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Efficacy of New Post Emergence Herbicides in *Rabi* Maize (*Zea Mays* .L)

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ABSTRACT

A field experiment was conducted at Regional Agricultural Research Station, Lam, Guntur, A.P during *rabi* 2017-18 to study the efficacy of new post emergence herbicides on weeds in maize. Among the post emergence herbicides tested, tembotrione @ 100g a.i ha^{-1} , topramezone @ 25 g a.i ha^{-1} and nicosulfuron @ 700 ml ha^{-1} were found to be on par with each other. Any of these three post emergence herbicides appear to be an effective alternative for manual weeding as the return from each rupee invested has given higher benefit than that achieved with hand weeding.

Key words: *Economics, Maize, Post-Emergence herbicides.*

Maize (*Zea mays* L.) is the most versatile food crop of global importance. It is grown for grain as well as fodder purpose and is regarded as "queen of cereals". Presence of weeds in maize crop decreases the yield drastically. The extent of reduction in grain yield of maize has been reported to be in the range of 33 to 50 per cent depending on type of weed species in the standing crop (Hawaldar and Agasimani, 2012). The critical period of crop weed competition of maize is 15-45 DAS. Hence, control of weeds after 15 days of germination is very essential.

Keeping a crop weed free throughout the crop season is a labourious and cost intensive affair. With the discovery of synthetic herbicides in the early 1940s, there was a shift in control methods towards high input and target-oriented ones. Though the pre-emergence application of herbicides was found to be effective in controlling weeds, their usage is not only difficult but also can cause crop injury and effect environment because of higher doses used. Ecological problems emanating from the use of higher dose of herbicides lead to the birth of environmentally safer new generation of post-emergence herbicides, which are effective at very low doses in different crops (Dhiman and Singh, 2002). Hence, the present study was taken up to know the efficacy of different post emergence herbicides in maize which can bring about broader spectrum of weed control.

MATERIAL AND METHODS

An experiment was conducted at Regional Agricultural Research Station, Lam, Guntur, A.P during *rabi* 2017-18 in clay soil with a pH of 7.9, low in organic carbon (0.38%) and available nitrogen (189 kg ha^{-1}), medium in available phosphorus (42 kg ha^{-1}) and high in available potassium (870 kg ha-1). A total rainfall of 79.9 mm was received in 4 rainy days during the crop growth period and the crop was raised with supplemental irrigations. The experiment was laid out in a randomized block design with eight treatments and replicated three times. The entire recommended dose of phosphorus (80 kg P_2O_5 ha^{-1}) was applied in the form of single super phosphate (16 % P_2O_5) basally. Nitrogen (240 kg N ha^{-1}) was applied in the form of urea (46 % N), in three splits i.e. 50 % at the time of sowing, 25 % at knee high stage (30 DAS) and 25% at tasseling and silking stage (60 DAS). Potassium (80 kg K_2O ha^{-1}) was applied as Muriate of potash (60 % K_2O) in two splits, 50% at sowing and the other 50% at tasseling and silking stage along with urea. All the recommended package of practices except weed management was adapted to raise the crop during experimentation. In weedy check, weeds were allowed to grow throughout the crop growth period, where as in treatment T_8 weed free conditions were maintained. First hand weeding was done at 20 DAS followed by a second hand weeding at 40 DAS to remove weeds in (T_6). Treatments involving the application of post emergence herbicides (T_1, T_2, T_3, T_4, T_5) were sprayed uniformly with a knapsack sprayer fitted with flood jet nozzle at 20 DAS. The spray volume used for the herbicide application was 500 L ha^{-1}. The data on weed density and weed drymatter were recorded at harvest and were subjected to square root transformation ($\sqrt{X + 0.5}$) before statistical analysis to normalize the distribution. The growth and yield attributes were recorded at the time of maturity. Economics of different treatments were calculated taking into account the prevailing market prices of inputs and outputs.

RESULTS AND DISCUSSION

Among the weed species observed in the experiment, *Cyperus rotundus* was the sedge, *Dinebra*

Table 1. Effect of weed management practices on weed density, weed drymatter and weed control efficiency in Maize

