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RESPONSE OF SYNTHETIC CULTIVAR (5018) OF YELLOW CORN TO CHEMICAL AND BIO-FERTILIZATION

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Abstract

A field experiment was conducted on 20/7/2019 in one of the farms of the Al-Jelaweya village (30 km north of Babylon province), To study the effect of mineral fertilizers (Nitrogen, Phosphatic and potassium) and either bio fertilizers (Agrosoil-N that contains the Azotobacter and the Mycorrhiza (*Glomus mosseae*) separately and collectively on the synthetic cultivar. 5018 yellow corn in terms of growth and production, Mineral fertilizers were at three levels. As for bio fertilizers at two levels, the experiment was conducted using the Randomized complete block design (RCBD). The following results showed: Nitrogen fertilizer (Urea 46% N) excelled, giving the highest averages for plant height, leaf area and, chlorophyll content and total yield (183.22 cm, 540.22 cm^2, 54.44 spad, 5.41 ton/ ha), while phosphate fertilizer P_2O_5 excelled on The 500 grains weight and giving the highest averages, it reached 152.23 g. As for the bio fertilizer Agrosoil-N, it gave the highest values for the traits of plant height, leaf area and chlorophyll content, and the total yield was (183.36 cm, 612.82 cm^2, 52.04 spad, 5.060 tons / ha. Whereas, the treatment of two bio fertilizers gave the highest averages on all studied traits (193.38 cm, 572.06 cm^2, 58.22 spad, 153.59 g and 5,590 ton/ ha. The interaction between mineral and bio fertilizers (N2 x bio fertilizer together) excelled on all traits except for the 500grain weight trait as treatment (P2 x bio fertilizer together) excelled and gave the highest averages.

Key words : synthetic cultivar, yellow corn, bio-fertilization.

Introduction

The yellow corn crop (*Zea mays* L) is a grain field, industrial and Industrial and food suitable for human and animal consumption, and its stems and leaves are used for making paper, corn is the third crop after wheat and rice in terms of cultivated and productive area (Al-Roumi, 2016). It is considered one of the crops that are abundant in production, as it is cultivated with two seasons per year, bearing some cultivars and hybrids, more than cobs, and it is one of the crops tolerant of drought and other difficult environmental conditions such as heat (Taha, 2007). Its yield productivity in Iraq is still low compared to global production (FAO, 2016), and in order to improve the productivity of corn in general and the synthetic cultivar 5018 in particular, multiple methods must be found, including pollination with bio fertilizers (bacterial and fungal), but it is not considered a substitute for chemical fertilizers but rather increases The effectiveness of chemical fertilizers and reduce their quantities, bio fertilizers are inexpensive and environmentally friendly and increase the availability of fertilizers in the soil and reduces the use of chemical fertilizers and thus reduces the sources of pollution, which is done through vital vaccines for the soil, seeds or seedlings (Alwan, 2011). The adding of bio fertilizer has increased crop yields, foliar area and chlorophyll content (Jabbar *et al.,* 2018). One of the most important activities is to improve the absorption of elements that have a slow movement in the soil. Among the bio fertilizers that supplement the mineral fertilizer and increase its efficiency are mycorrhiza (Vesicular Arbuscular Mycorrhiza (VAM) fungi, which is one of the most important microorganisms used in this field, where adding them to the soil or seeds improves the performance of the plant by improving the relationship between the microorganisms and the plant (Taha, 2007). Al-Ta'i, (2010) showed that the Vaccination with the *Glomus mosseae* increased the dry and fresh weight of the vegetative growth and root system of corn. In addition,

