Research Article

EVALUATION OF MULTIPLE TOMATO VARIETIES FOR MORPHO-FLOWERING AND YIELD TRAITS UNDER NATURALLY VENTILATED POLYHOUSE

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ABSTRACT

An investigation was undertaken at Horticultural Research Station, Mahanandi, Kurnool Dist. Andhra Pradesh during 2008-2009 to study the performance of five tomato varieties under polyhouse condition. The study consisted of five tomato varieties laid out in Randomized Block Design with four replications. All the five varieties of tomato were planted under naturally ventilated polyhouse. Results revealed that significantly longer plant (116.50 cm), stem diameter (6.60 cm), number of primary (4.51), secondary (13.51), tertiary (11.25) branches, spread of the plant along the row (101.50 cm) and across the row (92.24 cm) were recorded maximum in cultivar skakthiman (V_2). Early days to flowering (35.83), minimum duration to 50 per cent flowering (58.67 days) and higher flower count per plant (63.75), maximum weight of the fruit (74.85 g), longer length of the fruit (13.10 cm), diameter of the fruit (18.21 cm) and fruit yield (47.59 t/ha) were recorded in cultivar shakthiman (V_2).

INTRODUCTION

One of the important vegetable crops cherished and grown throughout the world today is tomato (*Lycopersicon esculentum* Mill.) with an average yield of about 100 million tons from 3.70 million hectares of cultivated land (www.growtomatoes.com, 2012). Tomato ranks second following potato in terms of area cultivated, but first as a processing crop (Enujeke, 2013; Alawathugoda and Dehanayake, 2014). Because of the differences in the yield potentials of different ecological zones, testing of new varieties of crops must be adopted and established as a practice in plant breeding. Crop growth and yield are usually affected by varietal differences. Majambu *et al.* (1996) and Sajjan *et al*. (2002) reported that growth characters of crops such as plant height, leaf area, number of leaves or branches and fruit yield were influenced by genetic factors of different varieties and environmental conditions. The differences in growth indices of crops are normally influenced by their genetic constitution (Ibrahim *et al.*, 2000). Ray and Sinclair (1997) attributed differences between the growth character of crop genotypes to photosynthesis activity of leaves, plant and leaf arrangement, differences in stomatal conductance value. The genotype differences in yield and its components may be due to variation in genetic structure, mineral concentration and potentials to transport photosynthetic materials within plant (Clark *et al*., 1997). The early and higher yield of different vegetable crops inside the polyhouse was mainly because of better microclimate such as higher temperature (4-9 ^{0}C than the nearby open field) observed during winter months (Cheema *et al*., 2004). Hence, the naturally ventilated polyhouse environment may provide a new scope for commercial production of high value vegetable crops like tomato. Therefore, the present investigation was carried out to explore the growth, development and yield of tomato varieties grown under simple, environmentally friendly and low cost naturally ventilated polyhouse which can be used by the small and marginal farmers in the area.

MATERIALS AND METHODS

The investigation was carried out at the Horticultural Research Station, Mahanandi, Kurnool Dt. Andhra Pradesh during 2008-2009. The experimental field soil is sandy red loam in texture, low in nitrogen, medium in phosphorus,

fairly rich in potash and low in organic carbon content.The treatments consisted of five varieties *viz.* V_1-Lakshmi, V_2-Shakthiman, V_3-Abhinava (V_1, V_2, V_3- determinate type), V_4-Hamsa samole and V_5-US-618 (V_4, V_5-Indeterminate type).

A Randomized Block Design (RBD) with fivevarieties, four replications and ten plants from each plot were selected randomly and tagged for recording observations. Soil inside the naturally ventilated polyhouse was turned to a depth of 20 to 25 cm. One month prior to planting, weeds and stubbles were removed and the soil was brought to a fine tilth by ploughing 3 to 4 times with cultivator and rotovator. Fumigation was done with 20% formaldehyde solution to control soil borne pathogens. The nursery beds were prepared and watered regularly using a watering can and checked for seedling emergence which started on the 5th day after sowing. The nursery plots were mulched to avoid poor germination and prevent excessive heat. After application of formaldehyde, the soil was covered with black polythene sheet for one week and then removed. Well decomposed farm yard manure (FYM) was applied @ 20 t/ha at the time of last ploughing. The recommended dose of fertilizers followed for the experiment consisted of 110 kg urea, 375kg SSP and 100kg MOP per ha. The required dose of urea was calculated and applied in 3 equal split doses at 30th, 45th and 60 days after planting. The entire dose of SSP and MOP was applied before planting. The tomato was planted at a spacing of 60 cm x 45 cm. The size of the unit plot was 2.00 m x 1.50 m. All the required cultural practices were kept constant such as irrigation, weeding, pest and disease control *etc.* and given uniformly in all the experimental plots. All the four hoeings were practiced manually to check the growth of different weeds during the growth period of the crop. Ten plants were randomly selected from each plot in such a way that the marginal effect was avoided and data were recorded on biometric observations, flowering and fruit yield, respectively. The experimental data were analyzed as per Panse and Sukhatme (1985).

