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INSECT POPULATION DYNAMICS INFLUENCED BY IPM MODULE IN SUMMER GROUNDNUT

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Abstract

A field trial was conducted to evaluate four different IPM module of groundnut at Main Agricultural Research Station, Dharwad (Karnataka), India. Sucking pest population (thrips and leafhopper) was increased from 23 DAS to 37 DAS and reached its peak population at 37 DAS. At 44 DAS, it was lowest due to spraying insecticides. However, 51 DAS recovery of the pests was noticed since little increase in pest population was observed, after that gradual decrease in pest population seen in all the modules. At seedling stage population of leafminer was less and it was started increase and reached its peak population at 51 DAS and at 59 DAS decrease in pest population was noticed because of insecticidal treatment. Further, at 65 DAS there was increased population was observed and later goes on decreased. Similarly per cent leaf damage by the *Spodoptera litura* recorded from 51 DAS and the peak leaf damage was noticed at 79 DAS, after that crop was recovered by the pest damage and decreased damage was noticed in all the modules. Among the insect pest thrips, leafhopper and leafminer population was significantly lowest in Module III and per cent leaf damage by *S. litura* was lowest in Module I. The highest yield (27.57q/ha) and B: C (1:2.50) ratio was obtained in Module III.

Key words : IPM, modules, population, damage.

Introduction

Groundnut is an important oilseed crop of an India with an area of 5.5 million ha and production of 9.5 million tonnes of pods per annum. The average productivity of groundnut in the country is about 1723 kg ha^{-1}. The productivity of the crop is lower in the country as it is grown mostly in rainfed areas and in marginal lands receiving low inputs including crop protection intervention. Insect pests and diseases cause severe losses to groundnut in India and are recognized as one of the major constraint in groundnut production. Recently, the studies on insect pest population on *rabi*/summer groundnut at Dharwad revealed that sucking pests like thrips and leafhopper incidence are found crossing ETL at seedling and vegetative stage of the crop. Similarly leafminer incidence is also crossing ETL during vegetative and reproductive stages. Whereas incidence of *Spodoptera litura* was comparatively less during most of the years and their population started to build up at reproductive and maturity stage of the crop (Anonymous, 2013). In view of the economic damage caused by the pest to groundnut, integration of chemical insecticides with non-chemical methods pest control is highly desirable. With this background, IPM modules were developed and evaluated in field during *rabi*/summer 2014.

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Materials and Methods

An investigation was carried out under field condition during *rabi*/summer 2014 at Main Agricultural Research Station, University of Agricultural Sciences, Dharwad (Karnataka), India. An experiment was conducted on insect population dynamics influenced by IPM Module in summer groundnut. The sowing was done during first fortnight of January, 2014. Each module was implemented in 84.4 m^2 area with Dh-216 variety with spacing of 30x10cm. Four different IPM modules were developed against insect pests of *rabi*/summer groundnut *viz*., Module I comprised of sunflower as trap crop, spraying of spinosad 45 SC @ 0.25 ml/l (against thrips, leafhopper and leafminer) and thiodicarb 75 WP @ 1g/l. In Module

II, castor was grown as trap crop on bund and spraying was taken up with azadirachtin @ 3ml/l (neem based formulations 5000 ppm) against thrips, leafhopper and leafminer and thiodicarb 75 WP @ 1g/l agnaist *Spodoptera litura* Whereas, in Module III, cowpea was grown along the border as a conservation crop and the biopesticides, *Lecanicillium lecanii* @ 6 g/l (against thrips and leafhopper), *Beauveria bassiana* @ 6 g/l (against leafminer) and *Sl* NPV @ 100 LE/acre (against *S. litura*) were other components and Module IV consisted of recommended package of practices (RPP) where only insecticides such as dimethoate 30 EC @ 1.75 ml/l (thrips and leafhopper), profenophos 50 EC @ 2 ml/l (leafminer) and emamectin benzoate 5% SG @ 0.2 g/l (*S. litura*) were sprayed.

