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Article

Effect of adding vermicompost, ammonium sulfate and fertilizer batches on the absorbed amounts of some nutrients and the yield and quality of summer squash

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Abstract
A field experiment was conducted at one of the research stations of the College of Agricultural Engineering Sciences / University of Baghdad in the Al-Jadiriyah region for the autumn season of 2021, located within latitude 33.27 north and longitude 44.39 east in Silty Loam soil with a split -split plot design with three replicates. To study the effect of adding vermicompost and ammonium sulfate fertilizers and batches on the yield and quality of summer squash, nitrogen fertilizer was added at three levels (100%, 0, 50%) from the fertilizer recommendation (0, 80, 160) kg N ha^{-1} (N0, N1, N2).), using ammonium sulfate fertilizer containing (21% N) and organic fertilizer (vermicompost) were added at three levels (0, 5, 10) Mg ha^{-1} (V0, V1, V2) respectively, fertilizers were added in two batches after (10, 20) days of planting and three batches after (10,20 and 40) days of planting. The first batch was added after 10 days of planting. The concentration (N and P) in the fruits were measured, the amount of the total yield, the percentage of protein, the percentage of total soluble solids (TSS) and fruit hardness. The results showed the significant effect of adding vermicompost and ammonium sulfate fertilizers, the number of batches on the amount of nitrogen and phosphorous absorbed in the fruits, the total yield, the percentage of protein in the fruits, the percentage of total soluble solids (TSS) and the hardness of the fruits. The treatment P2V2N1 excelled and gave the highest amount of nitrogen absorbed in the fruits, which was 1995 kg N ha-1. Phosphorous absorbed in the fruits amounted to 172.10 kg P ha^{-1} and the highest total yield reached 21.53 Mg ha^{-1}. The percentage of protein in the fruits amounted to 36.63%, the percentage of total soluble solids TSS amounted to 4.90%, and the hardness of the fruits amounted to 10.27 B. From this, we conclude that by adding nitrogen fertilizer at the first level (N1) (80 kg N ha^{-1}) and organic fertilizer (V2) (10 Mg ha^{-1}) and in two batches (P2) we got the highest yield and the highest qualitative traits of hardness, protein percentage and TSS. Thus, we conclude that the organic fertilizer improved the qualitative traits, gave the highest yield and compensated for a part of the mineral fertilizer. The organic fertilizer has a role in raising the absorption efficiency of (N and P).

Keywords: vermicompost fertilizer, ammonium sulfate fertilizer, summer squash.

Introduction

Vermicompost is an organic fertilizer rich in macro and micronutrients necessary for plant nutrition, such as nitrogen, phosphorous, potassium, calcium, iron,

magnesium and copper. It is one of the fertilizers that are readily soluble and absorbed by the plant and activates the beneficial micro-organisms of soil, such as nitrogen-fixing bacteria and fungi, and a solvent for phosphate compounds, which secrete growth hormones such as cytokinin, auxin and gibberellin (Adhikary, 2012). It can be used to dispose of food residues and recycle plant and animal waste by earthworms in that garbage (Edwards, 2010). Worm manure is one of the highest quality fertilizers compared to conventional fertilizers and is the ideal fertilizer for better growth and higher yields for many crops (Lazcano et al., 2008). The summer squash plant responds significantly to the addition of mineral fertilizers, where the plants depend to a large extent on the absorption of nutrients from the soil. These elements are essential for plant growth and are taken up by plants through the root system below the soil surface (Ali, 2012). The summer squash (Cucurbita pepo L.) is a vegetable crop belonging to the cucurbitacea family, and all summer squash cultivars belong to the pepo type, one of the most important crops. The pulp of the summer squash fruit contains carbohydrates, protein, calcium, iron and phosphorous. It also contains vitamin A, thiamine, pantothenic acid, riboflavin, niacin, ascorbic acid, and seeds that contain 30%. Oil, vitamins, minerals, and zinc (Gossell et al., 2006; Boras et al., 2011). Therefore, the study aimed to know the effect of adding vermicompost and ammonium sulfate fertilizers and batches and their interactions in affecting the quantitative and qualitative characteristics of zucchini squash yield, and whether it is possible to reduce mineral fertilizers by adding organic fertilizers and maintaining soil health because the organic fertilizer is environmentally safe.

