



## POSITIVE INFLUENCE OF INTERCROPS ON COCCINELLID AND SPIDER FAUNA IN GROUNDNUT

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**ABSTRACT:** Groundnut, (*Arachis hypogaea* L.) is one of the major oilseed cum valuable cash crops for millions of small scale farmers in the semi-arid tropics. The insect pests of groundnut inflicts serious losses both directly as defoliators, sap suckers, root feeders etc and indirectly as vectors to dreaded viral diseases of the crop. Chemical control is being recommended with success but the awareness of deleterious effects of chemicals led to the thinking about alternatives to chemicals. Cultural operations in agriculture have well established history for their role in insect pest management. Of these, inter/mixed cropping systems have been considered as important components and constitutes the most practical oriented approach. A field trial in RBD was conducted at S.V.Agricultural College, Tirupati to study the influence of intercrops on natural enemies of groundnut insect pests during *kharif* 2011. The systems studied were groundnut + red gram, groundnut + castor (at 7:1 ratio), groundnut + cowpea, groundnut + field bean (at 6:1 ratio) and pure groundnut. Coccinellids and spiders were predominant during crop growth period. Various species of coccinellid predators were considered as a group, and their presence was recorded in all the cropping systems. All the spiders, irrespective of the family to which they belonged, were recorded together as one unit. Among the coccinellids, *Chelomenes sexmaculata* was the predominant predator which accounts for 70 per cent of the population. Spiders belonging to Lycosidae family were predominant. Population of coccinellids and spiders was increased up to 60 - 70 DAS and declined later. This may be due to availability of sufficient prey like aphids, jassids etc during vegetative stage of the crop. Change in microclimate due to shredded/shrunked foliage at later stages of the crop also may not favour the natural enemy fauna. The data shows that coccinellid population was comparatively high in groundnut + cowpea system (2.44 per plant). Aphids that prefer cowpea might have attracted the grubs and adults of coccinellids towards the crop, as coccinellids are the major predators of aphids. In the remaining intercrop systems also, significantly higher lady bird beetle population was observed. Spider population was comparatively higher in groundnut + field bean system (1.66 per plant) followed by groundnut + cowpea system (1.32 per plant). Other systems had nearly 0.8-1.3 spiders per plant

**Keywords:** Groundnut, coccinellids, spiders, intercrop, sole crop

### INTRODUCTION

Groundnut, (*Arachis hypogaea* L.) is one of the major oil seed cum valuable cash crops for millions of small scale farmers in the semi-arid tropics. It is the world's 4<sup>th</sup> most important source of edible oil and 3<sup>rd</sup> most important source of vegetable proteins. India has prime position in average area (4.93million ha) and production (7.17 million tonnes) of groundnut. However, the productivity (1144 kg/ha) is low compared to that of USA (3000 kg/ha) and China (2600 kg/ha). Andhra Pradesh holds a key position with an area of 16.22 lakh ha and with production of 14.57 million tones and productivity of 898 kg/ha [1]. The insect pests of groundnut inflicts serious losses both directly as defoliators, sap suckers, root feeders etc and indirectly as vectors to dreaded viral diseases of the crop. More than 350 spp of insects damage the crop in different parts of world [11]. Chemical control is being recommended with success but the awareness of deleterious effects of chemicals led to the thinking about alternatives to chemicals. Cultural operations in agriculture have well established history for their role in insect pest management. Of these, inter/mixed cropping systems have been considered as important components and constitutes the most practical oriented approach. Intercropping can affect the microclimate of the agro ecosystem and ultimately produce an unfavourable environment for pests. Thomas reported that natural enemies of insect pests tend to be more abundant in intercrops than in monocrops, as they find better conditions, such as better spatial and temporal distribution of nectar, pollen and prey sources and more congenial micro habits for their special requirements thereby enhances the biological control of crop pests. The present studies were carried out to find out the influence of some intercrops on the occurrence of natural enemies of insect pests of groundnut. The aggregation of predatory spiders at higher levels might be due to availability of sufficient food, shelter and congenial microclimate in the groundnut + field bean cropped area.

