Response of Two Pepper Varieties to Organic Fertilizer (Poultry Manure), and Spraying with Dry Yeast on Vegetative Growth Indicators

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The study was carried out in the vegetable crops research field of the Department of Horticulture and Landscape design, College of Agriculture and Forestry, University of Mosul during the spring 2023 agricultural season to study the response of two varieties of pepper to organic fertilizer, poultry manure, and spraying with dry baking yeast on vegetative growth indicators. The study included three factors, the first factor, which is Two types of pepper (California wonder MM75 and Sweet pepper Bloq IMP F1), and the second factor is organic fertilizer from poultry manure at three concentrations, which are (0, 1.5, and 2) tons/donum, and the third is spraying with dry baker's yeast at three concentrations, which are (0, 5, and 10 g/ l.) liter. The study included 18 experimental units with three replicates for each factor. The study was organized in a completely randomized block design with a split-plot system. Data were recorded on the following traits: determination of chlorophyll A, B, and total chlorophylls, plant height, number of side branches for each plant, percentage of dry matter in vegetative growth, area of one leaf, and total area of each plant. The results were that the pepper variety Sweet peper Bloq IMP F1was significantly superior in the traits Chlorophyll B content and in the percentage of dry matter. A concentration of 1.5 tons/dunum of organic fertilizer (poultry manure) gave the best significant values in the characteristics of chlorophyll B and total content, in plant height, in the number of side branches for each plant, and in the percentage of dry matter. Spraying with a concentration of 5 g/l. of dry yeast caused the highest results in the characteristics of chlorophyll B and total content. As for the binary interaction treatment between 1.5 tons/dunum of poultry manure fertilizer and 5 g/l. of dry yeast, the best significant values in vegetative growth characteristics, and the interaction between 1.5 tons of poultry manure fertilizer with the Sweet peper Bloq IMP F1 variety had the best results for vegetative growth characteristics.

Keywords: pepper, dry yyeast, poultry manure , Biofertilizer, vegetative growth.

1. Introduction

Pepper plant belongs to the genus Capsicum to the Solanaceae family, and its scientific name

is Capsicum annuum. From a Mexican word called most hot types of pepper in Europe and the United States of America (Greenleaf, 1986). The genus Capsicum contains about 20-30 species, all cultivated species of the genus Capsicum contain 12 pairs of chromosomes (2n=2x=24). The original homeland of pepper is Central and South America. Traces and remains of pepper fruits were found in caves in Mexico and Central America dating back to about 7000 years BC, while evidence of the cultivation of the crop dates back to about 5200 to 3400 years BC (Wien, 1997). Organic farming technology is one of the applied environmentally friendly agricultural technologies. This technology has grown and developed in recent years as a result of the increased need for sustainable agriculture (Pual et al., 2006). Organic fertilizers, such as farm waste (FYM), poultry manure, and renewable and environmentally friendly green fertilizer waste, are a goal of achieving sustainable crop production with a minimum of the harmful effects of traditional chemical fertilizers on the health of the soil and the environment through the balanced application of organic and bio-inorganic fertilizers. Dry yyeast, Saccharomyces cervisiae, is an important source of biological fertilization due to its ability to store excess phosphate in the form of chains containing (20-200) phosphate units in the vacuoles inside the cell (Urech et al. 1978). It also stores many amino acids, as It has the ability to produce essential materials for growth, such as hormones (auxins, gibberellins, and cytokinins), amino acids, and sugars, in addition to being a natural source of some nutrients such as Mo-B-Cu-Zn-Mn-Fe-Mg-Ca-K-P-N-C, in addition to... Cl-Na (Eata et al. 2001). Recent studies confirm the possibility of using natural and safe alternatives to Bio- fertilizers, such as yyeasts, to improve plant vegetative growth (Daman et al. 2004). Although the number of yyeasts is small compared to other microorganisms, many evidence indicates that this group of organisms plays a major role in soil fertility due to their ability to produce growth-stimulating substances such as plant hormones, amino acids, and vitamins (Monib et al. 1982). Sharma et al.,(2010) found in India that 23 genotypes differed significantly among themselves in traits such as plant height, number of side branches per plant, and leaf area per plant. Al-Shammari (2015) found, through his evaluation of four genotypes of pepper (Gedeon, Louay, Denver, E4I), the Denver variety was significantly superior to the other varieties in plant height and the number of side branches per plant. Rohini et al., (2017) in India indicated that there are significant differences in traits for plant height and number of lateral branches per plant through a study evaluating 23 genetic structures in pepper plants. Soares et al. (2018) in Brazil indicated through their study of (22) genetic compositions of pepper that differed significantly in terms of plant height traits. Khan and Sridevi (2018) obtained, through their study of variations in pepper, there is a significant variation in the traits of plant height and number of lateral branches. While Esho (2019) in Iraq found, when he evaluated ten varieties and genetic compositions of pepper, they differed significantly among themselves in the characteristics of the number of side branches / plant. Shakir and Salman (2021) when studied evaluating three varieties of pepper (Local, Anaheim, and Barbarian) in Najaf District, the Barbarian variety was significantly superior than two varieties plant height and area per leaf/100 g. While Berova et al., (2010) found in Bulgaria that when using organic and biological fertilizer on pepper variety (Buketen 50) at concentrations of 50 and 100 ml/plant, caused significant increases in vegetative characteristics, in addition to the content of chlorophyll (plastids), represented by plant height and leaf area. And the content of chlorophyll a, b and total. Dawa et al., (2012) in Egypt obtained by using organic fertilizer from poultry manure at 0, 2, and 4 tons/acre on pepper

