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Traits of maize primary and secondary ears under some integrated nitrogen and phosphorus fertilization regimes.

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A field experiment was conduct at the summer season of 2017, then repeated at the summer season of 2018 in Agricultural Research Station. Faculty of Agric. Zagazig Univ., Sharkia Governorate, Egypt. The study investigated the impact of eleven nitrogen and five phosphorus fertilization regimes on some ear traits for both primary and secondary ears of double eared plants as well as the primary ear of mono eared plants of maize cultivar single hybrid 168. Results showed that variation in each of ear leaf area (cm^2) at 70 days after sowing (DAS), ear weight with shells (g), shell weight (g), ear weight without shells (g), ear length, ear diameter, number of rows/ear, number of grains/row and ear grain weight (g) of both primary and secondary ears of the double eared plants, due to various nitrogen fertilization regimes was nonentily. It is noteworthy to observe that secondary ears were generally smaller than the primary ears by about 50%in each of ear weight with or without shells, shell weight, ear length, number of grains/row. The exiguous variation in most ear traits, due to various phosphorus fertilization, elicited the possibility of replacement of chemical phosphorus fertilizer by bio phosphorus fertilizer "Phosphorien" either partially (P_3 and P_4) or entirely (P_5) without the deleterious impact on ears traits.

Keywords: Nitrogen, phosphorus, fertilization regimes, maize.

INTRODUCTION

Maize (*Zea maize*) ranked third among the world cereal crop production (Majid et al., 2017). Maize is grown for grain as well as fodder in tropical, sub-tropical and temperate regions of the world (Kumar and Jhariya, 2013). Maize, has multiple uses such as bread making, corn syrup, corn flakes, corn starch and fuel production (ethanol and corn oil diesel). Maize is one of the most important cereal crops in summer season in Egypt, it ranks third after wheat and rice. Corn imports in marketing years (MY) 2018\2019 are forecast at 9.5MMT (GAIN Report, 2018) FAS Cairo forecasts Egypt's corn production in (MY) 2018\19 at 6.8 million metric tons (MMT). Planted area reached 850,000 hectares in 2018\19, reportedly white corn planted area accounts for 600,000 hectares, the residual area was planted with yellow corn (GAIN Report, 2018). Nitrogen is one of the essential nutrients for plants and their practical management as a major element of intensive crop production is as important aspect. Nitrogen absorbed adequately increases photosynthesis, vegetative growth and eventually high yield. Increased use of synthetic N-Fertilizers have led to pollution of the environment and destroyed micro- organisms, caused the plants more prone to diseases and reduced soil fertility (Khattab et al., 2016). Free living N_2 –Fixing bacteria are soil microbes widely used as biofertilizers, binds atmospheric nitrogen release it into the soil as ammonium ions form (Mahato and Neupane, 2017). Cerealine is a commercial product of nitrogen biofertilizer contains free living N_2 – Fixing bacteria (*Azospirillum brasilense* and *Bacillus polymyxa*) were used in this study. Compost is a mixture of organic residues. Composted organic material can be used as a source of important nutrients for sustainable crop production (Amanullah, et al., 2015). Application of compost at sowing improved maize yield and its components (Amanullah and Khan, 2015; Kamran ,et al., 2018). Phosphorus ranked second as plant is an essential nutrient affecting plant growth by inducing the basic metabolic processes (Khan,et al.,2014,Fazalullah, et al., 2018).The recapture efficacy of P is less than 20% of the added P in the world soil (Qureshi et al.,2012). In fact, the P fertilizer utilization is less than 3o%because soluble P is quickly fixed by reacting with free Al^{3+} ,Ca^{2+} ,Mg^{2+} and Fe^{3+} upon its application in the soil (Sharma et al.,2013). Phosphate solublizing bacteria (PSB) inoculation reduces, or may minimize the application of chemical P fertilizers up to 100% under exist soil and climatic conditions (Fazalullah et al., 2018). Phosphorin, is a Commercial PDB contains *Bacillus megatherium var phosphaticum* was used in this investigation. Most everyone knows that a Corn plant initiates a lot of ears, one at every stalk node up to the one that becomes the harvestable one (Nielsen, 2007). Normally, hormonal apical dominance exhibited by the primary ear on a stalk, suppresses the initiation or development of secondary ears at lower stalk nodes. However, under certain conditions or with certain genetic backgrounds, one or more secondary ear not only initiate successfully, but also continues to develop to harvestable ears (Nafziger, 2014). There is an urgent need for integrated management of fertilizers that are applied to the soil as agricultural inputs to reduce the adverse environmental impacts of chemical fertilizers. This investigation was performed to study the impact of integrated management of some nitrogen and phosphorus fertilizer regimes on some ear traits for both primary and secondary ears of the single-eared plants and double eared plants.

