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Effect of Intercrops on the Incidence of Insect Pests of Clusterbean, *Cyamopsis tetragonoloba*

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Abstract
The experiment on intercropping of clusterbean with pearl millet, sesame, green gram and sorghum was laid out with the view to find out the possibility of minimum incidence of insect pests on the main crop. It was observed that in the intercrop combinations, *viz*., clusterbean + pearl millet and clusterbean + sorghum the main crop (clusterbean) harboured significantly lower population of leaf hopper, *Empoasca motti* (4.0 and 4.2/ three leaves, respectively), whitefly, *Bemisia tabaci* (3.0 and 3.7/ three leaves, respectively) and aphid, *Aphis craccivora* (2.8 and 3.1/ central shoot) as compared to the sole crop of clusterbean. The aphid population was minimum in clusterbean + pearlmillet (2.8/ central shoot) followed by clusterbean + sorghum (3.1/ central shoot) as compared to sole crop (5.2/ central shoot). The highest yield was obtained from clusterbean + pearl millet (9.2 q ha^{-1}) and clusterbean + sorghum (9.1 q ha^{-1}), the two combinations being on par with each other. The equivalent yield was minimum in the sole crop (6.8 q ha^{-1}).

Keywords: Intercrop, clusterbean, *Bemisia tabaci, Empoasca motti, Aphis craccivora.*

Introduction
Clusterbean or Guar, *Cyamopsis tetragonoloba* (Linn.) Taub. is one of the major legume crops grown in arid and semi-arid regions of the country. The crop possesses high value due to green pods and seeds, the former are used as vegetable as it is rich in protein content and the latter as source of gum. The crop is also being used as green manure which improves the physical properties of the soil. The straw is known for better quality fodder. Insect pests are the major constraints in the productivity of clusterbean. Among them, leaf hopper, *Empoasca motti* Pruthi; whitefly, *Bemisia tabaci* (Genn.), *Acaudaleyrodes rachipora* (Singh); aphid, *Aphis craccivora* Koch; pod borer, *Helicoverpa armigera* (Hub.), leaf perforator, *Dichomeris inthes* Meyr, *Maruca testulalis* Geyer*; Protaetia terrosa* G. & P. are important infesting clusterbean (Muralidharan *et al,* 1999; Reddy and Rao, 2001; Arora and Kashyap, 2002; Khan *et al.,* 2002 and Singh, 2004) [5, 6, 1, 4, 10]. The leaf hopper, *E. motti* commonly known as leaf hopper is a serious polyphagous pest, which adversely affects the vegetative growth and seed yield upto 20 per cent (Singh, 1997) [11]. To combat the insect pests of clusterbean, the chemical control has been recommended by some workers (Singh, 2002 a and b and Dodia *et al.,* 2003) [8, 3] but due to one or the other reasons could not become panacea in the protection of this crop. Therefore, integrated control may be considered to be only answer to the problem. It is demonstrated that intercropping with similar plant types accentuates the pest problem. The principle behind using the intercrops in the integrated pest management is that the olfactory stimuli offered by the main crop could be camouflaged by various intercrops 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. In the present study, various intercrops have been tried in combination with the clusterbean as the main crop to find out the reaction of major insect pests.

Materials and methods
The experiment was laid out in a simple randomized block design (RBD) with four replications. Each plot was measured 3.0 x 2.7 m^2 and the crop was sown with a spacing of 30 x 10 cm. The intercrops sown with main crop, clusterbean (RGC-936) were pearlmillet (MH-171), sesame (RT-46), sorghum (local) and mungbean (RMG-62). A clusterbean sole crop was

maintained as check to compare the results. One row of intercrop was sown after three rows of main crop. The crop was sown on 10th July, 2007.

