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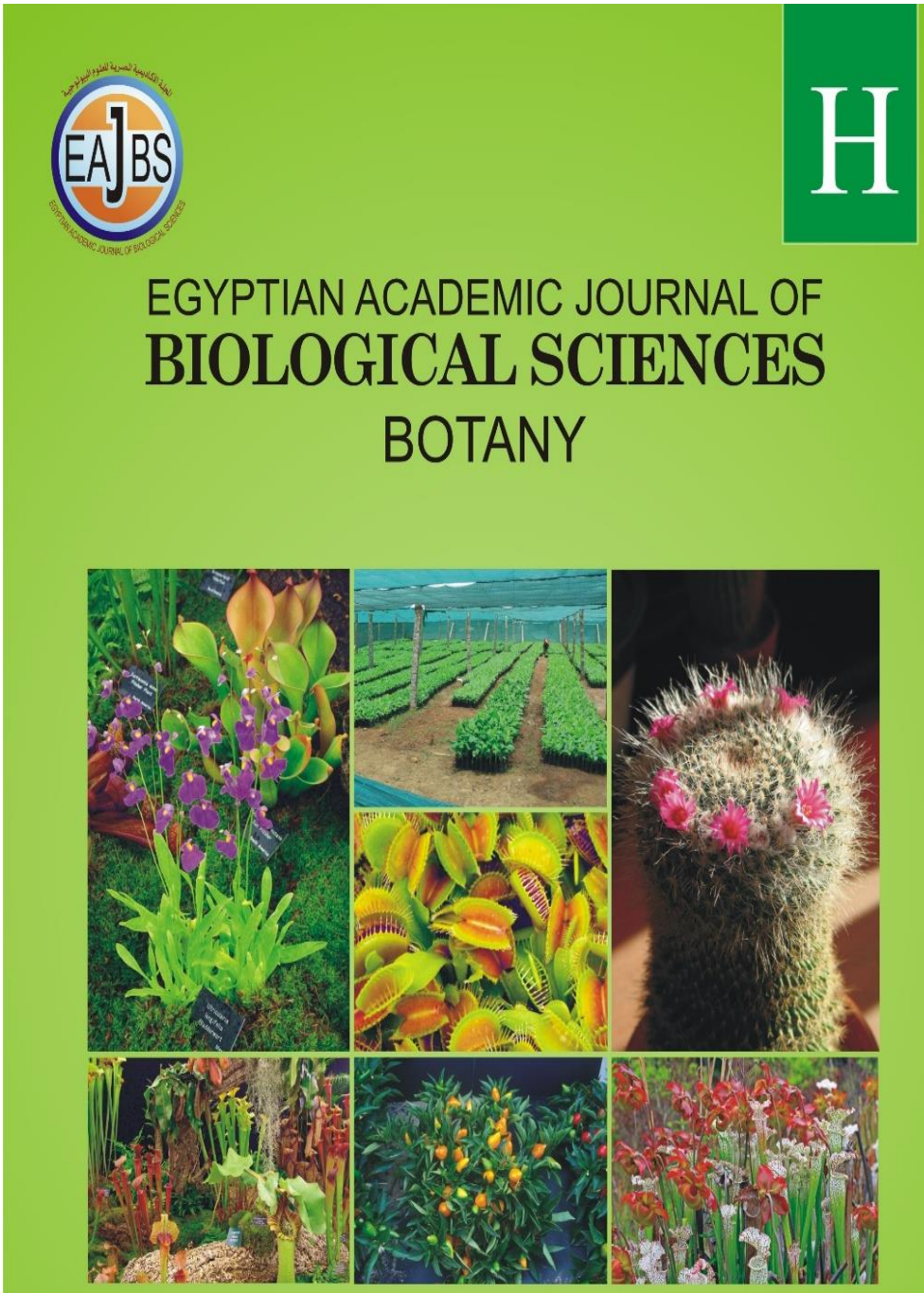

