International Scholars Journals

African Journal of Agricultural Economics and Rural Development ISSN: 2375-0693 Vol. 4 (7), pp. 458-462, July, 2016. Available online at www.internationalscholarsjournals.org © International Scholars Journals



*Full Length Research Paper*

# Participatory variety selection of improved tomato (*Lycopersicum esculentum* Mill.) varieties in the lowlands of Bale, South-Eastern Ethiopia

**Seifudin Mehadi[1], Mohammed Beriso[1] and Yonas Worku[1]**

[1]Sinana Agricultural Research Center, P.O. Box 208 Robe-Bale, South-Eastern Ethiopia.

Accepted 07 March, 2016

**Participatory evaluation of eight improved tomato varieties was carried out in Delo Mena and Barbare districts of Bale zone, South-Eastern Ethiopia. The purpose of the study was to test the adaptability and acceptability of the selected tomato varieties by farmers. The study was undertaken in four sites, with the treatments arranged in randomized complete block design with three replications. Both agronomic data and farmers preferences toward the varieties were collected and analyzed using SAS statistical software and pair-wise ranking respectively. The analysis result showed that there was significant ($p<0.05$) difference among the varieties in all agronomic parameters except number of branches per plant. Variety Cochoro gave the highest yield (56.02t/ha), followed by Roma VF (50.97t/ha) and Bishola (45.1t/ha). Pair-wise ranking of farmers' preference also showed that Roma VF and Cochoro varieties ranked first and second in both districts. Miya and Marglobe were not only the low yielding variety but also the least preferred varieties by farmers in the study districts. Therefore based on the findings, Cochoro and Roma VF varieties could be recommended to tomato growers in Delo-Mena and Berbere Districts for further promotion. Farmers also liked Melka Salsa for enhanced number of fruits and Chali for medium, firm and attractive fruits. However, they indicated that fruit size of Melka salsa is very small and Chali is susceptible to late blight. Therefore the two varieties could be used by tomato breeders in their breeding program to exploit their merits.**

**Keywords**: Participatory, evaluation, farmers' preferences, improved variety, tomato.

## INTRODUCTION

Tomato (*Lycopersicum esculentum* Mill.) is one of the most important edible and nutritious vegetable crops in the world (FAO, 2006). It is among the most important vegetables in Asia and Africa and these constituents account for more than 65% of global tomato production. Tomato is rich in nutrients such as vitamins, minerals, and antioxidants, which are important to well balanced human diet (Srinivasan, 2010).

In Ethiopia, there is no exact information as to when tomato was first introduced; however, the crop is cultivated in different major growing areas of the country. It is the 3rd most important vegetable grown in the country, next to hot pepper and Ethiopian cabbage. It covers about 7,256 hectares of land with total production of 0.82 million quintals per year. In Bale zone, although area coverage and total production is not well known, tomato is expected to be produced by 2940 farm households (CSA, 2012). It is cultivated under irrigation in Delo-Mena, Barbare and Agarfa districts (BZADO, 2012).

Despite its importance, production and productivity of this crop is constrained by different factors, among which lack of improved and adapted varieties, inadequate know-

Corresponding author. E-mail:seifisham2014@gmail.com

ledge of production and management, and poor marketing system were the major ones (Tewodros and Negasi, 2014)). Moreover, farmers in the study area experienced considerable economic losses due to late blight disease which is difficult to control once established in the field. Use of resistant variety is the most effective and simplest methods of controlling late blight and bacterial wilt (Timila and Sharada, 2007). Hence, introduction, evaluation and selection of improved tomato varieties that are high yielding and resistant to disease would help to improve production and productivity of the crop in the study area.

Therefore, the study was designed to test the adaptability of improved tomato varieties in the study area through participatory variety selection and ensure their acceptability by farmers.