Materials and Methods

A field experiment was conducted at one of the research stations of the College of Agricultural Engineering Sciences / University of Baghdad in Al- the Jadiriyah region for the autumn season 2021, located within latitude 33.27 north and longitude 44.39 east To study the effect of adding vermicompost and ammonium sulfate fertilizers and infusions on the yield and quality of summer squash in Silty Loam silty mixture, which is classified among the great soil groups Typic Torrifluvent according to the modern American classification, Soil Survey Staff, 2006). The experiment was conducted according to the order of the split-plot design (Al-Sahoki and Waheeb, 1990), with three factors and three replications after (10,20 and 40) days of planting, where the first batch was added after 10 days of planting. The second-factor sub-plot, the organic fertilizer (vermicompost), was denoted by the symbol (V0, V1 and V2). It was added in three levels, the first without addition, symbolized by V0, the second adding 5 Mg ha^{-1}, symbolized by V1, and the third adding 10 Mg ha^{-1}, symbolized by V2, and the third sub-plot factor was ammonium sulfate Where it was added to the soil in three levels, the first without addition and symbolized by N0, the second adding 50% (80 kg N ha-1) and symbolized by N1, and the third adding 100% (160 kg N ha^{-1}) and symbolizing it by N2 and according to the fertilizer recommendation. The field was prepared for cultivation by conducting the tillage process using the Moldboard plows at a depth of 25 cm, and it was smoothed using the disc harrows. The settlement process was conducted, and the field was divided into terraces. Three main water lines were extended, and nine branch lines branched off on both sides of each line. Each main line included 18 experimental units distributed on its sides. Then, before planting, soil samples were randomly taken from different field locations to a depth of (0-30) cm. It was mixed well to homogenize it, air dried, crushed using a wooden mallet and passed through a sieve with holes diameter of 2 mm. A composite sample was taken to conduct some chemical and physical analyses of the soil, as in Table 1.

units	values	Traits	
DS.m-1	2.6	Electrical conductivity EC (1:1)	
-	7.21	pH(1:1)	
centimole.charge/kg soil.	20.72	CEC	
g.kg-1 soil	11.4	Organic matter OM	
%	0.24	Ready water field capacity	
Mg.g-1	1.35	bulk density	
g.kg-1	266.4	Calcium Carbonate CaCO3	
Meq.L^{-1}	10.36	Ca2+	Dissolved positive ions
	7.27	Mg2+	
	4.21	Na+	
	0.32	K+	
Meq.L^{-1}	NILL	CO32-	Dissolved negative ions
	1.61	HCO3-	
	9.19	SO42-	
	12.32	Cl-	
mg.kg^{-1}	32	Available nitrogen	
	3.98	Available phosphorous	
	198.5	Available potassium	
mg.kg-1	150	sand	Soil Separators
	650	silt	
	200	Clay	
Silty Loam		Soil Texture	

Table 1. Chemical and physical properties of soil before planting.

EC 1:5	pH 1:5	Total N	Total P	Total K	C/N Ratio	O.M
1.1	7.66	1.69	0.010	0.394	15-25	32.77
DSM-1	-	%			-	%

Table 2. Shows the specifications of organic fertilizer (Vermicompost).

The summer squash seeds (Ghada cultivar) were cultivated in one of the agricultural nurseries, where they were cultivated in the form of dairies on 08/11/2121 and were transferred to the field on 08/25/2021 for the autumn season, with one daisy in each hole, and the number of plants in the experimental unit 10 plants. The plants were watered by drip irrigation method, and irrigation was conducted when 35% of the prepared water was drained, and the moisture content was brought to the limit of the field capacity. Nitrogen was added to the soil using ammonium sulfate fertilizer containing (21% N) at three levels (50.0%-100%) of the fertilizer recommendation (160 kg N ha^{-1}), Vermicompost decomposed vermicompost was added at three levels (0, 5, 10) Mg ha^{-1} as in (Ali et al., 2017) and symbolized by (V0, V1, V2) respectively in lines. The fertilizers were added in two and three batches after (10, 20,40) days from planting. The first batch of fertilizer was added 10 days after planting. Phosphorous was added to the soil at a level of 40 kg P ha^{-1} using MAP fertilizer containing (20%P) and (10%N), and potassium was added to the soil at a level of 100 kg KH-1 using potassium sulfate fertilizer containing (41.5% K). The summer squash fruits were harvested as the first harvest on 09/22/2021, and the harvest continued until 12 harvest only. Five fruits were taken to measure some of the qualitative traits of the fruits to measure the concentration of nitrogen and phosphorous in the fruits and then measure the absorbent.