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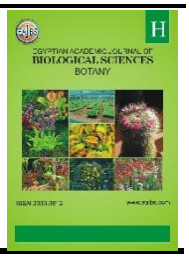

Growth and Productivity of Maize in Relation to Preceding Crops, Mineral and Biofertilization

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ABSTRACT

Two field experiments were conducted at the Experimental Farm in Etai El-Baroud Agricultural Research Station, El-Beheira Governorate, Egypt on yield, yield components and quality of maize plant grown on 2019 and 2020 summer seasons, to study the effect of three preceding crops {Wheat cv. (Sakha 94), Sugar beet cv. (Careem) and Berseem cv. (Meskawy)} and five fertilizer treatments of {mineral (NPK) and biofertilizers (Mycorrhiza + Microben + Potassiummag) as follow: {100% NPK (F1), 75% NPK + biofertilizers (F2), 50% NPK + biofertilizers (F3), 25% NPK + biofertilizers (F4) and biofertilizers only (F5)}.

The results revealed that berseem was the best preceding crop. Which gave the highest values for yield, yield components and quality. Most of the studied traits of maize did not reach the 5% level of significance between maize grown after berseem and maize grown after sugar beet. While planting maize after wheat recorded the lowest values.

Fertilizer treatments were significantly on all maize traits. (F2) gave the highest values for yield and its components, while (F5) gave the lowest values. Meanwhile, no significant differences were found between fertilizer systems (F1, F2 and F3) for plant height, grain weight/ear and biological yield/fed. While F5 and F4 recorded the highest quality traits.

The interaction had a significant effect on most studied characters in the two growing seasons. Grown maize after berseem with (F2) fertilizer resulted in the highest values, whereas grown maize after wheat with (F5) treatment recorded the lowest values on yield and its components, the interaction did not reach the 5% level of significance between maize grown after berseem and maize grown after sugar beet under fertilizer treatments (F1, F2 and F3) for ear height, grain weight/ear and biological yield/fed, while interaction did not reach the 5% level of significance between maize grown after berseem with fertilizer treatments (F1 and F3) for grain weight/ear and grain yield/fed in both seasons.

INTRODUCTION

Maize is one of the most important cereal crops the world maize is the third plant in crop production after wheat and rice (Majnoon Hosseini, 2006).

A well-planned cropping sequence is commonly conducted in order to improve or maintain soil fertility, reduce erosion, minimize the risk of weather damage, reduce reliance on agricultural chemicals and increase net profits (Liebman and Davis, 2000 and Kumbhar *et al.,* 2007). Moreover, several researchers reported that the soil macro and micronutrients, organic matter and C/N ratio of residues were affected by the preceding crops and consequently affect yield and yield components of the following crop (Farghly, 2001 and Sainju *et al.,* 2003).

The production of maize increased by application of fertilizer (biofertilizers especially), is the most important method of improving products (Ali *et al.,* 2008 and Hasaneen *et al.,* 2009). Increased populations of arbuscular mycorrhizal fungi (AMF) in soils after cultivation of mycorrhizal host crops improved AM colonization of succeeding crops in the following season, which consequently enhanced P uptake and early growth; (Arihara and Karasawa, 2000 and Miller, 2000) and yield of succeeding maize (Gavito and Miller 1998a). These systems depend in many important ways, on microbial activities, which appear to be tremendous potential for making use of microorganisms in increasing crop production and decrease environmental pollution (Ahmed, *et al.,* 2010; Javahery and Rokhzadi, 2011 and Esmaeilian, *et al.,* 2012).

The present instigation was carried to studying the influence of the preceding farming system and performance of maize to sources environmental during 2018/2019and 2019/2020 with the following objectives: to study the effect of different supplementary mineral fertilizers and bio-fertilizers on yield, yield components and quality of maize.

