Mysore J. Agric. Sci., 51 (2) : 454-457, 2017 **Research Note**

Growth and Yield of Tomato as Influenced by Polyhouse Conditions

TOMATO is considered as a warm season vegetable crop. Conventional cultural practices and mere application of chemical fertilizers are not enough to fill-up the gaps between production and demand. Therefore, a sustainable and low cost technology for tomato cultivation is very important. Phenological development governs the plant growth and productivity (Awal and Ikeda, 2003a). Days to flowering, fruiting and maturity of the crop are the important phenological events which determine the productivity of a crop. Temperature plays a major role in phenological development and productivity of crop plants. High temperature influences crops to early growth and flowering (Awal and Ikeda, 2003b). 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 open field) observed during winter months (Cheema *et al*., 2004). Therefore, the polyhouse environment may provide a new scope for commercial production of high value vegetable crops like tomato. It has been in use for vegetable production with far better yield in more than fifty countries all over the world (ICAR, 2005 and Aberkain *et al*., 2006). Therefore, the present experiment was conducted to explore the growth, development and yield of tomato grown under simple, environmentally friendly and low cost polyhouse which can be used by the small and marginal farmers in the area.

The investigation was carried out at the Horticultural Research Station, Mahanandi, Kurnool District, Andhra Pradesh during 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 V_1-Lakshmi, V_2-Shaktiman, V_3-Abhinava (V_1, V_2, V_3- determinate type), V_4-Hamsa samole, V_5-US-618 (V_4, V_5-Indeterminate type).

A Randomized Block Design (RBD) with five varieties, four replications and ten plants from each plot were selected randomly and tagged for recording observations. Soil inside the polyhouse was turned to a depth of 20 to 25 cm. One month prior to planting, weeds and stubbles were removed and the soil brought to a fine tilth by ploughing 3 to 4 times with cultivator. Fumigation was done with 20% formaldehyde to control soil borne pathogens. After application of formaldehyde, the soil was covered with black polythene for one week and then removed. Well decomposed farm yard manure (FYM) was applied at 20 t/ha at the time of last ploughing.

The recommended dose of fertilizers followed for the experiment consisted of 110 kg urea, 375 kg SSP and 100 kg MOP/ ha. The required dose of urea was calculated and applied in 3 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 m x 1.5 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 plant height, stem diameter, number of primary branches, number of secondary branches, number of tertiary branches, spread of the plant along the row, spread of the plant across the row, number of days taken for first flowering, number of days for 50 per cent flowering, number of flowers per plant, weight of the fruit, length of the fruit, diameter of the fruit and yield.

Data recorded on biometric observations as influenced by polyhouse on five varieties are presented in Table 1. Significantly highest plant height (116. 50 cm) and stem diameter (6.60 cm) was recorded in Shaktiman (V_2) compared to remaining varieties. Highest plant height might be due to uptake of N, the chief constituent of chlorophyll, protein and amino acids is accelerated through its increased supply at appropriate time to the plants. Similar line of results was also obtained by Parvej *et al*. (2010) in tomato. Among hybrids, significantly higher branches (4.51, 13.51, 11.25) was produced by Shaktiman (V_2) compared to all the varieties.

The lower amount of incident PAR under polyhouse was due to the greater inference of the roof of polyhouse against the incoming solar beam. Although, polyhouse permits easy entrance of short-wave radiation. As a result, the air temperature inside the polyhouse gradually increased due to the greenhouse effect. Thus, the inner of the polyhouse becomes warm to warmer and temperature remained at optimum level (about 28 ^{0}C) for the growth and development of tomato plants during the cooler months (November to February). Such warmer air inside the polyhouse induced the soil warming. Therefore, soil temperature was also higher under polyhouse than open field (Montero and Anton, 2003). Morphological development like plant height, stem diameter and number of branches were positively favoured due to the warmer environment inside the polyhouse (Pandey *et al*., 2004) in spite of lower amount of PAR.

The plant height, stem diameter and number of branches were influenced by growing environment. This may be due to enhanced photosynthesis and respiration due to the favourable micro-climatic conditions in the polyhouse. This agrees with results of Ramesh and Arumugam (2010) on vegetables grown under polyhouse.

The information made available in Table I showed significantly higher spread of the plant along the row (101.50 cm) and across the row (92.24 cm) in Shaktiman (V_2) among the varieties. This phenomenon could be due to the fact that favourable environmental conditions *viz*. higher temperature, lower relative humidity and high light intensity inside polyhouse during the period of crop growth favoured better growth which resulted in higher spread of the plant.

Data from the Table II revealed that the hybrid Shaktiman (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. This might also be due to accumulation of photosynthates which triggered early initiation of flowers.

Data presented in Table II indicated that significantly higher number of flowers (63.75) was also produced by Shaktiman (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.