Results

Nitrogen absorbed in fruits (kg N ha^{-1})

The results in Table 3 showed significant differences when adding vermicompost fertilizer, where the fertilizing treatment with vermicompost excelled on the nitrogen absorbed in the fruits. The treatment of adding vermicompost V2 gave the highest nitrogen absorbed in the fruits, which amounted to 1171.33 kg N ha^{-1}, with an increase of 104.83% compared to the treatment without adding V0, which gave the nitrogen absorbed in the fruits amounted to 571.83 kg N ha-1. As for the effect of adding ammonium sulfate fertilizer on the nitrogen absorbed in the fruits, the results of the table showed the treatment N1 excelled and gave the highest nitrogen absorbed in the fruits, 1041.50 kg N ha^{-1}, with an increase of 50.25% compared with the control treatment N0, which gave the nitrogen absorbed in the fruits amounted to 693.17 kg N ha^{-1}, The results also showed the effect of the number of batches of adding ammonium sulfate fertilizer on the nitrogen absorbed in the fruits, as the treatment of adding ammonium sulfate fertilizer in two batches P2 gave the highest nitrogen absorbed in the fruits amounting to 1182.78 kg N ha^{-1} with an increase of 82.15% compared to the treatment of adding ammonium sulfate fertilizer in three batches P3 which gave nitrogen absorbed in fruits amounted to 649.33 kg N ha^{-1}. The table also shows significant differences in the triple interaction between the addition of vermicompost fertilizer and ammonium sulfate fertilizer and the number of batches adding fertilizer to the nitrogen absorbed in the fruits. The treatment P2V2N1 excelled and gave the highest nitrogen absorbed in the fruits, which amounted to 1995 kg N ha^{-1}with an increased average of 571.71% compared to the treatment P3V0N0 which gave the absorbed nitrogen in the fruits amounted to 297 kg N ha^{-1}.

number of batches P	Vermicompost V	ammonium sulfate			V * P
		N0	N1	N2	
P2	V0	462.00	828.00	932.00	740.67
	V1	1110.00	1266.00	1403.00	1259.67
	V2	1099.00	1995.00	1550.00	1548.00
P3	V0	297.00	402.00	510.00	403.00
	V1	559.00	833.00	859.00	750.33
	V2	632.00	925.00	827.00	794.67
number of batches (P)		N * P			average P
P2		890.33	1363.00	1295.00	1182.78
P3		496.00	720.00	732.00	649.33
Vermicompost V		V * N			average V
V0		379.50	615.00	721.00	571.83
V1		834.50	1049.50	1131.00	1005.00
V2		865.50	1460.00	1188.50	1171.33
Fertilizer average of ammonium sulfate N		693.17	1041.50	1013.50	
factors	P	V	N	V * P	
LSD 0.05	Ns	259.60	106.10	Ns	
factors	N * P		V * N		V * N * P
LSD 0.05	367.2		285.3		ns

Table 3. Effect of adding vermicompost and ammonium sulfate fertilizers and batches on nitrogen absorption of summer squash fruits (kg N ha-1).

Phosphorous absorbed in fruits (kg P ha^{-1})

The results in Table 4 showed significant differences, where the vermicompost treatment excelled in the phosphorus absorbed in the fruits. In contrast, the

treatment of adding vermicompost V2 gave the highest phosphorus absorbed in the fruits, amounting to 99.05 kg Pha^{-1} with an increase of 89.67% compared to the treatment of no addition V0, which The absorbed phosphorous in the fruits was 52.22 kg P ha^{-1}. As for the effect of adding ammonium sulfate fertilizer on the phosphorus absorbed in the fruits, the results of the same table showed the superiority of the N1 treatment, which gave the highest absorbed phosphorus in the fruits amounting to 92.38 kg P ha^{-1}, with an increase of 60.57% compared with the control treatment N0, which gave the absorbent phosphorus in the fruits amounted to 57.53 kg P ha^{-1}. Table 4 also showed the effect of the number of batches adding ammonium sulfate fertilizer on the phosphorous absorbed in the fruits. Compared to the treatment of adding ammonium sulfate fertilizer to three batches of P3, which gave a phosphorous absorbed in the fruits of 51.16 kg P ha^{-1}. The results also showed significant differences in the triple interaction between the addition of vermicompost and ammonium sulfate fertilizer and the number of batches adding ammonium sulfate fertilizer in the phosphorous absorbed in the fruits. The treatment P2V2N1 excelled and gave the highest absorbed phosphorous in the fruits, amounting to 172.10 kg P ha^{-1} with an increased rate of 648.26% compared with the treatment P3V0N0 which gave the absorbed phosphorous in the fruits amounted to 23 kg P ha^{-1}.

