Effect of weed and irrigation management practices on sugarcane yield

Sappani muthu. K., G.Murugan, M.Saravana perumal, K. Suseendran and P.Stalin
Department of Agronomy, Faculty of Agriculture, Annamalai University
Annamalai nagar-608002, Tamil nadu.

Abstract

A field study was carried out at farmer's field, Manaveli, Cuddalore (Taluk), Tamil Nadu with sugarcane cv. EID PARRY 1110. The study was 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 @ 2.0kg a.i ha^{-1} was sprayed on 3 DAP, 2,4-D @ 1.0 v kg a.i ha^{-1} was sprayed on 21 DAP + metribuzin @ 1.0kg a.i ha^{-1} was sprayed on 21 DAP under subsurface drip irrigation proved its superiority over the other treatments on Individual weed population, weed drymatter and cane yield when compared to Conventional irrigation and unweeded control recorded higher Individual weed population, weed drymatter and cane yield.

Key words Cane yield, drip irrigation, weeds dry matter and cane yield.

Introduction

Sugarcane is an important cash crop cultivated in about 115 countries of the world and it produces about 133 million tonnes (m.t) of sugar which is three fourth of the total sugar production (169 m.t) of the world (Anonymous, 2011). In India, sugarcane is cultivated in an area of 5.08 million hectare (m.ha) with a cane production of 347.80 m.t. In Tamil Nadu, sugarcane is cultivated in 3.46 lakh hectares (l.ha) with a production of 36.54 m.t. In terms of productivity, it ranks first with 102.83 tonnes ha^{-1} ($t.ha^{-1}$) followed by Karnataka (90.25 $t.ha^{-1}$) against the national average of 70.31 $t.ha^{-1}$ (Agricultural statistics, 2012).

The sophisticated tools and technologies namely drip irrigation and fertigation will have to be put to use on farm level for enhancing production with improved water and nutrient use efficiencies. 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. Pawar *et al.* (2004) concluded that the critical period of crop weed competition in sugarcane was between 45 and 75 DAP.

Different kinds of social, economical and environmental factors influence the choice of weed control method to be used. Though it is uneconomical, hand weeding and manual digging is still practiced by the farmers in Tamil Nadu. The weed control strategy with the old traditional methods is not effective due to labour scarcity in addition timely weeding is also not possible due to intermittent rains. The manual and mechanical methods of weed control are less effective, costly, time consuming and to be repeated at frequent intervals.

A weed free environment during the germination and tillering phase is important for getting higher yield. This can be achieved by the introduction of new highly effective herbicides that has revolutionised the weed control in sugarcane. Selection of appropriate herbicides along with accurate dose and time of application is the key to success for controlling weeds. 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. A field experiment was conducted 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

Weed population

Weeds *viz.*, , *Commelina benghalensis, Dactylactenium aegyptium, Panicum repens, Phyllanthus niruri* and *Amaranthus viridi*es which were present in lesser proportion and were not significantly influenced by the treatment effects. Predominant weeds *viz., Cynodon dactylon, Echinocloa colonoum, Cyperus rotuntus* and *Trianthema portulacastrum* were significantly altered by weed control treatments. Among the methods of irrigation, sub surface drip irrigation recorded lowest weed population when compared to conventional irrigation of sugarcane.

Among the weed management practices studied, application of herbicides atrazine + metribuzin and 2,4 - D recorded least weed counts. These treatments were significantly superior to other treatments in restricting the individual weed population. The highest weed count was recorded in the unweeded control under conventional irrigation (M_1S_1).

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 individual weed population and its dry matter production. The increased weed population, 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.

Weed dry weight

Subsurface irrigation recorded the lowest total weed dry weight of 107.80m^{-2}. Conventional irrigation recorded the highest total weed dry weight of 151.98 m^{-2}. Among the different weed management practices applied, atrazine + metribuzin and 2.4.D registered low total weed dry weight of 90.65 m^{-2}. The highest total weed dry weight of 257.60 m^{-2} was recorded by the unweeded control.

Interaction effect of irrigation technique x weed management significantly influenced the total need dry weight. The lowest total dry weight of 61.30 m^{-2} was recorded in subsurface irrigation along with atrazine + metribuzin and 2.4-D. Conventional irrigation and unweeded control recorded highest total weed dry weight of 274.12 m^{-2}.