Treatments	Weed density at 50 DAS (No.m^{-2})	Weed drymatter at 50 DAS (g m^{-2})	Weed Control Efficiency at 50 DAS (%)
T_1: Tembotrione @ 100 g a.i ha^{-1} (PoE) at 20 DAS	6.4 (40)	6.9 (51.5)	73
T_2: Topramezone @ 25 g a.i ha^{-1} (PoE) at 20 DAS	6.8 (47)	7.2 (52.8)	70
T_3: Halosulfuron @ 67.5 g a.i ha^{-1} (PoE) at 20 DAS	9.4 (96)	10.3 (106.3)	28
T_4: Tolpyralate @ 125 ml ha^{-1} (PoE) at 20DAS	7.6 (63)	6.7 (56)	61
T_5: Nicosulfuron @ 700 ml ha^{-1} (PoE) at 20 DAS	6.7 (44)	7.5 58.1)	60
T_6: Two hand weedings at 20 and 40 DAS	4.5 (20)	4.5 (19.9)	88
T_7 : Weedy check	10 (103)	15.6 (251.8)	-
T_8 : Weed free	0.7 (0)	0.7 (0)	100
SEm±	1.2	1.2	10
CD (p=0.05)	3.6	3.7	30
CV (%)	31.4	28.4	28.9

Data were subjected to square root transformation $\sqrt{x+0.5}$. Figures in parenthesis are original values.

retroflexa was dominant grassy weed and among the broad leaved weeds, *Trianthema portulacastrum* and *Phyllanthus madaraspatanense* were predominantly observed in the experiment.

The data on density and drymatter recorded at 50 DAS (Table 1) indicated that the hand weeded treatment recorded significantly low density of the weeds(4.5) as compared to weedy check (10) and the treatments that received post emergence application of tembotrione @ 100 g a.i ha^{-1} (6.4), nicosulfuron @ 700 ml ha^{-1} (6.7), topramezone @ 25 g a.i ha^{-1} (6.8) and tolpyralate @ 125 ml ha^{-1} (7.6) were on par with hand weeded treatment. Similar trend was observed with respect to weed drymatter recorded at 50 DAS where all the herbicides except halosulfuron @ 67.5 g a.i ha^{-1} recorded on par weed drymatter as that of hand weeded check. These herbicides were effective in controlling BLW and also grassy weeds. Similar results were also reported by Schulte and Kocher (2009). Highest weed number and drymatter was recorded with halosulfuron @ 67.5 g a.i ha^{-1} and that may be due to non control of certain grasses and BLW.

Weed control efficiency recorded at 50 DAS was highest with hand weeding (88%) and was on par with all herbicide treatments except halosulfuron @ 67.5 g a.i ha^{-1} .

Herbicide application exhibited profound influence on growth and yield parameters of maize drymatter accumulation and kernel yield.

At harvest, the dry matter production recorded with all the herbicide treatments was on par with hand weeded treatment(15354 kg ha^{-1}) except halosulfuron. Highest kernel yield was recorded with hand weeding (7218) and was on par with tembotrione @ 100 g a.i ha^{-1} (T_1), topramezone @ 25 g a.i ha^{-1} (T_2), nicosulfuron @ 700 ml ha^{-1} (T_5). Similar results were also reported by Ashu Sharma *et al* (2017).

The highest net returns and benefit cost ratio are with application of Tembotrione @ 100 g a.i ha^{-1} (T_1). Though the hand weeding resulted in highest

Table 2. Plant drymatter at harvest, Kernel yield (kg ha^{-1}), Weed index (%), Net returns and B:C ratio of maize as influenced by different post emergence herbicide treatments

Treatments	Plant Drymatter at harvest (kg ha^{-1})	Kernel yield (kg ha^{-1})	Weed index (%)	Net returns (Rs. ha^{-1})	Benefit Cost Ratio
T_1: Tembotrione @ 100 g a.i ha^{-1} (PoE) at 20 DAS	15806	7111	5.30	44412	2.18
T_2: Topramezone @ 25 g a.i ha^{-1} (PoE) at 20 DAS	15507	7042	6.20	43694	2.17
T_3: Halosulfuron @ 67.5 g a.i ha^{-1} (PoE) at 20 DAS	8827	3889	48.21	12584	1.34
T_4: Tolpyralate @ 125 ml ha^{-1} (PoE) at 20DAS	14167	6301	16.09	40758	2.09
T_5: Nicosulfuron @ 700 ml ha^{-1} (PoE) at 20 DAS	15791	6778	9.68	35222	1.94
T_6: Two hand weedings at 20 and 40 DAS	15354	7218	3.82	35553	1.74
T_7 : Weedy check	10412	4301	42.81	15972	1.47
T_8 : Weed free	17227	7275	--	26173	1.45
SEm±	730	190.0	2.61	-	-
CD (p=0.05)	2213	576	7.92	-	-
CV (%)	8.9	5.3	5.3	-	-

Kernel yield, net returns and benefit cost ratio were lower compared tembotrione @ 100 g a.i ha^{-1} (T_1) due to expensive hand weeding.

CONCLUSION

On the basis of results obtained in the present experiment, it can be concluded that the application of Tembotrione @ 100 g a.i ha^{-1} (T1) was effective and economical in controlling weeds in rabi maize and is thus an effective alternative for manual weeding.

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