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Original Article

Effect of K Nano-Fertilizer and N Bio-Fertilizer on Yield and Yield Components of Tomato (*Lycopersicon Esculentum* L.)

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ABSTRACT

Objective: This field experiment was laid out in order to study on effect of Nano and Bio fertilizers on yield and yield components of tomato (*Lycopersicone sculentum* L.) during the growing seasons 2013- 2014. **Methods:** The experiment was laid out in a factorial based on randomized block design with three replications. Treatments were K nanofertilizer in five levels such as (0, 100, 200, 300 and 400 kg.ha^{-1}) and pure Azot in five levels such as (0, 50, 100, 150 and 200 kg.ha^{-1}). **Results:** Results showed that the application of humic acid and nitrogen fertilizer were significant of all traits of tomato but effect of humic acid on fruit length was not significant. Application of 400 kg per ha K nanofertilizer had the highest plant height and stem diameter. Also results showed that application of 300 kg per ha K nanofertilizer had the highest number of fruit per plant, fruit weight, fruit diameter and fruit yield. However application of nitrogen fertilizer increased yield and yield components of tomato. In final results of the present study reviled that application of K nanofertilizer and nitrogen fertilizer increased yield and yield components of tomato.

1.INTRODUCTION

Tomato (*Lycopersicone sculentum* L) is one of the most important agricultural plants in semi-arid and the Mediterranean areas and cultivation of tomato is very common as a major and productive crop in many parts of the world (MacCarthy et al, 1998). Tomato is rich in vitamins A, C (Block, 1992), B1, B2 and B3. Antioxidant and anticancer effects of tomato reflect the importance of its consumption (Soni, 2003). Tomato is a rich source of lycopene and vitamins. Lycopene may help counteract the harmful effects of substances called "free radicals", which are thought to contribute to age-related processes and a number of types of cancer, including, but not limited to, those of prostate, lung, stomach, pancreas, breast, cervix, colorectum, mouth and esophagus (DeStefani et al, 2000). Lycopene in addition to neutralizing ability to singlet oxygen and antioxidant properties than beta-carotene and alpha-tocopherol is able to prevent heart disease, cardiovascular disease and various cancers especially prostate, lung and stomach (Soni et al, 2003).

The nanofertilizer showed an initial burst and a subsequent slow-release even on day 60 compared to the commercial fertilizer, which released heavily early followed by the release of low and non-uniform quantities until around day 30 (Fujinuma and Balster, 2010) Work was also reported for Nitrogen release of the nanofertilizer from three elevations in Sri Lanka (pH 4.2,

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5.2 and 7) and these studies were compared with that of a commercial fertilizer (Corradini et al, 2010). Nanofertilizers will combine nanodevices in order to synchronize the release of fertilizer-N and -k with their uptake by crops, so preventing undesirable nutrient losses to soil, water and air via direct internalization by crops, and avoiding the interaction of nutrients with soil, microorganisms, water, and air (DeRosa et al, 2010). The antibacterial efficiency of the nanoparticles was investigated by introducing the particles into a media containing E. coli and it was found that they exhibited antibacterial effect at low concentrations (Baker et al, 2005). Kim et al (2009) have found that fungi growth in the presence of nanoparticles was inhibited significantly in a dose dependent manner. Microscopic observation revealed that silver nanoparticles had detrimental effects not only on fungal hyphae but also on conidial germination.

Therefore, the main aim of present study was evaluation the effects of nitrogen and K nano fertilizer on yield and yield components of tomato.

2. MATERIAL AND METHODS

A field experiment was laid out to study on evaluation the effects of nitrogen and K nano fertilizer on yield and yield components of tomato. The experiment was laid out in a factorial based on randomized block design with three replications. Treatments were K nano fertilizer in five levels such as (0, 100, 200, 300 and 400 $kg.ha^{-1}$) and pure Azot in five levels such as (0, 50, 100, 150 and 200 $kg.ha^{-1}$). Plant to plant distance was 25 cm and during growing stages weeds were control. After harvesting yield and it components were determined.