plants that high levels achieved significant increases in plant height, the number of side branches per plant, leaf area, fresh and dry weight of growth vegetative and in the content of chlorophyll a, b and total. Omar et al., (2018) obtained that fertilizing pepper plants with organic fertilizer and poultry manure (5, 10, and 15 m^3/acre) that a level of 15 m^3 /acre produced the highest significant values for vegetative growth characteristics represented by plant height, number of side branches per plant, and wet and dry weight. For plant. Rabie and Al-Duhami (2019) found, through their study of the use of organic fertilizer (poultry manure) and the amino acid proline in the growth and production of pepper, that adding organic fertilizer and poultry manure at a rate of 5 and 10 tons/ha showed that the 10 tons treatment caused significant increases in each of the traits. The length of the plant and the number of side branches for each plant and the wet and dry weight of vegetative growth. Zeyad and Salman (2021) also obtained in Najaf from their study of the effect of organic and biological fertilizer on the growth of three varieties of pepper (Anaheim, barberry, and local) the organic fertilizer caused a significant superiority in vegetative growth indicators. While many studies and research have indicated that yeast is a natural source of cytokinins and has stimulating effects on plant growth , yeast extract has a major role during the stages of vegetative growth in some vegetable crops because it contains auxins and the accumulation of carbohydrates (Barnett et al., 1990). It activates and stimulates cell division, elongation, and protein and acid synthesis Nuclear formation and chlorophyll formation .Natio (1981) mentioned that yeast is a natural stimulant and is rich in proteins and carbohydrates in addition to amino acids such as folic acid and B12. Yeast is also considered a natural substance and a source of cytokinins. Ghoname et al., (2010) obtained in Egypt when fertilizing pepper plants with levels of biological and organic fertilizers and mineral solutions, where concentrations of 1, 2, and 3 g/L of yeast were used, that high concentrations of yeast achieved significant increases in the characteristics of plant height and the number of side branches for each plant. The fresh and dry weight of vegetative growth. Dawa et al. (2012) showed that spraying Madir pepper plants in Egypt with dry yeast, humic acid, and poultry manure, adding (2.43, 3.1, and 3.4) tons/acre of poultry manure and bread yeast (0 and 5 grams/liter) showed that the vegetative growth characteristics represented by an increase Plant size, leaf area, number of side branches, wet and dry weight with the addition of chlorophyll b, a, and total weight were high when using 2.43 poultry manure, 2.5 marine algae, and 5 yeast. Nahed et al., (2015) indicated that when using organic and biological fertilizers on the growth and yield of pepper plants, using yyeast at concentrations of 10 or 20 l./acre of yeast (Saccharomyces cerevisiae) showed that the concentration of 20 liters per acre caused significant increases in the characteristics of plant height and the number of side branches per plant. Plant and number of leaves for each plant, in addition to the leaf area, the wet and dry weight of vegetative growth, and the chlorophyll content of the leaves. El_Fawy and Ahmed (2015) indicated in Egypt, through the use of yeast at concentrations (4, 6, and 8 g/l. for pepper plants ,Norhan variety) that the concentration of 6 g./l. was significantly superior to the other two levels in plant height characteristics. While Abd Alrahman and Aboud (2021) in Egypt, when spraying pepper plants with baking yeast at concentrations (3 and 6 g./l.) of yeast, at a concentration of 6 g./l., showed significant effect on the height of the plant, number of lateral branches, and area of leaf. Hanaa and Fatima (2021) also obtained in Egypt through their study that spraying yeast on pepper at 3 and 6 g./l. achieved a significant increase in the vegetative growth indicators of the pepper variety Gedeon F1, which are represented by the length of the plant, the number of lateral branches

per plant, and leaf area. Salloom et al. (2023) in Iraq, when spraying pepper plants with concentrations of yeast (0.3.6) g/L, showed that a concentration of 6 g/L of yeast caused significant increases in both plant height and the percentage of dry matter for vegetative growth with the addition of total chlorophyll. The aims of this study was to investigate the response of two types of pepper to organic fertilizer, poultry manure, and spraying with dry yeast on the characteristics of vegetative growth under conditions in the city of Mosul, Iraq.

2. Materials and Methods

The experiment was carried out in the vegetable research field of the Department of Horticulture and Landscape design/College of Agriculture and Forestry/University of Mosul during the growing season spring 2023. The experimental field was divided into experimental units. Each experimental unit consisted of two stakes, 1.5 m long and 75 cm wide. The area of the experimental unit was (4 m^2), with an experimental unit planted at the beginning of each sector that was used as guard plants. The seeds were planted in beds inside the unheated greenhouse on 1/2/2023, the seedlings were transferred on 4/19/2023 and planted in holes. one seedlings for each hole, and irrigation. The processes of hoeing and weeding were carried out continuously to get rid of the growing weeds periodically in the field. The first factor: It included three levels of organic fertilizer from poultry manure (0, 1.5, and 2 tons/dunum). The second factor: It included three concentrations of the biofertilizer of dry yeast (0, 5, and 10 g/l.). The third: included two varieties of pepper for using dry seeds (California wonder , and Bloq IMP F1 (Sweet Pepper). Number of treatments for each replicate was (3 x 3 x 2) = 18 experimental units. Each experimental unit consisted of two rows 1.5m, Seedlings were planted on one side of the row and at a distance of 30 cm between one plant and another (Matlob et al., 1989). Each row Contains 5 plants (the experimental unit contains 10 plants). The experiment was organized in a completely randomized block design with a split split plots, the organic fertilizer (poultry manure) were placed in the main plots, the yeast concentration was in the sub blot, and the varieties were in the sub sub plots, the bread yeast biofertilizer was sprayed three times and included: The first spraying was 20 days after the transplantation , the second spraying was 20 days after the first spraying, and the third spraying was 20 days after the second spraying. As for the organic fertilizer (poultry manure), it was added once to all experimental units and for each replicate on the date of 4/5/2023, a week before the transplantation . The following data and measurements were recorded: The content of chlorophyll a, b and total (mg/g fresh weight) in the leaves was estimated according to the Mackinney (1941) and Arnon (1949). The following equations were used to calculate chlorophyll a, b and total chlorophyll, respectively:

Ch.a = 12.7 a 663 2.69 a 645 , Ch.b = 22.9 a 645 4.68 a 663 , Total Chl. =Chl.a +Chl.b

and height of the plant (cm), number of lateral branches , the percentage of dry matter in vegetative growth (%), the leaf area (cm^2 leaf -1), the total leaf area for plant (cm^2). Data were analyzed using the program (SAS, 1999) and the means were compared at the 5% probability level for Duncan's multinomial test (Al-Rawi and Khalaf Allah, 2000).

