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Performance Evaluation of Different Tomato Lines Grown Organically in Catarman, Camiguin, Philippines

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ABSTRACT

Tomato (Solanum lycopersicum) is considered an important crop, but local producers face difficulties in choosing the appropriate variety due to its diversity and ecological adaptability. In order to provide an alternative option and selection of suitable varieties, this research was conducted to evaluate the comparative performance of 16 tomato genotypes (11 AVRDC lines, five check varieties) at Tangaro, Catarman, Camiguin from January to April 2014 using a randomized complete block design with three replications under field conditions. It was found out that different morphophysiological, yield and plant immunity except fruit size were significant among studied lines. Maximum plant height (65.30 cm) at 60DAT was recorded in T11 (AVTO 1002). Most check varieties produced first flowers earlier compared to AVRDC lines., with T15 (CV4 M) at 20.67 days and consequently mature early by having its first harvest (56DAT) at least two days earlier. T12 (CV1 TD) exhibited as the most vigorous plant. Checked varieties T12 (CV1 TD) have the highest percentage of survival, while T7 (AVTO 0101) and T10 (AVTO 9001) showed a percent plant survival statistically comparable to other check varieties. T14 (CV3 MF1) produced the most fruits, while T5 (AVTO 1004) produced the least. The highest computed yield per hectare was observed from T14 (CV3 MF1), whereas among AVRDC lines, only T4 (AVTO 1173) produced a comparatively better yield. AVRDC lines T1 (AVTO 1009), T2 (AVTO 1003), and T3 (AVTO 9803) were most susceptible to TYLCV, while checked varieties were more resistant. Considering the overall performance, it was found that the checked varieties performed well. AVRDC line T4 (AVTO 1173) was also promising for its growth, yield performance, and resistance to TYLCV. However, the potential of these varieties is needed to be further tested for verification under different growing seasons to elicit substantial conclusions.

INTRODUCTION

Tomato (Solanum lycopersicum) is one of the major commercial vegetable crops and is widely grown both in the highland and lowland areas in the Philippines. It ranked second in terms of the total area planted and volume of production estimated at 17, 228.31 ha and 207, 655.1 tons of the top 6 vegetables grown (BAS, 2014). The world's average tomato productivity was 34.84 tons/ha (FAO, 2009), and the average productivity of the Philippines was 12.05 tons/ha, while for Camiguin, it was estimated to be about 9.79 tons/ha (BAS, 2014). Although it ranks second to eggplant in terms of total production area, seasonality of production and limited domestic supply continues to plague the industry.

Fresh market tomato production is filled with many challenges because it is a high management crop (Palada and Davis, 2001). Tomatoes require intensive hand labor input for operations such as staking, fertilization, mulching, cultivation, pruning, tying, training, spraying, and harvest. Tomatoes are also highly vulnerable to insect and disease damage. Tomato yields in the Philippines are below the world average, in part due to the damage caused by three tomato viruses: the white fly-transmitted geminivirus (Tomato Leaf Curl Virus (ToLCV), Tomato Yellow Leaf Curl Virus (TYLCV)) and the Cucumber Mosaic Virus (CMV). Without a well-timed insect and disease management program in the tropics, yields can be greatly compromised. Fresh market tomatoes are also highly perishable, which requires efficient handling and marketing (Diver et al., 1999). Farm managers must also pay close attention to the weather, especially the seasonal variation in temperature and rain. High temperatures can inhibit fruit sets (Peet and Bartholemew, 1996), whereas heavy rains can deteriorate fruit quality (Diver et al., 1999). Successful tomato production requires intensive manual labor and sound management practices.

Tomato production is dominated by small-scale farmers who favor this crop for its relatively high cash value, which contributes significantly to their income. One of the most critical decisions a tomato farmer can make is variety selection (Fornaris et al., 1991). The use of well-adapted cultivars allows for stable yields under tough growing conditions, significantly increasing agricultural success (Colley & Myers, 2007). Variety trials are conducted to identify superior performing cultivars. Varieties often perform differently in different environments due to genotype-environment interactions (Lammerts van Bueren et al., 1999). Typically, a variety of trials is conducted at various locations, in different seasons, or in different years, due to the fact that soil type, climate, and the fluctuation in disease and insect pressure will all affect a cultivar's overall performance.

