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Short Communication

EFFECT OF SOWING METHODS AND TIME ON COTTON YIELD IN SALINE AREA OF BANGLADESH

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ABSTRACT

The experiment was conducted in a farmer's field at Tala Upzilla of Shatkhera district during the season of 2009-2010 to evaluate cotton yield in saline soil under two sowing methods and time. The experiment was arranged in Factorial Randomized Complete Block Design (RCBD) with four treatments such as, Direct Seed Sowing in December (DSSD); Polybag Seed Sowing in December (PSSD); Direct Seed Sowing in February (DSSF); Poly bag Seed Sowing in February (PSSF) with three replications. Significant variation among the treatments were observed for plant shoot elongation rate, no. of vegetative branches per plant, single boll weight, days to first flowering and days to first boll splitting. Significant differences among the treatments were not seen for no. of primary fruiting branches per plant, no. of effective boll per plant and for seed cotton yield. Better plant establishment was exhibited in PSSD and PSSF where poly bag-seedlings were transplanted. DSSF and PSSF showed higher seed cotton yield (2.17 - 2.25 t/ha) with earliness due to higher rate of initial plant shoot development up to 71 days after sowing (DAS) and with lowest values of vegetative branches per plant, days to first flowering and days to first boll splitting. Here the time of sowing was mainly responsible to make the result significant.

Key words: Cotton yield, saline soil, sowing methods, sowing time

Cotton is one of the major cash crops in Bangladesh. It can grow on moderately saline soil where its yield and quality is much lower (Khan, 1987). Salt tolerance range of cotton crop is about 7.7 ds/m (Maas and Grattan, 1999). Although soil salinity is a world wide problem but now it is more acute for Bangladesh. Coastal area in Bangladesh constitutes about 2.5 million hectare which amount to about 25% of total crop land of the country. Of this, nearly 0.84 million hectare are affected by different intensities of salinity. Agricultural land use in these areas is very poor, which is much lower than country's average cropping intensity. The cropping patterns followed in coastal areas are mainly Fallow-Fallow- Transplanted Aman Rice. Salinity causes unfavorable environment and hydrological situation that restrict the normal crop production throughout the year. The factors which contribute significantly to the development of saline soil are tidal flooding during wet season (June- October), direct inundation by saline water and upward or lateral movement of saline ground water during dry season (November- May). It affects crops depending on degree of salinity at the critical stages of growth, which reduces yield in severe cases total yield is lost (Haque, 2006.). Saline area of Bangladesh is increasing day by day on global warming situation through climatic change. Due to poor agricultural yield, lower living standards, health problems, difficulties in transportation and severe natural calamities many people of saline area are forced to migrate to other part of the country. So it is essential that income-generating agricultural system should be adopted immediately in saline areas.

India had also good experience on cotton cultivation in Sunderbans area. The early sowing of the crop will lead to pod formation in May/June when there is scorching summer heat and low humidity in the atmosphere. The scorching heat coupled with low humidity automatically creates conditions where pests cannot occur. Thus the farmers need not use any pesticides. The pests occur when the humidity level is above 70 percent. The average yield potential of the new varieties is two tone per hectare as against 3-3.5 tone in case of other varieties but the reduction in harvesting period by 40 days is an advantage for farmers (Sharma, 2004). Normal planting of cotton seed in saline fields faced with poor

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stand establishment, late, maturity etc. (Dong *et al.*, 2010). So, uniform stand establishment is very essential for commercial cultivation of cotton in saline areas. Keeping in view the above circumstances an experiment was undertaken with sowing time and planting method to determine the optimum yield of cotton in saline area.

