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Effect of locally prepared organic fertilizers by support with Phosphate rock and decomposed biology in the production of seedlings and the yield of the *lettuce* plant

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Abstract

The experiment included recycling solid organic waste and improving its components to produce organic fertilizers. In two stages: The first: achieved by preparing a mixture of organic wastes at a ratio of C: N 30: 1. Anaerobically I fermented for 60 days after inoculating 5% of the active soil pollen. Second: The fermentation products 0, 10% and 20% of the raw Phosphate Rock (RP) were prepared, and then the treatments were aerobically fermented for 30 days with inoculation from 3% active soil.

The products of the second fermentation stage were used with a treatment of commercial peatmoss and a control treatment using agricultural soil in testing the germination and production of seedlings of the *lettuce* plant of a local variety, and the most important results were: The superiority of my meaning in the germination percentage ranged between 93.2 and 96.5% for the treatments that made organic fertilizers prepared locally with investigation The highest rate ranged between 9.8 and 10.6 cm for the height of the seedlings during a period of 10 days, depending on the results of the test of germination and production of seedlings, the use of the same treatments was tested at a rate of 3% with agricultural soil in the anvil experiment, with the use of the first control treatments using fertilizer with a commercial seasonal addition of 3% and control Again, using the fertilizer recommendation from mineral fertilizers for the lettuce plant, as seedlings that were produced in the first test experiment were used, and the most important results were:

All the treatments prepared from fermentation of residues and equipped with phosphate rock outperformed the two treatments of peat moss and the recommendation of mineral fertilizers to achieve the best results in the morphological characteristics of plant height, number of total and edible leaves, and the average weight of the soft head, which ranged between 960.4 and 990.7 g. Significant superiority of all rates of locally prepared organic fertilizer treatments over fertilizer recommendation treatment, with chlorophyll values, lipid content, nitrogen and phosphorus concentration, and leaf content of Fe, Zn, Mn and Cu. With a significant effect of the treatments from prepared fertilizers and commercial peatmoss in increasing the content of Nitrogen fixing bacteria and Phosphate solvent and the concentration of Nitrogen and ready Phosphorous compared to what was found in soil treatment.

Introduction

The results of (1) demonstrated the possibility of adopting the technology of enrichment and fermentation of residues in the preparation of organic and biological fertilizers with low cost that improves crop production and preserves a healthy and clean environment (2). When examining the nitrogen concentration in the residues before and after fermentation, confirmed that they contained 13.6 and 15.3 gm N kg^{-1}. The process of difference depends

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on the ratio of C: N and the method of fermentation and the process of enrichment of the components of the mixture from other materials.

Also, organic fertilizers in the form of compost contain a percentage of nitrogen that must be mineralized by fermentation for a period of time before they are used by plants or are subject to losses in the form of volatile gases (3).

Some microorganisms that analyze nitrogen-fixing compounds play an important role in increasing the amount of nitrogen in organic fertilizers in addition to their analysis into useful and easy compounds (4). found(5) that when preparing 1.2% of phosphate rock for organic residues, inoculating with a mixture of active and beneficial microbes and fermenting them for a period of 90 days, they found an increase in nitrogen, phosphorous, potassium, iron, zinc concentration and microbial content of the fermentation products.

Found (6) and (7) similar results when preparing phosphate rock for fermented mixtures in increasing the content of fermented residues from ready-made phosphorous, especially with the addition of the phosphate-dissolving vaccine, and witnessed an increase in the total microbial content, total and mineral nitrogen, zinc, potassium and boron.

Also (8) studied the effect of processing phosphorous rock by 5% and 10% to solid fermented organic city wastes, and found that the rate of dissolved phosphorous increases its concentration with the increase in the production of organic acids that are produced in the early fermentation stages, and the fermentation processes of organic wastes contribute to the production of ready-to-plant compounds throughout the season. Growth and does not disturb the components of the soil, but increases its ability to provide water, air and other nutrients to the plant.

Carried out (9) an experiment to grow *lettuce* under protected conditions by using three types of mixtures of organic animal and plant fertilizers and sugar factory waste fermented and fresh mixed or unmixed with calcium carbonate, compared with the use of mineral fertilizers from urea, superphosphate and potassium sulfate. The fermented treatments with the use of the calcium carbonate treatment were characterized by the highest production of morphological and physiological characteristics. The solid organic waste of cities often contains high concentrations of heavy metals that are toxic to plants such as cadmium and lead and have varying effects according to the type of plant and soil (10).

