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Effect of different shelterbelts on growth and yield of brinjal (*Solanum melongena* L) under different environments

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ABSTRACT

The present study was conducted at the Research Farm, School of Climate Change and Agricultural Meteorology, Punjab Agricultural University, Ludhiana during Rabi season 2008-09. To protect the crop from low temperature injury investigations were carried out by three types of shelterbelts viz white polythene, black polythene and Sarkanda. The microclimatic conditions moderated by the shelterbelt were conducive for growth and development of the crop. The crop grown on 11 November recorded the highest growth and other plant characters under the white polyethene shelterbelt as compared to other two types of the shelterbelts. The yield of the crop sheltered by white polyethene was more (428.36 q/ha) as compared to black polyethene (420.58 q/ha) and Sarkanda (299.61 q/ha). Modified microclimatic conditions lead to enhanced total yield.

Keywords: Brinjal; LAI; plant height; yield; shelterbelts

INTRODUCTION

Brinjal (*Solanum melongena* L) is an important and indigenous vegetable crop of India and other parts of the world. It contributes to 9 per cent of the total vegetable production of the country. It is due to the improvement in production technology, plant protection measures and the genetic improvement of the crop which has shown significant advancement in the yield and quality of the produce and disease and insect-pest resistance has also been increased. Brinjal requires a long and warm growing season and is sensitive to frost injury. Chilling weather for longer time damages the crop. A temperature in the range of 20-30^{o}C is most favourable for its successful production (Anonymous 2008). Prolonged spell of frost many times leads to a failure of the crop. So for proper growth and development of crop it must be protected from frost injury. There are number of techniques developed for the protection of crop from frost and cold injury. Important techniques used for frost prevention are mulching, screening, use of heaters, wind machines, overhead sprinkler irrigation and wind breaks. Out of these techniques a physical shelterbelt is considered to be the best as it is cheap and ameliorates the microclimate of the crop by reducing the intensity of cold winds and in turn promotes growth, yield and yield contributing characters of the crop. Properly oriented and designed shelterbelts are very effective in stabilizing agriculture in the regions where strong winds cause mechanical damage and impose severe stress on growing crops (Mavi 1994). Shelterbelts have been found very effective in raising crop yield by increasing day time soil, air, canopy temperature and reducing wind speed on the leeward side of the barrier (Marshall 1967, Rosenberg 1967). Reduction of air flow in the leeward sides of shelterbelt may lead to poor vertical diffusion and air mixing causing higher day temperature (Brown and Rosenberg 1972). Benefits from the shelterbelts can be regarded as the increased daytime soil and air temperature, vapour pressure, relative humidity, soil moisture and decreased wind speed, evaporation, evapotranspiration and nocturnal leaf and air temperature in the leeward of the barrier which could result in increased yield.

MATERIAL AND METHODS

The field experiment was conducted at the Research Farm, School of Climate Change and Agricultural Meteorology, Punjab Agricultural University, Ludhiana during Rabi season 2008-09. The treatments consisted of four types of different shelterbelts (white polythene, black polythene, sarkanda and control) replicated three times and subjected to analysis of variance in Split Plot Design. Number of branches per plant was counted from the randomly sampled plants in each treatment of the experiment and average number of branches was calculated. Three randomly selected plant samples from each treatment were separated into leaf, stem and fruits, oven dried at 70°C for 72 h and average weight was taken as dry matter. The final biomass was determined at the time of harvest of fruits from the net plot area. The number of fruits picked from five plants selected at random in each plot was recorded at each harvesting and total number of fruits per plant was calculated after harvest. The fruits of five tagged plants were weighed and total weight was divided by the number of fruits to calculate the average fruit weight. For calculating average fruit size five fruits were randomly selected from each plot. Each fruit was measured for its length and breadth by using a thread which was further measured by using a scale. Taking the average of these five fruits the average fruit size was obtained. The mature fruits were taken from each plant then the total yield was taken by adding the yield of each picking in different treatments. The sum of weight of fruits from all pickings was taken from each plot and converted into q/ha.