MATERIALS AND METHODS

A field experiment was conducted at the summer season of 2017 then repeated at the summer season of 2018 in the Agricultural Research station, Faculty of Agriculture, Zagazig Univ,Ghazal Farm. Sharkia Governorate ,Egypt .The investigation studied the effect of eleven nitrogen and five phosphorus fertilization regimes on some ear traits for both primary and secondary ears of double –eared plants and the primary ear of single- eared plants of maize cultivar "single hybrid 186 (*Zea maize*)". Nitrogen fertilization regimes (N) are presented in Table 1.

Phosphorus fertilization regimes (P) included five treatments *i.e.*P_1 (control), P_2 (45kg P_2O_5/fad.), P3(30kg P_2O_5/ fad.+Phosphorien (1 borage 600g)), P_4(15kg P_2O_5/fad. +Phosphorien (2 package 1200g)), P_5 (Phosphorien (3 package=1800g)).

Chemical and biological fertilizers used

Urea (46.5%N) as chemical nitrogen fertilizer was used to detect nitrogen fertilizer regimes. Regimes which included adding chemical N fertilizer, and regardless its amount, fertilizer was split into three equal doses which applied at sowing , 20days after sowing (DAS) and 35 DAS.

Table 1: Nitrogen fertilization regimes.

Treatment	Nitrogen from chemical fertilizer (kg/fad.)	Nitrogen from Compost (kg/fad.)	Bio-fertilizer cerealine	Total nitrogen (Kg/fad.)
N_1	-	-	-	-
N_2	120	-	-	120
N_3	90	30	-	120
N_4	60	60	-	120
N_5	30	90	-	120
N_6	-	120	-	120
N_7	90	30	Cerealine	120
N_8	60	60	Cerealine	120
N_9	30	90	Cerealine	120
N^{10}	-	120	Cerealine	120
N_{11}	-	-	Cerealine	-

Fad=faddan=4200 m^2

The amount of the commercial fertilizer (Urea) was calculated according to each nitrogen level in nitrogen fertilization treatments (N_2, N_3, N_4, N_5, N_7, N_8, N_9). Respecting biological nitrogen fertilizers, a commercial bio-fertilizer "Cerealine"as a free living nitrogen fixing bacteria (*Azotobacter* SP.+ *Azospirillum* SP.) was used at the rate of 700g/seed/fad. Inoculation by cerealine was done by mixing with maize kernels with the aid of Arabic gum 5% as sticking substance, just before planting .The amount of compost was calculated according to each nitrogen level in fertilization treatments (N_3, N_4, N_5, N_6, N_7,N_8,N_9,N_{10}) . As for phosphorus fertilization regimes, calcium superphosphate (15.5%P_2O_5) as chemical fertilizer was supplied at sowing, whereas, the amount was determined based to each phosphorus level in treatments (P_2, P_3 and P_4). Phosphate dissolving bacteria (PDB) contains *Bacillus megatherium var phosphaticum*, is an Egyptian bio-fertilizer commercially named "phosphorien" used in detecting P_3,P_4 and P_5.Biofertilizers used in this study (cerealine and phosphorien) were produced by General organization for the Agricultural Equalization Fund (GOAEF), Ministry of Agriculture in Egypt. Compost is commercially produced by Al Arabia for organic Composition, Sharkia Governorate, Egypt. Nitrogen (%) in compost was 1%as reported in the chemical analysis of compost samples .The amount of compost [based on N (%)] was calculated according to each treatment (see Table 1). Compost was added at sowing. A split –plot design with three replicates was performed in the two seasons, nitrogenous fertilization regimes were allotted to the main plots, phosphorus fertilization treatments occupied the sub-plots. Area of each sub-plot was 15m^2, included 6 ridges. The preceding crop was wheat in both seasons, maize seeds were sown in hills, 25cm apart with 80cm space between ridges .Sowing took place on 20th May during two summers seasons in 2017 and 2018, while harvest was done 105 DAS in both seasons. In this study the following traits will be under focus, ear leaf area (cm^2) at 70 DAS, ear weight with shells (g), ears shell weight (g), ear weight without shells (g), ear length (cm), ear diameter, number of rows/ear, number of grains/ear. All above mentioned traits were measured for primary and secondary ears in duple eared plants as well as the primary ear in mono (single) eared plants. Combined data of both seasons were calculated and used in this study. Data recorded were analyzed using analysis of variance based on a split-plot design according to procedures outlined by Snedecor and Cochran (1967), mean comparisons were done using least significant difference (LSD) according to Duncan (1955).