The statistical analyses to determine the individual and interactive effects of treatments were conducted using JMP 5.0.1.2 (18). Statistical significance was declared at $P \leq 0.05$ and $P \leq 0.01$. Treatment effects from the two runs of experiments followed a similar trend, and thus the data from the two independent runs were combined in the analysis.

3. RESULTS AND DISCUSSION

Plant height: Analysis of variance of results showed that, the effect of K nanofertilizer and nitrogen fertilizer on plant height was significant (table 1). The comparison of the mean values showed that application of 400 kg per ha K nanofertilizer had the highest (92cm) and the control treatment had the lowest (77cm) plant height and difference between them was significant (figure 1). Between nitrogen fertilizer treatments application of 200 kg per ha treatment had the highest (100cm) plant height.

Stem diameter: Results results showed that, the effect of K nanofertilizer and nitrogen fertilizer on stem diameter was significant (table 1). The comparison of the mean values showed that application of 400 kg per ha K nanofertilizer had the highest (4cm) and the control treatment had the lowest (3cm) stem diameter and difference between them was significant (figure 2). Between nitrogen fertilizer treatments application of 100 kg per ha treatment had the highest (3.5cm) stem diameter.

Table 1.

Analysis of variance (mean squares) for yield and yield components of tomato under application of K nanofertilizer and nitrogen fertilizer

S.O.V	df	Plant height	Stem diameter	number of fruit per plant	fruit weight	fruit length	fruit diameter	fruit yield
R	2	114	0.15	111	66	2	1.7	1155
K nano fertilizer (K)	4	885**	0.71**	298**	118**	0.49	0.36*	2216**
N fertilizer(N)	4	72*	0.18*	593**	82**	1.5*	3.3**	1259**
K*N	16	31	0.02	55	43	0.27	0.23	340
Error	48	12	0.02	9.7	12	0.19	0.23	106
CV(%)		9	4.5	10	7	9	11	6

* And **: Significant at 5 and 1% probability levels, respectively.

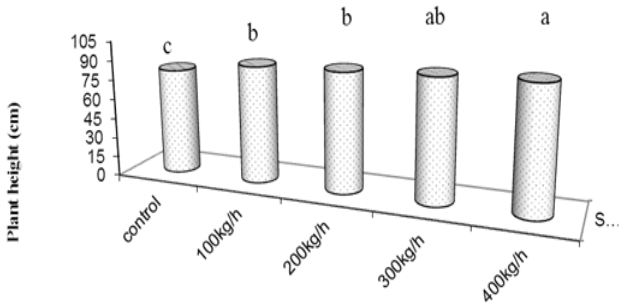

Figure 1. Effect of K nanofertilizer application on plant height

Means by the uncommon letter in each column are significantly different (p<0.05).

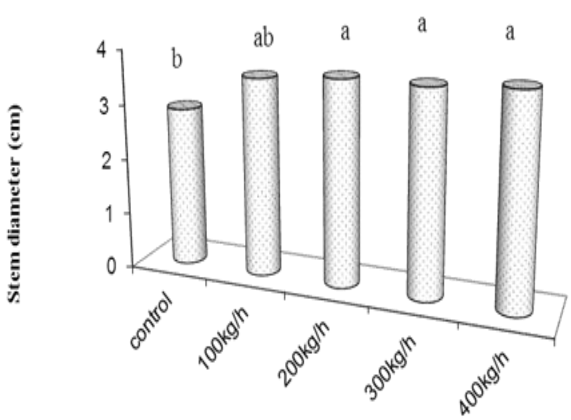

Figure 2. Effect of K nanofertilizer application on stem diameter

Means by the uncommon letter in each column are significantly different (p<0.05).

Number of fruit per plant: Results showed that, the effect of K nanofertilizer and nitrogen fertilizer on number of fruit per plant was significant (table 1). The comparison of the mean values showed that application of 300 kg per ha K nanofertilizer had the highest (38) and the control treatment had the lowest (23) number of fruit per plant and difference between them was significant (figure 3). Between nitrogen fertilizer treatments application of 150 kg per ha treatment had the highest (29) number of fruit per plant.