the amount of nutrients absorbed by the plant such as nitrogen, phosphorus and potassium increased by 133.09%, as noted (Galvez *et al.,* 2001) increased the plant's efficiency to absorb Phosphorus. (Hamdan, 2011) also confirmed that the adding of Mycorrhiza fungi increases the amount of free growth regulators in the medium of growth such as Auxin, gibberellin and cytokinin that stimulate the root hairs to grow faster. Jabbar et al. (2016) showed that the use of Azospirillum increases the speed of plant growth, the number of leaves and leaf area and thus increases production due to the supply of corn with nitrogen, which increases the chlorophyll content and then increases the efficiency of photosynthesis (Al-Obaidi, 2013). As mentioned (Thind *et al.,* 2002) the use of these bacteria as a bio fertilizer encourages plant growth through its supply of nitrogen, and this is reflected in all the characteristics of the corn plant. When using the two vaccines together, they gave the best results, because each type of bio fertilizer increases the effectiveness and efficiency of chemical fertilizers in a different methods (Alwan, 2011). Abdul Hamid and Adarah (2011) explained that nitrogen fertilizer increases the grain weight and this increase is due to the nitrogen that helps to increase the formation of chlorophyll and the increase in the leaf area, thus increasing the efficiency of photosynthesis, and hence the accumulation of dry matter during the period of grain filling stages, That is, an acceleration occurs of the dry matter accumulation (Tollenaar *et al.,* 1997). As for phosphorous, it is considered one of the necessary elements to increase the total yield of the yellow corn due to its participation in the formation of nucleic acids RNA and DNA.Proteins, cell membranes and enzyme accompaniments. As for its deficiency, it leads to a weakened plant in general, small leaves, weak root system, and delayed fruit ripening (Al-Naimi, 2011). Beiruti et al. (2008) concluded that spraying potassium fertilizer on yellow corn leaf resulted in a significant increase in plant height and foliar area. Yellow Rafat *et al.*, (2012) mentioned that spraying corn with potassium fertilizer has three concentrations (0, 1, 2)% and with three stages of sorghum growth (the vegetative stage, the flowering stage, the two phases together) where the 2%level excelled and the vegetative stage in giving the best vegetative and fruiting traits of the crop, El-Sye *et al.*, (2005) found that spraying potassium significantly increased the absorption of phosphorus in all parts of corn and this led to an increase in the total yield.

Materials and Methods

A field experiment was conducted on 20/7/2019 in one of the private farms in the Al Jelaweya village, To study the response of the synthetic cultivar of yellow corn for chemical and biofertilizer, where The seeds of the synthetic cultivar 5018 yellow corn were obtained from the Agricultural Research Department / Baghdad - Abu Ghraib. Three soil samples were taken from different locations with a depth of (0-30) cm to study their physical and chemical properties and their texture (Table 1).

Table 1: Chemical and physical properties of field soils.

Traits	Values	Units
Nitrogen availability	17.8	mg.kg/soil
Phosphorous availability	6.72	mg.kg/soil
Potassium availability	90.44	mg.kg/soil
Organic matter	2.8	%
PH	7.7	-
EC	3.1	$Ds.m^{-1}$
Clay	240	$g.kg^{-1}$ soil
Sand	330	$g.kg^{-1}$ soil
Silt	410	$g.kg^{-1}$ soil
Soil Texture	Sandy clay loam	

The experiment land was plowed perpendicularly, and it was smoothed, leveled and divided into furrows, the distance between one and another 75 cm and the distance between pit and the other 25 cm and the furrow length 4 m, and with three replicates, separators were left between the replicates with a distance of 2 m and between treatments 0.75 cm for work accuracy and the ability to take measurements easily. The Randomized Complete Block Design (R.C.B.D) was used and the averages were compared with the least significant difference(L.S.D).The (2-3) seeds were placed per pit, and two weeks after germination, the plants were Thinning to one plant in each pit. All crop service operations were conducted from irrigation and weeding whenever the need arose, and combating the corn stem borer with the diazinon granulator 10% effective substance and twice, the first two weeks after germination and the second after a month of germination. Bio fertilizer Agrosoil - N was used which contain Azotobacter, an Australian bio fertilizer containing several types of free nitrogen-fixing bacteria, was used: *A. Chroococcoccum*, *A.beijerinckii* and *A. Vinelandii* and was used in two levels without adding and adding it. Glomus mosseae was used and pollinated per kilogram of vaccine per 10 km with mixed and distilled and sterilized water. It was used in two levels (without adding and adding it)and the fourth treatment for the bio fertilizer is adding the two bio fertilizers together.

