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Avoidable yield loss in greengram due to major insect pests through insecticide spray schedules under field conditions

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Abstract
A field experiment was conducted at RARS, Lam Farm, Guntur to evaluate the spray schedules of insecticides in reducing the yield losses in greengram for two consecutive seasons i.e. during Rabi 2013-14 and 2014-15. Adoption of seed treatment with imidacloprid 600 FS @ 5.0 g/kg seed followed by one spray with either thaimethoxam 25 WG @ 0.2 g/lt or acetameprid 20 SP @ 0.2 g/lt at 25 DAS and flubendiamide 39.35 % SC @ 0.2 g/lt or indoxacarb 14.5 % SC @ 1.0 ml/lt at 40 DAS gave higher seed yield due to less incidence of YMV coupled with low pod damage due to spotted pod borer in greengram. The avoidable yield loss was highest with flubendiamide 39.35 % SC @ 0.2 g/lt followed by indoxacarb 14.5 % SC @ 1.0 ml/lt and spinosad 45 SC @ 0.3 ml/lt when sprayed at 40 DAS thus helps in attaining high seed yield in greengram.

Keywords: insecticide spray schedule, avoidable yield loss, greengram

1. Introduction
Greengram (*Vigna radiata* (L.) Wilczek, otherwise known as mungbean is an important legume crop widely grown in many Asian countries. In India, it occupies third place after chickpea and pigeonpea. It is one of the most important short duration pulse crop grown in India and occupies an area of about 3 m.ha with a production of 0.25 m.t and 425 kg ha-1 productivity. Andhra Pradesh is the fourth major state in India contributing 15.5 per cent of the national production of greengram with 351 kg/ha average productivity [1]. In Andhra Pradesh, it is grown throughout the year, i.e as kharif crop, rabi crop both in uplands and rice fallows and also as summer crop. Due to its more luxuriant vegetative growth, number of insects attack from seedling to harvesting stage which is detrimental factor for production and causing severe yield losses [2]. Among the different biotic stresses, thrips and whiteflies at vegetative stage and spotted pod borer during flowering to pod formation stage are the major insect pests causing considerable yield loss in greengram in Andhra Pradesh. Both the thrips and whiteflies acts as vectors for viral diseases such as leaf curl and yellow mosaic virus disease (YMV), respectively. Hence, it is important to avoid the incidence of both the sucking pests rather than control to escape from the viral diseases and to obtain higher seed yield. Further, the larval incidence of Maruca occurs from 40 days after sowing in single flowers and cause considerable damage [3]. But farmers are realising the Maruca pod borer larval incidence only after noticing the webbings in floral parts. By that time significant damage already occurs and causing yield looses. Though the farmers are using new insecticides, they are unable to avoid yield loss due to the above insect pests because of several reasons. Timing of insecticidal application as foliar sprays is the most important basic requirement for effective control of insect pests in greengram [4]. Hence, in the present study, insecticidal schedule was evaluated besides evaluation of best combination of insecticides for scheduling the foliar sprays against major insect pests in greengram to avoid yield loss.

2. Materials and Methods
The present study field trials on evaluation of insecticides schedule were conducted at RARS, Lam Farm, Guntur for two consecutive seasons, i.e. during Rabi 2013-14 and 2014-15. The most popularly grown variety in Andhra Pradesh, LGG 460 was selected as test variety and the seed was sown in plots each measuring 20 sq.m at 30 x 10 cm spacing. The crop was sown during last week of October and harvested during third week of