number of batches P	Vermicompost V	Fertilizer rate of ammonium sulfate N			V * P
		N0	N1	N2	
P2	V0	41.10	86.80	83.70	70.53
	V1	86.70	122.50	121.60	110.27
	V2	102.10	172.10	128.40	134.20
P3	V0	23.00	35.10	43.60	33.90
	V1	43.50	61.20	62.30	55.67
	V2	48.80	76.60	66.30	63.90
batches P		N * P			Average P
P2		76.63	127.13	111.23	105.00
P3		38.43	57.63	57.40	51.16
Vermicompost V		V * N			Average N
V0		32.05	60.95	63.65	52.22
V1		65.10	91.85	91.95	82.97
V2		75.45	124.35	97.35	99.05
Fertilizer rate of ammonium sulfate N		57.53	92.38	84.32	
factors	P	V	N	V * P	
LSD 0.05	Ns	20.89	9.41	Ns	
factors	N * P		V * N		V * N * P
LSD 0.05	33.22**		ns		Ns

Table 4. Effect of adding vermicompost and ammonium sulfate fertilizers and batches on the absorbed phosphorous of summer squash fruits (kg P ha-1).

Total product (Mg ha^{-1})

The results in Table 5 showed that there were significant differences for the fertilizing treatment with vermicompost, where the treatment of adding vermicompost V2 excelled and gave the highest total yield of 20.16 Mg ha-1with an increase of 17.61% compared with the treatment of no addition V0 and gave a total yield of 17.14 Mg ha^{-1}. As for the effect of adding ammonium sulfate fertilizer on the total yield, the results of the same table showed the treatment N2 excelled and gave the

highest total yield of 19.69 mcg ha^{-1}, with an increase of 12.57% compared with the control treatment N0, which gave a total yield of 17.49 Mg ha^{-1}. As for the number of batches of adding ammonium sulfate fertilizer in the total yield, the treatment of adding ammonium sulfate fertilizer in two batches of P2 gave the highest total yield of 19.07 Mg ha^{-1}with an increase of 2.52% compared to the treatment of adding ammonium sulfate fertilizer in three batches of P3, which gave a total yield of 18.60 Mg ha^{-1}. Table 5 shows that there were significant differences in the triple interaction between the addition of vermicompost and ammonium sulfate fertilizer and the number of batches of adding ammonium sulfate fertilizer in the total yield, as the treatment P2V2N1 excelled and gave the highest total yield of 21.53 Mg ha^{-1}with an increase of 57.96% compared with the treatment P3V0N0 Which gave a total yield of 13.63 Mg ha^{-1}.

number of batches P	Vermicompost V	Fertilizer rate of ammonium sulfate N			V * P
		N0	N1	N2	
P2	V0	14.08	18.11	19.46	17.21
	V1	18.96	18.71	20.01	19.22
	V2	20.14	21.53	20.67	20.78
P3	V0	13.63	18.42	19.17	17.07
	V1	18.77	19.23	19.59	19.19
	V2	19.37	19.96	19.26	19.53
batches P		N * P			Average P
P2		17.73	19.45	20.04	19.07
P3		17.25	19.20	19.34	18.60
Vermicompost V		V * N			Average V
V0		13.85	18.27	19.31	17.14
V1		18.86	18.97	19.80	19.21
V2		19.76	20.75	19.97	20.16
Fertilizer rate of ammonium sulfate N		17.49	19.33	19.69	
factors	P	V	N	V * P	
LSD 0.05	0.37*	0.22**	0.17**	0.32**	
factors	N * P		V * N	V * N * P	
LSD 0.05	0.29*		0.30**	0.43**	

Table 5. Effect of adding vermicompost and ammonium sulfate fertilizers and batches on the total yield of summer squash (Mg ha^{-1}).

