

Efficacy of Herbicides on Productivity and Profitability of Maize (*Zea Mays L.*) under South Gujarat Condition

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Abstract

A field research was carried out during summer 2015 at the College Farm, Navsari Agricultural University, Navsari on clayey soil having a pH 7.98 and poor in available nitrogen (230 kg/ha) medium in available phosphorus (38 kg/ha) and considerably rich in available potash (379 kg/ha). Ten treatments comprising of weed management practices were evaluated in randomized block design with three replications. Significantly higher grain yield and straw yield (kg/ha) were registered under weed free condition, which was statistically at par with atrazine @ 0.75 kg/ha + pendimethalin @ 0.75 kg/ha (6267 and 7921 kg/ha) as PE, alachlor @ 1.5 kg/ha + atrazine @ 0.5 kg/ha (5918 and 7316 kg/ha) as PE, atrazine @ 0.75 kg/ha + 2.4 D 0.5 @ kg/ha (5820 and 7276 kg/ha) as PE, atrazine @ 0.75 kg/ha (5680 and 6856 kg/ha) as PE and atrazine as PoE @ 1.5 kg/ha at 30 DAS (5619 and 6819 kg/ha), while weed control through sugarcane trash mulch @ 5 t/ha and alachlor @ 1.5 kg/ha PE were also at par in case of straw yield. Dry weight of weeds at harvest significantly minimum (60.96 g per m²) with highest WCE 82.97 %, and lowest weed index (3.36) were recorded under application of atrazine @ 0.75 kg/ha + pendimethalin @ 0.75 kg/ha PE, which was at par with T₇ (68.53 g per m², 80.75% and 9.28, respectively) and T₉ (70.16 g per m² 80.25% and 10.18, respectively). The significantly highest dry weight of weeds and lowest WI (360.86 g/m² and 45.53 respectively) was recorded under weedy check. Whereas, the lowest weed control efficiency (55.05%) was recorded under interculturing at 30 and 45 DAS followed by hand weeding. Among the weed control treatments highest net returns (₹92669/ha) was recorded in weed free check followed by tank mixture application of atrazine 0.75 kg/ha + pendimethalin @ 0.75 kg/ha PE (₹88979/ha) with B: C ratio (3.95) followed by alachlor @ 1.5 kg/ha + atrazine @ 0.5 kg/ha PE (₹83015/ha).

Keywords: Economics, tank mixture weed control efficiency, weed index and yield

I. INTRODUCTION

Maize (*Zea mays L.*) is third most emerging crop after wheat and rice in India, beside its use for human food it is a source for number of industrial products like animal feed, maize corn starch, corn oil, baby corn and popcorn etc. Being staple food it plays an important role in the economy of India, hence occupies a central position in agricultural policy making. In India, maize is grown over an area of 9.34 million ha with an annual production of about 24.35 million tonnes and an average productivity of about 2583 kg/ha. Gujarat occupy an area of 461 hectares with a production of 692 tonnes and productivity of 1501 kg/ha (IIMR, 2014, New Delhi). Among the factors responsible for low yields, severe infestation by weeds due to wider row spacing coupled with frequent rains in rainy season inflict huge yield losses up to 68.9 % (Walia et al. 2007). In order to obtain economical yield of maize, weeds must be kept under check. There are very few herbicide options available for weed control in maize in India. Currently, herbicides used for control of weeds include pre-emergence application of atrazine simazine, pendimethalin, alachlor and post-emergent application of 2,4-D. The infestation of these weeds is increasing day by day in the maize-growing areas of the state especially where the farmers are using atrazine year after year. So in order to widen the weed control spectrum it is imperative to use combination of herbicides having different mode of action (Kumar et al. 2011). Therefore, tank-mix combinations of herbicides, pre and post emergence herbicides were tried in the present investigation. Keeping all these aspects in view, an attempt was made to find out effective and economical herbicides for weed management in maize.

