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INFLUENCE OF CROP ASSOCIATION ON INSECT PEST INCIDENCE

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Influence of growing maize in association with four legumes and one grass on the incidence of stem borer (*Chilo partellus* Swin.) in maize and grasshopper (*Hieroglyphus nigrorepletus* Boisd), grey weevil (*Myllocerus maculosus* Des.) and the Bihar hairy caterpillar (*Diacrisia obliqua* Walk.) on the companion crops has been studied. Crop associations have tended to reduce the incidence of insect pest damage both to maize and the companion crops when compared with these crops grown singly.

Grass and velvet bean appeared to be the least preferred food plants for all the foliage feeders.

INTRODUCTION

Growing of one crop in association with the other (mixed-cropping) is an age old practice. Information on the effects of such associations on the crop yield and other attributes of growth is available, but very little is known about the influence of these associations on the insect pest incidence. As early as 1918, Mackenna reported about the control of *Myllocerus blandus*, a serious pest of cotton in the Punjab, by growing maize in association with cotton. Painter (1951) reported the use of wheat, oats or other plants for the protection of young legume seedlings. Control of insect pests through crop association has also been reported by various other workers (Blume, 1954; Aiyer, 1957; Gupta, 1971; and Anonymous, 1972). In Bihar, severe damage is caused by stem borer (*C. partellus*) to maize, foliage feeders, particularly grasshopper (*H. nigrorepletus*), grey weevil (*M. muculosus*), and the Bihar hairy caterpillar (*D. obliqua*) to forage legumes.

The present investigation deals with the effect of growing maize in association with four legumes and a grass on the incidence of the above pests.

MATERIALS AND METHODS

The experiment was conducted for two years (rainy seasons). The following mxied cropping patterns were studied:

C1 — Maize (*Zea mays L.*) alone
C2 — Maize+Soybean (*Glycine max* Merr.)
C3 — Maize+Calcaratus (*Phaseolus calcaaatus* Roxb.)
C4 — Maize+Black gram (*Ph. mungo* Roxb.)

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C5 — Maize+Grass (*Pennisetum pedicellatum* Trin.)
C6 — Maize+Velvet bean (*Mucuna cochinchinensis* Lour.)

For comparison companion crops were also grown singly side by side.
Observations were recorded with regard to the following :

(a) Stem borer incidence in maize
(b) Incidence of other insect pests
(c) Extent of damage caused to the companion crops

(a) *Stem borer incidence*: It was recorded twice during the crop seasons, i. e. 30 and 60 days after sowing (D A S).

(b) *Other insects*: Population of *Diacrisia* caterpillars was determined by counting their number in five randomly selected units (30 × 30 cm) per plot; while for other insects net sweeping method was adopted. The former was recorded only once at 60 D A S and the latter twice — 45 and 60 D A S.

(c) *Extent of damage*: For estimation of extent of damage, five plants were selected at random from each plot. Total number of leaves as well as those showing damage were counted on each plant. Damaged leaves were differentiated into four grades. (i) No damage, (ii) showing damage up to 25%, (iii) damage from 26 to 50% and (iv) damage more than 50%. The four grades were rated as 0, 1, 2 and 3 respectively. Observations were recorded twice, i. e. 45 and 60 D A S.

Results and Discussion

(*A*) *Stem borer incidence*

Companion crops affected borer incidence significantly on both the dates in the second year. In the first year, however, they only approached significance level for the second date of observation (Table I). Maize grown in pure stand recorded significantly higher incidence of stem borer as compared to that grown in association with any of the companion crops. Also, when the two years' data were pooled the effect of companion crops was out significant. Companion crops did not show significant differences among themselves.

The results thus indicate that growing of maize in association with different companion crops tends to reduce borer incidence.

(*B*) *Insect Population*

(i) Three species of insects were mainly found to occur namely, grasshopper, grey-weevil and the Bihar hairy-caterpillar. The average insect catches per four double stroke sweeps are presented in Tables II and III. Of the three species, population of the Bihar hairy-caterpillar adults was very low. But because of its potentiality for high fecundity, this could not be ignored. It was interesting to note that when maize was grown in association with legumes the population of grey weevil and grasshopper was higher than when it was grown either in pure stand or in association with grass. Further, the pure stand of companion crops generally harboured greater number of these insects. It was also noticed that the insect populations were comparatively higher on soybean, calcaratus and black gram under both the cultural practices.

