Vital Response of the Wheat to Gibberellic Acid "GA3" and Prolin Under Water Defect Conditions

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Abstract: A field experiment was carried out in the 2019-2020 agricultural season in the experimental fields of the College of Agriculture, University of Anbar, to study the effect of spraying with gibberellic acid 0, 100 and 200 mg. Liters and Proline (0, 300 and 400) in some characteristics of germination and growth of wheat, (class 33) the rate of irrigation every twenty days with the calculation of the rate of rain if it falls. The experimental units were distributed according to a randomized complete block design with three replications. It is evident from the results of the statistical analysis that there is a significant effect of gibberellic acid in all the studied traits, as the concentration of 200 mg. gave the highest Plant Height (cm), Chlorophyll rate, Percentage of protein % and Vegetative dry weight per plant (gm), as well as Proline recorded a high rate for all characteristics of the study. A high rate of interaction between the experimental factors was recorded in the Plant Height (cm), Chlorophyll rate, Percentage of protein % and Vegetative dry weight per plant (gm).

1. Introduction
Wheat is classified by a distinctive composition of gluten, which facilitates digestion compared to wheat, and is considered longer, and has long sides, a fragile, easy to break stem, successive spikes, and recently it has returned to its popularity with bakers [1][2]. This group also includes other important crops such as: rice, maize, barley, sorghum, oats, millet, triticale and rye. In parts of the Earth’s surface, wheat covers the largest area of any food crop. The main wheat producing countries in the world are: Canada, China, France, India, Russia, Ukraine and the United States. World production of wheat is about 735 million metric tons per year [3]. This amount could fill a freight train that runs around the world about two and a half times. People collected wild wheat long before the beginning of cultivation. Scientists believe that about 11,000 years ago, people in the Middle East took the first steps toward agriculture, and wheat was one of the first plants they cultivated. Over time, farmers produced more grain than they needed for their food; As a result, many people no longer needed to produce their own food, so they set out to master other useful skills. These changes led to the building of medium and large cities, the expansion of trade, the development of the great civilizations of ancient Egypt, India and Mesopotamia. Early farmers might have selected the grain from their best wheat plants to use as seed for the next crop. In this way, certain desirable qualities were transferred from wheat over the ages of its cultivation. Such practices resulted in a gradual development in the improvement of wheat strains and types [4]. It has been found that the use of growth regulators...
helps the wheat plant to withstand temporary drought when it is not long rain, as well as enduring premature aging, for this is one of the factors that help improve plant performance in different field conditions. It was shown increasing the growth of wheat plants with the presence of compound fertilizer that gibberellic acid plays an important role in increasing the vegetative growth of the plant and showing the growth behavior of plants to increase productivity and raising its yield. Interest in this group of important substances began in the past, as the two scientists Necki and Siebert mentioned in 1882 that indole acetic acid, which was then known as auxin, is found in human urine and that it is a stimulant substance. This alerted people to the importance of this substance. In 1910 Boysen-Jensen mentioned that the substance indole acetic acid is likely to be found in plants, and studies continued on the importance of this substance until the scientist Went proved in 1928 in a doctoral study the effect of auxin, which is indole acetic acid, on bending the sheath of oats when placing an agar cube on half the section of the sheath, the sheath is bent in the other direction [5].

Proline is the most important essential amino acid that enters in the formation of proteins. It is considered a non-polar amino acid that contains an aliphatic side chain, but it differs from the rest of the side chains in other acids. This does not prevent its biochemical characteristics from converging with those of the rest of the amino acids; Proline is the only amino acid out of 20 amino acids where the NH2 group is not free, so it contains a secondary and not a primary function, and this is called an amino acid. It is a white body, highly soluble in water and ethanol. Proline reacts with ninhydrin and gives a yellow colour. Continuous heating turns red-violet. Proline is dissolved in water at 25°C [6].

This study came to show the role of gibberellic acid and proline in improving some growth characteristics of two types of wheat.

2. Materials and methods:

2.1. Experiment Location:
A field experiment was carried out at the College of Agriculture, University of Anbar, for the purpose of studying the effect of gibberellic acid and proline on the growth of wheat during the period of (1/11/2019) to (20/5/2019).

2.2. Experimental Design:
Experimental treatments were applied, according to the design of (RCBD) with three replicates.

2.3. Gibberellic acid preparation:
A solution of gibberellic acid GA3 was prepared according to the required concentrations of 122, 522 and 022 mg / liter. And naphthalene was used at a concentration of 252.2% as Opener for every liter of rain solution, 5221 and bright detergent solution with a concentration of 1 ml/liter of spray solution was used as a diffuser. The plants were sprayed with the solutions by a 2-liter hand-held sprinkler until full wetness in the early morning. The plants were sprayed on two dates, the first when the plants reached the stage of 4-6 true leaves, and the second before the flowering stage. As for the control plants, they were sprayed with distilled water containing the opener and the diffuser with the same concentration. Guard lines were used between the experimental units to prevent the effect of the concentration of the treatment on other treatments [7].