This experiment was conducted in a farmer's field situated in the village of Nolta at Tala Upzilla under Sathkhera district of Bangladesh during 2009 – 2010 to determine the effect of cotton yield in saline soil. The experiment was arranged in Factorial Randomized Complete Block Design (RCBD) including four treatments with three replications. Four treatments such as, Direct Seed Sowing in December (DSSD); Poly bag Seed Sowing in December (PSSD); Direct Seed Sowing in February (DSSF) ; Poly bag Seed Sowing in February (PSSF). Unit plot size was 4x10 square meter including five cotton lines and plant spacing provided 40 cm from plant to plant and 80 cm from line to line. Sowing of seeds was done in DSSD and PSSD on 14, December, 2009 and in DSSF and PSSF on 4, February, 2010. Transplantation in PSSD and PSSF were done on 1st January, 2010 and 26, February, 2010 respectively. Final harvesting was done on 28, June, 2010. Delinted cotton seed of the variety Rupali-1 supplied by Supreme Seed Company Ltd. was sown in this experiment. In case of PSSD and PSSF, 50% field soil and 50% full-decomposed cow dung were properly mixed together at first and then used into the poly bags for seedling production.

Both chemical and organic fertilizers were used in this experiment. Decomposed cowdung 1.5 ton/ha and oil cake 125 kg/ha were applied at final land preparation. Before seed sowing and transplanting land had been converted to ridge and furrow across the sowing & seed transplanting lines. Then seeds and seedlings had been sown and transplanted at the slope of the ridge to escape from the extreme soil salinity. Chemical fertilizers were applied at the rate of Urea-200 kg/ha; Triple Super Phosphate (TSP)-200 kg/ha; Muriate of Potash (MoP)- 200 kg/ha; Gypsum-175 kg/ha ; Solubor Boron-10 kg/ha and Zinc Sulphate-10 kg/ha at different stages of plant growth. Triple Super Phosphate (TSP) was applied into two splits during 21 and 41 days after sowing (DAS). Urea, Muriate of Potash (MOP) and Gypsum were applied into 3 (three) splits during 21, 41 and 61 DAS. Solubor Boron and Zinc Sulphate were applied during 41 DAS.

Six irrigations were provided as per requirement of the crop. The crop was infested by Aphid, Jassid and Spodoptera at the vegetative and flowering stages which were controlled by proper application of insecticides as per recommendation of Cotton Development Board (CDB). Other intercultural operations such as thinning, gap-filling, weeding, mulching, earthing up etc. were done properly whenever those were needed. Soil salinity was managed by applying frequent irrigation (STW) water and mulching was done by half decomposed leaves available at that locality, to reduce the evaporation.

Data on seed germination (%), shoot elongation rate (mm/day), number of vegetative branches per plant, number of primary fruiting branches per plant, number of bolls per plant, single boll weight (g), days to first flowering (days), days to first boll splitting (days) and seed cotton yield (kg/ha) were taken. After ten days intervals (From 51 DAS to 91 DAS of the crop) data on plant shoot height were collected in centimeter (cm) and then shoot elongation rate was estimated from this data divided by the number of days and expressed in mm/day. Data on seed germination was collected and expressed in percentages. All data were statistically analyzed and estimated ANOVA according to Zaman *et al.* (1982).

The highest seed germination (90%) was observed in PSSF which was followed by PSSD (70%). On the other hand DSSD showed the lowest seed germination (27%) which was preceded by DSSF (30%). It was understood that germination percentages into poly bags were always higher than direct seed sowing in this trial (Table 1). So it might be an effective tool for smooth stand establishment in case of cotton cultivation in saline area. In this case, weather temperature were recorded 14 – 29 degree centigrade during 14-18 December, 2009 and 12 – 28 degree centigrade during 4 – 8 February, 2010 in the period of seed germination (Fig. 1&2). Soil salinity of the trial plot were ranged from 2.10 – 11.40 EC (ds/m) of that time (Table 2). But in case of poly bags it was used the mixture of 50% soil with 50% decomposed cowdung providing irrigation by the surface water that's salinity was ranged from 1.00 to 1.90 EC (ds/m) (Table 2). On the other hand poly bag increased the soil temperature that was

favorable to seed germination. So those are might be causes of better germination and seedlings production into poly bags.

