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Influence of Intercropping and Weed Control Measures on Weeds and Productivity of Rainfed Maize (*Zea mays*)

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ABSTRACT

The highest weed control efficiency (45.3%) was recorded in sole maize crop with alachlor at 1.5 kg ha^{-1} supplemented with hand weeding, closely followed by maize+blackgram intercropping with same weed control practice (37.1%). Intercropping with soybean or blackgram increased the maize grain yield by 18.8 and 16.6% over sole maize crop. Significantly higher maize equivalent was recorded in maize+soybean intercropping with alachlor at 1.5 kg ha^{-1} supplemented with hand weeding (8803 kg ha^{-1}), followed closely by maize+soybean with alachlor alone (8103 kg ha^{-1}).

INTRODUCTION

Maize (*Zea mays*) is the most important rainy season crop of Himachal Pradesh, mostly grown under rainfed conditions. Reductions in yield to the extent of 32.4 to 42.3% due to weed growth have been estimated (Sharma *et al.*, 2000). Factors like wider row spacing, high temperature and humidity and use of FYM full of weed seeds are responsible for weed infestation in **kharif** maize. The wider row spacing in maize can be used to grow legumes which not only will act as a smother crop but will give additional yield. Soybean and blackgram as a potential **kharif** legume of the state can be intercropped in maize with success provided effective weed control is available. Hence, an integrated weed management approach involving intercropping and herbicides in maize and maize based intercropping is very important to provide effective and acceptable weed control for realizing high production.

MATERIALS AND METHODS

An experiment was conducted during **kharif** seasons of 2001 and 2002 at Oilseeds Research Station, Kangra, Himachal Pradesh. The experiment consisted of three cropping systems (sole maize, maize+soybean and maize+blackgram) and six weed control practices (weedy check, one hand weeding, alachlor at 1.5 kg ha^{-1}, pendimethalin at 1.0 kg ha^{-1}, alachlor at 1.5 kg ha^{-1} followed by one hand weeding and pendimethalin at 1.0 kg ha^{-1} followed by one hand weeding). Hand weeding in sole maize was done at 20 DAS and in intercropping treatments at 30 DAS. The herbicides were applied as pre-emergence in 600 l ha^{-1} spray volume. The experiment was laid out in factorial randomized block design with three replications. The maize composite variety 'Girija' was sown at 60 cm x 20 cm spacing on 26 and 20 June during 2001 and 2002, respectively. One row of soybean variety 'Shivalik' and one row of blackgram variety 'UG 218' was sown in between rows of maize. The maize was fertilized with 120 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1}; soybean with 20 kg N, 60 kg P_2O_5 and 40 kg K_2O ha^{-1} and blackgram with 10 kg N, 40 kg P_2O_5 and 20 kg K_2O ha^{-1} on respective area basis. Full dose of P and K and one-third of N in maize, and full dose of N, P and K in intercrop were applied as basal dose. The remaining nitrogen in maize was applied in two splits, at knee high and silking stages. Observations on total weed density and weed dry matter accumulation were taken at harvest.

RESULTS AND DISCUSSION

The dominant weeds were *Echinochloa colona, E. crusgalli, Panicum dichotomiflorum, Cyperus iria* and *Ageratum conyzoides* constituting more than 90% of the total weed population. Intercropping with soybean or blackgram had no

Table 1. Effect of intercropping and weed control practices on weeds (Mean of two seasons)

Cropping system	Weed control practices						
	Weedy check	Hand weeding	Alachlor	Pendimethalin	Alachlor+ hand weeding	Pendimethalin+ hand weeding	Mean
				Weed density (No. m^{-2})			
Sole maize	1184 (34.4)	909 (30.2)	716 (26.8)	929 (30.5)	620 (24.9)	754 (27.5)	852 (29.0)
Maize+soybean	966 (31.1)	869 (29.5)	722 (26.8)	844 (29.1)	698 (26.4)	793 (28.2)	815 (28.5)
Maize+blackgram	1028 (32.0)	837 (28.9)	758 (27.6)	778 (27.9)	664 (25.8)	760 (27.6)	804 (28.3)
Mean	1059 (32.5)	872 (29.5)	732 (27.1)	850 (29.2)	660 (25.7)	769 (27.7)	
LSD (P=0.05)	Cropping system=NS		Weed control=1.04		Cropping system x Weed control=1.80		
				Weeds dry matter accumulation (g m^{-2})			
Sole maize	356 (18.9)	285 (16.9)	234 (15.3)	293 (17.1)	194 (13.9)	242 (15.6)	267 (16.3)
Maize+soybean	292 (17.1)	261 (16.2)	232 (15.3)	250 (15.9)	230 (15.2)	237 (15.4)	250 (15.8)
Maize+blackgram	324 (17.9)	255 (15.9)	245 (15.7)	241 (15.5)	224 (15.0)	246 (15.7)	256 (15.9)
Mean	324 (17.9)	267 (16.4)	237 (15.4)	261 (16.1)	216 (14.7)	242 (15.6)	
LSD (P=0.05)	Cropping system=NS		Weed control=0.62		Cropping system x Weed control=1.07		

