3 Response of Maize to Mineral Nitrogen and Bio- Fertilization

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Received: 30/11/2016
Accepted: 13/3/2017

TWO FIELD experiments were carried out during the summer seasons 2013and 2014 at the Experimental Farm of Sakha Agricultural Research Station to study the physiological attributes, yield and yield components of maize as affected by bio and mineral nitrogen fertilizers. The applied experiment was designed as complete randomized block design with four replications. The experiment included 10 treatments:60 kg N/fed.+ Cerealin (C), 60 kg N/fad.+ Microbien (M), 60 kg N/fad. + Rizobacterien (R), 80 kg N/fad. + Cerealin (C), 80 kg N/fad. + Microbien (M), 80 kg N/fad.+ Rizobacterien (R), 80 kg N/fad.+ Cerealin (C), 100 kg N/fad.+ Microbien (M), 100 kg N/fad.+ Rizobacterien (R) and 120kgN/fad. Grain maize (hybrid S.C.128) were sown in 14 and 16 July in both seasons. The results revealed that, application of 100 kg N+ bio-fertilizers Rizobacterien caused a significant increase in most studied characteristics in both seasons. This can greatly benefit farmers in an area where supply of nitrogen fertilizer is low and cases where farmers cannot afford the cost of high fertilizer input reduced the use a of chemical fertilizer and reduce the harmful effect on human health.

Keywords Maize, N fertilizer, Bio-fertilization , Growth, Yield .

INTRODUCTION

Maize (*Zea mays* L) or corn is the most important cereal crop in Egypt after rice and wheat. Maize is high yielding, easy to process, readily digested and cheaper than other cereal crops. It is also a versatile crop, growing across a range of agro ecological zones. Every part of the maize plant has economic value which the grain, leaves, stalk, tassel and ear can all be used to produce a large variety of food and non-food production (El-Kholy *et al.,* 2005).

Nitrogen is an important element for plant development and growth. In Egypt, maize crop needs huge amount of nitrogen fertilizer which is the important issue to increase production costs as well as environmental pollution that caused many hazards to human health. Therefore, considerable attention has been paid on the decrease of chemical N- fertilizers and substitute them with organic and biological fertilizers. There is a wide spread interest in the use of combination of mineral and bio-fertilizers as an alternative and cheap sources to chemical fertilizers (Boddey & Dobereiner, 1988).

A bio-fertilizer is a material containing microorganisms added to the soil which directly or indirectly make certain essential elements available to plants for their nutrition. Various sources of bio-fertilizers include nitrogen fixers, phytostimulators, phosphate solubilizing bacteria, plant growth promoting rhizobacteria (Shekh,2006).Application of bio-fertilizers become of great necessity to get a yield of high quality and to avoid the environmental pollution (Shevananda, 2008).

MATERIALS AND METHODS

Two field experiments were carried out during the summer seasons 2013 and 2014 at Experimental Farm of Sakha Agricultural Research Station to study the growth attributes, yield and yield components of maize plant. The experimental design was complete randomized block design with four replications. The experiment included 10 treatments:-

1-60 kg N/ fad +Cerealin (C) (50%mineral).

2- Fertilizer 60 kg N/ fad+ Microbien (M)(50 % mineral).

3- Fertilizer 60 kg N/ fad+ Rizobacterien (R) (50 % mineral).

4- Fertilizer 80 kg N/ fad + Cerealin (C)(66 % mineral).

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DOI :10.21608/agro.2017.427.1046

5- Fertilizer 80 kg N/ fad + Microbien (M) (66 % mineral) .

6- fertilizer 80 kg N/ fad + Rizobacterien (R)(66 % mineral).

7- Fertilizer 100 kg N/ fad + Cerealin (C) (83 % mineral) .

8- Fertilizer 100 kg N/ fad.+ Microbien (M) (83 % mineral).

9- Fertilizer100 kg N/ fad.+ Rizobacterien (R)(83%mineral).

