European Journal of Agricultural and Rural Education (EJARE)
Available Online at: https://www.scholarzest.com
Vol. 4 No. 9, September 2023
ISSN: 2660-5643

THE EFFECT OF ADDING HUMIC ACID AND FOLIAR APPLICATION WITH GIBBERELLIN (GA3) ON THE GROWTH AND YIELD OF BREAD WHEAT *TRITICUM AESTIVUM* L

Ahmed A. Abbas Al-Tayyar
Musa S. Abed El-Mali
Field Crops Department - College of Agriculture - Kirkuk University ahmed.tayyar90@gmail.com

Article history:

Received: 20th July 2023
Accepted: 20th August 2023
Published: 24th September 2023

Abstract:

A field experiment was conducted in one of the agricultural fields in Taza district - Kirkuk Governorate for the 2022/2023 agricultural season in a randomized complete block design (RCBD) with three replicates to determine the effect of ground addition of humic acid and foliar spraying with gibberellin on the growth and yield of bread wheat. The research results showed that the concentration exceeded 100 mg. L^{-1} of gibberellin acid in terms of the number of shoots, plant height, weight of 1000 seeds, and grain yield. The values were: 258.05 shoots. m2, 99.07 cm, 44.39 g, and 5.97 tons.ha^{-1}, respectively. The concentration also exceeded 100 mg. L^{-1} of gibberellic acid in weight of 1000 grains, protein percentage, and physiological maturity values were: 43.88 g, 14.02%, and 37.53 days, respectively. The level exceeds 8 kg. $Ha^{-1}$of humic acid in the characteristics of plant height and protein percentage. The values were: 98.99 cm and 13.43%, respectively. It also exceeded the level of 16 kg. E-1 of humic acid in the characteristics of number of branches, physiological maturity, weight of 1000 grains, grain yield, and percentage of protein. The values were: 268.06 trees. m2, 37.41 days, 844.2 g, 6.25 tons. $Ha^{-1}$and 13.60%, respectively. The combination (200 mg.L^{-1}) of gibberellin and (16 kg.L^{-1}) of Humic excelled in giving it the highest averages for the number of strands, 277.46 strands. m^2, and the grain yield was 6.52 tons.ha-1, and the protein percentage was 14.54%. The combination (100 mg.l^{-1}) and gibberellin (8 kg.ha^{-1}) Humic outperformed by giving the highest average plant height of 100.37 cm, and the grain yield was 6.54 tons.ha^{-1}. The combination (100 mg.L^{-1}) of Gibberellin (16 kg.L^{-1}) of Humic was superior in terms of weight of 1000 tablets, 45.82 grams.

Keywords: bread wheat, humic acid, gibberellin acid.

INTRODUCTION

Wheat (Triticum aestivum L.), the first crop in the world and Iraq in terms of importance, production and cultivated area, belongs to the group of high-energy foods due to its high content of protein, fats and carbohydrates necessary to nourish the body. Wheat in Iraq suffers from low productivity despite the availability of the necessary factors for the success of its cultivation due to... Lack of reliance on approved and improved varieties (Wahid et al., 2017) and the reason for the increase in wheat crop productivity in many developed countries and its decrease in Iraq is due to genetic improvements (Spink et al., 2000) and crop and soil service processes, the most important of which is the use of biofertilizers and plant growth regulators that It reflects positively on the biological, biological and chemical characteristics, which is reflected positively in increasing the yield and its components (Shearman et al., 2004). In recent years, researchers have turned to the use of humic organic materials, including adding humic acid to the soil, which would improve the plant's absorption of nitrogen, potassium, calcium, magnesium, and phosphorus and make it more ready for absorption from the soil (Chen, 2004), in addition to its basic role in activating and stimulating enzymatic reactions and increasing Permeability of cell membranes, cell elongation and division, and activation of vitamins within plant cells (Pettit, 2003). Developed countries are currently seeking to search for advanced and modern means aimed at increasing yields and improving their quality, including the use of plant growth regulators, the most important of which is gibberellins, which help overcome genetic stunting of the stem by stimulating the elongation of plant cells and increasing the number of shoots and flowers and the number of spikelets and grains, which is reflected in the increase in yield. Gibberellins stimulate the plant to increase the nutrients necessary for plant growth, including iron, manganese, and other nutrients that the plant needs (Belakbir et al. 1996). Spraying plants with gibberellic acid also stimulates plant stem cells to grow faster and longer than the normal rate, in addition to accelerating the flowering and fruiting process (Hopkins, 2004). Gibberellin has an important role in increasing the rates of photosynthesis in plants by increasing the accumulation of calcium and magnesium in the roots and stems of plants treated with gibberellin, which contributes to strengthening the osmotic defense system of the wheat plant (Abd El-Samad, 2013).

