



Research Article

INTEGRATED WEED MANAGEMENT IN SUGARCANE RATOON CROP

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Abstract- A field experiment was conducted on ratoon crop of sugarcane to develop suitable weed management practices during spring seasons of 2005 to 2009 at Central Sugarcane Research Station, Padegaon, Tal. Phaltan, Dist. Satara, Maharashtra, India. A total of ten treatments including weedy check were tested in randomized block design with three replication. Trash mulching between all rows with recommended practice applied in the ratoon recorded significantly the highest cane (98.00 t/ha) and CCS yield (15.50 t/ha). However, it was found at par with application of trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation, (95.28 t/ha) and in treatment of three hoeings (1st week, 4th week and 7th week after ratoon initiation), (93.99 t/ha) with respect to cane yield. Significantly higher net monetary returns (₹69719 /ha) were obtained in application of trash mulching between all rows with recommended practice which was followed by trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation (₹65841 /ha) and three hoeings (1st week, 4th week and 7th week after ratoon initiation) (₹63614 /ha).

Keywords- Cane yield, Economics, Growth, Ratoon, Sugarcane, Weed density, Integrated Weed Management.

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Introduction

Weeds compete for moisture, nutrients, space and light during growing period of ratoon crop, which reduces the yield. Ratoon play important role in sustainable sugarcane production and for profitable ratoon crop, weed management is one of the most important responsible factors of production. In sugarcane cultivation ratooning is an important aspect owing to its low cost of production when compared to plant crop as it saves the cost of field and planting operations and seed material. In India ratoon crop is more economical when it is managed with proper technology also it occupied more than 50 per cent of total sugarcane acreage. Weed control prior to crop canopy spread is critical. Cost-effectiveness of sugarcane production system in India largely depends on ratoon grown after a sugarcane plant crop and ratoon yield. A ratoon crop proves to be more profitable owing to substantially as lower cost of cultivation compared to that of plant crop. A well managed sugarcane ratoon crop is supposed to be as productive as plant crop of sugarcane. This, however, is rarely achieved. A gradual decline in the yield of ratoon is often witnessed mainly due to the lack of primary till age practice causing perpetuation and heavy build up of weeds [5] leading to poor average productivity of ratoon (45 t/ha) as compared to the productivity of sugarcane plant crop (79 t/ha) in the country [4]. Since losses due to weed depend on the density and type of weeds present in the field and changes that occur in the composition of weed flora due to the factors like tillage [7]. In weed management practices and cropping system [1], detailed studies are required in this aspect. Therefore, the present study was carried out to assess the effect of weed management involving cultural, mechanical and chemical methods on weeds, ratoon yield and on population dynamics of weeds.

Materials and Methods

The field experiment was conducted during 2005-09 involving three ratooning of sugarcane plant crop-ratoon at Central Sugarcane Research Station, Padegaon, Maharashtra. The experiment was conducted in randomized block design with

three replication wherein 10 treatments viz., T₁ (weedy check), T₂ (three hoeings each at 1st, 4th and 7th weekday after ratoon initiation DARI), T₃-Atrazine@ 2 kg a. i./ha (PE) + 2,4-D 1 kg a. i./ha at 45 days after ratoon initiation (DARI), T₄-Atrazine@ 2 kg a. i./ha (PE)+1 hoeing at 45 DARI, T₅-Metribuzin @ 1 kg a. i./ha (PE)+2, 4-D 1 kg a. i./ha at 45 DARI, T₆-Metribuzin @ 1 kg a. i./ha (PE)+1 hoeing at 45 DARI, T₇-Glyphosate @0.4 kg a. i./ha at 3-week stage as directed spray, T₈-Glyphosate@ 0.4 kg a. i./ha at 3-week stage as directed spray+1 hoeing at 60 DARI, T₉-Trash mulching in alternate rows+hoeing at 1 and 6 weeks after ratoon initiation and T₁₀-Trash mulching between all rows were applied in ratoon crop. The fertilizers were applied by crow bar and additional 80 kg N, 100 kg P₂O₅ and 10 kg decomposing culture were applied as recommended practice by this research station. In plant crop recommended package of practices were followed and weeds were managed through mechanical hoeing. Mid late maturing sugarcane (Co 86032) was planted in 75 cm row in the first week of February for three consecutive ratooning. The sugarcane plant crop was supplied with recommended dose of NPK (250: 115: 115 kg /ha). The data on dry matter of weed were collected from an area of 1 m² quadrat in plot at 15 and 45 DARI and were used for working out weed control efficiency and indices for abundance. The population of millable cane, cane length and cane yield were recorded at the time of harvest of ratoon crop in January, for all three consecutive ratoons, variances were subjected to Bartlett's test for homogeneity of variances. As variances were found to be homogenous, pooled data for three consecutive years for ratoon crops were presented.

