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EFFICACY OF POST-EMERGENCE HERBICIDES ON WEED CONTROL, PRODUCTIVITY AND ECONOMICS OF SUGARCANE

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ABSTRACT

A field experiment in sugarcane weed control was conducted from 2020-21 to 2022-23 in randomized block design with three replications in alluvial soils of Krishna – Godavari delta of Andhra Pradesh. Results revealed that, comparatively higher weed control efficiency was recorded with post-emergence application of tembotrione @ 125 g/ha + halosulfuran methyl @ 125 g/ha *fb* IC at 60 and 90 DAP. Significantly more cane yield was recorded with application of topramezone @ 40 g/ha + halosulfuron methyl @ 125 g/ha *fb* IC at 60 and 90 DAP (115.9 t/ha) which was however statistically at par with rest of the herbicide treatments. The quality parameters like sucrose %, CCS and purity % were not affected by the herbicide treatments. With regard to economics, higher gross returns (Rs. 3,43,296), net returns (Rs. 45,130/-) and B:C ratio (1.15) was recorded with topramezone @ 40 g/ha + halosulfuron methyl @ 125 g/ha *fb* IC at 60 and 90 DAP.

Keywords: Post emergence, Sugarcane, Weed management, Yield.

INTRODUCTION

Around 85 percent Sugarcane production of India comes from Uttar Pradesh, Maharashtra, Tamil Nadu, Andhra Pradesh, Karnataka and Gujarat (Takalkar and Pawar 2012). Sugarcane faces tough competition due to weeds during first 60 to 120 days of planting which causes heavy reduction in yield ranging from 40-67% (Shauhan and Srivastava 2002). Wide spacing of Sugarcane allows diverse weed flora to grow profusely in the interspaces between the rows. Frequent irrigations and heavy fertilizer application during early growth stages, increase the weeds problem by many folds in the crop (Ramesha *et al.* 2018). It is well known that cultural method of weed management is most effective to control weeds but timely availability of agricultural labourers is a limitation. Herbicidal control of weeds has been suggested to be economical in sugarcane (Chaudhari *et al.* 2016). The present experiment was undertaken to study the effect of weed control on growth and yield of sugarcane.

MATERIAL AND METHODS

The experiment was conducted from 2020-21 to 2022-23 at Sugarcane Research Station, Vuyyuru of Andhra Pradesh. Six treatments *viz*. metribuzine @ 0.75 kg/ha + 2,4-D amine salt @0.58 kg/ha *fb*inter cultivation (IC)

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Table 1. Weed density and weed dry matter as influenced by different herbicidal treatments in sugarcane (Pre spray at 20 DAP and Post spray at 40 DAP).

S. No	Treatment	Weed density (No./m^2)		Weed dry matter (g/m^2)	
		Pre spray	Post spray	Pre spray	Post spray
T_1	Weedy Check	13.68	12.21	86.2	63.1
T_2	Metribuzine @ 0.75 kg/ha + 2,4 D amine salt @ 0.58 kg/ha at 30 days fb IC at 60 and 90 DAP.	13.23	7.46	80.6	29.5
T_3	Topramezone @ 40 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	13.03	7.54	77.0	30.2
T_4	Tembotrione @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	12.79	6.93	75.8	23.2
T_5	Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	13.34	7.23	73.9	24.7
T_6	Topramezone @ 40 g/ha + Halosulfuran methyl @ 125 g /ha as post at 30 DAP fb IC at 60 and 90 DAP	13.54	4.63	78.0	15.4
T_7	Tembotrione @ 125 g/ha + Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	13.70	4.52	80.3	13.8
	CD at 5%	NS	0.7	NS	7.0
	CV %	7.5	5.6	10.4	9.6

at 60 and 90 DAP (T_2);topramezone @ 40g/ha as post at 30 DAP*fb* ICat 60 and 90 DAP (T_3);tembotrione @ 125 g/ha post at 30 DAP*fb* IC at 60 and 90 DAP (T_4); haloslfuron methyl @ 125 g/ha as post at 30 DAP *fb* IC at 60 and 90 DAP (T_5);topramezone @ 40 g/ha + halosulfuron methyl @125 g/ha as post at 30 DAP *fb* IC at 60 and 90 DAP (T_6); tembotrione @ 125 g/ha + halosulfuron methyl @ 125 g/ha as post at 30 DAP *fb* IC at 60 and 90 DAP (T_7) and weedy check (T_1) were tested under three replications in a randomized block design. All the chemicals were applied at 30 DAP of sugarcane with spray volume of 500 l/ha. Two inter cultivations at 60 and 90 DAP were uniform for all the treatments**.** The soils of experimental site comprised of alluvial soils of Krishna delta region with low available form of nitrogen, medium available phosphorus and high potassium. Single node seedlings of sugarcane variety 2003 V 46 were planted in the month of January. Irrigation was scheduled once in a week during formative phase and once in three weeks during maturity phase**.** Weed density was recorded as pre and post emergence weedicide application using quadrat of 1 m^2 from three randomly selected spots in each treatmental plot. Further, total