10- Fertilizer120 kg N/ fad (100 % mineral).

The preceding crop was wheat in the two seasons. The size of each plot was 14m^2 included 5 rows (4 m length and 0.7m width). The maize grains *i.e.* single cross 128 cultivar (S.C.128) were sown in hills 25cm apart at 14th and 16th July in both seasons at a rate of 10 kg of grains in both seasons. The experiment was irrigated six times, where the first irrigation was applied 21days after sowing and the following irrigations were applied every 15 days. The plants were thinned to one plant/ hill before the first irrigation producing 24000 plants/fad. The other mineral fertilizers were applied at the recommended levels, *i.e*.30 kg P_2O_5/fad. Superphosphate forms of calcium superphosphate (15% P_2O_5) was added before planting. The mineral N fertilizer was applied to the soil at the tested levels in the form of urea (46.5%N) and added in two equal split at first and second irrigations thinning (21 days after sowing, DAS). Grains were inoculated with the tested bio-fertilizer at a rate of 30g /kg grains from Cerealien, Microbien and Rizobacterien using sugar solution as an adhesive agent. Grains were left for drying before sowing far from direct sunlight and irrigated directly after sowing. The bio-fertilizers used in the present study are produced by the General Organization for Agricultural Equalization Fund, Ministry of Agriculture. It consist of mixture of N_2-fixing bacteria *e.g.,* Ceralien contant (*Azotobacter* and *Azospirllum*). Microbien content *(Azospirllum* sp. and *Bacillus megatherium*). Rhizobacterien content (*Azotobacter Chroococcum* and *Azospirillum brasilense*). Soil samples (Table 1) were randomly taken from the experimental area at depth of 0 to 30 Cm from soil surface and were analyzed for both physical and chemical contents according to Page *et al.* (1982).At 30 , 45 and 65 days five plants were taken at random from each plots to determine the following characters:- plant height(cm), leaf area (dm^2) and chlorophyll content (a, b and total Chl.). (Moran 1982).

Yield and Yield Components

At harvest ten guarded plants were taken from the 2nd and 3th ridges in each plot to determine plant height (cm), ear height (cm), ear weight (g), ear length (cm), ear diameter (cm) , 100-grain weight (g) , grain weight ear (g) and grain yield (ard/fad).

Chemical analysis

(0.5 g) of plant material was wet-digested with H_2SO_4-H_2O_2 mixture (Lowther, 1980) and the following determination were carried out in the digested solutions to determine the following:-

1- Nitrogen in grains was determined using the modified "Micro Kjeldahl" method according to A.O.A.C.(1990).

2-Phosphorus was calorimetrically estimated by using stannous chloride reduced ammonium sulphomolybdate method(the method of Kuttner & Lichtenstein; 1932 as described by Humphries, 1956 and adopted by Haroun, 1985).

3-Potassium was determined using a flame-photometer as described by Jackson (1973).

4-The total nitrogen in grains of wheat was determined using Micro-Kjeldahl method and multiplied by 5.85 to obtain the percentage of grain protein according to A.O.A.C.(1990).

5-Grain carbohydrate %was determined according to Dubois *et al*.(1956).

Statistical analysis

All data were statistically analyzed according to the technique of analysis of variance (ANOVA) as published by Gomez & Gomez(1984).

RESULTS AND DISCUSSION

Growth characteristics

Data in Tables 2 and 3 showed that, plant height, leaf area, chlorophyll a, chlorophyll b and total chlorophyll at 30 and 45 days after sowing was significantly affected by different fertilization treatments in both growing seasons. The highest values were obtained by using 100 kg N /fad.+ Rizobacterien in the two

growing seasons. This increase may be due to the fact that, bio-fertilizers led to increase in nitrogen fixation of growth promoting substance and enhancing nutrient uptake. Using suitable N (100 kg N /fad) as 83 % mineral plus bio-fertilizers resulted in enhancing growth characteristics of maize plants rather than application of mineral N alone

The fertilizer could benefit the plant growth through, fixing molecular nitrogen and its transfer to the plant as direct effect on growth hormones auxins (GA_3) and (CK) that bacteria could release in the root media and effect its growth and expansion positively. The present results are in agreement with those obtained by Abdel Gader (2007), Shah *et al.*(2009) and Yasin *et al*.(2012).

