

Response of Sugarcane Intercropped with Potato at Various Irrigation Levels

M.A.B. Siddique, K.M. Hassanuzzaman¹

A.H.M.D. Hossain, S.M.I. Hossain and M.A. Hossain

Bangladesh Sugarcane Research Institute,
Ishurdi, Pabna, Bangladesh.

Received on 20.8.97

ABSTRACT

An experiment was conducted in the loamy soil of Bhramaputra River Flood Plain of Jamalpur district during 1989-90 and 1990-91 crop years. Potato cultivar 'Cardinal' and sugarcane variety Isd 16 were used. Four treatments viz. base irrigation, irrigation at PR (Pan ratio) 0.90, 0.70 and 0.50 during intercrop as well as premonsoon period were tested. In both the years ten irrigations including six irrigation during intercrop period given at PR 0.90 gave the highest yields of potato and cane. The yields were significantly different from those of the other treatments. The same treatment produced the maximum number of tillers and millable canes. It also resulted overall water use efficiency (WUE) of 78.2, and 105.3 kg ha⁻¹ mm⁻¹ for potato and cane respectively. Total water use was 1200 mm for sugarcane intercropped with potato.

INTRODUCTION

Intercropping increase the crop yield per unit area by intensifying the use of land. Growers achieve additional benefit from sugarcane, as the yield of sugarcane is increased by intercropping with potato by 64.26% (Imam *et al.* 1987). In the monsoon climatic region, the best period of planting of both sugarcane and potato is from October to 3rd week of November (Nankar, 1993). If sugarcane & potato are planted in that period, both the crops remain shallow rooted i.e. 0.4 to 0.6 m rooting depth; (FAO, 1988) until potato is harvested. Moreover, it needs frequent irrigation during premonsoon period for optimum growth and yield of both the crops. But to irrigate efficiently, appropriate irrigation schedule is necessary.

Frequent irrigation promotes rapid canopy development of both potato & sugarcane. But yields are reduced when excess irrigation water is applied (Marutani & Guz, 1989). Khalak and Kumaraswamy (1992) reported that tuber yield along with growth attributes of potato increase with the increase of irrigation frequency and found best yield at PR 1.00 (IW: CPE=1). Singh (1980 and 1981) got similar results. Jose and Rubens (1977 found the mean crop coefficient, K_c (PR) obtained with class A pan to be 0.74 for plant cane. Yang (1979) stated that the relationship between E_t and evaporation from class A pan is linear with a slope (PR) of 0.75. Islam *et al.* (1990) found maximum total water use for

¹Associate Professor, Department of Irrigation and Water Management, BAU, Mymensingh, Bangladesh.

optimum growth of potato to be 267 mm by 5 irrigations with 40 mm of average irrigation water (depth) whereas Karim *et. al.* (1982) found 284 mm by 6 irrigations in silt loam red soil of Joydebpur, Bangladesh. But in Bangladesh, there is no research finding regarding the effect of irrigation (moisture) level on the growth of sugarcane & potato when they are intercropped. Hence an experiment was carried out in loamy alluvial soil during 1989-90 and 1990-91 crop years to find the effect of irrigation on sugarcane with potato as intercrop.

MATERIALS AND METHODS

The experiment was carried out in a grower's field of Jamalpur District. The soil was loamy alluvial having bulk density 1.40 gm/cc and field capacity (FC) 36.4 (vol%). The treatments (Irrigation levels) were as follows:

- I_1 = Irrigation at PR 0.90 during intercrop and premonsoon periods including two base irrigations.
- I_2 = Irrigation at PR 0.70 for the said period including two base irrigations.
- I_3 = Irrigation at PR 0.50 for the said period including two base irrigations.
- I_4 = Only two common base irrigations.