3. Results and Discussion

It appears from Table (1) that the levels of organic fertilizer and poultry manure e did not reach the level of significance due to its effect on the chlorophyll a content. The dry yeast agent and other types of yeast also have the same effect as poultry manure fertilizer. As for the percentage of interaction between the organic fertilizer, poultry manure, and dry yeast, it did not reach the level of significance. As for the binary interaction between the organic fertilizer and the varieties, it may appear from the same table that the level of organic fertilizer from poultry manure (5 tons/ha) with the second variety (Calif. wonder MM75) was significantly superior with some binary interaction coefficients, and the lowest content was the result of the binary interaction coefficient between 2 tons. The percentage of poultry manure fertilizer with the second type (Calif wonder MM75), which amounted to 25.283, significantly according to Duncan's polynomial test under the 5% probability level.

Table (1) The effect of organic fertilizer, yeast, varieties, and their interaction on the chlorophyll A content in the leaves of pepper plants for the growing season of spring 2023 *

Organic fertilizer (ton/donum	Dry yeast (g/l.)	Variety		Organic fertilizer x dry yeast
		Calif wonder MM75F	Bloq IMPF1	
0	0	26.180 b	a7.137	a 26.658
	5	a27.023	a 27.280	a 27.152
	10	a 25.733	b 26.887	a 26.310
1.5	0	a 25.993	b 26.867	a 26.428
	5	c 24.257	b 26.480	a 25.368
	10	b 26.590	bc 25.113	a 25.852
2	0	b26.080	bc 25.983	a 26.032
	5	b26.320	c 24.183	a 25.252
	10	b 26.597	bc 25.683	a 26.140
Organic x variety		Calif wonder MM75F	Bloq IMPF1	Organic fertilizer
0		a 27.1011	a 26.3122	a 26.706
1.5		a 26.1533	b 25.6122	b 25.8828
2		b 25.2833	a 26.3322	b 25.8078
Dry yeast x variety		Calif wonder MM75F	Bloq IMPF1	Dry yeast
0		a 26.6622	a 26.0833	a 26.3728
5		a 25.9811	a 25.8667	a 25.9239
10		a 25.8944	a 26.3067	a 26.1006
Variety		a 26.1793	a 26.0856	

*The values with similar letters for each factor or their interactions individually do not differ

It also appears from the same table that the interaction between the levels of dry yeast and varieties did not reach significance. It also appears from the same table that the triple interaction treatment between poultry manure fertilizer (0) with 5 g./l. of dry yeast and the second variety (Calif wonder MM75)) had the highest content of chlorophyll A, reaching a value of 27.280, and the lowest content resulting from the triple interaction was 2 tons/ha. of poultry manure fertilizer with 5 g. of dry yeast, the variety (Calif wonder MM75), its value reached 24.183.

Table (2) shows that organic fertilizer and poultry manure had a significant effect on the content of chlorophyll b, if the level of 1.5 tons/ha gave the highest content, which amounted to 30.676, and the lowest value was from the second level of organic fertilizer, which amounted to 26.103. as for the percentage of effect of dry yeast on this trait did not reach the level of significance. As for the effect of the varieties, the first variety (Bloq (IMPF1)) was significantly superior to variety (Calif wonder MM75) in this trait, which amounted to 30.403.

Table (2) The effect of organic fertilizer, yeast, varieties, and their interaction on the chlorophyll B content in the leaves of pepper plants for the growing season of spring 2023 *

Organic fertilizer (ton/donum	Dry yeast (g/l.)	Variety		Organic fertilizer x dry yeast
		Calif wonder MM75F	Bloq IMPF1	
0	0	ef 28.823	gh 25.270	cd 27.0467
	5	h 24.643	gf 27.580	d 26.1117
	10	ce 30.493	ce 30.437	b 30.4650
1.5	0	ce 30.987	b 36.387	a 33.6867
	5	df 29.933	a 38.933	a 34.4333
	10	j 14.977	c 32.837	e 23.9067
2	0	df 29.257	fg 27.393	c28.3250
	5	gh 25.303	cd 31.827	c 28.5650
	10	i 19.870	h 22.967	f 21.4183
Organic x variety		Calif wonder MM75F	Bloq IMPF1	Organic fertilizer
0		b 27.9867	b 27.7622	b 27.8744
1.5		c 25.2989	a 36.0522	a 30.6756
2		c 24.8100	b 27.3956	c 26.1028
Dry yeast x variety		Calif wonder MM75F	Bloq IMPF1	Dry yeast
0		b 29.6889	b 29.6833	a 29.6861a
5		c 26.6267	a 32.7800	a 29.7033
10		d 21.7800	b 28.7467	b 25.2633
Variety		b 26.0319	a 30.4033	

*The values with similar letters for each factor or their interactions individually do not differ significantly according to Duncan's polynomial test under the 5% probability level.

