

Row Arrangement for Mustard Intercropping with Sugarcane

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ABSTRACT

An experiment was carried out in the farmers field located at the village Ruppur, Ishurdi, Pabna during 1988-89 crop season to determine an ideal row arrangement for both mustard and sugarcane to make mustard intercropping more remunerative and to minimize the adverse effect of mustard on cane. Mustard intercropping caused an adverse effect on different yield parameters of sugarcane viz. emergence, tillering, millable stalks and yield of cane. The degree of reduction in cane yield due to mustard intercropping varied with the row arrangement of canes and number of mustard row grown in between cane rows. Paired row arrangement of cane proved to be better giving almost one and half times higher yield of mustard intercrop compared to that of single row system of plantation. The reduction in cane yield due to mustard intercropping was found minimum under paired row arrangement where three rows mustard were grown in 135 cm vacant space. Growing three rows of mustard intercrop in 135 cm space keeping in between two paired rows cane at 45 cm interrow space was found the best row arrangement for economic and profitable production of both the crops.

INTRODUCTION

Sugarcane is a long duration crop usually requires 12-16 months from planting to harvesting, and the traditional cane growers of Bangladesh grow various wintercrops viz. potato, garlic, onion, tomato, mustard etc. as intercrop with sugarcane. Among different wintercrops mustard ranks the highest position in respect of area. Out of total intercropped area about 55% are covered by mustard intercropping (Haque and Yasin, 1984). Farmers grow mustard as intercrop with sugarcane following broadcasting method of seeds in cane field. Mustard is a quick growing profusely branching habit exhaustive crop, and uptake large amount on nutrients and moisture from the soil. Due to high competition with sugarcane for nutrient, moisture and space at early stage of sugarcane, intercropping of mustard in general shows an adverse effect on the emergence, tillering, millable canes and yield (Rathi *et al.*, 1974). In abroad some authors have shown that this adverse effect of mustard on cane yield could be minimized through widening of interrow space in between the paired rows of cane (Matherne, 1974 ; Roach, 1977). However, under Bangladesh condition much less work has been done with paired row planting system to grow intercrops with sugarcane.

Therefore, the present study was undertaken to (i) minimize the adverse effect of mustard on cane yield through establishing an ideal row arrangement which is conducive for both cane and intercrop mustard, (ii) increase the productivity of both cane and intercrop mustard.

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MATERIALS AND METHODS

The experiment was conducted at grower's field located at the village Ruppur, Pabna during 1988-1989 cropping season. The study included the following treatments :

- T₁— Paired row cane at 30 cm distance keeping 150 cm vacant space between two paired rows without mustard intercrop.
- T₂— Paired row cane at 30 cm apart keeping 150 cm vacant space with four rows of mustard intercrop in between two paired rows of cane.
- T₃— Paired row cane at 45 cm distance keeping 135 cm vacant space in between two paired rows of cane without mustard intercrop.
- T₄— Paired row cane at 45 cm distance keeping 135 cm vacant space with three rows of mustard intercrop in between the two paired rows of cane.
- T₅— Single row cane at 90 cm apart and without mustard intercrop (check).
- T₆— Single row cane at a distance of 90 cm with one row of mustard intercrop in between two rows of cane.

The experiment was laid down in a Randomized Complete Block Design with four replications. The unit plot size was 10.8 m × 9 m. Sugarcane variety Isd 16 and Tori-7 local mustard variety were used for this experiment. For sugarcane commercial fertilizer @ 125-125-110 kg N, P₂O₅ and K₂O per hectare respectively were applied in all the treatments. One third of Nitrogen, full dose of P₂O₅ and half dose of K₂O were applied in the treanches as a basal dose. One third of Nitrogen and rest half of K₂O were applied as first top dress after 180 days of plantation along with earthing up. The last one third dose of Nitrogen was applied as second top dress after 240 days of plantation. For mustard, the recommended doses of fertilizers viz. urea, TSP and MP @ 176 kg/ha and 57 kg/ha and 161.6 kg/ha respectively were applied. Full dose of P₂O₅, K₂O and half of Nitrogen were applied as basal dose. The remaining half of Nitrogen was applied 45 days after sowing of mustard.

RESULTS AND DISCUSSION

The effect of intercropping mustard at different plant populations and row arrangements of sugarcane has been shown in the Table 1. It may be seen that mustard intercropping did not show significant adverse effect on germination and recoverable sucrose content in different row arrangements of sugarcane. However, under paired row planting of sugarcane mustard intercropping reduced the germination of sugarcane in between 9.6 to 14.5 percent compared to that of sole cropping. On the other hand in single row method of planting, intercropping mustard with cane decreased the emergence of sugarcane buds by 1.90 per cent only over the sole cane (Table 2).