RESULTS AND DISCUSSION

Impact of both nitrogen and phosphorus fertilization regimes on each of ear leaf area (cm^2), ear weight with shells (g) and shell's weight (g) are compiled in Table 2.Ear leaf area (cm^2) at 70 DAS, ear weight with shells (g) and shell's weight (g) of both primary and secondary ears of duple eared plants reflected insignificant variation duo to both nitrogen and phosphorus fertilization regimes studied .Results of nitrogen fertilization regimes elucidated that primary ear's leaf area ranged from 614.5 to 695.9 cm^2,as well secondary ear's leaf area ranged between 654.3 and 73.4cm^2.Ear leaf area (cm^2) of mono eared plants ranged from 475.8 to 625.9cm^2.Duple eared plants tended to have a larger ear leaf area ,so they may be more vigor in growth , the average ear leaf area valued as much as 665.3,691.2 and 546.7cm^2 for primary ,secondary ears of duple eared plants and primary ear of mono eared plants, in respective order .In regard to shelled ear weight (g), it ranged from 259.1 to 335.7, 95.7 to 143.5 and 149.0 to 271.0 (g) for primary ,secondary ears in duple eared plants and primary ear of mono eared plants. Its worth to noting that the shelled ear weight of the secondary ear valued as less than 50% of the shelled ear weight of the primary ear in duple eared plants (average values). Shell's weight ranged from 44.1 to 55.9, from 16.1 to 23.9, from 37.93 to 57.5 (g) for primary, secondary ears in duple eared plants and a primary ear of single eared plants.The shell's weight of the secondary ear valued less than 50% of that of primary ears. Impact of phosphorus fertilization regimes on ear leaf area (cm^2), ear weight with shells (g) and shell's weight (g) (Table 2), was on a par, so significant differences were not detected. The three traits in general exhibited the same trend as in nitrogen fertilizer regimes. The exiguous variation in the ear leaf area, ear weight with shells and shell's weight were due to various phosphorus fertilization regimes, elicited the possibility of replacement of chemical phosphorus fertilizer by bio-phosphorus fertilizer "Phosphorien" either partially (P_3 and P_4) or entirely (P_5) without deleterious impact on the above named traits.

Table (2) Effect of nitrogen and phosphorus fertilization regimes on ear leaf area (cm^2) at 70 DAS, ear weight (g) with shells and ear‹s shell weight(g) (Combined data).

Main treatments and interaction	Ear leaf area (cm^2)at 70 DAS			Ear weight(g) with shells			Ear's shell weight(g)		
	Duple eared plants		Mono eared plants	Duple eared plants		Mono eared plants	Duple eared plants		Mono eared plants
	Primary ear	Secondary ear		Primary ear	Secondary ear		Primary ear	Secondary ear	
Nitrogen fertilization regimes(A)									
N_1-Control	645.8	678.7	481.9e	295.4	131.7	149f	49.2	22	46.4bd
N_2-120KgN/fad .	690.4	717.8	606.0ab	335.7	142.9	258b	55.9	23.8	55.4ab
N_3 -90KgN/fad.+ 30kgN(Compost)	675.3	711	582.7abc	310.2	135	271a	51.8	22.5	57.5ab
N_4 . 60KgN/fad.+ 60kgN(Compost)	660.5	703.9	526.2de	306.1	143.5	264ab	51	23.9	54.3ab
N_5-30KgN/fad.+ 90kgN(Compost)	660	692.5	524.9de	302.7	95.7	238c	50.5	16.1	58.7a
N_6-120kgN(Compost)	662.8	683.7	526.2cbe	294.4	103.8	213d	49.1	17.3	40.7cd
N_7 - Cerealine+90KgN/fad. (Chemical) +30kgN(Compost)	679.8	692.2	604.1ab	290.4	138.5	253b	48.3	23	48.9abcd
N_8 Cerealine+60KgN/fad. (Chemical) +60kgN (Compost).	695.9	723.4	625.9a	309.5	120.2	231c	51.7	20.1	51.1abc
N_9 - Cerealine+30KgN/fad. (Chemical)+90kgN(Compost).	676.5	706.4	560.7bcd	272.8	111.7	201d	45.6	18.8	47.0bcd
N_{10} -Cerealine +120kgN (Compost).	614.5	654.3	499.47e	264.8	120.7	172e	44.1	20.1	37.93d
N_{11} -Cerealine	657.1	639.2	475.8e	259.1	124.6	177e	43.2	20.7	40.1cd
Average	665.3	691.2	546.7	294.7	124.4	221	49.1	20.8	48.9
F.test	NS	NS	**	NS	NS	**	NS	NS	**
Phosphorus fertilization regimes(B)									
P_1 –control	659.5	692.5	537.8	305	131.8	215	50.8	22	49.6
P_2 -45 kgP_2O_5/ fad.	654.4	685.3	539.8	286.1	126.7	218	47.7	21.1	48.8
P_3 -30kg P_2O_5/ fad.+Phosphorien (600g).	658.4	691.6	542.1	299.1	118.8	221	49.9	19.8	47.7
P_4 -15 kg P_2O_5/ fad +Phosphorien (1200g).	685.6	685.2	550.3	283.1	129.9	231	47.2	21.7	51.1
P_5 –Phosphorien(1800g).	668.8	701.4	563.5	300	114.8	218	50	19.2	47.3
Average	665.3	691.2	546.7	294.7	124.4	221	49.1	20.8	48.9
F.test	NS	NS	NS	NS	NS	NS	NS	NS	NS
AB	NS	NS	**	NS	NS	**	NS	NS	**