Materials and methods

A field experiment was carried out in one of the agricultural fields in Taza district - Kirkuk Governorate during the winter season (2022/2023) with the aim of studying the effect of ground addition of humic acid and foliar spraying with gibberellin on the growth and yield of bread wheat (*Triticum aestivum* L.). The crop service operations were carried out by plowing the land with a flip disc plow, smoothing it, and leveling it, and a randomized complete block design (R.C.B.D) was used in three blocks, which included matching between three levels of ground addition of humic acid, which is (0, 8, 16) kg.ha^{-1}, and three spraying levels for gibberellin (0). , 100, 200) mg. L^{-1}. The area of each experimental unit was 3 m2, with four planting lines of 3 m length, leaving a distance of 25 cm between one line and another, and 1 m between each experimental unit and another. The means were compared according to the Duncan multinomial test at the probability level of 0.05. Add DAP fertilizer (18% N and 45% P2O5) before planting at a rate of 24 grams per line based on 320 kg$^{.-1}$. The weight of 12 g of seeds required for each planting line is based on 160 kg. E-1 Add urea fertilizer (46% N) at a rate of 200 kg. ha^{-1} in two batches, the first in the branching stage and the second in the endothelial stage. All crop service operations, including weeding, insect control, and weed control, were carried out according to the need of the crop, and the crop was harvested when the plants reached full maturity.

Table (1) some physical and chemical characteristics of the soil used in the experiment

Type of analysis	analysis' results	
Ph	7.85	
Ec	1.20	Dessie Siemens. M^{-1}
OM	9.00	G. kg soil^{-1}
N	20	gm. kg^{-1} soil
P	6.2	gm. kg^{-1} soil
K	80	gm. kg^{-1} soil
sand	29	%
silt	35	%
clay	36	%
Soil texture	Clay mixture	-----------

The experiment included the following factors:

1- Three levels of humic acid (0, 8, and 16) kg. ha^{-1} American origin (85%) type (Biofix) obtained from Debbana Modern Agriculture Company Limited, which was added to the soil at the beginning of the branching stage by dissolving 2.4 g and 4.8 g of fertilizer in 2 liters of water.

2- Three levels of gibberellic acid (0, 100, and 200) mg. L^{-1} by dissolving 12 and 24 mg of gibberellic acid in 120 ml of distilled water to determine the required concentrations and spraying it on the plant until it is completely wet at the beginning of the branching stage on the experimental units.

3- The experiment used wheat seeds of the Baraka variety, which were obtained from the Alrafidain General Seed Company / Kirkuk site.

The following characteristics were studied:

A number of rips (m^2).

1-The total number of shoots was measured at the completion of the flowering stage at a distance of one meter in length randomly from each experimental unit and then converted to square meters in proportion.

Plant height (cm).

2-The height of ten randomly selected plants was measured using a graduated ruler from each experimental unit at the fully mature stage from the base of the plant at soil surface level to the base of the spike of the main stem, excluding the length of the spike.

3-Physiological maturity (day).

The time period for physiological maturity was calculated as the number of days from flowering to the yellowing of the leaves of the plant, by monitoring them during each week.

4-Weight of 1000 tablets.gm^{-1}

It was calculated by taking a random sample of 1000 grains from each experimental unit and then weighing it using a sensitive electronic balance.

