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Role of organic nutrient (Tecnokel) and application methods on some productive traits of two cauliflower hybrids (*Brassica Oleracea* var. botrytis)

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***Abstract*---**The experiment was carried out in the vegetable field of the Department of Horticulture and Landscape/College of Agriculture and Forestry/Mosul University, during the autumn growing season (2021). The experiment included the study of three factors, the first: two hybrids of broccoli (Raheq and Ice ball) ,the second factor included application methods of (foliar spray method and the method of adding to the soil)and third factor included the use of the organic nutrient (Tecnokel) at four concentrations (0, 2 , 4 and 6 $g.L^{-1}$) plants were treated with the organic nutrient during three stages of plant growth: - the first two weeks after seedling, second and the third with an interval of 15 days between one stage and another. Thus, the experiment included 16 treatments (2x2x4) arranged in a factorial experiment within split-plot using the Randomized Complete Block Design, the hybrids were placed in the main plots and the compatibility between the application methods and the organic nutrient concentrations in the sub-plots. Each treatment was repeated three times, the results were analyzed statistically, according to the design used and the comparison of means according to Duncan's polynomial test at the 0.05 probability level. The results can be summarized as follows: 1) hybrid Ice ball plants were significantly superior in the average weight of the curd, total yield of the curd, the weight of the marketing curd, and the marketing yield of the curds, while Raheq hybrid plants outperformed a significant decrease in the date of maturity and harvest 20% of the curds; 2) The application method to the soil had a significant decrease in the date of ripening

and harvesting of 20% of the curd compared to the foliar spray method; 3) The use of the nutrient at all its concentrations led to significant effects in most of the traits of the quantitative yield compared to the control plants.

***Keywords*---**organic nutrient (Tecnokel), cauliflower hybrids, vegetable.

Introduction

Cauliflower (Brassica oleracea var. botrytis) belongs to the Brassicaceae family with high nutritional value due to its low calories and high content of fibers, fatty acids and vitamins including B, C, E and A nutrients such as P, Mg, Fe and Mn (Kapusta _ Duch etal, 2019). In addition to the high nutritional value of the plant, it has medical benefits, as its medical benefits lie in the fact that it contains compounds that protect against bowel cancer, which are compounds formed by chewing cauliflower, vitamin A useful for the eyes, bones and teeth, diindolylmethane, which stands in the face of the growth of breast cancer cells, and a high percentage of fiber. Which helps build a healthy intestine, galactose, which prevents colon cancer-causing compounds, glucoraphanin, which keeps heart disease away, indole three-carbinol, which stops prostate gland cells from being infected with cancer, and calcium, which is important for bones and teeth (Sharma etal, 2004), which increased the demand for its consumption and drew the attention of many farmers and amateurs in recent years in the country with interest and expansion in its cultivation. Cauliflower is grown in most of the governorates of Iraq as a winter crop to obtain the curds, which is fused flower buds and is the part that is eaten before they open. The cultivated area is 990 hectares, and the production rate per unit area is 7266.94 g. ha^{-1}" (the Arab Organization for Agricultural Development, 2019). This requires studying the reasons and expanding the cultivation of the crop and trying to raise the productivity per unit area by using advanced agricultural methods and technologies in its production to provide the crop with good quality and high productivity in application to the use of varieties or hybrids, increasing yields can be achieved using nutritional technology or organic fertilization.‹The results of Ibrahim etal (2014) in Mosul indicated about the effect of ground application of seaweed extract (Acadin) by transmitting three concentrations (1, 2, and 3 $g.L^{-1}$)tThe results of this study showed that the two concentrations (2 and 3) $g.L^{-1}$ of this extract were significantly superior in the characteristics of the yield, weight of the curds and the total yield of the marketing curds in comparison with the first concentration, it was mentioned by Islam etal (2016) in India when they compared to five cultivars of cauliflower (Remi, White Excelle, Girija and White Marvel Pushpa) that Excelle White was significantly superior in the weight of the curds and the total and marketing yield The unit area of curds compared to the rest of the varieties. An experiment was conducted by Omar etal (2018) in Sulaymaniyah the study was carried out on the effect of decomposed animal manure (sheep waste) to the soil on the yield of two types of cauliflower led to a decrease in the number of days for the formation and maturity of the flowering s and gave a significant increase in the total yield of the curds. Manpreet etal (2018) in India studied 8 behavior of cauliflower genotypes they noticed that the two