January during both the seasons. A total of 14 insecticide schedule treatments were evaluated including untreated control and each treatment was replicated thrice. The seed treatment with imidacloprid 600 FS @ 5.0 ml/kg seed was done commonly for all the treatments excluding untreated control. Two popularly used neonicotiniods i.e. thaimethoxam 25 WG and acetamepird 20 SP were selected against sucking pests and six different molecules with different modes of action were selected against spotted pod borer for the present study. The conventional insecticides such as triazophos 40 EC and chlorpyriphos 50 EC were selected as standard insecticide checks against sucking pests and pod borer, respectively along with one untreated check. One spray was given at 25 DAS against sucking pests followed by second spray at 40 DAS against spotted pod borer using water volume of 500 liters per hectare. Observations were taken at one day before spraying as pre treatment count, as well as at 3 and 7 days after each application from five randomly selected plants per plot. The sucking pests such as thrips and whiteflies were counted from three trifoliate leaves each one from top, middle and bottom canopies, while the larvae and pod damage were counted on whole plant basis. The incidence of yellow mosaic virus (YMV) disease was recorded at 60 days after sowing from all the treatments. The seed yield was recorded from net plot and then converted to hectare basis. The data thus obtained from both the seasons regarding the pest incidence, disease incidence and yield was pooled and statistically analysed and presented hereunder.

The percentage reduction in the population of thrips, whiteflies and spotted pod borer larvae over untreated check in different treatments was computed using the modified Abbot's formula [5] as given below.

$$\text{Percent population reduction} = \left[1 - \left(\frac{\text{Post treatment population in treatment}}{\text{Pre treatment population in treatment}} \times \frac{\text{Pre treatment population in the untreated check}}{\text{Post treatment population in the untreated check}} \right) \right] \times 100$$

The pod damage was recorded at the time of harvesting from 10 randomly selected plants and per cent pod damage was calculated as given below.

$$\text{Per cent pod damage} = \frac{\text{Number of damaged pods}}{\text{Total number of pods}} \times 100$$

The per cent avoidable yield loss due to insecticide schedule was calculated by using the formula given below [6].

$$\text{Avoidable yield loss (\%)} = \frac{\text{Yield of Protected crop} - \text{Yield of Unprotected crop}}{\text{Total number of pods}} \times 100$$

The data thus obtained were analyzed statistically by ANOVA after converting it to suitable transformed values.

3. Results

3.1 Incidence of sucking pests

The data revealed that the per cent reduction in thrips population was slightly high with thimethoxam 25 WG@ 0.2 g/lt (around 88 %) when compared to acetameprid 20 SP @ 0.2 g/lt (around 86 %), but both were statistically on a par with each other. The trend was vice versa with whiteflies, since, the per cent reduction in whitefly population was comparatively high with acetameprid 20 SP (more than 88 %) than with thiamethoxam 25 WG (around 86 %). However, both the insecticides were found significantly superior over the conventional insecticide check, triazophos 40 EC @ 1.0 ml/lt (around 73 %) and untreated check in reducing the population of both the thrips and whiteflies. The two insecticides tested against sucking pests i.e. thimethoxam 25 WG and acetameprid 20 SP were found effective against both the thrips and whiteflies in greengram (Table.1).

3.2 Incidence of YMV

The incidence of YMV was numerically low in acetameprid 20 SP @ 0.2 g/lt treated plots (below 15 per cent) compared to thiamethoxam 25 WG @ 0.2 g/lt (18 - 22 per cent), but statistically there were no significant differences between both the treatments. Among the different insecticide schedule treatments, the incidence of YMV was highest (35.0 %) from conventional check, i.e. triazophos 40 EC @ 1.0 ml/lt at 25 DAS fb chlorpyriphos 50 EC @ 2.0 ml/lt at 40 DAS treated plots which was found statistically at a par with the untreated check which recorded 41.66 per cent incidence of YMV at 60 DAS (Table.1).

3.3 Incidence of Spotted pod borer and pod damage

Among the different molecules used in schedule, the per cent reduction in larval population of spotted pod borer over untreated control was high with flubendiamide 39.35 % SC @ 0.2 g/lt and it was found significantly superior with more than 80 per cent reduction in larval population over the remaining treatments. The next best treatments in the descending order of efficacy were indoxacarb 14.5 SC @ 1.0 ml/lt, novaluron 10 EC @ 1.0 ml/lt and spinosad 45 SC @ 0.3 ml/lt with more than 60 per cent reduction in larval population over untreated control and were found on par with each other. The other conventional insecticide, acephate 75 SP @ 1.0 g/lt recorded more than 50 per cent reduction in larval population over untreated control. However, all the treatments were found significantly superior over the insecticidal check, chlorpyriphos 50 EC @ 2.0 ml/lt (less than 45 %) and untreated check in reducing the larval population of spotted pod borer in greengram (Table.1).

