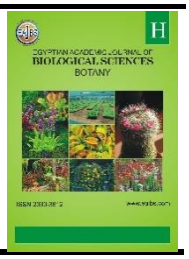
Egypt. Acad. J. Biolog. Sci., 11(1):29- 36(2020)

Egyptian Academic Journal of Biological Sciences
H. Botany
ISSN 2090-3812
www.eajbsh.journals.ekb.eg.



A Comparative Between Effect of Mineral Nitrogen Fertilizer and Nanotechnology Fertilizers on The Plant Growth, Yield And Yield Component of Potato

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ARTICLE INFO

Article History
Received: 6/6/2020
Accepted: 9/8/2020

***Keywords*:**
Mineral Nitrogen, Nanotechnology, Fertilizers, Potato

ABSTRACT

Two field experiments were conducted during the summer season of 2015and 2016 at EL-Nobaraya Region 71km, Alex-Cairo desert road, at Chipsy Company farm in Beheira Governorate. This investigation aimed to study the comparison between the effect of mineral nitrogen fertilizer and nanotechnology fertilizers on the plant growth, yield, and yield component of potato. that there were no significant among cultivars for the number of shoot character weights of tuber/plant (kg) and the number of tuber/plant during two years but there were significant differences among the examined two cultivars for plant length, dry matter, and yield component during two years. Impact the mineral nitrogen fertilizer and nanotechnology fertilizer levels on the studied vegetative traits. It became clear from these data that there was no significant effect of mineral nitrogen fertilizer and nanotechnology fertilizers level of character number of the shoot during the two years of study and plant length in the first year, the weight of tuber/plant (gm) and the number of tuber/plant during the two years of study but there was a significant effect of mineral nitrogen fertilizer and nano technology fertilizers level of character average of tuber /plant (gm) and dry matter during two season.

Moreover that most of the morphological studied characters did not show any significant differences due to the interaction between cultivars and mineral nitrogen fertilizer and nanotechnology fertilizer level but there were significant differences due to the interaction between cultivars and mineral nitrogen fertilizer and nanotechnology fertilizers of yield component of potato cultivars.

INTRODUCTION

One of the most important solanaceous vegetable crops grown in Egypt is potato (Solanum tuberosum L.).Its tubers are rich in carbohydrates and contain considerable amounts of proteins, vitamins, and minerals. Potato is the fourth most important world crop, after rice, wheat, and maize(Spooner and Bamberg,1994).

Carter and Bosma (1974) found that there may be adverse relations between tuber and plant aerial parts growth so that, nitrogen application stimulates the growth of aerial parts and delays tuber initiations. In addition, nitrogen has different effects on tuber.

Nitrogen is of vital importance for plant growth due to being a part of amino acid, protein, and chlorophyll molecule (Tisdale and Nelson 1956). Potato needs a large amount of nitrogen. Generally, tuber yield increased with increases in nitrogen fertilizer application (El Gamal, 1985, and Gebre et al 2005.

The overuse of different chemical fertilizers is one of the causes of the degradation of the environment and soil. Nano fertilizers are the newest and most technologically advanced way of supplying mineral nutrients to crops. Compared to chemical fertilizers, their supply nutrient for plant needs minimizes leaching and therefore improves fertilizer use efficiency (Subbarao et al,2013). fertilizer management is one of the most important factors in the successful cultivation of crops affecting yield quality and quantity (Tahmasbi et al,2011). In the present century, environmental protection is more important for the agrarian, considering sustainable agriculture (Pepo et al,2005). They add nanotechnology can have a profound impact on energy the economy and environment, by improving fertilizer products

The present investigation was initiated to study the effect of nanotechnology in combination with different rates of mineral nitrogen on the growth, yield and quality character of potato.

MATERIALS AND METHODS

Experimental Site:

Two field experiments were carried out at EL-Nobaraya Rigion71km, Alex-Cairo desert road, at in Beheira Governorate at Chipsy Company during the summer seasons of 2015 and 2016. Some of the physical and chemical properties of employed soil were determined before carrying out the experiments according to Jackson (1973). The determinations are presented in Table(1).

