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Ecologically Sustainable Pest Management for Thrips and Aphids in Groundnut

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Two field experiments were conducted in groundnut for the management of aphids and thrips in an ecologically sustainable manner during 2014 - 15 at Agricultural Research Station, Bhavanisagar. The results showed that seed treatment with imidacloprid 70 FS 5 ml/kg followed by spraying with thiamethoxam 25 WG at 0.4 ml/l at 30 DAS (or) seed treatment with imidacloprid 70 FS at 5 ml/kg of seed followed by spraying with neem seed kernel extract (NSKE) 5% at 30 DAS + placing yellow sticky trap at 25/ha. at 30 DAS+ raising cow pea as trap crop+ release of green lace wing predator *Chrysoperla zastrowi* at 30 DAS @ 2500 / ha. (or) spraying neem oil 2% at weekly interval from 20 DAS five times (or) basal application of neem cake @ 250 kg/ha.+ placing yellow sticky trap @ 25/ha. at 20 DAS+ release of green lace wing predator *C. zastrowi* @ 2500 /ha. at 20 DAS+ Azadirachtin 1% spray at 2 ml/l. at 30 DAS + raising cow pea as trap crop/ cumbu as intercrop recorded significantly lower population of thrips and aphids along with higher pod yield. These pest management approaches are useful in formulating ecologically sustainable biointensive IPM strategies.

Key words: Groundnut, Sucking Pests, Sustainable Pest Management.

Groundnut *(Arachis hypogaea* L.) is one of the major oilseed crops cultivated in about eight million hectares, with annual production of over nine million tonnes of pods contributing 45% of oilseed production in India. Sucking pests are the major biotic constraints in groundnut production. The major sucking insect pests of groundnut comprise of thrips *Scirtothrips dorsalis* Hood, leaf hopper *Empoasca kerri* Pruthi and aphid *Aphis craccivora* Koch (David and Ramamurthy, 2011). Thrips are the important sucking pests that live in the flowers and folded leaflets of groundnut known to cause yield loss and also responsible for spreading bud necrosis, a viral disease in groundnut. Aphids suck the sap from tender shoots and twigs and sometimes severely infest the plant and act as vectors of rosette disease (Mayeux, 1984). Leafhoppers suck the sap from the leaves and petioles and mainly prefer the first three terminal leaves and feeding symptoms induce yellowing of foliage that begins at the tip, known as hopper burn (Khan and Hussain, 1965). A heavy infestation of sucking pests on young plants results in considerable damage both by direct injury and by transmission of diseases such as bud necrosis and rosette. Yield loss of 16% was recorded in groundnut in India due to a complex of insect pests, the predominant one being *A. craccivora* (Jagtap *et al*., 1984). Timely and integrated management of these sucking pests are therefore inevitable. Different treatments/ treatment combinations preferably eco-friendly strategies were designed in two modules and evaluated at Agricultural Research Station, Bhavanisagar for the management of sucking pests of groundnut.

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Materials and Methods

Two field experiments in two modules (comprising of 11 and 10 treatment, respectively) were taken up, during Kharif 2014 and 2015 in the Northern Block of Agricultural Research Station, Bhavanisagar for the management of sucking pests *viz.,* thrips *S. dorsalis* and aphids *A. craccivora*. Different combinations of treatments in the above two modules as detailed below consisting of seed treatment with imidacloprid, soil application of neem cake, placing yellow sticky trap, raising trap crop/ intercrop, release of green lace wing predator with need based insecticide/ botanical spray were evaluated in TMV (Gn)13 cultivar.

Seed treatment with imidacloprid and neem cake application was made before sowing. Release of green lace wing predator *Chrysoperla zastrowi* @ 2500/ ha. and installation of yellow sticky traps @ 25/ ha. were made at 20 days after sowing (DAS) in module II and 30 DAS in module I. The botanicals / insecticides were applied either once/ repeated many times according to the treatment details. Cow pea was grown as trap crop in the border in treatments 7, 8, 9 and 10 in module I and treatments 6 and 8 in module II. Cumbu (bajra) crop was grown as intercrop in groundnut (1:6 ratio) in treatments 7 and 9 of module II. Observations on the incidence of sucking pests and the occurrence of natural enemies were made at weekly interval in 5 randomly selected plants/ plot from 20 DAS. The observations on the incidence of

sucking pests were made at 20, 27, 35, 42, 50, 57 and 64 DAS during 2014 and at 20, 27, 34, 41, 48, 55 and 62 DAS during 2015. The population of thrips was recorded in top 3 buds and aphid population in top 2 cm shoot length/ plant, whereas, the coccinellids was recorded from the entire plant. The yield data was recorded at harvest. Pooled mean analysis was carried out to differentiate the treatments.