MATERIALS AND METHODS

Two field experiments were carried out at Etai El-Baroud Experimental station in El-Beheira Governorate, Agriculture Research Center, Egypt has grown on 2018/2019 and 2019/2020 winter seasons to study the effect of three preceding crops and five differences fertilizer treatments mineral and biofertilizers on yield and yield components and quality characters of maize (Zea mays, L.) cultivar (W S C, 30B74 Baioneare) grown on 2019 and 2020 summer seasons as follow:

1- Wheat cv. (Sakha 94).
2- Sugar beet cv. (Careem).
3- Berseem cv. (Meskawy). And, five differences fertilizer treatments of meniral and bio fertilizers as follow:

1-F1: 100% mineral NPK.
2-F2: 75% mineral NPK +Mycorrhiza + Microben + Potassiummag.
3-F3: 50% mineral NPK +Mycorrhiza + Microben + Potassiummag.
4-F4:25% mineral NPK +Mycorrhizal + Microben + Potassiummag.
5-F5: Mycorrhiza + Microben + Potassiummag only.

The experimental design was a randomized arrangement in a split-plot with four replications; preceding winter crops were located in the units of the main plot, while fertilizer treatments were randomized distributed to the sub-plots units. The area of each sub-plot was 5 ridges in (70 cm width), the length of the ridge was 3 m (plot area was 10.50 m^2 = 1/400 of feddan). All the other culture treatments were done according to the recommendation of the Ministry of Agriculture and Land Reclamation.

Table 1: Meteorological records of Central Laboratory for Agriculture Climate (Source: Etay El-Baroud Research Station) El-Beheira Governorate The Agriculture Research Center, Egypt during 2019 and 2020 seasons.

Meteorological records	HC Air temperature (C0)				HC Relative humidity (%)	
Season	2019	2020	2019	2020		
Month	Minimum		Maximum		2019	2020
May	17.1	16.6	26.7	27.7	58	60
June	18.4	20.3	30	29.6	58	60
July	22.1	22.8	31	30.7	84	85
Aug.	23.1	23	31.5	31.4	75	77
Sep.	21.3	21.4	29.9	30.6	68	69

The maize plant was planted in the summer season. Soil samples of the experimental sites were taken at the depth (0-30cm), to determine the physical and chemical analysis of the soil. According to the methods described by Page et al. (1982) the soil characteristics were determined from soil extract of 1:1 used for measuring soil pH using pH meter and potassium by flame photometer instrument. Total nitrogen was measured by kjeldhal method using a micro-Kjeldahl instrument (Bremner, 1965). Organic matter was measured in the soil by wet digestion with concentrated sulphuric acid using Walky and Black method (Black *et al.,* 1965).

Preceding crops was planted on 11th Nov. and 14th Nov. and harvested on 1st May in the first and second seasons, while maize as relay crop planted on 15th and 17th May and harvested on 15th and 17th September in the first and second seasons, respectively

Table 2: Some physical and chemical properties of the Soil of the Experiment Site after harvesting winter crops.

Soil variable	Wheat		Sugar beet		Berseem	
	2019	2020	2019	2020	2019	2020
PH	7.79	7.71	7.91	7.81	8.09	7.79
Organic matter (%)	2.07	1.99	2.28	2.19	3.07	2.99
Available N (%)	0.040	0.041	0.059	0.057	0.072	0.073
Available P (mg/kg)	2.09	2.01	2.66	2.34	2.67	2.77
Available K(mmol/L)	0.544	0.554	0.688	0.679	0.688	0.696

Table 3: Mechanical and chemical analysis of experimental soil carried out before planting in 2018/2019 and 2019/2020 seasons**.**

Soil properties	Soil texture	Sand %	Silt%	Clay %	PH	Organic matter%	Available N (%)	Available P (%)	Available K (ppm)	EC (m mhos) cm-1 (1;5)
2019	Clay	7.09	32.50	61.41	7.71	1.99	1.50	0.39	278.86	1.93
2020	Clay	8.59	31.80	59.61	7.79	2.07	1.52	0.38	286.79	1.61

Mineral fertilizers were added in two equal doses, the 1st dose was added before the first irrigation and the second one was added before the second irrigation. Whereas, biofertilizers were applied to maize grains before sowing directly, then planting and Irrigation done immediately.

