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RESPONSE OF TWO MAIZE CULTIVARS (*Zea mays* L.) TO ORGANIC MANUR AND MINERAL NANO NITROGEN FERTILIZER UNDER SIWA OASIS CONDITIONS

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ABSTRACT

Two trials were carried out at the Experimental Station farm of Desert Research Center, Teggzerty from Siwa Oasis, Matroh Governorate during the two summer seasons, 2015 and 2016. Trials were performed to study response of two maize hybrids.(Single hybrid 131 and Triple hybrid 329) to organic manure (OM) levels (15 and 30 m^3/fed.) and five combinations between mineral and nano nitrogen (N) fertilizers: 1)100% mineral N from the recommended dose (120 kg N/fed.), 2)75% mineral + 25% nano N fertilizers, 3)50% mineral + 50% nano N fertilizers, 4)25% mineral + 75% nano N fertilizers, 5)100% nano N as the recommended rate (500 ppm as foliar application). Mineral N rates were added in three equal doses, with foliar application by nano N rates, after 30, 45 and 60 days from sowing. Treatments, included twenty treatments, was laid out in a splilt-split plot design, with three replicates, OM levels were arranged in the main plots, maize cvs. were allocated in the sub plots, and mineral nano N fertilizer treatments were assigned in the sub-sub plots. At harvest the following characters were recorded, plant height (cm), number of rows/ear, ear length (cm), ear diameter (cm), number of grains/row, 100-grain weight (g), ear weight (ton/fed), grain, straw and biological yields (ton/ fed), shelling (%) and harvest index(%).

Results indicated that increasing OM levels significantly increased ear length harvest index and protein content (%), in the 2nd season only, triple hybrid gave the maximum values of all parameters, except no. of rows/ear and harvest index, in the 1st season, and 100-grain weight and carbohydrate (%), in both seasons, which had no significant difference with single hybrid in the most cases. Concerning with the effect of mineral and nano N, all parameters, except carbohydrate (%), were increased with increasing mineral N (%) and/or with decreasing nano N (%). Fertilized maize crop by mineral N at 100% or 75% plus 25% nano N fertilizer gave the maximum values of plant ht., no. of rows/ear, ear length and diameter, no. of grains/row, 100-grain wt.,ear weight, grain, straw and biological yields, shelling (%), protein (%), protein yield and harvest index in both seasons. However, fertilized maize crop by nano N at 100% produced the highest value of carbohydrate content (%) in two seasons. Results suggested that selected triple maize hybrid cv. (329), at 30 m^3 OM, with 100% mineral N (120 kg N/fed.) or with 75% mineral N (90 kg N/fed.) plus 25% nano N (125 ppm as foliar application) fertilizers could be utilized for attaining the maximal improvement in farmer income by increasing the maize yield under saline conditions at Siwa Oasis, Egypt.

Key words: Maize, Cultivars, Organic fertilizer, Mineral, Nano; Nitrogen.

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important crops after wheat and rice crops which occupied the third order in Egypt and the world.

Siwa Oasis, as a depression in the Western desert of Egypt, is located within the extrmely arid zone. The scarcity of fresh water sources forces to use of saline groundwater for the agricultural purposes leading to the risk of soil salinization.Therefore, Siwan farmers are not acquainted with such crop. So, they need maize crop more than in Delta Governorates.

The most of crops tolerate salinity to a threshold level and above which yield decreases as the salinity increases **(Khan et al 2006)**. However, the threshold of maize crop; the maximum allowable salinity without grain yield reduction is approximmately 1.7 dSm^{-1}, as a moderately salt sensitive crop plants (**Maas and Hoffman, 1977)**. They estimated yield reduction which was about 7.4 to 12.0% per dSm^{-1} above this threshold. In another studies of **Hoffman et al (1983 and 1986)**, on organic soils, the threshold and percentage slope decrease had slightly higher values of 3.7 dSm^{-1} and 14.0% per dSm^{-1}, respectively.

Organic manure improves soil fertility, by influencing its physical, chemical, biological properties and its release nutrients for a good response to plant growth. It improves water circulation, soil aeration, and increases the soil moisture holding capacity **(Soltner, 1985 and Boateng*et* et al 2006)** reported that application of 2 t polutry manure (pm)/ha was capable to increase maize yield by more than 100% over the control, while applied 4 t pm/ha may be recommended to produce grain yields similar to the chemical fertilizer rate.

Nitrogen fertilizer is very important particulary for cereal crops **(Khan et al 2017)**, enhancing the vegetative growth, biomass, dry matter and crop productivity of maize crop (**Ogola et al 2002 and Habtegebrial et al 2007**). But, it had also adverse effects on soil environment as well as the continued escalation prices of mineral N fertilizer **(Waseem et al 2012)**. Moreover, about 40–70% of N is lost causing a very serious environmental pollution (**Trenkel, 1997 and Ombódi & Saigusa, 2000).** In addition, adding any mineral fertilizer well be raises the osmotic pressure of soil solution and consequantly soil salinization according to salt index of fertilizer type. So, recently, the use of slow release fertilizer combined with mineral N fertilizers, has become a new trend to save fertilizer consumption and to minimize environmental pollution **(Guo et al 2005** and **Wu and Liu, 2008).** The idea of developing encapsulated fertilizers, in which NPK fertilizers are entrapped within nanoparticles **(Teodorescu et al 2009).** Consequently, the fertilizers are protected by the nanoparticles for better survival in inoculated soils, allowing for their controlled release into the soil **(Ombódi and Saigusa, 2000)** or plant. Therefore, the method of encapsulation of fertilizers components in polymeric nanoparticles is relatively novel, with potential commercial applications. Therefore, the objective of this study was to increase maize production and to improve soil productivity through use of organic, inorganic and nano N fertilizers.

MATERIALS AND METHODS

Two field experiments were conducted at Experimental Station of Desert Research Center at Tegzerty, Siwa Oasis, Matroh Governorate during the two successive summer seasons, 2015 and 2016. These experiments were performed to study the response of two maize hybrid cvs.(Single hybrid 131 and Triple hybrid 329) to OM levels (15 and 30 m^3/fed.) and the combination between mineral and nano N fertilizers: 1.100% mineral N from the recommended dose.

2. 75% mineral + 25% nano N fertilizers.
3. 50% mineral + 50% nano N fertilizers.
4. 25% mineral + 75% nano N fertilizers.
5. 100% nano N from the recommended rate.

The recommended dose of mineral N (120 kg N/fed.), as ammonium sulphate form (20.6% N) where added in three equal doses, after 30, 45 and 60 days from sowing. While, the recommended rate of nano N was 500 ppm as foliar application at three times after 30, 45 and 60 days from sowing date. Each experiment, included twenty treatments, was laid out in a splilt-split plot design with three replicates.Organic fertilizer were arranged in the main plots, maize cvs. were allocated in the sub plots, and mineral nano N fertilizer treatments were assigned in the sub-sub plots. Each experimental unit area was 10.5m^2 (3m x 3.5m) and contained four furrows (3.5 m in length and 60 cm apart).

