Available online at www.scholarsresearchlibrary.com

Scholars Research Library

Scholars Research Library

Annals of Biological Research, 2015, 6 (6):65-68
(http://scholarsresearchlibrary.com/archive.html)

Annals of Biological Research
Scholars Research Library
ISSN 0976-1233
CODEN (USA): ABRNBW

Evaluation of hybrid indeterminate tomato (*Solanum lycopersicum L.*) varieties for commercial greenhouse production

Farai Isabel Chibi[1], Tsvakai Mushayabasa*[1] and Elphigio Magejo[2]

[1]Department of Horticulture, Faculty of Natural Resources Management and Agriculture, Midlands State University, Gweru, Zimbabwe
[2]Pedstock Investments, Mount Pleasant, Harare, Zimbabwe

ABSTRACT

A study was conducted during the period of October 2013 to May 2014 at Pedstock Investments, Harare, Zimbabwe. The primary objective of the study was to assess growth and yield performance of new Israeli hybrid tomato (Solanum lycopersicum) varieties against Nemo-Netta variety under Zimbabwe conditions. The experimental was laid in a Randomized Complete Block Design with four treatments replicated four times. Treatments consisted of Israeli varieties (72061, 72205 and 79272) and Nemo-Netta as a control. Seedlings were transplanted at a spacing of 30cm x 1m in-row and interrow respectively and spacing between blocks was 50 cm. Data was analyzed using GenStat 14th edition and means were separated using Least Significant Difference (LSD) at 5% level of significance. There were no significant differences ($P > 0.05$) in stem thickness and distance between clusters among tomato varieties. There were significant differences ($P < 0.05$) in leaf area, days to maturity, shelf life and total fresh yield among varieties. Variety 79272 had the highest leaf area (131.2 m^2) but was not significantly different from variety 72205 (127.1m^2) whilst variety 72061 had the lowest leaf area (115.6m^2) but was not significantly different from Nemonetta variety (116.3m^2). Nemo-Netta took the shortest time to maturity (65.25 days) followed by variety 72061 (68.5 days) whilst variety 79272 took the longest time to maturity (90.25 days) followed by variety 72205 which was intermediate (70.25 days). Variety 72205 had the highest yield (153.6t/ha) followed by variety 79272 (134.6t/ha) which was not significantly different from Nemonetta variety (129.1t/ha). Variety 72061 produced the highest yield (116.5t/ha). Variety 72205 had fruits with the highest shelf life (25.5 days) followed by Nemonetta variety (23.75 days). Variety 72061 had the shortest shelf life (20.25 days) followed by variety 79272 which was intermediate (21.25 days). Results of this study show that Israeli tomato variety 72205 is better than Nemo-Netta variety in terms of yield and shelf life. Therefore farmers are recommended to grow 72205 and variety 79272 though further research is recommended in terms of diseases tolerance and other quality parameters.

Key words: *Tomato, variety, growth, yield, indeterminate*

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is one of the most popular and widely consumed vegetable crops worldwide and has recently gained considerable attention in relation to its health benefits. Tomato fruit contains lycopene an antioxidant that contributes to the prevention of certain cancers [1] such as cancers of prostate, lung and stomach [2]. The fruit also contains vitamin A which is important for growth, improvement of eyesight and the regulation of immune system [3]. Moreover, the fruit contains vitamin C which is important in formation of collagen, a protein that gives structure to bones, cartilage, muscles and blood vessels [3]. Tomatoes can be consumed fresh or in a multiple of processed forms. There has been a marked increase in the consumption of fresh cut vegetables around the globe due to heath concerns [4]. Tomatoes require different climatic range for seed germination, seedling growth, and flower set and fruit maturity. The optimum average monthly temperature range is 21°C - 30°C [5].

Tomato cultivation can be conducted in open field conditions or in the greenhouse under environmentally regulated conditions. There has been a rapid increase in vegetable production in Zimbabwe in the recent years with tomato ranking high amongst the list [6]. This rapid production calls for high yielding and efficient methods for tomato production. Over the years, a lot of emphasis has been made on developing improved varieties with better processing qualities as well as horticultural characteristics which include field vine storage, disease and nematode resistance, transportability and early maturing among others. This led to tomato breeding companies producing F1-hybrids. This study therefore aims at investigating the growth and yield performance of Israeli tomato varieties against Nemo-Netta under Zimbabwean conditions.

MATERIALS AND METHODS

The study was carried out at Pedstock Investments Harare, Zimbabwe. It is located in Natural region IIA and its geographical coordinates are 17° 45' 25" South, 31° 4' 28" East. The average annual temperature is 17.95 °C. The soils are well drained clay loam.

