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RESEARCH ARTICLE :

Effect of chemical weed management on quality parameters, yield parameters and yield in sugarcane in western zones of Tamil Nadu

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SUMMARY : Field experiment was conducted from October 2011 to Feb. 2013 in sugarcane at Tamil Nadu Agricultural University, Coimbatore to find out the influence of chemical weed management on total weed density, weed control efficiency on yield attributes, yield and quality parameters in sugarcane. The experiments were laid out in a Randomized Block Design with three replications. The treatments included four doses of halosulfuron methyl (60, 90, 120, 180 g ha^{-1}) chlorimuron ethyl (24, 36, 48 and 72 g ha^{-1}) and halosulfuron methyl + chlorimuron ethyl (combi) (60, 90.120 and180 g ha^{-1}) compared with atrazine (2.0 k.g ha^{-1}) hand weeding and unweeded control. The results of the experiments showed that, post emergence application of combi at 120 and 180 g ha^{-1} and chlorimuron ethyl at 48 and 72 g ha^{-1} offered better weed control and resulted in increased plant growth and yield attributes which resulted in increased cane yield and didn't show any significant variation in quality parameters. This was comparable with recommended weed control methods of pre emergence application of atrazine at 2.0 kg ha^{-1} and hand weeding on 30 DAP.

KEY WORDS :
Halosulfuron methyl, Chlorimuron ethyl, Chemical weed management, Sugarcane

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BACKGROUND AND OBJECTIVES

Sugarcane (*Saccharum officinarum* L.) is the most important commercial crop cultivated widely in India since time immemorial. Sugarcane covers a total acreage of about 19 million hectares for a production of 1.3 billion tonnes of cane and 127 million tonnes of sugar. Today, India maintains the second position, next to Brazil in terms of production (Shrivastava *et al*., 2011). Among the various factors limiting cane production, weed infestation is one of the major biotic constraints in sugarcane production (Malik and Gurmani, 2005). Many sugarcane workers have reported that there is a wide yield gap between the actually harvested and estimated potential and the gap is estimated to be around 20.3 per cent (Nair, 2011). Slow germination at initial growth, wider spacing, heavy fertilization and frequent irrigations in sugarcane, weeds pose serious threat. The weeds germinate before the crop and become

good competitor for the sugarcane crop (Khan *et al*., 2004). Weed management through herbicides is also economical and can be adopted in a situation where scarcity of agricultural labour exists.

Energy shortage and to prevent loss of non-renewable costly inputs applied under intensive agriculture, weed management through chemicals will be of great help in crop production in the present context. Currently for sugarcane, the triazine group of herbicides like atrazine and metribuzine are being widely used for weed control. The herbicides belonging to this group like atrazine are effective against certain grasses and broad leaved weeds and not effective against sedges.

In this context, there is need to evaluate new formulation of herbicides which are effective against better control of weeds in sugarcane. Keeping these views in mind, field experiments were taken upto evaluate the new early post emergence herbicides halosulfuron methyl and chlorimuron ethyl and their combination (combi) along with atrazine herbicide for weed management in sugarcane.

RESOURCES AND METHODS

Field experiments were conducted in field No. 74 and NA5 of Eastern Block farm, Tamil Nadu Agricultural University, Coimbatore during main (Oct.-Nov.) season 2011 and late (April-May) season 2012. The soil of the experimental fields were of clay loam and sandy clay loam in texture, respectively during main and late seasons. The soil fertility status of the experimental site was low in available nitrogen (253 kg ha^{-1}), medium in available phosphorus (22.3kg ha^{-1}) and high in available potassium (688 kg ha^{-1}). The soil was alkaline in reaction and the pH is 9.13.

