FACULTY OF AGRICULTURE

Minia J. of Agric. Res. & Develop.
Vol. (43), No.4, pp 507- 519, 2023

INFLUENCE OF BIOFERTILIZATION AND MINERAL NITROGEN TREATMENTS ON MAIZE (*ZEA MAYS* L.) PRODUCTIVITY UNDER MINIA GOVERNORATE CONDITIONS

Abd El-Mageed, M.M.; Tantawy, A.A.; Dardeer, Eman, E.R. and Gomaa, Amal, D.
Agron. Dep., Fac. of Agric., Minia Univ., Egypt.

Received: 17 Sept. 2023 Accepted: 2 Oct. 2023

ABSTRACT

Two field trials were conducted for two successive seasons 2017 and 2018 at a private farm located in Menpal Village, Matay District, EL- Minia governorate, Egypt. To study the effect of three biofertilization treatments (control, Minia azotine and Nitrobine) with five mineral nitrogen fertilization levels (20, 40, 60, 80 and 100 kg/fed.) as well as their interactions on the growth, yield and yield components of maize (*Zea mays* L.) yellow SC Pioneer 999.

The results illustrated that all tested aspects of growth characters (plant height, stem diameter and leaf area) and yield and yield components (ear length, number of grains / row and grain yield) were significantly improved with applying biofertilizers relative to the check treatment in both seasons. Minia azotine biofertilizer was more effective than Nitrobine. In addition, all previous traits were significantly increased due to increasing nitrogen levels from 20 to 100 kg N/fed. in both seasons. Minia azotine plus fertilizing with nitrogen at 80 kg/fed. was the superlative interaction treatment for grain production of maize in both seasons. A result of this research confirms the importance of biofertilizers application to compensate for artificial fertilizers to boost crop yield and quality while minimizing environmental impacts.

Keywords: Biofertilization, Minia azotine, Nitrobine, Nitrogen, yield and yield components.

INTRODUCTION

Maize (*Zea mays* L.) is one of the most important cereal crops not only especially in Egypt but also worldwide, belongs to the *Poaceae* family. It is considered as a short duration and quick growing crop. It is the third-largest cereal crop in the world after rice and wheat. Maize is essential for livestock and human consumption as an available source of carbohydrates, oil and partly protein, **(Martin *et al*., 2006 and Abd El-Gawad and Morsy, 2017)**.

Generally, useing of biofertilizers in agriculture have many recompences: such as, it's most safe, decreased environmental contamination and potentially smaller risks for human health. Biofertilizers also are effective in small quantities, much more targeted activity, multiply themselves faster, however they are controlled by the plant as well as decompose indigenous more quickly than conventional fertilization systems, and finally, it can be used in an integrated or traditional agricultural management systems **(Berg, 2009; Abd El-Azeim *et al.*, 2023)**. *Azotobacter* ***spp.*** **are characterized by nitrogen fixation, siderophore , exopolysaccharide and IAA production, that improve the plant health and indol-3-acetic acid and exopolysaccharides (EPS) production** (Gauri *et al*., 2012)**. According to** Abd El-Azeim *et al.* (2023)**, biofertilizers are necessary to safeguard the soil, vegetation, and ecosystem due to the adverse effects of chemical fertilizers. In agriculture, where it is used as a biofertilizer, it may fix atmospheric nitrogen and convert it to ammonia for plant growth and soil stabilization.** Many researchers emphasized that using biofertilizers enhanced growth parameters and yield traits **(Singh *et al*., 2018; Mtaita *et al*., 2019; Hamza *et al.*, 2021; Abd El-Azeim *et al*., 2021; Sabur *et al*.**, **2021 and Kebede *et a1*., 2023)**.

Positive response of maize growth traits (leaf area, plant height, stem diameter and ear height) to nitrogen fertilizers had been reported by **Soleymanifard and Naseri, 2014; Jena *et al*., 2015; Krismawati, 2020; Kubheka *et al.*, 2020 and Ibrahim *et al*., 2022.** Also, the positive of mineral nitrogen fertilization on maize yield and yield components (ear length, ear diameter, number of rows / ear, number of grains / row and grain yield) were pointed out by **Sharifi and Taghizadeh, 2009; Aminzadeh and Namazari, 2013; Mohammadi *et al.*, 2014; Krismawat, 2020 and Adhikari *et al*., 2021**.