Results and Discussion

The results of field experiments conducted in two years during kharif 2014 and 2015 for the management of sucking pests in groundnut using two modules showed that in module I, seed treatment with imidacloprid 70 FS at 5 ml/kg of seed followed by spraying with thiamethoxam 25 WG at 0.4 ml/l at 30 DAS (T_3) was significantly superior by recording the lowest population of thrips and aphid (2.79 and 0.86 respectively /5 plants) with higher pod yield of 3.15 kg of pods per plot of 20 sq.m. The combination treatment (T_9) comprising of seed treatment with imidacloprid 70 FS at 5 ml/kg of seed followed by spraying with NSKE 5% at 30 DAS + placing yellow sticky trap at 25/ha. at 30 DAS+ raising cow pea as trap crop in the borders+ release of green lace wing predator *Chrysoperla zastrowi* at 30 DAS @ 2500 /ha.

Module I	Module II
T_1 Seed treatment with imidacloprid 70FS @ 5 ml/kg	T_1 Basal application of neem cake @ 250kg /ha.
T_2 Seed treatment with imidacloprid 17.8SL @ 2 ml/kg	T_2 Weekly sprays of neem oil 2% from 20 DAS- 5 sprays
T_3 T_1 + Thiamethoxam 25WG @ 0.4g/l at 30 DAS	T_3 Weekly sprays of Nochi leaf extract 2% from 20 DAS- 5 sprays
T_4 T_2 + Thiamethoxam 25WG @ 0.4g/l at 30 DAS	T_4 T_1+ NSKE 5% spray at 30DAS
T_5 T_1 + NSKE 5% spray at 30 DAS	T_5 T_1 + Azadirachtin 1% spray at 2ml/l. at 30 DAS
T_6 T_2 + NSKE 5% spray at 30 DAS	T_6 T_5+ Placing yellow sticky trap @ 25/ha at 20 DAS + raising cowpea as trap crop in borders
T_7 T_5+ Placing yellow sticky trap @ 25/ha at 30 DAS + raising cowpea as trap crop in borders	T_7 T_5+ Placing yellow sticky trap @ 25/ha at 20 DAS + raising cumbu (bajra) as inter crop (Groundnut and cumbu at 6:1 ratio)
T_8 T_6+ Placing yellow sticky trap @ 25/ha at 30 DAS + raising cowpea as trap crop in borders	T_8 T_6+ release of green lace wing *Chrysoperla* @ 2500 first instar grubs / ha. at 20 DAS
T_9 T_7 + release of green lace wing *Chrysoperla* @ 2500 first instar grubs / ha. at 30 DAS	T_9 T_7 + release of green lace wing *Chrysoperla* @ 2500 first instar grubs / ha. at 20 DAS
T_{10} T_8+ release of green lace wing *Chrysoperla* @ 2500 first instar grubs / ha. at 30 DAS	
T_{11} Control	T_{10} Control

which was on par with the earlier treatment by recording lower thrips and aphids population (2.69 and 1.26 number / 5 plants) and pod yield of 3.10 kg/plot. The next best treatment (T_7) comprising of seed treatment with imidacloprid 70 FS at 5 ml/ kg of seed followed by spraying with NSKE 5% at 30 DAS + placing yellow sticky trap at 25/ha. at 30 DAS+ raising cow pea as trap crop recorded thrips population of 3.05/5 plants and yield of 3.10 kg/ plot. All the other treatments performed significantly inferior to the above three treatments but superior to untreated check and the untreated check recorded more numbers of thrips and aphids (13.24 and 4.46 per 5 plants respectively) with low pod yield (2.70 kg/ plot) (Table 1).