orial structures Rijke Denali were the best among the eight , Rijk genotype achieved significant superiority in the total curds weight, while it was found through a study conducted by Hammad etal (2019) in Baghdad on the effect of fresh fertilizer. organic in quality of broccoli plants, where several organic fertilizers were used (cow rot, culling and poultry waste), the results of the study showed a significant increase when using organic fertilizers over untreated plants, where plants treated with organic fertilizer outperformed the soil in needing the least number of days of maturity and harvesting .In Bangladesh, when studying two cauliflower cultivars (White Angle and Snow White), the results showed that the White Angle cultivar needed the least number of days of intiation and exudation of curds and was significantly superior in the curds, total yield and market weight of curds compared to the cultivar Snow White (Eimon etal, 2019). As for Pade1etal (2019), in a study conducted on two cauliflower cultivars (Kathmandus and Snow Grace) in Nepal, they observed that the Snow Grace cultivar needed the least number of days for ripening and harvesting the curds, and it was significantly superior on the weight of the curds , the total yield per unit area and the percentage of phosphorus in curds compared to the Kathmandus cultivar. Hussain etal (2020) in Pakistan, when studying the effect of adding three organic fertilizers SMC PM FYM at a rate (3: 6: 15) ton per hectare, respectively, to a decrease in the number of days to form and advise curds and a significant increase in curd weight, Shrestha etal (2021), studied in China on two cauliflower cultivars (Snow Graces and Kathmandu Local). The results showed that plants of Snow Grace cultivar needed the least number of days to curd initiation and a significant increase in the weight of the cauliflower and the total yield.

Research aims

Evaluation and behavioral study of two hybrids of cauliflower imported under the conditions of Nineveh Governorate in order to test which is the best suitable for cultivation under the conditions of the region with the use of the organic nutrient (Tecnokel) with different concentrations and two ways of application: foliar spray and soil application in order to raise and improve productivity and find the best organic nutrition concentration that responds to cauliflower plants and to find the best triple interaction between hybrids, organic nutrient compositions and application methods.

Materials and Methods

The experiment was carried out in a vegetable field of the Department of Horticulture and Landscape /College of Agriculture and Forestry/Mosul University during the autumn growing season (2021). Two hybrid seeds of cauliflower (lee ball and Raheq) were used in the experiment. Plastic plates containing 50 eyes using peat moss as a medium for planting, after the formations reached the stage of three - four real leaves that were transplanting in the morning in the field with complete care while keeping the peatmoss around the roots during transplantation and maintaining soil moisture, the statistical analysis of the results was adopted using a system (SAS 2017) and Technological Polynomial Test, Choice Means at the Probability Level of 0.05 (Al-Rawi and Khalaf Allah, 2000). The experiment included the study of three factors**:**

The first factor: Hybrids

This factor included two hybrids of imported cauliflower, namely:

1. Raheq hybrid produced by the American company Vegetables Global, with a germination rate of 90% and a purity of 99%, produced on the date Well 2021 from the information on the seed envelope.
2. Ice ball hybrid produced by the American company Quantum, with a germination rate of 90% and a purity of 99%, produced on the date May 2020 from the information on the seed envelope.

The second factor: application methods, the application method was used.

1. Add to soil.
2. Foliar spraying.

The third factor: The organic nutrient (Tecnokel) consisted of four concentrations:

1- 0 $g.L^{-1}$(the comparison treatment).
2- 2 $g.L^{-1}$.
3- 4 $g.L^{-1}$.
4- 6 $g.L^{-1}$.

Studied traits

1 –speed of curd initiation (day).
2- date of ripening and harvesting 20% of curds (day).
3- average weight of the curds (gm. $curd^{-1}$).
4- total yield of curds (ton.Ha^{-1}).
5- average weight of marketing curd (g. $curd^{-1}$).
6- Marketing yield of curds (tons. Ha^{-1}).

