BIOEFFICACY OF INSECTICIDES AS SEED TREATMENT AGAINST EARLY SUCKING PESTS OF SOYBEAN CROP.

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Abstract : A Field experiment was laid out in randomized block design with six treatments including untreated control replicated four times. This crop was sown on 5th July 2009 in plot size of 25 square meters. The crop management practices (i.e. field preparation, sowing, weeding, fertilizer application etc.) were adopted as per the recommended practices.
In this experiment numbers of sucking pests were counted at seven days interval starting from 20 days of sowing till five weeks after first observation. The number of jassids and white flies were counted from top three and two middle leaves of randomly selected 5 plants in each plot. The whitefly population was comparatively higher than that of jassids.
Imidacloprid 600 FS when applied as seed treatment at the rate of 0.75 g.a.i/kg seed was most effective against the sucking pests upto four week of seed germination with least 6.71 insect/plant. It was followed by Imidacloprid 600 FS @ 0.60 g.a.i./ kg seed and Thiamethoxam 70 WS @ 2.1 g.a.i./kg seed with 9.66 and 11.02 sucking pests/plant.

Keywords : Bioefficacy, Imidacloprid, Sucking pests, Thiamethoxam, Seed treatment, Soybean

INTRODUCTION

Soybean (2n = 40) is a very important leguminous seed crop known for its highly valued protein and oil owing to its use in food, feed and industrial applications. It enriches the soil by fixing nitrogen in symbiosis with bacteria. In the International World Trade markets, soybean is ranked number one in the world among the major oil crops such as rapeseed, groundnut, cottonseed, sunflower, linseed, sesame and safflower (Chung and Singh, 2008). Presently, India ranks fifth in the world after USA, China, Brazil and Mexico in soybean production and acreage. Area under soybean cultivation has steadily increased over the years from 300 ha in 1961 to the present area of 9.67 million ha producing a whopping 10.22 million tons with productivity level of 1.06 ton ha-1 (SOPA, 2009). The productivity of soybean is less as compared to World average (92.99 million ha and 2.04 ton ha^{-1}). (http://www.sopa.org/st1.htm).

The total geographical area of Chhattisgarh is 137 m ha, of which, 58.91 m ha area (43%) is under gross cultivation. Soybean occupies 1.12 million ha with production of 1.35 metric tonne. The average productivity of soybean in Chhattisgarh is 1204 kg ha^{-1} (http:// agridept.cg.gov.in). In Chhattisgarh, among all the districts, maximum area and production of soybean comes under Rajnandgaon followed by Durg, Kabirdham, Raipur and has proved to be a remunerative crop in Kanker upland area.

Soybean is a wonder crop of twentieth century. It is an excellent source of protein and oil. It is a two dimensional crop as it contains about 40-42 per cent high quality protein and 20-22 per cent oil. It also contains 20-30 per cent carbohydrates. However, Gangrade (1976) reported over 99 insect species attacking soybean crop at Jabalpur.but now the situation has changed and as many as 275 insect species have been recorded attacking soybean crop in India. Researchers in many parts of India have confirmed that seed yield and seed quality are being adversely affected by major insect pests viz. girdle beetle, tobacco caterpillar, green semilooper, *Helicoverpa armigera*, jassids and white fly.

MATERIAL AND METHOD

A Field experiment was laid out in randomized block design with six treatments including untreated control replicated four times. This crop was sown on 5th July 2010 in plot size of 25 square meters. The crop management practices (i.e. field preparation, sowing, weeding, fertilizer application etc.) were adopted as per the recommended practices.

In this experiment numbers of sucking pests were counted at seven days interval starting from 20 days of sowing till five weeks after first observation. The number of jassids and white flies were counted from top three and two middle leaves of randomly selected 5 plants in each plot. The whitefly population was comparatively higher than that of jassids. The layout and other treatment details of this experiment are given in table 1.1.

Design : Randomized Block Design
Treatment: 6
Replication : 4
Plot size : 25 square meter
Spacing between row: 30 cm

Variety: Amber
Seed treatment: 1 ml of product was mixed in 5 ml of water in a poly bag containing required quantity of seed. It was mixed well and dried in shade before sowing.