The lowest pod damage was recorded from flubendiamide 39.35 % SC @ 0.2 g/lt treated plots (less than 6 %) which was due to highest per cent reduction in larval population of spotted pod borer and it was found significantly superior over the remaining treatments. The next best treatment was indoxacarb 14.5 SC (less than 10 %) followed by spinosad 45 SC @ 0.3 ml/lt (10-11.5 %) and novaluron 10 EC @ 1.0 ml/lt (around 16 %). The other treatment, acephate 75 SP @ 1.0 g/lt recorded around 20 per cent pod damage. However, all

the treatments were found significantly superior over the insecticidal check, chlorpyriphos 50 EC @ 2.0 ml/lt (more than 25 %) and untreated check in reducing the pod damage by spotted pod borer in green gram (Table.1).

3.4 Seed Yield

The seed yield was ranged from 2.99 to 7.77 q/ha in different treatments. The seed yield was numerically highest from the plots treated with acetameprid 20 SP @ 0.2 g/lt at 25 DAS fb flubendiamide 39.35 % SC @ 0.2 g/lt at 40 DAS but it was found statistically at a par with indoxacarb 14.5 SC @ 1.0 ml/lt and spinosad 45 SC @ 0.3 ml/lt. The seed yield was lowest (5.15 q/ha) from conventional check, i.e. triazophos 40 EC @ 1.0 ml/lt at 25 DAS fb chlorpyriphos 50 EC @ 2.0 ml/lt at 40 DAS treated plots. However, it was found significantly superior over the untreated check which recorded only 2.99 q/ha seed yield (Table.1).

3.5 Avoidable Yield loss (AYL %)

The avoidable yield loss was highest with acetameprid 20 SP @ 0.2 g/lt at 25 DAS fb flubendiamide 39.35 % SC @ 0.2 g/lt at 40 DAS followed by thiamethoxam 25 WG @ 0.2 g/lt at 25 DAS fb flubendiamide 39.35 % SC @ 0.2 g/lt at 40 DAS. The avoidable yield loss was low (72.2 %) from conventional check, i.e. triazophos 40 EC @ 1.0 ml/lt at 25 DAS fb chlorpyriphos 50 EC @ 2.0 ml/lt at 40 DAS treated plots. (Table.1).

Table 1: Mean efficacy of different insecticidal spray schedules against incidence of major pests, pod damage and yield (Pooled data of 2013-14 and 2014-15)