Effect on ear leaf

The results in Table 4 indicate that, ear leaf area, chlorophyll a, chlorophyll b and total chlorophyll was significantly affected by 83% mineral fertilizers + bio-fertilizers followed in a descending order by 50% in the first and second seasons. These results are in agreement with those obtained by Gholomi *et al.*(2012) who reported that the improving effect of N mineral fertilizers can be attributed to their influence in increasing the organic matter in the soil. Also, Khan *et al.*, (2008) found that bio-fertilizers help in availability of mineral and their forms in the composted material and increase levels of extractable concentration of chlorophyll from leaves. Generally, the enhancing effect of N fertilization may be due to the positive effect of nitrogen on activation of photosynthesis and metabolism of organic compounds that encourage plant development.

Yield characteristics

Data in Table 5 indicate that, the number of days to 50% and 100% silking, plant height at harvest, ear height and ear length were greatly affected by mineral nitrogen fertilizers and bio-fertilizers in the two seasons of this study. The highest value of yield was obtained with maize plants receiving 83%mineral nitrogen fertilizers plus bio fertilizers compared with 100% mineral nitrogen fertilizers in the first and second seasons.

The interaction of N_2-fixing bacteria with other bacteria could also inhibit their diastrophic activity (Ragab & Ibrahim, 2009). Soil microbial cultures with similar or different functions might express beneficial actions in a soil or Rizobacterien (Hassan *et al.,* 2013).

Ear diameter, ear weight, 100-grain weight, ear grain weight and grain yield fad^{-1}

The data in Table 6 clearly showed that, all the characteristics, *i.e.,* ear diameter, ear weight, 100- grain weight, ear grain weight and grain yield/ fad were significantly affected by fertilization treatments in the two seasons of this study. The highest mean values of these were obtained by application of 100 kg N fad.$^{-1}$ with bio-fertilizer (Rizobacterien). Salomone & Dobereiner (2004) and Gomaa *et al.* (2013) reported that, photosynthetic activity is stimulated through symbiosis with microorganisms in inoculated plants that increases three efficiency of photosynthetic nitrogen. Therefore, it may be concluded that photosynthetic capacity of plants treated with N_2 fixing microorganisms increases due to increased supply of nitrogen nutrition. Grain weight also increases due to better transfer of photosynthetic substances. The content of corn seeds in terms of conservation of plant materials is a function of number of endosperm and starch granules generated 10 to 14 days after pollination (Hay & Gilbert, 2001).

Grain carbohydrate %, grain protein %, N%, P% and K%

Increasing mineral nitrogen rates from 60 to 100 kg / fad and inoculation grain maize with bio-fertilizers gave the highest mean values of grain carbohydrate %, protein %, N %, P % and K%. in both seasons. The favorable effect of nitrogen on grain quality might be due to that nitrogen increases photosynthetic pigments content and photosynthesis rate, which in turn increased the amount of metabolites synthesized and consequently resulted in higher dry matter accumulation in grains. Also, these results might be due to the important role of nitrogen in the activation synthesis of protein and many other compounds including starch, sugar, cellulose, cell wall and vitamins. Also, K encourages various enzymes and photosynthesis as well as plant root development. These results are in agreement with those obtained by Ibrahim *et al*. (2009) and Ewais *et al.* (2015).

TABLE1. Physical and chemical properties of soil at experimental site during 2013 and 2014 seasons.

