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MANAGEMENT OF SUCKING INSECT PESTS IN SOYBEAN, *GLYCINE MAX* (L.) MERILL

SANGEETA MAHRANIA, AKHIL KUMAR SRIVASTAVA, O.P. AMETA AND N.K. PADIWAL

Department of Entomology, Rajasthan College of Agriculture MPUAT, Udaipur

ABSTRACT

The management schedule containing spray of methyl demeton 25 EC at 0.04% at 20 DAG followed by quinalphos 25 EC at 0.04% at flowering and acephate 75 WP at 0.075% at pod initiation was found most effective against sucking insect pests; jassid, *Amrasca kerri* Pruthi and white fly, *Bemisia tabaci* Gennadius of soybean. It yielded highest seed yield of 23.10 q/ha, with highest net return of Rs. 19,842/ha and C: B ratio of 1:1.867. It was followed by management schedule consisting one spray of methyl demeton at 20DAG and two spray of NSKE 5% at flowering and pod initiation stage.

INTRODUCTION

Soybean, *Glycine max* (L.) Merill, is an important oil seed crops grown throughout the world. Soybean ranks first in the world for production of edible oil and it is also a low cost source of high quality protein.

In India, it is cultivated in 6.5 million hectare with production of 7.61 million tonnes and the productivity is 11.71 q/ha. Rajasthan ranks third in the country occupying an area of 6.59 lakh hectares and production of 4.56 lakh tonnes with the productivity of 691 kg/ha which is relatively low as compared to the other states of India, national and the world average. The sucking insect pests *viz*; jassid, *Amrasca kerri* Pruthi and white fly, *Bemisia tabaci* Gennadius are the important pests which causes considerable damage to crop (Sharma, 1999).

Now a days the incorporation of botanical and bio-pesticides in pest management programme is gaining importance. Therefore, an effort has been done to test the relative efficacy of some insecticides and plant products in different combinations to find out the effective management schedule for the management of sucking insect pests.

MATERIAL AND METHODS

The experiment was conducted at the Instructional Farm, Rajasthan College of Agriculture, MPUAT, Udaipur during *kharif* 2006. The crop was sown on 7th July during *kharif* 2006. Row to row and plant to plant spacing was maintained at 30 cm and 10 cm, respectively. The soybean cultivar JS-335 was sown during the *kharif* 2006.

The populations of jassid, *A. kerri* and white fly, *B. tabaci* were recorded on top, middle and bottom leaves of five plants selected randomly at 1, 3 and 7 days after each spray and efficacy of each schedule was worked out.

The economics of different schedules were calculated by taking into consideration the cost of treatment combinations and the prevailing market price of seed and strains. The increase in seed yield was calculated as yield increase in plots of treatment schedule compared to untreated control plots.

RESULTS AND DISCUSSION

The bioefficacy of different management schedules comprising either three spray of insecticides T_4 or three spray of plant products T_7 (Jatropha leaf extract and neem seed kernal extract), two spray of insecticides T_1, T_2, T_3, T_8, and T_9 and one spray of plant products [either Jatropha leaf extract or Neem seed kernel extract] one spray of insecticides [methyl demeton 25 EC 0.04%] and two spray of botanicals [Jatropha leaf extract or neem seed kernel extract T_5 and T_6] at the appearance of the pest at vegetative stage, at flowering and pod filling stage was evaluated against sucking insect pests, jassid, *Amrasca kerri* Pruthi and white fly, *Bemisia tabaci* (Genn.).

The jassid, *Amrasca kerri* (Pruthi)

First spray: It is evident from Table-1 that all the management schedules were significantly superior over control right from one day after spraying. The management schedules T_1, T_4, T_5 and T_6 containing methyl demeton 25 EC at 0.04% spray at the appearance of the

Table 1: Effectiveness of insecticides and botanicals against jassid, *Amrasca kerri* Pruthi during *kharif* 2006