5-Grain yield (tons.ha^{-1}).

It was calculated from the harvest of the two average lines (1.5) m2 for each experimental unit based on a humidity of 12% and converted to (tons.ha-1).

6-Protein percentage in grains %.

The percentage of protein in wheat grains was estimated by estimating the total nitrogen content in the flour using a macro calculator according to the method (A.O.A.C, 1975), then the percentage of protein was calculated according to the following equation: Crude protein content = total nitrogen content in flour x 5.7 (at 14% moisture) (Bruckner and Morey, 1988).

Results and discussion:

The results of the statistical analysis in Table (2) show that there are highly significant differences between the studied factors regarding the number of total fractures. M^{-2}. The spraying level of gibberellin (100 mg.l-1) gave a significant

Gibberellic acid (GA3) mg. L^{-1}	Humic acid kg. h^{-1}			Effect of gibberellin
	0	8	16	
0	244.46 cd	230.60 d	264.19 ab	246.42 b
100	252.63 bc	258.98 bc	262.53 abc	258.05 a
200	231.78 d	247.01 bcd	277.46 a	252.09 ab
Effect of humic	242.96 b	245.53 b	268.06 a	

***Values bearing the same letter are not significantly different from each other according to Duncan's test at the 0.05 level**

difference, outperforming the rest of the levels by recording the highest average of 258.42 showers. M^{-2}, while the spray level (0 mg.L-1) gave gibberellin the lowest average for the characteristic, which amounted to 246.42 shots. M^{-2} The reason for this increase is due to the effect of gibberellin in stimulating plant cells to grow, increasing their division and elongation, and interfering with auxins (Abdel Majeed et al., 1991), which was reflected in an increase in the number of shoots in the plant, and this was confirmed by Al-Tayyar (2019), Al-Obaidi (2015), and Hamdi. et al (2009). The results of the analysis of variance in Table (2) also show the presence of highly significant differences in the number of fractions, as the treatment of humic addition to the soil at a concentration of (16 $kg.ha^{-1}$) showed a significant superiority by recording the highest average for the trait, amounting to 268.06 fractions m^{-2}, compared to the addition level (0 kg. ha^{-1}) Humic, which recorded the lowest average of 242.96 beaches. M^{-2} The reason for this superiority is due to the increase in the proportion of micro- and macronutrients, cytokinins, auxins, and gibberellins contained in humic, which is reflected in the increase in the number of branches in the plant (Jenson 2004 and Al-Tamimi 2009). These results are consistent with Muhammad et al. (2013) and Al-Tayyar (2019). The results of Table (2) also indicate that there were significant differences in the binary interaction between the levels of gibberellin and humic acid in affecting the average of this trait, as the combination (200 $mg.L^{-1}$) of gibberellin with (16 kg. ha^{-1}) of humic acid was characterized by giving the highest average for the trait. It reached 277.46 strands m-2 at the time when the combination (0 mg.l-1) gibberellin with (8 $kg.ha^{-1}$) humic gave the lowest average for the characteristic, amounting to 230.60 strands m^{-2}.

Table (2) shows the effect of different concentrations of humic and foliar spraying with gibberellin on the characteristic of the number of moieties m^{-2}.

2- Plant height (cm)