Determination 2013		Season 2014	
Mechanical analysis	Sand%	27.06	21.37
	Silt%	28.34	31.45
	Clay%	44.60	47.18
	Textural class	Clay	Clay
Chemical analysis	PH	8.37	8.21
	EC ds.m^{-1}(soil paste)	3.25	3.09
	Organic matter %	1.65	1.60
	Total nitrogen mg/kg	510.00	490.00
	Available P mg/kg	15.00	17.14

TABLE2. Effect of mineral nitrogen and bio-fertilizers on some growth characteristics at 45 days after planting in 2013 and 2014 seasons .

Treatment	2013season					2014 seasoո				
	Plant height (cm)	Leaf area (dm)^2	Chl. a	Chl. b	Total chl.	Plant height (cm)	Leaf area (dm)^2	Chl. a	Chl. b	Total chl.
			mg/dm^{2}L A					mg/dm^{2}L A		
kg N / fad.+ C 60	45.0 d	18.957 d	1.404 h	0.840g	2.244 g	48.5 f	16.753e	1.217 j	0.728 g	1.945 h
kg N/ fad.+ M 60	45.8 d	20.323 d	1.443 g	0.864fe	2.307 g	49.5 ef	18.840d	1.262 i	0.811fg	2.073 gh
kg N /fad. + R 60	47.5 d	22.657 d	1.454 g	0.909fg	2.363 fg	52.4 e	21.407d	1.297 h	0.856 efg	2.153 g
kg N/ fad.+ C 80	50.8 c	23.119 c	1.488 f	0.922 efg	2.410 ef	56.5 d	22.070cd	1.341 g	0.831 def	2.172 f
kg N /fad.+ M 80	51.8 c	25.607 b	1.501 ef	0.938 def	2.439 e	58.2 cd	24.627bc	1.365 f	0.835 de	2.200 ef
kg N / fad.+ R 80	55.0 c	26.334ab	1.527 e	1.003cde	2.530 de	63.0 c	26.077ab	1.415 e	0.929 cd	2.344 e
kg N / fad.+ C 100	57.0 b	27.302 ab	1.542 d	1.013 cd	2.555 cd	65.8 b	26.837ab	1.441 d	0.947 bc	2.388 d
kg N /fad. + M 100	57.0 b	27.349 ab	1.570 c	1.046 bc	2.616 bc	67.0 b	27.183ab	1.478 c	0.987 b	2.465 c
kg N / fad. + R 100	61.7 a	28.258 a	1.616 a	1.144 a	2.760 a	73.9 a	28.230a	1.552 a	1.099 a	2.651 a
.kg N / fad 120	58.0 a	27.460 ab	1.584 b	1.118 ab	2.702 ab	68.8 b	27.757ab	1.508 b	1.064 a	2.572 b
L.S.D at 5%	2.83	2.216	0.016	0.081	0.090	3.24	3.100	0.014	0.075	0.073

TABLE 3 . Effect of mineral nitrogen and bio-fertilizers on some growth characteristics at 45 days after planting in 2013 and 2014seasons .