The population count of sucking pests (per terminal bud for thrips and per sweep for leafhopper), defoliating pests (per plant for leafminer and per cent defoliation for *S. litura*) was taken at weekly intervals starting from 23rd day after sowing up to crop maturity. Imposing of respective components in IPM module started when the pest populations reached ETL on groundnut. The components spinosad 45 SC @ 0.25ml/l and azadirechtin 5000 ppm @ 3ml/l, used twice respectively in Module I and Module II as both the sucking pests and leafminer crossed ETL on groundnut during the season at different stage of the crop. All the data were compared by using paired‘t’ test. After harvest, pod yield of groundnut was recorded from each module. Based on the yield data, the gross returns and net returns were calculated for each module. The Benefit-Cost ratio (B: C) was determined by dividing gross returns by cost of cultivation for each module.

Results and Discussion

Thrips population varied from 1.60 to 10.60, 1.90 to 13.00, 1.10 to 8.20 and 0.80 to 15.20 per terminal bud, respectively in Module I, Module II, Module III and Module IV from 23 DAS to 72 DAS. Similarly, leafhopper population in different IPM modules ranged from 0.30 to 3.80, 0.50 to 5.00, 0.20 to 2.40 and 0.60 to 6.10 leafhopper per sweep respectively, in Module I, Module II, Module III and Module IV. The highest (above ETL) population both pest (thrips and leafhopper) was recorded at 37 DAS in all the modules and lowest population was at 72 DAS in Module I, Module II and Module III. However, Module IV recorded lowest pest population at 44 DAS. As per paired‘t’ value, there was significant variation in sucking pests population across different IPM modules. The Module III was significantly superior to Module I, Module II and Module IV during 23 to 58 DAS. Whereas, Module I was significantly superior to Module II and Module IV during the same period. However, at 72 DAS all the modules were on par with each other (table 1). The Module III recorded significantly lowest population of leafhopper (table 2), which ranged from 0.20 to 2.50 per sweep at 23 to 51 DAS. Module I was the next best which recorded the population of leafhopper in the range of 0.30 to 3.80 per sweep. However, the highest population was recorded by Module IV at 23, 30 and 37 DAS. But from 58 to 72 DAS all the modules were on par with each other. The least sucking pest population in Module III might be due to presence of cowpea along the border as conservation crop which conserved and promoted the natural enemy fauna as evidenced by higher coccinellid and predatory spider population. These natural enemies might have kept the sucking pest population under check and hence Module III recorded comparatively lower number of sucking pest population compared to other three modules. Reduction in the population of thrips and leafhoppers in an IPM module with different components tested on summer groundnut in Andhra Pradesh (Sreenivasalu, 2002) is in line with the present findings. Similar findings were made by Shambharkar (2006). When cowpea and pearl millet was intercropped with groundnut reduced crop damage by the sucking pest was observed (Baskarn and Thangavelu, 1993) support present findings.

The population of leafminer varied from 0.20 to 3.3, 0.60 to 4.50, 0.40 to 2.60 and 0.80 to 5.60 larvae per plant respectively, in Module I, Module II, Module III and Module IV. The highest (above ETL) leafminer population was observed at 51 DAS in all the modules and the lowest was at 79 DAS in Module II, Module III and Module IV. However, Module I recorded lowest leafminer population at 58 DAS due to spraying of spinosad. As per the paired‘t’ test, Module III was significantly superior over other modules by recording 0.40 to 2.60 larvae per plant at 30 to 65 DAS which was followed by Module I(0.20 to 3.3 larvae per plant). Whereas, at 72 and 79 DAS all the modules were on par with each other except Module IV, which was inferior to Module I and Module II (table 3). The per cent leaf damage by *S. litura* ranged from 2.10 to 19.00, 3.20 to 21.40, 5.00 to 24.70 and 7.80 to 26.30 in Module I, Module II, Module III and Module IV, respectively during 51 to 100 DAS. The highest (above ETL) per cent leaf damage was recorded at 79 DAS and lowest was at 51 DAS. From 51 DAS to 86 DAS, the Module I recorded significantly lower per cent leaf damage when compared to other modules, which was followed by Module II. However, there was no statistical difference among the

Table 1 : Thrips population in different IPM modules of groundnut during *rabi*/summer, 2014.

