

Impact of Planting Distances and Humic Acid on Oat *Avena sativa*

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Abstract

A study was conducted at the Field Crops Research Station at College of Agriculture, University of Diyala during the season (2017-2018) to evaluate the effect of planting distances and spraying of a humic acid on the growth characteristics of Oats. The factorial experiment was carried out according to the complete randomized blocks design (RCBD) with three replicates and two factors, the first include planting distances (10-20-25 cm) between the plants and the second is spraying of the humic acid at a concentration of 2 and 4 ml / L. Results revealed that the distance (25 cm) between the plants had a significant effect on the studied traits such as number of leaves/plant 37.22, number of panicle/ plant 5.67, weight of 1000 grain 25.30 g, grains yield 16.33 g, dry plant weight 28.33 g, number of branches / plant 6.11, number of grains / plant 368.6, protein (6.77), fat (1.84) and fiber (15.06), also the findings showed that the spraying of humic acid at a concentration of 4 ml / L was superior significantly in the studied traits viz, plant height 147.33 cm, number of branches/plant 5.67, number of leaves/plant 36.44, number of panicle/plant 5.11, grains yield 14.67 g, dry plant weight 26.11 g, number of grains/plant 371.7, weight of 1000 grains 24.52 g, grain yield 1924 kg / h, protein (6.67), fat (1.80), fiber (14.60).

Keywords: Oats, Humic acid, planting distances

1. Introduction

The oat (*Avena sativa*), is a species of cereal crop grown for its seed, belong to Poaceae family, oats are suitable for human consumption as oatmeal and one of the most common uses is as livestock feed, oat is ranking fourth after wheat, rice, and maize economically, Russia, the United States, Canada, and Australia are at the forefront of producing countries to this crop (Ghani, 2011). Plants need space in which to live, grow, and reproduce and to make the best use of available essentials like water, air, and light. Therefore it is important in conventional cultivation to carefully assess distances between plants. Several studies were indicated that planting distances affect the growth of oats and the amount of its chemical compounds. Nasser and Ahmad, (2017) were noted when using three quantities of seeds are (80,100,120 kg/h) superiority of treatment 120 kg in recording the highest rates of plant height, leaf area, number of Panicles, number of grains/Panicle, and grain yield compared to other treatments. Kumar *et al.* (2006) found significant differences in dry feed yield between seeds rates (60,80,100 kg / h). Romitti *et al.* (2016) showed that when using four seed levels (100,300,600,900 seed/m²), the rate of 600 seed / m² was higher in the number of seeds/pod and the weight of the green yield. Banisaeidi *et al.* (2014) studied that four plant densities (400,500,600,700 plant / m²) of oats plant and recorded the highest rate of seeds at the rate of 700 and highest dry weight of oats in the rate of seed 400. In recent years, organic fertilizers such as humic acids have been used to improve soil properties, plant nutrition, accelerate growth and increase production (Zidan and Samer, 2005). Humic acids have a positive effect on nutrient uptake by plants (Lutzow *et al.*, 2006). Delfine *et al.*, (2005) found that humic acid led to increase plant dry mass, grain yield, high fertility, and protein content in grains. Lindaw *et al.* (2010) noted that the addition of humic acid significantly increased Plant height and spike length And the weight of 1000 grains and the yield of grain and straw / fed and protein content in grain. Jan *et al.* (2014) showed that when used levels of humic fertilizer, there is a significant increase in the paper area and dry weight of the total plant. the study was conducted to investigate the effect of planting distances and humic acid on growth characteristics and yield of oat plants.

2. Materials and Methods

This experiment was carried out in the field of a department of field crops at the College of Agriculture / University of Diyala during the season 2017-2018 to study the effect of planting distances and spraying of the humic acid in the growth and yield characteristics of oats, A factorial experiment was used in the randomized complete block design (RCBD) in three replicates, the replicates were distributed randomly and the rates were compared by using the least significant difference L.S.D at the level of probability of 5% (Al-Rawi and Khalaf Allah, 1980). The experiment included two factors, the first is the effect of the planting distances (10,20,25 cm) between the plants and the second is spraying of the humic acid (0,2,4 ml / L) on the plants of oats. Soil samples were taken before planting to analyze some of the physical and chemical properties, five random samples were collected at a depth of 0-30 cm, the samples were mixed and exposed to sunlight for 8 hours then grinded and sieving, Physical and chemical analysis was conducted in the soil department laboratories, college of Agriculture, Diyala University, Table (1) shows the results of soil analysis.