The treatments included were four doses of halosulfuron methyl (60, 90, 120 and 180 g ha^{-1}) (or) halosulfuron methyl (45, 67.5, 90 and 135.5 g a.i. ha^{-1}) chlorimuron ethyl (24, 36, 48 and 72 g ha^{-1}) (or) chlorimuron ethyl (6, 9, 12 and 18 g a.i. ha^{-1}) and halosulfuron methyl + chlorimuron ethyl (combi) (60, 90.120 and180 g ha^{-1}) (or) combi (45, 67.5, 90, 135.5 g a.i. ha^{-1}) compared with atrazine (2.0 k.g ha^{-1}) (or) atrazine (1.0 kg a.i. ha^{-1}) hand weeding on 30 DAP and unweeded control. The experiments were laid out in a Randomized Block Design (RBD) with three replications. Calculated quantity of early post emergence herbicides (T_1 to T_{12}) for the respective treatment plot was diluted in water at the rate of 750 lit ha^{-1} and sprayed with a knapsack sprayer fitted with fan type WFN 40 nozzle at 2- 3 leaf stage of weed, maintain optimum soil moisture in the field. Atrazine as pre emergence herbicide (T_{13}) was applied at 3 DAP. In hand weeding treatment (T_{14}) hand weeding was given at 30 DAP and followed by earthing up was done at 60 DAP. The unweeded control plots were kept undisturbed during the entire cropping period. All the treatments received partial earthing up at 60 DAP and following all recommended package of practices. For weeds, the original values were transformed using $\sqrt{(X+2)}$ transformation and statistically analysed (Snedecor and Cochran, 1967).

OBSERVATIONS AND ANALYSIS

The results obtained from the present study as well as discussions have been summarized under following heads:

Weed flora :

The weed flora of the experimental fields were grouped into grasses, sedges and broad leaved weeds. Major broad leaved weeds of the experimental fields were *Trianthema portulacastrum, Digera arvensis, Amaranthus viridis, Cleome gynandra, Partheneium hysterophorus* and *Datura fastuosa*. Predominant grassy weeds found in the experimental site were *Dactyloctenium aegyptium, Echinochloa colonum, Setaria verticillata* and *Dinebra retroflexa*. *Cyperus rotundus* was the only predominant sedge weed observed in the experimental fields.

Effect of herbicide on weed density and weed control efficiency :

All the weed control treatments significantly reduced the weed density. Total weed density was lower (34 and 30.3 m^{-2}) at 30 Days After Planting (DAP) in post emergence application of combi 180 g ha^{-1} in both the crops, respectively (Table 1). Like wise at 60 DAP also the total weed density was lower in combi at 180 g ha^{-1} and recorded the total weed density. These treatments were comparable with combi at 120 g ha^{-1} chlorimuron ethyl at 48 and 72 g ha^{-1}. The results of new herbicides were comparable with the existing herbicides like atrazine. Atrazine controls the broad leaved weeds effectively which recorded the total weed density of 40.0

and 48.7 m^{-2} at first and second crop at 30 DAP, respectively. Suryavanshi *et al*.(2012) reported that pre emergence application of Atrazine 2.0 kg ha^{-1} followed by 2,4-D 1.0 kg ha^{-1}at 45 days after ratoon initiation reduced the weed population results in highest cane yield (94.76 t ha^{-1}) over the control treatment. Lower doses of test herbicides recorded significantly higher weed density.

Analysis of weed control efficiency is important because it is directly correlated with yield. Weed control efficiency was higher in treatments *viz*., combi at 120 and 180 g ha^{-1} and chlorimuron ethyl at 48 and 72 g ha^{-1} and it was comparable with atrazine and hand weeding on 30 DAP (Table 1). This may be due to lower weed dry weight in combi and chlorimuron ethyl. During the early stage of the crop (30 DAP) pre emergence application of atrazine performed better. The total weed dry weight was lower in atrazine at 2.0 kg ha^{-1} because of its application time where as at later stages, it was comparable with the test herbicides. Thus the weed control efficiency was also higher with theses treatments.

Effect of herbicide on quality parameters :

The brix per cent, sucrose percentage, purity co-efficient and commercial cane sugar percentage of juice were estimated at the time of harvest. Weed management practices did not have any significant influence on the quality characters like brix percentage, sucrose percentage, purity co-efficient and commercial cane sugar percentage during both the year of study (Table 2). Sharma and Gupta (2010) reported that various weed control methods did not result in any significant difference in brix content, sucrose per cent, purity per cent, polarity per cent and commercial cane sugar per cent.