## MATERIALS AND METHODS

### Description of the Study Area

The study was conducted in Delo-Mena and Berbere districts of Bale zone during 2012/13 growing season. Delo-Mena district is located in south western part of Bale zone, Ethiopia. It has a distance of 125 km from Robe town and 555km from Addis Ababa. Berbere district is located in the central western part of Bale zone, Ethiopia and it has a distance of 100 km from zonal capital Robe and 530 km from Addis Ababa. The mean annual temperature for Delo-Mena and Berbare districts is 29.5$^{o}$c and 16.5$^{o}$c respectively, while mean annual rainfall is 701.5mm for Delo-Mena and 850mm for Berbare districts. Agriculture is the back bone of the economy of the districts. It provides means of occupation for almost all population of the districts. The districts have two major cropping seasons which is known as Maher and Belg. The potentiality of the districts for crop production, livestock rearing, and mining is high. Welmel and Yadot rivers for Delo-Mena and Dumal river for Barbare district are the major sources of irrigation water. In Barbare district about 3277 and 961 hectares of land were under traditional and modern irrigation respectively. Vegetables such as tomato, onion, pepper and sweet potato, cereals, pulses, oilseed, fruit, and spice are the major crops grown in the districts (BOFED, 2009).

### Experimentation, Data Collection and Analysis

Field experiments were conducted during 2012/13 in Dello Mena and Berbare districts, south eastern Ethiopia. Eight tomato varieties: namely Cochoro, Bishola, Eshet, Chali, Roma VF, Melka Salsa, Marglob and Miya were introduced from Melkasa Agricultural Research Center and evaluated for their adaptability, yield potential and resistance to diseases at four irrigation sites in the two districts. Seedlings of each variety were raised on seed bed with the size of 1mx2m. Uniform and vigorous seedlings of each variety were selected and transplanted to well-prepared field on plot size of 4mx3m, with 0.8m and 0.3m spacing between rows and plants respectively (Tesfaye, 2008). The treatments were laid down in Randomized Completed Block Design (RCBD) with three replications. Agronomic as well as other management practices were carried out according to the recommendation. Finally multi-disciplinary team of researchers from breeder, pathology and extension were involved to evaluate the performance of the varieties. Agronomic data such as Plant height, number of branches per plant, fruits per plant, marketable yield and late blight severity were collected from the middle rows and analyzed using SAS statistical software.

### Farmers' selection and participatory evaluation of the varieties

In this study, two groups of tomato growers having 24 members each were selected from the two districts with the help of development agents. Training was given to the farmers to create general awareness about the experiment. Group discussion and debates were made to seriously observe and clear contradictory ideas on issue like farmers' preferences, criteria for evaluation and characteristics of good tomato varieties. Evaluation criteria were set by farmers' prior to evaluation as: vegetative performance, maturity, number of fruits per plant, fruit size, fruit shape, transportability, market preference and resistance to late blight. According to the participant farmers, good tomato verities should have the following characteristics: vigorous, free from disease, with higher number of fruits per plant, firm and medium fruit size with oval shape. Therefore, the varieties were evaluated by the farmers using these criterion and analyzed using pair wise and matrix ranking (Boef and Thijssen, 2007).

## RESULT AND DISCUSSION

### Data from field experiment

Field data were collected by multi-disciplinary team of researchers and analyzed using SAS statistical software. The analysis result showed that there was significant ($p \leq 0.05$) difference among the varieties in all parameters except branches per plant. There was significant ($p \leq 0.05$) height difference among the varieties. The tallest variety was Eshet (96.1 cm) while the shortest was Cochoro (47.5). There was no significant height difference among Cochoro, Chali, Roma VF, Melka Salsa and Miya (Table 1).

