African Journal of Agricultural Research Vol. 6(13), pp. 2978-2981, 4 July, 2010
Available online at http://www.academicjournals.org/AJAR
DOI: 10.5897/AJAR10.061
ISSN 1991-637X ©2010 Academic Journals

*Full Length Research Paper*

# Effect of inter-row spacing with double row arrangement on yield and yield component of tomato (*Lycopersicon esculuntum* Mill.) at Adami Tulu Agricultural Research Center (Central Rift Valley of Oromia, Ethiopia)

**Geremew Awas*, Teshome Abdisa, kasaye Tolosa and Amanti Chali**

Adami Tulu Agricultural Research Center, P. O. Box 35, Ziway, Ethiopia.

Accepted 6 August, 2010

**The effect of inter- row spacing with double row arrangement on yield and yield components of tomato (*Lycopersicon esculuntum* Mill.) was conducted at Adami Tulu agricultural research center, Ethiopia, during the season of 2007 and 2008 using irrigation. The experiment was conducted to determine the optimum inter-row spacing for tomato production with double row arrangement, using randomized complete block design (RCBD) with 4 replications. Area occupied by a single plot was 4 m × 3 m with spacing of 1.5 m x 1 m between block and plot, respectively. There were a total of 5 treatments (inter-row spacing). The analyzed result at α = 0.05 indicated that ,there was no significance difference among treatments (100 × 30, 60 × 30, 50 × 30, 40 × 30 and 30 × 30 cm) between row and plant, respectively for marketable yield. Even though marketable yield showed no significance difference, 40 × 30 cm gave higher marketable yield (607.9 q/ha) followed by 60 × 30 cm and 50 × 30 cm (570.4 q/ha and 568 q/ha, respectively). From the treatments 100 × 30 cm inter -row spacing showed the least marketable yield (475.85 q/ha) as compared with the rest 4 treatments.**

**Key words:** Marketable, spacing, tomato, unmarketable, yield.

## INTRODUCTION

Vegetables are important component of human diet. They are rich in protein, mineral, vitamins and fiber. Tomato is the most prominent and known fruit vegetables cultivated in Ethiopia. It is widely accepted and commonly used in variety of dishes as raw, cooked or processed product more than any other vegetables. It is also a cash generating crop to small farmer and provides employment in the production and processing industries. Farmers are interested in tomato production than other vegetables for its multiple harvests, high profitability and its potential to improve income and nutrition of household. Such diverse uses made it an important vegetable in irrigated agriculture (Lemma, 2003). Due to the presence of processing industries in the country (Upper Awash and Wondogenet), the production of tomato has increased enormous in the last 2 to 3 decades. According to Lemma et al. (1994), tomato is the most profitable vegetables which gives net income of about 11000 to 14000 birr/ha. The over all yield of tomato in the country is often low compared to yield of many producing country in Africa and the world average (FAO, 1989). The reason behind such low yield is possibly due to practice of unimproved method of production generally followed by farmers. The optimum level of any agronomic practice such as plant population, planting date, harvesting date and fertilizer of the crop varies with environment, purpose

*Corresponding author. E-mail: gerewas@yahoo.com

**Abbreviations: Q/ha,** quintal per hectare; **SAS,** statistical analysis system; **Masl,** meters above sea level; **N,** north; **CV,** coefficient of variation.

**Table 1.** Descriptive summary of total average yield obtained in quintals, marketable and unmarketable yield in quintals per hectare, cluster number per plant, fruit number per cluster for 2007.

| Treatment (cm) | Fruit number per cluster | Cluster number per plant | Marketable yield (q/ha) | Unmarketable yield (q/ha) | Total yield (q/ha) |
|---|---|---|---|---|---|
| 100 x 30 | 3.66 ± 0.08[a] | 15.25 ± 2.57[a] | 490.8 ± 182.82[a] | 55.13 ± 25.09[a] | 545.9 ± 192.88[a] |
| 60 x 30 | 3.12 ± 0.36[a] | 12.5 ± 0.71[ab] | 639.4 ± 86.12[a] | 44.6 ± 17.07[a] | 684.04 ± 93.28[a] |
| 50 x 30 | 3.25 ± 1.05[a] | 12.7 ± 2.69[ab] | 565.4 ± 153.1[a] | 47.36 ± 19.92[a] | 612.8 ± 161.59[a] |
| 40 x 30 | 3.65 ± 0.86[a] | 10.5 ± 3.31[b] | 589.4 ± 242.38[a] | 59.2 ± 42.66[a] | 648.5 ± 276.4[a] |
| 30 x 30 | 3.18 ± 0.13[a] | 11.7 ± 1.59[ab] | 734.8 ± 268.51[a] | 85.2 ± 34.03[a] | 819.9 ± 298.38[a] |
| CV% | 21.3 | 18.6 | 33.9 | 51.2 | 33.9 |

Different letter across the column (treatments) indicates significant difference at $P < 0.05$. Cv = Coefficient of variation.

of that crop and cultivar. Thus, it is very difficult to give general recommendation that can be applicable to the different agro- ecological zone where major growing area of tomato occurs.

