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Performance Evaluation and Participatory Variety Selection of Released Tomato (Lycopersicon Esculentum Mill.) Varieties in West Shewa, Ethiopia

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Abstract: Tomato (Lycopersicon esculentum Mill.) is one of the most important edible and nutritious vegetable crops in the world. In Ethiopia there is a huge market for tomato as it is widely used as fresh and processed forms. The objective of the experiment is to select released tomato varieties with participation of local farmers for specific areas/location. Four varieties of tomato, which includes two processing type (Melka Shola and Melka Salesa) and two fresh market type (Bishola and Gelilema) were evaluated and selected on farmers field of Toke kutaye and Ambo Agriculture Research Center (AmARC on station) to identify and select the best performed varieties. RCBD design with three replications were used for evaluating the varieties. Combined analysis of variance of the two-year results showed that the varieties have highly significant difference on number of fruits per plant, fruit size, marketable fruit yield and total fruit yield. The highest total fruit yield was obtained from variety melka shola both on station and on farm (628.33 and 655.35 qt/ha); followed by melka salsa, (628.58 and 599.02 qt/ha), Gelilema (620.75 and 584.03 qt/ha) whereas, the lowest yield was obtained from Bishola (495.47 and 459.00qt/ha). The two-year results showed that Melka shola was much better on their inherent yielding potential to the area as compared to the other varieties. Thus, depending on the statistical result and farmers demand Melka shola was best variety in West Shewa and it's better to multiply the seed of this variety for seed multipliers.

Keywords: Tomato, Varieties, Farmers, Ambo and Tokekutaye

1. Introduction

Tomato (Lycopersicon esculentum Mill.) is one of the most important edible and nutritious vegetable crops in the world. It ranks next to potato and sweet potato with respect to world vegetable production. It is widely cultivated in tropical, subtropical and temperate climates and thus ranks third in terms of world vegetable production [1]. Tomato is an important source of vitamin A and C, minerals and carotenoids [2]. For instances, Lycopene is a powerful antioxidant cartenoid naturally synthesized in tomato, which has many human health benefits as it reduces the risks of nervous system problems, various cancers and cardiovascular disease [2]. Ethiopia is the world's 84th largest producer of tomato [3, 4]. In Ethiopia there is a huge market for tomato as it is widely used as fresh and processed forms [5]. Currently tomato is one of the major regional export vegetables of the country. In Ethiopia, the crop is produced in the range of 700 up to 2200 meter above sea level, with about 700 to over 1400 mm annual rain fall, in different areas and seasons, in different soils, under different weather conditions, but also at different levels of technology (e.g., with furrow, drip or spate irrigation) and yields [6]. In Ethiopia, the national average yield of tomato apart from the importance and significant effort made, is 5.3 tons/ha [7]. From the total annual production of vegrtable, tomato shared 3.49% of production and onion shared b7.07 %of root crop production [8]. In addition; tomato production provides higher benefit per unit area from continues harvest [9]. Thus, increasing productivity and production of tomato will have a potential to improve the nutritional status of the community and enable farmers to earn more income. However, the potential of the

plant is not exploited well because of less availability of improved varieties seeds and knowledge on varieties and crop management practices that are suitable to specific locations [10]. Adaptation of improved tomato varieties at Ambo area was studied by Yohannes and Wondu, 2022 in 2017 and Melka shola and some varieties were given a promising yield [11]. Thus, depending on this study farmers preference variety selection is mandatory for local farmers and other private investors to demonstrated and supply the seed in the study area. Therefore; the objective of the experiment is to select released tomato varieties with participation of local farmers for specific areas/location.

2. Materials and Methods

2.1. Description of the Study Area

The field experiment was conducted in two locations at Ambo and Tokekutaye discrits in the West Shewa zone, central high land part of Ethiopia during 2021 and 2022 cropping seasons.

The first experiment was situated at Ambo Agricultural Research Center (AmARC) and the center situated 126 km West of Addis Ababa and is located at 2220 m.a.s.l. The center received average minimum and maximum temperatures of 10.4°C and 26.3°C respectively. The annual rainfall was 1050 mm with relative humidity of 64.4%. The second experiment also situated 140 km West of Addis Ababa and is located at 2272 m.a.s.l. The center received average annual rain fall of 1128 mm with minimum and maximum temperatures of 11°C and 26°C respectively.

2.2. Experimental Materials, Treatments and Designs

Four varieties of tomato, which includes two processing type (Melka Shola and Melka Salesa) and two fresh market type (Bishola and Gelilema) were evaluated and selected on farmers field of Toke kutaye and Ambo Agriculture Research Center (AmARC on station) to identify and select the best performed varieties. RCBD design with three replications were used for evaluating the varieties. Spacing between plants and rows was 30cm and 75cm respectively. The experiment was replicated for two years during 2013 and 2014 E.C under irrigated condition. Fertilizer 200Kg/ha DAP was applied at time of transplanting and 100 Kg/ha Urea was side dressed at early flowering stage [12]. Weeding, hoeing and watering were implemented as required.

2.3. Data Collection and Analysis

Data on plant height, number of fruits per plant, average fruit weight, marketable and unmarketable fruit yield were recorded. The data was subjected analysis of variance (ANOVA) performed using statistical software (SAS 9.3). The treatment shows significant difference was subjected least significant difference (LSD) test at 5% level.

