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Effect on weed dynamics, crop growth and yield of maize (*Zea mays* L.)

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Abstract

A field experiment entitled “Effect on weed dynamics, crop growth and yield of maize (*Zea mays* L.)” was conducted on sandy loam soil at Instructional-cum-Research Farm, Raj Mohini Devi College of Agriculture & Research Station, Ambikapur (C.G.) during the *kharif* season 2021 by adopting the randomized block design with replication and eight treatment. From the results, it is concluded that weed management practices two hand weeding at 15 and 30 DAS not only reduce total weed density, weed dry weight at crop growth stages and weed index also increased weed control efficiency and grain yield which was at par with application of atrazine 1000 g/ha (PE) *fb* topramezone 25.2 g/ha (PoE) at 25 DAS. The highest net return (Rs.123550 ha⁻¹) was recorded under two hand weeding at 15 and 30 DAS followed by atrazine 1000 g/ha (PE) *fb* topramezone 25.2 g/ha (PoE) at 25 DAS (Rs.115467 ha⁻¹) but the B:C ratio was the highest at atrazine 1000 g/ha (PE) *fb* topramezone 25.2 g/ha (PoE) (2.87) than atrazine 1000 g ha⁻¹ (PE) *fb* tembotrione 120 g ha⁻¹ as (PoE) at 25 DAS(2.63) due to the high cost of cultivation.

Keywords: Topramezone, tembotrione, maize and atrazine

Introduction

Maize (*Zea mays* L.), is also known as corn, and one of the most important cereal in the agricultural economy. It ranks third most important cereal crop after rice and wheat in India providing food, feed, and fodder and also a good source of basic raw material for number of industrial products. Maize has a multitude of industrial uses. The crop which give high biological yield as well as grain yield in a short period of time due to its unique photosynthetic mechanism owing to C4 mechanism. Hence it is globally known as “Queen of cereals” because of its high genetic potential and wider adaptability. Maize cultivation in *kharif* season associated with heavy rainfall and higher relative humidity, which leads to many infestation in which weeds are major problem. Weeds mainly compete with crop for light nutrient and space by which it reduce the maize yield. It is infested by a vast weed flora including grassy, broad leaved weeds and sedges *Cynodon dactylon*, *Echinochloa colona* among grasses, *Cyperus rotundus*, *Phyllanthus niruri* among sedges and *Commelina benghalensis*, *Alternanthera sessilis* and *Amaranthus viridis* among broad leaved weeds. Weeds are the unwanted plants which affect crop production, both in quality and quantity. Due to vast weed flora, weeds become a major constraints in maize. Chemical weed control is efficient and cost effective control of the modern crop production. Every herbicide has its own spectrum to control weeds. Many of them active against annual weeds and some are effective to perennial weeds. Among herbicide, atrazine is widely used by the farmers. It has also been observed that continuous used of atrazine evolves resistance in weeds. Hence, the use of two different chemicals with different mode of action enhances the efficacy of weed control. It is also important to use post emergence herbicide as topramezone and tembotrione. It controls both grassy and broad leaved weeds. Therefore, the weed management through chemical control is better management in the modern crop production. Thus, considering the important facts and problems above, the present investigation entitled “Effect on weed dynamics, crop growth and yield of maize (*Zea mays* L.)” was carried out during *kharif* season of 2021 at the Research-cum-Instructional farm of Raj Mohini Devi College of Agriculture & Research Station, Ambikapur.

Materials and Methods

Field experiment was carried out at Instructional-cum-Research Farm, Raj Mohini Devi College of Agriculture & Research Station, Ambikapur (C.G.) during *kharif*, 2021 by adopting the randomized block design with three replication and eight treatment.

