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Effect of organic and phosphate fertilizers on the growth traits of several sesame cultivars of *Sesamum indicum* L.

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ABSTRACT— During the summer season of 2021, a field experiment was carried out in the Al-Saqlawiyah district of the Kasaiba region of the Anbar province in order to investigate the impact that organic and phosphate fertilizers have on the growth characteristics of a number of different sesame cultivars (Sumer, Al-Rafidain, Wade, Had, Giza-32, Turkish, Malaysian black, local, Maghali -57, Golmarmara, Batem) The first factor represents the cultivar, the second factor represents 0 before adding phosphate fertilizer 100 kg.ha-1 and organic fertilizer 2 tons. ha-1, and the third factor represents a mixture of phosphate fertilizer 100 kg.ha-1, organic fertilizer 2 tons. ha-1, and the first factor represents the cultivar. The experiment was carried out using a methodology known as a factorial experiment, in which the treatments were arranged in a manner known as a randomized complete block design (RCBD), and there were three repetitions. The following are the most significant findings from the study: 1- The addition of the mixture (organic fertilizer 2 tons. ha-1 and phosphate fertilizer 100 kg. ha-1 gave a significant increase in the traits of the study represented by plant height (127.39 cm. plant-1), several branches (6.76 branches. plant-1), Stem diameter (1.65 cm), leaf area (16491.87 cm2.plant-1), and dry weight of the plant (169.20 g.plant-1), in comparison to the control treatment, which gave the lowest averages in the above 2- The local cultivar performed exceptionally well in most of the traits that were studied, including plant height, the number of branches, stem diameter, leaf area, and plant dry weight, with averages of 12,601 centimeters, 1.68 centimeters, 12,180 cm2 plant-1, and 146.26 grams plant-1 respectively for plant height, the number of branches, and stem diameter.

KEYWORDS: vitamin D, type 2 diabetes mellitus, HbA1c, BMI.

1. INTRODUCTION

The sesame plant (Sesamum indicum L.), which is a member of the Pedaliaceae family and is recognized to be one of the oldest oil crops known to man and whose oil was utilized, is a crop that belongs to the genus Sesamum [10]. The primary purpose of sesame cultivation is the extraction of oil, which accounts for between 50 and 60 percent of the seed's weight. Because of the presence of the antioxidant sesamin, sesamolin, and sesamol, as well as its iodine number (103-116) and its saponification degree (188-193), and its refractive index at a temperature of 20 °C (0.922-0.924), it is regarded as one of the types of oils that are among the most beneficial [1]. Twenty-five to twenty-eight percent of it is comprised of protein, fifteen percent of carbohydrates, and seven to eight percent of minerals. In terms of its application in animal husbandry, sesame meal boasts a nutrient profile that includes high levels of calcium, phosphorus, and vitamins such as vitamin B12 [2]. Phosphorous is the primary constituent of nucleic acids (RNA and DNA) and nucleoproteins, in addition to playing a significant part in the formation of energy-rich phosphate bonds, ATP, ADP, proteins, and phospholipids. Phosphorous also plays a crucial role in the formation of phospholipids. Phosphorous is the most vital nutrient for plants, and it is also an indispensable component in the process of converting solar energy into chemical energy. The phosphorus found in sesame helps to improve the biological, physical, and chemical qualities of the soil, which in turn results in a higher-quality production [11]. It has a role in the building of organic compounds and increases the improvement of the path of vital activities in the plant [4]. The use of organic fertilizers is another factor that has a significant impact on the growth and activity of plants. Adding organic fertilizers to the soil improves its ability to retain soil moisture and, as a result, its biological properties. Increasing the cationic exchange capacity of the soil [5]. There is little doubt that climate has an impact on the genotype of sesame plants, as it is directly related to the length of time flowering takes and low output [13]. The growth characteristics of sesame might vary according on the genotype [12]. As there are not many sources available on the topic of the study, the purpose of this investigation is to determine the influence that organic and phosphate fertilizers have on a number of different genotypes of the sesame crop.