Unlike plant height (PH), there was no significant difference in number of branches among the varieties. Number of fruits per plant was statistically ($p \leq 0.05$) diff-

**Table 1.** Mean plant height, branches per plant, fruit number, fruit weight, total yield and late blight of tomato at Delo-Mena and Barbare districts.

| Treatment (varieties) | Plant Height (cm) | Branches per plant | Fruits/ plant | Weight/ fruit (gm) | Mark. Yield (Qt/ha) | Disease (1-9) |
|---|---|---|---|---|---|---|
| Cochoro | 47.5$^{c}$ | 5.4 | 28.1$^{b}$ | 59.6$^{d}$ | **560.2$^{a}$** | 4.2$^{abc}$ |
| Bishola | 66.7$^{b}$ | 4.6 | 17.8$^{d}$ | 77.0$^{a}$ | 451.4$^{bc}$ | 3.7$^{ab}$ |
| Eshet | 96.1a | 4.6 | 18.3$^{d}$ | 70.7$^{b}$ | 441.2$^{bc}$ | 4.7$^{dc}$ |
| Chali | 58.8$^{bc}$ | 5.0 | 22.2$^{c}$ | 59.9$^{d}$ | 438.3$^{bc}$ | 5.3$^{d}$ |
| Roma VF | 58.2$^{bc}$ | 5.7 | 31.8$^{a}$ | 48.1$^{e}$ | **509.7$^{ab}$** | 4.0$^{ab}$ |
| Melka Salsa | 53.5$^{c}$ | 5.8 | 34.3$^{a}$ | 37.7$^{f}$ | 429.9$^{cd}$ | 3.5$^{a}$ |
| Marglob | 66.2$^{b}$ | 4.7 | 16.7$^{d}$ | 65.4$^{c}$ | 362.6$^{d}$ | 4.8$^{dc}$ |
| Miya | 59.0$^{c}$ | 3.8 | 18.2$^{d}$ | 50.0$^{e}$ | 302.8$^{e}$ | 4.8$^{dc}$ |
| **Mean** | **62.8** | **5.0** | **23.4** | **58.5** | **437.0** | **4.4** |
| **LSD** | **12.6** | **1.2** | **3.5** | **4.8** | **76.7** | **1.5** |
| **CV (%)** | **21.4** | **26.1** | **16.1** | **8.7** | **18.6** | **22.4** |

The t-test at a level of 5% probability was applied. For each variety, means within columns bearing different lowercase letters differ significantly at 5% level of confidence.

**Table 2.** Matrix ranking of tomato varieties based on criteria selected by farmers (n=24).

| Evaluation criteria | Delo-Mena District | | | | | | | | Barbare District | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Co | Bi | Es | Ch | Ro | MS | MR | Mi | Co | Bi | Es | Ch | Ro | Ms | Ma | Mi |
| Vegetative performance | 4 | 2 | 5 | 2 | 3 | 4 | 3 | 1 | 3 | 2 | 4 | 2 | 4 | 5 | 3 | 1 |
| Maturity | 4 | 2 | 3 | 4 | 5 | 3 | 2 | 1 | 4 | 2 | 3 | 4 | 5 | 3 | 2 | 1 |
| No. fruits/plant | 4 | 2 | 3 | 3 | 4 | 5 | 1 | 2 | 4 | 2 | 3 | 3 | 4 | 5 | 1 | 2 |
| Fruit size | 5 | 4 | 2 | 5 | 4 | 1 | 2 | 3 | 5 | 3 | 2 | 4 | 4 | 1 | 2 | 3 |
| Fruit shape | 4 | 2 | 2 | 3 | 5 | 4 | 1 | 3 | 4 | 2 | 2 | 3 | 5 | 4 | 1 | 3 |
| Transportability | 4 | 5 | 3 | 4 | 3 | 2 | 1 | 2 | 4 | 5 | 3 | 4 | 3 | 2 | 1 | 2 |
| Market preference | 4 | 3 | 2 | 4 | 5 | 3 | 1 | 2 | 4 | 3 | 2 | 4 | 5 | 3 | 1 | 2 |
| Disease resistance | 4 | 4 | 3 | 1 | 3 | 5 | 2 | 2 | 3 | 4 | 3 | 1 | 4 | 5 | 2 | 2 |
| Overall mean | 4.1 | 3.0 | 2.9 | 3.3 | 4.0 | 3.4 | 1.6 | 2.0 | 3.9 | 2.9 | 2.8 | 3.1 | 4.3 | 3.5 | 1.6 | 2.0 |
| **Overall Rank** | **1** | **5** | **6** | **4** | **2** | **3** | **8** | **7** | **2** | **5** | **6** | **4** | **1** | **3** | **8** | **7** |