Table 1.1: List of test insecticides against early sucking pest on soybean

	Treatments	Dose Gm a.i./kg seed
T1	Untreated control	0
T2	Imidaclorprid 600 FS (Gaucho 600 FS)	0.45 gm
T3	Imidaclorprid 600 FS (Gaucho 600 FS)	0.6 gm
T4	Imidaclorprid 600 FS (Gaucho 600 FS)	0.75 gm
T5	Imidaclorprid 600 FS (Gaucho 600 FS)	1.5 gm
T6	Thiamithoxam 70 WS	2.1 Gm

Statistical analysis

The above mentioned four experiments were laid out in Randomized Block Design (RBD). The data obtained were converted into square root transformation, by using the formula ($\sqrt{x}$ +0.5). This transformed data was then analyzed by the method of analysis of variance as described by Gomez and Gomez (1984). The "F" test was used at 5 per cent level of significance.
Critical difference (CD) values were analyzed at 5 per cent level of significance. The skeleton of analysis of variance and formula used for various estimations are given in table 1.2.

Table 1.2: The skeleton of the analysis of variance

Source of variation	DF	SS	MSS	F cal	F tab	S.Em±	CD 5%
Replication (R) Treatment (T) Error	(R-1) (T-1) (R-1)(T-1)						
Total	RT-1						

The following formulae were used for standard error, critical difference and coefficient of variance estimations.

(a) S.Em $\pm$ = $\sqrt{\frac{EMS}{R}}$

(b) C.D. = $\sqrt{\frac{2EMS}{R}}$ x t (D.F. at 5%)

(c) C.V. (%) = $\sqrt{\frac{EMS}{GM}}$ X 100

Where,
R = Number of Replications, D.F = Degrees of Freedom
T = Number of Treatments, S.S. = Sum of Square
C.D. = Critical Difference, C.V. = Coefficient of Variance
M.S.S. = Mean Sum of Square, EMS = Error Mean Square
S.Em± = Standard Error of means.

RESULT AND DISCUSSION

Study was carried out during the rainy season of 2010 in soybean field to evaluate the relative efficacy of Imidacloprid 600 FS as seed treatment against incidence of sucking pests (jassids + white fly) at the early growth stage of the crop. Sucking pest complex is a serious menace for soybean production, therefore, different doses of Imidacloprid along with standard check Thiamethoxam 70WS were tested as seed treatment and observation recorded from 2-3 leaf stage at weekly interval for 35-40 days. Observations recorded comprised of nymph and adult count on five leaves (top 3 and middle 2 leaves per plant) from randomly selected five plants per plot.
Twenty five days after seed treatment, first observation indicated that the sucking pest population ranged from 3.25 to 8.74 sucking pests per plant. The treatment seed treated with Imidacloprid 600 FS @ 0.75 gm ai/kg seed with 3.25 sucking pests/plant was most effective against the sucking pests. It was significantly superior over the remaining treatments, which were at par with the untreated control.

Table.1.3 : Relative efficacy of Imidacloprid 600 FS as seed treatment against early sucking pests on Soybean during *Kharif*, 2010**.**

S.No.	Treatments	Dose g.a.i./ kg seed	Mean population of sucking pests (Jassids & whitefly) per plant							Grain yield Q/ha.
			30.07.10	06.08.10	13.08.10	20.08.10	27.08.10	03.09.10	Seasonal mean	
1.	Untreated Control	-	8.74 b (3.03)	12.25 c (3.56)	15.50 c (3.99)	18.75 b (4.38)	13.75	15.50	14.08 c	16.25
2.	Imidacloprid 600 FS	0.45	6.75 b (2.68)	10.25 be (3.27)	13.50 be (3.74)	15.25 (3.96)	12.25	13.00	11.80 be	17.50
3.	Imidacloprid 600 FS	0.60	7.00 b (2.73)	7.50 ab (2.82) a	9.50 b (3.15)	11.50 b (3.80)	10.25	12.25	9.66 ab	19.15
4.	Imidacloprid 600 FS	0.75	3.25 a (1.92)	5.75 a (2.49)	4.50 a (2.22)	6.50 a (2.63)	8.50	11.75	6.71 a	19.65
5.	Thiamethoxam 70 WS	2.1	6.50 b 2.63	9.75 be (3.19)	11.50 be (3.45)	15.0 b x,92)	11.40	12.00	11.02 b	18.25
CD at 5%			**0.58**	**0.47**	**0.74**	**1.11**	NS	NS	**0.53**	NS

Figures in parenthesis are under root transformed values.
In a column, means followed by a common letter are not significantly different at 5 percent level.