Protein in fruits%

The results in Table 6 showed that the treatment of fertilizing excelled with vermicompost in the percentage of protein in the fruits, where the treatment of adding vermicompost V2 gave the highest protein percentage of 32.04% and an increase of 56.98% compared with the treatment of no addition of V0, which gave a protein percentage of 20.41%. As for the addition of ammonium sulfate fertilizer, it affected the protein content of the fruits. The results showed the superiority of the N2 treatment. It gave the highest protein percentage of 29.37 % and an increase of 26.05% compared to the comparison treatment N0, which gave a protein percentage of 23.30%. The results of the same table also showed the effect of the number of batches of adding ammonium sulfate fertilizer on the percentage of protein in

fruits, where the treatment of adding ammonium sulfate fertilizer in two batches of P2 gave the highest protein percentage of 27.71%, and an increase of 3.70% compared to the treatment of adding ammonium sulfate fertilizer to three batches of P3 where it was The protein content is 26.72%. Table 6 shows significant differences in the triple interaction between the addition of vermicompost and ammonium sulfate fertilizer and the number of batches adding ammonium sulfate fertilizer in the fruits' protein percentage. The treatment P2V2N1 was superior and gave the highest protein value of 36.63%, with an increase of 141.46% compared with the treatment P2V0N0, which gave a percentage of Protein that amounted to 15.17%.

number of batches P	Vermicompost V	Fertilizer rate of ammonium sulfate N			V * P
		N0	N1	N2	
P2	V0	15.17	24.30	23.73	21.07
	V1	28.30	27.87	31.00	29.06
	V2	27.27	36.63	35.13	33.01
P3	V0	16.83	19.53	22.87	19.74
	V1	24.77	31.43	31.83	29.34
	V2	27.47	34.13	31.63	31.08
batches P		N * P			Average P
P2		23.58	P2	29.95	27.71
P3		23.02	P3	28.78	26.72
Vermicompost V		V * N			Average P
V0		16.00	V0	23.30	20.41
V1		26.54	V1	31.42	29.20
V2		27.37	V2	33.38	32.04
Fertilizer rate of ammonium sulfate N		23.30	Fertilizer rate of ammonium sulfate N	29.37	
factors	P	V	N	V * P	
LSD 0.05	Ns	1.57**	0.74**	Ns	
factors	N * P		V * N		V * N * P
LSD 0.05	Ns		1.78**		2.36**

Table 6. Effect of adding vermicompost and ammonium sulfate fertilizers and batches on the percentage of protein in fruits.

Total soluble solids (TSS) %

The results in Table 7 showed significant differences, where the fertilization with vermicompost excelled in the percentage of total soluble solids (TSS). The treatment of adding vermicompost V2 gave the highest value of 4.57%, with an increase of 10.92% compared to the treatment of no addition V0, which gave a value of 4.12%. As for the effect of adding ammonium sulfate fertilizer on the percentage of total soluble solids TSS, the results of the same table showed the treatment N2 excelled, which gave the highest value of 4.52% and an increase of 9.70%

compared with the control treatment N0, which gave a value of 4.12%. The results in Table 7 also showed the effect of adding batches of ammonium sulfate fertilizer on the percentage of total soluble solids TSS, where the treatment of adding ammonium sulfate fertilizer in two batches P2 gave the highest value of 4.37% and an increase of 1.86% compared to the treatment of adding ammonium sulfate fertilizer on three P3 payments that gave a value of 4.29%. Table 7 shows significant differences in the triple interaction between the addition of vermicompost and ammonium sulfate fertilizer and the number of batches adding ammonium sulfate fertilizer in the total soluble solids (TSS) percentage. The treatment P2V2N2, which did not differ significantly from the treatment P2V2N1, excelled and gave the highest value of 4.90% with an increased average of 27.93% compared with the treatment P2V0N0 which gave a value of 3.83%.

