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Performance of Open Pollinated Tomato (Lycopersicum esculantum Mill) Varieties at Humbo Larena, Wolaita Zone

Birhanu Lencha Denk Dana
Wolaita Sodo University, College of Agriculture and Department of Horticulture

Abstract
A field experiment was conducted during the 2014/2015 cropping season a site called Humbo Larena, Wolaita Zone. Therefore, these research main objectives to evaluate the performance of tomato varieties and select relatively high yielder with acceptable quality. Ten open pollinated tomato varieties were tested along with Melka Sala and Marglob as a standard check in a randomized complete block design (RCBD) in 2014 and 2015 under irrigation. The result indicated that treatments differ significantly both horticultural parameter and yield except days to 50 % flowering across cropping years. Accordingly, Woyno was recorded the highest total yield 41.18 t ha^{-1} followed by Cochero and Miya 36.24, and 35.33 t ha^{-1} respectively with statistically non-significant yield difference among them. Therefore, these three varieties are recommended for Humbo Larena and round irrigation command area and similar agro-ecologies.

Introduction

The cultivated tomato (*Lycopersicum esculantum* Mill) is the most important and grown vegetable in the world. To date, its importance is increasing worldwide. It is wildly accepted and commonly used in a variety of dishes as row, cooked or processed products more than other vegetable (Shibli, 2002). Tomato is the important crops grown by both small farmers and commercial growers. It is produced in both the rainy and dry season Tomato have high local uses and commercials according to FAO(3),1985 the overall yield of this crop in Ethiopia is often very low compared to the yield of many producing countries in Africa and world .

There is no definite time recorded regarding to introduction of cultivated tomato in Ethiopia .however ,cherry type has been growing for long around big city and in the small garden ,recently the crop has expanded to commercial production for home use ,export and processing industry .The bulk of fresh market tomatoes are produced by small scale farmers processing type mainly produced in large scale horticultural farms .Farmers are interested in tomato production more than other vegetable for its multiple harvests which result in high profit per unit area(Brady, N. and R.R. (2002) .Like in many other countries , it is also becoming importance in Ethiopia in a variety of dishes ,the fresh product is sliced and used as salad .It is also cooked for making local source (wot).The processed product used such as paste, tomato juice tomato ke-chup and whole peel tomato are produced for local market and export(Lemma *.et.al.,*2000)

Farmers are in tomato production more than other vegetables for its multiple harvests, which results in high profit per unit area. It is an important cash generating crop to small- scale farmers and provides employment opportunities in production and processing industries (CACC, 2003). It is also important source of vitamin A and C as well as minerals. Such diverse uses make tomato an important vegetable in irrigated agriculture in the country. Various crop improvement research activities have been carried out in the country in order to selected acceptable varieties by consumers (Lemma, 2002).

With the realization and advance in expansion of irrigation projects in the region, large volume of tomato produce will be expected for in country and foreign market. However, limitation of improved tomato varieties and its production technique affects to exploit the full potential benefits. In the earlier years except Melka Salsa, Melka Sholla and Roma VF there was no any other improved tomato varieties in the areas. Recently these varieties become low acceptance in the market due to poor quality. Instead cylindrical shaped cultivars which have thick flesh, long shelf life and a potential for long distance transportation have better acceptance. Therefore, this study was conducted to evaluate performance of tomato varieties released by regional and national research system and select relatively high yielder with acceptable qualities for Humbo larena irrigation command areas and other similar agro ecologies.

MATERIALS AND METHODS

Description of the Study Area

The study was conducted at Humbo Larena Kebele (Irrigation Based Integrated Livelihood Activities) at Humbo Woreda, Wolaita Zone, Irrigation Based Integrated Livelihood Activities on Household Asset Accumulation in 2014 growing season. Larena Kebele is located in the Southern Nation Nationalities and Peoples Regional State. It is located at 6°40’46"N latitude and 37°46’56"E longitude at an altitude of 1450 m.a.s.l and 408 km south of Addis Ababa.

The area has bimodal rainfall distribution with mean annual rainfall of 500 mm. Seventy percent of the Woreda has hot to warm climate with mean minimum and maximum air temperature of 24°C and 32°C,

respectively. The soil is Nitisol, reddish brown in color and classified as sandy loam in texture (Amare, 2004).

Experimental design and procedures

Ten open pollinated tomato varieties were tested along with Melka Salsa and Marglobe as a standard check in a Randomized Complete Block Design (RCBD) with three replications. Seedlings were raised on seedbed. A month aged seedlings were transplanted on $6m^2$ plots with spacing of 100*30 cm between rows and plants respectively. P_2O_5 and N fertilizer were applied at the rate of 92 and 82 kg ha^{-1} respectively. Full rate of P_2O_5 was applied at the time of transplanting while N was applied in two splits half at time of transplanting and half at 1½ months after transplanting before stacking.

Data to be collected

Data like plant height, number of cluster per plant, number of fruits per cluster and average fruit weight on five plants randomly selected, days to 50% flowering, marketable and unmarketable yield were recorded. Weed and disease control was done as required.

