



IMPACT OF INTERCROPPING SYSTEM TO MINIMISE THE PEST INCIDENCE IN GROUNDNUT

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Received: December 24, 2015; Revised: December 31, 2015; Accepted: January 01, 2016

Abstract- Field experiment was carried out during 2014 – 2015 at DARS, Chettinad, Sivagangai district to find out cost-effective groundnut based inter-cropping system for the management of key pests. Groundnut (*Arachis hypogaea* Linnaeus; Variety: VRI II) when intercropped with bajra (*Pennisetum glaucum* L.; Variety: Co 7), sorghum (*Sorghum bicolor* L.; Variety: Co 30) and maize (*Zea mays* L.; Variety: Co 6) 4:1 ratio harboured significantly less mean population of *Aproaerema modicella* Deventer, recording 8.58, 9.67 and 10.00 larvae / 10 plants respectively, whereas intercropping with redgram (*Cajanus cajan* L.; Variety: VBN (Rg) 3), marigold (*Tagetes erecta* L.; Variety: MDU 1) and onion (*Allium cepa* L.; Variety: Co 1) recorded mean population of 11.25, 11.46 and 11.50 larvae / 10 plants. Groundnut + sesame (*Sesamum indicum* L.; Variety: Co 1) intercropping system recorded high mean population of 12.12 larvae / 10 plants as compared to other cropping systems while groundnut as pure crop recorded the highest mean population of 13.75 larvae/10 plants. Same trend could be noticed in turn leaflet damage by *A. modicella*.

Keywords- *Aproaerema modicella*, *Arachis hypogaea*, Intercropping system, IPM.

Citation: Parthiban P., et al., (2016) Impact of Intercropping System to Minimise the Pest Incidence in Groundnut. International Journal of Agriculture Sciences, ISSN: 0975-3710 & E-ISSN: 0975-9107, Volume 8, Issue 1, pp.-944-946.

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Introduction

Groundnut (*Arachis hypogaea* L.) is a leading oilseed crop in India and an important oilseed crop of tropic and subtropic regions of the world. The seeds are rich source of edible oil (43-55%) and protein (25-28%), also a valuable source of vitamins viz., E, K and B [1]. In India, it is grown on 5.5 Million hectares with a production of 9.7 Million tones and contributing to 55 percent of the total oil seed production in the Country and ranks first in the world in total area and 2nd in production.

The mean yield of groundnut is about 1784 kg of pods/ha. In Tamil Nadu, which is higher than the world average (1336 kg/ha) and it ranks first in India. Tamil Nadu accounts for 12 percent (0.41 Million hectares) of the total area under groundnut, it contributes to 22 percent (0.81 Million Tons) of the total production [2]. Pests and diseases are the major biotic factors affecting the groundnut yield. Groundnut crop is attacked by lepidopteran as well as sucking pests. Among the lepidopteran pests attacking the groundnut crop, leaf miner occurs from vegetative stage till the harvest of the crop results in low yield and in extreme cases complete failure of the crop. Under these situations, the intercropping can play a significant role to enhance the productivity and profitability per unit area and time through more efficient use of land, water and solar energy besides assuring insurance against crop failure.

Intercropping with main crop to reduce pest pressure is one of the promising Integrated Pest Management (IPM) strategies and study of such a technique will be useful for formulating location specific IPM module against major insect pests of groundnut. Information on this aspect is meager particularly in Tamil Nadu. In IPM, cropping system approach, particularly, use of different varieties and various intercrops are vital tools that alter population status of pests and natural enemies. Local varieties are reported to harbour lower number of pest fauna and higher number of beneficials and vice versa in hybrid and other improved varieties.

Similarly, intercropping system is reported to change the bio-diversity of pests and beneficials on the main crop. The intercropping leads to a change in crop

canopies and bring about a resultant change in the climate at the micro level [3]. Further, taller intercrops have been observed to check the dispersal of flying insect pests of shorter crops, thus preventing migration towards the main crop [4]. Therefore, the present field experiment was undertaken to study the impact of intercropping on the incidence of *A. modicella*.

