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Interaction of Different Nutrient Sources with Tomato (*Lycopersicum esculantum* L.)

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Abstract: Tomato (*Lycopersicum esculantum* L.) is one of the most popular, essential and widely used vegetable as ranked number two vegetable of the world after potato. A field trial was conducted in experimental field, Department of Botany, Hazara University Mansehra. The experiment was laid out in completely randomized block design (RCBD) with three treatments replicated three times. The treatments were T1= (20% nitrogen, 20% P_2O_5, 20% K_2O), T2= Urea+DAP (Di-ammonium phosphate), T3= poultry manure and a control (T0). The study was carried out to investigate the effects of different nutrient sources on growth parameters of tomato (*Lycopersicum esculantum* L.) i.e. plant height, root length, root weight, number of branches, shoot weight, number of fruits, fruits weight plant^{-1} and yield ha^{-1} etc. The results revealed that all the growth and yield parameters were significantly affected by NPK (foliar spray), except root weight which includes; plant height (75.3 cm), root length (22.4 cm), no. of branches (9.4), shoot weight (152.3), number of fruits (9.8) and fruits weight plant^{-1} (209.3g). Root weight (23.4 g) was significantly affected by urea + DAP in comparison with other treatments except foliar NPK. Foliar NPK also showed significant increase in fruit yield (18325 kg ha^{-1}). It is concluded that foliar NPK might be due to its rapid absorption rate significantly affected on most of tomato growth and yield attributes.

Key words: *Lycopersicum esculantum* · Foliar spray · Growth · Yield · Mansehra

INTRODUCTION

Tomato (*Lycopersicum esculantum* L.) is an important, most popular and widely used vegetable as ranked number two vegetable of the world after potato. It is used as a essential ingredient in pasta, pizza, hot dogs, hamburger and other food stuffs. It is also a rich source of nutrients and calories and also of vitamin A, B, C and iron [1]. About 150 million tons of tomatoes were produced in the world in 2009 [2]. In Pakistan tomato is cultivated on total area of 47100 ha and production 10.7 tons/ha [3], it is very less production as compared to other countries i.e. Spain (63.55 tons /ha), the Netherland (146 tons /ha) and California (88.91 tons /ha) [4].

Fertilizers play a critical role in increasing yield and improving the value and quality of crops. Balanced nutrition is one of the fundamental constituent of nutrient management and plays a vital role in improving crop production and its quality. The occurrence of nutrients like N, P, K, S and Mg etc in balance form are essential for the most important processes of plant development and yield production [5]. Fertilizers play important role in improving crop production [6]. Hague *et al*. [7] found that foliar spray nutrients are essential for the production of high yield and quality products [8]. As the foliar method facilitate easy and rapid intake of nutrients by penetrating through the stomata and enters the cells [9].

Keeping these facts in view, field experiment was carried out to check the nutrients suitable foliage spray and basal applied fertilizers on growth and yield of tomato *(Lycopersicum esculantum* L.) for the comparison between them.

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MATERIALS AND METHODS

In the experimental field a trial was performed at Hazara University Mansehra. Field was ploughed and the beds were made with tractor. The experiment was arranged in a randomized complete block design with 4 treatments replicated three times. Area for each plot was 2.4 x 1.5m. The plants were transplanted on 30 March, 2013. Before transplanting the field was well irrigated. Five plants were transplanted in each line of each plot. Plant to plant distance was one feet and row to row distance was 1.5 ft, four lines were made by hand drilling.

Treatments:

T0 = Control (No application)
T1 = Poultry manure
T2 = Urea + DAP
T3 = Unec spray (NPK 20:20:20) {Powder for 6177.4g + 1235.4 L H2O /ha}.

Di-ammonium phosphate (DAP) was applied as basal placement. And urea was applied at sowing. Foliar fertilizers were applied in solution form. The rate of foliar fertilizer (NPK 20:20:20) for one hectare is 6177.4g. One gram of foliar fertilizer in 500 ml of water was given for 2.4 x 1.5m^2 area. The same amount of solution of foliar spray was revised after every 14 days till harvesting. Recommended rate of poultry manure for one hectare is 1953.125kg and for 2.4 x 1.5 m^2 area one kg of poultry manure was applied. The rate for DAP in one hectare is 78.125 kg for the plot size of 2.4 x 1.5m^2 area 46.84g of DAP was applied. The rate for Urea in one hectare is 117.1 Kg for the plot size of 2.4 x 1.5m^2 area 46.84 g of Urea was applied.

