The Effect of Temperature Stress Associated With Different Planting Dates and Levels of Gibberellic Acid on The Growth of Sorghum Spring

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Abstract

A field experiment was carried out in the experimental field of the Department of Field Crops, College of Agriculture / University of Al-Muthanna during the spring season 2021 to determine the effect of planting dates on some growth characteristics of sorghum. The experiment was applied by arranging the split panels according to the RCBD design and with three replications. The main panels included three planting dates (4/15 · 4/5 · 3/25) while the secondary panels included gibberellin treatments (0, 100ppm) and the results were as follows: The planting date exceeded the first date 3/25 in the number of days to 75% flowering (97.5 days), the height of the plant (143.74 cm) and the diameter of the stem (2.34 cm) and the number of leaves per plant (8.73 leaves). 75% flowering, giving (92.33) days, plant height (136.55 cm), stem diameter (2.04 cm) and number of leaves (8.10 leaves).

1. Introduction

Sorghum bicolor L. Moench is one of the most important major cereal crops in the world, and ranks fifth in terms of economic importance. It is cultivated in semi-arid regions, as its seeds are used mainly in human food in a large number of countries. Growing in the continents of Asia and Africa, and to a second in feeding animals, and the products of this crop are included in some chemical industries, such as the manufacture of dyes and the production of alcohol, and dry straw is used in cooking operations [1]. As a result of the importance of the crop, the cultivated area has increased in the world until it reached more than 41 million hectares [2]. Despite the importance of this crop in Iraq, its seed productivity still suffers from a severe low compared to global rates. Therefore, it has become necessary to search for other means or technologies that lead to an increase in the yield, such as studying the best dates for planting, especially with the presence of A number of varieties and hybrids introduced to Iraq that need to test which dates are best for their cultivation, as well as to test the efficiency of the varieties and their ability to express themselves in the best possible way by increasing production per unit area. Varieties differ in their growth and productivity in different environments depending on the climatic conditions, the nature of the soil and the different environmental stresses, and this was confirmed by the results of a number of previous studies [3]. [4] showed that the number of leaves in sorghum plants varied according to the planting dates. [5] noted that the planting date on July 31 gave the highest rate of plant height and growth characteristics compared to the planting date of August 8, which gave the lowest rate for these Characteristic This research was carried out in order to determine the effect of planting dates on some growth characteristics of sorghum.

2. Materials and Methods

A field experiment was carried out in the experimental field of the Department of Field Crops, College of Agriculture / University of Al-Muthanna during the spring season 2021 in order to determine the effect of planting dates on some growth characteristics of sorghum. The experiment was applied by arranging the split panels according to the RCBD design and with three replications. The main panels included three planting dates (4/15 · 4/5 · 3/25), while the secondary panels included gibberellin coefficients (0, 100ppm). Soil and its physical and chemical properties were explained in Table 1 in order to determine the effect of planting dates and gibberellin on some growth characteristics of sorghum Sorghum bicolor (L.). The experimental land was prepared from plowing, smoothing and leveling, then it was divided into experimental units with an area of 3 x 3 m$^2$, each experimental unit contained 4 lines, the length of the line was 3 m, the distance between one line and another was 70 cm, and between one hole and another 20 cm. Sowing was done manually by placing 5 seeds in the hole according to the specified dates, then it was reduced to one plant after three weeks of planting. The experimental land was
fertilized with NPK compound fertilizer before planting, at a rate of 278 kg/ha, and 46% urea N fertilizer was added at a rate of 390 kg/ha, in three stages [6]. Crop service operations were carried out including hoeing, weeding and irrigation whenever needed.

Table 1. Some chemical and physical properties of field soil.

| Soil separators(%) | K (mg kg⁻¹) | P (mg kg⁻¹) | N (mg kg⁻¹) | EC (ds.m) | PH |
|-------------------|-------------|-------------|-------------|-----------|----|
| Sand%             | 140.2       | 14.4        | 23          | 1.4       | 7.1|
| Clay%             |             |             |             |           |    |
| Silt%             |             |             |             |           |    |

2.1 studied traits

2.1.1 Number of days from planting up to 75% flowering (day)

2.1.2 Plant height (cm)

2.1.3 The area of the flag leaf

2.1.4 The number of leaves in the plant

2.1.5 Diameter of the leg (cm) The diameter of the leg was measured using by Vernier

3. Results and Discussion

3.1 Number of days from planting up to 75% flowering (day)

The results of Table (2) showed significant differences in the number of days from planting up to 75% flowering between planting dates and gibberellin levels and the interaction between them. The first date exceeded 25/3 and gave the highest number of days, which reached 97.5 days, while the last date gave 15/4 the lowest number of days. It reached 79.5 days. The reason for the early dates is due to high temperatures, which leads to early flowering of plants. [7]. The level of gibberellin also exceeded 100ppm significantly and gave 92.33 days, and this is due to the role of gibberellic acid in increasing seed strength and germination speed as a result of increasing the percentage and rate of germination and the emergence of seedlings early by stimulating the hydrolysis enzymes necessary for the analysis of nutrients and cell division such as alpha-amylase. And beta-amylase, as well as a number of enzymes, the most important of which are protease and ribonuclease [8]. Also, a significant interaction was found between planting dates and gibberellin levels, and the treatment 15/4 * 100ppm gave the highest number of days, reaching 99 days.