2. Materials and Methods

2.1 Preparing the experimental ground

In order to investigate the impact that organic and phosphate fertilizers have on the development characteristics of a number of different sesame cultivars, the experiment was carried out in the Kusaiba region (x384161, y3731180) in the Al-Saqlawiyah district in the Anbar province of Iraq. After the experiment land had been tilled twice vertically with a disc, smoothed, and modified, random samples were taken from the experiment land at depths ranging from 0 to 30 centimeters to estimate some of the physical and chemical properties of the experiment soil. The results of these estimates are presented in Table 1. (1). The design used and the studied factors and their levels:

Within the framework of the factorial experiment system, the experiment was carried out using a randomized complete block design (RCBD), and there were three separate trials carried out. It consisted of the following two aspects:
The first of these factors is:
- Eleven cultivars (Sumer, Al-Rafidain, Wade, Had, Giza-32, Turkish, Malaysian black, local, Maghali -57, Golmarmara, Batam)

Table (1) Some physical and chemical properties of the experimental soil for a season (2021).

Traits	values	units
pH	7.4	--
Electrical conduction (EC)	2.2	DSM^{-1}
available Nitrogen (N)	1.2	$g.kg^{-1}$
available phosphorous (P)	0.4	$mg.kg^{-1}$
dissolved potassium (K)	9.7	$mg.kg^{-1}$
Organic matter	9.83	$g.kg^{-1}$
the sand	713	$g.kg^{-1}$
silt	182	$g.kg^{-1}$
Clay	105	$g.kg^{-1}$
Texture	Sandy loam	--

The laboratories of the Anbar Agriculture Directorate were responsible for conducting the soil analysis.

The experimental plot was subdivided into three replicates, and each replication had a total of 44 experimental units.

In the form of 80 kilograms of urea per hectare, the fertilizer was applied. [6] and in two batches, the first batch being applied at the time of planting and the second batch being applied 45 days following the initial planting. The next step is to apply phosphate fertilizer, which has the formula P2O5, at a rate of 100 kg ha-1, together with potassium fertilizer, which has a rate of 20 kg ha-1. The amount of potassium added was 20 kg. Acres [14], [23]. After that, the quantities of the second ingredient, which were organic and phosphate fertilizers, were included in the process of soil preparation.

Second piece of work:
phosphate fertilizer at 100 kilograms per hectare (ha-1), organic fertilizer at 2 tons per hectare (ha-1), and the mixture at 100 kilograms per hectare (ha-1) and organic fertilizer at 2 tons per hectare (ha-1)

Each replicate had a different number of experimental units receive each treatment in a manner that was completely random. After that, on May 1, 2021, the cultivar seeds were planted in the ground. The seeds were planted in lines, with a distance of 40 centimeters separating each line, and a distance of 25 centimeters separating each plant [7]. As a result, the number of lines contained within the experimental unit was (7 lines). The number of plants that make up an individual line is 12, whereas the total number of plants that make up the experimental unit is 84. At a depth of 2-3 centimeters, several seeds were planted for a single crop. The experiment was then described in a low voice in order to prevent the seeds from being washed away by the water stream. After germination, the process of grafting was performed on the pits that were not growing anything. After that, the process of thinning the plants was performed by leaving one plant in the hole after the plant reached a height of 10 centimeters. When it came to the process of weeding, counts were taken whenever it was necessary.

When the crop first showed indications of maturity, that was the indication that it was ready to be harvested.

A total of ten plants were chosen at random from each experimental unit's median lines, then bundled together in such a way that the direction of the capsules was upwards and marked with suggestive signs. In particular, in such a way that the capsules were oriented in an upward manner. After 7–10 days of drying, the packets of the crop were waxed, flipped over, and shaken off to collect the yield for each packet. The packets were then subjected to the drying process once more. This procedure was carried out numerous times until the capsules containing the seeds had been completely emptied of their contents.

studied traits

Plant height (cm. plant^{-1}).

(10) plants were taken at random from the median lines of each experimental unit. The height of the plant was taken from the level of the soil surface to the top of the plant using the measuring tape, and its average was calculated.