Data on plant shoot elongation rate is presented in the Table-3. Significant differences were observed among the treatments for plant shoot elongation rate at different plant growth stages. The highest shoot elongation rates were observed for DSSF at 51, 61 and 71 DAS by 9.97, 21.33 and 17.80 mm/day respectively which was followed by PSSF. On the other hand PSSD showed the lowest shoot elongation rates at the same stages of plant growth which was preceded by DSSD. So plant shoot elongation rate was seen higher in February than December and in the same time it was observed always more in case of direct seed sowing than transplanting (Fig 3). It was also observed no significant differences among the treatments for shoot elongation rate at 81 DAS. In this stage shoot elongation rates of all treatments were more or less statistically similar. But after this stage the tendency of shoot elongation rate was observed vice versa of its previous stages (Fig 3).

At 91 DAS shoot elongation rate of DSSD and PSSD (sowing in December) were exceeded over DSSF and PSSF (sowing in February), it indicated that the crop sowing in February was going to cut out from this stage. It was also observed that sowing time was mainly responsible to make the result significant. There was less significant effect of sowing methods. Interaction between sowing methods and time showed statistically insignificant. The responses of sowing time were positive for shoot elongation

Table 1. Effect of sowing methods on seed germination

Treatment	Date of sowing	Date of transplanting	Seed germination (%)
DSSD	14.12.09	---	27 c
PSSD	14.12.09	01.01.10	70 b
DSSF	04.02.10	---	30 c
PSSF	04.02.10	26.02.10	90 a
CV (%)			5.45

Table 2. Results of salinity test of collected soil and irrigation water sample

Soil Sample		Irrigation water Sample	
Date of collection	Salinity EC (ds/m)	Date of collection	Salinity EC (ds/m)
07-11-09	1.80	02-01-10	1.00
17-11-09	1.70	11-01-10	1.0
27-11-09	2.23	30-01-10	1.40
14-12-0	2.10	22-02-10	1.10
29-12-09	4.10	06-03-10	1.50
11-01-10	4.18	26-03-10	1.10
30-01-10	10.50	---	---
10-02-10	11.41	---	---
22-02-10	10.14	---	---
06-03-10	10.26	---	---
26-03-10	10.0	---	---
06-04-10	11.15	---	---
18-04-10	4.70	---	---
28-04-10	4.70	---	---
24-05-10	4.44	---	---

Table 3. Plant shoot elongation rate (mm/day) at different growth stages

Treatment	Plant shoot elongation rate (mm/day) at different plant growth stages				
	At 51 DAS	At 61 DAS	At 71 DAS	At 81 DAS	At 91 DAS
DSSD	3.87 b	3.77 b	4.57 c	12.10	11.60 ab
PSSD	2.13 b	1.63 b	2.77 c	11.97	12.67 a
DSSF	9.97 a	21.33 a	17.80 a	10.77	10.17 b
PSSF	9.27 a	20.57 a	13.13 b	11.37	8.90 c
CV (%)	12.37	20.81	20.42	7.24	9.80