Table 2. Effect of planting dates and gibberellins on the number of days from plantling up to 75% of flowering (days).

| Gibberellin | planting dates | average |
|-------------|----------------|---------|
|             | 4/15 | 5/4  | 25/3 |         |
| 0           | 96   | 90   | 75   | 87.00   |
| 100ppm      | 99   | 94   | 84   | 92.33   |
| Average     | 97.5 | 92   | 79.5 |         |
| L.S.D0.05   | D    | G    | D*G  | 3.44    |
|             | 2.3  | 6.4  |      |         |

3.2 plant height (cm)

The results of Table (3) showed significant differences in plant height between planting dates and gibberellin levels. The first date was 3/25 and gave the highest plant height, as it reached 143.74 cm, while the last date gave 4/15 the lowest plant height, reaching 107.27 cm. The reason for early dates [9]. Also, the level of gibberellin was significantly superior to 100ppm and gave 136.55 cm. This is due to the role of gibberellic acid in increasing seed vigor and speed of germination as a result of increasing the percentage and rate of germination and the emergence of seedlings early by stimulating the hydrolytic enzymes
necessary for the analysis of nutrients and cell division such as alpha-amylase and beta-amylase, as well as a number of enzymes, the most important of which are protease and ribonuclease [10].

**Table 3. Effect of planting dates and gibberellins on plant height (cm).**

| Gibberellin | planting dates | 4/15 | 5/4 | 25/3 | average |
|-------------|----------------|------|-----|------|---------|
| 0           | 133.10         | 102.11 | 95.80 | 110.34 |
| 100ppm      | 154.37         | 136.54 | 118.73 | 136.55 |
| Average     | 143.74         | 119.33 | 107.27 |         |
| L.S.D0.05   | D              | G     | D*G  |       |
|             | 3.99           | 4.1   | Ns   |       |

3.3 The area of the flag leaf (cm²)

The results of Table (4) showed that there were significant differences in the area of the flag leaf between the planting dates, but it was not significant between the gibberellin treatments. The results of Table (4) showed that the planting date 4/5 was significantly superior to the rest of the dates and gave the highest leaf area of 200.15 cm² when it gave The planting date is 3/25, the least leaf area is 168.2 cm², and this may be due to the delay in planting that led to the matching of the stages of vegetative growth with the beginning of the increase in the light duration and the intensity of solar radiation, and this is consistent with what [1] concluded regarding the existence of a significant effect on the dates of planting On the vegetative growth characteristics of sorghum.

**Table 4. Effect of planting dates and gibberellins on the area of the flag leaf (cm²).**

| Gibberellin | planting dates | 4/15 | 5/4 | 25/3 | average |
|-------------|----------------|------|-----|------|---------|
| 0           | 159.5          | 188.5 | 168.6 | 172.2 |
| 100ppm      | 176.9          | 211.8 | 176.5 | 188.4 |
| Average     | 168.2          | 200.15 | 172.55 |       |
| L.S.D0.05   | D              | G     | D*G  |       |
|             | 4.6            | Ns    | Ns   |       |

3.4 Diameter of the leg (cm)

The results of Table (5) showed significant differences in stem diameter between planting dates and gibberellin levels. The first date 3/25 outperformed and gave the highest stem diameter (cm) as it reached 2.34 cm, while the last date gave 4/15 the lowest stem diameter (cm) as it reached 1.79 cm The reason for the early dates is due to high temperatures, which leads to a short growth period and a decrease in stem diameter[6]. The level of gibberellin also exceeded 100ppm significantly and gave 2.04 cm, and this is due to the role of gibberellic acid in stimulating the hydrolysis enzymes necessary for the breakdown of nutrients and cell division such as alpha-amylase and beta-amylase, as well as a number of enzymes, the most important of which are protease and ribonuclease [5].

**Table 5. Effect of planting dates and gibberellins on plant diameter (cm).**

| Gibberellin | planting dates | 4/15 | 5/4 | 25/3 | average |
|-------------|----------------|------|-----|------|---------|
| 0           | 2.29           | 1.85 | 1.77 | 1.97 |
| 100ppm      | 2.38           | 1.95 | 1.80 | 2.04 |
| Average     | 2.34           | 1.90 | 1.79 |       |
| L.S.D0.05   | D              | G    | D*G  |       |
|             | 0.21           | 0.2  | Ns   |       |
3.5 The number of leaves in the plant (leaf.plant)

The results of Table (6) showed significant differences in the number of leaves per plant between planting dates and gibberellin levels. The first date outperformed 25/3 and gave the number of leaves per plant, reaching 8.73 leaves, while the last date gave 15/4 the lowest number of leaves per plant, as it reached 6.74 leaves. The reason for the early dates is due to high temperatures, which leads to a short period of growth and a small number of leaves [11]. Also, the level of gibberellin significantly exceeded 100ppm and gave 8.10 leaves. This is due to the role of gibberelic acid in stimulating the hydrolytic enzymes necessary for the breakdown of nutrients and cell division such as alpha-amylase and beta-amylase, as well as a number of enzymes, the most important of which are protease and ribonuclease [5].

Table 6. Effect of planting dates and gibberellins on the number of leaves per plant (leaf.plant).

| Gibberelin | planting dates | average |
|------------|----------------|---------|
| 0          | 4\15           | 5/4     | 25/3   | 7.45   |
| 100ppm     | 9.33           | 8       | 6.98   | 8.10   |
| Average    | 8.73           | 7.87    | 6.74   |        |
| L.S.D0.05  | D              | G       | D*G    |        |
|            | 0.11           | 0.12    |        |

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