Treatments	Thrips population / terminal bud								
	23 DAS	30 DAS	37 DAS	44 DAS	51 DAS	58 DAS	65 DAS	72 DAS	79 DAS
Module I: (Groundnut + sunflower)	6.90	9.10	10.60	3.20	6.20	4.80	2.30	1.70	1.60
Module II: (Groundnut+ castor	8.80	11.40	13.00	4.50	8.30	6.60	3.40	2.20	1.90
)Module III: (Groundnut + cowpea)	6.00	7.10	8.20	1.90	4.70	3.80	2.00	1.50	1.10
Module IV: (RPP)	9.50	14.00	15.20	0.80	2.90	2.60	2.40	1.90	1.40
Paired 't" test values for comparison of means									
Module I & Module II	3.47*	2.86*	2.39*	2.51*	3.50*	2.86*	2.70*	0.83	0.50
Module II & Module III	3.44*	6.28*	4.27*	3.67*	5.51*	4.45*	2.80*	1.02	1.17
Module III & Module IV	4.97*	10.77*	9.58*	2.73*	2.58*	2.62*	1.00	0.59	0.36
Module III & Module I	3.47*	3.46*	6.14*	2.76*	3.50*	2.37*	1.15	0.27	0.56
Module IV & Module I	3.54*	5.60*	2.46*	8.05*	6.37*	5.81*	0.55	0.39	0.33
Module IV & Module II	0.84	3.54*	2.29*	6.32*	8.05*	8.50*	2.53*	0.50	0.80

* Significant at 5 % level, DAS- days after sowing. Module - I : Sunflower (trap crop), spinosad 45 SC @ 0.25ml/l and thiodicarb 75 WP @ 1g/l spray; Module - II : Castor (trap crop), spraying of Azadirechtin 5000 ppm @ 3ml/l and thiodicarb 75 WP @ 1g/l ; Module - III : Cowpea (conservation crop), spraying of *Lecanicillium lecanii* @ 6g/l, *Beauveria bassiana* @ 6g/l and *Sl* NPV @ 100LE/acre; Module – IV : Spraying of dimethoate 30 EC @ 1.7 ml/l, profenophos 50 EC @ 2 ml/l, emamectin benzoate 5 SG @ 0.2g/l.

Table 2 : Leafhopper population in different IPM modules of *rabi*/summer groundnut.

Treatments	Leafhopper population / sweep							
	23 DAS	30 DAS	37 DAS	44 DAS	51 DAS	58 DAS	65 DAS	72 DAS
Module I: (Groundnut + sunflower)	2.40	2.90	3.80	3.40	3.70	2.50	1.20	0.30
Module II: (Groundnut+ castor)	3.50	4.00	5.00	4.70	4.90	3.20	1.40	0.50
Module III: (Groundnut + cowpea)	1.10	1.70	2.40	2.30	2.50	1.80	0.60	0.20
Module IV (RPP)	3.80	5.40	6.10	1.20	1.60	2.00	0.90	0.60
Paired 't" test values for comparison of means								
Module I & Module II	2.29*	2.28*	2.71*	2.62*	2.44*	0.93	0.24	0.51
Module II & Module III	5.06*	6.27*	6.50*	3.62*	4.00*	1.90	1.10	0.52
Module III & Module IV	5.16*	6.39*	8.25*	2.53*	2.37*	0.39	0.63	1.15
Module III & Module I	2.32*	2.40*	3.50*	2.51*	2.25*	1.29	1.32	0.48
Module IV & Module I	2.34*	5.23*	4.66*	4.11*	3.58*	1.10	0.55	1.15
Module IV & Module II	0.84	2.58*	2.40*	5.24*	4.94*	1.47	0.88	0.21

* Significant at 5% level, DAS- days after sowing.

Module - I : Sunflower (trap crop), spinosad 45 SC @ 0.25ml/l and thiodicarb 75 WP @ 1g/l spray.

