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Effect of Humic and Fulvic Acids on the Yield of Maize Cultivars

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Abstract. A field experiment was carried out in the spring season 2022 in the organic fertilizer project in Thi Qar Governorate, Shatrah District, 40 km to the north of the city. The factorial experiment includes two factors. The first factor includes four varieties of maize (ZP, Maha Kaws and Forat), which were varieties approved by the Ministry of Agriculture and are sourced from the Agricultural Research Department, Department of Yellow Maize. The second factor was levels of humic acids (without the addition of control treatment and 1, 2 and 3 g L^{-1}) of fulvic and humic acids. the results indicate that there was a significant superiority of the cultivars, the Kaws cultivar was superior in length of ear 20.98 cm , nitrogen 1.3142%, and protein 8.15% , the Forat cultivar was superior in the 1000 grain 444.7 g and grain yield 9089 kg h^{-1}.As for humic acids treatments at a concentration of 3 g on nitrogen 1.4592%, protein 9.11% ,oil 5.321%, 1000 grain 449.9 g and grain yield 7239.75 kg h^{-1}. As for the interaction, the combination (treatment 3 g x Kaws cultivar) on length of ear 21.67 cm , nitrogen 1.4833%, and protein 9.27% .

Keywords. Protein, Oil, Yield, Maize cultivars.

1. Introduction

Maize (*Zea mays* L.) is one of the most important Cereal crops on the world for its numerous utilizations: in human or animal food as green fodder or silage [1]. Yellow maize occupies the second place in the world in terms of cultivated area and the first in the world in terms of production The global area cultivated for yellow corn in (2016) of grain yield reached 7.296 tons ha^{-1}, in some developed countries, such as the United States of America, global productivity may reach double, while the productivity rate in Iraq was 3.425 h^{-1}, despite the great importance of this crop and the growing interest in its cultivation in Iraq, however, its production rate is still low per unit area for many reasons, including the lack of productivity of cultivated varieties and not adding the appropriate amount of fertilizers, especially chemical ones that contain elements (NPK), with the neglect of foliar feeding, which plays an important role in increasing the quantity of the crop and improving its qualityLikewise, not choosing the dates for adding fertilizer at the appropriate or critical stages of plant growth that greatly affect its productivity [2]. Rahim and others (2019) found in an experiment on eighteen genotypes of the yellow corn crop, there are three cultivars 200 - Agaiti, Local chdck (xy) and 6089 (EV -) that recorded the highest averages for the characteristic of the proportion of protein in grains, amounting to 11.76%, 11.27 % 11.17%, as well as the characteristic of the percentage of oil in grains (5.80%, 6.20%, 6.37%) for the genotypes, respectively [3].

Corn flour was used in the production of bread after mixing it with wheat flour, corn starch is used in making pastries and various foods, the sugary juice is extracted from its stems and oil from the embryo of its seeds, in addition to using its stems and leaves in the manufacture of different types of paper [4].

Humic organic matter, including humic acid, plays an effective role in improving the physical and chemical properties of soil, by the interaction of these compounds with soil minerals and then improve the physical properties of the soil as well as the adsorption capacity of mineral elements, humic organic acids affect the improvement of plant growth and the availability of elements. Humic acid is a complementary source of polyphenols in the early stages of plant growth, acts as a chemical intermediate, leads to an increase in the vital activity of the plant, as the enzyme system becomes more effective, cell division increases, the root system develops, and dry matter production increases. Organic acids increase nutrient availability as well as act as a buffer against changes in soil reactivity, as well as preserving nutrients from loss to the bottom away from the roots, for its ability to hold ions on its surface, many researchers have reached, that the organic and biological fertilization led to an increase in the concentration of element availability in the soil when planting [5].

Therefore, the study aimed to know the best studied varieties in production under the influence of organizations and to determine the best level of humic acids in terms of the effect on increasing production and the studied traits.

2. Materials and Methods

2.1. *Experiment Site*

A field experiment was carried out in the spring season 2022 in the organic fertilizer project in Thi Qar Governorate, Shatrah district, which is 40 km north of the city.

2.2. *The Experience Factors*

2.2.1. The First Factor

Four cultivars of maize (Zp, Maha, Kaws and Forat) and the following codes were given (V1, V2, V3, V4) respectively, and they were cultivars approved by the Ministry of Agriculture and their source is the Agricultural Research Department, Department of Yellow Maize.

2.2.2. The Second Factor: Levels of Fulvic Humic Acids

- Control Without adding (T1) comparison.
- 1 g L^{-1} (T2) of fulvic and humic acids.
- 2 g L^{-1} (T3) of fulvic and humic acids.
- 3 g L^{-1} (T4) of fulvic and humic acids.

2.3. *Agricultural Operations*

Cultivation took place in the middle of March, the spring season, and the experimental land was prepared in terms of plowing, smoothing, and leveling as needed, fertilized the field with

compound fertilizer (NPK) and urea fertilizer 100 kg per dunum, in three batches, the first at planting, the second after a month of planting, and the third at the beginning of flowering, in the form of a row.