One of the management practices that greatly influence tomato fruit yield is plant population and spacing. The distance between row and plant depend on the production purpose, soil fertility and plant structure. So, to optimize tomato productivity, full package of information is required (Khan et al., 2003). The economics of tomato is influenced by the plant spacing. For transplanting of seedling, intercultural operation, controls of pests and diseases and post harvest processing, closer spacing need more cost of production compared to wider spacing. The plant grown under wider spacing receive more nutrient, light and moisture round each plant surrounding, compared to plant of closer spacing, which probably is the cause of better performance and yield of individual tomato in wider spacing .Thus, this experiment identified the optimum inter-row spacing for tomato production with double row arrangement.

## MATERIALS AND METHODS

### Description of the study area

Adami Tulu Agricultural Research Center is located in the mid rift valley (MRV) of oromia, Ethtiopia, 167 km south of Addis Ababa on Awassa road. It lies at a latitude of 7° 9'N and 38° 7'E longitude. Its altitude is about 1650 m.a.s.l. It has unevenly distributed average annual rainfall of 760 mm. It has a bimodal rainfall extends from February to September with a dry period in May to June, which separates the preceding "short'' rains from the following "long'' rains. The soil is fine sandy loam with sandy silt clay in proportion of 34, 48 and 18%, respectively and pH of 7.88 (Adami Tulu Research Center profile, 1998).

### Experimental methodology

The experiment was conducted at Adami Tulu Agricultural Research Center during 2007 and 2008 off season using irrigation. Tomato (malka shola variety) was used with the spacing of 30 cm between plant and 100, 60, 50, 40 and 30 cm between rows for this trial. Other agronomic practice (weeding, irrigation, fertilizer application and pesticide application) were adopted uniformly as per recommendation for tomato production. The experiment was conducted using randomized complete block design (RCBD) with 4 replications. Area occupied by a single plot was 4 m × 3 m with spacing of 1.5 m × 1 m between block and plot, respectively.

### Statistical analyses

The collected data were subjected to SAS software using Duncan multiple range test for total average yield obtained in quintals per hectare, marketable and unmarketable yield in quintals per hectare, number of cluster per plant and number of fruit per cluster at $\alpha = 0.05$. Fruits attacked by birds, rot and sun burns were categorized under unmarketable yield because they do not have demand from the market by the customer.

## RESULTS AND DISCUSSION

### Fruit number per cluster

The two year average analysis result shows that, fruit number per cluster had no significant difference among treatments at $p > 0.05$ significance level. Among all treatments, treatment 1 (100 × 30 cm) gave the higher fruit number per cluster (4.01) followed by treatment 4 (40 × 30 cm) and treatment 3 (50 × 60 cm) 4.03 and 3.71, respectively. Among the tretments, 60 × 30 showed the least fruit number per cluster (3.77) (Table 1).

### Marketable yield (Q/ha)

Analyzed results showed that the 2 years average marketable yield was not significant difference among treatments, but there was clear mean difference among treatments; treatment 4 (40 × 30 cm) gave higher marketable yield (607.9 q/ha) followed by treatment 2 (60 × 30 cm) and treatment 3 (50 × 30 cm) which were 570.4 and 568.05 q/ha, respectively. Among the treatments, treatment 1 (100 × 30 cm) gave the least markatable yield (475.85 q/ha) (Table 2).

**Table 2.** Descriptive summary of total average yield obtained in quintals, marketable and unmarketable yield in quintals per hectare, cluster number per plant, fruit number per cluster for 2008.

| Treatment (cm) | Fruit number per cluster | Cluster number per plant | Marketable yield (q/ha) | Unmarketable yield (q/ha) | Total yield (q/ha) |
|---|---|---|---|---|---|
| 100 x 30 | 4.375 ± 0.25[a] | 13.125 ± 6.41[a] | 460.9 ± 107.3[ab] | 64.4 ± 29.83[a] | 525.4 ± 127.09[b] |
| 60 x 30 | 4 ± 0.41[a] | 14.25 ± 2.66[a] | 501.4 ± 75.56[a] | 63.4 ± 22.61[a] | 564.9 ± 86.08[ab] |
| 50 x 30 | 4 ± 0.91[a] | 12.625 ± 2.39[a] | 570.6 ± 147.16[a] | 53.6 ± 34.31[a] | 624.2 ± 143.32[ab] |
| 40 x 30 | 4.50.41 [a] | 10.75 ± 3.93[a] | 626.4 ± 88.35[a] | 95.3 ± 75.3[a] | 721.7 ± 108.72[a] |
| 30 x 30 | 4.375 ± 0.85 [a] | 11.75 ± 1.89[a] | 288.8 ± 96.45[b] | 47.7 ± 19.26[a] | 336.5 ± 91.05[c] |
| CV% | 14.9 | 20.9 | 23.4 | 67.5 | 21.4 |

Different letter across the column (treatments) indicates significant difference at $P < 0.05$. Cv = Coefficient of variation.