In module II, spraying neem oil 2% at weekly interval from 20 DAS (T_2) recorded significantly lower populations of thrips and aphids (2.24 and 0.62 numbers, respectively/ 5 plants) as well as significantly superior yield (3.09 kg/plot). The treatment (T_8) comprising of basal application of neem cake @ 250 kg/ha.+ placing yellow sticky trap@ 25/ ha. at 20 DAS+ release of green lace wing predator *C. zastrowi* @ 2500 / ha. at 20 DAS+ Azadirachtin 1% spray @ 2ml/l. at 30 DAS + cowpea as trap crop (T_8) and T_9 comprising of the same components as T_8 except the cowpea trap crop instead of which cumbu was grown as intercrop, recorded lower thrips and aphid population and higher pod yield, which were on par with weekly spraying of neem oil treatment (T_2). All the other treatments performed not as effective as that of the above three treatments, but better than the untreated check (Table 2). These findings are in accordance with the one made by Hanamant *et al*. (2014), which revealed that reduction in the number of thrips caused enhanced pod and haulm yield of groundnut.

Further, it was noticed that in module II, the treatments having cow pea as trap crop or cumbu as intercrop (T_6, T_7, T_8 and T_9) recorded more number of predatory coccinellids in the range of 1.00 to 1.89/ 5 plants compared to other treatments and untreated check, which recorded 1.00 or < 1.00 coccinellid/5 plants both during kharif 2014 and Kharif 2015 (Table 3).

Table 1. Management of sucking pests in groundnut (Module I- Pooled mean of 2014 and 2015 data)

Treatments	Thrips/ 5 plants	Aphid/ 5 plants	Yield kg/plot
T_1 Seed treatment with imidacloprid 70FS @ 5 ml/kg	6.047^{e}	1.903^{cd}	3.037^{bc}
T_2 Seed treatment with imidacloprid 17.8SL @ 2 ml/kg	7.000^{f}	2.213^{de}	2.990^{c}
T_3 T_1 + Thiamethoxam 25WG @ 0.4g/l at 30 DAS	2.787^{a}	0.857^{a}	3.147^{a}
T_4 T_2 + Thiamethoxam 25WG @ 0.4g/l at 30 DAS	4.837^{c}	1.477^{b}	3.030^{bc}
T_5 T_1 + NSKE 5% spray at 30 DAS	4.383^{b}	2.333^{ef}	3.010^{c}
T_6 T_2 + NSKE 5% spray at 30 DAS	5.500^{d}	2.643^{f}	2.993^{c}
T_7 T_5+ Placing yellow sticky trap @ 25/ha at 30 DAS + raising cowpea as trap crop in borders	3.047^{a}	1.573^{bc}	3.097^{ab}
T_8 T_6+ Placing yellow sticky trap @ 25/ha at 30 DAS + raising cowpea as trap crop in borders	4.763^{bc}	1.810^{bcd}	3.037^{b}
T_9 T_7+ release of green lace wing *Chrysoperla* @ 2500 first instar grubs / ha. at 30 DAS	2.690^{a}	1.260^{a}	3.103^{ab}
T_{10} T_8+ release of green lace wing *Chrysoperla* @ 2500 first instar grubs / ha. at 30 DAS	4.717^{bc}	1.740^{bc}	3.053^{b}
T_{11} Control	13.240^{g}	4.463^{g}	2.703^{d}
CD	0.415	0.403	0.084

In a column, means followed by same letter(s) are not significantly different by DMRT at (P=0.05) level

This might be due to the availability of alternate food *viz*., pollen for the adult coccinellids in times of scarcity of the prey insects in the intercrop cumbu or trap crop cow pea. Similar studies were made by Robert *et al*. (2012), who stated that the coccinellid population was most abundant in the mixed stands of maize and beans as compared to their occurrence in pure stands of cowpeas.

Table 2. Management of sucking pests in groundnut (Module II- Pooled mean of 2014 and 2015 data)

Treatments	Thrips/ 5 plants	Aphid/ 5 plants	Yield kg/plot
T_1 Basal application of neem cake @ 250kg /ha.	8.23^{f}	4.427^{e}	2.727^{e}
T_2 Weekly sprays of neem oil 2% from 20 DAS- 5 sprays	2.24^{a}	0.617^{a}	3.087^{a}
T_3 Weekly sprays of Nochi leaf extract 2% from 20 DAS- 5 sprays	6.24^{d}	2.307^{c}	2.903^{cd}
T_4 T_1+ NSKE 5% spray at 30DAS	6.60^{de}	2.717^{d}	2.960^{bc}
T_5 T_1+ Azadirachtin 1% spray at 2ml/l at 30 DAS	6.93^{e}	2.930^{d}	2.880^{d}
T_6 T_5+ Placing yellow sticky trap @ 25/ha at 20 DAS + raising cowpea as trap crop in borders	4.45^{c}	2.117^{c}	2.987^{b}
T_7 T_5+ Placing yellow sticky trap @ 25/ha at 20 DAS + raising cumbu (bajra) as inter crop (groundnut and cumbu at 6:1 ratio)	4.38^{c}	2.093^{c}	2.990^{b}
T_8 T_6+ release of green lace wing *Chrysoperla* @ 2500 first instar grubs / ha. at 20 DAS	3.76^{b}	1.643^{b}	3.067^{a}
T_9 T_7 + release of green lace wing *Chrysoperla* @ 2500 first instar grubs / ha. at 20 DAS	3.43^{b}	1.407^{b}	3.033^{ab}
T_{10} Control	11.24^{g}	6.120^{f}	2.680^{e}
CD	0.48	0.289	0.067

