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Annals of Agricultural Science, Moshtohor (ASSJM)
https://assjm.journals.ekb.eg/

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Original Article Vol. 61(1) (2023), 307 –314 DOI: 10.21608/ASSJM.2023.338635

Impact of Some Organic and Mineral Fertilizers on Productivity and Quality of Cabbage (*Brassica oleracea L)*

Hasnaa , E. Elmehy[1] ; Rafat,S.ElSayed[2] ; Heba, S.A. Rashed[2] ; AbdElazeem,A.Yassen[1] and Entsar.M.Essa[1]

1- National Research Center, Giza, Egypt.
2- Fac. Agri. Benha. univ., Egypt.
***Corresponding author:** hasnaa.ezat20@gmail.com

Abstract

In Egypt, cabbage is key sources of fibers and nutraceutical compounds for human diets. A field experiment was conducted at the experimental station of the National Research Center in Nubaria region, Egypt to study the effect of different rates of compost and vermicompost, alone or mixed between these two organic fertilizers in varying proportions, in addition to the study of spraying vermicompost tea in the presence of mixing between compost and vermicompost on growth, yield and nutritional status of cabbage plants (*Brassier operated L*). The results showed that application of different rates of compost and vermicompost and foliar application of vermicompost tea treatments alone or together gave significantly positive effects on all growth and yield parameters under investigation as compared with control treatment. Data also found that increasing chlorophyll a and b, total carotenoids (content of leaves), N, P and K concentrations and uptake in roots, stem and leaves as compared with control treatment. The use of vermicompost as a fertilizer was more expedient, as it contains more nutrients as compared with horse compost treatment and control treatment.

Key words: compost -vermicompost - vermicompost tea- growth – yield Chemical composition – Cabbage plants.

Introduction

Cabbage (*Brassier oleracea L*), a member of Cruciform and a useful vegetable, belongs to the genus Brassier (**Jim and Tony, 2006**). Cabbage was used for medicinal purposes like a cleanser for the gastrointestinal tract and liver, a detoxifier, and a lipid solvent in the body. In addition, as it is a cholesterol remover, sugar, and pressure stabilizer its use can prevent cancer due to its antioxidant substances, such as ascorbic acid and phenolic compounds (**Sousa *et al*.,2005; Posed 2007 and TSE, and Slick, 2014**) and since cabbage is poor in protein, calories, and fats; Therefore, it is considered an important food to reduce weight.

Organic agriculture has a significant role to play in addressing two of the world's most pressing issues: climate change and food security. Climate change mitigation and adaptation, as well as food safety, are inextricably linked and inherent benefits of organic agriculture. More evidence suggests that chemical-based fertilizers, herbicides, and pesticides are extremely hazardous to our health and the environment. The use of inorganic fertilizer in agriculture is not good for health due to the residual impact on soil and plants. However, in the case of organic fertilizer, such a problem does not arise, and on the other hand, it increases soil productivity as well as crop quality and yield.

Recently, there has been great interest in using earthworms as a treatment method for the disposal of many wastes. Vermicompost has been touted as an alternative to conventional organic fertilizers due to its additional benefits such as reducing environmental pollution and detoxing some toxic chemicals. Also, prevent certain issues, such as nutrient loss, nutrient toxicity, and salinity that may be associated with organic amendments under certain conditions could also be avoided by vermicompost application due to the more gradual release of nutrients from vermicompost to the soil (**Kharraz*iet al.*, 2014**). Vermicompost is made through the biodegradation of natural wastes (animal excrement-vegetable waste-fish remains and seaweed) via interplay among earthworms and microorganisms.This process is called vermicomposting, while the rearing of worms for this purpose is called vermiculture. Vermicompost is a very good soil conditioner that has great potential for soil modification such as high porosity, aeration, drainage, and water holding capacity, and is rich in NPK, and micronutrients.Vermicompost soil application also increases microbial populations and activities that further influence the cycling of nutrients(**Sharma, and Banik, 2014**). Several

studies report that vermicompost has positive effects on the growth and yield (**Yassen*et al.*, 2020**) of lettuce ;(**Jandaghi *et al.*, 2020**) on cucumber and (**Aslam, and Ahmad, 2020**) on maize plants.Also, **Ahmed *et al.*, (2017)** concluded that increasing the vermicompost rate from 10 to 30 % led to an increase in N, P, and K contents of celery and red cabbage compared to the control treatment.**Yassen*et al.*, (2020)** mentioned that the application of vermicompost fertilizer at a rate of 4 tons fed^{-1} with foliar spray of vermicompost tea (vermiwash) might be raising NPK contents in lettuce plants.