Prior to planting, OM rates and phophorus as calcium superphosphate (15.5% P_2O_5), at 30 kg P_2O_5/fed., were added during soil preparation. The preceding crop was alfalfa in both seaons. Maize grains were sown in hills, 25 cm apart, at the 1st week of August in both seasons. After 4 weeks, weed control was performed by hoeing and seedlings were thinned to one plant/hill. Soil samples(0-30 cm) was taken for mechanical and chemical analysis in the both seasons **(Table 1).** Chemical analysis of water irrigation and OM are presented in **Tables (2 and 3).**

Table 1. Mechanical and chemical analysis of the soil in the two seasons.

a): Mechanical analysis

Depth (cm)	Coarse sand (0.5–1.0 mm)	Fine sand (0.1–0.25 mm)	Silt (0.002 - 0.05mm)	Clay (<0.002mm)	Class Texture
1st season (2015)					
0-30	51.1	42.1	6.8	0	Sandy loam
2nd season (2016)					
0-30	48.6	42.7	8.7	0	Sandy loam

b): chemical analysis

Seasons	EcdS/m	pH	Cations (meq/L)				Anions (meq/L)		
			Ca^{++}	Mg^{++}	Na^{+}	K^{+}	Hco_3^{-}	cl^{-}	So_4^{--}
1st	7.6	7.5	34.6	17.24	65.7	1.43	2.45	85.4	35.6
2nd	7.3	7.4	35.8	16.33	63.1	1.22	2.1	81.5	32.8

Table 2. Chemical analysis of saline water irrigation.

Well	**EC ds/m**	**pH**	**Soluble anions (meq/L)**				**Soluble cations (meq/L)**			
			$CO_3^{=}$	**HCO_3^{-}**	**$SO_4^{=}$**	**Cl^{-}**	**Ca^{++}**	**Mg^{++}**	**Na^{+}**	**K^{+}**
Well	5.43	7.1	0	3.04	9.12	50.62	15.20	5.06	40.5	2.02

Table 3. Chemical analysis of OM.

Seasons	pH	EC dSm^{-1}	N (%)	P (%)	K (%)	O.M (%)	O.C (%)	C:N Ratio	Humidity (%)
1st	7.89	2.78	0.68	0.31	0.20	27.6	16.0	23.5:1	18.8
2nd	7.78	2.69	0.70	0.29	0.22	26.9	17.0	22:1	18.1

At harvest, samples of 5 plants/plot were randomly taken after 119 and 120 days from sowing date in 2015 and 2016 seasons, respectively from the middle of plot for every treatments to determine the following characters, plant height (cm), number of rows/ear, ear length (cm), ear diameter (cm), number of grains/row, 1000-grain weight (g), ear weight (ton/fed), grains weight (ton/fed), straw yield (ton/fed), biological yield (ton/ fed), shelling (%) (grains wt. of ten ears/ten ears wt. x 100) and harvest index (%). All the obtained data for the experiment of each season were subjected to statistical analysis according to the method described by **Gomez and Gomez (1984).** Means comparison were done using least significant difference (LSD) at 5% level of probability.

RESULTS AND DISCUSSION

1. Effect of OM

Data in **Table (4)** show that yield and most its components did not affected significantly by OM levels, except ear length, harvest index and grain protein (%) in the 2nd season only. Ear length, harvest index and protein (%) were significantly increased with increasing OM levels. These increments may be attributed to insignificant increase in the most yield attributes particularly number of grains/row and 100-grain wt., in both seasons, as well as to a significant increase in ear length, in the 2nd one. In this regard, grain yield of corn was increased by application of manure or compost and

Table 4. Effect of organic manure (OM) fertilizer (%) on yield, yield components and grain chemical contents of maize crop during the two seasons (2015 and 2016).

Organic manure fertilizer levels	Yield and yield components												Chemical content of grains	
	Plant height (cm)	Number of rows/ear	Ear length (cm)	Ear diameter (cm)	Number of grains/row	100-grain weight (gm.)	Ear weight (ton/fed.)	Grain yield (ton/fed.)	Straw yield (ton/fed.)	Biological yield (ton/fed.)	Shelling (%)	Harvest index (%)	Protein content (%)	Carbo-hydrate content (%)
1st season (2015)														
50%	**163.1**	**12.34**	**15.82**	**4.09**	**33.67**	**31.19**	**4.12**	**3.17**	**6.35**	**10.47**	**76.08**	**30.18**	**8.47**	**76.17**
100%	**178.4**	**12.38**	**16.41**	**4.27**	**36.98**	**33.70**	**4.65**	**3.72**	**6.37**	**11.02**	**79.66**	**33.73**	**8.58**	**75.95**
LSD at 5%	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**
2nd season (2016)														
50%	**185.7**	**12.88**	**13.50**	**3.84**	**28.67**	**26.25**	**2.05**	**1.59**	**11.45**	**13.49**	**75.41**	**12.10**	**8.26**	**76.78**
100%	**194.1**	**12.79**	**14.12**	**4.07**	**30.58**	**26.75**	**2.85**	**2.29**	**11.54**	**14.39**	**80.05**	**16.37**	**8.54**	**75.45**
LSD at 5%	**n.s**	**n.s**	**0.553**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**4.22**	**0.17**	**n.s**

poultry manure **(Boateng et al 2006)** as compared with the unfertilized check or control**.**

Increasing harvest index with OM application means that OM encarged photosynthates transformation into economic yield. Similar findings were found by **Khan et al (2017)** by application of 5 t ha^{-1} of sheep manure. These increments of harvest index with higher sheep manure levels could be associated with enhanced soil cation exchange capacity, increased C, N, and P content, and lowered hydraulic conductivity of soil as noticed by **Uzoma et al (2011).**

2. Maize cultivares differences

Maize cultivars had a significant effect on plant height, number of rows/ear, grain protein (%) and protein yield (kg/fed.), in the 1st season, and number of rows/ear, ear length and diameter, number of grains/row, ear weight grain protein (%) and protein yield (kg/fed.), in th 2nd one as shown in **Table (5).** Maize trible hybrid had a significant increase in the above mentioned attributes, except number of rows/ear in the 1st season.

Table 5. Cultivar differences in some yield, yield components and grain chemical contents of maize crop during the two seasons (2015 and 2016).

maize **cultivars**	Yield and yield components												Chemical content of grains	
	Plant height (cm)	Number of rows/ear	Ear length (cm)	Ear diameter (cm)	Number of grains/row	100-grain weight (gm.)	Ear weight (ton/fed.)	Grain yield (ton/fed.)	Straw yield (ton/fed.)	Biological yield (ton/fed.)	Shelling (%)	Harvest index (%)	Protein content (%)	Carbo-hydrate content (%)
1st season (2015)														
Single hybrid	**162.3**	**12.53**	**15.93**	**4.18**	**33.54**	**34.06**	**4.34**	**3.36**	**5.99**	**10.33**	**77.02**	**32.51**	**8.42**	**76.64**
Triple hybrid	**179.2**	**12.19**	**16.30**	**4.18**	**37.21**	**30.83**	**4.43**	**3.53**	**6.73**	**11.17**	**78.72**	**31.39**	**8.63**	**75.48**
LSD at 5%	**14.40**	**0.22**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**0.15**	**n.s**
2nd season (2016)														
Single hybrid	**188.8**	**12.64**	**13.17**	**3.90**	**28.25**	**26.56**	**2.24**	**1.78**	**10.60**	**12.84**	**77.86**	**14.21**	**8.12**	**76.61**
Triple hybrid	**191.0**	**13.02**	**14.45**	**4.01**	**31.01**	**26.43**	**2.66**	**2.10**	**12.39**	**15.04**	**77.60**	**14.26**	**8.69**	**75.62**
LSD at 5%	**n.s**	**0.24**	**0.87**	**0.11**	**1.19**	**n.s**	**0.23**	**n.s**	**n.s**	**n.s**	**n.s**	**n.s**	**0.09**	**n.s**

In this connection, a significant differences in yield and its components of maize cultivars were noticed by many authors (**Hassan, 1998 and 1999, Soliman et al 2004, Shahrokhi and Khorasani, 2013 and Awdalla et al 2018)**. **Hassan (1998)** who reported that grain yield and its attributes of S.C.103 and T.W.C.310 were superior than that of other maize cultivars.