Chemical fertilizer (mineral)

Therefore, three types of fertilizers were used, including nitrogenous fertilizers, using urea (46% active

substance. With three levels (0, 160, 320) kg/ ha and which is symbolized by (N0, N1, N2), respectively, and phosphate fertilizer was used in the form of "P_2O_5" and three levels are: (0, 50, 100) kg/ha which is symbolized by (P0, P1, P2), respectively. Potassium fertilizer was sprayed with three concentrations (0, 500, 1000) mg /L which is symbolized by (K0, K1, K2), Ten plants were randomly selected for each treatment and were taught to study some of their vegetative and Fruiting traits, including:

1. The plant height (cm) was measured using a tape measure from the soil surface to the node of the male inflorescence.
2. The leaf area (cm^2) is calculated by multiplying the length x the width x 0.75
3. Chlorophyll content: The chlorophyll content of the leaf was measured under the cob leaf by the Chlorophyll meter Spad 502.
4. The 500 grains weight (g), and then adjust the weight based on the moisture content of 15.5%.
5. Total grain yield: ($ton.ha^{-1}$) by multiplying the total plant yield x plant density

Results and Discussion

It is clear from table 2 the excelled of nitrogen fertilizer on the rest of the mineral fertilizer components by giving it the highest averages of 183.22 cm, while potassium gave the lowest average of the studied traits amounted to 171.40 cm, While the highest level (N2, P2, K2) of mineral fertilizer of the studied trait excelled on the rest of the levels, the highest averages were recorded (194.79, 189.79, 180.83) cm respectively. As for biofertilizers, the fertilizer (Agrosoil-N) was excelled to the mycorrhizal (*Glomus mosseae*) and the control treatment by giving it the highest average plant height of the synthetic cultivar 5018 yellow corn reached 183.36 cm, compared with Mycorrhiza fertilizer and the control treatment is given (172.99, 161.66) cm, respectively. Whereas, the treatment of adding two biofertilizers together recorded the highest averages of 93.381 cm compared to all levels of mineral and biofertilizer. As for the interaction between the levels of mineral and bio-fertilizers, the interaction (N2 X biofertilizers together)excelled and giving the highest averages amounted to 217.18 cm. A.O.A.C, (2003) emphasized that pollination with double biofertilizer (bacterial and fungal) increased plant height by 21.5 compared to the control treatment and in the case of fertilizing with mineral fertilizers recommended with biofertilizers the plant height increased by 50% compared to not adding. Albidi et al. (2010) agree with the findings of the research by obtaining a 14.62% increase in plant height compared to the lack of addition. We can explain the increase in plant height in the case of using mineral fertilizers with biofertilizers together. In this case, biofertilizers increase the effectiveness of mineral fertilizers and reduce the pollution caused by mineral fertilizers and encourage the plant to absorb nutrients and water more effectively than if mineral fertilizers were alone.

Table 2: Effect of Mineral and Biofertilizers of plant height trait for synthetic cultivar 5018 for yellow corn.

Mean	The two Bio fertilizer together	Mycorrhiza (Glomus Mosseae)	Agrosoil-N	Without Fertilizer	Mineral Fertilizer levels	Mineral Fertilizer
171.93	185.11	168.40	181.60	152.60	N0	Urea
182.95	201.64	175.30	187.44	176.40	N1	
194.79	217.18	188.97	198.10	174.89	N2	
168.10	180.49	165.80	175.69	150.40	P0	P_2O_5
178.42	196.39	172.66	183.31	161.33	P1	
189.79	207.09	182.40	193.06	176.60	P2	
163.34	176.17	159.40	171.20	146.60	K0	K_2O
170.03	181.67	166.44	175.25	156.83	K1	
180.83	192.69	177.54	184.64	168.43	K2	
	193.38	172.99	183.36	161.66		Mean

Table 3: Effect of Mineral and Biofertilizers of leaf area trait for synthetic cultivar 5018 for yellow corn.

Mean	The two Bio fertilizer together	Mycorrhiza (Glomus Mosseae)	Agrosoil-N	Without Fertilizer	Mineral Fertilizer levels	Mineral Fertilizer
476.10	498.10	473.66	480.89	451.66	N0	Urea
539.38	582.63	530.93	560.87	483.10	N1	
600.18	680.19	579.34	620.93	520.27	N2	
468.09	495.62	472.21	477.33	425.62	P0	P_2O_5
504.68	539.22	499.37	523.89	456.25	P1	
542.70	603.91	527.89	558.83	481.20	P2	
462.90	502.93	451.55	463.74	433.39	K0	K_2O
516.30	579.57	501.53	533.49	450.62	K1	
597.76	664.41	591.71	642.82	492.10	K2	
	572.06	514.24	540.31	466.02		Mean

