Effect of weed management practices on weed population, crop nutrient uptake and cane yield in subsurface and conventional irrigation practices

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Abstract

Field investigation was carried out at farmer's field, Manaveli, Cuddalore (Taluk), Tamil Nadu during (January to December) during 2014 with sugarcane cv. EID PARRY 1110. The objectives of the study were to compare the conventional and modern irrigation practices and weed management practices for sugarcane. The main plot treatments were M_1 - Conventional irrigation and M_2 - Sub surface drip irrigation and the sub plot treatments were S_1-Unweeded (Control), S_2 - Hand weeding thrice (30, 60 and 90 DAP), S_3 - Atrazine alone, S_4 - Atrazine + 2,4-D, S_5 - Atrazine + metribuzin and S_6 - Atrazine + 2,4-D + Metribuzin. The treatments were compared in split plot design with 3 replications and a plot size of 40m^2. Among the treatment combinations, application of atrazine @ 2.0 kg a.i ha^{-1} was sprayed on 3 DAP, 2,4-D @ 1.0 kg a.i ha^{-1} was sprayed on 21 DAP + metribuzin @ 1.0 kg a.i ha^{-1} was sprayed on 21 DAP under subsurface drip irrigation proved its superiority over the other treatments on weed population, crop nutrient uptake and cane yield when compared to conventional irrigation and unweeded control recorded higher weed population, lower crop nutrients removal and cane yield.

Key words: cane yield, irrigation, nutrients and weed population.

Introduction:

Sugarcane (*Saccharum officinarum*) is a traditional crop in India grown since time immemorial. In India, sugarcane is cultivated in an area of 5.08 m.ha with a cane production of 347.80 m.t (Agricultural statistics, 2012). India with the distinction of being the second largest producer of sugar after Brazil and the world's biggest consumer of the sweetener (22.5 m. t).

Sugarcane being a long duration crop, its irrigation water requirement is relatively higher compared to other crops, which ranges from 1400 to 3000 mm depending upon the climate (Verma, 2004). Heavy infestation of weeds comprising grasses, broad leaf weeds and sedges poses a big challenge for sugarcane production. Initial slow growth and wider row spacing in sugarcane provides ample opportunity for weeds to easily occupy vacant space between rows and offer serious competition to crop (Sandeep Kumar *et al.*, 2014).

Weed competition leads to substantial harvest losses, increasing production cost and also intensify the problems of diseases and insect pests by serving as the alternate host. There is no simple method to control weeds of all groups. Mechanical weed control method was partially effective because most of the weeds growing in intra rows escaped from weeding and incessant rains make the manual weeding impossible which resulted in an efficient weed control and low sugarcane yield (Srivastava and Chauhan, 2002).

Among the different weed management practices, chemical weed control is time saving, easier, economical and can be adopted timely, particularly where scarcity of agricultural labour exists at appropriate stages of weeding. Consequently, keeping in view of these perspectives, the present experiment was planned to find out an efficient method of irrigation and weed management option.

Materials and methods

Field experiment was carried out at farmer's field, Manaveli, Cuddalore (Taluk), Tamilnadu. The field is located at 12˚05' N latitude and 79˚ 37' E longitude at an altitude of 10.00 m above mean sea level. The

topography of the experimental field is fairly leveled and about 1.0 m in depth with good drainage. The soil was sandy loam in texture and low in available nitrogen, medium in available phosphorus and high in available potassium. The field experiment was conducted during January – December, 2014 (Early season) using EID parry 1110 with 2 main plot treatments and 6 sub plot treatments replicated three times in a split plot design. The details of the treatments imposed in the experiment are Main plot treatments: M_1 - Conventional irrigation, M_2 - Sub surface drip irrigation and Sub plot treatments: S_1- Unweeded (Control), S_2- Hand weeding thrice (30, 60 and 90 DAP), S_3- Atrazine @ 2.0 kg a.i ha^{-1}, S_4- Atrazine @ 2.0 kg a.i ha^{-1} + 2,4-D @ 1.0 kg a.i ha^{-1}, S_5- Atrazine @ 2.0 kg a.i ha^{-1} + metribuzin @ 1.0 kg a.i ha^{-1}, S_6 - Atrazine @ 2.0 kg a.i ha^{-1} + 2,4-D @ 1.0 kg a.i ha^{-1} + Metribuzin @ 1.0 kg a.i ha^{-1}.

Before planting, the field was irrigated to keep it under saturated condition for easy planting and uniform establishment. The life irrigation was given on the third day after planting. Subsequently the crop was irrigated as per the requirement and irrigation was with held 30 days prior to harvest. Weed control was carried out as per the treatment schedule. The pre-emergence herbicide atrazine @ 2.0 kg a.i ha^{-1} was sprayed on 3 DAP using the hand operated knapsack sprayer fitted with flat fan nozzle. The post-emergence herbicides viz., 2,4-D @ 1.0 kg ha^{-1}, metribuzin @ 1kg ha^{-1} were applied as directed spray on 21 DAP using the hand operated knapsack sprayer fitted with flat fan nozzle covered by a spray hood. A spray volume of 500 l of water was used per hectare. The hand hoeing operations were carried out with the help of hand hoe at 30, 60 and 90 DAP.