Means followed by different letters are(**) significantly different at P≤ 0.1 level; according to Duncan's multiple range test

Table (3) Effect of nitrogen and phosphorus fertilization regimes on ear weight(g)without shells, ear length (cm) and ear diameter (cm) (combined data).

Main treatments and interaction	Ear weight(g)without shells			Ear length (cm)			Ear diameter (cm)		
	Duple eared plants		Mono eared plants	Duple eared plants		Mono eared plants	Duple eared plants		Mono eared plants
	Primary ear	Secondary ear		Primary ear	Secondary ear		Primary ear	Secondary ear	
Nitrogen fertilization regimes(A)									
N_1-Control	246.2	109.8	96e	18.8	11.7	15.60bc	4.5	3.6	4.19
N_2-120KgN/fad .	279.8	119.2	202a	20.9	13	17.80a	4.8	3.6	4.51
N_3 -90KgN/fad.+30kgN(Compost)	258.5	112.6	213a	20.3	11.5	17.46a	4.8	3.5	4.43
N_4 . 60KgN/fad.+60kgN(Compost)	255	119.7	209a	24	11.3	17.44a	4.6	3.4	4.45
N_5-30KgN/fad.+90kgN(Compost)	252.2	79.8	179b	20.3	10.4	15.91bc	4.8	3	4.33
N_6-120kgN(Compost)	245.4	86.5	172b	20.2	11.6	15.39bc	4.6	3.3	4.31
N_7 - Cerealine+ 90KgN/fad. (chemical) +30kgN(Compost)	242.1	115.5	203a	19.7	12	17.26a	4.7	3.5	4.39
N_8 Cerealine+ 60KgN/fad. (chemical) +60kgN(Compost).	258	100.3	180b	20.8	10.7	16.25ab	5.2	3.4	4.29
N_9 - Cerealine+ 30KgN/fad. (chemical) +90kgN(Compost).	227.4	93.2	155c	20.2	11.8	15.18bc	4.8	3.6	4.25
N_{10} -Cerealin +120kgN (Compost).	220.6	100.8	134d	19.8	12.4	14.44c	4.8	3.6	4.23
N_{11} -Cerealien	215.8	103.9	137d	19.7	13.1	14.35c	4.7	3.8	4.3
Average	245.5	103.7	171	20.4	11.8	16.1	4.8	3.5	4.33
F. test	NS	NS	**	NS	NS	**	NS	NS	NS
Phosphorus fertilization regimes(B)									
P_1 -control	254.1	110	162	19.7	11.9	16.09	4.7	3.5	4.35
P_2 -45 kg P_2O_5/ fad.	238.4	105.7	169	22.1	11.2	15.95	4.7	3.4	4.3
P_3 -30kg P_2O_5/ fad. +Phosphorien (600g).	249.3	99	173	20.1	11.3	16.32	4.7	3.3	4.32
P_4 -15 kg P_2O_5/ fad +Phosphorien (1200g).	235.9	108.2	179	19.8	12.5	16.29	4.7	3.7	4.34
P_5 -Phosphorien(1800g).	250	95.8	170	20.4	12	15.85	4.9	3.4	4.35
Average	245.5	103.7	171	20.4	11.8	16.1	4.8	3.5	4.33
F. test	NS	NS	NS	NS	NS	NS	NS	NS	NS
AB	NS	NS	**	NS	NS	NS	NS	NS	NS

Means followed by different letters are(**) significantly different at P≤ 0.1 level; Duncan's multiple range test

An allusion to the results in Table (3), it could be demonstrates that,the ear weight without shells for both primary and secondary ears of duple eared plants, was insignificantly affected by various nitrogenous fertilization regimes. The range of ear weight was from 215.8 to 279.8 g for primary ears, while that range was from 79.8 to 119.7g for secondary ones, the average ear weight without shells overall nitrogen fertilization regime valued 245.5 and 103.7g for primary and secondary ears in the same order. It is worthy to observing that secondary ears were generally smaller than the primary ones and their weights were less than 50%of primary ears. On the other side, ear weight without shells in mono eared plants impacted significantly by regimes of N fertilization.