The purpose of the present investigation is to study the effects of compost, vermicompost, and their interaction with foliar spray vermicompost tea on growthand yield parameters, and the chemical composition of cabbage plants (*Brassica oleracea* L).

Materials and Methods

A field experiment was conducted at the experimental station of the National Research Centre in Nubaria region, Egypt to study the effect of compost, vermicompost, and their interaction with foliar spray vermicompost tea on growth and parameters, and the chemical composition of cabbage plants (*Brassica oleracea* L). Soil samples to a depth of 0-15 cm were collected before the initiation of the experiment and after the harvesting of crops. Before initiation and the completion of the experiments, soil samples were collected from each plot (three replications) at 0-15 cm depth. Soil sample from the experimental field was air-dried and passed through a 2-mm sieve and stored for laboratory analysis. Some physical and chemical properties of soil were determined according to **Klute (1986)** a**nd Page *et al.*, (1982)** and presented in Table (1).

Table 1. Chemical and physical characteristics of the investigated soil.

Physical properties					Chemical properties					
Sand	Silt	Clay	Texture	pH	EC	$CaCO_3$	OM	N	P	K
	%				dSm^{-1}	%	%		(ppm)	
92.65	5.07	2.28	sandy	7.9	0.98	2.20	1.11	50	2	60.3
					Meq./L					
Ca		Mg	Na		K	CO3	HCO3		CL	SO4
5.10		2.70	0.96		0.81	-	1.61		0.93	7.30

Seedlings were transplanted when 4-5 leaves were completely expanded 35 days after sowing seeds of cabbage plants (*Brassica oleraceaL*) cv, Chinese varieties were obtained from the Vegetable Department, Ministry of Agriculture. Seedlings were set up in the field on the 30th of October when the average height of seedlings was about 10 cm. The experimental area was dripped irrigation lines were established over the ditches and soil was irrigated continuously for three days before transplanting. Seedlings were pressed down firmly into the soil, then lightly irrigated immediately after transplanting. The area of the experimental plot was 16.8 m and consisted of three rows; each row was 8 m in length and 0.7 m in width. Cabbage transplants were sown 0.5 m apart on one side of the irrigation line, one seedling was adjacent to every irrigation eye. Ditches of 20 cm width and 20 cm depth were prepared beside every irrigation line.The recommended dose of chemical fertilizers (NPK) was applied according to the Ministry of Agriculture, Egypt as control treatment (200 kg fed^{-1} ammonium sulfate N, 75 kg fed^{-1} super phosphate 15.5% P_2O_2 and 100 kg potassium sulfate 48% K_2O). The vermicompost used in this experiment was made from horse manure, which has been digested by the Earthworm called *Eisenia fetida*.Analyses of compost, vermicompost, and vermicompost tea were shown (Tables 2and 3).

The organic manure (compost and vermicompost) was mixed with a 0-20 cm soil surface layer before being transplanted at the rate of 3 tons fed^{-1}. Vermicompost tea was mixed with water to get the desired concentration. Spraying was applied in the morning (8-10 a.m.) using a hand pressure sprayer. The control plants were sprayed with distilled water. The foliar spray of vermicompost tea fertilizer application at a rate of 10 $Lfed^{-1}$was added after transplantation and added one, two, and three months later.

Table 2. Some chemical properties of horse compost vermicompost used:

Organic fertilizers	pH	EC dSm^{-1}	Organic carbon	N	P	K	Fe	Zn	Mn
			%		%			ppm	
Horse compost	7.1	2.11	17.44	1.2	0.5	3.9	584	76	**133**
Vermicompost	**7.7**	**2.03**	**19.18**	**2.3**	**0.8**	**4.5**	**490**	**55**	**97**

Table3. Some chemical properties of vermicompost tea used:

	N	P	K	Fe	Zn	Mn
	%			ppm		
Vermicompost tea	**2.4**	**0.3**	**4.2**	**7.5**	**1.2**	**1.9**

The experimental treatments were as follows:

- (T1): Control (recommended dose) (T2): Compost 100%
- (T3): Vermicompost 100% (T4): Vermicompost25% + compost 75%
- (T5): Vermicompost50% + compost 50% (T6): Vermicompost75% + compost 25%
- (T7): Vermicompost25%+ compost75%+vermicompost tea 10 $Lfed^{-1}$foliar application.
- (T8): Vermicompost50%+compost 50%+vermicompost tea10 $Lfed^{-1}$foliarapplication.
- (T9): Vermicompost75%+ compost 25%+vermicompost tea10 $Lfed^{-1}$foliar application.