With the numerous tomato varieties available from local nurseries, retailers, and seed company Solanum lycopersicum catalogs, it can be challenging for the farmers to select a variety that is suited to the local climate and

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will fit their needs for end-use. Although many tomatoes varieties will grow in the Province of Camiguin, little is known about their actual production. Also, there is a need for information on tomato cultivar performance under organic management in the tropics. The utilization of organic amendments such composts and vermincompost could help in improving soil nutrients and promoting soil health (Jack & Thies, 2002) and several studies have showed positive effects on various crops such as an increase in the soil organic carbon, exchangeable calcium , nitrates, phosphates, and some other nutrients for plants (Wang et al., 2017). In an effort to provide an alternative option of varieties and selection of suitable varieties, and to determine whether applying vermicompost and manure compost to soils this research was conducted.

This study aimed to evaluate different tomato lines as to performance and disease resistance under low elevation. Specifically, the study aims to: 1.) evaluate growth performance of different tomato lines; 2.) determine the yield and its components; and 3.) assess the resistance of the different tomato lines to TYLCV under organic practices.

MATERIALS AND METHODS

A varietal screening of tomatoes was conducted in the experimental area of the Institute of Agriculture, Camiguin Polytechnic State College-Catarman Campus, Tangaro, Catarman, Camiguin from January to April 2014. The area was previously planted to rice.

This study was laid out in a Randomized Complete Block Design (RCBD) with sixteen tomato genotypes as treatments and replicated three times. Among the 16 entries, 11 of which were acquired from the World Vegetable Center (AVRDC) following international plant quarantine rules and regulations, and the remaining entries were commercial varieties that are locally available. The different treatments were as follows:

T1 (AVTO 1009)	T9 (AVTO 1008)
T2 (AVTO 1003)	T10 (AVTO 9001)
T3 (AVTO 9803)	T11 (AVTO 1002)
T4 (AVTO 1173)	T12 (CV 1 TD)
T5 (AVTO 1004)	T13 (CV 2 IM)
T6 (AVTO 1007)	T14 (CV 3 MF1)
T7 (AVTO 0101)	T15 (CV 4 M)
T8 (AVTO 1130)	T16 (CV 5 DMF1)

Land Preparation and Lay outing

The land was plowed and harrowed twice thoroughly using animal-drawn equipment. A total area of around 504 square meters was used in the study which was divided into six plots. Each treatment composed of two (2) rows planted to a total of twelve (12) plants with six (6) plants per row. The distance between plots was 1 meter. Each plot has a dimension of 1.5 x 3 meters.

Seedling establishment

Seeds were sown in multicellular plastic 100 cell- seedling trays using a sterilized sowing medium. Seedlings were raised in an enclosed site protected with nylon netting to keep it safe from pest and insect infestations. Prior to transplanting, seedlings were hardened by gradual reduction of water application and gradual exposure to full sunlight five days before transplanting. Plants were transplanted when it reached the five-leaf stage about four to five weeks after sowing. Mounding of additional soil media at 30 and 60 days after planting were done to avoid root exposure and supplement the fertility of the soil. Placements of bamboo sticks as trellis were done 45 days after transplanting to support the plant from lodging.

Cultural and Pest Management Practices

Fertilizer application was done using vermicasts based on the recommended rate at 200 g per hill.. Removal of weeds was done along with cultivation to facilitate proper aeration and growth. The entire area was grown with companion plants such as Marigold as border crop to minimize the incidence of pests and diseases.

Data Gathered

Growth Parameters

1. Plant height – was taken during 15, 30, 45, and 60 DAT from 5 randomly selected plants. Plant height was measured from the base of the soil level up to the longest shoots.

2. Days to 50% flowering- this was recorded as to the number of days from transplanting until 50% of the plant population has flowered.

3. Days to the first harvest – refers to the number of days after transplanting (DAT) that 50% of the plants in a plot have mature green fruits ready to harvest.