Results and Discussion

1 - Speed of formation of the main curds (day):
The results of Table (1) show that the speed of curds initiation was not significantly affected by the hybrids factors and the two methods of application, while the use of 4 $g.L^{-1}$ of organic nutrient gave the least number of days in the speed of curds initiation , and thus this treatment differed significantly decreased only with the comparison treatment. As for the binary interaction between the hybrids and the application methods, the results indicate that there is no significant effect between the two hybrids and the two methods.

The results of the binary interaction between hybrids and the organic nutrient showed that the plants of the hybrid Raheq when treated with a concentration of 4 $gm.L^{-1}$ outperformed with a significant decrease and gave the least number of days for the curds initiation of their curds, which amounted to 81.66 days, and thus it differed significantly with the control plants for both hybrids, as well as it differed significantly with the plants treated with (2 and 6) $gm.L^{-1}$ in the case of

the Ice ball hybrid plants. The least number of days required for the curds initiation reached 83.73 days, which was reached when using the method of adding to the soil intertwined with the concentration of 4 gm.L^{-1} of organic nutrient. In the triple interaction between the studied factors, the Raheq hybrid plants needed when adding the organic nutrient to the soil at a concentration of 4 gm.L^{-1} lowest number of days required for the curds initiation which amounted to 78.80 days.

Table (1): Effect of hybrids, application methods, organic nutrient (Tecnokel) and interaction between them on the speed of curds initiation (day)

Hybrids	Application Method	Organic Nutrient Concentrations (Tecnokel) g.L^{-1}				Hybrids **X** Application Method	Average Hybrids effect
		0	2	4	6		
Raheq	Foliar spray	87.56 ab	85.83 bc	84.53 bc	82.70 bc	85.15 a	84.57 a
	Add to soil	87.26 b	85.86 bc	78.80 c	84.03 b c	83.99 a	
Ice ball	Foliar spray	95.66 a	86.80 bc	85.40 bc	88.13 a b	89.00 a	88.98 a
	Add to soil	89.66 ab	89.16 ab	87.34 b	89.66 ab	88.96 a	
Hybrids **X** Organic Nutrient	Raheq	87.41 ab	85.85 bc	81.66 c	83.36 bc	Average Effect Method add	
	Ice ball	92.66 a	87.98 ab	86.37 bc	88.90 ab		
Application Method **X** Organic Nutrient	Foliar spray	91.61 a	86.31 ab	84.96 b	85.41 b	87.07 a	
	Add to soil	88.46 ab	87.51 ab	83.07 b	86.85 ab	86.47 a	
Average effect of Organic Nutrient		90.04 a	86.91 ab	84.01 b	86.133 b		

*The averages that share the same letter for each factor and each overlap do not differ significantly between them according to Duncan's polynomial test at the probability level ($P < 0.05$).

2 The date of ripening and harvesting 20% of the curds (day)

The number of days required for ripening and harvesting of 20% of curds was significantly decreased in the hybrid Raheq plants compared with the hybrid Ice ball plants. While the use of the soil application method led to a significant decrease in this trait compared to the foliar spray method. While the concentrations (2 and 4) g.L^{-1} gave the least number of days from sowing seeds and until maturity and harvest 20% of the curds with a significant decrease only with the comparison plants (Table 2).

The results of the binary interaction between hybrids and the method of Application on the ripening and harvesting date of 20% of the curds show the superiority of plants hybrid Raheq and with both methods of adding a significant

decrease on the plants of the hybrid Ice ball and with the difference of the two methods of application, and the least number of days in this trait was 111 days found in the plants of the hybrid Raheq when using the method of adding to the soil, thus the treatment of this interaction with a significant decrease outperformed all other treatments.

It is evident from the binary interaction between the hybrid and the organic nutrient that the hybrid Raheq and with all the concentrations of the organic nutrient has a significant decrease of this trait over the plants of the hybrid Ice ball treated and untreated with the organic nutrient and the least number of days of maturity and the harvest of 20% of the curds was reached in the hybrid Raheq plants when using 4g.L^{-1} of the organic nutrient, it was 110.08 days. The lowest number of days required for ripening and harvesting 20% of the curds was reached in the case of the two-way interaction between the method of adding to the soil and using the organic nutrient at a concentration of 4 g.L^{-1}, where the treatment of this interaction recorded the lowest number of days 114.75 for ripening and 20% of the curds were harvested, and thus differed significantly with all the treatments of the application to the soil and the organic nutrient 2 g.$L^{-1.}$ From the observation of the triple interaction between the three studied factors, it was found that all treatments of the hybrid Raheq and the two methods of application outperformed by a significant decrease over all treatments of the hybrid Ice ball and for the same two methods of application.