The results of the analysis of variance table (3) indicate that there are significant differences in the plant height (cm), as the level of spraying gibberellin at a concentration (100 $mg.L^{-1}$) was distinguished from the rest of the levels by recording the highest average plant height of 99.07 cm at the time the level was recorded. (0 $mg.L^{-1}$) and level (200 $mg.L^{-1}$) the lowest averages for the trait are 97.78 cm and 97.53 cm, respectively. The reason for this increase is attributed to the importance of gibberellins and their effective role in stimulating plant growth and development and stem elongation (Magome 2004), which was reflected in an increase in the average of this trait. These results are consistent with Al-Obaidi (2015), Attiya (2015), and Al-Tayyar (2019). As the results of Table (3) show, the addition level (8 $kg.ha^{-1}$) Humic was significantly superior to the rest of the addition levels by giving it the highest average of 98.99 cm compared to the addition level (0 kg.ha-1) Humic, which gave the lowest average of 97.23 cm, and this The increase in plant height may be attributed to the role of humic acid in increasing the activity of microorganisms in the soil, which increases the availability of nutrients in the soil, as well as its positive and stimulating effect in increasing the speed of permeability of cellular membranes and thus increasing plant height (Al-Dulaimi and Al-Sunbul, 2012). These results are consistent with the findings of (Al-Hadithi, 2018) and Al-Tayyar (2019). The results of Table (3) also indicate that there are significant differences in the interaction of the studied factors in the plant height characteristic, as the compatible combination (100 $mg.L^{-1}$) gibberellin and (8 kg.H-1) humic gave the highest average plant height of 100.37 cm, while it was recorded The combination of (0 $mg.L^{-1}$) gibberellin and (0 $kg.H^{-1}$) Humic. The minimum average plant height is 96.16 cm.

Table (3) shows the effect of different concentrations of humic and foliar spraying with gibberellin on plant height (cm).

3- Physiological maturity (day):
The results of the analysis of variance table (4) show that there are significant differences for the studied factors in their effect on the physiological maturity of the plant, as the concentration level (200 $mg.L^{-1}$) of gibberellin outperformed the rest of the levels by recording the highest average for the trait at 37.53 days, while the level recorded (0 $mg.L^{-1}$) of gibberellin average minimum 34.73 days. The reason for this increase is attributed to the importance of gibberellin and its role in regulating the plant's osmotic defense system and reducing the negative effect of ethylene accumulation, which causes growth deficiency and plant weakness and increases the rate of leaf fall, as well as delaying premature leaf senescence by stimulating the plant to produce chloroplasts, as it is one of the plant growth regulators that stimulate The plant is able to maintain green leaf area for long periods, which increases the efficiency of the photosynthesis process and increases its duration, which was reflected positively in increasing the duration of the plant's physiological maturity (Hamdia, 2012). As the results of Table (4) show, the level of humic addition (16 $kg.ha^{-1}$) exceeded the highest

Gibberellic acid (GA3) $mg.L^{-1}$	Humic acid $kg.h^{-1}$			Effect of gibberellin
	0	8	16	
0	33.50 f	35.86 d	38.83 e	34.73 c
100	37.73 b	34.76 b	36.66 c	36.40 b
200	36.22 cd	35.63 d	40.73 a	37.53 a
Effect of humic	35.27 c	35.42 d	37.41 a	
***Values bearing the same letter are not significantly different from each other according to Duncan's test at the 0.05 level**				

average for the trait, which was 37.41 days, significantly superior to the level (0 kg.ha-1), which recorded the lowest average, which was 35.27 days. The reason for this increase is attributed to the efficiency of the photosynthesis process and the increased concentrations of gibberellins, auxins, and cytokinins (Yuan and Lin, 2008) for plants treated with humic, which contributed to improving growth characteristics, yield, and its components, and their interaction with gibberellin acid, which encourages the plant to grow and produce new cells by stimulating plant cells. Division and elongation, mainly affect the period of physiological maturity of plants. As for the interaction of the studied factors, the results of the analysis of variance table (4) indicated that the compatible treatment (200 $mg.l^{-1}$) gibberellin and (16 $kg.ha^{-1}$) humic was superior to the rest of the treatments, recording the highest rate of 40.73 days at the time it was recorded. The treatment with (0 $mg.l^{-1}$) gibberellin and (0 $kg.l^{-1}$) humic had a minimum rate of 33.50 days.
Table (4) shows the effect of different concentrations of humic and foliar spraying with gibberellin on the physiological maturity (day).
4- Weight of 1000 wheat grains (g):

Gibberellic acid (GA3) $mg.L^{-1}$	Humic acid $kg.h^{-1}$			Effect of gibberellin
	0	8	16	
0	96.16 d	99.19 b	97.98 c	97.78 b
100	97.64 c	100.37 a	99.19 b	99.07 a
200	97.88 c	97.41 c	97.30 c	97.53 b
Effect of humic	97.23 c	98.99 a	98.15 b	
***Values bearing the same letter are not significantly different from each other according to Duncan's test at the 0.05 level**				