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

The number of branches connected to the main stem of ten plants taken for the study was measured and then averaged.

Leaf area (cm^2.plant^{-1}).

The bottom, middle, and upper leaves of each of ten plants were removed, placed in the Portable Leaf Area Meter, and measured. The average of these three measurements was then determined, and this value was multiplied by the total number of leaves on each plant.

The weight of the plant after it has been dried (gm. plant -1)
After drying the samples in an electric oven at a temperature of 70 °C for 48 hours, the samples were weighed repeatedly until the weight remained consistent, and then their average was computed. Ten different plants were sampled at random.

The dry weight of the first plant (W1) was measured exactly one month after it had been planted, and then the dry weight of the second plant (W2) was measured exactly one month after that. This was done in order to determine the physiological characteristics of the plant.

An examination of the statistics:
At the 5% significance level, the data were statistically examined using Duncan's polynomial test. The results of this test indicate that the averages that come after the same alphabetic letter do not differ from one another in a way that can be considered statistically significant. As for the averages that are followed by a variety of letters, they are morally distinct from one another [3].

3. Result and Discussion

3.1 Height of the plant (cm. plant-1)

Plant height is one of the hereditary qualities that can be altered by environmental conditions, particularly those that are related to the fertility of the soil and the numerous operations that can be performed in the field. Researching this characteristic is essential because of the connection it has with lodging, homogeneity in fruit production and ripening, and yield [15]. The results of this study are presented in Table 1, which illustrates the large disparities in plant height that exist across cultivars, organic fertilizers, and phosphate fertilizers (cm. plant-1). Organic and phosphate fertilizers were applied at rates of 2 tons.ha-1 for organic and 100 kg. ha-1 for phosphate respectively. Phosphate fertilizer resulted in a plant height that was 127.39 centimeters plant-1 higher than the control treatment (which did not include any additions), which produced the lowest value of 114.83 centimeters plant-1 (cm. plant -1). It's possible that this is because of the significant effects that phosphorous and organic fertilizers have, either on their own or in combination with each other, on the vegetative growth of plants, the process of stimulating cell division and its expansion, as well as the growth of terminal and apical buds, which led to an increase in plant height. Phosphorous and organic fertilizers can be applied singly or in combination with each other. This finding is in line with what [21]. The information that was found in the same Table demonstrated that the local cultivar was superior in terms of the average plant height, since it reached a value of (126.01 cm). Plant-1 as compared to the Malaysian black cultivar, which was distinguished by its short plant height, which reached (111.49 cm. plant-1. plant-1. plant-1. plant-1. plant-1. plant-1. plant-1. plant-1. plant-1. plant-1. plant-1. plant-1 This is due to the genetic characteristics of the cultivar, which led to it significantly excelling in the trait of plant height, as well as the adaptation of the cultivar to non-genetic conditions. The reason for this can be broken down into two categories: the first category is non-genetic conditions, and the second category is genetic conditions (local environmental). This result is consistent with what [8]. Regarding the interaction between cultivars and the addition of fertilizer, the interaction between the local variety and the addition of the mixed fertilizer (2 tons.ha-1 organic and 100 kg.ha-1 phosphate fertilizer) significantly excelled in the majority of the interactions, where it reached (135.93) centimeters. plant -1 In contrast, the result of the interaction between the Malaysian black cultivar and the control treatment (which did not involve the addition of fertilizer) was 103.43 centimeters on average. plant-1

Table (2) Effect of organic and phosphate fertilizers and cultivars on plant height cm. plant-1 for sesame crop