At harvest time at age of 120 days from sowing maize sample of ten plants were chosen randomly from each plot to estimate plant height (cm), number of grain/rows, 100-grain weight (g), grain weight /ear (g), grain yield (ton/fed) and biological yield (ton/fed).

A sample of maize grains, then 0.5 g were taken of each sample digested by a mixture of sulfuric (H2SO4) and perchloric (HClO4) acids (1:1) to analyze N, P and K content of grains as described by (Cottenie *et al.,* 1982).

Statistical Analysis:

The obtained data were analyzed according to Snedecor and Cochron (1967). The treatment's means were compared by using the least significant differences (L.S.D.) lest at 5% of probability. The analysis of variance (ANOVA) was computed using CoStat V 6.4 (2005) program.

RESULTS AND DISCUSSION

1- Effect of Preceding Crops on Yield and Its Components of Maize:

Data in Table (4) show the effect for preceding crops on yield and its components of maize as it cleared in the first and second seasons. The data obtained that plant height and 100-grain weight was significantly affected by preceding crops in 2020 only, the tallest plant and 100-grain weight (271.57cm and 37.63g) have resulted when grown maize after berseem, respectively. While the number of grain/row, grain weight/ear, grain yield/fed and biological yield/fed were significantly affected by the residual effect left by preceding crops in the first and second seasons. The highest values (33.08 and 33.17grain,151.21 and 152.70g, 3.518 and 3.552ton and13.481 and 13.905ton) have resulted when planting maize after berseem, whereas the lowest values (30.61 and 29.52 grain,120.60 and 122.20g, 3.019 and 3.054ton and12.331 and 12.584ton) obtained when grown maize after wheat for the number of grain/row, grain weight/ear, grain yield/fed and biological yield/fed in both seasons, respectively. Preceding crops did not reach the 5% level of significance between growing maize after berseem and growing maize after sugar beet for ear height, ear length, number of row/ear and grain yield/fed in the first and second seasons. Similar results were reported by Zuhri (2009), El-Sodany and Abou-Elela (2010) and El-Sobky (2016).

Table 4: Effect of preceding crops on yield and yield components of maize during 2019 and 2020 seasons.

Preceding crops	Plant height (cm)	No. of grain /row	100-grain weight (g)	Grain weight /ear (g)	Grain yield (ton /fed)	Biological yield (ton/fed)
	2019					
Wheat	260.22	30.61	36.81	120.60	3.019	12.331
Sugar beet	264.70	32.27	38.02	144.07	3.396	12.752
Berseem	265.90	33.08	37.79	151.21	3.518	13.481
L.S.D.at 5%	N.S.	1.56	N.S.	7.39	0.163	0.224
	2020					
Wheat	255.88	29.52	36.24	122.20	3.054	12.584
Sugar beet	264.47	31.67	37.07	145.17	3.449	13.282
Berseem	271.57	33.17	37.63	152.70	3.552	13.905
L.S.D.at 5%	13.04	1.17	0.38	5.78	0.192	0.696

2- Effect of Fertilizer Treatments on Yield and Its Components of Maize:

Data in Table (5) showed that yield and its components were significantly affected by fertilizer treatments in both seasons. (F1) achieved the highest values for plant height and biological yield/fed. While (F2) gave the highest mean values (34.88 and 34.14grain, 155.33 and 155.61g and 3.588 and 3.634ton) for the number of grain/row, grain weight/ear and grain yield/fed, whereas the lowest mean values (28.20 and 27.87grain, 118.17 and 120.61 and 2.854 and 2.930ton) were recorded when maize plants were fertilized by (F5) for the number of grain/row, grain weight/ear and grain yield/fed in 2019 and 2020 seasons, respectively. Meanwhile, no significant differences were found between fertilizer treatments (F1, F2 and F3) for ear length, the number of row/ear, biological yield/fed and straw yield/fed, in 2019

and 2020 seasons, meanwhile no significant differences were found between fertilizer treatments (F1 and F3) for grain weight/ear and grain yield/fed in 2020 season. Maize is known to be a heavy feeder of nitrogen fertilizer (Muhamman *et al.*, 2014). Nitrogen is one of the mineral fertilizers very important elements which affects maize cultivation and vegetative growth (Khalid and Islam Zadeh, 2001 and Zaremanesh *et al.*, 2017). On the other hand, the combination of bio and chemical fertilizer increased the grain yield of maize, these results are largely compatible with those obtained by Salimpour *et al.* (2010), Hasaneen *et al.* (2009) and El-Azab and El-Dewiny (2018).