Materials and Methods

Field experiment was conducted during October 2014 – January 2015 in an area of 22 cents in a weather condition of 26 ± 20°C and 73 ± 5 % RH at Dryland Agricultural Research Station (DARS), Chettinad, Sivagangai District, Tamil Nadu, India. The experiment was carried out in a randomized block design and each treatment was replicated thrice. Groundnut seeds were sown in the field at a spacing of 30 x 10 cm. All the standard package of practices recommended for the crops were followed except plant protection measures. Seven intercropping systems were tried as detailed below:

1. Groundnut (VRI II) + Bajra (*Pennisetum glaucum* L.) (Co 7)
2. Groundnut (VRI II) + Sorghum (*Sorghum bicolor* L.) (Co 30)
3. Groundnut (VRI II) + Maize (*Zea mays* L.) (Co 6)
4. Groundnut (VRI II) + Sesame (*Sesamum indicum* L.) (Co 1)
5. Groundnut (VRI II) + Onion (*Allium cepa* L.) (Co 1)
6. Groundnut (VRI II) + Marigold (*Tagetes erecta* L.) (MDU 1)
7. Groundnut (VRI II) + Redgram (*Cajanus cajan* L.) (VBN (Rg) 3)
8. Groundnut (VRI II) pure crop

The above said intercropping system was planted at 4:1 ratio with recommended spacing. Observations were recorded on population and percent leaflet damage by *A. modicella* in ten randomly selected groundnut plants in each intercropping system and groundnut as pure crop, commencing from sowing to harvest of crops at ten days interval.

Statistical analysis

Data obtained from the field study were subjected to ANOVA. Before analysis, data on per cent leaflet damage were subject to arcsine transformation. In order to know the interaction between treatments, data were subject to factorial RBD analysis and the means obtained were separated by LSD (Least Significant Difference) [5].

Results

Population of *A. modicella*

Field experiments on the impact of seven intercrops on the incidence of *A. modicella* in groundnut indicated that groundnut intercropped with bajra (4:1) recorded significantly the lowest mean population of 8.58 larvae/10 plants, as compared to groundnut as sole crop (13.75 larvae/10 plants) [Table-1] which was significantly different from the remaining intercropping system. The next in the intercropping order is groundnut + sorghum, registering the low mean population (9.67 larvae/10 plants), followed by groundnut + maize (9.67 larvae/10 plants), groundnut + redgram (11.25 larvae/10 plants), groundnut + marigold (11.46 larvae/10 plants) and groundnut + onion (11.25 larvae/10 plants) which were significantly different from each other with reference to *A. modicella* [Table-1]. The intercrop sesame was less effective in reducing the mean population, resulting 12.12 larvae / 10 plants. On 20 and 30 DAS, no significant difference was noticed among different intercropping systems on the incidence of leafminer. On 40 DAS,

lowest mean population was recorded in groundnut intercropped with bajra (5.33 larvae/10 plants), followed by groundnut + sorghum (7.00 larvae/10 plants), groundnut + marigold (7.67 larvae/10 plants), groundnut + redgram (8.00 larvae/10 plants) and groundnut + maize (8.33 larvae/10 plants) which were significantly different from each other with reference to *A. modicella*. Groundnut + onion (9.00 larvae/10 plants) and groundnut + sesame (9.33 larvae/10 plants) recorded the high population of larvae as compared to other intercropping systems, and groundnut sole crop (10.33 larvae / 10 plant on 40 DAS. Same trend was noticed on 50, 60, 70, 80 and 90 DAS in various intercropping system.

Percent leaflet damage by *A. modicella*

Among seven intercrops tried for the management of *A. modicella* in groundnut, bajra as intercrop in groundnut (1:4) recorded the lowest mean leaflet damage of 15.98 percent, followed by groundnut + sorghum (18.10%), groundnut + maize (18.65%), groundnut + redgram (20.37%), groundnut + marigold (20.66%) and groundnut + onion (21.01%) which were on a par with one another [Table-2]. The influence of sesame in reducing the leaflet damage in groundnut was less recording 22.43 percent, whereas groundnut sole crop recorded 27.08 percent leaflet damage. On 20 DAS, there is no significant difference among intercropping systems while on 30, 40, 50, 60, 70, 80 and 90 DAS, the percent leaflet damage which explicated the result same manner.