4. Plant Vigor – the overall plant growth or plant stand was observed visually and was taken one month after transplanting and during the first harvest using the scale below:

1 - most vigorous
2 - vigorous
3 - moderately vigorous
4 - weak
5 - very weak

5. Percent survival – the number of standing plants per plot was counted at 15, 30, 45, and 60 DAT, which was divided by the total number of plants grown per plot times 100.

Yield Parameters

6. Fruit yield – fruits harvested in each plant per plot from first up to the last harvest were weighed and classified into marketable and non-marketable.

7. Number of Fruits – the number of marketable and non-marketable fruits harvested per plant was counted and recorded from the first harvest up to the last harvest.

8. Fruit weight - Average weight (grams) of 10 fruits from the second harvest was recorded.

9. Marketable yield per hectare – the total marketable yield was obtained by adding the yields of harvest. The

marketable yield was converted into tons per hectare using the following formula:

$$\text{Marketable Yield per hectare } \left(\frac{t}{ha}\right) = \frac{marketable\ yield\ (kg)}{harvested\ area\ (m^2)} x\ 10$$

10. Fruit size –fruit size was determined by selecting ten random fruit samples at maturity, and the cross-sectional area was measured. Fruit size was then categorized based on the following scale.

1	Very small	(<3 cm)
2	Small	(3 - 5 cm)
3	Intermediate	(5.1 - 8 cm)
4	Large	(8.1 - 10 cm)
5	Very large	(>10 cm)

Source: IPGRI

11. TYLCV rating – the overall plant appearance was taken into consideration for TYLCV and sample plants were rated as follows:

1-Resistant (very minimal)

2-Mild symptoms (light foliar yellowing)

3-Moderate symptoms (light foliar yellowing and curling and slight plant stunting)

4-Severe symptoms (very severe plant stunting, leaf size reduction, leaf curling and yellowing)

Data Analysis

The data gathered were analyzed using ANOVA by the Statistical Tool for Agricultural Research (STAR) version 2.0.1 software. The means were compared using Tukey's Honest Significant Difference (HSD) at a 5% level of significance.

RESULTS AND DISCUSSION

Plant Height

Table 1 shows the mean plant height of tomatoes at different growth stages which were determined from five (5) randomly selected plants per plot and was measured from the base of the plant to the longest shoot. T11 (AVTO 1002) and T8 (AVTO 1130) exhibit taller plant and differs significantly in plant height as compared among different tomato varieties.

Table 1: Mean plant height (cm) of tomato at different growth stages

Treatments	Plant Height, (cm)			
	15 DAT	30 DAT	45 DAT	60 DAT
T1 (AVTO 1009)	13.73^{e}	29.03^{f}	49.33^{f}	57.60^{f}
T2 (AVTO 1003)	19.77^{ab}	35.07^{ab}	55.37^{ab}	63.67^{ab}
T3 (AVTO 9803)	14.97^{de}	30.27^{ef}	50.57^{ef}	58.87^{ef}
T4 (AVTO 1173)	16.80^{bc}	32.10^{bc}	52.40^{bc}	60.67^{bc}
T5 (AVTO 1004)	17.90^{ab}	33.20^{ab}	53.50^{ab}	61.80^{ab}
T6 (AVTO 1007)	15.83^{de}	31.13^{de}	51.43^{de}	59.70^{de}
T7 (AVTO 0101)	18.77^{ab}	34.07^{ab}	54.37^{ab}	62.67^{ab}
T8 (AVTO 1130)	21.13^{a}	36.43^{a}	56.73^{a}	65.0^{a}
T9 (AVTO 1008)	17.77^{ab}	34.00^{ab}	54.30^{ab}	62.57^{ab}
T10 (AVTO 9001)	15.57^{de}	30.87^{de}	51.17^{de}	59.47^{de}
T11 (AVTO 1002)	21.47^{a}	36.77^{a}	57.07^{a}	65.30a
T12 (CV 1 TD)	18.23^{ab}	34.23^{ab}	54.53^{ab}	62.83^{ab}
T13 (CV 2 IM)	17.73^{ab}	33.03^{ab}	53.33^{ab}	61.63^{ab}
T14 (CV 3 MF1)	13.30^{e}	28.60^{f}	48.90^{f}	57.17^{f}
T15 (CV 4 M)	20.27^{ab}	35.57^{ab}	55.87^{ab}	64.17^{ab}
T16 (CV 5 DMF1)	16.03^{cd}	31.33^{cd}	51.63^{cd}	59.93^{cd}
$HSD_{\alpha 0.05}$	**	**	**	**
CV (%)	11.59	6.03	3.73	3.22