Agronomic Traits: In this study, the following characters i.e. plant height, root length, root weight, no. of branches, shoot weight, no. of fruits, fruits weight and fruit yield were observed.

Statistical Analysis: The recorded data was analyzed through SPSS 16.0 and Statistix 8.1.

RESULTS AND DISCUSSION

Plant Height (Cm): Highly significant differences were found in tomato plant height (Table 1). The maximum plant height (75.3 cm) was noticed in T3 treatment, followed by T2 and T1 with an average mean value of (75) and (60.4 cm) respectively while minimum plant height (53 cm) was noticed in T0 treatment (Fig. 1). These findings are in agreement with Olson *et al*., (1971) who reported nitrogen as an essential constituent in pepper metabolites and chlorophyll required for promoting aerial growth. Similar findings were reported by Rahman *et al*. [10] for common bean and Rahman *et al*. [11] for cauliflower.

Root Length (cm): Highly significant differences in root length were found with a maximum root length (22.4 cm) in T3 treatment, followed by T2 and T1 with an average mean value of (21.1) and (18.6 cm) respectively (Table 1). Whereas the lowest root length (14.2 cm) was observed in T0 treatment (Fig. 2).

Root Weight (g): Highly significant differences in root weight were found with a maximum root weight (23.4 g) in T2 treatment (Table 1), followed by T3 and T1 with an average mean value of (22.8) and (16.3 g) respectively. Whereas the lowest root weight (6 g) was observed in T0 treatment (Fig. 3). John *et al*. [12] found similar results that poultry manure consists of important nutrient elements related with high photosynthetic actions and thus promoted root weight and vegetative growths of tomato.

Number of Branches Plant^{-1}: Results for number of branches trait revealed highly significant differences (Table 1). The maximum number of branches plant^{-1} (9.4) was noticed in T3 treatment, followed by T2 and T1 with an average mean value of (8.2) and (7.6) respectively (Fig. 4). Whereas the lowest no. of branches (4.2) was noticed in T0 treatment. Rahman *et al*. [13] found agreed findings who stated highest no. of branches by applying foliar spray of B, Mo and Zn. Jeybal *et al*. [14] also found similar findings.

Shoot Weight (g): Results for shoot weight trait revealed highly significant differences. The maximum shoot weight (152.3 g) was noticed in T3 treatment (Table 1), followed by T2 and T1 with an average mean value of (126.7 g) and (84.8 g) respectively. Whereas the lowest shoot weight (38.3 g) was observed in T0 treatment (Fig. 5). John *et al*. [12] found similar results that poultry manure contains fundamental nutrient elements associated with high photosynthetic activities and thus improve vegetative growths of tomato.

Table 1: Effect of different nutrient sources on growth and yield of tomato

Treatment	Plant height (cm)	Root length (cm)	Root weight (g)	No. of branches	Shoot weight (g)	No. of fruits	Fruits weight (g)	Yield (kg ha^{-1})
T0	53 B	14.2 C	6 C	4.2 C	38.3 C	4.2B	49.9 C	5329 C
T1	60.4 B	18.6 B	16.3 B	7.6 B	84.8 B	9.2A	169.8 B	14493 B
T2	75 A	21.1 A	23.4 A	8.2 AB	126.7 A	8.1A	174.8 B	15425 B
T3	75.3 A	22.4 A	22.8 AB	9.4 A	152.3 A	9.8A	209.3 A	18325 A
LSD $_{(0.05)}$	8.6	2.1	6.9	1.6	34	2.4	31.5	579

Within each column, treatments carrying different letter indicate the least significant (P<0.05) according to LSD test