The populations of major insect pests were recorded at weekly interval from their appearance till harvesting of the crop. The observations on absolute population of leaf hopper, whitefly and thrips were recorded soon after their appearance. All the observations were recorded early in the morning. The methods used for recording the population of major insect pests, *viz*., leaf hopper, *Empoasca motti*; whitefly, *Bemisia tabaci* and aphid, *Aphis craccivora* have been described below:

The populations of leaf hopper and whitefly were recorded on each five randomly selected and tagged plants in each plot. Three leaves, *viz*., one each from top, middle and lower canopy of the plant were selected for recording the leaf hoppers. The population of aphid was recorded from the central shoot of each five randomly selected tagged plants in each plot. The population was recorded in the early morning hours. The crop had been grown in tune with natural environmental conditions without interception of any kind. For comparison of the yield data, the seed yields of different intercropping systems were converted into equivalent yield of clusterbean, using prevailing market rate of clusterbean and other crops with the help of following expression:

$$\underset{(q\ ha^{-1})}{\text{Equivalent yield}} = \underset{(q\ ha^{-1})}{\text{Seed yield of main crop}} + \left(\underset{(q\ ha^{-1})}{\text{Seed yield of intercrop}} \times \frac{\text{Price of intercrop}}{\text{Price of main crop}} \underset{(Rs.\ q^{-1})}{} \right)$$

The equivalent yield so obtained was subjected to analysis of variance.

Results and discussion

There were four intercrop combinations, *viz.*, pearl millet, sesame, green gram and sorghum along with sole crop (clusterbean) studied in the present investigation. The data on population of leaf hopper, *E. motti* on clusterbean grown along with intercrops revealed that the crop was not found completely free from the attack of insect pests (Table-1). The infestation of leaf hopper was first observed in the second week of August. The infestation increased gradually and reached maximum in the first week of September and continued till first week of October. The data indicated that minimum mean leaf hopper population (4.0/ three leaves) was observed on clusterbean + pearl millet and clusterbean + sorghum (4.2/ three leaves) intercrop combinations and they were found on par with each other. The maximum leaf hopper population was observed in the sole crop (6.8/ three leaves) followed by clusterbean + sesame (6.1/ three leaves) and clusterbean + green gram (5.6/ three leaves). The present findings are in conformity with that of Singh and Singh (1978) [9] who reported that intercropping system had considerable effect of minimising the incidence of insect pests in comparison to monocrop. In present investigation, the intercropping of pearl millet, and sorghum with clusterbean as main crop had minimum population as compared to sole crop which gets partial support from Dhuri *et al.* (1986) [2].

The data on population of whitefly, *B. tabaci* revealed that none of the intercrops was found completely free from the attack of whitefly (Table-1). The infestation of whitefly was first observed in the second week of August. The infestation increased gradually and reached to maximum in the first week of September and continued upto first week of October. The data indicated that minimum mean whitefly population was harboured on clusterbean + pearl millet intercrop combination (3.0/ three leaves) followed by clusterbean + sorghum (3.7/ three leaves), which were found on par with each other. The maximum whitefly population was observed on sole crop (7.6/ three leaves) which was found on par with clusterbean + green gram (5.9/ three leaves) and clusterbean + sesame (6.3/ three leaves). The present finding gets support from that of Dhuri *et al.* (1986) [2] who reported that the intercrops reduced pest population invariably than the sole crop.

The data on infestation of aphids revealed that the intercropped clusterbean was not found free from the attack of aphid, *A. craccivora* (Table-1). The infestation of aphid was first observed in the second week of August. The infestation increased gradually and reached to peak in the last week of August and continued upto the second week of September. The mean aphid population ranged from 2.8 (clusterbean + pearl millet) to 5.2/ central shoot (sole crop) in the present investigation. The minimum aphid population (2.8/ central shoot) was observed on clusterbean + pearl millet intercrop combination followed by clusterbean + sorghum (3.1/ central shoot). The maximum aphid population was observed on sole crop (5.2/ central shoot) and clusterbean + sesame (4.6/ central shoot) and clusterbean + green gram (4.7/ central shoot).

the equivalent yield was minimum in the sole crop (6.8 q ha^{-1}) as evident in table-2. 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 clusterbean + green gram (8.6 q ha^{-1}) was significantly higher than the sole crop.

