

## Effect of Atrazine on Weed Management in Winter Maize-greengram Cropping System in Central Plain Zone of Uttar Pradesh

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### ABSTRACT

Field investigation was carried out during two consecutive years (2005-06 and 2006-07) at Kanpur to find out direct and residual effects of atrazine application with regard to weed growth and crop growth of maize-greengram cropping system. Manual weeding followed by earthing operation done at 20 days after sowing (DAS) prevented weed competition (85.98% WCE) resulting in higher values of growth attributes viz., plant height 30.99%, culm girth 36.81%, leaf area index 76.19%, dry weight of plant 41.55% and crop growth rate 37.63% than weedy check which recorded lowest values of growth characters. Atrazine 0.50 kg/ha showed at par results with two manual weedings done at 20 and 40 DAS. Atrazine applied in maize had no residual effect on weed emergence and crop stand of succeeding greengram.

**Key words :** Crop diversification, crop rotation, residual effect

### INTRODUCTION

The crop diversification involving maize in place of wheat during winter has been found an effective approach in minimizing weed competition especially *Phalaris minor*. The heavy application of fertilizers coupled with frequent irrigation favours the rank and profuse growth of grassy and broad-leaved weeds in this crop. Ultimately the yields are reduced to the extent of 77.4, 44.2 and 38.4% due to grassy, non grassy and sedges weeds, respectively (Pandey *et al.*, 2002). Atrazine—a selective herbicide is well known and being extensively used in maize crop grown during rainy season in the country. It has also been reported that this herbicide carries over to succeeding winter crop like wheat in rotation. Since winter maize is gaining popularity, it is important to standardize the dose of atrazine in maize crop, grown during winter and its residual effect on weed growth and yield of succeeding crop of greengram in sequence. It is worth mentioning that greengram occupies sizeable area in semi-arid tract of Uttar Pradesh during summer.

### MATERIALS AND METHODS

The field experiment was conducted during consecutive years of 2005-06 and 206-07 at Students' Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur. The soil was sandy loam in texture consisting of 0.34% organic

carbon, 5.0 kg available  $P_2O_5$ , 181.0 kg /ha available  $K_2O$  with pH 8.0 and electrical conductivity 0.38 mhos/cm. Experiment was laid out in randomized block design with four replications. The fixed plots of 5 x 3 m size were prepared for maize in **rab**i season and same were used for greengram in summer. Treatments were  $T_1$ —weedy,  $T_2$ —weeding at 20 DAS,  $T_3$ —weeding at 20 DAS fb earthing,  $T_4$ —weeding at 20 and 40 DAS,  $T_5$ —atrazine 0.25 kg/ha and  $T_6$ —atrazine 0.50 kg/ha, applied in maize and residual effect of treatments was analyzed in succeeding rotation crop of greengram. Atrazine treatment was given as early post-emergence spray. Recommended dose of fertilizers viz. 150-60-60 kg/ha of N,  $P_2O_5$  and  $K_2O$  was applied in winter maize and 20 kg/ha N and 45 kg/ha  $P_2O_5$  were applied in greengram. In all, six irrigations in maize and four irrigations in greengram including one pre-sowing were applied. Greengram was sown just after the harvesting of maize crop.

### RESULTS AND DISCUSSION

#### Weed Infestation and Weed Control Efficiency (WCE)

The winter maize field was predominated with abundant population of *Chenopodium album* which appeared to be very aggressive at initial growth and developmental stages of maize. The competition of *C. album* with other weed species in the experimental field, namely, *Phalaris minor* and *Convolvulus arvensis* was

Table 1. Weed population dynamics in winter maize as influenced by weed management practices