Table1. The main chemical analysis of the experimental soil:

PH	EC (ds/m)	Soluble anions (meq/l)		Soluble cations (meq/l)				Available nutrients (ppm)						
		Cl	HCO^-_3	Na^{++}	Ca^{++}	Mg^{++}	K^{++}	N	P	K	Zn	Cu	Mn	Fe
7.98	2.85	6.7	3	12.8	6.8	7.05	1.02	11	9	151	0.85	1.01	1.83	3.6

Planting Material:

Certified potato seed named Hermes which imported from Netherland and Karozo which imported from Germany were tested on the first of January of both seasons in wet soil, using whole seed tubers. One hundred seed tubers for each cultivar were planted in two rows, 0.90m wide, 12.5m long, and 0.25m apart between hills, making an area of 22.5m^2 for each experimental plot. The experiments were laid out in a split-plot design with three replicates .

Field Experiment:

Phosphorus fertilizer was applied at the rate of 46.5 kg P2O5/fed.in the form of superphosphate (15.5%P2O5), added once in the opened row at planting time to all of the experimental plots. Nitrogen fertilizer was added at the rate of 120 unit/fed., in the form of ammonium nitrate (33.5%),60,120 and 150 unit N /fed in the form of nanotechnology (from Geolife company. India).

Potassium was added at the rate of 120kg K2O/fed. which were added on three equal doses the first one was during soil preparation and the 2nd and 3rd at 45 and 60 days after planting in the form of potassium sulphate (48%K2O).

The Recorded Data, Foliage Measurements:

The number of main stems/hill was determined using the average number of main stems per hill after planting. Plant height (cm) was determined using the average height of the main stem of 10 plants at 75 days after planting .

Yield and Its Component:-

Total tuber yield: Another ten random plants were used at harvest to determine plant tuber yield (kg). Tuber yield was determined in weight and number of all tubers per plant.

Tuber Quality:-

Random samples of 10 tubers per treatment for each replicate were randomly used to determine the tuber quality characters

1-Tuber dry matter (%): Was carried out by weighing a certain weight of fresh tubers and then dried

Dry matter % =dry weight/fresh weight x 100

2-Tuber starch percentage (%) was determined using a sample 0f 1 g of a fresh tuber, according to the method described in A.O.A.C.(1970).

3-A Known mass (5 g) of fresh tuber was taken to determine reducing sugars, using sulphuric acid and phenol (5%); then they were calorimetrically determined, according to the method of Dubios et.al.(1956).

Experimental Design And Statistical Analysis:

The used experimental layout was arranged as a split-plot in a randomized complete blocks design (R.C.B.D.), with three replicates. Two potato cultivars were considered as main plots and four treatment of nitrogen fertilizer (120 unit/fed., in the form of ammonium nitrate (33.5%), 60,120, and 150 unit N /fed in the form of nanotechnology) for every cultivar as sup plots. Collected data of the experiments were statistically analyzed, using the analysis of variance method. Comparisons among the means of different treatments were done. Using Duncan's multiple range test procedures at p=0.05 level of significant, as illustrated by Snedecor and Cochran (1980). Computation was done using SAS (2001).

RESULTS AND DISCUSSION

Morphological Characters:

Data presented in table (2), clearly, showed that there were no significant among cultivars for the number of shoot characters for two years but there were significant differences among the examined two cultivars for plant length during two years. Data of table(2) Impact the mineral nitrogen fertilizer and nanotechnology fertilizers levels on the studied vegetative traits. It became clear from these data that there was no significant effect of mineral nitrogen fertilizer and Nanotechnology fertilizers level of character number of the shoot during the two years of study and plant length in the first year of experiment moreover the lowest values of a number of shoots/plant and plant length were obtained by using 60 unit N /fed in the form of nanotechnology.

Values of table (2) revealed that most of the morphological studied characters did not show any significant differences due to the interaction between cultivars and mineral nitrogen fertilizer and nanotechnology fertilizers level moreover the highest values of a number of shoots/plant and plant length were obtained by using 150 unit N/fed in the form of nanotechnology with Hermes cultivar but the lowest values of the number of shoots/plant and plant length were obtained by using 60 unit N /fed in the form of nanotechnology with karozo cultivar. Melek Ekinci et.al.(2014)reported that nanotechnology liquid fertilizer gives the highest plant length in cucumber. Ekinci et al.2012 reported that nanotechnology liquid fertilizer improved plant growth of tomatoes. In another study, it was shown that nano-preparation coated nitrogen fertilizer improved plant growth in rice (Wang et al.2001).