Table 5: Effect of fertilizer treatments on yield and yield components of maize during 2019 and 2020 seasons**.**

Fertilizer treatments	Plant height (cm)	No. of grain /row	100-grain weight (g)	Grain weight /ear (g)	Grain yield (ton /fed)	Biological yield (ton/fed)
	2019					
F1	266.60	33.49	38.77	150.67	3.544	13.603
F2	266.70	34.88	37.68	155.33	3.588	13.503
F3	261.40	32.27	36.99	140.22	3.436	13.030
F4	262.80	31.09	37.33	128.74	3.133	12.437
F5	260.50	28.20	36.92	118.17	2.854	11.699
L.S.D.at 5%	N.S.	1.10	1.32	8.69	0.102	0.623
	2020					
F1	271.18	32.49	39.01	150.95	3.562	14.026
F2	270.88	34.14	36.88	155.61	3.634	13.978
F3	264.17	32.27	36.68	142.78	3.427	13.390
F4	259.91	30.50	36.18	130.83	3.206	12.814
F5	253.71	27.87	36.17	120.61	2.930	12.077
L.S.D.at 5%	14.51	0.93	1.01	8.14	0.141	0.709

Where: F1= 100% NPK, F2=: 75% NPK + Mycorrhiza + Microben + Potassium mag, F3= 50% NPK + Mycorrhiza + Microben + Potassium mag, F4= 25% NPK + Mycorrhizal + Microben + Potassium mag and F5= Mycorrhiza + Microben + Potassium mag only. L.S.D. = Less difference of significance.

3- Effect of Interaction Between Preceding Crops and Fertilizer Treatments:

Data in Table (6) indicated that 100-grain weight was significantly affected by interaction in 2020 season only, the highest mean value of 100-grain weight (41.00g) when maize plants by fertilized (F1) and maize sowing after berseem. While the number of grain/row, grain weight /ear, grain yield / fed and biological yield/fed were significantly affected by interaction in 2019 and 2020 seasons. (F2) gave the highest mean values (35.13 and 35.23grain, 161.67 and 163.50g, 3.686 and 3.721ton and 13.986 and 14.442ton) were obtained when maize plants are sown after berseem, while the lowest mean values (24.87 and 24.60gran, 94.67 and 96.33g, 2.334 and 2.426ton and 10.711 and 10.561ton) were obtained when maize plants are sown after wheat with fertilization biofertilizer only (F5) for the number of grain/row, grain weight/ear, grain yield /fed and biological yield/fed in both seasons, respectively. Meanwhile, no significant differences were found between fertilizer treatments (F2, F3 and F1) under planting maize after berseem or sugar beet. The highest maize yield and its attributes obtained by fertilizer maize plant 50.8 kg N/fed compared with 105.7 kg N/fed when maize was preceded by berseem (El-Sobky, 2016). On the other side, Thompson (1991) reported that one of the causes of the effect of preceding crops on the growth of succeeding crops was the difference in arbuscular mycorrhizal (AM) colonization in the roots of succeeding crops when available P in the soil limited the growth of succeeding crops.

Table 6: Effect of interaction on yield and yield components of maize during 2019 and 2020 seasons.