3. Effect of mineral nano N fertilizers

Results in **Table (6)** indicate that fertilized maize plants by combination of mineral and nano N fertilizers had a significant effect on all yield and yield components in the two growing seasons, except, number of rows/ear, shelling and harvest index percentages, in the 1st season, and plant height, in the 2nd one. In both seasons, all parameters, except carbohydrate (%) were increased with increasing mineral N percentage and/or with decreasing nano N percentage. Fertilized maize crop by mineral N at 100% or 75% plus 25% nano N fertilizer gave the maximum values of plant height., number of rows/ear, ear length and diameter, number of grains/row, 100-grain wt.,ear weight, grain, straw and biological yields, shelling (%), protein (%), protein yield and harvest index in both seasons. However, fertilized maiz crop by nano N at 100% produced the highest value of carbohydrate content (%) in the two seasons. The highest grain yield/fed. was obtained from the application of 100% mineral N fertilizer. These increments may be due to the increase in one or more triangle attributes, i.e. number of rows/ear, number of grains/row and/or 100-grain weight. Whereas, the lowest grain yield/fed.was produced from 75% nano N plus 25% mineral N, in the 1st season, and 100% nano N, in the 2nd one. Many workers came to similar trend as **Fan et al (2012), Kandil (2013)**, **Awadalla and Morsy (2016), Ahmad et al (2018) and Emara et al (2018).**

4. Effect of the interaction between organic and maize cultivars

Interaction between OM levels and maize cultivars had a significant effet on plant hieght, number of rows/ear , 100 grain weight, shelling percentage, harvest index and protein (%), in the 1st season and number of rows/ear, ear length and diameter, number of grains/row, ear weight, grain yield/fed., protein (%) and protein yield, in the 2nd one **(Table 7).**

At the highest OM rate (30 m^3/fed.), triple maize cv. had a significant increase in plant height., shilling (%), and protein (%), in the 1st season, ear length and diameter, number of grains/row, ear weight/fed., grain yield/fed and protein (%) and protein yield, in the 2nd one. Moreover, at the same level of OM, single hyprid maize cv. gave the highest value of 100-grain weight and harvest index in the 1st season. While, single hybrid maize at the lowest OM level (15 m^3/fed.), gave the highest value of number of rows/ear. At the lowest OM level (15 m^3/fed.), the highest value of number of rows/ear was obtained from single and triple maize hybrids in the 1st and 2nd seasons, respectively. This result may be due to better growth and positive influence on yield parameters under organic production system as reported by **Layek et al (2014 and 2016)** and **Kareem et al (2017)**.

5. Effect of interaction of OM and mineral nano N fertilizers

Interaction between OM and mineral, nano N fertilizers had a significant effect on yield and yield components of maize plants in the two seasons except number of rows/ear in the 1st season as shown in **Table (8).** In the 1st season, at 30m^3/fed.organic level, fertilized maize plants by 100% mineral N produced the maximum plant height, ear length and diameter, number of grains/row, 100 grain weight, ear weight/fed., grain, straw and biological yields per fed, protein (%) and protein yield. However, the highest values of shelling (%) and harvest index were obtained from fartilized maize plants by 75% mineral plus 25% nano N at 30m^3/fed. organic level. In the 2nd season, at 30 m^3/fed. organic level, fertilized maize plants with 75% mineral plus 25% nano N fertilizers gave the highest values of plant height, number of rows/ear, ear length and diameter, number of grains/row and biological yield/fed. While, at the lowest organic level (15m^3/fed.), fertilized maize plants by 75% mineral plus 25% nano and 100% mineral N recorded the highest values of 100 grain weight and straw yield/fed., respectively. Moreover, fertilized maize plants by 100% mineral N, at 30m^3/fed. organic level, gave the maximum ear wt./fed., grain yield/fed., shelling (%), harvest index, protein (%) and protein yield .

It is obvious that, at the highest organic level (30m^3/fed.), yield and the most yield components were increased when fertilized maize plants by 100% mineral N, and to some extent, 75% mineral plus 25% nano N fertilizers.

Table 6. Effect of mineral and nanoN fertilizers percentage on yield, yield components and grain chemical contents of maize crop during the two seasons (2015 and 2016).

Mineral andnanoN fertilizers (%)	Yield and yield components												Grain chemical content	
	Plant height (cm)	Number of rows/ear	Ear length (cm)	Ear diameter (cm)	Number of grains/row	100-grain weight (gm.)	Ear weight (ton/fed.)	Grain yield (ton/fed.)	Straw yield (ton/fed.)	Biological yield (ton/fed.)	Shelling (%)	Harvest index (%)	Protein content (%)	Carbo-hydrate content (%)
	1st season (2015)													
Mineral N (100%)	179.2	12.44	16.81	4.29	37.07	34.92	4.78	3.78	7.24	12.02	78.86	31.72	8.97	74.46
Mineral N (75%) + Nano N (25%)	176.6	12.56	16.80	4.28	36.64	32.19	4.47	3.54	6.50	10.97	78.47	32.56	8.77	76.2
Mineral N (50%) + Nano N (50%)	169.4	12.43	15.67	4.10	35.13	32.35	4.35	3.39	5.64	9.99	77.20	33.43	8.33	75.98
Mineral N (25%) + Nano N (75%)	163.1	12.13	15.28	4.07	34.42	30.39	3.91	3.04	5.80	9.71	77.72	31.31	8.49	75.72
Nano N 100%	165.5	12.23	16.02	4.16	33.63	32.38	4.42	3.46	6.63	11.05	77.10	30.74	8.06	77.87
LSD at 5%	12.20	n.s	0.92	0.16	3.36	2.37	0.52	0.45	1.156	1.372	n.s	n.s	0.25	1.53
	2nd season (2016)													
Mineral N (100%)	194.5	12.95	14.33	4.18	31.75	29.93	3.43	2.82	13.52	16.95	82.32	17.37	8.97	75.18
Mineral N (75%) + Nano N (25%)	188.6	13.38	15.69	4.28	33.13	29.65	2.92	2.27	12.57	15.49	78.70	15.63	8.73	75.67
Mineral N (50%) + Nano N (50%)	190.0	12.73	14.23	4.07	30.08	26.79	2.39	1.89	10.37	12.76	78.13	14.91	8.51	75.81
Mineral N (25%) + Nano N (75%)	184.1	12.81	12.68	3.77	27.71	23.82	2.06	1.62	9.572	11.63	76.41	13.98	7.99	76.19
Nano N 100%	192.2	12.30	12.11	3.55	25.48	22.30	1.45	1.10	11.32	12.88	73.11	9.292	7.80	77.73
LSD at 5%	n.s	0.35	0.88	0.17	1.99	1.71	0.67	0.32	2.34	2.680	5.302	3.571	0.24	1.33

Table 7. Effect of interaction between organic manure (OM) fertilizer (%) and maize cultivars on yield, yield components and grain chemical contents during the two seasons (2015 and 2016).

