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EFFECT OF NITROGEN AND HUMIC ACID ON FRUIT YIELD AND QUALITATIVE CHARACTERISTICS OF OLIVE TREES (*OLEA EUROPAEA* L.) CV. KISTAWY

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Abstract

This study was conducted in private orchards in Kurdistan region, Dohuk Governorate, Sharia, Sina Village during the 2019 growing season on olive(*Oleae europaea* L.) olive trees. to know the effect of nitrogen and humic acid on the yield and the qualitative characteristics of olive trees cv. kistawy, as it is fertilized with four levels of nitrogen (0, 150, 300 and 450 g N.Tree^{-1}) and two levels of humic acid at (0 and 75 g H.Tree^{-1}). The results confirmed that the addition of nitrogen and humic acid separately and their two-way interactions had a significant effect on the yield and its specific characteristics (the total of soluble solids, the total of carbohydrates in the fruits and the percentage of oil in the fruits), especially at the level of 450g N.Tree^{-1} and Level 75 g H.Tree^{-1}.

Key words: Nitrogen (N), Humic acid (H), Olive, Fruit yield, Qualitative characteristics.

Introduction

Olive tree (*Olea europaea* L.) is tropics and sub tropical, which is believed to have originated in Syria, southern Turkey and Palestine about 300 years BC. It was domesticated about 6000 years ago (Montemurro *et al*., 2005) and belongs to the Oleaceae family. Olive trees are distinguished by their longevity and adaptation to climatic conditions, and their fruits are considered to be of commercial value due to their oil content as well as their edible or pickled flesh (Fayed, 2010), olive production in the world plays an important role in the economy of many countries including Spain, Italy, Greece , Turkey and Tunisia (Sibbett *et al.,* 2005) and olive trees grow in the central and Kurdistan regions of Iraq, (Mahdi, 2007 and Abdul-Qader, 2012).

Olive trees fertilize annually with nitrogen because of nitrogen effect on the productivity of the olive tree (Bouhafa *et al*., 2014).

Nitrogen classified one of the most important nutrients in the life of the plant, as it is the main component of the amino acids that are the building blocks of protein, as it represents about 16% of the weight of the protein, also it is included in the synthesis of enzymes, some growth regulators, vitamins, chlorophyll, cell membranes, and alkaloids, However, its rate ranges between 2-4% of the dry weight of plant tissue (Alwan, 2018) and many studies indicate that nitrogen fertilization has a significant effect on the yield and its qualitative characteristics.

Abou-Amer (2013) indicated that the fertilization of olive trees is a class of Manzanillo. Nitrogen and 800 g N. Tree^{-1} spraying leaves with urea at a concentration of 1% led to increased yield and improved oil quality in the fruits compared to the treatment of 800 g N.Tree^{-1} sprayed urea on leaves with a concentration of 3% and the comparison treatment.

Elbedawy *et al.,* (2016) found that manzanillo variety olive trees were fertilized 10 years old with nitrogen by using ammonium sulfate as nitrogen source and at 1000 gN. Tree-1, when this fertilizer was added on seven dates (January, February, March, May, Jun, July and August), and they noticed that adding this fertilizer in the following months: February, June and August to a significant increase in the yield of trees and the characteristics of the fruits (weight, size, diameter and percentage of the fruit) Flesh/Seed) and oil content in fruits during the 2009 and 2010 growing seasons compared to comparison treatment.

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Randa (2017) found that fertilizing "Abu Surra" orange trees with nitrogen at three levels (100, 120 and 140 kg N. acre^{-1}. year) and noticed that there was a significant increase in the yield of trees and improving the quality of fruits by increasing the weight of the fruits and the percentage of juice, by increasing Nitrogen levels from 100 to 140 kg N.acre^{-1}. year.

Ucgun (2019) studied the effect of fertilizing sweet cherry trees with nitrogen and for two consecutive seasons at several levels (0, 50, 125 and 250 g N.Tree^{-1}), noting that the level 250 g N.Tree^{-1} caused a significant increase in fertility and tree yield compared to the comparison treatment.