Treatments	First spray			Second spray			Third spray		
	1 day	3 day	7 day	1 day	3 day	7 day	1 day	3 day	7 day
T_1 – Mehyl demeton 25 EC 0.04% + NSKE 5% + Acephate 75 WP 0.075%	42.63 (45.87)*	42.35 (45.39)	47.10 (53.65)	49.87 (58.45)	51.01 (60.42)	58.38 (72.52)	54.13 (65.67)	56.04 (68.80)	72.47 (90.93)
T_2 – Dimethoate 30 EC 0.04% + NSKE 5% + Acephate 75 WP 0.075%	40.29 (41.81)	41.39 (43.67)	45.08 (50.14)	48.88 (56.76)	50.02 (58.72)	54.00 (65.46)	51.52 (61.29)	53.38 (64.42)	68.65 (86.75)
T_3 – Carbosulfan 25 EC 0.04% + JLE 5% + Malathion 50 EC 0.05%	38.34 (38.48)	39.43 (40.33)	44.93 (49.88)	41.36 (43.67)	45.83 (51.44)	44.38 (48.92)	49.06 (57.07)	50.88 (60.20)	65.36 (82.62)
T_4 – Methyl demeton 25 EC 0.04% + Quinalphos 25 EC 0.04% + Acephate 75 WP 0.075%	44.16 (48.54)	45.22 (50.39)	47.74 (54.78)	53.11 (63.96)	54.29 (65.93)	63.78 (80.49)	49.81 (58.36)	53.93 (65.33)	70.59 (88.95)
T_5 – Methyl demeton 25 EC 0.04% + NSKE 5% + NSKE 5%	43.57 (47.51)	44.63 (49.36)	46.50 (52.61)	47.73 (54.77)	48.87 (56.73)	53.08 (63.92)	52.06 (62.20)	51.64 (61.49)	58.67 (72.96)
T_6 – Methyl demeton 25 EC 0.04% + JLE 5% + JLE 5%	42.63 (45.87)	43.69 (47.72)	47.24 (53.90)	37.73 (37.44)	38.89 (39.41)	42.36 (45.40)	42.00 (44.78)	43.80 (47.90)	46.38 (52.40)
T_{-7} – JLE 5% + NSKE 5% + NSKE 5%	29.69	30.91	28.09	43.08	44.21	53.38	45.46	47.25	55.83
T_8 – Triazophos 40 EC 0.075% + NSKE 5% + Triazophos 40 EC 0.075%	35.35 (33.48)	36.47 (35.33)	40.50 (42.17)	49.81 (58.60)	44.13 (49.53)	52.19 (62.42)	46.73 (53.02)	48.53 (56.15)	56.41 (69.39)
T_9 – Endosulfan 35 EC 0.07% + NSKE 5% + Endosulfan 35 EC 0.07%	37.22 (36.58)	38.31 (38.43)	42.07 (44.90)	45.37 (50.65)	46.43 (52.50)	50.72 (59.91)	47.88 (55.03)	49.69 (58.14)	58.38 (72.52)
T_{10} – Control	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
S. Em. ±	0.616	0.654	0.744	0.799	0.826	1.007	0.890	0.965	1.687
C.D. at 5%	1.831	1.943	2.211	2.374	2.455	2.991	2.644	2.867	5.014

* Figures in parenthesis are retransformed per cent value.

pest (20 DAG) gave the best results with highest per cent reduction in population of jassid, *A. kerri*. The mean reduction in jassid population was 45.87, 48.54, 47.51 and 45.87 per cent, respectively. It was closely followed by management schedules T_2 and T_3 containing spray of dimethoate 30 EC at 0.04% and carbosulfan 25 EC at 0.04% which caused 41.81 and 38.48 per cent reduction in jassid population, respectively.

The management schedules T_9 and T_8 containing the spray of endosulfan 35 EC at 0.07% and triazophos 40 EC at 0.075% were next in order of effectiveness which caused 36.58 and 33.48 per cent reduction. Management schedule T_7 containing spray of Jatropha leaf extract 5% was found least effective.

At seven days after treatment application again the response followed the same as above treatment. The highest reduction was shown by management schedules T_1, T_4, T_5, and T_6 containing methyl demeton 25 EC at 0.04% giving 53.65, 54.78, 52.61 and 53.90 per cent reduction.

Second Spray: The data presented in Table 1 revealed that one day after the second spray the management schedule T_4 containing spray of quinalphos 25 EC at 0.04% spray at flowering offered best control with 63.96 per cent reduction in jassid population. It was followed by management schedule T_1, T_2, T_5, T_7, T_8, and T_9 containing spray of neem seed kernel extract at 5% which caused mean reduction ranging from 46.66 to 58.60 per cent reduction in jassid population.

The management schedule T_3 and T_6 containing spray of Jatropha leaf extract 5% were found least effective. All most similar results were obtained at 3 and 7 days after spray.