number of batches P	Vermicompost V	Fertilizer rate of ammonium sulfate N			V * P
		N0	N1	N2	
P2	V0	3.83	4.23	4.50	4.19
	V1	4.07	4.00	4.63	4.23
	V2	4.27	4.90	4.90	4.69
P3	V0	3.97	3.97	4.23	4.06
	V1	4.27	4.43	4.37	4.36
	V2	4.33	4.53	4.47	4.44
batches P		N * P			average P
P2		4.06	P2	4.68	4.37
P3		4.19	P3	4.36	4.29
Vermicompost V		V * N			average V
V0		3.90	V0	4.37	4.12
V1		4.17	V1	4.50	4.29
V2		4.30	V2	4.68	4.57
Fertilizer rate of ammonium sulfate N		4.12	4.34	4.52	
factors	P	V	N	V * P	
LSD 0.05	Ns	0.12**	0.11	0.14*	
factors	N * P		V * N		V * N * P
LSD 0.05	0.13**		0.18*		0.24**

Table 7. Effect of adding vermicompost and ammonium sulfate fertilizers and batches on the percentage of total soluble solids (TSS).

Fruit hardness (Brix)

The results in Table 8 showed that there were significant differences, where the treatment of fertilizing with vermicompost excelled in the trait of fruit hardness, and the treatment of adding vermicompost V2 gave the highest value of 9.76 B, with an increase of 14.958% compared with the treatment of no addition V0, which gave a value of 8.49 B, As for the effect of adding ammonium sulfate fertilizer on fruit hardness, the results of the table showed the treatment N2 excelled, which gave the highest value of 9.48 B, with an increase of 6.997% compared to the control treatment N0, which gave a value of 8.86 B. The results in Table (8) also showed the effect of the number of batches of adding ammonium sulfate fertilizer on the firmness of the fruits, as the treatment of adding ammonium sulfate fertilizer in two batches P2 gave the highest value of 9.41 B and an increase of 2.617%

compared to the treatment of adding ammonium sulfate fertilizer to three batches of P3, which gave a value of 9.41 B. reached 9.17 B, Table 8 also shows that there are significant differences for the triple interaction between the addition of vermicompost and ammonium sulfate fertilizer and the number of batches of adding ammonium sulfate fertilizer in the trait of fruit hardness. The treatment P2V2N1 excelled and gave the highest value of 10.27 B, with an increase of 33.376% compared with the treatment P2V0N0, which gave a value of B 7.70.

number of batches P	Vermicompost V	Fertilizer rate of ammonium sulfate N			V * P
		N0	N1	N2	
P2	V0	7.80	8.73	9.20	8.58
	V1	9.30	10.10	9.90	9.77
	V2	9.93	10.27	9.50	9.90
P3	V0	7.70	8.47	9.07	8.41
	V1	9.00	9.70	9.80	9.50
	V2	9.40	10.03	9.40	9.61
batches P		N * P			average P
P2		9.01	P2	9.53	9.41
P3		8.70	P3	9.42	9.17
Vermicompost V		V * N			average V
V0		7.75	V0	9.13	8.49
V1		9.15	V1	9.85	9.63
V2		9.67	V2	9.45	9.76
Fertilizer rate of ammonium sulfate N		8.86	9.55	9.48	
factors	P	V	N	V * P	
LSD 0.05	ns	0.26**	0.16**	ns	
factors	N * P		V * N		V * N * P
LSD 0.05	ns		0.32**		Ns

Table 8. Effect of adding vermicompost and ammonium sulfate fertilizers and batches on the hardness of fruits (Brix).

Discussion

The treatment P2V2N1 excelled by giving the highest nitrogen absorbed in the fruits. This may be due to the continuous supply of nitrogen to the soil through vermicompost fertilizer and ammonium sulfate fertilizer added to the soil and in batches as a result of the liberation of nitrogen from the vermicompost fertilizer added to the soil as a result of the decomposition and oxidation of organic fertilizer by the revival of the microscopic soil in the rhizosphere and its transformation into mineral form by the process of mineralization. This led to an increase in its availability in the soil and thus increased its uptake by the plant, which greatly helped the plant to obtain greater amounts of nitrogen [13]. It is also due to the nutrients contained in vermicompost and ammonium sulfate fertilizer and their role in the physiological processes inside the plant, which was reflected in the increase in the plant's ability to absorb nitrogen from the soil, which helped to increase its concentration in the vegetative system, its transmission and collection in the fruits. These findings are in agreement with those of [8] and [6]. Moreover, the treatment P2V2N1 excelled and gave the highest absorbed phosphorous in the fruit. The reason for this may be that vermicompost has an effective effect on the