Table (1) Some physical and chemical characteristics of soil before planting

Measurements	Unit of measurement	Field soil
PH	—————	8.4
Ec	dS siemens /m	2.74
N	Mg/Kg	34.8
P	Mg/Kg	13.7
K	Mg/Kg	509
So ₄	Mg/Kg	1.4
Organic matter	g/ Kg	18.26
porosity	—————	52%
Gypsum	g/ Kg	1.34
sand	g/Kg	24%
Clay	g/Kg	22%
Texture	—————	Mixed clay

the soil was Irrigated until the immersion before tillage, then it was plowed by using Plow, the field was divided into three sectors, each containing 9 treatments, length of treatment 2m and the distance between the lines and between the treatments 0.5 m and the distance between plants according to the study, the area of experimental unit 4 m and the number of plants in the experimental unit according to the distance required in the study, nitrogen fertilization was added in the form of urea before planting at a rate of 75 kg/ h, phosphorus and potassium at 40 kg/h (Ghani, 2009).

The seeds (Possum variety) were obtained from the market. The seeds germination were tested by placing the seeds in the Petri dishes, adding a little water and recording the number of seeds germinated per day, the germination rate was 90%. The seeds were planted on 15/10/2017 at a depth of 3-4 cm then covered and irrigated and harvested the plants after reaching maturity.

The spraying of the humic acid was started after one month of planting and three times during the growing season (Al Sahaf, 1994) with one spraying every two weeks with 4 and 8 ml / L.

The experimental measurements of vegetative growth were carried out on five plants randomly taken from each experimental unit, which included plant height (cm), a total number of leaves/ plant, number of branches/plant, dry weight of the plant, number of panicle/ plant , number of grains/ plant , grains yield/ plant, total yield kg/h, weight of 1000 grains and the chemical properties of protein, fat, and fiber.

3. Results and Discussion

3.1 Plant height

Table (2) shows that the effect of planting distances on plant height was significant. The plant height was increased with decreased the distance between the plants where the distance 10 cm was superior in highest rate reached (152.89 cm) compared to the distance 20 cm that record lowest rate of this characteristic, which reached (124.44 cm). This is due to that reducing the distance between the plants led to an increase in the total vegetation in the area unit which led to decrease introduce of light into the vegetation that allowing the auxin and gibberellin to prolong the stalks and then increase the plant height and this agree With (Banisaeidi, 2014; Romitti, 2016; Younis and Aziz, 2013).

The effect of organic fertilizer spraying on the plant height was significant, the treatment of 4 ml / L was superior reached 147.33 cm compared with the non-sprayed treatment which gave the lowest rate 127.56 cm, this is due to the positive role of the humic acid through its direct intervention in plant functional processes, leading to an increase in cellular division and elongation of cells (Nardi *et al.*, 2002). It is also due to the availability of nutrients which enters the building of chlorophyll, protein and nucleic acids and thus increase the plant's ability to perform photosynthesis and food processing, which plays a role in cell division and prolongation (Abdul, 1978; Lindaw *et al.*, 2010; Fakera and Al-Shaabi, 2015). The effect of the interfere of the distances of agriculture and spraying with organic fertilizer on the plant height in oats showed significant differences due to different response of plant densities for spraying, the first distance and spraying at 4 ml / L showed the highest plant height of 162.67 cm whereas the third distance with non-sprayed treatment recorded the lowest plant height (113.67 cm).

Table (2) Effect of planting distances and spraying of humic acid on plant height

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	143.33	152.67	162.67	152.89
Second distance 20 cm	125.67	131.67	146.00	134.44
Third distance 25 cm	113.67	126.33	133.33	124.44
Rate	127.56	136.89	147.33	
L.S.D 0.05	Distance =3.505, Spraying =3.505, Interfere = 6.071			

3.2 Number of branches

Data presented in Table 3 revealed that influence of planting distances significantly on the number of plants branches. The third distance between plants was recorded the highest rate of branches (6.11 branch/ plant), In contrast to the first distance between the plants that recorded the lowest rate of this characteristic (3.89 branch/plant).the superiority of the third distance between plants in the number of branches was due to the distance gave the least length for plant (Table 2) , therefore the plants tended to form lateral branches instead of an increase in length ,this agrees with findings of (Abuzeid, 2000; Nasir and Ahmed, 2017; Younis and Aziz, 2013; Kumar *et al.*, 2006).