Treatments	<i>C. album</i> /m <sup>2</sup>			<i>C. arvensis</i> /m <sup>2</sup>			<i>A. arvensis</i> /m <sup>2</sup>			<i>M. alba</i> /m <sup>2</sup>			<i>P. minor</i> /m <sup>2</sup>			<i>P. hysterophorus</i> /m <sup>2</sup>		
	45	90	At	45	90	At	45	90	At	45	90	At	45	90	At	45	90	At
	DAS	DAS	harvest	DAS	DAS	harvest	DAS	DAS	harvest	DAS	DAS	harvest	DAS	DAS	harvest	DAS	DAS	harvest
Weedy	42.19 (6.52)	44.19 (6.68)	44.00 (6.67)	3.81 (2.07)	3.81 (2.07)	4.74 (2.27)	11.31 (3.44)	12.75 (3.63)	11.94 (3.45)	10.81 (3.36)	10.04 (3.12)	9.56 (3.15)	16.81 (4.14)	18.44 (4.31)	20.94	0.00	43.56	62.19
Weeding at 20 DAS	12.00 (3.53)	13.56 (3.74)	13.62 (3.73)	2.31 (1.62)	2.56 (1.75)	3.24 (1.93)	6.87 (2.71)	8.69 (3.02)	7.81 (2.85)	5.31 (2.41)	5.75 (2.49)	6.00 (2.54)	4.75 (2.28)	5.37 (2.42)	6.63	0.00	41.31	59.38
Weeding at 20 DAS fb earthing	0.00 (0.71)	0.81 (1.13)	0.62 (1.04)	0.00 (0.71)	0.56 (1.03)	0.62 (1.04)	0.44 (0.95)	0.69 (1.07)	0.44 (0.96)	0.19 (0.82)	0.25 (0.86)	0.31 (0.88)	0.19 (0.89)	0.31 (0.82)	0.63	0.00	58.44	108.88
Weeding at 20 and 40 DAS	4.50 (2.01)	5.63 (2.34)	7.44 (2.47)	0.69 (1.06)	0.69 (1.09)	1.00 (1.19)	2.00 (1.46)	2.56 (1.61)	3.00 (1.67)	1.62 (1.39)	1.25 (1.25)	1.25 (1.23)	1.06 (1.23)	1.13 (1.25)	1.81	0.00	41.06	69.25
Atrazine 0.25 kg/ha	1.88 (1.48)	0.69 (1.06)	0.81 (1.09)	1.38 (1.35)	1.19 (1.30)	1.68 (1.46)	0.00 (0.71)	0.13 (0.78)	0.00 (0.71)	0.25 (0.86)	0.00 (0.71)	0.12 (0.78)	3.12 (1.85)	2.62 (1.74)	4.81	0.00	39.94	64.00
Atrazine 0.50 kg/ha	0.00 (0.71)	0.00 (0.71)	0.12 (0.77)	1.00 (1.17)	1.31 (1.35)	1.62 (1.42)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	0.00 (0.71)	2.75 (1.77)	2.37 (1.68)	4.25	0.00	23.13	34.38
LSD (P=0.05)	0.17	0.16	0.21	0.13	0.57	0.22	0.11	0.16	0.17	0.16	0.35	0.13	0.17	0.15	0.91	0.00	4.14	6.74

quite obvious. In fact, the population of *C. arvensis*, *Anagallis arvensis* and *Melilotus alba* was found to be affected owing to the competitive effect of *C. album* and *P. minor* plants.

The weed population and dry weight decreased significantly by weed control measures (Tables 1 and 2). Atrazine 0.50 kg/ha registered 79.12% weed control efficiency followed by two weeding with 87.55% WCE and one weeding fb earthing treatment with maximum 93.88% WCE at 45 DAS indicating suppression of first flush of weeds successfully. Higher WCE of atrazine has been reported by Singh *et al.* (2003), while Sharma *et al.* (2000) reported that earthing up at 30 DAS resulted in the virtual elimination of weeds throughout the crop growth period. In controlling second flush of weeds till harvest earthing up was found better with 85.98% average WCE over other treatments.

### Plant Population and Growth of Maize

The plant population (initial and final) of maize was not influenced due to weed management practices (Table 3). Results indicated that growth characters viz., plant height, culm girth, leaf area index, dry weight of plant and crop growth rate were maximum under atrazine 0.50 kg/ha at 45 DAS stage. It was due to atrazine reduced crop-weed competition at critical stage of crop which is 20-60 days after sowing as reported by Hejazi *et al.* (2001). An augmentation in growth characters of maize after atrazine treatment has been reported by Khan and Haq (2004) also. Results of observations recorded at 90 DAS and harvesting stage depicted that growth parameters were maximum under hand weeding fb earthing at 20 days after sowing (plant height 85.61 and 220.29 cm, culm girth 7.65 and 7.99 cm, leaf area index 3.24 and 6.29

Table 2. Weed dry weight and weed control efficiency in maize influenced by weed control practices

