LR-4905
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RESEARCH ARTICLE Legume Research- An International Journal, Volume Issue : ()

Effect of Various Intercrops on the Incidence of Major Sucking Insect Pests of Cowpea [*Vigna unguiculata* (Linn.) Walp]

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10.18805/LR-4905

ABSTRACT

Background: Ecological maneuvering of major sucking insect pests of cowpea, [*Vigna unguiculata* (Linn.) Walp.] at the micro level was aimed through various agronomic techniques. The tactics of appropriate intercropping is gaining thrust in the present scenario in overall strategy of insect pest management.

Methods: The experiment was conducted during *kharif*, 2018 in a randomized block design (RBD) with 5 treatments and 4 replications. The populations of major sucking insect pests were recorded at weekly interval from their appearance till harvesting of the cropearly in the morning of 10 cm terminal shoot for aphid and from three leaves, *viz*., one each from top, middle and lower canopy of the plant for leafhopper and whitefly.

Result: The experiment on cowpea [*Vigna unguiculata* (Linn.) Walp.] grown along with, pearlmillet [*Penisetum glucum* (Linn.) R.Br.emend stunntz] sesame, (*Sesamum indicum,*) sorghum (*Sorghum bicolor*) and cluster bean (*Cyamopsis tetragonloba*) as intercrops showed reduced population of sucking insect pests (aphid, *Aphis craccivora* Koch, leafhopper, *Empoasca fabae* (Harris) and whitefly, *Bemisia tabaci* (Genn.) over the sole crop (cowpea), cowpea with pearlmillet and sorghum combinations proved significantly less conducive to aphid, leafhopper and whitefly infestation as compared to other intercrops.

Key words: Cowpea, Ecological maneuvering, Intercrop, Sucking insect pests.

INTRODUCTION

Cowpea, [*Vignaunguiculata* (Linn.) Walp.] is one of the important legume crops grown in Rajasthan that belongs to family Leguminosae. It is used as a green legume, vegetable and fodder as well as green manure crop. Its seeds contain 23.4 per cent protein, 1.8 per cent fat, 60.3 per cent carbohydrate and also rich source of lysine and tryptophan (Singh, 1983). Sardhana and Verma (1986) reported 21 insect pests of different groups damaging the crop from germination to maturity. The important insect species infesting cowpea are aphid, *Aphis craccivora* Koch; leafhopper, *Empoasca fabae* (Harris); thrips, *Megaleurothrips distalis* Karny; army worm, *Mythimna separata* (Walker); semilooper, *Thysanoplusia orichalcea* (Fab.); Leafminer, *Phytomyza horticola* Meigen and pod borer, *Helicoverpa armigera* (Hubner) resulting in heavy yield losses (Prasad *et al*., 1983 and Satpathy *et al*., 2009). Studies on formulation of an appropriate blend of agronomic, genetic, biological and chemical methods of pest control is very essentia linlowering the pest population below EIL to reduce pesticide consumption. It is demonstrated that intercropping with similar plant types accentuates the pest problem. Further, the olfactory stimulus offered by the main crop could be camouflaged by various intercrops (Aiyer, 1949). In such systems, many photophilic pest avoid crops when they are shaded by the taller crops. The species diversity or the population level of natural enemies may be influenced by the complex environment of the crops. This paper deals with the effect of various intercropping systems on the population of aphid, leafhopper and whitefly associatedwiththe cowpea.

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How to cite this article: Choudhary, S., Khinchi, S.K. and Kumar, S. (2022). Effect of Various Intercrops on the Incidence of Major Sucking Insect Pests of Cowpea [*Vigna unguiculata* (Linn.) Walp.] Legume Research. DOI: 10.18805/LR-4905.

Submitted: 24-02-2022 **Accepted:** 13-06-2022 **Online:** 13-07-2022

MATERIALS AND MEHTODS

The experiment was laid out in a simple randomized block design with four replications. Each plot was measured 3.0 m × 2.5 m each at the Agronomy farm of S.K.N College of Agriculture, Jobner during *kharif* 2018. The intercrops sown with main crop, cowpea (RC-19) were pearlmillet (MH-171), sorghum (local), sesame (RT-351) and cluster bean (RGC-936). The crop was sown on 1st July, 2018 at row to row and plant to plant distance of 30 cm and 10 cm, respectively. In intercrops plots, four rows of cowpea were alternated with one row each of the intercrop. The experiment was conducted as per recommended agronomics practices and fertilized with 20 kg N ha^{-1} as a starter dose and 40 kg P_2O_5 ha^{-1} in the soil before sowing.

