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Weed management in pigeonpea (*Cajanus cajan*)–sesame (*Sesamum indicum*) intercropping system in Vindhyan red-loam tract of eastern Uttar Pradesh

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ABSTRACT

A field experiment was conducted during the rainy seasons of 1989 and 1990 to find out the suitable weed-control measures and intercrop population pressure of sesame (*Sesame indicum* L.) in pigeonpea [*Cajanus cajan* (L.) Millsp.] + sesame intercropping system. The major weeds of experimental field were *Eleusine indica* (L.) Gaertn. (20%), *Digitaria ciliaris* (Retz.) Koeler (18%), *Cyperus rotundus* L. (20%) and *C. iria* L. (18%). Pigeonpea intercropped with 100% sesame had the maximum weed-smothering efficiency (36.4%), followed by pigeonpea +75% sesame intercropping system (29.4%). Pigeonpea intercropped with 75% population of sesame was most advantageous over sole crop (46%) and resulted in the maximum pigeonpea-equivalent yield (15.44 q/ha). Amongst the weed-control treatments, hand-weeding twice at 20 and 40 days after sowing was most effective in minimizing the weed growth, followed by fluchloralin @ 1.0 kg/ha. The interaction of cropping system and weed-control methods showed the superiority of pigeonpea + 75% sesame intercropping system in combination with hand-weeding twice at 20 and 40 days after sowing, which was comparable to fluchloralin @ 1.0 kg/ha in the same intercropping system and pigeonpea + 100% sesame intercropping system with 2 hand-weedings.

Pigeonpea [*Cajanus cajan* (L.) Millsp.] being a widely-spaced and slow-growing crop during early stage provides ample opportunity for weed growth, which results yield reduction up to 68% (Malik *et al.*, 1986). The importance of intercropping has been realized long back to combat weed problem as well as total productivity. Goyal *et al.* (1991) reported beneficial effect of sesame as an intercrop. Pigeonpea–sesame (*Sesame indicum* L.) intercropping is now one of the established cropping systems of the eastern Uttar Pradesh. However, information on suitable plant population in relation to weed-smothering efficiency and higher productivity and suitable weed-control method in pigeonpea–seasame intercropping is lacking. Hence the present investigation was undertaken to find out the optimum plant population and weed-control measure to increase the productivity of the system.

MATERIALS AND METHODS

The field experiement was conducted at Research Station, Barkachha, Mirzapur, during the rainy seasons of 1989 of 1990 in rainfed condition. The soil represents a

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typical Vindhyan red loam of eastern Uttar Pradesh. The experiment was laid out in randomized block design with 3 replications. The gross and net plot sizes of experimental units were 7.2 m × 5.0 m and 6.0 × 4.0 m respectively. There were 5 cropping systems and 4 weed-control methods. In cropping systems, 3 treatments were of intercropping where pigeonpea (100%) grown at 60 cm apart was intercropped with 50, 75 and 100% of sesame population and 2 sole treatments of respective crops. The weed-control treatments were unweeded control, hand-weeding twice (20 and 40 days after sowing), fluchloralin @ 1.0 kg/ha and pendimethalin @ 1.0 kg/ha. One row of the intercrop was taken between 2 rows of pigeonpea, and population of intercrop sesame was adjusted by packing more plants within the row. The soil of the experimental site was sandy-clay loam and having medium fertility (140.0 kg N, 9.0 kg P_2O_5 and 230 kg K_2O/ha). Variety 'T 21' of pigeonpea and variety 'T 12' of sesame were used in the experiment as test entries. Recommended doses of nutrients for pigeonpea (N @ 18 kg/ha and P @ 46 kg/ha) and sesame (N @ 40 kg, P @ 30 kg/ha and K @ 20 kg/ha) were applied at the time of sowing in rows of respective crop, 2–3 cm below the seeds according to the plant population of the crop. Fluchloralin was applied as pre-planting incorporation in the upper 2–3 cm layer of the soil, whereas pendimethalin was applied as pre-emergence. The sowing was done after a good-soaking rain in the first fortnight of July. The mean relative humidity was 22.9–89.8% and 22.0–97.0% during 1989 and 1990 respectively. The average maximum and minimum temperature ranged between 38.9 and 7.4°C and 43 and 9.3°C during respective year. The total rainfall during the experimental period from

Table 1. Effect of cropping system and weed-control method on weed population, biomass and smothering efficiency in pigeonpea–sesame intercropping system