2.4. Proline preparation:
A base solution stok was prepared from proline acid with a weight of 1 gm of it and dissolved in -1-1000 ml of distilled water to obtain a base solution with a concentration of 1000 ppm (mg). liters, then prepare the required concentrations of it 30, 60 mg. Liters according to the dilution law and sprayed evenly in the early morning until complete wetness. The control treatments were sprayed with distilled water [8].

2.5. Studied parameters:
Ten random plants were taken in each experimental unit before harvesting the total leaf yield in May 12, the following measurements were made:

1. **Plant Height (cm):**
   It was calculated from the base of the plant touching the surface of the soil to the top of the main spike without the sap in each experimental unit from the middle lines as an average of ten plants taken randomly.

2. **Chlorophyll rate.**
   The total chlorophyll content of ten plants randomly selected from each experimental unit upon completion of 100% flowering was estimated as an average of ten readings per experimental unit in the field using a device (Chlorophyll Cometmt- 200 plus) [9].

3. **Percentage of protein %:**
   A sample of the same grains was taken for each experimental unit and the percentage of protein in it was estimated by means of a device. (Cropscan Bnir analyses., 2000).

4. **Vegetative dry weight (gm):**
   The plants were dried aerobically, taking care to turn them until the weight was stable, then extracting the average dry weight of the vegetative mass. It includes the weight of the total dry matter above the soil surface.

3. **Results and discussion:**
   3.1. **Plant Height (cm):**
   The results of the statistical analysis in Table (1) indicated that there was a significant effect of gibberellic acid and Proline concentrations on the plant height, cm.
   It was found from the results in Table (1) that spraying with a concentration of 200 mg of gibberellic acid gave the highest ratio of the plant height of 132cm, while the comparison treatment (without adding) gave the lowest average for this trait, which was 80cm, may be due to the effect of Gibberellic acid to increase the vital activities of the plant and raises the rate of absorption of nutrients, which leads to an increase in the growth rate of the plant. This result agreed with the findings of [10], which stated that the increase in the concentration of gibberellic acid in the wheat caused an increase in the height of the plant. The results of Table (1) showed that spraying with a concentration of 300mg of Proline gave the highest ratio of plant height, this was significantly superior to the treatment of 200 gm, , were significantly superior to the comparison treatment without adding. this may be due to the presence of nitrogen, which is fast moving inside the plant, to the parts of the plant and modern growth, working on the formation and regulation of gibberellic acid, which makes the plant thicker and prevents it from falling asleep, as well as being involved with the element Zinc, in turn, in the formation of the amino acid tryptophan, which is the basis for building auxin, which has an effect on cell division and elongation. The rise is due to an increase in the concentration of nitrogen, in addition to the effect of potassium and phosphorus in increasing the division and elongation, which results in an increase in the height of the plant in agreement with in his study on the wheat crop. This was attributed to the presence of boron, which has a positive effect on Activating meristematic tissues, increasing the production and effectiveness of the growth hormone cytokinin [11].
Table 1. The Effect of Spraying Gibberellic acid (G) and Proline (P) and the Interaction on the Rate of The Plant High.

| P  | GA3 0 | GA3 100 | GA3 200 | Average |
|----|-------|---------|---------|---------|
| 0  | 80    | 99      | 106     | 95      |
| 200| 113   | 119     | 126     | 119.3   |
| 300| 1.32  | 137     | 140     | 136.3   |
| Average | 108.3 | 118.3 | 124    |

G X P

L.S.D 0.05 1.438 1.438 2.490

3.2. Chlorophyll rate.
The results of the statistical analysis in Table (2) indicated that there was a significant effect of gibberellic acid (G) and Proline (P) and the interaction on the content of the chlorophyll in the leaves of (SPAD).

It was found from the results in Table (2) that spraying with a concentration of 200 mg of gibberellic acid recorded the highest ratio of chlorophyll content of the leaves, which recorded an average of 32.57 SPAD, which didn't differ significantly from the concentration of 100 mg, while recorded a significant difference when compared with the comparison treatment (without addition), which recorded an average of 20.20 SPAD, may be due to the effect of gibberellic acid on some metabolic processes of the plant, such as respiration and photosynthesis, as well as its increase in antioxidants, thus preserving the chlorophyll content of the leaves from the demolition process. It was found from the results in Table (2) that spraying with a concentration of 300 mg of Proline gave the highest mean of chlorophyll content of leaves reached of 42.40 SPAD. This result agreed with [12] in his study on the oats crop who indicated an increase in chlorophyll content with an increase in nitrogen fertilization, it may be due to the presence of potassium, which has a role in delaying leaf aging through its role in delaying protein catabolism, and it may be due to the presence of iron, which has an auxiliary role in the formation of the two compounds lavulinic amino-α and protochlorophllic, which are two essential compounds in the chain of building chlorophyll [13], so 70% of the iron in the plant is in the chloroplasts. As for the interaction, the results showed that the combination (200 mg gibberellic acid x 300 mg proline) gave the highest mean of chlorophyll content, while the combination 0 mg gibberellic acid x 0 gm proline gave the lowest mean for this trait. It is noticeable from the data is the increase in the content of chlorophyll with an increase in the concentration on the nutrient humic acid workers, and this is due to the influencing role of it, which was referred to when discussing the effect of the factors which are singular and because of their important role in building and forming chlorophyll and keeping the leaves as effective as possible As well as the delay in entering old age [14].
Table 2. The Effect of Spraying Gibberellic acid (G) and Proline (P) and the Interaction on the Chlorophyll rate.