cultivars	fertilizer levels				average cultivars
	without adding (0)	Phosphate fertilizer 100 kg .ha^{-1}	Organic fertilizer 2 tons. ha^{-1}	Organic fertilizer 2 tons. ha^{-1}+ Phosphate fertilizer 100 kg. ha-1	
Sumer	l-q 119.93	h-m122.13	f-g 126.9	a135.93	a126.01
Al-Rafidain	o-u 118.5	j-o 121.40	g-i124.46	b 132.70	b124.27
Wadea	q-w117.8	J-p 121.20	g-j 124.1	b-c 131.20	bc123.60
Had	s-x 117.0	l-q 120.86	h-k 123.2	b-d 130.33	c122.87
Giza-32	x-z 115.0	q-u 118.23	h-l 122.6	c-d 129.30	d121.30
Turkish	x-a 114.8	u-x 117.50	l-n 121.8	d-f 128.13	de120.57
Malaysian black	x-a 114.8	u-z 117.30	k-q 120.6	e-g 126.93	ef119.91
local	x-a 114.7	u-z 116.93	l-s119.96	g-h 124.80	f119.11
Maghali -57	x-a114.70	u-z 115.33	n-u 119.0	h-m122.13	g117.80
Golmarmara	a 112.10	z-a 113.96	u-z 116.7	l-r 120.43	h115.81
Batem	c 103.43	b 108.61	y-a 114.2	m-u119.43	i111.49
fertilizer averages	d114.83	c117.61	b121.17	a127.39	

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

The branching in the sesame plant is one of the genetic processes that are affected by different agricultural processes and climatic conditions. Table (2) showed that there are significant differences between the cultivars and the organic and phosphate fertilizers and the interaction between them in the number of branches trait (Branch. Plant^{-1}) that the addition of organic and phosphate fertilizers at a level of 2 tons. ha^{-1} is organic and 100 kg. ha^{-1} Phosphate fertilizer gave the highest number of branches, which amounted to (6.76) branches. Plant $^{-1}$Compared with the control treatment (without addition), which gave the lowest value of (4.38) branches. Plant^{-1} The increase in the number of branches in the plant may be due to the phosphorous and organic fertilizers, which helped in the nutrition of the plants with the necessary nutrients in activating cell division. This level in the number of branches in the plant is also due to an excel in plant height (Table 1), which leads to an increase in the number of branches in the plant. This result agrees, with [16], [22]. The data contained in the same Table showed the local excelled in the average number of branches, which amounted to (8.26) branches. Plant $^{-1}$ compared to the Malaysian black cultivar, which was characterized by a decrease in the number of branches, as it reached (4.35) branches. Plant $^{-1}$ This may be due to the genetic factors of the genotype that led to its significantly excelled in the character of the number of branches in the plant and its significantly excelled in plant height, and this is reflected positively in the number of branches as well as the adaptation of genotype to the local environmental conditions. This result agrees with [8]. As for the interaction between genotypes and fertilizer additions, the interaction between the local cultivar and the addition of the mixed fertilizer (2 tons.ha^{-1} organic and 100 kg.ha^{-1} phosphate fertilizer) significantly excelled most of the interactions, as it reached (11.00) branches. Plant $^{-1,}$ while the interaction between the Malaysian black cultivar and the control treatment (without adding fertilizer) gave an average of (3.26) branches. plant^{-1}

Table (3) Effect of organic and phosphate fertilizers and cultivars on the number of plant branches. Branch. plant-1 for sesame crop

cultivars	fertilizer levels				average cultivars
	without adding (0)	Phosphate fertilizer 100 kg .ha^{-1}	Organic fertilizer 2 tons. ha^{-1}	Organic fertilizer 2 tons. ha^{-1}+ Phosphate fertilizer 100 kg. ha-1	
Sumer	c-d 6.43	b 7.60	b 8.03	a 11.00	a 8.26

Al-Rafidain	d-h 5.73	c-d 6.46	cd 6.50	b 8.03	b 6.68
Wadea	i-m 4.96	d-g 6.03	c-e 6.40	b 7.63	c 6.25
Had	k-o 4.60	g-j 5.40	d-g 6.03	c 6.90	d 5.73
Giza-32	n-q 4.13	g-k 5.30	e-i 5.70	c 6.83	de 5.49
Turkish	h-q 4.10	j-l 5.20	f-j 5.53	c-f 6.26	ef 5.27
Malaysian black	o-r 3.93	h-l 5.13	f-j 5.50	d-h 5.90	f 5.11
local	o-r 3.83	i-l 5.03	g-k5.26	d-g 5.73	fg 4.96
Maghali -57	qr 3.73	l-p 4.46	h-k 5.13	g-j 5.46	fg 4.70
Golmarmara	qr 3.50	m-q4.26	j-n 4.86	g-j 5.40	h 4.50
Batem	r 3.26	n-q 4.16	j-n 4.80	h-l 5.20	h 4.35
fertilizer averages	d 4.38	c 5.36	d 5.79	a 6.76	

