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EFFECT OF NITROGEN, PHOSPHORUS AND BIOFERTILIZERS ON MAIZE: I- GROWTH TRAITS

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ABSTRACT

Two field experiments were carried out during two summer seasons 2001 and 2002 at the Experimental Farm, Faculty of Agriculture, Kafr EL Sheikh, Tanta University to study the effect of [bio fertilizer notroben+phosphorus]with levels of nitrogen and phosphorus fertilization on growth of maize plants of cultivar [single cross 10].

The results obtained could be summarized as follows

A- Nitrogen levels plus notroben;

1- Addition of high dose of nitrogen [120 kg N/fed] alone caused a significant effect on total dry weight of the plant and its organs[stem, leaves, ears and tassel] and days to 50 % silking
2- Addition of 60 kg N/fed plus notroben results in a significant increase in dry weight of stem and tassel, and days; to 50 % silking.
3- Nitogen levels [90 kg N/fed] plus notroben caused a significant increase in number of leaves per plant
4- 120 kg N/fed plus notroben resulted in a significant effect on dry weight of total plants and its organs [stem, leaves, ears and tassel], number of leaves/plant and ear leaf area.

B- Phosphorus levels plus phosphoren:

1- Zero of P_2O_5/ fed resulted in a significant increase in area of ear leaf
2- 15 kg P_2O_5/fed alone caused a significant increase in total dry weight of plant and its organs [stem, leaves, ears and tassel] and number of leaves/ plant
3- 7.5 kg P_2O_5/fed plus phosphoren gave the significant increase in DM of leaves, ears and stem] and total plant, number of leaves/ plant and ear leaf area.
4- 15kg P_2O_5/fed plus phosphoren resulted in a significant increase in DM of leaves, stem, ears and plants, number of leaves /plant and ear leaf area.

C- Interaction effect:

The significant interaction was found on DM of ears, number of leaves/plant, DM of stem, leaves, tassel and plant as a whole, ear leaf area and days to 50 % silking.

From the obtained results, it could be recommended that the use of bio fertilizer to minimize the chemical nitrogen fertilizer, reduced the costs of production and pollution which could be occurred be excessive use of chemical fertilizer.

INTRODUCTION

In Egypt, maize [*Zea mays* L] is one of the most important cereal crops used for human consumption and many other purposes such as animal feeding one to rich sources of carbohydrate, oil and some what of protein. Nitrogen is a major nutrient element and it is needed in large amount for high yield of maize, it considers the most factor affecting the growth and productivity of maize plants. Increasing nitrogen fertilizer levels increased dry mater accumulation in plant up to 90 days after sowing [Ashoub *et al*., 1987 and Ammer *et al.,* 1995] .Moreover, encouraged the photosynthesis at higher levels which led to an increase in dry matter production in the different organs of the plants [Esmail and EL Sheikh, 1994]. Concerning phosphorus fertilizer, it is an important nutrient in plant life where it is used in trans formed of chemical energy to stable organic compounds from which dry matter is

produced [Gardner *et al.*, 1986]. The effect of combined inoculate Azotobacter and phosporen on the growth in the several plants was found of great interest. The aim of this investigation is to study the effect of nitrogen and phosphorus fertilization plus bio fertilizer treatments on growth of maize [S.C.10] variety.

MATERIALS AND METHODS

Two experiments were carried out at Farm of the Faculty of Agriculture at Kafr El-Sheikh during 2001 and 2002 summer seasons. The soil is clay in texture contained 1.66 and 1.50 organic matter and 5ppm available N, 14.5 and 13.8 available P_2O_5 and 420 and 452 ppm available K and had pH of 7.95 and 7.86 in the two seasons, 2001 and 2002, respectively. The preceeding crop was wheat in the two seasons. Every experiment included sixteen treatments was performed to investigate the combination of four levels of nitrogen + notroben and four phosphorus fertilization treatments + phosphoren expressed as apportions from the recommended dose [120 kg N/fed and 15 kg P_2O_5/fed] the nitrogen treatments were as follow:

120 kg N without addition of bio fertilizer as follow, one fourth dose at sowing date + half dose at first irrigation + one fourth dose at second irrigation.

1- 60 kg N plus notroben as follow, 15 kg N at sowing date + 30 kg N at the first irrigation +15 kg N at second irrigation.
2- 90; kg N plus notroben as follow; 15 kg N at sowing date + 45kg N at the first irrigation +30 kg N at second irrigation.
3- 120 kg N plus notroben as follow; 30 kg N at sowing date + 60 kg N at the first irrigation +30 kg N at the second irrigation.