Table (2): Effect of hybrids, application method, organic nutrient (Tecnotel) and interaction between them on the time of ripening and harvesting of 20% of the curds (day)

Hybrids	Application Method	Organic Nutrient Concentrations (Tecnokel) g.L^{-1}				Hybrids **X** Application Method	Average Hybrids effect
		0	2	4	6		
Raheq	Foliar spray	114.50 b	114.00 b	114.00 b	114.50 b	114.25 b	112.62 b
	Add to soil	115.50 b	111.16 b	106.16 c	111.16 b	111.00 c	
Ice ball	Foliar spray	124.33 a	122.66 a	123.66 a	122.33 a	123.25 a	123.58 a
	Add to soil	124.66 a	122.66 a	123.33 a	125.00 a	123.91 a	
Hybrids **X** Organic Nutrient	Raheq	115.00 b	112.58 b c	110.08 c	112.83 bc	Average Effect Method add	
	Ice ball	124.50 a	122.66 a	123.50 a	123.66 a		
Application Method **X** Organic Nutrient	Foliar spray	119.41 ab	118.33 ab	118.83 ab	118.41 ab	118.75 a	
	Add to soil	120.08 a	116.91 bc	114.75 c	118.08 ab	117.45 b	
Average effect of Organic Nutrient		119.75 a	117.62 b	116.79 b	118.25 ab		

*The averages that share the same letter for each factor and each overlap do not differ significantly between them according to Duncan's polynomial test at the probability level (P < 0.05).

3- Average weight curd (g. curd^{-1}) and the total yield of the curds (ton.h^{-1}):

Through the results of tables (3 and 4), it is noticeable that the hybrid Ice ball plants significantly outperformed the curd weight and the total yield of the curds compared to Raheq hybrid plants, with an increase of 20%, while the differences of the two methods of application did not significantly affect in these two traits, and the use of the organic nutrient at a concentration of 4 gm.L^{-1} led to significant increases in tow traits as compared to control plants and plants treated with a concentration of 6 gm.L^{-1}. Through the results of the binary interaction between the hybrids and the method of application, it was noticed that the Ice ball hybrid plants and the two methods of application were superior compared to the hybrid Raheq plants and for the same two methods of application.

The best dual interaction treatment between hybrids and organic nutrient in the two studied traits was in the case of Ice ball plants with 2 g.L^{-1} of organic nutrient, the treatment of this interaction gave the highest significant value In the average weight of the curds and the highest significant value in the total yield of curds 40,886 tons.ha^{-1} and thus this treatment outperformed significantly on the comparison treatment for the same cultivar and on most of the treatments of the hybrid Raheq.

The results of the binary interaction between the pplication method and the organic nutrient show the superiority of the method of adding the organic nutrient to the soil at a concentration of 4 g.L^{-1}. In the case of the triple interaction, the use of the foliar spray method and the organic nutrient at a concentration of 2 gm.L^{-1} for Ice ball hybrid plants achieved the highest significant values in these two traits, amounting to 1146.47 g.curd^{-1} and 43.765 tonsHa^{-1}. The interaction was significant over most of the other triple interaction treatments.