Among the two base irrigations, the 1st one was applied at 14 days after potato plantation for saving cane seedlings and the 2nd one was applied at 14 days after plantation of seedlings to facilitate urea application for sugarcane. The treatments were tested in the plots under RBD with 4 replications. The individual plot size was 8x12.5m², Potato was planted on the ridge in between two cane rows having plant to plant spacing of 22.5 cm and row to row spacing of 90 cm. Cane Seedling of 40 days were planted with a spacing of 45 cm from plant to plant. In both the years potato was planted in the 2nd week of November & harvested in the 1st week of February (110 days).

Manure and fertilizer doses were cowdung 6 t. ha⁻¹, N₁₀₀ P₇₅ K₁₀₀ Kg ha⁻¹ for potato. Urea, TSP & MP were used as the source of NPK. Cowdung +TSP were mixed well with soil before seed planting. 1/2 Urea and full Mp were applied in the rows at the time of planting and properly mixed with soil. Rest of urea was top-dressed at 40 days after planting potato. For sugarcane, fertilizer was applied at the rate of N₁₂₅ P₁₂₅ K₁₀₀ kg ha⁻¹. All TSP+1/3 Urea+ 1/3 Mp were applied at planting. Remaining Urea & Mp were applied in two splits during tillering & first earthing up respectively. One eyed cane seedlings of 40 days were transplanted and 2 to 3 eyed sprouted tuber cuttings were used as potato seeds. Data on tillering, millable cane (Nos.), the yield of potato and cane were taken. Soil moisture was recorded before each irrigation and soil moisture of plots under I_1 & I_2 were taken simultaneously. Brix% was also taken by refractometer immediately before harvest of cane.

RESULTS AND DISCUSSION

Data on yield of potato at various moisture level is presented in the Table 1. It was observed that soil moisture level significantly influenced the yield of potato. The highest

Treatment	Cane tiller '(000)'/ha	Millable cane '(000)'/ha	Brix (%)	Cane yield (t. ha ⁻¹)	Potato yield (t. ha ⁻¹)
I ₁	175.50 a	109.9 a	20.25	103.4 a	13.6 a
I ₂	152.50 b	98.5 b	19.65	100.0 b	12.7 b
I ₃	130.75 c	89.4 c	19.70	90.7 c	9.7 c
I _B	132.50 c	79.2 d	18.20	75.2 d	7.3 b
LSD (5%)	8.23	5.23	NS	2.334	0.659
LSD (1%)	11.82	7.51	NS	3.354	0.940

The Table 2 shows that before two base irrigations the moisture level dropped to 20% of available moisture in all plots on an average. Subsequently, in the plots under treatment I_1 , I_2 , I_3 & I_4 , the moisture depletions were, on an average 42, 61, 70 & 82 percent of available moisture respectively for both the intercrop and premonsoon periods. Hence the treatments had significant effect on the yields of both potato & cane and effects differed significantly from each other which agree with the findings of Clements (1980), FAO (1988) & Islam *et al.* (1987). Temporary wilting was observed in sugar cane leaves under I_1 in late March & early April in the afternoon but recovered by night. Taking 80% water use of potato for intercrop period, PR (Kc) stands as 0.72 under I_1 (Table 2). Subtracting 0.35 for evaporation from cultured soil, the ratio of average transpiration of potato under I_1 to that of Khalek & Kumaraswami (1992) stands as $0.72-0.35$: $(1.0-0.35)$ i.e. $0.35:0.65=50:90$ which is the inverse ratio of row spacings of the related experiments. Rather the ratio of water uses and yields (highest values taken) of this experiment are equivalent to that of Islam *et al.* (1990).

Table 2. Irrigation water (IW), effective rainfall (ER), average crop coefficient (Kc) used, average moisture depletion, water use efficiencies (WUE) and total water use of cane and potato for different treatments.