Effect of herbicide on yield parameters :

The yield parameters like cane length, cane girth, number of internodes and internode length were significantly influenced by the weed control treatments over unweeded control. Among the test herbicides, combi at 180 g ha^{-1} recorded the highest millable cane (000' ha), cane length (cm), number of internodes and internode length (cm) during both the crop periods (Table 3). This was on par with combi at 120 g ha^{-1} and higher doses of chlorimuron ethyl at 48 and 72 g ha^{-1}. This was also comparable with existing pre emergence herbicide like atrazine at 2.0 kg ha^{-1}. This was due to effective control of weeds which resulted in increased growth promoting attributes. There was no significant difference in cane girth among the treatments. The results are in

Table 1 : Effect of different weed control treatments on total weed density (No. m^{-2}) and weed control efficiency (%) in sugarcane

Treatments	Main season 2011				Late season 2012			
	Weed density		Weed control efficiency		Weed density		Weed control efficiency	
	30 DAP	60 DAP	30 DAP	60 DAP	30 DAP	60 DAP	30 DAP	60 DAP
T_1 - EPOE-Halo. 45 g a.i. ha^{-1}	10.65 (111.3)	12.57 (156.0)	31.73	31.37	10.52 (108.7)	12.57 (156.0)	32.25	32.85
T_2 – EPOE-Halo. 67.5 g a.i. ha^{-1}	9.64 (91.0)	11.83 (138.0)	43.73	39.14	9.66 (91.3)	11.80 (137.3)	42.66	40.74
T_3 - EPOE-Halo. 90 g a.i. ha^{-1}	8.90 (77.9)	11.39 (127.7)	48.81	43.18	9.00 (79.1)	11.31 (125.9)	46.52	45.02
T_4 - EPOE-Halo. 135.5 g a.i. ha^{-1}	8.49 (70.0)	10.92 (117.3)	52.78	48.08	8.44 (69.3)	11.01 (119.3)	51.09	48.72
T_5 - EPOE-Combi. 45 g a.i. ha^{-1}	9.87 (95.3)	11.72 (135.3)	44.64	41.21	9.78 (93.7)	11.56 (131.7)	44.92	40.89
T_6 - EPOE-Combi. 67.5 g a.i. ha^{-1}	8.08 (63.3)	10.23 (102.7)	62.09	55.10	7.91 (60.7)	10.33 (104.7)	62.74	55.82
T_7 - EPOE-Combi. 90 g a.i. ha^{-1}	6.73 (43.3)	9.37 (85.71)	74.09	62.63	6.63 (42.0)	9.48 (87.9)	74.10	62.03
T_8 - EPOE-Combi. 135.5 g a.i. ha^{-1}	6.00 (34.0)	8.87 (76.70)	79.91	66.73	5.67 (30.3)	8.83 (76.0)	81.72	67.36
T_9 - EPOE-Chlori. 6 g a.i. ha^{-1}	9.83 (94.7)	11.43 (128.7)	45.27	44.11	9.69 (91.9)	11.49 (130.0)	46.50	44.92
T_{10} - EPOE-Chlori. 9 g a.i. ha^{-1}	9.27 (84.0)	11.15 (122.2)	51.82	47.15	9.09 (80.7)	11.12 (121.6)	53.22	48.51
T_{11} - EPOE-Chlori. 12 g a.i. ha^{-1}	8.56 (71.3)	10.55 (109.3)	60.09	52.99	8.28 (66.7)	10.46 (107.3)	63.99	55.05
T_{12} - EPOE-Chlori. 18 g a.i. ha^{-1}	8.04 (62.7)	10.17 (101.3)	66.16	56.21	7.83 (59.3)	10.07 (99.3)	66.91	58.45
T_{13} - PE-Atrazine 1.0 kg a.i. ha^{-1}	6.48 (40.0)	8.94 (78.0)	79.36	67.46	7.11 (48.7)	8.91 (77.3)	76.35	68.53
T_{14} - HW on 30 DAP	13.04 (168.0)	8.41 (68.67)	0.000	70.91	12.94 (165.3)	8.87 (76.67)	0.18	68.52
T_{15} - Unweeded control	13.06 (168.7)	15.28 (231.5)	-	-	12.99 (166.7)	15.29 (231.9)	-	-
S.E. $\pm$	0.46	0.41	-	-	0.46	0.38	-	-
C.D. (P=0.05)	0.95	0.84	-	-	0.94	0.79	-	-

Figures in the parenthesis are original values

agreement with the findings of Singh *et al.* (2011).

