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Incidence of Whitefly and Virus Diseases in Cowpea and Greengram Intercropped with Cereals and Oilseeds

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ABSTRACT

Intercropping with non host or dissimilar plant type (sorghum) reduced whitefly population and yellow mosaic virus and Golden mosaic virus diseases. The highest whitfly population and disease incidence was observed in greengram + soyabean + sorghum and lowest in cowpea + sorghum combination. Considering the grain yield data, highest monetary return was obtained from greengram + sorghum and cowpea + sorghum combinations.

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INTRODUCTION

Intercropping is a traditional system of cultivation in India and elsewhere practiced since ancient time. One of the advantages of this practice is the reduction in losses from insects and diseases (Norton 1975; Perrin, 1977; Perrin and Phillips, 1978) as proper crop mixtures create a less favourable environment for certain pests of one or both of the component crops (Gerard, 1976). In intercropping systems many photophilic pests avoid short crops when they are shaded by taller crops. The taller crops also check the dispersal of the flying pests of shorter crops (Gerard, 1976). It is assumed that yellow mosaic virus (YMV) in greengram and Golden mosaic virus (GMV) disease incidence in cowpea could be reduced due to decreased population of vector in intercropping system. This paper deals with the effect of intercropping on whitefly (Bemisia tabaci) population as well as virus disease incidence associated with cowpea and greengram.

MATERIALS AND METHODS

Two field experiments were conducted during summer (March to June) and rainy (July to October) seasons in the year 1988 adopting a randomised block design with seven different crop combinations replicated three times at Indian Agricultural Research Institute, New Delhi. Details of crop combination are furnished in Table 1. Normal tillage operations were followed to prepare the experimental polts. Distance between the two lines was 50 cm. Fresh seeds of cowpea 779, greengram Pusa 105, Sorghum CSV 10, Soybean Harosoy 63, Sunflower EC 27621 and Bajra MH 279 were used for the trials. Furrows were opened with hand plough and seeds were dibbled uniformly. After sowing the seeds, the furrows were closed.

Whitefly observations were recorded at 10 days interval from 20 randomly selected

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leaves (one trifoliate leaf/plant). They were counted during early morning hours (6.00 to 7.00 a.m.) without disturbing the plant. The number of plants infected by yellow mosaic virus (YMV) and cowpea golden mosaic virus (CGMV) as well as total number of plants were recorded separately from whole plot, 30, 45 and 60 days after germination. Per cent disease incidence was worked out from these data. Grain yield of main and intercrops was recorded separately from whole plot area in all the treatments. The data on whitefly population were analysed after replacing zero value by 0.5 wherever necessary. The percentage disease incidence were subjected to arc Sin $\sqrt{\text{percentage}}$ transformation before statistical analysis.

RESULTS AND DISCUSSION

Mean number of whiteflies recorded at an interval of 10 days starting from sowing till maturity of the crop are given in Table 1 and 2. Significant differences were observed in whitefly population in all the periodical observations during summer as well as rainy seasons. Whitefly population was minimum (1.0 and 1.67/20 leaves) when cowpea was intercropped with soughum and maximum (4.67 and 8.0/20 leaves) in the combination of greengram + soybean + sorghum 10 DAG during summer and rainy season, respectively. Whitefly population did not differ significantly in cowpea monocrop, greengram + sorghum, cowpea + sorghum, cowpea + sunflower + sorghum and cowpea/greengram + sorghum/bajra. On 30th DAG, whitefly population increased suddenly in all crop combinations and varied from 9.33 (T4) to 23.67 (T6) and 4.0 (T4) to 19.33 (T6) per 20 leaves during summer and rainy seasons, respectively. Whitefly population reached its peak in May-June (summer) and September-October (rainy season) and decreased gradually in all crop combinations in the last two observations, as the crop reached maturity.

The whitefly population was comparatively higher during summer than rainy season (Fig. 1 and 2). Highest population of whitefly was recorded in all the periodical observations in combination of greengram + soybean + sorghum with an average of 22.79 and 11.62 whiteflies per 20 leaves and lowest in cowpea + sorghum with an average of 7.92 and 1.86 white flies during summer and rainy season 1988, respectively. Whitefly population in different crop combinations was in order of T6 > T1 > T3 > T5 > T7 > T7 > T2 > T4. It was observed that intercropping with non host or dissimilar plant type (sorghum) reduced whitefly population, whereas similar host plant (soybean or sunflower) increased whitefly population. It is well known that soybean and sunflower are the preferred host of whitefly and their presence in the field might have favoured build-up of whitefly population in these combinations.