Table (3): Effect of hybrids, application methods, organic nutrient (Tecnokel) and interaction between them on the average weight of the curd (gm.curd^{-1})

Hybrids	Application Method	Organic Nutrient Concentrations (Tecnokel) g.L-1				Hybrids X Application Method	Average Hybrids effect
		0	2	4	6		
Raheq	Foliar spray	576.53 h	874.47 c-e	930.33 b-d	746.00 e-g	781.83 b	816.95 b
	Add to soil	671.07 g h	878.20 c-e	1025.07 ab	833.93 d - f	852.07 b	
Ice ball	Foliar spray	783.50 e - g	1146.47 a	1051.73 ab	1060.20 ab	1010.48 a	981.19 a
	Add to soil	713.65 f - h	1000.07 a-c	1073.10 ab	1020.80 ab	951.90 a	
Hybrids	Raheq	623.80	876.33	977.70	789.97	Average Effect	

X Organic Nutrient		d	b	a	bc	Method add
	Ice ball	748.58 c	1073.27 a	1062.42 a	1040.50 a	
Application Method X Organic Nutrient	Foliar spray	680.02 d	1010.47 ab	991.03 a-c	903.10 c	896.15 a
	Add to soil	692.36 d	939.13 b c	1049.08 a	927.37 bc	901.99 a
Average effect of Organic Nutrient		686.19 c	974.80 ab	1020.06 a	915.23 b	

*The averages that share the same letter for each factor and each overlap do not differ significantly between them according to Duncan's polynomial test at the probability level (P < 0.05).

Table (4): Effect of hybrids, application methods, organic nutrient (Tecnokel) and the interaction between them on the total yield of curd (ton. ha^{-1})

Hybrids	Application Method	Organic Nutrient Concentrations (Tecnokel) g.L1				Hybrids X Application Method	Average Hybrids effect
		0	2	4	6		
Raheq	Foliar spray	21.963 h	33.313 c - e	35.441 b - d	28.419 e - g	29.784 b	31.121 b
	Add to soil	25.564 g h	33.455 c – e	39.050 ab	31.769 d - f	32.460 b	
Ice ball	Foliar spray	29.848 e - g	43.675 a	40.066 ab	40.389 ab	38.494 a	37.378 a
	Add to soil	27.187 f - h	38.098 a - c	40.880 ab	38.888 ab	36.263 a	
Hybrids X Organic Nutrient	Raheq	23.764 d	33.384 b	37.246 a	30.094 b c	Average Effect Method add	
	Ice ball	28.517 c	40.886 a	40.473 a	39.638 a		
Application Method X Organic Nutrient	Foliar spray	25.905 d	38.494 a b	37.754 a - c	34.404 c	34.139 a	
	Add to soil	26.376 d	35.777 b c	39.965 a	35.328 b c	34.361 a	
Average effect of Organic Nutrient		26.140 c	37.135 ab	38.859 a	34.866 b		

*The averages that share the same letter for each factor and each overlap do not differ significantly between them according to Duncan's polynomial test at the probability level (P < 0.05).

4 Weight of curds for the marketing yield (g. curd^{-1}) and the marketing yield for the curds (ton. Ha^{-1})

In the absence of a non-marketing yield, the effect of the studied factors and their binary interactions and the triple interference in the two characteristics of the weight of the curds of the marketing yield (g.curd^{-1}) and the marketing yield of curds plants was ton. Ha^{-1} Tables 5 and 6 behave the same as the two weight adjectives curd (g.curd^{-1}) and the total yield curd (ton. ha^{-1}) Tables (3 and 4) .

Table (5): Effect of hybrids, application methods, organic nutrient (Tecnokel) and interaction between them on average weight of the marketing curds (kg. curd^{-1}).

Hybrids	Application Method	Organic Nutrient Concentrations (Tecnokel) g.L-1				Hybrids X Application Method	Average Hybrids effect
		0	2	4	6		
Raheq	Foliar spray	576.53 h	874.47 c-e	930.33 b-d	746.00 e-g	781.83 b	816.95 b
	Add to soil	671.07 g h	878.20 c - e	1025.07 ab	833.93 d-f	852.07 b	
Ice ball	Foliar spray	783.50 e-g	1146.47 a	1051.73 ab	1060.20 ab	1010.48 a	981.19 a
	Add to soil	713.65 f-h	1000.07 a-c	1073.10 ab	1020.80 ab	951.90 a	
Hybrids X Organic Nutrient	Raheq	623.80 d	876.33 b	977.70 a	789.97 b c	Average Effect Method add	
	Ice ball	748.58 c	1073.27 a	1062.42 a	1040.50 a		
Application Method X Organic Nutrient	Foliar spray	680.02 d	1010.47 ab	911.03 a-c	903.10 c	901.99 a	
	Add to soil	692.36 d	939.13 bc	1049.08 a	927.37 bc	896.15 a	
Average effect of Organic Nutrient		686.19 c	974.80 ab	1020.06 a	915.23 b		

*The averages that share the same letter for each factor and each overlap do not differ significantly between them according to Duncan's polynomial test at the probability level ($P < 0.05$).