The spraying of plants with an organic fertilizer at a concentration of 4 ml / L resulted in a significant increase in the number of branches/plant (5.67 branches/plant) compared to non-sprayed plants which gave the lowest rate (4.11 branches/plant). This is due to that the proper concentration of humic acid has increased the efficiency of photosynthesis process, which leads to the accumulation of nutrients in the plant and stimulation the plant to increase the number of branches, and it has a role in increasing the cytokines that have an obvious effect in promoting the growth of side buds, and it has a role in increasing the cytokines that have an obvious effect in promoting the growth of side buds and helped to grow a large number of side branches, this is consistent with the results of (Moore, 1982; Delfine *et al* ,2005; Jan *et al* , 2014; Joddo *et al* , 2017).

The results indicated in Table (3) that there was a significant interfere between the distances of cultivation and spraying with organic fertilizer, where the third distance and spraying at a concentration of 4 ml / L recorded the highest rate (6.67 branches/plant).

Table (3) Effect of planting distances and spraying of humic acid on number of branches

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	2.67	4.33	4.67	3.89
Second distance 20 cm	4.33	5.00	5.67	5.00
Third distance 25 cm	5.33	6.33	6.67	6.11
Rate	4.11	5.22	5.67	
L.S.D 0.05	Distances =0.645, Spraying =0.645, Interfere = 1.117			

3.3 Number of leaves

There are significant differences in the effect of planting distances between plants on the number of leaves (Table 4). The third distance recorded the highest rate (37.22 leaves/plant) while the first distance between plants recorded the lowest number of leaves (22.89 leaves/plant) ,this is due to the competition for food and light which leads to low of photosynthesis, therefore increasing the number of leaves of the plant when increasing the distance between plants, this is agreed with (Nasir and Ahmed, 2017;Younis and Aziz, 2013; Romitti *et al* , 2016) .

The increase in levels of organic fertilizer resulted in a significant increase in the number of plant leaves, the concentration of 4 ml / L recorded the highest rate (36.44 leaves/plant) compared with the non-sprayed plants which recorded the lowest rate (23.56 leaves/plant), the reason is that the element of the humic is a necessary element for the growth and development of the plant although it does not enter into any of the cellular components and acts as a co-factor in many of the biological processes including the formation of proteins, nucleic acids and photosynthesis, in addition to the importance of humic acid in cell division due to activation of special enzymatic systems ,this is agreed with the findings of (Bidwell, 1979 ; Delfine *et al* , 2005).as well as the effect of interfere between the distances of planting and the spraying on number of leaves, where the results indicated that there were significant differences, the third distance and spraying at a concentration of 4 ml / L recorded the highest rate (42.00 leaves/plant) while the first distance and the treatment without spraying recorded the lowest rate (15.00 leaves / plant).

Table (4) Effect of planting distances and spraying of humic acid on number of leaves

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	15.00	23.67	30.00	22.89
Second distance 20 cm	24.67	32.00	24.67	31.33
Third distance 25 cm	31.00	38.67	42.00	37.22
Rate	23.56	31.44	36.44	
L.S.D 0.05	Distances =2.196, Spraying =2.196, Interfere = 3.804			

3.4 A total dry weight of the plant

The results of the variance analysis of Table (5) showed a significant effect of the planting distances between plants on a total dry weight of the plant. The third distance between the plants recorded the highest rate of (28.33) g / plant while the first distance between the plants recorded the lowest rate of (18.22) g / plant, this has been positively correlated with all the traits studied in Table 3.4.5 where dry weight is very important and It is an indicator of the efficiency of photosynthesis, 90% of dry weight is producing from this process, this agrees with the findings of (Ghani, 2011; Zidan and Samir, 2005).

The effect of spraying an organic fertilizer on the dry weight of the plant was significant, the concentration of 4 ml / L recorded the highest rate of 26.11 g compared with the non-sprayed treatment which recorded the lowest rate of 19.44 g , This is due to the organic fertilizer has a positive effect on the improvement of photosynthesis and oxidation and reduction processes within plants, which has the role in increasing the meristem divisions that encourage vegetative growth and increase the accumulation of organic matter and thus increase the dry matter of the plant (Abdel Hafez, 2008) .