Table 2. Tiller/stalk population at different stages of sugarcane as influenced by different herbicides

S.No	Treatment	Number of tillers/stalks		
		90 DAP	180 DAP	240 DAP
T_1	Weedy Check	69027	65681	64949
T_2	Metribuzine @ 0.75 kg/ha + 2,4 D amine salt @ 0.58 kg/ha at 30 days fb IC at 60 and 90 DAP.	82862	80627	78069
T_3	Topramezone @ 40 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	89934	84970	82112
T_4	Tembotrione @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	89794	90064	85197
T_5	Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	87100	92842	85817
T_6	Topramezone @ 40 g/ha + Halosulfuran methyl @ 125 g /ha as post at 30 DAP fb IC at 60 and 90 DAP	90628	94491	88452
T_7	Tembotrione @ 125 g/ha + Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	90650	98704	91558
	CD at 5%	12547	13945	13521
	CV %	8.2	9.1	9.3

weeds biomass was recorded for calculating weed control efficiency (WCE). WCE was calculated by using the following formula

$$\text{Weed control efficiency (WCE)} = \frac{\text{DWC - DWT}}{\text{DWC}} \text{ X } 100$$

DWC= Dry weight of weeds in control plot
DWT= Dry weight of weeds in treatment plot

Similarly weed index is calculated by using the formula

$$\text{Weed Index (WI)} = \frac{\text{Yield in treatment plot- Yield in weed free plot}}{\text{Yield in weed free plot}} \text{ X } 100$$

Sugarcane cane yield was recorded plot wise and expressed as yield per hectare. The data of each year were analysed separately. OPSTAT was used for statistical analysis and means were separated using critical difference (CD) at p=0.05. The weed density and biomass values were transformed by square root transformation before being subjected to ANOVA (Gomez and Gomez 1984).

RESULTS AND DISCUSSION

Major weeds in experimental field were of sedges (*Cyperus rotundus*), grasses (*Echinochloa crusgalli*, *Digitaria sanguinalis* and *Dactyloctenium aegyptium*) and broad leaved weeds (*Trianthema portulacastrum*,

Table 3. Length, girth and yield of sugarcane as influenced by different herbicides.

S.No	Treatment	At Harvest		
		LMC (cm)	Girth (cm)	Cane yield (t/ha)
T_1	Weedy Check	256	2.66	79.23
T_2	Metribuzine @ 0.75 kg/ha + 2,4 D amine salt @ 0.58 kg/ha at 30 days fb IC at 60 and 90 DAP.	264	2.73	110.1
T_3	Topramezone @ 40 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	262	2.70	109.7
T_4	Tembotrione @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	261	2.78	112.0
T_5	Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	275	2.72	111.5
T_6	Topramezone @ 40 g/ha + Halosulfuran methyl @ 125 g /ha as post at 30 DAP fb IC at 60 and 90 DAP	266	2.65	115.9
T_7	Tembotrione @ 125 g/ha + Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	262	2.68	114.8
	CD at 5 %	NS	NS	18.6
	CV %	4.4	4.6	9.7

Phyllanthus niruri and *Ipomoea* sps). Post-emergence application of tembotrione @ 125 g/ha + halosulfuran methyl @ 125 g/ha *fb* IC at 60 and 90 DAP(T_7) recorded significantly low weed density (4.52m^{-2}) and weed dry matter (13.8 g/m^2), but it is statistically on par with topramezone @ 40 g/ha + halosulfuran methyl @ 125 g /ha at 30 DAP *fb* IC at 60 and 90 DAP in terms of reduced weed density (4.63) and weed dry matter (15.4 g/m^2) (Table 1).With regard to number of tillers/stalks, application of tembotrione @ 125 g/ha + halosulfuran methyl @ 125 g/ha as tank mix *fb* IC at 60 and 90 DAP (T_7) recorded significantly higher number of tillers/stalks per hectare at all the stages of crop growth i.e at 90, 180 and 240 days after planting which was however statistically at par with the number of tillers/ stalks recorded in all the weedicide treated plots(Table 2). Similar results were also obtained by Ramesha *et al*., 2018.

