

Planting method of sugarcane in relay intercropping with paddy in Bangladesh

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ABSTRACT

An experiment was conducted on the method of relay cropping of sugarcane in transplanted Aman paddy field. The planting methods involved were-flat, high beded, oblique, plough furrow, cane after paddy and only sugarcane.

There was no significant effect on the yield of paddy among the treatments. The 16 inches vacant space after each 4 rows of paddy had no significant effect on the yield of paddy. Among the planting methods high beded method of cane planting produced significantly higher cane yield (40.67 TCA) followed by oblique, flat and furrow method of planting. Poorest yield (31.84 TCA) was obtained when canes were planted after harvesting paddy. Highest combined net return (Tk. 12,828.72) was obtained from paddy and high beded method; paddy-flat method of cane planting was close to it (Tk. 12,783.66). Although highest benefit cost ratio (Tk. 1:4.08) was obtained from paddy and flat method of planting, paddy - high beded method secured second position (Tk. 1:3.97).

High beded, flat, oblique and furrow method of cane planting may be recommended in succession for paddy cane relay planting in the Sugarcane Research Institute field conditions.

INTRODUCTION

Higher prices of agricultural commodities prompted the farmers to grow short duration crop than sugarcane requiring 13-16 months to harvest. Increased demand of agricultural products encourages the farmers to adopt intensive farming rather than extensive one.

To make a short crop available and to make cane cultivation productive, remunerative and viable intercropping of sugarcane was introduced. Nearly all the farmers of Bangladesh are rice farmer and the major cropping system is also based upon it. Rice occupies most of the area around mill zone which are also suitable for sugarcane cultivation. Thus to make cane cultivation more remunerative around mill zone intro-

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duction of paddy cane relay intercropping system was felt essential. Paddy-sugarcane is a special cultivation method developed in Taiwan that rendered sugarcane a firm footing where it faces keen competition with rice and Tobacco (Fu, 1958). This is the most intensive method of paddy-sugarcane cultivation and a new system in the sugar world (Chang, 1957).

To implement the concept of paddy-sugarcane a suitable method is required to be found out which does not affect the yield of both paddy and cane crop. Experiments were conducted in Taiwan on a number of methods of planting cane in the paddy field. Chang (1960) reported that there was no significant difference between the yield of flooded paddy and cane planted obliquely and that of high beded system. Results of several experiments on the method of planting paddy-cane reported by Sun (1961), Chang (1960) and Fu (1958) revealed that there was no significant difference on flooded, high beded and Hei-Ko method of paddy-cane planting.

The present research work was undertaken to find out the best adaptable method of cane planting and to compare the economic benefit of paddy-cane relay intercropping with that of clean crop of paddy and cane.

MATERIALS AND METHODS

The experiment was conducted at the Sugarcane Research Institute farm in 1976-77 following randomized complete block design (RCB) with 4 replication. IR-20, a HYV rice was transplanted at the age of 30 days where spacings between rows and plants were 8 inches and 6 inches respectively. After planting each 4 rows of rice a gap of 16 inches was kept vacant for planting of sugarcane setts in different methods in the flowering stage of paddy. A control plot of rice was maintained where paddy seedlings were planted normally on the same date without keeping any extra space and cane were planted after harvesting paddy. In another treatment only sugarcane was grown in its optimum time following normal cultural practices. The rice crop was fertilized at the rate of 2 md Urea, 2 md TSP and 1 md MP per acre. All normal cultural practices including irrigation were followed. The rice crop was harvested 123 days after transplanting.

Sugarcane setts containing three eye buds of Co. 1158 variety were planted in the following methods :

- (1) Flat method
- (2) Oblique method
- (3) High beded method
- (4) Plough furrow method
- (5) Normal cane (fallow during T. Aman season)
- (6) Cane after harvesting T. Aman.

1. **Flat method :** In this method sugarcane setts were planted horizontally on the soft mud without any land preparation in the vacant spaces in the end to end method keeping the eye buds side ways. The setts were planted on 1st November, 1976.