Nitrogen, which is one of the most important nutrients in agricultural production, might be given only very few parts to plant and soil need, although it has been reported that the use of very small nano fertilizer particles is more effective than this rate. This effect is also provided with other plant nutrients. The nutrients which are available for the plant can be encapsulated in nanomaterial which coated with thin protective polymer film or added as particles or emulsions of the Nano scale (Srilatha 2011,). As a result of this study, it can be expressed that the fertilizer used in this study showed this effect and becomes available for cucumber plants. Amin Farnia and Abbas Ghorbani indicated that yield and yield components of red bean increased with the application of N biofertilizer and KKCNFand could be replaced chemical fertilizers by these fertilizers. Amin Farnia and Abbas Ghorbani(2014)reported that nano fertilizer might have helped seed produces more vigorous plants. However, our results showed that yield and yield components of red bean increased with the application of N biofertilizer and Knano-fertilizer.

Table 2:-Effect of mineral nitrogen fertilizer and nanotechnology fertilizers on plant growth of the potato.

season		2015		2016	
Treatments		No of shoot	Plant hight	No of shoot	Plant hight
Cultivars					
Hermes		4.8a	67.93a	4.4a	70.93a
Karozo		4.5a	63.2b	4.47a	64.13b
Fertilization					
*M units	120	5.17a	68.1a	4.67a	70.98a
N* units	60	3.83b	55.52b	3.67b	58.18c
	90	4.83a	67.4a	4.67a	69.81ab
	120	4.8a	68.08a	4.67a	69.72ab
	150	5.33a	68.33a	4.66a	68.95b
Cultivarsxfertilizar					
Hermes	120	5.33a	70.9a	5a	74.5a
	60	3.33b	59.1b	3.33b	62.17ab
	90	5a	69.4a	4.33a	71.73a
	120	5.33a	70.86a	4.67a	73.9a
	150	5a	69.4a	4.67a	72.37a
Karozo	120	5a	65.3a	4.33a	67.47a
	60	3b	51.9b	3.33b	54.2b
	90	4.67a	65.4a	4.33a	67.9a
	120	5.33a	66.6a	4.367a	65.53a
	150	4.67a	66.76a	4.33a	65.53a

M* =Mineral nitrogen units
N* = Nano nitrogen units

Yield and Yield Component:-

Data presented in table (3), clearly, showed that there were no significant among cultivars for the weight of tuber/plant (gm)and a number of tuber/plant character during two years with exception weight of tuber /plant(gm) in the first season and average of tuber/plant (gm)and dry matter during two years. Data on table (3) Impact the mineral nitrogen fertilizer and nanotechnology fertilizer levels on the studied yield and its component traits. It became clear from these data that there was no significant effect of mineral nitrogen fertilizer and nanotechnology fertilizers level of character weight of tuber/plant (gm) and number of

tuber/plant during the two years of study but there were significant effects of mineral nitrogen fertilizer and nanotechnology fertilizers level of character average of tuber /plant (gm) and dry matter during two moreover the highest values of the number of weight of tuber/plant (gm), number of tuber/plant, an average of tuber/plant(gm)and dry matter were obtained by using 90 unit N/fed in the form of nanotechnology but the lowest values weight of tuber/plant (gm), number of tuber/plant, an average of tuber/plant(gm)and dry matter were obtained by using 60 unit N /fed in the form of nanotechnology.

Values of table (3)revealed that most of the yield studied characters did not show any significant differences due to the interaction between cultivars and mineral nitrogen fertilizer and nanotechnology fertilizers level one exception average of tuber/plant (gm) in the first season. moreover, the highest values number of weight of tuber/plant (gm), number of tuber/plant, an average of tuber/plant(gm)and dry matter were obtained by using 90 unit N/fed in the form of nanotechnology with karozo cultivar but the lowest values of the number of weight of tuber/plant (gm), number of tuber/plant, an average of tuber/plant(gm)and dry matter were obtained by using 60 unit N /fed with herms cultivar in the form of nanotechnology

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Table 3:-Effect of mineral nitrogen fertilizer and nanotechnology fertilizers on yield of potato.

