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PJBS

ISSN 1028-8880

Pakistan Journal of Biological Sciences

ANSInet
Asian Network for Scientific Information
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan

Pakistan Journal of Biological Sciences 3 (8): 1260-1261, 2000

Relationship Between Age of Seedlings on Productivity of Tomato (*Lycopersicon esculentum* L.) Grown under Plastic Tunnel

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Abstract: The studies were conducted to find out the best age of seedling for transplanting and to compare three varieties of tomato i.e., Money maker, Peelo and IT-378-87. As regards the age of seedlings, medium aged seedlings i.e., 5 weeks were found best for survival percentage of plants, height of plant, number of fruits and yield of the plants followed by six weeks and four weeks. Time taken for flowering was observed less in case of four week seedlings than others. Number of branches were maximum in six weeks seedlings. Varieties did not show any difference for survival percentage or height of plants at first flowering. However, V_1 was found best of all followed by V_2 and V_3 for number of branches, height at maturity, number of fruits per plant and yield, although this variety took maximum time for flower opening than V_2 and V_3. As regards interaction of varieties and treatments, no significant response was observed except number of fruits per plant.

Key words: Tomato, seedlings age, plastic tunnel, productivity

Introduction

Tomato (*Lycopersicon esculentum* L.) is one of the prominent vegetable crop. Age of the seedlings would affect the crop to a greater degree. Small sized and low aged seedlings are thought to be more successful for survival percentage. Maeso (1984) reported that four cultivars were sown in the nursery on 17 September, 6 October, 24 October and 12 November transplanted on 1 November, 21 November, 6 December and 21 December respectively. Yields were highest at first sowing date (37500, 39300, 28900 and 36300 kg ha^{-1} in Loica, Ronita, Roma U.F. and Heinz 1730 respectively). Loica had consistently higher yield at all sowing times. El-Aidy (1984) explained that in trials between December and March, the average fruit yield of tomatoes grown under plastic tunnels was 12.4 kg/m^2 and for the crop grown in the open only 1.53 kg/m^2. In a trial with tomatoes shaded by nets, yield under 63, 55 and 40% were 9.48, 9.83 and 11.77 kg/13.6 m^2, respectively compared with 8.64 kg/3.6 m^2 in the control. Rahman and Quasem (1986) reported that age of seedlings did not show any significant difference for all yield contributing characters studied except days to first flower and days to fruit set, whereas earliness was observed with the increased age of seedlings. Yield increase of 8 tons per hectare was obtained from 40 days of seedlings. Silvestri *et al.* (1986) suggested that the optimum time for transplanting tomatoes, cv. 'Canaria' in the field was towards the end of May. If transplanting took place 15-30 days earlier, harvesting was advanced by 12 days but yield was reduced by 12%, and if transplanting was delayed by 15 days, harvesting was delayed by 12 days but there was a 20% loss of yield. Hossain *et al*. (1986) worked with 15 lines of tomatoes. Early November was found generally the best time for sowing, although some lines performed best with sowing in September or October. The line TM 0367 gave a significantly higher (54.2 t ha^{-1}) than the other lines. Lipari and Paratore (1989) worked with four tomato cultivars namely F_1 vemone, Capsicums, Lamuyo and Aubergines. They were sown on 10 December in 100 cm^2 peat pots. Then they were transferred to other peat pots with special reference to 3 transplanting dates. The mean yields of tomatoes were 3.6, 2.0 and 0.8 kg/plant respectively with transplanting 60, 90 and 120 days after sowing. Corresponding yields for Capsicum were 2.4, 1.7 and 1.0 kg and for Aubergines 3.7, 2.4 and 2.1 kg per plant. Early transplanting gave good results than later ones. Jain and Bhatti (1988) reported that in a field naturally infested with *M. javanica* in Haryana, India, transplanting of 8 week-old seedlings alone reduced root knot index and final population of nematodes resulting in better yield as compared with transplanting 4-week old seedlings.