Therefore, the main aim of this study to determine the impact of different combination of mineral N fertilizer levels with biofertilizers , as well as their interactions on the growth traits, yield and its components of yellow maize SC Pioneer 999.

MATERIALS AND METHODS

The current investigation was conducted in Menpal Village, Mattay District, EL- Minia governorate, Egypt during two successive summer seasons of 2017 and 2018 to test the impact of three types of biofertilizers and five levels of inorganic nitrogen on growth parameters, yield, and its components of maize (*Zea mays* L.). A randomized complete block design (RCBD) was used, in a split-plot design with three replicates. The main plots (A) include 3 biofertilization treatments (control, Minia azotine and Nitrobine), while 5 levels of mineral nitrogen (20, 40, 60, 80 and 100 kg N/fed.) occupied the sub-plots (B). Each plot area was 10.5 m^2 (3.0 m length x 3.5 m width), including 5 ridges (equal to 1/400 of feddan). Therefore, the replicate contains 15 experimental units (3 x 5) and the total number of experimental units was 45 units in both seasons. The preceding winter crop was wheat in both seasons. Physical and chemical analysis of the experimental soil during both seasons of 2017 and 2018 were performed according to **Chapman and Pratt (1961); Avery and Bascomb (1982)** and presented in Table (1).

Grains of yellow maize SC Pioneer 999 were obtained from Pioneer Co. and sown on 1^{st} week of May in both seasons. Three grains were hand planted in each hill (25 cm spaces between hills) and thinned to six plants/1.0 m^2. The experimental units were hoeing twice after 15 and 25 days from planting, calcium super phosphate of 15.5% P_2O_5 at rate of 200kg./ fed. Was added during land preparation, the normal agricultural practices for growing maize i.e., irrigation, pest and diseases control were done as recommended by Ministry of Agriculture.

Two inner ridges was used for collecting data of growth characters, while the middle ridge for estimating yield and its components at harvesting time.

Biofertilizers, Minia azotine containing N-fixing bacteria; and Nitrobine contains two non-symbiotic nitrogen fixing bacteria, *Azotobacter chroococcum* and *Azospirillum barasilense*, were obtained from the Laboratory of Bio-fertilizers, Fac. of Agric., Minia Univ. Nitrobine was inoculated with maize grains before planting at rate of 100 g./ plot, while Mina azotine was sprayed at a rate of 5 L/fed. three times (one week after nitrogen application).

Each main plot was divided into five sub-plots as width strips, which occupied by nitrogen fertilizer treatments, nitrogen fertilizer used in the form of urea (46% N) and divided into 3 doses. The first one was added after thinning (18 days from planting), while the second and third doses were added with monthly intervals. The maize crop was harvested manually in the middle of August in both growing seasons.

Data recorded:

A. Growth characters: Five guarded plants were randomly chosen from the two inner rows of each sub-plot after 75 days from planting in both seasons and labeled, to be used in defining the following traits: plant height (cm), stem diameter (cm): using a venire caliper in determining stem diameter of the second internode; and leaf area of the top-most ear/plant (cm^2), according to **Alessi and Power (1975)** formula:

$$\text{Leaf area} = \text{leaf length} \times \text{maximum width} \times 0.75.$$

B. Yield and its components: The middle ridge of each sub- plot was harvested, and ears were collected, counted, and weighted. Samples of 10 ears were chosen at random from each sub- plot to determine the ear characters and yield components. The grains were separated, weighted, and adjusted to 15.5% moisture. The following data were recorded: ear length (cm), number of grains/rows and grain yield (ard/fed).

Statistical analysis:

The obtained data were tabulated and statistically analyzed according to **McIntosh (1983) and Gomez and Gomez (1984)** using the L.S.D. test at 5 % to compare between the treatments means as described by **Steel and Torrie (1980)**.

