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RESPONSE OF GROWTH AND YIELD OF TWO VARIETIES OF RAPESEED (*BRASSICA NAPUS* L.) TO DIFFERENT CONCENTRATIONS OF HUMIC ACID

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Abstract

During the winter season of (2018-2019), a field experiment was conducted in two locations, the first was the station of research and agricultural experiments of the College of Agriculture and Forestry, Mosul University; and the second location was in Wana district in a muddy and sandy loam soils successively. The aim is to study the effect of two varieties of rapeseed which are (Srew and Pactol) and five concentrations of humic acid (0, 20, 40, 60, 80 mg/l) on the characters of growth and yield. The experiment was conducted as a Randomized Complete Block Design (RCBD) with three replications. The results revealed that there are abstract differences between the two varieties in all the studied features and for both locations of the college and Wana. The verity Pactol recorded the highest rate of the plant's height and the number of the branches of the plant successively. The variety Srew showed the highest rate of the number of the branches and the dry weight of the plant and the number of siliques in the plant and the number of seeds in a single silique and 1000 seed weight and seed yield of the seeds and percentage of oil and oil yield for both locations successively. The concentrations of humic acids affected abstractly all the studied features. The concentration (40 mg/l) recorded the highest rate of plant height, the branches of the plant, the number of siliques in the plant, the number of seeds in the one silique, seed yield, percentage of oil and oil yield. The concentration (60 mg/l) recorded the highest rate of plant height and 1000 seed weight in both locations successively. The overlap between the two varieties and the concentrations of the humic acid were abstract only in seed yield, the plants of the Srew verity and the sprayed with the humic acid (40 mg/l) recorded the highest rate of characters of seed yield in both locations.

***Keywords*:** Rapeseed, varieties, humic acid.

Introduction

Rapeseed is considered of the important oil crops in the world and occupies the third place in the production and consumption of oil after palm oil, soya beans, the rate of oil in the seeds of some of its varieties reached up to 49%. In Iraq signs lead to an expansion in the agriculture of this crop for it is a winter yield which does not require a lot of water for irrigation compared with summer oil crops.

The genetic and environmental factors play an important role in the growing of and production of Brassica napus, of the most important factors is the difference between varieties. The differences among varieties affects the production and quality of the yield.

The world tends to employ clean agriculture techniques together with decreasing pollution and then using natural substances such as organic and vital fertilizers which are considered a suitable alternative of chemical fertilizers (El-Akabawy, 2000), and organic fertilizers such as humic acid, these are complex organic substances which are produced by the decomposition of vegetable substances and animal substances by the process of alternation. These substances consist namely of humic, folic acids and humane. These substances play an important role in plant nutrition and soil fertility. The qualities of the humic acids have positive effects, thus the plant grows, such as the increase in the permeability of cellular tissues and stimulating enzyme reactions and improving cellular split and the lengthening of cells and increasing the production of vegetable enzymes and stimulating vitamins inside cells (Pettit, 2003).

Al-Doori and Al-Dulaimy (2011) found, in the course of their study which holds three varieties of Rapeseed(Monty, Emma and Topas), that the Emma was abstractly the first in the qualities of the height of the plant, its number of branches, the dry weight of the plant, the number of mustards in the plant, the number of seeds in the one mustard, 1000 seed weight, the yield of the seeds, and the rate and yield of the oil. And Shati *et al*. (2011) explained in their experiment in which three varieties of rapeseed were used (Srew, Star, Pactol) that were abstract differences among varieties in a number of branches of the plant. Monfared *et al*. (2019) noticed, in their study which used a varieties of Rapeseed (Julius, Dalgan, Zafar, Sarigol, and RGS003). The variety (Sarigol) was the first in branch number of the plant, the number of mustards in the plant, the number of seeds in the one mustard, 1000 seed weight, the yield of the seeds, and the rate of the oil. The results reached at by Barekati *et al*. (2019) throughout their studying of a variety of Rapeseed (Natali, Tassilo, hl3721, L14, WPN6, and HW118) and two concentrations of humic acid (0, 0.2%) exceed the variety (WPN6) abstractly in branch number of the plant, the number of mustards in the plant, the number of seeds in the one mustard, 1000 seed weight , the yield of the seeds, and the rate of the oil, and exceed the concentration of humic acid (0.2%) in branch number of the plant, the number of mustards in the plant, the number of seeds in the one mustard, 1000 seed weight , the yield of the seeds, and the rate of the oil.

