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Comparative Study of Tomato under Polyhouse and Rainshelter Conditions

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Abstract:
A study was conducted in the Instructional Farm of KCAET, Tavanur, Kerala, during the period from December 2016 to April 2017 to compare the performance of tomato grown under polyhouse and rainshelter cultivation. The maximum temperature (36.4^{0}C) was recorded inside the naturally ventilated polyhouse during the month April and minimum temperature (22.3^{0}C) was recorded in rainshelter during month of January. The maximum relative humidity (83.82%) was recorded in the month of December in the polyhouse and the minimum relative humidity (70.2%) was recorded in the month of April in the rainshelter in the morning. During all growth stages, the plant height and inter-nodal length were significantly higher inside the polyhouse than rainshelter. The Stem girth and higher numbers of leaves per plant were observed under rainshelter structure than polyhouse. The total yield of tomato recorded from polyhouse and rainshelter were 1.31 kg/m^2 and 4.15 kg/m^2 respectively. TSS content of tomato under the polyhouse system was found 4.56 ^{0}B and rainshelter was found 4.0 ^{0}B. The maximum benefit cost ratio of 2.00 was noted in rainshelter than 0.46 under polyhouse cultivation.

Key worlds: Polyhouse, rainshelter, tomato**,** benefit cost.

I. INTRODUCTION

Protected cultivation is a unique and specialized form of agriculture in which the microclimate surrounding the plant is controlled partially or fully, as per the requirement of the plant species grown during their growth period. The intent is to grow crops where otherwise they could not survive by modifying the natural environment to prolong the harvest period often with earlier maturity, to increase yield, improve quality, enhance the stability of production and make commodities available when there is no outdoor production. The principal vegetable crops, produced under protected conditions in India are tomato, cucumber, muskmelon, capsicum, lettuce and cauliflower. Many greenhouses in southern and western states are specialized in the production of vegetable transplants, particularly tomato, lettuce, sweet pepper, eggplant, cabbage, broccoli and cauliflower. Tomato (*Solanum lycopersicum)* is a warm season crop and requires a relatively long growing season and moderately high temperature (20-28°C). The optimum fruit setting is at night temperature and the optimum range is 15°-20°C. Tomato, the globally leading popular vegetable belonging to *Solanaceae* family is being extensively cultivated under protected conditions and gives higher returns. Protected cultivation of tomato offers distinct advantages of earliness, higher productivity and quality particularly pesticide residue free produce, besides higher returns to growers. Being an important vegetable crop, research on every aspect of tomato cultivation to improve the productivity becomes essential. India has entered into the area of greenhouse vegetable cultivation more recently only. India being a vast country with diverse and extreme agro-climatic conditions, the protected vegetable cultivation technology can be utilized for year round and off-season production of high value, low volume vegetables, production of virus free quality seedlings, quality hybrid seed production and as a tool for disease resistance breeding programs (Wani *et al.,* 2011). In the present scenario of perpetual demand of vegetables and drastically shrinking land holdings in the country, it is the best alternative and drudgery less approach for using land and other resources more efficiently. In Kerala, there are different arguments regarding the adaptability and advantages of polyhouse and rainshelter for protected cultivation, keeping these in view, the present study was to compare the polyhouse and rainshelter on the performance of tomato.

II. MATERIALS AND METHODS

The present investigation was conducted at the Department of Land and Water Resource Engineering, Kelappaji College of Agricultural Engineering, Tavanur during December 2016 to April 2017 to identify the best suitable condition for Kerala condition. Seedlings were raised in portrays filled with potting mixture. The tomatos used for this experiment were laid out in CRD with ten replications five in each treatment. The experiment was conducted in naturally ventilated polyhouse and rainshelter. The naturally ventilated polyhouse in saw tooth type height 6 m, length 36 m, width 8 m and size 292 m^2 located in Instructional farm, KCAET. The framework is made of GI pipes of 76mm ID, 2-3 mm thickness. The roof is made of 200 micron UV stabilised polyethylene sheet and the sides made of 40 mm mesh net. The poly house is provided with fogger unit to control temperature. The other structure rainshelter in gabble shape of height 3 m, lenth 20 m, width 5 m and size of 100 m^2 located in the farm oriented east west direction. Seedlings were raised in portrays filled with potting mixture. Transplanting was done at a spacing of 60 x 50 cm in raised beds. Plants were supported with stakes

and trained to grow vertically upwards along a polythene twine which was tied at gutter height of 3m. Periodic pruning the plants helped to facilitate easy training operation, but also permit closer planting, early ripening of fruits and get higher yields of larger sized fruits. Five plants were randomly selected per replication for recording observations and the mean worked out. Analysis of variance was done by using SPSS software.