It was seen from the Table II that the variety Shaktiman (V_2) produced significantly higher fruit weight (74.85 g), longer fruit (13.10 cm) and diameter of the fruit (18.21 cm). Similar trend of results were

TABLE I

Growth parameters of tomato varieties influenced by 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: Shaktiman	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: Hamsa samole	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

TABLE II

Flower, fruit characters of tomato varieties as influenced by 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	10.233	17.48	31.10
V_2: Shaktiman	35.83	58.67	63.75	74.85	13.108	18.21	47.59
V_3: Abhinava	36.41	59.00	34.67	56.54	9.300	16.22	36.74
V_4: Hamsa samole	42.41	62.41	20.83	44.17	6.880	11.62	32.89
V_5: US-618	38.67	62.41	27.50	49.86	10.215	12.73	24.34
S. Em ±	0.75	0.75	0.79	0.74	0.377	0.27	1.23
CD (*P*=0.05)	2.17	2.19	2.30	2.17	1.174	1.71	3.84
CV%	5.36	3.50	7.44	4.06	7.574	5.22	7.14

obtained by Yeptho *et al*. (2012) and Rajasekhar *et al*. (2013) in tomato.

Table II revealed that significantly higher yield (47.59 t/ha) was obtained from Shaktiman (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. Higher values of all the yield components and yield of tomato crop grown under polyhouse was due to the taller plants and more number of branches attributed by warmer temperature. Tomato had higher yield under polyhouse conditions due to light compensation for higher photosynthesis.

Since hi-tech glasshouse technology requires huge initial investments where production cost is very high. The small and marginal farmers cannot afford that technology due to high capital investment. Hence, low cost with locally available materials like bamboo and transparent polyethylene have been found quite effective for nursery raising and off-season production of tomato which fetched premium prices in the market. It is concluded that the better growth, development and yield of tomato were achieved under polyhouse due to the higher (optimum) temperature and lower relative humidity during the winter months (November to February) which positively influenced the morpho-phenological and physiological events of tomato plants. This simple and low cost polyhouse may be suitable for Kurnool District. 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.

Horticultural Research Station, Vijayarai Dr. Y.S.R. Horticultural University, West Godavari Dist. Andhra Pradesh

M. RAJA NAIK
C. H. CHINNABBAI

E-mail : naik_raja2006@rediffmail.com

REFERENCES

ABERKAIN, K., GOSSELIN, A., VINEBERG, S. AND DORAIS, M, 2006, Effects of insulating foams between double polyethylene films on light transmission, growth and productivity of greenhouse tomato plants grown under supplemental lighting. *Acta Hort.*, **711**: 449-454.

AWAL, M. A. AND IKEDA, T, 2003a, Effect of elevated soil temperature on radiation-use efficiency in peanut stands. *Agric. Forest Meteoro.,* **118** (1-2) : 63-74.

AWAL, M. A. AND IKEDA, T., 2003b, Controlling canopy formation, flowering and yield in field grown stands of peanut (*Arachis hypogaea* L.) with ambient and regulated soil temperature. *Field Crops Res*., **81** (2-3): 121-132.

CHEEMA, D. S., KAUR, P. AND KAUR, S., 2004, Off-season cultivation of tomato under net house conditions. *Acta Hort*., **659**:177-181.

ICAR (Indian Council of Agricultural Research), 2005, Low cost polyethylene technology for off-season vegetable production. Dr. Mangala Rai, Secretary (DARE) and Director-General, ICAR, New Delhi, 110 001. India. **11** (2): April-June. 2005.

KANG, B. S. AND SIDHU, B. S., 2005, Studies on growing off-season tomato nursery under polyhouse. *Ann. Agri. Bio. Res*., **10** (1): 53-56.

MONTERO, J. J. AND ANTON, A., 2003, Greenhouse characteristics and microclimatic conditions. *Acta Hort*., **614**: 323-333.

PANDEY, V. K., DWIVEDI, S. K., PANDEY, A. AND SHARMA, H. G, 2004, Low cost polyhouse technology for vegetable cultivation in Chhattisgarh Region. *Plant Archives*, **4** (2): 295-301.

PARVEJ, M. R., KHAN, M. A. H. AND AWAL, M. A., 2010, Phenological development and production potentials of tomato under polyhouse climate. *J. Agric. Sci*. **5**(1):19-31.

RAJASEKHAR, M., ARUMUGAM, T. AND RAMESH KUMAR, S., 2013, Influence of weather and growing environment on vegetable growth and yield. *J. Hortic. Forestry*, **5** (10): 160-167.

RAMESH, K. S. AND ARUMUGAM, T., 2010, Performance of vegetables under naturally ventilated polyhouse conditions. *Mysore J. Agric. Sci*., **44** (4): 770-776.

YEPTHO, V., KANAUJIA, S. P., SINGH, V. B. AND SHARMA, A., 2012, Effect of integrated nutrient management on growth, yield and quality of tomato under polyhouse conditions. *J. Soils Crops*, **22** (2): 246-252.

(*Received :* January, 2017 *Accepted :* June, 2017**)**