Treatments	No. of grain /row		100-grain weight (g)	Grain weight /ear (g)		Grain yield (ton /fed)		Biological yield (ton/fed)	
Wheat	2019	2019	2020	2019	2020	2019	2020	2019	2020
F_1	33.07	33.07	36.93	137.33	139.67	3.442	3.360	13.242	13.627
F_2	34.30	34.30	36.46	146.33	147.33	3.438	3.415	13.705	13.459
F_3	32.00	32.00	36.03	118.33	119.67	3.119	3.189	12.302	12.900
F_4	28.80	28.80	35.97	106.33	108.00	2.761	2.881	11.695	12.373
F_5	24.87	24.87	35.80	94.67	96.33	2.334	2.426	10.711	10.561
S. beet									
F_1	33.40	32.13	39.10	154.67	152.67	3.561	3.593	13.672	14.116
F_2	35.20	34.20	36.93	158.00	156.00	3.640	3.765	12.818	14.032
F_3	32.07	32.40	36.83	145.67	149.67	3.493	3.438	12.982	13.238
F_4	31.87	31.13	36.40	135.69	139.50	3.255	3.329	12.587	12.708
F_5	28.80	28.47	36.10	126.33	130.00	3.033	3.121	11.700	12.315
Berseem									
F_1	34.00	34.14	41.00	160.00	160.50	3.629	3.733	13.896	14.334
F_2	35.13	35.23	37.25	161.67	163.50	3.686	3.721	13.986	14.442
F_3	32.73	33.80	37.17	156.67	159.00	3.696	3.655	13.807	14.033
F_4	32.60	32.17	36.13	144.19	145.00	3.384	3.407	13.029	13.362
F_5	30.90	30.50	36.60	133.50	135.50	3.196	3.243	12.685	13.354
L.S.D. at 5%	1.90	1.61	1.74	15.05	14.09	0.176	0.244	1.179	1.233

Quality Attributes.

1- Preceding Crops:

Data in Table (7) showed that nitrogen%, phosphorus% and potassium% in grain were significantly affected by preceding crops in the first and second seasons. The highest mean values (2.010 and2.020%, 1.002 and 0.986% and 1.381 and 1.375%) have resulted when maize plants are sown after berseem, while the lowest values (1.774 and 1.761%, 0.858 and 0.870% and 1.224 and 1.236%) were recorded when maize was sown after wheat for nitrogen%, phosphorous% and potassium% in the first and second seasons. The preceding crop is an important crop technology measure with a significant influence upon the yield, respectively upon the yield components which represent those elements participating in the yield formation (Ion *et al.*, 2015).

2- Fertilizer Treatments:

Data in Table (7) cleared that nitrogen%, phosphorius% and potassium% in maize grains were significantly affected by fertilizer treatments in the two studied seasons. Biofertilizer increased quality characters in grain maize, the highest nitrogen% (2.010 and 2.020%) obtained when maize plants were fertilized by biofertilizer only (F5). The highest phosphorus% (1.014) obtained when maize plants were fertilized by (F4) in 2019 season while, in 2020 season the highest phosphorus% (1.007%) showed when maize plants were fertilized by biofertilizer only (F5) whereas, the highest potassium% (1.419 and 1.409%) resulted when added to maize plants fertilizer(F4) in both seasons. The lowest nitrogen% and phosphorous% in grains (1.726 and 1.707% and 0.883 and 0.892%) were obtained when maize fertilized by (F1), while the lowest potassium% in grains (1.236 and 1.249%) were obtained when maize fertilized by (F2) in the two seasons, respectively. These results were in agreement with that obtained by (Akbari *et al.*, 2011) who reported that biofertilizer improved plant productivity and quality in the sunflower seed. Ahmed *et al.* (2013) found that the highest values of vegetative growth, oil yield, chlorophyll content and NPK percentages were recorded by the treatment of bio-fertilizer plus two-third of the recommended dose of nitrogen fertilizer.

Table 7: Effect of preceding crops and fertilizer treatments on quality characters of maize during 2019 and 2020 seasons.