3.3 Leaf area (cm^2. $Plant^{-1}$)

It is clear from looking at Table (4) that there are substantial variations in the cultivars of hunger, organic fertilizers, and phosphate fertilizers, as well as the interactions between these factors in the leaf region (cm2 plant-1). The use of organic and phosphate fertilizers at rates of 2 tons of organic fertilizer per hectare (ha-1) and 100 kg of phosphate fertilizer per hectare (ha-1) produced the greatest increase in leaf area (16491.87 cm2) Plant-1, in comparison to the treatment that served as the control (which did not include any additions), produced the lowest value of (4949.15) cm2. Plant-1. This may be due to the fact that these fertilizers led to the nutrition of plants with the necessary nutrients, which was reflected in vegetative growth traits, or it may be due to the fact that phosphate and organic fertilizers lead to an increase in the leaf area by activating cell division. Both of these possibilities are possible. The excellence of this level in the plant's leaf area is also related to the excel in the number of branches (Table 2), which this result coincides with. This is one of the reasons for the plant's excellence in this level [17]. The results from the same table demonstrated that the local cultivar was superior in terms of the overall average leaf area, which came to 12180.67 cm2 in total. Comparing Plant-1 to the Malaysian black cultivar, which had the smallest leaf area at (9598.92 cm2), we see that the Malaysian black cultivar has the lowest value. Plant-1 It is possible that this is because of the genetic genes of the genotype, which led to a significant excel in leaf area and its significance in plant height, the number of branches, and stem diameter (Table 1, 2, 3). This is reflected positively in the leaf area, as well as the adaptation of the cultivar to local natural conditions. This finding is in line with what [18]. Regarding the interaction between the genotypes and the additions of fertilizer, the interaction between the local excelled, and the addition of the mixed fertilizer (2 tons.ha-1 organic and 100 kg.ha-1 phosphate fertilizer) significantly excelled in the majority of the interactions, as it reached 17560.67 cm2. Plant-1 further. The interaction between the Malaysian black cultivar and the control treatment (which did not include the addition of fertilizer) resulted in an average of 4100.00 cm2 being produced. Plant-1

Table (4) Effect of organic and phosphate fertilizers and cultivars on the leaf area of the plant (cm2. Plant-1) of sesame crop

cultivars	fertilizer levels				average cultivars
	without adding (0)	Phosphate fertilizer 100 kg .ha^{-1}	Organic fertilizer 2 tons. ha^{-1}	Organic fertilizer 2 tons. ha^{-1}+ Phosphate fertilizer 100 kg. ha-1	
Sumer	d 5814.33	q 11590.67	k 13757.00	a 17560.67	a 12180.67
Al-Rafidain	e 5628.33	t 11015.33	l 13637.00	b 17410.33	b 11922.75
Wadea	f 5492.33	u 10847.67	m 13259.00	c 17228.00	c 11706.75
Had	g 5312.33	v 10619.67	n 13113.67	d 16730.67	d 11444.08
Giza-32	h 5002.33	w 10414.00	o 11954.67	e 16550.67	e 10980.42
Turkish	h 4984.33	x 9710.00	p 11744.67	f 16428.33	f 10716.83
Malaysian black	i 4860.33	y 9468.67	q 11634.00	g 16144.67	g 10526.92

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local	j 4643.00	z 9236.00	r 11274.00	g 16110.00	h 10315.75
Maghali -57	k 4382.00	a 8618.00	s 11184.00	h 15968.00	i 10038.00
Golmarmara	l 4221.33	b 8332.33	t 10958.67	i 15756.00	j 9817.08
Batem	m 4100.00	c 7932.00	u 10840.33	j 15523.33	k 9598.92
fertilizer averages	d 4949.15	c 9798.57	b 12123.36	a 16491.87	

