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Effects of Surface Irrigation Systems and Organic Fertilizer (Humic Acid) on the Growth and Yield of Maize Yellow Corn

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Abstract

This field experiment was conducted in the autumn of 2025 on agricultural land belonging to the Technical Institute of Al- Musayyib, which is part of Al-Fur at Al-Awsat Technical University. The study employed two traditional surface irrigation methods—basin irrigation and furrow irrigation—and included two application levels of an organic fertilizer (humic acid): no application and an application rate of 20 kg/ha Fertilization recommendations indicate that this fertilization approach helps reduce water consumption in yellow corn plants compared to the control treatment (no fertilization). The experiment followed a completely randomized design (CRD). Seeds were sown on July 27, 2025, at a depth of 0–30 cm, and the plants might be harvested on July 17, 2025. The plant height or yield has no significant differences observed among various irrigation system treatments of yellow corn kernels.

Keywords

Irrigation,
Humic Acid,
Yellow Corn.

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Introduction

Iraq is situated in an arid and semi-arid region—a fact that, alongside challenges such as desertification, climatic fluctuations, and recurring droughts, serves as a major obstacle to the development of irrigated agriculture. These factors have collectively led to the loss of vast tracts of arable land. Consequently, increasing the availability of water for irrigation is of critical importance. The productivity per unit of water is so important, especially in regions where the water resources act as a crucial factor for crop's growth and yield (Hameedi et al., 2015)

Surface irrigation systems are considered easy to implement and low in cost. Furthermore, farmers have extensive experience with these irrigation methods, having employed them for a long time—most notably furrow irrigation, which is recognized for its high irrigation efficiency

Adding the humic acid to the soil will improve its chemical, physical, and biological properties. Furthermore, it enhances root respiration, which in turn supports the growth and development of both the root system and the parts above-ground (stems and leaves), ultimately leading to increased plant yields (Li, 2020; Purwanto et al., 2021)

Yellow corn is an important cereal crop, characterized by its high content of carbohydrates, dietary fiber, essential minerals, and calories, which makes it a significant source of energy. Yellow corn flour is frequently used in bread-making (often blended with wheat flour) and is also incorporated into various pastries and other food products. Furthermore, it is used for the extraction of A sugar-containing sap can be extracted from its stalks, while its seeds can be used to obtain oil. Furthermore, its stalks and leaves can be utilized in the production of various types of paper. Maize crops not only provide approximately 25% of human nutritional requirements but also meet about 60%–70% of the feed requirements for poultry and large livestock (Saritha et al., 2020; Staller, 2021).

Materials and Methods

This scientific experiment was done in autumn of 2025 on agricultural land belonging to the Al-Musayyib Technical Institute, an institution under the Middle Euphrates Technical University. Preliminary soil analysis indicated that the soil at the site is an alluvial soil with a mixed texture, according to the classification system established by the Soil Survey Staff (2014),

Using certain methods, it is found that there were several physical and chemical properties of the as described below. Soil texture was assessed via the pipette method (Day, 1965), whereas the core method was used to measure soil bulk density (Klute, 1986).

The determination of certain cations and anions in the soil was conducted following the procedures described by Richards (1954). Carbonate minerals were measured using a calcimeter, in accordance with the method proposed by Hesse (1971). Table 1 presents the results of selected physicochemical analyses of the soil prior to cultivation. Furthermore, several chemical properties of the irrigation water were evaluated based on the Food and Agriculture Organization (FAO) classification system for irrigation water (Phocaides, 2001); these results are shown in the Table 2.

Table No. 1. Chosen physicochemical properties of soil before planting Property

	units	Property
0-30 cm		
460	$G.kg^{-1}$	Sand
333		Silt

200		Clay
Loam		Soil texture
1.13	Mica g m^{-1}	Bulk density
7.30	-	PH
1.68	Dc m^{-1}	EC
5.5		Ca
4.10		Mg
1.78		Hco_3

Table No.2. Selected Chemical Characteristics of Irrigated Water

River water	Units	Property
1.30	Dc m^{-1}	EC
7.21	—	Ph
4.00	Malli mole $^{-1}$	Ca
2.00		Mg
1.50		Na
7.52		CL
1.46		HCo_3

preparation prior to cultivation was carried out by plowing with a

moldboard plow, followed by breaking up, leveling, and refining the soil. The land was then divided into individual plots. Based on fertilization recommendations, humic acid was applied to the soil at two different rates: 0 kg/ha and 20 kg/ha

Fertilizer specifications (brown powder; composition includes: 6% potassium, 20% organic matter, 15% amino acids, 1% gibberellic acid, and 20% seaweed-derived components. The pH value ranges from 5 to 7, and it offers excellent fertilizing efficacy

improves and promotes root system development, resulting in more robust plants with greater resilience to environmental conditions, while also mitigating damage caused by frost We employed five irrigation methods and set two application levels for organic fertilizer (humic acid).

The seeds were sown on July 27, 2025, and the crops were harvested on November 17, 2025. Subsequently, the following measurements were taken.

1-Plant height: Determined by measuring the height of three plants from each treatment group and calculating the mean value (Al-Sahuki, 1990).

