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# Determination the Effect of Irrigation Water Quality and Soil Fertility Index on Primary Metabolites and Maize Yield Producutivity.

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## ABSTRACT

Three sites were selected to assess the impact of irrigation water quality and soil fertility on primary metabolites and maize crop productivity in Hawija district, Kirkuk governorate, for the summer of 2023. Irrigation water quality index values documented unsuitable values for irrigation in all the wells used. Its values ranged from 27.5-59.13, while the soil fertility values were poor in all locations and ranged from 0.46-0.5. These values affected the yield of the maize crop in different ways at the selected sites, where the effect of irrigation water quality index and soil fertility on carbohydrate values recorded a range of values of 50.5-68.6 ppm, proteins 4.02-57 ppm, fatty acids 68.54-84.34 ppm, total chlorophyll 25.84-33.71 ppm. The study also included the studied characteristics and included physical characteristics in the soil of the sites (soil texture, which in the first site is Seltieh Lomia, and in the second site is Seltieh Lomia, and in the third site is sandy loamy clay, and the values of total dissolved solids (230-467.8) parts per million andsusceptibility Electrical conductivity (0.51-2.73) ppm, irrigation water values for dissolved solids (315-3170) ppm, electrical conductivity (1315-6241) ppm, and soil chemical values at sites pH (7-8.7) ppm, potassium (79.4-264.8) ppm, nitrogen (0.02-0.05) ppm, irrigation water values (pH (6.4-7.8), total alkalinity (126-162) ppm, and potassium (79.4-482.9) , While the weight of 100 grains the highest weight was recorded in the first and third sties at 75and the lowest value was recorded in the second site 65, and the harvest index were recorded gradually in the study sites the highest value recorded in the first location was 0.0421% and the lowest value recorded in the third location was 0.283%. The biological outcome explains that the least productive site is the second site, and the highest is the first site.

***Keywords*:** IWQI, SQI, Zea mays, Harvest Index, Primary productivity.



## INTRODUCTION

Groundwater is one of the main resources supporting economic development in rural and arid areas. It is used for crop irrigation and industrial production due to the low availability of fresh water and its mineral quality [1]. Irrigation water quality is affected by agricultural activities, nature and geochemical factors [2] therefore, the quality of irrigation water is determined according to several criteria, including physical and chemical properties to reduce its negative impact on the productivity of crops [3]The irrigation water quality index has a role in deternmening the effects of ions and nutrients concentrations and the percentage of sodium absorption in irrigation water and its negative impact on the soil and the growth of plants and determines its suitability for irrigation [4]. High-quality irrigation water is important in maintaining economic crop productivity and soil fertility, changing soil quality, and increasing trace elements in the soil [5]. The soil quality index is defined as the soil ability to provide support for plants with everything you need during the growth stages by providing large nutrients in the soil and micro-nutrients that can increase the soil fertility[6] The growth and quality of the crops, so the fertility of the ground and its suitability for the cultivation [7]and soil fertility is reflected in the values of physical and chemical factors and the availability of nutrients for plants in the soil that plants need in adequate quantities and the appropriate ratios [8]The corn crop is important in providing many nutrients, basic minerals, proteins, carbohydrates and fats, as well as in multiple industries[ 9]. The corn is also used as an animal feeding crop, such as raw feed with high nutrients rich in nutrients and vitamins [10]. The study aims to determine the effect of irrigation water quality index and soil fertility index on primary metabolites and crop productivity.

## Materials and methods:

Study area:

The study area is located in Hawija District - Kirkuk Governorate approximately 60 km west of it, three flieds were selected to evaluate the impact of the soil fertility quality index and irrigation water quality index in the productivity of the maize crop and some of its vegetative properties and components of its primary metabolism in villages of Al-Islanah (First site) in the east 35°39'14'28'-43°92'75'57' and Al-Hayash (Second site) in the south 35°19'12' -43°45'52' and Tal Ali(Third site) in the west 35°21'44'-43°39'58'(figure 1).

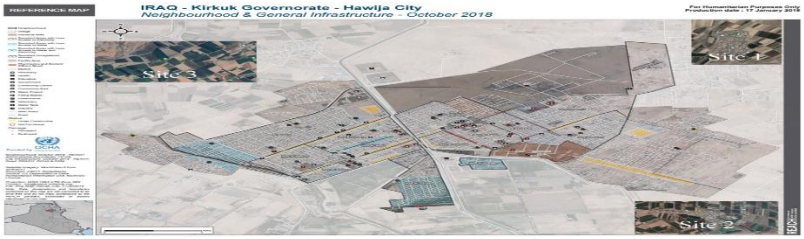

Figure 1 Study sites

Samples Collections

Irrigation water, soil and plant samples were collected triple first before the agricultural crop, in the growth period and after the harvest in the summer of 2023, in July, September and November. Irrigation water samples were collected in sterile plastic bottles, and soil and plant samples were recorded in sterile plastic bags. All the information was recorded, and the samples were transferred to laboratories immediately [12].