Data Analysis

Analysis of variance (ANOVA) was done for the measured variables using SAS 8.12 statistical computer software. Differences between treatments mean were delineated using Duncan's multiple range at ≤ 0.05.

RESULT AND DISCUSSION

The combined analysis of variance revealed that, there was a significant ($P<0.05$) difference among varieties for number of cluster per plant, number of fruits per cluster, fruit weight and fruit yield except days to 50% flowering. Cropping year was non-significant for fruit yield. Variety by cropping year interaction was significant for cluster per plant and yield (Table 1). The significant variety by cropping year interaction effect indicates that the varieties respond differently to variation of cropping years. Generally the varieties yield was markedly affected by cropping years. This is attributed to the shortage of irrigation water in 2014 cropping year. Significant difference was observed among varieties in all parameters including fruit yield except days to 50% flowering.

Even though, there is non-significant yield difference among each other Woyno was recorded the highest total yield 41.18 tone ha^{-1} followed by Cochero and Miya 36.24, and 35.33 tone ha^{-1} respectively. Mersa variety recorded the lowest total yield 16.76 tones ha^{-1} (table 4). Lemma (2002) reported that around Jimma yield of several cultivars (12 to 134 quintal ha^{-1}) were lower than the yield obtained at Melkassa and Bako.

The result showed that Cochero, Miya and Woyno gave higher marketable fruit yield exceed by Melka-Salsa in 2014 and Woyno followed by Miya and Cochero in 2015. It indicates these varieties gave stable fruit yield in both cropping years though, most varieties responded differently to the cropping years. Generally, the performance of the varieties was better in 2016 than 2015 cropping year (Table 2 and 3).

Table 2: Performance of OPV Tomato Varieties at humbo Larena research site in 2014 Cropping Year

	Characters						
Treatment	Day to 50% flowering	No CL/plant	No F/cluster	FWT (gm)	MY (t ha^{-1})	UNMY (t ha^{-1})	TY (t ha^{-1})
Woyno(p)	45.33	13.73bc	3.20de	31.13cd	22.74abc	3.64e	26.38abc
Mersa(p)	49.00	13.46bc	3.53cde	30.06cd	18.75bc	1.81e	20.56bc
Srinka-1(fm)	47.66	11.83bcd	4.60b	39.00bcd	20.23bc	8.49bcd	28.73abc
Cochero(p)	43.66	15.06b	3.93bcd	40.16bcd	26.95ab	5.55cde	32.50ab
Miya(fm)	43.00	15.60b	3.80cd	31.40cd	23.91abc	4.54de	28.46abc
Bishola(fm)	44.00	10.40cde	3.66cd	56.00b	24.02abc	10.65ab	34.69a
H-1350 (fm)	50.66	6.800e	2.80e	29.96cd	12.06c	5.89cde	17.95c
Fetan(fm)	47.00	12.26bcd	3.40cde	42.76bcd	16.61bc	9.06bc	25.67abc
Melka sa.(p)	45.00	25.66a	4.20bc	22.03d	33.22a	2.95e	36.16a
Marglob(fm)	42.33	8.20de	5.40a	77.03a	20.75bc	13.37a	34.11a
Mean	45.86	12.79	3.78	41.23	21.10	7.12	28.22
CV (%)	7.78	18.72	11.07	26.00	16.12	14.32	12.01
LSD	Ns	**	**	**	*	**	*

Mean separation in columns is by Duncan's multiple range at ≤ 0.05
P=processing type fm=fresh market type.

Table 3: Performance of Tomato Varieties at Humbo Larena in 2015 year

Treatment	Characters						
	Day to 50% flowering	No of cluster/plant	No F/cluster	FW (gm)	MY (t ha^{-1})	UNMY (t ha^{-1})	TY (t ha^{-1})
Woyno(p)	46.66	14.33a	3.60ab	59.26de	50.75a	5.25bcde	56.00a
Mersa(p)	51.00	8.60c	3.33ab	73.73bcde	10.48e	2.48e	12.96g
Srinka-1(fm)	47.00	10.13bc	4.06a	87.09abcd	12.85de	5.53bcde	18.38fg
Cochero(p)	47.33	11.73abc	3.33ab	86.37abcd	32.78bc	7.22bcde	39.99bcd
Miya(fm)	48.33	14.00a	3.60ab	53.41de	37.69b	4.51cde	42.19abc
Bishola(fm)	49.00	10.26bc	2.93ab	116.02abc	17.09de	12.22ab	29.31cdef
H-1350 (fm)	50.00	9.86bc	2.73b	121.54ab	13.34de	10.77abc	24.11efg
Fetan(fm)	47.66	10.06bc	2.80b	71.13cde	42.24ab	3.09de	45.33ab
Melka salsa	48.00	13.33ab	3.73ab	32.89e	24.67cd	1.29e	25.96defg
Marglob(fm)	47.66	9.40c	3.46ab	128.21a	20.31de	14.75a	35.06defg
Mean	48.16	10.88	3.27	83.83	24.26	7.07	31.32
CV (%)	4.54	18.60	19.08	29.91	26.78	24.92	24.78
LSD	Ns	*	Ns	**	**	*	**

