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Winter Production of Tomatoes under Plastic Tunnel

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Abstract: The performance of eight tomato hybrids was studied under plastic tunnel for number of days to flowering and maturity, number and weight of fruit per plant, single fruit weight and yield. The sequential pickings in tomato hybrids started in second week of December 1991 and finished in the last week of March 1992. The cultivars parana and turquesa matured earlier taking 95.25 and 98.75 days, respectively. The cultivar turquesa with maximum fruit weight plant⁻¹ exhibited the highest yield of 20.45 kg m⁻² followed by fortara, royesta and jacinto yielding 19.55, 18.92 and 18.30 kg m⁻², respectively.

Key words: Tomato, hybrids, yield off-season production

Introduction

Tomato (*Lycopersicon esculentum* L.) is one of the important summer vegetable crops of Pakistan grown over an area of 29413 ha with production of 283216 tons. Tomato is grown in all provinces of Pakistan in varying volumes and its production started in the market from April to November. From November onward, because of low temperature, its supply cuts down resulting in shortage in the market. As a result of limited supply during this period, the prices of tomatoes shoot up to more than three times compared to that of normal season. Off season production of tomatoes would not only ensure its supply during scarcity period but also help the grower to fetch reasonable return for his produce. The use of plastic tunnels for off-season production of vegetables has gained popularity in horticulturally advanced countries. It is possible to produce warm season vegetables during winter season under such structures, which protect the crop from low temperature/frost injuries. Furthermore, the temperature under such tunnels remains high enough to produce the crop successfully, which otherwise would not be produced in the open field.

Many workers have reported higher yields and better quality tomatoes grown under plastic tunnels. Kruglyakov and Stepanova (1988) reported yields ranging from 8.6 to 10.8 kg m⁻² in different tomato cultivars. Hussain *et al.* (1990) and Chaudhry *et al.* (1998) reported that fruit maturation period in different cultivars grown under plastic tunnel ranged from 65–114 days. They further reported that in various cultivars, number of fruit per plant, average weight of single fruit and total weight of fruit per plant ranged from 19.82 to 57, 53 to 167 g and 2.0 to 4.78 kg, respectively. Hussain *et al.* (1990) and Chaudhry *et al.* (1998) observed the flowering in different tomato hybrids grown under plastic tunnel in the range of 30–52 days. Other research workers (Popescu *et al.*, 1984; Gnatyuk *et al.*, 1987; Borrelli, 1983; Haupt, 1986; Buitelaar, 1987) also reported earliness in maturity, better quality and higher yield in various cultivars of tomato grown for protected culture.

It was therefore, planned to conduct an experiment for off season production of tomatoes under plastic tunnel and to find out high yielding cultivars with good market quality and disease resistance as these qualities are essential for profitable culture (Vooren *et al.*, 1986).

Materials and Methods

An experiment to study the performance of tomato hybrids was conducted under Walk-in-plastic Tunnel during winter season 1991-92 at National Agricultural Research Center, Islamabad. Seed of eight tomato hybrids, namely, royesta, jacinto, fortara, everset, parana, grinta, turquesa and bornia, received from Royal Sluis, a reputed seed company of Holland, were sown on 5th September, 1991 in multipots filled with growing media of soil, sand and well rotten farm yard manure in equal proportions. Three weeks after sowing seedlings were shifted into back plastic tubes (12 x 22 cm²) containing same growing media for plant establishment. Finally these were transplanted under plastic tunnel on 9th October,

1991 at a distance of 60 cm between rows with plant to plant distance of 40 cm. The experiment was laid out in a randomized complete block design with four replications. The plastic of the tunnel from both sides was removed at 8.00 a.m and covered at 4.00 p.m to ensure better growth conditions for the plants. Soil under plastic tunnel was thoroughly prepared. Nitrogen, phosphorus and potash at the rate of 50, 60 and 40 kg ha⁻¹ was incorporated in the soil at the time of bed preparation. Another dose of nitrogen at the rate of 50 kg ha⁻¹ was applied at the time of flowering. All plants were trained to a single stem during entire growth period. Observations on days to flowering, days to fruit maturity, number of fruit per plant, total fruit weight per plant, average fruit weight and yield/m² were recorded on five randomly selected plants of each variety. Incidence of virus attack in each variety was also recorded.

The data were analyzed statistically and test of significance was applied following Duncan's multiple range test (Steel and Torrie, 1980).

Results and Discussion

Days to flowering: Data show significant cultivar differences for time taken to flowering. Cultivar parana and turquesa took minimum time to flower (30.25 and 30.50 days) whereas royesta and fortara flowered late taking 39.75 and 38.75 days, respectively (Table 1). Other cultivars were intermediate in flowering. These results are in agreement with those of Khan *et al.* (1989), Hussain *et al.* (1990) and Chaudhry *et al.* (1998) who reported flowering period in the range of 30 to 51.7 days in different tomato hybrids grown in plastic tunnel.

