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RESEARCH ARTICLE

Effect of Some Treatments on the Vegetative Growth Characteristics of Two Varieties of Tulipa spp

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ABSTRACT

This study was conducted within the wooden canopy of the Department of Horticulture and Landscape Engineering / College of Agriculture and Forestry / University of Mosul, during the period from November 1, 2023 to June 1, 2024, with the aim of studying the effect of soaking bulbs with gibberellic acid (GA3) at different concentrations (0, 100). 200 mg L-1 and spraying with organic fertilizer (Organic Extra plus) at different concentrations (0, 2, 4) ml L-1 and the interaction between the characteristics of vegetative and flowering growth and the yield of bulbs and follicles for two types of bulbs of tulip spp L. Tulipa. The study was carried out using a factorial experiment in a randomized complete block design (R.C.B.D.) in a split plot, with three replicates and 10 plants per replicate. The results indicated that the purple Negrita variety was superior in characteristics (plant height 39.610 cm, length of longest leaf 17.808 cm, average number of leaves .1144 leaves per plant, leaf area 150.635 cm2, dry weight of leaves 2.350 g, number of branches 1.672 branches per plant).

INTRODUCTION

The Tulipa plant belongs to the Lilyacea family and is native to Turkey. People call it the turban flower because it consists of several layers of colored petals, which resemble the turban that men in Turkey wrap around their heads. The tulip flower is shaped like a tea cup or an inverted bell. These flowers moved to Europe 400 years ago and their cultivation spread in the Netherlands, which has become a major source of income for it, as it produces a billion flowers annually that are exported to all countries of the world. It is a true bulb. Its original homeland is northeastern Europe to central-eastern Asia, especially the mountains of Iran, Turkey, and Iraq. (Bettucci, 2011). Flowering bulbs constitute 90% of the world's production for the purpose of producing cut flowers such as tulips, cladiolus, hyggeus, iris, lilium and daffodils. Tulips can be considered one of the main flowering bulbs around the world, and the Netherlands contributes to the production of 60% of its production (Gursan, 1998). Tulip bulbs have now become one of the most important ornamental crops due to their wide availability and moreover they are the fourth major flower in the global floriculture trade (Jhon and Neelofar, 2006). Foliar nutrition plays an important role in plant growth. It means spraying

the plant's shoots with nutrients in the form of dissolved solutions. Macro- and micro-nutrients have an important role in the growth and development of plants, and their presence in concentrations less than what the plant needs may weaken its growth. The leaf is considered the basis for the process of photosynthesis, so a deficiency of elements appears. On the leaf, nutrients must be sprayed on the leaves in a homogeneous manner compared to fertilization (Hamad and Jumah 2000 and Al-Zurfi, 2009). The organic fertilizer (Organic Extra plus) contains many amino acids, as spraying with organic fertilizers for plants has a role in improving vegetative and root characteristics through the nutrients that enter into the formation of amino and nuclear acids and enzymes that are important in increasing vegetative growth and the formation of the chlorophyll molecule, which is the basis for the metabolism process. Photosynthesis, which increases carbohydrates manufactured and increases growth rates (Zahwan et al., 2010; Abdel Hafez, 2012;) .

Gibberellic acid (GA3) is known for its role in elongation of abaxial organs (stems, petioles, and inflorescences) and flower development (Hsu et al., 2008). Gibberellic acid is involved in many plant development processes and promotes a number of desirable effects including regular and early flowering, and increased number of flowers (Pogroszewska et al., 2007). It is known that treatment with gibberellic acid plays an important role in enhancing various processes during plant development, induced early flowering, increased plant height, number of leaves, chlorophyll content, yield and quality in various flowering crops such as Lilium, Tulip and Claudius (Emami et al., 2011, Sure et al., 2012; Kumar et al. 2013, Zeiger, Taiz 2006) Gibberellins represent a group of plant hormones that stimulate growth. The physiological effects of gibberellins are attributed to their control of enzymatic activity and their activation of metabolic processes such as increasing carbohydrates, cell division and elongation, and increasing or decreasing fruit set and ripening (Al-Khafaji, 2014), which has a role in The flowering process through its combination with Anthesin and the production of the flowering hormone Florogen, which has a role in stimulating flowering (Hassanein et al., 2010). Gibberellin also stimulates seed germination, fruit set, and sex determination, and also works to regulate the transition from the juvenile stage to the adult stage (Hedden and Thomas, 2006).