Table 1. Effect of mustard intercropping under paired rows arrangement on the yield and yield contributing parameters of sugarcane.

Treatments	Germination (%)	Tiller population ('000/ha)	Millable stalks at harvest ('000/ha)	Yield of cane (t/ha)	Yield of mustard (t/ha)	Recoverable sucrose (%)
T ₁ - Paired row cane at 30 cm distance keeping 150 cm vacant space between two paired rows without mustard.	30.1 a*	110.0 b	70.1 bc	104.2 a	—	10.9 a
T ₂ - Paired row cane at 30 cm distance keeping 150 cm vacant space with four rows of mustard intercrop in two paired rows of cane.	25.8 a	88.5 c	60.3 d	93.4 b	0.28	11.0 a
T ₃ - Paired row cane at 45 cm distance keeping 135 cm vacant space in between two paired rows of cane without mustard intercrop.	26.4 a	106.6 b	66.8 cd	101.4 ab	—	11.3 a
T ₄ - Paired row cane at 35 cm distance keeping 135 cm vacant space with three rows of mustard in between two paired rows of cane.	27.3 a	105.0 b	66.2 cd	100.7 ab	0.27	11.2 a
T ₅ - Single row cane at 90 cm distance (check).	30.2 a	128.0 a	80.0 a	106.0 a	—	11.8 a
T ₆ - Single row cane at a distance of 90 cm with one row of mustard intercrop in between two rows of cane	29.6 a	102.3 bc	74.3 ab	100.7 a	0.20	11.5 a

* Figures in columns accompanied by similar letters do not differ significantly at 5% level as per DMRT test.

Table 2. Effect of mustard intercropping on the emergence, tillering, millable stalks and yield of cane.

Treatments	percent decrease (-)/increase (+) over respective sole cane			
	Emergence	Tillers	Millable cane	Yield
T ₁ - Paired rows cane at 30 cm distance keeping 150 cm vacant space between two paired rows without mustard.	—	—	—	—
T ₂ - Paired row cane at 30 cm distance keeping 150 cm vacant space with four rows of mustard intercrop in two paired rows of cane.	(-)14.5	(-)19.6	(-)13.9	(-)10.4
T ₃ - Paired row cane at 45 cm distance keeping 135 cm vacant space in between two paired rows of cane without mustard intercrop.	—	—	—	—
T ₄ - Paired row cane at 45 cm distance keeping 135 cm vacant space with three rows of mustard in between two paired rows of cane.	(-)9.6	(-)1.4	(-)0.9	(-)0.7
T ₅ - Single row cane at 90 cm distance (check).	—	—	—	—
T ₆ - Single row cane at a distance of 90 cm with one row of mustard intercrop in between two rows of cane	(-)1.9	(-)20.1	(-)7.1	(-)5.0

Data on tiller population revealed that mustard intercropping has reduced significantly the number of tillers compared to the purestand single row cane. The highest tiller population ($128 \times 10^3/\text{ha}$) was obtained from the single row cane at 90 cm row spacing (T_5) and was significantly superior to rest of the treatments. The lowest number of tillers ($88.5 \times 10^3/\text{ha}$) were obtained from the treatment T_2 where four rows of mustard were grown in 150 cm vacant space in between two paired rows of cane at 30 cm row spacing. It was further observed that (Table 2) mustard intercropping decreased tillering by 1.4 to 19.6% under paired row planting and by 20.1% under single row planting (T_6) than purestand cane. Bose and Ashraf (1972) reported that intercropping of mustard reduced tillering of sugarcane by 23%. Linseed also adversely reduced tillering of cane (Bhel and Narwal, 1977).

The reduction in tiller population under intercropped condition might be attributed due to adverse effect on cane compared to single row system. More or less similar trends were found in millable cane production. It is revealed from the Table 2 that mustard intercropping under paired row arrangement (T_2 and T_4) lowered the number of millable stalks ranging from 0.9 to 13.9% depending upon the number of mustard rows grown as intercrop. Intercropping mustard under single row method at planting (T_6) decreased the millable stalks by only 7.1% compared to the check (T_5). This findings are in agreement with that of Rathi *et. al.* (1974) and Kanwar (1975). The reduction in millable stalks under intercropped condition might be due to the adverse effect of mustard on the tiller production as well as higher tiller mortality of sugarcane resulted from greater competition for light, nutrients and moisture.