The treatment consisted of T₁: weedy check, T₂: two hand weeding at 15 and 30 DAS, T₃: atrazine 1000 g ha⁻¹ as (PE) fb hand weeding at 25 DAS, T₄: atrazine 1000 g ha⁻¹ as (PE) fb topramezone 25.2 g ha⁻¹ as (PoE) at 25 DAS, T₅: atrazine 1000 g ha⁻¹ as (PE) fb tembotrione 120 g ha⁻¹ as (PoE) at 25 DAS, T₆: topramezone 25.2 g/ha + atrazine 750 g/ha at 15 DAS and T₇: tembotrione 120 g/ha + atrazine 750 g/ha at 15 DAS, T₈: weedy check. Maize variety NK30 was sown with spacing 75 x 20 cm, seed rate 20 kg ha⁻¹ with recommended dose of fertilizer (150:80:60 kg ha⁻¹ N: P₂O₅: K₂O).

Results and Discussion

Weed density and weed dry weight

Experimental results revealed that weed management practices has a significant effect on weed density and weed dry weight at 60 DAS (Table 1). The lowest density of weed was recorded under treatment two hand weeding at 15 and 30 DAS at 60 DAS (7.03 no. m²). Among herbicidal combination treatment application of atrazine 1000 g ha⁻¹ as (PE) fb topramezone 25.2 g ha⁻¹ as (PoE) at 25 DAS (8.55 no.m²), followed by atrazine 1000 g ha⁻¹ as (PE) fb tembotrione 120 g ha⁻¹ as (PoE) at 25 DAS (9.02 no.m²). The maximum density of weed was recorded under weedy check (14 no. m²). Similarly the lowest dry weight of weed was recorded under two hand weeding at 15 and 30

DAS (5.27 g/m²) which was at par with application of atrazine 1000 g ha⁻¹ as (PE) fb topramezone 25.2 g ha⁻¹ as (PoE) at 25 DAS (7.94 g/m²), atrazine 1000 g ha⁻¹ as (PE) fb tembotrione 120 g ha⁻¹ as (PoE) at 25 DAS (8.70 g/m²).

Weed control efficiency

At 60 DAS, amongst weed management practices, the highest weed control efficiency was recorded under two hand weeding at 15 and 30 DAS (75.77%) while the lowest weed control efficiency was observed under weedy check. Among herbicidal treatment the application of atrazine 1000 g ha⁻¹ as (PE) fb topramezone 25.2 g ha⁻¹ as (PoE) at 25 DAS (44.39%), T₅: atrazine 1000 g ha⁻¹ as (PE) fb tembotrione 120 g ha⁻¹ as (PoE) at 25 DAS (33.15%). This is due to the reduction in weed dry weight. These results are in conformity with the findings of Praveen *et al.*, (2017) [15].

Weed index

Maximum weed index value is recorded under weedy check (38.44%) as comparable to two hand weeding at 15 and 30 DAS (Table 1). Among, herbicidal treatment the lowest value obtained under application of atrazine 1000 g ha⁻¹ as (PE) fb topramezone 25.2 g ha⁻¹ as (PoE) at 25 DAS (8.98%), atrazine 1000 g ha⁻¹ as (PE) fb tembotrione 120 g ha⁻¹ as (PoE) at 25 DAS (10.35%).

Table 1: Effect of weed management practices against weed density (no. m²), dry weight (g/m²), weed control efficiency (%) and weed index (%)