In a study conducted by Altaee and Saeed (2020) on two types of tulip bulbs, upstar and van eijk, the results obtained were summarized by the fact that the plants of the van eijk variety were significantly superior to the upstar variety in the number of leaves, 6.53 compared to 5.88, and the leaf area, 695.94 compared to 551.89, as well as in proportional characteristics. Percentage of nitrogen, phosphorus, and potassium. Byram (2013) stated in a study he conducted on two varieties of tulips, namely the white Lily Flowring and the red Fringed, that they differed significantly in most of the vegetative and floral traits, as the Fringed variety was superior in plant height (46.97) cm compared to (36.67).) cm for the other variety, the leaf area, the percentage of chlorophyll (66.51) spad versus (56.24) spad, the time of flower bud emergence at (10.1) days, the diameter of the flower buds (4.63) mm versus (3.88) mm, and the yield of bulbs and bulbs. In the experiment carried out by Hussein (2021), where treatment of soaking Polianthes tuberosa L. bulbs with gibberellin (GA) at a concentration of 400 mg/L led to early emergence, which occurred after 35.27 days, recording the largest significant values for the characteristics of plant height, 58.25 cm, and leaf area, 53.54 cm, and early in The duration and length of the basal floret to open and increased the number of florets in the inflorescence, as well as it led to a significant increase in the chlorophyll content in the leaves 3.71 SPAD, the zinc concentration 54.93 mg L, and the percentage of carbohydrates in the leaves 22.50%. On the other hand, not treating with and GA led to an increase Significant in the diameter of the basal floret, the length of the inflorescence (spike), its length with the inflorescence, the diameter of the inflorescence, the weight of the wet shoot with the inflorescence, and the number of florets opened until the end of the flower life, 11.91 inflorescences. This treatment also increased the weight of the bulbs by 37.66 grams, their circumference by 12-12 mm, and the weight of the bulbs. 20.07 g and its circumference is 3.51 cm. In a study conducted by Ajeel (2018) on the tulip plant, Tulip Upstar, with

the aim of finding the effect of different levels of liquid organic fertilizers as well as the chemical fertilizer NPK and the effect of this on the characteristics of vegetative and flowering growth and bulb yield, the factors studied included adding three levels of organic fertilizers and chemical fertilizers, which are 0, 1 and 2 ml/L. It was added by spraying on the leaves. It was noted that spraying the plants with high levels of artificial foliage fertilizer was significantly superior and caused a significant increase in terms of vegetative characteristics, which include plant height (16.36 cm), leaf area (587.9 cm2), number of leaves (5.5 leaves/plant), and stand length. The flower size (6.32 cm/plant), the percentage of chlorophyll pigment (53.61), the fresh weight of the flower stand and flower (12.80), the diameter of the flower stand (0.810), the diameter of the flower (9.010), the flower age (14.633) days, the length of time the flowers remain on a plant (18.566), and the time required for flowering (84.35), as well as a significant increase in the characteristics of the yield and the weight of the bulb, which reached (37.66), the diameter of the bulb (3.833), the size of the bulb (4.5), the size of the bulbs (4.166), and the number of bulbs (7.520), while there were no significant differences in the characteristic of the weight of the bulbs, as the highest value reached at 2 Foley Artal (8.54) and for comparison plants it reached (5.653.(

MATERIALS AND METHODS

The experiment was carried out inside the wooden canopy of the Department of Horticulture and Landscape Engineering / College of Agriculture and Forestry / University of Mosul, during the period from November 1, 2023 to June 1, 2024, for the purpose of studying the effect of soaking bulbs with gibberellic acid (GA3) and spraying with organic fertilizer (Organic Extra plus). And the interaction between them in the characteristics of vegetative and flowering growth and the yield of bulbs and bulbs for two varieties of Tulipa spp.

