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Influence of Tillage and Weed Control Methods on Weeds, Yield and Yield Attributes of Maize (*Zea mays* L.)

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ABSTRACT

A field experiment was conducted at Palampur, Himachal Pradesh during **kharif** seasons of 2002 and 2003, to study the weed competitive ability and productivity of maize as influenced by tillage and weed control methods. Among tillage methods, raised seed bed resulted in significantly lowest density and dry matter of weeds at 60 days after sowing (DAS) and harvest of the crop and was followed by conventional tillage. Raised seed bed and conventional tillage increased grain yield by 13.74 and 16.90% over zero tillage. Among weed control methods, atrazine 1.5 kg/ha being statistically at par with acetachlor 1.25 kg/ha produced significantly lower density and dry matter of weeds and resulted in significant increase in all the yield attributes of maize crop and thereby its grain yield by 75.18 and 71.66%, respectively, over unweeded check.

Key words : Zero and conventional tillage, herbicides, weed management, maize

INTRODUCTION

Maize, being grown during rainy season in hills, suffers heavily due to severe weed infestation owing to congenial weather conditions of monsoon, which provides suitable temperature, high humidity and adequate moisture for weeds growth. Addition of farm yard manure and wider row spacing of the crop provide enough opportunities for the weeds to invade and offer competition. A single factor weed, if left uncontrolled, mitigates the benefits obtainable from different agricultural inputs. Season long infestation of composite weed flora in maize reduces grain yield by 28-100% (Saini and Angiras, 1998; Pandey *et al*., 2001). Frequent and heavy rainfall during **kharif** season, unavailability of human labour at critical period of competition and its high costs coupled with unfavourable soil physical conditions for interculture operations make the chemical weed control a suitable option. But at present, the prohibitive costs, unavailability of herbicides, herbicide residues, their environmental hazards and establishment of resistant species and biotypes are major constraints in the adoption of herbicides alone as a regular practice. These facts necessitate the use of herbicide in integration with other production practices like tillage methods to manage the weeds on effective, economical and ecological viable basis. Taking this into account, the present study was undertaken to study the weed competitive ability and productivity of maize as influenced by tillage and weed control methods.

MATERIALS AND METHODS

A field experiment was conducted during the rainy seasons of 2002 and 2003 at the experimental farm of Department of Agronomy, Chaudhary Sarwan Kumar Himachal Pradesh Krishi Vishvavidyalaya, Palampur, Himachal Pradesh. The soil of the experimental field was silty clay loam in texture and acidic in reaction. Soil had 296.6 -302.8 kg available N/ha, 17.8-18.6 kg available P_2O_5/ha and 316.7-321.9 kg K_2O/ha. The experiment consisting of three tillage methods (Zero tillage, conventional tillage and raised seed bed) in main plots and four weed control methods (unweeded check, acetachlor 0.75 kg/ha, acetachlor 1.25. kg/ha and atrazine 1.5 kg/ha) in sub-plots was laid out in split plot design with three replications. Maize hybrid PSCL-3438 was sown on second week of June during both the crop seasons with seed rate of 20 kg/ha. The crop was sown at 60 cm rows apart with plant to plant distance of 10 cm following different tillage methods as per treatments. The sowing of the seed and basal fertilizer application in zero tilled and raised seed bed plots was done with zero tilled maize and raised seed bed planter, respectively. The crop was given recommended amount of nutrients i. e. 120 kg N, 60 kg P and 40 kg K/ha. One-third nitrogen and full dose of phosphorus and potassium was applied as basal dose and remaining two-third of nitrogen was applied in two equal splits at knee-high and pre-tasseling stages. All herbicides were applied as pre-emergence within 48 h of sowing with the help of Maruyama power

sprayer fitted with flat fan nozzle using 600 l of water per hectare. Zero tilled plots were sprayed with paraquat 0.6 kg/ha before sowing to kill the existing weeds. The crop was harvested in the last week of November during both the years. Data related to weed density and dry weight recorded at 60 DAS (maximum dry matter stage) and harvest stage of the crop were analysed after √X+1 transformation.

RESULTS AND DISCUSSION

Digitaria sanguinalis (L.) Scop. was the predominant weed constituting 38.08% of the total weed flora. *Echinochloa colona* (L.) Link was the next important weed (25.37%), which was followed by *Panicum dichotomiflorum* (L.) Michx. (13.84%), *Commelina benghalensis* L. (11.54%), *Cyperus iria* L. (4.96%), *Brachiaria ramosa* (L.) Stapf. (3.56%) and others (5.70%) including *Oxalis latifolia* Kunth, *Ageratum conyzoides* L., *Cynodon dactylon* (L.) Pers., *Ipomoea purpurea* (L.) Roth and *Polygonum alatum* Buch.-Ham. Ex D. Don.