RESULTS AND DISCUSSION

1. Growth characters:

Data showed in Table (2) indicates that biofertilizer treatments had significant effect on all studied growth traits in both seasons, all growth traits i.e., plant height, stem diameter and leaf area were improved due to biofertilization in both seasons. Minia Azotine surpassed the other biofertilizer treatments for all previous traits in both seasons except stem diameter and leaf area in the second one. The enhancement of growth aspects attributed to supplying biofertilization may be since biofertilizers develop nutrient availability to plants either by rising primary nutrient liberate in the root area or by facilitating nutrient absorption and uptake **(Kebede *et a1*., 2023)**. Our results are in agreement with those mentioned by **Soleimanzadeh and Ghooshchi (2013); Maghsudi *et al*. (2014); Rodrigues *et al.* (2019); Abd El-Azeim *et al*., (2023); and Kebede *et a1*. (2023)**.

Concerning the impact of nitrogen fertilization, the presented data in Table (2) clarified that all abovementioned characters were significantly affected by mineral nitrogen levels treatments in both seasons. In most cases, there was an ascending order in growth parameters due to the increase in nitrogen level in both seasons and the treatment of 100 kg/fed. was more effective than other treatments in this concern without significant different between 80 kg/fed. in all traits. The enrichment in growth traits as a result of mineral nitrogen fertilization may be due to that N-fertilizer plays vital role on plant growth and cell division as promotes plant growth, increases the number of internodes and length of the internodes. These results are in agreement with those reported by **El-Hassanin *et al*. (2002); EI-Yazied *et al*. (2007); Onasanya *et al*. (2009); Sharifi and Taghizadeh (2009); Gasim (2011); Hafez and Abdelaal (2015); Krismawati (2020) and Ibrahim *et al*. (2022).**

The interaction between biofertilization and nitrogen treatments was not significant for leaf area, plant height and stem diameter in both seasons.

2. Yield and its components:

Data showed in Table (3) observed that yield and its components [ear length, number of grains / row and grain yield (ard/fed)] differed significantly as affected by biofertilizer treatments. Ear length, number of grains / row and grain yield (ard/fed.) was improved since applying biofertilizers to maize plant relative to the control treatment in both seasons. Minia azotine biofertilizer was superior to Nitrobine in this concern. The enhancement on maize productivity as a result to supplying biofertilization may be reflecting the stimulating effect of biofertilizers on increasing growth, consequently, increasing the transfer of photosynthetic products to the storage organs. Results of this study indicated that Minia azotine and Nitrobine can play a particularly crucial function in agriculture where it is utilized as a biofertilizer.

Biofertilizers are necessary to protect the soil, plants, and environment from the negative impacts of chemical fertilizers. It is able to fix atmospheric nitrogen because it can transform atmospheric nitrogen into ammonia for plant growth and soil stabilization **(Abd El-Azeim *et al*., 2023)**. According to **Abd El-Azeim *et al.* (2023)**, using biofertilizers as a source to increase soil fertility is an inventive and ecologically responsible technique to promote plant growth while benefiting agricultural ecosystems and environment. The pronounced role of biofertilization was proved by **Baral and Adhikari (2013); EI Gohary *et al*. (2018)**; **Hassanein *et al*. (2019) and Sabur *et al.* (2021)**.

With regard to the effect of mineral nitrogen levels treatments, data in Table (3) indicated that mineral nitrogen fertilization levels significantly increased all tested yield and its components traits comparing with the low level (20 kg N/fed.) in both seasons. In most cases, the treatment of 100 kg N/fed. was more effective in most parameters, however, the treatment of 80 kg N/fed. was superior to other nitrogen treatments in grain yield (ard/fed.). This result is in the line with those mentioned by **Abdel-Aty (2007); Ashok (2009); Sharifi and Taghizadeh (2009); Aminzadeh and Namazari (2013); Mohammadi *et al.* (2014); Krismawati (2020) and Adhikari *et al*. (2021)**.

The interaction between biofertilizers treatments and mineral nitrogen levels treatments was not significant for all ear length, number of grains/row and grains yield (ard/fed) during both seasons. In spite of the interaction effect was not significant, it could be concluded that Minia azotine with 60 kg N/fed. recorded the highest ear length (18.20 and 14.50 cm.) in the first and second seasons ,respectively and number of grains/row (41.95) in the first season , as well as with80 kg N/fed. surpassed for grain yield (ard/fed) of 22.93 and 25.68 in the first and second seasons ,respectively.