Studied characteristics:

Number of days required for emergence (day): It was calculated as the number of days from planting until the plant emerges above the surface of the soil

Percentage of emergence:

$$\frac{\text{Number of sprouting plants}}{\text{Number of plants planted}} \times 100$$

The percentage of emergence was calculated =

Plant height (cm): The plant height was measured from the soil surface to the highest point of the flower using a measuring tape.

Number of leaves (leaf. plant^{-1}): The total number of leaves of the plant was calculated when the flowers were harvested.

Length of longest leaf (cm): Calculate the length of the longest leaf.

Plant leaf area (cm2):

Dry weight of leaves (g): The dry weight of leaves was calculated using an electronic scale after all the leaves on the plants had dried.

Number of branches (plant branch^{-1}): Calculate the number of branches for each plant.

RESULTS AND DISCUSSION

First: The effect of the studied factors on vegetative traits:

1- Number of days required for emergence (day):

The results of Table (1), which shows the number of days required for vegetative growth to emerge, show that there are significant differences between the two varieties in the period required for emergence, as the purple variety Negrita recorded the least number of days for emergence, amounting to 40 days, while the white variety, White Prince, recorded a greater number of days for .emergence, amounting to 35 days

Table (1): Number of days required for emergence (day) for two varieties of tulip plants, *Tulipa spp* L.

Duration to emergence (day)	Varieties
40 a	Negrita
45 b	White Prince

Values with similar letters for each factor are not significantly different according to Duncan's * .multinomial test under the 5% probability level

Emergence percentage: It was noted from the data in Table (2) that the percentage of emergence was 100% in all plants of the purple Negrita and White Prince varieties**.**

Table (2): Emergence percentage of two varieties of tulip plants, *Tulipa spp* L.

Varieties	Emergence percentage
Negrita	% 100
White Prince	% 100

Plant height (cm) The results of the statistical analysis in Table (3) showed that there were significant differences between the two varieties in plant height, where the plants of the purple variety Negrita recorded the highest plant height of 39.610 cm, while the plants of the white variety White Prince recorded a height of 22.781 cm. Soaking with gibberellic acid at a concentration of 200 mg L^{-1} resulted in a significant increase in plant height, reaching 33.567 cm compared to 27.996 cm in the comparison treatment. It was also found that spraying with Organic Extra Plus at a concentration of 4 ml L^{-1} led to a significant direct increase in plant height with an increase in The concentration reached 33.164 cm compared to 28.935 cm for the comparison treatment plants. On the other hand, the results of the binary interaction between the variety and gibberellic acid showed that the largest values of plant height were recorded when treated with soaking with gibberellic acid, as it reached 42.152 cm for plants of the purple variety at a concentration of 200 mg L^{-1}, but it did not differ significantly with a concentration of 100 mg. L^{-1}, which amounted to 40.562, and this value decreased to 19.876 cm for the plants of the white variety in the comparison treatment. The largest values were also recorded for plant height, which amounted to 41.837 cm for the plants of the purple variety treated with the organic fertilizer Organic Extra Plus, while it decreased to 20.642 cm for the plants in the comparison treatment of the white variety. It showed Results of the interaction between gibberellic acid and the organic fertilizer. The highest values when interacting between the two concentrations, 200 mg L^{-1} of gibberellic acid with 4 ml L^{-1} of the organic fertilizer Organic Extra Plus, reached 35,400 cm compared to the comparison treatment, which reached 25,466 cm. The results of the triple interaction of the factors subject of the study showed that soaking the purple variety Negrita with gibberellic acid at a concentration of 200 mg L^{-1}, interspersed with spraying with the organic fertilizer Organic Extra Plus at a concentration of 4 ml L-1, resulted in giving the highest moral values, reaching 43,900 cm, and this value decreased to the lowest, reaching 18,200 cm for comparison treatment plants of the White Prince variety**.**

Table (3): The effect of soaking with gibberellic acid and spraying with organic fertilizer and their interactions on plant height (cm) for two varieties of *Tulipa spp* L.