Effect of herbicide on yield :

The highest individual cane weight and cane yield was recorded with combi at 120 and 180 g ha^{-1} and this was followed by atrazine at 2.0 kg ha^{-1}, hand weeding during both the seasons. Among the test herbicides, chlorimuron ethyl at 48 and 72 g ha^{-1} also recorded highest cane yield and individual cane weight (Table 4). This was due to effective control of weeds which resulted in good soil aeration. It enhanced the uptake of nutrients by crop coupled with growth characters and yield

Table 2 : Effect of different weed control treatments on quality parameters in sugarcane

Treatments	Main season 2011				Late season 2012			
	Brix (%)	Sucrose (%)	Purity (%)	CCS (%)	Brix (%)	Sucrose (%)	Purity (%)	CCS(%)
T_1 - EPOE-Halo. 45 g a.i. ha^{-1}	21.49	18.23	84.83	12.36	20.80	18.64	89.61	12.98
T_2 – EPOE-Halo. 67.5 g a.i. ha^{-1}	20.81	18.17	87.31	12.49	20.90	18.58	88.90	12.89
T_3 - EPOE-Halo. 90 g a.i. ha^{-1}	21.01	18.75	88.36	12.84	19.90	18.97	95.32	13.63
T_4 - EPOE-Halo. 135.5 g a.i. ha^{-1}	21.00	18.23	86.81	12.50	21.40	18.64	87.11	12.80
T_5 - EPOE-Combi. 45 g a.i. ha^{-1}	20.52	18.17	88.55	12.58	21.00	18.54	88.28	12.81
T_6 - EPOE-Combi. 67.5 g a.i. ha^{-1}	20.41	18.34	89.86	12.78	22.30	18.71	83.90	12.61
T_7 - EPOE-Combi. 90 g a.i. ha^{-1}	20.60	18.35	89.08	12.74	21.30	19.05	89.45	13.25
T_8 - EPOE-Combi. 135.5 g a.i. ha^{-1}	21.18	18.45	87.11	12.67	22.70	18.82	82.91	12.61
T_9 - EPOE-Chlori. 6 g a.i. ha^{-1}	20.30	18.23	89.80	12.70	19.80	18.65	94.19	13.28
T_{10} - EPOE-Chlori. 9 g a.i. ha^{-1}	20.79	18.65	89.71	12.99	21.40	19.07	89.11	13.24
T_{11} - EPOE-Chlori. 12 g a.i. ha^{-1}	19.84	18.7	94.25	12.80	20.40	19.12	93.73	13.58
T_{12} - EPOE-Chlori. 18 g a.i. ha^{-1}	21.60	18.23	84.40	12.84	19.70	18.65	94.67	13.31
T_{13} - PE-Atrazine 1.0 kg a.i. ha^{-1}	20.82	18.56	89.15	12.89	21.30	18.98	89.11	13.18
T_{14} - HW on 30 DAP	21.50	18.6	86.51	12.73	20.40	19.02	93.24	13.48
T_{15} - Unweeded control	21.79	18.3	83.98	12.34	19.80	18.72	94.55	13.35
S.E.±	1.15	1.01	4.82	0.69	1.15	0.89	4.13	0.61
C.D. (P=0.05)	NS	NS	NS	NS	NS	NS	NS	NS

NS=Non-signficant

Table 3 : Effect of different weed control treatments on yield parameters in sugarcane

