Efficiency of some sustainable agriculture applications on traits of two cultivars of broad beans *Vicia faba* L.

Ehab Nawfal Mageed[1*], Muthanna Abdulbasit Ali[2]

1- Iraqi Ministry of Education, General Directorate of Education of Nineveh, Iraq

2- Department of Field Crops, College of Agriculture and Forestry, University of Mosul, Mosul, Iraq.

*Corresponding author's email: ehab.22agp40@student.uomosul.edu.iq

Email addresses of coauthors: drmothanaalameri86@.uomosul.edu.iq

Abstract

A field experiment was conducted during the agricultural season for the year 2022-2023 in Nineveh province and for two location, the first in the Al-Rashidiyah area, a suburb of Mosul District, and the second location in Al- Yerganti area - a suburb of Al-Hamdaniyah District, to study the effect of soaking treatments with water and different concentrations of bread yeast 3 and 6 $g.L^{-1}$ for 12 hours for two cultivars of broad bean (Histal, luz de otono), the results showed that the spraying treatments with 3.6 $g.L^{-1}$ of bread yeast was significantly excelled with Histal cultivar in most studied traits and for both location, except for the protein percentage trait at Al- Yergenti location, where the Luz de Otono cultivar excelled. The spraying treatment with a concentration of 6 $g.L^{-1}$ of bread yeast excelled on the other treatments used for all the studied traits and for both location, while The bi-interaction recorded a significantly excelled, especially the interactions in which one of the components is the Histal cultivar and the spray treatment with a concentration of 6 $g.L^{-1}$ of bread yeast.

Keywords: broad bean , bread yeast, spraying, soaking

introduction:

It is no secret to those interested in the field of food security the great importance of broad bean and its role in achieving sustainable agriculture, where this crop is considered the basic food for millions of people in countries, whether poor or with certain customs and traditions. The reason is that its seeds contain high concentrations of protein, 24-35%, and carbohydrates 51-68% and minerals such as potassium, calcium, iron, and zinc (14), and broad bean is considered one of the most important leguminous crops grown in the world (10). In addition, broad bean increases soil fertility because it works to raise the nitrogen content in the soil. This is done through the root nodules found in the roots that fix nitrogen (8). The difference in the response of cultivars to environmental conditions and crop service operations depends on the genetic nature of the cultivar in addition to its adaptation to different environmental conditions, as well as on the variation in its response to fertilizers and their levels. (11), thus achieving part of the goals of sustainable agriculture. The method of treating plants with bread yeast (Saccharomyces cervisiae) is one of the most promising methods used in the agricultural field to achieve sustainable agriculture. It is a natural material that does not contain any chemical substance in its manufacture that increases pollution in the environment. Saccharomyces cervisiae bread yeast is a biological stimulant and natural bio fertilizer that clearly enhances the growth and productivity of many crops (2), and has a clear and important role in increasing the effectiveness of enzymes and improving the absorption of nutrients and

ISSN 2072-3857

others, which stimulates the vegetative growth of the plant in general (1). The use of fertilizers and growth regulators alone is not sufficient to raise the productivity of broad bean unless a cultivar is used with high efficiency in exploiting the nutrients available in the soil in addition to other environmental factors to increase the efficiency of plant growth and then transform the products of the photosynthesis process into a yield with high economic returns (6). In order to provide the missing elements from the soil, it was necessary to find a safe method that helps increase the activity of microorganisms, which reflects their role positively in the growth and productivity of the crop (5). Treating plants with Saccharomyces cervisiae bread yeast was one of the most promising methods in the agricultural field, which seeks to reduce the use of chemicals, as it is a natural material that does not contain any chemical substance that pollutes the environment in its manufacture, and bread yeast is a single-celled eukaryotic microorganism that belongs to the kingdom of fungi (19), and bread yeast is considered Saccharomyces. cervisiae is one of the biological stimulants and natural biofertilizers that clearly enhance the growth and productivity of many crops (2) as it is a natural source of cytokinins that stimulate cell division and differentiation and contribute to the synthesis of amino or nuclear acids, and thus the production of protein and chlorophyll (7), and it has a clear role in increasing the effectiveness of enzymes and improving nutrient absorption, which in turn stimulates the vegetative growth of the plant in general (1).