Varieties	Concentration of gibberellic acid (mg l^{-1})	Organic fertilizer (ml L^{-1})Organic Extra plus			Overlapping of categories X Gibberellic acid	Item response
		0	2	4		
Negrita	0	32.733g	36.470f	39.146de	36.116b	39.610a
	100	38.763e	40.456c	42.466b	40.562a	
	200	40.190cd	42.366b	43.900a	42.152a	
White Prince	0	18.200m	20.010l	21.420k	19.876d	22.781b
	100	21.343k	23.953j	25.153i	23.483c	
	200	22.383k	25.666i	26.900h	24.983c	
Overlapping of categories X Organic fertilizer	Violet	37.228c	39.764b	41.837a	effect Gibberlic Acid	
	White	20.642f	23.210e	24.491d		
Gibberellic acid interference X Organic fertilizer	0	25.466g	28.240f	30.283e	27.996c	
	100	30.053e	32.205c	33.810b	32.022b	
	200	31.286d	34.016b	35.400a	33.567a	
Effect of organic fertilizer		28.935c	31.487b	33.164a		

Values with similar letters for each factor are not significantly different according to Duncan's * .multinomial test under the 5% probability level

Length of longest sheet (cm):

The data of the results of the statistical analysis in Table (4) indicated that the varieties differed significantly among themselves, as the plants of the purple variety Negrita were significantly superior, reaching 17.808 cm, compared to 14.593 cm for the plants of the white variety White Prince. Also, soaking with gibberellic acid at a concentration of 200 mg L^{-1} led to a significant increase in the length of the longest leaf, reaching 17.913 cm compared to 056.14 cm for the comparison treatment. It was also found that spraying with the organic fertilizer Organic Extra Plus at a concentration of 4 ml L^{-1} led to a significant increase in The length of the longest leaf reached 714.17 cm compared to 625.14 cm for the comparison treatment. On the other hand, the results of the interaction between the variety and gibberellic acid showed the largest values for the length of the longest leaf that was soaked with gibberellic acid, which amounted to 751.19 cm for plants of the purple variety treated with a concentration of 200 mg L^{-1} of gibberellic acid, and this value

decreased to 608.12 cm for plants in the comparison treatment of the white variety. The largest values were also recorded in leaf length, which amounted to 517.19 cm for the plants of the purple variety treated with a concentration of 4 ml L^{-1} of organic fertilizer, while it decreased to 35,413 cm for the plants treated in the comparison treatment of the white variety. The results of the interaction between the two concentrations of 200 mg L^{-1} of gibberellic acid also showed. With 4 ml L^{-1} of Organic Extra plus, the highest values were obtained, reaching 383.19 cm compared to 233.12 cm for the control treatment plants. Through the results of the triple interaction of the factors subject of the study, it was found that soaking the tulip bulbs of the purple Negrita variety with gibberellic acid at a concentration of 200 mg L^{-1} combined with spraying with the organic fertilizer Organic Extra Plus at a concentration of 4 ml L^{-1} led to giving the highest significant values, which amounted to 533.21

cm. You reduced this value to a minimum of 766.10 cm for plants in the comparison treatment of the White Prince variety

Table (4): The effect of soaking with gibberellic acid and spraying with organic fertilizer and their interactions on the length of the longest leaf (cm) of two varieties of *Tulipa spp* .