The results showed that there were significant differences in the interfere between the distances of planting and the spraying, where the third distance and spraying at a concentration of 4 mm / L recorded the highest rate was 31.67 g while the first distance and the treatment without spraying recorded the lowest rate 15.00 g.

Table (5) Effect of planting distances and spraying of humic acid on A total dry weight of the plant

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	15.00	19.00	20.67	18.22
Second distance 20 cm	18.67	21.67	26.00	22.11
Third distance 25 cm	24.67	28.67	31.67	28.33
Rate	19.44	23.11	26.11	
L.S.D 0.05	Distances = 1.184, Spraying = , 1.184 Interfere = 2.050			

3.5 Number of panicles

The results of Table (6) showed that significant differences between the planting distances in the number of panicles per plant, the third distance between plants recorded the highest rate (5.67 panicles/plant) while the first distance between the plants recorded the lowest rate of this trail reached (3.33 panicles/plant), The decrease in the number of panicles in high plant densities may be due to the competition between plants on light, water and other essential nutrients which reduces the size of the plant and the number of fruit branches and thus reduces the number of panicles in the plant, this agrees with the findings of (Abuzeid, 2000; Nasir and Ahmed, 2017; Banisaeidi *et al*,2014).

The spraying of plants with humic acid led to significantly increased in the number of panicles, the concentration of 4 ml / L recorded the highest rate of (5.11 panicles/ plant) compared with the non-sprayed treatment which recorded the lowest rate of (3.67 panicles/plant), this is due to the humic acid from nutrients elements that entering in the synthesis of the number of enzymes (Mikkelsen, 2005) and may be due to its hormone effect which resembles the work of Auxin, this causes an increase in the number of flowers (Zhang and Ervin, 2004).

There was a significant effect of the interfere in the distances between the plants and spraying of the humic acid, the third distance and the concentration of 4 ml / L recorded the highest rate of (6.67 panicles/plant) while the treatment without spraying with the first distance recorded the lowest rate (2.67 panicles/plant).

Table (6) Effect of planting distances and spraying of humic acid on number of panicles

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	2.67	3.33	4.00	3.33
Second distance 20 cm	3.67	4.00	4.67	4.11
Third distance 25 cm	4.67	5.67	6.67	5.67
Rate	3.67	4.33	5.11	
L.S.D 0.05	Distances = 0.597, Spraying = 0.597 , Interfere = 1.033			

3.6 Number of grains /plant

Table (7) revealed that a significant effect of the planting distances on the number of grains per plant. The third distance recorded the highest rate (368.6 grains/plant) while the first distance recorded the lowest rate (253.1 grains/plant), this is due to an increase in the number of branches and the number of panicles and thus the number of grains and this agrees with (Younis and Aziz, 2013).

Also, there are significant differences in the spraying with the element of humic for the number of grains in the plant. spraying treatment of humic acid at a concentration of 4 ml / L recorded the highest rate (371.7 grains/plant), while non-sprayed treatment recorded the lowest rate reached (231.1 grains/ plant), this is due to the contribution of the nutrients elements that forming the nutritious solution in increase the activity of enzymes and the organization of the vital activities of the plant, including the stimulation of flowers and increase its numbers in addition to the role of some nutrients in the solution nutritious in increasing the number of grains through achieving the highest percentage in pollen germination and increase the length of pollen tube, this is agrees with the findings of (Manjumatheredy and Kulharni, 1986 ; Zidan and Samir, 2005; Lindaw *et al*,2010).

There was a significant effect of the interfere between the distances of cultivation and spraying with the element of the humic, the third distance with the concentration of 4 ml/L recorded the highest rate (440.0 grains/plant) while the treatment without spraying with the first distance recorded the lowest rate (150.0 grains/plant).

Table (7) Effect of planting distances and spraying of humic acid on number of grains /plant

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	150.0	284.3	325.0	253.1
Second distance 20 cm	253.7	336.7	350.0	313.4
Third distance 25 cm	289.7	376.0	440.0	368.6
Rate	231.1	332.3	371.7	
L.S.D 0.05	Distances =8.83, Spraying =8.83, Interfere =15.30			

3.7 Weigh 1000 grain

Table (8) shows that significant differences between the planting distances of plants in the weight of 1000 grain / g, the third distance recorded the highest rate of (25.30 g), while the first distance recorded the lowest rate (19.27 g), this is due to cultivation of plants leads to an increase in the number of branches and the biological yield which leads to the increase of provided materials from photosynthesis which is transmitted to the grains and thus lead to increased weight compared to plants that are planted in narrow distances between plants, this corresponds with the findings of (Romitti, 2016).

