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EFFECT OF NEW GENERATION POST EMERGENCE HERBICIDE 2,4-D SODIUM SALT 95% SP ON YIELD, QUALITY, NUTRIENT UPTAKE AND ECONOMICS OF SUGARCANE

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Abstract: A field trial was carried out in Sebbakkam village, Veppur taluk, Cuddalore District in the year 2023-24. The experiment was laid out in randomized block design with seven treatments and three replications. The results have been found that all the weed control measure significantly influence yield, quality, nutrient uptake and economics of sugarcane in comparison to control. Among the various herbicidal treatments, application of 2, 4-D Sodium salt 95% SP @ 2990 g a.i. ha^{-1} (T3) on 20 DAP has recorded the higher yield, quality and nutrient uptake. This was on par with the application of 2, 4-D Sodium salt 95% SP @ 2600 g a.i. ha^{-1} (T2). The next best was application of 2, 4-D Sodium salt 95% SP @ 2210 g a.i. ha^{-1} (T1). Hence it can be concluded that application of 2, 4-D Sodium salt 95% SP @ 2990 g a.i. ha^{-1} (T3) holds immense potentiality to give higher yield of sugarcane.

Keywords: New generation herbicides, quality, yield, nutrient uptake and economics.

I. INTRODUCTION

Sugarcane (*Saccharum officinarum* L.) is an important commercial crop in India and holds a prominent position as a cash crop. In India, it is cultivated under a wide range of agro-ecological situations both in tropical and subtropical regions on area of about 5.15 m ha with annual production of 431.81 mt and productivity of 83.8 t ha^{-1} (Anonymous, 2022). Uttar Pradesh, Maharashtra, Karnataka, Tamil Nadu, Bihar and Andhra Pradesh are the leading states for the sugarcane production in India. Among the various factors limiting the cane production, weed infestation is one of the major biotic constraints. In tropical agriculture, weeds are the major threat in crop production which affects the yields considerably. Weeds are considered as a major biotic constraint for higher production and the critical period of crop weed competition has been recorded as 60- 120 days after planting (DAP) in spring cane and 150 DAP in autumn cane (Rohitashav *et al*., 2011). Hence, weed management is must during this period in order to achieve higher yield of the crop. The objective of conducting this experiment to compare the efficacy of herbicides applied at Pre-mergence, Postemergence, early post-emergence and 2-4 leaf stage of weed on sugarcane yield, quality and uptake of nutrient by the crop.

II. MATERIALS AND METHODS

The experiment was conducted at sebbakkam village, veppur taluk of cuddalore district during the year 2023-24. The soil of the experimental field is classified as sandy clay loam in texture. The crop season recorded a maximum temperature range from 28.2°C to 38.1°C with a mean of 32.79°C and the minimum temperature ranges from 16.8°C to 26.2°C with a mean of 22.23°C. The relative humidity ranges from 62 to 91 per cent with a mean of 74.9 per cent. The annual rainfall receive during the experiment period is 1474.3 mm and showers spread over 71 rainy days. The treatment comprised of 2, 4-D Sodium salt 95% SP @ 2210 g a.i. ha^{-1} (T1), 2, 4-D Sodium salt 95% SP @ 2600 g a.i. ha^{-1} (T2), 2, 4-D Sodium salt 95% SP @ 2990 g a.i. ha^{-1} (T3), Diuron 80% WP @ 3200 g a.i. ha^{-1} (T4), Metsulfuron methyl 20% WP @ 6 g a.i. ha^{-1} (T5), Hand Weeding on 30, 60 and 90 DAP(T6) and Untreated control (T7). The experiment comprised of seven treatments laid out in randomized complete block design replicated thrice. For this study, double budded setts of sugarcane variety Co-86032 were planted at 90 cm row spacing and 20 cm plant to plant spacing using sett rate of 75000 two-budded setts ha^{-1}. The post-emergence herbicide viz., 2, 4, D - Na salt, Diuron and Metsulfuron methyl were sprayed on the twenty days after planting. The herbicides were sprayed using knapsack sprayer fitted with flat fan nozzle.