Seeds were inoculated with bio fertilizer (notroben) before sowing at rate of ½ kg per 15 kg of maize seeds. Phosphorus fertilizer in form calcium super phosphate [15.5 % P_2O_5] as follow; 1- Zero phosphorus 2-15 kg P_2O_5. 3-7.5 kg P_2O_5 plus phosphoren 4-15 kg P_2O_5 plus phosphoren. Three samples were taken at 65, 80 and 95 days from planting in both seasons. Total dry weight (DM) of plant in gm and its organs, ear leaf area in dm square, plant height in cm, leaf number /plant, total chlorophyll in leaves was determined according to Marquard and Timpton (1987), stem diameter in cm and number of days to 50 % silking.

All the data were subjected to the standard analysis of variance procedure as decreased Snedecor and Cochran 1967. Treatment means were comprised by Duncan Multiple range test (Duncan, 1991).

RESULTS AND DISCUSSION

A- Nitrogen levels plus notroben:

Addition of the high dose of nitrogen[120 kg N/fed] caused a significant effect on DM of total plant and its organs [stem, leaves, ears and tassel] at age of 80 days in the in the first season and DM of total plant and tassel in the second season. [Table 6].These results may be due to the fact that N fertilizer resulted in increasing the vegetative growth related to the

source capacity of maize plants, also it may be attributed to the favorable effect of nitrogen in the metabolic processes and physiological activities of meristems which are responsible for cell division and elongation in addition to formation of plant organs. Similar results were obtained by Ahmed 1990 and Attah, 1998. Also, the days to 50 % silking, mineral nitrogen form tended to decrease

1-The number of days to mid silking, these results may be attributed to the role of nitrogen in encouraging the meristematic activity to create a strong and healthy plants, which in tern push maize plants toward building the sexual organs early. The same results were obtained by EL Kady *et al* 1996, EL Agamy *et al.* 1999 and Khalil *et al* 2001 Generally, nitrogen has major roles in plant nutrition namely, component of chlorophyll and amino acids, essential for carbohydrates utilization, components of enzymes, vitamins and hormones, simulative of root development and activity and supportative the uptake of other nutrients. [Stevenson 1986], These finding are in general agreement with reported by Nawar *et al.* 1992, Esmail and EL Skeikh 1994, EL Kady *et al.* 1996, EL Agamy *et al*. 1999 and EL Domby *et al*. 2001.

2- Addition of 60 kg N/fed plus notroben results in a significant increase in DM of stem and tassel at age of 80 day, days to 50 % silking in the second season [Table 27] and number of leaves /plant at age of 95 days in the second season [Table 9] . These results are agree with those obtained by Hassanein *et al.* 1997.

3-Nitrogen levels 90 kg N /fed plus notroben caused a significant increase in number of leaves /plant at age of 65 and 80 days in the first season and days to 50 % silking in second season, plant height at all ages [Table 1] .DM of total plant at age of 80 day in first season and DM of ears at age of 80 day in second season ear leaf area at age of 65 days in both seasons and at age of 80 day in second season, total chlorophyll in leaves at age of 65 day in first season and at age of 80 day in both seasons and at age of 95 day in the second season [Table 19] and on stem diameter at age of 80 and 95 day in second season [Table 24] . These results agree with those obtained by Kapulnik *et al*. 1981, Reiad *et al.* 1987, Hassanein *et al.* 1997 and Allah 1998 on plant height. From these results, this increase in plant height may be due mainly to the role of nitrogen as a constituent of all portions and nucleic acids which led to increase cells number and size which in turn encourage the elongation of the internodes of the stem[Ahmed1990 and Allah 1998] and on DM of total plant and its organs and on number of leaves /plant [Ahmed 1990, Nawar *et al.,* 1992 and EL Agamy *et al*. 1999. These results may be attributed to increasing the amount of absorbed nitrogen by plants especially at early growth stages, which led to increase cell number and size and allowed maintaining the oldest leaves healthy .And on ear leaf area [Ahmed 1990, EL Kady *et al.,* 1996 and EL Agamy 1999.Such increase in the area may be due to the increase in meristemic party activity in plant during those period in this respect or on chlorophyll content in leaves by Ishac *et al.* 1986 and EL Kady *et al*. 1996 and on stem diameter by Hassanein *et al*. 1997 and EL Douby *et al.* 2001

Table (1):Plant height (cm) as influenced by different levels of nitrogen and phosphorus with or without biofertilizer during 2001 and 2002 seasons.