III. RESULTS AND DISCUSSION

Analysis of variance revealed significant differences among the tomato under polyhouse and rainshelter condition for all the characters studied *viz.*, plant height (cm), internodal length(cm), leaf number , no. of branches, days to first flowering, days to fruit set, flowers per cluster, inflorescence per plant, fruits per plant, shelf life. TSS, fruit weight (g), yield /plant (g), TSS. Mean sum of squares were found significant for all treatment and showed significant variation among each other. Temperature is the major regulator of the development process for the crops which influences on the flower and fruit development. The effect of temperature on net photosynthesis is important for crop production. The higher temperatures has more adverse influence on net photosynthesis of the crop than lower temperature leading to decreased production of photosynthetic activity above a certain temperature (Bhatt and Rao, 1989). The maximum temperature (36.4^{0}C) was observed inside the polyhouse during the month of April in the afternoon and minimum temperature (22.3 ^{0}C) was recorded inside the rainshelter during the month of January. The temperature was found higher inside the polyhouse than the rainshelter throughout the period. The monthly average maximum and minimum temperature in the afternoon was higher compare to morning and evening inside both the structures. The rise in air temperature inside the polyhouse compared to rainshelter ranges from 2.5°C to 3.6°C. The similar results obtained by Parvej *et al.* (2010). Bakker (1991) reported that the photosynthetic rate was improved by high humidity with increasing stomatal conductance. The yield of crop is to be increased by higher relative humidity (Leonardi *et al.*, 2000). The maximum relative humidity (83.82%) was recorded during the month of December in the polyhouse and the minimum relative humidity (70.2%) was recorded during the month of April in the rainshelter. Similar results reported that the relative humidity was found higher inside the polyhouse than in the open field which influenced tomato growth and yield (Nimje and Shyam.1993). Soil temperature was observed higher in polyhouse than the rainshelter throughout the crop period. Soil temperature inside the polyhouse was always found 3 to 5 ºC higher as compared to the rainshelter throughout the growth period of the crop. The maximum soil temperature (37.8 ºC) was observed inside the polyhouse during the month of March in the morning and minimum soil temperature (25 ^{0}C) was observed inside the rainshelter during the month of February in the afternoon. The higher temperature inside the polyhouse is due to the green house effect. Similar results were reported by Sam and Regeena. (2016) that soil temperature in the polyhouse was 2- 3 ºC higher than at the outside soil during all the growing stages of crops. Lesser plant height (44 cm and 65.2 cm) was recorded inside the rainshelter at 45 DAT and 60 DAT compared to polyhouse (49.8 cm and 78.2 cm). Similar trend was noted at 75 DAT and 90 DAT and was found that plant height was more inside the polyhouse than the rainshelter. At 105 DAT, plant height was 155 cm inside the polyhouse, which was significantly superior over the rainshelter (111.4cm). This may be attributed to the enhanced plant metabolic activities like photosynthesis and respiration due to favorable micro-climatic conditions that prevailed in the polyhouse as compared to the rainshelter. Similar results of higher growth rates in the polyhouse were reported by More *et al.* (1990) in cucumber and Ganesan (1999) in tomato plants. The number of branches was found as 27.8 inside the rainshelter and 23.2 inside the polyhouse at 105 DAT. More number of branches inside rainshelter as compared to polyhouse was reported by Gokul (2015) for cowpea. The result indicates that the crop might require more light intensity for better growth and development of the plant (Marcelis and Hofman-Eijer, 1993). The inter-nodal length was significantly higher inside the polyhouse (39.6) compared to the rainshelter (33.9). The increase in inter-nodal length inside polyhouse may be due to enhanced plant metabolic activities like photosynthesis and respiration due to favourable micro-climatic conditions that prevailed inside the polyhouse as compared to rainshelter. Similar results were reported by Ramesh and Arumugam (2010) for vegetables grown inside the polyhouse. The number of leaves was more inside the rainshelter compared to the polyhouse at all stages of crop growth and numbers of leaves were 24.6 and 15.2 at 30 DAT. At the final stage the number of leaves was 105.4 and 101 inside the rainshelter and the polyhouse respectively. This indicates that the crop might require more light intensity for better growth and development of the plant (Marcelis and Hofman-Eijer, 1993). Compared to the rainshelter early flower initiation was noted inside the polyhouse. The time taken to the first harvest was less in case of polyhouse compared to the rainshelter. Similar result was obtained by Kang and Sidhu (2005) and it was reported that polyhouse climate influenced the crops to open flower and mature of fruits earlier. Early harvesting (82 days) was possible inside the polyhouse compared to the rainshelter (74 days). This is in agreement with the finding of Zende(2008). Tomato plants under rainshelter gave significantly higher yield per plant (3.4 kg) and yield per square meter (4.15 kg). This higher yield per plant and yield per square meter may be due to higher number of leaves which in turn increased the photosynthetic activity and ultimately resulted in higher yield per plant. Similar results were reported by Kengar (2008). Fruits grown under polyhouse recorded higher shelf life 9 days which was significantly higher than the rainshelter. The lower shelf life 7 days was recorded under rainshelter. The similar results obtained by Yellavva (2008) which reported that greenhouse capsicum have higher shelf life compare to other shallow structures. The data on total soluble solids as influenced by the tomato under polyhouse and rainshelter was found by using refractrometer. The results indicated that TSS content of tomato under the polyhouse system was found 4.56 ^{0}B and rainshelter was found 4.0 ^{0}B. Similar results were obtained by Hazarika and Phookan (2005) in tomato in polyhouse condition. Benefit cost (B:C) ratio for each treatment was calculated. The maximum benefit cost ratio of 2.00 was noted in rainshelter than the 0.46 under polyhouse cultivation. Similar results obtained by Gokul (2015) on performance of cowpea.