## MATERIALS AND METHODS

A field experiment was conducted during *kharif* season with the groundnut variety Narayani at wetland farm, S.V.Agricultural College, Tirupati. The experiment was laid out in a Randomized Block Design (RBD) with five treatments replicated four times in a plot size of 10m×5m. The crops viz., red gram (LRG-41), castor (local variety), cowpea (TPTC-8) and field bean (TFB-5) were used for intercropping with groundnut. The treatments consisted of growing one row of red gram after every seven rows of groundnut (1:7), one row of castor after every seven rows of groundnut (1:7), one row of cowpea after every six rows of groundnut (1:6), one row of field bean after every six rows of groundnut (1:6) and a pure crop of groundnut. Sowing was done during first fortnight of July (6<sup>th</sup> July), 2011. All agronomic practices from sowing to harvesting were followed. The trial received no plant protection measures. Various species of coccinellid predators were considered as a group, and their presence was recorded in all the cropping systems. All the spiders, irrespective of the family to which they belonged, were recorded together as one unit. The final pooled mean data was analyzed and presented.

## RESULTS AND DISCUSSION

### Observations on coccinellid and spider population

During the study period several coccinellids were observed viz., *Cheilomenes sexmaculata*, *Coccinella transversalis*, *Coccinella septumpunctata*, *Scymnus spp etc.* Among the coccinellids, *Cheilomenes sexmaculata* was the predominant predator which accounts for 70 per cent of the population. Several spp of spiders were recorded in different cropping systems. Spiders belonging to Lycosidae family were predominant. The data on coccinellid and spider population is presented below.

#### At 20 DAS

High population of coccinellids of 0.75/plant was observed in groundnut + cowpea intercropping system. Remaining systems recorded nearly 0.45 to 0.65 coccinellids per plant. Groundnut + field bean system recorded 0.75 spiders per plant where as other systems recorded 0.4 to 0.69 spiders per plant

#### At 30 to 40 DAS

Groundnut + cowpea and Groundnut + redgram systems recorded higher number of coccinellids (0.75 to 1.72 per plant) which are significantly different from remaining systems. Groundnut + field bean, groundnut + castor systems and sole groundnut recorded nearly 0.50 to 1.12 coccinellids per plant. Spider population was also slightly increased in different treatments

#### At 50 DAS

The population of coccinellids was slightly increased in all the systems when compared to 40 DAS. Groundnut + cowpea system recorded high population i.e. 1.99 per plant followed by groundnut + redgram and groundnut + castor systems with 1.44 and 1.35 respectively. Sole groundnut and groundnut + field bean only 0.94 to 1.27 coccinellids per plant. Comparatively high spider population was noticed in Groundnut + field bean system (2.15 per plant). In other systems, 1.05 to 1.88 spiders per plant were present.

#### At 60 DAS

High population of coccinellids was noticed in groundnut + cowpea system 3.13 per plant and it is significantly different from other systems. Groundnut + red gram and groundnut +field bean consisted of 2.4 coccinellids per plant. Comparatively less population of 2.0 per plant were there in sole groundnut and groundnut + castor systems. Groundnut + field bean system recorded high population of 3.18 per plant and it is significantly different from other systems. Groundnut + red gram and groundnut +cowpea systems recorded nearly 2.1-2.3 spiders per plant. Sole groundnut and groundnut + castor systems recorded nearly 1.2-1.5 spiders per plant.

#### At 70 to 80DAS

At 70DAS, The coccinellid population was increased. Groundnut + cowpea harboured highest population i.e.up to 5.60 per plant followed by Groundnut + red gram system (4.75 per plant). Groundnut + field bean, sole groundnut and groundnut + castor recorded 3.4 -3.8 coccinellids per plant. At 80DAS, Groundnut + cowpea system had 3.29 coccinellids per plant where as remaining systems recorded nearly 1.7 to 2.20 per plant.

Spider population was slightly decreased at 70 and 80 DAS when compared to 60 DAS. Among all the intercropping systems groundnut + field bean system recorded comparatively high spider population i.e. 2.0 per plant.

#### At 90 DAS

The coccinellids were decreased at 90 DAS when compared to 80 DAS. All the intercropping systems recorded nearly 0.8 to 1.72 coccinellids per plant. Spider population at 90 DAS was ranged from 0.4 to 1.0 per plant.