In a column, means followed by same letter(s) are not significantly different by DMRT at (P=0.05) level

Studies conducted by Rabindra (1985) also showed that intercropping pulses in cotton reduced the population of leaf hopper on cotton. Intercropping with 7 rows of green gram or black gram in *kharif* red gram and two rows of cumbu in *rabi* red gram found to encourage and conserve parasitoids and predators. Intercropping of groundnut with pearl millet reduced the incidence of thrips, leaf hoppers and leaf miners. When pearl millet was grown as an intercrop in groundnut, the parasitic activity of *Goniozus* sp. was considerably enhanced. The pollen grains of the pearl millet were preferably used as food by the adult parasitoids. Similar observations were recorded by Kennedy *et al.* (1990), who found that the groundnut intercropped with pearl millet, cowpea and sorghum has reduced population of jassids, thrips and aphids

and also lowered the population of *Spodoptera litura.* Similarly, the lowest population of defoliators in groundnut + sorghum and groundnut+ foxtail millet (Rashmi, *et al.* 2011) intercropping system was reported earlier.

Table 3. Mean population of coccinellids in different treatments (Module II)-2014 and 2015

Treatments	Coccinellid population / 5 plants*							
	2014				2015			
	20DAS	50 DAS	64 DAS	Mean	20DAS	48 DAS	62 DAS	Mean
T_1 Basal application of neem cake @ 250kg /ha.	0.33	0.33	0.33	0.33	0.33	0.67	1.00	0.67
T_2 Weekly sprays of neem oil 2% from 20 DAS- 5 sprays	0.33	1.00	0.67	0.67	0.67	1.00	1.67	1.11
T_3 Weekly sprays of nochi leaf extract 2% from 20 DAS- 5 sprays	0.33	0.33	0.33	0.33	0.33	0.67	1.00	0.67
T_4 T_1+ NSKE 5% spray at 30DAS	0.33	0.33	0.33	0.33	0.33	1.00	1.33	0.89
T_5 T_1 + Azadirachtin 1% spray at 2ml/l at 30 DAS	0.33	0.33	0.33	0.33	0.00	0.67	1.00	0.56
T_6 T_5+ Placing yellow sticky trap @ 25 ha at 20 DAS + raising cowpea as trap crop in borders	0.67	1.33	1.33	1.11	0.67	1.67	3.33	1.89
T_7 T_5+ Placing yellow sticky trap @ 25 ha at 20 DAS + raising cumbu (bajra) as inter crop (Groundnut and cumbu at 6:1 ratio)	0.33	1.67	1.33	1.11	0.33	1.67	3.67	1.89
T_8 T_6+ release of green lace wing *Chrysoperla* @ 2500 first instar grubs / ha. at 20 DAS	1.00	1.00	1.00	1.00	0.67	1.67	3.00	1.78
T_9 T_7 + release of green lace wing *Chrysoperla* @ 2500 first instar grubs / ha. at 20 DAS	0.67	1.67	1.33	1.22	0.67	1.33	2.67	1.56
T_{10}– Control	0.33	1.33	0.67	0.78	0.33	0.67	1.33	0.78

*Mean of three replications

The importance of intercropping in groundnut for the management of *S. litura* is reported by Girija *et al*. (2015). Intercropping can affect the micro-climate of the agro-ecosystem and ultimately, create an unfavourable environment for pests (Wilken, 1972; Singh, 1976). Trap crops are useful in attracting the natural enemies of pest insects to the fields and concentrating them in the field to enhance naturally occurring biological control. Thus, in the present study, the combination of seed treatment/ use of botanicals+ sticky trap+ trap crop/ intercrop + biocontrol agent reduced the population of sucking pests and enhanced the activity of natural enemies.

