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Evaluation the Adaptability of Different Released Tomato (*Solanum lycopersicum* Mill.) Varieties at West Showa Zone

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Abstract

Tomato (*Solanum lycopersicum* Mill.) is the major horticultural crop with an estimated global production of 164 million metric tons from 4.73 million ha of land. In Ethiopia, it is an important food ingredient in daily diet of people in almost all regions. The crop is an important cash-generating crop to small-scale farmers and provides employment in the production and processing industries. The shortage of improved varieties that are adaptable to different agro-ecologies is one of the most problems to production of tomato in West Shewa. Therefore, this study was design to test the best adaptable tomato varieties and to increase production and productivity of tomato through introducing nationally released cultivars, thereby contribute to food security, poverty alleviation and sustainable environment. Seven recently released tomato varieties were used in the field experiment obtained from Melkasa Agricultural Research Center (MARC). The experiment was conducted at Ambo Agricultural Research Center (AmARC) on station in order to evaluate different released tomato varieties. It was laid out on randomized complete block design (RCBD) with three replications. The analysis of variance was showed a significant difference among the treatment on the most parameters at Ambo in both years. Although number of fruits per cluster in year one 2017 and days to ripen in year two 2018 were not showed a significant difference among the treatment. This was an indication that the responses of the varieties were different in each year. Depending on the two years experiment the variety Melka shola was the best adaptable variety compared to the other varieties in yield parameter it gives around 29- and 32-ton h^{-1} in both year 2017 and 2018 G.C respectively at Ambo. The variety Melka shola it is high yielding and relatively disease and insect pest resistance around Ambo area in the off-season of 2017 G.C and 2018 G.C by using furrow irrigation.

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Tomato, Variety,
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Introduction

Tomato (*Solanum lycopersicum* Mill.) is the major horticultural crop with an estimated global production of 164 million metric tons from 4.73 million ha of land (FAO, 2014). In Ethiopia, almost all regions tomato is an important food ingredient in daily diet of people. It is an

important crop to cash-generating crop to small-scale farmers and provides employment in the production and processing industries (Sora, 2018). A number of improved varieties and other agronomic packages have been recommended resulting in improvement of production and productivity tomato in Ethiopia. According to MoA (2013), Ethiopian National

Agricultural Research System (NARS) has released about 25 tomato varieties so far (Alo *et al.*, 2017). Open pollinated tomato varieties such as 'Melkashola', 'Marglobe', 'Melkasalsa', 'Heinz 1350', 'Fetan', 'Bishola', 'Eshet' and 'Metadel' had been released by the Melkassa Agricultural Research Center (MARC) and nationally recommended both for commercial and small-scale production in Ethiopia (Lemma, 2002; Dessalegn, 2002).

Tomato production is challenged with a number of constraints which are biotic and abiotic factors and that reduced the yield. Biotic factors contributing for lower yield of tomato in Ethiopia include insect pests (Gashewbeza *et al.*, 2009). The abiotic factors of tomato production are constrained by different factors such as lack of adopted improved varieties, pest and disease attack and poor cultural practice. The shortage of improved varieties that are adaptable to different agro-ecologies is one of the most problems to production of tomato in West Shewa. Therefore, this study was design to test the best adaptable tomato varieties and to increase production and productivity of tomato through introducing nationally released cultivars, thereby contribute to food security, poverty alleviation and sustainable environment.

Materials and Methods

Description of the Study Area

The experiment was conducted at Ambo Agricultural research center (AmARC) on station. This center is situated 126 km west of Addis Ababa and is located at 8°57'N latitude, 38°7'E longitude with an altitude of 2200 meters above sea level. The center receives an average annual rainfall of 1050 mm with average minimum and maximum temperatures of 10.4°C and 26.3°C, respectively, and relative humidity of 64.4%.

Experimental Materials

Seven recently released tomato varieties were used in the field experiment obtained from Melkasa Agricultural Research Center (MARC) which are listed table.1.