Humic acid, it is considered one of the humic organic acids that result naturally from the decomposition of organic matter and affects the growth of plants through its effect on photosynthesis and respiration processes (Dantas *et al.,* 2007). Also humic acids, has an effective role in improving plant growth and development due to its presence in some nutrients (Sebahttin and Necdet, 2005). Humic acid leads to increased plant yields through its influence on many important biological processes in plants such as cell respiration, photosynthesis and building Proteins, water and nutrient absorption and increased enzyme activity (Ferrara and Bruntti, 2010).

Shahin *et al.,* (2015) carried out a study on fertilizing 10-year-old Kalamata cultivars with humic acid in the form of Actosol (20% humic acid + NPK 1: 5: 6) and they noticed that adding this fertilizer for one time was 150 ml. Tree^{-1} cunses a significant increase in the weight and size of the fruit and the percentage of fruit/seed and tree yield during the 2013 and 2014 growing seasons compared to adding it at a concentration of 50 and 75 ml. Tree^{-1} and comparison treatment.

Aisha *et al*., (2017) found when fertilizing mandarin cultivar trees, 14-year-old "Kinnow" with humic acid with nitrogen at 600, 900 and 2001 g levels.Tree^{-1} with 120 ml. L^{-1} of humic acid increased the yield of trees, the ratio of soluble solids and total sugars in the fruits.

Whereas Haggag *et al*., (2018) showed that fertilizing 10-year-old Cyprus olive trees with Actosol liquid fertilizer (20% humic acid + NPK 1: 5: 6) was 150 ml.Tree^{-1} with sheep residues for one time upon complete flowering led to a significant increase in the tree yield during the 2015 and 2016 growing seasons compared to the comparison treatment, and indicated that the reason for this is due to the increase in the percentage of fruit contract and the percentage of remaining fruits on trees when harvesting.

Hidayatullah *et al*., (2018) studied the effect of fertilizing apple trees planted in limestone soils with humic acid at several levels (0, 50, 75, 100, 125 and 150g potassium humate.Tree^{-1}) and observed that the trees to which this fertilizer was added amounted to 125 and 150 g potassium humate.Tree^{-1} gave the highest number of fruits per tree and increased tree yield.

Khan *et al.,* (2019) showed the effect of humic acid fertilization on apple trees during 2017 and 2018 with three concentrations (0.05%, 0.010% and 0.015%), which resulted in increased tree yields, especially when the concentration was 0.015% compared to other concentrations.

Therefore and due to the lack of previous studies in the Dohuk governorate on olive trees *cv.* Khistawi fertilizing with nitrogen and humic acid, so we decided to do this study to improve tree fruit Yields and fruit characteristics.

Materials and Methods

This study was conducted in private orchards in Kurdistan region, Dohuk Governorate, Sharia, Sina Village at season 2019 on olive trees *cv.* Kistawy to know the effect of adding nitrogen and humic acid in the growth and yield of olives and developing trees in clay soil and some of their physical and chemical characteristics are shown in the table 1, by making several amounts in the soil with a depth of 75 cm for each of them and I took the soil along each depth and mixed it well and estimated some of the characteristics in it.

The experimental study was conducted according to the randomized complete block design (RCBD) on olive trees cv. Kistawy, with two factors: Nitrogen and Humic acid and with four replicates and one tree per experimental unit, trees age 10 years and almost identical growth, planted at distance of 6 * 6 m and it is irrigated by drip.

Trees were fertilized with four levels of nitrogen (0, 150, 300 and 450 g N.Tree^{-1}), was added in two batches evenly (half the amount of each level in each Batch), the

Table 1: Physical and chemical analyses soil samples*.