Finally, in order to combat rising population, increased food demand, poverty, and severe climate change, it is imperative to discover creative and affordable fertilization techniques. By assessing the use of the integrated fertilization system, which has been supported by numerous literature reviews, this study makes a positive contribution to addressing the advantages of integrated fertilization systems and addressing the challenge of the high cost and environmental risks associated with applying artificial fertilizers alone. With increased crop yield and quality, using biofertilizers in agriculture will be a useful substitute for artificial fertilizers. According to this research's findings, the integrated fertilization system is an environmentally friendly farming technique because it has a positive impact on soil properties, crop yield and quality, and the environment.

CONCLUSION

For the best growth, yield, and its components of maize plant, it could be recommended that spraying plants with Minia azotine at 5 L/fed. and fertilizing them with 80 kg N/fed. under the experiment condition. These results focus on the capability of partially replacement of mineral nitrogen by biofertilizers, and this is very important for environmental friendly materials and for health issues. More research is required in order to better understand the various combined artificial and biofertilizer fertilization systems for sustainable agriculture.

Table (1): Physicochemical properties of the experimental soil during both seasons of 2017 and 2018.

Soil character	Values		Soil character	Values	
	2017	2018		2017	2018
Physical properties:			**Soluble nutrients:**		
Sand (%)	24.77	23.58	**Ca^{++} (mg/100 g soil)**	2.29	2.18
Silt (%)	27.66	26.76	**Mg^{++} (mg/100 g soil)**	1.07	1.03
Clay (%)	47.57	49.66	**Na^{+} (mg/100 g soil)**	1.58	1.51
Soil type	Clay loam	Clay loam	**K^{+} (mg/100 g soil)**	0.91	0.87
Chemical properties:			**DTPA-Extractable nutrients:**		
pH (1:2.5)	7.89	7.83	**Fe (ppm)**	3.14	3.28
E.C. (dS/m)	1.19	1.17	**Cu (ppm)**	1.13	1.15
O.M. (%)	1.58	1.54	**Zn (ppm)**	2.01	1.98
$CaCO_3$ (%)	2.14	2.17	**Mn (ppm)**	4.45	4.41

Table (2): Effect of biofertilizers, mineral nitrogen treatments and their interactions on plant height (cm), stem diameter (cm) and leaf area (cm^2) of maize in2017 and 2018 growing seasons.

Nitrogen treatments (kg/fed.) (B)	Biofertilization treatments (A)							
	Control	Minia-azotine	Nitrobine	Mean (B)	Control	Minia-azotine	Nitrobine	Mean (B)
	The 1st season (2017)				The 2nd season (2018)			
	Plant height (cm)							
20 kg N/fed.	273.50	289.50	258.25	**273.75**	226.50	245.15	227.50	**233.05**
40 kg N/fed.	276.50	286.50	259.80	**274.27**	228.13	240.38	242.63	**237.05**
60 kg N/fed.	275.40	265.50	269.40	**270.10**	264.40	247.63	249.65	**253.89**
80 kg N/fed.	280.00	285.75	269.25	**278.33**	256.18	251.98	252.25	**253.47**
100 kg N/fed.	283.35	284.50	274.35	**280.73**	261.50	256.25	242.90	**253.55**
Mean (A)	**277.75**	**282.35**	**266.21**		**247.34**	**248.27**	**242.99**	
L.S.D. at 5 %	**A: 16.00**	**B: 6.66**	**AB: -**		**A: 5.43**	**B: 16.48**	**AB: -**	
	Stem diameter (cm)							
20 kg N/fed.	2.35	2.60	2.45	**2.47**	2.30	2.03	1.90	**2.08**
40 kg N/fed.	2.55	2.93	2.50	**2.66**	2.03	1.48	2.03	**1.85**
60 kg N/fed.	2.45	2.80	3.03	**2.76**	2.63	2.25	2.23	**2.37**
80 kg N/fed.	2.70	2.80	2.78	**2.76**	2.65	2.30	2.20	**2.38**
100 kg N/fed.	2.88	2.90	2.85	**2.88**	2.48	2.33	2.25	**2.35**
Mean (A)	**2.59**	**2.81**	**2.72**		**2.42**	**2.08**	**2.12**	
L.S.D. at 5 %	**A: 0.21**	**B: 0.25**	**AB:-**		**A: 0.35**	**B: 0.38**	**AB: -**	
	Leaf area (cm^2)							
20 kg N/fed.	512.86	533.98	421.96	**489.60**	555.86	510.58	598.80	**555.08**
40 kg N/fed.	485.71	574.33	492.13	**517.39**	572.09	545.63	575.53	**564.42**
60 kg N/fed.	518.71	531.28	541.75	**530.58**	564.00	543.81	599.21	**569.01**
80 kg N/fed.	502.74	558.80	550.81	**537.45**	578.11	568.27	598.38	**581.59**
100 kg N/fed.	552.73	537.50	572.56	**554.26**	541.00	569.89	584.64	**565.18**
Mean (A)	**505.01**	**549.59**	**501.66**		**567.52**	**542.07**	**592.98**	
L.S.D. at 5 %	**A: 35.55**	**B: 38.85**	**AB: -**		**A: 42.70**	**B: 15.39**	**AB: -**	

