

Article

## Effect of spraying with organic nutrients and adding levels of potassium fertilizer on the growth and yield of red cabbage

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Available from: <http://dx.doi.org/10.21931/RB/CSS/2023.08.02.69>

### Abstract

The research was conducted at Research Station (A) of the College of Agricultural Engineering Sciences - University of Baghdad in the autumn season 2022-2021 to know the effect of spraying the organic fertilizer Fertiorgan and adding potassium fertilizer on the growth and yield of red cabbage. The research was done using a randomized complete block design R.C.B.D. with three replications. The first factor included spraying with the organic nutrient (Fertiorgan) with three concentrations (0, 1.5 and 3 ml. L<sup>-1</sup>) symbolized by F0, F1, and F2, respectively. The second factor included the addition of potassium fertilizer in the form of potassium sulfate at four levels (0, 100, 135 and 170 kg.ha<sup>-1</sup>) with a symbol K0, K1, K2, and K3, respectively. The results showed the superiority of the concentration (3 ml. L<sup>-1</sup>) of the organic nutrient in the characteristics of plant height (47.53 cm), stem length (18.83 cm), number of outer leaves (18.74 leaves. plant<sup>-1</sup>) and leaf area (1214.96 dm<sup>2</sup>.plant<sup>-1</sup>). The dry weight of the vegetative total was (225.92 g) and the total yield (45.53 tons. ha<sup>-1</sup>), and the level (170 kg. ha<sup>-1</sup>) of potassium fertilizer showed a significant increase for the same trait above, reaching (45.80 cm) and (17.72 cm) and ( 18.18 leaves. plant<sup>-1</sup>), (1171.02 dm<sup>2</sup>.plant<sup>-1</sup>), (208.11 g) and (40.48 tons. ha<sup>-1</sup>), As for the two working interactions, the interaction treatment (F2K3) was excelled in giving it the highest values for these traits, as it reached (52.62 cm), (21.39 cm), (21.55 leaves. ) and (1296.97 dm<sup>2</sup>.plant<sup>-1</sup>) and (248.33 gm) and (50.00 tons.ha<sup>-1</sup>)

**Keywords:** organic nutrients, red cabbage, potassium fertilizer, Fertiorgan.

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### Introduction

Brassica oleracea var. capitata L. belongs to the Brassicaceae family. It is a winter leafy crop. The eastern Mediterranean region is the original home of the red carnivorous plant. The head resulting from wrapping the leaves around the enlarged terminal bud is eaten, where every 100 grams of fresh leaves of the red cabbage plant contains 93.9-88.8% moisture, 11.2-6.1% dry matter, 5.4-3% carbohydrates, 2-1% proteins, and 0.2% fat, 49 mg of phosphorous, 238 mg of potassium, 9 mg of magnesium, in addition to some vitamins<sup>1</sup>, It contains anthocyanin pigment, which is a powerful antioxidant <sup>2</sup>. Recently, companies specializing in fertilizers started to produce humic and non-humic organic nutrients. They encouraged the spread of these nutrients because of their impact on increasing production and being environmentally safe. <sup>3,4</sup>Also, the foliar spraying of organic fertilizers

increased production by 15-30% compared to the control treatment<sup>5</sup>. found a significant increase when spraying cauliflower with organic nutrient (Vegamino at a concentration of 1 ml. L<sup>-1</sup>) in the traits of vegetative growth represented by plant height, leaf area and dry weight of the vegetative group; on the other hand, potassium is one of the determinants of production, in addition to being one of the main elements needed by the plant, where the plant needs relatively large quantities of potassium<sup>7</sup>. Its role in maintaining the water balance is highlighted by controlling the opening and closing of stomata<sup>8</sup>, regulating the osmotic effort in the cells, and increasing the inflated pressure of the cells<sup>9</sup>. The potassium deficiency may negatively affect the distribution of manufactured carbohydrates in the leaves and their transfer to other parts of the plant<sup>10</sup>. Therefore, the research aimed to know the effect of spraying with organic nutrients with levels of potassium fertilizer on the growth and yield of the red cabbage plant.