Treatment	2013 season					2014 season				
	Plant height (cm)	Leaf area (dm)^2	Chl. a	Chl. b	Total chl.	Plant height (cm)	Leaf area (dm)^2	Chl. a	Chl. b	Total chl.
			mg/dm^{2}L A					mg/dm^{2}L A		
kg N /fad + C 60	80.5 e	22.490 d	1.857e	1.096e	2.953e	78.0 h	23.74 f	1.396 j	0.960 f	2.356 j
kg N /fad + M 60	85.9 d	23.060 d	1.908d	1.125de	3.033de	84.1 g	24.59 ef	1.462 j	0.966 ef	2.428 h
kg N / fad + R 60	93.2 c	26.460 cd	1.922cd	1.151d	3.073d	93.5 f	28.78 def	1.531 h	1.028 e	2.559 h
kg N / fad.+ C 80	93.8 c	27.087 bcd	1.968c	1.192cd	3.160cd	94.5 ef	29.74cde	1.597 g	1.074 d	2.671 g
kg N/ fad + M 80	94.8 c	27.393 bcd	1.985bc	1.211c	3.196c	96.4 de	30.35cde	1.647 f	1.101 d	2.748 f
kg N / fad + R 80	100.2 c	28.680 bcd	2.019b	1.297bc	3.316bc	103.8 d	32.38 cd	1.733 e	1.202 c	2.935 e
kg N /f ed + C 100	101.0 b	28.753 abc	2.039ab	1.327b	3.366b	105.6 c	32.74 bc	1.782 d	1.241 bc	3.023 d
kg N /fad + M 100	102.0 ab	29.250 abc	2.072ab	1.361ab	3.433ab	108.5 bc	33.59 bc	1.844 c	1.284 b	3.128 c
kg N / fad+ R 100	105.5 a	33.253 a	2.137a	1.449a	3.586a	114.3 a	38.92 a	1.972 a	1.392 a	3.364 a
kg N / fad 120	103.6 ab	31.480 ab	2.095ab	1.429a	3.524ab	111.2 ab	36.49 ab	1.898 b	1.360 a	3.258 b
L.S.D at 5%	3.537	4.901	0.021	0.064	0.076	3.481	5.45	0.018	0.059	0.068

TABLE 4. Effect of mineral nitrogen and bio-fertilizers on some growth characteristics of ear leaf during 2013 and 2014 seasons

Treatment	2013 season				2014 season			
	Leaf area (cm)²	Chl. a	Chl. b	Total chl.	Leaf area (cm)²	Chl. a	Chl. b	Total chl.
		mg/dm²L A				mg/dm²L A		
kg N / fad. + C 60	5.044 c	2.722 f	1.823 c	4.545 e	4.425 e	2.638 g	1.823 c	4.461 d
kg N / fad. + M 60	5.165 c	2.846 ef	2.045 bc	4.891 d	4.575 e	2.785 fg	2.045 bc	4.830 cd
kg N / fad .+ R 60	5.891 c	2.948 ef	2.193 bc	5.141 d	5.320 e	2.941 ef	2.193 bc	5.134 cd
kg N / fad. + C 80	6.033 b	2.970 e	2.219 bc	5.189 d	5.500 d	2.991 def	2.219 b	5.210 bcd
kg N / fad. + M 80	6.099 b	2.996 de	2.603 ab	5.599 c	5.613 cd	3.045 de	2.603 a	5.648 abc
kg N / fad. + R 80	6.389 b	3.123 cde	2.717 a	5.840 c	5.989 cd	3.234 d	2.660 a	5.894 abc
kg N / fad. + C 100	6.405 b	3.199 bcd	2.766 a	5.965 b	6.059 bc	3.343 c	2.717 a	6.060 ab
kg N / fad. + M 100	6.524 b	3.229 bc	2.910 a	6.139 b	6.228 b	3.405 bc	2.860 a	6.265 ab
kg N / fad .+ R 100	7.461 a	3.447 a	2.927 a	6.374 a	7.251 a	3.701 a	2.924 a	6.625 a
.kg N / fad 120	7.052 a	3.356 ab	2.924 a	6.282 ab	6.792 a	3.573 ab	2.910 a	6.483 ab
L.S.D at 5%	4.96	0.196	0.419	0.263	4.619	0.203	0.359	0.991

TABLE 5. Effect of mineral nitrogen rates with and without bio-fertilizers on some yield components in 2013 and 2014 seasons.