Table-1 Population of *A. modicella* on groundnut intercropping systems (Season: October 2014 to January 2015)

Treatment	Population of <i>A. modicella</i> (Nos. of larvae / 10 plants)*								Mean	% reduction over control
	20 DAS**	30 DAS	40 DAS	50 DAS	60 DAS	70 DAS	80 DAS	90 DAS		
Groundnut + Bajra	3.00 (1.73)	4.67 (2.16) ^a	5.33 (2.31) ^a	8.67 (2.94) ^a	10.33 (3.21) ^a	14.00 (3.74) ^a	13.67 (3.70) ^a	9.00 (3.00) ^a	8.58 (3.93) ^a	37.60
Groundnut + Sorghum	2.67 (1.63)	6.00 (2.45) ^{bc}	7.00 (2.65) ^b	10.67 (3.27) ^b	11.33 (3.37) ^b	15.33 (3.92) ^b	14.33 (3.79) ^{ab}	10.00 (3.16) ^b	9.67 (3.11) ^b	29.67
Groundnut + Maize	3.00 (1.73)	6.33 (2.52) ^c	8.33 (2.89) ^{cd}	10.33 (3.21) ^b	11.67 (3.42) ^b	16.00 (4.00) ^b	14.67 (3.83) ^b	9.67 (3.11) ^{ab}	10.00 (3.16) ^b	27.27
Groundnut + Sesame	2.67 (1.63)	6.33 (2.52) ^c	9.33 (3.05) ^e	12.33 (3.51) ^d	14.33 (3.79) ^{cd}	18.67 (4.32) ^{de}	19.00 (4.36) ^{de}	14.33 (3.92) ^{de}	12.12 (3.48) ^d	11.85
Groundnut + Onion	3.00 (1.73)	6.33 (2.52) ^c	9.00 (3.00) ^{de}	12.33 (3.51) ^d	13.67 (3.70) ^c	17.67 (4.20) ^c	17.00 (4.12) ^c	13.00 (3.61) ^c	11.50 (3.39) ^c	16.36
Groundnut + Marigold	2.33 (1.53)	5.67 (2.38) ^{bc}	7.67 (2.77) ^{bc}	11.00 (3.32) ^{bc}	14.00 (3.74) ^c	18.67 (4.32) ^{de}	18.33 (4.28) ^d	14.00 (3.74) ^d	11.46 (3.39) ^c	16.65
Groundnut + Redgram	2.67 (1.63)	5.33 (2.31) ^{ab}	8.00 (2.83) ^c	11.67 (3.42) ^{cd}	13.33 (3.65) ^c	18.00 (4.24) ^{cd}	17.33 (4.16) ^c	13.67 (3.70) ^{cd}	11.25 (3.35) ^c	18.18
Groundnut pure crop	2.33 (1.53)	6.33 (2.52) ^c	10.33 (3.21) ^f	13.67 (3.70) ^e	17.00 (4.12) ^e	21.33 (4.62) ^f	20.67 (4.55) ^f	18.33 (4.28) ^f	13.75 (3.71) ^e	--
SEd	NS	0.0811	0.0706	0.0586	0.0548	0.0476	0.0487	0.0570	0.0599	--
CD (P=0.05)	NS	0.1739	0.1535	0.1256	0.1176	0.1021	0.1044	0.1222	0.1284	--

NS: Non-significant; **DAS: Days after sowing

*Mean of three replications; Figures in parentheses are square root transformed values

In a column, means followed by common letter(s) are not significantly different by LSD (P= 0.05)

Discussion and Conclusion

Intercropping is one of the important cultural practices in pest management, reducing insect pests by increasing the diversity of an eco-system [6]. Intercropping affects the pests by changing micro-climate through change in crop canopies [7 & 8], influencing the pest population build-up through physical factors like protection from wind, shading, sheltering, prevention of dispersal, alteration of colour, shape of the stand etc. and through biological factors like presence of natural enemies, production of adverse chemical stimuli, availability of alternate food etc.

Among the seven intercrops tried, groundnut intercropped with bajra (4:1) was the best in reducing the larval population of *A. modicella* and their leaflet damage when compared to other intercropping systems. The findings emerged from the present study is supported by Murali Baskaran and Thangavelu [9] who explicated the growing bajra as an intercrop in groundnut (1:4 or 1:6) received low incidence of leaf miner and the larval population, recording 45.0 larvae per meter row and 20.8 percent leaflet damage, respectively while in the pure crop of groundnut, they

were 82.9 larvae per meter row with 62.7 percent leaflet damage. The present result endorsed with the findings of Dhaliwal and Arora [10] who reported that intercropping of groundnut with pearl millet reduced the incidence of thrips, jassid and leaf miner.