Module - II : Castor (trap crop), spraying of Azadirechtin 5000 ppm @ 3ml/l and thiodicarb 75 WP @ 1g/l.

Module - III : Cowpea (conservation crop), spraying of *Lecanicillium lecanii* @ 6g/l, *Beauveria bassiana* @ 6g/l and *Sl* NPV @ 100LE/acre.

Module – IV : Spraying of dimethoate 30 EC @ 1.7 ml/l, profenophos 50 EC @ 2 ml/l, emamectin benzoate 5 SG @ 0.2g/l.

Table 3 : Leafminer population in different IPM modules of *rabi*/summer groundnut.

Treatments	Larvae / plant							
	30 DAS	37 DAS	44 DAS	51 DAS	58 DAS	65 DAS	72 DAS	79 DAS
Module I: (Groundnut + sunflower)	1.20	2.10	1.80	3.30	0.20	1.60	0.60	0.50
Module II: (Groundnut+ castor)	2.20	3.20	3.00	4.50	3.70	2.80	0.80	0.60
Module III: (Groundnut + cowpea)	0.50	1.60	0.60	2.60	1.50	0.90	0.50	0.40
Module IV : (RPP)	2.80	4.10	3.90	5.60	2.60	2.00	1.20	0.80
Paired 't" test values for comparison of means								
Module I & Module II	2.73*	2.70*	2.27*	3.08*	6.72*	2.27*	1.07	0.28
Module II & Module III	5.66*	3.36*	11.75*	4.38*	5.23*	3.07*	1.67	0.55
Module III & Module IV	8.83*	5.00*	10.00*	8.21*	2.42*	2.73*	1.90	1.80
Module III & Module I	3.27*	1.10	2.32*	3.27*	2.44*	2.31*	1.17	0.20
Module IV & Module I	5.23*	3.46*	3.99*	5.43*	5.66*	5.07*	3.77*	1.78
Module IV & Module II	2.71*	3.25*	2.44*	3.08*	2.53*	5.46*	4.82*	2.01

* Significant at 5 % level DAS- days after sowing

Module - I : Sunflower (trap crop), spinosad 45 SC @ 0.25ml/l and thiodicarb 75 WP @ 1g/l spray

Module - II : Castor (trap crop), spraying of Azadirechtin 5000 ppm @ 3ml/l and thiodicarb 75 WP @ 1g/l

Module - III : Cowpea (conservation crop), spraying of *Lecanicillium lecanii* @ 6g/l, *Beauveria bassiana* @ 6g/l and *Sl* NPV @ 100LE/ acre

Module – IV : Spraying of dimethoate 30 EC @ 1.7 ml/l, profenophos 50 EC @ 2 ml/l, emamectin benzoate 5 SG @ 0.2g/l

Table 4 : Per cent leaf damage by defoliators different IPM modules of *rabi*/summer groundnut.

Treatments	Per cent leaf damage by defoliators							
	51 DAS	58 DAS	65 DAS	72 DAS	79 DAS	86 DAS	93 DAS	100 DAS
Module I: (Groundnut + sunflower)	2.10	4.20	9.10	11.30	19.00	12.80	10.40	7.80
Module II: (Groundnut+ castor)	3.20	6.20	10.90	13.70	21.40	14.90	11.80	8.60
Module III: (Groundnut + cowpea)	5.00	8.70	12.90	15.20	24.70	18.30	13.80	8.90
Module IV (RPP)	7.80	10.30	14.80	17.70	26.30	20.40	14.60	9.50
Paired 't" test values for comparison of means								
Module I & Module II	2.27*	7.74*	2.58*	2.42*	2.32*	3.44*	1.57	1.61
Module II & Module III	2.29*	3.33*	3.87*	2.35*	2.53*	3.42*	1.09	0.83
Module III & Module IV	2.28*	2.31*	2.29*	2.86*	3.06*	2.38*	0.82	1.26
Module III & Module I	3.97*	5.78*	5.58*	5.29*	4.19*	2.88*	2.67*	2.02
Module IV & Module I	4.50*	6.23*	5.48*	7.86*	5.16*	5.36*	3.04*	2.20
Module IV & Module II	3.01*	3.27*	7.12*	3.55*	4.81*	4.63*	1.90	1.89

*Significant at 5% level, DAS- days after sowing.