The experiment was arranged in a randomized complete block design with three replicates. All agricultural practices' of operation-other than experimental treatments-necessary for growth as cultivation, irrigation, and pest control were followed whenever it was necessary and were done according to the recommendations of the Ministry of Agriculture, Egypt.

Plant growth and yield: Five plants were randomly selected from each unit plot. The following data were recorded: Plant height - diameter of the stem (mm)- Stem length(cm) -stem fresh and dry matter(g) – root fresh and dry matter (g)- the total fresh weight of the plant (kg/plant) -head length (cm)- head diameter (cm)-a fresh matter of head ($kgplant^{-1}$) –a dry matter of head ($gplant^{-1}$) - yield of cabbage $tonfed^{-1}$**.**

Chemical constituents: The concentrations of N, P, and K, (%) in roots, stem and leaves were determined according to the methods described by**Cottenie *et al.*, (1982)**. Chlorophyll a, b, and Carteniodes (mg/g) were determined in leaf fresh samples as described by **Sadasivam and Manickam (1992)**

Statistical analysis: All obtained data were subjected to statistical analysis of variance according to **Snedecor and Cochran (1980).** The least significant differences (LSD) at P= 0.05 level were used to verify the difference among means of the treatments.

Results and Discussion

Growth parameters:

It is evident from data presented in Table (4A&B) that application of different ratios of organic residues (vermicompost and compost) and foliar application of vermicompost tea treatments alone or together gave statistically significant positive effects on all growth parameters and yield productivity under investigation as compared with control. The increased vegetative growth may be due to the increasing availability of nutrients(N, P, and K) uptake through the application of organic fertilizers in the soil, as well as the accumulation and translocation of more photosynthesis that helps to absorb and store carbon and improve some properties of soil and increase water retention, the soil texture the structural improvement and improving the aeration in the soil forming longer and stronger roots to absorb sufficient water and nutrients as compared with that of chemical fertilizers. These results agreed with the finding of on cabbage plants **Getnet and Raja (2013)and Akimew*et al.*, (2020)**whofound that the growth parameters were developed and increased as a result of applying vermicompost. Plant height, cabbage head, and yield production were also significantly increased as compared to the control. **Devi *et al,* (2017)**indicated that the application of vermicompost at the rate of 8.5 tha^{-1} significantly gave the highest head diameter, the average weight of the head, the average volume of the head, head yield per plot, and total head yield (ton ha^{-1}) of cabbage.

The results in table (4A&B) showed that using vermicompost or compost as the sole source of fertilizers increased growth parameters and yield of cabbage plants as compared to the inorganic fertilizers (control). These results agree with **Sinha *et al.*, (2010)** who found that vermicompost promotes growth from 50-100% over conventional compost and 30-40% over chemical fertilizers. In comparison, between vermicompost and conventional compost (horse's compost), the results demonstrated the effectiveness of vermicompost in increasing the biological yield as compared to conventional compost. A similar result was reported by**Chatterjee (2013)** whofound that the use of various organic manures (farmyard manure and vermicompost) improved the growth and head of cabbage plants. Furthermore, vermicompost application emerged as a better source of organic nutrients over manure from the farmyard manure. Also, **Abul-Soud *et al.*, (2014); Abul-Soud et al., (2015 a and b)**mentioned that the use of vermicompost as a substrate amendment had a significant encouragement impact on the growth and yield of sweet paper, snap bean, lettuce, strawberry, celery, salad cabbage, and red cabbage. These results might be due to the complete decomposition of vermicompost and the release of nutrients in usable form, as well as the significant increases in soil microbial biomass following vermicompost addition. These results were in agreement with of those **Tognetti *et al.*, (2013)**.