The observations on population of aphid, *Aphis craccivora* Koch, leafhopper, *Empoascafabae* (Harris) and whitefly, *Bemisiatabaci* (Genn) were recorded soon after their appearance. Observations on major sucking pests population were recorded early in the morning from (10 cm

terminal shoot) for aphid and from three leaves, *viz*., one each from top, middle and lower canopy of the plant for leafhopper and whitefly. The data were converted into $\sqrt{X+0.5}$ value for analysis of variance.

The seed yield of different intercropping systems were converted into equivalent yield of cowpea at prevailing market rate of cowpea and other crops with the help of following expression and data so obtained were subjected to analysis.

Equivalent yield (qha^{-1}) =

$$\left[\begin{array}{c}\text{Seed yield of main crop} \\ (q\ ha^{-1})\end{array} + \begin{array}{c}\text{Seed yield of intercrop} \\ (q\ ha^{-1})\end{array} \times \begin{array}{c}\text{Price of intercrop} \\ (Rs\ q^{-1})\end{array} \div \begin{array}{c}\text{Price of main crop} \\ (Rs\ q^{-1})\end{array}\right]$$

RESULTS AND DISCUSSION

The principle behind using the intercrops in the integrated pest management is that the intercrops camouflage the insect pest activity and therefore, the main crop is saved from the pest menace. The intercrops are also responsible for modifying the agroecosystem, thereby, making it less conducive for development of insect pest population. The pest-wise incidence in different cropping systems is discussed below:

Aphid, *Aphis craccivora* Koch

The data presented in Table 1 revealed that none of the intercrop combinations was found completely free from the incidence of aphid, but showed a definite impact of intercropping on the incidence of pest. The infestation of aphid was first observed in the last week of July. The infestation of aphid increased gradually and reached to peak in the third week of August and continued till second week of September.

The overall mean incidence of aphid, *A. craccivora* showed that in all the intercrop combinations, the incidence was lower (31.08-43.92 aphid/10 cm terminal shoot) as compared to sole crop (53.39 aphid/10 cm terminal shoot). The minimum population of aphid was found in the intercrop combinations of cowpea + pearl millet (31.08 aphid/10 cm terminal shoot) and cowpea + sorghum (32.74 aphid/10 cm terminal shoot) and both were on par with each other whereas, more infestation was on cowpea + clusterbean (47.69 aphid/10 cm terminal shoot) and cowpea + sesame (43.92 aphid/10 cm terminal shoot) intercrop combinations. The present findings are supported by Yadav *et al*. (2017) who reported that the minimum aphid, leafhopper and whitefly population were observed on clusterbean + pearl millet and clusterbean + sorghum intercrop combinations and maximum aphid, leafhopper and whitefly population were observed in the sole crop.

Leafhopper, *Empoasca fabae* (Harris)

A perusal of Table 2 indicates that the infestation of leafhopper started in the last week of July. The infestation of leafhopper increased gradually and reached to peak in the third week of August and continued till second week of September. The mean leafhopper population during the season ranged from 4.12-7.12 per three leaves. The minimum population of leafhopper was found in the intercrop combination of cowpea + pearl millet (4.12 leafhopper/ three leaves) and cowpea + sorghum (4.33 leafhopper/three leaves) and both were on par with each other whereas, maximum on sole crop (7.12 leafhopper/ three leaves) followed by cowpea + cluster bean (6.34 leafhopper/ three leaves) and cowpea + sesame (5.84 leafhopper/ three leaves). Thus, an overall view of mean incidence of leafhopper *E. fabae* on cowpea and different intercrop combination showed a definite effect on the pest incidence. A striking reduction in the population of leafhopper was noticed in cowpea + pearl millet and cowpea + sorghum intercrop combinations.. The results fully supported from the

Table 1: Effect of various intercrops on the incidence of aphid *Aphis craccivora* Koch. on cowpea.