Rajpar *et al*. (2011) pointed out, in the course of their study in which they used four concentrations of humic acid (0, 3.17, 6.35, 9.53 kg/acre), that the concentration 6.35 kg/acre was the first abstractly concerning the height of the plant, branch number, number of mustards in the plant, the yield of the seeds, and the rate of the oil. The results reached at by Sani (2014) during studying four concentrations of humic acid (0, 1, 1.5, 2 %) which were sprayed on the plant showed that the concentration of humic acid 2% was dominant in character of the height of the plant. Ahmad *et al*. (2016) showed, in their experiment in which they used three

levels of humic acid (0, 10, 20 kg/ha) that the concentration 20 kg/ha of humic acid was dominant abstractly concerning the height of the plant, branch number, number of mustards in the plant, the yield of the seeds, and the rate of the oil. Eledawy (2017) discovered, in his experiment in which he used three levels of humic acid (0, 24 kg/ha which were added to the soil, 50 mg/l sprayed on the plant) that the humic acid 50 mg/l was abstractly dominant concerning the height of the plant, its number of branches, the dry weight of the plant, the number of mustards in the plant, the number of seeds in the one mustard, 1000 seed weight , the yield of the seeds, and the rate and yield of the oil. Gursoy and Kolsarici (2017) pointed out, in their study of four concentrations of humic acid (0, 5000, 10000, 20000 m/ha) during the two seasons of agriculture (2014, 2015) that the humic acid concentration 10000 m/ha was the first as to oil rate and oil yield.

The aim of the research is to know the extent of the response of two varieties of rpeseed to different concentrations of humic acid.

Materials and Methods

A field experiment during the winter season of (2018-2019) in two locations: the first was in the station of research and agricultural experiments of the college of agriculture and forestry-Mosul university and the second in Wana district in an muddy and sandy soils respectively, the aim was to know the impact of two important factors in the production of the yield Brassica napus, which are two varieties of rapeseed (Srew and Pactol) and the humic acid which was added to the plant by the spray method with five concentrations (0, 20, 40, 60, 80 H.A. mg/l) after 60 days of cultivation. The experiment was designed according to the design of full random sectors (RCBD) with two factors the first was two varieties of rapeseed and the second was five concentrations of humic acid in three trials. The land of experiment was plowed twice vertically with the mould board plough, tendered by disc combs, the levelled by the surfacing machine, the land of experiment was divided into slatted floors and each one was detached from the other by one meter, the number of the experimental units would be 2×5×3=30 experimental unit, and the latter consists of four barometers of 2.5 m. length and the distance between each one is 30 centimeters, leaving the two side lines as guard lines and the readings were taken from the plants of the middle lines. Some of the physical and chemical properties of the experiment land were analyzed (Table 1) under 0-30 centimeters, the seeding took place on the 28 of October 2018 inside the lines. Processes of yield service of cultivating and hoeing were conducted when necessary. Ten plants were randomly selected from the middle lines for each experimental unit at the flowering stage 50%.

The following qualities were studied:

1- **Plant height (cm):** measured from the base of the plant up to the highest point in the plant at the ripening stage.

2- Number of branches plant.

3- **Dry weight of the plant (g):** the plants were cut except the roots at the ripening stage and put in holed thermo-sacs and placed in an eclectic furnace at 70 degree centigrade for three days until the weight was fixed (Hocking, 1997).

4- **Number of siliques/plant:** these were calculated as an average for ten plants selected randomly at the ripening stage.

5- **Number of seed/silique:** calculated by dividing the seed average number on the average number of plant capsules.

6- **1000 Seed weight (g):** after mixing the seeds of the harvested plants, 1000 seeds were randomly selected from each experimental unit then weighed.

7- **Seed yield (kg/ha):** that was done by harvesting all the lines in the experimental unit except the guard lines and then estimated according to area.

8- **Oil content (%):** calculated by using the Soxhlet device using the A.O.A.C method, (2000).