Furthermore, vermicompost releases nutrients in a short time compared to compost. According to the data in Table (4&5) the highest results in fresh weight and dry weight of head plant^{-1}, fresh weight and dry weight of steam plant^{-1}, and fresh weight and dry weight of roots plant^{-1} and yield were noticed by the treatment of **T_9**(vermicompost 75 % + compost 25 % + vermicompost tea 10 Lfed^{-1}), followed by **T_8**(vermicompost50 % + compost 50 % + vermicompost tea10 Lfed^{-1}) as compared to other treatments and control.This finding is similar to those of **Yassen *et al.*,(2020)** on lettuce; **Jandaghi *et al.*, (2020)** on cucumber **and Aslam, and Ahmad, (2020)** on maize plants. They also found that the addition of vermicompost or compost with foliar spray vermicompost tea led to improvements in growth parameters and yield production. Data also, revealed that when vermicompost and vermicompost tea mixed together led to increasing plant height and dry weight of stem to (54.66 cm and 29.1 gplant $^{-1}$) in **T_8**as compared to control (42.88 cm and17.8 gplant^{-1}) respectively. These results may be due to the that application of vermicompost tea exhibited growth-promoting effects on the exomorphological parameters such as plant height and yield These results agreed with**Samadhiya*et al.* (2013)** who reported that vermiwash sprayed on the tomato plants, showed significant growth of plants, such as., shoot length, number of leaves. In addition, vermicompost tea was able to supply balanced nutrients to plant roots and stimulate growth; increase the organic matter content of the compost including the (humic substances) that affect the nutrient accumulation and promote root growth. Furthermore, data showed that cabbage that grew in **T_5**(Vermicompost 50% + compost 50%) showed the greatest increase in fresh biomass. These results could be attributed to changes in the physicochemical and microbiological state of the growth media. This is in line with the findings of **Truong and Wang's (2015)** on tomato seedlings. On the other hand, the lowest fresh biomass was obtained with **T_6**(Vermicompost 75% + compost 25%). Data also, reported that the high concentration of vermicompost inhibited the vegetative and reproductive in cabbage. Our observations are in agreement with **Ievinsh (2011)** who discovered that applying more than 50% vermicompost to radish, cabbage, Swedish turnip, beetroot, beans, and peas inhibited seed germination. They concluded that vermicompost fertilizer with compost increased maximum vegetative growth parameters led to a reduction in the use of chemical fertilizers and provided high-quality products free of harmful.

Table 4. Effect of vermicompost, compost, and foliar application of vermicompost tea on some of the growth parameters and yield in cabbage plant

(A)

Treatments	Plant height cm	F.W* of stem g/plant	D.W* of stem g/plant	Diameter of the stem (mm)	Stem length (cm)	F.W* of root g/plant	D.W* of root g/plant
T1	42.88	69.1	17.8	19.66	14.3	25.2	9.3
T2	44.26	60.8	20.1	21.55	22.1	33.9	11.9
T3	46.35	61.1	20.8	22.10	22.6	36.7	12.1
T4	48.67	68.3	23.7	22.80	23.0	45.7	16.0
T5	49.07	71.8	24.8	24.00	23.3	47.9	17.7
T6	47.21	66.3	21.5	23.71	22.4	41.8	13.5
T7	51.19	76.3	26.0	23.41	25.0	52.5	18.9
T8	54.66	81.9	29.1	25.48	25.8	58.1	19.0
T9	52.73	88.2	27.5	25.40	27.5	60.9	23.6
LSD $_{0.05}$	4.84	5.48	4.40	5.39	6.22	4.23	4.53

(B)

Treatments	Total fresh weight of the plant (kg/plant)	Head length (cm)	Head diameter (cm)	F.W* of head kg/plant	D.W* of head g/plant	Yield ton fed $^{-1}$	Increased yield (%) over control
T1	4.643	23.21	15.70	4.360	370.52	37.14	-
T2	5.415	24.80	17.33	5.246	539.96	46.32	24.71
T3	6.138	25.15	18.41	5.830	785.22	49.10	32.20
T4	7.677	25.90	18.93	7.150	703.40	50.41	35.73
T5	7.867	26.73	20.00	7.333	733.59	52.93	41.11
T6	7.100	26.60	20.28	6.634	945.71	51.41	38.42
T7	9.038	28.44	21.60	8.749	721.32	62.30	67.74
T8	9.612	31.80	23.15	8.960	869.21	65.89	77.40
T9	10.136	33.54	23.22	9.305	919.04	68.08	83.30
LSD $_{0.05}$	1.840	3.086	2.969	1.560	70.30	6.709	

*FW = fresh weigh *DW = dry weight

Chemical composition:

Nitrogen, phosphorus, and potassium contents and uptake by cabbage plants as affected by different ratios of vermicompost, compost as well as their interaction with foliar application of vermicompost tea are shown in Tables (5&6). Results revealed that all treatments tended to increase N, P, and K concentrations and uptake in roots, stems, and leaves as compared with the control treatment. Application of organic fertilizer can provide easily available nutrients, growth-promoting substances, and a variety of useful microorganisms by biological nitrogen fixation and biological solubilization of P, and cellulose-decomposing organisms **(Vimala*et al*., 2006).**These results coincided with **Reza *et al*., (2016)** who noticed that using organic fertilizers (cow dung, poultry manure, and vermicompost) resulted in increasing nutrient uptake (N, P, and K) as compared to the chemical fertilizers. Thus, these organic fertilizers can be substituted for the most commonly used nitrogen sources for the production of cabbage. Also**, Ahmed *et al*., (2017)**concluded that increasing the vermicompost rate from 10 to 30 % led to an increase in N, P, and K contents of celery and red cabbage compared to the control treatment.The collected results in this research revealed that the best treatments which led to the highest values of nitrogen phosphorus and potassium contents (%) in roots, stem, and leaves were recorded by foliar spray of vermicompost tea with different ratios of vermicompost and horse's compost as compared with the other used treatments and the control. The maximum N and K contents were noticed with**T_9**(vermicompost 75 % + compost 25 % + vermicompost tea 10 L fed^{-1}). (1.82% and 2.22) in roots and (2.01 and 2.63) in the stem), respectively.Whereas the highest N content (3.23%) in leaves was obtained with **T_8**(vermicompost 50 % + compost 50 % + vermicompost tea10 L fed^{1}). On the other hand, the phosphorus content of cabbage roots ranged between 0.13 and 0.31 %, stems between 0.21 and 41 %, and leaves between 0.30 and 49 %. The highest P % valuewas obtained with **T_8**, followed by **T_9**. The highest nitrogen uptake in roots (429.5 $mgplant^{-1}$) was recorded in the **T_9** treatment and also the lowest nitrogen uptake (104.2 mg/plant) was recorded in **the T_1** treatment (control). Whereas the highest value of nitrogen uptake in stem and leaves (576.2 mg/plant and 28,08 g/plant, respectively) was recorded in T_8 and also the lowest nitrogen uptake (236.7 mg/plant and 6.67 g/plant, respectively) was recorded in T_1 treatment (control). The highest P and K uptake in roots was observed with **T_9** whereas lesser P and K uptake in roots was observed with **T_8**. The opposite was observed with P and K in the leaves. The increase in nutrient uptake of roots, stems, and leaves, may be due to the increase in dry matter production. The application of organic matter not only enhanced the chemical contents of plants but also improved the physical properties of the treated soil, reflecting on the growing plants. Results showed that foliar treatments in combination with organic material added were much more effective than organic alone. The concentrations of NPK in the roots, stem and leave of cabbage plants were progressively increased by foliar application of vermicompost tea with vermicompost and horses compost added to the soil. Concerning the effect of foliar feeding with vermicompost tea on root macronutrients concentration and uptake, it is quite clear that both concentration and uptake of root macronutrients were significantly affected by foliar feeding with vermicompost tea as compared to other treatments and control.**Yassen *et al*., (2020)** mentioned that the application of vermicompost fertilizer at the rate of 4 tons fed^{-1} with foliar spray of vermicompost tea (vermiwash) might be raising NPK contents in lettuce plants.In the present investigation Tables (5&6) indicated that comparing the application of organic fertilizer, horse's compost and/or vermicompost as a single treatment showed that using vermicompost increased N, P, and K contents and uptake as compared with the application of horses' compost under study. These results corresponded with**Abd El-Rheem *et al*., (2019)** who pointed out that vermicompost application at the rate of 0.5, 1, and 2 ton fed^{-1} increased N, P, and K uptake of lettuce as compared with compost application. The highest values of N, P, and K uptake were obtained with the highest rate of vermicompost (2-ton fed^{-1}).

The results of the Chlorophyll content study are summarized in table (7), and it is concluded that increasing chlorophyll a and b, Carotenoids, and Total Chlorophyll in comparison to the control treatment. The increasing chlorophyll content was due to the presence of microorganisms in the VC and compost that colonize the rhizosphere and stimulate the plant growth and biochemical contents. These findings agreed with those of **(Karmegam and Daniel, 2008)** in Bean. Also, information in the table showed that **T_7**(Vermicompost 25% + compost 75 % +vermicompost tea 10 Lfed-1) foliar application resulted in a better increase in pigment content (chlorophyll a and b andtotal chlorophyll).Thehighest value of carotenoid was observed in **T_3**(Vermicompost 100%), followed by T_5(Vermicompost 50% + compost 50%). The lowest value was observed with T_1(control). With respect to the foliar application of vermin extracts, the foliar application is possibly responsible for the largest content of chlorophyll observed in plants receiving previous treatment. These results are in agreement with (**Tejada *et al*.,2007**).When comparing application compost and vermicompost treatment data, it was revealed that vermicompost application resulted in a higher pigment content (chlorophyll a and b, carotenoids) than the control treatments.