Table (6): Effect of hybrids, application methods, organic nutrient (Tecnokel) and interaction between them on the marketing yield of curds (tons. Ha^{-1})

Hybrids	Application Method	Organic Nutrient Concentrations (Tecnokel) g.L-1				Hybrids X Application Method	Average Hybrids effect
		0	2	4	6		
Raheq	Foliar spray	21.963 h	33.313 c-e	35.441 b-d	28.419 e-g	29.784 b	31.121 b
	Add to soil	25.564 g h	33.455 c-e	39.050 ab	31.769 d-f	32.460 b	
Ice ball	Foliar spray	29.848 e-g	43.675 a	40.066 ab	40.389 ab	38.494 a	37.378 a
	Add to soil	27.187 f-h	38.098 a-c	40.880 ab	38.888 ab	36.263 a	
Hybrids X Organic Nutrient	Raheq	23.764 d	33.384 b	37.246 a	30.094 b c	Average Effect Method add	
	Ice ball	28.517 c	40.886 a	40.473 a	39.638 a		
Application Method X	Foliar spray	25.905 d	38.494 a b	37.754 a - c	34.404 c	34.139 a	

Organic Nutrient	Add soil	26.376 d	35.777 b c	39.965 a	35.328 bc	34.361 a
Average effect of Organic Nutrient		26.140 c	37.135 ab	38.859 a	34.866 b	

*The averages that share the same letter for each factor and each overlap do not differ significantly between them according to Duncan's polynomial test at the probability level ($P < 0.05$).

The variation in the significant differences between the hybrids under study in the traits of the productive is probably due to genetic differences between the two hybrids under study, as the traits of the quantitative yield and awareness are controlled by a number of genetic genes for the hybrid. These results agree with (Shrestha etal, 2021؛ Pade1 and Khanal,2019؛ Manpreet etal, 2018). As for the significant superiority of the foliar spray method compared to the method of adding to the soil in each of the characteristics of the ripening date and harvest of 20% of the curds (Table 2), it may be due to the fact that the spraying method has led to the pH reaching the lowest limit for the leaves, and thus the conditions became suitable for the absorption of nutrients What the plant needs. (Abdul Wahed, 2019) which reflects positively on this trait, as the leaves can absorb the nutrients sprayed, because after absorption through the vegetative system is fast because the period is shorter between the process of absorption and Application, and this process is considered important in the stage of rapid growth In Application to its distinction in the availability of elements that may encounter some obstacles if they are through the soil (Al-Akashi and Al-Sahhaf, 2017).

The significant effect when using the organic nutrient Tecnokel on the speed of curd initiation when using the two concentrations 4 and 6 $g.L^{-1}$ table (1) and the concentrations 2 and 4 $g.L^{-1}$ at the time of maturity and harvest 20% of the curds tablets table (2) and all productive traits Tables (3-6) when using all concentrations of the organic nutrient compared to the comparison treatment, the reason for this may be due to the physiological role played by this extract in the significant increases in the quantitative and qualitative yield traits our significant results agreed with what was found (Hussain etal, 2020). Odell (2003) mentioned that organic nutrition with amino acids and other nutrients stimulates the growth and development of both groups root and vegetative and prevents the oxidation of vitamins (C) and (E), which are found in chloroplasts, which increases the efficiency of the photosynthesis process and the production of carbohydrates, as well as organic nutrition, stimulate the growth of flower buds. Norrie (1996) that spraying vegetable plants with extracts containing amino acids plays an important role in the regulation of vital processes and is involved in the formation of nucleotides, vitamins and growth hormones and in the synthesis of necessary enzymes. The study on calcium, which has a direct or indirect effect on vegetative growth in general and on production indicators in particular, in application to the content of the nutrient solution on boron, which has a role in improving the characteristics of the quantitative yield due to its contribution to the processes of contracting, fertilization and pollination. And for the role of the positive element of boron in facilitating the transfer of photosynthesis products from the leaves to other plant areas, as sugar can be easily transferred after union with boron in cell membranes, and it is necessary for the process of cell division, phloem formation, and the transfer of some of the activating plant hormones (Mengel etal. 2001) as