Table 1. Chemical and physical properties of soil.

Chemical properties		Physical properties	
Available Nitrogen	2.08	Sand	16.00
Available Phosphorus	0.33	Silt	39.70
Available potasium	1.13	Clay	44.30
Organic matter	12.80		
pH	8.35	Soil texture	Silty clay
EC	3.47		

2.4. *The Traits Studied are Traits of Growth*

- Length of ear
- 1000 grains weight
- The biological yield
- The grain yield
- Nitrogen %
- Protein %
- Oil %

3. Results and Discussion

3.1. Length of Ear

Table 2. showed that there were significant differences between cultivars, and also the interaction between them in the length ear flowering. Table 2. showed a significant superiority among the cultivars in the length ear, where the Maha and Kaws cultivar was superior, as it gave 20.48 and 20.98cm, while the cultivar Forat gave the length of ear 18.77cm. The results showed that there was a significant interaction between the levels of humic and fulvic acid and the cultivars, the combination (T4 × Kaws cultivar) gave the length ear 21.67cm .

Table 2. Effect of humic, fulvic and cultivars on the length ear.

V	T				Average
	T1	T2	T3	T4	
V1	20.47	20.73	17.73	18.80	19.43
V2	20.67	21.13	19.40	20.73	20.48
V3	20.60	19.97	21.67	21.67	20.98
V4	17.00	19.40	18.81	19.87	18.77
Average	19.68	20.31	19.40	20.27	
L.S.D0.05	T		V		T*V
	NS		0.93		1.97

3.2. 1000 Grains Weight

Table 3. showed significant differences between the levels of humic and fulvic acid, and the cultivars and the interaction between them did not show significant differences in 1000 grains weight.

Table 3. showed a significant superiority of the levels of humic and fulvic acid in 1000 grains weight, where the 3 g treatment excelled and gave a 1000 grains weight of 449.9 g, while the control treatment gave the lowest 1000 grains weight of 341.7g , perhaps the reason is due to the effect of humic acid in increasing the vital activities of the plant and raising the rate of absorption of nutrients, which leads to an increase in 1000 grains weight as this result agreed with what was reached by [6],

Table 3. showed a significant superiority among the cultivars in the 1000 grains weight, where

the Forat cultivar was superior, as it gave 444.7 g, while the cultivar ZP gave the 1000 grains weight 352.5 g.

Table 3. Effect of humic, fulvic and cultivars on 1000 grains weight.

V	T				Average
	T1	T2	T3	T4	
V1	300.4	337.2	373.0	399.2	352.5
V2	340.9	383.9	440.8	481.1	411.7
V3	356.7	429.5	441.7	441.5	417.3
V4	368.9	468.3	463.8	477.8	444.7
Average	341.7	404.7	429.8	449.9	
L.S.D0.05	T		V		T*V
	61.9		34.2		NS

3.3. The Biological Yield (kg.h^{-1})

Table 4. showed that there were no significant differences between the levels of humic and fulvic acid and between cultivars, and the interaction between them in the biological yield .

Table 4. The effect of humic, fulvic and cultivars on the biological yield (kg.h^{-1}).

V	T				Average
	T1	T2	T3	T4	
V1	16133	16067	20378	22924	18875
V2	17026	19555	21000	20289	19468
V3	14689	21511	19089	19111	18600
V4	14378	16222	15911	15582	15523
Average	15557	18339.	19094.	19476	
L.S.D0.05	T		V		T*V
	NS		NS		NS

3.4. The Grain Yield (kg.h^{-1})

Table 5. showed that there were significant differences between the levels of humic and fulvic acid, between the cultivars and no significant differences of interaction between them in the grain yield (kg.h^{-1}). Table 3. showed a significant superiority of the levels of humic and fulvic acid in the grain yield(kg.h^{-1}), where the 3 g treatment excelled and gave 7239.75 kg.h^{-1} , while the control treatment gave the lowest 5994.44 kg.h^{-1}, Increase the rate of carbonation and this increases the yield of the plant (1). This results are consistent with the findings of AL.Khafaji .

Table 5. showed a significant superiority among the cultivars on the grain yield(kg.h^{-1}) ,where the Forat cultivar excelled as it gave 9089 kg.h^{-1} ,while the Kasws variety gave the least in the grain yield 5311 kg.h^{-1}.

Table 5. Effect of humic, fulvic and cultivars on the grain yield(kg.h^{-1}).

V	T				Average
	T1	T2	T3	T4	
V1	4244.44	4755.56	5400.00	6844.44	5311.00
V2	5133.33	5368.89	6444.44	6311.11	5814.25
V3	6244.44	8755.55	6248.89	6933.33	7045.50
V4	8355.55	9422.22	9711.11	8866.67	9089.00
Average	5994.44	7076.75	6951.00	7239.75	

L.S.D0.05	T	V	T*V
	1202.6	889.2	NS

3.5. Nitrogen %

Table 6 showed that there were significant differences between the levels of humic and fulvic acid, and between cultivars, and the interaction between them in nitrogen percentage.