Results and Discussion

Weed dynamics:

The pooled data regarding weed intensity (/m²), dry weight of weeds (g/m²) and weed control efficiency (%) are presented in [Table-1]. The pooled data revealed that at 30 DAR, treatment of trash mulching between all rows with recommended

practice recorded significantly lower weed count (15.67 /m²), dry weight (10g/m²) and maximum weed control efficiency (77.53 %) and was found at par with trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation (16.33 / m², 12g /m² and 73.19 %, respectively) and the treatment where in pre emergence application of Atrazine, Metribuzin at 45 DAR and post emergence application of Glyphosate at 3 week stage as directed spray.

At 60 DARI, trash mulching between all rows with recommended practice recorded significantly lower weed count (17/ m²), dry weight (13g /m²) and maximum weed control efficiency (69.44 %) and it was found comparable with trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation (20.33/m², 15 g /m² and 64.45 %, respectively), pre emergence application of herbicides followed by one hoeing at 45 DARI and three hoeing treatment.

Table-1 Effect of weed management treatments on weed intensity weed dry weight and weed control efficiency in sugarcane ratoon. (Pooled mean)

Treatments	Weed intensity(m ²)				Weed dry wt. (g/m ²)				Weed Control Efficiency (%)			
	30 DAP	60 DAP	90 DAP	120 DAP	30 DAP	60 DAP	90 DAP	120 DAP	30 DAP	60 DAP	90 DAP	120 DAP
T ₁ - Weedy Check	58.67 (7.69)	59.33 (7.75)	68.00 (8.30)	71.00 (8.45)	46.00 (6.84)	42.00 (6.53)	61.00 (7.85)	69.00 (8.33)	--	--	--	--
T ₂ - Three hoeings (1 st , 4 th and 7 th week after ratoon initiation)	29.67 (5.52)	24.00 (4.98)	36.00 (6.04)	37.00 (6.12)	15.00 (3.97)	18.00 (4.29)	32.00 (5.72)	39.00 (6.31)	66.71	59.45	47.15	44.64
T ₃ - Atrazine 2.0 kg a.i./ha PE + 2, 4-D 1.0 kg a.i./ha at 45 days after ratoon initiation (DARI)	24.67 (5.06)	27.67 (5.35)	41.00 (6.47)	43.00 (6.59)	16.00 (4.10)	19.00 (4.40)	35.00 (5.97)	44.00 (6.64)	66.25	57.85	41.45	37.72
T ₄ - Atrazine 2.0 kg a.i./ha PE + one hoeing at 45 DARI	22.00 (4.79)	20.67 (4.65)	40.00 (6.36)	41.00 (6.41)	16.00 (4.11)	18.00 (4.30)	37.00 (6.13)	42.00 (6.45)	64.38	60.52	40.73	39.13
T ₅ - Metribuzin 1.0 kg a.i./ha PE + 2.4-D 1.0 kg a.i./ha at 45 DARI	22.00 (4.80)	24.67 (5.06)	35.00 (5.98)	38.00 (6.21)	16.00 (4.11)	17.00 (4.18)	37.00 (6.13)	41.00 (6.44)	65.95	62.94	47.81	41.14
T ₆ - Metribuzin 1.0 kg a.i./ha PE + one hoeing at 45 DARI	23.33 (4.91)	22.33 (4.82)	36.00 (6.07)	37.00 (6.15)	14.00 (3.81)	16.00 (4.09)	37.00 (6.12)	41.00 (6.45)	68.79	62.35	48.63	45.42
T ₇ - Glyphosate -41@ 0.4 kg a.i./ha at 3 weeks stage as directed spray + 2, 4-D 1kg a.i./ha at 60 DARI	20.33 (4.61)	26.00 (5.16)	35.00 (5.97)	41.00 (6.44)	16.00 (4.10)	22.00 (4.74)	31.00 (5.63)	41.00 (6.46)	64.69	50.49	37.85	40.02
T ₈ - Glyphosate- 41 @ 0.4 kg a.i./ha at 3 weeks stage as directed spray + one hoeing at 60 DARI	25.67 (5.16)	25.33 (5.11)	36.00 (6.05)	44.00 (6.69)	18.00 (4.31)	24.00 (4.94)	32.00 (5.70)	44.00 (6.65)	61.01	47.95	37.87	36.13
T ₉ - Trash mulching in alternate rows + hoeings at 1 and 6 week after ratoon initiation	16.33 (4.16)	20.33 (4.58)	33.00 (5.81)	35.00 (5.96)	12.00 (3.56)	15.00 (3.99)	29.00 (5.41)	36.00 (6.04)	73.19	64.45	50.46	47.94
T ₁₀ -Trash mulching between all rows with recommended practice	15.67 (4.02)	17.00 (4.21)	28.00 (5.33)	29.00 (5.47)	10.00 (3.30)	13.00 (3.73)	26.00 (5.10)	30.00 (5.53)	77.53	69.14	50.72	54.62
SE	0.32	0.32	0.24	0.50	0.37	0.48	0.27	0.30				
CD at 5%	0.95	0.95	0.72	1.48	1.09	1.44	0.80	0.91				