Treatment	Insecticide	% Reduction over control		% YMV	% reduction over control in Maruca larvae	% Pod Damage	Yield (Q/ha)	AYL (%)
		Thrips	WF					
T1	Thiamethoxam 25 WG @ 0.2 g/lt at 25 DAS fb Spinosad 45 SC @ 0.3 ml/lt at 40 DAS	90.18 (71.78)	85.43 (67.59)	18.33 (24.74)	64.33 (53.35)	10.54 (18.95)	6.44	115.4
T2	Thiamethoxam 25 WG @ 0.2 g/lt at 25 DAS fb Indoxacarb 14.5 SC @ 1.0 ml/lt at 40 DAS	88.81 (70.49)	84.69 (67.00)	18.33 (26.58)	69.95 (56.78)	9.78 (18.23)	6.69	123.7
T3	Thiamethoxam 25 WG @ 0.2 g/lt at 25 DAS fb Flubendiamide 39.35 % SC @ 0.2 g/lt at 40 DAS	88.02 (69.78)	85.63 (67.76)	18.33 (25.36)	81.61 (64.64)	5.84 (13.99)	7.44	148.8
T4	Thiamethoxam 25 WG @ 0.2 g/lt at 25 DAS fb Novaluron 10 EC @ 1.0 ml/lt at 40 DAS	88.17 (69.92)	83.59 (66.14)	20.00 (26.58)	67.41 (55.22)	16.51 (23.98)	6.04	102.0
T5	Thiamethoxam 25 WG @ 0.2 g/lt at 25 DAS fb Acephate 75 SP @ 1.0 g/lt at 40 DAS	89.75 (71.36)	84.53 (66.94)	21.67 (27.76)	52.23 (46.30)	18.25 (25.30)	5.62	88.0
T6	Thiamethoxam 25 WG @ 0.2 g/lt at 25 DAS fb Chlorpyriphos 50 EC @ 2.0 ml/lt at 40 DAS	88.11 (69.87)	86.32 (68.33)	20.00 (26.58)	43.62 (41.36)	26.63 (31.08)	5.29	76.9
T7	Acetameprid 20 SP @ 0.2 g/lt at 25 DAS fb Spinosad 45 SC @ 0.3 ml/lt at 40 DAS	86.27 (68.29)	89.39 (71.02)	11.67 (18.44)	63.69 (52.97)	11.49 (19.82)	6.56	119.4
T8	Acetameprid 20 SP @ 0.2 g/lt at 25 DAS fb Indoxacarb 14.5 SC @ 1.0 ml/lt at 40 DAS	86.06 (68.11)	88.92 (70.60)	13.33 (20.72)	70.76 (57.29)	9.87 (18.31)	6.92	131.4
T9	Acetameprid 20 SP @ 0.2 g/lt at 25 DAS fb Flubendiamide 39.35 % SC @ 0.2 g/lt at 40 DAS	85.77 (67.87)	88.68 (70.38)	13.33 (19.98)	81.70 (64.71)	5.18 (13.16)	7.77	159.9
T10	Acetameprid 20 SP @ 0.2 g/lt at 25 DAS fb Novaluron 10 EC @ 1.0 ml/lt at 40 DAS	85.71 (67.82)	89.08 (70.74)	13.33 (20.72)	65.56 (54.09)	15.95 (23.55)	6.25	109.0
T 11	Acetameprid 20 SP @ 0.2 g/lt at 25 DAS fb Acephate 75 SP @ 1.0 g/lt at 40 DAS	85.63 (67.76)	92.05 (73.66)	11.67 (18.44)	53.62 (47.10)	19.03 (25.87)	5.81	94.3
T 12	Acetameprid 20 SP @ 0.2 g/lt at 25 DAS fb Chlorpyriphos 50 EC @ 2.0 ml/lt at 40 DAS	86.83 (68.76)	91.80 (73.40)	13.33 (19.98)	45.68 (42.54)	25.89 (30.60)	5.54	85.3
T 13	Triazophos 40 EC @ 1.0 ml/lt at 25 DAS fb Chlorpyriphos 50 EC @ 2.0 ml/lt at 40 DAS	72.69 (58.52)	73.15 (58.82)	35.00 (36.29)	42.88 (40.93)	27.82 (31.85)	5.15	72.2
T 14	Untreated control	0.00 (0.00)	0.00 (0.00)	41.67 (40.22)	0.00 (0.00)	43.68 (41.39)	2.99	
	CD (p=0.05)	9.55	7.69	7.10	2.73	2.25	1.50	
	CV %	8.90	7.15	16.20	7.10	6.20	13.00	