Materials and Methods:

The experiment was conducted during the agricultural season for the year 2022-2023 and for two different location, the first location was Al-Rashidiya on the northern outskirts of the city of Mosul (about 10 km from the city center of Mosul) and the second location in the Yerganti area - a suburb of Al-Hamdaniya district. The experiment included studying the effect of soaking and spraying treatments with different concentrations of bread yeast in traits of two cultivars of broad bean. All agricultural operations were conducted identically for all experimental units. The rain that fell during the growing season was also relied upon (Tables 1 and 2). The soil was also analyzed according to Table (3) to know its physical and chemical traits. The experiment included two factors, the first was two cultivars (Histal and Luz de otono), and the second was soaking the seeds and spraying the plants with 3, 6 $g.L^{-1}$ of bread yeast, as shown in Table 4. The experimental units for each replicate were 10 units. The dimensions of the experimental unit were 2*2 m, with an area of 4 m^2 and a line length of 2 m. Where 10 plants were planted, between one hole and another 20 cm and between one line and another 50 cm. The distance between the experiment unit and another was 50 cm and between the replications were 1 m. The seeds were planted in the first location on November 17/2022, and the second location on November 20/2022, at depth of around 3-5 cm, the Luz de cultivar was harvested Luz de otono and for the two experiment location on 4/15/2022, and the Histal cultivar was harvested on 5/8/2022. For both experiment location, the Duncan multiple range test was used to determine the most significantly excelled differences between the means.

ISSN 2072-3857

Table (1) Rainfall for Al-Rashidiya location

Rainfall and temperature status for each location	Relative humidity (%)	Minimum temperature	Maximum temperature	Month
38.5	78	7	26	November 2022
11.5	87	3	15	December 2022
51	84	4	17	January 2023
17.5	83	2	18	February 2023
17.5	81	11	24	March 2023
17.5	75	8	24	April 2023
153.5 mm	Total			

Table (2) Rainfall for Al- Yerganti location

Rainfall and temperature status for each location	Relative humidity (%)	Minimum temperature	Maximum temperature	Month
45	78	7	26	November 2022
2	87	3	15	December 2022
49	84	4	14	January 2023
26	83	2	17	February 2023
26	81	11	18	March 2023
26	75	8	24	April 2023
174 mm	Total			

Table (3): Some physical and chemical traits of the soil of the two experimental sites.

soil % separations		PH	EC (dS/m)	K (ppm)	P (ppm)	N (ppm)	Organic matter %	Calcium carbonate %	Soil texture	location
14.7	Clay	7.5	2.2	120	45.0	156.5	2.59	41	Silty loam	Al-Rashidiya
64	Silt									
21.3	Sand									
48.2	Clay	7.3	0.2	56	25.0	58.7	2.06	31.5	Clay	Al-Yerganti
36	Silt									
15.8	Sand									

Source (Central Laboratory / College of Agriculture and Forestry)

ISSN 2072-3857

Table (4): Componentsof bread yeast

%	Elements
1.2	N
0.13	P
1.2	K
0.013	Mn
0.02	Ca
0.01	Na
0.07	Mg
0.04	Zn
0.04	Cu
0.016	B
0.0003	Mo
5.3	Total protein
4.7	Carbohydrates
0.5	IAA
0.03	GA3

Results and discussion :

The Histal cultivar was significantly excelled on the Luz de Otono cultivar in Al-Rashidiya and Al-Yerganti experiment location, recording a significantly excelled for the traits: plant height (85.160, 066.10 cm), pod length (24.454, 023.48 cm), number of pods (16.180, 013.50 pods. Plant-1), and weight of 100 seeds. (128.200, 124.340 g), seed yield (098.14, 085.20 gm), biological yield (285.658, 289.620 gm. plant^{-1}), and harvest index (34.176, 28.600%), while the Luz de Otono cultivar gave the lowest significant value for the above traits (5 42.880, 4.534 cm , 017.62, 20.000 cm, 11.208, 11.140 pods, 107.400, 108.080 g, 71.816, 070.14 gm, 0212.11, 0256.10 gm 7.280% respectively, and the Histal cultivar excelled may be due to most of traits The studied plant is due to the large size of the plant, which in turn is due to genetic differences compared to the Luz de Otono cultivar, which is smaller in size than the first cultivar, and thus this was reflected in traits of the two cultivars. These results agreed with (4), and the ability of each cultivar to express its genetic contents is very clear. In the standard traits of the cultivars, the Histal cultivar is characterized by the large size of the plant, and this is reflected positively on its components, including the pod length. In contrast to the Luz de otono cultivar, the Histal cultivar was significantly excelled on the Luz de otono cultivar in the attribute of protein percentage, and for the Al-Rashidiya location, it recorded 19.86%, while it recorded The Luz de otono cultivar had the lowest significant value (18.81%). As for Al-Yerganti experiment location, the data in the table below showed that the Luz de otono cultivar recorded a significantly excelled for the trait, amounting to 19.46%, while the Histal cultivar recorded the lowest value for the trait, amounting to 19.02%. The Luz de

