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Effect of intercropping systems Coincidence of *Spodoptera litura* in groundnut

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Abstract

A field study on the effect of various intercrops viz., redgram, pearl millet, castor, cowpea, barnyard millet, proso millet, little millet and foxtail millet on the incidence of *Spodoptera Litura* in groundnut during *kharif*, 2021 was conducted at Regional Agricultural Research Station, Tirupati. The data on larval population per ten randomly selected plants was taken at weekly intervals. The data revealed that the minimum overall mean larval count was recorded in groundnut intercropped with cowpea (1.23 larvae plant⁻¹) followed by groundnut intercropped with pearl millet (1.43 larvae plant⁻¹) which were statistically at par. The maximum overall mean larval population was observed in sole groundnut (2.79 larvae plant⁻¹) followed by groundnut intercropped with castor (2.49 larvae plant⁻¹) which were found to be statistically at par.

Keywords: *Spodoptera litura*, larval incidence, groundnut, *kharif* season

Introduction

Groundnut or peanut, is commonly called the poor man's nut or poor man's almond is an important oil seed food crop which has been cultivated in more than 100 countries in the world covering six continents and is the sixth most important oilseed crop in the world contributing around 35.29 per cent of the total oilseeds production in the country during 2021-22 (Indiastat.com, 2022). Asia accounts for about 70 per cent of the total global production of oil seeds. Whereas, the world's leading groundnut producers, China and India together accounting for nearly 60 per cent of the Asia production with 52 per cent of the crop area. In India, groundnut is cultivated in one or more seasons (*kharif*, *rabi* and summer). In India groundnut acreage is 49.14 lakh hectares with production of 101.06 lakh tones and productivity of 1679 kg ha⁻¹. Groundnut is cultivated in an area of 0.66 M ha area of Andhra Pradesh. The production of groundnut in Andhra Pradesh is 0.85 Mt. The productivity of groundnut in Andhra Pradesh is 928 kg ha⁻¹. In Andhra Pradesh, Anantapur (4.09 L ha⁻¹), Chittoor (1.08 L ha⁻¹), Kurnool (0.95 L ha⁻¹) and Kadapa (0.22 L ha⁻¹) districts are the major groundnut growing districts occupying 97 per cent of total groundnut growing area of the state (Directorate of Economics and Statistics, India, 2022).

Andhra Pradesh occupies largest area under cultivation but the productivity is very low when compared with other states mainly due to abiotic and biotic factors, Amongst which damage caused by lepidopteran pest complex is considered as major limiting factor for yield. Therefore, under these situations it is necessary to manage the lepidopteran pest complex by sorting to intercropping which plays a significant role in enhancing the productivity and profitability per unit area and time through more efficient use of land, water and solar energy. Intercropping of cereals or pulses with oilseeds is one of the best ways to increase the pulse and oilseed production and also to reduce the disease severity. With this motto, the present study was undertaken to study the impact of intercrops on *S. litura* on groundnut crop.

Materials and Methods

The impact of different intercropping systems on the incidence of *S. litura* in groundnut was recorded in a field experiment carried out at Regional Agricultural Research Station (RARS), Tirupati during *kharif*, 2021. The seed material used for the conducting the experiment was obtained from different research stations of ANGRAU as mentioned below.

Table 1: List of experimental material

S. No.	Crop	Variety	Source
1	Groundnut	Kadiri -6	Agricultural Research Station, Kadiri
2	Redgram	LRG-105	Krusha Vignana Kendra, Kalikiri
3	Pearl millet	ABV-04	Agricultural Research Station, Perumalpalli
4	Castor	IICH-06	Agricultural Research Station, Ananthapur
5	Cowpea	TPTC-29	Krusha Vignana Kendra, Kalikiri
6	Barnyard millet	VL -204	Agricultural Research Station, Perumalpalli
7	Proso millet	GPUP-8	Agricultural Research Station, Perumalpalli
8	Little millet	OLM-203	Agricultural Research Station, Perumalpalli
9	Foxtail millet	SIA- 3156	Agricultural Research Station, Perumalpalli

The intercropping systems were sown in 7: 1 ratio (main crop: inter crop) in a plot of 8 m X 3 m with three replications. The spacing followed was 30 x 10 cm

Table 2: Details of the intercropping systems evaluated against *S. litura* in groundnut during *kharif*, 2021

