03 (22.64)	7.66 (16.06)	23.69 (29.12)
T_7	Flubendiamide 20 WDG	10.56 (19.99)	5.15 (13.11)	15.71 (23.35)
T_8	Control(water spray)	27.32 (31.63)	10.57 (18.97)	37.89 (37.99)
F test		Sig	Sig	Sig
S.E (m)±		0.59	0.52	1.51
CD at 5%		1.81	1.59	4.57
CV		6.09	12.23	10.79

(Figures in parentheses are the corresponding arc sine transformed values)

Table.2 Effect of different treatments on per cent pod damage at harvest

Treatment no	Treatment	Per cent pod damage at harvest		
		Lepidopteran pest	Dipteran pest	Pod borer complex
T_1	NSE 5%	22.66 (28.01)	13.07 (21.19)	35.73 (36.70)
T_2	Neem oil 2%	23.20 (28.79)	14.01 (21.98)	37.11 (37.53)
T_3	Chlorantraniliprole 18.5 SC	18.56 (25.54)	9.75 (18.19)	28.31 (32.14)
T_4	Spinosad 45 SC	20.36 (26.82)	11.06 (19.42)	31.42 (34.09)
T_5	Indoxacarb14.5 SC	21.09 (27.33)	12.14 (20.39)	33.23 (35.20)
T_6	Emmamectin benzoate 5 SG	19.90 (26.49)	10.06 (18.49)	29.96 (33.18)
T_7	Flubendiamide 20 WDG	15.27 (23.00)	8.22 (16.66)	23.49 (28.99)
T_8	Control (water spray)	31.87 (34.37)	17.11 (24.43)	48.98 (44.41)
F test		Sig	Sig	Sig
S.E (m)±		0.66	0.49	2.15
CD at 5%		2.00	1.48	6.50
CV		5.34	7.15	11.13

(Figures in parentheses are the corresponding arc sine transformed values)

Table.3 Effect of different treatments on per cent grain damage at harvest

Treatment no	Treatment	Per cent grain damage at harvest		
		Lepidopteran pest	**Dipteran pest**	**Pod borer complex**
T_1	NSE 5%	22.46 (28.28)	11.84 (20.12)	34.30 (35.84)
T_2	Neem oil 2%	23.78 (29.18)	12.06 (20.32)	35.84 (36.77)
T_3	Chlorantraniliprol 18.5 SC	12.88 (21.03)	8.27 (16.71)	21.15 (27.38)
T_4	Spinosad 45 SC	16.88 (24.25)	9.05 (17.50)	25.93 (30.61)
T_5	Indoxacarb14.5 SC	17.54 (24.75)	10.69 (19.08)	28.23 (32.09)
T_6	Emmamectin benzoate 5 SG	18.87 (25.75)	11.78 (20.07)	30.65 (33.61)
T_7	Flubendiamide 20 WDG	10.62 (19.01)	8.05 (16.48)	18.67 (25.60)
T_8	Control(water spray)	30.85 (33.74)	18.94 (25.79)	49.79 (44.87)
F test		Sig	Sig	Sig
S.E (m)±		0.56	0.50	1.94
CD at 5%		1.71	1.53	5.86
CV		5.12	7.78	11.12

(Figures in parentheses are the corresponding arc sine transformed values)

Fig.1 Effect of different treatments on per cent fruiting body damage by pod borer complex (On green pod)