At 90 DARI, trash mulching between all rows with recommended practice also recorded lower weed count (28 /m²), dry weight (26 g /m²) and maximum weed control efficiency (50.72 %) while it was found at par with trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation (33 /m², 29 g /m² and 50.46 %, respectively), three hoeing treatment and application of Glyphosate followed by 2, 4-D spray or hoeing at 60 DARI.

At 120 DARI, trash mulching between all rows with recommended practice also recorded lower weed count (29/m²), dry weight (30g /m²), and maximum Weed control efficiency (54.62 %) and it was at par with trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation (35 /m², 36 g /m² and 47.94 %, respectively) and three hoeing. This results confirms the findings of Srivastava and Chauhan (2006) and Pramod (2012) [2,6]. The reduction weed intensity and weed dry weight at 30 and 60 DARI might be due to trash mulching and application of pre-emergence spray of herbicides followed by one hoeing at 45 DARI.

During later stages keeping trash mulch and three hoeing and also hoeing at 60 DARI suppress the weed intensity as compared to other treatments. These results are in conformity with those reported by [3].

Effect of weed management methods on growth, yield and quality of sugarcane

Pooled data regarding growth, yield and quality attributes are presented in [Table-2]. The pooled data revealed that treatment of trash mulching between all rows with recommended practice recorded significantly higher stool count (49883 /ha), millable height (218 cm) and girth (8.08 cm) while it was at par with treatment of trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation (48835 /ha, 211 cm and 7.88 cm, respectively) and three hoeings (1st week. 4th

week and 7th week after ratoon initiation) (47778 /ha, 211 cm and 7.8 cm respectively). While same treatment of trash mulching between all rows with recommended practice recorded significantly higher internodes per cane (21) than other treatments. The treatment of trash mulching between all rows with recommended practice also recorded significantly higher millable cane (90390 /ha) and weight per cane (1.09 kg). However, it was at par with trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation (89510 /ha and 1.06 kg, respectively), three hoeings (1st week. 4th week and 7th week after ratoon initiation) (87510 /ha and 1.06 kg, respectively) and Metribuzin 1.0 kg a. i/ha PE spray + one hoeing at 45 DARI. (86680 /ha and 1.05 kg, respectively). Significantly the highest cane (98.00 t/ha) and CCS yield (15.50 t/ha) were recorded in treatment of trash mulching between all rows with recommended practice. However, the cane yield obtained in treatment of trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation, (95.28 t/ha) and in treatment of three hoeings (1st week, 4th week and 7th week after ratoon initiation), (93.99 t/ha) were at par with treatment of trash mulching between all rows with recommended practice. Increase in cane and CCS yield might be due to higher weed control efficiency with higher cane height, cane girth, number of internodes and millable cane and average cane height. The juice quality parameters revealed that trash mulching between all rows with recommended practice recorded significantly higher CCS (14.76 %). However, it was at par with trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation (14.58 %), three hoeings (1st week. 4th week and 7th week after ratoon initiation) (14.38 %), Metribuzin 1.0 kg a.i./ha PE spray + 2.4 - D 1.0 kg a.i./ha at 45 DARI (14.32 %), Metribuzin 1.0 kg a.i./ha PE spray + one hoeing at 45 DARI.(14.25 %) and atrazine 2.0 kg a.i./ha PE spray + 2, 4-D 1.0 kg a.i./ha at 45 days after ratoon initiation (DARI) (14.20 %). [2,3] also reported similar findings.

Economics:

Pooled economic aspects as influenced by various weed management methods are presented in [Table-3]. Significantly the higher gross monetary returns (₹ 107831 /ha) and net monetary returns (₹ 69719 /ha) B:C ratio (2.69) were obtained in treatment of trash mulching between all rows with recommended

practice followed by application of trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation (₹ 104850 /ha, ₹ 65841 /ha and 2.69, respectively) and three hoeings (1st week, 4th week and 7th week after ratoon initiation) (₹ 103435 /ha, ₹ 63614 /ha and 2.60 respectively). [2] also reported similar findings.