Disease Incidence

There was no virus disease incidence on both the crops in summer, however, it was observed during rainy season. The disease incidence was low in cowpea + sorghum, greengram + sorghum and greengram/cowpea + sorghum/bajra combinations but high in the combination of cowpea + sunflower + sorghum and greengram + soybean + sorghum, though the differences aomng various combinations were nonsignificant.

Wilken (1972) and Singh and Singh (1978) observed that intercropping with suitable crops affected the microclimate of the ecosystem and ultimately produced an unfavourable environment for the pests. Gravena *et al.* (1984) found that tomato planted with band of grain sorghum round the crop reduced the incidence of whitefly and virus disease. Blackgram intercropped with sorghum and pigeonpea carried comparatively lower incidence of most of the

TABLE 1

Incidence of whitefly on cowpea and greengram intercropped with cereals and oilseeds (Summer 1988).

Tr. No.	Crop combination	Average no. of whitefly adults / 20 leaves DAG								
		10	20	30	40	50	60	70	80	Average
T_1	Greengram	3.33	7.00	21.67	26.33	27.00	28.00	15.33	14.00	17.83
T_2	Cowpea	1.33	2.33	11.67	19.00	17.00	10.67	6.33	5.67	9.25
T_3	Greengram + Sorghum	2.67	5.67	20.33	24.67	26.67	24.67	14.33	8.67	15.96
T_4	Cowpea + Sorghum	1.00	1.33	9.33	16.00	17.00	11.33	4.33	3.00	7.92
T_5	Cowpea + Sunflower + Sorghum	2.33	5.33	16.00	22.00	21.33	20.33	13.33	8.00	13.58
T_6	Greengram + Soybean + Sorghum	4.67	10.67	23.67	29.33	34.33	35.00	24.67	20.00	22.79
T_7	Cowpea / Greengram + Sorghum / Bajra	1.67	3.00	17.33	20.00	21.33	22.33	8.67	6.00	12.54
	S. Em. ±	0.57	0.88	2.87	2.12	3.61	1.56	1.59	0.92	
	C. D. at 5%	1.76	2.71	8.84	6.53	11.12	4.80	4.90	2.83	

TABLE 2

Incidence of whitefly and virus diseases on cowpea and greengram intercropped with cereals and oil seeds (Rainy season 1988).

Tr. No.	Crop combination	Average no. of whitefly adults/20 leaves - DAG							Average	Per cent disease incidence DAG**		
		10	20	30	40	50	60	70*		30	45	60
1.	Greengram	5.33	11.67	17.33	7.67	11.67	8.67	3.67	9.43	2.95	5.92	7.55
								(4.17)		(9.81)	(13.95)	(15.83)
2.	Cowpea	2.67	5.33	6.33	2.00	2.33	2.33	0.00	3.00	2.86	5.32	7.04
								(0.50)		(9.50)	(13.29)	(15.36)
3.	Greengram + Sorghum	4.33	8.67	11.67	4.00	7.00	6.67	2.33	6.38	1.93	4.14	6.13
								(2.83)		(7.83)	(11.56)	(14.20)
4.	Cowpea + Sorghum	1.67	4.00	4.00	1.00	1.33	1.00	0.00	1.86	1.85	3.93	6.00
								(0.50)		(7.80)	(11.47)	(14.16)
5.	Cowpea + Sunflower + Sorghum	2.67	8.00	8.67	3.00	4.67	3.33	2.00	4.62	3.06	6.39	8.72
								(2.50)		(10.06)	(14.50)	(17.09)
6.	Greengram + Soybean + Sorghum	8.00	12.00	19.33	10.00	16.00	12.00	4.00	11.62	3.52	7.01	9.35
								(4.50)		(10.73)	(15.31)	(17.80)
7.	Greengram/Cowpea + Sorghum/Bajra	3.67	7.33	9.33	3.00	4.67	2.67	0.33	4.43	1.99	4.45	5.51
								(0.83)		(8.05)	(12.09)	(13.52)
	S. Em. ±	0.72	1.33	1.68	0.56	1.03	0.91	(0.22)		(0.80)	(1.25)	(1.08)
	C.D. at 5%	2.22	4.10	5.17	1.72	3.17	2.80	(0.68)		NS	NS	NS

* Figures in parentheses are X + 0.5 values

** Figures in parentheses are transformed values = Arc sin $\sqrt{\text{percentage}}$

NS = Non significant.