ISSN 2072-3857

Otono cultivar was significantly excelled on the Histal cultivar in Al-Rashidiya and Al-Yerganti experimental location for the number of seeds (6.052, 05.96 seeds. pod^{-1}) while the Histal cultivar gave the lowest significant value 04.80, 05.12 seeds. pod^{-1} for Al-Rashidiya and Al-Yerganti experiment location. The reason for the superiority of the Luz de Otono cultivar over the Histal cultivar in this trait is attributed to the role played by the genetic factor of the cultivar, where the seed size The Luz de Otono cultivar is smaller in size than the seeds of the Histal cultivar, and there is an inverse relationship between the seed size and the number of seeds, as the smaller the seed size, the greater the number of seeds. This results is consistent with those who stated that it is not possible to improve all components of seed yield at the same time and for all location. These results were consistent with the results of (16) and (17).

The most important results of the soaking and spraying treatments indicate the excelled of the spray treatment at a concentration of 6 g.L^{-1}, for both Rashidiya and Yerganti experiment location, recording a significantly excelled for plant height (74,735, 62,000 cm), pod length (22,250, 24,450 cm) and number of pods (15,515, 14,800 pods. plant^{-1} 100 seed weight recipe (122.500, 122.850 gm), seed yield recipe (107.685, 113.700 gm), harvest index recipe (38.890, 34.400%) and protein percentage recipe (23.27, 22.44%), while control treatment recorded the lowest significant value for the above-mentioned traits (65.215, 47.650 cm, 010.75, 09.75 pods.plant^{-1}, 110.000, 108.860 g, 51.900, 51.250 g, 22.975, 21.150%, 16.20, 17. 26%, respectively, with regard to the interaction between the cultivars and treatments used in this study, the spraying treatment with bread yeast at a concentration of 6 g.L^{-1} was excelled on the plants of the Histal cultivar in the two experimental location (Rashidia and Yerganti) for both traits: plant height (90,100, 74,800 cm) and pod length (26,370, 27,000). cm) and number of pods. plant^{-1} (18.630, 017.10 pods. plant^{-1}), weight of 100 seeds (0134.00, 132.700 gm), seed yield (120.090, 0133.40 g), biological yield (326.920, 356.300 g. Plant^{-1}), and percentage of protein (24. 42, 22.83% While control treatment with the Luz de otono cultivar recorded the lowest rate of the above-mentioned characteristics in the two experimental location, respectively (50.130, 37.500 cm), (016.97, 017.20 cm), (10.200, 09.50 pod.plant^{-1}), (101.000, 0100.70). Seeds), (45.170, 51.600 g), (201.960, 243.000 g.plant^{-1}), (16.19, 17.98%). The interaction of the Luz de otono cultivar with the spray treatment at a concentration of 6 g recorded a significantly excelled in the number of seeds for both location, where it reached 06.84, 06.80, Qarna,1 while the double interaction of the soaking treatments used for the seeds of the Histal cultivar recorded the lowest significant average for both location. The reason for this superiority may be due that the yeast extract contains many growth hormones such as cytokinins, gibberellins, auxins, and group B vitamins. These growth-promoting molecules have an effect It stimulates cell division, expansion, and the biosynthesis of proteins (18), (2), and (7), in addition to its promising role in stimulating the vegetative growth of plants (1). It works to raise the nitrogen content in the soil by effective root nodules found in the roots that fix nitrogen (8). Bread yeast also contains high percentages of proteins, carbohydrates, reducing sugars, amino acids, enzymes, as well as mineral elements (N, P, K, Mg, Ca, Na, Mn, Zn, Cu, B, and Mo) (14), and a natural source of many growth stimulants such as thiamin, riboflavin,

ISSN 2072-3857

niacin, pyridoxine, and vitamins B1, B2, B3, (13) and (3) These substances helped increase the height of the bean plant when using bread yeast, and these results are in line with what was found by (15), (9), and (12).