### Materials and methods

The research was conducted at Research Station (A) of the College of Agricultural Engineering Sciences - University of Baghdad (Al-Jadiriya Complex) for the autumn season 2021-2022 to find out the effect of spraying the organic nutrient Fertioorgan and adding potassium fertilizer on the growth and yield of the red cabbage plant. Urea fertilizer was added as a source of nitrogen and triple superphosphate fertilizer as a source of phosphorous, and according to the fertilizer recommendation (125 kg N and 135 kg P), Phosphate fertilizer was added at once when planting and nitrogen fertilizer in two batches, the first 10 days after transferring the seedlings, and the second batch one month after the first batch. The treatments were as follows: The treatment of the organic fertilizer Fertioorgan of Spanish origin (the manufacturer's recommendation is 2 ml. L<sup>-1</sup>) with three concentrations (0, 1.5 and 3 ml. L<sup>-1</sup>) with a symbol F0, F1, F2, respectively. The plants were sprayed until entirely wet, three sprays. The first spray was two weeks after the transplanting process, the second was two weeks after the first spray, and the third was when the heads were wrapped. The spraying process was carried out in the early morning. The second factor included the addition of potassium fertilizer in the form of potassium sulfate at four levels (0, 100, 135 and 170 kg.ha<sup>-1</sup>) symbolized by K0, K1, K2, and K3, respectively. Potassium fertilizer was added in two batches; the first batch was a week after planting the seedlings in the field, and the second batch was at the beginning of the heads turning. A factorial experiment (4×3) was designed using the R.C.B.D. randomized complete block design with three replicates. The experiment included 36 experimental units, in each experimental unit 15 plants. The averages of the treatments were compared with the L.S.D. test at a probability level of 5%.

studied traits

1. Plant height (cm)
2. stem length (cm)
3. The number of outer leaves of the plant (leaf. plant<sup>-1</sup>)
4. Total leaf area of the plant (dm<sup>2</sup>.plant<sup>-1</sup>)
5. Vegetative dry weight (g)
6. Total yield (tons. ha<sup>-1</sup>)

### Results

The results in Table 1 indicate significant differences in traits of vegetative growth and the total yield due to spraying the organic nutrient Fertioorgan, especially the F2 treatment. The plant height, the stem length, the number of external leaves of the plant, the leaf area, the dry weight of the vegetative total and the total yield (47.53 cm, 18.83 cm, and 18.74 leaves. Plant<sup>-1</sup>, 1214.96 cm<sup>2</sup>, 225.92 g, 45.53 tons. ha<sup>-1</sup>) respectively. The control treatment for the same traits gave the

lowest value, which was (41.70 cm, 15.70 cm and 16.14 leaves. plant<sup>-1</sup>, 1038.92 dm<sup>2</sup> and 163.17 g and 29.46 tons. ha<sup>-1</sup>) respectively; as for the effect of potassium fertilizer on the same traits, we note from the table the treatment of K3 excelled on the rest of the levels. The height of the plant, the length of the plant stem, the number of outer leaves, the leaf area, the dry weight of the vegetative total and the total yield (45.80 cm, 17.72 cm and 18.18 leaves. Plant<sup>-1</sup> and 1171.02 dm<sup>2</sup>, 208.11 g and 40.48 ton ha<sup>-1</sup> respectively. The control treatment for the same traits gave the lowest value (42.69 cm, 15.22 cm and 16.53 leaves. plant<sup>-1</sup>, 1079.81 dm<sup>2</sup> and 181.67 g and 33.93 tons. ha<sup>-1</sup>), respectively. As for the two interactions, the (F2K3) treatment excelled in giving it the highest values for the traits of vegetative growth and the total yield of the red cabbage, where it reached the height of the plant, the length of the stem, the number of outer leaves of the plant, the leaf area, the dry weight of the vegetative total and the total yield (52.62 cm, 21.39 cm and 21.55 leaves. plant<sup>-1</sup>, 1296.97 dm<sup>2</sup>, 248.33 g, and 50.00 ton.ha<sup>-1</sup>) respectively. The control treatment for the traits gave the lowest value as it reached (38.96 cm, 13.44 cm, 13.81 leaves. plant<sup>-1</sup>, 989.60 dm<sup>2</sup>, 150.67 g and 26.79 tons. ha<sup>-1</sup>) respectively. This is due to the components of the organic nutrient and potassium fertilizer.