A biofertilization treatments (a_1=control , a_2= Minia azotin , a_3= Nitrobine); B Nitrogen treatments (kg/fed.) (b1=20, b2= 40, b3=60, b4=80 and b5=100).

Table (3): Effect of biofertilizers, mineral nitrogen treatments and their interactions on ear length (cm), number of grains/row and grain yield (ard/fed) of maize in2017 and 2018 growing seasons.

Nitrogen treatments (kg/fed.) (B)	Biofertilization treatments (A)							
	Control	Minia-azotine	Nitrobine	Mean (B)	Control	Minia-azotine	Nitrobine	Mean (B)
	The 1st season (2017)				The 2nd season (2018)			
Ear length (cm).								
20 kg N/fed.	17.73	17.50	17.43	**17.55**	14.00	13.50	14.00	**13.83**
40 kg N/fed.	17.30	17.83	17.28	**17.47**	13.50	14.00	14.50	**14.00**
60 kg N/fed.	17.53	18.20	17.93	**17.89**	14.00	14.50	14.00	**14.17**
80 kg N/fed.	17.43	18.18	17.93	**17.85**	14.00	14.00	14.00	**14.00**
100 kg N/fed.	17.53	17.73	18.03	**17.76**	14.00	14.00	14.00	**14.00**
Mean (A)	**17.50**	**17.89**	**17.72**		**13.90**	**14.00**	**14.10**	
L.S.D. at 5 %	**A: 0.37**	**B: 0.29**	**AB: 0.93**		**A: 0.52**	**B: 0.86**	**AB: 1.96**	
Number of grains per row.								
20 kg N/fed.	35.55	40.00	40.30	**38.62**	32.90	38.70	36.70	**36.10**
40 kg N/fed.	37.65	41.80	40.70	**40.05**	42.40	33.83	36.95	**37.73**
60 kg N/fed.	40.75	41.95	39.78	**40.83**	37.20	38.53	37.30	**37.68**
80 kg N/fed.	39.50	39.85	39.60	**39.65**	36.93	38.83	37.70	**37.82**
100 kg N/fed.	39.40	40.15	41.30	**40.28**	37.48	38.05	38.70	**38.08**
Mean (A)	**38.57**	**40.75**	**40.34**		**37.38**	**37.59**	**37.47**	
L.S.D. at 5 %	**A: 2.23**	**B: 1.32**	**AB: 4.88**		**A: 0.20**	**B: 1.26**	**AB: 4.63**	
Grain yield (ard/fed).								
20 kg N/fed.	10.42	10.71	10.69	**10.61**	11.04	11.36	11.33	**11.24**
40 kg N/fed.	20.11	21.05	20.21	**20.46**	18.56	22.95	22.03	**21.18**
60 kg N/fed.	20.63	21.65	21.73	**21.33**	22.69	23.82	23.90	**23.47**
80 kg N/fed.	22.53	22.93	22.15	**22.53**	25.22	25.68	24.81	**25.24**
100 kg N/fed.	20.44	20.13	20.08	**20.21**	22.69	22.34	22.28	**22.44**
Mean (A)	**18.82**	**19.29**	**18.97**		**20.04**	**21.23**	**20.87**	
L.S.D. at 5 %	**A: 0.46**	**B: 7.69**	**AB: 13.59**		**A: 1.17**	**B: 8.81**	**AB: 15.79**	