Treatments	Plant height					
	2001			2002		
	65 days	80 days	95 days	65 days	80 days	95 days
A. Nitrogen with biofertilizer						
120 kg N/fed.	252.34 b	259.58 b	262.92 b	230.81 ab	235.65 b	249.06 b
60 + notrobin	231.05 c	244.32 c	249.99 c	224.48 b	234.98 b	246.26 b
90 + notrobin	263.63 a	266.90 a	273.31 a	234.94 a	244.00 a	257.41 a
120 + notrobin	256.57 ab	268.53 a	271.60 a	230.00 ab	242.43 a	253.22 ab
F. Test	**	**	**	*	*	*
B. Phosphorus with biofertilizer						
Zero	249.60	259.47	260.45 b	231.05 ab	239.84	253.10
15 kg/fed.	253.16	258.94	260.78 b	236.51 a	242.75	251.08
7.5 + phosphoren	157.55	262.98	268.21 a	226.68 b	238.58	250.94
15 + phosphoren	253.27	257.54	268.39 a	226.00 b	235.90	250.78
F. Test	NS	NS	**	**	NS	NS
eraction						
A x B	**	**	**	NS	*	NS

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

4- Addition of the high dose of nitrogen 120 kg N/fed plus notroben caused a highly significant effect on DM of total plant and its organs [stem, leaves, ears and tassel] at age of 65 days in the two seasons and on DM of plant and tassel in the second season at age 80 day, while at age of 95 day the effect was showed on DM of stem and leaves in season 2002 at age 95 day and on number of leaves at all ages in both seasons, ear leaf area at all ages, and on plant height at age of 80 day in both seasons and at age of 95 day in the first season and on DM of stem, ear and total plant at age of 80 day in season 2001, total chlorophyll in leaves at age of 65 day in the first season and at age of 80 and 95 day in the first season on stem diameter These results may be attributed to the nitrogen fixation by non symbiotic bacteria present in notroben for their ability to fix free molecular nitrogen. Stimulate germination, improve plant stand, synthesis of chlorophyll, secret growth hormones and consequently increases uptake of nutrients by plants .So, an improve in soil properties and uptake of micro nutrients could be expected. This reflect on growth characters

B.Effect of phosphorus levels plus phosphoren:

1-Addition of zero P_2O_5 /fed obtained a significant increase in ear leaf area at age of 65 day or 80 in the first season [Table 15], DM of total plant at age of 65 day in season 2002, DM of stem at age of 80 day in season 2001 and DM of tassel in second season at the same age, [Table 6] number of leaves at age of 80 day in season 2002, [Table 9] stem diameter at age of 65 day and 95 day in season 2001 [Table 24]. Khalil *et al.* 2001 found that phosphorus fertilizer did not effect on number of leaves of maize plants.

2- The high dose of 15 kg P_2O_5 /fed all one caused a significant increase in DM of total plant and its organs, stem and ears in the first season at age of

65 day and DM of total plants at age of 80 day in the second season, number of leaves at age of 65 day in the first season and at age of 80 day in both seasons, days to 50 % silking in second season [Table 27] .Plant height at age of 65 days in the second season [Table 1], DM of leaves and tassel at age of 65 day in the second season and at age of 95 day on DM of ears and tassel in the first season, DM of stem and ears at age of 80 day in the first season, ear leaf area at age of 80 day in season 2001 [Table 15], total chlorophyll in leaves at age of 80 day in season 2002 [Table 19] . These results showed that the element of phosphorus is an important role in plant life where it is used in transformation of chemical energy to stable organic compound from which dry matter is produced [Gardener *et al* 1986].

3-Addition of 7.5 kg P_2O_5/ fed plus phosphoren gave the significant increase in plant height at age of 95 day in the first season [Table 1], DM of total plant and its organs [stem+ leaves] at age of 65 day in the first season and at age of 80 day in season 2001 and on DM of total plant or DM of ears in the second season and on DM of total plant or stem and leaves at age of 95 day in the first season, number of green leaves /plant at age of 65 and 80 day in the first season and at age of 95 day in the two seasons, ear leaf area at age of 80 and 95 days in the first season, total chlorophyll in leaves at age of 95 day in the first season, stem diameter at age of 65 day in season 2001 and at age of 95 day in season 2002 [Table 24] and on day to 50 % silking in season 2001 [Table 27] .

4-The high dose of phosphorus fertilization [15 kg P_2O_5/fed] plus phosphoren resulted in a significant increase in plant height at age of 95 day in season 2001, DM of leaves at age of 65 day in season 2002, DM of total plant at age of 80 day in season 2001, ear leaf area at age of 80 day in season 2002, total chlorophyll in leaves at age of 80 day in first season, stem diameter at all ages in first season. These results showed that phosphate dissolving bacteria [phosphoren] are considered as a biological fertilizer which have an important role in solubility of P and enhance its absorption by the roots [Azcon *et al.,* 1976 and Kencey 1988]. Increasing plant dry matter due to inoculation with phosphoren was attributed to the reduction of media PH and hence the solubility of phosphate [Kencey, 1988] .

C. Interaction effect:

1-The significant interaction was found between nitrogen plus notroben and phosphorus fertilizer plus phosphoren on the following characters and the best resulted in DM of ears at age of 65 day in first season [120 kg N/fed plus notroben and 15 kg P_2O_5/fed], number of leaves at age of 80 day in first season [90kg N/fed plus notroben or with 120 N/fed alone with 7.5 kg P_2O_5 /fed plus phosphoren or 15 kg P_2O_5/ fed alone [Table 10] and at age of 95 day in second season [60 kg N/fed plus notroben and 7.5 P_2O_5 /fed plus phosphoren] [Table 11] .