treatments	Total yield (tons. ha <sup>-1</sup> )	Vegetative dry weight (g)	Leaf area (dm <sup>2</sup> )	Number of outer leaves (leaf. plant <sup>-1</sup> )	stem length(cm)	plant height (cm)	
F0	29.46	163.17	1038.92	16.14	15.70	41.70	
F1	36.36	192.50	1110.91	17.58	16.22	43.93	
F2	45.53	225.92	1214.96	18.74	18.83	47.53	
L. S. D	0.571	1.122	3.001	0.412	0.607	1.308	
K0	33.93	181.67	1079.81	16.53	15.22	42.69	
K1	36.17	189.00	1106.64	16.78	16.93	44.40	
K2	37.90	196.67	1128.92	17.84	17.24	44.66	
K3	40.48	208.11	1171.02	18.18	17.72	45.80	
L. S. D	0.659	1.295	3.465	0.475	1.214	1.511	
F×K							
F0	K0	26.79	150.67	989.60	13.81	13.44	38.96
	K1	29.17	160.00	1035.13	16.11	15.80	43.00
	K2	30.36	165.33	1064.97	17.11	16.44	43.96
	K3	31.55	176.67	1065.97	17.55	15.44	41.89
F1	K0	33.33	182.00	1069.20	17.22	15.89	43.44
	K1	35.31	192.67	1097.90	18.22	16.66	46.29
	K2	36.90	196.00	1146.40	17.55	16.00	43.11
	K3	39.88	199.33	1150.13	17.33	16.33	42.88
F2	K0	41.67	212.33	1180.63	18.55	16.33	45.66
	K1	44.05	214.33	1186.90	16.00	18.32	43.92
	K2	46.43	228.67	1195.40	18.86	19.29	47.93
	K3	50.00	248.33	1296.97	21.55	21.39	52.62
L. S. D	1.142	2.243	6.002	0.823	0.701	2.617	

**Table 1. The effect of spraying the organic nutrient and adding levels of potassium fertilizer and the interaction between them on the vegetative growth and the total yield of the red cabbage plant.**

## Discussion

The organic nutrient contains organic matter in addition to the macro and Micro-elements needed by the plant, which is involved in the vital processes inside the plant represented by building proteins and enzymes in addition to growth hormones and porphyrin's important groups in the formation of chlorophyll and cytochromes, which are essential for photosynthesis, respiration and the formation of new cells, which leads to an increase in plant growth<sup>11</sup>. Potassium is directly absorbed from the leaves, which is crucial in increasing cell division and elongation<sup>12,13,14</sup>. It is a catalyst for the representation of proteins and enzymes accompanying the representation of carbohydrates, leading to increased vegetative growth. It also regulates the osmotic effort in cells, affecting the process of opening and closing stomata and the subsequent absorption of water and nutrients necessary for the growth and increase of vegetative growth<sup>15</sup>. We also notice from the table that there is a significant difference in the total yield of the red cabbage plant. The reason for the significant increase in the total yield is attributed to the role of organic nutrients and potassium fertilizers in increasing the products of carbon metabolism. The increase in carbohydrates accumulated in the plant, which was positively reflected in the yield, in addition to the fact that potassium works to transfer carbohydrates from the places of manufacture to the crop and store them in it by moving through the cell membranes and this contributes to the expansion of plant cells and an increase in their size<sup>16,17,18</sup>.

## Conclusions

The results showed the superiority of the concentration (3 ml. L<sup>-1</sup>) of the organic nutrient in the characteristics of plant height (47.53 cm), stem length (18.83 cm), number of outer leaves (18.74 leaves. plant<sup>-1</sup>) and leaf area (1214.96 dm<sup>2</sup>.plant<sup>-1</sup>). The dry weight of the vegetative total was (225.92 g) and the total yield (45.53 tons. ha<sup>-1</sup>), and the level (170 kg. ha<sup>-1</sup>) of potassium fertilizer showed a significant increase for the same trait above, reaching (45.80 cm) and (17.72 cm) and ( 18.18 leaves. plant<sup>-1</sup>), (1171.02 dm<sup>2</sup>.plant<sup>-1</sup>), (208.11 g) and (40.48 tons. ha<sup>-1</sup>), As for the two working interactions, the interaction treatment (F2K3) was excelled in giving it the highest values for these traits, as it reached (52.62 cm), (21.39 cm), (21.55 leaves. ) and (1296.97 dm<sup>2</sup>.plant<sup>-1</sup>) and (248.33 gm) and (50.00 tons.ha<sup>-1</sup>)