Treat ment	Intercrop period		Premonsoon period		Effective rainfall (mm)		Average moisture depletion		Average crop coefficient Kc (PR)				Total water use (mm)		Water use efficiency (WUE) kg ha ⁻¹ mm ⁻¹	
	Total iW (mm) *	ER (mm)	Total IW (mm) **	ER (mm)	Mon soon	Post mon soon Sep-Nov.	Base Period (%)	Rest Premo nsoon	Intercrop period (C+P)	For Potato (P)	Premon soon cane	Total period cane	Cane	Potato	Potato	Cane
I ₁	200(6)	17	420(10)	96.5	460	160	20	42	0.90	0.72	0.61	0.74	982	174	78.2	105.3
I ₂	160(5)	17	310(8)	96.5	460	160	20	61	0.73	0.58	0.44	0.68	904	142	89.7	110.7
I ₃	120(4)	17	215(6)	80.0	460	160	20	70	0.57	0.46	0.31	0.62	826	110	88.2	109.8
I _B	40(2)	17	40(2)	96.5	460	160	20	82	0.24	0.19	0.23	0.60	738	46	160.0	101.9

* The figure within brackets indicate irrigation numbers.

** IW for base 20 mm, for intercrop period 40 mm & then 60 mm, 70 mm etc.

During May to August (monsoon), a total of 1862 mm rainfall occurred in 98 rainy days. The amount clearly indicates that the aeration problem of root system and hence evapotranspiration was less than optimum (Humbert, 1968). Hence taking PR (Kc) for the period as 1, the total water use (effective rainfall) was 460 mm. Again for September to November the average PR (Kc) was taken as 0.60 (drying period for ripening). Thus taking 20 mm for settling raising and 20% of total water use in intercrop period, the total water use of cane for 400 days was found to be 982 mm under I_1 , and average crop coefficient Kc (PR) was 0.74 mm which is similar to Sousa and Scardua (1977) and Yangs' (1979) results.

Hence, recommendation can be made to apply irrigation water at PR 0.90 during both intercrop period and premonsoon period for Autumn planted sugarcane intercropped with potato specially for Greater Mymensingh Agricultural Region having alluvial soil.

REFERENCES

- Clements, H.F. 1980. Sugarcane crop logging and crop control, Principles & Practices. The university press of Hawaii, Honolulu. p. 219.
- FAO, 1988. Generalised data on rooting depth & readily available fraction of ASM (Table 2 and Table 10). Land Resources Appraisal of Bangladesh. Report-6. p. 25.
- Humbert, R.P. 1968. The growing of sugarcane. Revised Edition. Elsevier Publishing Co. Amstardam. pp. 1-779.
- Imam, S.A.; Muslemuddin, S.M. and Hossain, A.H.M.D. 1987. Performance of Intercropped Sugarcane under Reduced Fertilizer Management. *Bangladesh J. Sugarcane*, 9:77-82.
- Islam, T.; Sarkar, H.; Alam, J. and Harun-ur-Rashid, 1990. Water use and yield relationship of irrigated potato. *Agricultural Water Management*, 18:173-179.
- Khalek, A. and Kumaraswamy, A.S. 1992. Effect of irrigation schedule and mulch on growth attributes and dry matter accumulation in potato. *Indian J. Agron.*, 37(3): 510-513.
- Kushwai, V.S. 1993. Effect of spacing and seed size on yield and tuber number in potato variety 'kufri sindury'. Journal of the Indian Potato Association. Special Issue. 1993 (March).
- Marutani, M. and Guz, F. 1989. Influence of supplemental irrigation on the development of potatoes in the tropics. *Hort. Science*, 24(6): 920-923.
- Nankar, J.T. 1993. Achieving targetted area & yield of potato with intercropping in sugarcane by the end of twentieth century. Journal of the Indian Potato Association (Special Issue).
- Sousa, J.A.G.C. and Scardua, R.S. 1977. Furrow irrigation of sugarcane in Araras,. Sao Paulo. *Proc. ISSCT. XVIth Congr.*, 2 :1091-1111.
- Yang, S.J. 1979. The role of soil moisture on the growth & yield of sugarcane under the subtropical climate. *Taiwan Sugar*, 26(3):5-10.