As for the percentage of the effect of interaction between the organic fertilizer poultry manure, 1.5 tons/ha with 5 g. of dry yeast, the highest content of chlorophyll b was reaching 34.433, and it was significantly superior to most of the binary interaction treatments, while the binary interaction factor achieved 2 tons/ha of poultry manure with 10 g. of dry bread yeast, the content in it reached 21.418. It also appears from the same table that the triple interaction coefficients between the three factors under study were significantly superior to each other if the triple interaction treatment between the level of 1.5 tons/ha of organic fertilizer poultry manure with 5 grams of dry baker's yeast and the variety (Bloq IMPF1) achieved the highest level. The significant content in this amounted to 38.933, and the lowest content resulted from the triple interaction factor between the level of 1.5 tons/ha of poultry manure with 10 grams of dry baking yeast and the second type (Calif wonder MM75) if it reached 14.977.

Table (3) showed that the levels of organic fertilizer had a significant effect on the total

chlorophyll content, with the level of 1.5 tons/ha achieving the highest significant content in this trait, amounting to 54.922, and the lowest content resulting from the level of 2 tons of poultry feed, amounting to 50.801, as shown in the same table. Yeast concentrations of 5 g/L achieved the highest significant total chlorophyll content, which amounted to 55.617, and the lowest value.

Table (3) .Effect of organic fertilizer, yeast, varieties, and their interaction on the total chlorophyll content in the leaves of pepper plants for growing season, spring 2023 *

Organic fertilizer (ton/donum	Dry yeast (g/l.)	Variety		Organic fertilizer x dry yeast
		Calif wonder MM75F	Bloq IMPF1	
0	0	fe 52.627	h 46.450	d 49.5383
	5	fg 51.923	cf 54.603	c 53.2633
	10	cb 57.380	cd 56.170	b 56.7750
1.5	0	Sb 57.853	a 62.417	a 60.1350
	5	cd 56.413	a 63.123	a 59.7750
	10	i 40.090	a 49.633	e 44.8617
2	0	be 55.240	g 53.473	c54.3567
	5	be 49.493	de 58.147	c 53.8200
	10	i 38.890	g 49.563	e 44.2267
Organic x variety		Calif wonder MM75F	Bloq IMPF1	Organic fertilizer
0		b 53.9767	bc 52.4078	b 53.1922
1.5		c 51.4522	a 58.3911	a 54.9217
2		d 47.8744	b 53.7278	c 50.8011
Dry yeast x variety		Calif wonder MM75F	Bloq IMPF1	Dry yeast
0		b 55.2400	bc 54.1133	a 54.6767
5		cd 52.6100	a 58.6244	a 55.6172
10		e 45.4533	b 51.7889	b 48.6211
Variety		b 51.1011	a 54.8422	

*The values with similar letters for each factor or their interactions individually do not differ significantly according to Duncan's polynomial test under the 5% probability level.

was when spraying pepper plants with a concentration of 10 g/L, which amounted to 48.621. The variety (Bloq IMPF1) also outperformed the variety (Calif wonder MM75) in this regard. Characteristic: As for the ratio of the binary interaction coefficients between the organic fertilizer poultry manure at 1.5 tons/ha with dry yeast at a concentration of 0 g./l. , I achieved the highest content of total chlorophyll, 60.135, and differed significantly with the rest of the binary interaction coefficients, except for the interaction coefficient of 1.5 tons/ha of poultry manure and 5 g./l. of dry yeast, and the lowest content resulted from the bilateral interaction between 2 tons/ha of poultry manure with 10 g./l. of yeast amounted to 44.227. The binary interaction coefficient between the poultry manure was 1.5 tons/ha with the variety (Bloq IMPF1) had the highest content in that amounted to 58.391 and differed significantly with the rest of the treatments, while it achieved the same level of organic fertilizer with variety (Calif wonder MM75)) the lowest content in that amounted to 51.452, and the interference of 5 g./l. yeast with the variety (Bloq IMPF1) was highest significant value in the total chlorophyll content amounted to 58.624, while the binary interaction factor of 10 g. yeast with the variety

(Calif wonder MM75) gave the lowest content at the 5% probability level of the Duncan multinomial test, amounting to 45.453. It also appears from Table (3) that the triple intervention treatment between 1.5 tons/ha of poultry manure fertilizer with 5 g./l. of dry yeast and the variety (Bloq IMPF1) achieved the highest total chlorophyll content, reaching 63.123, and it differed significantly with most treatments. the lowest total chlorophyll content resulted from the effect of the triple interaction between 2 tons/ha of organic fertilizer with 10 g./l. of yeast and variety (Calif wonder MM75), which amounted to 38.890.

Table (4) shows the effect of the three factors and their interaction on the character of plant height. If a level of 1.5 tons/ha of organic fertilizer and poultry manure gave the highest plant was 93.264 cm, it differed significantly from the remaining two levels, while dry yeast achieved a concentration of 10 g./l. The highest significant height of a plant was 94.639 cm, and the lowest height was at the level of 0 g/L of yeast, which was 91.333.

Table (4) The effect of organic fertilizer, yeast, varieties, and their interaction on plant (cm) of pepper plants for growing season of spring 2023 *

Organic fertilizer (ton/donum	Dry yeast (g/l.)	Variety		Organic fertilizer x dry yeast
		Calif wonder MM75F	Bloq IMPF1	
0	0	Ef 88.500	f 87.147	c 87.958
	5	bf 92.833	f 87.167	bc 90.000
	10	A 98.667	ac 95.583	a 97.125
1.5	0	ad 96.667	ab 94.583	a 95.625
	5	ad 94.333	ae 93.250	ab 93.792
	10	fe 88.250	bf 92.500	bc 90.375
2	0	bf 91.833	fe 89.000	bc 90.417
	5	cf 91.667	cf 90.500	bc 91.083
	10	ab 96.917	ac 95.914	a 96.417
Organic x variety		Calif wonder MM75F	Bloq IMPF1	Organic fertilizer
0		a 93.333	b 90.056	c 91.694
1.5		ab 93.083	a 93.444	a 93.264
2		a 93.472	ab 91.806	b 92.639
Dry yeast x variety		Calif wonder MM75F	Bloq IMPF1	Dry yeast
0		ab 92.333	b 90.333	b 91.333
5		ab 92.944	b 90.306	b 91.625
10		a 94.611	a 94.667	a 94.639
Variety		a 93.2963	b 91.7685	

*The values with similar letters for each factor or their interactions individually do not differ significantly according to Duncan's polynomial test under the 5% probability level.