2-The highly significant interaction on DM of stem at age of 65 days [120 kg N/fed and 15 kg P_2O_5 /fed or90 and 120kg N/fed plus notroben and 7.5 P_2O_5 plus phosphoren, or on DM of leaves at age 65 day in first season [120 kg N/fed plus notroben+ 7.5 kg P_2O_5 plus phosphoren] and on DM of stem or leaves [120 kgN/fed plus notroben +15 kg P_2O_5 /fed plus

phosphoren] or tassel [120kg N/fed plus notroben + 15 kg P_2O_5/fed alone at age of 65 day in second season. At age of 80 day in first season on DM of stem [90 or 120 kg N/fed plus notroben + zero or 15 kg P_2O_5 /fed alone] or on DM of leaves [90 kg N/fed plus notroben + 7.5 kg P_2O_5/fed plus phosphoren] or DM of ear [120 kg N /fed plus notroben +15 kg p2 05/fed alone] or DM of tassel [90 kg N/fed plus notroben + 7.5 kg P_2O_5 /fed plus phosphoren] .While in the second season at age of 80 day, the high significant effect on DM of leaves [120 kg N /fed plus notroben +15 kg P_2O_5 /fed plus phosphoren] or DM of ear [90kgN/fed plus notroben +7.5 P_2O_5 /fed plus phosphoren] or tassel DM[120 kg N/fed plus notroben +zero P_2O_5 /fed] .At age of 95 day in the first season, the highly significant interaction on DM of stem [120 kg N/fed alone +7.5 kg P_2O_5 /fed plus phosphoren] or DM of leaves [120 kg N /fed alone or 90 kg N/fed plus notroben +7.5 kg P_2O_5 /fed plus phosphoren] or DM of ears [120 kg N/fed plus notroben + zero or 15 kg P_2O_5 /fed alone] or tassel [120 kg N/fed alone + 7.5 kg P_2O_5 /fed plus phosphoren] or DM of the plant [120 kg N/fed alone + 7.5 P_2O_5/fed plus phosphoren] [Table 8], or number of leaves /plant at age of 95 day in first season [120 kg N/fed plus notroben +zero P_2O_5] [Table 11], while in the second season at age of 65 day [120 kg N /fed alone or plus notroben + zero or 7.5 kg p205 /fed plus phosphoren] [Table 12] or at age of 80 day [120 kg N/fed alone or plus notroben + zero P_2O_5] [Table 10]or on ear leaf area at age of 80 day in first season [120 kg N/fed alone + zero P_2O_5] [Table 16], also at age of 95 day [120 kg N/fed plus notroben + 7.5 kg P_2O_5 /fed plus phosphoren] [Table 18], while in the second season at age of 80 day [120 kg N/fed alone with 15 kg P_2O_5 plus phosphoren] [Table 17] or on total chlorophyll in leaves at age of 80 day in first season [120 kg N /fed alone + 15 kg P_2O_5 /fed alone] [Table 20], also at age of 95 day [120 kg N /fed alone or plus notroben + zero P_2O_5 or 7.5 kg P_2O_5 /fed plus phosphoren] [Table 22], while in the second season at age of 80 day [120 kg N /fed alone +15 kg P_2O_5 /fed alone] [Table 21] or at age of 95 day [60 or 120 kg N/fed plus notroben + zero P_2O_5 or 15 kg P_2O_5 /fed alone] [Table 23] .Also, on stem diameter at age of 95 day in first season [120 kg N /fed plus notroben + 15 kg P_2O_5 /fed plus phosphoren] [Table 25] while in the second season at age of 95 day [120 kg N /fed alone + 7.5 kg P_2O_5 /fed plus phosphoren] [Table 26]. As well as on days to 50 % silking in first season [120 kg N /fed plus notroben + 7.5 kg P_2O_5 /fed plus phosphoren] [Table 27] and in the second season [60 kg N/fed plus notroben + 15 kg P_2O_5 /fed alone] [Table 29].

From the obtained results, it could be recommended that the use of bio fertilizer to minimize the chemical nitrogen fertilizer, reduce the costs of production and pollution which could be occurred by excessive use of chemical fertilizer.

Table (2):Plant height (cm) as influenced by the interaction between nitrogen and phosphorus fertilization plus fertilizer in 2001 season.

