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Integrated Weed Management in Rainy Season Maize (*Zea mays* L.) in Central Uttar Pradesh

A. K. Tripathi, A. N. Tewari and A. Prasad
Department of Agronomy
C. S. Azad University of Agriculture & Technology, Kanpur-208 002 (U. P.), India

Weeds are the main hurdle in exploiting potential yield of rainy season maize (*Zea mays* L.). The competition with broad spectrum of weeds reduced yield of this crop to a great extent. Integrated weed management is the preferable approach to minimize the crop-weed competition, alleviate the residue and pollution problems besides giving higher production. Therefore, the present study was planned and undertaken to find out the effect of integrated weed management involving intercropping, inter- and intra-cultivation and low doses of herbicides on weeds in maize crop.

The field experiment was conducted at Oilseed Research Farm, Kalyanpur, Kanpur, during rainy season of 2001 in randomized block design with 10 treatments replicated thrice (Table 1). The experimental field was sandy loam in texture with 0.44% organic carbon, 27 kg ha^{-1} available phosphorus, 175 kg ha^{-1} available potassium and soil pH of 7.1. A composite maize cultivar 'Azad Uttam' was sown at plant geometry of 60 x 25 cm on July 1, 2001 behind country plough at 18 kg seed ha^{-1}. The crop was harvested on September 30, 2001. Two rows of blackgram cultivar 'T-9' were sown in between two rows of maize as per treatment. Crop was fertilized at 80, 40 and 40 kg N, P_2O_5 and K_2O ha^{-1}, respectively. Blackgram was fertilized separately with diammonium phosphate at 100 kg ha^{-1} as per treatment. Crop was thinned 10 days after maize emergence and plant to plant distance of 25 cm was maintained. Pendimethalin and atrazine were applied in 500 l of water ha^{-1} as spray next day after sowing as pre-emergence through knapsack sprayer. Manual weeding and inter-cultivation were done with help of **khurpi** and hand hoe, respectively.

Weeds in the experimental field were *Cyperus rotundus*, *Digera arvensis*, *Phyllanthus niruri* and *Commelina benghalensis*. There was reduction in the weed density and weed dry matter production due to various weed control treatments when compared with weedy check (Table 1). Manual weeding twice registered 22.2, 17.6, 22.0 and 20.3% reductions in *C. rotundus*, *D. arvensis*, *P. niruri* and *C. benghalensis* population resulting in heavy decline in weed dry weight (87.8% WCE). Atrazine (0.5 kg ha^{-1}) supplemented with one hand weeding was found second in order (64.3% WCE). Intercropped blackgram suppressed the weed growth to the extent of 28.3%. Inter-cultivation done at 20 days after sowing proved advantageous in reducing weed competition. Inter-cultivation in rows of sole maize coupled with removal of weeds from intra spaces registered 57.5% weed control efficiency.

The highest maize equivalent grain yield of 5026 kg ha^{-1} was registered in maize+blackgram intercropping treated with pendimethalin at 1 kg ha^{-1} followed by maize+blackgram intercropping supplemented with one hand weeding (4356 kg ha^{-1}) and only blackgram as smother crop (4004 kg ha^{-1}). Atrazine at 0.5 kg ha^{-1}+one hand weeding yielded at par with manual weeding twice. Highest net monetary return due to weed control was received (Rs. 16,395 ha^{-1}) when blackgram was intercropped with maize supplemented with pre-emergence application of pendimethalin at 1 kg ha^{-1}. Intercropping of maize with blackgram+one hand weeding proved next alternative in terms of net monetary income (Rs. 13,638 ha^{-1}). The lowest net return was obtained in case of inter-cultivation done at 20 days after sowing.

Based on results of above experiment, it can be concluded that two hand weedings at 15 and 30 DAS provided effective control of weeds in maize. Atrazine alone at 0.75 kg ha^{-1} could not provide effective control of weeds but its efficacy increased when it was supplemented with one hand weeding at 20 DAS.

Table 1. Effect of treatments on weeds, crop and economics

Treatment	Weed density (No. m^{-2}) at 45 DAS				Total weed dry matter ($g\ m^{-2}$)	Grain yield ($kg\ ha^{-1}$)		Maize equivalent grain yield ($kg\ ha^{-1}$)	Additional income over unweeded (Rs. ha^{-1})	Cost of treatments (Rs. ha^{-1})	Net income due to weed control (Rs. ha^{-1})
	C. rotundus	*D. arvensis*	*P. niruri*	*C. benghalensis*		Maize	Blackgram				
Weedy	5.4	5.1	5.0	6.4	295.2	2051	-	2051	-	-	-
	(29)	(25)	(24)	(40)							
Hand weeding twice at 15 and 30 DAS	4.2	4.2	3.9	5.1	36.0	3230	-	3230	9802	1810	7992
	(17)	(18)	(15)	(26)							
Intercropping of blackgram as smother crop	5.3	4.4	4.8	7.2	211.7	2161	676	4004	10638	-	10638
	(28.1)	(19)	(23)	(51)							
Intercropping of blackgram+pendimethalin	5.3	4.1	4.6	6.6	204.9	2326	991	5026	18240	1845	16395
(1 $kg\ ha^{-1}$)	(27)	(18)	(20)	(43)							
Intercropping of blackgram fb HW at 15 DAS	4.9	4.2	4.3	5.4	155.9	2341	739	4356	14548	910	13638
	(24)	(17)	(18)	(29)							
Intercultivation at 20 DAS	5.0	4.3	4.4	6.2	176.8	2412	-	2412	3378	910	2468
	(24)	(18)	(19)	(38)							
Intercultivation at 20 and 30 DAS	4.6	4.1	4.4	5.2	145.3	2779	-	2779	6226	1810	4416
	(21)	(16)	(19)	(26)							
Intercultivation at 20 and 30 DAS fb	4.5	4.0	4.1	5.0	125.5	2875	-	2875	8940	2530	6410
removal of weeds from intraspaces	(19)	(15)	(17)	(25)							
Atrazine 0.75 $kg\ ha^{-1}$	4.8	4.1	4.2	5.1	166.8	2651	-	2651	5323	575	4748
	(22)	(17)	(17)	(26)							
Atrazine 0.50 $kg\ ha^{-1}$+1 HW at 30 DAS	4.4	3.8	4.0	4.8	105.5	3146	-	3146	8860	1335	7525
	(18)	(14)	(16)	(22)							
LSD (P=0.05)	0.67	0.33	0.27	0.92	6.0	234	-	213	-	-	-

Figures in parentheses show original values which were transformed to $\sqrt{X+0.5}$. DAS–Days after sowing, HW–Hand weeding.