Studies on influence of herbicides on nutrient uptake and yield in maize

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ABSTRACT

A field experiment was conducted during Kharif 2015 under rainfed conditions of Agricultural College Farm, Bapatla to study the nutrient uptake and yield in maize as influenced by pre-emergence (atrazine @ 1.0 kg ai/ha and pendimethalin @ 1.5 kg ai/ha) and post-emergence herbicides (halosulfuron methyl @ 90 g/ha). The experimental results revealed that among various weed management treatments the highest nutrient uptake by maize and lowest by weeds was recorded with weed free treatment. Among various herbicides tested pre-emergence application of atrazine @ 1.0 kg ai/ha + post-emergence application of halosulfuron methyl @ 90 g/ha registered the highest nutrient uptake by maize and lowest by weeds and this was statistically on par with pre-emergence application of pendimethalin @ 1.5 kg ai/ha + post-emergence application of halosulfuron methyl @ 90 g/ha.

Keywords: Maize; pre-emergence; post-emergence; herbicides; nutrient uptake; yield

INTRODUCTION

Maize, *Zea mays* L is an important cereal crop of India and potentiality of it can be fully exploited by adopting suitable agronomic practices. Among them weed management plays a significant role in enhancing the crop yield. Weeds emerge with the germination of maize seeds and grow along with plants till the early growth period causing severe weed competition and cause a heavy drain of plant nutrients. Hence the present investigation was planned to find out effective herbicide mixtures for weed control in maize.

MATERIAL and METHODS

The study was conducted under rainfed conditions of Agricultural College Farm, Bapatla during Kharif 2015. Soil of the experimental site was neutral with pH of 7.6, low in available nitrogen (192.4 kg/ha), medium in phosphorus (22.0 kg/ha) and high in potassium (293.8 kg/ha). The experiment was laid out in randomized block design with four replications. The experiment consisted of eight treatments viz T_1: Weedy check, T_2: Weed free, T_3: Hand weeding at 20 and 40 days after sowing (DAS), T_4: Atrazine @ 1.0 kg ai/ha (pre-emergence (PE) at 2 DAS), T_5: Halosulfuron methyl @ 90 g/ha (post-emergence (PoE) at 20 DAS), T_6: Pendimethalin @ 1.5 kg ai/ha (PE at 2 DAS), T_7: Atrazine @ 1.0 kg ai/ha (PE at 2 DAS) + halosulfuron methyl @ 90 g/ha (PoE at 20 DAS), T_8: Pendimethalin @ 1.5 kg ai/ha (PE at 2 DAS) + halosulfuron methyl @ 90 g/ha (PoE at 20 DAS). The maize hybrid 30-V-92 was dibbled manually at a spacing of 60 × 20 cm at 25 kg seed/ha on 26 August. Light irrigation was given to the crop for uniform germination immediately after sowing of the seed. Thinning and gap filling was done at 10 DAS by keeping one seedling/hill. Atrazine and pendimethalin were applied as pre-emergence and halosulfuron methyl as post-emergence. Fertilizers were scheduled to supply 120:60:60 kg/ha N, P and K in the form of urea, SSP and MoP. Entire quantity of P and K and one third of the N were applied as basal dose at the time of sowing. Remaining N was applied in two equal splits one at knee-high stage and the other at tasseling stage. A total rainfall of 483.2 mm was received in 21 rainy days during the crop growth period.

RESULTS and DISCUSSION

Nutrient uptake by crop

The highest nitrogen, phosphorus and potassium uptake by crop was recorded with weed

free (T_2) at 60 DAS and at harvest and this was on par with hand weeding at 20 and 40 DAS (T_3), application of atrazine as pre-emergence @ 1.0 kg ai/ha + halosulfuron methyl @ 90 g/ha as post-emergence (T_7) and pendimethalin as pre-emergence @ 1.5 kg ai/ha + halosulfuron methyl @ 90 g/ha as post-emergence (Table 1). This might be due to the fact that the effective control of initial stages of weeds by pre-emergence application of atrazine and later emerged weeds by post-emergence herbicide substantially increased nutrient uptake in these treatments. Similar results were reported by Sinha et al (2005) and Malviya et al (2012).