Value	Soil properties	Value	Soil properties
29.37	EC(Cmol.kg^{-1})	165.25	Sand (gm.kg^{-1})
7.924	pH Soil	390.00	(gm.kg^{-1}) Silt
35.29	(%) CaCo3	444.75	Clay (gm.kg^{-1})
10.2	Available potassium(mg.kg^{-1})	Clay	Texture
60.2	Available nitrogen(mg.kg^{-1})	13.7	Organic matter(gm.kg^{-1})
1.2	Available sulphur(mg.kg-^{1})	157.35	U.S.
5.86	Available phosphor(mg.kg-^{1})	3.8	Bicarbonate (mg.kg^{-1})

*The measurements were made in the consulting laboratory of the College of Agricultural Engineering Sciences - University of Duhok.

first in the first week of April and the second 15 days after flowering is complete and two levels of humic acid (0 and 75 g H.Tree^{-1}), as for humic acid, it has been added in three batches (in the first week of the following months: April, May and June) with an amount of 25 g H. Tree^{-1} in each batch. The tree yield were determined by the digital scale (100 kg), the total soluble solids in fruits was measured by a Refractometer of ATAGO type Brix%), the concentration of carbohydrates in the fruits according to the method mentioned by Kerepesi and Galiba (2000) and the oil was also estimated in the fruits according to the method mentioned in A.O.A.C (1970).

Results and Discussion

Tree yield (kg):

Table 2: Effect of Nitrogen, Humic acid and their interactions on tree yield (Kg) of olive trees *cv.* kistawy.

	Humic acid levels (gm. tree $^{-1}$)	Nitrogen levels (gm.tree^{-1})				Mean Humic acideffect
		0	150	300	450	
Humic acid x Nitrogen effect	0	50.33 d	55.92 b-d	57.58 bc	61.50 b	56.33 b
	75	54.08 cd	59.50 bc	61.92 b	68.33 a	60.96 a
Mean Nitrogeneffect		52.21 c	57.71 b	59.75 b	64.92 a	

Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.

Table 3: Effect of Nitrogen, Humic acid and their interaction on Total soluble solids in fruits(TSS)(%) of olive trees - *cv.* kistawy.

	Humic acid levels (gm. tree $^{-1}$)	Nitrogen levels (gm.tree^{-1})				Mean Humic acideffect
		0	150	300	450	
Humic acid x Nitrogen effect	0	14.60e	14.59e	14.89d	15.12c	14.80b
	75	14.57e	15.14c	15.42b	16.05a	15.29a
Mean Nitrogeneffect		14.58d	14.87c	15.16b	15.58a	

Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.

Table 4: Effect of Nitrogen, Humic acid and their interaction in Total carbohydrate in fruits (%) of olive trees *cv.* kistawy.

	Humic acid levels (gm. tree $^{-1}$)	Nitrogen levels (gm.tree^{-1})				Mean Humic acideffect
		0	150	300	450	
Humic acid x Nitrogen effect	0	11.83e	12.41d	12.35d	12.69c	12.32b
	75	11.96e	12.66c	13.07b	13.50a	12.80a
Mean Nitrogeneffect		11.89d	12.53c	12.71b	13.10a	

Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.

Table 2 clarified that the treatment 450 g N.Tree^{-1} gave the highest yield (64.92 kg) compared with other treatments, while the lowest yield (52.21 kg) was recorded with untreated treatment. While the humic acid we notice that the treatment was 75 g H.Tree^{-1} gave the highest yield (60.96 kg.) significantly outperformed the comparison treatment.

Humic acid and nitrogen interactions, was noticed that the treatment 75 g H.Tree^{-1} + 450 g N.Tree^{-1} increased yields significantly 68.33kg, compared with other treatments, while the lowest yield (50.33 kg), which recorded in control.

Total soluble solids (TSS%):

Table 3 clarified that the treatment 450 g N.Tree^{-1} gave the highest total soluble solids (15.58%) compared with other treatments, while the lowest total soluble solids (14.58%) was recorded with untreated treatment. While the humic acid we notice that the treatment was 75 g H.Tree^{-1} gave the highest total soluble solids (15.29%) significantly outperformed the comparison treatment.

Humic acid and nitrogen interactions, was noticed that the treatment 75 g H. Tree^{-1} + 450 g N.Tree^{-1} increased total soluble solids significantly (16.05%), compared with other treatments.

