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Study to Evolve Technology for Controlling Binding Weeds in Grown-up Sugarcane Crop

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ABSTRACT

Field investigations were carried out at Sugarcane Research Station, Cuddalore Tamil Nadu Agricultural University, to evolve technology for controlling binding weeds in grown-up sugarcane crops during 2015-18. The experiments were laid out in Randomized Block Design with three replications and the sugarcane variety tested wasCoC(SC)24. The treatments constituted of T_1 – PE. atrazine @ 1.0 kg/ha and Po.Emetribuzin 0.75 kg/ha @ 60 DAP, T_2 - PE atrazine 1.0 kg/ha and Po.E 2,4D Na salt 1.25kg/ha @ 60 DAP, T_3 – P.E atrazine 1.0 kg/ha followed by weeding and earthing up on 75 DAP, T_4 – Mechanical weeding by power tiller (45, 90 and 120 DAP), T_5 – Intercropping of sun hemp and its incorporation as insitu on 60 DAP, T_6 – Detrashing and mulching at 150th&210th DAP, and T_7 – hand weeding and manual removal of weeds on 45, 90 and 120th days and T_8 – Control. Based on the performance of herbicides, the Pre-emergence application of atrazine @ 1.0 kg a.i/ha followed by post-emergence application of metribuzin @ 0.75 kg/ha on 60 days after planting was the best treatment for controlling weeds in grown-up sugarcane and also the yield attributes increased in sugarcane compared to control. The critical period of weed crop competition in sugarcane ranged between 27 and 50 days (Srivastava et al., 2003). Sugar yield as well as juice quality greatly affected by the application of weed control treatments. The presence of weeds in the sugarcane fields and no control has also led to a decrease in sugar yield (Roshan et al., 2006.; Patel et al., 2007; Kanchan, 2009) in proportion of sucrose , purity and brix (Bahadar et al. , 2004 ; Annual Report, 2012) . Generally, the increase in by weed growth one kilogram corresponds to a reduction in one kilogram of the crop. The reduction in cane yield due to weeds ranged from 40-60% (Kadam et al., 2011).

Keywords: *Technology for control binding weeds -grown-up sugarcane*

INTRODUCTION

Sugarcane is one of the important cash crops of India and is cultivated in different Agro-Climatic zones. In Tamil Nadu, sugarcane is cultivated in an area of 2.0 lakh hectares with average productivity of 100 tonnes per hectare. The increased productivity in India is only due to favorable climatic conditions of tropical and management practices that India adopted by the growers, guided by the well-structured cane department of the sugar industry. Still, there is a hope to increase productivity by eliminating the yield-reducing factors. Sugarcane yield is severely affected by the presence of weeds. The wider row spacing between cane rows, initial slow growth, heavy application of fertilizers, and frequent irrigation encourage the growth of weeds. The weeds compete for land, moisture, sun light and other nutrients and reduce the cane yield Weeds limit the cane and sugar yield, relative to its species and intensity. Due to weed infestation, the yield loss in cane crops was estimated from 40 to 60 per cent.

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The annual grasses and broad-leaved weeds can be effectively managed by spraying pre-emergence herbicide viz., atrazine. Due to the selectivity of herbicide, sedges viz., Cyperus sp. was dominant over other species and spread to other areas of the field. Though manual weeding is being practiced for the control of sedges, it is not as effective as that of herbicide; spotted spray of total weed killer is advocated for effective sedges control. Nowadays, a new problem has been noticed in the cane field that the dominance of twining weeds, particularly in the ratoon crop. These weeds are grown after 120 days of the crop age. Though the critical period of weed competition in cane crops is 90 days. Weeds compete with crops for all the inputs and the total actual economic loss, due to weeds in 10 major crops in India, was estimated at US$ 11 billion (Gharde et al. 2018). Hence managing weeds is critical in attaining higher productivity of crops with improved resource use efficiency, to meet the food and nutritional demands of the increasing Indian population as well as increasing income of the farmers (Rao and Chauhan 2015). Weed management involves integrated efforts to manage weeds in crops to selectively minimize the weed competition so as to enable crops to optimally use resources such as soil fertility, water, and sunlight, for attaining the optimal harvestable crop yield (Quimby and Birdsall, 1995).

