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ENHANCEMENT OF THE NUTRIENTS EFFICIENCY AND PRODUCTIVITY OF TOMATO (*LYCOPERSICUM ESCULENTUM MILL.*) PLANTS BY USING NANO SILVER

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Abstract

The experiment was conducted in the Green House of Ayat City- Giza governorate -Egypt in the season 2019-2020 to study the effect of Nano silver supplement on tomato plants (*Lycopersicum esculentum Mill.*) using 10 kg plastic pots filled with soil. Use Nano silver foliar spray at (0.0, 10, 20, 25ppm), spray the seedlings when forming the third true leaf. The experiment was laid out in a factorial based on randomized complete block design with three replications.

Results Showed that the foliar application of nano silver were significant of all growth parameters and yield characteristics of tomato plants. Application of 20 ppm of nano silver as a foliar application had the highest figures of fruit yield per gm and fruit yield per kg. Addition of nano silver in foliar application at 20 ppm gave the highest figures of yield characteristics compared with other treatments. In final results of the present study estimated that application of nano silver at 20 ppm in foliar application enhanced yield characteristics of tomato.

Keywords : Nano Silver – Tomato –Yield characteristics - foliar application -Growth Parameters.

Introduction

The tomato (*Lycopersicum esculentum Mill.*) belongs to the family Solanaceae. Tomato is a very important vegetable crop in the world, The tomato is the eatable, often red berry of the plant *Solanum lycopersicum*, commonly known as a tomato plant. The species originated in western South America and Central America. The Nahuatl (the language used by the Aztecs) word tomato gave rise to the Spanish word tomato, from which the English word tomato derived. Its domestication and use as a cultivated food may have originated with the indigenous peoples of Mexico .The fruits is used as a fresh salad vegetable and is also a popular ingredient in soups stews, sauces and various other dishes.

Production and quality of food can be improved by modern technologies which can meet ever increasing world food demand in environment friendly way (Wheeler, 2005). Nanotechnology seems to have potential for addressing the problem of food security (Anonymous, 2009). Application of nano particles in agriculture and food system can reform the field by detection of diseases, resistance against diseases, targeted delivery, promoting the efficiency of plants to uptake more nutrients; endure environmental pressure and efficient system for processing and storage (Mousavi and Rezaei, 2011). It offers a new dimension for selection and dispensation of those resources that improve the eminence of product (Sharon *et al*., 2010).

Silver nano particles (SNPs) are excellent material having antibacterial, antifungal properties and are used in food and agriculture such as food security, food packaging and pathogen detection (Quardos and Mar, 2010). It has great influence on plant growth and development such as germination, root-shoot ratio, seedling growth, root growth, root elongation, and senescence inhibition (Ma *et al*., 2010; Shah and Belozerova, 2009). Nano-bentonite and nano active carbon coated nitrogen fertilizer increased the absorption and transportation of N, P, K to seed and yield of rice significantly (Wang *et al*., 2011). Nano carbon as slow release fertilizer increased chlorophyll content, grain yield and nitrogen use efficiency of rice (Wu *et al*., 2010). Application of control release fertilizer coated by nano-material increased Chinese cabbage yield and improved nutrient use efficiency significantly as compared to common straight fertilizer (Ding *et al*., 2009). Use of mineral fertilizers has played an important role for the survival of mankind in terms of increasing yield (Smil, 2001; Stewart *et al*., 2005), maintaining soil productivity and fertility (Balmford *et al*., 2005). Nutrient removal is a major cause for low crop yield in parts of the developing world. In Pakistan, 50%losses occur due to low nutrient use efficiency (Zia *et al*., 1991). Moreover, socio-economic constraints have made it more imperative to increase nutrient use efficiency. Hence, increasing nutrient use efficiency continues to be a major challenge for world agriculture, and nano technology can potentially address this issue. Therefore, present study was carried out to explore the role of SNPs to enhance wheat growth, yield and nutrient use efficiency.

Material and Methods

Source of nano silver from paradesia company,Egypt.

Soil analysis

Determination of some Physical and Chemicals Soil Green House of Ayat City- Giza governorate - Egypt characteristics that used in the experiment as described by (Blackmore *et al*. 1972). Table (1).

Table 1 : Some Physical and Chemical properties of soil samples.

pH (1:2.5)	Ec (ds/m)	N	P	K
		Ppm		
8.0	1.0	25.2	15.3	10.2

Experimental Work

At 10 September 2019 seeds of tomatoes *(Lycopersicon esculentums Mill crs* .448) were sown in sand soil with practicing agricultural management required for production of tomato seedlings. The concentrations used were a foliar application: 10-20 and 25 ppm nano silver once beside the control. Each treatment was three replicates and arranged in a randomized complete block design. All required agriculture

managements for growth and production were carried out as recommended by Ministry of Agriculture.