Materials

Tomato seedlings**,** fumigants (Basamid Granular)**,** fertilisers (Compound C, Gatit 18:18:18, Gatit 20:10:20, Gatit 15:5:35, Calcium Nitrate)**,** fungicides (Copper Oxychloride, Dithane M45, Benomyl)**,** pesticides (Lambda, Abamectin, Methamidiphose, Confidor, Malathion, Carbaryl and Decis).

Experimental design

The experiment was laid out in a randomized complete block design (RCBD) with four treatments replicated. The varieties used were 72601, 72205, 79272 and Nemo-Netta. Slope was used as the blocking factor.

Experimental procedure

The tomato plants were grown following standard greenhouse conditions.

Data collection

Leaf area

Leaf meter was measured using a tape measure and recorded cm^2.

Stem thickness

The thickness of the stem throughout the production cycle was measured using a veneer caliper.

Distance between clusters

Distance from one cluster to the next was measured using a tape measure.

Days to maturity days

This was determined as the number of days taken from date of transplanting to the date of the first harvest for each variety.

Shelf Life

Eight randomly selected matured ripe fruits where each treatment was represented were harvested from each block and stored at room temperature. The maximum number of days the tomato could stay in condition that is acceptable consumers from the day of harvesting was recorded as shelf life.

Total fresh yield

The total fresh weight of fruits produced per variety was weighed using a digital scale and expressed in tonnes per hectare.

Data analysis

All data was analyzed using GenStat statistical package 14th edition. Separation of means was done using the least significance difference (LSD) at 5% level of significance.

RESULTS AND DISCUSSION

Effects of tomato variety on leaf area

There were significant differences (P = 0.017) on leaf area among varieties. Variety 79272 had the highest leaf area (131.2 cm^2) but was not significantly different from variety 72205 (127.1 cm^2). Variety 72061 had the lowest leaf area (115.6 cm^2) but was not significantly different from the Nemonetta variety (116.3 cm^2) (Table 1.). These results concur with research findings observed by Deouk *et al*. [7] who highlighted that at the full blooming stage certain

hybrids exhibit good number of leaves per plant and total leaf area per plant. The lower leaf length for variety 72061 and Nemonetta compared to variety 72205 and 79272 might be due to the fact that the first two had less time for food assimilation as they were earlier in flowering and fruit setting tomato hybrids. Thus, these two varieties had less time for vegetative growth. In addition, the differences may be attributed to the genetic makeup of these tomato hybrids [8]. Moreover, Rainwater *et al.* [9] highlighted that different genotypes of tomato exhibit considerable variation in their sensitivity to heat stress. Furthermore, is was also noted that heat tolerant cultivars produce a higher leaf area than heat sensitive ones under high temperature conditions Nkansah and Ito [10].

Table 1: Growth parameters, yield and fruit shelf life of different tomato varieties

Tomato variety	Leaf area (cm^2)	Days to maturity (days)	Yield (tonnes/ha)	Shelf life (days)
72061	115.6^{a}	68.50^{b}	116.5^{a}	20.25^{a}
72205	127.1^{b}	70.25^{c}	153.6^{c}	25.50^{d}
79272	131.2^{b}	90.25^{d}	134.6^{b}	21.25^{b}
Nemonetta	116.3^{a}	65.25^{a}	129.1^{ab}	23.75^{c}
P value	**0.017**	**<0.001**	**0.001**	**0.01**
L.S.D	**10.35**	**0.40**	**14.05**	**0.766**
C.V	**5.3**	**0.3**	**6.6**	**2.1**
Grand mean	**122.6**	**73.56**	**133.9**	**22.69**

Key: Means followed by same letters (superscript) are not significantly different from each other

Effects of tomato variety on days to maturity

There were significant differences (P = 0.017) on days to maturity among the varieties. Variety 79272 (90.25 days) took the longest time to maturity and fruit set followed by variety 72205 (85.75 days) which was second (Table 1). Nemonetta variety took the least number of days to maturity (65.25 days) followed by variety 72061 (68.50 days) which was intermediate. These results get support from the previous work by Khokar *et al*. [11] Choudhary *et al*. [12] and Hussain *et al*. [8] who observed time variation in fruit setting in different tomato cultivars. They highlighted that the genetic factors of the hybrids and the environmental conditions prevailing at the experimental site might have caused the earliness in fruit set of some of the varieties.

Effects of tomato variety on total fruit fresh yield

There were significant differences (P = 0.001) in yield among varieties. Variety 72205 had the highest yield (153.6t/ha) while variety 72061 had the lowest yield (116.5t/ha) but it was not significantly different from Nemonetta variety (129.1t/ha). Variety 79272 was intermediate 139.1t/ha and was not significantly different from Nemonetta variety (Table 1). The highest yield recorded from variety 72205 is most likely to have been caused by the highest leaf area observed that lead to the greater photosynthetic area compared to other varieties. These findings are similar to those reported by Olaniyi and Fagbayide [13] who observed significant differences in fruit yield per plant and total fruit yield among different varieties. Rehman *et al*. [14] also obtained significant differences amongst different tomato varieties. The yield variation could be related to genetic differences among the varieties since they were grown under the same environ-mental conditions [13].