Treatments	Intercropping systems	Planting ratio
T ₁	Groundnut + Redgram	7:1
T ₂	Groundnut + Pearl millet	7:1
T ₃	Groundnut+ Castor	7:1
T ₄	Groundnut + Cowpea	7:1
T ₅	Groundnut + Barnyard millet	7:1
T ₆	Groundnut + Proso millet	7:1
T ₇	Groundnut + Little millet	7:1
T ₈	Groundnut+ Foxtail millet	7:1
T ₉	Sole Groundnut (Control)	----

Data recorded

Spodoptera litura (Tobacco caterpillar)

The per cent incidence in terms of larval population in each plot of 10 randomly selected plants were recorded. The incidence of *S. Litura* was recorded by taking counts on number of larvae per plant. The collected data was subjected to square root transformation and the data was analysed through OP STAT software and Duncan's Multiple Range Test (DMRT) ($p \leq 0.05$) by using IBM SPSS (Statistical Package for Social Sciences) statistics version 20 for drawing the conclusions.

**Plate 1:** Experimental plot view of intercropping systems in Groundnut

Results and Discussion

It was observed that during *kharif*, 2021 at seven days after sowing all the treatments (Table 1, Table 2) recorded lower population of *Spodoptera Litura* when compared to sole groundnut. Least mean larval count was observed in the treatment groundnut intercropped with cowpea (0.69 larvae plant⁻¹) and groundnut intercropped with barnyard millet (0.72 larvae plant⁻¹) which were statistically at par with each other.

Maximum mean larval population count was observed in sole groundnut crop (2.23 larvae plant⁻¹) (Plate 1)

At fourteen days after sowing, minimum mean larval count was recorded in groundnut intercropped with cowpea (0.91 larvae plant⁻¹) followed by barnyard millet (0.94 larvae plant⁻¹) and proso millet (0.95 larvae plant⁻¹) respectively which were found to be statistically at par with each other. Maximum mean larval population was recorded in sole groundnut (2.39 larvae plant⁻¹) followed by groundnut intercropped with castor (1.97 larvae plant⁻¹) which were statistically at par with each other.

At twenty one days after sowing data revealed that the mean larval population was minimum and statistically at par in groundnut intercropped with cowpea (1.15 larvae plant⁻¹) followed by groundnut intercropped with proso millet (1.17 larvae plant⁻¹). The maximum mean larval count was recorded in sole groundnut (2.45 larvae plant⁻¹) followed by groundnut intercropped with castor (2.15 larvae plant⁻¹).

During twenty eight days after sowing the minimum larval population was recorded in groundnut intercropped with cowpea (1.20 larvae plant⁻¹), followed by proso millet (1.21 larvae plant⁻¹) and barnyard millet (1.24 larvae plant⁻¹) which were statistically at par with each other. The maximum mean larval count was recorded in sole groundnut (2.56 larvae plant⁻¹).

After thirty five days of sowing, it was observed that the mean larval population was minimum and statistically at par in groundnut intercropped with cowpea and groundnut intercropped with proso millet with larval count of (1.36 larvae plant⁻¹) and (1.39 larvae plant⁻¹) respectively. The maximum mean larval count was recorded in groundnut sole crop (3.09 larvae plant⁻¹) followed by groundnut intercropped with castor (2.98 larvae plant⁻¹).

The minimum mean larval count at forty two days after sowing was recorded in groundnut intercropped with cowpea (1.39 larvae plant⁻¹) followed by pearl millet (1.41 larvae plant⁻¹) and proso millet (1.47 larvae plant⁻¹) which were statistically at par with each other. The maximum mean larval count was observed in sole groundnut (3.09 larvae plant⁻¹) followed by groundnut intercropped with castor (2.78 larvae plant⁻¹) which were found to be statistically at par with each other.

During the period of forty nine days after sowing, the mean minimum larval count per plant was recorded in groundnut intercropped with barnyard millet (1.36 larvae plant⁻¹) followed by cowpea (1.37 larvae plant⁻¹) and proso millet (1.42 larvae plant⁻¹) which were found to be statistically at par with each other. The maximum mean larval count was recorded in sole groundnut (3.07 larvae plant⁻¹) followed by groundnut intercropped with castor and redgram with a population of (2.74 larvae plant⁻¹) and (2.45 larvae plant⁻¹)

respectively which were found to be statistically at par with each other.