## Mean population at different intervals of data record

Days after sowing	*No. of coccinellids per plant	*No. of spiders per plant
20 (II FN of July)	0.59	0.56
30 (I FN of August)	0.79	0.79
40 (II FN of August)	1.14	1.12
50 (II FN of August)	1.39	1.52
60 (I FN of September)	2.46	2.09
70 (I FN of September)	4.23	1.40
80 (II FN of September)	2.14	1.06
90 (I FN of October)	1.18	0.69

\*Mean of different cropping systems

Population of coccinellids and spiders was increased up to 60 - 70 DAS and declined later. This may be due to availability of sufficient prey like aphids, jassids etc during vegetative stage of the crop. As the prey population decreased, predator population also declined due to lack of sufficient food. Change in microclimate due to shredded/shrunk foliage at later stages of the crop also may not favour the natural enemy fauna. Duffield [3] noticed peak population of coccinellids on sorghum during early September.

## Overall record of Coccinellids and spiders in different intercropping systems

Treatments	*No. of coccinellids per plant	*No. of spiders per plant
Groundnut +redgram	1.85 <sup>ab</sup>	1.13 <sup>bc</sup>
Groundnut + castor	1.44 <sup>b</sup>	0.81 <sup>bc</sup>
Groundnut + cowpea	2.44 <sup>a</sup>	1.32 <sup>ab</sup>
Groundnut + field bean	1.63 <sup>b</sup>	1.66 <sup>a</sup>
Groundnut alone	1.34 <sup>b</sup>	0.87 <sup>c</sup>
Mean	1.74	1.16
SEm±	0.48	0.19
<b>CD 0.05%</b>	<b>1.50</b>	<b>0.36</b>

\*Mean at different intervals of data record

The data in table shows that coccinellid population was comparatively high in groundnut + cowpea system (2.44 per plant). Aphids that prefer cowpea might have attracted the grubs and adults of coccinellids towards the crop, as coccinellids are the major predators of aphids. In the remaining intercrop systems also, significantly higher lady bird beetle population was observed. Baskaran *et al.* [2] reported that growing intercrops such as cowpea and pearl millet reduce pest damage and favours natural enemies on groundnut. Kennedy *et al.* [7] noticed that intercropping groundnut with pearl millet favours the predators and parasites of groundnut insect pests. Duffield and Reddy [4] reported increased activity of coccinellids and spiders in leguminous intercrops. Surulivelu [12] reported that Cowpea is a short-duration pulse crop which attracts aphids, thus increasing occurrence of coccinellids and multiplication of coccinellids and other predators in groundnut. Coccinellids were significantly more abundant in pigeonpea with sorghum or greengram or groundnut systems. [10]. Spiders were comparatively high in groundnut + field bean system (1.66 per plant) followed by groundnut + cowpea system (1.32 per plant). Other systems recorded nearly 0.8-1.3 spiders per plant. The aggregation of predatory spiders at higher levels might be due to availability of sufficient food, shelter and congenial microclimate in the groundnut + field bean cropped area. Singh *et al.* [9] studied influence of intercropping on natural enemy complex in groundnut and reported that the population of spiders was higher in intercropping system than that of the sole crop. Wu [13] reported that intercropping maize in cotton fields increased the population of Araneae, Coccinellidae and Chrysopidae by 62.8-115.7% compared with control fields. Mahabaleshwar *et al.* [8] noticed that average population of *C. carnea* and spiders were significantly high on cotton intercropped with lucerne, cowpea, and groundnut. Gavarra and Raros [5] found more predatory spiders and predatory coccinellids in groundnut and maize intercropping system than in sole crop of groundnut. Gyawali [6] studied the effect of companion crops on the incidence of predatory spiders in rice and soybean fields in Nepal. The population densities of the predatory spiders were higher in the maize + soybean intercrop compared to the rice + soybean intercrop and soybean alone.