Nitrogen	Phosphorus			
	P_1	P_2	P_3	P_4
N_1	246.17 c-f	262.10 a	251.10 a-e	249.99 a-f
N_2	244.84 c-f	233.65 fg	216.50 g	229.21 fg
N_3	265.40 abc	268.72 ab	256.80 a-d	263.60 abc
N_4	242.02 def	248.17 a-f	265.82 abc	270.27 a

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (3):Plant height (cm)at age of 80 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2001 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	265.86 a-d	265.63 a-d	253.51 def	253.33 def
N_2	258.49 c-f	242.21 fg	246.50 ef	230.10 g
N_3	255.55 c-f	261.29 b-e	280.18 a	270.60 abc
N_4	259.59 b-e	266.66 a-d	271.73 abc	276.15 ab

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (4):Plant height (cm) at age of 80 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2002 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	24610 a	242.66 ab	226.41 e	227.45 de
N_2	229.66 b-e	243.24 a	239.30 a-e	227.71 cde
N_3	243.21 a	241.21 ab	243.69 a	247.91 a
N_4	240.37 a-d	243.88 a	244.91 a	240.55 abc

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (5):Plant height (cm) at age of 95 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2001 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	261.24 cde	265.46 bcd	258.52 cde	266.45 bcd
N_2	251.41 ef	251.47 ef	254.14 def	242.96 f
N_3	263.71 cde	263.33 cde	290.18 a	276.02 b
N_4	265.44 bcd	262.85 cde	269.99 bc	288.15 a

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (6):Total dry mater accumulation/plant (g) at age of 65, 80 and 95 days as influenced by different levels of nitrogen and phosphorus with or without biofertilizer during 2001 and 2002 seasons.

Treatments	Total dry matter accumulation/plant(g)					
	2001			2002		
	65 days	80 days	95 days	65 days	80 days	95 days
A. Nitrogen with biofertilizer						
120 kg N/fed.	143.12 c	349.43 b	512.73 a	308.32 ab	388.61 ab	613.32
60 + notrobin	170.86 bc	358.35 b	344.52 c	201.37 c	301.35 c	823.08
90 + notrobin	184.31 b	396.10 a	471.13 b	280.85 bc	357.02 b	864.05
120 + notrobin	255.57 a	405.22 a	509.54 a	371.94 a	419.87 a	677.13
F. Test	**	**	**	**	**	NS
B. Phosphorus with biofertilizer						
Zero	207.74 a	358.17 b	422.97 b	243.56	357.17 b	548.41
15 kg/fed.	222.10 a	359.44 b	483.89 b	240.43	418.67 a	651.40
7.5 + phosphoren	202.42 a	395.12 a	571.43 a	354.22	411.93 a	649.03
15 + phosphoren	171.54 b	396.37 a	412.61 c	268.87	274.87 c	848.44
F. Test	**	**	**	NS	**	NS
eraction A x B	NS	**	**	NS	NS	NS

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (7):Dry matter accumulation per plant (g) at age of 80 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer during 2001 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	384.75 bcd	343.79 def	308.62 ef	360.57 b-f
N_2	298.02 f	377.81 b-e	376.28 b-e	381.31 bcd
N_3	364.55 b-ef	347.07 c-f	478.79 a	430.48 ab
N_4	385.38 bcd	369.08 b-e	369.08 abc	413.13 bcd

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (8):Dry matter accumulation per plant (g) at age of 95 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer during 2002 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	463.35 fgh	522.93 cde	638.33 a	426.29 hi
N_2	394.52 k	398.95 ij	492.37 def	359.15 jk
N_3	479.13 gh	477.43 efg	594.85 ab	378.89 j
N_4	509.46 fgh	536.58 cd	560.18 bc	486.13 efg

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (9):Number of green laves/plant as influenced by different levels of nitrogen and phosphorus with or without biofertilizer during 2001 and 2002 seasons.

Treatments	Number of green leaves/plant					
	2001			2002		
	65 days	80 days	95 days	65 days	80 days	95 days
A. Nitrogen with biofertilizer						
120 kg N/fed.	15.43 a	14.17 a	7.75 c	14.65 b	13.29 c	7.49 b
60 + notrobin	15.20 b	13.74 b	7.66 c	14.16 c	13.42 bc	8.10 a
90 + notrobin	15.87 a	14.23 a	8.32 b	15.03 ab	13.80 ab	8.08 a
120 + notrobin	15.96 a	14.26 a	8.58 a	15.38 a	13.96 a	8.22 a
F. Test	**	**	**	**	**	*
B. Phosphorus with biofertilizer						
Zero	15.51 b	13.89 b	7.59 c	15.05	14.19 a	7.49 b
15 kg/fed.	15.90 a	14.38 a	7.96 b	14.70	14.18 a	7.65 b
7.5 + phosphoren	16.01 a	14.27 a	8.32 a	14.89	13.52 b	8.56 a
15 + phosphoren	15.55 b	13.86 b	8.20 ab	14.59	12.58 c	7.74 b
F. Test	**	**	**	NS	**	*
eraction						
A x B	NS	*	**	**	**	*