Table 5. Effect of vermicompost, compost, and foliar application of vermicompost tea on N, P, and K, content (%) on roots, stems, and leaves in cabbage plant.

Treatments	Roots			Stem			Leaves		
	N	P	K	N	P	K	N	P	K
					%				
T1	1.12	0.13	1.55	1.33	0.21	1.60	1.80	0.30	2.36
T2	1.23	0.18	1.60	1.45	0.25	1.76	2.12	0.33	2.70
T3	1.42	0.20	1.68	1.57	0.27	1.81	2.36	0.35	2.94
T4	1.54	0.25	1.72	1.60	0.31	2.08	2.47	0.39	3.20
T5	1.62	0.27	1.86	1.78	0.33	2.27	2.50	0.39	3.56
T6	1.58	0.27	1.79	1.86	0.35	2.39	2.50	0.40	3.77
T7	1.72	0.30	2.10	1.85	0.40	2.28	2.70	0.49	3.55
T8	1.76	0.33	2.11	1.98	0.46	2.44	3.23	0.55	4.11
T9	1.82	0.31	2.22	2.01	0.41	2.63	2.96	0.49	3.87
LSD $_{0.05}$	0.451	0.077	0.527	0.363	0.054	0.507	0.363	0.077	0.486

Table 6. Effect of vermicompost, compost, and foliar application of vermicompost tea on N, P, and K, uptake (mg/plant) on roots, stems, and leaves in cabbage plant.

Treatments	Roots			Stem			Leaves		
	N	P	K	N	P	K	N	P	K
			mg/plant					mg/plant	
T1	104.2	12.1	144.2	236.7	37.4	284.8	6.67	1.11	8.75
T2	146.4	21.4	190.4	291.5	50.3	353.8	11.44	1.78	14.58
T3	171.8	24.2	203.3	326.6	56.2	376.5	18.53	2.75	23.09
T4	246.4	40.0	275.2	379.2	73.5	493.0	17.37	2.73	22.51
T5	286.7	47.8	329.2	441.4	81.8	563.0	18.34	2.86	26.13
T6	213.3	36.5	241.7	399.9	75.3	513.9	23.64	3.78	35.65
T7	325.1	56.7	396.9	481.0	104.0	592.8	19.48	3.54	25.61
T8	334.4	62.7	400.9	576.2	112.8	710.0	28.08	4.78	35.73
T9	429.5	73.2	523.9	552.8	133.9	723.3	27.24	4.50	35.57
LSD $_{0.05}$	4.699	3.113	2.505	5.230	3.232	7.460	0.017	0.017	0.010

Table 7. Effect of vermicompost, compost, and foliar application of vermicompost tea on Chlorophyll content, on leaves in cabbage plant

Treatments	Chlorophyll a	Chlorophyll b	Carotenoid
	mg/g		
T1	1.987	1.258	0.366
T2	3.038	1.302	0.632
T3	3.432	1.542	1.074
T4	2.840	2.344	0.430
T5	3.277	2.096	0.907
T6	4.339	2.428	0.552
T7	4.730	2.515	0.781
T8	2.706	1.507	0.680
T9	3.344	2.155	0.697
LSD $_{0.05}$	0.707	0.238	0.056

References

Abd El-Rheem, Kh. M.; Essa, E.M.; El-Damarawy, Y.A. and Zaghoul S.M. (2019).comparison Study between Compost and Vermicompost Application on Lettuce Production under Potassium Fertilization. J. Basic Sci. Appl. Res., 5(1): 1-6.

Abul-Soud, M.A.; Emam, M.S.A. and Abd El-Rahman, N.G. (2015). The potential use of vermicompost in soilless culture for producing strawberry. Int. J. Pl. and Soil Sci., 8 (5): 1-15.

Abul-Soud, M.A.; Emam, M.S.A.; Abdrabbo, M.A.A. and Hashem, F.A. (2014).Sustainable urban horticulture of sweet pepper via vermicomposting in summer Season. J. Adv. in Agric., 3 (1): 110-122.

Abul-Soud, M.A; Emam, M.S.A.; Hawash, A.M.H.; Mohammed, M.H. and Maharik, Z.Y. (2016).The utilize of vermicomposting outputs in ecology soilless culture of lettuce. J. Agric. and Ecol. Res., 5 (1): 1-15.