Table (5) The effect of study factors on the studied traits for both location

t	Pod length		Number of pods		Number of seeds per pod		Weight of 100 seeds		Seed yield/plant		Biological yield		Harvest in	
	R	Y	R	Y	R	Y	R	Y	R	Y	R	Y	R	
10	24.454 A	23.48 A	16.18 A	13.50 A	4.80 B	5.12 B	128.20 A	124.34 A	98.14 A	85.20 A	285.658 A	289.62 A	34.176 A	2
88	17.62 B	20.00 B	11.208 B	11.14 B	6.052 A	5.96 A	107.40 B	108.082 B	71.816 B	70.14 B	212.11 B	256.10 B	33.582 B	2
65	20.50 B	19.30 C	10.75 C	9.75 D	4.58 D	5.00 C	110.00 B	108.855 D	51.900 D	51.250 E	227.020 B	242.500 C	22.975 C	2
80	20.32 B	21.15 B	12.82 B	11.25 C	5.185 C	5.15 C	114.00 B	114.35 C	72.975 C	63.500 D	215.545 B	246.450 C	33.735 B	2
65	21.00 AB	21.85 B	13.95 B	12.20 C	5.46 BC	5.15 C	120.00 A	117.15 B	87.055 B	68.950 C	231.335 B	251.050 C	37.385 A	2
85	21.115 AB	21.95 B	15.435 A	13.60 B	6.02 A	5.90 B	122.50 A	117.85 B	105.275 A	90.950 B	290.975 A	296.000 B	36.410 A	3
00	22.25 A	24.45 A	15.515 A	14.80 A	5.885 AB	6.50 A	122.50 A	122.85 A	107.685 A	113.700 A	279.545 A	328.300 A	38.890 A	3
80	24.03 B	21.40 BCD	11.30 DE	10.00 FG	4.59 C	4.40 C	119.00 C	117.00 D	58.630 E	50.900 G	252.080 BC	242.000 C	23.600 D	2
40	22.97 B	22.70 BC	14.57 C	11.70 CDE	4.58 C	4.70 C	126.00 B	122.00 C	82.630 D	64.700 F	226.920 CD	256.900 C	36.460 B	2
20	24.50 B	23.00 BC	16.80 B	13.00 C	5.14 BC	4.60 C	128.00 AB	123.30 C	106.180 B	68.400 E	274.670 B	248.500 C	38.640 AB	2
80	24.40 B	23.30 B	19.60 A	15.70 B	4.76 C	5.70 B	134.00 A	126.70 B	123.170 A	108.600 B	347.700 A	344.400 A	35.430 B	3
80	26.37 A	27.00 A	18.63 A	17.10 A	4.93 C	6.20 AB	134.00 A	132.70 A	120.090 A	133.400 A	326.920 A	356.300 A	36.750 B	3

ISSN 2072-3857

50	16.97 C	17.20 E	10.20 E	9.50 G	4.57 C	5.60 B	101.00 E	100.70 I	45.170 F	51.600 G	201.960 DE	243.000 C	22.350 D	21
20	17.67 C	19.60 D	11.07 DE	10.80 EFG	5.79 B	5.60 B	102.00 E	106.70 H	63.320 E	62.300 F	204.170 DE	236.000 C	31.010 C	20
10	17.50 C	20.70 CD	11.10 DE	11.40 DEF	5.78 B	5.70 B	112.00 D	111.00 F	67.930 E	69.500 E	188.000 E	253.600 C	36.130 B	27
40	17.83 C	20.60 CD	11.27 DE	11.50 CDE	7.28 A	6.10 AB	111.00 D	109.00 G	87.380 CD	73.300 D	234.250 CD	247.600 C	37.390 AB	29
20	18.13 C	21.90 BCD	12.40 D	12.50 CD	6.84 A	6.80 A	111.00 D	113.00 E	95.280 C	94.000 C	232.170 CD	300.300 B	41.030 A	31

