The Andhra Agric. J 62(3): 621-624, 2015

Evaluation of Different Neem Products Against *Aproaerema modicella* (Deventer) and *Spodoptera litura* (Fabricius) in Groundnut

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ABSTRACT

Field studies were carried out to evaluate six different neem derivatives against major defoliator pests infesting groundnut *viz*., leaf miner, *Aproaerema modicella* (Deventer) and tobacco caterpillar, *Spodoptera litura* (Fabricius) during *Rabi* 2011-12 in comparison with an insecticidal check, Quinalphos 25EC. The results revealed that Quinalphos 25EC was found to be significantly superior to all other tested neem derivatives in suppressing *A. modicella* and *S. litura* larval population with a maximum mean per cent larval population reduction of 66.91and 57.31, respectively over untreated check. Neem Seed Kernel Extract (NSKE) 5% was found to be the effective treatment among the different neem derivatives tested in suppressing the larval population of *A. modicella* (43.17%) followed by neemazal 10000ppm (33.23%), neem oil (31.56%), neem leaf extract 5% (31.24%) and nivaar 1500ppm (30.20%), respectively. Whereas, NSKE 5% was found to be superior in bringing down the larval population of *S. litura* (42.25%) followed by neem oil (31.87%), neem leaf extract 5% (28.85%), neemazal 10000ppm (27.26%) and nivaar 1500ppm (25.26%), respectively.

Key words : Groundnut, Leaf miner, Tobacco caterpillar, Neem derivatives.

Groundnut (*Arachis hypogea* L.) is an important oilseed crop of tropical and subtropical regions of the world. In India, groundnut occupies an area of 6.22 million ha with total production of 7.34 million tones. Andhra Pradesh state shares about one third of groundnut area of the country and occupies third place in production contributing 18.81 per cent of the production in the country (http://www.agricoop.nic.in). In the rainy season, leaf miner, *Aproaerema modicella* (Deventer); tobacco caterpillar, *Spodoptera litura* (Fabricius); red headed hairy caterpillar, *Amsacta albistriga* and off late, gram caterpillar, *Helicoverpa armigera* (Hubner) are economically important pests in groundnut as defoliators during the pegging, podding and pod maturation stages of growth. Yield losses due to these leaf eating caterpillars can reach up to 76 per cent (Anon, 1988). The control of these caterpillar pests on groundnut involves mostly pesticides and only very rarely do farmers use alternative cultural, physical or biological methods. Additionally, many pests including *S. litura* have developed resistance to many commercially available pesticides. This can have negative impact on integrated pest management programmes with chemical control as one of the components (Jensen, 2000). The use of neem and its products could be an economically viable alternative to synthetic insecticides and use of neem could form an important component of Integrated Pest Management of groundnut (Nandagopal and Ghewande, 2004). Hence, present study was taken up to identify suitable botanical alternatives to synthetic pesticides in the management of leaf miner and tobacco caterpillar pests of groundnut.

MATERIAL AND METHODS

A field experiment was laid out at Agricultural Research Station, Darsi, Prakasam District during *Rabi* 2011-12 in Randomized Block Design (RBD) with 8 treatments including control and replicated thrice. Three commercial grade neem formulations *viz*., Nimbecidine (300 ppm) @ 1%, Nivaar (1500 ppm) @ 0.2%, Neemazal (10000 ppm) @ 0.03%, aqueous extracts of neem leaf and neem kernel @ 5% and Neem oil @ 0.2 % were used in the field study to know their efficacy against leaf miner and tobacco caterpillar in comparison with an insecticidal check, Quinalphos 25 EC. The aqueous extracts of neem leaf and kernel were prepared in a manner similar to that described by Mehta *et al*. (2005). K6 variety of groundnut was sown in plots of 3.0 m x 4.0 m size maintaining the spacing of 30 cm between rows and 10 cm from

Table 1. Efficacy of different neem products in the suppression of *Aproaerema modicella* and *Spodoptera litura.*