Table-2 Effect of weed management treatments on growth, yield and quality in sugarcane ratoon (Pooled mean)

Treatments	Stool count (/ha)	Height (cm)	Girth (cm)	No. of Internodes	Millable canes (000 ha)	Wt./ cane (kg)	Cane yield (t/ha)	CCS yield (t/ha)	CCS (%)
T ₁ - WeedyCheck	41176	192	6.95	18	75.75	0.87	66.64	9.08	13.64
T ₂ - Three hoeings (1 st , 4 th and 7 th week after ratoon initiation)	47778	211	7.86	19	87.51	1.06	93.99	13.51	14.38
T ₃ - Atrazine 2.0 kg a.i./ha PE + 2, 4-D 1.0 kg a.i./ha at 45 days after ratoon initiation (DARI)	44742	201	7.32	19	80.29	0.95	76.94	11.17	14.20
T ₄ - Atrazine 2.0 kg a.i./ha PE + one hoeing at 45 DARI	45000	202	7.31	19	82.05	1.01	82.94	11.45	13.82
T ₅ - Metribuzin 1.0 kg a.i./ha PE + 2,4-D 1.0 kg a.i./ha at 45 DARI	46050	207	7.75	19	83.35	1.03	87.76	12.56	14.32
T ₆ - Metribuzin 1.0 kg a.i./ha PE + one hoeing at 45 DARI	45548	210	7.71	19	86.68	1.05	91.56	13.05	14.25
T ₇ - Glyphosate-41@ 0.4 kg a.i./ha at 3 weeks stage as directed spray + 2, 4-D 1kg a.i./ha at 60 DARI	45261	199	7.45	19	82.20	0.99	81.67	11.52	14.14
T ₈ - Glyphosate- 41 @ 0.4 kg a.i./ha at 3 weeks stage as directed spray + one hoeing at 60 DARI	45108	199	7.37	18	80.47	0.98	79.16	11.07	14.02
T ₉ - Trash mulching in alternate rows + hoeings at 1 and 6 week after ratoon initiation	48835	211	7.88	20	89.51	1.06	95.28	13.87	14.58
T ₁₀ -Trash mulching between all rows with recommended practice	49883	218	8.08	21	90.39	1.09	98.00	15.50	14.76
SE ±	912.06	3.53	0.15	0.30	1.40	0.014	1.68	0.40	0.21
C.D at . 5%	2709	10.47	0.44	0.88	4.14	0.042	4.99	1.20	0.61

Table-3 Effect of weed management treatments on economics in sugarcane ratoon (Pooled)

Treatment	Cane yield (t/ha)	Gross monetary returns (Rs/ha)	Cost of cultivation (Rs/ha)	Net profit (Rs/ha)	B:C ratio
T ₁ - WeedyCheck	66.64	73425	35930	37495	2.04
T ₂ - Three hoeings (1 st , 4 th and 7 th week after ratoon initiation)	93.99	103435	39821	63614	2.60
T ₃ - Atrazine 2.0 kg a.i./ha PE + 2, 4-D 1.0 kg a.i./ha at 45 days after ratoon initiation (DARI)	76.94	84762	39007	45755	2.17
T ₄ - Atrazine 2.0 kg a.i./ha PE + one hoeing at 45 DARI	82.94	91305	39437	51868	2.31
T ₅ - Metribuzin 1.0 kg a.i./ha PE+2,4-D 1.0 kg/ha at 45 DARI	87.76	96608	40175	56434	2.40
T ₆ - Metribuzin 1.0 kg a.i./ha PE + one hoeing at 45 DARI	91.56	101030	40349	60681	2.50
T ₇ - Glyphosate @ 0.4 kg a.i./ha at 3 weeks stage as directed spray + 2, 4-D 1.0 kg a.i./ha at 60 DARI	81.67	89932	37525	52407	2.40
T ₈ - Glyphosate @ 0.4 kg a.i./ha at 3 weeks stage as directed spray + one hoeing at 60 DARI	79.16	87827	38417	49409	2.29
T ₉ - Trash mulching in alternate rows + hoeings at 1 and 6 week after ratoon initiation	95.28	104850	39009	65841	2.69
T ₁₀ -Trash mulching between all rows with recommended practice	98.00	107831	38112	69719	2.83
SE ±	1.68	-	-	-	-
C.D at . 5%	4.99	-	-	-	-

Conclusion

Trash mulching between all rows with recommended practice applied in the ratoon recorded significantly the highest cane (98.00 t/ha) and CCS yield (15.50 t/ha). However, it was found at par with application of trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation, (95.28 t/ha) and in treatment of three hoeings (1st week, 4th week and 7th week after ratoon initiation), (93.99 t/ha) with respect to cane yield. Significantly higher net monetary returns (₹ 69719 /ha) were obtained in application of trash mulching between all rows with recommended practice which was followed by trash mulching in alternate rows + hoeings at 1st and 6th week after ratoon initiation (₹ 65841 /ha) and three hoeings (1st week, 4th week and 7th week after ratoon initiation) (₹ 63614 /ha).

Future Perspective:

As this is three year, study needs to be tested on different location to assess the weed management practices found better in this experiment.

Conflict of Interest: None declared**References**

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