Co=Cochoro, Bi=Bishola, Es=Eshet, Ch=Chali, Ro=Roma VF, MS= Melka-Salsa, MR=Marglobe and Mi= Miya. Rank: Degree of satisfaction 1=Low/Bad, 5=High/Good.

erent among the varieties. The highest number of fruit per plant (34) was recorded from variety Melka Salsa while the lowest (17) was from Marglob. Similar to number of fruits per plant, there was significant weight difference among fruits harvested from the varieties (Table 1). Bishola gave the highest fruit weight as compared to the others. Generally, fruits obtained from verities with less number of fruit per plant are bigger in size.

There was significant total yield difference among the varieties (Table 1). The maximum yield (560.19 q/ha) was obtained from the shortest variety, Cochoro. This is in line with the negative correlation between plant height and total yield by Manna and Paul (2012). However, the total yields harvested from Cochoro and Roma VF were not statistically different. The minimum total yield was harvested from Miya (302.81 q/ha). Cochoro and Roma VF had about 85 and 68% yield advantage over this variety, respectively.

Regarding late blight, which is the most important production constraint of the crop in the areas, all of the varieties were fallen in severity range of 3.5 to 5.3. Among the varieties, Chali was found to be moderately susceptible while Melka Salsa was moderately resistant (Table 1).

## Farmers' preference

Farmers' perception on the performance of tomato varieties were tested at Delo-Mena and Barbare districts and analyzed using matrix and pair wise ranking. As a result,

**Table 3.** Pair wise ranking on the overall preference of farmers toward different tomato varieties at Dello-Mena and Barbare districts.

| | Cochoro | Bishola | Eshet | Chali | Roma VF | M/Sal | Marg | Miya | Total score |
|---|---|---|---|---|---|---|---|---|---|
| **Cochoro** | | | | | | | | | **6** |
| **Bishola** | Cocho | | | | | | | | **3** |
| **Eshet** | Cocho | Bishola | | | | | | | **2** |
| **Chali** | Cocho | Chali | Chali | | | | | | **4** |
| **Roma VF** | Roma | Roma | Roma | Roma | | | | | **7** |
| **M/Salsa** | Cocho | M/Sal | M/Sal | M/Sal | Roma | | | | **5** |
| **Marglob** | Cocho | Bishola | Eshet | Chali | Roma | M/Sal | | | **0** |
| **Miya** | Cocho | Bishola | Eshet | Chali | Roma | M/Sal | Miya | | **1** |

the majority of participant farmers in the districts have good interest to grow tomato. All the evaluated varieties preformed well as compared to the local varieties. The tested varieties showed similar performance in the two districts. After discussion and debates, farmers ranked the varieties based on their preference and degree of satisfaction by giving the values 1-5 (Boef and Thijssen, 2007). i.e. 1=Low/Bad, 5=High/Good.

Generally, matrix ranking result showed that overall mean of the ranks for all performance indicators at Delo Mena district were higher for Cochoro (4.1), Roma VF (4.0), Melka Salsa (3.4) and Chali (3.3). On the other hand, the overall mean of the ranks for all performance indicators at Barbare district were higher for Roma VF (4.3), Cochoro (3.9), Melka Salsa (3.5) and Chali (3.1). This means farmers have better preference towards these varieties as compared to others (Table 2).