Table 6 showed a significant superiority of humic and fulvic acid levels in nitrogen percentage. Where the treatment of the third level excelled 3 g gave the highest percentage of nitrogen 1.4592%, while the comparison treatment and the control gave the lowest percentage of nitrogen 1.0700%, and this is consistent with Islam and Munda [7] that adding humic acid to the soil or spraying on the leaves led to the accumulation of nitrogen in the leaves of yellow corn.

Table 6 showed a significant superiority among the cultivars in the percentage of nitrogen %. Whereas, the Kaws variety was superior, as it gave 1.3142% nitrogen. While the zp cultivar and the Maha cultivar gave the lowest nitrogen content of 1.2575%. The results showed that there was a significant interaction between the levels of humic and fulvic acid and the cultivars, the combination (T4 × Kaws cultivar) gave the highest percentage of nitrogen 1.4833% .

Table 6. Effect of humic, fulvic, and cultivars on nitrogen percentage.

V	T				Average
	T1	T2	T3	T4	
V1	1.0300	1.230	1.3200	1.4300	1.2575
V2	1.0700	1.2500	1.3467	1.4667	1.2833
V3	1.0967	1.2633	1.4133	1.4833	1.3142
V4	1.0800	1.2767	1.3500	1.4500	1.2892
Average	1.0700	1.2567	1.3583	1.4592	
L.S.D0.05	T		V		T*V
	0.03		0.02		0.03

3.6. Protein %

Table 7 showed that there were significant differences between the levels of humic and fulvic acid, and between cultivars, and the interaction between them in protein %.

Table 7 showed a significant superiority of humic and fulvic acid levels in nitrogen percentage. Where the treatment of the third level excelled 3 g gave the highest protein 9.11%, while the comparison treatment and the control gave the lowest protein 6.19%, and this is consistent with Islam and Munda [7] that adding humic acid to the soil or spraying on the leaves led to the accumulation of nitrogen and protein in yellow corn.

Table 7 showed a significant superiority among the cultivars in the percentage of protein . Whereas, the Kaws variety was superior, as it gave 8.15%. While the Forat cultivar gave the lowest protein content of 7.56%. The results showed that there was a significant interaction between the levels of humic and fulvic acid and the cultivars, the combination (T4 × Kaws cultivar) gave the highest percentage of protein 9.27% .

Table 7. Effect of humic, fulvic and cultivars on protein %.

V	T				Average
	T1	T2	T3	T4	
V1	6.44	7.71	8.25	8.94	7.84
V2	6.70	7.80	8.40	9.15	8.01
V3	6.84	7.88	8.61	9.27	8.15
V4	4.78	7.96	8.42	9.06	7.56
Average	6.19	7.84	8.42	9.11	
L.S.D0.05	T		V		T*V
	0.01		0.01		0.01

3.7. Oil %

Table 8 showed that there were significant differences between the levels of humic and fulvic acid, oil %. Table 8 showed a significant superiority of humic and fulvic acid levels in oil%. Where the treatment of the third level excelled 3 g gave the highest oil 5.321%, while the comparison treatment and the control gave the lowest oil 3.338%, This results are consistent with the findings Rahim et al 2019.

Table 8. Effect of humic, fulvic, and cultivars on oil %.

V	T				Average
	T1	T2	T3	T4	
V1	3.093	4.200	4.627	5.253	4.293
V2	3.140	4.260	4.723	5.340	4.366
V3	3.207	4.343	4.720	5.263	4.383
V4	3.913	3.913	4.733	5.427	4.497
Average	3.338	4.179	4.701	5.321	
L.S.D0.05	T		V		T*V
	0.03		NS		NS

References

[1] Rong, Y. (2012). Estimation of maize evapotranspiration and yield under different deficit irrigation on a sandy farmland in Northwest China. Afr. J' Agric. Res., 7(33) : 4698-4707 .

[2] F. A. O., 1996. Improving nitrogen use efficiency for cereal production. FAO state. W. W. W. fao org.

[3] Rahim Faisal , Khan Ashraf , Muhammad Shahzad , Ahmed Muhammad , Shahzad Ahmed . 2019. characterization of(*zea mays* l.) through morphological, biochemical and molecular markers . article In Applied Ecology And Environmental Research.

[4] Dahmardeh .M.2012 . Effects of sowing date on the growth and yield of maize cultivas (zea mays L.) and the growth temperature requirements.African J. of Biot . 11(61) : 12450-12453.

[5] Alkhafaji, H. A. 2015. Effect of concentration and spraying date of humic acid on growth and yield of (Zea mays. L.) Kufa J. for Agric.Sci., 7(1), 155-170

[6] Hashem, M. A. 2018. Effect of humic acid and potassium on the growth and yield of bread wheat Triticum aestivum L. Thi-Qar University Journal of Agricultural Research, Volume 7 (1).

[7] Islam, M. and G. C. Munda. 2012. Effect of organic and inorganic fertilizer on growth, productivity, nutrient uptake and economics of maize (Zea mays L.) and toria (Brassica campestris L.). Agric. Sci. Res. J., 2(8): 470-479.