

Irrigation Scheduling of Sugarcane with Onion as Intercrop

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ABSTRACT

An experiment was conducted in Bangladesh Sugarcane Research Institute (BSRI) farm at Ishurdi during 1994-95 and 1995-96 cropping seasons to develop an irrigation schedule for sugarcane with onion as intercrop using pan ratio (PR) method. Irrigation was applied during premonsoon only. No irrigation was applied during monsoon or post monsoon. The highest yield of sugarcane as well as onion were obtained during both 1994-95 and 1995-96 cropping when irrigation was applied at PR = 1.0. With this PR, the highest yield of sugarcane (102.95 t ha^{-1}) was obtained with 360 mm irrigation water in addition to 75 mm of effective rainfall during 1994-95. The highest yield of onion (4.461 t ha^{-1}) was obtained with 220 mm of irrigation water in addition to 61 mm effective rainfall in the same year.

Key words: Irrigation schedule, sugarcane, onion, intercrop, pan ratio.

INTRODUCTION

Intercropping in sugarcane with various short duration crops like cabbage, potato, mugbean etc has been proven profitable in comparison to growing sugarcane as sole crop. Onion is also an important crop to be intercropped with sugarcane. It is also an usual practice of cane growers in some northern parts of Bangladesh. Due to crop competition, of onion is being decreased, which results less production of onion in the country (Modak *et al.* 1998). Hence, onion intercropping with sugarcane may contribute to increase onion production in the country. Water requirement of onion as reported by Bautista (2000) is 25.4 - 35.4 mm per week and on an average 30 cm of water during its growth period of 3 months. On the other hand, sugarcane requires about 120-150 cm water during its growth period of 12 months. In the early 3 months of sugarcane, it requires about 3 - 4 irrigations amounting 50 cm water for its establishment and tillering. These irrigations if scheduled for onion may increase onion production without hampering sugarcane. Onion can be profitably grown in soils having PH around 6.5 (Heliburton, 1965) and low salinity (Karim *et al.* 1982). Due to shallow root zone of onion, frequent light irrigation is required in the light soil while less frequent heavy irrigation is required for heavier soil. Begum (1990) reported that onion should be cultivated keeping soil moisture status at 0.60 bar which required two to four irrigations in Grey terrace soils of Joydebpur and three to four irrigations in Calcareous Floodplain soils of Jessore. Sugarcane can be grown in a wide range of soils. But loamy to sandy loamy soil is better for sugarcane cultivation.

Irrigation scheduling is an important technique to optimize crop yield with minimum water use. No irrigation schedule has yet been developed for sugarcane with

onion as intercrop. Hence, an experiment was conducted at BSRI farm, Ishurdi, with a view to develop an irrigation schedule for sugarcane with onion as intercrop.

MATERIALS AND METHODS

The experiment was conducted at BSRI farm, Ishurdi, during 1994-95 and 1995-96 cropping seasons. Sugarcane variety Isd 16 and onion variety Faridpur (local) were used as planting material. Sugarcane was planted following STP method, while two rows of onion seedlings were transplanted in between 90 cm spaced sugarcane rows. The experiment was set in a randomized complete block design with three replications.

The treatments of the experiment were as follows:

I_B = Only two base irrigation at 1 and 15-20 d after plantation (DAP)

I_1 = I_B + Irrigation at PR = 0.6 followed by PR = 0.4 three months before harvest of sugarcane.

I_2 = I_B + Irrigation at PR = 0.9 followed by PR = 0.6 three months before harvest of sugarcane.

I_3 = I_B + Irrigation at PR = 1.0 followed by PR = 0.6 three months before harvest of sugarcane.

Where pan ratio (PR) is the ratio of irrigation water (IW) applied plus effective rainfall (ER) to the cumulative open pan evaporation (CPE) from USWB class A open pan (i.e. $PR = (IW+ER)/CPE$). Irrigation water (IW) was calculated considering 40 cm effective root depth at the start and 100 cm during tillering stage and assuming 50% depletion of available soil moisture allowable. Irrigation interval was determined using following equation:

$$CPE = \frac{IW + ER}{PR}$$

In each irrigation a prefixed amount of irrigation water was applied. No irrigation was needed during and after monsoon.

RESULTS AND DISCUSSION

The effects of irrigation on yield and yield components of sugarcane as well as onion during 1994-95 are given in table 1(a & b). It is evident from the table 1(a) that irrigation has significant effects on tillers, millable cane and yield of sugarcane. The Highest yield was obtained from treatment I_3 (102.95 t ha⁻¹) followed by treatment I_2 (98.16 t ha⁻¹) though they did not differ significantly from each other.

It is seen from the Table 1(b) that treatment I_3 which had the highest yield of sugarcane received seven irrigations including five during intercrop period. It received a total of 360 mm of irrigation water including 220 mm during intercrop period. Effective rainfall during intercrop period was 61 mm and premonsoon total was 75 mm. From the Table 1(a & b) it is also seen that irrigation had significant effects on the yield of onion. The highest yield of onion was obtained by treatment I_3 (4.462 t ha⁻¹) followed by the treatment I_2 (4.257 t ha⁻¹). Treatment I_3 received five irrigations having 220 mm irrigation water and 61 mm effective rainfall during intercrop period.