II. MATERIALS AND METHODS

A field research was carried out during summer 2015 at the College Farm Navsari Agricultural University, Navsari on clayey soil having a pH 7.98 and poor in available nitrogen (230 kg/ha), medium in available phosphorus (38 kg/ha) and considerably rich in available potash (379 kg/ha). Ten treatments comprising of weed management practices viz., Weedy check, Weed free, interculturing at 30 and 45 DAS fb and weeding, sugarcane trash mulch @ 5 t/ha, alachlor @ 1.5 kg/ha PE, atrazine @ 0.75 kg/ha PE, alachlor @ 1.5 kg/ha + atrazine @ 0.5 kg/ha PE, atrazine @ 0.75 kg/ha + pendimethalin @ 0.75 kg/ha PE atrazine @ 0.75 kg/ha + 2.4 D @ 0.5 kg/ha PE, atrazine @ 1.5 kg/ha PoE 30 DAS were evaluated in randomized block design with three replications. Gujarat Maize 6 was sown during second week of February keeping row to row spacing of 60 cm and plant to plant spacing of 20 cm (15 kg/ha seed rate). The crop was harvested in the second week of May.

The crop was fertilized with 120 kg N and 60 kg P₂O₅ through urea and single superphosphate, respectively. The required quantity of half N and whole P₂O₅ was drilled at the time of sowing. The remaining half N was band placed in two equal splits at knee high and tasseling stages. Herbicides were applied as per treatment with backpack power sprayer using 600 liter water/ha. Pre-emergence application of herbicides was made within 24 hours of sowing. Post-emergence application was made on the emergence of broadleaf weeds at 30 DAS. Weed counts and dry weight were recorded at two spots using a quadrat. Yields were harvested from net plot. Economics of the treatments was computed based upon prevalent prices. Keeping all these aspects in view, an attempt was made to find out the economical and effective herbicides weed management in maize under south Gujarat condition.

III. RESULTS AND DISCUSSION

Significantly higher grain yield and straw yield (kg/ha) were registered under weed free condition, which was statistically at par with atrazine @ 0.75 kg/ha + pendimethalin @ 0.75 kg/ha (6267 and 7921 kg/ha) as PE, alachlor @ 1.5 kg/ha + atrazine @ 0.5 kg/ha (5918 and 7316 kg/ha) as PE, atrazine @ 0.75 kg/ha + 2.4 D 0.5 @ kg/ha (5820 and 7276 kg/ha) as PE, atrazine @ 0.75 kg/ha (5680 and 6856 kg/ha) as PE and atrazine as PoE @ 1.5 kg/ha at 30 DAS (5619 and 6819 kg/ha), while weed control through sugarcane trash mulch @ 5 t/ha and alachlor @ 1.5 kg/ha PE were also at par in case of straw yield. Among herbicide treatment, atrazine @ 0.75 kg/ha + pendimethalin @ 0.75 kg/ha PE recorded significantly higher with grain yield (6267 kg/ha) followed by T₇ and T₉. The lowest grain and straw yield (3505 and 5526 kg/ha respectively) were recorded under weedy check (T₁). It was mainly due to minimum crop-weed competition which had influence the growth and yield components. The higher grain yield could be attributed to improved yield components consequence of lower crop-weed competition, throughout the crop growth period, thus enabling the crop for maximum utilization of nutrients, moisture, light and space. These results are in conformity with the findings of Mathukia et al. (2014), Dobariya et al. (2015) and Samant et al. (2015) in maize.