3. Results and Discussion

Combined analysis of variance of the two-year results showed that the varieties have highly significant difference on number of fruits per plant, fruit size, marketable fruit yield and total fruit yield. The highest total fruit yield was obtained from variety melka shola both on station and on farm (628.33 and 655.35 qt/ha); followed by melka salsa, (628.58 and 599.02 qt/ha), Gelilema (620.75 and 584.03 qt/ha) whereas, the lowest yield was obtained from Bishola (495.47 and 459.00qt/ha). The maximum marketable yield per hectare was obtained from Melka shola, Melka salsa, Fetene and Miya, respectively in the study of Kibru *et al*., in Qelem Wollega [13]. Similarly on a study conducted in Jimma area of Ethiopia, variety Eshet showed poor performance [14]. The combined analysis results showed that processing type tomato varieties are much better on their inherent yielding potential and adaptability to the area as compared to fresh market type varieties. However; processing type tomato varieties that gave higher fruit yield (Melka shola, Melka salsa and Gelilema) are less acceptable for fresh market because of their appearance; small average fruit weight that ranges from 40 g to 60 g. For fresh market consumption round, large, free from defects, good flavor, attractive red and evenly colored, firm, healthy fruits having good keeping quality and high vitamins content are demanded characteristics [9]. On the other hand, the Mean of marketable fruit yield in ton per hectare was highly significant difference in variety Melkasalsa (33.01ton ha-1) in Jimma [15]. Hence, Introduction of small-scale processing technologies like tomato paste and ketch up preparation methods will enable farmers to exploit the high yielding and good adaptability potential of processing type tomato varieties on the area. On other hand, taking into consideration the fact that the current Ethiopian tomato market is almost wholly focused on fresh market consumption; Production of Variety Melk shola which gave 655 qt/ha can be more profitable for farmers as variety melka shola is adaptable to the area and well acceptable for both processing and fresh market consumption.

Table 1. *Mean yield and agronomic performance of tomato varieties for two years.*

Varieties	Ambo On station				Tokekutaye On farm			
	NFPP	Fs	MFYPH	TFYPH	NFPP	Fs	MFYPH	TFYPH
Bishola	21.842d	120.56a	417.90b	495.47b	24.13	125.90a	411.00b	459.00b
Melka salsa	72.93a	44.25d	526.74a	628.58a	87.67	44.23d	505.11a	599.02a
Melka shola	54.04c	60.92c	553.65a	655.35a	64.30	60.53c	560.76a	628.33a
Gelilema	60.66b	81.26b	547.69a	620.75a	77.00	79.50b	502.16a	584.03a
LSD	6.93	2.26	82.35	82.97	23.53	9.42	75.78	71.65
CV (%)	7.49	2.98	16.45	14.12	17.04	5.47	6.88	5.68

PH=Plant height (cm), NFPP=Number of fruits per plant, FS=Fruit size (g) MFYH= Marketable fruit yield (quintal/hectare) TFYH=Total fruit yield (quintal/hectare). Means followed by the same letter with in the same column are statistically non-significant at $P < 0.05$ according to least significant difference (LSD) test

Farmer Preference on Basis of Some Qualitative Traits

Field evaluation of the fruits was done during peak harvest period. The evaluation was done by farmers research groups, about 30 & 24 neighboring farmers, at Ambo on station on two years respectively and 22 &23 neighboring farmers, at Tokekutaye on farm on two years respectively.

The cumulative relative ranking result indicated that varieties Melkashola, was better preferred by community on the basis of fruits quality, color, shape, free to any pest and diseases, general appearance and market acceptance in both year on both locations (Tables 2 and 3).

Figure 1. *Varieties of tomato.*

Table 2. *Farmers preference of the varieties on the basis of appearance evaluation and market acceptance at Ambo on station.*

No.	Varieties	Number of farmers select the varieties		Average	Rank
		Year-1 (30 farmers)	Year-2 (24 farmers)		
1	Bishola	8	4	6	2
2	Melka salesa	4	8	6	2
3	Melka shola	12	8	10	1
4	Geli lema	6	4	5	4

Table 3. *Farmers preference of the varieties on the basis of appearance evaluation and market acceptance at Tokekutaye on farm.*

No.	Varieties	Number of farmers select the varieties		Average	Rank
		Year-1 (22 farmers)	Year-2 (23 farmers)		
1	Bishola	2	1	1.5	4
2	Melka salesa	4	2	3	2
3	Melka shola	14	18	16	1
4	Geli lema	2	2	2	3

4. Conclusion

The varieties have highly significant difference on plant height, fruit size, number of fruits per plant, total fruit yield and marketable fruit yield. The highest total fruit yield was obtained from variety Melka shola; followed by Melka salesa whereas, the lowest yield was obtained from Bishola. On the other hand, the variety Melka shola was selected by the farmers on all criteria of the local farmers. Thus, depending on the statistical result and farmers demand Melka shola was best variety in West Shewa and it's better to multiply the seed of the variety melka shola for seed multipliers.

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Conflicts of Interest

The authors declare no conflicts of interest.

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