Days to fruit maturity: The early flowering cultivars were proportionately quick maturing. The cultivars parana and turquesa matured earlier taking 95.25 and 98.75 days, respectively whereas 'royesta' was late taking 118.75 days to mature followed by fortara and everset which took 116.5 and 114.5 days for fruit maturity, respectively (Table 1). Khan *et al.* (1988), Hussain *et al.* (1990) and Chaudhry *et al.* (1998) also reported variation in time to maturity in different tomato cultivars.

Single fruit weight: It is evident from the results that cultivar royesta exhibited maximum single fruit weight (202 g) followed by everset (193.15 g). Minimum single fruit weight (103.38 g) was recorded in bornia (Table 1). Khan *et al.* (1988), Hussain *et al.* (1990) and Chaudhry *et al.* (1998) also reported that tomato cultivars differed in fruit weight.

Number of fruit per plant: Statistical analysis of data (Table 1) regarding number fruit per plant showed significant results. Cultivar bornia produced the maximum number of fruits (52.25) while Parana produced minimum number of fruits per plant (25.75). Khan *et al.* (1988), Hussain *et al.* (1990) and Chaudhry *et al.* (1998) who studied the performance of tomato hybrids under plastic tunnel, also reported variation in number of fruit per plant. This variation may be due to genetic make-up of the cultivars used in the trial.

Khokhar *et al.*: Off-season tomato production

Table 1: Performance of some tomato hybrids under plastic tunnel during 1991-92

Tomato hybrids	Days to flowering	Days to maturity	Single fruit weight (g)	No. of fruit per plant	Fruit weight per plant (kg)	Yield m ⁻² (kg)	Virus attack (%)
Royesta	39.75a	118.75a	202.00a	30.25d	6.10ab	18.92ab	28.8a
Jacinto	35.75c	112.25d	154.60bc	38.25c	5.90abc	18.30abc	8.3c
Fortara	38.75a	116.50b	168.10b	37.50c	6.30a	19.55a	5.5d
Everset	37.50b	114.50c	193.15a	27.00d	5.20c	16.15c	9.3c
Parana	30.25f	095.25h	140.02c	25.75d	3.60d	11.18d	3.5d
Grinta	32.50e	100.25f	107.50d	38.25c	4.10d	12.70d	12.8b
Turquesa	30.50f	098.75g	140.77c	47.00b	6.60a	20.45a	9.0c
Bornia	34.25d	102.25e	103.38d	52.25a	5.40bc	16.75bc	8.5c

Means followed by different letter differ significantly at P < 0.01

Table 2: Percentage of total respective yields in high yielding tomato hybrids during sequential harvesting (1991-92)

Tomato hybrids	Percentage of total yield harvested in December 1991	Percentage of total yield harvested in January 1992	Percentage of total yield harvested in February 1992	Percentage of total yield harvested in March 1992
Turquesa	13.2a	38.6b	26.4c	21.9b
Fortara	7.3b	45.6a	31.4b	15.7c
Royesta	5.4c	33.0d	36.9a	24.8a
Jacinto	7.9b	35.3c	32.9b	23.9ab

Means followed by different letter differ significantly at P < 0.05

Fruit weight per plant and yield m⁻²: Fruit weight per plant is the most important factor affecting the yield of a cultivar. The cultivar turquesa having the maximum fruit weight per plant produced the highest yield (20.45 kg m⁻²). It was followed by fortara, royesta and jacinto yielding 19.55, 18.92 and 18.30 kg m⁻², respectively. Minimum yield was recorded in everset (16.15 kg m⁻²). Abo-Hadid and El-Abd (1986), Tarakanov *et al.* (1987), Kruglyakov and Stepanova (1988), Hussain *et al.* (1990) and Chaudhry *et al.* (1998) reported yield ranging from 6.28 to 20.5 kg m⁻² in various tomato cultivars grown under plastic tunnel. This reflects that there exists distinct variation in yield potential among different genotypes of tomato.

Incidence of virus attack: Viral diseases, particularly tobacco mosaic virus, damage protected crop, highest incidence of viral diseases (29 %) was observed in cultivar royesta while minimum was recorded in parana (3 %). In high yielding cultivar, turquesa, 9 % plants showed incidence of viral attack.

Monthly yield potential of tomato hybrids during harvesting period: Sequential pickings in hybrids started in the month of December 1991 and finished in March 1992. However, in cultivar parana final picking lasted till February 1992. There is always a great fluctuation in tomato prices that depend mainly on time of the year. Therefore, it is important that keeping in view the prices trend, only those cultivars be selected which are not only high yielding but also give better returns during harvesting period. The results of the studies reveal that cultivars turquesa, fortara, royesta and jacinto prove better in respect of yield potential. Among these high yielding cultivars, turquesa gave highest sequential yield during December 1991, which was 13.2 % of its total yield per plant (Table 2). During January cultivar fortara gave highest sequential yield which was 45.6 % of its total yield per plant. In the month of February, highest sequential yield was recorded in royesta showing 36.9 % of the total yield per plant. Sequential yield obtained in cultivars royesta and jacinto during March was highest with 24.8 and 23.9 % of the respective total yield per plant.

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