Varieties	Concentration of gibberellic acid (mg l^{-1})	Organic fertilizer (ml L^{-1})Organic Extra plus			Overlapping of categories X Gibberellic acid	Item response
		0	2	4		
Negrita	0	13.700hi	15.866efg	16.946cde	15.504b	17.808a
	100	16.400def	18.033c	20.073b	18.168a	
	200	17.586cd	20.133b	21.533a	19.751a	
White Prince	0	10.766j	12.586i	14.473gh	12.608c	14.593b
	100	14.133h	15.120fgh	16.026ef	15.093b	
	200	15.163fgh	15.833efg	17.233cde	16.076b	
Overlapping of categories X Organic fertilizer	Violet	15.895c	18.011b	19.517a	effect Gibberlic Acid	
	White	13.354e	14.513d	15.911c		
Gibberellic acid interference X Organic fertilizer	0	12.233f	14.226e	15.710cd	14.056c	
	100	15.266d	16.576c	18.050b	16.631b	
	200	16.375c	17.983b	19.383a	17.913a	
Effect of organic fertilizer		14.625c	16.262b	17.714a		

*Values with similar letters for each factor are not significantly different according to Duncan's multinomial test under the 5% probability level.

Number of leaves (leaf^{-1}):

The results of Table (5) showed that there were significant differences between the two varieties in the number of leaves, where the plants of the purple Negrita variety recorded the largest significant values, reaching .1144 leaves. Plant^{-1} compared to 3,478 leaves^{-1} for White Prince plants. Also, soaking with gibberellic acid at a concentration of 200 mg L^{-1} led to the highest values, reaching 3,978 leaves^{-1} compared to 3,583 leaves-1 for the comparison treatment. It was also found that spraying with the organic fertilizer Organic Extra Plus at a concentration of 4 ml L^{-1} led to The highest significant values reached 4,138 leaves per plant-1 compared to 3,400 leaves per plant-1 for the comparison treatment. On the other hand, the results of the interaction between the variety and gibberellic acid recorded the highest significant values for the number of leaves when treated with soaking with gibberellic acid, which amounted to 4.366 leaves per plant for the plants of the purple variety treated with a concentration of 200 mg l $^{-1}$ of gibberellic acid, and it decreased to 3.288 leaves. 1 for plants of the white variety not treated with gibberellic acid. The largest values were also recorded in the number of leaves, amounting to 4,511 leaves per plant^{-1} for plants of the purple variety treated with a concentration of 4 ml l^{-1} of organic fertilizer, while it decreased to 3,090 leaves per plant-1 for plants treated with the comparison treatment of the variety. White, and also showed the results of the interaction between the two concentrations: 200 mg l^{-1} of gibberellic acid with 4 ml l^{-1} of the organic fertilizer Organic Extra plus. The highest significant values were recorded at 4,350 plant leaves^{-1}, while the lowest values were recorded at 2,900 plant leaves-1 for the comparison

plants. While the results of the triple interaction of factors indicated that soaking the purple variety Negrita with gibberellic acid at a concentration of 200 mg L^{-1}, interspersed with spraying with the organic fertilizer Organic Extra Plus at a concentration of 4 ml L^{-1}, gave the highest significant values, amounting to 4.933 plant leaves^{-1}, while this value decreased. It reached a minimum of 2,600 leaves per plant for plants in the control treatment of the White Prince variety

Table (5): The effect of soaking with gibberellic acid and spraying with organic fertilizer and their interactions on the number of leaves of two varieties of, *Tulipa spp* L.

Varieties	Concentration of gibberellic acid (mg l^{-1})	Organic fertilizer (ml L^{-1})Organic Extra plus			Overlapping of categories X Gibberellic acid	Item response
		0	2	4		
Negrita	0	3.200h	4.100be	4.333b	3.877b	4.114a
	100	3.866cg	4.166bcd	4.266bc	4.100b	
	200	4.100bf	4.100be	4.933a	4.366a	
White Prince	0	2.600i	3.566gh	3.766efg	3.288d	3.478b
	100	3.200h	3.633fgh	3.833cg	3.555c	
	200	3.470gh	3.533gh	3.766dg	3.590c	
Overlapping of categories X Organic fertilizer	Violet	3.711c	4.122b	4.511a	effect Gibberlic Acid	
	White	3.090d	3.577c	3.766c		
Gibberellic acid interference X Organic fertilizer	0	2.900d	3.833bc	4.016b	3.583b	
	100	3.533c	3.900b	4.050b	3.827a	
	200	3.768bc	3.816bc	4.350a	3.978a	
Effect of organic fertilizer		3.400c	3.850b	4.138a		