Pesticide Post [11] reported that in Central and Southern India, intercropping of cotton with black gram, green gram and cowpea was aimed to divert the population of sucking pest and American bollworm from cotton and helped colonization of coccinellids and enhanced parasitization of spotted bollworm mostly on cowpea. Intercropping groundnut with pearl millet reduced the incidence of thrips, jassids and leaf miner. It could be inferred from the study that pulse crops as intercrops reduced bollworm attack and cereal and oil seed crops brought down certain pests. Thus in intercropping systems, greater diversity of crops was required.

Allelochemicals emanated from intercrop of the present study might be responsible to repel the herbivores of groundnut, as pointed by Murali Baskaran and Thangavelu [9] and Kennedy and Raveendran [12] who reported that the

application of aqueous leaf extract of bajra on groundnut repelled and changed the oviposition behaviour of gravid moths of *A. modicella*. The presence of allelochemicals in intercrops worked well in reducing the incidence of herbivores in

several intercropping systems [13 & 14]. Intercropping, particularly with four row of groundnut to one row of bajra seems to encourage less population of leaf miner infestation and abundance in groundnut, and stepping up the oilseeds production.

Table-2 Percent leaflet damage by *A. modicella* on groundnut intercropping systems (Season: October 2014 to January 2015)

Treatment	% leaflet damage*								Mean	% reduction over control
	20 DAS**	30 DAS	40 DAS	50 DAS	60 DAS	70 DAS	80 DAS	90 DAS		
Groundnut + Bajra	15.87 (23.47)	12.14 (20.39) ^a	14.02 (21.99) ^a	17.33 (24.60) ^a	18.96 (25.81) ^a	19.13 (25.94) ^a	17.46 (24.70) ^a	12.96 (21.10) ^a	15.98 (23.56) ^a	40.99
Groundnut + Sorghum	15.94 (23.53)	14.88 (22.69) ^c	16.33 (23.83) ^b	20.74 (27.09) ^c	20.89 (27.20) ^b	21.00 (27.27) ^b	21.00 (27.27) ^b	14.00 (21.97) ^b	18.10 (25.18) ^b	33.16
Groundnut + Maize	16.05 (23.62)	15.19 (22.94) ^c	19.86 (26.46) ^e	19.11 (25.92) ^b	22.00 (27.97) ^c	22.29 (28.17) ^c	21.42 (27.57) ^b	13.26 (21.35) ^{ab}	18.65 (25.58) ^b	31.13
Groundnut + Sesame	16.21 (23.71)	16.44 (23.92) ^{de}	20.94 (27.23) ^f	24.54 (29.70) ^f	28.00 (31.95) ^g	27.54 (31.65) ^e	25.62 (30.41) ^d	20.11 (26.64) ^e	22.43 (28.27) ^d	17.17
Groundnut + Onion	16.03 (23.60)	15.61 (23.27) ^{cd}	20.34 (26.81) ^{ef}	23.97 (29.31) ^f	24.96 (29.97) ^e	26.00 (30.66) ^d	23.86 (29.24) ^c	17.27 (24.55) ^c	21.01 (27.28) ^c	22.41
Groundnut + Marigold	15.39 (23.10)	13.54 (21.59) ^b	17.58 (24.79) ^c	21.59 (27.69) ^d	26.18 (30.77) ^f	27.33 (31.52) ^e	24.69 (29.79) ^c	19.01 (25.85) ^d	20.66 (27.03) ^e	23.70
Groundnut + Redgram	16.13 (23.68)	13.05 (21.17) ^b	18.82 (25.71) ^d	22.84 (28.55) ^e	23.19 (28.79) ^d	26.67 (31.09) ^{de}	24.00 (29.33) ^c	18.28 (25.31) ^d	20.37 (26.83) ^c	24.78
Groundnut pure crop	15.24 (22.98)	17.00 (24.35) ^e	22.13 (28.06) ^g	27.76 (31.79) ^g	32.85 (34.97) ^h	36.12 (36.94) ^f	35.46 (36.55) ^e	30.11 (33.28) ^f	27.08 (31.36) ^e	--
SEd	NS	0.3177	0.2917	0.02716	0.2652	0.2619	0.2672	0.3028	0.2815	--
CD (P=0.05)	NS	0.6815	0.6256	0.5826	0.5689	0.5619	0.5731	0.6496	0.6038	--

NS: Non-significant; **DAS: Days after sowing

*Mean of three replications; Figures in parentheses are arcsine transformed values

In a column, means followed by common letter(s) are not significantly different by LSD (P= 0.05)

Conflict of Interest: None declared

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