One third of the recommended dose (3 md Urea, 3 md. TSP & 2 md. MP) of Urea and MP and entire quantity of TSP were applied as basal dose in the side band method at the time of planting. This is the most common and oldest paddy — cane method in Taiwan (Fu, 1958).

2. **High beded method :** A raised bed of about 1'-1½" high and 6" width were constructed accumulating soft mud from the 16" gap along the middle of the vacant space after each 4 rows of rice. Cane setts were planted on the beds in the end to end method keeping the eye buds side ways. The beds were constructed to save the eye buds from rotting due to submergence in case of heavy rainfall and also to ensure quick germination.

3. **Oblique method :** Sugarcane setts were planted obliquely at a 45° angle after each four rows of rice. In this method, one eyebud was put under the mud. The eyebud situated at the middle of the sett remained just in touch with the wet ground and the upper one in the open air. The bottom eye bud placed under the mud mostly failed to germinate but the upper two germinated satisfactorily. When the field dried to some extent, the obliquely planted setts were pressed to the ground by foot and allowed to produce sett roots from the upper two nodes.

Table 1. Dates of planting/harvesting, spacing, fertilizer dose and variety of cane and paddy.

Treatments	Date of planting		Spacing	Date of harvesting	Variety	Fertilizer dose/acre.	
	Cane	Paddy					
Only cane (Fallow during T. Aman Season)	8th Nov. '76	—	Cane—6' rows	Cane—7th Jan. '78	Cane — Co1158	Cane	
						Urea	3 md
						TSP	3 md
						MP	2 md
Paddy + flat method of cane planting	1st Nov. '76	26th July '76	Paddy rows—8" plant,—6"	Paddy 26th Nov. '76	Paddy IR—20	Paddy	
						Urea	2 md
						TSP	2 md
						MP	1 md
Paddy + high beded method of cane planting	"	"	"	"	"	"	
Paddy + plough furrow method of cane planting	8th Nov. '76	"	"	"	"	"	
Only paddy followed by only cane.	28th Nov. '76	"	"	"	"	"	

4. **Plough furrow method :** As soon as the soil of the plot became dried and workable condition prevailed to some extent but the paddy was still in the field this method of planting cane was followed. One wooden plough was drawn by hand on

the vacant space in between four rows of paddy to construct a furrow. Normal basal dose of Urea, TSP and MP fertilizers were placed in these furrows and the plough was worked again to mix them. Planting of cane was done on 18th November, 1976 and the setts were covered by a thin layer of soil.

5. Normal Cane : The plot under this treatment were kept fallow during T. Aman growing season. As the soil became workable the land was prepared properly by power tiller and all normal procedures of cane planting were followed.

6. Cane after harvesting T. Aman Paddy : This was the normal practice of cane planting followed by cane growers. In this method sugarcane setts were planted on 28th November, 1976, immediately after harvesting paddy. All normal land preparation and planting practice were followed.

The rice stubbles were removed by plough and spade immediately after rice was harvested.

The cane crop received recommended doses of fertilizers at the rate of 3 md Urea, 3md. TSP and 2 md. MP per acre. All normal cultural practices for cane were followed which includes three weeding, three mulching, two irrigation and frequent control measures against insects and diseases. The crop was harvested on 7th January, 1978.

Data of planting and harvesting, fertilizer dose and row spacing of paddy and sugarcane were shown in Table 1. Data on yield of paddy, sugarcane and germination %, number of tiller per acre, number of millable cane per acre, plant height, sucrose content and pink borer infestation of sugarcane were recorded. Appropriate statistical and economical analysis for yield components of sugarcane were made to isolate desirable treatments. The benefit cost ratio per unit of investment were also calculated.

RESULTS AND DISCUSSION

Yields of Paddy : Highest yield of 1.92 MT/acre were produced when paddy were grown normally without keeping any vacant space and also where the cane setts were planted in flat method (Table 2). Poorest yield of 1.78 MT/acre were produced where canes were planted in furrow method. But there was no significant difference in the yield of paddy in any of the treatments. Chang (1957) reported that intercropping cane into the spring crop of rice has no significant effect upon the yield of rice.

