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# Performance of Intercropped Sugarcane under Reduced Fertilizer Management

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## ABSTRACT

An investigation was carried out to study the field performance of intercropping potato with sugarcane under varying fertilizer rates to cane at the Sugarcane Research & Training Institute Farm. Significantly higher yield of cane (98. 3 t/ha) and highest net return as well as highest profit were obtained from cane potato with the application of full recommended rates of fertilizers (Cane : 125, 125 & 110 kg N, $P_2o_5$ & $K_20$ per hectare and potato : 120, 150 & 120 kg N, $P_2o_5$ & $K_20$ per hectare respectively) for both the crops. Residual fertilizers applied for intercropped potato help increasing cane yields. Potato was always found to accelerate cane yield even at lower fertilizer rates to sugarcane. Pure stant potato followed by pure stand spring cane although gave highest total production (140.8 t/ha) but was not comparable with intercropped cane in terms of profitability. Intercropping potato with sugarcane using recommended rates of fertilizers for both the crops produced higher yield and gave the highest economic benefit.

## INTRODUCTION

Intercropping increases the crop yield per unit area by intensifying the use of land. Potato, onion, garlic and mustard are widely grown as intercrop with sugarcane. Among the intercrops, potato occupies 15% of the total sugarcane area intercropped. In Bangladesh about 1. 12 thousand hectare is covered by potato with average production of 10.24 t/ha (Anon, 1986). Rathi and Singh (1980) reported that in the intercropping sequence of sugarcane+potato there has been an increase in the cane yield in comparison to pure stand autumn cane as well as to spring planted cane after harvesting of potato. Singh and Singh (1973), found maximum increase in cane yield by 64. 26% at Pantnagar from intercropping of potato with sugarcane. Highest net profit was earned by intercropping potato over cane grown as pure stand (Anon. 1982). Maximum increase in the net profit by intercropping potato with autumn planted sugarcane over spring planted cane after potato has been reported by Mathur (1976).

It is generally found that cane yield increases when potato was grown as intercrop with sugarcane. Rathi and Singh (1980) reported that cane yield increases

probably due to the resudal effect of fertilizer applied to potato and improvement in the physical, chemical and biological conditions of the soil. Highest yiled of cane might be due to non exhaustive and dwarf nature of the intercrop and residual effect of added fertilizer to intercrop, cultural practices and irrigation (Imam, *et. al.* 1982). Fertilizer is one of the costly inputs for cane cultivation. The farmers find it difficult to purchase it and as such they are applying under dose of fertilizers to sugarcane.

It has been found that application of fertilizer to intercrop specially potato sometimes contribute in increasing the yield of sugarcane. No sufficient research findings on the actual requirement of NPK fertilizer to cane when potato was grown as intercrop are available. So, attempts were made to find out appro priate dose of NPK requirement, and to reduce fertilizer cost for cane cultivation when potato is grown as intercrop. The present study reports the two consecutive years field experiment carried out at the Sugarcane Research & Training Institute farm during 1985-86 and 1986-87 crop season.

## MATERIALS AND METHODS

The soils of the experimental plot belongs to Ganges River Flood Plain (Calcareous dark gray flood plain) with pH value 7.8. The experiment comprised of the following five trearments and was laidout in a randomized block design with 4 replications.

$T_1$-Pure stand autumn (early) cane receiving N, $P_2O_5$, $K_2O$ @ 125,125 & 110 kg/ha respectively.

$T_2$-Potato receiving N, $P_2O_5$, $K_2O$ @ 120 150 & 120 kg/ha respectively followed by spring (late) cane in the same plot receiving N, $P_2O_5$, $K_2O$ @ 125, 125 & 110 kg/ha respectively.

$T_3$ Autumn cane receiving N, $P_2O_5$, $K_2O$ @ 125,125 & 110 kg/ha respectively inter cropped with potato receiving N, $P_2O_5$, $K_2O$ @ 120, 150 & 120 kg/ha respectively.

$T_4$ Autumn cane receiving N, $P_2O_5$, $K_2O$ @125, 62.5 & 55 kg/ha respectively intercropped with potato receiving N, $P_2O_5$, $K_2O$ @ 120, 150 & 120 kg/ha respectively.

