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Short Note

Response of Maize (*Zea mays* L.) + Legume Inter Cropping System to Different Weed Control Practices

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A study was under taken to evaluate the response of maize + legume intercropping system (I.C.S.) under additive series to different weed control practices. Soybean, blackgram and greengram were used as intercrops with weed control methods *viz.*, pre-emergence (PE), pendimethalin and alachlor each @ 1.0 kg/ha, hand weeding at 20 DAS. Blackgram and greengram as inter crops reduced the weed density and weed dry matter. Alachlor recorded higher weed control efficiency. Introduction of different rainy season legumes did not affect the yield attributes and yield of maize but significantly increased maize equivalent yield. All weed control treatments resulted in significant enhancement in maize yield attributes and yield. Weed control through alachlor @ 1.0 kg/ha recorded higher maize equivalent yield. Higher net returns and benefit: cost ratio were obtained in maize + greengram intercropping system.

Key words: Maize, intercropping, Legumes, weed control

In maize based intercropping system, selection of an appropriate intercrop having desirable plant type and growth pattern which does not coincide with the peak period of growth of main crop is important. Research on intercropping indicated how niche differences in crop species can lead to resource capture and conversion leading to increased biological efficiency and yield advantage (Willy, 1979). Maize based intercropping system are also subjected to stress offered by weeds. Though intercropping has a potential to suppress weeds, it offers the possibility of capturing a greater share of available resources than sole crop (Altier and Liebman, 1986). However, intercropping alone is not sufficient to prevent weed infestation during rainy season. Though tradition bound agriculture does manual weeding in crop husbandry which is difficult due to closely spaced plants of components and continuous rains. Therefore, pre-emergence herbicides which are selective to maize and intercrops, can hold a key for weed control. Hence the experiment was conducted to investigate the response of maize + legume intercropping system under additive series to different weed control practices.

Materials and Methods

A field experiment was conducted at Crop Research Farm, Department of Agronomy, Allahabad Agricultural Institute - Deemed University, Allahabad during rainy season of 2006. The soil of the experimental site was sandy loam in texture, pH 7.7. It was medium in available NPK status. The experiment comprised of 16 treatment combinations of 4 intercropping systems (sole maize and maize intercropped with soybean, blackgram and greengram) and 4 weed control methods Pre-emergence pendimethalin and alachlor each @ 1.0 kg/ha and hand weeding at 20 DAS, control) replicated thrice in Factorial Randomized Block Design. Maize hybrid 'PAC - 711' was planted in rows 60 cm apart with a row of legume in between two rows of maize as per treatment. Plant to plant distance within maize rows was kept as 20 cm and for legumes as 10 cm. The main crop was fertilized with 120 kg N/ha and 60 kg P_2O_5 / ha and 40 kg K_2O/ ha. One third of N and whole P_2O_5 and K_2O were drilled at the time of sowing while remaining two - third nitrogen was top dressed in 2 splits, at knee heigh and at tasseling stage. Inter crops were fertilized with 10 kg N /ha, 20 Kg P_2O_5 / ha (all legumes) at the time of sowing. The herbicides were sprayed as per treatment, 1 day after sowing with the help of knap - sack sprayer using 800 liters water/ha. In hand weeding plots, weeds were removed manually at 20 days after sowing.

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Results and Discussion

Weed density and dry matter

The weed intensity was brought down by intercropping maize with all the intercrops as compared to sole maize (Table 1). Maize + greengram, maize + soybean and maize + blackgram were statistically at par with each other. Introduction of blackgram, greengram and soybean as inter crops between the rows of maize crop suppressed weeds, as evident from reduced weed dry matter, which may be attributed to intense competition given to weeds for light and space by maize and intercrops. Maximum weed intensity was recorded in control. The weed control treatments

significantly reduced the total number of weeds and weed dry matter as compared to control. Alachlor was statistically superior to pendimethalin and hand weeding. The percentage reduction of weed dry matter due to alachlor, pendimethalin and hand weeding over control were 68, 65 and 64 per cent respectively.

The maximum weed control efficiency among intercropping systems was recorded by maize+ blackgram followed by maize+greengram. Application of alachlor registered the highest weed control efficiency followed by pendimethalin and hand weeding.