IV. CONCLUSION

Under rainshelter conditions, tomato performed well for yield characters because of favourable conditions which positively

influenced the morpho-phenological and physiological events of tomato plants. From the study it is evident that there was significant difference in total yield of tomato harvested from the polyhouse and rainshelter during the entire growing season. The lesser cost in case of rainshelter resulted in a higher benefit cost ratio as compared to naturally ventilated polyhouse. So cultivation of tomato (Akshaya) in second season is not recommended for polyhouse but recommended for rainshelter and also Incidence of pests and diseases were comparatively low inside the rainshelter and higher incidence of pests and diseases were noticed polyhouse. Hence it can be concluded from the study that growing tomato inside the rainshelter will be more profitable than growing it inside naturally ventilated polyhouse for Kerala condition.

V. REFERENCE

[1]. Bakker, J.C. 1991. Effects of humidity on stomatal density and its relation to leaf conductance. *Sci. Hortic*. 48: 205–212.

[2]. Bhatt, R.M. and Rao, N.K.S. 1993. Response of bell pepper to photosynthesis, growth flower and fruit setting to night temperature. *Photosynth.* 28:127132.

[3]. Ganesan, M. 1999. Effect of poly-greenhouse models on plant growth and yield of tomato (Lycopersiconesculentum). *Indian J. Agric. Sci.* 10: 586-588.

[4]. Gokul, A. 2015. Comparative evolution of naturally ventilated polyhouse and rainshelter on the performance of cowpea. Match (Ag. Engg.) Thesis, Kerala Agricultural University, Tavanur.

[5]. Hazarika, T.K. and Phookan, D.B. 2005. Performance of tomato cultivars for polyhouse cultivation during spring summer in Assam. *Indian J. Hortic*. 62(3): 268-271.

[6]. 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.*

[7]. Kengar, I. 2008. Performance of tomato (*Solanum Lycop ersicum L*.) Hybrids under shade house condition. M.Sc. (Ag) Thesis, Univ. Agric. Sci., Dharwad. 62 p.

[8]. Leonardi, C., Guichard, S., and Bertin, N., 2000. High vapour pressure deficit influences growth, transpiration and quality of tomato fruits. *Sci. Hortic.* 84: 285–296.

[9]. Marcelis, L.F.M. and Hofman-Eijer, B.L.R. 1993. Effect of temperature on growth of individual cucumber fruits. *Physiol. Plantarum 87: 321-328.*

[10]. More, T.A., Chandra, P., Majumdar, G., and Singh, J.K. 1990. Some observations on growing cucumber under plastic greenhouse In: *Proceedings of X1 International Congress on the use of Plastics in Agriculture,* pp.49-55.

[11]. Nimje, P.M. and Shyam, M. 1993. Effect of plastic Greenhouse on plant microclimate and vegetable production. *Farm Syst.* 9:13-19.

[12]. Parvej, M.R., Khan, M.A., and Awal, M.A. 2010. Phenological development and production potentials of tomato under polyhouse climate. *J. Agri. Sci*. 5: 19-31.

[13]. Ramesh, K.S. and Arumugam, T. 2010. Performance of vegetables under naturally ventilated polyhouse condition. *Mysore J. Agric. Sci.* 44(4):770-776.

[14]. Sam, B. and Regeena, S. 2014. Production potentials of tomato and capsicum under poly house condition in kerala. *Int. J. Scientific Eng. Res*. 4: 24-27.

[15]. Wani, K. P.; Singh, P. K.; Amin, A.; Mushtaq, F. and Dar, Z. A. 2011. Protected cultivation of tomato, capsicum and cucumber under Kasmir valley conditions. *Asian J. Sci. Tech.*, **1**(4): 56-61.

[16]. Yellavva, K. and Patil, A.A. 2008. Evaluation of capsicum hybrids under different protected structures. M.Sc.(Horti.) thesis.University of Agricultural Science. Dharwad, 63p.

[17]. Zende, U.M. and Mathad, J.C. 2008. Investigation on production techniques in capsicum under protected Cultivation. M.Sc.(Horti.) thesis. University of Agricultural Science. Dharwad, 83p.