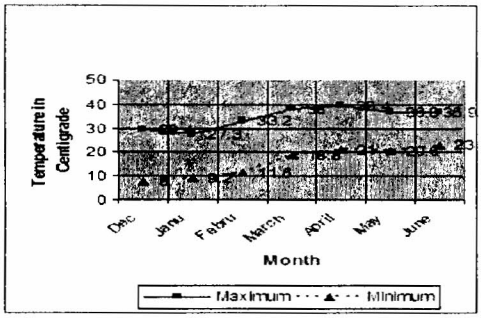

Fig. 1. Monthly Temperature graph

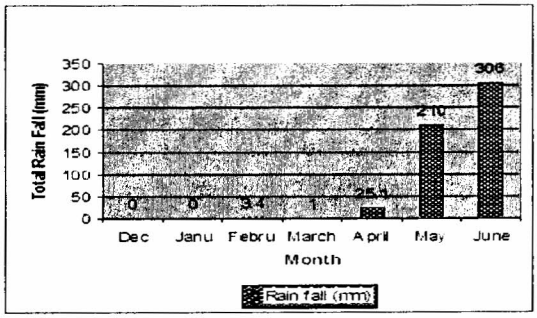

Fig. 2. Monthly Rain fall (mm) graph

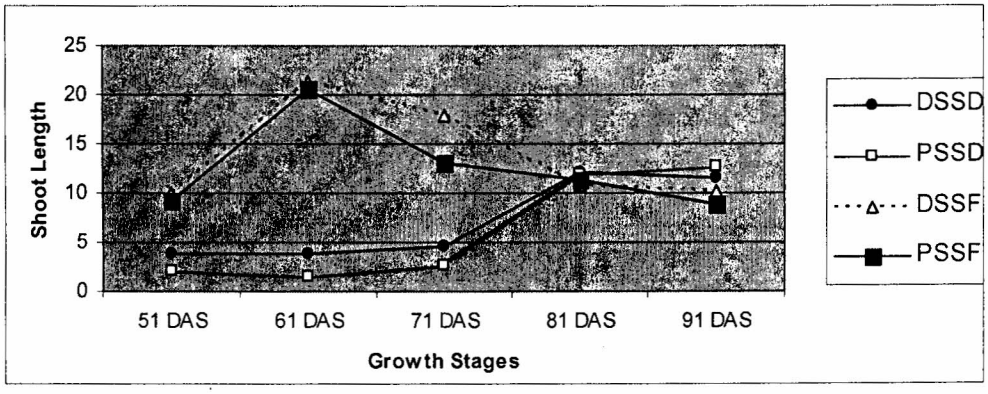

Fig 3. Effect of sowing methods and time on shoot elongation rate

rates at 51, 61 and 71 DAS but it was observed negative at 81 and 91 DAS. According to this growth tendency, it was considered that direct seed sowing or transplanting of cotton in February might lead it's short duration or earliness that was desirable for better cotton yield in saline areas.

Mean values on seed cotton yield and different agronomic characteristics are presented in the Table 4. Significant variations among the treatments were observed for no. of vegetative branches per plant, single boll weight, days to first flowering and days to first boll splitting. Variations among the treatments were not seen statistically significant for no. of primary fruiting branches per plant, no. of effective boll per plant and for seed cotton yield. It was observed that sowing time exhibited significant effect over no. of vegetative branches per plant, single boll weight, days to first flowering and days to first boll splitting. On the other hand, the response of sowing method on those traits was not significant. It was also observed that response of sowing time from December to February was negative to no. of

vegetative branches per plant, days to first flowering and days to first boll splitting. But the response of sowing time was positive on single boll weight. DSSF produced the highest seed cotton yield (2250 kg/ha) which was followed by PSSF (2166 kg/ha) due to higher single boll weight (2.90 – 2.93 g). The treatment DSSF and PSSF were also earlier than DSSD and PSSD. Comparatively very lower value of DSSF and PSSF for no. of vegetative branches per plant, days to first flowering and days to first boll splitting might be the causes of their earliness.

Table 4. Mean values on different agronomical characteristics and seed cotton yield

Treatments	No. of vegetative branches per plant	No. of fruiting branches per plant	No. of effective bolls per plant	Single boll weight	Days to first flowering	Days to first boll splitting	Seed cotton yield (kg/ha)
DSSD	1.87 a	18.53	24.53	2.43	95.00	145.00	1958.00
PSSD	2.07 a	17.13	20.23	2.40	95.00	145.00	2083.00
DSSF	0.07 b	18.27	22.97	2.90	62.33	114.00	2250.00
PSSF	0.10 b	17.40	20.33	2.93	61.67	113.67	2166.67
F test	3.57**	1.36 (NS)	13.25 (NS)	0.25**	1089.20**	971.42**	46441 (NS)
CV (%)	15.68	5.44	17.08	1.25	1.46	0.39	5.83

"*" indicate F-test significant at 5% level.
"**"indicate F-test significant at 1% level.
"NS" indicate not significant

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