OM fertilizer (%)	Maize Varieties	Plant height (cm)	No. row ear	Ear length (cm)	Ear diameter (cm)	No. grains/ row	100-grain wt. (gm.)	Ear weight ton/fed	Grain wt. ton/fed	Straw yield ton/fed	Biological yield per fed. (ton)	Shelling %	HI %	Grain chemical content	
														Protein %	Carbohydrate (%)
1st season (2015)															
50%	Single hybrid	158.6	12.69	15.89	4.13	32.69	33.86	4.31	3.29	6.26	10.57	75.80	31.24	8.39	76.86
	Triple hybrid	167.6	12.00	15.76	4.05	34.84	28.52	3.93	3.05	6.44	10.37	76.36	29.11	8.55	75.49
100%	Singlehybrid	166.0	12.37	15.97	4.23	34.39	34.27	4.37	3.42	5.72	10.08	78.24	33.78	8.46	76.42
	Triple hybrid	190.8	12.38	16.84	4.31	39.57	33.13	4.94	4.01	7.02	11.96	80.07	33.67	8.71	75.48
LSD at 5%		20.36	0.31	n.s	n.s	n.s	5.37	n.s	n.s	n.s	n.s	3.34	4.14	0.21	n.s
2nd season (2016)															
50%	Singlehybrid	183.4	12.57	13.03	3.77	27.07	26.56	1.81	1.40	11.05	12.86	74.74	11.06	7.95	77.12
	Triple hybrid	187.9	13.18	13.97	3.91	30.28	25.94	2.28	1.79	11.84	14.13	76.08	13.14	8.58	76.45
100%	Singlehybrid	194.2	12.71	13.31	4.03	29.43	26.56	2.68	2.16	10.15	12.82	80.98	17.36	8.28	76.10
	Triple hybrid	194.1	12.87	14.93	4.11	31.73	26.93	3.03	2.41	12.93	15.96	79.13	15.39	8.80	74.80
LSD at 5%		n.s	0.34	1.24	0.16	1.68	n.s	0.43	0.45	n.s	n.s	n.s	n.s	0.13	n.s

In this respect, **Munyabarenzi (2014)**, **Wapa (2014)** and **Admas et al (2015)** came to similar results.

6. Effect of the interaction of maize cultivars and mineral nano N fertilizers:

Data **in Table (9)** pointed out that the effect of interaction between maize cvs. and mineral, nano N fertilizers had a significant effect on yield and yield attributes in the two seasons, except shelling (%) in the 1st season. At the 1st season, fertilized single hybrid maize cv. by 100% mineral N gave the maximum number of rows/ear, ear diameter and 100-grain weight. Also, fertilized trible hybrid cv. by the same N fertilizer treatment produced the highest values of number of grains/row, straw, biological yields per fed. and protein (%). Moreover, triple hybrid maize cv. which fertilized by 75% mineral plus 25% nano N fertilizers gave the highest values of plant height, ear length, ear weight/fed., grain and protein yields per fed. Whereas, shelling (%) and harvest index (%) were obtained from fertilized triple hybrid by 50% mineral plus 50% nano N fertilizers. Yet, fertilized single hybred maize cv. by 100% nano N gave the highest value of carbohydrate (%). At the 2nd season, 100% mineral N fertilizer had the highest values of plant height, 100.grain weight, straw yield/fed., shelling (%) and harvest index with single hybrid, and ear wt./fed., grain yield/fed. protein (%) and protein yield/fed. for triple hybrid maize cv. Moreover, applied 75% mineral plus 25% nano N fertilizers gave the maximum values of number of rows/ear, ear dimater for single hybrid, and ear length, number of grains/row and biological yield for triple hybrid maize cv.

This finding was confirmed with **Awadalla and Morsy (2016) and Ahmad et al (2018) and Awdalla et al (2018)** who reported that maize cultivars differ in grain yield and yield attributes response to N application.

Table 8. Effect of interaction between OM fertilizer (%) and mineral nano fertilizer on yield, yield components and grain chemical contents of maize plants during the two seasons (2015 and 2016).

OM Fertilizer (%)	Mineral and nanoN fertilizers (%)	Plant height (cm)	No. row ear	Ear length (cm)	Ear diameter (cm)	No. grain row	100-grain wt. (gm.)	Ear weight ton/fed	Grain wt. ton/fed	Straw yield ton/fed	Biological yield per fed. (ton)	Shelling %	HI %	Protein %	Carbohydrate %
1st season (2015)															
50%	Mineral N (100%)	171.4	12.35	16.32	4.15	35.32	34.23	4.47	3.51	7.12	11.59	78.68	31.08	8.86	74.35
	Mineral N (75%) + Nano N (25%)	173.1	12.53	16.90	4.25	36.67	29.90	4.23	3.23	7.12	11.34	75.92	29.09	8.68	76.61
	Mineral N (50%) + Nano N (50%)	160.7	12.30	14.90	3.97	32.07	32.06	3.90	2.96	5.04	8.938	74.57	32.20	8.28	76.03
	Mineral N (25%) + Nano N (75%)	152.2	12.20	15.13	4.00	33.33	29.76	3.81	2.90	5.90	9.702	76.12	29.82	8.46	76.03
	Nano N 100%	158.1	12.33	15.87	4.08	31.43	30.01	4.10	3.25	6.59	10.79	75.12	28.77	8.06	77.85
100%	Mineral N (100%)	186.9	12.53	17.30	4.43	38.77	35.61	5.10	4.04	7.35	12.45	79.03	32.35	9.08	74.57
	Mineral N (75%) + Nano N (25%)	180.2	12.58	16.70	4.30	36.62	34.47	4.71	3.85	5.88	10.59	81.02	36.10	8.86	75.92
	Mineral N (50%) + Nano N (50%)	178.1	12.57	16.43	4.23	38.20	32.65	4.80	3.83	6.23	11.04	79.83	34.67	8.39	75.94
	Mineral N (25%) + Nano N (75%)	174.1	12.07	15.43	4.13	35.50	31.02	4.01	3.19	5.71	9.719	79.32	32.80	8.53	75.41
	Nano N 100%	172.9	12.13	16.17	4.23	35.82	34.74	4.64	3.67	6.67	11.31	79.08	32.72	8.06	77.89
LSD at 5%		17.26	n.s	1.30	0.22	4.76	3.35	0.73	0.63	1.64	1.94	4.95	6.05	0.35	2.169
2nd season (2016)															
50%	Mineral N (100%)	197.3	12.98	14.23	4.13	30.67	30.38	3.12	2.54	14.34	17.45	81.55	15.12	8.82	75.67
	Mineral N (75%) + Nano N (25%)	177.7	12.90	15.23	4.23	31.30	31.23	2.40	1.86	10.87	13.28	78.28	15.07	8.64	75.90
	Mineral N (50%) + Nano N (50%)	189.3	12.90	13.63	4.07	29.75	26.55	2.14	1.73	9.54	11.68	79.30	14.82	8.42	76.33
	Mineral N (25%) + Nano N (75%)	173.9	13.42	12.70	3.58	26.92	24.12	1.62	1.19	10.22	11.84	71.43	10.66	7.84	77.04
	Nano N 100%	190.1	12.18	11.68	3.20	24.73	18.97	0.95	0.64	12.26	13.21	66.48	4.833	7.59	78.98
100%	Mineral N (100%)	191.8	12.92	14.43	4.23	32.83	24.49	3.74	3.11	12.70	16.44	83.08	19.62	9.12	74.69
	Mineral N (75%) + Nano N (25%)	199.5	13.87	16.15	4.33	34.95	28.07	3.44	2.67	14.27	17.71	79.12	16.20	8.82	75.44
	Mineral N (50%) + Nano N (50%)	190.7	12.55	14.83	4.07	30.40	27.02	2.63	2.04	11.20	13.83	76.95	15.00	8.60	75.29
	Mineral N (25%) + Nano N (75%)	194.3	12.20	12.67	3.83	28.50	23.52	2.49	2.05	8.923	11.41	81.38	17.30	8.13	75.34
	Nano N 100%	194.3	12.42	12.53	3.90	26.22	25.63	1.95	1.56	10.59	12.54	79.73	13.75	8.02	76.48
LSD at 5%		14.84	0.49	1.25	0.24	2.82	2.41	0.94	0.45	3.31	3.79	7.50	5.05	0.34	1.878