**Table 3.** Descriptive summary of total average yield obtained in quintals, marketable and unmarketable yield in quintals per hectare, cluster number per plant, fruit number per cluster for two years average (2007 and 2008).

| Treatment (cm) | Fruit number per cluster | Cluster number per plant | Marketable yield (q/ha) | Unmarketable yield (q/ha) | Total yield (q/ha) |
|---|---|---|---|---|---|
| 100 X 30 | 4.01 ± 0.42[a] | 14.25 ± 4.67[a] | 475.85 ± 139.6[a] | 59.76 ± 26.0[a] | 535.66 ± 151.61[a] |
| 60 X 30 | 3.55 ± 0.59[a] | 13.40 ± 2.02[ab] | 570.44 ± 105.16[a] | 54.06 ± 21.09a | 624.50 ± 104.69[a] |
| 50 X 30 | 3.71 ± 0.96[a] | 12.56 ± 2.35[ab] | 568.05 ± 139.04[a] | 50.47 ± 26.18[a] | 618.53 ± 142.52[a] |
| 40 X 30 | 4.03 ± 0.79[a] | 10.66 ± 3.36[b] | 607.91 ± 170.04[a] | 77.24 ± 60.11[a] | 685.1 ± 198.15[a] |
| 30 X 30 | 3.77 ± 0.85[a] | 11.74 ± 1.61[ab] | 511.8 ± 302.8[a] | 66.43 ± 32.49[a] | 578.2 ± 329.3[a] |
| CV% | 18.1 | 19.75 | 28.65 | 59.35 | 27.65 |

Different letter across the column (treatments) indicates significance difference at $P < 0.05$. Cv = Coefficient of variation.

## Unmarketable yield (Q/ha)

The analyzed result showed that the average result of unmarketable yield had no significant difference among treatments with unmarketable yield at $p > 0.05$. Even if the result verify no significant difference among treatments, there was average unmarketable yield difference; treatment 4(40 × 30 cm) had 77.24 q/ha followed by treatment 5(30 × 30 cm) (66.43 q/ha).

Treatment 2 (60 × 30 cm) gave the least unmarketable yield (54.06 q/ha). From this, treatments 4 and 5 showed maximum unmarketable yield which have no demand on market and this showed that, the closer the inter row spacing, the maximum the unmarketable yield was (Table 3).

## Cluster number per plant

The 2 years average analyzed result indicated that there was high statistical significant difference among treatments at $p > 0.05$ significance level. From this, treatment 1(100 x 30 cm) gave the highest cluster number per plant (14.25) followed by treatment 2 (60 × 30 cm) and treatment 3 (50 × 30 cm); 13.40 and 12.56, respectively. Among the 5 treatments, treatment 4 (40 × 30 cm) gave the least cluster number per plant (10.66) than the rest treatment.

## Total yield (Q/ha)

From the analysis result of the 2 years average, total yield showed no significant difference at $p > 0.05$ among treatments (different inter row spacing). Even though it showed no significant difference, there was high average mean difference among treatments. From this, treatment 4 (40 × 30 cm) gave the highest total yield (685.10 q/ha) followed by treatment 2 (624.50 q/ha) and treatment 3 (618.53 q/ha) respectively. Among all treatments, treatment 1(100 × 30 cm) gave the least total yield (535.65 q/ha).

## Conclusion and recommendation

Obtaining high marketable yield is a key point to obtain high demand from the market for what is produce. For this, the best agronomic practice like plant density is the factor for determining marketable yield and reducing or decreasing unmarketable yield. From this finding, it is recommended that treatment 4 (40 × 30 cm) inter row

spacing is the best inter row spacing for high marketable yield. For farmers and other private investors around Adami Tulu Jido Kombolcha, using this inter row spacing is recommended to obtain maximum marketable yield (Table 3).

## ACKNOWLEDGEMENTS

We owe a great appreciation to Oromia Agricultural Research Institute for the budgetary allocation to this research. Our thanks also go to Adami Tulu Agricultural Research Center, Horticulture Research team researcher Mr. Ayana Itana for his enthusiasm, assistance and hospitability in editing the paper.

## REFERENCES

Khan MA, Hasan MK, Miah MAJ, Alam MM, Masum ASMH (2003). Effect of Plant Spacing on the Growth and Yield of Different Varieties of Onion. Spice Research Center, Bangladesh Agricultural Research Center Institute, Shibganj, Borga, Bangladesh.

Lemma D (2003). Research Experiences in Tomato production, Research Report No. 55.Ethiopia Agricultural Research Organization, Addis Ababa.

Lemma D, herath E (1994). Varital Development on Vegetables. In: Proceeding of the Second National Horticultural Workshop (eds.), Herath and Lemma), pp. 1-3.1992.Addis Ababa, Ethiopia.