Values with similar letters for each factor are not significantly different according to Duncan's * .multinomial test under the 5% probability level

Plant leaf area (cm2):

The data in Table (6) showed that there was a significant difference between the two varieties in the leaf area of the plants, where the plants of the purple variety Negrita recorded the largest significant values, reaching 150.635 cm2, compared to 132.790 cm2 for the plants of the white variety White Prince, while soaking with gibberellic acid at a concentration of 200 mg L^{-1} resulted in It resulted in obtaining the highest significant values, reaching 167,418 cm2, compared to 123,279 cm2, for the comparison treatment. Spraying with Organic Extra Plus, at a concentration of 4 ml L^{-1}, led to obtaining the highest significant values, reaching 159,456 cm2, compared to 123,481 cm2, for the comparison treatment. The results of the interaction between the variety and gibberellic acid indicated the largest significant values for the leaf area trait when soaking with gibberellic acid, which amounted to 180.972 cm2 for the plants of the purple variety treated with a concentration of 200 mg L^{-1} of gibberellic acid, compared to 116.734 cm2 for the plants in the comparison treatment for the white variety. The largest significant values were also recorded in the trait. The leaf area amounted to 170,812 cm2 for the plants of the purple variety that were sprayed with the organic fertilizer at a concentration of 4 ml L^{-1}, while it decreased to 119,387 cm2 for the plants in the control treatment, the white variety. The results of the interaction between gibberellic acid and the organic fertilizer

showed that the soaking treatment with gibberellic acid at a concentration of 200 mg L^{-1} interacted. Spraying with organic fertilizer at a concentration of 4 ml L^{-1} gave the highest significant values, reaching 189.811 cm2, while this value decreased to the lowest and reached 99.417 cm2 for the comparison treatment plants. In general, it can be said, by studying the results of the triple interaction of the factors under study, that treatment by soaking the purple variety Negrita with gibberellic acid at a concentration of 200 mg L^{-1}, interspersed with spraying with the organic fertilizer Organic Extra Plus at a concentration of 4 ml L^{-1}, gave the highest significant values, which amounted to 210.407 cm2, while This value decreased to the lowest and reached 95.314 cm2 for plants in the comparison treatment of the White Prince variety.

Table (6): The effect of soaking with gibberellic acid and spraying with organic fertilizer and their interactions on the leaf area of two varieties of tulip plants, *Tulipa spp* L.

Varieties	Concentration of gibberellic acid (mg l^{-1})	Organic fertilizer (ml L^{-1})Organic Extra plus			Overlapping of categories X Gibberellic acid	Item response
		0	2	4		
Negrita	0	103.521m	140.303gh	145.648efg	129.824d	150.635a
	100	130.099ijk	136.852ghi	156.381d	141.111c	
	200	149.107def	183.401b	210.407a	180.972a	
White Prince	0	95.314n	113.498l	141.389fgh	116.734e	132.790b
	100	124.003k	125.617jk	133.693hij	127.771d	
	200	138.845gh	153.532de	169.215c	153.864b	
Overlapping of categories X Organic fertilizer	Violet	127.576d	153.519b	170.812a	effect Gibberlic Acid	
	White	119.387e	130.882d	148.099c		
Gibberellic acid interference X Organic fertilizer	0	99.417e	126.901d	143.519c	123.279c	
	100	127.051d	131.235d	145.037c	134.441b	
	200	143.976c	168.466b	189.811a	167.418a	
Effect of organic fertilizer		123.481c	142.201b	159.456a		

Values with similar letters for each factor are not significantly different according to Duncan's multinomial * .test under the 5% probability level

Dry weight of leaves (g):