Treatments and Experimental Design

The experiment was conducted at Ambo Agricultural Research Center (AmARC) on station in order to evaluate different released tomato varieties. It was laid out on randomized complete block design (RCBD) with

three replications. All agronomic practice was applied based on the recommended rate.

The plant was transplanted from the nursery to the field after one month with in a ridge combination of spacing 30cmx100cm between plant and row respectively and 1.5m between block. The plot size of each treatment was 3.3mx3m or 9.9m². All management practice was done as planed starting from site selection to harvesting.

Methods of Data Collection

All vegetative and yield data was recorded at field which are: Days to 50% flowering, Number of fruits per cluster, Days to 50% fruit ripening, Number of fruits per plant, Marketable fruit weight per hectare, Un marketable fruit weight per hectare, Marketable number of fruits per hectare and Un marketable number of fruits per hectare. Fruit weight per hectare and numbers of fruits per hectare were taken from 9.9m²plot area and convert to 10000m².

Data Analysis

The data was subjected analysis of variance (ANOVA) performed using statistical software (SAS 9.4). The treatment shows significant difference was subjected least significant difference (LSD) test at 5% level.

Results and Discussion

Analysis of Variance

The analysis of variance was showed a significant difference among the treatment on the most parameters at Ambo in both years. Although number of fruits per cluster in year one 2017 and days to ripen in year two 2018 were not showed a significant difference among the treatment. This was an indication that the responses of the varieties were different in each year.

Days to 50% flowering

The analysis of variance the days of 50% flowering at Ambo was significantly different ($p < 0.05$) among the treatment on each year (Table 2). In the first year 2017 G.C the earliest days to 50% flowering was recorded from variety Fetan (33 days) which is significantly different from the Cochoro (40 days) and Melka shola (42.3 days) (table 2). On year two (2018 G.C) the analysis of variance showed significantly different ($p < 0.05$) among the treatment at Ambo. The variety,

Fetan, Bishola and Melka salsa were taken little days to 50% flowering (47 days each variety) compared to Melka shola (50 days) (Table 3).

Days to 50% ripening date

The analysis of variance the days of 50% ripening at Ambo was significantly different (p<0.05) among the treatment on each year (Table 2).

In the first year 2017 G.C the earliest days to 50% ripening was recorded from variety Fetan (73 days) which is significantly differ from the Cochoro (81 days), Melka shola (86 days) and oval red (87 days) (table 2). On year two (2018 G.C) the analysis of variance showed there is no significantly different (p<0.05) among the treatment on 50% ripening date at Ambo (Table 3).

Number of fruits per cluster

The analysis of variance was showed there was no a significant difference among the treatment on the number of fruits per cluster in the year one (table 2). While on the year two the analysis of variance was showed a significant difference among the treatment and Melka shola (4.8per cluster) was have many fruits compared to Oval red, Cochoro and Fetan. In addition to Chali Miya (4.1), Melka salsa (4) and Chali (3.99) also showed have many fruits and there is no a significant difference compared to Chali (table 3).

Marketable fruit weight

In the first year of (2017 G.C), in marketable fruit weight the analysis of variance was showed a significant

difference among the treatments. In this year Melka shola was showed higher yield than compared to the others. The variety Melka shola was given around 29.53qt ha⁻¹and it's significantly different from the other varieties at Ambo. Melka salsa (19.4qt ha⁻¹) and Bishola (16.03qt ha⁻¹) also have good yield next to Melka shola and oval red was the weakest variety it gives around 5.97qt ha⁻¹(table 2).

In second year (2018 G.C) also the analysis of variance showed a significant difference among the treatment and Melka shola (32.37qt ha⁻¹) was showed high yield compared to the others at Ambo (table 3).

The variety Melka shola was showed higher yield of marketable fruit compared to the others in both year and it is similar to the study of Gebisa *et al.*, 2017, and the maximum fruit yield per hectare were obtained from 'Melkashola at Harer. Getachew and Tewodros, 2019 also in Erer valley of Babile, Melka shola scored 30.86-ton ha⁻¹.