Table 1: Population of insect pests of clusterbean grown with different intercrops

Intercrop combination	Population of insect pests																					Mean of season		
	14.08.07			21.08.07			28.08.07			04.09.07*			11.09.07			18.09.07		25.09.07		02.10.07				
	L	W	A	L	W	A	L	W	A	L	W	A	L	W	A	L	W	L	W	L	W	L	W	A
Clusterbean + Pearlmillet	1.7	1.1	2.5	3.6	2.0	3.5	6.1	4.3	4.0	7.0	5.4	2.6	5.6	4.5	1.6	4.5	4.0	2.4	1.9	1.1	1.2	4.0	3.0	2.8
	(1.5)	(1.2)	(1.7)	(2.0)	(1.6)	(2.0)	(2.6)	(2.2)	(2.1)	(2.7)	(2.4)	(1.8)	(2.5)	(2.2)	(1.4)	(2.2)	(2.1)	(1.7)	(1.6)	(1.2)	(1.3)	(2.1)	(1.9)	1.8
Clusterbean + Sesame	2.8	2.5	3.3	5.9	4.8	5.9	9.3	9.8	6.7	10.5	10.9	4.3	8.5	9.3	2.6	6.4	8.0	3.5	3.1	2.0	2.0	6.1	6.3	4.6
	(1.8)	(1.7)	(1.9)	(2.5)	(2.3)	(2.5)	(3.2)	(3.2)	(2.7)	(3.3)	(3.4)	(2.2)	(3.0)	(3.1)	(1.8)	(2.6)	(2.9)	(2.0)	(1.9)	(1.6)	(1.6)	(2.6)	(2.6)	(2.3)
Clusterbean + Sorghum	1.8	1.3	2.9	3.8	3.0	3.7	6.5	4.7	4.3	7.3	7.3	2.8	6.0	5.1	1.8	4.7	4.5	2.5	2.2	1.2	1.3	4.2	3.7	3.1
	(1.5)	(1.3)	(1.8)	(2.1)	(1.9)	(2.1)	(2.6)	(2.3)	(2.2)	(2.8)	(2.8)	(1.8)	(2.6)	(2.4)	(1.5)	(2.3)	(2.2)	(1.7)	(1.6)	(1.3)	(1.3)	(2.2)	(2.0)	(1.9)
Clusterbean + Green gram	2.5	2.3	3.5	5.0	4.2	6.4	8.6	9.2	7.2	9.9	10.4	4.6	7.8	8.6	2.8	6.1	7.8	3.3	3.2	1.8	2.0	5.6	5.9	4.7
	(1.7)	(1.7)	(2.0)	(2.4)	(2.2)	(2.6)	(3.0)	(3.1)	(2.2)	(3.2)	(3.3)	(2.3)	(2.9)	(3.0)	(1.8)	(2.6)	(2.9)	(1.9)	(1.9)	(1.5)	(1.6)	(2.5)	(2.5)	(2.3)
Clusterbean sole	2.8	3.0	4.1	6.3	5.5	6.5	10.5	11.7	7.3	12.0	13.7	5.0	9.4	11.2	3.3	7.5	10.0	4.1	4.1	2.0	2.0	6.8	7.6	5.2
	(1.8)	(1.9)	(2.1)	(2.6)	(2.5)	(2.7)	(3.3)	(3.5)	(2.8)	(3.5)	(3.8)	(2.4)	(3.1)	(3.4)	(1.9)	(2.8)	(3.2)	(2.1)	(2.1)	(1.6)	(1.6)	(2.7)	(2.9)	(2.4)
S.Em.±	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
CD (p=0.05)	0.2	0.3	0.2	0.3	0.3	0.3	0.4	0.4	0.3	0.4	0.4	0.2	0.3	0.4	0.2	0.2	0.4	0.2	0.3	0.2	0.2	0.3	0.3	0.3

L= Leaf hoppers/ 3 leaves, W= Whiteflies/ 3 leaves, A= Aphids/ central shoot
Figures in the parentheses are $\sqrt{x+0.5}$ values.
* Peak population of leaf hopper during the crop season.

Table 2: Mean yield of different intercropping combinations

S. No.	Intercrop combinations	Yield (q ha^{-1})		
		Main crop	Intercrop	Equivalent yield
1.	Clusterbean + pearlmillet	7.4	5.1	9.2
2.	Clusterbean + sesame	6.1	1.1	8.7
3.	Clusterbean + sorghum	7.1	5.0	9.1
4.	Clusterbean + green gram	6.0	1.8	8.6
5.	Sole crop	6.8	-	6.8
	S.Em.±			0.1
	CD (p=0.05)			0.3

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