The results of Table (7) showed that there were significant differences between the two varieties in the dry weight of the leaves, where the plants of the purple variety Negrita recorded the largest significant values, reaching 2.350 (g) compared to 107.2 (g) for the plants of the white variety White Prince. It was also found that soaking with gibberellic acid at a concentration of 200 mg L^{-1} gave the highest significant values and reached 2.790 (g) compared to 606.1 (g) for the comparison treatment. Spraying with the organic fertilizer Organic Extra Plus at a concentration of 4 ml L^{-1} gave the highest significant values and reached 2.643 (g) compared to 1.797 (g) for comparison treatment plants. The results of the interaction between the variety and gibberellic acid showed significant differences in the dry weight of the leaves when treated with soaking with gibberellic acid, which amounted to

2.936 (g) for the purple variety treated with a concentration of 200 mg L^{-1} and decreased to 1.481 (g) for the plants in the control treatment, the white variety. The largest values were also recorded. The significance of the dry weight of the leaves reached 2.779 (g) for the purple variety plants that were sprayed at a concentration of 4 ml L^{-1} with the organic fertilizer, while it decreased to .6761 (g) for the white variety plants with the comparison treatment. The results of the interaction between gibberellic acid and the organic fertilizer indicate that when treated Soaking with gibberellic acid at a concentration of 200 mg L^{-1}, interspersed with spraying with fertilizer Organic Extra plus at a concentration of 4 ml L^{-1} gave the highest significant values, reaching 3.433 (g), while this value decreased to the lowest, reaching 1,336 (g) for the comparison plants. According to what was mentioned, it can be said that the results of the triple interaction of the factors under study, when treating the bulbs by soaking the purple Negrita variety with gibberellic acid at a concentration of 200 mg L^{-1}, combined with spraying with the organic fertilizer Organic Extra Plus at a concentration of 4 ml L^{-1}, gave the highest significant values, reaching 3,700 (g). While this value decreased to the lowest and reached 1.133 (g) for the comparison treatment plants of the White Prince variety.

Table (7): The effect of soaking with gibberellic acid and spraying with organic fertilizer and their interactions on the dry weight of leaves of two varieties of, Tulipa spp L.

Varieties	Concentration of gibberellic acid (mg l^{-1})	Organic fertilizer (ml L^{-1})Organic Extra plus			Overlapping of categories X Gibberellic acid	Item response
		0	2	4		
Negrita	0	1.540ij	1.727hij	1.928fi	1.731d	2.350a
	100	2.000fgh	2.436de	2.710cd	2.382c	
	200	2.216ef	2.893bc	3.700a	2.936a	
White Prince	0	1.133k	1.500j	1.810gj	1.481e	2.107b
	100	1.846fj	2.193efg	2.546cde	2.195c	
	200	2.050fgh	2.7167cd	3.166b	2.644b	
Overlapping of categories X Organic fertilizer	Violet	1.918d	2.352b	2.779a	effect Gibberlic Acid	
	White	1.676e	2.136c	2.507b		
Gibberellic acid interference X Organic fertilizer	0	1.336g	1.613f	1.869e	1.606c	
	100	1.923de	2.315c	2.628b	2.288b	
	200	2.133cd	2.805b	3.433a	2.790a	
Effect of organic fertilizer		1.797c	2.244b	2.643a		

Values with similar letters for each factor are not significantly different according to Duncan's multinomial * .test under the 5% probability level

Number of branches (plant branch^{-1})

The results data in Table (8) showed that the variety had a significant effect on the number of branches per plant, as the plants of the purple variety Negrita recorded the largest significant values, amounting to 1,672 branches per plant^{-1}, compared to 489.1 branches per plant-1 for the plants of the white variety White Prince. Soaking with gibberellic acid at a concentration of 200 mg L^{-1} led to a significant increase in the number of branches in the plants of the purple variety, reaching 813.1