Module - I : Sunflower (trap crop), spinosad 45 SC @ 0.25ml/l and thiodicarb 75 WP @ 1g/l spray; Module - II : Castor (trap crop), spraying of Azadirechtin 5000 ppm @ 3ml/l and thiodicarb 75 WP @ 1g/l; Module - III : Cowpea (conservation crop), spraying of *Lecanicillium lecanii* @ 6g/l, *Beauveria bassiana* @ 6g/l and *Sl* NPV @ 100LE/ acre; Module - IV : Spraying of dimethoate 30 EC @ 1.7 ml/l, profenophos 50 EC @ 2 ml/l, emamectin benzoate 5 SG @ 0.2g/l.

Table 5 : Economics of IPM modules for *rabi*/summer groundnut.

Treatments	Yield (q/ha)		Equivalent yield (q/ha)	Gross returns (Rs./ha)	Cost of cultivation (Rs./ha)	Net profit (Rs./ ha)	B:C Ratio
	Groundnut	Intercrop					
Module I: (Groundnut + sunflower)	25.55	1.65	26.60	1,10,789.00	46,500.00	64,289.00	1:2.38
Module II: (Groundnut+ castor)	26.20	0.95	26.87	1,119,14.00	46,110.00	65,804.00	1:2.43
Module III: (Groundnut + cowpea)	26.55	1.19	27.57	1,14,829.00	45,635.00	69,194.00	1:2.50
Module IV (RPP)	26.34	00.00	26.34*	1,09706.00	46,040.00	63,666.00	1:2.38

* Yield of groundnut sole crop.

modules with respect to leaf damage at 93 and 100 DAS (table 4). IPM module developed at Tamil Nadu (Kennedy, 1990) found that the presence of foxtail millet as inter crop effectively checked the infestation of leafminer on groundnut. Similar results were also recorded at Dharwad (Yambhatnal, 2011), Maharashtra (Shambharkar, 2006) and Andhra Pradesh (Sreenivasalu, 2002). Among the different IPM modules, the highest equivalent yield was obtained in Module III, resulted in maximum net returns (Rs. 69,194.00) and highest B: C ratio (1:2.50) followed by Module II where in net returns and B: C ratio was Rs. 65,804.00 and 1:2.43, respectively. Net returns (Rs. 63,666.00) and B:C (1:2.38) ratio was lowest in Module IV compared to Module III and Module II due to the low yield. Present studies are in conformity reported IPM modules evaluated at Andhra Pradesh (Sreenivasalu, 2002) with different components gave higher profit in comparison to farmer's practice and chemical method of pest management in groundnut crop (table 5).

References

Anonymous (2013). *Annu. Prog. Rep, AICRP on groundnut*, Directorate of Groundnut Research , Junagadh, pp E 155.

Sreenivasalu, B., V. Govardhrana and B. Rajendra Prasad (2002). Integrated pest management in groundnut against *Spodoptera litura* (Fabr.) and other sucking pest. *Pest. Mngt. Econ. Zool.,* **10** : 193-19.

Shambharkar, D. A., P. K. Dharne, T. M. Bahale, A. Deshmukh, R. T. Suryawanshi and R. B. Jadhav (2006). Assessment of integrated pest management of modules in groundnut on farmer's fields. *Int. Arachis Newslett*, **26** : 31-33.

Baskarn, R. K. M. and S. Thangavelu (1993). Non conventional method to minimize the incidence of groundnut leafminer. *Groundnut News*, **2** : 6.

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

Yambhatnal, R., M. G. Hegde, R. K. Patil and R. A. Balikai (2011). Evaluation of IPM modules of defoliators in groundnut. *Ann. Pl. Prot*., **19** : 321-323.