Table 9. Effect of interaction between maize cultivars and mineral nano fertilizer on yield, yield components and grain chemical contents during the two seasons (2015 and 2016).

OM Fertilizer (%)	Mineral and nanoN fertilizers (%)	Plant height (cm)	No.of rows/ ear	Ear length (cm)	Ear diameter (cm)	No. of grains/ row	100-grain wt. (gm.)	Ear weight ton/fed	Grain wt. (ton/fed.)	Straw yield (ton/fed.)	Biological yield (ton/fed.)	Shelling (%)	HI %	Protein (%)	Carbohydrate (%)
1st season (2015)															
Single Hybrid	Mineral N (100%)	170.6	12.82	16.45	4.35	34.28	37.53	4.81	3.80	7.05	11.85	79.03	32.53	8.79	75.53
	Mineral N (75%) + Nano N (25%)	160.5	12.47	16.27	4.20	34.00	34.08	4.05	3.16	5.92	9.97	77.40	31.55	8.68	77.13
	Mineral N (50%) + Nano N (50%)	160.3	12.65	16.02	4.05	33.70	34.30	4.49	3.37	5.74	10.22	74.85	32.55	8.24	76.44
	Mineral N (25%) + Nano N (75%)	157.1	12.13	15.15	4.10	33.40	31.56	3.93	3.02	5.36	9.29	76.33	32.35	8.38	75.67
	Nano N 100%	163.2	12.58	15.77	4.18	32.30	32.84	4.44	3.44	5.87	10.31	77.48	33.57	8.02	78.40
Triple Hybrid	Mineral N (100%)	187.7	12.07	17.17	4.23	39.80	32.31	4.76	3.76	7.43	12.19	78.68	30.90	9.15	73.38
	Mineral N (75%) + Nano N (25%)	192.7	12.65	17.33	4.35	39.28	30.29	4.89	3.92	7.07	11.96	79.53	33.57	8.86	75.40
	Mineral N (50%) + Nano N (50%)	178.5	12.22	15.32	4.15	36.57	30.41	4.22	3.42	5.54	9.75	79.55	34.32	8.42	75.52
	Mineral N (25%) + Nano N (75%)	169.2	12.13	15.42	4.03	35.43	29.23	3.88	3.07	6.25	10.13	79.10	30.27	8.60	75.77
	Nano N 100%	167.8	11.88	16.27	4.13	34.95	31.91	4.41	3.49	7.38	11.79	76.72	27.92	8.09	77.34
LSD at 5%		17.26	0.92	1.30	0.22	4.76	3.35	0.73	0.63	1.64	1.94	n.s	6.05	0.35	2.17
2nd season (2016)															
Single Hybrid	Mineral N (100%)	199.1	12.52	14.22	4.12	31.22	30.76	3.35	2.76	14.34	17.45	82.47	17.98	8.57	75.82
	Mineral N (75%) + Nano N (25%)	182.0	13.50	14.13	4.33	31.33	29.27	2.87	2.26	10.87	13.28	80.67	17.82	8.35	76.11
	Mineral N (50%) + Nano N (50%)	185.6	12.43	13.67	3.97	29.20	25.34	2.01	1.58	9.54	11.68	77.77	14.68	8.31	76.16
	Mineral N (25%) + Nano N (75%)	185.0	12.77	12.43	3.50	27.25	22.39	1.73	1.31	10.22	11.84	72.50	11.49	7.80	76.85
	Nano N 100%	192.2	12.00	11.40	3.60	22.23	25.03	1.25	1.00	12.26	13.21	75.90	9.07	7.55	78.10
Triple Hybrid	Mineral N (100%)	189.9	13.38	14.45	4.25	32.28	29.11	3.51	2.88	12.70	16.44	82.17	16.75	9.37	74.54
	Mineral N (75%) + Nano N (25%)	195.2	13.27	17.25	4.23	34.92	30.02	2.97	2.28	14.27	17.71	76.73	13.45	9.12	75.23
	Mineral N (50%) + Nano N (50%)	194.4	13.02	14.80	4.17	30.95	28.23	2.77	2.19	11.20	13.83	78.48	15.13	8.71	75.46
	Mineral N (25%) + Nano N (75%)	183.2	12.85	12.93	3.92	28.17	25.25	2.38	1.94	8.92	11.41	80.32	16.47	8.17	75.53
	Nano N 100%	192.3	12.60	12.82	3.50	28.72	19.56	1.65	1.20	10.59	12.54	70.32	9.52	8.06	77.36
LSD at 5%		14.84	0.49	1.25	0.24	2.82	2.41	0.94	0.45	3.31	3.79	7.50	5.05	0.34	1.88

Table 10. Effect of interaction between organic manure(OM)fertilizer (%), maize cultivars and mineral nano fertilizers on yield, yield components and grain chemical contents during the two seasons (2015 and 2016).