Days to 50% Flowering, Days to First Harvest, and Plant Vigor

Table 2 presents the mean number of days to 50% flowering, the number of days to first harvest, and plant vigor of the different tomato varieties. Results show that most check varieties significantly produced first flowers earlier as compared to the AVRDC lines; hence the number of days to first harvest was observed to be significantly earlier with the check varieties. However, some of the AVRDC lines were statistically comparable with the check varieties in terms of earliness in the number of days to flowering, but as to the earliness of the number of days to first harvest, most of the AVRDC lines significantly took 2 to 8 days more to be harvested except for T1 (AVTO 1009), T2 (AVTO 1003) and T3 (AVTO 9803).

Vigor rating of different tomato lines was monitored at 30 DAT and at the first harvest (Table 2). Results showed that among all the varieties, T2 (AVTO 1003) and T8 (AVTO 1130) showed a weak stand at first harvest compared to other varieties. On the other hand, the check varieties exhibited the lowest mean vigor rating for both 30 DAT and during the first harvest, which can be described as more vigorous as compared to the other tomato lines.

Table 2: Mean number of days to 50% flowering, first harvest, and plant vigor.

Treatments	Days To 50% Flowering	Days To 1st Harvest	Plant Height, (cm)	
			30 DAT	@ 1st Harvest
T1 (AVTO 1009)	26.67^{bc}	56.00^{e}	2.00^{de}	4.00^{ab}
T2 (AVTO 1003)	27.67^{ab}	56.00^{e}	1.73^{e}	4.22^{a}
T3 (AVTO 9803)	26.00^{bc}	56.33^{e}	3.96^{a}	3.67^{ab}
T4 (AVTO 1173)	31.67^{a}	61.67^{bc}	2.22^{cd}	3.89^{ab}
T5 (AVTO 1004)	23.67^{bc}	60.67^{c}	2.00^{de}	3.89^{ab}
T6 (AVTO 1007)	25.33^{bc}	63.67^{a}	2.00^{de}	4.00^{ab}
T7 (AVTO 0101)	26.67^{bc}	64.00^{a}	2.67^{bc}	3.33^{bc}
T8 (AVTO 1130)	22.33^{cd}	60.67^{c}	2.00^{de}	4.22^{a}
T9 (AVTO 1008)	22.00^{cd}	61.00^{bc}	1.00^{f}	3.89^{ab}
T10 (AVTO 9001)	27.33^{ab}	58.00^{d}	2.96^{b}	3.11^{cd}
T11 (AVTO 1002)	26.00^{bc}	62.00^{b}	2.89^{bc}	3.78^{ab}
T12 (CV 1 TD)	21.33^{de}	56.00^{e}	2.18^{de}	2.00^{g}
T13 (CV 2 IM)	21.00^{e}	56.00^{e}	2.00^{de}	2.33^{fg}
T14 (CV 3 MF1)	21.67^{de}	56.00^{e}	1.67^{ef}	2.44^{ef}
T15 (CV 4 M)	20.67^{e}	56.00^{e}	1.67^{ef}	3.00^{de}
T16 (CV 5 DMF1)	21.00^{e}	56.00^{e}	1.00^{f}	3.33^{bc}
$HSD_{\alpha 0.05}$	**	**	**	**
CV (%)	10.11	1.17	18.34	12.51

Percent Plant Survival

Table 3 presents the mean percent plant survival of different tomato varieties at different growth stages. Results of the study showed that all the check varieties have high percent survival at different growth stages as compared to other entries. T7 (AVTO 0101) and T10 (AVTO 9001) showed a percent plant survival statistically comparable with the check variety T16 (CV5 DMF1), particularly at 60 DAT. It can be observed that tomato lines that have poor growth at an early seedling stage have consequently low percent survival in the later growth stage. The percent survival rate among the different tomato varieties could be attributed to environmental factors and with insect and pest damaged.be attributed to environmental factors and with insect and pest damaged.