Data on dry weight of weeds at harvest indicated that the significantly minimum dry weight of weeds at harvest (60.96 g per m²) with highest WCE 82.97 %, while lowest weed index (3.36) were recorded under application of atrazine @ 0.75 kg/ha + pendimethalin @ 0.75 kg/ha PE which was at par with T₇ (68.53 g per m², 80.75% and 9.28, respectively) and T₉ (70.16 g per m², 80.25% and 10.18, respectively). The significantly highest dry weight of weeds and lowest WI (360.86 g /m² and 45.53, respectively) was recorded under weedy check. Whereas, the lowest weed control efficiency (55.05%) was recorded under interculturing at 30 and 45 DAS fb hand weeding. It might be due to effective weed control obtained under hand weeding, pre-emergence application of herbicides mixture at initial and early growth stage, which resulted into the lowest weed counts and finally reduced the total dry weight of weeds at harvest, low weed index and higher WCE. This result is in conformity with the findings of Inalli et al. (2014) and Dobariya et al. (2015) in maize.

Among the weed control treatments, highest net returns (₹92669/ha) was recorded in weed free check followed by tank mixture application of atrazine 0.75 kg/ha + pendimethalin @ 0.75 kg/ha PE (₹88979/ha) followed by alachlor @ 1.5 kg/ha + atrazine @ 0.5 kg/ha PE (₹83015/ha) and atrazine @ 0.75 kg/ha + 2.4 D 0.5 @ kg/ha PE (₹81761/ha) however, the maximum B:C ratio (3.95) was recorded by tank mixture application of atrazine 0.75 kg/ha + pendimethalin @ 0.75 kg/ha PE followed by weed free condition (3.92) and alachlor @ 1.5 kg/ha + atrazine @ 0.5 kg/ha PE (3.81). This was mainly due to higher economic yield, net returns and lower cost of cultivation. Though there were higher yield and gross income in weed free-check in comparison to tank mixture of atrazine 0.75 kg/ha + pendimethalin @ 0.75 kg/ha PE the B: C was low due to higher cost of cultivation. These findings are in close vicinity with those reported by Hawaldar et al. (2012) and Mathukia et al. (2014).

Table – 1

Yield, WCE, WI, dry weight of weed and economics as influenced by weed management in summer maize

Treatments	Yield (kg/ha)		Weed control efficiency (%)	Weed Index (%)	Dry weight of weeds at harvest (kg/ha)	Gross return (₹/ha)	Total cost of Cultivation (₹/ha)	Net return (₹/ha)	B:C Ratio
	Seeds	Straw							
T ₁ Weedy check	3505	5526	--	45.53	360.86	65648	20510	45138	2.20
T ₂ Weed free	6566	8135	100.00	--	0.00	116329	23660	92669	3.92
T ₃ Weed control through interculturing at 30 and 45 DAS fb HW)	5228	5910	55.05	19.37	161.09	90922	21880	69042	3.16

T ₄	Weed control through sugarcane trash mulch @ 5 t/ha	5513	6752	64.69	15.11	125.81	97438	25810	71628	2.78
T ₅	Pre-emergence application of Alachlor @ 1.5 kg/ha	5460	6536	68.47	16.41	112.38	96048	22028	74020	3.36
T ₆	Pre-emergence application of Atrazine @ (0.75 kg/ha)	5680	6856	68.86	12.21	110.34	100088	21335	78753	3.69
T ₇	PE application of Alachlor @ 1.5 kg/ha + Atrazine @ 0.5 kg/ha	5918	7316	80.75	9.28	68.53	104800	21785	83015	3.81
T ₈	PE application of Atrazine @ 0.75 kg/ha + Pendimethalin @ 0.75 kg/ha	6267	7921	82.97	3.36	60.96	111501	22522	88979	3.95
T ₉	PE application of Atrazine @ 0.75 kg/ha + 2.4 D @0.5 kg/ha	5820	7276	80.25	10.18	70.16	103308	21547	81761	3.79
T ₁₀	Post emergence application of Atrazine @ 1.5 kg/ha, 30 DAS	5619	6819	60.30	14.03	142.94	99123	22010	77113	3.50
	S.Em. ±	312.3	505.7	-	-	9.66				
	C.D at 5 %	999.1	1617.7	-	-	30.91				
	C.V. %	9.73	12.68	-	-	13.80				

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