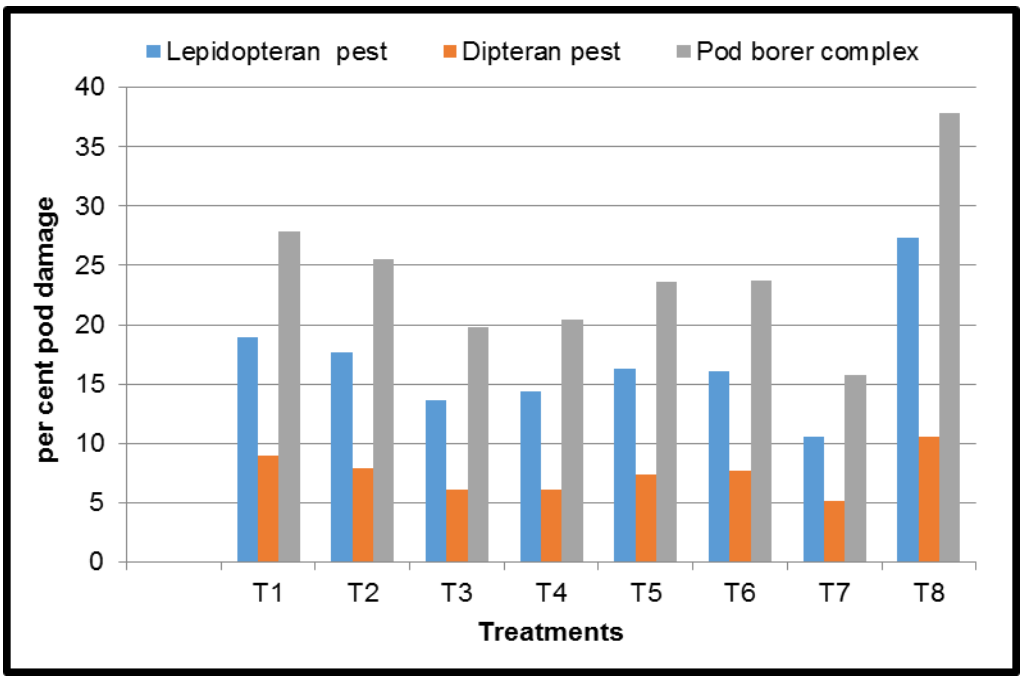


Fig.2 Effect of different treatments on per cent pod damage at harvest

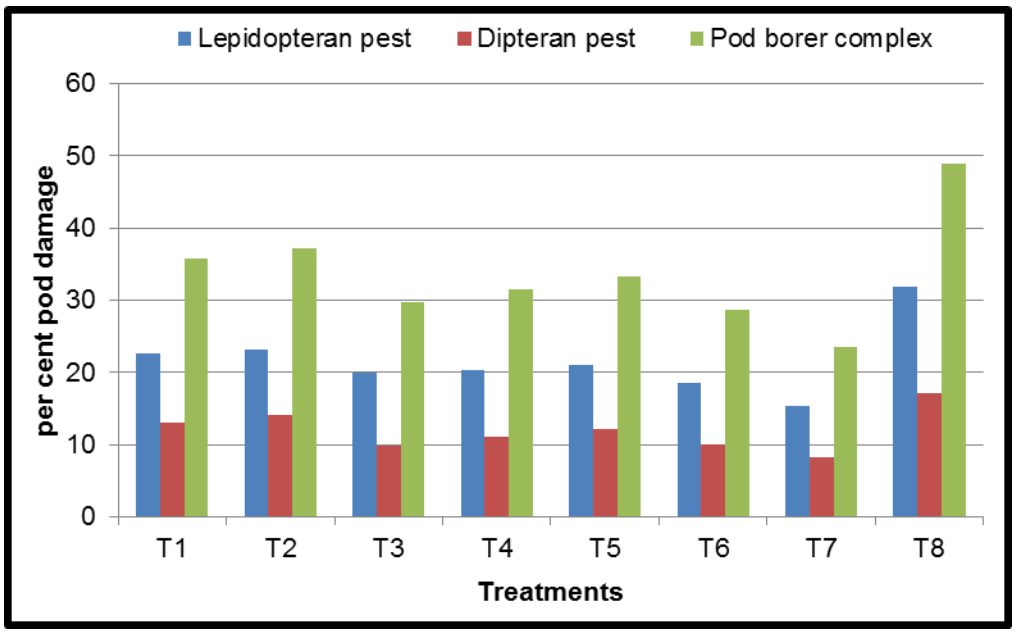
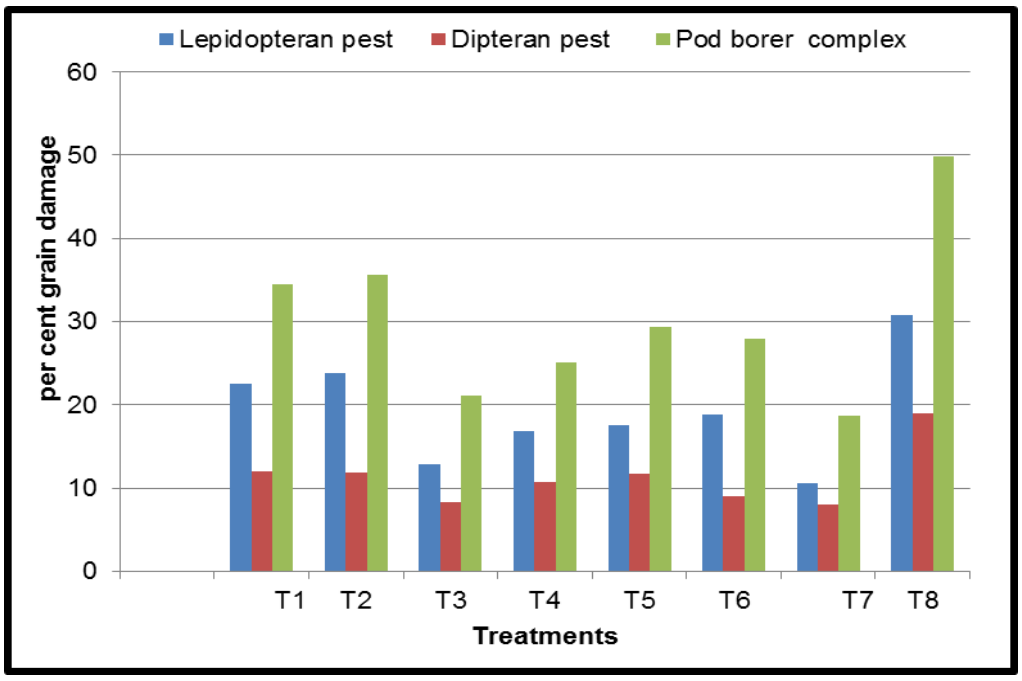