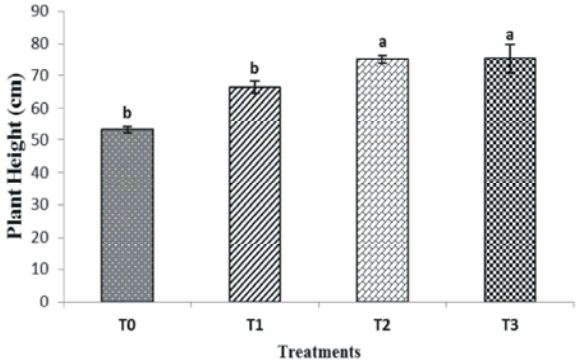

Fig. 1: Effect of different nutrient sources on plant height of tomato

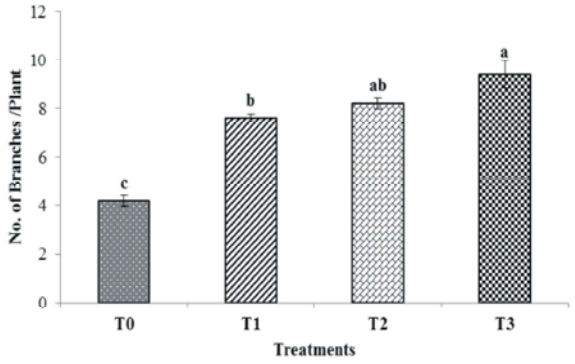

Fig. 4: Effect of different nutrient sources on number of baranches of tomato

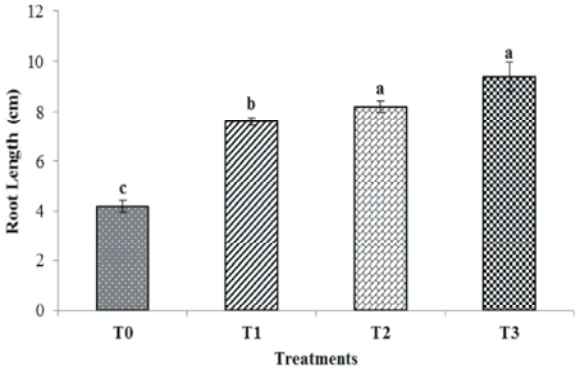

Fig. 2: Effect of different nutrient sources on root length of tomato

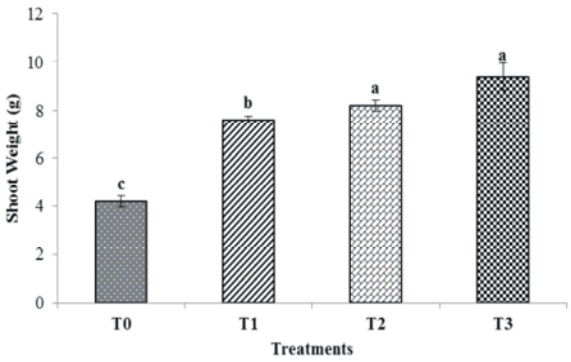

Fig. 5: Effect of different nutrient sources on shoot weight of tomato

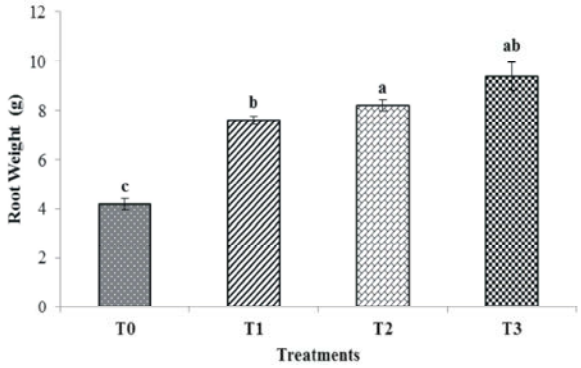

Fig. 3: Effect of different nutrient sources on root weight of tomato

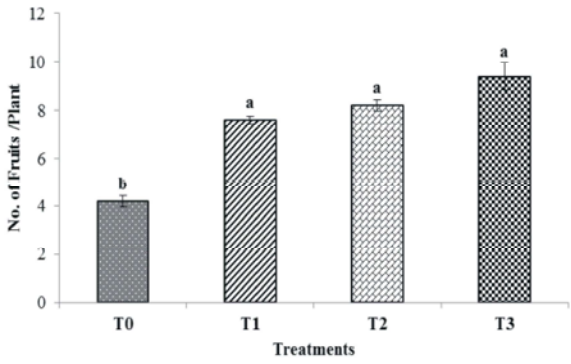

Fig. 6: Effect of different nutrient sources on number of fruits of tomato

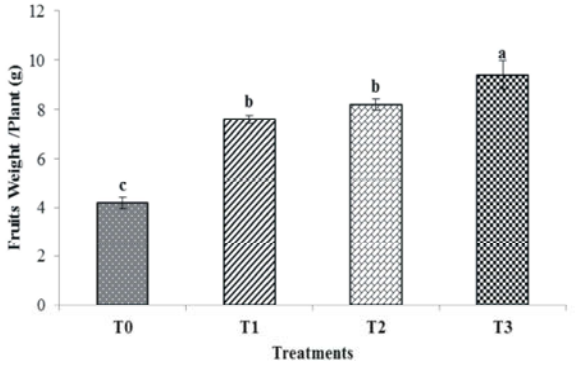

Fig. 7: Effect of different nutrient sources on fruits of wqeight of tomato

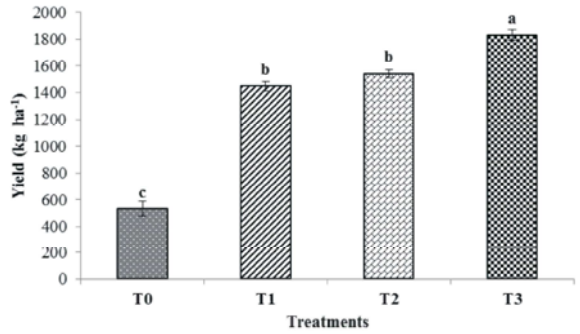

Fig. 8: Effect of different nutrient sources on tomato yield

Number of Fruits: Results for number of fruits trait revealed maximum no. of fruits (9.8) noticed in T3 treatment (Table 1), followed by T1 and T2 with an average mean value of (9.2) and (8.1) respectively. Whereas the lowest number of fruits (4.2) was observed in T0 treatment (Fig. 6). Jeybal *et al*. [14] found growth parameters of tomato significantly varied with the foliar application of water soluble fertilizers.

Fruits Weight Plant^{-1} (g): Results for fruits weight plant^{-1} trait revealed highly significant differences (Table 1). The maximum fruits weight plant^{-1} (209.3 g) was noticed in T3 treatment, followed by T2 and T1 with an average mean value of (174.8) and (169.8 g), respectively. Whereas the lowest fruits weight plant^{-1} (49.4 g) was observed in T0 treatment (Fig. 7). However, Tamilselvi *et al.