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (10):Number of green leaves/plant at age of 80 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2001 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	13.77 cd	14.38 abc	14.55 a	13.99 abc
N_2	13.33 d	14.11 abc	14.21 abc	13.33 d
N_3	14.45 a	14.57 a	13.91 bcd	13.88 bcd
N_4	13.88 bcd	14.48 ab	14.44 ab	14.26 abc

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (11):Number of green leaves/plant at age of 95 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2001 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	7.12 ef	8.14 bc	7.44 bcd	7.71 cde
N_2	6.97 f	7.40 def	8.19 bc	8.10 bc
N_3	7.19 ef	8.02 bc	8.57 ab	8.52 ab
N_4	9.10 a	8.23 bc	8.52 ab	8.49 b

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (12): Number of green leaves/plant at age of 65 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer during 2002 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	15.20 abc	14.57 bc	16.13 a	12.70 d
N_2	14.10 c	14.07 c	14.20 c	14.25 c
N_3	14.75 bc	14.77 bc	15.14 abc	15.49 ab
N_4	16.17 a	15.37 ab	14.07 c	15.92 a

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (13): Number of green leaves/plant at age of 80 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer during 2002 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	15.06 a	13.85 b-e	13.40 def	10.86 f
N_2	13.20 de	13.70 b-e	13.35 de	13.45 cde
N_3	13.52 cde	124.50 abc	14.17 a-d	13.02 e
N_4	14.47 a	14.70 ab	13.16 de	13.00 e

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (14): Number of leaves/plant at age of 95 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer during 2002 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	7.33 cd	7.92 bcd	7.94 bcd	6.77 d
N_2	8.22 abc	7.36 cd	9.27 a	7.55 bcd
N_3	7.41 bcd	7.78 bcd	8.69 abc	8.44 abc
N_4	8.77 ab	7.56 bcd	8.36 abc	8.21 abc

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (15): Ear leaf area (cm^2) as influenced by different levels of nitrogen and phosphorus with or without biofertilizer during 2001 and 2002 seasons.

Treatments	Ear leaf area (cm^2)					
	2001			2002		
	65 days	80 days	95 days	65 days	80 days	95 days
A. Nitrogen with biofertilizer						
1- 120 kg N/fed.	478.11 a	1013.49 a	945.35 b	484.79 a	603.39 b	729.21
2- 60 + notrobin	376.16 b	706.00 c	745.37 d	350.30 b	543.10 c	683.83
3- 90 + notrobin	469.10 a	828.31 b	846.24 c	492.44 a	648.76 a	822.18
4- 120 + notrobin	520.13 a	951.81 a	1102.21 a	512.70 a	602.22 b	749.38
F. Test	**	**	**	**	**	NS
B. Phosphorus with biofertilizer						
1- Zero	518.41 a	934.87 a	975.17 bc	451.24	543.06 c	702.33
2- 15 kg/fed.	492.44 ab	861.35 a	935.78 b	462.49	579.84 bc	802.67
3- 7.5 + phosphoren	452.84 b	945.83 a	1013.42 a	446.62	596.91 b	702.38
4- 15 + phosphoren	388.88 c	757.55 b	813.80 c	479.88	677.66 a	777.16
F. Test	**	**	**	NS	**	NS
Interaction A x B	NS	**	**	NS	**	NS

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (16): Ear leaf area (cm^2) at age of 80 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2001 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	1419.62 a	932.26 b	880.62 bc	821.46 bc
N_2	778.10 bc	827.20 bc	704.77 c	513.93 d
N_3	790.66 bc	889.62 bc	79306 bc	839.77 bc
N_4	751.11 bc	796.21 bc	1404.86 a	855.05 bc

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (17): Ear leaf area (cm^2) at age of 80 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2002 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	422.11 I	644.45 bcd	570.74 d-g	776.25 a
N_2	519.20 gh	492.04 hi	617.65 c-f	5435 fgh
N_3	672.48 bc	590.55 b-g	619.42 cde	712.62 ab
N_4	558.44 a-h	592.34 d-g	579.84 d-g	678.26 bc

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (18): Ear leaf area (cm^2) at age of 95 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2001 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	1262.02 b	886.10 c	803.97 cde	829.31 cde
N_2	693.42 e	837.20 cde	741.87 cde	708.99 de
N_3	800.26 cde	866.88 cd	865.10 cd	852.73 cd
N_4	744.97 cde	1152.95 b	1642.73 a	864.19 cd

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (19): Total chlorophyll as influenced by different levels of nitrogen and phosphorus with or without biofertilizer during 2001 and 2002 seasons.