MATERIAL AND METHODS

Field experiments were conducted at Sugarcane Research Station, Cuddalore Tamil Nadu Agricultural University, to evolve

technology for controlling binding weeds in grown-up sugarcane crops during 2015-18. The experiments were laid out in Randomized Block Design with three replications and the sugarcane variety tested wasCoC(SC)24.The planting of sugarcane was done at 120 cm row spacing on ridges and furrows. The treatments constituted of T_1 – PE. atrazine @ 1.0 kg/ha and Po.Emetribuzin 0.75 kg/ha @ 60 DAP, T_2 - PE atrazine 1.0 kg/ha and Po.E 2,4D Na salt 1.25kg/ha @ 60 DAP, T_3 – P.E atrazine 1.0 kg/ha followed by weeding and earthingup on 75 DAP, T_4 – Mechanical weeding by power tiller (45, 90 and 120 DAP), T_5 – Intercropping of sun hemp and its incorporation as insitu on 60 DAP, T_6 – Detrashing and mulching at 150th&210th DAP, and T_7 – hand weeding and manual removal of weeds on 45, 90 and 120th days and T_8 –Control. All the recommended management practices were followed. Among broad-leaved weeds *Euphorbia geniculate, Parthenium hysterophorus, Digeraarvensis, Mereimiaemergianta, Alternanthera sessile, lactularuncianata, chenopodium album were found dominate. While, among grassy weeds Cynodondactylone, Brachiariaeruciformis, cyperusrotundus* were found as dominant

RESULT AND DISCUSSION

Table 1. Effect of weed control treatments on weed flora /m^2 (120 DAP)

Among the weed control treatments the pre-emergence application of atrazine @ 1.0 kg a.i/ha followed by post-emergence application of metribuzin @ 0.75 kg/ha 60 days after planting(Table.1) recorded the lowest weed flora of the sedges(32), monocots (21), dicots (10) and creeper (3) / m^{2}120 days after planting compared to other weed control. The treatments control registered more no of weed flora.

Table 2.Total weed numbers (m^2) and weed control efficiency (%)

The pre-emergence application of atrazine @ 1.0 kg a.i/ha followed by post-emergence application of metribuzin @ 0.75 kg/ha on 60 days after planting table.2 (T_1) significantly registered the minimum weed numbers 78.0 (m^2) and weed control efficiency of 85.0 (%) and it was on par with the treatment (T_3) Pre-emergence application of atrazine 1.0 kg/ha followed by weeding and earthing up on 75 days after planting the weed numbers of 86.43 /m^2 and weed control efficiency 83.52 (%). The same result was recorded during the second season of the crop study.

Table.3 Germination (%), Tillers (000/ha), and Economic shoots (000/ha)

The pre-emergence application of atrazine @ 1.0 kg a.i/ha followed by post-emergence application of metribuzin @ 0.75 kg/ha 60 days after planting significantly registered the maximum germination per cent (93.7), tiller population of 1, 83,230 on 90 days after planting and 2,11,520 on 120 days after planting. Regarding the economic shoot population the same treatment recorded the maximum economic shoots of 1, 66,220/ha on 210 days after planting, the same trend was followed during the second season crop study and the lower growth attributing characters were observed in the control.

Table.4 Effect of weed control treatments on sugarcane yield parameters

Among the treatments thepre emergence application of atrazine @ 1.0 kg a.i/ha followed by post-emergence application of metribuzin @ 0.75 kg/ha on 60 days after planting (T_1) significantly registered the maximum values of millable canes 1,33,500 and 1,32,400 ha^1, cane length of 270 and 271 cm, cane girth of 2.54 and 2.49 cm and the individual cane weight of 1.25 kg and it was comparable with the (T_3) Pre-emergence application of atrazine 1.0 kg/ha followed by weeding and earthing up on 75 days after planting during both the years of the study 2015-16 and 2017-18. The lowest yield parameters were recorded in the treatment control.

Table.5 Effect of treatments on cane yield

The pre-emergence application of atrazine @ 1.0 kg a.i/ha followed by post-emergence application of metribuzin @ 0.75 kg/ha on 60 days after planting (T_1) significantly registered the maximum cane yield of 131.40 and 132.98 t/ha, the CCS per cent of 10.73 and 10.74 and the sugar yield of 12.37 and 12.52 t/ha in both the years of study and it was on par with the treatment (T_3) Pre-emergence application of atrazine 1.0 kg/ha followed by weeding and earthing up on 75 days after planting. The treatment control registered the lowest yield attributing characters.

Table.6 Effect of Treatments on Economics

Among the weed control treatment, the pre-emergence application of atrazine @ 1.0 kg a.i/ha followed by post-emergence application of metribuzin @ 0.75 kg/ha on 60 days after planting (T_1) registered the maximum net income of Rs.1,81,675/ha and the highest B: C ratio of 2.22. The Pre-emergence application of atrazine 1.0 kg/ha followed by weeding and earthing up on 75 days after planting stands next in order with a net income of 1,75,050 Rs./ha. The treatment control registered the lowest in economic characteristics.

CONCLUSION

Based on the performancePre-emergence application of atrazine @ 1.0 kg a.i/ha followed by post-emergence application of metribuzin @ 0.75 kg/ha 60 days after planting was the best treatment for controlling weeds in grown-up sugarcane and yield attributing characters compared to control. The lowest weed flora of sedges(32), monocots (21), dicots (10), and creeper (3) / m^{2}120 days after planting.