The quality parameters and sugar yield are calculated as the methods given below

2.1 Total Soluble Solids (TSS)

The total solids (Brix %) were recorded from the juice by using Brix hydrometer and corrected readings were worked out by noting the room temperature at the time of observation with the help of bar standards and expressed in percentage (Meade and Chen, 1977).

2.2 Sucrose content (Pol value)

The sucrose per cent of juice was estimated by Hornes lead acetate clarification method by using polariscope (Meade and Chen, 1977).

2.3 Purity coefficient

The purity coefficient of juice was worked out from the total solids (Brix) and sucrose percentage with the following formula

$$\text{Purity coefficient (\%)} = \frac{\text{Sucrose (\%)}}{\text{Brix (\%)}} \times 100$$

2.4 Commercial cane sugar percentage (CCS %)

Commercial cane sugar percentage is the amount of white sugar commercially attainable from the unit weight of cane. It was worked out by using the formula as reported by Meade and Chen, (1977).

$$\text{CCS (\%)} = 1.022\ S - 0.292\ B$$

Where,

S - Sucrose percentage of juice and

B - Brix percentage of juice.

2.5 Sugar yield

The yield of sugar was calculated based on CCS per cent and cane yield and expressed in t ha^{-1} by using the formula.

$$\text{Sugar yield (t ha}^{-1}\text{)} = \frac{\text{CCS (\%)} \times \text{Cane yield (t ha}^{-1}\text{)}}{100}$$

III. Results and Discussion

3.1 Effect on cane and sugar yield

The data presented in table no.1 showed that among the various herbicide treatments, post-emergence application of 2,4-D Sodium salt 95% SP @ 2990 g a.i. ha^{-1} on 20 DAP (T3) significantly registered highest cane yield of 195.37 t ha^{-1} which was 104.4 per cent increased over control. Similarly, this treatment (T3) registered highest sugar yield of 24.74 t ha^{-1} which was 107.5 per cent increased over control and this was on par with 2,4-D Sodium salt 95% SP @ 2600 g a.i. ha^{-1} on 20 DAP (T2). The reduced weed population, weed dry matter and lesser nutrient removal by weeds which eliminated the deleterious effect of weeds on sugarcane and helped in increasing cane length, cane girth, number of internodes, number of millable cane and individual cane weight which ultimately increase the cane yield of sugarcane. This confirmed the finding of Lal *et al*. (2006) and Abdelhalim (2018). The sugar yield is a function of cane yield and CCS per cent and hence trend was similar as in cane yield. The increase in sugar yield was mainly due to higher cane yield recorded and CCS per cent. The results are in accordance with the findings of Tomar *et al*. (2003) and Yadav (2018). The lowest cane and sugar yield was recorded in unweeded control.

3.2 Effect on quality of sugarcane

The data presented in table no.1 revealed that the weed control methods had no significant influence on the quality Characters viz., brix, pol, purity and CCS per cent. This implies that the quality characters do not have any significant effect due to weed infestation. Similar findings were reported by Cheema *et al*. (2010)

3.3 Effect on nutrient uptake by cane

The data presented in table no.2 reported that the among the various weed control treatments, application of 2,4-D Sodium salt 95% SP @ 2990 g a.i. ha^{-1} on 20 DAP (T3) recorded higher nutrient uptake by sugarcane and this was on par with 2,4-D Sodium salt 95% SP @ 2600 g a.i. ha^{-1} on 20 DAP (T2). Increase availability of N, P and K under these treatments as a result of suppression of weeds growth might have been the driving force behind higher dry matter production and nutrient uptake in sugarcane. Similar result has also been reported by Choudhary (2015).