A biofertilization treatments (a_1=control , a_2= Minia azotin , a_3= Nitrobine); B mineral nitrogen fertilization levels (b_1=20, b_2= 40, b_3=60, b_4=80 and b_5=100 kg/fed.).

REFERENCES

Abd El-Gawad, A.M. and Morsy, A.S.M. (2017). Integrated impact of organic and inorganic fertilizers on growth, yield of maize (*Zea mays* L.) and soil properties under Upper Egypt conditions. Journal of Plant Production, 8 (11): 1103-1112.

Abd El-Aty, M. S. (2007). Diallel analysis of some quantitative traits in seven white inbred lines of maize under three nitrogen levels. J. Agric. Res, 551-575.

Abd El-Azeim, M.; El-Azeim, M.; Menesi, A.; El-Mageed, M. (2021). Alluvial Soil Quality Indicators as Affected by Different Land-Uses. J. Soil Sci. Agric. Eng., 12(4): 267–277.

Abd El-Azeim, M.M.; Menesi, A.M.; Abd El-Mageed, M.M.; Lemanowicz, J.; Haddad, S.A. (2022). Wheat Crop Yield and Changes in Soil Biological and Heavy Metals Status in a Sandy Soil Amended with Biochar and Irrigated with Drainage Water. Agriculture, 12(10), 1723.

Abd El-Azeim, M.M.; Yousef, E.; Hussien, M.; Hamza, A.; Menesi, A.; Youssef, N.; Omar, M.; Lemanowicz, J.; Eldesoky, G.E.; Abdelkarim, N.S. and Haddad, S.A. (2023). Sustainable Solutions for Arid Regions: Harnessing Aquaponics Water to Enhance Soil Quality in Egypt. Agriculture ,13(8),1634.

Adhikari, K.; Bhandari, S.; Aryal, K.; Mahato, M. and Shrestha, J. (2021). Effect of different levels of nitrogen on growth and yield of hybrid maize (*Zea mays*, L.) varieties. J. of Agric. and Natural Reso., 4 (2): 48-62.

Alessi, J. and Power, J.F. (1975). Response of an early - maturing corn hybrid to planting date and population in the northern plains. Agron. J., 67 (6): 762-765.

Aminzadeh, H. and Namazari, M. R. (2013). Effect of different amount of mineral nitrogen and biological fertilizer on yield and yield components of corn. J. of Agric. and Bio. Sci., 8 (6): 487-492.

Ashok, K. (2009). Production potential and nitrogen-use efficiency of sweet corn (*Zea mays*) as influenced by different planting densities and nitrogen levels. Indian J. of Agric.Sci., 79 (5): 351-355.

Avery, B.W.; Bascomb, C.L. (1982). Soil Survey Laboratory Methods; Technical Monograph No. 6.; Soil Survey: Harpenden, UK,.

Baral, B.R. and Adhikari, P. (2013). Effect of *Azotobacter* on growth and yield of maize. SAARC J. of Agric., 11 (2): 141-147.

Berg, G. (2009). Plantmicrobe interactions promoting plant growth and health: perspectives for controlled use of microorganisms in agriculture. Applied microbiology and biotechnology, 84 (1): 11-18.

Chapman, D.H and Pratt, P.F. (1961). Methods of Analysis for Soils, Plants and Water. University of California, Riverside: Division of Agric. Sci., USA.

El Gohary, A.E.; Gaballah, E.S.; Mansour, A.E.G. and Abo El Kheer, N. (2018). The effect of maize (*Zea mays*, l.) hybrids, nitrogen source and bio-fertilizer levels on yield and its components and yield analysis under mid delta region conditions. Journal of Productivity and Development, 23 (2): 215-234.