* fb – followed by; AYL: Avoidable yield loss; DAS – Days after sowing

* Figures in parenthesis are arcsine transformed values

4. Discussion

The results obtained from the present study revealed that the seed treatment with imidacloprid 600 FS @ 5.0 ml/kg followed by foliar spraying with either of the neonicotiniods such as thiamethoxam 25 WG or acetameprid 20 SP were found effective against both the thrips and whiteflies in greengram and able to reduce the incidence of YMV, if sprayed at appropriate time i.e at 20- 25 days after sowing. The present findings are in accordance with many of the earlier reports. Foliar spray with thiamethoxam @ 0.2 g/lt was highly effective against whitefly in mungbean by recording minimum population (11.4/10 plants) at 15 days after spraying [7]. Foliar application of thiamethoxam 25 WG at 100 g a.i./ha resulted in more than 90 per cent reduction in the population of aphids, leafhoppers and whiteflies in cotton[8]. Foliar spray with acetamiprid 20 SP @ 40 g a.i/ha recorded highest reduction in whitefly population over untreated control in bhendi and least incidence of YVMV disease [9]. Thiamethoxam 25 WS @ 0.005 % was highly effective against whiteflies with the lowest population of 2.60 whiteflies/ plant and low MYMV incidence (10.7 %) in mungbean [10]. In Mesta, acetamiprid @ 0.2 g/lt and thiamethoxam @ 0.2 g/lt were found highly effective in reducing both the whitefly population and YMV disease [11]. In the present study, the conventional check, triazophos 40 EC @ 1.0 ml/lt was found less effective against both thrips and whiteflies when compared to the neonicotinoids which might be due to development resistance against triazophos. Guntur population of *B. tabaci* has developed 1.41 folds resistance to triazophos when compared with baseline data [12].

Among the different insecticides tested against spotted pod borer in the schedule, flubendiamide 39.35 % SC @ 0.2 g/lt was found significantly superior over the rests of the

treatments against pod borer and in reducing the pod damage. The next best treatments were indoxacarb 14.5 SC @ 1.0 ml/lt, spinosad 45 SC @ 0.3 ml/lt and novaluron 10 EC @ 1.0 ml/lt with more than 60 per cent reduction in larval poplation of spotted pod borer. The efficacy of flubendiamide 39.35 % SC against different lepidopteron pests in different crops was reported by many of the earlier research workers [13, 14, 15]. The efficacy of spinosad 45 EC and indoxacarb 14.5 EC was proved against spotted pod borer in pigeon pea [16, 17].

The avoidable yield loss was slightly high with combination of acetameprid 20 SP at 25 DAS irrespective of insecticide spray at 40 DAS. This can be attributed to the higher efficacy of acetameprid 20 SP against whiteflies which recorded numerically lower incidence of YMV when compared to thiamethoxam 25 WG treated plots. The effect of acetamiprid 20 SP is due to its systemic translaminar action and results in the destruction of hidden pests and assures the protection of young rapidly growing shoots. The present findings were in agreement with [18] who reported that, the ovicidal activity of foliar applications of acetamiprid 20 SP was 10-18 fold more potent than imidacloprid 200 SL under controlled conditions on cotton seedlings. The avoidable yield loss was highest with flubendiamide 39.35 % SC @ 0.2 g/lt at 40 DAS either with acetameprid 20 SP @ 0.2 g/lt or thiamethoxam 25 WG @ 0.2 g/lt at 25 DAS when compared to indoxacarb 14.5 SC @ 1.0 ml/lt, spinosad 45 SC @ 0.3 ml/lt and novaluron 10 EC @ 1.0 ml/lt due to added suppression of spotted pod borer larvae and less pod damage.

5. Conclusion

Adoption of seed treatment with imidacloprid 600 FS followed by one spray with either thaimethoxam 25 WG or acetameprid 20 SP at 25 DAS and flubendiamide 39.35 % SC or indoxacarb 14.5 % SC at 40 DAS provides the higher seed yield because of highest avoidable yield loss due to less incidence of YMV coupled with less pod damage by the spotted pod borer in greengram.