Table 3: Mean percent plant survival of different tomato varieties at different growth stages

Treatments	Percent Plant Survival			
	15 DAT	30 DAT	45 DAT	60 DAT
T1 (AVTO 1009)	73.33^{de}	70.00^{de}	60.00^{fg}	56.67^{f}
T2 (AVTO 1003)	70.00^{e}	66.67^{e}	56.67^{g}	53.33^{f}
T3 (AVTO 9803)	80.00^{cd}	76.67^{bc}	66.67^{de}	63.33^{ef}
T4 (AVTO 1173)	76.67^{de}	73.33^{cd}	66.67^{de}	63.33^{ef}
T5 (AVTO 1004)	76.67^{de}	73.33^{cd}	63.33^{ef}	60.00^{ef}
T6 (AVTO 1007)	76.67^{de}	70.00^{de}	60.00^{fg}	56.67^{f}
T7 (AVTO 0101)	93.33^{ab}	86.67^{ab}	73.33^{bc}	70.00^{bc}
T8 (AVTO 1130)	70.00^{e}	66.67^{e}	56.67^{g}	56.67^{f}
T9 (AVTO 1008)	76.67^{de}	73.33^{cd}	63.33^{ef}	60.00^{ef}
T10 (AVTO 9001)	96.67^{a}	86.67^{ab}	80.00^{ab}	73.33^{bc}
T11 (AVTO 1002)	86.67^{bc}	76.67^{bc}	70.00^{cd}	66.67^{ef}
T12 (CV 1 TD)	100.00^{a}	93.33^{a}	93.33^{a}	90.00^{a}
T13 (CV 2 IM)	100.00^{a}	90.00^{ab}	86.67^{ab}	83.33^{ab}
T14 (CV 3 MF1)	100.00^{a}	86.67^{ab}	83.33^{ab}	80.00^{ab}
T15 (CV 4 M)	100.00^{a}	83.33^{ab}	83.33^{ab}	80.00^{ab}
T16 (CV 5 DMF1)	100.00^{a}	76.67^{bc}	76.67^{bc}	73.33^{bc}
$HSD_{\alpha 0.05}$	**	**	**	**
CV (%)	6.06	9.10	11.71	10.58

Number of Fruits per Plant

The mean total number of fruits per plant comprising the marketable and non-marketable fruits from first to last harvest was recorded and presented in Table 4. Data revealed that check varieties significantly produced the greatest number of fruits, especially T14 (CV3 MF1) and AVRDC line T8 (AVTO 1130) showed to be statistically comparable to the check varieties. In terms of the number of marketable fruits, AVRDC lines T1 (AVTO 1009), T4 (AVTO 1173), and T10 (AVTO 9001) produced the highest marketable fruits among AVRDC lines and statistically comparable to the check varieties. However, check varieties significantly produced the greatest number of non-marketable fruits compared to AVRDC. Results can be attributed to the percent plant survival, which has a direct effect on the number of fruits bearing plants. In a study conducted by Ortiz et al., (2007), there were observed substantial variations among the 15 genotypes in terms of marketable yield and fruit sizes when grown in a multienvironment as a response to different factors such as climate, soil conditions, and cultural practices. The selection of suitable tomato lines or cultivar and utilization of established cultural management practices are vital for acceptable and increased levels of productivity (McGraw et al., 2007).