9- **Oil yield (kg/ha)** = seed yield (kg/ha) × Oil content (%)

Statistical analysis:

The data were analyzed statistically for all the studied qualities according to the method of difference analysis by using the ready to use statistical program (SAS, 2005), the mathematical rates were compared by using the multi-extent Dunkin Test and at probability level of 1 and 5% (Al-Rawi and Khalaf-Allah, 2000).

Table 1 : Some chemical and physical analyses of the experiment soil.

physical characters	College location	Wana location
Sand (%)	18.75	55.41
Silt (%)	37.45	26.29
Clay (%)	43.8	18.3
Texture	Clay	Sandy loam
Chemical characters		
Available N (ppm)	41	60
Available P (ppm)	5.5	1.5
Available K (ppm)	186	111.5
E.C. (mmhos/cm)	0.55	0.13

Results and Discussion

Plant height (cm)

The results in table (2) showed that there abstract differences between the two varieties in character of plant height in both locations of the experiment. The verity (Pactol) was distinct and showed the highest quality rate reaching (110.16, 116.05 cm), whereas the variety (Srew) showed the lowest quality rate reaching (113.23, 114.24 cm) and the increase rate reached 1.70 and 1.58%. And this so because of the genetic difference between the two used varieties in the experiment. This result coincides with what

was reached at by A-Doori and Al-Dulaimy (2011) and Monfared *et al*. (2019) and Barekati *et al*. (2019).

The concentrations of humic acid had an abstract impact in character of plant height in both locations of the experiment as illustrated in table (3) the plants, to them the humic acid was added by 60 mg/l recorded the highest average of quality reaching at (25, 120, 73, 120 centimeters), whereas the plants that were not treated with humic acid recorded the lowest quality rate (107.55, 110,11 cm). The reason may be the effect of humic acid in increasing the vital activities in the plant and increasing the rate of absorbing the nutritional elements which was reflected positively in increasing plant growth rate. This result accords with what was found by Sani (2014) and Eledfawy (2017) and Barekati *et al*. (2019).

From table (4) it is clear that there is no abstract divergence between the two varieties and the concentrations of humic acid in plant height.

Number of branches/plant

It is noticed from table (2) that there were abstract differences between the two varieties in character of branch number of the plant in the two locations in the college and Wana district, the (Srew) showed the highest quality rate reaching (4.68, 4.87 branch/plant) whereas the (Pactol) verity showed the lowest quality rate of (4.29, 4.48 branch/plant) in the two locations respectively. This result coincides with what was found by Al-Doori and Al-Dulaimy (2011) and Shati *et al*. (2011) and Barekati *et al*. (2019).

Table (3) shows that there were abstract differences among the concentrations of Boron in character of branch number of the plant in both experiment locations; the plants to which humic acid was added by (40 mg/l) recorded the highest quality rate (5.85, 6.05 branch/plant). Whereas, the plants that were not treated with humic acid recorded the lowest rate of (3.16, 3.33 branch/plant). The reason may be due to the increase in humic acid which led to an increase in phosphorus in the leafs for phosphorus is one of the elements in the phospholipids which are important in the composition of cellular tissues and in the composition of enzymes such as DNA and NADP which are necessary in the oxidation and reduction reactions via which hydrogen is transferred and are important in the process of photosynthesis, breathing and carbohydrate assimilation (Suhuoni, 2004) which in turn are reflected in stimulating the locations of new growth in the plant such as buds which turn into new branches in the plant and so increasing the branch number of the plant. This result coincides with what was mentioned by Ahmad *et al*. (2016), Eledfawy (2017), and Barekati *et al*. (2019).

The results in table (4) show that there were no abstract differences of divergence between the two varieties and the concentrations of humic acid in plant branch number.

Dry weight/plant (g)

The results in table (2) show that there were abstract differences between character of the dry weight of the plant in both locations of the experiment, the variety (Srew) recorded the highest amount of character(24.68, 26.52 g), whereas the variety (Pactol) recorded the lowest amount of character(22.89, 24.08 g). The reason may be due to the dominance (Srew) in the number of branches in the plant which negatively affected the increase in the dry weight of the plant. This result coincides with what was found by Al-Doori and Al-Dulaimy (2011).