branches per plant^{-1} compared to 335.1 branches per plant^{-1} for the control treatment, while the spraying treatment with the organic fertilizer Organic Extra Plus at a concentration of 4 ml L^{-1} led to -1 There was a significant increase in the number of branches in the plants of the purple variety, which amounted to 770.1 branches of plant^{-1} compared to 394.1 branches of plant-1 for the comparison treatment. From reviewing the results of the binary interaction between the variety and gibberellic acid at a concentration of 200 mg L^{-1}, significant differences were noted in the number of branches in the plants of the purple variety, amounting to 915.1 branches per plant^{-1} compared to 237.1 branches per plant-1 for the plants of the comparison treatment of the white variety. On the other hand, the interaction between the variety and the organic fertilizer Organic Extra Plus at a concentration of 4 ml l-1 resulted in significant differences in the number of branches in the plants of the purple variety, reaching 851.1 branches per plant compared to 293.1 branches per plant for the plants of the control treatment of the white

variety, while The results indicated that treatment with soaking with gibberellic acid at a concentration of 200 mg L^{-1}, interspersed with spraying with organic fertilizer Organic Extra Plus

at a concentration of 4 ml L^{-1}, resulted in recording the highest significant values of 083.2 plant shoots, while the lowest values were recorded as 168.1 plant shoots^{-1}. For comparison treated

Table (8): The effect of soaking with gibberellic acid and spraying with organic fertilizer and their interactions on the number of branches (plant branch^{-1}) of two varieties of Tulipa spp

Varieties	Concentration of gibberellic acid (mg l^{-1})	Organic fertilizer (ml L^{-1})Organic Extra plus			Overlapping of categories X Gibberellic acid	Item response
		0	2	4		
Negrita	0	1.333ef	1.450ef	1.520de	1.434c	1.672a
	100	1.506de	1.666cd	1.833bc	1.668b	
	200	1.646d	1.900b	2.200a	1.915a	
White Prince	0	1.004g	1.289f	1.418ef	1.237d	1.489b
	100	1.376ef	1.500de	1.683cd	1.520bc	
	200	1.498de	1.666cd	1.966b	1.710b	
Overlapping of categories X Organic fertilizer	Violet	1.495c	1.672b	1.851a	effect Gibberlic Acid	
	White	1.293d	1.485c	1.689b		
Gibberellic acid interference X Organic fertilizer	0	1.168e	1.369d	1.469cd	1.335c	
	100	1.441d	1.583c	1.758b	1.594b	
	200	1.572c	1.783b	2.083a	1.813a	
Effect of organic fertilizer		1.394c	1.578b	1.770a		

Values with similar letters for each factor are not significantly different according to Duncan's multinomial * .test under the 5% probability level

plants. When looking at the results of the triple interaction of the factors under study, it can be said that the soaking treatment of the violet variety Negrita with gibberellic acid at a concentration of 200 mg L^{-1}, interspersed with spraying with the organic fertilizer Organic Extra Plus at a concentration of

4 ml L^{-1}, led to recording the largest significant values in the number of branches in the plants. For the purple variety, 200.2 plant $shoots^{-1}$, while this value decreased to a minimum and reached 004.1 .plant $shoots^{-1}$ for the comparison treatment plants of the White Prince variety

The results of vegetative growth show that varieties play a major role in influencing the characteristics of vegetative growth, as the purple Negrita variety outperforms the White Prince variety in all characteristics of the vegetative plant. The reason for this may be due to genetic differences between the varieties depending on the genes that each variety carries (Azimi and Banijamali, 2019). The results showed that soaking tulip bulbs with gibberellic acid had a positive effect on the characteristics of vegetative growth, in giving the best final height of the plant, the length of the longest leaf, the number of leaves, the dry weight of the leaves, and the number of branches. The positive effects of gibberellin on vegetative growth characteristics are due to the increase in the internal content of gibberellin, which encourages vegetative growth by stimulating active cell division and cell elongation in the apical meristem (Sharma et al., 2004). Another possible reason for the significant increase in plant height could be attributed to the effect of gibberellins on the activity of the photosynthesis process, thus increasing the efficiency of utilization of the products of the photosynthesis process by plants. The results show the clear effect of organic fertilizer on vegetative growth, as the high concentration of organic fertilizer led to an increase in the studied vegetative growth characteristics. The reason may be due to the content of this fertilizer of amino acids that play a major role in the construction of proteins and then the formation of enzymes that are considered the key to the vital processes of the plant.

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