RESULTS AND DISCUSSION

Data recorded on biometric observations as influenced by naturally ventilated polyhouse and multiple response of five varieties are presented in Table 1. Significantly taller plant (116. 50cm), maximum stem diameter (6.60 cm), higher branch count (4.51, 13.51, 11.25), spread of the plant along the row (101.50 cm) and across the row (92.24 cm) was recorded in cultivar shakthiman (V_2). The higher values obtained in growth parameters of shakthiman over other varieties may be attributed to differences in genetic constitution with respect to higher growth rate and suitability of agro-ecological conditions for the variety. Congenial environmental conditions prevail under natural ventilated polyhouse favour for luxurious growth of the variety. This is consistent with the findings of Majanbu *et al.* (1996), Ibrahim *et al.* (2000) and Sajjan *et al.* (2002) who reported that genetic constitution of crop varieties influence growth characters which they express. It is also similar to the findings of Iken and Anusa (2004) that attributed the growth and yield differences of crop varieties to right choice of suitable agro-ecological zone. The plant height, stem diameter, number of branches and plant spread were influenced by growing environment. This may be due to enhanced photosynthesis and respiration due to the favourable micro-climatic conditions in the polyhouse conditions. This agrees with results of Ramesh and Arumugam (2010) on vegetables grown under polyhouse.

Table 1: Vegetative parameters of tomato varieties under polyhouse conditions

Varieties	Plant height (cm)	Stem diameter (cm)	Number of primary branches	Number of secondary branches	Number of tertiary branches	Spread of the plant along the row (cm)	Spread of the plant across the row (cm)
V_1: Lakshmi	100.25	6.14	2.88	12.12	9.95	88.59	87.95
V_2: Shakthiman	116.50	6.60	4.51	13.51	11.25	101.50	92.24
V_3: Abhinava	94.50	5.98	2.49	8.79	9.81	70.52	74.15
V_4: Hamsasamole	74.25	5.05	2.23	6.95	7.88	63.81	65.32
V_5: US-618	97.50	5.88	2.32	10.44	10.20	70.54	73.09
S. Em ±	4.31	0.16	0.09	0.19	0.34	2.49	0.45
CD (*P*=0.05)	13.44	0.50	0.30	0.59	1.07	7.76	1.43
CV %	8.93	5.49	6.76	3.68	7.02	6.30	1.16

A perusal of the data presented in the Table 2 revealed that the variety shakthiman (V_2) took minimum period for first flowering (35.83 days) and 50 per cent flowering (58.67 days). Polyhouse climate influenced the crops to open

flower and mature of fruits earlier than open field (Cheema *et al.*, 2004; Kang and Sidhu, 2005) due to the advancement of required heat unit or thermal time of the crops (Awal and Ikeda, 2003a) grown inside the polyhouse. Significantly higher number of flowers (63.75) was produced by shakthiman (V_2). This could be due to the fact that the hybrid had higher number of branches which would result in production of higher number of flowers per plant compared to other hybrids.

Table 2: Flowering and fruit attributes of tomato varieties under polyhouse conditions

Varieties	Number of days for flowering	Number of days for 50% flowering	Number of flowers per plant	Weight of the fruit (g)	Length of one fruit (cm)	Diameter of the fruit (cm)	Yield (t/ha)
V_1: Lakshmi	42.33	63.08	37.67	65.59	10.23	17.48	31.10
V_2: Shakthiman	35.83	58.67	63.75	74.85	13.10	18.21	47.59
V_3: Abhinava	36.41	59.00	34.67	56.54	9.30	16.22	36.74
V_4: Hamsasamole	42.41	62.41	20.83	44.17	6.88	11.62	32.89
V_5: US-618	38.67	62.41	27.50	49.86	10.21	12.73	24.35
S. Em ±	0.75	0.75	0.79	0.74	0.38	0.27	1.23
CD (*P*=0.05)	2.17	2.19	2.30	2.17	1.17	1.71	3.84
CV %	5.36	3.50	7.44	4.06	7.57	5.22	7.14

Naturally ventilated polyhouse had significant influence on fruit attributes (Table 2). It was seen from the Table 2 that the variety shakthiman (V_2) produced significantly higher fruit weight (74.85 g), longer fruit length (13.10 cm) and diameter of the fruit (18.21 cm). This is probably due to higher number of fruits per cluster and per plant that was observed in this variety. As the number of fruits per plant increases, competition among the fruits increase and fruits cannot grow to their full size and weight. Similar trend of results was obtained by Yeptho *et al.* (2012) and Rajasekhar *et al.* (2013) in tomato.

Yield was significantly influenced by different varieties under naturally ventilated polyhouse condition (Table 2). Significantly higher yield (47.59 t/ha) was recorded in shakthiman (V_2). Significantly higher fruit yield in the plants grown under polyhouse condition was associated with the production of higher number of fruits with greater length and diameter. Similar trend of results was also obtained by Yeshiwas *et al.* (2016) in tomato. Hybrid variety shakthiman had higher number of flowers per plant over other varieties tested possibly because of its genetic resources, special reproductive traits and favourable or right choice of site with congenial micro climate. This is harmony with the findings of Iken and Anusa (2004) who attributed the growth and yield differences of crop varieties to genetic resources, special traits of the cultivar, favourable and right choice of the site. Similar type of findings in five varieties of tomato was reported by Enujeke and Emuh (2015). The varietal differences in growth and yield might be attributed to the differences in ecological distribution of the tomato varieties (Olaniyi, 2007).

CONCLUSION

It is concluded that the better growth, development and yield of tomato were achieved under naturally polyhouse due to the higher (optimum) temperature and lower relative humidity during the winter months which positively influenced the morpho-phenological and physiological events of tomato plants. This simple and low cost polyhouse may be suitable for Kurnool Dt. Andhra Pradesh where the temperature falls during winter. The growth and development of tomato plant becomes restricted during the cold winter months. Therefore, if tomato is planted under polyhouse, it will establish good stands that mature earlier. The optimum temperature accompanied by low relative humidity inside polyhouse hasten crop development and early maturity, so growers are benefited by being able to produce higher and off-season tomato which fetched premium prices in the market.

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