Treatment	Weed count/ m^2		Weed-dry weight (g/m^2)		Weed-smothering or control efficiency (%)	
	1989	1990	1989	1990	1989	1990
Cropping system						
Pigeonpea sole	95.0	110.5	175.8	284.9		
Sesame sole	93.6	99.3	166.1	273.0	5.5	4.2
Pigeonpea + 50% sesame	89.7	75.9	161.2	208.1	8.3	27.0
Pigeonpea + 75% sesame	85.2	58.1	148.2	162.4	15.7	43.0
Pigeonpea + 100% sesame	81.7	45.0	136.3	141.6	22.5	50.3
LSD (P = 0.05)	8.07	6.96	6.99	7.99		
Weed-control method						
Unweeded check	125.0	87.2	297.0	306.8		
Hand-weeding (twice)	71.2	75.2	28.5	104.7	90.4	65.9
Fluchloralin (1 kg/ha)	75.6	66.7	110.3	202.5	62.9	34.0
Pendimethalin (1 kg/ha)	83.2	81.9	126.1	241.7	57.5	21.2
LSD (P = 0.05)	7.22	6.23	6.25	7.15		

June–December was 1,007.4 and 1,119.7 mm in 1989 and 1990 respectively.

RESULTS AND DISCUSSION

Weed flora

The dominant weeds recorded in the experimental field were *Eleusine indica* (L.) Garetn. (20%), *Digitaria ciliaris* (Retz.) Koeler (18%), *Cyperus rotundus* L. (20%), and *Cyperus iria* L. (18%). The broad-leaf weeds like *Amaranthus viridis* L., *Commelina benghalensis* L. and *Eclipta alba* (L.) Haask. were also present in very low proportions in the field.

Effect of weed

The effect of cropping system and weed-control methods on weed count, their dry weight and on weed smothering or control efficiency are given in Table 1. The maximum reduction in weed population and dry weight was recorded in pigeonpea with 100% sesame intercropping system. The weed-smothering efficiency of this intercropping system was also higher than low population pressure of intercropping systems. This may be attributed to relatively less space available for the growth of weeds from early stage of crop growth and more shading effect. Kolar *et al.* (1986) and Prasad and Srivastava (1991) also reported similar effects.

Different weed-control treatments showed marked effect on weed population and their dry-matter accumulation. Hand-weeding (twice) at 20 and 40 days after sowing proved significantly superior in reducing the weed population and their dry weight compared with unweeded control and herbicides except in first year, where this was comparable with fluchloralin application for weed count only. Fluchloralin was more effective than pendimethalin. The maximum weed-control

Table 2. Seed yield of pigeonpea and sesame and land-equivalent ratio under different cropping systems and weed-control methods

Treatment	Pigeonpea-grain yield (q/ha)			Land-equivalent ratio		
	1989	1990	Pooled	1989	1990	Mean
Cropping system						
Pigeonpea sole	8.23	7.91	8.07	1.00	1.00	1.00
Sesame sole	(5.49)	(5.26)	(5.36)	1.00	1.00	1.00
Pigeonpea + 50% sesame	8.55 (2.62)	8.27 (2.74)	8.41 (2.68)	1.23	1.26	1.25
Pigeonpea + 75% sesame	8.80 (3.99)	8.64 (3.81)	8.72 (3.90)	1.46	1.46	1.46
Pigenpea + 100% sesame	8.14 (4.07)	7.55 (3.90)	7.85 (3.99)	1.40	1.36	1.38
LSD (P = 0.05)	0.22 (0.29)	0.14 (0.17)	0.14 (0.16)			
Weed-control method						
Unweeded check	6.02 (2.80)	5.83 (2.71)	5.93 (2.76)	1.01	1.00	1.01
Hand-weeding (twice)	9.62 (4.79)	9.42 (4.62)	9.25 (4.71)	1.33	1.33	1.33
Fluchloralin (1.0 kg/ha)	9.10 (4.36)	8.75 (4.44)	8.93 (4.40)	1.28	1.29	1.29
Pendimethalin (1.0 kg/ha)	8.97 (4.19)	8.39 (4.09)	8.68 (4.14)	1.25	1.23	1.24
LSD (P = 0.05)	0.22 (0.29)	0.14 (0.17)	0.14 (0.16)			

Figures in parentheses are sesame yield

Table 3. Pigeonpea-equivalent yield (q/ha) as affected by cropping systems and weed-control methods

Weed control	Cropping system					
	C_{1a}	C_{1b}	C_2	C_3	C_4	Mean
			1989			
W_1	5.63	4.71	9.63	11.40	10.87	8.45
W_2	10.15	10.92	14.65	16.99	16.85	13.91
W_3	8.60	10.06	13.67	16.71	15.67	12.94
W_4	8.52	9.74	13.21	16.04	15.43	12.59
Mean	8.23	8.86	12.79	15.29	14.71	
LSD (P = 0.05)						
Cropping system	0.43					
Weed control	0.38					
Cropping system × weed control	0.85					
			1991			
W_1	5.50	5.25	9.75	11.40	11.14	8.61
W_2	9.89	11.92	15.68	17.50	16.40	14.28
W_3	8.20	11.48	14.37	17.38	15.91	13.47
W_4	8.06	10.79	13.16	16.08	15.20	12.66
Mean	7.91	9.86	13.24	15.59	14.66	
LSD (P = 0.05)						
Cropping system	0.48					
Weed control	0.43					
Cropping system × weed control	0.96					
			Pooled			
W_1	5.57	4.98	9.69	11.40	11.01	8.53
W_2	10.02	11.42	15.17	17.25	16.63	14.10
W_3	8.40	10.77	14.02	17.05	15.79	13.21
W_4	8.29	10.27	13.19	16.06	15.32	12.63
Mean	8.07	9.36	13.02	15.44	14.69	
LSD (P = 0.05)						
Cropping system	0.34					
Weed control	0.30					
Cropping system × cropping system	0.67					