Table (3) shows that there are abstract among the concentrations of boron in the dry weight of the plant in the two locations in the college and Wana, and the plants to which humic acid by 40 mg/l was added showed the highest quality rate of (30.08, 32.01 g), however that did not differ abstractly from the plants to which humic acid by 60 mg/l in Wana location, whereas the plants that weren't given humic acid showed the lowest average of character of (15.45, 16.23 g) for the two locations respectively. The reason may be due to the increase in the height of the plant and its number of branches (table 3) which were positively reflected on the accumulation of the results of this process at the storage center and consequently an increase in the dry weight of the plant and this result accords with what was found by Eledfawy (2017).

The results in table (4) show that there was no abstract effect of divergence between the two varieties and the concentrations of humic acid in character of dry weight of the plant.

Number of siliques /plant:

The results of statistical analysis in table (2) showed that there were abstract differences between the two varieties in the number of siliques of the plant in the two locations of the college an Wana; the variety Srew showed the highest rate of the number of siliques reaching at (134.56, 136.78 silique/plant), whereas the variety Pactol recorded the lowest rate of mustard number of (129.95, 128.00 silique/plant), the reason why the variety Srew was dominant is its dominance in the number of branches which led to an increase in the number of siliques in the plant. This result accords with what was referred to by Monfared *et al*. (2016) and Barekati *et al*. (2019).

Table (4) shows that there was no abstract divergence between the two varieties and the concentrations of humic acid in character of siliques number in plant.

Number of seeds/siliques:

The results illustrated in table (2) that there were abstract differences between the two varieties in the number of seeds in the one silique in the two locations of the college and Wana, the variety Srew recorded the highest rate of (14.43, 15.53 seed/silique), whereas the variety Srew recorded the lowest rate of (12.86, 14.06 seed/silique). The reason may be due to the dominance of the variety Pactol in the number of seeds in the one mustard was that this variety showed the lowest indicators of mustards in the plant (table 2) which in the end was reflected on the number of seeds in the mustard on the basis of plant compensation. This result coincides with what was reached at by Monfared *et al*. (2019) and Barekati *et al*. (2019).

It is clear that from the results of table (3) that the concentrations of humic acid had an abstract effect in the number of seeds in corner in both locations of the experiment, the concentration of humic acid 40 mg/l recorded the highest rate of character of (17.00, 18.33 seed/silique), but didn't abstractly differ from the concentration of humic acid 60 mg/l, whereas the process of not treating with spray recorded the lowest rate (10.78, 11.71 seed/silique) for both locations respectively. That may be due to the role of humic acid in increasing the readiness of

phosphorus which had a big role in seed formation and increasing the number of seeds in fruits (Snyder, 2000). This result accords with what was mentioned by Ahmad *et al*. (2016).

From table (4) it is clear that there was no abstract effect of divergence between the varieties and spray with humic acid in the number of seeds in the silique.

1000 Seed weight (g):

The results in table (2) show that there were abstract differences between the two varieties in 1000 seed weight in both locations, the variety Srew recorded the highest rate of (3.05, 2.97 g), whereas the variety Pactol recorded the lowest rate (2.63, 2.43 g). The reason may be the important role of the genetic composition in accumulating the dry substance via its effect in growth indicators which would lead to affecting the weight of the seed and speed in growth. This result accords with what was stated by Al-Doori and Al-Dulaimy (2011), Monfared *et al*. (2019) and Barekati *et al*. (2019).

The results which were pointed out in table (3) that there were abstract differences among the concentrations of humic acid in character of 1000 seed weight in both locations of the experiment, at the college location the plants that received humic acid by (60.40 mg/l) recorded the highest rate of (3.21, 3.34 gram), as for Wana location, the plants which received humic acid by (60 mg/l) recorded the highest rate of (3.41 g), whereas the plants that were not treated with humic acid recorded the lowest rate of (2.25, 2.05 g) in the two locations successively. The reason behind that may be the increase in the efficiency of photosynthesis and the processes of food industry positively reflected in 1000 seed weight. This result coincides with what was reached at by Barekati *et al*. (2019).

Table (4) indicates that there were no abstract differences for divergence between the two varieties and the concentrations of humic acid in 1000 seed weight.