El-Hassanin, A.S.; Mahmoud, M.I.; Amer, M.M. and El Mekser H.K.A. (2002). Response of maize to mineral, organic and Biofertilizers under calcareous soil conditions. Egypt. J. Appl. Sci., 17 (1): 91-104.

EI-Yazied A.A.; Ragab, M.E.; Rawia, E.L. and El-Wafaa, S.M.A. (2007). Effect of nitrogen levels and cheated calcium foliar application on the productivity of sweet corn. Arab Univ. J. of Agric. Sci. Fac. of Agri. Ain Shams Univ., Cairo, Egypt, 15 (1): 131-139.

Gasim, M.E.M.H. (2011). Effect of different nitrogen sources on growth, yield and quality of fodder maize (*Zea mays* L.). J. of the Saudi Soci. of Agric. Sci., 10 (1): 17-23.

Gauri, S.S.; Mandal, S.M. and Pati, B.R. (2012). Impact of Azotobacter exopolysaccharides on sustainable agriculture. Applied microbiology and biotechnology, 95 (2): 331-338.

Gomez, K.A. and Gomez, A.A. (1984). Statistical procedures for agricultural research (2 ed.). John Wiley and Sons, New York, p. 680.

Hafez, E.M. and Abdelaal, K.A. (2015). Impact of nitrogen fertilization levels on morpho-physiological characters and yield quality of some maize hybrids (*Zea mays*, L.). Egypt. J. Agron., 37 (1): 35-48.

Hamza, A.H.; Shereif, M.; Abd El-Azeim, M.M.; Mohamed, W.A. (2021). Impacts of Magnetic Field Treatment on Water Quality for Irrigation, Soil Properties and Maize Yield. J. Modern. Res., 3(1), 51–61.

Hassanein, A.M.; Mesbah, E.A.E.; Soliman, F.H. and El-Aidy, T.E.T. (2019). Effect of nitrogen rates, biofertilizers and foliar urea application on yield and yield components of maize (*Zea mays*, L.). J. of Plant Prod., 10 (1): 53-58.

Ibrahim, F.; Anjembe, B.C.; Usman, M. and Obam, J.O . (2022). Effects of nitrogen fertilizer rates on growth and yield of maize in Makurdi-Nigeria. J. of Agric. and Ecosystem Management, 2 (1): 8-13.

Jena, N.; Vani, K.P.; Rao, V.P. and Sankar, A.S. (2015). Effect of nitrogen and phosphorus fertilizers on growth and yield of quality protein maize (QPM). Inter. J. of Sci. and Res., 4 (12): 197-199.

Kebede, T.; Keneni, Y.G.; Senbeta, A.F. and Sime, G. (2023). Effect of bioslurry and chemical fertilizer on the agronomic performances of maize. Heliyon, 9(1).

Krismawati, A. (2020). Crop productivity and financial feasibility of corn farming with various diverse fertilizer treatments on dry land. In IOP Conference Series: Earth and Environmental Science (Vol. 456, No. 1, p. 012090). IOP Publishing.

Kubheka, B.P.; Laing, M.D. and Yobo, K.S. (2020). Combinations of a biofertilizer with micro-dosed chemical fertilizers increased yield of maize in a high acid saturated soil. Rhizosphere, 13, 1 0 0 189.

Maghsudi, E.; Ghalavand, A. and Aghaalikhan, M. (2014). The effect of different levels of fertilizer (organic, biological and chemical) on morphological traits and yield of maize single cross hybrid 704. Appl. Field Crops Res., 27 (104): 129-135.

Martin, J.H.; Waldren, R.P. and Stamp, D.L. (2006). Principles of field crop production. Pearson Education, Inc., Upper Saddle.

McIntosh, M.S. (1983). Analysis of combined experiments. Agron. J., 75 (1): 153-155.

Mohammadi, A.S.; Yeganehpoor, F.; Kahrariyan, B. and Shabani, E. (2014). Effect of different urea levels on yield and yield components of corn 704. Inter. J. of Advanced Biological and Biomedical Res., 2 (2): 300-305.

Mtaita, T.A.; Nyaera, K.; Mutetwa, M. and Masaka, T. (2019). Effect of bio fertilizer with varying levels of mineral fertilizer on maize (*Zea mays*, L) growth. Galore International Journal of Applied Sciences and Humanities, 3 (4): 1-9.