By considering the overall data, the following treatments are recommended for effective management of sucking pests in groundnut.

1. Seed treatment with imidacloprid 70 FS at 5 ml/kg of seed followed by spraying with thiamethoxam 25 WG at 0.4 ml/l at 30 DAS (Module I-T_3),
2. Seed treatment with imidacloprid 70 FS at 5 ml/ kg of seed followed by spraying with NSKE 5% at 30 DAS + placing yellow sticky trap at 10/acre at 30 DAS+ raising cow pea as trap crop+ release of green lace wing predator *C. zastrowi* @ 2500 first instar grubs / ha. at 30 DAS (Module I-T_9)
3. Spraying neem oil 2% at weekly interval from 20 DAS recorded significantly lower population of aphid and thrips (Module II-T_2)
4. Basal application of neem cake @ 250 kg/ha.+ placing yellow sticky trap@ 25/ha. at 20 DAS+ release of green lace wing predator *C. zastrowi* @ 2500 /ha. at 20 DAS+ Azadirachtin 1% spray @ 2 ml/l. at 30 DAS + Cumbu as intercrop (Module II-T_9).

Conclusion

The ecofriendly approaches evaluated are useful in formulating ecological and biointensive IPM (BIPM) relying on the use of botanicals, sticky trap, trap crop/ intercrop and use of biocontrol agents with less reliance of chemical pesticides. In modern IPM, emphasis is given to Agro Eco System Analysis (AESA), where farmers take decision based on understanding the ecosystem. The pest: defender ratio can be increased by enhancing the biodiversity (by growing flowering plants) that provides pollen and nectar for adult natural enemies in times of non availability of pests besides, inundating with natural enemies when the beneficial insect population is low. The combination treatments studied are useful in formulating ecologically sustainable insect pest management in groundnut.

References

David B.V. and V. V. Ramamurthy. 2011. Elements of Economic Entomology. Namrutha publications, Chennai, Tamil Nadu. p: 385.

Girija,T., Mahabaleshwar Hegde and Jayant Bhat. 2015. Influence of groundnut based intercropping system on *Spodoptera litura* (Fab.). *Journal of Eco-friendly Agriculture* **10(2)**: 163-167.

Hanamant, G., HMahabaleshwar,H and Balikai, R. A. 2014. Yield loss and economic injury level (EIL) estimation for Thrips in groundnut crop. *J. Exp. Zool. India* **17(2)**: 683-686

Jagtap, AB, Ghule BD, Deokar AB, 1984. Assessment of losses in yield of 'Phule Pragati' groundnut caused by insect pests. *Indian Journal of Agricultural Sciences*, **54(8)**:697-698

Khan, M. K. and Hussain, M., 1965, Role of coccinellid and syrphid predators in biological control of aphid. *Indian Oilseed J*., **9**:67-70.

Kennedy, F. J. S., Rajamanickam, K. and Raveendran, T. S. 1990. Effect of intercropping on insect pests of groundnut and their natural enemies. *Journal of Biological Control*, **4**: 63-64.

Mayeux A, 1984. The groundnut aphid. Biology and control. *Oleagineux*, **39(8/9)**:425-434.

Rabindra, R. J. (1985). Transfer of plant protection technology in dry crops. In : *Integrated Pest and Disease Management* (Ed. S. Jayaraj). Proc. Natl. Seminar, Tamil Nadu Agricultural University, Coimbatore. pp: 337-383.

Rashmi, Y., Hegde, M. G., Patil, R. K. and Balikai, R. A. 2011. Evaluation of IPM modules for management of defoliators in groundnut. *Annals of Plant Protection Sciences,* **19**: 321-323.

Robert W. N., Stella C. K., Fred, M. E. W., Jared O. O. and Cheramgoi, E. 2012. The Effectiveness of *Coccinellids* as Natural Enemies of *Aphids* in Maize, Beans and Cowpeas Intercrop. *Journal of Agricultural Science and Technology* **A 2** : 1003-1010.

Singh, K. M. 1976. Ecology-cum-economics based pest management. National seminar on Entomologist Role in Rural development, January 23-25, BCKVV, Kalyani, West Bengal, India.

Wilken, G. C. 1972. Microclimate management by traditional farmer. *Geographic Review,* **62**: 544-560.

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