Treatments	Main season 2011			Late season 2012		
	Millable cane (000 ha^{-1})	Cane length (cm)	No. of internodes	Millable cane (000 ha^{-1})	Cane length (cm)	No. of internodes
T_1 - EPOE-Halo. 45 g a.i. ha^{-1}	137.0	113.10	12.33	144.0	126.20	14.00
T_2 – EPOE-Halo. 67.5 g a.i. ha^{-1}	140.7	127.80	14.00	146.0	136.50	14.00
T_3 - EPOE-Halo. 90 g a.i. ha^{-1}	148.5	136.70	14.67	150.0	144.30	14.33
T_4 - EPOE-Halo. 135.5 g a.i. ha^{-1}	155.6	143.70	15.00	152.0	148.00	14.67
T_5 - EPOE-Combi. 45 g a.i. ha^{-1}	138.9	115.50	12.00	143.0	150.80	11.67
T_6 - EPOE-Combi. 67.5 g a.i. ha^{-1}	143.8	129.30	16.67	150.4	151.30	13.67
T_7 - EPOE-Combi. 90 g a.i. ha^{-1}	164.0	155.30	17.00	168.0	173.60	16.33
T_8 - EPOE-Combi. 135.5 g a.i. ha^{-1}	167.9	160.00	18.00	172.0	174.40	18.33
T_9 - EPOE-Chlori. 6 g a.i. ha^{-1}	136.6	126.00	14.00	145.7	154.60	13.67
T_{10} - EPOE-Chlori. 9 g a.i. ha^{-1}	151.9	138.40	14.67	148.0	155.50	14.00
T_{11} - EPOE-Chlori. 12 g a.i. ha^{-1}	154.3	158.30	15.33	165.7	163.40	16.33
T_{12} - EPOE-Chlori. 18 g a.i. ha^{-1}	157.0	155.20	17.33	170.6	169.30	17.00
T_{13} - PE-Atrazine 1.0 kg a.i. ha^{-1}	158.6	154.30	17.33	168.3	173.40	17.67
T_{14} - HW on 30 DAP	157.4	155.00	17.00	168.6	173.30	18.00
T_{15} - Unweeded control	116.0	96.00	9.00	124.7	120.20	13.67
S.E.±	8.122	7.73	1.32	8.46	9.16	1.17
C.D. (P=0.05)	16.63	15.84	2.71	17.33	18.76	2.39

Table 4 : Effect of different weed control treatments on cane and sugar yield in sugarcane

Treatments	Main season 2011			Late season 2012		
	Individual cane weight (kg)	Cane yield (t ha^{-1})	Sugar yield (t ha^{-1})	Individual cane weight (kg)	Cane yield (t ha^{-1})	Sugar yield (t ha^{-1})
T_1 - EPOE-Halo. 45 g a.i. ha^{-1}	0.833	96.78	11.96	1.183	107.60	13.97
T_2 – EPOE-Halo. 67.5 g a.i. ha^{-1}	1.050	98.15	12.26	1.400	109.00	14.05
T_3 - EPOE-Halo. 90 g a.i. ha^{-1}	1.073	99.92	12.83	1.423	110.80	14.26
T_4 - EPOE-Halo. 135.5 g a.i. ha^{-1}	1.167	101.74	12.72	1.517	112.60	14.75
T_5 - EPOE-Combi. 45 g a.i. ha^{-1}	1.200	96.95	12.19	1.428	107.80	13.69
T_6 - EPOE-Combi. 67.5 g a.i. ha^{-1}	1.367	98.38	12.58	1.617	109.20	13.77
T_7 - EPOE-Combi. 90 g a.i. ha^{-1}	1.423	119.14	15.18	1.773	130.00	17.22
T_8 - EPOE-Combi. 135.5 g a.i. ha^{-1}	1.600	120.09	15.22	1.850	130.60	17.78
T_9 - EPOE-Chlori. 6 g a.i. ha^{-1}	1.090	96.16	12.22	1.440	107.00	14.21
T_{10} - EPOE-Chlori. 9 g a.i. ha^{-1}	1.233	101.15	13.14	1.583	112.00	14.83
T_{11} - EPOE-Chlori. 12 g a.i. ha^{-1}	1.410	112.70	14.43	1.660	123.50	16.55
T_{12} - EPOE-Chlori. 18 g a.i. ha^{-1}	1.447	116.86	15.01	1.697	126.00	16.77
T_{13} - PE-Atrazine 1.0 kg a.i. ha^{-1}	1.467	116.13	14.97	1.817	128.40	16.92
T_{14} - HW on 30 DAP	1.473	120.00	15.28	1.823	128.70	17.35
T_{15} - Unweeded control	0.773	83.52	10.31	1.123	94.40	12.60
S.E. $\pm$	0.068	5.75	0.70	0.085	8.33	0.84
C.D. (P=0.05)	0.139	11.77	1.43	0.173	17.06	1.71