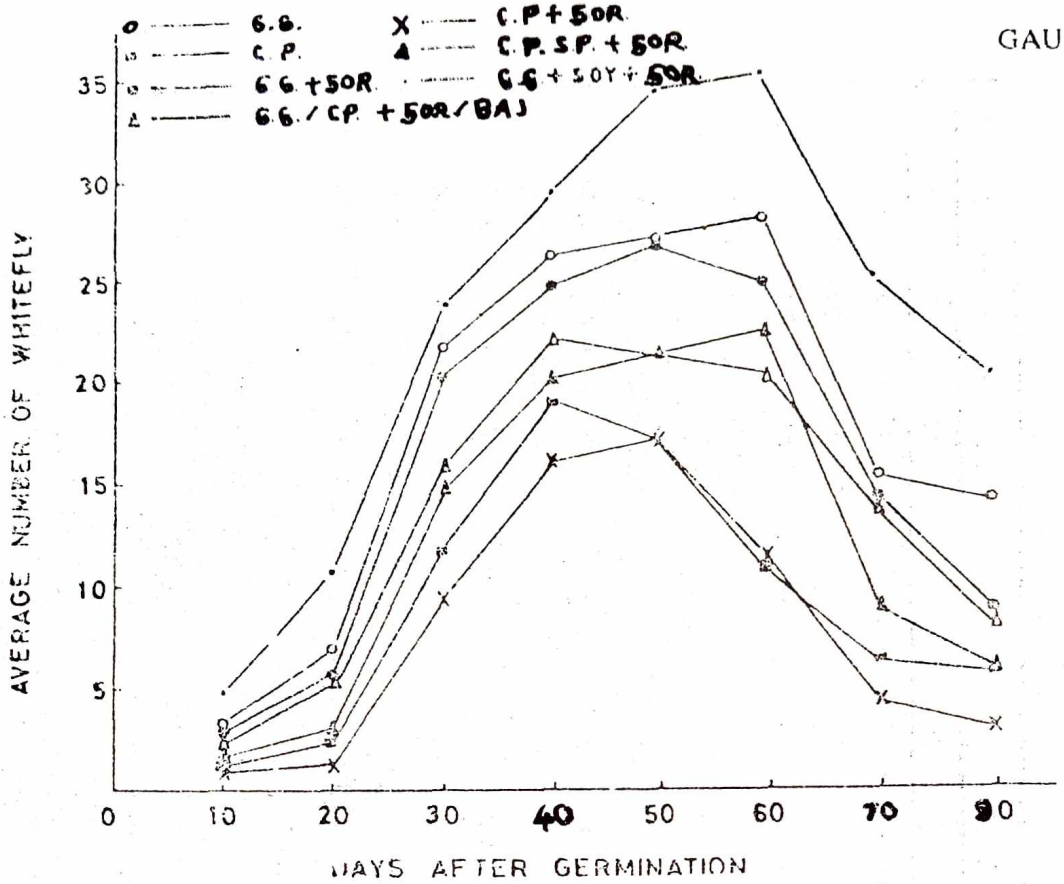

Fig. 1 : Incidence of whitefly in cowpea and greengram intercropped with cereals and oilseeds (Summer 1988).