Effects of tomato variety on shelf life of fruits

There were significant differences (P = 0.01) in shelf life among the varieties. Variety 72205 had the highest shelf life (25.50 days) followed by Nemonetta variety (23.75 days). Variety 72061 showed the lowest shelf life (20.25 days) followed by variety 79272 which was intermediate (21.25 days) (Table 1). According to the seed producer [15] for the Israel tomato varieties, variety 72205 has a shelf life range of about 25-30 days and this tally with the findings obtained from this study. The seed producer [15] indicated that variety 79272 has a shelf life of about 15-20 days and this matches with the findings of this study. The fruits have a low water content which allows them to have long shelf life [15]. The same trend in shelf life has been reported by Ghosh *et al*. [16] and Shashikanth *et al*. [17] reporting varietal differences in shelf life in hybrid tomatoes. It also stated that the differences are due to their genetic characteristics [16; 17]. These differences occur because the ripening gene mutants in certain hybrids participate in ethylene-independent signalling and impart delayed ripening in the tomato [18].

CONCLUSION

Israeli varieties (72205 and 79272) have potential in terms of yield and shelf life. Results from the study show various differences among different tomato varieties. Authors recommend that Pedstock Investments and tomato growers grow variety 72205 for higher fruit fresh yield and longer shelf life of fruits.

Acknowledgements

The authors would like to acknowledge Pedstock Investments for their financial assistance in conducting the research project.

REFERENCES

[1] Giovannucci, E. **1999**. *Journal of the National Cancer Institute*, *91*(4), 317-331.
[2] Canene-Adams, K., Campbell, J. K., Zaripheh, S., Jeffery, E. H., and Erdman, J. W. **2005**. *The Journal of nutrition*, *135*(5), 1226-1230.
[3] Fontem, D. A. **1991**. An assessment of potato diseases in the western highlands of Cameroon. In *Biosciences Proceedings* (Vol. 2, pp. 82-86).
[4] Das, B. K., Kim, J. G., and Choi, J. W. **2011**. *Food Science and Technology International*, 1082013211398842.
[5] Brentlinger, D. **1997**. Status of the commercial hydroponic industry in the United States of America. In *International Symposium on Growing Media and Hydroponics 481* (pp. 731-734).
[6] Jackson, J. E., Turner, A., and Matanda, M. **1997**. *Smallholder horticulture in Zimbabwe*. University of Zimbabwe.
[7] Deouk, E. S. A., Fathy, E. L. E and Farid, S. **2000**. *Ann. Agric. Sci. Moshtohor*. 38(1):179-197
[8] Hussain, S. I., Khokhar, K. M., Mahmood, T., Laghari, M. H and Mahmud, M. M. **2001**. *Pakistan Journal of Biological Sciences;* 10(4):1215–1216
[9] Rainwater, D. T., Gossett, D. R., Mollhollon, E. P., Hanna, H. Y., Banks, S. W and Lucas, M. C. **1996**. *Free Radical Research*; 25:421–435
[10] Nkansah, G. O and Ito, T. **1994**. *Journal of Japanese Society for Horticultural Science*; 62(4):781–788.
[11] Khokar, K.M., Hussain S. I, Mahmood T., Hidayatullah and Laghari M. H. **2002**. *Asian J. Plant Sci*. 6: 659-660
[12]Chaudhry, M. F., Khokhar, K. M., Hussain, S. I., Mahmood, T., and Iqbal, S. M. **1999**. *Pakistan Journal of Arid Agriculture (Pakistan)*.
[13] Hussain, S. I., Khokhar, K. M., Mahmood, T., and Laghari, M. H. **2002**. Varietal Differences in Tomato Crop Grown in Islamabad Conditions. *Asian Journal of Plant Sciences*.
]14] Olaniyi, J. O and Fagbayide, J. A. **1999**. *Journal of Agricultural Biotechnology and Environment*. 1:4-10.
[15] Rehman, F., S. Khan, Faridullah and Shafiullah, **2000**. *Pak. J. Biol. Sci*., 3: 833-835.
[16] Nirit seeds. Breeder's Manual. **2013**. Indeterminate single harvesting. http:niritseeds.com. Accessed 01/06/2014
[17] Ghosh, K. P., Islam, A. K., Mian, M. A. K., and Hossain, M. M. **2010**. *Journal of Applied Sciences and Environmental Management*, *14*(2).
[18] Shashikanth, S., Basavaraj, N., Hosamani, R. M., and Patil, B. C. **2010**. *Karnataka Journal of Agricultural Sciences*, *23*(3).
[19]Barry, C. S., and Giovannoni, J. J. **2007**. *Journal of Plant Growth Regulation*, *26*(2), 143-159.