Season		2015				2016			
Treatments		Weight of tubers gm)	No of tuber	Average of tuber weight	Dry matter	Weight of tubers (gm)	No of tuber	Average of tuber weight	Dry matter
Cultivars									
Hermes		557.13b	4.13a	134.77a	21.18b	634.34a	4.67a	133.98b	21.83b
Karozo		706.33a	4.66a	148.14a	24.09a	694.32a	4.46a	151.39a	23.07a
Fertilization									
M*	120	708.33a	4.5a	161.a	23.48a	750.5a	5a	150.1a	23.62a
N* units	60	310b	3.83ab	80.69c	19.84b	288.33b	3.5b	83.33b	20.02c
	90	708.33a	4.83a	146.08b	23.15a	754.16a	4.83a	156.6a	22.65b
	120	714.17a	4.5a	161.08a	23.37a	753.33a	4.66a	162.42a	23.62a
	150	725.33a	4.33ab	161.02a	23.13a	775.33a	4.83a	160.99a	22.76b
Cultivarsxfertilizar									
Hermes	120	605.0a	4a	159.33b	22.8a	720a	5a	144bc	24.43a
	60	293.33b	4a	73.33e	19.23b	310b	3.6b	85.56c	20.8b
	90	626.6a	4.67a	134.17c	22.24a	720a	5a	143.2bc	23.06a
	120	637.33a	4a	155.85b	22.64a	706a	4.67a	153.14b	23.75a
	150	623.33a	4a	151.17b	22.56a	715a	4.33a	144bc	23.29a
Karozo	120	796.67a	5a	162ab	22.56a	781a	5a	156.2b	23.62a
	60	326.6b	3.67b	88.06d	24.43a	266.67b	3.3b	81.11c	20.05b
	90	790.0a	5a	158b	23.06a	830.66a	4.67a	170a	22.65a
	120	813.33a	5a	161ab	23.75a	800a	4.67a	171.67a	23.19a
	150	805a	4.67a	171a	23.29a	793.33	4.67	177.99a	22.76a

M* =Mineral nitrogen units
N* = Nano nitrogen units

Data presented in table (4), clearly, showed that the cultivar herms give the highest value of character component during two years. Data of table,… Impact the mineral nitrogen fertilizer (120unit/fed.) and nanotechnology fertilizers(120unit/fed.)Give the highest value of character components for two years.

Values of table (4) revealed that most of the character component studied show significant differences due to the interaction between cultivars and mineral nitrogen fertilizer and Nanotechnology fertilizers level moreover the highest values of starch content total sugar and reducing sugar were obtained by using 120unit N/fed in the form of nanotechnology with Hermes cultivar but the lowest values of the number of starch content, total sugar and reducing sugar by using 60 unit N /fed in the form of Nanotechnology with karozo cultivar.

Table 4:-Effect of mineral nitrogen fertilizer and nanotechnology fertilizers on component yield of potato.

Season		2015			2016		
Treatments		Starch content	Suger content	Reducing sugar	Starch content	Suger content	Reducing suger
Cultivars							
Hermes		11.96b	5.86b	2.04b	12.16b	5.33b	1.95b
Karozo		13.05a	6.15a	2.11a	12.58a	6.06a	2.11a
Fertilization							
*M units	120	12.79b	6.03ab	2.19ab	12.09b	5.75b	2.16a
N* Units	60	11.69c	5.87b	1.85d	11.8b	5.48d	1.76c
	90	11.78c	5.89b	1.98c	11.91b	5.57c	1.91b
	120	14.46a	6.19a	2.22a	14.12a	5.95a	2.19a
	150	11.82c	6.02ab	2.12b	11.93b	5.75b	2.13a
Cultivars x fertilizer							
Hermes	120	13.36b	6.18b	2.14bc	12.52b	6.21ab	2.22b
	60	12.23c	5.93cd	1.73f	11.81bcd	5.85c	1.83d
	90	12.24c	5.94cd	1.95e	11.86bcd	5.83c	2.0c
	120	15.16a	6.53a	2.26a	14.21a	6.29a	2.32a
	150	12.29c	6.14bc	2.09cd	12.49bc	6.12b	2.16b
Karozo	120	12.23c	5.87d	2.15bc	12.05bcd	5.36e	2.15b
	60	11.15d	5.82d	1.93e	11.34d	5.1f	1.69e
	90	11.28d	5.84d	2.02de	11.65d	5.28e	1.83d
	120	13.76b	5.92cd	2.23ab	14.03a	5.6d	2.16b
	150	11.40d	5.85d	2.18abc	11.73cd	5.32e	1.92cd

M* =Mineral nitrogen units
N* = Nano nitrogen units

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