Effect on Weeds

Tillage and weed control methods significantly reduced the weed density and dry matter at 60 DAS and at harvest of the crop during both the years (Table 1). However, tillage methods did not significantly influence the total weed density at harvest stage of the crop during 2002. Among various tillage methods, raised seed bed resulted in significantly lowest dry matter and density of total weeds at 60 DAS and at harvest of the crop during both the years. Conventional tillage was next best in significantly reducing the dry matter and density of total weeds at both the stages of observations (i. e. 60 DAS and harvest of the crop) during both the years except for weed density at 60 DAS and dry matter during harvest stage of the crop during 2003.

Among various weed control methods, atrazine 1.5 kg/ha being statistically at par with acetachlor 1.25 kg/ha significantly reduced the weed count at 60 DAS and harvest of the crop and dry matter of weeds at harvest stage of the crop during both the years (Table 1). However, at 60 DAS atrazine 1.5 kg/ha was proved

Table 1. Effect of tillage and weed control methods on total weed density and dry matter at 60 DAS

Treatment	Total weed density (No./m^2)				Total weed dry matter (g/m^2)			
	60 DAS		Harvest		60 DAS		Harvest	
	2002	2003	2002	2003	2002	2003	2002	2003
Tillage methods								
Zero	13.8	16.5	9.9	11.1	10.0	11.4	6.9	8.7
	(206.0)	(283.3)	(102.7)	(128.7)	(112.6)	(139.4)	(50.9)	(78.2)
Conventional	13.1	16.1	9.4	10.6	9.2	11.1	6.4	8.5
	(186.0)	(270.0)	(92.7)	(117.3)	(94.6)	(131.3)	(42.6)	(75.6)
Raised seed bed	12.4	15.3	8.6	9.9	8.1	9.8	5.7	7.7
	(164.3)	(241.0)	(77.7)	(103.0)	(73.7)	(107.3)	(35.0)	(62.3)
LSD (P=0.05)	0.7	0.5	NS	0.4	0.4	0.3	0.4	0.4
Weed control methods								
Unweeded	19.4	21.2	12.9	14.8	14.8	16.3	9.7	11.9
	(377.3)	(447.1)	(165.3)	(216.0)	(219.0)	(265.3)	(93.1)	(140.8)
Acetachlor 0.75 kg a. i./ha	12.9	16.2	9.7	11.0	8.7	10.8	6.3	8.4
	(165.8)	(260.0)	(92.4)	(119.1)	(75.5)	(115.8)	(38.1)	(68.2)
Acetachlor 1.25 kg a. i./ha	10.3	13.5	7.3	8.1	6.7	8.1	4.8	6.4
	(104.9)	(180.9)	(51.6)	(63.6)	(42.8)	(63.8)	(21.6)	(39.4)
Atrazine 1.5 kg a. i./ha	9.8	13.2	7.5	8.3	6.2	7.8	4.5	6.4
	(93.8)	(171.1)	(54.7)	(66.7)	(31.2)	(59.0)	(18.5)	(39.8)
LSD (P=0.05)	0.6	0.6	0.5	0.7	0.5	0.3	0.5	0.4

Values in parentheses are means of original values. NS–Not Significant.
The weed data are subjected to square root transformation √X+1.

Table 2. Effect of tillage and weed control methods on yield contributing characters and yield of maize

Treatment	Effective plant population (No./ha)		Cob length (cm)		No. of rows/ cob		1000-grain weight (g)		Shelling percentage		Grain yield (kg/ha)		
	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	2002	2003	Mean
Tillage methods													
Zero	65972	66425	13.0	12.5	14.3	13.1	252.9	239.3	77.0	78.0	5862.3	5735.9	5799.1
Conventional	71105	72464	14.8	14.3	15.9	14.6	266.0	250.7	79.0	79.7	6872.1	6686.7	6779.4
Raised seed bed	71332	70275	14.6	14.0	15.8	14.2	263.9	248.3	78.8	80.0	6638.2	6551.9	6595.1
LSD (P=0.05)	3370	2575	1.2	0.7	1.2	0.7	9.1	8.5	1.6	1.5	236.4	446.3	341.4
Weed control methods													
Unweeded	55354	60286	12.2	10.9	13.0	11.4	241.0	226.8	75.2	76.8	4379.1	4172.0	4275.6
Acetachlor 0.75 kg a. i./ha	69545	70049	13.74	13.3	15.7	13.4	259.5	243.8	77.7	78.7	6382.8	6542.3	6462.6
Acetachlor1.25 kg a.i./ha	75584	73470	15.07	15.0	16.1	15.4	269.0	253.4	79.8	80.0	7527.4	7152.0	7339.7
Atrazine 1.5 kg a.i./ha	77396	75081	15.57	15.1	16.6	15.8	274.2	260.4	80.4	81.3	7540.9	7433.0	7487.0
LSD (P=0.05)	3214	3303	0.58	0.7	1.0	0.5	8.4	9.9	1.6	1.8	311.7	289.3	300.5