$T_5$-Autumn cane receiving N, $P_2O_5$, $K_2O$ @ 62.5, 62.5 & 55 kg/ha respectively intercropped with potato receiving N, $P_2O_5$, $K_2O$ @ 120, 150 & 120 kg/ha respectively.

The individual plot size was 8m x 8m. Three budded setts of the variety Isd-16 were planted end to end in Autuman at a row spacing of 1m. Similar setts were planted half overlapped in spring (February at a row spacing of 90 cm after harvesting pure stand potato). Cardinal variety of potato was used as intercrop. One row of potato was planted on ridge in between two rows of sugarcane with plant spacing 22.5 cm. pure potato were planted at row and plant spacing of 60 cm and 22.5 cm respectively.

Spacing 22.5 cm. Pure Potato were planted at row and plant spacing of 60 cm. and 22.5 cm. respectively.

Urea, Triple Super Phosphate (TSP) and Muriate of potash were used as source of NPK respectively. All TSP, Urea and MP were applied to sugarcane as basal dose. Remanining MP and Urea were applied as 1st top dressing at tillering stage of cane and the rest of urea was top dressed at the time of first earthing up to cane.

The intercrop potato was fertilized with normal recommended dose of fertilizers and the requirements were estimated on the basis of plant population. Half Urea, full TSP, and MP were applied as basal dose. Remaining Urea was applied as first top dressing 40 days after planting of potato. All normal cultural practices appropriate for cane as well as intercrop were done. Both potato and sugarcane were grown under rainfed condition utilizing residual soil moisture.

## RESULTS AND DISCUSSION

Germination, tillers and millable canes : Representative results of two years experiments for germination, tiller and millable cane production are presented in Table 1. It is seen from the table that similar germination of cane was obtained in pure stand cane planted either in Autumn (Nov.), or Spring (Feb.) after harvesting of pure stand potato. No significant effect of application of different rates of fertilizers to cane was obtained in respect of germination. Autumn planted pure stand cane gave about 4% higher germination than that of potato intercropped treatments. Application of nitrogen and potassium fertilizers for both cane and potato might have exerted some adverse effect on germination of sugarcane. Verma and Matiwale (1985) reported that cane germination was adversely affected when basal application of nitrogen was increased to 60 kg/ha. These might have been due to damage caused by higher concentration of free ammonia around the cane setts. Significantly lower number of tillers per hectare were produced by Spring planted cane, and the rest treatments were found identical to one another.

Highest number (170 thousand/ha) of tiller were produced by cane+potato with 100% NPK to both the crops and were indentical to rest of the treatments except

**Table 1. Yield and economics of sugarcane-potato intercropping as fluenced by different fertilizer rates to sugarcane.**

| Treatments | Germination (%) | Tillers ($x10^3$/ha) | millable cane ($x10^3$/ha) | Yield of Cane (TCH) | Yield of potato (t/ha) | Adjusted yield* (TCH) | Net return (Tk/ha) | Profit over pure stand cane (Tk/ha) | Recoverable sugar (%) | Reduction of yield (%) * * |
|---|---|---|---|---|---|---|---|---|---|---|
| $T_1$-pure stand cane | 40.8 | 169.8 a | 71.9 ab | 85.5 b | — | 85.5 | 31,906 | — | 10.07 a | — |
| $T_2$-potato followed by can | 41.8 | 142. 2 b | 71.1 ab | 87.8 b | 11.13 a | 140.8 | 43,306 | 11,402 | 10.27 a | — |
| $T_3$-Cane + potato (100% NPK to cane). | 36.5 | 170.8 a | 98.3 a | 98.3 a | 7.80 c | 135.6 | 50,522 | 18,616 | 10.29 a | — |
| $T_4$-Cane + potato (100% N & 50% PK to cane). | 36.4 | 167.2 a | 73.6 ab | 91.9 b | 7.00 c | 125.4 | 46,381 | 14,475 | 10.66 a | 10.00 |
| $T_5$-Cane + potato (50% NPK to cane) | 36.1 | 161.0 a | 69.6 b | 87.3 b | 8.80 b | 129.2 | 45.588 | 13,692 | 10.62 a | 14.18 |

1* Figures in column bearing similar letters do not differ significantly at 5% level of probability.
* Adjusted yield represents cane + potato.
* * Reduction of yield is calculated in relation to full rates of NPK applied to can.

potato followed by Spring planted cane. Late (Spring) planted cane, inspite of having the highest percent germination showed poorest performance in tiller production. The higher germination percentage of this crop was due to higher as well as favourable soil temperature during planting, and planting of 50% higher number of setts compared to Autumn planting (March). However, late planted cane got little time to produce sufficient tillers.