well. It controls the speed of absorption by the plant of water. It also has a great relationship with the hormones that have an effect on the developing peaks and has a relationship in: Regulating the absorption of calcium. On this, it has a major role in the formation of nucleic acids and thus will increase the protein building inside the plant (David, 2007) In Application to the fact that this organic nutrient contains EDTA, which is important in chelating the nutrients in the soil to the plant, and therefore these effects of the substances included in the composition of this nutrient will be reflected in improving the plant's production and quality specifications.

Conclusions and Recommendations

1- The plants of the hybrid Ice ball showed the clear significant superiority in the characteristics of the desired productive, where the plants of this hybrid outperformed in the average weight of the curds disc, the total yield of the curds , the weight of the marketing curd and the marketing yield of the unit aria, the study recommends the possibility of adopting this hybrid for the cultivation of cauliflower in Mosul, with conducting comparative studies with hybrids or other varieties with this hybrid, especially those characterized by early production in order to prolong the presence of this crop in the market with taking into account the economic feasibility of the hybrids or the varieties used.
2- Variation of the significant effect when using the two methods of application in influencing some traits. The method of application to the soil was significantly lower than the foliar spray method at the time of ripening and harvesting of 20% of the curds, knowing that the significant difference in this trait did not exceed 1.3 days, while it was noted that the use of the foliar spray method in the case of the triple overlap was the best method in the characteristics of the distinct yield, including the average weight of the curds disc, the total yield of the curds, and the weight of the curds and marketing yield of curds compared to the method of adding to soil, this study recommends following the foliar spray method in the fields of commercial production of cauliflower in the city of Mosul.
3- The use of the organic nutrient Tecnokel in all its concentrations led to positive results in most of the characteristics of productive the concentration of 4 $g.L^{-1}$ of this nutrient had the best significant role in each of the characteristics of the average weight of the curds and the yield the total and the weight of the curds for the marketing yield and the marketing yield for the curds on it.This study recommends the adoption of concentration 4 $gm.L^{-1}$ organic nutrient in the cauliflower production fields in the governorate, with a recommendation to conduct future studies using other organic nutrients and comparing it with the organic nutrient under study.

References

Abdul Wahed, K. B. (2019) Physiological study of the improvement growth and yield of summer squash (*Cucurbita pepo* L) Master Thesis. Agriculture and Forestry, University of Mosul/ Iraq.

Al-Akaishi, H. M. S. & Al-Sahaf. F. H. R. (2017). Spraying of some plant extracts and their role in the vegetative and flowering growth characteristics of three

okra cultivars (*Abelmoschus esculentus* L.).*Kufa Journal of Agricultural Sciences* .60-77: (3) 9

Al-Rawi, K. M. & Khalaf Allah. A. M. (2000). Design and Analysis of Agricultural Experiments, University of Mosul, Ministry of Higher Education and Scientific Research, *Dar al-Kutub for Printing and Publishing, Iraq*.

Anchundia, M. J. L., Gámez, M. R., Quiroz, A. M. V., Miles, G. M., & Molina, L. A. V. (2022). Energy efficiency and the link with society. International Research Journal of Management, IT and Social Sciences, 9(4), 398-404. https://doi.org/10.21744/irjmis.v9n4.2094

Arab Organization for Agricultural Development (2019). Agricultural Statistics Yearbook, Volume 40, Khartoum, Sudan.

David, J. P. (2007). Handbook of Plant Nutrition - Philips. Morley WightSalads Ltd. Arreton. *United Kingdom*. 121-144.

Eimon, M. M. I., Rasal-Monir, M., Modak, S., Fatima, S., Ali, M., & Malek, M. A. (2019). Growth and yield of cauli flowers effectd by NPK, Zn, B fertilizers. *International Journal of Natural and Social Sciences*, 6(3), 17-31.