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 (El-Shafai *et al.*, 2010 and Suganthi and Sakthivel, (2013)).

References

Agricultural Statistics, 2012. Directorate of economics and statistics, dept .of agricultural and co-operation, ministry of agriculture, government of India: 4-23.

Anonymous. 2011. Annual Report, Indian institute of Sugarcane Research, Lucknow, Uttar Pradesh, *India*. p. 72-73.

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

Pawar, S.M., R.P. Gaikwad, P.G. Bhoi and R.S. Verma. 2004. Assessment of critical period of crop-weed competiton in pre-seasonal sugarcane in western maharashtra. **Indian J. Agrl. Sci., 74(6):** 343-345.

Suganthi , M.and N. Sakthivel. 2013. Efficiency of low dose herbicides and their combination on weed biomass and productivity of sugarcane. **J. Agron., 12(2):** 104-108.

Table 1. Effect of irrigations techniques and weed management practices on individual weed species count (m^2) at 90 DAP

Treatments	*Cynodon dactylon*	*Echinochloa colonum*	*Dactyloctenium aegyptium*	*Panicum repense*	*Cyperus rotuntus*	*Trianthema portulacastrum*	*Commelina benghalensis*	*Phyllanthus niruri*	*Amaranthus viridis*
M_1	2.77 (7.20)	3.09 (9.10)	2.66 (6.60)	2.78 (7.25)	3.57 (12.30)	3.28 (10.30)	3.14 (9.40)	0.70 (0.00)	2.59 (6.24)
M_2	2.43 (5.45)	2.96 (8.30)	1.96 (3.35)	0.70 (0.00)	3.16 (9.46)	3.14 (9.40)	2.71 (6.89)	2.68 (6.75)	0.70 (0.00)
S.Ed	0.03	0.03	0.05	0.02	0.03	0.04	0.03	0.03	0.02
CD	0.07	0.06	0.09	NS	0.05	0.07	0.06	NS	NS
S_1	3.82 (14.15)	3.97 (15.30)	2.94 (8.20)	3.44 (11.40)	4.87 (23.30)	3.89 (14.70)	4.25 (17.63)	3.59 (12.44)	3.69 (13.15)
S_2	2.15 (4.15)	2.55 (6.01)	2.41 (5.35)	2.00 (3.53)	2.26 (4.61)	2.56 (6.08)	2.29 (4.76)	0.70 (0.00)	2.21 (4.39)
S_3	2.50 (5.76)	2.76 (7.12)	0.70 (0.00)	2.47 (5.62)	2.70 (6.81)	2.77 (7.19)	2.81 (7.45)	2.81 (7.44)	2.41 (5.34)
S_4	2.25 (4.59)	2.67 (6.68)	2.55 (6.02)	2.11 (3.99)	2.40 (5.29)	2.59 (6.23)	0.70 (0.00)	2.76 (7.12)	2.31 (4.84)
S_5	2.37 (5.12)	2.74 (7.02)	2.66 (6.60)	2.35 (5.06)	2.55 (6.01)	2.69 (6.75)	2.70 (6.82)	2.91 (8.01)	0.70 (0.00)
S_6	2.17 (4.25)	2.25 (4.60)	2.17 (4.25)	0.70 (0.00)	2.16 (4.20)	2.36 (5.10)	2.14 (4.10)	2.69 (6.75)	1.60 (2.06)
S.Ed	0.06	0.03	0.02	0.03	0.05	0.04	0.03	0.03	0.03
CD (P=0.05)	0.10	0.07	NS	NS	0.10	0.08	NS	NS	NS

Table 2. Effect of irrigations techniques and weed management practices on weed dry weight (g/m^2)

Main plot treatment			
Sub plot treatment	**M_1**	**M_2**	**Mean**
S_1	274.1	241.0	257.6
S_2	123.0	76.9	100.0
S_3	136.6	104.3	120.4
S_4	125.2	79.0	102.1
S_5	132.8	84.0	108.4
S_6	120.0	61.3	90.6
Mean	151.9	107.8	

	S.Ed	**CD (P=0.05)**
Main	1.42	2.85
Sub	1.90	3.81
M × S	2.32	4.65
S × m	2.54	5.08

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