Marketable fruit number

The analysis of variance of was showed a significant difference among the treatments in the marketable fruit numbers in the year of 2017 G.C. The result showed that have many marketable numbers of fruit was Melka shoal (477265 ha⁻¹) and Cochoro (351068 ha⁻¹) at Ambo in 2016 G.C of the first cropping season (table 2).

In the second year 2018 G.C also the analysis of variance was showed significantly difference among seven released tomato varieties. Melka shola was showed that have many numbers of fruit 585043 ha⁻¹ (table 3).

Table.1 Recently released tomato varieties

S.No.	Variety	Year of Release	Responsible Centers
1	Chali	2007	MARC
2	Cochoro	2007	MARC
3	Melka shola	2005	MARC
4	Fetan	2005	MARC
5	Bishola	2005	MARC
6	Melka salsa	2007	MARC
7	Oval red	2006	MARC

Table.2 Mean value of different parameters on tomato varieties in 2017 G.C at Ambo

Variety	Days to 50% flowering	Days to 50% ripening	No. Of fruit per cluster	Marketable fruit weight (toneh ⁻¹)	Marketable. Fruit no. ha ⁻¹
Bishola	39 ^{ab}	79 ^{bcd}	3	16.03 ^{bc}	244444 ^{bcd}
Chali	36.667 ^{ab}	78 ^{cd}	3	9.93 ^{cd}	170940 ^{cd}
Cochoro	40 ^a	81 ^{abc}	3.3	12.81 ^{bcd}	351068 ^{ab}
Fetan	33 ^b	73.333 ^d	3.3	12.97 ^{bcd}	208376 ^{bc}
Melka shola	42.333 ^a	86 ^a	4	29.53 ^a	477265 ^a
Melka salsa	37.667 ^{ab}	79 ^{bcd}	3	19.4 ^b	301709 ^{bc}
Oval red	39 ^{ab}	86.667 ^a	3	5.97 ^d	111154 ^d
Cv%	9.287106	5.189	19.84	32.5	31.63
Lsd(5%)	6.3176	7.425	ns	8.8104	149923

Table.3 Mean value of different parameters on tomato varieties in 2018G.C at Ambo

Variety	Days to 50% flowering	Days to 50% ripening	No. Of fruit per cluster	Marketable fruit weight (toneh ⁻¹)	Marketable fruit no.
Bishola	47 ^b	99.33	4.1 ^{ab}	23.5 ^{bc}	274145 ^b
Chali	48 ^{ab}	98.67	3.97 ^{ab}	22.77 ^{bc}	328205 ^b
Cochoro	48 ^{ab}	103.3	3.2 ^b	19.98 ^{bc}	260684 ^b
Fetan	47 ^b	104.3	3.1 ^b	25.13 ^b	200427 ^b
Melka shola	50 ^a	105	4.77 ^a	32.37 ^a	585043 ^a
Melka salsa	47 ^b	105.7	4.03 ^{ab}	24.9 ^b	323932 ^b
Oval red	48 ^{ab}	100	3.5 ^b	17.8 ^b	282479 ^b
Cv%	2.902	3.904	17.32	14.93765	34.23897
Lsd (5%)	2.471	7.107	1.174	6.32	196213

Production of tomato is needed in West Shewa zone for the consumption and commercial purposes. Therefore, evaluating the adaptability of different tomato varieties for yield and yield components is very important at Ambo West Shewa, Ethiopia.

This area is potential for production of tomato in the offseason by using furrow irrigation. Depending on the two years experiment the variety Melka shola was the best adaptable variety compared to the other varieties in yield parameter it gives around 29- and 32-tonh⁻¹ in both year 2017 and 2018 G.C respectively at Ambo.

The variety Melka shola it is high yielding and relatively disease and insect pest resistance around Ambo area in the off-season of 2017 G.C and 2018 G.C by using furrow irrigation. Therefore, I recommended for investors, farmers and local producers to use the variety Melka shola. On the other hand, the variety Melka shola is recommended for researchers to further demonstration, popularization and other research work.

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