Treatments	Mean no. of *A. modicella* larvae / 10 plants			Mean no. of *S. litura* larvae / 10 plants			
	*Pre-treatment count	*Overall efficacy (mean values of two sprays)	**Mean per cent larval reduction over check	*Pre-treatment count	*Overall efficacy (mean values of two sprays)	**Mean per cent larval reduction over check	**Mean per cent defoliation
Nimbecidine (300 ppm)@ 1%	27.33 (5.27)	23.39 (4.88)	23.43 (28.63)	27.67 (5.29)	20.94 (4.63)	19.76 (26.23)	35.0 (36.3)
Nivaar (1500 ppm)@ 0.2%	26.67 (5.21)	21.28 (4.66)	30.20 (33.20)	28.67 (5.39)	19.50 (4.47)	25.26 (29.93)	28.3 (32.1)
Neemazal (10000 ppm)@ 0.03%	33.33 (5.77)	20.44 (4.57)	33.23 (35.23)	22.67 (4.80)	19.00 (4.42)	27.26 (31.47)	24.7 (29.7)
Neem Seed Kernel Extract @ 5%	26.67 (5.20)	17.44 (4.24)	43.17 (41.10)	29.00 (5.42)	15.06 (3.94)	42.25 (40.53)	19.4 (26.0)
Neem oil @ 2 ml/lt	32.00 (5.65)	21.11 (4.64)	31.56 (34.17)	32.00 (5.65)	17.83 (4.28)	31.87 (34.30)	24.3 (29.6)
Neem Leaf Extract @ 5%	29.33 (5.42)	21.11 (4.65)	31.24 (33.97)	21.00 (4.63)	18.56 (4.36)	28.85 (32.47)	23.8 (28.9)
Quinalphos 25 EC @ 2 ml/lt	31.33 (5.60)	10.11 (3.26)	66.91 (54.93)	28.33 (5.35)	11.17 (3.41)	57.31 (49.27)	18.3 (25.3)
Untreated check	30.67 (5.51)	30.83 (5.59)	0.00	26.00 (5.13)	26.17 (5.16)	0.00	39.1 (38.7)
F-Test	NS	Sig	Sig	NS	Sig	Sig	Sig
SEM ±	0.36	0.11	2.07	0.32	0.09	1.77	1.56
CD (P=0.05)	-	0.32	6.29	-	0.26	5.37	4.72
CV%	11.5	4.0	11.0	10.60	3.40	10.00	8.70

Sig: Significant NS: Non Significant

* Values in parentheses are SQRT (X+0.5) transformed values

** Values in parentheses are angular transformed values

plant to plant. All the recommended package of practices were followed except plant protection measures. The treatments were imposed soon after noticing the incidence of target pests or their damage symptoms in the experimental plots. A total of six neem derivatives were imposed in trial plots twice during the cropping period at 37 and 53 days after sowing. The observations on larval numbers of leaf miner and tobacco caterpillar were made on 10 randomly selected plants from each treatment plot one day before spraying as pre-treatment count and 3, 8 and 15 days after spraying as post-treatment counts. Observations recorded on fifteenth day after the first spray served as pre-treatment count for the second spray. The defoliation caused by tobacco caterpillar was also counted from randomly selected 10 plants in each treatment plot and calculated the percentage defoliation based on total leaves count. The population of natural enemies including Spiders and Coccinellids was also collected from randomly selected 10 plants in each treatment plot. Based on the insect larval number at each spray application, per cent reduction in larval population over untreated check was calculated. The recorded data corresponding to each treatment was subjected for statistical analysis after suitable transformation (Gomez and Gomez, 1984). After the crop attained maturity, it was harvested, pods and haulms were separated in each treatment, dried properly and pod and fodder yields were recorded. Plot wise yield

Table 2. Influence of different neem products on spiders, coccinellids and yield of Groundnut.

Treatments	Mean no. of Spiders / 10 plants	Mean no. of Coccinellids / 10 plants	No. of pods / plant	Dry pods (Kg / Ha)	Haulms (Kg / Ha)
Nimbecidine (300 ppm)@ 1%	7.7 (2.9)	10.3 (3.4)	18.7	1736	4588
Nivaar (1500 ppm)@ 0.2%	8.7 (3.1)	9.0 (3.1)	14.3	2014	4734
Neemazal (10000 ppm)@ 0.03%	6.7 (2.8)	9.0 (3.2)	13.0	1858	4930
Neem Seed Kernel Extract @ 5%	6.7 (2.8)	11.0 (3.5)	20.0	2819	5750
Neem oil @ 2 ml/lt	7.3 (2.9)	10.3 (3.4)	16.7	2601	4927
Neem Leaf Extract @ 5%	7.3 (2.9)	9.7 (3.3)	20.0	2231	5688
Quinalphos 25 EC @ 2 ml/lt	2.3 (1.8)	3.0 (2.0)	16.3	2837	5412
Untreated check	7.7 (2.9)	9.7 (3.3)	19.0	1563	4310
F-Test	Sig	Sig	NS	Sig	NS
SEM ±	0.16	0.17	3.3	172.8	700.7
CD (P=0.05)	0.49	0.50	-	524.1	-
CV%	10.1	9.1	32.7	13.6	24.1

Sig: Significant NS: Non Significant

* Values in parentheses are SQRT (X+0.5) transformed values

** Values in parentheses are angular transformed values

was computed on hectare basis for statistical interpretations.