Germination of cane : Highest germination of sugarcane were obtained when sugarcane was plante on high bed (65%) followed by flat method of planting (61%) and were statistically identical. All other treatments were found to differ significantly from each other. Poorest germination (46%) were produced where cane setts were planted in the trench following normal cane planting procedures after the harvest of paddy (Table 2). Fu (1958) reported that in case of odd climate condition like excess rainfall or flood germination of cane was found guaranteed in oblique method of planting.

Tiller production of cane : High bedded planting method of cane produced highest number of tillers (97.92×10^3) per acre which were identical to that produced by oblique, flat and furrow method (Table 2). Cane setts planted early in the season following normal method produced higher number of tillers than that of canes planted after harvesting paddy. Chang (1960) reported that the important tillering period of spring paddy cane is about 20 days to one month after the harvesting of rice. He also reported that the quick growth after harvest of rice is the main reason of good yield of cane.

Production of millable cane : Sugarcane planted in the high bedded method induced highest number of millable cane (44.24×10^3) which were identical to that produced by flat method of cane planting and were superior to all other treatments. Planting cane obliquely or in the furrow produced equal number of cane and was superior to the rest of the treatments except that mentioned above. Poorest number of millable canes were produced when the setts were planted after harvesting paddy following normal planting procedures (Table 2). The above results almost corresponds with the pattern of germination and tiller production of the cane as influenced by the methods of planting. Chang (1960) reported about 16.7% of primary stalks, 54.7% of secondary stalks and 28.6% of tertiary stalks in the component of millable cane. There was no significant effect on the height of cane plants grown under different treatments (Table 2).

Yield of cane : The high bedded method of cane planting out yielded all other treatments by producing 40.67 ton cane per acre (TCA).

Flat, oblique and plough furrow method produced identical yield and was similar to that produced by only cane planted in the normal method (control). Cane planted after harvesting of rice produced the lowest yield of 31.54 TCA (Table 2). Fu (1958) reported that the yield of paddy-cane methods were significantly higher than that of cane planted after harvesting rice. The highest yield obtained from high bedded method of cane planting was supported by its increased germination, more tiller and millable cane production. Chang (1960) reported that there was no significant difference between the yield of flooded paddy cane planted obliquely and that of high bedded-paddy-cane planted flatwise. Sun (1961) reported a number of experimental results of different planting methods of autumn paddy cane in saline soils. He stated that if 100 is the index of planting cane after harvesting paddy then high bedded paddy cane produces 134.8% cane and significantly superior to other methods. But Fu (1958) reported that among different cultural methods of paddy sugarcane highest yield was obtained by flooded paddy cane (oblique method) which was 108.33 TCH (Ton cane/ha) followed by high bedded method (105.25 TCH). Poorest yield (80.12 TCH) was obtained when canes were planted after harvesting rice. He also reported that high bedded method of cane planting was advantageous in poorly drained regions.

Relay interplanting method raise the unit yield of cane about 30/60% per month than a normal crop with a growing period of 17 months (Chang, 1957).

Table 2. Yield of cane, paddy and yield contributing factors of cane under paddy-cane relay inter-planting system.

Treatments.	Germination (%)	No. of tiller (10 ³ /ac)	No. of millable cane (10 ³ /ac)	Cane height (ft)	Yield of cane (TCA)	Recoverable sucrose (%)	Pink borer infestation (%)	Yield of paddy MT/ac
Flat method	61.23ab	87.64a	43.58a	9.08	38.24ab	9.81	4.36	1.92
High beded	64.65a	97.92a	44.24a	9.29	40.67a	9.81	2.85	1.78
Oblique planting	51.80bcd	94.09a	40.84ab	9.32	38.54ab	10.06	4.81	1.85
Plough furrow method	58.05abc	87.87a	42.38ab	9.21	38.03ab	10.28	4.37	1.79
Normal cane (control)	47.77cd	67.45b	39.34bc	9.46	36.99ab	10.11	1.92	fallow during T. Aman season
Normal paddy followed by cane,	46.24d	52.52c	35.96c	9.16	31.54b	10.45	2.70	1.92
S.E. of mean	3.49	3.18	1.25	N.S.	2.23	N.S.	N.S.	N.S.