A detailed study would then be needed to establish a relationship between age of the seedlings and productivity of the individual plants. Present research project was therefore, envisaged to find out the best age of seedlings for enhanced yield of tomato plant grown under plastic tunnel.

Materials and Methods

The project was carried out in Vegetable Research Area, Department of Horticulture, University of Agriculture, Faisalabad during 1996-97. Three tomato varieties namely money maker, Peelo and IT 378-87 were tested for various ages of seedlings at the time of transplanting. Seeds were sown in last week of October and 1st and 2nd week November. Seedlings were transplanted in a tunnel after 4, 5 and 6 weeks of sowing. The plastic sheet over the tunnel was introduced during the second fortnight of November. Following data were collected:

Survival/mortality percentage of transplanted seedlings Height of plants at first flowering (cm)
Number of days taken for flowering after transplanting Number of branches per plant
Height of plants at maturity (cm)
Number of fruits per plant
Weight of fruits per plant (kg)
Weight of fruits per plot (kg)
Yield per acre (Tons)

The experiment was laid out according to split plot design. Age of the seedlings was given more emphasis, thus these treatments were kept in sub-plots and varieties in the main plots. After statistical analysis, the values of different means were compared in accordance with DMR test (Steel and Torrie, 1980).

Results and Discussion

Highly significant results were observed for different treatments (sowing dates) (Table 1). In case of varieties, no effect was observed for mortality percentage and height of plants at first flowering whereas other factors were found significantly different for each variety (Table 2). The interaction among treatments and varieties was found non-significant for all characters, observed, except number of fruits per plant (Table 3).

Survival percentage: It is clear from the Table 1 and 2 that T_2 got the height position although it was statistically similar to T_3. T_1 got the lowest position with 71.11% of survival the differences among varieties appeared non-significant.

Table 1: Relationship between age of seedlings and productivity of tomato (*Lycopersicon esculentum* L.) grown under plastic tunnel

Treatment	survival/ mortality (%)	Height of plants at first flowering (cm)	No. of days taken for flowering	No. of branches per plant	Hieght of plant at maturity (cm)	No. of fruits per plant	Wt. of fruits per plant (kg)	Wt. of fruits per plot (kg)	Total yield per acre (Tones)
T_1	11.11 b	28.36 c	38.32 a	16.37 c	101.1 c	119.4 c	4.327 b	15.20 c	29.42 c
T_2	88.89 a	31.27 b	28.91 b	23.01 a	113.2 a	141.7 a	4.759 a	20.32 a	39.34 a
T_3	82.22 a	25.01 a	20.27 c	19.16 b	109.3 b	126.8 b	4.415 b	17.37 b	33.63 b

Table 2: Comparison of varieties for productivity of tomato (*Lycopersicon esculentum* L.) grown under plastic tunnel

Treatment	survival/ mortality (%)	Height of plants at first flowering (cm)	No. of days taken for flowering	No. of branches per plant	Hieght of plant at maturity (cm)	No. of fruits per plant	Wt. of fruits per plant (kg)	Wt. of fruits per plot (kg)	Total yield per acre (Tones)
V_1	76.91 a	31.15 a	22.57 b	27.35 a	171.1 c	194.6 a	6.760 a	24.87 a	48.16 a
V_2	73.87 a	30.43 a	30.78 a	18.37 b	86.21 b	163.3 b	4.699 b	18.90 b	36.59 b
V_3	72.58 a	31.61 a	34.16 a	12.83 c	66.23 c	29.95 c	2.042 c	9.11 c	17.64 c

Table 3: Effect of interaction of varieties and treatments on number of fruits per plant

1	2	3	4	5	6	7	8	9
V_1T_1	V_1T_2	V_1T_3	V_2T_1	V_2T_2	V_2T_3	V_3T_1	V_3T_2	V_3T_3
211.7 a	182.6 be	189.5 b	150.0 e	179.8 c	160.3 d	25.67 f	33.53 f	30.65 f

Height of plants at first flowering: T_1 superceeded other treatments with a height of 35.01 cm. This was followed by T_2. T_1 produced the lowest height of plants. The differences for varieties was formed non-significant.