Intercrop combinations	Population of Aphid /10 cm terminal shoot								Mean of the season
	28.07.2018	04.08.2018	11.08.2018	18.08.2018*	25.08.2018	01.09.2018	08.09.2018	15.09.2018	
Cowpea +	6.10	28.10	54.20	79.45	40.15	22.35	12.45	5.80	31.08
Pearlmillet	(2.57)	(5.35)	(7.40)	(8.94)	(6.38)	(4.78)	(3.60)	(2.51)	(5.19)
Cowpea +	10.60	39.10	79.30	105.35	58.95	31.25	17.40	10.30	43.92
Sesame	(3.33)	(6.29)	(8.93)	(10.29)	(7.71)	(5.63)	(4.23)	(3.29)	(6.20)
Cowpea +	6.90	29.60	58.25	81.45	43.60	23.35	12.70	6.05	32.74
Sorghum	(2.72)	(5.49)	(7.66)	(9.05)	(6.64)	(4.88)	(3.63)	(2.56)	(5.33)
Cowpea +	11.95	45.95	86.35	110.25	64.95	33.00	18.70	10.60	47.69
Cluster bean	(3.53)	(6.82)	(9.32)	(10.52)	(8.09)	(5.79)	(4.38)	(3.33)	(6.47)
Sole crop	12.20	48.60	98.40	122.40	72.20	38.60	21.80	12.90	53.39
	(3.56)	(7.01)	(9.94)	(11.09)	(8.53)	(6.25)	(4.72)	(3.66)	(6.85)
SEm±	0.13	0.24	0.36	0.38	0.31	0.23	0.17	0.12	0.24
CD (p=0.05)	0.39	0.72	1.09	1.17	0.94	0.70	0.52	0.38	0.74

Figures in the parentheses are $\sqrt{X + 0.5}$ values.

*Peak population of aphid during the crop season.

findings of Choudhary and Kumawat, (2007) reported that cowpea with pearlmillet and sorghum combinations proved significantly less conducive to aphid, leafhopper and whitefly infestation compared to other intercrops.

Whitefly, *Bemisia tabaci* (Genn.)

Table-3 reveal a definite impact of intercropping on the buildup of whitefly population. The mean whitefly population during the season ranged from 2.98-6.50 per three leaves. The minimum population of whitefly was found in the intercrop combination of cowpea + pearl millet (2.98 whitefly/ three leaves) and cowpea + sorghum (3.55 whitefly/ three leaves) and both were on par with each other, whereas, maximum was on sole crop (6.50 leafhopper/ three leaves) followed by cowpea + clusterbean (5.59 whitefly/ three leaves) and cowpea + sesame (5.34 whitefly/ three leaves). In present investigation, the intercropping of pearl millet and sorghum with cowpea as main crop had minimum population of aphid, leafhopper and whitefly as compared to sole crop which gets partial support from Bairwa*et al.* (2007).

The highest equivalent yield was obtained from intercrop combination of cowpea + sorghum (11.22 q ha^{-1}) which was significantly higher than all the intercrop combinations evaluated and sole crop. The higher equivalent yield was also obtained in the intercrop combinations of cowpea + pearl millet (10.48 q ha^{-1}) andcowpea + sesame (10.37 q ha^{-1}). The minimum equivalent yield was obtained in the sole crop (9.90 q ha^{-1}). These results get support from that of Yadav *et al.* (2017)who found that the highest yield was obtained from clusterbean + pearl millet (9.2 q ha^{-1}) and clusterbean + sorghum (9.1 q ha^{-1}), which were on par with each other. The yield of clusterbean + sesame (8.7 q ha^{-1}) and

Table 2: Effect of various intercrops on the incidence of leafhopper, *Empoasca fabae* (Harris) on cowpea.

Intercrop combinations	Population of leafhopper/3 leaves								Mean of the season
	28.07.2018	04.08.2018	11.08.2018	18.08.2018*	25.08.2018	01.09.2018	08.09.2018	15.09.2018	
Cowpea +	1.15	3.70	5.40	9.80	4.70	4.40	2.40	1.40	4.12
Pearlmillet	(1.28)	(2.05)	(2.43)	(3.21)	(2.28)	(2.21)	(1.70)	(1.38)	(2.07)
Cowpea +	2.00	5.15	7.90	13.00	6.90	6.15	3.35	2.25	5.84
Sesame	(1.58)	(2.38)	(2.90)	(3.67)	(2.72)	(2.58)	(1.96)	(1.66)	(2.43)
Cowpea +	1.30	3.90	5.80	10.05	5.10	4.60	2.45	1.45	4.33
Sorghum	(1.34)	(2.10)	(2.51)	(3.25)	(2.37)	(2.26)	(1.72)	(1.40)	(2.12)
Cowpea +	2.25	6.05	8.60	13.60	7.60	6.50	3.60	2.50	6.34
Clusterbean	(1.66)	(2.56)	(3.02)	(3.75)	(2.85)	(2.65)	(2.02)	(1.73)	(2.53)
Sole crop	2.30	6.40	9.80	15.10	8.45	7.60	4.20	3.10	7.12
	(1.67)	(2.63)	(3.21)	(3.95)	(2.99)	(2.85)	(2.17)	(1.90)	(2.67)
SEm±	0.06	0.09	0.12	0.14	0.11	0.10	0.08	0.07	0.10
CD (p=0.05)	0.19	0.27	0.36	0.41	0.34	0.32	0.24	0.20	0.30