Values in parentheses are transformed x+1 mean for weed density and dry matter.

effect on weed density and dry matter accumulation (Table 1). The maize crop yield increased by 18.8 and 16.6% when intercropped with soybean and blackgram, respectively. The soybean grain yield was 618 kg ha^{-1} and blackgram yield was only 54 kg ha^{-1} (Table 2). All the weed control treatments significantly reduced the weed density and dry matter accumulation.

In all cropping systems, alachlor at 1.5 kg ha^{-1} supplemented with hand weeding resulted in lower weed density and dry matter accumulation (Table 1), higher maize and maize equivalent yield (Table 2). This was followed by alachlor at 1.5 kg ha^{-1} in these systems. Just intercropping in maize with soybean and blackgram decreased the weed density by 18.4 and 13.2% and increased the weed control efficiency by 18.0 and 9.0%, respectively. The lowest weed density (620 m^{-2}), dry matter accumulation (194 g m^{-2}) and highest weed control efficiency (45.3%) were recorded in sole maize with alachlor at 1.5 kg ha^{-1} supplemented with hand weeding. However, these parameters in maize+ blackgram intercropping with same weed control treatment were statistically at par with above giving

Table 2. Effect of treatments on grain yield of crops and maize equivalent yield (Mean of two seasons)

Cropping system	Weed control practices						
	Weedy check	Hand weeding	Alachlor	Pendimethalin	Alachlor+ hand weeding	Pendimethalin+ hand weeding	Mean
				Grain yield (kg ha^{-1})			
Sole maize	2807	4360	5327	4900	5530	5017	4656
Maize+soybean	4140 (528)	5507 (632)	6093	5540 (575)	6147 (585)	5773 (748)	5533 (618)
Maize+blackgram	4313 (08)	5830 (64)	5617 (67)	5053 (39)	6270 (83)	5477 (62)	5427 (54)
Mean	3753	5232	5679	5164	5982	5422	
LSD (P=0.05)	Cropping system=163		Weed control=231		Cropping system x Weed control=399		
				Maize equivalent yield (kg ha^{-1})			
Sole maize	2806	4360	5327	4900	5530	5017	4656
Maize+soybean	6013	7757	8133	7627	8803	8050	7731
Maize+blackgram	4350	6170	5973	5263	6713	5806	5713
Mean	4389	6096	6478	5930	7016	6291	
LSD (P=0.05)	Cropping system=202		Weed control=285		Cropping system x Weed control=495		

Values in parentheses are legume yield.

weed control efficiency of 36.5%. Application of alachlor at 1.5 kg ha^{-1} in all sequences also remained at par with maize+blackgram with alachlor 1.5 kg ha^{-1} followed by hand weeding. Significantly higher maize grain yield was obtained from maize+blackgram intercropping with alachlor at 1.5 kg ha^{-1} followed by hand weeding (6270 kg ha^{-1}). However, yield in maize+soybean with alachlor at 1.5 kg ha^{-1} followed by hand weeding and alachlor at 1.5 kg ha^{-1} alone (6147 and 6093 kg ha^{-1}) was also at par with above practice.

Significantly highest maize equivalent yield (8803 kg ha^{-1}) was obtained from maize+soybean intercropping with alachlor at 1.5 kg ha^{-1} followed by hand weeding as weed management practice. This was followed by maize+soybean with alachlor at 1.5 kg ha^{-1} as weed management practice (8103 kg ha^{-1}). One hand weeding in maize+soybean and maize+blackgram intercropping gave 7757 and 6170 kg ha^{-1} yield which was 77.9 and 41.5% higher than sole maize crop.

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