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7. References

1. AICRP on MULLARP Report. All India Co-ordinated Research Project on MULLaRP. Project Coordinator's Report, 2014.
2. Lal SS, Sachan L. Insect pests of mungbean, urdbean, cowpea and pea and their management. Plant Protection in field crops (eds: Veerabadhara Rao, M and Sithanantham, S). Plant Protection Association of India. 1987; 185-201.
3. MahaLakshmi MS, Sreekanth M, Adinarayana M and Rao YK. Efficacy of some novel insecticide molecules against incidence of whiteflies (*Bemisia tabaci* Genn.) and occurrence of Yellow Mosaic Virus (YMV) disease in urdbean. International Journal of Pure and Applied Biosciences. 2015; 3(5):101-106.
4. Khaliq N, Virender K, Uma Shankar, Suheel AG and Norboo T. Bio-efficacy of Certain Selective Insecticides against whitefly, (*Bemisia tabaci*) on Mungbean, (*Vigna radiata* L., Wilczek). International Journal of Current Microbiology and Applied Sciences. 2017; 6(7):2344-2351.
5. Fleming R, Retnakaran A. Evaluation of single treatment data usingAbott's formula with reference to insects. Indian Journal of Economic Zoology. 1985; 78:1179-1181.
6. Sharma VK, Pandey SN, Singh R. Avoidable yield losses in pigeon pea, *Cajanus cajan* variety UPAS-120 due to insect pests. Indian Journal of Entomology. 1991; 53(3):511-512.
7. Ganapathy T, Karuppiah R. Evaluation of new insecticides for the management of Whitefly (*Bemisia tabaci* Genn.), Mungbean Yellow Mosaic Virus (MYMV) and Urdbean Leaf Crinkle Virus (ULCV) diseases in Mungbean [*Vigna radiata* (L.) Wilczek]. Indian Journal of Plant Protection. 2004; 32(1):35-38.
8. Mathirajan VG, Regupathy A. Thiamethoxam 25 WG (Actara): A novel Nicotinyl insecticide for the management of sucking pests of Cotton. Journal of Ecobiology. 2005; 17(3):223-228.
9. Aswathnarayana Reddy N, Gowdar SB, Chandrashekar SY. Efficacy of Acetamiprid against whitefly, *Bemisia tabaci* and Incidence of Okra Yellow Vein Mosaic Virus. Pest Management and Economic Zoology. 2007; 15(1):89-92.
10. Panduranga Rao GS, Vijayalakshmi K and Reddy KL. Evaluation of insecticides for management of *Bemisia tabaci* and MYMV disease in mungbean [*Vigna radiata* (L.) Wilczek]. Annals of Plant Protection Sciences. 2010; 19(2):295-298.
11. Seetharamu P, Venugopala Rao N, Harisatyanarayana N and Chengareddy V. Evaluation of insecticides to control Whitefly, *Bemisia tabaci* vector of Yellow Vein Mosaic disease on Mesta. Indian Journal of Plant Protection Sciences. 2011; 39(1):1-3.
12. Balakrishnan N, Subbaratnam GV, Madhumati T. Assessment of development of resistance in cotton whitefly of Guntur strain. Pesticide Research Journal. 2002; 14(2):251-254.
13. Deshmukh SG, Sureja BV, Jethva DM, Chatar VP. Field efficacy of different insecticides against *Helicoverpa armigera* (Hubner) infesting chickpea. Legume Research. 2010; 33(4):269-273.
14. Mallikarjuna J, Kumar CTA and Rashmi MA. Field evaluation of indigenous materials and newer insecticide molecules against pod borers of dolichos bean. Karnataka Journal of Agricultural Sciences, 2009; 22(3):617.
15. Ashok Kumar CT and Shivaraju C. Evaluation of newer insecticide molecules against pod borers of Blackgram. Karnataka Journal of Agricultural Sciences. 2009: 22(3):521-523.
16. Rao GVR, Kumari PRA, Rao VR, Reddy YVR. Evaluation of Spinosad and Indoxacarb for the management of legume pod borer, Maruca vitrata (Geyer) in Pigeonpea. Journal of Food Legumes, 2007; 20(1):126-127.
17. Sunitha V, Vijayalakshmi K and Rao GVR. Laboratory evaluation of certain insecticides against pigeonpea pod borer *Maruca vitrata* (Geyer). Journal of Food Legumes 2008; 21(2):137-139.
18. Horowitz AR, Mendelson Z, Weintraub PG, Ishaaya I. Comparative toxicity of foliar and systemic applications of acetamiprid and imidacloprid against the cotton whitefly, *Bemisia tabaci* (Hemiptera: Aleyrodidae). Bulletin of Entomological Research. 1998; 88:437-442.