Treatments	Nitrogen % content		Phosphor % content		Potassium% content	
	2019	2020	2019	2020	2019	2020
Wheat	1.774	1.761	0.858	0.870	1.224	1.236
Sugar beet	1.955	1.933	0.977	0.975	1.361	1.365
Berseem	2.010	2.020	1.002	0.986	1.381	1.375
L.S.D.at 5%	0.082	0.171	0.034	0.025	0.043	0.066
F1(100%NPK)	1.726	1.707	0.883	0.892	1.248	1.263
F2(75%NPK+biofertilizer)	1.765	1.774	0.885	0.915	1.236	1.249
F3(50%NPK +biofertilizer)	1.920	1.856	0.939	0.930	1.349	1.338
F4(25%NPK +biofertilizer)	2.063	2.072	1.014	0.974	1.419	1.409
F5 (biofertilizer only)	2.092	2.114	1.007	1.007	1.358	1.367
L.S.D.at 5%	0.076	0.115	0.044	0.042	0.052	0.042

3- Interaction Effect:

Data reported in Table (8) obtained that, quality attributes were significantly affected by interaction, in 2019 and 2020 seasons. The highest mean values of nitrogen% (2.254%) was recorded in the treatment biofertilizer only (F5) in the first season, while in the second season the highest nitrogen% (2.275%) was recorded when maize plants were fertilized by (F4) treatment under maize sowing after berseem in both seasons. Whereas, the lowest nitrogen% (1.704 and 1.681%) have resulted when maize fertilized by 100% NPK (F1) with growing maize after wheat in both seasons. The highest mean value of phosphorous% (1.110%) was recorded under the treatment (F4) in the first season, while in the second season the highest phosphorus% (1.105%) was registered under the treatment of biofertilizer only (F5) when maize sowing after berseem in both seasons, the lowest mean values of phosphorous% (0.815 and 0.816%) were obtained when maize fertilized by biofertilizer only (F5) with growing maize after wheat in the first and second seasons. beet in the second season.

Table 8: Effect of interaction on quality characters of maize during 2019 and 2020 seasons.

Treatments	Nitrogen % content		Phosphor % content		Phosphorus% content	
Wheat	2019	2020	2019	2018	2019	2020
F1(100%NPK)	1.704	1.681	0.881	0.891	1.252	1.264
F2(75%NPK +biofertilizer)	1.757	1.735	0.856	0.865	1.244	1.249
F3(50%NPK +biofertilizer	1.816	1.675	0.868	0.887	1.241	1.255
F4(25%NPK +biofertilizer	1.800	1.850	0.870	0.889	1.230	1.256
F5 (biofertilizer only)	1.794	1.864	0.815	0.816	1.153	1.154
S. beet						
F1(100%NPK)	1.757	1.724	0.885	0.888	1.243	1.269
F2(75%NPK +biofertilizer)	1.742	1.721	0.883	0.931	1.221	1.256
F3(50%NPK +biofertilizer	1.879	1.917	0.952	0.925	1.394	1.379
F4(25%NPK +biofertilizer	2.171	2.092	1.063	1.032	1.504	1.460
F5 (biofertilizer only)	2.228	2.210	1.104	1.101	1.444	1.462
Berseem						
F1(100%NPK)	1.718	1.715	0.882	0.897	1.248	1.255
F2(75%NPK +biofertilizer)	1.796	1.867	0.916	0.949	1.244	1.241
F3(50%NPK +biofertilizer	2.065	1.976	0.998	0.977	1.411	1.481
F4(25%NPK +biofertilizer	2.218	2.275	1.110	1.001	1.524	1.512
F5 (biofertilizer only)	2.254	2.268	1.103	1.105	1.478	1.486
L.S.D. at 5%	0.132	0.199	0.076	0.072	0.090	0.082

While the highest mean values of potassium% (1.524 and 1.512%) were registered under the treatment (F4) when maize plants are sown after berseem, while the lowest potassium% (1.153 and 1.154%) were obtained when maize fertilized by biofertilizer only (F5) with growing maize after wheat in the two studded seasons, respectively. The interaction did not reach the 5% level of significance for phosphorus% and potassium% in fertilizer treatments F3 and F4 under grown maize after berseem or sugar Mahrous *et al.* (2014) obtained that applying of compost, biofertilizers and natural mineral rocks had support Rhizosphere microorganism (RMO) and gave higher values of total bacteria counts, nitrogenase and dehydrogenase activity as compared to untreated treatments. Using growth regulators (IAA or Kainten) as a foliar application in combination with 50% mineral fertilizer and biofertilizers (Cerealine and Nitrobine) with biofertilizer (Nitrobine) achieved the highest quality of sugar beet crop (Abd El-Aziz *et al.*, 2019).