One week after the first observation, the sucking pest population ranged from 5.57 to 12.25 sucking pests per plant. Plot treated with Imidacloprid 600 FS @ 0.75 gm ai/kg seed with 5.57 sucking pests per plant was least infested by sucking pests. It was at par with Imidacloprid 600 FS @ 0.60 gm ai/kg seed with 7.50 sucking pests per plant, but significantly varied from Thiamethoxam 70 WS @ 2.1 g a.i./kg seed with 9.75 sucking pests per plant. Imidacloprid 600 FS @ 0.45 g.a.i./kg seed with 10.25 sucking pests per plant was least effective treatment and was at par with untreated control.

Two weeks after the first observation, the population of sucking pests ranged from 4.50 to 15.50 sucking pests per plant. Imidacloprid 600 FS @ 0.75 g.a.i./kg seed continued to express its supremacy over other treatments in controlling the sucking pests with 4.50 sucking pests per plant. It was significantly followed by Imidacloprid 600 FS @ 0.60 g.a.i./kg seed and Thiamethoxam 70 WS @ 2.1 g.a.i./kg seed with 9.50 and 11.50 sucking pests per plant. Imidacloprid 600 FS @ 0.45 g.a.i./kg seed with 13.50 sucking pests per plant was least effective treatment and was at par with untreated control with 15.50 sucking pests per plant and thiamethoxam 70 WS @ 2.1 g.a.i/kg seed.

Three weeks after the first observation, the sucking pest population ranged from 6.50 to 18.75 sucking pests per plant. Like the previous observations, plot treated with Imidacloprid 600 FS @ 0.75 g.a.i./kg seed with 6.50 sucking pests per plant was observed least infested by sucking pests. It
was significantly more effective than the remaining treatments which in turn, were at par with the untreated control.

Observation taken on 27-08-10 (fifth week) revealed that the sucking pest population ranged from 8.50 to 13.75 sucking pests per plant. Imidacloprid 600 FS when applied at the rate of 0.75 g.a.i./kg seed continued to exhibit its superiority over other treatments in controlling the sucking pests. However, it did not differ significantly from the remaining treatments including the untreated control.

In the sixth week, it was noticed that the effect of seed treatment was diminishing as is indicated by increase in pest population in different treatments. The data recorded in the sixth week showed non-significant differences among different treatments which ranged from average 11.75 to 15.50 sucking pests per plant. Grain yield recorded at harvest also showed non-significant differences among different treatments that might be due to loss of effect of seed treatment at the later stage of the crop.

Based on seasonal mean, Imidacloprid 600 FS, when applied as seed treatment at the rate of 0.75 g.a.i./kg seed, was most effective against the early sucking pests on soybean with minimum 6.71 sucking pests per plant. It was at par with the same insecticide when applied at rate of 0.60 g.a.i./kg seed with 9.66 insects/plant but differed significantly from Thiamethoxam 70 WS and Imidacloprid 600 FS @ 0.45 g.a.i./kg seed. The latter was least effective against the sucking pests and at par with untreated control.

CONCLUSION

Imidacloprid 600 FS when applied as seed treatment at the rate of 0.75 g.a.i/kg seed was most effective against the sucking pests upto four week of seed

germination with least 6.71 insect/plant. It was followed by Imidacloprid 600 FS @ 0.60 g.a.i./ kg seed and Thiamethoxam 70 WS @ 2.1 g.a.i./kg seed with 9.66 and 11.02 sucking pests/plant.

Future Scope

No conclusion can be drawn from one season study on population dynamics. Hence, such studies should by carried for 3-5 years to identify the most vulnerable stage of the pest and the crop. Studies to workout economic threshold level of major insect pests should be under taken to identify appropriate time of chemical protection. Insecticides comparatively safer to natural enemies should be identified. Further studies on the residual periods of insecticides on the crop and development of insecticide resistance in insect pests should be carried out.

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