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Research Article

Evaluation of New Herbicide Molecules in Irrigated Maize

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Abstract

Field experiment was carried out at Department of Millets, Tamil Nadu Agricultural University, Coimbatore during *Kharif*, 2019 in sandy clay loam soil to evaluate different new herbicide molecules for controlling weeds in irrigated maize.The experiment was laid out in a Randomized Complete Block Design (RCBD) with the following treatments *viz*., T_1 – Weedy check, T_2 – Weed free check, T_3 – Atrazine 1kg/ha (PE) *fb* HW at 25 DAS,T_4 – Atrazine 0.75kg/ha (PE) *fb* Topramezone 25.2 g/ha at 25 DAS, T_5 – Atrazine 0.75kg/ha (PE) *fb* Tembotrione 120 g/ha at 25 DAS, T_6 – Atrazine 1kg/ha (PE) *fb* Topramezone 25.2 g/ha at 25 DAS, T_7 – Atrazine 1kg/ha (PE) *fb* Tembotrione 120 g/ha at 25 DAS, T_8 – Topramezone 25.2 g/ha + Atrazine 0.75kg/ha at 15 DAS and T_9 – Tembotrione 120 g/ha + Atrazine 0.75kg/ha at 15 DAS and replicated thrice. Based on the results of experimentation, it is concluded that application of Atrazine at 1kg/ha as pre emergence *fb* Topramezone at 25.2 g/ha on 25 DAS as post emergence recorded higher grain yield (7586 kg/ha), net return (Rs.70928/ha) and B: C ratio (2.28).

Keywords: Maize, pre and post emergence herbicides, growth and yield

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Introduction

Maize is the most demanding cereal crop in India after rice and wheat and it is cultivated in almost all parts of India for multivarious purpose owing to its wide adaptability and high yielding potential [1].The productivity of maize is influenced by various factors *viz*., usage of conventional and poor responsive varieties, drought, inadequate plant population, weed menace, poor soil fertility, indiscriminate use of pesticides and fungicides [2, 3]. Among the different factors, weeds cause yield loss of about 28 to 100 % [4] as they compete for light, space, water and nutrients owing to their wider adaptability and prolific growth rate compared to crops [5].

Crop weed competition from 30 to 45 days from sowing [6] influences the yield of maize to a greater extent as they reduce photosynthetic efficiency and partitioning of photosynthates thus reducing sink capacity of crop leading to poor grain yield [7]. Hence, appropriate weed management practices should be adopted during the critical period for minimizing yield loss due to weeds. Weed control through herbicides is cost effective and consume less labour for spraying compared to manual weeding [8].Generally, farmers apply atrazine as pre emergence herbicide for managing weeds in maize. Application of atrazine alone is ineffective against different weed flora in the field as each herbicide has its own spectrum of weed control. New herbicide molecules with varied mode of action are highly essential for effective control of grasses, sedges and broad leaved weeds. Hence, the present experimentation was carried out to evaluate different new herbicide molecules for controlling weeds in irrigated maize.

Materials and Methods

Field experiment was carried out at Department of Millets, Tamil Nadu Agricultural University, Coimbatore during *Kharif*, 2019 to evaluate different new herbicide molecules for controlling weeds in irrigated maize. The soil was sandy clay loam and low in available N (162 kg/ha), medium in available P (14.6 kg/ha) and high in available K (493 kg/ha) with a pH of 8.20.The experiment was laid out in a Randomized Complete Block Design (RCBD) with the following treatments *viz*., T_1 – Weedy check, T_2 – Weed free check, T_3 – Atrazine 1kg/ha (PE) *fb* HW at 25 DAS,T_4 – Atrazine 0.75kg/ha (PE) *fb* Topramezone 25.2 g/ha at 25 DAS, T_5 – Atrazine 0.75kg/ha (PE) *fb* Tembotrione 120 g/ha at 25 DAS, T_6 – Atrazine 1kg/ha (PE) *fb* Topramezone 25.2 g/ha at 25 DAS, T_7 – Atrazine 1kg/ha (PE) *fb* Tembotrione 120 g/ha at 25 DAS, T_8 – Topramezone 25.2 g/ha + Atrazine 0.75kg/ha at 15 DAS and T_9 – Tembotrione 120 g/ha + Atrazine 0.75kg/ha at 15 DAS and replicated thrice. Sowing of Maize hybrid CO H(M) 6 was done during kharif season. The cultural operations were carried out as per TNAU, 2019 Crop Production Guide [9]. Observations on weed density, weed dry matter, yield attributes and yield were recorded. The data on aforementioned characters studied during the experimentation were statistically analyzed by Gomez and Gomez

(2010) [10] for Randomized Complete Block Design. Wherever the treatment difference was significant, critical differences were worked out at 5 per cent probability level.

Results and Discussion

The data on the effect of weed management practices on weed density, growth, yield attributes and yield of maize are given in **Table 1**.