The results of the analysis of variance table (5) show that there are significant differences in the weight of 1000 grains (g). The level of spraying (100 $mg.L^{-1}$) of gibberellins recorded the highest average for the characteristic, amounting to 44.39 g, while the level of (0 $mg.L^{-1}$) of gibberellins recorded the lowest average for the characteristic, amounting to 42.65 g. The reason for this increase is due to the role of gibberellins in Increasing the division and elongation of plant cells, which contributed significantly to increasing the number of shoots in the plant, which was reflected in increasing the number of ears and increasing the products of the photosynthesis process and distributing them to a larger number of grains, which contributed to increasing the average of this trait. These results are consistent with Hamed (2015) and El- Mali (2019). The results of Table (5) also indicate that the level of humic addition at a concentration of (16 $kg.ha^{-1}$) was superior to the soil, recording the highest average for the characteristic, 44.28 grams, compared to the addition level (8 $kg.ha^{-1}$), which recorded the lowest average, 42.97 grams. The reason for this may be due to the ability of the

source to supply the downstream with the products of the photosynthesis process and the ability of the downstream to store these nutrients, which was reflected in an increase in the average of this trait (Khuhn and Honfer, 1982). These results are consistent with Kamel and Abdel Hamza (2014) and Al-Ghazi (2016). As for the interaction of gibberellin and humic levels, the results of Table (5) indicated the presence of highly significant differences between the studied factors on the average weight of 1000 grains, as the results showed the superiority of the compatible treatment (100 $mg.l^{-1}$) gibberellin and (16 $kg.h^{-1}$) humic. The highest average was recorded at 45.82 g, while the compatible treatment (0 $mg.L^{-1}$), gibberellin (0 kg.H-1), and Humic recorded the lowest average, amounting to 42.11 g.
Table (5) shows the effect of different concentrations of humic and foliar spraying with gibberellin on the weight of 1000 wheat grains (g).

5- Grain yield (tons ha-1)
The results of the analysis of variance table (6) indicate that there are highly significant differences between the levels of the studied factors in the character of grain yield ($ton.ha^{-1}$). The level of spraying gibberellin at a concentration of (100 mg.L-1) significantly exceeded the rest of the levels, recording the highest amount of 5.97 tons. E-1 at a time when the spray level (200 mg.L-1) recorded the lowest average of 5.56 tons. ha^{-1} the reason for this increase is attributed to the important role of gibberellins in improving the efficiency of the products of the photosynthesis process in the leaves and stimulating the production of the Carboxylase enzyme, which increases the vital processes within the cells, which contributes to increasing the grain yield (Saleh, 1991). These results agree with Jadoua and Al-Silawi (2012).) and Al-Naimi (2015) and Al-Tayyar (2019). The results of the analysis of variance (Table 6) indicate that the level of humic addition at a concentration of (8 $kg.ha^{-1}$)
Table (6) shows the effect of different concentrations of humic and foliar spraying with gibberellin on the grain yield ($ton.ha^{-1}$)
led to a significant increase in grain yield, recording the highest average of 6.25 tons. ha^{-1}, while the addition level (0 kg. ha^{-1}) gave the lowest average for the trait, 5.30 tons. E-1 This is due to the importance of humic in increasing the effectiveness of plant hormones, nutrients, and some enzymes that increase the production of carbohydrates in larger quantities, which is reflected in increased plant productivity and increased yield (Kumar, 2010). These results are consistent with the findings of Al-Hadithi (2018), Al-Khafaji (2015), and Al-Tayyar (2019). As for the interaction of the studied factors, the results of the analysis of variance table (6) indicate that there are significant differences between the compatible treatments, as the compatible treatment (100 $mg.L^{-1}$) gibberellin and (8 $kg.H^{-1}$) humic was superior to the compatible treatment (200 $mg.L^{-1}$). Gibberellin and (16 kg. ha^{-1}) Humic recorded the highest averages of 6.54 tons. E-1. And 6.52 tons. E-1. Respectively, at the time when the compatible treatment (200 $mg.L^{-1}$) gibberellin and (0 $kg.L^{-1}$)