Hammad, H. S., Al-Mandalawi, A. A. M., & Hamdi, G. J. (2019). Effect of manure on growth and yield of broccoli. *International Journal of Vegetable Science,* 25(4), 400-406.

Hussain, Z., Alam, M., Ullah, I., Ahmad, I., Sajid, M., Alam, I., & Asif, M. (2020). Effect of organic and inorganic regimes on growth, production and quality characteristics of cauliflower *Bioscience research.* 17(2): 1289-1298.

Ibrahim, F. F.R, Shamil. Y. H. & Safwan. M. H. (2014). Effect of soil mulching and ground application of marine extract (Acadian) on growth and yield of cauliflower (*Brassica oleracea* var. botrytis). International Scientific Conference the third for agricultural sciences.

Islam, S., Datta, S., & Chatterjee, R. (2016). Effect of Planting Date on Performance of Cauliflower (*Brassica oleracea* var. botrytis) Varieties at Terai Region of West Bengal, *India International Journal of Bio-Resource and Stress Management,* 7(3), 426-431.

Jalal,O. S., Al-Obaidi. K. S. A. & Hadeer S. S. (2018). The impact of decomposing animal monkeys and ramusin, the compound fertilizer NPK in the net yield of cauliflower, the Third International Scientific Conference on Agricultural Sciences, Faculty of Agriculture, Kirkwa University, *an example research from a master's thesis* / 450-456.

Kapusta-Duch, J., Szeląg-Sikora, A., Sikora, J., Niemiec, M., Gródek-Szostak, Z., Kuboń, M., ... & Borczak, B. (2019). Health-promoting properties of fresh and processed purple cauliflower. *Sustainability*, 11(15), 4008.

Manpreet, K., Janeja, H. S., & Balwinder, S. (2018). Effect of spacing on growth and yield of promising cultivars of cauliflower (*Brassica oleracea* var. botrytis). *Agriways, 6*(2), 32-36.

Mengel, K. E.A., Kirkby,H. Kosegarten E.A & Appel, T. (2001) Principles of Plant Nutrition, 5th ed. (Klwer Academic publisher, Dordrecht). Annals of botany 93 (4): 479-480.

Merta, I. N., & Suderana, I. W. (2020). COVID-19 pandemic handling community social and cultural sector stimulus efforts. International Journal of Social Sciences and Humanities, 4(3), 1–12. https://doi.org/10.29332/ijssh.v4n3.434

Norrie, J. (1996). Seaweed extracts and their application in crop management programs. Acadian sea plant limited, 30 Brown Avenue. Dartmouth Nova.

Odell, C. (2003). Natural plant hormones are biostimulants helping plants develop higher plant antioxidant activity for multiple benefits. Virginia vegetable small fruit and specialty crops. *November-December* 2003 2(6): 1-3.

Omar , J., Saeed Aziz A., & Hadeer S.S. (2018). The effect of NPK fertilizer on the yield of two cultivars of cauliflower, the third international scientific conference.

Pade1, T., Shrestha, R., & Khanal, A. (2019). Performance of Different Varieties of Cauliflower (*Brassica Oleracea* Var. botrytis) Under Different Levels of Phosphorus Application in Pot Culture at Lamjung, Nepal. *World Journal of Agriculture and Soil Science, 3*(5), 1-5.

SAS (2017). Statistical Analysis System. *SAS Institute. Inc. 27511,USA.*

Sharma, S. R., Singh, P. K., Chable, V., & Tripathi, S. K. (2004). A review of hybrid cauliflower development. Journal of New Seeds, 6(2-3), 151-193.

Shrestha, R,K., Paudel, R,T& Khana, A (2021). Performance of Varieties of Cauliflower (*Brassica Oleracea* Var. botrytis) Under Different Levels of Phosphorus Application in Pot Culture at Lamjung, Nepal, *Asian Journal of Plant Science and Research.*11(7): 224-228.

Suryasa, I. W., Rodríguez-Gámez, M., & Koldoris, T. (2022). Post-pandemic health and its sustainability: Educational situation. International Journal of Health Sciences, 6(1), i-v. https://doi.org/10.53730/ijhs.v6n1.5949