

EFFECT OF MULCHES ON THE GROWTH AND YIELD OF TOMATO IN THE COASTAL AREA OF BANGLADESH UNDER RAINFED CONDITION

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ABSTRACT

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An experiment was conducted at Farming Systems Research and Development (FSRD) site Atkapalia, Noakhali to observe the effect of different mulches for production of tomato (*Lycopersicon esculentum* Mill.). Treatments with mulches- rice straw, water hyacinth, and wastage of rice straw significantly increased tomato yield over control (no mulch). Salinity was found to be higher in no mulch treatment than different mulch materials during the experimental period. From the average of two years results it was found that the highest yield (59.41 t/ha) and the highest gross margin (Tk 244450 per hectare) obtained by rice straw mulch followed by water hyacinth mulch with yield 52.5 t/ha and gross margin Tk 223450 per hectare. The benefit cost ratio was found to be highest (5.65) in rice straw followed by water hyacinth (5.56), wastage of rice straw (5.01) and no mulch (4.51). However, tomato could be cultivated in coastal area minimizing soil salinity with application of mulch.

Key words: Mulch, coastal area, rainfed condition and tomato.

INTRODUCTION

Tomato (*Lycopersicon esculentum* Mill.) is an important vegetable in Bangladesh. It contributes significantly to the nutrition of the people of this country as a source of vitamins and minerals. The production of tomato is constrained in the coastal area of Noakhali due to lack of knowledge of improved technology and upward or lateral movement of saline groundwater during the dry season viz, November-May (Karim *et al.*, 1990). Salinity is an important determinant for soil capability and it is seen as a “modifier” which put restrictions on possible crop choices (Wilde, 2000).

Escaping or minimizing soil salinity is very important for the tomato cultivation in the saline soil. Any practices that reduce evaporation from soil surface and or encourage downward flux of soil water will help to control root zone salinity. Mulch is one the effective management means to reduce dry season salinity and conserve moisture in the root zone. This practice also encourages deeper and denser rooting. Reduction of soil salinity and 36.32% more tomato fruit yield was recorded by mulch over control (Anonymous, 2000). Mulches have been found to decrease soil moisture losses by reducing soil temperature and evaporation, promoting favorable soil biotic activities, reducing hard soil setting and contributing plant nutrients (Pal *et al.*, 1994).

Little information regarding mulching on tomato cultivation in the coastal area is available in Bangladesh. So with this view in mind, the experiment was conducted at the Farming Systems Research and Development site Atkapalia, Noakhali under the AEZ 18.

MATERIALS AND METHODS

The experiment was conducted at farmer's field under Farming Systems Research and Development (FSRD) site, Atkapalia, Noakhali, during the winter season of 1999-2000 and 2000-2001 under rainfed condition. The soil comprises grey to olive, finely stratified, silty alluvium which becomes saline in the dry season (FAO, 1988). Salinity is strongly related to rainfall and it varies from year to year (Fig.1).

The soil was silt loam to clay loam under the Ramgati soil series of AEZ 18 (Young Meghna Estuarine Flood plain). Organic matter content, pH, nitrogen, phosphorus, potassium, zinc and sulphur of soils were 1.41%, 7.06, 0.03%, 5.7 µg/g soil, 0.231 meq/100g soil, 0.66 µg/g soil and 65.2 µg/g soil, respectively.

Different mulch treatments viz. T₁= Control (no mulch), T₂= Wastage of rice straw, T₃= Rice straw and T₄=Water hyacinth amounting 8.0 t/ha were tested in the experiment. The experiment was conducted under randomized block design with six replications having unit plot size of 8m x 5m. The crop was fertilized with N₁₈₅P₇₀K₅₄Zn₂ + Cow dung 5 t/ha. All fertilizers were applied at the final land preparation as basal. The 25-30 days old seedlings of tomato (BARI Toamto 2) were planted within 25-27 November, in both the years. Mulches were applied one week after planting of tomato seedling to check the loss of soil moisture. The crop

was grown under rainfed situation. Electrical conductivity (EC) was determined using conductivity bridge (model-EIJLKLKAMP pH/EC 18.38) under 15 days interval during the experimental period. Ten plants avoiding 1m border area were selected for collecting data on yield and yield contributing characters. All the data were statistically analyzed with MSTAT-C program. The means were compared by Duncan Multiple Range Test (DMRT) test.