3.4 Dry weight of the plant (g. plant $^{-1}$)

The percentage of dry plant weight that determines genetic features is influenced by environmental factors, particularly those that are associated with the fertility of the soil and the many processes that take place in the field. Table (9) showed that there are significant differences between the cultivars and the organic and phosphate fertilizers and the interaction between them for the dry weight of the plant (g. plant -1) that the addition of organic and phosphate fertilizers at a level of 2 tons. This was determined by measuring the plant's weight after it had been exposed to the fertilizers. ha-1 is considered organic, and applying 100 kg.ha-1 of phosphate fertilizer resulted in the highest possible value for the plant's dry weight (169.20 g). When compared to the control treatment, which did not include any additions, the fresh weight of plant-1 was lower, coming in at 98.48 grams per plant-1. This may be due to the role that phosphate fertilizers and organic fertilizers play in the process of increasing photosynthesis. This, in turn, causes a rise in the activated physiological processes and an increase in their dry weight in them. Additionally, level excelled in the weight of the dry plant to excel in the height of the plant, the number of branches, Stem diameter, leaf area, and chlorophyll table (1,2,3,4,5,7,8), which was reflected in the accumulation of dry weight. The data in the same Table showed that the local cultivar prevailed in the average dry weight of the plant, which amounted to (146.26) g. plant -1 when compared to the Malaysian black cultivar, which was characterized by the lowest value of the dry weight of the plant as it reached (124.40) g. plant -1. The data in the same Table also showed that the Malaysian black cultivar was characterized by the highest value of the dry weight of the plant as it reached It is possible that the reason is due to the genetic traits of the cultivar, which led to a significantly excelled in the dry weight of the plant; in addition, it is possible that the reason is due to the adaptation of the cultivar to the local natural conditions, which resulted in the plant being better able to withstand the conditions of the environment [19]. In terms of the interactions between the cultivars and the fertilizer additions, the interaction between the local variety and the addition of the mixed fertilizer (2 tons.ha-1 organic and 100 kg.ha-1 phosphate fertilizer) significantly outperformed the majority of the other interactions, as it reached 180.74 g. plant-1. In contrast, the interaction between the Malaysian black cultivar and the control treatment (which did not include the addition of fertilizer) resulted in an average yield of 88.19 grams of plant-1.

Table (5): Effect of organic and phosphate fertilizers and cultivars on plant dry weight (g. plant -1) for sesame crop

cultivars	fertilizer levels				average cultivars
	without adding (0)	Phosphate fertilizer 100 kg .ha^{-1}	Organic fertilizer 2 tons. ha^{-1}	Organic fertilizer 2 tons. ha^{-1}+ Phosphate fertilizer 100 kg. ha-1	
Sumer	u-z108.66	k-p134.99	c-g160.65	a180.74	a146.26
Al-Rafidain	u-z106.43	l-q132.71	c-h157.75	Ab178.76	ab144.16
Wadea	u-a103.66	m-r131.25	d-h157.00	a-c175.29	a-c141.87
Had	v-a102.00	m-s128.70	d-i155.12	a-d170.94	a-d139.19
Giza-32	w-a100.75	n-s126.51	d-j153.46	a-e169.31	b-d137.50
Turkish	w-a98.93	o-t123.17	e-k151.67	a-f167.02	d-e135.19
Malaysian black	x-a96.95	o-u121.09	f-l148.89	a-f165.23	d-f133.29
local	y-a94.56	p-v118.97	h-m146.25	a-f165.35	d-g131.28

Maghali -57	za92.16	q-w116.43	h-n141.93	a-g164.24	e-g128.69
Golmarmara	za90.78	r-x114.00	i-0138.62	b-g162.23	fg126.42
Batem	A88.19	s-y111.59	j-o136.77	b-g161.63	g124.40
fertilizer averages	d98.48	c123.58	b149.92	a 169.20	

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