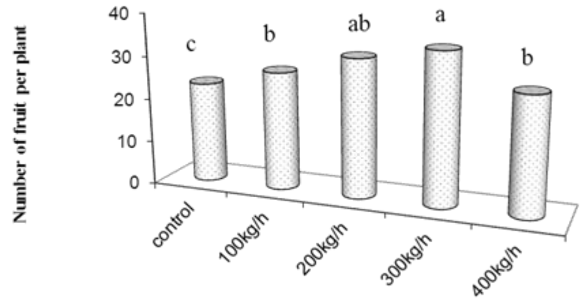

Figure 3. Effect of K nanofertilizer application on number of fruit per plant

Means by the uncommon letter in each column are significantly different (p<0.05).

Fruit weight: The effect of K nanofertilizer and nitrogen fertilizer on fruit weight was significant (table 1). The comparison of the mean values showed that application of 300 kg per ha K nanofertilizer had the highest (75g) and the control treatment had the lowest (62g) fruit weight and difference between them was significant (figure 4).

Between nitrogen fertilizer treatments application of 200 kg per ha treatment had the highest (79g) fruit weight.

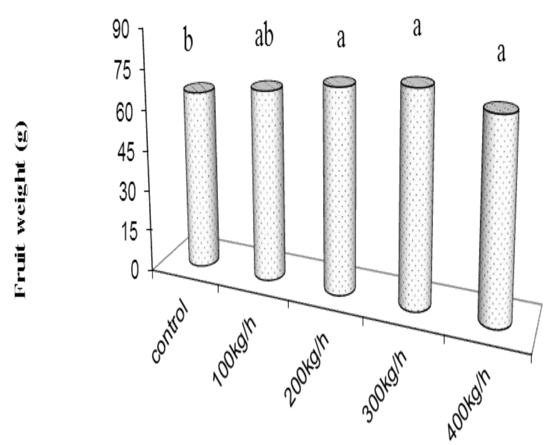

Figure 4. Effect of K nanofertilizer application on fruit weight

Means by the uncommon letter in each column are significantly different (p<0.05).

Fruit length: The effect of nitrogen fertilizer on fruit length was significant (table 1). Between nitrogen fertilizer treatments application of 100 kg per ha treatment had the highest (6.5cm) fruit length.

Fruit diameter: The effect of K nanofertilizer and nitrogen fertilizer on fruit diameter was significant (table 1). The comparison of the mean values showed that application of 300 kg per ha K nanofertilizer had the highest (5.7cm) and the control treatment had the lowest (5cm) fruit diameter and difference between them was significant (figure 5). Between nitrogen fertilizer treatments application of 150 kg per ha treatment had the highest (5.8cm) fruit diameter.

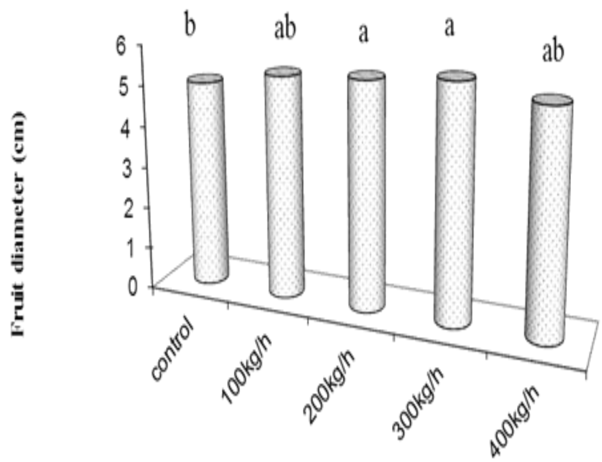

Figure 5. Effect of K nanofertilizer application on fruit diameter
Means by the uncommon letter in each column are significantly different ($p<0.05$).

Fruit yield: The effect of K nano fertilizer and nitrogen fertilizer on fruit yield was significant (table 1). The comparison of the mean values showed that application of 300 kg per ha K nanofertilizer had the highest (90 ton per ha) and the control treatment had the lowest (46 ton per ha) fruit yield and difference between them was significant (figure 6). Between nitrogen fertilizer treatments application of 150 kg per ha treatment had the highest (88 ton per ha) fruit yield.