**Table 1. Impact of intercropping of kharif groundnut on occurrence of coccinellid predators**

Treatments	Mean number per plant								Mean
	20 DAS	30 DAS	40 DAS	50 DAS	60 DAS	70 DAS	80 DAS	90 DAS	
Groundnut +redgram	0.59 (1.10) <sup>ab</sup>	0.75 (1.17) <sup>ab</sup>	1.29 (1.42) <sup>a</sup>	1.44 (1.66) <sup>ab</sup>	2.46 (2.19) <sup>ab</sup>	4.75 (2.65) <sup>b</sup>	2.20 (1.65) <sup>b</sup>	1.29 (1.32) <sup>ab</sup>	1.85 (1.65) <sup>ab</sup>
Groundnut + castor	0.44 (0.83) <sup>b</sup>	0.65 (1.12) <sup>ab</sup>	0.94 (1.25) <sup>ab</sup>	1.35 (1.41) <sup>ab</sup>	2.12 (1.65) <sup>c</sup>	3.38 (1.99) <sup>c</sup>	1.74 (1.52) <sup>b</sup>	0.94 (1.09) <sup>b</sup>	1.44 (1.35) <sup>b</sup>
Groundnut + cowpea	0.79 (1.19) <sup>a</sup>	1.24 (1.45) <sup>a</sup>	1.72 (1.63) <sup>a</sup>	1.99 (1.85) <sup>a</sup>	3.13 (2.34) <sup>a</sup>	<b>5.60</b> <b>(3.40)<sup>a</sup></b>	3.29 (2.70) <sup>a</sup>	1.72 (1.53) <sup>a</sup>	<b>2.44</b> <b>(2.03)<sup>a</sup></b>
Groundnut + field bean	0.64 (1.12) <sup>ab</sup>	0.79 (1.18) <sup>ab</sup>	1.12 (1.32) <sup>ab</sup>	1.27 (1.37) <sup>b</sup>	2.43 (1.75) <sup>bc</sup>	3.86 (2.12) <sup>bc</sup>	1.79 (1.55) <sup>b</sup>	1.12 (1.22) <sup>ab</sup>	1.63 (1.45) <sup>b</sup>
Groundnut alone	0.46 (0.90) <sup>ab</sup>	0.50 (0.98) <sup>b</sup>	0.62 (1.09) <sup>b</sup>	0.94 (1.25) <sup>b</sup>	2.15 (1.66) <sup>c</sup>	3.50 (2.03) <sup>c</sup>	1.70 (1.42) <sup>b</sup>	0.82 (1.05) <sup>b</sup>	1.34 (1.29) <sup>b</sup>
Mean	0.59 (1.03)	0.79 (1.18)	1.14 (1.34)	1.39 (1.53)	2.46 (1.92)	4.23 (2.43)	2.14 (1.77)	1.18 (1.24)	1.74 (1.56)
<b>SEm±</b>	<b>0.40</b>	<b>0.43</b>	<b>0.46</b>	<b>0.48</b>	<b>0.56</b>	<b>0.67</b>	<b>0.51</b>	<b>0.46</b>	<b>0.48</b>
<b>CD 0.05%</b>	<b>1.25</b>	<b>1.31</b>	<b>1.40</b>	<b>1.47</b>	<b>1.73</b>	<b>2.06</b>	<b>1.59</b>	<b>1.41</b>	<b>1.50</b>

**Table 2. Spider population in different intercropping systems of groundnut during kharif**

Treatments	Mean number per plant								Mean
	20 DAS	30 DAS	40 DAS	50 DAS	60 DAS	70 DAS	80 DAS	90 DAS	
Groundnut +redgram	0.54 (1.08) <sup>ab</sup>	0.69 (1.12) <sup>ab</sup>	1.16 (1.28) <sup>bc</sup>	1.39 (1.44) <sup>b</sup>	2.32 (2.38) <sup>b</sup>	1.28 (1.42) <sup>b</sup>	0.94 (1.21) <sup>ab</sup>	0.68 (1.12) <sup>ab</sup>	1.13 (1.38) <sup>bc</sup>
Groundnut + castor	0.45 (1.03) <sup>ab</sup>	0.59 (1.10) <sup>ab</sup>	0.91 (1.24) <sup>bc</sup>	1.06 (1.29) <sup>b</sup>	1.27 (1.38) <sup>c</sup>	0.96 (1.25) <sup>b</sup>	0.75 (1.07) <sup>b</sup>	0.46 (0.96) <sup>ab</sup>	0.81 (1.17) <sup>bc</sup>
Groundnut + cowpea	0.69 (1.14) <sup>ab</sup>	0.79 (1.19) <sup>ab</sup>	1.31 (1.59) <sup>b</sup>	1.88 (1.68) <sup>b</sup>	2.16 (2.26) <sup>b</sup>	1.65 (1.50) <sup>b</sup>	1.20 (1.35) <sup>ab</sup>	0.85 (1.21) <sup>ab</sup>	1.32 (1.49) <sup>ab</sup>
Groundnut + field bean	0.75 (1.16) <sup>a</sup>	0.95 (1.25) <sup>a</sup>	1.43 (2.01) <sup>a</sup>	2.15 (2.46) <sup>a</sup>	<b>3.18</b> <b>(2.95)<sup>a</sup></b>	2.10 (2.06) <sup>a</sup>	1.65 (1.50) <sup>a</sup>	1.09 (1.30) <sup>a</sup>	<b>1.66</b> <b>(1.83)<sup>a</sup></b>
Groundnut alone	0.38 (0.84) <sup>b</sup>	0.50 (0.91) <sup>b</sup>	0.79 (1.09) <sup>c</sup>	1.13 (1.32) <sup>b</sup>	1.53 (1.16) <sup>c</sup>	1.01 (1.27) <sup>b</sup>	0.78 (1.08) <sup>b</sup>	0.40 (0.90) <sup>b</sup>	0.87 (1.07) <sup>c</sup>
Mean	0.56 (1.05)	0.79 (1.11)	1.12 (1.44)	1.52 (1.64)	2.09 (2.03)	1.40 (1.50)	1.06 (1.24)	0.69 (1.09)	1.16 (1.39)
<b>SEm±</b>	<b>0.14</b>	<b>0.18</b>	<b>0.20</b>	<b>0.22</b>	<b>0.25</b>	<b>0.22</b>	<b>0.21</b>	<b>0.19</b>	<b>0.19</b>
<b>CD 0.05%</b>	<b>0.30</b>	<b>0.32</b>	<b>0.41</b>	<b>0.44</b>	<b>0.49</b>	<b>0.42</b>	<b>0.40</b>	<b>0.34</b>	<b>0.36</b>