Seed yield (kg/ha)

The results of table (2) show that there were abstract differences between the two varieties in the seed yield in both locations of the experiment, the variety Srew recorded the highest amount of this quality (1257.43, 1282.87 kg/ha), whereas the variety Pactol recorded the lowest amount (1190.75, 1235.12 kg/ha). The reason may due to the increase in the number of mustards in the plant and 1000 seed weight (table 2) and which was directly reflected in an increase in seed yield. This result accords with what was found by Al-Doori and Al-Dulaimy (2011), Monfared *et al*. (2019), and Barekati *et al*. (2019).

The results illustrated in table (3) show that there were abstract differences among the concentrations of humic acid in character seed yield in both locations in the college and Wana, the plants to which humic acid was added by (40 mg/l) showed the highest rate of (1356.80, 1384.63 kg/ha), whereas the plants that were not sprayed by humic acid showed the lowest rate of (1045.70, 1086.08 kg/ha) in both locations successively. That may be due to the effect humic acid had in increasing the number of mustards in the plant and the number of seeds in the one mustard and 1000 seed weight (table 2) via the stimulating of humic acid to the physiological processes through the ripening phases of the rapeseed yield, this result coincides with what was found by Rajpar *et al* (2011) and Eledfawy (2017).

It is evident, from table (4), that there were abstract differences of divergence between the varieties and the concentrations of humic acid in seed yield, the plants of Srew which were sprayed with humic acid by 60 mg/l recorded the highest rate (1385.13, 1400.53 kg/ha), whereas the plants of Pactol that were not sprayed with humic acid recorded the lowest rate of (993.86, 1041.88 kg/ha).

Oil content (%):

The results shown in table (2) indicate that there were abstract differences between the two varieties in oil content in both locations of the experiment, the Srew variety was dominant and showed the highest rate of (34.14, 34.88 %), whereas the Pactol variety recorded the lowest rate of (32.14, 32.87 %) and the reason may be due to the genetic difference between the two varieties and the extent of reaction with the environmental conditions. The result coincides with what was mentioned by Monfared *et al*. (2019) and Barekati *et al*. (2019).

It can be noticed from the results in table (3) that the concentrations of boron had an abstract impact on oil content in the two locations of the experiment, the plants to them a concentration of 40 mg/l of humic acid was added, showed the highest rate of (38.31, 39.11%), whereas the treatment not sprayed with humic acid showed the lowest rate of (28.06, 28.63%) in the two locations successively. This result coincides with what was reached at by Rajpar *et al*. (2011), Eledfawy (2017), and Gursoy and Kolsarici (2017).

Oil yield (kg/ha)

The results of statistical analysis in table (2) show that there was an abstract impact of the two varieties in oil yield in the two locations of the college and Wana, the Srew variety recorded the highest oil yield of (433.11, 451.19 kg/ha), whereas recorded the lowest oil yield of (387.14, 410.41 kg/ha). The reason of the increase in oil yield may be its prominence in seed yield and oil rate. This result coincides with what was mentioned by Al-Doori, Al-Dulaimy (2011) and Barekati *et al*. (2019).

Table (3) shows that there were abstract differences among boron concentrations in seed yield in both locations of the experiment, the plants to which humic acid was added by concentration of 40 m.g/litre recorded the highest rate of (520.12, 541.81 kg/ha) whereas the plants that were not treated with humic acid recorded the lowest rate of (294.16, 311.54 kg/ha) in the two locations successively. The reason may be due to the fact that adding humic acid led to improving the physiological qualities and dominance in seed yield (table 3). This result accords with what was found by Gursoy and Kolsarici (2017) and Barekati *et al*. (2019).

The results of table (4) indicate that there were abstract effect of divergence between the two varieties and spray with humic acid in oil yield.

It can be concluded from this experiment: that the best variety for cultivation is Srew with humic acid by 4o mg/l to get the highest yield of rapeseed.