Third spray: One day after spraying of management schedules T_1, T_2 and T_4 containing spray of acephate 75 WP at 0.075% spray at pod filling stage was found superior to remaining all other sprays with 65.67, 61.29 and 58.36 per cent reduction in jassid population. It was followed by management schedules T_3, T_9 and T_8 containing spray of malation 50 EC at 0.05%, endosulfan 35 EC at 0.07% and triazophos 40 EC at 0.075% with 57.07, 55.03 and 53.02 per cent reduction in jassid population, respectively.

The efficacy of management schedule at three and seven days after spray was similar to first day after treatment application.

The white fly, *Bemisia tabaci* (Genn.)

First spray: At one day after spraying the management schedules T_1, T_4, T_5 and T_6 containing spray of methyl demeton 25 EC at 0.04% at the appearance of the pest (20 days after germination) gave the best results with highest per cent reduction in population of white fly. The mean reduction in white fly population was 51.05, 52.90, 50.49 and 53.75 per cent, respectively. It was closely followed by management schedules T_9 containing spray of endosulfan 35 EC at 0.07% which caused 46.65 per cent reduction. Management schedule T_2 and T_3 containing spray of dimethoate 30 EC at 0.04% and carbosulfan 25 EC at 0.04% at the appearance of the pest were next in order of effectiveness which caused 44.65 and 41.86 per cent reduction in white fly population, respectively was found (Table-2).

The efficacy of these schedules at three and seven days after spray was similar to first day after treatment.

Second spray: The data presented in Table 2 revealed that one day after the second spray the management schedule T_4 containing spray of quinalphos 25 EC at 0.04% spray at flowering was found best with 68.39 per cent reduction in white fly, *Bemisia tabaci* population.

Three days after second application of management schedule T_4 containing quinalphos 25 EC at 0.04% was found significantly superior over other management schedules with the highest mortality 85.35 per cent.

Seven days after second application of management schedule T_4 containing spray of quinalphos 25 EC at 0.04 found superior to all other management schedules at it caused 82.11 per cent reduction in white fly population. It was followed by management schedules T_1, T_2, T_5, T_7, T_8 and T_9 containing spray of neem seek kernel extract 5%.

Third spray: One day after spraying of management schedules T_1, T_2 and T_4 containing spray of acephate 75 WP at 0.075% spray at pod filling stage were found significantly superior to remaining all other sprays with 61.35, 64.90 and 62.35 per cent reduction in white fly population, respectively. It was followed by management schedules containing T_3, T_9 and T_8 containing spray of malathion 50 EC at 0.05%, endosulfan 35 EC at 0.07% and triazophos 40 EC at 0.075%.

The efficacy of management schedule at three and seven days after spray was similar to first day after treatment.

CUMULATIVE EFFECTIVENESS

The cumulative data presented in Table-3 revealed that at 1, 3 and 7 days after spraying the management schedule T_4 consisting spray of methyl demeton 25 EC at 0.04% at appearance of the pest followed by quinalphos 25 EC at 0.04% at flowering and acephate 75 WP at 0.075% at pod filling stage caused highest reduction with mean of 56.96, 90.55 and 74.74, 61.22, 70.44 and 80.28 per cent in jassid and white fly population, respectively. It was followed by management schedules T_2 consisting spray of dimethoate 30 EC at 0.04% at appearance of the pest

Table 2: Effectiveness of insecticides and botanicals against white fly, *Bemisia tabaci* Gennadius during *kharif* 2006