Gibberellic acid (GA3) mg. L^{-1}	**Humic acid kg. h^{-1}**			**Effect of gibberellin**
	0	8	16	
0	42.11 e	43.26 cde	42.58 de	42.65 B
100	45.06 ab	42.29 de	45.82 a	44.39 A
200	43.87 bcd	43.35 cde	44.43 abc	43.88 A
Effect of humic	43.68 b	42.97 b	44.28 a	
***Values bearing the same letter are not significantly different from each other according to Duncan's test at the 0.05 level**				

humic recorded the lowest average of 4.99 tons. ha^{-1}.

6- Protein percentage:
It is noted from the results of Table (7) that there are significant differences between the studied factors in influencing the percentage of protein in the grains, as the results of the statistical analysis showed that the level of spraying with a concentration of (200 mg.L-1) of gibberellin was superior, recording the highest percentage of protein in the grains, reaching 14.02%. While the spraying level (0 mg.L-1) recorded the lowest average for the trait, 12.72%, this is due to the increased ability of the plant to fix nitrogen and to activate antioxidants, which reduced the effect of antioxidants

Gibberellic acid (GA3) mg. L^{-1}	Humic acid kg. h^{-1}			Effect of gibberellin
	0	8	16	
0	5.56 d	5.49 d	6.22 b	5.76 b
100	5.34 e	6.54 a	6.02 c	5.97 a
200	4.99 g	5.17 f	6.52 a	5.56 c
Effect of humic	5.30 c	5.73 b	6.25 a	
***Values bearing the same letter are not significantly different from each other according to Duncan's test at the 0.05 level**				

responsible for the activity of enzymes responsible for building proteins, such as nitrate reductase enzymes, as a result of spraying. Gibberellin, which played an important role in increasing the protein content (Vopyan, 1984), and these results agree with Abboud and Abbas (2013), Al-Zubaidi (2015), and Al-Tayyar (2019). It

Table (7) shows the effect of different concentrations of humic and foliar spraying with gibberellin on the character of protein percentage.
is also noted from the results of Table (7) that the levels of humic addition (8 and 16 kg.ha^{-1}) were superior, recording the highest averages of 13.43% and 13.60%, respectively, while the level (8 kg.ha^{-1}) recorded the lowest average of 13.10. %. The reason for the increase in the percentage of protein in grains is attributed to the positive and stimulating effect of humic in improving the plant's physiological ability to transfer the products of the photosynthesis process from sources to outfalls and to the ability of outfalls to store these nutrients, which contributed to increasing the percentage of protein in wheat grains (Ellis and Kirby, 1980). These results are consistent with Alinezhad and colleagues (2013), Al-Ghazi (2016), Al-Hadithi (2018), and Al-Tayyar (2019). As for the interaction of the levels of gibberellin and humic, the results of Table (7) indicated that the combination (200 mg.l^{-1}) of gibberellin and (8 kg.l^{-1}) of humic was superior, recording the highest protein percentage of 14.89%, while the compatible treatment gave (0 mg.l^{-1}). Gibberellin with (8 kg. ha^{-1}) humic and the combined treatment (0 mg. l^{-1}) gibberellin with (16 kg. ha^{-1}) humic had the lowest averages for the trait, reaching 11.65% and 11.65%, respectively.