Table.1 Effect of weed control treatments on weed flora /m^2 (120 DAP)

Treatments	2015-16				2017-18			
	Sedges	Monocots	Dicots	Creeper	Sedges	Monocots	Dicots	Creeper
T_1 – P.E atrazine 1.00 kg/ha and Po.Emetribuzin @ 0.75 kg/ha on 60 DAP	32	21	10	3	33	23	9	2
T_2 - P.E atrazine 1.00 kg/ha and Po.E 2,4D Na salt 1.25kg/ha on 60 DAP	51	34	11	5	52	32	12	4

T_3 - P.E atrazine 1.0 kg/ha followed by weeding and earthing up on 75 DAP	55	38	14	10	37	37	13	9
T_4 – mechanical weeding by power tiller on 45, 90, and 120 DAP	80	37	16	7	39	39	17	8
T_5 – Inter-cropping of sunn hemp and its incorporation in situ at 60 DAP	87	22	23	11	21	21	24	10
T_6 – Detrashing and mulching at 150th&210th DAP	92	42	23	13	44	44	25	12
T_7 – Hand weeding and manual removal of weeds on 45, 90, and 120th day	79	30	21	8	29	29	22	9
T_8 Control	311	123	52	26	126	126	60	24

Table.2 Weed no/m² and Weed control efficiency (%)

Treatments	2015-16		2017-18	
	Weed no. / m²	WCE (%)	Weed no. / m²	WCE (%)
T_1 – P.E atrazine 1.00 kg/ha and Po.Emetribuzin @ 0.75 kg/ha on 60 DAP	78.00	85.00	78.56	85.28
T_2 - P.E atrazine 1.00 kg/ha and Po.E 2,4D Na salt 1.25kg/ha on 60 DAP	95.23	81.80	98.43	81.50
T_3 - P.E atrazine 1.0 kg/ha followed by weeding and earthing up on 75DAP	86.43	83.52	87.36	83.58
T_4 – mechanical weeding by power tiller on 45, 90 and 120 DAP	126.52	75.86	125.49	76.41
T_5 – Inter-cropping of sunn hemp and its incorporation in situ at 60 DAP	134.00	74.32	132.61	75.09
T_6 – Detrashing and mulching at 150th&210th DAP	147.26	71.83	146.53	75.09
T_7 – Hand weeding and manual removal of weeds on 45, 90, and 120th day	122.00	76.62	123.39	72.45
T_8 Control	522.00	-	530.00	-
SEd	4.15	0.59	0.73	0.31
CD	12.58	1.83	2.21	0.99

Table.3 Germination (%), Tillers (000 /ha) and Millable cane (1000/ha)

Treatments	2015-16				2017-18			
	Germination (%)	Tiller population (000 /ha)		Economic shoots (000/ha)	Germination (%)	Tillers population (000 /ha)		Economic shoots (000/ha)
	30 DAP	90 DAP	120 DAP	210 days	30 DAP	90 DAP	120 DAP	210 days
T_1 – P.E atrazine 1.00 kg/ha and Po.Emetribuzin @ 0.75 kg/ha on 60 DAP	83.40	183.23	211.52	166.22	83.70	184.00	215.33	170.55
T_2 - P.E atrazine 1.00 kg/ha and Po.E 2,4D Na salt 1.25kg/ha on 60 DAP	81.62	175.00	195.21	160.30	82.00	176.12	198.24	164.32
T_3 - P.E atrazine 1.0 kg/ha followed by weeding and earthing up on 75 DAP	83.00	180.50	202.33	154.51	83.42	181.32	157.62	156.40
T_4 – Mechanical weeding by power tiller on 45, 90 and 120 DAP	82.73	175.30	182.16	147.32	83.13	176.00	150.14	149.32
T_5 – Inter-cropping of sunn hemp and its incorporation in situ at 60 DAP	81.55	173.12	180.30	143.20	82.17	172.32	182.35	146.61

T_6 – Detrashing and mulching at 150th&210th DAP	82.50	169.29	175.60	140.71	82.74	170.32	178.32	142.82
T_7 – Hand weeding and manual removal of weeds on 45, 90, and 120th day	80.81	170.21	172.34	138.65	81.00	171.39	174.54	140.53
T_8 Control	77.97	140.25	153.41	108.10	79.00	145.50	156.25	110.20
SEd	0.44	1.00	1.03	1.55	0.54	0.76	1.60	1.89
CD	1.34	3.02	3.13	4.70	1.80	2.31	4.85	5.72

Table.4 Effect of treatment on Millable canes (000/ha), Cane length (cm), Cane girth (cm), and Individual cane wt (kg)