Treatment	2013 season					2014 season				
	No. of days to 50% silking	No. of days to 100% silking	Plant height (cm)	Ear height (cm)	Ear length (cm)	No. of days to 50% silking	No. of days to 100% silking	Plant height (cm)	Ear height (cm)	Ear length (cm)
kg N / fad. + C 60	73.0 **e**	77.0 **d**	248.8 **b**	85.1 e	19.13 **b**	71.5 **g**	79.0 **e**	267.5 **c**	94.0 **d**	21.33 **c**
kg N / fad. + M 60	73.0 **e**	77.0 **d**	255.3**ab**	89.5 **d**	19.65**ab**	72.5 **fg**	80.0 **e**	274.8 **c**	96.5**cd**	21.39**bc**
kg N / fad .+ R 60	75.3**de**	80.5**d**	259.5**ab**	90.8**d**	20.70**ab**	75.8 **f**	85.0**e**	277.3**c**	97.8**cd**	23.51**bc**
kg N / fad. + C 80	75.7**cd**	81.0 **c**	261.3**ab**	91.6 **c**	20.83**ab**	77.2 **e**	86.3 **d**	277.8 **c**	99.5**bcd**	23.87**bc**
kg N / fad. + M 80	75.7**cd**	81.5**bc**	262.5**ab**	92.9**bc**	20.98 **ab**	77.7 **de**	87.7**d**	280.5**c**	102.5**abc**	24.02**bc**
kg N / fad. + R 80	76.7 **c**	83.5 **bc**	267.5 **b**	93.3**bc**	21.78 **ab**	80.8 **d**	92.0**cd**	288.5 **c**	103.5**abc**	24.36 **bc**
kg N / fad. + C 100	79.3 **b**	83.5 **abc**	272.0 **b**	94.9 **b**	21.83**ab**	83.8 **c**	92.7**bc**	289.5**bc**	106.3**abc**	24.85 **b**
kg N / fad. + M 100	79.7**ab**	84.5**ab**	278.0**ab**	95.2 **b**	22.43 **b**	85.2 **bc**	95.0 **b**	310.0**bc**	108.5**ab**	25.11 **b**
kg N/ fad .+ R 100	81.7 **a**	86.5 **a**	290.8 **a**	97.8 **a**	23.25 **a**	88.7 **a**	99.0 **a**	339.0 **a**	113.3 **a**	31.52 **a**
.kg N / fad 120	80.3**ab**	84.5**ab**	278.5**ab**	95.3**ab**	22.60**ab**	86.3 **ab**	95.7**ab**	322.5**ab**	111.3**ab**	25.96**ab**
L.S.D at 5%	2.15	3.31	32.37	11.13	3.73	2.15	3.75	36.95	11.76	2.90

TABLE 6. Effect of mineral nitrogen rates with and without bio-fertilizers on yield and its components in 2013 and 2014 seasons.

Treatments	2013 season					2014 season				
	Ear diameter (cm)	Ear weight (g)	100-grain weight (g)	Ear grain weight (g)	Grain yield (ard./fad)	Ear diameter (cm)	Ear weight (g)	100-grain weight (g)	Ear grain weight (g)	Grain yield (ard./fad)
60 kg N / fad+ C	5.90 cd	134.7 d	35.9 d	120.5 d	17.01 i	6.50 cd	141.5 d	36.0 e	121.0d	17.90 d
60 kg N / fad + M	6.48 cd	143.4 d	36.6d	124.9 d	18.11 hi	6.90 c	151.2 cd	37.3 de	127.8d	19.10 cd
60 kg N / fad + R	6.70 bcd	152.2 c	38.1cd	134.5 cd	19.23 gh	7.30 b	162.7 cd	40.0 de	138.0cd	20.55 cd
80 kg N / fad + C	7.00 bcd	156.0 cb	38.7 bcd	137.3 cd	19.70 fg	7.48 b	170.2 cd	40.8 cde	144.5c	21.50 bcd
80 kg N / fad + M	7.28 abc	163.3 bc	39.3 bcd	144.7 c	20.63 ef	7.60 cb	177.8 bc	41.5 cde	153.8bc	22.45 bcd
80 kg N / fad + R	7.43 abc	175.7 b	40.4 bc	149.9 c	22.19 de	7.77 b	181.9 bc	43.8 bcd	160.8b	22.98 abc
100 kg N / fad + C	7.68 ab	181.6 b	41.1 b	157.6 c	22.93 cd	7.80 b	196.7 b	45.0 abc	170.5ab	24.85 abc
100 kg N / fad + M	7.73 ab	188.7 b	41.9 b	170.9 b	23.84 bc	7.82 b	198.6 b	46.3 abc	185.8ab	25.08 ab
100 kg N / fad + R	8.30 a	201.3 a	47.7 a	192.7 a	25.43 a	8.43 a	202.3 a	49.8 a	196.0a	25.55 a
120 kg N / fad	8.28 a	194.8 a	42.5 b	187.6 ab	24.60 ab	8.13 ab	200.1 ab	48.5 ab	187.0ab	25.28 a
L.S.D at 5%	1.37	6.57	3.60	7.58	1.510	1.72	5.49	6.02	6.1	4.08