RESULTS AND DISCUSSION

Effect of different shelterbelts on leaf area index

Leaf area is one of the most important factors that influences interception of radiation, transpiration and ultimately photosynthesis. Leaf area development and maintenance are considered to be key factors for maximum dry matter production. Types of shelterbelts significantly influenced the leaf area index (LAI) and it was observed that the maximum LAI was obtained in the crop sheltered by white polythene followed by black polythene and Sarkanda. The crop kept under open conditions produced least LAI as compared to different shelterbelts (Fig 1). Kavita et al (2003) also reported that leaf area index in brinjal inside the poly-house was 71 per cent more than the open conditions.

Effect of different shelterbelts on plant height

Plant height of the crop grown under white polythene shelterbelt was more than in black polythene shelterbelt and Sarkanda shelterbelt. This may be due to the fact that the radiation reflected by white polythene raised the temperature of the inter and intra rows in the crop which might have added to the better plant growth and thereby increased height (Fig 2). Puri et al (1992) and Zhang et al (1999) found that sheltered plants exhibit earlier development and faster growth. Similar results were reported by Singh (2002) in capsicum, Khera (2004) in cauliflower and Cheema (2005) in brinjal.

Average fruit size

The effect of different dates of transplanting and different types of shelterbelts and row width on average fruit size of brinjal was observed and the results presented in Table 1. Maximum fruit size in terms of length (12.67 cm) and breadth (10.13 cm) was found in D_1 followed by D_2 and D_3. The fruit length differed non-significantly however the differences in fruit breadth were significant. The length of the fruit in D_2 and D_3 was 12.16 and 11.92 cm respectively. The breadth of the fruits was 9.41 cm in D_2 and 9.32 cm in D_3. (Table 1).

Average fruit weight and total yield per hectare

The highest total yield per hectare (458.53 q/ha) was obtained in the crop transplanted on 11 Nov (D_1) followed by 25 Nov (D_2) (333.29 q/ha) and 9 Dec (D_3) (280.66 q/ha). The crop sheltered with white polythene shelterbelt gave maximum average fruit weight (122.2 g) followed by black polythene (121.23 g) and Sarkanda (116.28 g) as compared to control (111.11 g). The mean difference between control and white polythene, black polythene and Sarkanda, white polythene and Sarkanda was more than the critical difference but the mean difference between white and black polythene was less than critical difference which indicated