After fifty six days of sowing, minimum mean larval population was recorded in groundnut intercropped with cowpea (1.35 larvae plant⁻¹) followed by pearl millet (1.36 larvae plant⁻¹) and proso millet (1.37 larvae plant⁻¹) which were statistically at par with each other. The maximum mean larval count was recorded in sole groundnut (3.01 larvae plant⁻¹) followed by groundnut intercropped with castor (2.69 larvae plant⁻¹).

The minimum mean larval count at sixty three days after sowing was recorded in groundnut intercropped with cowpea (1.32 larvae plant⁻¹) followed by barnyard millet (1.76 larvae plant⁻¹). The maximum mean larval population was observed in sole groundnut (2.97 larvae plant⁻¹), groundnut intercropped with castor (2.59 larvae plant⁻¹) and groundnut intercropped with foxtail millet (2.45 larvae plant⁻¹) were found to be statistically at par.

During seventy days, the mean minimum larval count per plant was recorded in groundnut intercropped with cowpea and groundnut intercropped with pearl millet which were statistically at par with a population (1.26 larvae plant⁻¹) and (1.30 larvae plant⁻¹) respectively. The maximum mean larval count was recorded in sole groundnut (2.96 larvae plant⁻¹) followed by groundnut intercropped with castor (2.61 larvae plant⁻¹).

At seventy seven days after sowing, minimum mean larval population was recorded in groundnut intercropped with cowpea and groundnut intercropped with proso millet which were statistically at par with a population (1.30 larvae plant⁻¹) and (1.33 larvae plant⁻¹) respectively. The maximum mean larval count was recorded in sole groundnut (2.94 larvae plant⁻¹).

During eighty four days after sowing, the mean minimum larval count was recorded in groundnut intercropped with cowpea (1.29 larvae plant⁻¹) followed by groundnut intercropped with pearl millet (1.30 larvae plant⁻¹) which were statistically at par with each other. The maximum mean larval count was recorded in sole groundnut (2.98 larvae plant⁻¹) followed by groundnut intercropped with castor (2.57 larvae plant⁻¹).

The minimum mean larval count at ninety one days after sowing was recorded in groundnut intercropped with cowpea (1.27 larvae plant⁻¹). The maximum mean larval population was observed in the groundnut sole crop (2.76 larvae plant⁻¹) followed by groundnut intercropped with castor (2.54 larvae

plant⁻¹)

The minimum mean larval count at ninety eight days after sowing was recorded in groundnut intercropped with cowpea (1.24 larvae plant⁻¹). The maximum mean larval population was observed in sole Groundnut (2.63 larvae plant⁻¹) followed by groundnut intercropped with castor (2.51 larvae plant⁻¹) which were found to be statistically on par.

The minimum overall mean larval count during the entire season was recorded in groundnut intercropped with cowpea (1.23 larvae plant⁻¹) followed by groundnut intercropped with pearl millet (1.43 larvae plant⁻¹) which were statistically at par. The maximum overall mean larval population was observed in sole groundnut (2.79 larvae plant⁻¹) followed by groundnut intercropped with castor (2.49 larvae plant⁻¹) which were found to be statistically on par. (Table 3).

The lower incidence of *S. litura* in groundnut intercropped with cowpea plot was recorded due to the presence of natural enemies viz., coccinellids and spiders that caused a reduction in the larval population.

The present results are in tune with the findings of Girija *et al.* (2015) [3] who reported significantly lower larval population in groundnut + foxtail millet intercropping system (0.73 larvae) and it was on par with groundnut + bajra, groundnut + sorghum, groundnut + sunflower and groundnut + lucerne intercropping systems, which recorded 0.80, 0.94, 1.00 and 1.07 larvae per plant respectively. Significantly highest larval population was recorded in sole groundnut crop and differed significantly from all the other treatments.

The present findings are also in close conformity with the findings of Agasimani *et al.* (1993) [1] who recorded minimum incidence of *Spodoptera* in groundnut + jowar (4:1) intercropping system. Nath and Singh (1998) [5] recorded the minimum incidence of *S. litura* in groundnut + bajra intercropping system. Rashmi *et al.* (2011) [6] recorded lowest population of defoliators in groundnut + foxtail millet intercropping systems and is in line with the present study. The variation in the *Spodoptera* larval population on groundnut crop in different groundnut based intercropping systems may be due to the differential preferences attributed to the various volatile cues released by the host plants that release HIPV compounds which in turn enhance the population of natural enemies which further does not encourage the pest fauna to build up above economic threshold level as generally found in monocropping, which keeps the larval population under check as opined by Nath and Singh (1998) [5].