Table 1 Effect of weed management practices on growth, weed density, yield attributes and yield of maize

Treatments	Weed density on 50 DAS (No/m^2)			Plant height (cm)	Cob length (cm)	Cob girth (cm)	Grain rows/cob	Grains /row	100 seed weight (g)	Grain yield (kg/ha)
	G	S	BLW							
T_1	54.3	13.0	71.0	241.1	19.0	15.5	14.1	30.9	36.3	5402
T_2	0	0	0	255.2	22.7	16.3	14.9	36.5	39.7	7814
T_3	32.7	117.0	4.33	254.1	22.0	16.2	14.9	35.9	39.7	7678
T_4	54.3	21.7	0	250.7	21.7	15.9	14.7	35.1	37.8	7469
T_5	115.0	17.7	0	247.1	21.2	15.8	14.3	34.4	37.7	7173
T_6	28.3	48.0	0	251.3	22.0	16.0	14.8	35.6	38.3	7586
T_7	67.7	5.3	0	250.1	21.5	15.8	14.7	34.8	37.8	7301
T_8	25.0	65.3	0	246.8	20.9	15.6	14.3	34.0	37.2	6621
T_9	68.7	46.7	2.0	243.1	20.3	15.5	14.1	33.9	36.8	6314
CD(p=0.05)	NS	NS	37	NS	1.92	NS	NS	NS	NS	1046

Effect of weed management practices on weed density on 50 DAS

Experimental results revealed that weed management practices evinced no significant influence on grassy weeds and sedges. Nevertheless, application of Topramezone at 25.2 g/ha + Atrazine at 0.75kg/ha on 15 DAS and Atrazine at 1kg/ha (PE) *fb* Topramezone at 25.2 g/ha on 25 DAS recorded lesser grassy weed count of 25.0 and 28.3 No/m^2, respectively. With respect to sedges, application of Atrazine at1kg/ha (PE) *fb* Tembotrione at 120 g/ha on 25 DAS (T_7) and Atrazine at 0.75kg/ha (PE) *fb* Tembotrione at 120 g/ha on 25 DAS(T_5) recorded lesser count of 5.3 and 17.7 No/m^2, respectively. Both the post emergence herbicides *viz*., Topramezone and Tembotrione were highly effective in controlling BLW. This might be ascribed to inhibition of 4- hydroxy phenyl pyruvate dioxygenase activity in weeds leading to disruption of carotenoid synthesis resulting in bleaching of leaf, necrosis and finally death. The results are in accordance with the findings of Bollmanet al.(2008) [11]

Effect of weed management practices on growth, yield attributes and yield of maize

Weed management practices failed to exert significant influence on plant height of maize at harvest. Nevertheless, weed free check (T_2) recorded higher plant height of 255.2cm, which was superior to other treatments. This might be due to more availability of resources to the plant which favoured plant height. The results confirm the findings of Satyendra et al.(2018) [12].In respect of cob length, weed free check (T_2) recorded higher cob length of 22.7 cm, which was comparable with T_6, T_3, T_4, T_7, T_5 and T_8 but was significantly superior to T_9 and T_1.The increased cob length was due to more accumulation of photosynthates owing to lesser weed density. The results corroborate the findings of Sivamurugan et al. (2017) [13].There was no significant influence of weed management practices on cob girth. However, weed free check (T_2) recorded higher cob girth of 16.3cm, which was closely followed by T_3 and T_6.Though weed free check (T_2) recorded higher number of grain rows/cob (14.9) and number of grains/row (36.5), weed management practices failed to evince significant influence on grain rows/cob and number of grains/row. This was closely followed by T_3,T_6,T_4 and T_7. There was no significant influence of weed management practices on 100 seed weight. Grain yield was significantly influenced by the weed management practices.

Among the treatments, weed free check(T_2) recorded higher yield of 7814 kg/ha, which was comparable with T_3,T_6,T_4,T_7 and T_5 but was superior to T_8 andT_9.This might be due to minimum crop-weed competition prevailed during crop growth thus ensuring the effective utilization of available resources which in turn favoured growth and yield components. The results are in accordance with the findings of Chandrabhan (2016) [14].The lowest yield of 5402 kg/ha was recorded in weedy check (T_1).In respect of pre and post emergence herbicides, application of Atrazine at 1kg/ha (PE) *fb* Topramezone at 25.2 g/ha on 25 DAS (T_6) recorded higher yield of 7586 kg/ha, which was closely followed by application of Atrazine at 0.75kg/ha (PE) *fb* Topramezone at 25.2 g/ha on 25 DAS. This might be ascribed to lower weed density owing to bleaching of leaf and finally death of weeds. The reduction in weed density

improved the yield attributes through more translocation of photosynthates to the sink thus enhanced the yield. The results are in accordance with the findings of Vikram et al.(2017) and Arunkumar et al.(2019) [15, 16].

The data on the effect of weed management practices on yield and economics of maize are given in **Table 2**.

Table 2 Effect of weed management practices on yield and economics of maize

Treatments	Grain yield (kg/ha)	Net return (Rs./ha)	B:C ratio
T_1	5402	39518	1.81
T_2	7814	71132	2.19
T_3	7678	70353	2.22
T_4	7469	68909	2.25
T_5	7173	64110	2.18
T_6	7586	70928	2.28
T_7	7301	66368	2.22
T_8	6621	54436	2.00
T_9	6314	50235	1.94
CD (p=0.05)	1046		

Effect of weed management practices on yield and economics of maize

With respect to economics, application of Atrazine at 1kg/ha as pre emergence *fb* Topramezone at 25.2 g/ha on 25 DAS as post emergence registered higher yield(7586 kg/ha), net return (Rs.70928/ha) and B:C ratio(2.28) and it was closely followed by application of Atrazine at 0.75kg/ha as pre emergence *fb* Topramezone at 25.2 g/ha on 25 DAS as post emergence, which registered relatively lower yield(7469 kg/ha), net return(Rs. 68909/ha) and B:C ratio(2.25).

Conclusion

Based on the results of experimentation, it is concluded that application of Atrazine at 1kg/ha as pre emergence *fb* Topramezone at 25.2 g/ha on 25 DAS as post emergence recorded higher grain yield (7586 kg/ha), net return (Rs.70928/ha) and B: C ratio (2.28). This appropriate combination of pre and post emergence herbicides should be adopted by the farming community to enhance the productivity of maize under irrigated conditions which will help to improve the net income of farmers.

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