The variety (Calif wonder MM75) also outperformed the variety (1Bloq IMPF) in this characteristic, which gave the highest 93.296.cm . As for the effect of the interaction between the organic fertilizer of poultry manure at 0 tons/ha, with 10 grams of yeast, the highest height of the plant reached 97.125, and the lowest height resulting from the second treatment, 0 fertilizer of poultry manure , with 0g. dry baking yeast reached 87.958 cm. As shown in the same table, the treatment interaction of 2 tons/ha of organic fertilizer from poultry manure e

with the type (Calif Wonder MM75) had the highest significant increase amounting to 93.472, and the lowest significant increase resulted from the use of 0 tons of organic fertilizer with the (Bloq IMPF1) reached 90.056. As for the interaction between a concentration of 10 grams/ A liter of baking yeast with the variety (Bloq IMPF1) achieved the highest plant of 94.667 cm and differed significantly with the levels of (0.5) grams of yeast with the same variety. It also appears from Table (4) that the triple interference treatments under study had a significant effect on the plant height at the 5% probability level from Duncan's polynomial test if the triple interference treatment was superior to 0 tons of organic fertilizer with 10 g./l. of yeast. The variety (Calif wonder MM75) had the highest significant height of 98.667 cm, and the lowest height resulted from the triple interaction of 0 tons of organic fertilizer with 0 yeast. The type (1Bloq IMPF) reached 87.147 cm.

Table (5) shows that the level of 1.5 tons/ha of organic fertilizer achieved the highest significant value in the number of side branches, which reached 4.014, and it differed significantly with (0 and 2) tons of organic fertilizer from the data of the same table, the concentrations of the dry bread yeast used did not reach a significant effect on the character of the number of lateral branches, while the variety (Calif wonder MM75) was significantly superior to the first variety (Bloq IMPF1) in terms of the effect on the character of the number of lateral branches. Data from Table (5) also show that the double interference coefficients of 1.5 tons of poultry manure e with 0 grams of dry baking yeast achieved the highest number of 4.125 and differed significantly with some of the double interference coefficients if the smallest number of side branches resulted from the interference 5 tons/ha of organic fertilizer with 0 grams of baking yeast reached 3.250, and the binary intervention equation between 1.5 tons of organic fertilizer and the second type (Calif wonder MM75) achieved the highest number of side branches/plant reached 4.167, and the lowest resulted from no interaction between 2 tons/ha of organic fertilizer with the second variety (Calif wonder MM75), which was 3.278. As shown from the data of the same table, the interaction between the concentrations of yeast and the varieties did not reach the level of significance. According to this characteristic, the highest significant number of lateral branches for each plant resulted when mixing 1.5 tons/ha of organic fertilizer with 5 g./l. of dry yeast with the variety (Calif wonder MM75), it reached 4,250 branches for each plant, and the lowest number resulted. From the triple interaction of 2 tons/ha of organic fertilizer with 0 yyeast with variety (Calif wonder MM75), the minimum number reached 3,167 branches per plant. It appears from Table (6) that the 1.5 level of organic fertilizer from poultry manure achieved the highest percentage of dry matter in vegetative growth, reaching 18.935, and it differed significantly with the level of 0 tons, but did not differ significantly with the level of 2 tons/ha of organic fertilizer.

Table (5) The effect of organic fertilizer, yeast, varieties, and their interaction on the number of lateral branches/ plants for growing season, spring 2023 *

Organic fertilizer (ton/donum	Dry yeast (g/l.)	Variety		Organic fertilizer x dry yeast
		Calif wonder MM75F	Bloq IMPF1	
0	0	ad 4.000	bd 3.3333	bc 3.6667
	5	ad 3.8667	ad 3.8333	ab 3.8500
	10	ad 3.9167	ad 3.9500	ab 3.9333
1.5	0	a 4.1667	ac 4.0833	a 4.1250
	5	a 4.2500	ad 3.8333	a4.0417

	10	ac4.0833	ad 3.6667	ab 3.8750
2	0	d3.1667	bd 3.3333	c 3.2500
	5	cd3.2500	bd 3.3333	c 3.2917
	10	ad3.4167	ad 3.4167	bc 3.4167
Organic x variety		Calif wonder MM75F	Bloq IMPF1	Organic fertilizer
0		ab 3.9278	bc 3.7056	b 3.8167
1.5		a 4.1667	ab 3.8611	a4.0139
2		c 3.2778	c 3.3611	b 3.3194
Dry yeast x variety		Calif wonder MM75F	Bloq IMPF1	Dry yeast
0		a 3.7778	a 3.5833	a 3.6806
5		a 3.7889	a 3.6667	a 3.7278
10		a 3.8056	a 3.6778	a3.7417
Variety		a 3.7907	b 3.6426	

*The values with similar letters for each factor or their interactions individually do not differ significantly according to Duncan's polynomial test under the 5% probability level.