Use of half dose of NPK resulted lower number of millable cane. Significantly higher number of millable canes were obtained in the Autumn planted cane

receiving N, $P_2O_5$, $K_2O$ @ 125, 125 & 110 kg/ha intercropped with potato receiving 120, 150 & 120 kg/ha compared to Autuman planted canes receiving half of the dose applied to canes.

**Cane yield :** Intercropping potato with cane and application of full dose of NPK fertilizer to cane produced significantly higher cane (89.3 t/ha). The cane yield in other treatments were identical to one another and ranged between 45.5 to 91.9 t/ha. The lowest cane yield was obtained from pure stand Autumn cane indicating that intercropping potato with cane has some advantageous effect on sugarcane yield. Among the fertilizer treatments to cane the contribution of residual fertilizers were prominent. About 10% reduction in yield were occured when 50% nitrogen dose to cane was curtailed and the yield reduction was 14.18% when the rate of NPK to cane were reduced to 50%. Yet the cane yield was about 2 tonnes higher than that of purestand cane. The similar beneficial effect of intercropped potato on cane yield were reported elsewhere (Kanwar, 1975; Imam, 1982; Rathi, 1980; Verma, 1980).

**Potato yield :** Highest potato yield was obtained when potato was grown as pure stand at 60x25 cm row and plant spacing and were significantly superior to rest of the treatments. Among intercropped potatoes, significantly superior yields were obtained with 50% NPK to cane and 100% NPK to potato treatments. Application of fertilizer to cane at planting did not show any positive effect on potato yield rather it reduced the yield to a considerable extent. Application of half TSP and MP at planting and half nitrogen top dressing to cane was found superior over application of full TSP and half Urea and MP at planting and half Urea and MP top dressing to cane on potato yield. This finding partially agreed with the report of Verma (1985) who reported that different levels of nitrogen application to sugarcane at planting did not bring about any significant change in potato tuber yield but increased the potato foliage yield. It is assumed from the result that potato plants absorbed part of the nitrogen applied to cane at planting, and used it to build its foliage without producing additional tuber as laxuary consumption.

**Adjusted total production in terms of cane yield and economics :** The combined yield of cane and potato in terms of cane yield shows that highest production per unit area, and time were obtained from pure stand potato followed by spring cane (140.8 t/ha) and was followed by cane+potato with full dose of NPK for both the crops. Highest net return was also obtained from cane+potato with full dose of NPK for both the crop followed by cane+potato with 50% N and full P & K to cane. The profit loss account compared with pure stand cane also showed similar trend.

Although pure stand potato followed by pure stand spring cane gave highest production but input investment in terms of seed cost for both cane and potato were also much higher resulting lower amount of profit compared to intercropped cane. Although application of half dose of NPK to cane in potato intercropped condition could produce higher yield of cane compared to pure stand cane still the yield was further increased with the application of full dose of fertilizer for cane. Thus the result indicate that the currently recommended rate is not sufficient to meet the fertilizer requirement of sugarcane.

The treatments included comparison between pure stand autumn cane and pure stand potato followed by pure stand spring cane and also application of reduced rates of fertilizers to potato intercropped cane.

Highest yield of cane was obtained from cane + potato with full rate of fertilizer but total highest production was achieved from pure stand potato followed by spring cane. When net return and porfit loss account was considered it revealed that cane+potato with full dose of fertilizer for both the crops gave highest net return and profit. The profit gradually decreased as the rate of fertilizer to cane were reduced. Hence, full rates of NPK fertilizer for both cane and potato may be recommended for higher yield and income from sugarcane+potato intercropping.

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