Treatments	First spray			Second spray			Third spray		
	1 day	3 day	7 day	1 day	3 day	7 day	1 day	3 day	7 day
T_1 – Mehyl demeton 25 EC 0.04% + NSKE 5% + Acephate 75 WP 0.075%	45.60 (51.05)*	46.66 (52.90)	55.71 (68.27)	46.66 (52.90)	55.79 (68.39)	62.35 (78.46)	51.56 (61.35)	53.85 (65.21)	73.59 (92.02)
T_2 – Dimethoate 30 EC 0.04% + NSKE 5% + Acephate 75 WP 0.075%	41.93 (44.65)	42.99 (46.50)	46.50 (52.61)	49.81 (58.36)	51.19 (60.73)	63.87 (80.60)	53.67 (64.90)	56.02 (68.76)	71.38 (89.80)
$_3$ – Carbosulfan 25 EC 0.04% + JLE 5% + Malathion 50 EC 0.05%	40.32 (41.86)	41.39 (43.72)	44.66 (49.40)	46.74 (53.04)	48.10 (55.41)	56.44 (69.44)	50.81 (60.06)	53.08 (63.92)	68.81 (86.93)
T_4 – Methyl demeton 25 EC 0.04% + Quinalphos 25 EC 0.04% + Acephate 75 WP 0.075%	46.66 (52.90)	50.61 (59.73)	57.07 (70.45)	55.79 (68.39)	67.50 (85.35)	64.98 (82.11)	52.15 (62.35)	54.46 (66.21)	69.98 (88.28)
T_5 – Methyl demeton 25 EC 0.04% + NSKE 5% + NSKE 5%	45.28 (50.49)	46.34 (52.34)	57.32 (70.84)	50.61 (59.73)	55.46 (67.85)	67.85 (76.87)	47.80 (54.88)	50.03 (58.73)	58.01 (71.94)
T_6 – Methyl demeton 25 EC 0.04% + JLE 5% + JLE 5%	47.15 (53.75)	48.22 (55.61)	60.99 (76.48)	57.06 (70.43)	53.55 (64.71)	55.71 (68.27)	41.95 (44.69)	44.16 (48.54)	50.68 (59.84)
T_{-7} – JLE 5% + NSKE 5% + NSKE 5%	32.15 (28.32)	33.32 (30.17)	34.69 (32.39)	49.02 (56.99)	50.61 (59.73)	58.20 (72.30)	48.20 (55.57)	50.43 (59.42)	56.55 (69.61)
T_8 – Triazophos 40 EC 0.075% + NSKE 5% + Triazophos 40 EC 0.075%	38.59 (38.90)	39.67 (40.75)	43.22 (46.90)	44.57 (49.25)	50.61 (59.73)	56.44 (69.44)	48.97 (56.90)	51.21 (60.76)	63.19 (79.66)
T_9 – Endosulfan 35 EC 0.07% + NSKE 5% + Endosulfan 35 EC 0.07%	43.08 (46.65)	44.14 (48.50)	46.95 (53.40)	49.02 (56.99)	50.39 (59.35)	55.26 (67.53)	50.02 (58.72)	52.29 (62.58)	64.61 (81.61)
T_{10} – Control	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
S. Em. ±	0.711	0.743	0.978	0.978	1.035	1.322	0.912	0.992	1.958
C.D. at 5%	2.114	2.207	2.904	2.904	3.075	3.927	2.709	2.946	5.816

* Figures in parenthesis are retransformed per cent value.

Table 3: Cumulative reduction in population of insect pests after application of different management schedules

Management Schedules	Jassid, *Amrasca kerri* Pruthi			White fly, *Bemisia tabaci* Gennadius		
	1 DAT	3 DAT	7 DAT	1 DAT	3 DAT	7 DAT
T_1 – Mehyl demeton 25 EC 0.04% + NSKE 5% + Acephate 75 WP 0.075%	56.67	58.21	72.36	55.11	62.16	79.58
T_2 – Dimethoate 30 EC 0.04% + NSKE 5% + Acephate 75 WP 0.075%	53.29	55.61	67.49	55.98	58.66	74.33
T_3 – Carbosulfan 25 EC 0.04% + JLE 5% + Malathion 50 EC 0.05%	46.40	50.66	60.49	51.66	54.36	68.59
T_4 – Methyl demeton 25 EC 0.04% + Quinalphos 25 EC 0.04% + Acephate 75 WP 0.075%	56.96	60.55	74.74	61.22	70.44	80.28
T_5 – Methyl demeton 25 EC 0.04% + NSKE 5% + NSKE 5%	54.83	55.86	63.17	55.04	59.65	73.21
T_6 – Methyl demeton 25 EC 0.04% + JLE 5% + JLE 5%	42.69	45.01	50.57	56.30	56.29	68.19
T_7 – JLE 5% + NSKE 5% + NSKE 5%	40.66	42.97	51.68	49.96	49.77	58.11
T_8 – Triazophos 40 EC 0.075% + NSKE 5% + Triazophos 40 EC 0.075%	48.37	47.00	57.99	48.35	53.75	65.33
T_9 – Endosulfan 35 EC 0.07% + NSKE 5% + Endosulfan 35 EC 0.07%	47.42	49.69	59.11	54.13	56.82	67.51

Table 4: Economics and cost benefit ratio of different treatments in soybean during *kharif* 2006