Ahmed, S.H.; Emam, M.S.A. and Abul-Soud, M. (2017). Effect of different vermicompost rates

and pot volume on producing celery and red cabbage under urban horticulture conditions. Zagazig J. Agric. Res., 44 (4): 1245-1258.

Akimew, A.A.; Ademe, B.E. and Shah, G.H. (2020).Optimization of Variety-Vermicompost dose Synchrony on the Yield Traits of Hybrid cabbage (Brassica oleraceaevar. capitata L.) Varieties.Journal of Agricultural Science and Technology.19:3.

Aslam, Z. and Ahmad, A. (2020).Effects of Vermicompost, Vermi-tea and chemical fertilizer on morpho-physiological characteristics of maize (Zea mays L.) in Suleymanpasa District, Tekirdag of Turkey. Journal of Innovative Sciences, 6(1): 41-46.

Chatterjee,R.; Bandhopadhyay,C.R. and Jana,S.J.C. (2013). Influence of different organic amendments on growth, head yield and nitrogen use efficiency in cabbage. American International Journal of Research in Formal, Applied and Natural Sciences, 5(1): 90-95.

Cottenie, A.M; Verloo,L. Velghe, K.G. and Camerlynck, R. (1982). Chemical Analysis of Plant and Soil. PP. 100 – 129. Laboratory of Analytical and Agrochemistry, State Univ. Ghent. Belgium.

Coulibaly, S.S.; Kouassi, K.l.; Tondoh, E.J. and Zoro, Bi.I.A. (2011). Impact of the population size of the earthworm Eudrilus eugeniae (Kinberg) on the stabilization of animal wastes during vermicomposting. Philippine Journal Agricultural Scientist, 94: 88-95.

Devi, S.; Choudhary, M.; Jat, P.K.; Singh, S.P and Rolaniya, M. K. (2017). Influenced of organic and biofertilizers on yield and quality of cabbage (Brassica oleracea var. capitata). International Journal of Chemical Studies 2017, 5(4): 818-820.

Getnet, M. and Raja, N. (2013). Impact of Vermicompost on Growth and Development of Cabbage, Brassica oleracea Linn. And their Sucking Pest, Brevicorynebrassicae Linn. (Homoptera: Aphididae). Research Journal of Environmental and Earth Sciences, 5(3): 104-112.

J**andaghi, M.; Hasandokht, M. R., Abdossi, V. and, Moradi, P. (2020)**.the effect of chicken manure tea and vermicompost on some quantitative and qualitative parameters of seedling and mature greenhouse cucumber. Journal of Applied Biology and Biotechnology, 8(1): 33-37.

Jim, M. and Tony, N. (2006). Cabbage growing Primefact 90 (replaces AGFACT. H8. 1.27. NSW Department of primary Industries (publ) :1-7.

Karmegam, N. and Daniel, T. (2008).Effect of vermicompost and chemical fertilizer on growth and yield of Hyacinth Bean (Lablab purpureas). Dynamic Soil, Dynamic Plant, Global Science Books, 2: 77-81.

Kharrazi, S.M.; Younesi, H.; Abedini-Torghabeh,J. (2014). "Microbial biodegradation of waste materials for nutrients enrichment and heavy metals removal: An integrated composting-vermicomposting process". International Biodeterioration and Biodegradation, 92: 41–48.

Klute, A. (1986). Methods of Soil Analysis, Part 1, Physical and Mineralogical Methods 2nd edition.American Society of Agronomy, Madison, Wisconsin, USA.

Levinsh, G. (2011). Vermicompost treatment differentially affects seed germination, seedling growth and physiological status of vegetable crop species. Plant Growth Regul, 65:169–181.

Nath, G. and Singh, K. (2011).Effect of foliar spray of Biopesticides and vermiwash of Animal, Agro and Kitchen wastes on Soybean (Glycine max L.)Crop. Botany Research International, 4(3):25-27.

Page, A.I.; Miler, R.H. and Keeny, D.R. (1982). Methods of Soil Analysis part II. Chemical and Microbiological Methods.Amer. Soc. Agron., Madison, Wisconsin, USA.

Podsędek, A. (2007). Natural antioxidants and antioxidant capacity of Brassica vegetables: a review. LWT Food Sci Technol, 40:1–11.

Reza, M. S.; Islam, A. K. M. S.; Rahman, M. A.; Miah, M. Y.; Akhter, S. and Rahman, M. M. (2016). Impact of organic fertilizers on yield and nutrient uptake of cabbage (Brassica Oleracea var. capitata). Journal of Science, Technology and Environment Informatics, 03(02), 231-244.