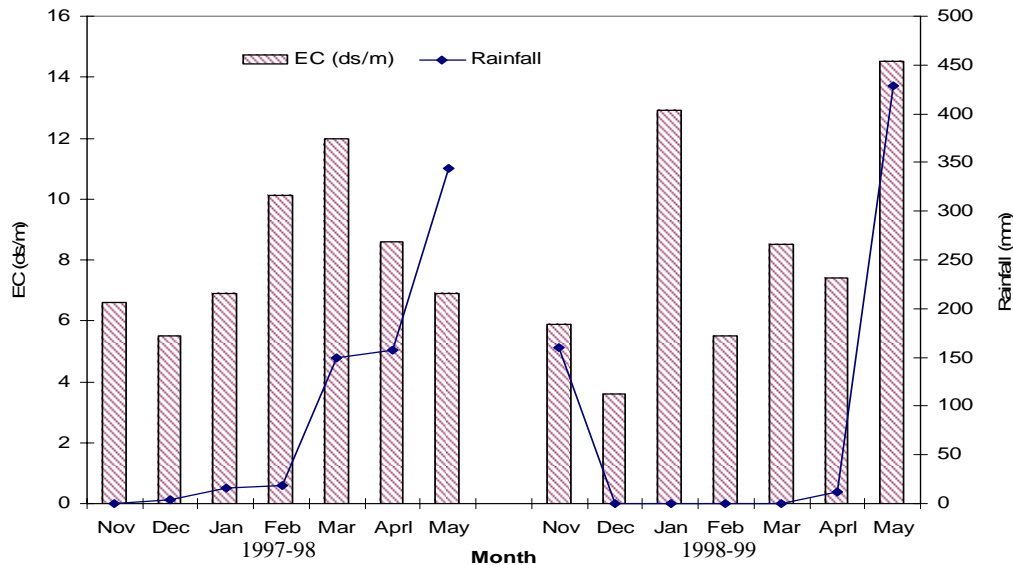


Fig.1 Salinity and rainfall data of Atkapalia, Noakhali during 1997-98 and 1998-99 (Anonymous, 2000)

RESULTS AND DISCUSSION

The result of the effect of different mulches on the yield and yield contributing characters are presented in Table 1 and 2.

The influence of different mulches on plant height of tomato was insignificant during 1999-00 (Table1) and significant during 2000-01 (Table2). The mulch treatments- wastage of rice straw, rice straw and water hyacinth, being at par showed significant difference over control (no mulch) during 2000-01. The plant height 73.2, 80.0, 83.2 and 82.5 cm were recorded from control, wastage of rice straw, rice straw and water hyacinth, respectively. The plant height was affected by salinity and lower plant height was found from the control (no mulch) treatment. Higher salinity was found in control treatment and lower salinity was observed in mulched plot (Fig.2). Anonymous (2001) reported similar results. The lower salinity in the mulched plot attributed because of hindering or prevention of upward movement of ground water through capillary rise in the root zone.

Different mulch treatments had significant influence on number of fruits per plant during 1999-00 (Table1) and 2000-01 (Table2). The higher number of fruit per plant 33.50 during 1999-00 and 38.60 during 2000-01 were found from the treatment rice straw mulch. The mulch treatments -wastage of rice straw, rice straw and water hyacinth were found to produce similar number of fruit per plant during both the years. The lowest number of fruit per plant 28.55 and 28.68 were recorded from the no mulch treatment during 1999-00 and 2000-01, respectively. The lower number of fruit per plant was only due to higher salinity in the non mulch treatment. The similar number of fruits was observed in the Farming Systems Research and Development (FSRD) site Atkapalia, Noakhali (Anonymous, 2001).