Total carbohydrates in fruits (%):

Table 4 clarified that the treatment 450 g N.Tree^{-1} gave the highest total carbohydrates in fruits (13.10%) compared with other treatments, while the lowest total carbohydrates in fruits (11.89%) was recorded with untreated treatment, while the humic acid we notice that the treatment was 75 g H.Tree^{-1} gave the highest total carbohydrates in fruits (12.80%) significantly outperformed the comparison treatment.

Humic acid and nitrogen interactions, was noticed that the treatment 75 g H.Tree^{-1} + 450 g N.Tree^{-1} increased total carbohydrates in fruits significantly (13.50%), compared with other treatments, while the lowest total carbohydrates in fruits (11.83%), which recorded in control.

Percentage of oil in fruit flesh (%):

Table 5 cleared that the treatment 450

Table 5: Effect of Nitrogen, Humic acid and their interaction on Percentage of oil in fruit flesh (%) of olive trees - *cv.* kistawy.

	Humic acid levels (gm. tree $^{-1}$)	Nitrogen levels (gm.tree^{-1})				Mean Humic acideffect
		0	150	300	450	
Humic acid x	0	24.81g	26.80e	27.37d	28.58b	26.89b
Nitrogen effect	75	25.79f	27.42d	28.14c	30.01a	27.84a
Mean Nitrogeneffect		25.30d	27.11c	27.75b	29.30a	

Means of each factor and their interactions followed by the same letters are not significantly different from each other according to Duncan's multiple ranges test at 5% level.

g N.Tree^{-1} gave the highest percentage of oil in fruit flesh (29.30%) compared with other treatments, while the lowest percentage of oil in fruit flesh (25.30%) was recorded with untreated treatment, while the humic acid we notice that the treatment was 75 g H.Tree^{-1} gave the highes percentage of oil in fruit flesh (27.84%) significantly outperformed the comparison treatment.

Humic acid and nitrogen interactions, was noticed that the treatment 75 g H.Tree^{-1} + 450 g N.Tree^{-1} increased percentage of oil in fruit flesh significantly (30.01%), compared with other treatments, while the lowest percentage of oil in fruit flesh (24.81%), which recorded in control.

It is clear from the results mentioned in Tables (2-5) that fertilizing with nitrogen and humic acid separately, especially the high concentrations (450 g N and 75 g H.Tree^{-1}), It gave the highest values of the quotient, its attributes and the studied quality, which included the yield of one tree and the ratio of each of the total soluble solids, carbohydrates and oil in the flesh of fruits, which significantly outperformed the comparison treatment and most of the treatments for each worker separately. This may be due to an increase in the speed and products of photosynthesis as a result of an increase in the amount of chlorophyll in the leaves when fertilizing with nitrogen or humic acid, which the plant benefits from in all its various biological processes, including cell division and expansion, and the construction of new tissues that have led to an increase in the weight of the fruits, thus increasing the yield table 2 as a result of the increase in the weight of the flesh of the fruits and perhaps the number of fruits remaining on the trees at the harvest, which was reflected positively on the yield of the trees, In addition, the increase in the materials manufactured in the leaves, which are sugars, may increase the accumulation of surplus of them in the form of total carbohydrates in the fruits table 4 and turn part of it into compounds or other components, including oil table 5.

These results are consistent with the results obtained by El-Sonbaty *et al*., (2012), Abo-Amer (2013) and Elbedawy *et al*., (2016), who found that nitrogen fertilization improved the yield of olive trees, their qualitative and quantitative characteristics, and the oil yield, as well as these. Results with Elamin *et al.,* (2017) in date palm and Randa (2017) in oranges.

When fertilizing with humic acid, these results are consistent with the results of Omer (2010), El-Sayed (2013), Hagagg *et al.,* (2013), Shahin *et al.,* (2015) and Hagagg *et al.,* (2018) when fertilizing the trees of several varieties of olives with humic acid.

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