TABLE I

Effect of companion crops on maize borer incidence (Arcsin/percentage)

Crop associations	*Mean P.C. plants showing borer attack					
	1st year		2nd year		Two years data	
	30 DAS	60 DAS	30 DAS	60 DAS	30 DAS	60 DAS
Maize alone	14.6 (6.8)	19.2 (11.1)	17.3 (9.4)	20.0 (12.6)	16.6 (8.1)	19.6 (11.9)
Maize+soybean	11.9 (4.9)	14.2 (6.8)	11.2 (4.9)	15.3 (7.4)	11.5 (4.9)	14.8 (7.1)
Maize+calcaratus	9.3 (3.8)	12.7 (5.8)	10.5 (4.5)	14.4 (6-7)	9.9 (4.2)	13.6 (6.3)
Maize+black gram	11.5 (4.7)	14.8 (8.1)	13.1 (6.2)	16.0 (8.6)	12.3 (5.5)	15.4 (8.4)
Maize+grass	11.0 (4.7)	15.7 (8.1)	8.4 (3.8)	13.0 (6.3)	9.7 (4.3)	14.4 (7.2)
Maize+velvet bean	13.0 (5.8)	14.5 (6.9)	10.4 (5.1)	14.4 (6.6)	11.7 (5.5)	14.5 (6.8)
S. Em (C_1)±	2.40	1.43	1.78	1.21	1.51	1.13
S. Em ($C_2 - C_6$)	———	———	Not done	———	1.23	0.92
C. D. 5%	N.S.	N.S.	5.2	3.5	3.90	2.92

D A S, Days after sowing

**Note* : Figures in parentheses indicate original values

TABLE II

Mean number of insects ($\sqrt{n+1}$) *caught per 4 double stroke sweeps*

	Days after sowing (First year)						Days after sowing (Second year)					
	45			60			45			60		
	G	M	D	G	M	D	G	M	D	G	M	D
Maize alone(M)	1.7 (2.0)	1.3 (1.3)	1.0 (0.0)	1.6 (1.7)	1.5 (1.3)	1.0 (0.0)	1.8 (2.3)	1.3 (0.7)	1.0 (0.0)	1.4 (1.0)	1.7 (2.0)	1.0 (0.0)
M+S	2.2 (4.0)	4.1 (6.3)	1.4 (1.0)	3.2 (9.0)	3.1 (8.3)	1.3 (0.7)	2.3 (4.3)	1.9 (2.7)	1.3 (0.7)	2.2 (.40)	3.3 (10.3)	1.1 (0.3)
S alone	2.9 (7.1)	3.6 (11.7)	1.7 (2.0)	4.1 (15.3)	3.9 (12.7)	1.0 (0.0)	3.7 (12.7)	3.5 (11.3)	1.5 (1.1)	3.7 (11.7)	3.8 (13.7)	1.4 (1.0)
M+C	2.1 (3.1)	2.2 (4.0)	1.4 (1.0)	2.8 (7.0)	2.8 (6.7)	1.3 (0.7)	2.4 (5.3)	1.8 (2.3)	1.1 (0.3)	2.5 (5.7)	2.9 (7.7)	1.1 (0.3)
C alone	2.7 (6.3)	3.0 (7.7)	1.6 (1.7)	4.0 (14.7)	3.6 (12.0)	1.0 (0.0)	3.3 (9.3)	2.6 (5.7)	1.7 (2.0)	3.8 (13.3)	4.3 (17.3)	1.5 (1.0)
M+B	2.1 (3.7)	2.1 (3.7)	1.5 (1.3)	3.0 (7.0)	2.9 (7.1)	1.1 (0.3)	2.5 (5.7)	2.3 (4.3)	1.0 (0.0)	2.2 (3.7)	1.9 (2.7)	1.1 (0.3)
B alone	3.1 (8.7)	2.7 (6.3)	1.9 (2.7)	4.3 (17.3)	4.1 (15.3)	1.4 (1.0)	3.1 (8.7)	3.2 (9.3)	1.0 (0.0)	2.8 (6.7)	2.3 (4.3)	1.0 (0.0)
M+Gr	1.6 (1.7)	1.1 (0.3)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.0 (0.0)	1.8 (2.3)	1.1 (0.7)	1.0 (0.0)	1.1 (0.3)	1.0 (0.0)	1.0 (0.0)
Gr alone	1.8 (2.3)	1.4 (1.3)	1.0 (0.0)	2.1 (3.1)	1.3 (1.3)	1.0 (0.0)	2.1 (3.3)	1.3 (0.7)	1.0 (0.0)	1.4 (1.0)	1.0 (0.0)	1.0 (0.0)
M+Vo	2.1 (3.3)	1.8 (2.3)	1.1 (0.3)	1.7 (2.0)	2.1 (3.3)	1.1 (0.3)	2.4 (5.0)	1.9 (3.0)	1.0 (0.0)	1.9 (3.3)	1.9 (2.7)	1.0 (0.0)
Vo alone	2.5 (5.3)	2.3 (4.1)	1.0 (0.0)	2.1 (3.1)	2.5 (5.3)	1.0 (0.0)	2.7 (7.1)	2.2 (3.7)	1.0 (0.0)	2.5 (5.1)	2.4 (4.7)	1.0 (0.0)
S.Em. M+c.c.	0.15	0.18	0.16	0.23	0.20	0.14	0.25	0.18	0.10	0.20	0.22	0.10
C.D.5% M+c.c.	NS	0.74	NS	0.70	0.58	NS	NS	0.55	NS	0.80	0.68	NS
S.Em. c.c.±	0.17	0.20	0.14	0.29	0.26	0.12	0.29	0.21	0.10	0.25	0.25	0.09
C.D. 5% c.c.	0.73	0.80	0.65	0.96	0.90	NS	0.96	0.81	0.57	0.89	0.89	NS