It is clear from table 3 that nitrogen fertilizer is excelled to other components of mineral fertilizer (phosphorous and potassium) by giving it the highest averages of 540.22 cm^2,While phosphate fertilizer (P_2O_5) gave the lowest average of the leaf area reached 505.16 cm2. The higher level for all types of mineral fertilizers (N2, P2, K2) excelled the averages (605.18, 542.70 and 586.76) cm^2, respectively. As for the biofertilizers, the biofertilizer (Agrosoil-N)on Mycorrhiza and compared to the treatment by giving it the highest average of the leaf area amounted to 540.31 cm^2. when comparing mineral fertilizers, Bio fertilizer, lack of addition and bio-composts, it is clear that the addition of bio-composts together gives it the highest average size of the leaf area of 572.06 cm^2. As for the interaction between mineral and biofertilizers, the treatment (N2 x biofertilizers together)excelled and gave 680.19 cm^2. The increase in the leaf area when pollinating the seeds with the biofertilizer (Agrosoil-N) or mycorrhiza compared to the control treatment may be due to the increase in metabolic processes and the promotion of absorption of nutrients and water and the secretion of these organisms by some growth regulators in the rhizosphere and that these secretions have a major role in elongating the roots and stimulating them and increasing Its density and then its efficiency in the absorption of mineral fertilizers, especially nitrogen fertilizers, was reflected positively in the traits of plant growth (Saleem, 2001).

From table 4, the excelled of nitrogen fertilizers on the rest of the mineral fertilizing components (phosphate and potassium) is shown by giving it the highest average of chlorophyll content which reached 54.44 spad followed by potassium fertilizer. Phosphate fertilizer has given the averages amounted to (49.20, 45.99) spad respectively. The second level of all types of mineral fertilizer (Urea, P_2O_5, K_2O) excelled and gave the averages (63.50, 53.21, 55.64) spad respectively.As for biofertilizers, Agrosoil-N biofertilizer excelled on the Mycorrhiza fungus and control treatment, giving the highest average of the trait 42.03 spad. The adding of the two biofertilizers together achieved the highest average studied traits amounted to 58.22 spad and for this reason, this treatment excelled on all the added treatments of cultivars 5018, whether mineral or biofertilizer. As for the interaction between mineral and biofertilizers, the treatment (N2 X biofertilizers together) was distinguished by giving it the highest average quality amounted to 76.32 spad. The researcher supported Khalifa *et al.*, (2018) because they obtained a 22.07% increase in the content of chlorophyll when treating seeds with bacterial and fungicidal fertilizer together. As for bio-fertilizers with mineral fertilizers, the increase was 25.35% in the chlorophyll content in the plant. This can be explained by the positive role of inoculation with Azotobacter in Agrosoil –N in fixing atmospheric nitrogen and then increasing the content of chlorophyll and thus increasing the efficiency of photosynthesis and this leaves its impact on increasing plant growth. A.O.A.C *et al.*, (2001) confirmed an increase in the chlorophyll content in the leaves of corn when using the two biological vaccines together compared to the control

Table 4: Effect of Mineral and Biofertilizers of Chlorophyll content for synthetic cultivar 5018 for yellow corn.

Mean	The two Bio fertilizer together	Mycorrhiza (Glomus Mosseae)	Agrosoil-N	Without Fertilizer	Mineral Fertilizer levels	Mineral Fertilizer
42.91	49.66	41.22	45.65	35.10	N0	Urea
54.45	63.71	50.47	59.41	44.22	N1	
62.97	76.32	58.81	64.12	52.61	N2	
39.13	45.17	37.30	40.66	33.39	P0	P_2O_5
45.62	53.23	42.19	48.44	38.60	P1	
53.21	58.71	50.80	55.70	47.66	P2	
43.75	51.51	41.10	45.44	36.93	K0	K_2O
48.22	55.95	45.66	50.17	41.10	K1	
55.64	62.82	52.29	58.79	48.66	K2	
	57.45	45.65	52.04	42.03		Mean

Table 5: Effect of Mineral and Biofertilizers of the 500 grain weight for synthetic cultivar 5018 for yellow corn.