It also achieved a concentration (0 and 5) g./l. of yeast showed significant differences in this characteristic compared to 10 grams of yeast, which had the lowest percentage of 17.071. As for the percentage of the effect of the interaction between organic fertilizer, poultry manure , and dry baking yeast 1.5 tons/ha with 5 grams of yeast, the highest percentage of dry matter in vegetative growth reached 21.550, and it differed significantly with some interaction coefficients, while the lowest percentage of dry matter in vegetative growth. The effect of the interaction between 1.5 tons/ha of organic fertilizer and 10 grams/liter of yeast reached 16.043, and the double interaction treatment between 2 tons/ha of organic fertilizer and poultry manure e with the type (Bloq IMPF1) achieved the highest value in that amounted to 20.659 at the probability level. 5% for the Duncan multiple test and the lowest value for the interaction effect of 1.5 tons of organic fertilizer with variety (Calif wonder MM75) was 18.104. It also appears from the data of the same table that the same interaction coefficients of 5 grams/liter of yeast with variety (1Bloq IMPF) were It has a significant effect on this trait, which achieved the highest percentage of 19.377 and the lowest percentage that resulted from the interaction effect between 10 grams/liter of yeast with variety (Calif wonder MM75) was 16.1278.

Table (6) The effect of organic fertilizer, yeast, varieties, and their interaction on the percentage of dry matter(%) in vegetative growth of pepper plants for growing season, spring 2023 *

Organic fertilizer (ton/donum	Dry yeast (g/l.)	Variety		Organic fertilizer x dry yeast
		Calif wonder MM75F	Bloq IMPF1	
0	0	eg 15.650	ce 17.803	cd 16.7267
	5	bd 19.203	h 13.243	d 16.2233
	10	b 20.427	df 16.850	b 18.6383
1.5	0	a 24.004	h 14.420	b 19.2122
	5	ce 17.683	a 25.417	a 21.5500
	10	h 12.623	bc 19.463	d 16.0433
	0	df 16.600	a 24.780	a 20.6900

2	5	fe 16.417	bc 19.470	bc 17.9433
	10	eg 15.333	ce 17.727	cd 16.5300
Organic x variety		Calif wonder MM75F	Bloq IMPF1	Organic fertilizer
0		bc 18.4267	d 15.9656	b 17.1961
1.5		c18.1037	ab 19.7667	a 18.9352
2		d 16.1167	a 20.6589	a 18.3878
Dry yeast x variety		Calif wonder MM75F	Bloq IMPF1	Dry yeast
0		ab 18.7514	ab 19.0011	a 18.8763
5		b 17.7678	a 19.3767	a 18.5722
10		c 16.1278	ab 18.0133	a 17.0706
Variety		b 17.5490	a 18.7970	

*The values with similar letters for each factor or their interactions individually do not differ significantly according to Duncan's polynomial test under the 5% probability level.

As it appears from Table (6) that the treatment The triple interaction between 2 tons of organic poultry manure with 0 grams of yeast and the type (Bloq IMPF1) achieved the highest significant value in this trait at the 5% probability level for the Duncan multinomial test, which amounted to 24.780 and the lowest percentage of dry matter in growth. It was the result of an interaction between 1.5 tons/ha of organic fertilizer and 10 grams of yeast with the variety (Calif wonder MM75), which amounted to 12.623 From Table (7), it appears that when using a level of 2 tons/ha of organic fertilizer from poultry manure , it had a significant effect on the area of one leaf, amounting to 43,408 cm^2, and the smallest area came from the level of 0 tons/ha of fertilizer from poultry manure e, which was 38,948 cm^2. The spraying treatment also 0 g. of yeast had a significant effect on this trait. It achieved the highest area per leaf, 43.966 cm^2, and it differed significantly with the other two concentrations. The variety (Calif wonder MM75) was also significantly superior than variety (Bloq IMPF1) in this trait. It gave the highest value for the area. The plant which reached 41,700 cm^2. As for the effect of the double interaction, poultry manure , 1.5 tons/ha with 0 grams of yeast, achieved the highest significant value for leaf area,

Table (7) The effect of organic fertilizer, yeast, varieties, and their interaction on the area of one leaf (cm^2) on the vegetative growth of pepper plants for growing season of spring 2023 *

Organic fertilizer (ton/donum	Dry yeast (g/l.)	Variety		Organic fertilizer x dry yeast
		Calif wonder MM75F	Bloq IMPF1	
0	0	dc 42.283	de 39.857	d 41.0700
	5	gh 34.673	h 34.103	g 34.3883
	10	b 46.913	hg 35.860	cd 41.3867
1.5	0	a50.450	a 51.653	a 51.0517
	5	eg 37.523	eh 36.897	f 37.2100
	10	fh 36.673	ef 39.360	ef 38.0167
2	0	gh 36.647	c42.903	de 39.7750
	5	b47.290	b 46.923	b 47.1067
	10	c 42.817	c 43.867	c 43.3417
Organic x variety		Calif wonder MM75	Bloq IMPF1	Organic fertilizer
0		b 41.2900	c 36.6067	c 38.9483

1.5	b 41.5489	b 42.6367	b 42.0928
2	b 42.2511	a 44.5644	a 43.4078
Dry yeast x variety	Calif wonder MM75	Bloq IMPF1	Dry yeast
0	b43.1267	a 44.8044	a 43.9656
5	c 39.8289	c 39.3078	c 39.5683
10	b 42.1344	c 39.6956	b 40.9150
Variety	a 41.6967	a 41.2693	

*The values with similar letters for each factor or their interactions individually do not differ significantly according to Duncan's polynomial test under the 5% probability level.

which amounted to 51,052 cm^2, and the lowest area per leaf, which was 34,388 cm^2, which came as a result of the effect of the double interaction, 0 tons of organic fertilizer with 5 grams. Of yeast, as the table shows that the binary interaction coefficient between 2 tons of organic fertilizer and poultry manure e with the first type (Bloq IMPF1) achieved the highest area per leaf, which amounted to 44.564 cm^2. Most of the interaction coefficients differed significantly, and the lowest area per leaf reached 36.607 cm^2. The result of the effect of the intervention between 0 tons of organic fertilizer (poultry manure) with cultivar (Bloq IMPF1) was as shown from the data in the same table that the interaction between 0 grams of yeast with cultivar (Bloq IMPF1) achieved the highest area per leaf, amounting to 44.804 cm^2. It was significantly superior to the rest of the bilateral interaction coefficients for these two treatment. As for the effect of the triple interaction between the three factors under study, it had a significant effect on this trait, this trait received the triple interaction treatment of 1.5 tons of organic fertilizer with 0 yeast with the first type (Bloq IMPF1), the highest area per leaf reached 51.653 cm^2 and the lowest area per leaf. One was due to the effect of the triple interaction between 0 tons of organic fertilizer and 5 grams of yyeast with the first type (Bloq IMPF1), which amounted to 34.103 cm^2.