The individual fruit weight was presented in the Table 1 and 2. The highest individual fruit weight was recorded 68.33g and 83.40g during 1999-00 and 2000-01 from the treatment rice straw mulch. In both the year, individual fruit weight was significantly influenced by different mulching materials (wastage of rice straw, rice straw and water hyacinth) over control (no mulch) treatment. But each fruit weight found from wastage of rice straw, rice straw and water hyacinth were statistically similar.

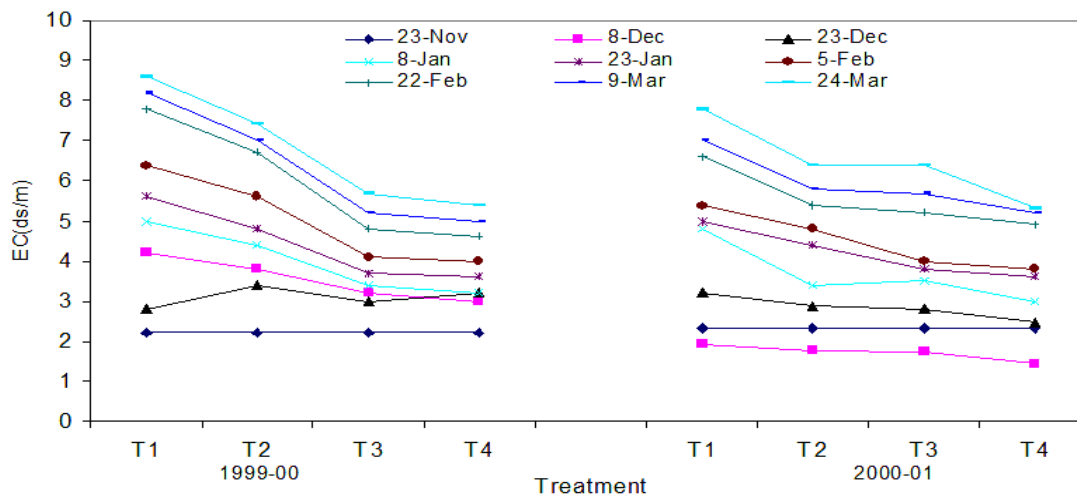


Fig.2 Effect of different mulches on the salinity of the experimental plot during 1999-00 and 2000-01

The lowest fruit weight was found 54.83g and 64.80g during 1999-00 and 2000-01. The similar result was obtained at FSRD site Atkapalia, Noakhali (Anonymous, 2001). The decrease of individual fruit weight might be due to higher soil salinity in the experimental plot. Higher soil salinity might be cause of lesser nutrient uptake by the plant. Plants in salt-affected soils often have the same appearance as plants growing under moisture stress/drought (FAO, 2001).

Significant variation in weight of fruit per plant was observed from the treatments- wastage of rice straw, rice straw and water hyacinth over control (no mulch) during both the year. The highest fruit weight per plant 1651.3g and 1823.0g were recorded during 1999-00 and 2000-01, respectively from the treatment rice straw, which is significantly higher than rest of the other treatments (Table 1 & 2). But the treatments- wastage of rice straw and water hyacinth are at per. The lowest fruit weight per plant 930.6g and 1158.0g were recorded during 1999-00 and 2000-01 from the control (no mulch) treatment. The lowest fruit weight was mainly due to higher salinity in the later stage of tomato in the experimental plot. Similar results were obtained by Anonymous (2001).