The smallest ear weight (96.0g) was produced by unfertilized plants N_1 (control treatment), while the greatest ear weight (213.0g) was the resultant of plants fertilized with N_3 treatment (90kgNfrom chemicalfertilizer+30kg N from compost). Results of ear weight without shells of mono eared plants displayed that analogous ear weight was appreciable when any of N_2, N3,N4 or N_7 nitrogen fertilization regime was applied, accordingly limitation of nitrogen from the chemical fertilizer up to 50%could be obtained via the application of the bio-chemical fertilization regimes ($N_3$and N_4), *i. e*. application of nitrogen from chemical fertilizer and from compost.

Results of ear length (cm) for both primary and secondary ears of the duplex eared plants (Table 3) exhibited that various nitrogen fertilization regimes came to nothing. In other wordage, variation in ear length of both primary and secondary ears of the duplex eared plants due to various nitrogen fertilization regimes was a nonentity. Regarding to duplex eared plants, ear length (cm)of primary and secondary ears ranged from 18.8 to 24 and from 10.4 to 13.1cm, in a respective order .The average of ear length overall nitrogen fertilization regimes valued at 20.4 and 11.8cm for primary and secondary ears of duple eared plants. It is obvious from the average values of ear length that secondary ears were shorter than the primary ones, wherein their length was 57.84% of primary average length.

Ear length (cm) of mono eared plants was significantly affected by nitrogen fertilization regimes, plants fertilized with any of the following regimes N_2, N3, N4 and N_7 produced the longest ears without significant variation among them. Reduction of nitrogen from chemical fertilizer up to50% could be attained by the application of 50% of nitrogen from compost as in fertilization regime N_4 (60kg N from chemical fertilizer+60kg N from compost). The five phosphorus fertilization regimes were affected less by ear length for primary and secondary ears in duple plants and primary ear in singly eared plants. An elaborate look at that results allusive to the efficaciousness of biophosphorus fertilizers "phosphorien" as an alternative choice than the chemical phosphorus fertilizer up to 100% replacement .Sham (2018) in Egypt elaborated that each N increment up to 120kg N/fad., caused a significant increment in ear length of duple eared plants. Increasing the maize ear length due to application of nitrogenous fertilizers was also reported by Shams (2000),Soliman et al.,(2001), El-Nagar(2003),Abd El-Maksoud and Sarhan (2008) and Seadh et al., (2015).

Ear diameter (cm) as influenced by both nitrogen and phosphorus fertilization regimes are depicted in Table (3). Results in that Table cleared that both nitrogen and phosphorus fertilization regimes efficacy on ear diameter were immaterial. These results were inshore for each of primary and secondary ears of duple eared plants as well as primary ones of single eared plants. Regardless the fertilization regimes, the average of the ear diameter of secondary ears (3.5cm) were smaller than that of primary ears (4.8cm) in double eared plants.

Allusive to the results in Table (4) it could be noted that the number of rows/ear was not affected by either nitrogen or phosphorus fertilization regimes. That was genuine in both duple and mono eared plants. It's worthy to noting that primary ears had more number of rows/ear (average=14.8) compared to the secondary ears (average=10.1) of duple eared plants. Supreme of primary ears over secondary ones in number of rows/ear, may be ascribed to their supremacy in both ear length and diameter. A significant increase in the number of rows/ear was detected due to application with 120kgN/Fad., in both mono and double eared plants (Sham,2018). He, also, reported that plants treated with 15kg P_2O_5/Fad. +phosphorien produced ears with the outmost row number which valued as much as 16.39 and 16.19 for mono and duple eared plants, respectively.

Results of a number of grains/row reflected insignificant variation due to the nitrogen fertilization regimes when plants were duple eared. Grain/row, ranged from38.9 to 43.7 as well as from 17.3 to 26 in primary and secondary ears in the same order.

Table (4) Effect of nitrogen and phosphorus fertilization regimes on number of rows/ear, number of grains/row and grain weight/ear (g) (Combined data).