Maize yield attributes and yield

Variations in yield attributes and yield due to maize based intercropping were significant (Table 1). Maize yield was adversely affected under maize + inter crops as compared to sole maize. Similar result was obtained by Pandey *et al.* (2000). Alachlor, pendimethalin and hand weeding increased the numbers of cobs/plant. The test weight also increased significantly owing to control of the weeds by either herbicides or hand weeding. All the treatments applied to control weeds resulted in significant enhancement in maize grain yield. Alachlor gave significantly higher grain yield over pendimethalin, hand weeding and control (5.7, 12.3 and 84.6 respectively). Similar trend was also observed in straw yield.

Table 1. Effect of intercropping and weed control on weed density, weed dry matter, weed control efficiency, yield attributes and yields of maize

Treatment	Weed density (No./m²)*	Weed dry matter (g./m²)	Weed control efficiency (%)	Cobs/ plant	Test weight (g)	Grain yield (q/ha)	Stover yield (q/ha)
Cropping system (M)							
Sole maize	16.1 (270.0)	175.7	49.0	1.07	229.4	62.8	111.5
Maize + Soybean	15.8 (261.67)	171.2	49.6	1.03	227.4	58.8	106.5
Maize + Blackgram	15.5 (252.5)	165.4	50.1	1.05	228.8	60.8	109.2
Maize + greengram	15.7 (258.3)	169.2	49.7	1.05	228.2	60.4	108.0
CD (P=0.05)	**0.5**	**4.7**	**-**	**NS**	**0.6**	**0.7**	**0.8**
Weed control (W)							
Pendimethalin @ 1 kg/ha	14.0 (198.3)	115.6	65.8	1.07	238.5	68.0	116.4
Alachlor @ 1 kg/ha	13.4 (179.1)	106.5	68.5	1.12	240.3	71.9	122.5
Hand weeding at 20 DAS	14.2 (203.3)	121.1	64.1	1.02	236.5	64.0	111.2
Control	21.4 (461.6)	338.0	0.0	1.00	198.4	38.9	85.2
CD (P=0.05)	**0.5**	**4.7**	**0.9**	**0.07**	**0.6**	**0.7**	**0.8**

*Values are $x + \sqrt{0.5}$ transformed and actual values are in parentheses.

Inter crop and maize - equivalent yield

Variations were observed in grain and stover yields of intercrops due to maize based inter cropping system (Table 2). The maize equivalent yield varied significantly due to different intercrops. Maize equivalent yield for all the intercropping systems were significantly superior to sole maize.

Table 2. Effect of intercropping and weed control on intercrop yield, maize - equivalent yield and economics

Treatment	Intercrop yield (q/ha)		Maize equivalent yield (q/ha)		Net return (Rs/ha)	Benefit cost ratio
	Grain	Stover	Grain	Stover		
Cropping system (M)						
Sole maize	-	-	62.8	111.5	14638	2.2
Maize + Soybean	4.8	11.3	67.7	117.9	24316	2.3
Maize + Blackgram	3.3	7.0	70.2	116.2	26916	2.3
Maize + greengram	4.2	9.1	72.2	117.1	28835	2.4
CD (P=0.05)	**0.2**	**0.3**	**1.1**			
Weed control (W)						
PE pendimethalin @ 1 kg/ha	4.3	9.6	75.9	123.6	29189	2.6
PE alachlor @ 1 kg/ha	4.6	11.0	80.2	130.8	33310	2.7
Hand weeding at 20 DAS	4.3	9.3	71.9	118.1	19663	2.3
Control	3.2	6.8	44.9	90.3	11173	1.6
CD (P=0.05)	**0.2**	**0.3**	**1.1**			

Higher maize - equivalent yield was obtained under maize + greengram. This may be due to higher additional yield of greengram. Patra et al. (1999) also reported similar observations. Alachlor, pendimethalin and hand weeding resulted in significantly higher maize- equivalent grain yield than control. Alachlor was the most effective herbicide for controlling weeds in maize, soybean, blackgram and greengram. Similar result was obtained by Thakur (1994).

Net return and benefit cost ratio

Maize intercropping with legumes gave higher net returns, benefit cost ratio than sole maize. M+gg gave highest NR. Among the weed control methods, the highest net return was obtained in PE alachlor @ 1.0 kg/ha and pendimethalin. Thakur (1994) also reported better economics of maize-based intercropping system weed control. It can be inferred that maize can be intercropped with legumes, viz soybean, blackgram or greengram and weed control may be done by either pre-emergence application of pendimethalin or alachlor 1 kg/ha or hand weeding at 20 day after sowing depending on the availability and prevailing conditions.

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