Figures in the parentheses are $\sqrt{X + 0.5}$ values.

*Peak population of aphid during the crop season.

Table 3: Effect of various intercrops on the incidence whitefly, *Bemisia tabaci* (Genn.) on cowpea.

Intercrop combinations	Population of White fly /3 leaves								Mean of the season
	28.07.2018	04.08.2018	11.08.2018	18.08.2018*	25.08.2018	01.09.2018	08.09.2018	15.09.2018	
Cowpea +	1.10	1.10	3.15	6.10	4.50	3.75	1.70	1.15	2.98
Pearlmillet	(1.26)	(1.70)	(1.91)	(2.57)	(2.24)	(2.06)	(1.48)	(1.28)	(1.81)
Cowpea +	1.85	4.75	7.15	11.50	6.65	5.90	3.00	1.90	5.34
Sesame	(1.53)	(2.29)	(2.77)	(3.46)	(2.67)	(2.53)	(1.87)	(1.55)	(2.33)
Cowpea +	1.25	2.80	3.65	7.95	4.90	4.75	1.95	1.30	3.57
Sorghum	(1.32)	(1.82)	(2.04)	(2.91)	(2.32)	(2.29)	(1.57)	(1.34)	(1.95)
Cowpea +	1.90	5.15	7.45	11.75	7.25	6.50	3.10	1.95	5.59
Clusterbean	(1.55)	(2.38)	(2.81)	(3.50)	(2.78)	(2.65)	(1.90)	(1.57)	(2.39)
Sole crop	1.95	5.90	8.75	14.30	8.00	7.25	3.85	2.00	6.50
	(1.57)	(2.53)	(3.04)	(3.85)	(2.92)	(2.78)	(2.09)	(1.58)	(2.54)
SEm±	0.07	0.08	0.10	0.12	0.11	0.10	0.07	0.06	0.09
CD (p=0.05)	0.20	0.24	0.30	0.37	0.33	0.31	0.23	0.19	0.27

Figures in the parentheses are $\sqrt{X + 0.5}$ values.

*Peak population of aphid during the crop season.

Table 4: Mean yield of different intercropping combinations.

Intercrop combinations	Yield (q ha^{-1})		
	Main crop	Intercrop	Equivalent yield
Cowpea + Pearlmillet	8.44	4.20	10.48
Cowpea + Sesame	7.28	1.98	10.37
Cowpea + Sorghum	7.41	6.10	11.11
Cowpea + Clusterbean	7.22	2.43	9.95
Sole crop	9.90	-	9.90
SEm±			0.09
CD. (p=0.05)			0.30

clusterbean + green gram (8.6 q ha^{-1}) was significantly higher than the sole crop (Table 4).

The present result agrees with the findings of Yadav *et al.* (2022) who reported that the different intercrop combinations significantly influenced the equivalent yield of cluster bean. The maximum equivalent yield was obtained from cluster bean + pearl millet (1065 kg ha^{-1}) followed by cluster bean + green gram (974 kg ha^{-1}) and cluster bean + moth bean (933 kg ha^{-1}) intercrop combination. The minimum yield was obtained from sole crop (763 kg ha^{-1}).

CONCLUSION

The intercrop combinations, *viz.,* cowpea + pearl millet and cowpea + sorghum harboured significantly lower population of aphids, leafhoppers and whiteflies as compared to the sole crop of cowpea.The highest equivalent yield was obtained from intercrop combination of cowpea+ sorghum (11.22 q ha^{-1}). Whereas, the minimum equivalent yield was obtained in the sole crop (9.90 q ha^{-1}).

ACKNOWLEDGEMENT

The authors are thankful to the Dean, S.K.N. College of Agriculture, Jobner for providing necessary facilities to accomplish this study.

Conflict of interest: None.

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