Organic fertilizer	Varieties	Mineral, nano fertilizer	Plant height (cm)	No. of rows/ ear	Ear length (cm)	Ear diameter (cm)	No. of grains/ row	100-grain wt. (gm.)	Ear weight ton/fed	Grain yield. (ton/fed)	Straw yield (ton/fed)	Biological yield (ton/fed)	Shelling (%)	HI (%)	Protein (%)	Carbohydrate (%)
			1st season (2015)													
Organic 50%	Single hybrid	Mineral N 100%	164.4	13.10	15.60	4.20	31.90	37.67	4.52	3.61	7.21	11.73	80.13	32.13	8.68	75.91
		Nano N 25%+ mineral 75%	161.0	12.53	16.50	4.23	34.73	32.75	4.00	3.02	6.69	10.68	75.50	28.17	8.60	77.56
		Nano N 50%+ mineral 50%	155.6	12.57	15.53	3.97	31.47	35.90	4.07	3.00	5.46	9.53	73.37	31.10	8.17	76.23
		Nano N 75%+ mineral 25%	148.1	12.40	16.03	4.07	34.87	30.93	4.28	3.17	5.83	10.10	73.37	31.20	8.46	75.97
		Nano N 100%	164.1	12.83	15.77	4.17	30.47	32.05	4.72	3.63	6.12	10.84	76.63	33.60	8.02	78.62
	Triple hybrid	Mineral N100%	178.4	11.60	17.03	4.10	38.73	30.80	4.42	3.41	7.04	11.46	77.23	30.03	9.04	72.79
		Nano N 25%+ mineral 75%	185.1	12.53	17.30	4.27	38.60	27.05	4.45	3.42	7.54	12.00	76.33	29.87	8.75	75.66
		Nano N 50%+ mineral 50%	165.8	12.03	14.27	3.97	32.67	28.22	3.73	2.91	4.62	8.35	75.77	33.30	8.38	75.82
		Nano N 75%+ mineral 25%	156.3	12.00	14.23	3.93	31.80	28.58	3.34	2.63	5.96	9.31	78.87	28.43	8.46	76.10
		Nano N 100%	152.1	11.83	15.97	4.00	32.40	27.97	3.70	2.88	7.06	10.75	73.60	23.93	8.09	77.08
Organic 100%	Single hybrid	Mineral N 100%	176.8	12.53	17.30	4.50	36.67	37.40	5.09	3.99	6.89	11.98	77.93	32.93	8.90	75.16
		Nano N 25%+ mineral 75%	160.0	12.40	16.03	4.17	33.27	35.42	4.10	3.29	5.16	9.26	79.30	34.93	8.75	76.70
		Nano N 50%+ mineral 50%	164.9	12.73	16.50	4.13	35.93	32.70	4.91	3.73	6.01	10.92	76.33	34.00	8.31	76.66
		Nano N 75%+ mineral 25%	166.1	11.87	14.27	4.13	31.93	32.18	3.60	2.86	4.89	8.48	79.30	33.50	8.31	75.38
		Nano N 100%	162.3	12.33	15.77	4.20	34.13	33.63	4.15	3.25	5.63	9.78	78.33	33.53	8.02	78.19
	Triple hybrid	Mineral N100%	197.0	12.53	17.30	4.37	40.87	33.82	5.11	4.10	7.81	12.92	80.13	31.77	9.26	73.97
		Nano N 25%+ mineral 75%	200.3	12.77	17.37	4.43	39.97	33.53	5.33	4.41	6.60	11.93	82.73	37.27	8.97	75.14
		Nano N 50%+ mineral 50%	191.2	12.40	16.37	4.33	40.47	32.60	4.70	3.93	6.45	11.16	83.33	35.33	8.46	75.22
		Nano N 75%+ mineral 25%	182.1	12.27	16.60	4.13	39.07	29.87	4.42	3.51	6.54	10.95	79.33	32.10	8.75	75.45
		Nano N 100%	183.5	11.93	16.57	4.27	37.50	35.85	5.12	4.09	7.71	12.84	79.83	31.90	8.09	77.60
LSD at 5%			24.41	1.30	1.85	0.32	6.73	4.74	1.03	0.89	2.31	2.74	7.00	8.55	0.50	3.07

Table (10): cont.

Organic fertilizer	Vareities	Mineral, nano fertilizer	Plant height (cm)	No. of rows/ ear	Ear length (cm)	Ear diameter (cm)	No. of grains/ row	100-grain wt. (gm.)	Ear weight ton/fed	Grain yield. (ton/fed)	Straw yield (ton/fed)	Biological yield (ton/fed)	Shelling (%)	HI (%)	Protein (%)	Carbohy-drate (%)
									2nd season (2016)							
Organic 50%	Single Hybrid	Mineral N 100%	204.5	12.5	14.33	4.10	30.33	33.10	2.97	2.43	15.32	18.29	82.03	13.70	8.38	75.98
		Nano N 25%+ mineral 75%	175.1	12.90	14.63	4.33	30.67	30.50	2.18	1.68	9.31	11.48	79.17	15.90	8.31	76.17
		Nano N 50%+ mineral 50%	181.4	12.23	13.17	3.90	27.33	23.73	1.67	1.30	8.74	10.40	76.33	12.50	8.24	76.30
		Nano N 75%+ mineral 25%	170.0	13.47	13.00	3.33	29.20	23.87	1.60	1.11	11.24	12.84	65.23	8.680	7.59	77.70
		Nano N 100%	185.9	11.77	10.00	3.20	17.80	21.58	0.64	0.48	10.63	11.27	70.93	4.500	7.22	79.44
	Triple Hybrid	Mineral N100%	190.0	13.47	14.13	4.17	31.00	27.65	3.27	2.64	13.35	16.62	81.07	16.53	9.26	75.36
		Nano N 25%+ mineral 75%	180.3	12.90	15.83	4.13	31.93	31.97	2.64	2.05	12.44	15.08	77.40	1423	8.97	75.63
		Nano N 50%+ mineral 50%	197.2	13.57	14.10	4.23	32.17	29.37	2.62	2.16	10.35	12.96	82.27	17.13	8.80	76.36
		Nano N 75%+ mineral 25%	177.9	13.37	12.10	3.83	24.63	24.37	1.64	1.28	9.199	10.84	77.63	12.63	8.10	76.38
		Nano N 100%	194.3	12.60	13.37	3.20	31.67	16.35	1.26	0.80	13.89	15.15	62.03	5.167	7.95	78.52
Organic 100%	Single Hybrid	Mineral N 100%	193.8	12.53	14.10	4.13	32.10	28.42	3.74	3.09	10.90	14.63	82.90	22.27	8.75	75.66
		Nano N 25%+ mineral 75%	188.8	14.10	13.63	4.33	32.00	28.05	3.57	2.84	11.60	15.18	82.17	19.73	8.38	76.05
		Nano N 50%+ mineral 50%	189.8	12.63	14.17	4.03	31.07	26.95	2.34	1.86	9.641	11.98	79.20	16.87	8.38	76.02
		Nano N 75%+ mineral 25%	200.0	12.07	11.87	3.67	25.30	20.92	1.86	1.51	8.188	10.05	79.77	14.30	8.02	75.99
		Nano N 100%	198.5	12.23	12.80	4.00	26.67	28.48	1.87	1.52	10.40	12.27	80.87	13.63	7.88	76.76
	Triple hybrid	Mineral N100%	189.8	13.30	14.77	4.33	33.57	30.57	3.75	3.13	14.51	18.26	83.27	16.97	9.48	73.72
		Nano N 25%+ mineral 75%	210.2	13.63	18.67	4.33	37.90	28.08	3.30	2.51	16.94	20.24	76.07	12.67	9.26	74.83
		Nano N 50%+ mineral 50%	191.6	12.47	15.50	4.10	29.73	27.10	2.92	2.22	12.76	15.68	74.70	13.13	8.82	74.55
		Nano N 75%+ mineral 25%	188.5	12.33	13.47	4.00	31.70	26.13	3.12	2.60	9.66	12.78	83.00	20.30	8.24	74.68
		Nano N 100%	190.2	12.60	12.27	3.80	25.77	22.77	2.04	1.60	10.78	12.82	78.60	13.87	8.17	76.20
	LSD at 5%		20.99	0.70	1.77	0.35	3.99	3.41	1.33	0.63	4.68	5.26	10.60	7.14	0.49	2.66