Tomato Yield

After 100 days from transplanting tomato fruits were harvested and yield parameters such as fruits fresh weight per plant (gm and kg) were recorded according to Gabal *et al.* (1984).

Nutritional Status of Tomato

In tomato fruits, macronutrients (N, P and K) were determined according to Cottenie *et al.* (1982).

Statistical Analysis

All data were subject to statistical analysis according to procedure outlined by (SAS 1996) computer program and means were compared by LSD method according to (Snedecor and Cochran 1982).

Results and Discussion

Growth Parameters and Yield Characteristics

Data in table (2) and table (3) indicate the influence of nano silver on growth parameters and Yield Characteristics of tomato such as plant height, number of brunches per plant, no. of leaves per plant, root length (cm) and weight of fruit per gm and kg are given in table (2) and table (3). The results indicate that all nano silver levels in foliar application has a favorable effect on the studied growth parameters and yield parameters compared with control. Nano silver at 20 ppm in foliar application gave the highest values (1653.3g/plant), The reason for this may be due to that each compound does not show its effect until it reaches the effective concentration (Hussain *et al.*, 2018).

These results agrees with those obtained by (Sharon *et al.*, 2010) study that Minimum 100 grain weight (3.78 g) was recorded with 150 ppm treatment at 5% probability level. Maximum grain yield (13.3 g) was obtained with 25 ppm SNPs followed by 50 ppm (12.45 g) as compare to control (7.18 g) where no SNPs were applied. SNPs increased the yield may be due to growth, stimulating effect of silver.

Table 2 : Effect of nano silver levels at foliar application on growth parameters of tomato plants.

Nano Silver (ppm)	Plant height (cm)	Number /Plant		Root length (cm)
		Brunches	Leaves	
Control	40.7	15	6	33.7
10	43.5	18.3	6.7	37.3
20	56	23.7	9	46
25	51.5	23	7.7	41.3
L S D 0.05%	2.41	2.61	1.22	2.7

Table 3 : Effect of nano silver levels at foliar application on Weight of fruit of tomato plants after100 days from transplanting.

Nano silver (ppm)	Weight of fruit / plant		Relative % from control
	(g / plant)	(kg / plant)	(%)
control	900	0.9	100
10	1388.3	1.4	155.6
20	1653.3	1.7	188.9
25	1633	1.6	177.8
L S D 0.05%	2.43	1.11	--------

Nutritional status :Macronutrients

Results in Table (4) and Figure(1) estimated that the addition of nano silver in plant media has a significant effect on the status of nitrogen , phosphorous and potassium in tomato fruits compared with control. Nano silver at 20 ppm gave the greatest values. These data are in harmony with those obtained by Nano blended fertilizer were also found to enhance nitrogen use efficiency. Slow and controlled release fertilizer coated and blended by nano materials significantly increased nitrogen use efficiency and yield of wheat (Zhang *et al.*, 2006).

Confirm these results Nano-bentonite and nano-active carbon coated nitrogen fertilizer increased absorption and transportation of N, P, K to seed and increase yield in rice significantly (Wang *et al.*, 2011).

Table 4: Effect of nano silver levels at foliar application on nutritional status of tomato fruits .

Nano Silver (ppm)	Macronutrients (%)		
	N	P	K
Control	0.22	0.41	0.21
10	0.29	0.50	0.34
20	0.31	0.62	0.54
25	0.25	0.58	0.43
L S D 0.05%	0.031	0.045	0.038

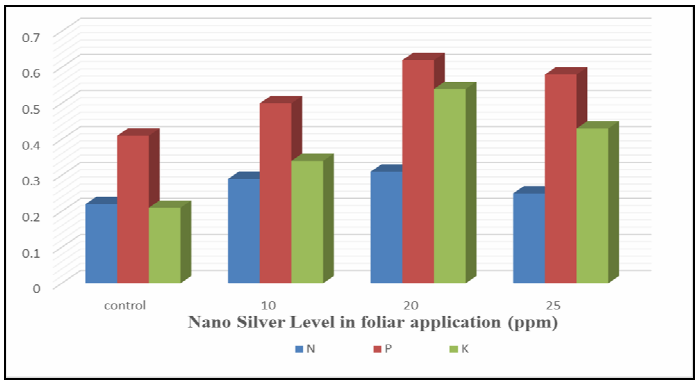

Fig. 1 : Effect of foliar application of nano silver on nutritional status of tomato fruits.

Conclusions

Results of present study demonstrated that nano silver particles, improved most of the parameters of growth and development. Nano silver particles at 20 ppm gived significantly enhanced in growth parameters, yield and N, P and K use efficiency. Nano silver significantly increase tomato fruits quantity compared with control.

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