Table 2 : The effect of varieties on the growth, yield and its components in the experiment locations

Varieties	Plant height (cm)	No. fruiting branches/plant	Dry weight/ plant (g)	No. siliques/ plant	No. seeds/ silique	1000-seed weight	Seed yield (kg/ha)	Oil (%)	Oil yield (kg/ha)
College location									
Pactol	115.02a	4.29b	22.89b	128.00b	14.43a	2.63b	1190.75b	32.14b	387.14b
Srew	113.10b	4.68a	24.68a	134.56a	12.86b	3.05a	1257.43a	34.14a	433.11a
Wana location									
Pactol	116.12a	4.48b	24.08b	1129.95b	15.53a	2.43b	1235.12b	32.87b	41041b
Srew	114.30b	4.87a	26.52a	136.78a	14.06b	2.97a	1282.87a	34.88a	451.19a

The values followed by different letters in the same column differ from each other's at probability 1 and 5% levels.

Table 3 : The effect of nitrogen fertilization on growth, yield and its components in the experiment locations.

Humic acid (mg/l)	Plant height (cm)	No. fruiting branches/ plant	Dry weight/ plant (g)	No. siliques/ plant	No. seeds/ silique	1000-seed weight	Seed yield (kg/ha)	Oil (%)	Oil yield (kg/ha)
College location									
0	107.55d	3.16e	15.45e	110.48e	10.78d	2.25c	1045.70e	28.06d	294.16e
20	111.23c	3.73d	20.88d	118.41d	11.71cd	2.53bc	1156.51d	30.65c	354.86d
40	117.43b	5.85a	30.08a	152.86a	14.00a	3.21a	1356.80a	38.31a	520.12a
60	120.25a	5.40b	27.51b	141.78b	15.18ab	3.43a	1330.13b	35.65b	474.61b
80	113.85	4.30c	25.01c	132.86c	13.55bc	2.78b	1231.31c	33.03c	406.90c
Wana location									
0	110.11d	3.33e	16.23d	112.21e	11.71d	2.05d	1086.08e	28.63d	311.54e
20	112.71cd	4.00d	22.18c	120.86d	12.93cd	2.30cd	1180.01d	31.56c	372.84d
40	117.93b	6.05a	32.01a	156.93a	18.33a	3.06ab	1384.63a	39.11a	541.81a
60	120.73a	5.43b	29.51ab	145.13	116.45ab	3.41a	1357.25b	36.41b	494.56b
80	114.56c	4.58c	26.58b	131.68c	14.55bc	2.68bc	1287.00c	33.66c	433.25c

The values followed by different letters in the same column differ from each other's at probability 1 and 5% levels.

Table 4 : The effect of interaction between varieties and nitrogen fertilization on growth trait, yield and its components in the experiment locations

Varieties	Humic acid (mg/l)	Plant height (cm)	No. fruiting branches/plant	Dry weight/plant (g)	No. siliques/ plant	No. seeds/ silique	1000-seed weight	Seed yield (kg/ha)	Oil (%)	Oil yield (kg/ha)
College location										
Pactol	**0**	108.96	3.00	14.40	107.46	11.30	2.06	993.86j	26.83	266.71
	20	112.00	3.63	19.50	116.53	12.30	2.30	1117.63h	29.76	332.71
	40	118.43	5.60	29.53	147.60	18.13	2.93	1328.46c	37.53	498.64
	60	120.86	5.13	26.73	138.26	16.26	3.33	1296.46d	34.46	446.88
	80	114.86	4.10	24.30	130.13	14.16	2.53	1217.30f	32.10	390.77
Srew	**0**	106.13	3.33	16.50	113.50	10.26	2.43	1097.53i	29.30	321.61
	20	110.46	3.83	22.26	120.30	11.13	2.76	1195.40g	31.53	377.02
	40	116.46	6.10	25.73	135.60	12.93	3.03	1245.33e	33.96	423.02
	60	115.63	5.66	30.53	158.13	15.86	3.50	1385.13a	39.10	541.60
	80	112.83	4.50	28.30	145.30	14.10	3.53	1363.76b	36.83	502.34
Wana location										
Pactol	**0**	110.43	3.13	15.10	109.93	12.50	1.80	1041.76j	27.43	285.82
	20	113.13	4.06	30.53	118.30	13.40	2.06	1135.40h	30.83	350.11
	40	119.30	5.80	25.30	127.56	15.63	2.43	1295.53e	32.76	424.52
	60	122.03	5.16	31.33	150.70	19.36	2.80	1368.73c	38.10	521.51
	80	115.70	4.26	28.16	143.26	16.76	3.06	1334.16d	35.23	470.09
Srew	**0**	109.80	3.53	17.36	114.50	10.93	2.30	1130.40i	29.83	337.26
	20	112.30	3.93	23.83	123.43	12.46	2.53	1224.63g	32.30	395.57
	40	116.56	6.30	32.70	163.16	17.301	3.33	1400.53a	40.13	562.10
	60	119.43	5.70	30.86	147.00	16.13	3.76	1380.33b	37.60	519.03
	80	113.43	4.90	27.86	135.80	13.46	2.93	1278.46f	34.56	441.97