phosphorous readiness of the plant through its effect on soil phosphorus by producing CO_2 gas and releasing it after its decomposition, which by dissolving it in water produces carbonic acid that dissolves some of the precipitated phosphate compounds. When the organic matter is decomposed, various organic acids are produced that can increase the availability of phosphorus in the soil solution and then increase its absorption by the roots of plants, which leads to its transfer to the leaves and then collecting in the fruits [13]. The results are consistent with that obtained by [6]. As well as the role of ammoniac nitrogen fertilizers in increasing the availability of phosphorus in the soil through the contribution of ammonium ions to the liberation of phosphorous as well as reducing the degree of soil reaction pH due to hydrogen ions H+ released from the nitrification process, which leads to the dissolution of some precipitated phosphorous compounds as well as the role of nitrogen in increasing growth [8]. However, the data shows significant differences in the triple interaction between adding vermicompost and ammonium sulfate fertilizer and the number of batches adding ammonium sulfate fertilizer in the total yield. The reason for this may be due to the effect of vermicompost fertilizer in increasing the vegetative growth of the plant, which leads to an increase in the processed nutrients in the leaves and their transfer to the fruiting parts, which leads to an increase in the number of fruits of the plant and thus an increase in the total yield, in addition to the important role of vermicompost in increasing the average of female flowers. of the plant and an increase in the percentage of the set, which is reflected in an increase in the number of fruits of the plant and an increase in the total yield.The results agree with [23, 5, 6, 11, 18, 15]. In addition to the role of nitrogen and sulfur present in ammonium sulfate fertilizer in encouraging vegetative growth as a result of the increase in the process of carbon metabolism that increases the number of flowers formed and the increase of manufactured materials in the leaves and their transmission to the fruits. Which increased the number of fruits and the length and diameter of the fruit, which was positively reflected in the increase in the total yield of the plant, as well as their entry into the composition of the chlorophyll molecule, proteins and enzymatic conjugates, so the manufactured substances increased, which were transferred to other parts of the plant, including the fruits. The results are consistent with those obtained by [4, 19, and 8]. The results also showed significant differences in the triple interaction between the addition of vermicompost and ammonium sulfate fertilizer and the number of batches adding ammonium sulfate fertilizer in the fruits' protein percentage. The reason for this may be because the added fertilizers have a role in providing most of the nutrients, especially nitrogen, phosphorous and potassium, which play an important role in the manufacture and accumulation of protein in fruits when they enter into the composition of amino acids, which are the basic building blocks of protein [14], This is reflected positively in the increase in the protein content of the fruits and the increase in the availability of nutrients in the soil and their absorption by plants, which has a positive effect in increasing the proportion of protein in the fruits. The results are in agreement with that of [22]. Besides, the results show significant differences in the triple interaction between the addition of vermicompost and

ammonium sulfate fertilizer and the number of batches adding ammonium sulfate fertilizer in the total soluble solids (TSS) percentage. The reason for this may be because the increase in the TSS percentage is due to the good size of the vegetative group, which leads to the accumulation of carbohydrates in the fruits of zucchini, resulting from the effectiveness of carbon metabolism, which leads to an increase in total soluble solids (TSS) [17]. The reason for the increase in TSS may also be attributed to the addition of vermicompost to the soil because it contains nitrogen, which has a role in increasing the products of carbon metabolism and their transmission to the fruits, which led to an increase in the percentage of total dissolved solids.It also contains potassium, which has a role in stimulating and transferring substances resulting from the process of carbon metabolism and their transfer to fruits, as well as its role in physiological processes in plants, such as the formation of proteins and chlorophyll and the representation of carbohydrates [13]. In addition to increasing the availability and uptake of nitrogen by the plant, which led to an increase in the vegetative growth of the plant and an increase in the activity of the photosynthesis process, the amount of sugars manufactured by the plant increases [6, 22]. Finally, the data also shows significant differences in the triple interaction between the addition of vermicompost and ammonium sulfate fertilizer and the number of batches of adding ammonium sulfate fertilizer in the trait of fruit hardness. This may be because the added fertilizer contains nitrogen, which is included in forming basic compounds such as amino acids, proteins and nucleotides based on nucleic acids and building energy compounds. It also participates with magnesium to build the chlorophyll molecule and increase construction efficiency [24,25].

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