Main treatments and interaction	Number of rows/ear			Number of grains/row			Grain weight/ear(g)		
	Duple eared plants		Mono eared plants	Duple eared plants		Mono eared plants	Duple eared plants		Mono eared plants
	Primary ear	Secondary ear		Primary ear	Secondary ear		Primary ear	Secondary ear	
Nitrogen fertilization regimes(A)									
N_1-Control	14.5	10.6	14.28	38.9	22.8	19.9e	123.5	52.7	55.1d
N_2-120KgN/fad .	14.9	10.9	14.4	43.7	25.6	35.1a	161.8	61.9	144.1a
N_3 -90KgN/fad.+30kgN(Compost)	15	10	14.3	42.3	22.4	34.9a	147.1	57	147.8a
N_4 . 60KgN/fad.+60kgN(Compost)	14.4	9.7	14.44	41	21.5	35.7a	150.8	58.7	150.3a
N_5-30KgN/fad.+90kgN(Compost)	14.6	8.3	15.27	42.7	17.3	33b	137.8	40	126.1b
N_6-120kgN(Compost)	14.2	9.3	14.12	41.3	21.4	32.4b	150.1	45.4	126.3b
N_7 - Cerealine+ 90KgN/fad. (chemical) +30kgN(Compost)	15.3	10.4	14.71	42.4	24.7	35.3a	142.2	59	148.1a
N_8 Cerealine+ 60KgN/fad. (chemical) +60kgN(Compost).	15.5	9.6	14.19	41.7	18.9	32.4b	161.7	55.3	128.5b
N_9 - Cerealine+ 30KgN/fad. (chemical) +90kgN(Compost).	15.4	10.3	14.41	43.1	29.3	29.1c	145.9	52.6	110.4c
N_{10} -Cerealin +120kgN (Compost).	14.8	10.8	14.43	42.6	24.1	27.7d	139.2	55.4	102c
N_{11} -Cerealien	14.6	11.7	13.9	41.7	26	27d	133.4	63.2	99.4c
Average	14.8	10.1	14.4	42	23.1	31.1	144.9	54.7	121.6
F.test	NS	NS	NS	NS	NS	**	NS	NS	**
Phosphorus fertilization regimes(B)									
P_1 -control	14.6	10.5	14.35	41.7	26.3	30.6	140.1	57.8	114.9
P_2 -45 kg P_2O_5/ fad.	14.8	10.2	14.19	42.4	22.7	30.9	141.6	52.7	120.1
P_3 -30kg P_2O_5/ fad. +Phosphorien (600g).	15	9.1	14.07	41.5	20.5	31	148.3	52.3	123.1
P_4 -15 kg P_2O_5/ fad +Phosphorien (1200g).	15	11.2	14.76	41.9	24	31.7	140	60.1	124.6
P_5 -Phosphorien(1800g).	14.8	9.8	14.65	42.4	22	31.4	154.3	50.4	125.6
Average	14.8	10.1	14.4	42	23.1	31.1	144.9	54.7	121.6
F.test	NS	NS	NS	NS	NS	NS	NS	NS	NS
AB	NS	NS	NS	NS	NS	**	NS	NS	NS

Means followed by different letters are(**) significantly different at P≤ 0.1 level; Duncan's multiple range test

. Average number of grains/row in secondary ears (23.1) was markedly less than that number (42) in primary ears.

Mono eared plants impacted significantly by nitrogen fertilization regimes, where in N_2,N_3,N_4 and N_7 treatments produced the largest number of grains/row compared with the other nitrogen fertilization regimes. It is worth noting that N_4 treatment (60kgN from chemical fertilizer +60kgN from compost) can save about 50% of the chemical fertilizer without deficit in the number of grains/row.

The five phosphorus fertilization regimes under study were of none effect on the number of grains/row, whereas maize plants were duple or mono eared. Based on the average number of grains/row overall phosphorus treatment, it could be noted that primary ears outnumber secondary ears in grains/row by about 81.81%.It could by ascribed to longer ears of the primary ears compared to secondary ones double eared plants (Table3). The acquirement of the largest grain number/row was the amenability of biofertilizer "phospjorien" sole application in mono eared maize plants, while in duple eared plants, application of 15kg P_2O_5/Fad., +phosphorien produced the largest number of grains/ row, these findings were reported by Sham (2018).

Nitrogen fertilization regime results (Table 4) revealed insignificant differences in ear grain weight (g). When plants were duple eared , grain weight/ear ranged between 123.5 and 161.8 (g) in primary ears as well as 40 and 63.2g in secondary ears .The average grain weight/ear overall nitrogen fertilization regimes amounted as 144.9 and 54.7gram for primary and secondary ears, in a respective order. Primary ears in double eared plants surpassed secondary ears in each of ear weight with shells, shell weight (Table 2); ear weight without shells, ear length and ear diameter (Table 3) as well as number of rows/ear and number of grains/row.