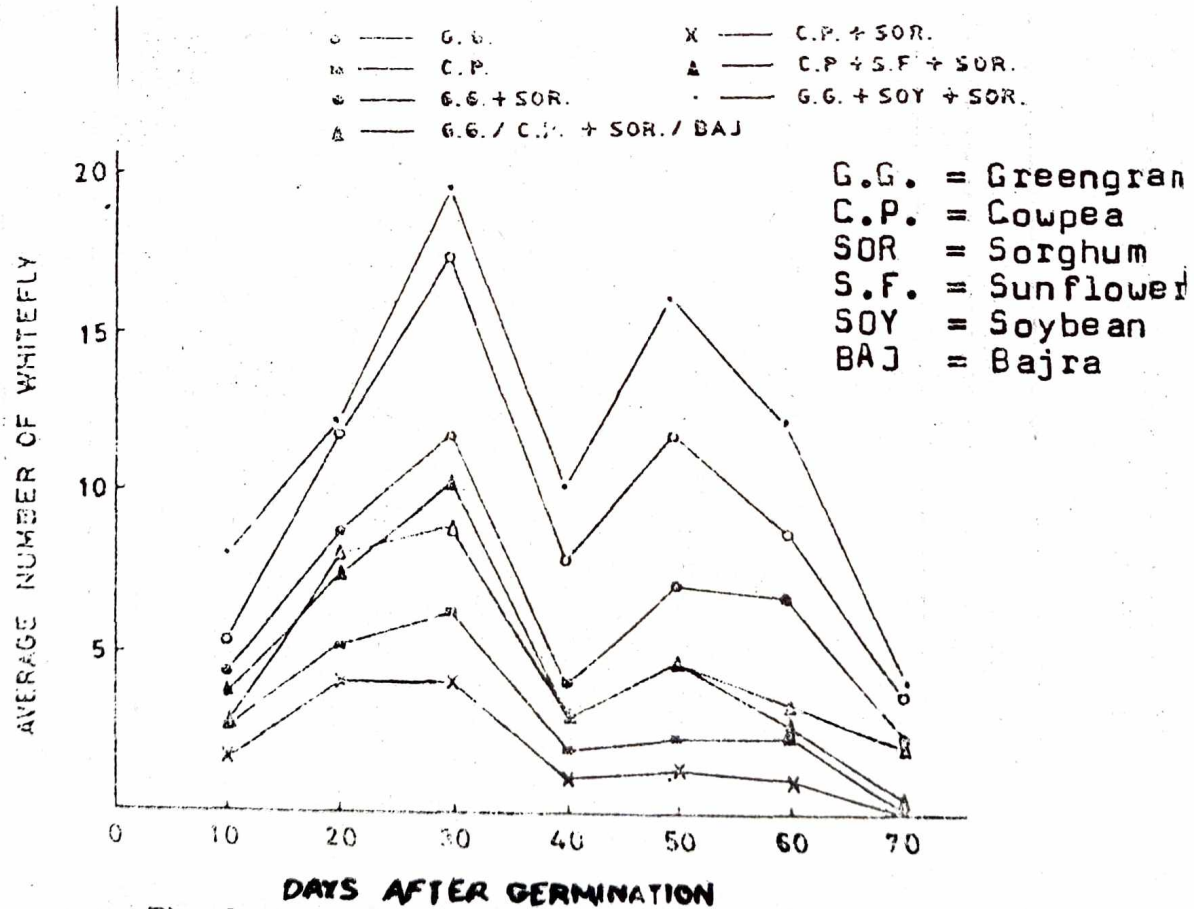

Fig. 2 : Incidence of whitefly in cowpea and greengram intercropped with cereals and oilseeds (Rainy 1988).

TABLE 3

Gain yield and monetary return from cowpea and greengram intercropped with cereals and oil seeds (summer 1988 and rainy season 1988).

Sr. No.	*Crop combination*	*Grain yield kg/ha.*		*Income Rs./hs.*	
		Summer 1988	*Rainy Season 1988*	*Summer 1988*	*Rainy Season 1988*
T_1	Greengram	827.87	808.63	6620.53	6469.07
				(81.37)	(80.43)
T_2	Cowpea	725.13	750.53	6163.63	6379.53
				(78.51)	(79.87)
T_3	Greengram	540.53	469.10		
	+			6658.87	6624.55
	Sorghum	1037.33	1276.33	(81.60)	(81.39)
T_4	Cowpea	455.96	472.90		
	+			6029.13	6711.40
	Sorghum	957.07	1196.33	(74.97)	(81.92)
T_5	Cowpea	278.37	304.83		
	+				
	Sunflower	273.33	273.70	5387.32	5959.78
	+			(73.40)	(77.20)
	Sorghum	613.87	767.33		
T_6	Greengam	342.30	311.17		
	+				
	Soybean	237.33	255.37	5164.55	5367.19
	+			(71.85)	(72.25)
	Sorghum	682.73	853.43		
T_7	Greengram/	186.13	166.20		
	Cowpea	124.60	140.17		
	+			5007.42	5017.76
	Sorghum/	444.00	509.33	(70.77)	(70.83)
	Bajra	644.00	600.33		
	S. Em. ±			(0.94)	(0.47)
	C. D. at 5%			(2.91)	(1.45)

Figurse in parentheses are $\sqrt{X}$ values.

Price for 100 kg.

Greengram	Rs. 800/-	Sunflower	Rs. 600/-
Cowpea	Rs. 850/-	Sorghum	Rs. 225/-
Soybean	Rs. 375/-	Bajra	Rs. 250/-

pests including whitefly whereas intercropping with similar plant type of another legume (greengram) provided better conducive conditions at micro level for multiplication of insect pests(Dhuri *et al.*, 1986).

Grain yield and income

Grain yield of main crop and intercrop recorded from the net plot area was converted into kg/ha. For statistical analysis, realization in terms of Rs/ha was worked out for each crop combination. Data on mean grain yield and income are given in Table 3. The highest income of Rs. 6658=87 was obtained from greengram + sorghum followed by greengram alone (Rs. 6620-53) and lowest (Rs. 5007-42) from green gram/ cowpea + sorghum / bajra, during summer season, while during rainy season highest income (Rs. 6711=40) was obtained from cowpea + sorghum followed by greengram + sorghum (Rs. 6624=55) and lowest (Rs. 5017=76) from greengram / cowpea + sorghum/bajra. The higher grain yield of component crops may be attributed to lower whitefly population and virus disease incidence in cowpea + sorghum and cowpea + greengram, ultimately resulting in the highest monetary return from these combinations. The higher monetary return obtained in monocrop of cowpea and greengram was attributed to higher market price per unit of the commodity involved.

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