Table 3: Effect of intercropping systems on *Spodoptera Litura* incidence in Groundnut during kharif, 2021

Treatment number	Name of the treatment	Mean number of larvae per plant														Overall mean larval count
		7 DAS	14 DAS	21 DAS	28 DAS	35 DAS	42 DAS	49 DAS	56 DAS	63 DAS	70 DAS	77 DAS	84 DAS	91 DAS	98 DAS	
T ₁	Groundnut + Redgram	1.94 (1.71)abc	1.91 (1.70)bc	2.10 (1.76)b	2.11 (1.76)b	2.24 (1.80)ab	2.23 (1.79)b	2.45 (1.85)ab	2.40 (1.84)bc	2.42 (1.84)bc	2.32 (1.82)bc	2.34 (1.82)bc	2.21 (1.79)bc	1.99 (1.72)bc	1.96 (1.72)bc	2.18 (1.78)bc
T ₂	Groundnut + Pearl millet	0.81 (1.34)cd	0.99 (1.41)cd	1.23 (1.49)c	1.34 (1.53)bc	2.27 (1.80)ab	1.41 (1.54)d	2.21 (1.79)c	1.36 (1.53)d	1.91 (1.70)e	1.30 (1.51)de	1.34 (1.53)de	1.30 (1.52)de	1.29 (1.51)de	1.28 (1.51)de	1.43 (1.55)de
T ₃	Groundnut + Castor	1.87 (1.69)abcd	1.97 (1.72)ab	2.15 (1.76)ab	2.28 (1.80)ab	2.98 (1.99)a	2.78 (1.94)ab	2.74 (1.93)a	2.69 (1.92)b	2.59 (1.89)ab	2.59 (1.90)ab	2.59 (1.89)ab	2.57 (1.88)ab	2.54 (1.88)ab	2.51 (1.87)ab	2.49 (1.86)ab
T ₄	Groundnut + Cowpea	0.69 (1.30)e	0.91 (1.38)de	1.15 (1.48)d	1.20 (1.50)e	1.36 (1.54)c	1.39 (1.55)d	1.37 (1.53)c	1.35 (1.53)d	1.32 (1.52)e	1.26 (1.50)de	1.30 (1.51)de	1.29 (1.51)de	1.27 (1.50)de	1.24 (1.49)de	1.23 (1.49)e
T ₅	Groundnut + Barnyard	0.72 (1.31)e	0.94 (1.39)d	1.19 (1.48)d	1.24 (1.49)d	1.47 (1.57)b	1.42 (1.55)d	1.36 (1.53)c	1.39 (1.54)a	1.76 (1.65)bc	1.39 (1.74)bc	2.37 (1.83)bc	2.38 (1.83)bc	2.34 (1.82)bc	2.35 (1.83)bc	1.78 (1.66)cd
T ₆	Groundnut + Proso millet	0.95 (1.40)cd	0.95 (1.39)d	1.17 (1.47)de	1.21 (1.48)d	1.39 (1.54)bc	1.47 (1.57)d	1.42 (1.55)c	1.37 (1.53)d	1.87 (1.69)de	1.29 (1.69)de	1.33 (1.52)de	1.31 (1.51)de	1.28 (1.51)de	1.26 (1.50)de	1.76 (1.64)cd

T ₇	Groundnut + Little millet	0.97 (1.40) ^{bcd}	0.96 (1.40) ^d	1.18 (1.47) ^{cd}	1.29 (1.51) ^{cd}	1.45 (1.56) ^{bc}	1.57 (1.60) ^c	1.43 (1.56) ^{bc}	1.36 (1.59) ^{cd}	1.89 (1.66) ^d	1.38 (1.60) ^{cd}	1.33 (1.52) ^{cd}	1.37 (1.62) ^{cd}	1.79 (1.67) ^{cd}	1.78 (1.66) ^{cd}	1.79 (1.67) ^{cd}
T ₈	Groundnut + Foxtail millet	1.99 (1.72) ^{ab}	1.96 (1.72) ^a	1.99 (1.72) ^{bc}	2.14 (1.77) ^b	2.54 (1.88) ^a	2.61 (1.90) ^b	2.67 (1.91) ^{ab}	2.47 (1.86) ^{bc}	2.45 (1.85) ^{ab}	2.39 (1.84) ^{bc}	2.37 (1.83) ^{bc}	2.31 (1.81) ^{bc}	2.30 (1.81) ^{bc}	2.29 (1.81) ^{bc}	2.32 (1.82) ^{abc}
T ₉	Groundnut (Sole Crop)	2.23 (1.76) ^a	2.39 (1.88) ^a	2.45 (1.85) ^a	2.56 (1.87) ^a	3.09 (2.01) ^a	3.09 (2.02) ^a	3.07 (2.01) ^a	3.01 (2.00) ^a	2.97 (1.99) ^a	2.96 (1.99) ^a	2.94 (1.98) ^a	2.98 (1.99) ^a	2.76 (1.93) ^a	2.63 (1.90) ^a	2.79 (1.94) ^a
S.Em.+		0.10	0.13	0.26	0.15	0.20	0.19	0.15	0.26	0.14	0.21	0.16	0.21	0.15	0.14	0.29
CD (P = 0.95)		0.32	0.42	0.79	0.48	0.69	0.57	0.49	0.87	0.47	0.65	0.52	0.65	0.47	0.42	0.87
CV%		14.39	18.81	16.99	12.85	16.98	16.71	17.04	16.78	10.96	15.19	12.45	16.39	14.75	12.49	13.33