Nutrient uptake by weeds

Weed free (T_2) recorded the lowest nitrogen, phosphorus and potassium uptake by weeds and this was closely followed by hand weeding at 20 and 40 DAS (T_3). Pre-emergence application of atrazine @ 1.0 kg ai/ha + halosulfuron methyl @ 90 g/ha as post-emergence (T_7) also recorded lower potassium uptake by weeds and this was comparable with hand weeding at 20 and 40 DAS (T_3) and pre-emergence application of pendimethalin @ 1.5 kg ai/ha + halosulfuron methyl @ 90 g/ha as post-emergence (T_8) and significantly superior to remaining herbicidal treatments. This might be due to effective control of weeds that resulted in less nutrient uptake by weeds in these treatments. Weedy check (T_1) registered the highest potassium uptake by weeds at 30 and 60 DAS which could be attributed to lowest weed control in these treatments (Table 1). Similar results were reported by Sinha et al (2005) and Malviya et al (2012).

Yield

Among the various weed control treatments the highest kernel yield (7435 kg/ha) was recorded with weed free (T_2) which was at par with hand weeding at 20 and 40 DAS (T_3). In case of herbicide treatments pre-emergence application of atrazine @ 1.0 kg ai/ha + halosulfuron methyl @ 90 g/ha as post-emergence (T_7) recorded the highest kernel yield (6495 kg/ha) and it was comparable with pre-emergence application of pendimethalin @ 1.5 kg ai/ha + halosulfuron methyl @ 90 g/ha as post-emergence (T_8) and significantly superior to T_4, T_6 and T_5 treatments (Table 1). The weedy check (T_1) recorded significantly lowest kernel yield over the other treatments. This might be due to poor weed control and severe weed competition as evidenced by higher weed density and dry weight which resulted in reduced crop growth and yield attributing characters thereby resulting in lower kernel yield. These results are in agreement with the findings of Malviya and Singh (2007), Walia et al (2007), Srividya et al (2011), Sanodiya et al (2013) and Singh et al (2014).

CONCLUSION

Among the herbicides tested the highest nutrient uptake by crop and lowest by weeds was recorded with pre-emergence application of atrazine

Table 1. N, P and K uptake by crop and weeds and yield of maize as influenced by different weed management treatments

Treatment	Uptake by crop			Uptake by weeds			Kernel yield (kg/ha)
	N	P	K	N	P	K	
T_1	87.8	18.2	87.7	5.8 (33.6)	4.2 (17.1)	6.1 (36.8)	3205
T_2	143.7	39.9	123.8	0.7 (0.0)	0.7 (0.0)	0.7 (0.0)	7435
T_3	134.8	36.3	121.9	3.0 (8.5)	2.3 (4.9)	3.2 (9.5)	6740
T_4	110.4	23.6	98.2	4.2 (16.9)	3.3 (10.4)	4.7 (21.7)	5137
T_5	93.5	19.5	86.4	4.5 (20.3)	3.7 (13.4)	5.0 (24.4)	4781
T_6	107.4	22.0	94.8	4.3 (18.2)	3.5 (12.1)	4.8 (22.6)	4990
T_7	130.0	31.8	120.8	3.3 (10.1)	2.5 (5.8)	3.5 (12.1)	6495
T_8	126.9	29.5	116.5	3.4 (11.3)	2.7 (6.9)	3.8 (13.8)	6265
SEm±	5.61	1.48	6.23	0.21	0.16	0.19	297.3
$CD_{0.05}$	17.0	4.5	18.9	0.7	0.5	0.6	901
CV (%)	8.3	9.3	10.2	10.3	9.4	8.3	9.1

T_1= Weedy check, T_2= Weed free, T_3= Hand weeding at 20 and 40 DAS, T_4= Atrazine @ 1.0 kg ai/ha (PE at 2 DAS), T_5= Halosulfuron methyl @ 90 g/ha (PoE at 20 DAS), T_6= Pendimethalin @ 1.5 kg ai/ha (PE at 2 DAS), T_7= Atrazine @ 1.0 kg ai/ha (PE at 2 DAS) + halosulfuron methyl @ 90 g/ha (PoE at 20 DAS), T_8= Pendimethalin @ 1.5 kg ai/ha (PE at 2 DAS) + halosulfuron methyl @ 90 g/ha (PoE at 20 DAS)

@ 1.0 kg/ha + post-emergence application of halosulfuron methyl @ 90 g/ha (T_7) and pre-emergence application of pendimethalin @ 1.5 kg ai/ha + post-emergence application of halosulfuron methyl @ 90 g/ha (T_8) treatments though these two treatments were found statistically at par with each other.

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