REFERENCES:

1. Abboud, Muhammad Reda Abdel Amir, and Ahmed Karim Abbas, (2013). The use of some treatments to alleviate salt stress in the growth and production of wheat variety Sham 6 (Triticum aestivum L.). Al-Furat Journal of Agricultural Sciences. 5(3): 259-245.
2. Abd El-Samad. H. M.)2013(. The physicalation applaological response of wheat plants to exogenous application of gibberellic acid (GA3) or indole-3-acetic acid (IAA) with endogenous ethylene under salt stress conditions.
3. Al Nuaimi, Hala Talib Ahmed, (2015). The effect of irrigation water salinity and spraying with gibberellin and potassium on the growth and yield of wheat. Doctoral thesis, University of Baghdad, Department of Field Crops.
4. Al-Dulaimi, Rasmi Muhammad Hamad and Osama Khalil Ismail Al-Sunbul. (2012). The effect of foliar feeding

Gibberellic acid (GA3) mg. L^{-1}	Humic acid kg. h^{-1}			Effect of gibberellin
	0	8	16	
0	13.29 Bc	12.42 e	12.46 e	12.72 c
100	13.53 B	12.99 cd	13.79 b	13.44 b
200	12.63 de	14.89 a	14.54 a	14.02 a
Effect of humic	13.15 b	13.43 a	13.60 a	
***Values bearing the same letter are not significantly different from each other according to Duncan's test at the 0.05 level**				

with humic acid and soil mulching on the vegetative growth characteristics and yield of two cultivars of Fragaria ananassa Duch. Anbar University Journal of Agricultural Sciences, Volume (10), Issue (1). 1992-7479.