## References

1. Boras, Mitadi, Bassam Abu Turab and Ibrahim Al-Basit. Production of vegetable crops. Theoretical part. Al-Ajlouni Press. Damascus University, Faculty of Agriculture. Syria. 2011.
2. Bertuglia, S., S. Malandrino., A. Colantuoni. 1995. Effect vaccinium myrtillus anthocyanosides on its chemia reperfusion injury hamster cheek pouch microcirculation. *pharmacol Res*,31(3/4); 183-7.
3. Haddad, Suhail, Mitadi Bouras, and Ahmed Hariri. Effect of some humic compounds and amino acids on the vegetative characteristics and quality of cotyledon seedlings. Tishreen University for Research and Scientific Studies. Biology Series. 2009, 31 (1): 199-209.
4. Deore, G.B., A.S.L. imaye, B.M. Shinde and S.L. Laware . 2010. Effect of Novel Organic Liquid Fertilizer on Growth and Yield in Chili (*capsicum annum L.*) *Asian J.exp. Boil. sci.spl.pp* . 15-19.
5. Tugarinof, L. V. Some aspect lignogumat preparation application cropping. *J. Gavrish.*, **2002**, 5:15-17. (in Russian).
6. Al-Zamili, Naseer Fahem Yasser. 2012. The role of organic and chemical nutrients in the growth and production of cauliflower. Master Thesis . Department of Horticulture and Garden Engineering. faculty of Agriculture . Baghdad University . Iraq .
7. Ketterings, Q.M: S. D. Klausner, and K. J. Czymmet. Potassium recommendation for field crops in New York. Department of Crop and Soil Science Extension series E.O.L.- 6, Cornell University. 2001.

8. Al-Jumaili, Abdel-Wahhab Abdel-Razzaq. Mohammed Obaid Salloum Al-Jumaili. Effect of spraying with humic acid and potassium fertilizer on growth and yield of potato (*Solanum tuberosum* L.) under drip irrigation system. *Diyala Journal of Agricultural Sciences*. **2012**,4 (1): 205–219.
9. Abu Dahi, Youssef Muhammad and Muayyad Ahmad Al-Younis. Plant Nutrition Guide, Ministry of Higher Education and Scientific Research, Directorate of Dar Al-Kutub for Printing and Publishing. Baghdad University . Iraq . 1988.
10. Yang, X. E.; X. Liu, W. M.wang , Z . Q. Ye, A. C. luo. 2004. Potassium internal use efficiency relative to growth vigor, potassium distribution, and carbohydrate allocation in rice genotypes -J. of plant Nutrition, Vol .27. Issu.5.
11. Heldt, H., Plant Biochemistry. An update and Translation of The German Third Edition, Library of Congress Cataloging in Publication Data. U.S.A. 2005, pp. 630.
12. Jaspinder,S . K. and H. S. Grewal, Effect of split application of potassium on growth, *yield and potassium accumulation by soybean*. *Agroeco system J*. **2005**, 39(30)217-222.
13. Al-Dulaimi, Muhammad Ali Ahmed Darg. Response of Soybean Growth, Yield and Specific Characteristics of Potassium Fertilizer and Foliar Nutrition with Zinc. Master's Thesis, Department of Field Crops. College of Agriculture - University of Anbar. 2015.
14. Hanshal, Majed Ali. Effect of potassium fertilization levels on yield and quality of seeds of Einward cultivar peas. *Anbar Journal of Agricultural Sciences*. **2004**, 2 (2) 214: -219.
15. Al Rayes, Abdul Hadi Jawad. Plant Nutrition - Part Two - Nutrient deficiency - University of Baghdad - Iraq. 1987.
16. Salloum, Muhammad Ghassan, Mona Jamal and Abera Mualla. Plant Environmental Physiology. practical part. Damascus University Publications. College of Science. 2011, p. 247.
17. M. Ajeel, A.; A. Mehdi, L. . Effect Of Eruca Sativa Seeds Powder As Feed Supplementation On Some Physiological Traits Of Male Lambs. *Journal of Life Science and Applied Research*. 2020, 1, 20-30.
18. Ibraheem M W, Muhaimed A R, Mohammed Th. T. Leg cuts from Awaasi lambs fed a diet with varying levels of *Rhus coriaria* L., Physical dissection and chemical composition. *Revis Bionatura* 2022;7(4) 4. <http://dx.doi.org/10.21931/RB/2022.07.04.4>.

Received: May 15, 2023/ Accepted: June 10, 2023 / Published: June 15, 2023

Citation: Hadid, B.A.; Abdel Hussein, R.M.. Effect of spraying with organic nutrients and adding levels of potassium fertilizer on the growth and yield of red cabbage. *Revis Bionatura* 2023;8 (2) 69. <http://dx.doi.org/10.21931/RB/CSS/2023.08.02.69>