Data on cane yield indicated that in general, intercropping of mustard showed a depression effect on yield in varying poportion amongst the treatments. Significantly the lowest cane yield of 93.5 ton/ha was obtained from the treatment where sugarcane was grown in paired rows at 30 cm distance keeping 150 cm space for growing of four rows of mustard. All the treatments except T_2 showed statistically identical yield. However, the highest cane yield (106.0 t/ha) was obtained from single row purestand cane at 90 cm row spacing (check). The highest adverse effect (10.4%) on cane yield was received in T_2 treatment compared to its respective sole cane (T_1). The lowest adverse effect (0.7%) on cane yield due to mustard intercropping was observed in the treatment T_4 compared to its respective sole cane (T_3). The minimum adverse effect of mustard intercropping on cane yield in T_4 treatment might be attributed due to lower competition between sugarcane and intercrop resulted from optimum interrow spacing (45 cm) of mustard than that of closer interrow spacing of mustard (30 cm) in the T_2 treatment. The adverse effect of mustard intercropping on cane yield has been reported by Kanwar (1975) and Anon (1965). They reported the reduction of 2 to 64% cane yield with mustard intercropping. However, the above authors did not clearly indicated any reasons for reduction of cane yield due to mustard intercropping.

The yield of intercrop mustard has been shown in the Table 1. It is evident from the table that the yield of mustard under paired row arrangement of cane planting was almost one and half times higher than obtained from single row mustard raised

in between two single rows of cane at 90 cm row distance. One of the main objective of the experiment was to widen the interrow space of cane to accomodate higher mustard population through more rows of mustard to increase the yield of mustard as well as to reduce the adverse effect of mustard on sugarcane

It is evident from the Table 3 that all treatments did not differ significantly in respect of combined and adjusted yield of cane and mustard. However, the highest adjusted yield of cane (105.2 t/ha) under intercropped condition was obtained from the treatment T_4 where three rows of mustard were grown in between two paired rows of cane at 135 cm vacant space. The lowest adjusted yield of 98.2 t/ha was obtained from the treatment T_2 where four rows of mustard were grown in between two paired rows of cane at 150 cm vacant space. Although four rows of mustard in T_2 produced higher mustard yield but it suppressed the cane yield to a great extent resulting lower combined and adjusted yield.

Table 3. Effect of mustard intercropping on the emergence of sugarcane cultivation under paired row planting.

Treatments	Adjusted yield of cane* (Taka/ha)	Cost of cultivation (cane + mustard) (Taka/ha)	Gross income (cane + mustard) (Taka/ha)	Net return (Taka/ha)
T_1 - Paired rows cane at 30 cm distance keeping 150 cm vacant space between two paired rows without mustard.	104.2 a	21859.00	97748.00	75,890.00
T_2 - Paired row cane at 30 cm distance keeping 150 cm vacant space with four rows of mustard intercrop in two paired rows of cane.	98.2 a	23441.00	92121.10	68,680.00
T_3 - Paired row cane at 45cm distance keeping 135 cm vacant space in between two paired rows of cane without mustard intercrop.	101.4 a	21895.00	95113.00	73,254.00
T_4 - Paired row cane at 45 cm distance keeping 135 cm vacant space with three rows of mustard in between two paired rows of cane.	105.2	23046.00	98687.00	75,641.00
T_5 - Single row cane at 90 cm distance (check).	106.0	19881.00	98687.00	78,806.00
T_6 - Single row cane at a distance of 90 cm with one row of mustard intercrop in between two rows of cane.	104.1 a	20277.00	97617.70	77,340.70

*Price of cane was Tk 938/ton and price of mustard was Tk 16,074/ton.

The economic analysis of the experiment has been shown in the Table 3. The monetary advantage provided an appropriate economic assessment of intercropping in term of net return. The highest net return of Tk 78806.00/ha was obtained from the purestand single row cane (T_5) followed by treatment T_6 (Tk 77340.66/ha) where

one row of mustard was raised in between two rows of cane at 90 cm interrow spacing. The lowest net return of Tk 68680.00/ha was received from treatment T₂ where four rows of mustard were grown in 150 cm space in between two paired rows of cane at 30 cm interrow spacing. Further, it is evident from the results in the Table 3 that the variation in net return due to mustard intercropping under paired row system (T₄) was comparatively smaller to that under single row arrangement of planting cane.

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