3.4 Effect of weed control treatments on economics of sugarcane

The data presented in table no.2 showed that the application of post-emergence herbicide 2,4-D Sodium salt 95% SP @ 2990 g a.i. ha^{-1} on 20 DAP (T3) recorded higher gross income of Rs. 5,95,879 ha^{-1} which was 104.4 per cent increased over control. This was followed by 2,4-D Sodium salt 95% SP @ 2600 g a.i. ha^{-1} on 20 DAP (T2) and recorded the gross income of Rs. 5,94,171 ha^{-1}. This might be due to lesser cost of cultivation and also the effective weed management practices which reduced the weed density, dry weight and nutrient removal by weeds and positively enhanced the growth attributes, yield parameters and yield of sugarcane. The least net income and benefit cost ratio was optained in control due to lesser cane yield. The similar findings reported by Kadam *et al*. (2011) and Abdelhalim (2018).

Table 1: Effect of weed control treatments on quality, cane and sugar yield (t ha^{-1}) of sugarcane

Treatments	Brix (%)	Sucrose (%)	Purity (%)	CCS (%)	Cane yield (t ha^{-1})	Sugar yield (t ha^{-1})
T1 - 2, 4-D Sodium salt 95% SP @ 2210 g a.i. ha^{-1} on 20 DAP	20.47	18.23	89.06	12.65	185.15	23.43
T2 - 2, 4-D Sodium salt 95% SP @ 2600 g a.i. ha^{-1} on 20 DAP	20.72	18.27	88.18	12.62	194.81	24.59
T3 - 2, 4-D Sodium salt 95% SP @ 2990 g a.i. ha^{-1} on 20 DAP	20.79	18.33	88.17	12.66	195.37	24.74
T4 - Diuron 80% WP @ 3200 g a.i. ha^{-1} on 20 DAP	20.77	18.29	88.06	12.63	165.27	20.87
T5 - Metsulfuron methyl 20% WP @ 6 g a.i. ha^{-1} on 20 DAP	20.63	18.25	88.46	12.63	168.76	21.31
T6 - Hand Weeding on 30, 60 and 90 DAP	21.11	18.27	86.55	12.51	179.63	22.47
T7 - Untreated control	20.81	18.15	87.22	12.47	95.54	11.92
S.Em+	1.13	1.01	4.84	0.75	2.25	0.44
CD (P = 0.05)	NS	NS	NS	NS	4.57	0.85

Table 2: Effect of different herbicide on nutrient uptake by cane (kg ha^{-1}) and economics of sugarcane

Treatments	N	P2O5	K2O	Cost of cultivation (Rs. ha^{-1})	Gross income (Rs. ha^{-1})	Net income (Rs. ha^{-1})	BCR
T1 - 2, 4-D Sodium salt 95% SP @ 2210 g a.i. ha^{-1} on 20 DAP	259.17	29.49	208.61	1,69,137	5,64,708	3,95,571	3.34
T2 - 2, 4-D Sodium salt 95% SP @ 2600 g a.i. ha^{-1} on 20 DAP	267.58	31.78	217.19	1,72,484	5,94,171	4,21,687	3.44
T3 - 2, 4-D Sodium salt 95% SP @ 2990 g a.i. ha^{-1} on 20 DAP	271.33	32.31	223.48	1,76,184	5,95,879	4,19,695	3.38
T4 - Diuron 80% WP @ 3200 g a.i. ha^{-1} on 20 DAP	241.42	23.44	188.63	1,63,508	5,04,074	3,40,566	3.08
T5 - Metsulfuron methyl 20% WP @ 6 g a.i. ha^{-1} on 20 DAP	244.61	24.89	193.17	1,64,976	5,14,718	3,49,742	3.12
T6 - Hand Weeding on 30, 60 and 90 DAP	256.27	28.61	205.71	1,86,685	5,47,872	3,61,187	2.93
T7 - Untreated control	211.07	19.17	138.32	1,35,782	2,91,397	1,55,615	2.15
S.Em+	2.54	0.48	3.66	-	-	-	-
CD (P = 0.05)	5.17	0.92	7.36	-	-	-	-

IV. Conclusion

Based on the result of field experiment, it can be concluded that post-emergence application of 2,4-D Sodium salt 95% SP @ 2990 g a.i. ha^{-1} on 20 DAP (T3) holds immense weed management practice to give higher nutrient uptake, cane and sugar yield of sugarcane.

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