CONCLUSION.

Based on this investigation and under the same conditions of El-Behaira Governorate, we can recommend planting maize after berseem and sugar beet with fertilizer systems75% NPK + biofertilizer (Mycorrhiza + Microben + Potassium mag) (F2) and 50% NPK + biofertilizer (Mycorrhiza + Microben + Potassium mag) (F3). To increase growth and get high maize grain yield and quality.

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ARABIC SUMMARY

نمو وإنتاجية الذرة الشامية وعلاقتها بالمحاصيل السابقة والتسميد المعدني والحيوي

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أقيمت تجربتين حقليتين بمحطة البحوث الزراعية- بإيتاي البارود – البحيرة, خلال موسمي 2019 و2020 لدراسة تأثير ثلاث محاصيل سابقة [القمح صنف (سخا94), بنجر السكر صنف (كريم), والبرسيم صنف (مسقاوى)] و خمس معاملات سماد " السماد المعدنيNPK والحيوي (الميكوريزا + المكروبين + بوتاسيوماج) أضيفت بالنظم الأتية [100% NPK (F1), 75% NPK + السماد الحيوي (الميكوريزا + المكروبين + بوتاسيوماج) (F2), 50% NPK + السماد الحيوي (الميكوريزا + المكروبين + بوتاسيوماج) (F3), 25% NPK + السماد الحيوي (الميكوريزا + المكروبين + بوتاسيوماج) (F4), السماد الحيوي (الميكوريزا + المكروبين + بوتاسيوماج) فقط (F5)] على الذرة الشامية.

أظهرت النتائج أن البرسيم أفضل محصول سابق، الذي أعطى أعلى القيم للمحصول ومكوناته والجودة في الذرة. معظم الصفات الدراسية في الذرة لم تصل إلى مستوى 5% من المعنوية بين زراعة الذرة عقب برسيم وزراعة الذرة عقب بنجر السكر. زراعة الذرة بعد القمح سجل أقل القيم.

معاملات السماد اعطت تأثيرا معنويا على كل صفات الذرة في كلا الموسمين.

(F2) أعطت أعلى القيم في المحصول ومكوناته, بينما المعاملة (F5)سجلت أقل القيم. أثناء ذلك لم يوجد فروق معنوية بين المعاملات (F1, F2 وF3) في طول النبات، وزن حبوب الكوز والمحصول البيولوجى للفدان في كلا الموسمين . المعاملتين (F4 وF5) سجلتا أعلى القيم في صفات الجودة.

التفاعل أعطى تأثيرا معنويا على معظم الصفات الدراسية في كلا الموسمين. زراعة الذرة الشامية بعد البرسيم مع معاملة السماد (F2) أعطى أعلى القيم في حين زراعة الذرة الشامية عقب القمح مع معاملة السماد (F5) سجل اقل القيم على المحصول ومكوناته. التفاعل لم يصل إلى مستوى 5% من المعنوية بين زراعة الذرة بعد البرسيم وزراعة الذرة عقب بنجر السكر بإستخدام معاملات السماد (F1, F2 وF3) في وزن حبوب الكوز والمحصول البيولوجي للفدان. بينما لم يصل التفاعل إلى مستوى 5% من المعنوية بزراعة الذرة بعد البرسيم بإستخدام معاملاتي السماد (F1 وF3) في وزن حبوب الكوز، ومحصول الحبوب للفدان في كلا الموسمين.