Treatments	Weed density(no.m ²) at 60 DAS	Dry weight(g/m ²) at 60 DAS	WCE (%)	WI (%)
T ₁ : Weedy check	14 (195.67)	10.63 (112.66)	---	38.44
T ₂ : Two hand weeding at 15 and 30 DAS	7.03 (49)	5.27 (27.33)	75.77	---
T ₃ : Atrazine 1000 g/ha (PE) fb hand weeding at 25 DAS	10.52 (110.33)	8.74 (76)	32.54	12.08
T ₄ : Atrazine 1000 g/ha (PE) fb topramezone (PoE) 25.2 g/ha at 25 DAS	8.55 (72.67)	7.94 (62.67)	44.39	8.98
T ₅ : Atrazine 1000 g/ha (PE) fb tembotrione (PoE) 120 g/ha at 25 DAS	9.02 (81)	8.70 (75.33)	33.15	10.35
T ₆ : Topramezone 25.2 g/ha + atrazine 750 g/ha at 15 DAS	13.05 (170)	9.66 (93)	17.39	27.21
T ₇ : Tembotrione 120 g/ha + atrazine 750 g/ha at 15 DAS	12.74 (162)	9.51 (190)	20.12	24.85
T ₈ : Mulching with mustard stover at 15 DAS	11.49 (131.67)	9.30 (86)	23.65	14.60
SEm±	0.10	0.07	----	----
CD (at 5%)	0.34	0.21	-----	-----

*Values in without parenthesis indicates the transformed value. $\sqrt{X} + 0.5$

Yield

The yield of maize was significantly influenced by the weed management practices (Table 2). Among treatments highest kernel yield (7935 kg ha⁻¹) was recorded under treatment two hand weeding at 15 and 30 DAS, which was at par with the application of atrazine 1000 g/ha PE fb topramezone 25.2 g/ha PoE at 25 DAS (7222 kg ha⁻¹). The highest stover yield (10217

kg ha⁻¹) was recorded under treatment two hand weeding at 15 and 30 DAS to that of other treatments. The highest yield was obtained due to the less weed competition and better growth of crop by the control of weeds at initial stage. This results are agreement with the findings of Srividya *et al.*, (2010) [16] and Shantveerayya *et al.*, (2011) [7].

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

Treatments	Kernel yield(kg/ha ⁻¹)	Stover yield(kg/ha ⁻¹)	Net return(Rs. ha ⁻¹)	B:C ratio
T ₁ : Weedy check	4884	7748	74168	2.09
T ₂ : Two hand weeding at 15 and 30 DAS	7935	10217	123550	2.60
T ₃ : Atrazine 1000 g/ha (PE) fb hand weeding at 25 DAS	6993	8954	105959	2.37
T ₄ : Atrazine 1000 g/ha (PE) fb topramezone (PoE) 25.2 g/ha at 25 DAS	7222	9219	115467	2.87
T ₅ : Atrazine 1000 g/ha (PE) fb tembotrione (PoE) 120 g/ha at 25 DAS	7115	9120	111080	2.63
T ₆ : Topramezone 25.2 g/ha + atrazine 750 g/ha at 15 DAS	5775	7775	85429	2.12
T ₇ : Tembotrione 120 g/ha + atrazine 750 g/ha at 15 DAS	5986	8294	89153	2.14
T ₈ : Mulching with mustard stover at 15 DAS	6777	8331	100301	2.23
SEm±	1.81	2.31	57.37	0.07
CD (at 5%)	5.49	6.99	174.04	0.23

Economics

Based on above results (Table 2) the highest net return and benefit-cost ratio was recorded under two hand weeding at 15 and 30 DAS (Rs.123550 and 2.60). Among herbicidal combination the maximum net return and benefit-cost ratio was under (Rs. 115467 and 2.87) application of atrazine 1000 g/ha PE fb topramezone 25.2 g/ha PoE at 25 DAS. The differences in benefit-cost ratio is due to the cost of cultivation (cost of herbicides and productivity of the crop). Similar results were also reported by Shantveerayya and Agasimani *et al.*, (2011) ^[7], Swetha *et al.*, (2015) ^[9] and Gupta *et al.* (2018) ^[4].

Conclusions

It is concluded that among herbicidal combination treatments the application of atrazine 1000 g/ha PE fb topramezone 25.2 g/ha PoE at 25 DAS, fb atrazine 1000 g ha⁻¹ as (PE) fb tembotrione 120 g ha⁻¹ as (PoE) at 25 DAS was found to be most effective herbicidal combination against complex weed flora and productivity of maize.

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