Table 4: Mean total number of fruits per plant, marketable and nom-marketable fruits per plant

Treatments	Number Of Fruits Per Plant	Number Of Marketable Fruits	Number Of Non-Marketable Fruits
T1 (AVTO 1009)	69.0^{cd}	57.67^{cde}	11.33^{cde}
T2 (AVTO 1003)	52.7^{de}	43.67^{ef}	9.00^{de}
T3 (AVTO 9803)	58.7^{de}	44.33^{ef}	14.33^{bcde}
T4 (AVTO 1173)	67.7^{d}	52.67^{de}	15.00^{bcde}
T5 (AVTO 1004)	40.7^{e}	34.33^{f}	6.33^{e}
T6 (AVTO 1007)	63.7^{d}	51.33^{e}	12.33^{cde}
T7 (AVTO 0101)	59.0^{de}	46.00^{ef}	13.00^{cde}
T8 (AVTO 1130)	89.0^{ab}	71.00^{abc}	18.00^{abcd}
T9 (AVTO 1008)	59.7^{de}	47.67^{ef}	12.00^{cde}
T10 (AVTO 9001)	67.3^{d}	52.00^{de}	15.33^{bcde}
T11 (AVTO 1002)	58.3^{de}	45.33^{ef}	13.00^{cde}
T12 (CV 1 TD)	102.3^{a}	84.00^{a}	18.33^{abc}
T13 (CV 2 IM)	88.7^{ab}	71.33^{abc}	17.33^{abcd}
T14 (CV 3 MF1)	105.0^{a}	79.00^{ab}	26.00^{a}
T15 (CV 4 M)	88.3^{abc}	66.00^{bcd}	22.33^{ab}
T16 (CV 5 DMF1)	71.0^{bcd}	53.67^{de}	17.33^{abcd}
HSDα0.05	**	**	**
CV (%)	8.91	8.5	20.3

Weight of Fruits per Plant, Weight of Fruit, Fruit Size, and Yield

Mean fruit weight per plant (marketable and non-marketable), weight per fruit, fruit size, and yield are presented in Table 5. Results showed that the percentage weight of marketable fruits per plant was observed to be consistently higher for check varieties T14 (CV3 MF1) and T15 (CV4 M). However, check varieties significantly produced the most non-marketable weight of fruits compared to AVRDC lines. AVRDC lines produced lightest weight of marketable fruits per plant. This can be attributed to the from the fact wherein this line produces the least number of fruits and lowest percent plant survival. Genotype × environment interaction (GEI) affects marketable fruit yield and average fruit weight of different tomato lines (Ortiz et al., 2007).

T15 (CV4 M) consistently showed to weigh more and bigger in terms of weight per fruit and fruit size. However, AVRDC lines T4 (AVTO 1173) and T5 (AVTO 1004) produced comparable weight per fruit with the check varieties, although both AVRDC lines and check varieties did not differ significantly in fruit sizes.

1004) produced more or less comparable weight per fruit with the check varieties, although both AVRDC lines and check varieties did not differ significantly in fruit sizes.

Table 5: Yield and yield components of different tomato lines

Treatments	Weight Of Fruits Per Plant, g			Weight Per Fruit, g	Fruit Size	Yield, tons/ha
	Total Weight	Marketable	Non-Marketable			
T1 (AVTO 1009)	1610.00^{efg}	1345.56^{cdef}	264.44^{de}	23.33^{a}	2.33^{a}	8.97
T2 (AVTO 1003)	1141.11^{g}	946.11^{g}	195.00^{e}	21.67^{a}	2.67^{a}	6.31