Regarding to mono eared plants, tremendous grain weight/ear was appreciable through the application of any the following nitrogen fertilization regimes.*i.e*.N_2, N_3, N4 or N_7. That results pave the way for reducing nitrogen from chemical fertilizer up 50% as in N_4 fertilization regimes (60kgN from chemical fertilizer+60kgN from compost) without any hurt in grain weight/ear.

The five phosphorus fertilization regimes were affectless by grain weight/ear in both primary and secondary ears of duple eared plants and primary ear in single eared plants as well. It is of great moment to elaborate the above mentioned results which exposed the availability of using the bio-phosphorus fertilizer "phosphorien" as an alternative choice than the chemical phosphorus fertilized up to 100% replacement. Analogous findings were reported in each of ear leaf area (cm^2),ear diameter (Table 3)as well as number rows/ear, number of grains/row and grain weight/ear(Table 4).Sham(2018) in Egypt ensured that application 120kgN/Fad. Produced the heaviest ear grain weight, Azeez et al.,(2006), Ali et al.,(2012)and Ikramuiiah et al.,(2015) come to analogous conclusion.

Normally hormonal apical dominance exhibited by the primary or apical ear or simple competition for photosynthesis. Suppresses the initiation or development of secondary ears at lower stalk nodes. However, under certain conditions on with certain genetic backgrounds, one or mono secondary ear not only initiate successfully, but also continue developing up to the one that becomes harvestable one (Nielsen.2014).It is also true that most of the plants at a low plant density were exhibiting more traditional secondary ears at stalk nodes below the primary ear (Nielsen.2014).

Davidson (2014) suggested that the abundance of double ears could do with genetics that limits expansion of the primary ear.
Therefore, the only outlet for the sugars produced by photosynthesis is developing a second ear . Generally, second ears are either barren on produce only 5% to 10% of the grain of primary ear. However, the appearance of a second ear that is filling suggests the crop is producing much more sugar than normal and not losing it during warm nights due to dark respiration.

CONCLUSION

The investigation aimed at study the impact of integrated managcment of some nitrogen and phosphorus fertilizer regimes on some ear traies for both primary and secandary ears of the single and double eared plants. It's worth to note that most triats of the secandary ear valued about 50% or less that those of the primary ear. Reduction of nitrogen from chemical fertilizer up to 50%could be attained by the application of 50%of nitrogen from compost as in fertilization regime N_4 (60kg N from chemical fertilizer + 60 kg N from compost). An elaborate look at phosphorus fertilization regimes alternative to the efficacious of biophosphorus fertilizer asalternative choice than the chemical phosphorus fertilizer up to100% replacement.

CONFLICT OF INTEREST

The authors have declared that the present study was performed in absence of any conflict of interest.

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AUTHOR CONTRIBUTIONS

Conceived and designed the experiments and write the paper: AAH Khawaga, performed the experiment, collecting and analyzed the data: Amira WM. Khattab. Contributed materials, analysis, tools: Ramadan IEA, and Mohamed E S M.

REFERENCES

Abd El-Maksoud MF and Sarhan AA, 2008. Response of some maize hybrids to bio and chemical nitrogen fertilization. Zagazig J. Agric.Res.,35(3):497-511.

Ali S, Sahiba M, Malik A, Ul-Hassan F and Ansar M, 2012. Growth of rainfed fodder maize under different levels of nitrogen and phosphorus. Pak. J. Agric. Res., 25(3):196-205.

Amanullah and Khan A, 2015. Phosphorus and Compost Management Influence Maize (*Zea mays*) Productivity Under Semiarid Condition withand without Phosphate Solubilizing Bacteria. FrontPlant Sci. 6:1083. doi: 10.3389/fpls.2015.01083.

Amanullah, Khan I, Jan A., Jan MT, Khalil S. K, Shah Z., et al. 2015. Compost and nitrogen management influence productivity of spring maize (*Zea mays* L.) under deep and conventionaltillage systems in Semi-arid regions. Commun.Soil Sci. Plant Anal. 46, 1566–1578.

Azeez JO, Adetunji MT, and Lagoke STO, 2006. Response of low-nitrogen application in a tropical Alfisol in northern Nigeria. Soil and Tillage Res., 91(1):181-185.

Davidson D, 2014. Corn: Are 2 Ears Better Than 1? That is the Question — DTN.Contributing AgronomistAugust1,2014.https://agfax.com/2014/08/01/corn-2-ears-better-1-question-dtn/

Duncan DB, 1955. Multiple Range and Multiple F-Test. Biometrics, 11:1-42.

El-Nagar GR, 2003 .Influence of mineral and bio-fixed nitrogen fertilization in maize producing under different irrigation regimes. Assuit. J. Agric.Sci.,34(5):53-76.