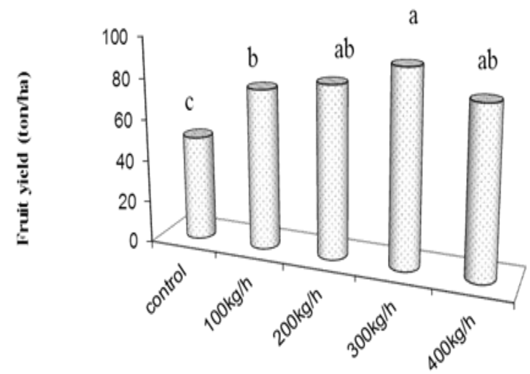

Figure 6. Effect of K nanofertilizer application on fruit yield
Means by the uncommon letter in each column are significantly different ($p<0.05$).

The results of present study showed that the application of K nanofertilizer and nitrogen fertilizer were significant of all traits of tomato but effect of K nano fertilizer on fruit length was not significant (table 1). The K nanofertilizer increases the absorption of nitrogen, potassium, calcium, magnesium and phosphorus by plants (9 and 16). Also K nanofertilizer can directly cause the positive effects on plant growth. Shoot and root growth is stimulated by K nanofertilizer, but its effect is more prominent on the roots. K nanofertilizer increased root content and caused the root system effectiveness. Plant height was affected by K nanofertilizer and nitrogen fertilizer. In the present study application of 400 kg per ha K nanofertilizer had the highest and the control treatment had the lowest plant height and difference between them was significant. Application of K nano fertilizer had the positive effect on yield and its components of tomato. Results showed that the effect of soil and foliar application of K nano fertilizer and interaction between them were significant on all traits of tomato. Ghosh et al (1981) told that some fertilizers such as K nano fertilizer can directly cause the positive effects on plant growth. However they told that shoot and root growth is stimulated by K nano fertilizer, but its effect is more prominent on the roots. In the present study plant height was affected by soil and foliar application of K nano fertilizer and combined soil application of 400 kg per ha K nano fertilizer and foliar application of K nano fertilizer. Ghosh et al (1981) proposed that K nano fertilizer and humic acid increased root content and caused the root system effectiveness that lead to the higher plant growth and plant height. Halime et al (2011) told that K substances are generated through organic matter decomposition and employed as soil fertilizers in order to improve soil structure and soil microorganisms. Yousef et al (2011) indicated that treated Chemlali olive seedlings with K fertilizer treatments was the most effective one compared with the other treatment since

this treatment gave the best results concerning plant height, brunch numbers, dry weight, leaf numbers, also it increased plant diameter and leaves area comparing with control.The results found are in agreement with the findings of Abdel Fatah et al, (2008); Yaseen et al, (2006); Kashif et al, (2007) who observed that application of nano fertilizer improved growth parameters and increased plant height.
Also, El-Ghozoli (2003) and L-Ghanam and El-Ghozoli (2003) indicated that the application of humic acid and K nano fertilizer significantly increased the dry matter production of faba bean plants. K nanofertilizer effectively improves soil fertility and crop production especially in poor soils and alkaline-calcareous soils (Rajaei, 2010). The positive effects of the K substances were also observed on the studies such as dry matter yield that increases on corn and oat seedling (Celik et al, 2008); yield increases on radish and green bean seedlings (Bramley, 2000). Our results are supported by the finding of Russo and Berlyn (1992) and Hao and Papadopoulos (2003) who reported that K increased fruit yield and reproductive growth of tomato. Tahir et al (2011) by investigating the effect of different levels of K nano fertilizer and humic acid on wheat concluded that humic acid and K levels had significant differences between stem weight and plant height and crop yield. In the present study combined application K nanofertilizer and nitrogen had the better effect than single application of them. However, we concluded that of K nano fertilizer and N fertilizer had the synergistic effect on growth and fruit yield of tomato.

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