Number of days taken for flowering after transplanting: Table 2 expresses the significant inferiority of V_1 while V_2 and V_3 joined hands statistically and no significant difference could be located between them. V_3 occupied the highest and V_1 the lowest position. In case of treatments, T_1 enjoyed significant superiority over others and T_2 attained the second best position. T_3 was observed at the bottom.

Number of branches per plant: Table 2 depicts that three varieties differ significantly from each other and followed a sequence of V_1, V_2 and V_3 in a descending order. V_1 was at the top and V_3 got the lowest position. In case of treatments T_2 got the top position followed by T_3 whereas the T_1 was at the bottom with a value of 16.37.

Height of plants at maturity (cm): Table 2 reveals the significant superiority of V_1 over other others. This was followed by V_2 whereas V_3 was found at the bottom with 66.23 cm plant height. It is clear from Table 1 that T_2 secured the highest position significantly followed by T_3. T_1 was found at the bottom which produced 101,1 cm plant height.

Number of fruits per plant: One would observe from the Table 2 that V_1 enjoyed significant superiority over rest of the varieties. This was followed by V_2 while V_3 was observed at the bottom by producing 29.95 fruits per plant. Table 1 depicts significant difference among various transplanting dates. T_2 was observed at the top. T_3 occupied the next best position while T_1 was observed at the bottom. Table 3 revealed significant differences for interaction among varieties and treatments. T_1 in combination with V_1 proved better than T_2 and T_3 in combination with V_1. Similarly, T_2 in combination with V_2 was significantly better than T_1 and T_3 in interaction with V_2. The interaction of T_1, T_2 and T_3 with V_3 was found non-significant and no difference could be located among them Statistically.

Weight of fruits per plant (kg): It may be observed from the Table 2 that the three means for varieties differed significantly from each other. These means followed a sequence of V_1, V_2 and V_3 in a descending order. V_1 was observed at the highest position and V_3 at the lowest positions. V_2 was found at Intermediate level. Table 1 revealed significant superiority of 12 over other treatments which, in turn stood at par. The lowest position was obtained by T_1 while T_3 was in between.

Weight of fruits per plot and per acre (kg): It will appear from the Table 2 that the three means differ significantly from each other. Same trench was noted for yield of fruits per plot and per acre with regard to three varieties. V_1 stood at the highest position by producing 24.87 kg fruit plot^{-1} and 48.16 tons acre^{-1}. V_3 was observed at the bottom with 9.11 kg and 17.64 tons of fruits per plot^{-1} and per acre, respectively, while the V_2 occupied the intermediate position. One would observe from the Table 1 that T_2 enjoyed significant superiority over other treatments and produced 20.32 kg plot^{-1} and 39.34 tons fruits^{-1} acre. This was followed by T_3 in which weight of fruits per plot was 17.37 kg and per acre was 33.63 tons. T_1 occupied the lowest position and produced only 15.20 kg fruits plot^{-1} and 29.42 tons acre^{-1}.

Discussion

Age of the seedlings affected the plant survival because in older seedlings. The root system has well established than younger ones which helped to enhance the survival ratio. The same conclusion was also found supporting for old shoots to flower earlier. For expansion of vegetative growth, the middle aged seedling were found promising because the younger seedlings have stored less food needed for vegetative extension and older shoots have become mature which limits vegetative extension. On the same principle, it can be concluded that middle aged seedlings on account of extended lateral branches had produced maximum number of fruits per plant, per plot and per acre. Among varieties V_1 (Money maker) was found best for giving higher yields but this may be related to its genetic potential. Our results are in agreement with the findings of El-Aidy (1984). Silvestri *et al*. (1986) and Lipari and Paratore (1989).

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