Mulch treatments- wastage of rice straw, rice straw and water hyacinth being at par produced significant yield difference over control during 1999-00 (Table1). The highest yield 45.25 t/ha and the lowest yield 28.42 t/ha were obtained from the treatments rice straw and control, respectively during 1999-00. In the year 2000-01, the highest yield (73.75 t/ha) was obtained from rice straw mulch, which is significantly different from other treatments. The lowest yield (50.21 t/ha) was found from control (no mulch) treatment. The treatment wastage of rice straw and water hyacinth are statistically similar. The higher yield from different mulched plot might be due to lower soil salinity than no mulched plot. Rahman *et al.* (2001) reported soil salinity 7.8 and 4.8 ds/m from non mulched and mulched plot, respectively. At the same time fruit yield was found to increase 30-35% from mulched plot over non mulched plot. These results support the research results of Anonymous (2001). Mulching is reported to have conserved soil moisture, reduced soil temperature, minimized evaporation loss and enhanced root growth (Allamanas *et al.*, 1977; Choudhury and Prihar, 1974).The yield performance was comparatively good during 2000-01 by all the treatments than the yield obtained during 1999-00. The trials were conducted under the rainfed situation, but sudden rainfall occurred and the yield of tomato was found to increase in the second year. The reason might be due to occurrence of a rainfall (39 mm) in the last week of November (Fig.3).

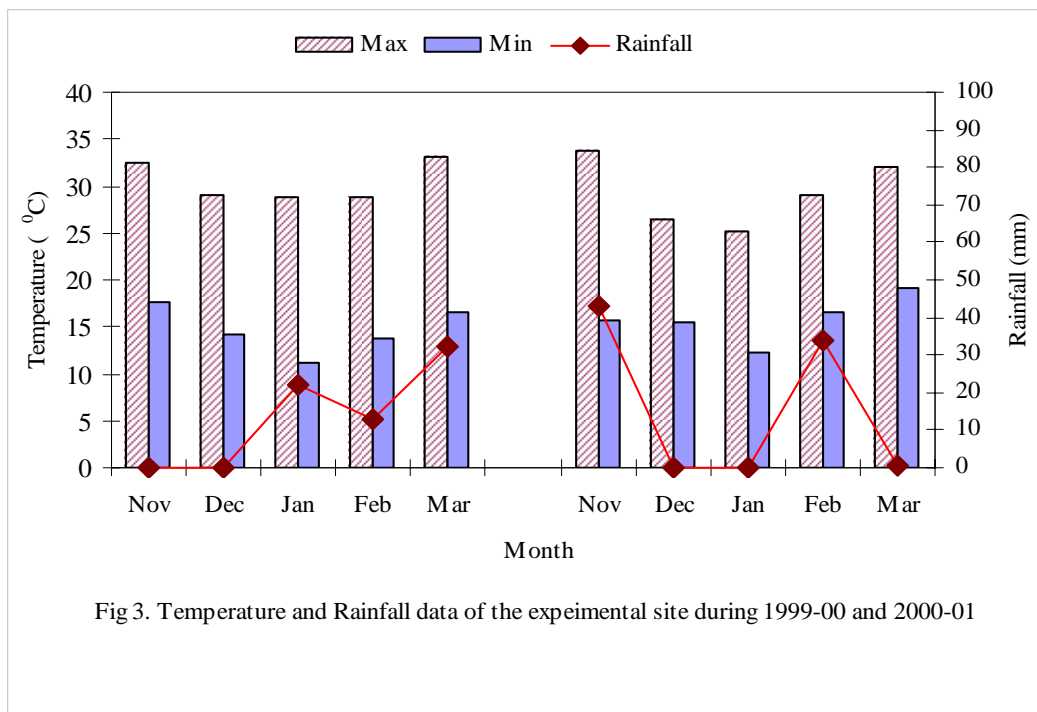


Fig 3. Temperature and Rainfall data of the experimental site during 1999-00 and 2000-01

Table 1. Effect of different mulches on the yield and yield contributing parameters of Tomato during 1999-2000 at Atkapalia, Noakhali