Results and discussion

Total weed population

Subsurface drip irrigation of sugarcane significantly recorded lowest total weed population of 49.60 m^{-2}. Conventional irrigation recorded the highest total weed population of 68.39 m^{-2}. Atrazine + metribuzin and 2,4-D produced a low total weed population of 36.99 m^{-2}. The highest weed population of 128.31 m^{-2} was recorded in unweeded (S_1) control. Interaction effect of irrigation techniques and weed management practices significantly influenced the total weed population. The lowest total weed population of 23.63 m^{-2} was recorded in subsurface irrigation and atrazine + metribuzin and 2.4-D application. Conventional irrigation and unweeded control registered the highest total weed population of 132.56 m^{-2}.

The integration of subsurface irrigation and application of atrazine + metribuzin and 2, 4 -D achieved a programmed and prolonged depletion of weed seed bank reserves of propagules of weeds in soil and there by total weed population and its dry matter production. The increased weed population, total weed population and dry matter production were recorded under conventional irrigation and unweeded control. This may be due to the better utilization of available resources by the weeds and the absence of weed management practices (Asokan and Mahadevaswamy, 2003).

Weed control index

Among the irrigation methods, subsurface drip irrigation was found to be superior as indicated by the higher WCI of 55.27. Conventional irrigation recorded the lowest WCI of 44.55. Among the different weed management practices applied Atrazine + metribuzin and 2,4-D observed highest WCI of 65.35. In the interaction effect of irrigation techniques + weed management practices compared, application of atrazine + metribuzin and 2.4-D under subsurface drip irrigation recorded the highest WCI of 74.50.

This might be due to the synergistic and cumulative effect of irrigation methods and application of pre – emergence and post – emergence herbicides. Crop plus weeds from a non weeded area will absorb about the same amount of N as that of the crop from weed free plot (Noda *et al.*, 1968). Thus the weeds deprive the nutrients that would have normally been available to the sugarcane crop. As the nutrient removal is increased by weeds on account of higher weed population, adverse effect could be expected on the crop. When the weed growth is effectively checked through herbicides, a reduction in nutrient removal by weeds and increased WCI are natural consequence.

Cane yield

Subsurface drip irrigation recorded the higher cane yield of 144.20 t ha^{-1} whereas conventional irrigation recorded the minimum cane yield of 103.31 t ha^{-1}. Application of atrazine + metribuzin and 2, 4-D

registered higher cane yield of 145.62 t ha^{-1}. The lowest cane yield of 82.85 t ha^{-1} was recorded by the unweeded control. Interaction effect of irrigation techniques + weed management practices significantly influenced the cane yield. Higher cane yield of 172.56 t ha^{-1} was recorded under sub surface irrigation along with application of atrazine + metibuzin and 2,4 – D. Conventional irrigation and unweeded recorded the lowest cane yield of 78.71 t ha^{-1}

Integration of subsurface irrigation to sugarcane and application of atrazine + metribuzin and 2, 4-D recorded highest yield attributes and yield of sugarcane. This may be due to efficient weed control throughout the critical periods of competition and sustained water and nutrient availability leads to better uptake of NPK by the crop might have contributed to synchronous tillering leading to higher number of millable cane and cane diameter. This had a favourable effect on source and sink capacity resulting in increased cane yield (Janagarathinam, 2004).

Table 1. Effect of irrigations techniques and weed management practices on total weed population

	Main plot treatment		
Sub plot treatment	**M_1**	**M_2**	**Mean**
S_1	132.56	124.07	128.31
S_2	52.06	32.39	42.22
S_3	59.62	47.68	53.65
S_4	53.29	33.53	43.41
S_5	57.49	36.35	46.92
S_6	50.39	23.63	36.99
Mean	68.39	49.60	

	S.Ed	**CD (P=0.05)**
Main	0.84	1.68
Sub	0.42	0.84
M × S	1.34	2.68
S × m	1.42	2.83

Table 2. Effect of irrigations techniques and weed management practices on weed control index

Main plot treatment			
Sub plot treatment	**M_1**	**M_2**	**Mean**
S_1	-	-	-
S_2	55.09	68.07	61.58
S_3	50.16	56.72	53.44
S_4	54.29	67.22	60.75
S_5	51.55	65.12	58.33
S_6	56.21	74.50	65.35
Mean	44.55	55.27	

	S.Ed	**CD (P=0.05)**
Main	0.31	0.62
Sub	0.40	0.81
M × S	1.51	3.02
S × m	1.48	2.96

Table 3. Effect of irrigations techniques and weed management practices on cane yield (t ha^{-1})

Main plot treatment			
Sub plot treatment	**M_1**	**M_2**	**Mean**
S_1	78.71	86.99	82.85
S_2	113.71	164.21	138.96
S_3	96.78	128.12	112.45
S_4	110.78	159.37	135.07
S_5	101.69	153.97	127.83
S_6	118.69	172.56	145.62
Mean	103.31	144.20	

	S.Ed	**CD (P=0.05)**
Main	1.62	3.24
Sub	1.89	3.79
M × S	3.06	6.13
S × m	3.41	6.82

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