Fazlullah MA, .Shah F, Iqbal S, Arshad, MMuhammad, F. Wahid, A. Hussain, M. Roman D, Perveez R, and Noor M, 2018. Integratedapplication of phosphorus (p) and phosphate solubilizing bacteria (psb) improve maize yield. Pureand Applied Biology *(PAB)* [Online],. Volume 7 Number2 : 494-499. Web. 17 Jul.

GAIN Report 2018. Number:EG18020. Date: 9/9/2018.jgjgjghttps://gain.fas.usda.gov/Recent%20GAIN%20Publications/Grain%20and%20Feed%20Update_Cairo_vhguEgypt_9-9-2018.pdf

Ikramullah.MI, Khakwani A.A, Sadiq M, Awan,I, Munir M and A.Ghzanfarullah 2015. Effect of nitrogen fertilization rates on growth, quality and economic return of fodder maize(*Zea mays* L.).arhad J. Agric.,31(1):22-29.

Kamran A, Ayub K, Farah N, Muhammad I and Imran A, 2018.The Impact of Different P FertilizerSources on Growth, Yield and Yield3Component of Maize Varieties. Agri Res & Tech: Open Access J. 2018; 13(3): 555881.

Khan MS, Zaidi A and Ahmad E, 2014. Mechanism of phosphate solubilization and physiological functions of phosphate solubilizing microorganisms, In: Phosphate Solubilizing Microorganisms: Principles and application of microphos technology. J Springer Inter Publishing Switzerland, Switzer Land 31: 62.

Khattab WMA, El-Khawaga AAH, Saleh ME and Ramadan IE, 2016. Some Bio-chemical Nitrogen and Phosphorus Fertilization Regimes Impacts on Wheat (*Triticum aestivum* L.) Productivity. Zagazig J. Agric. Res., Vol. 43 No. (1)

Kumar D, Jhariya AN, 2013. Nutritional, Medicinal and Economical importance of Corn: AMini Review. Research Journal of Pharmaceutical

Sciences 2 : 7-8.

Mahato S and Neupane S, 2017. Comparative study of impact of Azotobacter and Trichoderma withother fertilizers on maize growth. Journal of Maize Research and Development, 3(1), 1 -16.

Majid MA, Saiful M, Islam A, EL Sabagh MK, Hasan MO, Saddam C, Barutcular D, Ratnasekera Kh, Abdelaal AA, and Islam MS, 2017. Influence of varying nitrogen levels on growth, yield and nitrogen use efficiency of hybrid maize (*Zea mays*). Journal of Experimental Biology and Agricultural Sciences, May - 2017; Volume – 5(2).

Nafziger, 2014. Corn: Are 2 Ears Better Than 1? That is the Question — DTNAugust 1, 2014.By Daniel Davidson, DTN Contributing Agronomist.https://agfax.com/2014/08/01/corn-2-ears-better-1-question-dtn/

Nielsen RL, (Bob) 2007. Ear Size Determination in Corn. Corny News Network, PurdueUniv. http://www.kingcorn.org/news/timeless/EarSize.html. (URL accessed July 2014).

Nielsen, 2014. Multiple Ears of Corn on the Same Shank.URLaccessedJuly2014 http://www.kingcorn.org/news/timeless/MessyEars.html

Qureshi M.A, Ahmad ZA, Akhtar N, Iqbal A, Mujeeb F and Shakir MA 2012 . Role of phosphate solubiliing bacteria (PSB) in enhancing p availability and promoting cotton growth. The J of Animal & Plant Sci 22(1): 204-210.

Seadh S.E.;.Abido WAE and Abdulrahman DR, 2015.The role of foliar application in reducing maize nitrogen requirements. J. Plants Prod ., Mansoura Univ.,5(7):1168-1180.

Sham MAI.2018. Effect of some agronomic practices on yield and its attributes of some yellow maize hybrids.Agronomy Department Faculty of Agric. Zagazig Univ.

Shams SAA, 2000. Effect of some preceding winter crops, nitrogen levels and zine ffoliar application on grain yield of maize(*Zea mays* L.).Annals and Agric. Sci., Mohtohor,38(1):47-63.

Sharma SB, Sayyed RZ, Trivedi MH and Gobi TA, 2013 . Phosphate solubilizing microbes: Sustainable approach for managing phosphorus deficiency in agricultural soils. *SpringerPlus* , *2*, 587.

Snedecor GW and Cochran GW, 1967. 'Statistical Method 6th Ed. Iowa state Univ. Amer. Iowa. USA.

Soliman, MSM, Abdel-Aziz AA, and Derar RA, 2001. Effect of nitrogen rate, farm yard manuring and biofertilization on growth, yield components of maize (Zea mays, L.). Egypt Sci., 16(7): 151-167