Different mulches	Plant height (cm)	No of fruits/plant	Each fruit wt. (gm)	Wt. of fruit/plant	Yield (t/ha)
No mulch(T ₁)	66.8	28.55b	54.83b	930.67c	28.42c
Wastage of rice straw (T ₂)	71.5	30.40ab	64.83a	1406.17b	32.50b
Rice straw (T ₃)	74.2	33.50a	68.33a	1651.33a	45.25ab
Water hyacinth(T ₄)	73.5	33.40a	65.17a	1436.50b	37.03ab
CV (%)	8.4	8.0	8.1	9.40	14.12

Table 2. Effect of different mulches on the yield and yield contributing parameters of Tomato during 2000-01 at Atkapalia, Noakhali

Different mulches	Plant height(cm)	No of fruits/plant	Each fruit wt. (gm)	Wt. of fruit/plant	Yield (t/ha)
No mulch(T ₁)	73.2b	28.68c	64.80b	1158c	50.21c
Wastage of rice straw(T ₂)	80.0a	33.57b	76.20a	1448b	60.97b
Rice straw(T ₃)	83.2a	38.60a	83.40a	1823a	73.57a
Water hyacinth(T ₄)	82.5a	38.53ab	80.60a	1515b	66.08b
CV(%)	10.3	11.21	9.3	14.95	9.46

Table 3. Profitability level of different mulches on the yield of tomato at FSRD site, Atkapalia, during the winter seasons of 1999-00 and 2000-01

Treatment	Mean yield (t/ha)	Gross return (Tk)	Total variable cost (Tk)	Gross margin (Tk)	BCR
T ₁	39.31	196500	43550	152950	4.51
T ₂	46.73	233650	46550	187100	5.01
T ₃	59.41	297000	52550	244450	5.65
T ₄	52.5	272500	49050	223450	5.56

Benefit cost analysis

The economic profitability level obtained from different mulching treatment over two years was given in Table 3. The table reveals that rice straw mulch showed the highest gross return Tk 297000/ha followed by Tk 272500/ha in water hyacinth and Tk 233650/ha in wastage of rice straw mulch. Like gross return the highest gross margin Tk 244450/ha found in rice straw followed by water hyacinth (Tk 223450/ha).

REFERENCE

Allamanas, R.E.A., Halaure, W., Nelson, W. and Evans, S.D. 1977. Surface energy balance and soil thermal property modifications by tillage induced soil structure. Tech. Bull 306. University of Minnesota, USA, p 12.

Anonymous. 2000. BARI Annual Report 1999-2000. p242.

Anonymous. 2000. Annual Progress Report (1999-2000), Soil Resources Development Institute, District Office, Noakhali, Bangladesh, pp 25-26.

Anonymous. 2001. Annual Report, On Farm Research Division, BARI, p 26.

Choudhury, M. R. and Prihar, S.S. 1974. Root development and growth response of corn following mulching cultivation and inter row compaction. Agron. J. 66: 350-355.

FAO. 2001. Saline Soils and Their Management, Food and Agricultural Organization, UNDP, Rome, July 2001, <http://www.fao.org/>, p2.

FAO. 1988. Land Resources Appraisal of Bangladesh for Agricultural Development Report 2, Food and Agricultural Organization, UNDP, Rome, p 341.

Karim, Z., Hussain, S.G. and Ahmed, M. 1990. Salinity Problems and Crop Intensification in the Coastal Region of Bangladesh, p14.

Pal, A. R., Baghel, S.S., Rathore, A. L. and Sahu, R. K. 1994. Response management for rainfed rice and rice-based cropping Systems. A paper presented at the 29th All India Annual Rice Group Meeting, Indira Gandhi Agricultural University Raipur (MP), India, 20-22 March 1994.

Rahman, M. J., Uddin, M. S. and Rahman, A.F.M.F. 2001. Tomato Cultivation in Saline Area Using Mulch. Leaflet (in Bengali) published by On-Farm Research Division, Bangladesh Agricultural Research Institute, Noakhali, Bangladesh.

Wilde Koen de. 2000. Out of the Periphery Development of Coastal Chars in Southern Bangladesh. The University Press Limited, Red Crescent Building, Motijheel, Dhaka, p32.