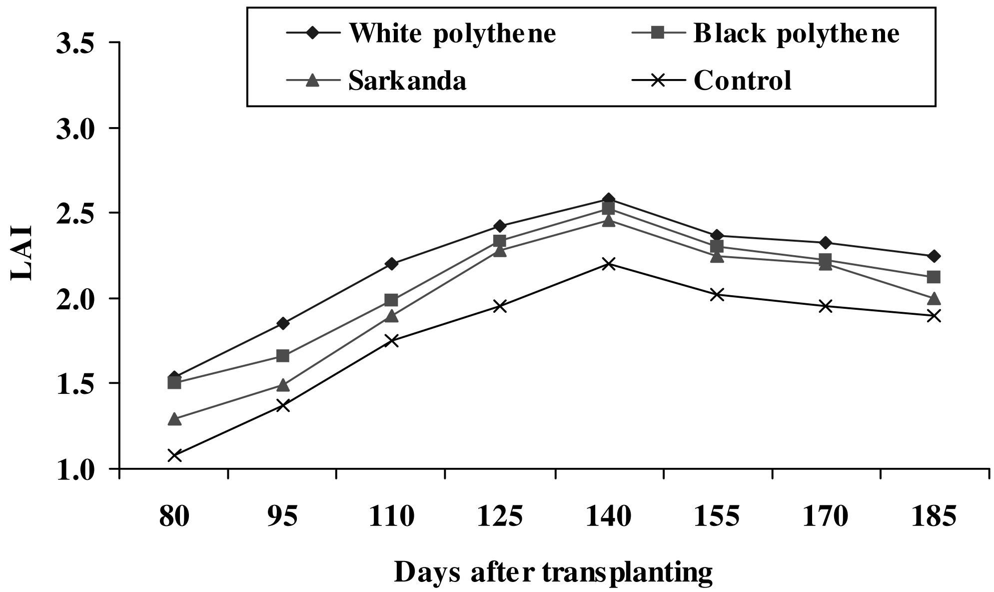

Fig 1. Effect of different types of shelterbelts on leaf area index of brinjal

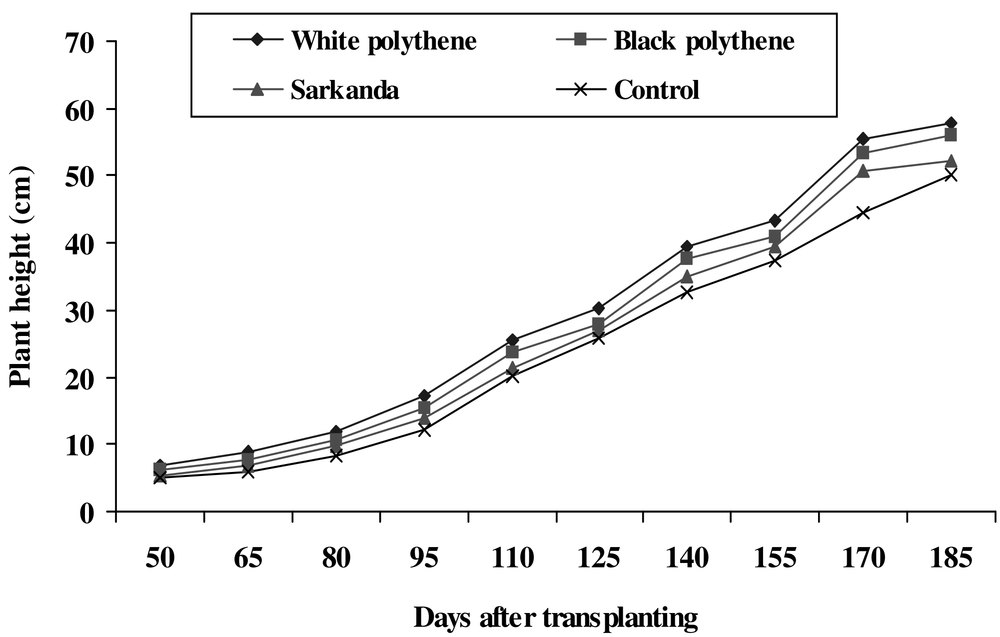

Fig 2. Effect of different types of shelterbelts on plant height of brinjal

Table 1. Average fruit size as influenced by dates of transplanting of shelterbelt and width of shelterbelt

	Average fruit size (cm)	
	Length	Breadth
Date of transplanting		
D_1 (11 Nov)	12.67	10.13
D_2 (25 Nov)	12.16	9.41
D_3 (9 Dec)	11.92	9.32
$CD_{0.05}$	NS	0.37
Shelterbelt		
S_0 (Control)	11.74	9.24
S_1 (White polythene)	12.56	10.33
S_2 (Black polythene)	12.43	9.51
S_3 (Sarkanda)	12.26	9.41
$CD_{0.05}$	NS	0.46
Row width		
W_1 (2 m)	12.00	9.29
W_2 (4 m)	12.53	9.80
W_3 (6 m)	12.22	9.78
$CD_{0.05}$	NS	0.28

that these differences were more significant. Similar results were observed by Gandhi (2001) in capsicum, Singh (1999) in pea, Cheema (2005) in brinjal and Bishnoi et al (1989) in tomato. Among different types of shelterbelts the white polythene had maximum crop yield per hectare (428.36 q/ha) followed by black polythene (420.58 q/ha) and Sarkanda (299.61 q/ha) as compared to control (281.43 q/ha). There were no significant differences for the yield between white polythene and black polythene (Table 2).

Table 2. Average fruit weight (g) and total yield (q/ha) as influenced by dates of transplanting, types and width of shelterbelt

	Average fruit weight (g)	Total yield (q/ha)
Date of transplanting		
D_1 (11 Nov)	139.80	458.53
D_2 (25 Nov)	109.44	333.29
D_3 (9 Dec)	103.88	280.66
$CD_{0.05}$	4.49	15.40
Shelterbelt		
S_0 (Control)	111.11	281.43
S_1 (White polythene)	122.2	428.36
S_2 (Black polythene)	121.23	420.58
S_3 (Sarkanda)	116.28	299.61
$CD_{0.05}$	3.87	17.58
Row Width		
W_1 (2 m)	114.31	344.57
W_2 (4 m)	121.73	382.21
W_3 (6 m)	117.09	345.71
$CD_{0.05}$	2.68	11.49

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