The non-significant difference among the treatments were noticed with regard to length and girth of harvested cane (Table 3). Significantly higher yield was recorded with application of topramezone @ 40 g/ha + halosulfuron methyl @ 125 g/ha *fb* IC at 60 and 90 DAP (T_6) (115.9 t/ha) which was however statistically at par with all the herbicide treatments.Singh *et al.* (2008 & 2012) stated that, on an average, presence of total weeds throughout the crop period caused 55.94% reduction in the cane yield.The quality parameters like sucrose %, CCS and purity %

Table 4. Juice quality of sugarcane as influenced by different herbicides.

S.No	Treatment	Juice quality parameters		
		Sucrose (%)	CCS (%)	Purity (%)
T_1	Weedy Check	19.8	14.3	97.5
T_2	Metribuzine @ 0.75 kg/ha + 2,4 D amine salt @ 0.58 kg/ha at 30 days fb IC at 60 and 90 DAP.	19.8	14.3	97.9
T_3	Topramezone @ 40 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	19.8	14.3	97.6
T_4	Tembotrione @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	19.8	14.4	98.1
T_5	Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	19.8	14.4	97.7
T_6	Topramezone @ 40 g/ha + Halosulfuran methyl @ 125 g /ha as post at 30 DAP fb IC at 60 and 90 DAP	19.8	14.3	98.0
T_7	Tembotrione @ 125 g/ha + Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	19.8	14.2	97.2
	CD at 5 %	NS	NS	NS
	CV %	1.1	1.3	2.8

Table 5.Weed parameters in sugarcane as influenced by different herbicides.

S.No	Treatment	Weed parameters	
		WCE (%)	Weed Index (%)
T_1	Weedy Check	—	33.2
T_2	Metribuzine @ 0.75 kg/ha + 2,4 D amine salt @ 0.58 kg/ha at 30 days fb IC at 60 and 90 DAP.	53.3	5.1
T_3	Topramezone @ 40 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	52.2	5.2
T_4	Tembotrione @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	63.2	4.0
T_5	Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	60.8	4.2
T_6	Topramezone @ 40 g/ha + Halosulfuran methyl @ 125 g /ha as post at 30 DAP fb IC at 60 and 90 DAP	75.5	—
T_7	Tembotrione @ 125 g/ha + Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	78.2	1.1

Table 6. Gross returns (Rs./ha) and cost of cultivation (Rs./ha) in sugarcane as influenced by different treatments.

S.No	Treatment	Economics(Rs./ha) B:C			
		Gross returns	Net returns	Cost of cultivation	Ratio
T_1	Weedy Check	2,34,679/-	-20,551/-	2,55,230/-	0.92
T_2	Metribuzine @ 0.75 kg/ha + 2,4 D amine salt @ 0.58 kg/ha at 30 days fb IC at 60 and 90 DAP.	3,26,116/-	37,286/-	2,88,830/-	1.13
T_3	Topramezone @ 40 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	3,24,931/-	37,131/-	2,87,800/-	1.13
T_4	Tembotrione @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	3,31,744/-	41,004/-	2,90,740/-	1.14
T_5	Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	3,30,263/-	37,597/-	2,92,666/-	1.13
T_6	Topramezone @ 40 g/ha + Halosulfuran methyl @ 125 g /ha as post at 30 DAP fb IC at 60 and 90 DAP	3,43,296/-	45,130/-	2,98,166/-	1.15
T_7	Tembotrione @ 125 g/ha + Halosulfuran methyl @ 125 g/ha as post at 30 DAP fb IC at 60 and 90 DAP	3,40,038/-	42,332/-	2,97,706/-	1.14

were not affected by the different herbicide treatments (Table 4). With regard to economics, higher gross returns (Rs. 3,43,296) and B:C ratio (1.15) was with topramezone @ 40 g/ha + halosulfuron methyl @ 125 g/ha *fb* IC at 60 and 90 DAP (T_6). Higher weed control efficiency in sugarcane was with post-emergence application of tembotrione @ 125 g/ha + halosulfuran methyl @ 125 g/ha *fb* IC at 60 and 90 DAP(T_7). Similar results of chemical control of weeds has been suggested to be economical in sugarcane by Chaudhari *et al.,* 2016.

CONCLUSION

Based on the above experimental results, for realizing higher weed control efficiency and benefit - cost ratio,post emergence application of tembotrione@ 125 g/ha (WCE of 78.245) and topramezone @ 40g/ha combined with halosulforon methyl @ 125 g/ha at 30 DAP followed by intercultivation at 60 and 90 days of planting is most suitable.

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