Treatments	Yield (q/ha)	Gross Returns (Rs./ha)	Yield increased over control	Per cent reduction	Value of increased yield over control (Rs./ha)	Cost of treatment application (Rs./ha)	Net Proft	B:C ratio
T_1 – Mehyl demeton 25 EC 0.04% + NSKE 5% + Acephate 75 WP 0.075%	18.90	34960	7.40	64.32	13685	2620	11065	1:1.463
T_2 – Dimethoate 30 EC 0.04% + NSKE 5% + Acephate 75 WP 0.075%	17.60	32560	6.10	53.04	11285	2487	8798	1:1.370
T_3 – Carbosulfan 25 EC 0.04% + JLE 5% + Malathion 50 EC 0.05%	15.70	29045	4.20	36.52	7770	2060	5710	1:1.245
T_4 – Methyl demeton 25 EC 0.04% + Quinalphos 25 EC 0.04% + Acephate 75 WP 0.075%	23.10	42735	11.60	100.87	21460	1618	19842	1:1.867
T_5 – Methyl demeton 25 EC 0.04% + NSKE 5% + NSKE 5%	22.30	41255	10.80	93.91	19980	3620	16360	1:1.657
T_6 – Methyl demeton 25 EC 0.04% + JLE 5% + JLE 5%	13.78	25493	2.28	19.83	4218	2620	1598	1:1.067
T_7 – JLE 5% + NSKE 5% + NSKE 5%	19.40	35890	7.90	68.70	14615	4090	10525	1:1.415
T_8 – Triazophos 40 EC 0.075% + NSKE 5% + Triazophos 40 EC 0.075%	17.34	32079	5.84	50.78	10804	2465	8339	1:1.351
T_9 – Endosulfan 35 EC 0.07% + NSKE 5% + Endosulfan 35 EC 0.07%	16.65	30803	5.15	44.78	9528	2550	6978	1:1.293
T_{10} – Control	11.50	21275	-	-	-	-	-	-

Soybean seed = Rs. 1850/1, Methyl demeton 25 EC 350/litre, NSKE = Rs. 50/kg, Acephate 75 WP = Rs. 500/kg, Dimethoate 30 EC = Rs. 220/litre, Carbosulfan 25 EC = Rs. 400/litre, JLE 5% = Rs. 30/kg, Malathion 50 EC Rs. 300/litre, Quinalphos 25 EC = Rs. 310/litre, Triazophos 40 EC = Rs. 200/litre, Endosulfan 35 EC = Rs. 230/litre and labour cost Rs. 70/day.

followed by neem seed kernel extract 5% at flowering and acephate 75 WP at 0.075% at pod filling stage, T_1 consisting spray of methyl demeton 25 EC at 0.04% at appearance of the pest followed by neem seed kernal extract 5% at flowering and acephate 75 WP at 0.075% at pod filling stage and T_5 consisting spray of methyl demeton 25 EC at 0.04% at appearance of the pest followed by neem seed kernal extract 5% at flowering and at pod filling stage.

The management schedule T_8 consisting spray of triazophos 40 EC at 0.075% at appearance of the pest followed by neem seed kernal extract 5% at flowering and triazophos 40 EC at 0.075% at pod filling stage was least effective among all other schedules. Though, it caused mean reduction of 48.37, 47.00 and 55.99; 48.35, 53.75 and 65.33 per cent mean cumulative reduction in jassid and white fly population at 1, 3 and 7 days after spraying, respectively.

The management schedule T_4 containing spray of methyl demeton 25 EC at 0.04% at appearance of the pest followed by quinalphos 25 EC at 0.04% at flowering and acephate 75 WP at 0.075% at pod filling stage was found most effective against the insect pests of soybean besides, it also yielded the highest seed yield of 23.10 q/ha, highest net return of 19, 842 Rs. /ha and B: C ratio of 1:1.867. While the management schedule T_5 comprising one spray of insecticide viz., methyl demeton 25 EC at 0.04% at the appearance of the pests and two sprays of neem seed kernal extract 5% at flowering and pod filling stage was next in order of its effectiveness which yielded mean seed yield of 22.30 q/ha with a net profit 16,360 Rs./ha and B: C ratio of 1:1.657.

The finding of present investigation is in close conformity with the finding of Keshbhat *et al.* (2002), Purwar and Yadav (2003 and 2004), Bajpai *et al.* (2004), Suryawanshi (2004), Gopal and Choudhary (2006).

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