5. Al-Ghazi, Iman Alaa El-Din, (2016). The effect of the interaction between organic and biological fertilization on the growth and yield of two varieties of white corn (Sorghum bicolor L. Moench). Master's thesis. University of Basra
6. Al-Hadithi, Reem Yas Khudair, (2018). The effect of humic acid addition methods and levels of fertilizer recommendation on the growth and yield of wheat. Master Thesis. College of Agriculture, Anbar University.
7. Alinezhad, S., J.M. Sinaki, M. Zarei and M.B.F. Abadi. (2013). Effects of organic fertilizers and drough stress on physiological traits in barley. Inti. J. Agron. Plant., 4(2):300-306.
8. Al-Mali, Mussa s. abed. (2019). Effect of seed stimulation by gibberlin and foliar boron application on growth and yield of bread wheat Triticum aestivum L. A Thesis -College of Agriculture – University of Kirkuk -Field Crops.
9. Al-Obaidi, Bushra Shaker Jassim. (2015). Stimulating wheat to resist drought, Triticum aestivum L. Doctoral thesis, College of Agriculture, University of Baghdad.
10. Al-Tamimi, Jamil Yassin Muhammad, (2009). Effect of humic acid and seaweed extracts on growth and chemical properties of rosemary oil Posemarinus offcinalis. Proceedings of the Sixth Scientific Conference. Department of Life Sciences, Tikrit University, pp. 1-17.
11. Al-Tamimi, Jamil Yassin Muhammad, (2009). Effect of humic acid and seaweed extracts on growth and chemical properties of rosemary oil Posemarinus offcinalis. Proceedings of the Sixth Scientific Conference. Department of Life Sciences, Tikrit University, pp. 1-17.
12. Al-Tayyar, Ahmed A. Abbas. (2019). Effect of spray by gibrllin and salicylic acids and humic addition on the soil in the growth and product of bread wheat (Triticum aestivum L.). A Thesis .College of Agriculture – University of Kirkuk -Field Crops.
13. Al-Zubaidi, Riam Shaker Mahmoud, (2015). The effect of foliar nutrition and growth regulators on the growth of barley and oats grown in the culture device and the field. Doctoral thesis, Field Crops Department, College of Agriculture, University of Baghdad.
14. Attia, Razzaq Lafta, (2015). The effect of different concentrations of gibberellic acid (GA3) on the growth and yield of some white corn varieties (Sorghum Bicolor L. Moench. Al-Furat Journal of Agricultural Sciences-7(3).
15. Belakbir; Z. Lamrani, L. Romero. (1996). Effect of bioregulaters on iron and manganese concentrations in leaves and fruits of pepper plants. Journal of plant nutrition, volume 19. Issue 8 & 9, pages 1269 – 1277.
16. Biol. Sci., (5): 12): 1233-1241.
17. Bruckner, P.L., and D. D. Morey. (1988). Nitrogen effects on soft red winter wheat yield agronomic characteristics and quality. Crop. Sci. 28: 152-157.
18. Ellis, S. E., and M. K. Pieta. (1992). Number of kernels in wheat crops and the influence of temperature. J. of Agric. Sci., Cambridge 105: 447-461.
19. Hamdi, Rajaa Fadel, Hammad Farhan Nawaf, and Saadi Sabaa Khamis, (2009). The effect of the growth regulator (gibberellic acid GA3) and organic fertilizer (sheep manure) on the growth and production of wheat (Triticum aestivum). Anbar University Journal of Pure Sciences. Volume (3), Issue (3).
20. Hamdia, M.A.(2012).The physiological response of wheat plant to exogenous application of gibberellic acid (GA3) or indole-3-acetic acis (IAA) with endogenous ethylene under salt stress conditions.
21. Hamed, Malaz Abdul Muttalib, (2015) The effect of gibberellic acid on the growth and yield of bread wheat (Triticum aestivum L.). Anbar Journal of Agricultural Sciences. Volume (13) Issue (2).
22. Hopkins, W.G and N.P.A. Huner. (2004). in the presence and absence of gibberellic acid on mineral nutrition of cow pea (Vigna unguiculate L.) During ontogenesis.King soud univ., vol (15), Agric. Sci(2) pp.141-151,Riyadh.
23. Jadou, Khudair Abbas Jadou and Razzaq Lafta Atiya Al-Silawi, (2012). The effect of seed stimulation on the growth and yield of some rice varieties. Iraqi Agricultural Sciences Journal – 43(5).
24. Jenson.; E. (2004). Seaweed Fact on Fancy. From the organic and sustainable education. From the broadcaster. Vol. 12(3): 164-170.
25. Khuhn. J. S. and Honfer, C. L. (1982). Nitrogen fertilization and plant growth regulator effect on yield and quality of four wheat cultivars. J. Prod. Agric. 1: 94-98.
26. Kumar, Vivek (2010). A lecture on biological plant fertilizers, the ideal alternative to chemical fertilizers, Working Authority for Agricultural Affairs, Kuwait. Al-Qabas Newspaper, Issue No. 13464.
27. Magome, H., S. Yamaguchi, A. Hanada, Y. Kamiya and K. Odadoi. (2004). Dwarf and delayed- flowering I, anovel Arabidoosis mutant srficient in gibberrllin biosyn- thesis because of over expression of aputative AP2 transciption factor plant J. 37, 720-739.
28. Muhammad, S., A.S. Anjum, M.I. Kasana and M.A. Randhawa. (2013). Impact of organic fertilizer, humic acid and seaweed extract on Weheat production pothow arregion of Pakistan. Pak. J. Agri. Sci., 50(4):677- 681.
29. Pettit, R.E. (2003). Organic metter Humus, Humates , Humic Acid , Fulvic Acid and Humin : Their importance in soil fertility and plant health.(On line) Available at www.humate.info/main page:htm.
30. Shearman, V. J. , R. Sylvester-Bradley, R.K. Scott and M. J. Foulkes, (2004). Physiological processes associated with wheat yield progress in UK. John.Foulkes@nottingham.as.uk
31. Spink, J., T. Semere., D. L. Sparkes, J. M. Whaley, M. J. Foulkes, R. W. Clare and R.K Scott. (2000). Effect of sowing date on the optimum plant density of winter wheat. Ann. Appl. Biol. 137: 179–188.
32. Vopyan, V. G. (1984). Agriculture chemistry. English translation, mir publishers. 1st. edition.

33. Wahid, S.A., Al-Hilfy, I.H.H. and Al-Abodi, H.M.K. (2017). Effect of sowing dates on the growth and yield of different wheat cultivars and their relationship with accumulated heat units. American-Eurasian Journal of Sustainable Agriculture 3(11): 7-13.
34. Yuan, S. and Lin, H. H. (2008). Role of salicylic acid in plant abiotic stress. Natur