* [15] reported that foliar application of iron combined with other micronutrients (Zn, Cu, Mn, B and Mo) significantly increased the single fruit weight, yield per plant of tomato and seed yield of tomato.

Yield (kg ha^{-1}): Results for tomato yield revealed highly significant differences. The maximum fruits yield (18325 kg) was noticed in T3 treatment (Table 1), followed by T2 and T1 with an average mean value of (15425) and (14492 kg) respectively. Whereas, the lowest fruits yield (5329 kg) was observed in T0 treatment (Fig. 8). Rahman *et al*. [16] reported that foliar application of macro and micro nutrients play an important role in the production of good crop and higher yield. Similar results were found by Tamilselvi *et al.* [15] who reported that foliar application of iron combined with other micronutrients (Zn, Cu, Mn, B and Mo) significantly increased the yield of tomato.

CONCLUSIONS

It was concluded that Unec spray (NPK) was found best as compared to other treatments. The application of Unec spray (NPK) increased most of the growth and yield parameters significantly which includes; plant height, root length, no. of branches, shoot weight, no. of fruits and fruits weight plant^{-1}. Root weight was significantly increased by urea + DAP in comparison with other treatments except foliar NPK. Foliar NPK also showed significant increase in fruit yield (18325 kg ha^{-1}).

It could be recommended that NPK in foliar form plays better role in enhancing the yield of tomato as compared to basal applied fertilizers.

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