Treatments	2015-16				2017-18			
	Millable canes (000/ha)	Cane length (cm)	Cane girth (cm)	Individual cane wt (kg)	Millable canes (000/ha)	Cane length (cm)	Cane girth (cm)	Individual cane wt (kg)
T_1 – P.E atrazine 1.00 kg/ha and Po.Emetribuzin @ 0.75 kg/ha on 60 DAP	133.50	270	2.54	1.25	132.40	271	2.49	1.25
T_2 - P.E atrazine 1.00 kg/ha and Po.E 2,4D Na salt 1.25kg/ha on 60 DAP	122.70	260	2.30	1.25	120.42	262	2.31	1.25
T_3 - P.E atrazine 1.0 kg/ha followed by weeding and earthing up on 75 DAP	127.30	267	2.30	1.23	128.36	266	2.38	1.22
T_4 – Mechanical weeding by power tiller on 45, 90 and 120 DAP	118.40	258	2.45	1.21	119.52	257	2.52	1.22
T_5 – Inter-cropping of sunn hemp and its incorporation insitu at 60 DAP	120.30	259	2.35	1.14	121.31	259	2.54	1.15
T_6 – Detrashing and mulching at 150th&210th DAP	115.12	242	2.06	1.12	116.03	243	2.04	1.13
T_7 – Hand weeding and manual removal of weeds on 45, 90, and 120th day	123.45	240	2.12	1.13	122.49	240	2.10	1.14
T_8 -Control	101.30	228	1.85	0.83	98.37	226	1.73	0.82
SEd	0.80	0.84	0.01	0.01	0.84	0.85	0.01	0.01
CD	2.48	2.55	0.04	0.02	2.54	2.53	0.03	0.02

Table.5 Effect of treatment on Cane yield (t/ha), CCS (%), and Sugar yield (t/ha)

Treatments	2015-16			2017-18		
	Cane yield (t/ha)	CCS (%)	Sugar yield (t/ha)	Cane yield (t/ha)	CCS (%)	Sugar yield (t/ha)
T_1 – P.E atrazine 1.00 kg/ha and Po.Emetribuzin @ 0.75 kg/ha on 60 DAP	131.40	10.73	12.37	132.98	10.74	12.52
T_2 - P.E atrazine 1.00 kg/ha and Po.E 2,4D Na salt 1.25kg/ha on 60 DAP	129.50	10.65	11.23	128.17	10.66	11.43
T_3 - P.E atrazine 1.0 kg/ha followed by weeding and earthing up on 75 DAP	131.76	10.70	12.60	130.26	10.71	12.67
T_4 – Mechanical weeding by power tiller on 45, 90, and 120 DAP	121.41	10.67	11.98	122.26	10.66	11.92
T_5 – Inter-cropping of sunn hemp and its incorporation in situ at 60 DAP	118.70	10.62	11.73	120.10	10.63	11.70
T_6 – Detrashing and mulching at 150th&210th DAP	113.29	10.63	12.12	112.19	10.65	12.15
T_7 – Hand weeding and manual removal of weeds on 45, 90, and 120th day	114.60	10.57	11.12	115.52	10.51	11.12
T_8 Control	85.70	10.31	9.00	86.49	10.32	8.92
SEd	0.65	1.12	0.17	1.06	0.01	0.14
CD	1.99	3.40	0.52	3.21	0.02	0.43

Table.6 Effect of treatment on Cane yield (t/ha), Gross income (Rs/ha), Cost of cultivation (Rs/ha), Net income (Rs/ha and B:C ratio

Treatments	Mean Cane Yield (t/ha)	Gross income (Rs/ha)	Cost of cultivation (Rs/ha)	Net income (Rs/ha)	B:C ratio
T_1 – P.E atrazine 1.00 kg/ha and Po.Emetribuzin @ 0.75 kg/ha on 60 DAP	132.19	330475	148800	181675	2.22
T_2 - P.E atrazine 1.00 kg/ha and Po.E 2,4D Na salt 1.25kg/ha on 60 DAP	128.84	322100	148650	173450	2.17
T_3 - P.E atrazine 1.0 kg/ha followed by weeding and earthing up on 75 DAP	130.98	327430	152400	175050	2.15
T_4 – mechanical weeding by power tiller on 45, 90 and 120 DAP	121.84	304600	148000	156600	2.06
T_5 – Inter-cropping of sunn hemp and its incorporation in situ at 60 DAP	119.40	297500	149100	149400	2.00
T_6 – Detrashing and mulching at 150^{th}&210^{th} DAP	112.74	281850	153400	128430	1.84
T_7 – Hand weeding and manual removal of weeds on 45, 90, and 120^{th} day	115.06	287650	158000	129630	1.82
T_8 Control	86.10	214250	150000	64250	1.43

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