Figures in the column followed by similar letters do not differ significantly at 5% level.

Recoverable sucrose : The sucrose content of cane under different treatments of the experiment were found to show no effect (Table-2).

Pink borer infestation : Paddy and sugarcane being the member of same family was found to be attacked by same insect. The pink borer, a pest of paddy was found to migrate to sugarcane as alternate host. But the rate of infestation was found insignificant as compared to the control (cane after harvesting paddy). Highest pink borer infestation was found in the canes planted obliquely (4.81%) followed by plough furrow (4.37%) and flat (4.36%) method of planting. Less number of infestation (1.92%) were found where paddy was not grown and cane setts were planted normally.

Economics : The combined highest return of paddy-cane planting system was obtained when the canes were planted on high bed (Tk. 12,828.72) followed by flat method (Tk. 12,783.66). The combined yields of all interplanting methods were found close to each other and higher than that obtained from cane after paddy and only cane plantation method. Chang (1957) reported that comparing the profit returns of different planting systems the single crop of spring and autumn rice and one crop of winter wheat as 100, the index for interplanting cane with spring rice is 164. The later system not only brought more profit but also gives more sugarcane harvesting area, more total sugar production and more rice production.

Highest benefit : Cost ratio per taka investment was obtained in the flat method of cane planting (Tk. 1:4.08) and high beded method was found very close to it (Tk. 1:3.97) followed by oblique method (Tk. 1:3.96). The least return per taka investment was obtained when only cane was grown (Tk. 1:3.20).

Although high beded method produced highest tonnage of cane the expenditure involved for constructing high bed has brought down the benefit cost ratio to second position. Comparatively low cost of production was involved in the flat method of planting.

Table 3. Economics of paddy cane relay interplanting system.

Treatments (method of cane planting)	Cost of cultivation		Total cost (Tk.)	Sale proceeds		Total sale proceed (Tk.)	Net return (Tk.)	Benefit cost ratio/Tk. investment.
	Paddy (Tk.)	Cane (Tk.)		Paddy (Tk.)	Cane (Tk.)			
Flat method	1130.60	3021.20	4151.80	6174.72	10760.74	16935.46	12,783.66(2)	4.08(1)
High bedded method	1130.60	3190.00	4320.60	5724.48	11424.84	17149.32	12,828.72(1)	3.97(2)
Oblique method.	1130.60	3120.00	4250.60	5949.60	10845.16	16794.76	12,544.16(3)	3.86(3)
Plough furrow method.	1130.60	3225.00	4355.60	5756.64	10701.64	16458.28	12,102.63(4)	3.78(4)
Normal cane (fallow during T. Aman season)	—	3260.00	3260.00	—	10408.99	10408.99	7,148.99(6)	3.20(6)
Paddy followed by cane.	1271.93	3260.00	4531.93	6174.72	8875.36	15050.08	10,518.15(5)	3.32(5)

Paddy @ Tk. 3216 and Cane @ Tk. 281.40/MT.

Figures in the parentheses indicate the relative rank of cropping system.

The results of the above experiment indicated the suitable method of planting sugarcane in T. Aman paddy field. This has not only increased the cane yield but also shortened the growing period of cane from 16 months to 13 months. Chang & Lin (1960) reported that under this new system of paddy cane cultivation the farmer might produce one crop of rice with one crop of cane within one year. It is the most effective method to shorten the growing period of sugarcane.

Among the planting methods studied, high bedded method of cane interplanting with paddy produced higher cane yield, net return and economic benefit followed by flat and oblique methods of planting. The farmers may choose any one of the above methods depending on the suitability of the land and variety of paddy and sugarcane grown. Thus it is assumed that the system of interplanting cane with paddy may prove most promising in the years to come.

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