Treatments	Total chlorophyll					
	2001			2002		
	65 days	80 days	95 days	65 days	80 days	95 days
A. Nitrogen with biofertilizer						
120 kg N/fed.	49.69 a	46.43 ab	43.962	47.013	44.97 a	42.67 b
60 + notrobin	46.84 b	42.96 c	44.100	43.131	42.86 b	42.81 b
90 + notrobin	49.48 a	47.96 a	45.987	44.621	46.06 a	44.92 a
120 + notrobin	48.96 a	44.71 bc	45.725	42.548	44.75 a	45.33 b
F. Test	*	**	NS	NS	**	*
B. Phosphorus with biofertilizer						
Zero	47.95	44.74 b	44.67 ab	41.49	43.98 b	44.15
15 kg/fed.	48.68	45.96 ab	43.96 b	44.72	47.78 a	44.69
7.5 + phosphoren	49.86	43.81 c	46.77 a	46.20	42.76 b	44.11
15 + phosphoren	48.48	47.11 a	44.36 b	44.54	44.12 b	42.79
F. Test	NS	**	*	NS	**	NS
eraction A x B	NS	**	**	NS	**	**

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (20): Total chlorophyll at age of 80 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2001 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	47.37 a-d	50.40 a	42.02 ef	45.95 a-e
N_2	36.00 g	44.40 cde	43.50 def	47.95 a-d
N_3	48.80 abc	49.60 ab	44.37 cde	47.30 a-d
N_4	46.20 a-e	39.45 fg	45.35 b-e	47.87 a-d

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (21): Total chlorophyll at age of 80 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2002 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	47.22 bcd	50.65 a	37.02 f	45.00 cde
N_2	35.00 f	46.72 bcd	45.35 b-e	44.40 cde
N_3	48.60 ab	47.75 abc	44.05 de	43.87 de
N_4	45.13 cde	46.0 b-e	44.65 cde	43.22 e

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (22): Total chlorophyll at age of 95 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2001 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	46.70 abc	4070 def	48.85 a	39.60 ef
N_2	37.25 f	46.80 abc	46.40 abc	45.95 abc
N_3	46.05 abc	43.25 cde	46.35 abc	48.30 ab
N_4	48.70 a	45.10 a-d	45.50 abc	43.60 b-e

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (23): Total chlorophyll at age of 95 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2002 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	46.50 ab	44.06 abc	41.16 bcd	38.95 cd
N_2	37.70 d	46.85 a	45.75 ab	40.95 bcd
N_3	43.40 ab	42.92 abc	45.02 ab	47.86 a
N_4	48.50 a	44.92 ab	44.50 ab	43.40 abc

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (24): Stem diameter (cm) as influenced by different levels of nitrogen and phosphorus with or without biofertilizer during 2001 and 2002 seasons.

Treatments	Stem diameter (cm)					
	2001			2002		
	65 days	80 days	95 days	65 days	80 days	95 days
A. Nitrogen with biofertilizer						
120 kg N/fed.	2.16	2.31 b	2.43 b	3.08	3.35 b	3.77 ab
60 + notrobin	2.05	2.29 b	2.41 b	2.97	3.27 b	3.62 bc
90 + notrobin	2.13	2.33 b	2.47 b	3.13	3.50 a	3.82 a
120 + notrobin	2.15	2.47 a	2.57 a	3.11	3.30 b	3.52 c
F. Test	NS	**	**	NS	**	**
B. Phosphorus with biofertilizer						
Zero	2.17 a	2.34 b	2.47 b	3.13	3.38	3.71 ab
15 kg/fed.	1.96 b	2.26 b	2.36 b	3.12	3.32	3.60 b
7.5 + phosphoren	2.15 a	2.39 b	2.50 a	3.09	3.34	3.85 a
15 + phosphoren	2.22 a	2.47 a	2.5 a	2.95	3.34	3.57 b
F. Test	**	**	**	NS	NS	**
eraction A x B	NS	NS	**	NS	NS	**

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (25): Stem diameter (cm) at age of 95 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2001 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	2.36 e	2.32 e	2.68 b	2.36 e
N_2	2.47 de	2.39 e	2.42 de	2.38 e
N_3	2.41 e	2.37 e	2.48 cde	2.60 bcd
N_4	2.65 bc	2.37 e	2.43 de	2.85 a

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (26): Stem diameter (cm) at age of 95 days as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2002 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	3.90 bcd	3.36 f	4.27 a	3.59 ef
N_2	3.58 def	3.61 c-f	3.64 c-f	3.66 b-f
N_3	3.76 b-e	3.98 ab	3.93 bc	3.61 c-f
N_4	3.60 c-f	3.46 ef	3.59 c-f	3.44 ef

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (27): Days to 50% silking as influenced by different levels of nitrogen and phosphorus with or without biofertilizer during 2001 and 2002 seasons.