TBLE 7 . Effect of mineral nitrogen rates with and without bio-fertilizers on grain carbohydrate, grain protein, N, P and K in 2013 and 2014seasons.

Treatments	2013 season					2014 season				
	Carbohydrate %	Protein %	N %	P %	K %	Carbohydrate %	Protein %	N %	P %	K %
60 kg N /fad + C	82.39 a	10.59 d	1.810 c	0.471 de	0.677 d	85.02 a	12.44 d	2.126 ef	0.515 de	1.068de
60 kg N / fad + M	79.73 ab	11.33 cd	1.936 c	0.562 d	0.717 c	82.37 a	12.95 d	2.214 e	0.575 d	1.128d
60 kg N / fad + R	77.90 b	11.37 cd	1.944 c	0.567 cd	0.723 c	81.24 ab	13.45 cd	2.299 de	0.581 cd	1.157cd
80 kg N / fad + C	77.70 b	11.60 c	1.984 c	0.577 cd	0.727 bc	80.80 ab	14.38 c	2.458 d	0.602 c	1.211c
80 kg N / fad + M	72.49 c	12.62 bc	2.157 bc	0.663 c	0.807 b	80.71 ab	15.25 bc	2.607cd	0.653bc	1.233 bc
80 kg N / fad + R	71.71 c	13.16 b	2.249 b	0.693 bc	0.856 b	73.46 b	15.31 bc	2.617c	0.662 b	1.267 b
100 kg N / fad + C	65.85 d	13.93ab	2.382ab	0.740 b	0.879 ab	70.96 b	16.11 b	2.754 bc	0.665b	1.354 ab
100 kg N / fad + M	64.30 d	14.41 ab	2.463ab	0.747 ab	0.883 ab	70.18 b	16.18ab	2.766 b	0.724ab	1.379 ab
100 kg N / fad+ R	63.93 d	15.27 a	2.610 a	0.807 a	0.921 a	69.71 bc	16.85a	2.880 a	0.743 a	1.449 a
120 kg N / fad	57.68 e	14.72 a	2.516 a	0.750 ab	0.902 a	62.90 c	16.25ab	2.778 ab	0.729ab	1.447a
L.S.D at 5%	3.342	1.268	0.249	0.057	0.086	11.44	1.426	1.426	0.114	0.083

CONCLUSIONS

Through this study it can be recommended using bio-fertilizer (Rizobacterien) with the addition of nitrogen fertilizer at rate of 100 kg fad^{-1}. which contributes to saving production costs by reducing the amount of chemical fertilizer addition and to minimizing the potential risk of environmental pollution coupled with the manufacture of chemical fertilizers.

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استجابة الذرة الشامية للتسميد النيتروجينى المعدني والحيوي

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أقيمت تجربتين حقليتين بمزرعة محطة البحوث الزراعية بسخا-محافظة كفر الشيخ خلال موسمي الدراسة 2014،2013م لدراسة تأثير التسميد النتيروجينى المعدني والحيوي على النمو والمحصول في الذرة الشامية صنف هجين فردى 128 ابيض .وكان التصميم الاحصائى المستخدم قطاعات كاملة العشوائية في أربع مكررات .وكانت المعاملات كالتالي:

1- التسميد النتيروجينى المعدني بمعدل 60كجم/ فدان (50 % معدني) + السيريالين.