2-Leaf area: Calculated by measuring the length and width of the leaves and multiplying the resulting values by a correction factor of 0.75.

3-Grain yield: At the stage of full maturity, the ears were separated from the vegetative parts of the plants, air-dried, and then threshed; the total yield was subsequently estimated depending on the method shown by Al-Sahuki (1990).

Subsequently, the results were statistically analyzed using the "Least Significant Difference" (LSD) test checked at a 0.05 significance level.

The aid of the Statistical Analysis System is used in this experiment (SAS, 2012).

Results and Discussion

1-Plant Height

Table (No.3) shed lights on the effects resulted from conventional irrigation treatments applied with humic acid on the plant height of maize. The mean plant heights under the various irrigation regimes were 215.47, 214.62, 210.80, 215.47, and 216.75 cm, respectively. Statistical analysis indicates no significant differences in plant height among the various irrigation treatments. This suggests that, regardless of whether humic acid is applied, certain irrigation methods are effective in controlling the plant height of maize.

Terraced or furrow irrigation yields results similar to those of furrow and surface irrigation (traditional irrigation). This may be because the alternating irrigation process enhances soil microbial activity and—thanks to improved aeration—promotes the decomposition of organic matter, which in turn leads to the formation of certain enzymes.

Amino acids can convert complex forms of nutrients—which plants otherwise cannot utilize—into forms that plants are able to absorb. This process enhances various plant functions, particularly physiological and biological activities as well as photosynthesis, which in turn promotes cell division. These findings are consistent with the results reported by Azarpour et al. (2022) and Rashid et al. (2017).

Table No. 3: Effect of irrigation and the application of organic fertilizer containing humic acid on plant height (cm)

Humic acid, irrigation systems						
212.25	213.50	212.89	211.00	211.80	212.06	Without
216.99	220.00	218.05	210.60	217.45	218.89	Addition
3.455	Irrigation 3.111					LSD 0.05
Humic acid,	216.75	215.47	210.80	214.62	215.47	The Average
						LSD 0.05

The results also showed that plants treated with humic acid were taller than those in the control (untreated) group, with average heights of 220.40 cm and 213.00 cm, respectively; this may be resulted from the effects of the humic acid.

2- Leaf Area

Table (4) shows the effect of conventional irrigation treatments and the addition of humic acid on the leaf area of yellow corn plants. The mean leaf areas under the different irrigation regimes were 3852.3, 4794.5, 4537.2, 5658.3, and 5366.6 cm^2, respectively. Statistical analysis indicates significant differences in plant leaf area among the various irrigation treatments. This implies that.

Surface irrigation (traditional irrigation) — this result can be attributed to the plants' ability to absorb water from adjacent furrows or beds (Kashini et al., 2011).

Table (4): Effect of irrigation and the application of organic fertilizer containing humic acid on leaf area ($cm^2 \cdot plant^{-1}$)

Humic acid, irrigation systems						
4722.2	5221.6	5508.1	4500	4644.7	3736.6	Without
4961.4	5511.7	5808.6	4574.4	4944.4	3968.1	addition
103.23	Irrigation 117.77					LSD 0.05
Humic acid	5366.6	5658.3	4537.2	4794.5	3852.3	The Average
	130.79					LSD 0.05

The results also showed that, compared to the control group (to which no substances were added), the humic acid-treated group exhibited a larger leaf area, with mean values of 220.40 cm^2 and 213.00 cm^2, respectively. This might be the effect of the role of organic matter which provides a variety of nutrients to plants, as well as its contribution to improving the physical properties of the soil; these factors, in turn, promote plant growth and facilitate the extension and distribution of the root system throughout the soil profile (Romero et al., 2012; Yechun et al., 2012.

Grain Yield 3-

Table No. 5 presents the impact of conventional irrigation operations and the application of humic acid on the grain yield of maize (yellow corn). The mean dry grain weights were 6544.3, 6727.8, 6675.2, 7024.8, and 6967.1 $kg \cdot ha^{-1}$, respectively.

For various types of irrigation systems, statistical analysis indicates no significant differences in grain yield per plant across various irrigation treatments (including surface/conventional irrigation). This may be attributed to the plants' ability to extract water from adjacent furrows or ridges (Kashini et al., 2011).

Table (5) Effect of irrigation and application of humic acid-containing organic fertilizer on grain yield ($kg\ ha^{-1}$)

Humic acid, irrigation system						
6453.5	6653.6	6658.1	6300	6355.7	6300.5	Without
7122.1	7280.7	7391.6	7050.4	7100	6788.1	Addition
99.20	Irrigation 115.55					LSD 0.05
Humic acid	6967.1	7024.8	6675.2	6727.8	6544.3	The Average
						LSD 0.05

The results also indicate that, in terms of grain yield, the humic acid treatment performed better than the control (no additives). The mean values for the two treatments were 220.40 cm and 213.00 cm, respectively. This may be attributed to the role of organic matter in providing a variety of nutrients to plants; furthermore, it helps improve the physical properties of the soil, which in turn has a positive impact on plant growth, root elongation, and the distribution of roots within the soil profile (Romero et al., 2012; Yechun et al., 2012).

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