Treatments	50% silking date 2001	50% silking date 2002
A. Nitrogen with biofertilizer		
120 kg N/fed.	59.5 a	59.3 c
60 + notrobin	58.4 ab	61.7 a
90 + notrobin	58.4 ab	61.2 a
120 + notrobin	57.8 ab	60.2 b
F. Test	*	**
B. Phosphorus with biofertilizer		
Zero	58.2 ab	61.0 ab
15 kg/fed.	58.9 a	61.4 a
7.5 + phosphoren	59.3 a	59.7 c
15 + phosphoren	57.7 ab	60.3 bc
F. Test	*	**
eraction		
A x B	**	**

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (28): Number of days to 50% silking as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2001 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	60.6 ab	59.3 ab	59.3 abc	59.0 a-d
N_2	57.0 de	60.5 ab	58.6 a-d	57.7 cde
N_3	57.0 cde	59.3 abc	58.3 bcd	59.0 a-d
N_4	58.3 bcd	56.6 de	61.0 a	55.3 e

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

Table (29): Number of days to 50% silking as influenced by the interaction between nitrogen and phosphorus fertilization plus biofertilizer in 2002 season.

Nitrogen with bioferitlizer	Phosphorus with biofertilizer			
	P_1	P_2	P_3	P_4
N_1	60.44 cd	60.66 bcd	57.16 e	59.11 d
N_2	62.22 ad	63.08 a	59.63 d	62.11 ab
N_3	60.00 cd	62.33 ab	62.16 ab	60.33 cd
N_4	61.41 abc	59.55 d	60.00 cd	60.00 cd

In the same column, means followed by the same letter are not significantly different at 5% level according to Duncan multiple range test

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تأثير التسميد النيتروجينى والفسفوري مع التسميد الحيوي على الذرة الشامية: ١- صفات النمو

عادل يوسف رجب و مجدى حليم ابراهيم
قسم المحاصيل ـ كلية الزراعة ـ جامعة كفرالشيخ

أقيمت تجربتان حقليتان في موسمي الزراعة٢٠٠١و٢٠٠٢ بمزرعة كلية الزراعة بكفر الشيخ جامعة طنطا لدراسة تأثير التسميد الحيوي النتروبين والفوسفورين مع مستويات مختلفة من الأسمدة النتروجينية والفوسفورية علي النمو علي صنف الذرة الهجين الفردي ١٠ ومن خلال النتائج يمكن تلخيص الأتى:

ا ــ تأثير الأسمدة النتروجينية مع التسميد الحيوي النتروبين

١- أدى إضافة اعلي مستوي من النتروجين ١٢٠ كيلو للفدان بمفرده إلى زيادة معنوية للوزن الجاف للنبات وجميع أعضائه من ساق وأوراق وكيزان وسنابل وعدد الأيام لظهور ٥٠ % من الحريره

٢- أدى إضافة ٦٠ وحده نتروجين + نتروبين إلى زيادة معنوية للوزن الجاف للساق والسنابل وعلي عدد الأيام لظهور ٥٠/ من الحريره

٣- أدى إضافة ٩٠ وحده نتروجين + نتروبين لزيادة معنوية في عدد الأوراق للنبات

٤- أدى إضافة ١٢٠ كيلو نتروجين +نتروبين الي زيادة معنوية للوزن الجاف للنبات الكامل وأعضائه وعدد الأوراق للنبات ومساحة ورقه الكوز

ب -تأثير الأسمدة الفوسفاتية مع الفوسفورين

١- أدى عدم إضافة الأسمدة الفوسفاتية الي زيادة معنوية لمساحة ورقه الكوز

٢- أدى إضافة ١٥ كيلو فوسفور للفدان الي زيادة معنوية في الوزن الجاف للنبات الكامل وأعضائه وعدد الأوراق للنبات وعلي عدد الأيام لظهور ٥٠ % من الحريره

٣- أدى إضافة ٧ ونصف كيلو فوسفور + فوسفورين الي زيادة معنوية للوزن الجاف للأوراق والكيزان والساق والنبات الكامل وعدد الأوراق ومساحة ورقة الكوز وعلي عدد الأيام لظهور ٥٠ % من الحريره

٤- أدى إضافة ١٥ كيلو فوسفور + فوسفورين الي زيادة معنوية فى عدد الايام لظهور الحريره والوزن الجاف للنبات وأعضائه وعدد الأوراق للنبات ومساحة ورقة الكوز

٥- تأثير التفاعل بين الأسمدة النتروجينية والفوسفورية مع السماد الحيوي كان تأثير التفاعل معنوي علي الوزن الجاف للكيزان وعدد الأوراق للنبات والوزن الجاف للساق والأوراق والسنابل والنبات الكامل ومساحة ورقه الكوز وعلي عدد الأيام لظهور ٥٠ % من الحريره ومن خلال النتائج المتحصل عليها يمكن التوصية باستخدام الأسمدة الحيوية بهدف تقليل استخدام الأسمدة الكيماوية وخفض تكاليف الإنتاج وتقليل التلوث.