7. Effect of the interaction between OM, maize cultivars and mineral, nano N fertilizers

Interaction between OM levels and mineral plus nano N fertilizers on the two maize cv. had a significant effect on yield and yield components as shown in **Table (10).** In the 1st season, at 100% OM, fertilized triple hybrid by 100% mineral N or 75% mineral plus 25% nano N fertilizers produced the highest plant ht., ear length, number of grains/row, ear weight/fed., grain, straw, biological yields per fed., protein (%) and protein yield/fed. However, fertilized single hybrid maize by 100% mineral**.**

N, at 50% OM, gave the maximum harvest index, number of rows/ear and 100 grain weight as well as ear diameter at 100% organic level. Whereas, the maximum value of shelling (%) was attained from fertlized triple hybrid maize cv. by 50% mineral plus 50% nano N fertilizerzs at 100% organic level.

In the 2nd season, adding 100% OM level, triple hybrid with 100% mineral N produced the highest values of ear diameter, ear weight/fed., grain yield/fed., shelling (%) and protein (%). While, fertilized the same maize cv. by 75% mineral plus 25% nano N fertilizers gave the highest values of plant height, ear length, number of grains/row, straw yeild/fed. and protein yield/fed. as shown in **Table (10).** The maximum of rows/ear were obtained from single maize hybrid. which ferilized by 100% mineral N fertilizer at the above mentioned organic level (100%). On the other hand, at 50% organic level, single hybrid maize cv. by 100% mineral N gave the highest values of 100-grain weight and biological yield/fed. In this respect, **Ali et al (2011)** came to similar trend.

REFERENCES

Admas, H., Gebrekidan H., Bedadi B., and Adgo E. 2015. Effects of organic and inorganic fertilizers on yield and yield components of maize at Wujiraba Watershed, Northwestern Highlands of Ethiopia. **Amer. J. Plant Nutr. Andfert. Tech., 5(1), 1-15.**

Ahmad, S., Khan, A.A., Kamran, M., Ahmad, I., Ali, S. and Fahad S. 2018. Response of Maize Cultivars to Various Nitrogen Levels**. Eur. Exp. Biol, 8(1), 1-4.**

Ali, K., Munsif, F., Zubair, M., Hussain, Z., Shahid, M., Din, I.U. and Khan, N. 2011. Management of organic and inorganic nitrogen for different maize varieties. **Sarhad J. Agric. 27(4), 525-529.**

Awadalla, A. and Morsy, A.S.M. 2016. Response of Some Yellow Maize Crosses to N-fertilizer Rates and Plant Densities at Toshka Region. **Egypt. J. Agron. 38(3), 337-354.**

Awdalla, H.A., El-Sheref, Gh.F.H. and Abd El-Hafeez, A.M. 2018. Response of some maize hybrids (*Zea mays* L.) to NPK fertilization. The **15th Inter. Conference of Crop Sci., Ain Shams Univ., Cairo, Egypt, Oct., pp. 1-70.**

Boateng, S.A., Zickermann, J. and Kornahrens, M. 2006. Poultry Manure Effect on Growth and Yield of Maize. **West Africa J. Applied Ecology. 9(1), 1-11.**

Emara, M.A.A., Hamoda, S.A.F. and Maha, M.A. Hamad 2018. Effect of nano-fertilizer and N-fertilization levels on productivity Egyptian cotton under different sowing dates. **The 15th Inter. Conference of Crop Sci., Ain Shams Univ., Cairo, Egypt, Oct., pp. 125-137.**

Fan, L., Wang, Y., Shao, X., Geng, Y., Wang, Z., Ma, Y. and Liu, J. 2012. Effects of combined nitrogen fertilizer and nano-carbon application on yield and nitrogen use of rice grown on saline-alkali soil. **J. Food, Agric. & Environ., 10(1), 558-562.**

Gomez, K.A. and Gomez, A.A. 1984. Statistical Procedures for Agricultural Research. 2nd Ed., Jhon Wiley and Sons Inc, New York, USA, **pp. 95-109.**

Guo M.Y., Liu, M.Z., Zhan, F.L. and Wu, L. 2005. Preparation and properties of a slow-release membrane-encapsulated urea fertilizer with superabsorbent and moisture preservation. **Indust. and Engin. Chem. Res., 44(12), 4206–4211.**

Habtegebrial, K., Singh, B.R. and M. Haile 2007. Impact of tillage and nitrogen fertilization on yield, nitrogen use efficiency of tef Eragrostis, Trotter and soil properties. **Soil Till. Res. 94(1), 55-63.**

Hassan, Kh.H. 1999. Response of maize cultivars to plant distribution under different salinity conditions at Siwa Oasis. **Annals Agric. Sci., Ain Shams Univ., Cairo, 44(1), 189-199.**

Hassan, Kh.H. 1998. Response of some maize cultivars to early planting dates under saline conditions at Siwa Oasis. **Annals Agric. Sci., Ain Shams Univ., Cairo, 43(2), 391-401.**

Hoffman, G.H., Prichard, T.L., Maas, E.V. and Meyer, H.L. 1986. Irrigation water quality options for corn on saline organic soils**. Irrig. Sci. 7(4), 265-275.**

Hoffman, G.H., Maas E.V., Prichard, T.L. and Meyer, H.L. 1983. Salt tolerance of corn in the sacramento-San Joaguin delta of California. **Irrig. Sci. 4(1), 31-44.**

Kandil, E.E.E. 2013. Response of some maize hybrids (*Zea mays* L.) to different levels of nitrogenous fertilization. **J. Appl. Sci. Res., 9 (3), 1902-1908**

Kareem, O.B., Jawando, E.K., Eifediyi, W.B. and Bello, Y Oladosu. 2017. Improvement of growth and yield of maize (*Zea mays*L.) by poultry manure, Maize variety and plant population. **Cercetări Agronomiceîn Moldova 4(172), 51-64**

Khan, M.A., Shirazi, M.U., Ali,M., Mumtaz, S., Sherin, A. and Ashraf. M.Y. 2006. Comparative performance of some wheat genotypes growing under saline water. **Pak. J. Bot., 38(5), 1633-1639.**

Khan, S., Khan, A., Jalal, F., Khan, M., Khan, H. and Badshah, S. 2017. Dry matter partitioning and harvest index of maize crop as influenced by integration of sheep manure and urea fertilizer. **Pure and Appl. Biology, 6(4), 1382-1396.**