Fig.3 Effect of different treatments on per cent grain damage at harvest



T_1: NSE 5%
T_2: Neem oil 2%
T_3: Chlorantraniliprol18.5 SC
T_4: Spinosad 45 SC
T_5: Indoxacarb 14.5 SC
T_6: Emamectin benzoate 5 SG
T_7: Flubendiamide 20 WDG
T_8: Control (water spray)

Damage by Dipteran pest at harvest

The data presented in table 2 and fig 2 revealed that the treatment of insecticide i.e (T_7) Flubendiamide 20 WDG, 0.02 per cent was significantly effective in recording minimum pod damage of 8.22% by Dipteran pest at harvest and followed by (T_3) Chlorantraniliprole 18.5 SC, 0.01 per cent (9.75%pod damage), (T_6) Emamectin benzoate 5 SG, 0.002 per cent (10.06%pod damage) and (T_4) Spinosad 45 SC, 0.027per cent (11.06%pod damage), (T_5) Indoxacarb 14.5 SC, 0.015per cent (12.14%pod damage) and (T_1) NSE 5% (13.07%pod damage). However the application of (T_2) i.e Neem oil 2% was least effective among all insecticidal treatments with 14.01% pod damage. Whereas highest pod damage of 17.11% was recorded by Dipteran pest pest at harvest in control (water spray).

Damage by pod borer complex at harvest

The data presented in table 2 and fig 2. Indicated that the treatment of insecticide i.e (T_7) Flubendiamide 20 WDG, 0.02 per cent was exhibited significantly promising by recording minimum pod damage of 23.49% by pod borer complex at harvest. This treatment was at par with (T_3) Chlorantraniliprole 18.5 SC, 0.01 per cent (28.31% pod damage), (T_6) Emamectin benzoate 5 SG, 0.002 per cent (29.96%pod damage), (T_4) Spinosad 45 SC, 0.027per cent (31.42%pod damage) and (T_5) Indoxacarb 14.5 SC, 0.015 per cent (33.23% pod damage). These treatments were followed by (T_1) NSE 5% recorded 35.73% pod damage. However the application of (T_2) i.e Neem oil 2% was least effective with 37.11% pod damage. Whereas highest pod damage of 48.98% was recorded by pod borer complex at harvestin control (water spray). Thakur and Thakre (2003) tested the efficacy of plant products viz., NSE 5 per cent in combination with half dose of endosulfan 0.035 per cent against pod borer complex of pigeon pea. Endosulfan 0.07 per cent has emerged as the most effective treatment followed by an equally effective treatments of NSE 5 per cent + half dose of endosulfan 0.035 per cent and azadiractin 10000 ppm, recording 28.54, 32.86 and 35.85 per cent pod damage, respectively. Dey *et al.*, (2012) who found that the bioefficacy of flubendiamide 480 SC against lepidopteran pod borers of pigeonpea [*Cajanus cajan* (L) Millsp.] cv. 'Shewta (B-7)'. The results revealed that flubendiamide 480 SC @ 48 or 36 g a.i./ha were the most effective treatment in reducing the larval population of *Helicoverpa armigera* (Hubner), flower damaged by *Maruca testulalis* and pod damage percentage. The highest seed yield was also recorded in these treatments. The chemical was very soft to the common natural enemies' *viz.*, *Menochilus* sp., *Chrysoperla* sp. and *Trichogramma* sp. Three application of flubendiamide 480 SC @ 48 or 36 g a.i./ha depending on the level of infestation at 10 days interval starting from peak flowering stage may be suggested to the farmers for controlling borer complex of pigeonpea. The result of the present investigation are nearest agreed with the result of said workers give support the data