| GA3 | 0   | 100 | 200 | Average |
|-----|-----|-----|-----|---------|
| 0   | 20.20 | 21.70 | 32.57 | 24.82   |
| 200 | 27.07 | 34.43 | 33.73 | 31.74   |
| 300 | 42.40 | 43.43 | 49.20 | 45.01   |
| Average | 29.67 | 33.19 | 38.50 |

L.S.D 0.05

3.3. Percentage of protein %:

It is noticed from the results of the statistical analysis shown in Table (3) that there are significant differences for gibberellic acid and Proline in the Percentage of protein. The third concentration (200 mg) for gibberellic acid gave the highest rate for this trait reached 14.36%.

As for the lowest rate, it was recorded by the control level (0) plants by 9.64 %. The reason for the superiority of gibberellins in this trait may be due to the effect of the the leaf area on the protein content in the grains. It is particularly suitable for converting nitrogen into protein inside the bean, encouraging the conversion of food prepared for the bean in general into protein, and this occurs when the planting date is delayed and the period of filling the bean is exposed to high temperatures. The results showed that the level of 300 mg proline gave the highest rate of protein, while the lowest rate recorded when the comparison treatment.

The interaction between the study factors showed a clear effect on all studied traits, including protein in the leaves, where the highest rate of protein was recorded at the interaction of 200 mg gibberellic acid and 300 mg proline, of protein rate was compared to the comparison treatment.

Several studies have indicated the positive role of Proline acid in improving the growth characteristics and yield of plants. A study showed that foliar spraying with proline acid depends on the type and variety of the plant, the time of addition and the appropriate concentration that has a role in improving the growth characteristics and yield.

Table 3. The Effect of Spraying Gibberellic acid (G) and Proline (P) and the Interaction on the Percentage of protein %.

| GA3 | 0   | 100 | 200 | Average |
|-----|-----|-----|-----|---------|
| 0   | 9.64 | 11.56 | 13.36 | 14.00   |
| 200 | 12.75 | 13.89 | 14.24 | 12.13   |
| 300 | 12.04 | 13.12 | 16.37 | 10.65   |
| Average | 29.67 | 33.19 | 38.50 |

L.S.D 0.05

G    P    P X G
3.4. Vegetative dry weight per plant (gm):

The results shown in Table 4 indicated the positive effect of gibberellic acid on the Vegetative dry weight per plant (gm), as the highest Vegetative dry weight per plant (gm) was recorded at the level of 200 mg gibberellic acid with a significant difference from the comparison treatment without adding, which recorded the lowest rate. The results of the study showed that there was a significant effect of the concentrations of proline (300) mg, on the Vegetative dry weight per plant (gm) of the plant. This result is consistent with what mentioned by [9] and [1], the reason for the increase in dry weight may be due to the functional role it plays in improving plant growth to withstand (the effect of water stress, by encouraging vegetative growth represented by the height of the plant, the number of leaves and the area.

The results of the interaction between the two experimental factors showed that there was a significant difference for spraying gibberellic acid and proline on the Vegetative dry weight per plant (gm), where the highest rate was recorded at the combination of 300 mg gibberellic acid and 400 mg proline with a significant difference from the rest of the other mixtures. The lowest Vegetative dry weight per plant (gm) rate was recorded in the non-addition treatments.

In the study of [5], it was shown that proline acid had a significant effect on vegetative growth characteristics, as it led to an increase in plant height, leaf area and dry weight of the vegetative group when using spraying at different concentrations, especially at concentration 20 mg.L-1 Under different levels of stress. In her study, [1] indicated that spraying sunflower plant with a concentration of 60 mg. L-1 of proline acid was the most efficient in reducing and inhibiting the negative effect of water deficiency [15].

Table 4. The Effect of Spraying Gibberellic acid (G) and Proline (P) and the Interaction on the Vegetative dry weight per plant (gm).

| GA3 | P   | 0    | 100  | 200  | Average |
|-----|-----|------|------|------|---------|
| 0   | 78  | 156  | 201  | 145  |
| 300 | 110 | 167  | 211  | 162  |
| 400 | 119 | 175  | 232  | 175  |
| Average | 102 | 166  | 214  |
| L.S.D 0.05 | 5.44 | 7.11 | 7.65 |

4. Conclusion:
The results of the above study revealed that gibberellic acid and proline have a clear effect on the growth characteristics of wheat, which led to a rise in these traits and thus reflected positively on the grain yield. As for the interaction between gibberellic acid and proline, it gave a good average of the characteristics of study.
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