EFFICACY OF SPLIT FERTILIZATION FOR SUGARCANE INTERCROPPED WITH POTATO AT TWO IRRIGATION LEVELS

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ABSTRACT

An experiment was conducted at Regional Sugarcane Research Station (RSRS), Thakurgaon during 2005-06 and 2006-07 cropping seasons to asses effects of different levels of irrigation and split application of N-K fertilizers in sugarcane (var. Isd 36) intercropped with potato (var. Dimond). The intercrop, potato received recommended fertilizer as usual. Application of Urea and Potash (N-K fertilizers) in two splits (B_1) produced highest number of tiller, millable cane and also highest yield in both levels of irrigation in both years. Though the difference was not significant over B_2 and B_3. But irrigation level A_1 (six light irrigation with 65 mm effective rainfall) had significant difference over A_2 (five comparatively deep irrigation with same effective rainfall). Highest number of tiller (215.3 X 10^3 ha^{-1}), millable cane (114.7 X 10^3 ha^{-1}) and cane yield (109.9 t ha^{-1}) were produced by the treatment B_1 under A_1 level of irrigation in the crop year 2006-07. Hence split application of N-K fertilizers with two equal splits applied at plantation and at 145 days after plantation and also light irrigation, 6 to 7 number with total amount of 460-500 mm including effective rainfall may be preferred for loamy and sandy loam soils.

Key words: Sugarcane, split fertilization, irrigation, intercropped.

INTRODUCTION

Fertilizers are indispensable for the crop production systems of modern agriculture. Among the factors that affect crop production, fertilizer is the single most important one that plays a crucial role in yield increase, provided other factors are not too limiting.

Sugarcane being a long duration and high yielding crop removes large quantity of nutrients from soil. Parthasarathy (1972) reported that a 46 ton crop of sugarcane removes from soil 164 Ibs nitrogen and 398 Ibs potash. Timely fertilization is the key for maximum benefit from the added fertilizers. Parthasarathy (1972) found that 40-50% of N and K_20 are taken up in October- December and 15-20% of P_20_5 taken up in the first 6 months of plantation. Bhoj *et.al.,* (1974) reported that the best practice would be to apply the fertilizer in two installments i.e. half at the time of planting and the rest half at tillering.

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). The combined return of cane and potato was always higher when both the crops were planted together and received their full rates of fertilizer (Imam *et. al.,* 1990).

For optimum growth of sugarcane 1500 to 1800 mm rainfall is necessary (Rashid *et.al.,* 1987). The annual rainfall in Bangladesh ranges from 1000-1500 mm, which is unevenly distributed throughout the year. Frequent irrigation promotes rapid canopy development of

both potato and sugarcane. 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). Islam *et.al.,* (1990) found maximum total water use for optimum growth of potato to be 267 mm by 5 irrigation with 40 mm of average irrigation water (depth). Siddique *et al.,* (1998) found highest yield for sugarcane intercropped with potato with the application of premonsoon total irrigation water 420 mm having 96 mm effective rainfall by the period. The soil was Brahmaputra River Plain loamy soil. In silty clay loam soil of calcarious type highest yield of cane intercropped with potato was found with 480 mm premonsoon total irrigation water having effective rainfall 65 mm. Number of irrigation was seven (Siddique *et al.*, 2005). For this experiment Principal Investigator budgeted premonsoon irrigation water range 420-525 mm (average 473 mm) and 450-540 mm (average 495 mm) by seven and six irrigation respectively (including effective rainfall). The range was thought for giving relaxation to the farmers who are not habituated to measure or estimate the amount of irrigation water they apply in the field. Hence the experiment was conducted to find out the effect of split application of N-K fertilizers with the variation of irrigation levels on sugarcane with potato as intercrop.

MATERIALS AND METHODS

The experiment was conducted at RSRS farm, Thakurgaon under Bangladesh Sugarcane Research Institute, Ishurdi, Pabna during the cropping seasons 2005-06 and 2006-07. The land selected had sandy loam soil of Old Himalayan Piedmont Plain as per research program. Sugarcane variety Isd 36 and potato variety Dimond were planted. Sugarcane was planted by Spaced Transplanting (STP) method. One row of potato was planted in the space of one meter between two rows of sugarcane. Two levels of irrigation and three levels spilt application of N-K fertilizers were tested. The experiment was set up in split plot design with the following treatments, having three replications [A (2) X B (3)] X 3:

Factor A: Irrigation

Level A_1: Seven light irrigation (60-75 mm) at 0, 25, 55, 80, 110, 140 & 175 days after transplanting (DAT)

Level A_2: Six comparatively deeper irrigation (75-90 mm) at 0, 25, 65, 110, 140 & 175 DAT respectively.

Factor B: Split application of top dressing fertilizers

Level B_1: 50% N and K-fertilizer as basal + 50% N and K fertilizers at 145 DAT

Level B_2: 30% N and K fertilizers basal + 35% N and K fertilizers at 115 DAT + 35% N and K fertilizers at 145 DAT

Level B_3: 25% N and K fertilizers as basal + 25% N and K fertilizers at 115 DAT + 25% N and K fertilizers at 145 DAT + 25% N and K fertilizers at 180 DAT

Plantation was done with two budded settling raised in soil bed in the end of November 2005 and 2006 with 45 cm spacing between planted settlings. Necessary intercultural operations were done as and when required. Collection of data on yield and various yield contributing characteristics for cane and intercrop were done. The average values of all parameters were analyzed statistically.