RESULTS AND DISCUSSION

The overall mean efficacy of different neem derivatives given in two sprays against *A. modicella* (Table 1) revealed that all the treatments were found to be significantly superior to untreated check in suppressing *A. modicella* larval population. Insecticidal check, Quinalphos 25EC was found to be significantly superior to all other tested neem derivatives at every observation in suppressing *A. modicella* larval population with a maximum mean per cent larval population reduction of 66.91 over untreated check. Among the neem derivatives, Neem Seed Kernel Extract (NSKE) 5% was found to be superior to the rest of tested neem derivatives with a mean per cent larval population reduction of 43.17. The next best treatments were Neemazal 10000ppm (33.23%), Neem oil (31.56%), Neem leaf extract 5% (31.24%) and Nivaar 1500ppm (30.20%), respectively and were at par with each other. Lowest mean per cent larval population reduction was recorded in case of Nimbecidine 300ppm (23.43%). The present results are in conformity with Gopal *et al.* (1992), Prabhakar and Rao (1994), Sahayaraj and Paulraj (1998) and Patil *et al.* (2003) who reported that neem was the most toxic plant product against *A. modicella* compared to other plant products.

Efficacy of different neem derivatives in the suppression of *S. litura* larval population (Table 1) showed that Quinalphos 25EC was found to be significantly superior to all other tested neem derivatives in suppressing *S. litura* larval population with a maximum mean per cent larval population reduction of 57.31 over untreated check. Among the tested neem derivatives, NSKE 5% was found

to be superior to other neem derivatives at every observation with a mean per cent larval population reduction of 42.25. The next best treatments which were at par with one another in reducing *S. litura* larval population over untreated check was in the order of Neem oil (31.87%), Neem leaf extract 5% (28.85%), Neemazal 10000ppm (27.26%) and Nivaar 1500ppm (25.26%), respectively. Blackening of the body, breaking of cuticle and oozing out of body fluid and death during molting were some of the direct effects observed in larvae in treated plots. Lowest mean per cent larval population reduction was recorded in case of Nimbecidine 300ppm (19.76%). These results are in line with the findings and reasoning by Patil *et al.* (2003).

There was a significant difference in defoliation caused by *S. litura* and the mean per cent defoliation in different neem derivatives tested plots ranged from 19.4 to 35.0 compared to 18.3% in Quinalphos 25EC treated plot and untreated check (39.1%). All the neem based treatments were ecofriendly to predatory population of Spiders (6.7 - 8.7 / 10 plants) and Coccinellids (9.0 - 11.0 / 10 plants) and significantly superior to insecticidal check plots (2.3 and 3.0 / 10 plants, respectively) in harboring their populations both after first and second round of imposition of treatments. It is suggestive that, neem products are relatively safe bio-pesticides to an array of beneficial organisms (Men *et al*., 2002). Being safer than conventional insecticides the plant products will fit well in the pest management of groundnut crop.

There was a significant difference between the treatments for pod yields (Table 2) and all the plots treated with various neem derivatives recorded higher dry pod yields compared to untreated control. The yields of dry pods were significantly high in NSKE 5% treated plots (2819 Kg/ha) which remained at par with Quinalphos sprayed plots (2837 Kg/ha). Neem oil @ 0.2% and Neem leaf extract @ 5% treatments have also recorded higher dry pod yields of 2601 and 2231 Kg/ha, respectively and remained comparable with NSKE 5%. Nimbecidine (300 ppm) @ 1% treated plots obtained low yields of 1736 Kg/ha due to more infestation caused by the target pests and is at par with control (1563 Kg/ha). NSKE 5% (5750 Kg/ha) and Neem leaf extract @ 5% (5688 Kg/ha) recorded higher dry haulms yield in comparison to the rest of neem derivatives (4588 – 4930 Kg/ha) and Quinalphos (5412 Kg/ha) treated plots but found at par with each other.

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(Received on 01.11.2013 and revised on 12.03.2014)