There were significant differences in the spraying of plants with the element of humic on the weight of 1000 grain, the sprayed treatment at a concentration of 4 ml / L recorded the highest rate (24.52 g) while the non-sprayed treatment recorded the lowest rate (19.72 g),this is due to the role of nutrients elements within the nutritious solution in the process of photosynthesis which increase in the vegetative weight and thus increase the manufacture of carbohydrate, causing an increase in the weight of the grains (Abu Dhahi and Al Yunis, 1988;Fakera and Al-Shaabi, 2015).

There are significant differences between the distances of planting and spraying with the element of the humic, the third distance and the sprayed treatment at a concentration of 4 mm / L recorded the highest rate of 27.53 g while the first distance with the non-sprayed treatment recorded the lowest rate 15.93 g.

Table (8) Effect of planting distances and spraying of humic acid on weigh 1000 grain

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	15.93	19.70	22.17	19.27
Second distance 20 cm	20.17	23.27	23.87	22.43
Third distance 25 cm	23.07	25.30	27.53	25.30
Rate	19.72	22.76	24.52	
L.S.D 0.05	Distances =1.248, Spraying =1.248, Interfere =2.161			

3.8 Grains yield / plant

there are significant effects for distances of planting on grains yield per plant (Table 9), the third distance got the highest rate (16.33 g / plant) while the first distance got the lowest rate (7.67 g / plant), this is due to the competition of plants on the requirements of growth and then decrease the ability of the plant to provide more grains per plant (Dulaimi, 2003 ; Banisaeidi *et al.*2014).

There were significant differences in the spraying of plants with humic acid on grains yield per plant, the sprayed treatment at a concentration of 4 ml/ L recorded the highest rate (14.67 g) while the non-sprayed treatment recorded the lowest rate (9.44 g), increase in total plant production may be explained as a direct result to increase morphological and fruiting effects and leads to an increase in the accumulation of Manufactured carbohydrate in addition to its role in the increase of enzymatic activities (Canellas and Olivares , 2014; Delfine *et al.*, 2005).

The table showed a significant interfere between the planting distances and the spraying of humic acid, the third distance and the spraying at 4 ml / L got the highest rate (19.00 g / plant) whereas the first distance and the treatment without spraying got the lowest rate (5.67 g / plant).

Table (9) Effect of planting distances and spraying of humic acid on grains yield / plant

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	5.67	7.67	9.67	7.67
Second distance 20 cm	9.33	12.67	15.33	12.44
Third distance 25 cm	13.33	16.67	19.00	16.33
Rate	9.44	12.33	14.67	
L.S.D 0.05	Distances =0.751, Spraying =0.751, Interfere =1.301			

3.9 Grains yield kg/h

The results of Table (10) showed no significant differences between the planting distances in the grains yield rate, while there are significant differences in the spraying of plants with the element of humic on grains yield, the sprayed treatment at a concentration of 4 ml / L recorded the highest rate (1924 kg / h), while the non-sprayed treatment recorded the lowest rate (1226 kg / h), Abu Dahi and Yunis, (1988); Joddo *et al.*, (2017) reported that the role of nutrients elements within the positive nutritious solution in the process of photosynthesis, which is to increase the vegetative weight and thus increase the manufacture of carbohydrate, causing an increase in the weight of grains. The table showed a significant interfere between the planting distances and the spraying of humic acid, the second distance and the spraying at 4 ml / L got the highest rate (1939 kg / h) whereas the first distance and the treatment without spraying got the lowest rate (1133 kg / h).

Table (10) Effect of planting distances and spraying of humic acid on grains yield kg/h

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	1133	1533	1933	1533
Second distance 20 cm	1213	1647	1939	1600
Third distance 25 cm	1333	1667	1900	1633
Rate	1226	1616	1924	
L.S.D 0.05	Distances =N.S, Spraying =118.1, Interfere =204.6			

3.10 Protein

Table (11) showed that there is a significant effect to the distances of planting on the protein compound, where the third distance between the plants got the highest rate (6.77) while the first distance got the lowest rate of (6.38), this agrees with Younis and Aziz (2013); Abu Zeid, (2000) that reported the absence of light and increase of shadow will lead to an internal genetic defect in the plant which leads to weak of growth and development and the reduce the content of active substances of natural products of medicinal and aromatic plants .