Treatments	Weed dry weight (g)/m <sup>2</sup>			Weed control efficiency ( % )			Average
	45 DAS	90 DAS	At harvest	45 DAS	90 DAS	At harvest	
Weedy	62.25	255.88	294.75	0.00	0.00	0.00	0.00
Weeding at 20 DAS	20.44	124.56	155.06	67.16	50.93	47.39	55.16
Weeding at 20 DAS fb earthing	3.81	23.06	79.31	93.88	90.99	73.09	85.98
Weeding at 20 and 40 DAS	7.75	63.13	105.44	87.55	75.33	64.23	75.70
Atrazine 0.25 kg/ha	21.31	95.25	135.38	65.77	62.78	54.07	60.87
Atrazine 0.50 kg/ha	13.00	56.69	107.81	79.12	77.85	63.42	73.46
LSD (P=0.05)	2.87	6.64	6.83	-	-	-	-

cm<sup>2</sup>, dry weight of plant 26.84 and 295.94 g and crop growth rate 0.533 and 4.312 g of dm/day, respectively). Earthing operation resulted in the virtual elimination of weeds throughout the crop growth period and higher values for growth (Thakur *et al.*, 2003). Results of manual weeding twice and once were at par with atrazine 0.50 and 0.25 kg/ha, respectively. Growth was minimum under weedy check at all the respective stages.

### Residual Effect of Treatments

Results in Table 4 show that atrazine had no

residual effect on the germination and plant stand of greengram as well as weeds. The results confirm the earlier reports of Latchanna (1987).

Manual weeding followed by earthing operation done at 20 DAS prevented weed competition (average WCE 85.98%) and resulted in higher values of growth parameters viz., plant height 30.99%, culm girth 36.81%, leaf area index 76.19%, dry weight of plant 41.55% and crop growth rate 37.63% than weedy check and found superior over other weed control practices. Atrazine applied in maize had no residual effect on weed emergence and crop stand of succeeding greengram.

Table 3. Growth characters of winter maize influenced by weed management practices

Treatments	Plant population ('000/ha)		Plant height (cm)		Culm girth (cm)		Dry weight of plant (g)		Leaf area index (cm <sup>2</sup> )		Crop growth rate (g of DM/day)					
	Initial	Final	45 DAS	90 DAS	45 DAS	90 DAS	45 DAS	90 DAS	45 DAS	90 DAS	45 DAS	90 DAS				
Weedy	100.50	96.39	19.91	64.93	168.17	5.69	5.84	1.94	13.30	209.07	0.24	1.91	3.50	0.043	0.253	3.133
Weeding at 20 DAS	100.35	98.32	20.77	75.23	191.88	6.66	7.01	2.04	20.70	230.13	0.26	2.51	4.63	0.045	0.415	3.355
Weeding at 20 DAS fb earthing	100.42	99.91	22.21	85.61	220.29	7.65	7.99	2.87	26.84	295.94	0.29	3.24	6.29	0.064	0.533	4.312
Weeding at 20 and 40 DAS	100.45	99.32	21.86	70.32	211.18	7.77	7.88	2.77	25.57	278.44	0.29	2.92	5.86	0.062	0.484	4.076
Atrazine 0.25 kg/ha	100.64	98.78	22.48	81.53	210.05	7.24	7.47	2.75	21.51	248.11	0.29	2.56	5.18	0.061	0.417	3.632
Atrazine 0.50 kg/ha	100.39	99.92	22.95	82.36	215.87	7.65	7.86	3.00	25.75	268.07	0.32	2.99	5.91	0.067	0.506	3.886
LSD (P=0.05)	NS	NS	1.08	5.56	4.92	0.41	0.28	0.16	1.37	10.62	0.01	0.20	0.27	0.0011	0.253	0.165

NS-Not Significant.

Table 4. Population of greengram and weeds as influenced by residual effect of weed control practices applied in maize

Treatments	Plant population of greengram ('000/ha)		Weed population in greengram/m <sup>2</sup>	
	Initial	Final	At 30 DAS	At harvest
Weedy	221.67	210.82	72.88	106.81
Weeding at 20 DAS	220.05	210.93	71.06	101.44
Weeding at 20 DAS fb earthing	220.61	209.22	67.44	101.06
Weeding at 20 and 40 DAS	221.31	209.93	71.38	101.94
Atrazine 0.25 kg/ha	220.97	210.30	67.50	102.69
Atrazine 0.50 kg/ha	220.91	209.63	70.79	100.06
LSD (P=0.05)	NS	NS	1.88	5.08

NS–Not Significant.

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