S, Soybean; *C*, Calcaratus; *B*, Black gram; *Gr*, Grass; *V*, Velvet bean; G, Grasshopper; M, *Myllocerus*; D, *Diacrisia*

Note: Figures in parentheses indicate original values

Various opinions have been expressed regarding the preference of some plants by insects for food or for oviposition (Fraenkel, 1951, 1953; Dethier, 1954; Painter, 1951; Kennedy, 1953). In the present investigation the grass harboured a very low population of insects probably due to its physical nature (densely pubescent leaves and coarse texture) and its nutritional inferiority. Other companion crops harboured greater number of insects because they belonged to family Leguminosae and provided better nutrition.

TABLE III

Mean (two years pooled data) of the difference in insect numbers on pure stand of the companion crops with respect to those grown as intercrop

Crops	Days after sowing					
	45			60		
	G	M	D	G	M	D
Soybean	5.7	7.0	0.7	7.0	3.6	0.0
Calcaratus	3 3	3.5	1.2	7.6	7.5	0.0
Black gram	4.0	3.8	0.7	6.6	4.9	0.2
Grass	2.0	1.2	(—)0.2	1.4	1.9	(—)0.2
Velvet bean	0.8	0.5	0.0	1.8	0.7	0.0

G, grasshopper
M, *Myllocerus*
D, *Diacrisia*

Population of insects on soybean, calcaratus, and black gram was more at 60 D A S because they attained peak vegetative phase by that time. Velvet bean in association with maize showed a lower population showing thereby that it was not preferred in close proximity of soybean, calcaratus and black gram which was further evidenced by the greater incidence of the pests on them in pure stand.

(ii) *Incidence of* Diacrisia obliqua *caterpillars*: Of all the crops grown only three suffered damage due to *Diacrisia* caterpillars. They were soybean, calcaratus and black gram. Data on the mean number of insects per unit area (900 sq. cm) has been presented in Table IV.

It would appear from the results that the pure stand of the above three crops showed 2 to 3 times higher population of caterpillars per unit area as compared to those grown in association with maize.

(*C*) *Extent of Damage*

Mean scores of damage to the companion crops grown in association with maize, grown as a pure crop and also their difference are presented in Table V. It would appear from the table that the pure crops suffered greater damage as compared to those grown as inter-crop.

When the companion crops were compared, the test of significance revealed the following results.

TABLE IV

Mean number ($\sqrt{n+1}$) Diacrisia obliqua *of caterpillars per* 900 cm^2

Cultural practice	Year	Maize alone	Soybean	Calcaratus	Black gram	Gram	Velvet bean	S. Em. ±	C.D. 5%
Grown in association with maize	First	—	2.1 (3.8)	2.2 (4.1)	2.3 (4.7)	1.0 (0.0)	1.0 (0.0)	0.15	0.42
	Second	—	2.3 (4.7)	2.3 (5.0)	2.6 (6.2)	1.0 (0.0)	1.0 (0.0.)	0.12	0.31
Growth in pure stand	First	—	3.3 (19.4)	2.7 (8.4)	3.6 (13.8)	1.0 (0.0)	1.0 (0.0)	0.46	1.30
	Second	—	3.0 (8.9)	2.3 (4.9)	3.3 (10.5)	1.0 (0.0)	1.0 (0.0)	0.34	0.97

TABLE V

Mean scores of damage of various companion crops and their difference

Cultural practice	Year	45 DSA				60 DAS			
		S	C	B	V	S	C	B	V
Grown as inter crop (I)	First	1.24	1.70	1.28	0.81	0.70	0.90	1.75	0.68
	Second	1.02	1.41	1.36	0.89	0.47	0.93	1.64	0.90
Grown in Pure stand (P)	First	1.79	1.79	2.03	1.28	1.88	0.77	2.16	0.36
	Second	1.59	1.97	2.27	1.49	1.67	0.83	1.83	0.42
(P—I)	First	0.55*	1.18*	0.09	(—)0.13	1.75*	0.41*	0.41*	(—)0.32
	Second	0.57*	1.20*	0.56*	(—)0.10	0.91*	0.19*	0.60*	(—)0.48

*Significant differences

	45 DAS	60 DAS
As inter crop :		
First year	C > B = S > V	B > C > S = V
Second year	C > B > S > V	B > C > V > S
As pure crop :		
First year	B = C = S > V	B > S > C > V
Second year	B = C > S > V	B = S > C > V

Among the crops grown as inter-crop, calcaratus showed the highest damage while in pure stand, black gram exhibited the highest score. A comparison of the mean scores of damage in the pure crop and in the inter-crop revealed that the differences were mostly significant. Soybean and black gram exhibited lower score of damage when grown as inter crop; because of their low growing habit they got better protection from maize. Calcaratus is a climber hence it was exposed more to insect attack although it does not appear to be a preferred host as is evidenced by the rating 60 D A S.

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