The table showed a significant differences in the spraying of plants with the element of humic on protein compound, the sprayed treatment at a concentration of 4 ml / L recorded the highest rate (6.67), while the non-sprayed treatment recorded the lowest rate (6.51), also, there is significant interfere between the planting distances and the spraying of humic acid on protein compound, the third distance and the spraying at 4 ml / L got the highest rate (6.80) whereas the first distance and the treatment without spraying got the lowest rate (6.21).

Table (11) Effect of planting distances and spraying of humic acid on protein

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	6.21	6.39	6.56	6.38
Second distance 20 cm	6.54	6.61	6.65	6.60
Third distance 25 cm	6.80	6.72	6.80	6.77
Rate	6.51	6.57	6.67	
L.S.D 0.05	Distances = 0.104, Spraying = 0.104, Interfere = 0.303			

3.11 Fat

Table (12) showed that the distances of planting have a significant impact on chemicals especially fat, the third distance got the highest rate (1.84) compared to the first distance which recorded the lowest rate (1.64), the change in the distances between the plants leads to obtaining different plant densities which causing different degrees of light and competition for water and nutrients and consequently reduced the yield and amount of active substance (Kumar *et al*,2006; Al-Rifai and Mandelawi,2016).

There were significant differences in the spraying of plants with humic acid on fat , the spraying treatment at a concentration of 4 ml/ L recorded the highest rate (1.80) while the spraying treatment at a concentration of 2 ml/ L recorded the lowest rate (1.72), the increase of total plant production as a direct result for the increase of morphological and fruiting effects, for example, the positive effect of organic fertilizer leads to an increase in the accumulation of manufactured carbohydrate in addition to its role in the increase of enzymatic activity (Canellas and Olivares ,2014;Linda *et al*, 2010).

Also, there is a significant interfere between the planting distances and the spraying of humic acid on protein compound, the third distance and the spraying at 4 ml / L got the highest rate (1.94) whereas the third distance and the treatment without spraying got the lowest rate (1.83).

Table (12) Effect of planting distances and spraying of humic acid on Fat

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	1.69	1.60	1.63	1.64
Second distance 20 cm	1.85	1.80	1.85	1.83
Third distance 25 cm	1.83	1.77	1.94	1.84
Rate	1.79	1.72	1.80	
L.S.D 0.05		Distances = 0.20, Spraying = 0.20, Interfere = 0.52		

3.12 Fibers

Table (13) showed that the distances of planting have a significant effect on the fibers ratio. The third distance got the highest rate of 15.06 and the first distance got the lowest rate of 13.39,this is due to the competition for food and light, which led to reduce the reducing the process of photosynthesis and this means increasing the number of fruits in the plant and thus the active substance when increasing the distance and reducing the shadow between plants (Jones *et al*, 1980; Nasser and Al-Muzaffar, 2017).also, there are significant differences in the spraying with the humic acid on fibers. spraying of humic acid at a concentration of 4 ml / L recorded the highest rate (14.60), while non-sprayed treatment recorded the lowest rate reached (13.78),the humic acid from nutrient elements that enter in a composition of enzymes (Mikkelsen 2005), it may be due to its hormonal effect which is similar to the action of auxin which causes an increase in the number of stable flowers and reduces the fallen flowers (Zhang and Ervin,2004; Linda *et al*,2010).

There was a significant effect of the interfere between the distances of cultivation and spraying with the element of the humic, the third distance with the concentration of 4 ml/L recorded the highest rate (15.12) while the treatment without spraying with the first distance recorded the lowest rate (12.13).

Table (13) Effect of planting distances and spraying of humic acid on Fibers

Treatments	Non- Spraying	Spraying 2 ml	Spraying 4 ml	Rate
First distance 10 cm	12.13	14.39	13.66	13.39
Second distance 20 cm	14.20	14.39	14.90	14.49
Third distance 25 cm	15.03	15.04	15.12	15.06
Rate	13.78	14.60	14.56	
L.S.D 0.05		Distances = 1.02, Spraying = 1.02, Interfere = 2.440		

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