The values followed by different letters in the same column differ from each other's at probability 1 and 5% levels.

References

A.O.A.C. (2000). Association of official agricultural chemist, official methods of analysis. 14th Ed Washington, D. C., USA.

Ahmad, S.; Daur, I.; Al-Solaimani, S.G.; Mahmood, S.; Bakhashwain, A.A.; Madkour, M.H. and Yasir, M. (2016). Effect of rhizobacteria inoculation and humic acid application on canola (*Brassica napus* L.) Crop. Pak. J. Bot., 48(5): 2109-2120.

Al-Doori, S.A.M. and Al-Dulaimy, M.Y.H. (2011). Effect of sowing dates on growth, yield and quality of three canola cultivars (*Brassica napus* L.). 550-569. College of Basic Education Researchers Journal, 10 (4): 550-569.

Al-Rawi, K.M. and Khalaf-Allah, A.M. (2000). Design and Analysis of Agricultural Experiments. Foundation of Dar AL-Ktob, University of Mosul, Ministry of Higher Education and Science Research, Iraq.

Barekatia, F.; Hervana, E.M.; Radb, A.H.S. and Mohamadia, G.N. (2019). Effect of sowing date and humic acid foliar application on yield and yield components of canola cultivars. Journal of Agricultural Sciences, 25: 70-78.

El-Akabawy, M.A. (2000). Effect of some bio fertilizers and farmyard manure on yield and nutrient uptake of Egyptian clover grown on lomy sand soil. Egypt. J. Agric. Res., 78(5).

Eledfawy, Y.M. (2017). Effect of NPK–fertilizers and humic acid applications on yield and quality of canola plant (*Brassica napus* L.) grown in sandy soil. Nature and Science, 15(12): 205-211.

Gursoy, M. and Kolsarici, O. (2017). Effects of different humic acid doses in leonardite environment on the oil percentage and fatty acids of summer rapeseed (*Brassica napus* ssp. Oleifera L.) Under central anatolian conditions. Fresenius environmental bulletin, 26(11): 6447-6456.

Hocking, P.J. (1997). Assessment of the nitrogen status of field grown canola (*Brassica napus* L.) by plant analysis. Aust. J. of Exptl. Agric., 37(1): 83-92.

Monfared, B.B.; Noormohamadi, G.; Rad, A.H.S. and Hervan, E.M. (2019). Effects of sowing date, cultivar and chitosan on quality and quantity of rapeseed (*Brassica napus* L.) Oil. Journal of agricultural sciences, 25: 508-517.

Pettit, R.E. (2003). Emeritus associate professor texas a & m university, organic matter, humus, humates humic acid, fulvic acid and humin: their importance in soil fertility and plant health.

Rajpar, I.; Bhatti, M.B.; Zia-ul-hassan, Shahand A.N. and Tunio, S.D. (2011). Humic acid improves growth, yield and oil content of (*Brassica compestris* L.). Pak. J. Agri 27(2): 125-133.

Sani, B. (2014). Foliar application of humic acid on plant height in canola. APCBEE Procedia, 8: 82-86.

SAS, (2005). Statistical analysis system. SAS Institute. Inc., Cary, NC, USA. Release 82.

Shati, R.K.; Mohammad, H.H. and Ahmad, H.T. (2011). Response three genotypes of rapeseed to weed control and effect of that on growth characteristics. Diyala Journal of Agricultural Sciences, 3(1): 228-239.

Snyder, C.S. (2000). Raise Soybean yields and profit potential with phosphorus and potassium fertilization. Potash and Phosphate Institute (PPI):1-4.

Suhuoni, F. (2004). Basics of plant physiology (theoretical part).