C_{1a}, Pigeonpea sole; C_{1b}, sesame sole; C_2, pigeonpea + 50% sesame; C_3, pigeonpea + 75% sesame; C_4, pigeonpea + 100% sesame

W_1, Unweeded control; W_2, hand-weeding (twice); W_3, fluchloralin @ 1.0 kg/ha; W_4, pendimethalin @ 1.0 kg/ha

efficiency was recorded in hand-weeding (twice), followed by fluchloralin application during both the years.

Yield potential and land-equivalent ratio

The grain yield of pigeonpea was significantly increased owing to inclusion of sesame up to 75%, but further increase in sesame population (100%) showed an adverse effect on pigeonpea, as the minimum yield was obtained (Table 2). The lower pigeonpea yield with 100% population of sesame may be due to more intense competition between the plants for space and light. The increase in pigeonpea yield in intercropping up to 75% was mainly due to low weed growth. The sesame yield increased with increasing sesame plant population and the maximum yield was attained in 100 + 100% pigeonpea + sesame intercropping system. However, it was significantly lower than sesame sole. The pigeonpea + sesame (75%) intercropping system accounted for maximum yield advantage (46%), followed by pigeonpea + sesame (100%) intercropping system. Amongst the weed-control treatments, hand-weeding (twice) accounted for the maximum yield advantage (33%), followed by fluchloralin application.

Pigeonpea-equivalent yield

The maximum total productivity in terms of pigeonpea-equivalent yield (15.44 q/ha on pooled basis) was recorded under pigeonpea with 75% sesame intercropping system, which was almost 2 times more than sole pigenpea (Table 3). This treatment was followed by pigeonpea + sesame (100%) intercropping system. The increased productivity of these systems may be due to higher yield of pigeonpea and sesame and higher market value of the same.

All the weed-control methods increased the pigeonpea-equivalent yield compared with the unweeded check. However, hand-weeding (twice) treatment showed the maximum pigeonpea-equivalent yield (14.10 q/ha), which was followed by fluchloralin application. The significant increase in pigeonpea-equivalent yield in these weed-control treatments may be due to higher weed-control efficiency of these weed control methods which resulted in higher crop yields (Tables 1, 2).

The pigeonpea-equivalent yield in all the intercropping combinations was higher in intergration with all the weed-control treatments compared with the unweeded control. Pigeonpea having 75% sesame intercropping system with 2 hand-weedings showed maximum pigeonpea-equivalent yield (17.25 q/ha) which was comparable to fluchloralin application under same cropping system (17.05 q/ha) and this was also comparable to pigeonpea + 100% sesame intercropping system in intergration with hand-weeding (twice). Thus application of flucholralin as weed-control measure proved as effective as hand-weeding (twice) and may prove equally effective in situation where manual weeding is not possible. The findings are in close agreement with those of Kolar *et al.* (1986) and Ahlawat and Venkateswarlu (1987).

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REFERENCES

Ahlawat, I. P. S. and Venkateswarlu, U. 1987. Weed management in pigeonpea based intercropping

systems. *International Pigeonpea Newsletter* **6** : 37–39.

Goyal, S. N., Patel, N. L., Patel, N. M. and Ahlawat, R. P. S. 1991. Intercropping studies in pigeonpea under rainfed conditions. *Indian Journal of Agronomy* **36** (1) : 49–51.

Kolar, J. S., Hosseini, N. M., Grewal, H. S. and Singh, Gurkripal. 1986. Weed management studies in pigeonpea, mungbean intercropping systems. *Indian Journal of Weed Science* **18** (1) : 12–13.

Malik, R. S., Malik, R. K. and Bhan, V. M. 1986. 'Chemical weed control in pigeonpea.' Paper presented at the *Annual Conference of Indian Society of Weed Science,* held during 20–21 March, at Durgapura, Jaipur, 84 pp.

Prasad K. and Srivastava, V. C. 1991. Weed management in pure and mixed crops of pigeonpea (*Cajanus cajan*) and soybean (*Glycine max*). *Indian Journal of Agricultural Sciences* **61** (6) : 374–378.