Table 1(a). Effects of irrigation on yield and yield components of sugarcane and onion during 1994-95 cropping season.

Treatment	Tillers (10^3 ha^{-1})	Millable canes (10^3 ha^{-1})	Height (m)	Internode (No)	Diameter (cm)	Weight (kg/cane)	Recovery (%)	Yield of sugarcane (t ha^{-1})	Yield of onion (t ha^{-1})
I_0	133.73 d	85.15 d	2.82	22.80	2.11	0.98 a	7.89	83.97 cd	3.132 d
I_1	145.63 c	96.00 c	2.62	21.06	2.09	0.89 b	8.72	86.16 bc	3.580 c
I_2	155.00 b	106.27 b	2.76	22.26	2.09	0.92 a	9.34	98.16 ab	4.257 b
I_3	165.37 a	117.12 a	2.60	21.86	2.25	0.87 b	8.22	102.95 a	4.462 a
LSD at 5%	8.87	9.85	NS	NS	NS	0.06	NS	5.782	0.357

Table 1(b). Irrigation water, effective rainfall, number of irrigations and yield of onion and sugarcane during 1994-95 cropping season.

Treatment	Irrigation water (mm)		Effective rainfall (mm)		No. of Irrigation		Yield (t ha^{-1})	
	Intercrop period	Total period	Intercrop period	Total period	Intercrop period	Total period	Onion	Sugarcane
I_0	80	80	61	75	2	2	3.132d	83.97cd
I_1	120	230	61	75	3	5	3.580c	86.16bc
I_2	180	310	61	75	4	6	4.257b	98.16ab
I_3	220	360	61	75	5	7	4.462a	102.95a

The effects of irrigation on yield and yield components of sugarcane as well as onion during 1995-96 are given in the Table 2 (a & b). Similar effects of irrigation on yield and yield components of sugarcane and onion were also observed during 1995-96 cropping season. The highest yield of sugarcane was obtained in the treatment I_3 (90.19 t ha^{-1}) followed by treatment I_2 (84.11 t ha^{-1}). Treatment I_3 received seven irrigations including four irrigations during intercrop period. It received 440 mm of irrigation water including 200 mm during intercrop period. Effective rainfall during intercrop period was zero and premonsoon total were 122.5, 74.0, 74.0, and 94.5 mm for treatment I_0 , I_1 , I_2 and I_3 respectively.

Table 2(a). Effects of irrigation on yield and yield components of sugarcane and onion during 1995-96 cropping season.

Treatment	Tillers (10^3 ha^{-1})	Millable canes (10^3 ha^{-1})	Height (m)	Internode (No)	Diameter (cm)	Weight (kg/cane)	Recovery (%)	Yield of Sugarcane (t ha^{-1})	Yield of Onion (t ha^{-1})
I_0	141.6c	107.7c	2.49	21.6	2.12	0.61	8.69	70.0c	2.6d
I_1	154.7bc	118.4bc	2.54	22.00	2.23	0.54	8.62	77.3bc	2.9c
I_2	166.4ab	125.0ab	2.50	20.26	2.18	0.65	8.12	84.1ab	3.5ab
I_3	177.3a	135.1a	2.48	21.6	2.10	0.62	8.58	90.2a	3.6a
LSD at 5%	14.71	11.84	NS	NS	NS	NS	NS	8.04	0.25

Table 2(b). Irrigation water, effective rainfall, number of irrigations and yield of onion and sugarcane during 1995-96 cropping season.

Treatment	Irrigation water (mm)		Effective rainfall (mm)		No. of Irrigation		Yield (t ha ⁻¹)	
	Intercrop period	Total period	Intercrop period	Total period	Intercrop period	Total period	Onion	Sugarcane
I ₀	80	80	0	122.5	2	2	2.56d	69.95cd
I ₁	140	300	0	74.0	3	5	2.94c	77.32c
I ₂	200	440	0	74.0	4	7	3.47ab	84.11ab
I ₃	200	440	0	94.5	4	7	3.55a	90.19a

Irrigation also had significant effects on yield of onion during 1995-96 cropping season. The highest yield of onion was obtained from treatment I₃ (3.55 t ha⁻¹) followed by treatment I₂ (3.47 t ha⁻¹). However, treatments I₂ and I₃ did not differ significantly. Both treatments I₂ and I₃ received same number of irrigations (4 No.) and same amount of irrigation water (200 mm) during intercrop period but their total effective rainfall were different; 74.0 mm and 94.5 mm respectively.

It may be concluded that irrigation to sugarcane with onion as intercrop should be given at pan ratio (PR) = 1 during intercrop period. After harvesting onion, irrigation to sugarcane alone can be scheduled at either PR=1 or PR = 0.9 for maximizing the yield of sugarcane.

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