Mean	The two Bio fertilizer together	Mycorrhiza (Glomus Mosseae)	Agrosoil-N	Without Fertilizer	Mineral Fertilizer levels	Mineral Fertilizer
139.59	145.75	142.20	136.60	133.80	N0	Urea
150.77	153.29	151.23	155.34	143.22	N1	
158.28	164.69	159.84	158.40	150.17	N2	
144.16	149.86	145.57	143.76	137.49	P0	P_2O_5
151.41	157.73	154.46	150.74	142.69	P1	
161.12	164.16	162.65	160.89	156.76	P2	
135.23	139.35	136.77	133.16	131.65	K0	K_2O
142.26	150.34	144.62	138.60	135.49	K1	
147.42	156.66	151.09	141.57	140.36	K2	
	153.54	149.83	146.57	141.29		Mean

Table 6: Effect of Mineral and Biofertilizers of Total yield for synthetic cultivar 5018 for yellow corn.

Mean	The two Bio fertilizer together	Mycorrhiza (Glomus Mosseae)	Agrosoil-N	Without Fertilizer	Mineral Fertilizer levels	Mineral Fertilizer
4.608	5.016	4.367	4.690	4.362	N0	Urea
5.520	6.190	5.287	5.669	4.916	N1	
6.350	7.610	6.278	6.744	5.489	N2	
4.281	4.720	4.010	4.410	3.980	P0	P_2O_5
4.700	5.233	4.444	4.826	4.288	P1	
5.563	6.262	5.469	5.700	4.820	P2	
4.150	4.602	4.060	4.350	3.640	K0	K_2O
4.620	5.201	4.803	4.492	3.980	K1	
4.758	5.460	4.591	4.691	4.290	K2	
	5.590	4.810	5.060	4.010		Mean

treatment, explaining their role in increasing the absorption of nutrients.

(Table 5) shows the phosphate fertilization excelled on the other two types of mineral fertilizers (nitrogen and Potassium) by giving it the highest averages for a 500-grain weight amounted to 152.23 g, while giving nitrogen and potassium fertilizer (149.54, 141.64) g respectively. The second level excelled by giving the highest averages compared to the first level and the control treatment, where it gave the averages amounted to (158.28, 161.12, 147.02) g. As for bio-fertilizers, the Mycorrhiza was excelled to Agrosoil-N by giving it the highest average amounted to 149.83 g. The adding of the two biofertilizers together achieved the highest average of the 500 grain weight 135.54 g. Thus, this treatment excelled on all treatments (mineral and biofertilizers) for this trait. As for the interaction between mineral and biofertilizers, the combination (N2 x biofertilizers together) was distinguished, giving the highest averages amounted to 168.16 g. The reason for this is that the bacteria the atmospheric Nitrogen fixation and increase its availability for the plant, which led to the continuation of metabolic processes in the formation of carbohydrates and proteins and the regularity of their transmission.

(Table 6) shows the excelled of nitrogen fertilizer on the rest of the mineral fertilizers by giving it the highest averages for the total yield of the synthetic cultivar 5018 yellow corn reached 5.49 tons/ha, while phosphate and potassium fertilizer gave an average amounted to (4.85, 4.51) tons / ha. The second level excelled on all types of mineral fertilizers, giving the highest average amounted to 6.350, 5.563 and 4.751 tons / ha, respectively. As for bio-fertilizers, Agrosoil-N bacterial fertilizer excelled on the treatment of Mycorrhiza, giving the highest averages of the trait amounted to 5.060 tons/ha, while the control treatment gave an average amounted to 4.010 tons/ha. The adding of biofertilizers together achieved the highest averages for all mineral and biofertilizers and gave 5,590 tons/ha. As for the interaction between mineral and biofertilizers, the treatment (N2 X bio-fertilizer together) excelled on the highest average amounted to 7.610 tons/ha. Alkurtany *et al.*, (2001) explain that high adding of mineral fertilizer with biofertilizers containing nitrogen-fixing bacteria increased the total yield of the yellow corn. Sommer, (2004) also confirmed that supplementing the mineral fertilizer recommendation with the double fungal bacterial vaccine contributes to raising the level of soil fertility and increasing its productivity by increasing fertilizer additives, and also concluded that the main effect of biofertilizer treatments regardless of mineral fertilizer has a significant effect on the percentage of nitrogen and then protein and this, in turn, it positively affects the increase in the total yield.

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