Layek, J.A., Chowdhury, S.A., Ramkrushna, G.I. and Das, A. 2014. Evaluation of different lentil cultivars in lowland rice fallow under no-till system for enhancing cropping intensity and productivity. **Indian J. Hill Farming 27(2), 4-9.**

Layek, J., Ramkrushna, G. I., Suting, D., Ngangom, B., Krishnappa, R., De, U. and Das, A. 2016. Evaluation of Maize Cultivars for their Suitability under Organic Production System in North Eastern Hill Region of India. **Indian J. Hill Farming, 29(2), 19-24.**

Maas, E.V. and Hoffman, G.J. 1977. Crop salt tolerance-current assessment. **J. Irrig. Drain. Div. ASCE, 103(2), 115-134.**

Munyabarenzi, I. 2014.Effect of farmyard manure and mineral fertilizers on maize yield and soil properties in huye and bugesera districts of Rwanda. M.Sc. Kenyatta Univ., Kenya**, pp. 40-44.**

Ogola, J.B.O., Wheeler, T.R. and Harris, P.M. 2002. Effects of nitrogen and irrigation on water use of maize crops. **Field Crop Res. 78(2-3), 105-117.**

Ombódi, A. and Saigusa, M. 2000. Broadcast application versus band application of polyolefin-coated fertilizer on green peppers grown on andisol. **J. Plant Nutr., 23(10), 1485–1493.**

Shahrokhi, M. and Khorasani, S.K. 2013. Comparison of Yield and Yield Component on Maize (*Zea mays* L.) Generations between Saline Condition and Normal Condition. **Intl. J. Agron. Plant. Prod. 4 (3), 399-404.**

Soliman, F.H.S., Abd El-Aal, A.I.N., Mohamoud, A.A., Ahmed, A.A. and Abd-El-Moula, M.A. 2004. Maize production in New land at Toshka and East El-Ewinat regions. **Fac. Agric. Cairo Univ., 55(2), 237-264.**

Soltner, D. 1985. Phytotechniegénérale, les bases de la production végétale. **Le Sol. 13th Ed., Angels, France, 338p.**

Teodorescu, M., Lungu, A. and Stanescu, P. O. 2009. Preparation and properties of novel slow-release NPK agrochemical formulations based on poly(acrylic acid) hydrogels and liquid fertilizer. **Indust. and Engin. Chem. Res., 48(14), 6527–6534.**

Trenkel, M.E. 1997. Controlled-release and stabilized fertilizers in agriculture. **Inter. Fert. Indus. Asso., Paris, pp. 47-53.**

Uzoma, K.C., Inoue, M., Andry, H., Fujimaki, H., Zahoor, A., and Nishihara, E. 2011. Effect of cow manure biochar on maize productivity under sandy soil condition. **Soil Use and Manag., 27(2), 205-212.**

Wapa, J. M. 2014. Effects of mineral fertilizer and different sources of organic manure combination on the growth and grain yield of maize in Sudano-Sahelian savanna, **Nigeria. Inter. J. Agric. Innov.and Res., 2(6), 1096-1100.**

Waseem, M., Ali, A., Tahir, M., Naeem, M., Ayub, M., Iqbal, A., Mohsin, A.U., Rehman, H., Ali, M., Ghaffari, A., Sarwar, M.A., and Khaliq, A. 2012. Consequences of diverse use of nitrogen sources on grain yield, quality and growth attributes of hybrid maize (*Zea mays*). **African J. Biotech. 11 (65), 13372-13386.**

Wu, L. and Liu M. 2008. Preparation and properties of chitosancoated NPK compound fertilizer with controlledrelease and water-retention. **Carbohydrate Polymers, 72(2), 240–247.**

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إستجابة صنفى الذرة الشامية للتسميد العضوى والنيتروجينى المعدنى والنانو تحت ظروف واحه سيوه

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الموجـــــز

أجريت تجربتان بمحطة مركز بحوث الصحراء بمنطقة تجزرتى – واحه سيوه بمحافظة مطروح خلال موسمى الزراعة المتتاليين 2015، 2016.

أجريت التجربتان لدراسة استجابة صنفى الذرة الشامية هجين فردى 131، هجين ثلاثى 329 لمستويات التسميد العضوى (15، 30 م^3/ فدان)، وخمس معاملات للتداخل بين التسميد النيتروجينى المعدنى الموصى به (120 وحده ازوت) والنانو (500 ملجرام/ لتر) وكانت المعاملات كالتالى 100 % نيتروجين معدنى، 75% نيتروجين معدنى+ 25% نيتروجين نانو، 50% نيتروجين معدنى+ 50% نيتروجين نانو، 25% نيتروجين معدنى + 75% نيتروجين نانو، 100% نيتروجين نانو. وقد أضيف التسميد النيتروجينى المعدنى على ثلاث دفعات متساوية مع الرش بالنيتروجين النانو بعد 30، 45، 60 يوم من الزراعة. وقد وضعت المعاملات فى تصميم قطع منشقة مرتين فى ثلاث مكررات وكان التسميد العضوى فى القطعة الرئيسية، واصناف الذرة فى القطعة الشقية الاولى ومعاملات التداخل بين التسميد المعدنى والنيتروجين النانو فى القطعة تحت الشقية، وقد تم أخذ القراءات التالية عند الحصاد: ارتفاع النبات/ سم، عدد صفوف الكوز، طول وقطر الكوز/ سم ، عدد حبوب الصف ، وزن 100 حبه/جم، محصول الكيزان والحبوب والقش والبيولوجى طن/ للفدان، النسبة المئوية للتصافى، دليل الحصاد.

أشارت النتائج الى زياده كل من طول الكوز، دليل الحصاد، النسبة المئوية لبروتين الحبوب مع زياده مستوى الماده العضوية فى الموسم الثانى فقط مع زياده غير معنوية عند مستوى معنوية 5% فى معظم صفات المحصول فى الموسمين. وقد أعطى الهجين الثلاثى أعلى قيمه فى كل الصفات تحت الدراسة ماعدا عدد صفوف الكوز ودليل الحصاد فى الموسم الاول ووزن 100 حبه ومحتوى الكربوهيدرات فى موسمى النمو مع عدم وجود أختلافات معنوية مع الهجين الفردى فى معظم القراءات. وقد أدى التسميد المعدنى والنانو الى زيادة كل الصفات ماعدا محتوى الحبوب من الكربوهيدرات مع زياده نسبة التسميد المعدنى او نقص التسميد النانو. وقد أدى التسميد النيتروجينى المعدنى 100% او 75 % معدنى+ 25% نانو أعلى قيم لكل من ارتفاع النبات، عدد صفوف وطول وقطر الكوز، ووزن 100 حبه، ومحصول الحبوب والكيزان، والمحصول البيولوجى، نسبة التصافى ودليل الحصاد فى كلا الموسمين، بينما أعطى التسميد النانو أعلى قيم لمحتوى الكربوهيدرات فى موسمى النمو.

الكلمات الدالة: الذرة الشامية، الاصناف، التسميد العضوى، المعدنى، النانو، النيتروجينى.

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