Farmers were also given chance to compare each variety to the other ones with regards to the values based on identified criteria. Pair wise ranking was used as a tool to summarize farmers' preference toward the varieties (Boef and Thijssen, 2007). The result showed that Roma VF was the most preferred varieties followed by Cochoro, Melka Salsa and Chali (Table 3). Farmers indicated that Roma VF and Cochoro was selected due to their higher yield potential and moderately resistance to late blight. Farmers also liked Melka Salsa for enhanced number of fruits and Chali for medium, firm and attractive fruits. However, they indicated that fruit size of Melka salsa was very small and Chali was susceptible to late blight.

## CONCLUSION AND RECOMMENDATION

The result of this study indicated that Cochoro and Roma VF were higher yielding and the most preferred tomato varieties by farmers at Delo-Mena and Barbare district. Miya and Marglobe were not only the low yielding variety but also the least preferred varieties by farmers in the study districts. Therefore, based on these findings, Cochoro and Roma VF could be recommended to tomato growers in Delo-Mena and Berbere Districts for further promotion. Farmers also liked Melka Salsa for enhanced number of fruits and Chali for medium, firm and attractive fruits. However, they indicated that fruit size of Melka salsa is very small and Chali is susceptible to late blight. Therefore the two varieties could be used by tomato breeders in their breeding program to exploit their merits.

## ACKNOWLEDGMENTS

The experiment was conducted with the financial support from Oromia Agricultural Research Institute. Therefore the Authors acknowledges Oromia Agricultural Research Institute, Sinana Agricultural research Center for the financial and logistic support.

## REFERENCES

Bale Zone Agricultural Development Office (BZADO). 2012. Bale Zone Agricultural Development Office, Annual Report 2012 (Unpublished). Bale-Robe, Ethiopia.

Boef, W.S., Thijssen, M.H. 2007. Participatory tools working with crops, varieties and seeds. A guide for professionals applying participatory approaches in agro-biodiversity management, crop improvement and seed sector development. Wageningen international. Wageningen University and Research Center. The Netherlands.

BOFED. 2009. Physical and Socio-Economic Profile of Oromiya. Bureau of Finance and Economic Development. The National Regional Government of Oromiya. Development- Regional Data and Information Core Process. Addis Ababa, Ethiopia.

Central Statistical Agency (CSA). 2012. The Federal Democratic Republic of Ethiopia. Central Statistical Agency Agricultural Sample Survey 2011 / 2012 (2004 E.C.): Report on Area and Production of Major Crops (Private Peasant Holdings, Meher Season), Volume I. Addis Ababa, Ethiopia.

FAO . 2006. FAO production yearbook, basic data unit, Statistics division, FAO, Rome Italy, No. 55, pp 125-127.

Manna Manna and Amitava Paul, 2012. Path analysis between fruit yield and some yield components in tomato (*Lycopersicon esculeutum* Mill). *Hort Flora Res. Spectrum,* 1(3): 215-219 (2012).

Pandey YR, Pun AB, Upadhyay KP (2006). Participatory varietal evaluation of rainy season tomato under plastic house condition. Nepal Agric. Res. J., 7, 11-15.

Srinivasan R. (Ed.) (2010). Safer tomato production methods: A field guide for soil fertility and pest management. AVRDC- The world vegetable center, Shanhua, Taiwan. AVRDC publication No. 10-710.97p.

Tesfaye Balemi (2008). Response of tomato cultivars differing in growth habit to nitrogen and phosphorus fertilizers and spacing on vertisol in Ethiopia. DOI: 10.2478/v10014-008-0011-8 *Agrovoc,* 103 - 119.

Tewodros Mulualem, Negasi Tekeste (2014). Evaluation of improved tomato (Lycopersicon esculentum Mill.)

Timila RD., Sharada Joshi. 2007. Participatory Evaluation of Some Tomato Genotypes for Resistance to Bacterial Wilt. Nepal Agric. Res. J. Vol. 8, pp 50-55.

varieties through participatory approach in South Ethiopia. Herald J. Agric. Food Sci. Res. Vol. 3 (1), pp. 055-060.