Determine Environmental Factors:

The physical and chemical properties of the soil were estimated according to [11]: soil texture, dissolved substances, electrical conductivity, pH, values of available phosphorus ions and total nitrogen. The physical and chemical properties of irrigation water were estimated according to the results of irrigation water characteristics, which were pH ranged (6.4-7.8) and dissolved solids (315-3170). potasum (79.4-264.8), the values of the soil properties products were recoded dissolved solids (230-467.8), pH (7-8.7), Nitrogen (0.02-0.05) phosphorus (3.33-29.30) (12); total dissolved solids, electrical conductivity, pH, total alkalinity, and the values of sodium, potassium, calcium, magnesium, chloride and sulfate ions.

The values of primary metabolites were estimated, including chlorophyll by [13], carbohydrates [14], proteins [15] modified by[16], fatty acids [17], productivity indicators were estimated, including the weight of 100 grains according to [18] and the harvest index according [19), the [20] were used to measure the soil fertility index, and the[21] method were used to measure the irrigation water quality index. The results were statistically analysed using SPSS version 26 by Analysis of variance (ANOVA) test and Duncan test ($p \leq 0.05$), and the Pearson correlation coefficient was calculated.

**Results and discussion:**

The values of the irrigation water quality index recorded variation, where the highest values were on the first site, 59.13 in November, and the lowest values 27.5 were recorded on the third site in November (Table 1). The soil quality index recorded similar values; the highest values were, in the first site, 0.5, and the lowest in the second site, 0.46 (Table 2). The results of the irrigation water quality index documented that the water quality was poor and rejected according to the full irrigation water quality index According to thy results of the registration in schedule 4[22].

Table of irrigation water and soil characteristics

| Dissolved material | | potassium | | PH | | EC | | Calcium | N | P | Sity |
|---|---|---|---|---|---|---|---|---|---|---|---|
| W | S | W | S | W | S | | S | Water | Soil | S | |
| 2181 | 1010 | 814.8 | 211.9 | 7.1 | 7.3 | 5768 | 2055 | 418.8 | 6.83 | 0.18 | 1 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1591 | 5166 | 165.6 | 26.61 | 7.3 | 7.5 | 2992 | 992 | 165.6 | 5.97 | 0.10 | 2 |
| 826.6 | 1582 | 177.6 | 132.6 | 7.1 | 7.4 | 1478 | 703 | 311.9 | 11.6 | 0.09 | 3 |

Table 1 Irrigation water quality index values

| Sites | July | September | November | Mean |
|---|---|---|---|---|
| First | 59.13 | 34.50 | 41.41 | ⇧45.01a |
| Second | 40.32 | 52.98 | 33.88 | 42.39a |
| Third | 46.33 | 34.62 | 27.50 | ⇩36.15b |

Table 2 Soil Quality index values

| Sites | SQI | RNPK | RpH | RSTC |
|---|---|---|---|---|
| First | 0.5 Poor | 0.8 | 1 | 0.8 |
| Second | 0.46 Poor | 0.6 | 1 | 0.8 |
| Third | 0.48 Poor | 0.6 | 1 | 1 |

An effect was observed in the productivity of the maize crop, especially in the values of carbohydrates in the third site of 50.5 ppm, and the values of the irrigation water quality index values documented effect on the total chlorophyll values, especially in the second site, whose plant had a lower content of 33.71 ppm (Table 3).

Table 3 Primary metabolites productes values

| Sites | Carbohydrates | Acid Fats | Total Chlorophyll | Protein |
|---|---|---|---|---|
| First | 65.8b | 68.54a | 25.84a | 5.77b |
| Second | 68.6b | 75.02b | 33.71b | 4.02a |
| Third | 50.5a | 84.34c | 28.49a | 5.42b |

The irrigation water quality index and soil fertility values may be due to the influence of a set of physical and chemical properties, which are affected as a result of the variation in their values in the primary productivity values of the corn crop (Table 4), because irrigation water quality is of great importance in increasing the value of primary metabolic materials on plants because it is an available quantity of nutrients [2].