Sadasivam, S. and Manickam, A. (1992). Biochemical methods for agriculture sciences. Wiley Eastern limited. PP. 181-185.

Samadhiya, H.; Dandotiya, P.; chaturvedi, J. and Agrawal, O.P. (2013). Effect of vermiwash on the growth and development of leaves and Stem of tomato plants. International Journal of Current Research, 5(10): 3020-3023.

Sharma, R.C.and Banik, P. (2014). Vermicompost and fertilizer application: Effect on productivity and profitability of baby corn (Zea Mays L.) and soil health. Compost Science and Utilization, 22(2): 83–92.

Sinha, R. K.; Agarwal, S.; Chaudhan, K. and Valani, D. (2010). The wonders of earthworms and its vermicomposting in farm production: Charles Darwin's friends of farmers', with potential to replace destructive chemical fertilizers from agriculture. Agri. Sci., 1(2): 76-94.

Snedecor, G.W. and Cochran, W.G. (1980). Statistical Methods.7th ed., Iowa State Univ. Press, Ames, Iowa, USA.

Sousa, C.; Valentão, P.; Rangel, J.; Lopes, G.; Pereira, J.A.; Ferreres, F.; Seabra, R.M. and

Andrade, P.B. (2005). Influence of two fertilization regimens on the amounts of organic acids and phenolic compounds of tronchuda cabbage (Brassica oleracea L. Var. costata DC). J. Agric Food Chem, 53:9128–9132.

Tejada, M.; Gonzalez, J.; Hernandez, M.and Garcia, C. (2007). Agricultural use of leachates obtained from two different vermicomposting processes.Bioresour. Technol., 99(14): 6228-6232.

Tognetti, C.; Laos, F.; Mazzarino, M.J. and Hernández, M.T. (2013).Composting vs. Vermicomposting: A Comparison of End Product Quality.Compost Science and Utilization 13(1):6-13.

Truong, H.D. and Wang, C.H. (2015). Effects of different combination of vermicompost on growth, yield, and fruit quality of two tomato varieties under greenhouse conditions. J. Agric Sci., 7(11): 216.

Tse, G. and Eslick, G.D. (2014). "Cruciferous vegetables and risk of colorectal neoplasms: a systematic review and meta-analysis". Nutrition and Cancer. 66 (1): 128–139.

Vimala, P. M.; Illias, K. and Salbiah, H. (2006).Effect of rates of organic fertilizer on growth, yield and nutrient content of cabbage (Brassica oleracea var. captitata) growth under shelter. Acta Horticulturae, 710: 391-397.

Yassen, A.A.; Essa, E. M.; Marzouk, N.M. and Zaghloul, S.M. (2020).impact of vermicompost and foliar spray of vermiwash on growth, yield and nutritional status of lettuce plants. Plant Archives, 20 (1): 449-455.

تأثير اضافة الاسمدة العضوية والمعدنية علي انتاجية وجودة نبات الكرنب

حسناء عزت الميهي1، رأفت سرور السيد2 ، هبة شوقي راشد2 ، عبد العظيم عبد العزيز ياسين1 ، انتصار محمد عيسي1

1 المركز القومي للبحوث– جيزة – مصر

2 كلية الزراعة جامعة بنها

تم اجراء هذا البحث في المزرعة الخاصة بالمركز القومي للبحوث في النوبارية لدراسة تأثير اضافة نسب مختلفة من الفيرميكمبوست والكمبوست وتفاعلهم مع الرش الورقي للفيرميكمبوست تي علي معدلات النمو والتركيب الكيميائي للكرنب، اظهرت النتائج ان اضافة معدلات مختلفة من الفيرميكمبوست والكمبوست مع الرش الورقي بالفيرميكمبوست تي وحدهما او خلطهم معا اعطت نتائج ايجابية علي جميع معدلات النمو وانتاجية المحصول مقارنة بالكنترول، كما ادت ايضا الي زيادة كلوروفيل أ و ب ، الكاروتينات الكلية ، تركيزات النيتروجين والفوسفور والبوتاسيوم والامتصاص ف الجذور والساق والاوراق مقارنة بالكنترول

وتفيد النتائج ايضا ان استخدام الفيرميكمبوست كان اكثر ملائمة حيث يحتوي علي المزيد من العناصر الغذائية مقارنة بمعاملات الكمبوست والكنترول.

الكلمات الدالة: كمبوست– فيرميكمبوست– فيرميكمبوست تي– النمو– المحصول– التركيب الكيميائي– نبات الكرنب