Mean separation in columns is by Duncan's multiple range at ≤ 0.05
P=processing type fm=fresh market type

Table 4: Performance of tomato varieties at Humbo Larena combined over two years

Treatment	Characters						
	Days to 50% flowering	No of cluster/plant	No F/cluster	AFwt (g)	MY(t ha^{-1})	UNIMY (t ha^{-1})	TY (t ha^{-1})
Woyno(p)	46.00c	14.03b	3.40cde	45.20def	36.74a	4.44de	41.18a
Mersa(p)	50.00ab	11.03cd	3.43cde	51.90cde	14.62b	2.14e	16.76d
Srinka-1(fm)	47.33abc	10.98cd	4.33ab	63.05bcde	16.54b	7.01cd	23.55cd
Cochero(p)	45.50c	13.40bc	3.63cd	63.27bcde	29.86a	6.38cd	36.24ab
Miya(fm)	45.66c	14.80b	3.70bcd	42.41ef	30.80a	4.53de	35.33ab
Eshet(fm)	46.33bc	8.87d	3.26cde	66.18bcde	15.78b	9.17bc	24.95cd
Bishola(fm)	46.50abc	10.33d	3.30cde	86.01ab	20.56b	11.44ab	32.00abc
H-1350 (fm)	50.33a	8.33d	2.76e	75.76bc	12.70b	8.33bcd	21.03d
Metadel(fm)	47.67abc	10.80cd	3.00de	69.63bcd	15.66b	9.46bc	25.12cd
Fetan(fm)	47.33abc	11.17cd	3.10de	56.95cde	29.00a	6.00cde	35.00ab
Melka sal(p)	46.50abc	19.50a	3.97abc	27.46ab	28.94a	2.12e	31.06bc
Marglob(fm)	45.00c	8.80d	4.43a	102.62a	20.53b	14.06a	34.59ab
Mean	47.01	11.83	3.52	62.53	22.68	7.09	29.77
CV (%)	6.29	18.73	15.07	30.84	28.57	22.67	23.94
LSD	ns	**	**	**	**	**	**

Mean separation in columns is by Duncan's multiple range at ≤ 0.05
P=processing type fm=fresh market type

Field day assessment

A field day was organized to be evaluated by Humbo Larena irrigation based, command area, model farmer's members, DAs and Woreda level expertise group. All participants allowed to evaluate based on their own selection criterion at the experimental site. Almost all participant model farmers group and DAs (selected Keble) members preferred Cochero first, Miya second and Woyno third accordingly. Their selection was based on earliness, tolerant to disease (blight), firmness (shelf life) and acceptability for market by consumers.

Conclusion and recommendation

Cochero followed by, Woyno and Miya have better performance in terms of earliness and fruit yield. According to the field assessment of farmers and expertise, these varieties more full fill the current consumers' preference than Malka salsa, Melka sholla and Roma VF in terms fruit firmness (perish ability), potential for long distance transportation, fruit shape and fruit color. Therefore, these three varieties are recommended for Humbo Larena irrigation command area and similar agro-ecologies. They need to be demonstrated along with seed production technique to small scale farmers and private investors to disseminate the new varieties to the areas.

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APPENDIX

Table 1: Combined analysis of variances for Yield and some traits in 007 tested varieties.

		Mean square						
Sources	Df	Days to 50% flowering	Cluster per plant	Fruit per cluster	AFW	MTY	UNMT	TY
Treat	11	1817.37ns	60.13**	1.57**	242.08**	386485**	78144**	324611**
rep(yr)	4	60.00ns	36.42ns	0.40ns	80.69ns	58591ns	29376ns	133072ns
Yr	1	95.68**	65.55**	4.70**	3266.99**	178973ns	509ns	172995ns
trt*yr	11	8.92ns	22.81**	0.46ns	637.76ns	250116**	1186**	240729**
Error	44	8.77	4.91	0.28	371.95	42008	9588	50840

Appendix Table-2.Analysis of variance fruit cluster as influenced by different time of tomato

Source of variance	DF	SS	MS	F_{cal}	F_{tab} (5%)
Treatment	3	3.79229	1.26410	16.06**	4.76
Replication	2	0.01455	0.00728		
Error	6	0.47218	0.07870		
Total	11	4.27902			
CV: 7.69					

S: significance ($P < 0.05$)

Appendix Table-3. Analysis of tomato varieties at Humbo Larena combined over two years

Source of variance	DF	SS	MS	F_{cal}	F_{tab} (5)%
Treatment	3	12.23	4.076	8.12*	4.76
Replication	2	0.0017	0.00085		
Error	6	3.012	0.502		
Total	11	15.250			
CV: 6.82					

S: significance (P < 0

**- highly significant (p<0.01) ns- non significant (p<0.05)