Table 4 Zea maize Primary productivity values

| Site | Weight100 grains | Biological quotient | Harvest index |
|---|---|---|---|
| First | ⇧75 b | 178 a | ⇧0.421 % b |
| Second | 65 a | 221 b | 0.291% a |
| Third | ⇧75 b | ⇧265 c | 0.283 % a |

Crop primary productivity may be due to the low quality of soil fertility and the lack of nutrients needed, which is among the highest nutrient absorption crops, in addition to agricultural practices and a shortage of agricultural fertilizers that led to a decrease in productivity levels [23].

The fertility of soil is important for providing the best services for the ecosystem, including biological diversity, climate regulation, and a conductor of elements and physical and chemical characteristics. All of this increases the productivity and weight of the agricultural product of the plants [24]. Irrigation water is a quality that weakens the quality of the soil and causes pollution and toxicity [28]. The enormous plants, increased salinity, and low elements thus cause a negative effect on plant quality and primary metabolic contents [25]. Environmental factors have an impact on the amount of proteins, fats and carbohydrates, which causes a reduction in the biological yield of plants [26].

**Conclusion:**

The well water used to irrigate the yellow corn crop in all locations was classified as unacceptable irrigation water according to the full irrigation water quality index.

The well water used to irrigate the yellow corn crop in all locations was classified as unacceptable irrigation water according to the full irrigation water quality.

The effect of the values of the soil fertility index and irrigation water was clear on the values of primary metabolites and crop yield, as the values of the maize crop decreased as a result of the decrease in soil fertility and the value of the irrigation water quality index

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# تقدير تأثير مؤشر جودة مياه الري و خصوبة التربة في نواتج الايض الأولى لمحصول الذرة الصفراء.

**ذنون حسن رحيم ذنون دكتور رشدي صباح عبدالقادر**
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الخلاصة
تم اختيار ثلاثة مواقع لتقييم تأثير جودة مياه الري وخصوبة التربة على نواتج الأيض الأولية وإنتاجية محصول الذرة في قضاء الحويجة بمحافظة كركوك لصيف عام 2023. أظهرت قيم مؤشر جودة مياه الري أن القيم غير مناسبة للري في جميع الآبار المستخدمة، حيث تراوحت قيمها بين 27.5-59.13، بينما كانت قيم خصوبة التربة منخفضة في جميع المواقع وتراوحت بين 0.46-0.5. أثرت هذه القيم على إنتاجية محصول الذرة بطرق مختلفة في المواقع المحددة، حيث تراوحت قيم تأثير مؤشر جودة مياه الري وخصوبة التربة على الكربوهيدرات بين 50.5-68.6 جزء في المليون، والبروتينات بين 4.02-57 جزء في المليون، والأحماض الدهنية بين 68.54-84.34 جزء في المليون، والكلوروفيل الكلي بين 25.84-33.71 جزء في المليون. كذلك واحتوت الدراسة على الصفات المدروسةُ و شملت صفات فيزيائية

في تربة المواقع ( نسجه التربة والتي في الموقع الأول سلتيه لوميه، وفي الموقع الثاني سلتيه لوميه، وفي الموقع الثالث رملية طينيه لوميه، وقيم المواد الصلبة الذائبة الكلية (230-467.8) جزء بالمليون و قابلية التوصيلية الكهربائية(0.51-2.73) جزء بالمليون، و قيم مياه الري للمواد الصلبة الذائبة (315-3170) جزء بالمليون، و قابلية التوصيلية الكهربائية(1315-6241) جزء بالمليون، و قيم كيميائية التربة في المواقع الاس الهيدروجيني(7-8.7) جزء بالمليون، و البوتاسيوم (79.4-264.8) جزء بالمليون ، والنتروجين (0.02-0.05) جزء بالمليون ، قيم مياه الري الاس الهيدروجيني (6.4-7.8)، والبوتاسيوم (79.4-482.9)، والصوديوم (26.8-664) جزء بالمليون، و الكالسيوم (132.2-482.96) جزء بالمليون، أما وزن 100 حبة فقد سُجل أعلى وزن في الموقعين الأول والثالث بـ75، بينما تم تسجيل أقل قيمة في الموقع الثاني بـ65، وسجل مؤشر الحصاد تدريجياً في مواقع الدراسة حيث تم تسجيل أعلى قيمة في الموقع الأول بـ0.0421% وأقل قيمة في الموقع الثالث بـ0.283%. وتوضح النتيجة البيولوجية أن أقل المواقع إنتاجية هو الموقع الثاني وأعلاها هو الموقع الأول

الكلمات المفتاحية : مؤشر جودة مياه الري - مؤشر جودة التربة – الذرة الصفراء- مؤشر الحصاد – الإنتاجية الاولية.