2- التسميد النتيروجينى المعدني بمعدل 60كجم/ فدان (50 % معدني) + الميكروبين.

3- التسميد النتيروجينى المعدني بمعدل 60كجم/ فدان (50% معدني) + الريزوباكتيرين.

4- التسميد النتيروجينى المعدني بمعدل 80كجم/ فدان (66% معدني) + السيريالين.

5- التسميد النتيروجينى المعدني بمعدل 80كجم/ فدان (66 % معدني) + الميكروبين.

6- التسميد النتيروجينى المعدني بمعدل 80كجم/ فدان (66 % معدني) + الريزوباكتيرين.

7- التسميد النتيروجينى المعدني بمعدل 100كجم/ فدان (83 % معدني) + السيريالين.

8- التسميد النتيروجينى المعدني بمعدل 100كجم/فدان(83 % معدني) + الميكروبين.

9- التسميد النتيروجينى المعدني بمعدل 100كجم/فدان (83 % معدني)+ الريزوباكتيرين.

10- التسميد النتيروجينى المعدني بمعدل 120كجم/فدان (100 % معدني).

تم اخذ قراءات حقلية عند عمرى30 ،45يوم من الزراعة وذلك لتقدير المساحة الورقية /نبات وطول النبات ومحتوى الأوراق من صبغات الكلوروفيل .كما تم حساب عدد الأيام من الزراعة حتى طرد الحريرة 50%و 100% من النباتات. وأخذت قراءات على ورقة الكوز(عند عمر 65يوم من الزراعة) حيث قدرت المساحة الورقية وتركيز صبغات الكلوروفيل وعند الحصاد قدرت بيانات المحصول ومكوناته حيث قدر كل من طول النبات عند الحصاد ،ارتفاع الكوز ،طول الكوز،وزن الكوز،قطر الكوز،وزن حبوب الكوز ،وزن ال 100حبة ،

كمية محصول الحبوب بالإردب /فدان.ومحتوى الحبوب من الكربوهيدرات والبروتين والنسب المئوية لكلا من النيتروجين والفوسفور والبوتاسيوم .

ويمكن تلخيص أهم النتائج المتحصل عليها في هذه الدراسة كالتالي:

1. تفوق التسميد النيتروجينى بمعدل 100كجم/ فدان مع خلط التقاوي قبل الزراعة بلقاح الريزوباكتيرين على التسميد النيتروجينى بمعدل 120كجم/ فدان في صفات محتوى الأوراق من صبغات الكلوروفيل وطول النبات والمساحة الورقية للنبات عند عمري30 ،45يوم من الزراعة وكذلك مساحة ورقة الكوز (عند عمر65يوم من الزراعة) ومحتواها من صبغات التمثيل الضوئي.

2.تفوق التسميد النيتروجينى بمعدل 100كجم/ فدان مع خلط التقاوي بالأسمدة الحيوية قبل الزراعة وخاصة لقاح الريزوباكتيرين على باقي المعاملات الأخرى . في صفات طول النبات عند الحصاد،ارتفاع الكوز ،طول الكوز،وزن الكوز،قطر الكوز،وزن حبوب الكوز ، وزن ال100حبة ،كمية المحصول الحبوب بالإردب /فدان. ومحتوى الحبوب من الكربوهيدرات والبروتين والنسب المئوية لكلا من النيتروجين والفوسفور و البوتاسيوم

3. من خلال الدراسة يمكن التوصية باستخدام الأسمدة الحيوية(الريزوباكتيرين) مع إضافة السماد النيتروجينى بمعدل 100كجم/ فدان مما يساهم في توفير تكاليف الإنتاج من خلال تقليل كمية السماد الكيماوي المضاف والحد من استخدام الأسمدة المعدنية باستخدام الأسمدة الحيوية والمحافظة على صحة الإنسان و البيئة.