favouring attributes. Pre emergence application of atrazine provided effective control of weeds at the early stages so that it increased the yield of the crop. The same results were obtained by El-Shafai *et al.* (2010). Hand weeding and atrazine was on par with higher dose of test herbicides like combi at 120 and 180 g ha^{-1} and chlorimuron ethyl at 48 and 72 g ha^{-1}.

Conclusion :

It can be concluded that early post emergence application of combi at 120 and 180 g ha^{-1} provided better weed control and resulted in increased growth attributes, yield attributes and yield of sugarcane. This was comparable with chlorimuron ethyl at 48 and 72 g ha^{-1}. Herbicide treatments increased the yield significantly compared to unweeded control. These test herbicides were also comparable with recommended weed control methods like hand weeding and pre emergence application of atrazine at 2.0 kg ha^{-1}. Thus early post emergence application of halosulfuron methyl + chlorimuron ethyl (combi) at 90 g a.i. ha^{-1} found to be best alternate for pre emergence application of atrazine.

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REFERENCES

El-Shafai, A.M., Fakkar, A.O. and Bekheet, M.A. (2010). Effect of row spacing and some weed control treatments on growth, quality and yield of sugarcane. *Internat. J. Academic Res.*, **2** (4): 1-10.

Khan, B., Jama, M. and Azim, H. (2004). Effect of weeds on cane yield and sugar content of sugarcane. *Pakistan. J. Weed Sci. Res.*, **10**(1-2) : 47-50.

Malik, K.B. and Gurmani, M.H. (2005). Cane Production Guide Dewan Farooque Sugarcane Research Institute Dewan City, District Thatta, Sind Pakistan.

Nair, N.V. (2011). The Challenges and opportunities in sugarcane agriculture.S.V.Parthasarthi memorial lecture presented at the 9th joint convention of sugar technologists association of India and the sugarcane and sugar technologists association held on August 19-21,2010 in Chennai.

Sharma, S. and Gupta, D.K. (2010). Effect of integrated weed management practices on growth and yield of soybean (*Glycine max* L.) under agro-climatic situation Chhattisgarh. *Internat. J. Agric. Sci.*, **6** (2) : 463-466.

Shrivastava, A.K., Srivastava, A.K., Solomon, S., Sawnani, A., Shukla, S.P. (2011). Sugarcane cultivation and sugar industry in India: Historical perspectives. *Sugar Technol.*, **13**(4) : 266–274.

Singh,W., Singh, R.R., Malik, P. and Mehta, R. (2011). Effect of planting density and weed management options on weed dry

weight and cane yield of spaced transplanted sugarcane after wheat harvest in sub-tropical India. *Indian J. Weed Sci.*, **43** (1&2) : 97-100.

Snedecor, G.W. and Cochran, W.G. (1967). *Statistical methods.* Oxford and IBH Publ. Co., New Delhi: p.593.

Suryavanshi, M., Kadam, B.S., Veer, D.M., Kudtarkar, U.S., More, S.M. and Gaikawad, B.G. (2012). Influence of weed management practices on cane yield, quality and weed intensity of ratoon sugarcane. In : Bien. Conf. Indian Soc. Weed Sci. on Weed threat to agriculture, Biodiversity and environment held at Kerala 19-20, April 2012. P128.

Zafar, M., Tanveer, A., Cheema, Z.A. and Ashraf, M. (2010). weed-crop competition effects on growth and yield of sugarcane planted using two methods. *Pakistan. J. Bot.*, **42**(2): 815-823.