*Figures in the parentheses are square root transformed values.

In each column the values having the same alphabet are non-significant.

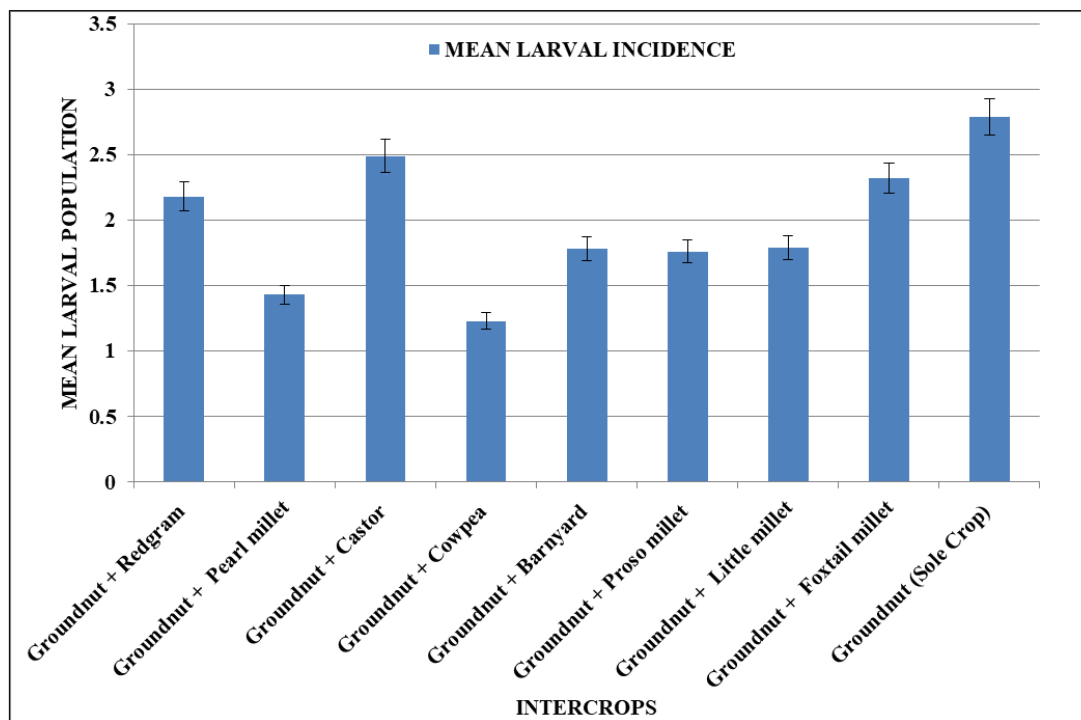


Fig 1: Figure depicting the influence of intercrops on larval incidence of *S. litura*

Conclusion

From the findings of the present study it can be concluded that groundnut intercropped with cowpea followed by groundnut intercropped with pearl millet, barnyard millet and proso millet can be taken up during the *kharif* season to lower the incidence of *Spodoptera Litura* (Fig 1).

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Declarations

Conflict of interest

The authors declare that they do not have any conflict of interest.

Ethical approval

This is an observational study. The University's Research Ethics Committee has confirmed that no ethical approval is required.

Consent to participate

Informed consent was obtained from all individual participants included in the study.

Consent to publish

No ethical approval is required as there is no personal data of the authors in the article.

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