**REFERENCES**

- [1] Annual Report of Regional Agricultural Research Institute. 47<sup>th</sup> ed. 2011. Acharya NG Ranga Agricultural university, Hyderabad.
- [2] Baskaran, R.K.M., Chandrasekharan, J and Tengavelu, S., 1993. Effect of intercrop on the incidence of groundnut leafminer. Madras Agricultural Journal. 80(1): 11-13.
- [3] Duffield, S.J. 1993. Crop specific differences in the seasonal abundance of four major predatory groups on sorghum and short-duration pigeon pea. Int. Chickpea and Pigeonpea News lett. 2: 74-76.
- [4] Duffield, S.J and Reddy, Y.V.R. 1997. Distribution and increment of predators of *Helicoverpa armigera* in intercropped sorghum and short duration pigeonpea. Crop Research. 14: 315- 335.
- [5] Gavarra, M.R and Raros, R.S. 1975. Crop – crop diversity as a key component of IPM - a review. *Philippines Ent.* 2: 427-444.
- [6] Gyawali, B.K. 1988. Effect of companion crops on the incidence of predatory spiders. *Quarterly Newsletter - Asia and Pacific Plant Protection Commission.* 31(2): 24-28. 16 ref.
- [7] Kennedy, F.J.S., Balaguranathan, R., Christopher, A and Rajamanickam, K. 1994. Insect pest management in peanut: a cropping system approach. *Tropical Agriculture.* 71(2): 116-118. 9 ref.

- [8] Mahabaleshwar Hegde, Kulkarni, K.A and Lingappa, S. 2003. Impact of intercrops on conservation of *Chrysoperla carnea* (Stephens) and other natural enemies in cotton ecosystem. Indian Journal of Plant Protection. 31(1): 98-104. 18 ref.
- [9] Singh, T.V.K, Singh, K.M and Singh, R.N. 1991. Impact of intercropping: III. Natural enemy complex of groundnut. Indian Journal of Entomology. 53(3): 369-372. 4 ref.
- [10] Srinivasa Rao, M. 2007. Paper on “organic farming in rainfed agriculture” held at CRIDA, 1-21 November.
- [11] Stalker, H.T and Campbell, W.N. 1983. Resistance of wild species of peanut to an insect pest complex. Peanut science. 10: 32-33.
- [12] Surulivelu, T. 2004. Pest Control in Organic Cotton. Research Notes. Available online, [www.cicr.org.in](http://www.cicr.org.in).
- [13] Wu, G., Chen, Z., Ji, M., Dong, S., Li, H., An, J and Shi, J. 1991. Influence of interplanting corn in cotton fields on natural enemy populations and its effect on pest control in southern Shaanxi [Chinese]. Chinese Journal of Biological Control. 7(3): 101-104. 4 ref.