References

1. Abbas, S. M. (2013). The influence of biostimulants on the growth and on the biochemical composition of Vicia faba CV. Giza 3 beans. Romanian Biotechnological Letters, 18(2), 8061-8068.
2. Abd El-Motty, E.Z.; Shahin, M.F.M.; El-Shiekh, M.H.; Abd-El-Migeed, M.M.M. (2010). Effect of algae extract and yeast application on growth, nutritional status, yield and fruit quality of Keitte mango trees. Agric. and Bio. J. of North Amer., 1:421-429.
3. Abdelaal, K. A., Hafez, Y. M., El Sabagh, A., & Saneoka, H. (2017). Ameliorative effects of Abscisic acid and yeast on morpho-physiological and yield characteristics of maize plant (Zea mays L.) under water deficit conditions. Fresenius Environmental Bulletin, 26(12), 7372-7383.
4. Al-Azir, Osama Marai (2022), Response of growth and yield of two cultivars of faba bean Vicia faba L. to antioxidants and diammonium phosphate fertilizer, University of Mosul - College of Agriculture and Forestry, Master's thesis.
5. Al-Obaidi, Saddam Ibrahim. (2020). The effect of methods of using seaweed extract and humic acid on the growth characteristics, yield and its components of the faba bean crop (Vicia faba L.), University of Mosul - College of Agriculture and Forestry, Master's thesis.
6. Al-Rawi, Diaa Saleh Allawi and Bashir Hamad Abdullah Al-Dulaimi.

ISSN 2072-3857

(2017). The effect of spraying with salicylic acid and ascorbic acid on some physiological and productive traits of two cultivars of fava beans. Al-Anbar Journal of Agricultural Sciences. 15 (1): 1-16.

7. Amer, S. (2004). growth, green pods yield and seeds yield of commom bean (phaseolus vulgaris l.) as affected by active dry yeast, salicylic acid and their interaction. Journal of Plant Production, 29(3), 1407-1422.
8. Dashadi, M., Khosravi, H., Moezzi, A., Nadian, H., Heidari, M., & Radjabi, R. (2011). Co-inoculation of Rhizobium and Azotobacter on growth of faba bean under water deficit conditions. American-Eurasian Journal of Agriculture & Environmental Sciences, 11(3), 314-319.
9. El-Kamar, F. A. (2020). Effect of Humic Acid and Yeast Waste Application on Fababean (Vicia Faba) Yield, Yield Components and some Soil Properties of Salt Affected Soil. Journal of Soil Sciences and Agricultural Engineering, 11(9), 483-488.
10. FAO, F. (2018). Food and agriculture organization of the United Nations. Rome, URL: http://faostat. fao. Org.
11. Issa, Talib Ahmed. 1990. Physiology of Crop Plants (translated). College of Agriculture - University of Baghdad, p. 493.
12. Khader, Wafa Suleiman (2020) The effect of spraying with a suspension of bread yeast and plant density on some components of broad bean. Syrian Journal of Agricultural Research.
13. Marzauk, N. M., Shafeek, M. R., Helmy, Y. I., Ahmed, A. A., & Shalaby, M. A. (2014). Effect of vitamin E and yeast extract foliar application on growth, pod yield and both green pod and seed yield of broad bean (Vicia faba L.). Middle East J Appl Sci, 4(1), 61-67.
14. Megawer, E. A., Abd El-Samie, F. S., El-Sherif, A. M., & Mohamed, M. S. (2021). Exogenous potassium or yeast extract boosts Faba bean seed yield and quality by modulating its components in nutrient-deficient soil. Discov Agric, 7(18), 166-172.
15. Mokhtar .Abdel-Rahman,. H., Hassan, H. R., Nassar, R. M., & Abdel-Aziz, H. S. (2020). Influence of foliar spray with yeast extract on faba bean plant (Vicia faba L.). Plant Archives, 20(1), 1439-1449.
16. Rafiq, Angie Fahad, Khaled Khalil Al-Jubouri (2020) The effect of humic acid and foliar spraying with iron and zinc on the yield characteristics of three bean genotypes. Kirkuk University Journal of Agricultural Sciences, Volume (11), Issue (3).
17. Sarhan, Ismail Ahmed (2022). The effect of phosphate fertilization on the growth and yield of three genotypes of beans. Iraqi Journal of Desert Sciences, Volume 12 (1): 29-37.
18. Taha, R., Seleiman, M. F., Alhammad, B. A., Alkahtani, J., Alwahibi, M. S., & Mahdi, A. H. (2020). Activated Yeast extract enhances growth, anatomical structure, and productivity of Lupinus termis L. plants under actual salinity conditions. Agronomy, 11(1), 74.
19. Youssef, F. A., El-Segai, M. U., Abou-Taleb, S. M., & Massoud, K. W. (2019). Response of cowpea (Vigna

unguiculata L.) plant to seaweed and yeast extracts. Plant Archives (09725210), 19(2).

ISSN 2072-3857