Effect of different treatments on per cent grain damage at harvest

Damage caused by Lepidopreran pest at harvest

The data presented in table 3 and fig 3, on per cent grain damage at harvest revealed that the treatment of insecticide i.e. (T_7) Flubendiamide 20 WDG 0.02 per cent was most effective recording minimum per cent grain damage i.e. (10.62%) by Lepidopteran pest at harvest followed by (T_3)

Chlorantriniliprole 18.5 SC 0.01 per cent recording (12.88%) and (T_4) Spinosad 45 SC 0.027per cent was next effective and recorded (16.88%)and both were significantly superior over all other treatments and at par with each other whereas (T_5) Indoxacarb 14.5 SC 0.015per cent was recorded (17.54%) per cent grain damage by Lepidopteran pest at harvest. Next treatment in order of efficacy was (T_6) Emamectin benzoate 5 SG 0.002 per cent was recorded (18.87%) per cent grain damage by Lepidopteran pest at harvest. Then (T_1) NSE 5% was recorded (22.46%) per cent grain damage by Lepidopteran pest at harvest. However the application of (T_2) i.e. Neem oil 2% was least effective and recorded (23.78%) pod damage, whereas highest per cent grain damage by Lepidopteran pest by at harvest was recorded (30.85%) in control (water spray).

Damage caused by dipteran pest at harvest

The data presented in table 3 and fig 3, on per cent grain damage at harvest revealed that the (T_7) Flubendiamide 20 WDG 0.02 per cent was most effective and recording minimum per cent grain damage i.e. (8.05%) by Dipteran pest at harvest and these treatment found at par with (T_3) Chlorantraniliprole 18.5 SC 0.01 per cent recorded (8.27%) and (T_4) Spinosad 45 SC 0.027per cent recorded (9.05%)and both were significantly superior over all other treatments and followed by (T_5) Indoxacarb 14.5 SC 0.015 per cent was recorded (10.69%) per cent grain damage by Dipteran pest at harvest. Next treatment in order of efficacy was (T_6) Emamectin benzoate 5 SG 0.002 per cent recorded (11.78%) per cent grain damage by Lepidopteran pest at harvest. Then (T_1) NSE 5% was recorded (11.84%) per cent grain damage by Dipteran pest at harvest. However the application of (T_2) i.e. Neem oil 2% was least effective and recorded (12.06%) pod damage, whereas highest per cent grain damage by Dipteran pest at harvest was recorded (18.94%) in control (water spray).

Damage caused by pod borer complex at harvest

The data presented in table 3 and fig 3, on per cent grain damage at harvest, revealed that the treatment of insecticide i.e. (T_7) Flubendiamide 20 WDG 0.02 per cent was most effective in recording minimum per cent grain damage i.e. (18.67%) by pod borer complex at harvest and this treatment found at par with (T_3) Chlorantraniliprol 18.5 SC 0.01 per cent recorded (21.15%) and followed by treatment (T_4) Spinosad 45 SC 0.027 per cent recorded (25.93%) and both were significantly superior over all other treatments and (T_5) Indoxacarb 14.5 SC 0.015per cent recorded (28.23%) per cent grain damage by pod borer complex at harvest. Next treatment in order of efficacy was (T_6) Emamectin benzoate 5 SC 0.002 per cent was recorded (30.65%) per cent grain damage by pod borer complex at harvest, Then treatment (T_1) NSE 5% was recorded (34.30%) per cent grain damage by pod borer complex at harvest. However the application of (T_2) i.e. Neem oil 2% was least effective treatment which recorded (35.84%) pod damage whereas highest per cent grain damage by pod borer complex at harvest was recorded (49.79%) in control (water spray). Similar result found by Meena *et al.,* (2006) that the bio-efficacy of some newer insecticides against gram pod borer in pigeon pea and reported that flubendamide 20 WDG @ 50 g a.i. / ha was found to be most effective and recorded minimum grain damage. Singh *et al.,* (2008) studied the relative performance of some newer and commonly used insecticides against insect-pest complex of short duration

pigeon pea. The damage to pod and grain by various insect pests was found to be minimum in coragen 20 per cent SC @40g *a.i.*/ha and maximum in the control. Highest grain yield (615.2 kg/ha) was recorded from the plots treated with spinosad 45 per cent SC @ 73g *a.i.*/ha. Sharma *et al.*, (2011) revealed the results over two years study indicate that the Emamectin benzoate 5 SG in combination with Acetamiprid 20 SP or Dimethoate 30 EC gave higher grain yield of 1399 and 1392 kg/ha and lower pod fly grain damage (13.30 and 11.95%).The results of the present investigation are agreed with the result of said workers and give support to the data.

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