Table (8) The effect of organic fertilizer, yeast, varieties, and their interaction on the total leaf area (cm^2/plant) of pepper plants for growing season of spring 2023 *

Organic fertilizer (ton/donum	Dry yeast (g/l.)	Variety		Organic fertilizer x dry yeast
		Calif wonder MM75	Bloq IMPF1	
0	0	bd 54308	hj36310	cd 45309
	5	cf 51788	j 32080	de 41934
	10	bc 57893	a 101762	a 75440
1.5	0	b 60819	be 52574	b 56697
	5	fi 43445	eg 45169	cd 44307
	10	gj 38553	gi 38197	e 38375
2	0	dg 46786	ij 37661	cd 42223
	5	ej 44250	df 47972	c 46111
	10	j 35185	j 34254	f34719
Organic x variety		Calif wonder MM75	Bloq IMPF1	Organic fertilizer
0		a 54663	ab 51087	a 52979.8
1.5		bc 47606	cd 45313	b 46459.5
2		de 42073	e 39962	c 41017.8

Dry yeast x variety	Calif wonder MM75	Bloq IMPF1	Dry yeast
0	a 53971	a42181	a 48076.1
5	a 46494	a 41740	b 44117.3
10	a 43877	a 52609	a 47986.2
Variety	a 48114	b 45237	

*The values with similar letters for each factor or their interactions individually do not differ significantly according to Duncan's polynomial test under the 5% probability level.

It appears from Table (8) that the levels of organic fertilizer had a significant impact on the total leaf area of the plant if it reached 5297.8 cm^2 at the level of 0 tons/ha of organic fertilizer from poultry waste, and the minimum area was when fertilized at a rate of 2 tons/ha of poultry waste per hectare if it reached 41017.8 cm^2. As for the concentration of dry yeast, the two concentrations (0 and 10) grams/liter gave the highest significant values for this characteristic, and they differed significantly with the concentration of 5 grams/liter, which amounted to 4417.3 cm^2. The second variety (Calif wonder MM75) was also significantly superior to the variety. The first (Bloq IMPF1) is a characteristic of the total leaf area of the plant. As for the percentage of the effect of the binary intervention between zero tons/ha of organic fertilizer mixed with 10 grams/liter of yeast, it achieved the highest leaf area per plant, amounting to 75440 cm^2, and it significantly outperformed the rest of the binary intervention treatments, while the binary intervention gave 2 tons/ha of fertilizer. The organic fertilizer with 10 grams/liter of yeast had the lowest leaf area of 34719 cm^2. As for the effect of the interaction between the organic fertilizer and the varieties, the double interaction treatment between 0 poultry waste and the second variety (Calif wonder MM75) achieved the highest leaf area of the plant, amounting to 54,663 cm^2 and less. The leaf area was the result of the interaction between two levels of organic fertilizer with the second type (Calif wonder MM75) and amounted to 39962 cm^2. As for the interaction between dry baking yeast and the types, it did not reach the level of significance for this characteristic when using the Duncan multinomial test at the 5% probability level. Table (8) also shows that the triple interaction between the three factors had a significant effect on this trait, if the interaction between 0 tons of organic fertilizer with 10 grams of yeast and the first type (Bloq IMPF1) achieved the highest leaf area per plant amounting to 101762 cm^2. The smallest area was the result of the triple interaction between organic fertilizer 2 tons and baking yeast 10 grams with the first type (Bloq IMPF1), which amounted to 34254 cm^2.

Discussion

Through the results shown in Tables (1, 2, 3, 4, 5, 6, 7, and 8), the organic fertilizer and poultry manure had a significant effect on the vegetative growth characteristics of pepper plants, represented by the content of chlorophyll A, B, and kidney, and in the height of the plant in cm. The number of side branches for each plant, the percentage of dry matter in vegetative growth, and the area of one leaf and the kidney of each plant (cm^2). These results may explain the high role of organic fertilizer, poultry manure e, as it contains the nutritional elements of nitrogen, phosphorus, potassium, organic matter, and the content of organic carbon and carbonic acid, which are important nutritional elements in plant nutrition, in addition to the iron element that enters into the composition of green matter. Poultry manure compost releases essential nutrients more quickly through microbial decomposition (Follett et al., 1981). The