to be significantly superior over all other weed control methods in significantly reducing the dry matter of weeds during both the years. Rout and Satapathy (1996) and Sharma *et al*. (2000) also proved the superiority of atrazine to control weeds.

Effect on Maize Yield Contributing Characters and Yield

Among tillage methods, raised seed bed being statistically at par with conventional tillage resulted in significantly higher effective plant population, shelling percentage, cob length, number of rows per cob, number of grains per row and 1000-grain weight of maize during both the years (Table 2). The reduced crop-weed competition by these methods caused significant increase in dry matter accumulation and yield attributes of maize over zero tillage. The grain yield, being a function of yield contributing characters, was also significantly increased by raised seed bed and conventional tillage methods which were statistically at par with each other. The raised seed bed and conventional tillage increased grain yield of maize by 13.2 and 17.2%, respectively, over zero tillage during first year and by 14.2 and 16.6%, respectively, during second year. These results are in conformity with those of Barry and Miller (1986) and Lal *et al.* (1988) who proved superiority of conventional tillage and ridge tillage, respectively, over zero tillage in maize.

All the herbicide treatments were significantly superior to unweeded check in increasing all the yield contributing characters of maize during both the years. Among herbicides, atrazine 1.5 kg/ha being statistically at par with acetachlor 1.25 kg/ha resulted in significantly higher values of various yield contributing characters of maize during both the years (Table 2). However, acetachlor 0.75 kg/ha was statistically similar to these two treatments in increasing the number of rows per cob of maize during 2002. Acetachlor 0.75 kg/ha was also statistically at par with atrazine 1.5 kg/ha in increasing number of grains per row and with acetachlor 1.25 kg/ha in increasing 1000-grain weight and shelling percentage of maize during 2003. Weeds in unweeded check reduced the grain yield of maize by 41.9 and 43.1% over effective control of weeds by atrazine 1.5 kg/ha during first and second year, respectively. The better growth and development of the crop due to effective weed control by atrazine 1.5 kg./ha and acetachlor 1.25 kg/ha reflected in better development of yield attributes of maize during both the years (Table 2). Consequently, the significant increase in sink formation in the form of yield attributes by both these herbicides increased the grain yield of maize significantly during both the years. Thakur and Sharma (1996) also reported increase in grain yield of maize with atrazine 1.5 kg/ha and by Geriev (1996) with acetachlor below 3.0 kg/ha.

REFERENCES

Barry, D. A. J. and M. H. Miller, 1986. Corn response to restricted nodal root growth with relevance to zero tillage. *Canadian J. Soil Sci*. **66 :** 689-699.

Geriev, K. T. 1996. Harness and roundup guarantee high yields of farm crops. *Zashchita-i-karantin-Rastenii* **5 :** 30.

Lal, B., N. Chandra and M. S. Yadav, 1988. Response of waterlogged maize to planting methods and time of nitrogen application. *Ind. J. Agron.* **33 :** 191-193.

Pandey, A. K., V. Prakash, R. D. Singh and V. P. Mani, 2001. Integrated weed management in maize. *Ind. J. Agron.* **46 :** 260-265.

Rout, D. and Satapathy, 1996. Chemical weed control in rainfed maize (*Zea mays*). *Ind. J. Agron.* **41 :** 51-53.

Saini, J. P. and N. N. Angiras, 1998. Efficacy of herbicides alone and in mixtures to control weeds in maize under mid-hill conditions of Himachal Pradesh. *Ind. J. Weed Sci.* **30 :** 65-68.

Sharma, A. R., A. S. Toor and H. S. Sur, 2000. Effect of interculture operations and scheduling of atrazine application on weed control and productivity of rainfed maize *(Zea mays)* in Shiwalik foothills of Punjab. *Ind. J. agric. Sci.* **70 :** 757-761.

Thakur, D. R. and V. Sharma, 1996. Integrated weed management in rainfed maize *(Zea mays* L.). *Ind. J. Weed Sci*. **28 :** 207-208.