RESULTS AND DISCUSSION

Data of cane yield and yield attributes of cane and potato at two levels of irrigation and split application of N-K fertilizers for the crops of 2005-06 and 2006-07 are presented in the Table 1 and Table 2 respectively.

Yield of Cane:
Non-significant difference was observed in cane yield among the treatments in both cropping seasons (Table 1 and Table 2). At 2005-06, the highest yield (70.6 t ha^{-1}) was found from the treatment B_1A_1 followed by 70.0 t ha^{-1} from the treatment B_1A_2 respectively. The lowest yield (56.1 t ha^{-1}) was recorded from B_2 treatment under A_2 level of irrigation. Incase of Table 2, B_1 showed the highest yield of 109.9 t ha^{-1} followed by 108.8 t ha^{-1} from B_2 under A_1 irrigation level. Lowest yield (100.0 t ha^{-1}) was found from B_3 treatment under A_2 level of irrigation.

Tiller:
No significant difference was observed in tiller production among the treatments at A_1 and A_2 levels of irrigation (Table 1 and Table 2). From the Table 1, highest tiller population of 162.6 X 10^3 ha^{-1} was produced from B_1 followed by B_3 treatments under A_2 irrigation level. Lowest tiller of 143.3 X 10^3 ha^{-1} was recorded from B_3 under A_1 irrigation level. From Table 2, the highest tiller population (215.3 X 10^3 ha^{-1}) was produced from B_1 followed by B_2 under A_1 level of irrigation.

Millable Cane:
No significant difference was observed in millable cane production in both cropping seasons (Table 1 and Table 2). The maximum millable cane 111.5 X 10^3 ha^{-1} was recorded from the B_1 and the minimum (93.4 X10^3 ha^{-1}) was from the B_2 treatment under A_2 irrigation level (Table 1). From Table 2, the maximum millable cane was found (114.7 X10^3 ha^{-1}) from B_1 treatment under A_1 level of irrigation and did not differ with other treatments in both irrigation levels.

Brix%:
The data presented in the Table 1 and Table 2 reveals that the different time of fertilizer applications and level of irrigation did not affect Brix%.

Intercrop Yield (Potato):
No significant difference was observed in potato yield at both cropping seasons (Table 1 and Table 2). The maximum potato yield was found 7.5 tha^{-1} from B_1 under A_1 irrigation level.

In the present experiment, split application of N and K fertilizers into two equal halves i.e. ½ N + ½ K at planting and the rest ½ N + ½ K at 145 days after planting (B_1) under A_1 level of irrigation was found superior to other treatments. This is evident from the results of the experiment that B_1 level of N-K fertilizers (2 splits) with A_1 level of irrigation (6 light irrigation) with 65 mm effective rainfall is superior in respect of cane yield improvement in sandy loam to loamy soil. As the difference between B_1 and B_2 is insignificant, we may assume that in case of heavy irrigation and heavy rainfall just after irrigation or fertilizer (N-K) application, three splits or additional split with additional dose of fertilizer to recover leaching loss of N and K elements may give higher yield. In that situation, three splits or an additional split with additional dose of N-K fertilizer or with only N-fertilizer may be recommended (hypothesis).

Table1. Yield and yield attributes of cane and potato at different levels of irrigation and split application of N-K fertilizers during 2005-06 cropping season.

Level of Irrigation	Level of N-K fertilizers	Tiller (x 10^3 ha^{-1})	Millable cane (x 10^3 ha^{-1})	Brix (%)	Cane Yield (t ha^{-1})	Potato Yield (t ha^{-1})
A_1 (6 light Irrigation)	B_1	155.5	107.1	19.1	70.6	7.4
	B_2	150.6	101.5	19.8	61.1	6.8
	B_3	143.3	99.3	18.7	63.2	6.8
A_2 (5 deep Irrigation)	B_1	162.6	111.5	19.3	70.0	6.1
	B_2	140.0	93.4	19.3	56.1	6.8
	B_3	157.0	106.0	19.1	60.1	6.6

Table2. Yield and yield attributes of cane and potato at different levels of irrigation and split application of N-K fertilizers during 2006-07 cropping season.

Level of Irrigation	Level of N-K fertilizers	Tiller (x 10^3 ha^{-1})	Millable cane (x 10^3 ha^{-1})	Brix (%)	Cane Yield (t ha^{-1})	Potato Yield (t ha^{-1})
A_1 (6 light Irrigation)	B_1	215.3	114.7	18.3	109.9	7.5
	B_2	211.9	114.6	19.0	108.8	6.9
	B_3	210.3	113.8	18.3	106.6	6.5
A_2 (5 deep Irrigation)	B_1	209.9	111.6	18.8	105.6	5.9
	B_2	204.2	111.5	19.0	103.8	6.3
	B_3	212.8	114.0	19.0	100.0	6.5

Irrigation level A_1 had significant difference over A_2 at 5% level of significance on cane yield in both the years. Other parameters had insignificant difference over each other.

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