T3 (AVTO 9803)	1466.67^{fg}	1108.33^{fg}	358.33^{cde}	25.00^{a}	2.00^{a}	7.39
T4 (AVTO 1173)	2030.00^{cde}	1580.00^{cde}	450.00^{cde}	30.00^{a}	2.67^{a}	10.53
T5 (AVTO 1004)	1287.78^{fg}	1087.22^{fg}	200.56^{e}	31.67a	2.33^{a}	7.25
T6 (AVTO 1007)	1485.56^{fg}	1197.78^{fg}	287.78^{de}	23.33^{a}	2.67^{a}	7.99
T7 (AVTO 0101)	1671.67^{ef}	1303.33^{defg}	368.33^{cde}	28.33^{a}	2.33^{a}	8.69
T8 (AVTO 1130)	1631.67^{efg}	1301.67^{efg}	330.00^{cde}	18.33^{a}	2.67^{a}	8.68
T9 (AVTO 1008)	1292.78^{fg}	1032.78^{fg}	260.00^{de}	21.67^{a}	2.67^{a}	6.89
T10 (AVTO 9001)	1795.56^{def}	1386.67^{cdef}	408.89^{cde}	26.67^{a}	2.33^{a}	9.24
T11 (AVTO 1002)	1361.11^{fg}	1057.78^{fg}	303.33^{cde}	23.33^{a}	2.00^{a}	7.05
T12 (CV 1 TD)	2046.67^{cde}	1680.00^{bcd}	366.67^{cde}	20.00^{a}	2.00^{a}	11.20
T13 (CV 2 IM)	2512.22^{bc}	2021.11^{ab}	491.11b^{cd}	28.33^{a}	2.33^{a}	13.47
T14 (CV 3 MF1)	3150.00^{a}	2370.00^{a}	780.00^{a}	30.00^{a}	2.00^{a}	15.80
T15 (CV 4 M)	2944.44^{ab}	2200.00^{a}	744.44^{ab}	33.33^{a}	2.67^{a}	14.67
T16 (CV 5 DMF1)	2248.33^{cd}	1699.44^{bc}	548.89^{abc}	31.67^{a}	2.00^{a}	11.33
HSDα0.05	**	**	**	*	ns	
CV (%)	9.01	8.50	20.26	20.35	20.21	

Fruit Yield

Based on the marketable yield, the highest computed yield per hectare was observed from T14 (CV3 MF1), having a yield of 15.8 ton-ha. AVRDC line T4 (AVTO 1173) produced a comparable yield to checked varieties. The lowest yield was computed from AVRDC line T9 (AVTO 1008). These results can be attributed to the number of marketable fruits harvested and the percent survival of the different tomato lines.

Tomato Yellow Leaf Curl Virus

Table 6 presents the mean resistance of the different tomato lines to TYLCV. Results revealed that AVRDC lines T1 (AVTO 1009), T2 (AVTO 1003), and T3 (AVTO 9803) are most susceptible to TYLCV. The plants exhibited stunted growth, size reduction, and curling of the leaves. Check varieties exhibited resistance to TYLCV.

Table 6: TYLCV disease rating of different tomato varieties

Treatments	Tylcv Rating		
	30 DAT	45 DAT	60 DAT
T1 (AVTO 1009)	3.0^{a}	4.0^{a}	4.0^{a}
T2 (AVTO 1003)	3.0^{a}	3.67^{ab}	4.0^{a}
T3 (AVTO 9803)	2.33^{ab}	3.67^{ab}	4.0^{a}
T4 (AVTO 1173)	2.0^{ab}	2.0^{c}	3.33^{ab}
T5 (AVTO 1004)	2.0^{ab}	2.3^{bc}	3.33^{ab}
T6 (AVTO 1007)	2.0^{ab}	2.3^{bc}	3.0^{abc}
T7 (AVTO 0101)	2.0^{ab}	2.3^{bc}	3.33^{ab}
T8 (AVTO 1130)	2.0^{ab}	2.0^{c}	3.33^{ab}
T9 (AVTO 1008)	1.33^{b}	2.0^{c}	3.67^{ab}
T10 (AVTO 9001)	1.67^{b}	2.33^{bc}	3.0^{abc}
T11 (AVTO 1002)	1.33^{b}	2.67^{abc}	3.0^{abc}
T12 (CV 1 TD)	2.0^{ab}	2.33^{bc}	2.0^{c}
T13 (CV 2 IM)	2.0^{ab}	2.33^{bc}	2.33^{bc}
T14 (CV 3 MF1)	1.67^{b}	2.33^{bc}	2.33^{bc}
T15 (CV 4 M)	1.67^{b}	2.33^{bc}	2.33^{bc}
T16 (CV 5 DMF1)	1.67^{b}	2.33^{bc}	2.33^{bc}
HSDα0.05	**	**	**
CV (%)	19.57	19.67	14.15

CONCLUSIONS

On the different varieties, considering the overall performance, it can be concluded that the checked varieties performed well. AVRDC lines T4 (AVTO 1173) was also promising in respect of yield attributes and disease resistancy to TYLCV. However, the potential of these varieties is needed to be further tested for verification under different growing seasons to elicit substantial conclusions.

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