role of organic fertilizer and poultry manure in improving the fertility and texture of the soil, which is an important basis for plant growth and development, as well as its role in improving the flavor and quality of the plant's yield (Huez-Lopez et al. 2011). These results were in line with (Shams, 2003; Berova et al., 2010, and Ann, 2012) for the characteristics of chlorophyll A, B and total chlorophyll content. These results are also consistent with (Legaspi et al., 2007; Efthimiadou, 2009; Taleb, 2012; Abo khdeer et al.; 2019, Dijlani et al., 2020; Abd-Alrahman and Aboud, 2021, and Gast Same, 2021) who mentioned Through their study, organic fertilizer and poultry manure e significantly affected the vegetative growth indicators of pepper plants, which are plant height, the number of side branches for each plant, and leaf area. It appears from Tables (3, 4, 5, 7 and 8) that dry yeast had a significant effect on the characteristics of vegetative growth, represented by the content of chlorophyll B and kidneys, the height of the plant in cm, and the area of one leaf and the kidney of the plant. These results may be explained by the effect dry yeast is considered a vital nutrient for the plant during the stages of plant growth and development because it contains macro- and micro-nutrients and physical factors, in addition to containing germ cells that have a major role in plant nutrition and in its content of percentages of growth regulators, represented by auxins and cytokinins, which promote accumulation Carbohydrate substances in plants (Barnett et al., 1990) and are considered a rich source of proteins and an important source of tryptophan, which is a stimulant for the production of indole acetic acid, which plays an important role in growing, strengthening and promoting plant growth (Khedr and Farid, 2000 and Darweesh et al., 2003). And bread yeast contains sugars and amino acids (Abbas, 2013). It has the ability to produce essential substances for plant growth, such as the plant hormones claoxins and gibberellins (Shady, 1978 and Eata et al., 2001). Yyeast works to stimulate cell division and elongation and plays an important role in the synthesis of protein and DNA and an increase in the content of green matter in the plant. (Spencer et al., 1983). These results were in line with what was reported by (Ghoname et al., 2010; Dawa et al., 2012; EL-Shimi et al., 2015; Nahed et al., 2015; Abd-Alrahman and Aboud, 2021 ; Hanaa and Fatima, 2021 and Salloom et al. 2023) who reported through their results that dry yeast had a significant effect on the vegetative growth characteristics of pepper plants, represented by the total chlorophyll content, plant height, and the number of side branches of each plant, in addition to the leaf area of the plant. These results also came with many studies that used baker's yeast on other vegetable crops, which significantly affected vegetative growth indicators., Mady (2009) on faba, Abou El-Yazied and Mady (2011) on tomato plants, Abokhdeer et al. (2019) on squash plants, and Ibrahim (2019) on tomato plants. It appears from the data in tables (3, 4, 5, 6, 7, and 8) that the pepper varieties differed significantly among themselves in some vegetative growth indicators, represented by the characteristics of chlorophyll B and total content, plant height, the number of side branches for each plant, and the percentage of dry matter. In vegetative growth and in the total leaf area of the plant. This result may be explained by the genetic differences between the two pepper varieties under study and by the location of the gene on the chromosome that expresses itself to show the characteristic of vegetative growth, in addition to the difference in the response of the two varieties to the environmental conditions prevailing in the area and location of the study . These results were consistent with many evaluation studies that pepper varieties differ in value among them in vegetative growth indicators. These studies and research include (Ngozi and Uguru, 2006; Lagaspi et al., 2007; Marame et al., 2009; Sharma et al., 2010; McGregor and Walters, 2011; Al-Shammari, 2015; Bianchi et al. 2016; Rohini

et al., 2017, and Zeyad and Salman, 2021) showed that the varieties and genotypes of pepper differ significantly from each other in vegetative growth indicators. As for the effect of the interaction between organic fertilizer, poultry manure e, and dry baking yeast, vegetative growth indicators in pepper, it is clear from tables (1,2,3,4,5,7 and 7) they were significantly affected by Duncan's multinomial test at the 5% probability level. On the characteristics of the chlorophyll B and total content in vegetative growth, the height of the plant, the number of side branches for each plant, and the percentage of dry matter in vegetative growth, in addition to the area of one leaf and the total per plant cm2. This result may be explained by the combined effect of the two factors: organic fertilizer and yeast, which contain nutritional mineral elements , in addition to the plant hormones and amino acids contained in dry yeast (Barnett et al., 1990). Yeast is also considered a rich source of proteins and mineral nutrients that have It plays a major role in plant growth and improvement through the vegetative indicators of the tables above. This is what many studies have confirmed regarding this (Fathy and Farid 1996; Abbas, 2013; Eata et al. 2001 and Darweesh et al., 2003). It is also clear from the data in the tables above for vegetative growth indicators that there is a clear significant effect of the bilateral interaction between pepper varieties and the levels of organic fertilizer and poultry manure e. These results may be explained by the macro- and micro-nutrient elements the organic fertilizer contains, in addition to organic matter, which plays a major role in Plant growth and nutrition, which works to improve growth and vegetative growth characteristics (tables above), and the interaction of the effect of organic fertilizer with the genetic indicators carried by each type and the location of the gene expressing itself on the chromosome, so that they worked to show the interfering effect between them on the vegetative growth characteristics of the pepper plant, in addition to The response of the two varieties of pepper varied under the influence of the interaction of genetic indicators for each variety with organic fertilizer, poultry manure e, and the prevailing environmental conditions at the study site, which are considered a good cradle for the growth, spread, and activity of root hairs. In addition, the organic fertilizer works to activate the microbial organisms present in the root bud, which work to Activating the activity of root hairs in strengthening and enhancing the plant's ability to benefit from them through the absorption of these organisms and nutritional mineral elements. They were the reason for activating and enhancing the strength of these vegetative characteristics of the plant. There was also a clear significant effect of the interaction between the varieties and dry yeast on the vegetative growth characteristics of pepper plants (tables above) above. These results may be explained by the cumulative interaction effect of pepper varieties and dry yeast on the vegetative growth indicators. As for the effect of the triple interaction between the factors under study (varieties, organic fertilizer, poultry manure e, and dry yeast), it appears from the tables above that there is a cumulative effect of these factors on the characteristics of vegetative growth.

5. Conclusion

Through the results obtained from this study, we conclude that the Sweet pepper Boq IMPFI variety was better than the other variety in terms of vegetative growth characteristics, and that using 1.5 tons/acre produced the best results, and spraying pepper plants with a concentration of 5 g/liter achieved the best results. Significance in the characteristics of vegetative growth.

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