Onasanya, R.O.; Aiyelari, O.P.; Onasanya, A.; Nwilene, F.E. and Oyelakin, O.O. (2009). Effect of different levels of nitrogen and phosphorus fertilizers on the growth and yield of maize (*Zea mays*, L.) in Southwest Nigeria. Inter. J. of Agric. Res., 4 (6): 193-203.

Rodrigues, J.S.; Garrido, M.S.; da Silva, J.A.B.; Simoes, W.L.; Silva, R.A. and Amorim, M.N. (2019). Growth and nutritional status of maize plants in response to different doses and application frequencies of biofertilizer. Cientifica, 47 (1): 123-131.

Sabur, A.; Pramudyani, L.; Yasin, M. and Purnomo, J. (2021). Application of biological fertilizers on growth and yield of sweet corn (*Zea mays* saccharata Sturt) in dry land. In IOP Conference Series: Earth and Environmental Science

(Vol. 807, No. 4, p. 042024). IOP Publishing.

Sharifi, R.S. and Taghizadeh, R. (2009). Response of maize (*Zea mays*, L.) cultivars to different levels of nitrogen fertilizer. Journal of Food, Agric. & Envi., 7 (3/4): 518-521.

Singh, S.; Singh, V.; Shukla, R.D. and Singh, K. (2018). Effect of fertilizer levels and Bio-fertilizer on green cob yield of corn (*Zea mays* L.). IJCS, 6 (2): 2188-2190.

Soleymanifard, A. and Naseri, R. (2014). The Effects of urea fertilizer and *Azotobacter* and *Azospirillum* on physiological characteristics of maize (*Zea mays*, L.) at Khash, Iran. J. of Crop Ecophysiology, 8 [31 (3)]: 301-316.

Soleimanzadeh, H. and Ghooshchi, F. (2013). Response of growth and yield of maize to biofertilizers in organic and conventional cropping systems. International Journal of Agriculture and Crop Sciences, 5 (7): 797.

Steel, R.G.D. and Torrie, J.H. (1980). Principles and procedures of statistics. A biometrical approach. 2nd edition. McGraw-Hill, New York, p. 384.

الملخص العربي

تأثير معاملات التسميد الأزوتى الحيوى والمعدنى على انتاجية الذرة الشامية تحت ظروف محافظة المنيا

محمود منصور عبدالمجيد - أبوبكر عبدالوهاب طنطاوي
إيمان عيد راضي دردير - أمل جمعة درويش

قسم المحاصيل – كلية الزراعة – جامعة المنيا – مصر.

أُجريت هذه الدراسة في مزرعة خاصة بقرية منبال – مركز مطاي - محافظة المنيا – مصر، خلال موسمي النمو 2017 و2018، لدراسة تأثيرثلاث معاملات للتسميد الحيوي (الكنترول - المنيا أزوتين - النيتروبين) ، وخس معاملات للنيتروجين المعدني (20 – 40 – 60 – 80 – 100 كجم نيتروجين/فدان) والتداخل بينهم علي صفات النمو الخضري والمحصول ومكوناته لمحصول الذرة الشامية هجين فردي أصفر بايونير 999.

أظهرت النتائج أن جميع صفات النمو الخضري (طول النبات – قُطر الساق- مساحة الورقة) وصفات المحصول ومكوناته (طول الكوز – عدد الحبوب في الصف – محصول الحبوب) قد تحسنت نتيجة التسميد الحيوي في مواجهة معاملة الكنترول في كلا موسمي النمو. وكانت معاملة المخصب الحيوي المنيا أزوتين أفضل من معاملة المخصب الحيوي النيتروبين. بالإضافة إلى ذلك، زادت جميع الصفات المدروسة زيادة معنوية نتيجة زيادة مستوي النيتروجين من 20 إلى 100 كجم نيتروجين/فدان في كلا موسمي النمو.

وكان التفاعل بين المنيا أزوتين ومستوي 80 كجم نيتروجين/فدان هي الأفضل للحصول على أعلي إنتاجية حبوب لمحصول الذرة في كلا موسمي النمو.