Also, (11) tested the use of organic and mineral fertilizers and their effect on the growth and yield of the lettuce plant and its superiority. The average yield from the treatment of a mixture of animal and green plant fertilizer to give the highest plant height of 32.2 cm for the two years and a head weight of 1060 and 1550 g for the first and second year respectively, as well as the organic fertilizers showed different effects in protecting the plant from cold waves. Found (12) an increase in growth rates and an improvement in the characteristics of composted *lettuce* from fermented city residues before use and gave the best results in nutrient readiness after the harvest phase.

Materials and methods

A quantity of solid organic components that are bio-recyclable and separated from the waste of the city were dried, crushed and mixed well and their chemical and biological components were analyzed in the laboratory Table (1), for the purpose of conducting the biological recycling for use in the production of bio-organic fertilizer. A mixture was prepared based on the concentration of organic carbon and nitrogen in the organic waste that could be bio-recyclable.

It was prepared in a ratio of C:N 30:1 by using an aqueous solution of urea fertilizer (46% N) to adjust the ratio from C:N 40:1 to C:N 30:1. The ingredients were moistened, to reach 70% with water. then the mixture was inoculated with 5% of soil pollen transferred from the

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rhizosphere, depth 0-15 cm, brought from a field planted with *maize* plants, for the purpose of increasing the diversity, activity and microbial density analyzed in the mixture (13).

The mixture components were fermented for 60 days by aerobic fermentation in the form of a 4.5 m^3 stack of pile, then 3 sections were divided and each section prepared 0, 10, or 20% RP (Rockphosphate), and the aerobic fermentation continued for 30 days.

Table (1) some characteristics and components of the organic matter separated from solid waste.

The value	Measurement	Adjective	the value	Measurement	Adjective
33.3	$Mg.kg^{-1}$	Cu	570.0	$g. kg^{-1}$	C
52.4	$Mg.kg^{-1}$	Zn	14.23	$g. kg^{-1}$	N
102.0	$Mg.kg^{-1}$	Na	40: 1	-	C: N
24.2	$Mg.kg^{-1}$	Cd	0.46	$g. kg^{-1}$	P
1.870	$logcfu\ g^{-1}$	Coliform	82.8	$Mg.kg^{-1}$	K
3.342		Nfix	480.0	$Mg.kg^{-1}$	Fe
2.623		BSP	90.0	$Mg.kg^{-1}$	Mn

The fermentation products were used for the 3 treatments (Table 2), with the use of a control treatment from the commercial peat moss brought from the local market and a second control treatment using agricultural soil whose characteristics are shown in Table (3), bringing the number of transactions to 5 treatments, which were used in three iterations in To test germination and production of seedlings of the lettuce plant, a local variety, I used cork boxes with dimensions 15 x 15 x 5 cm for the box (from the local market).

A layer of processing materials, 3 cm deep, was placed in the cork boxes and lettuce seeds were spread at a rate of 80 seeds for the box in a homogeneous manner, then covered with a depth of 2 cm from the same treatment materials, and carried out on 25\10\2017 in a protected place and moistened with water.

The parameters were arranged according to the CRD design and all service operations were performed, and after the seedlings reached the third true leaf stage, the percentage of germination, seedlings height and maturity age of the seedlings were recorded (14). The data were analyzed statistically as stated in the two previous experiments and according to the design used.

Experience of testing solid organic fermentation products in the production of lettuce

The prepared and used organic fertilizers were tested by producing seedlings to fertilize the *lettuce* plant whose seedlings were produced in the previous experiment and to know their role in the growth and production of the plant and soil characteristics, compared to using a first control treatment of commercial peatmoss fertilizer and a second control treatment using the fertilizer recommendation of mineral fertilizers, so that the number of treatments became 5 treatments (Table 2).

Table 2: Transaction codes used in the lettuce production test

Code	Add	Transaction
T1	88 and 210 Kg^{-1} P And the N batch3	T intestate in fertilizer metal
T2	70 + %3 kg N^{-1} third batch	Local Bmos
T3	70 + %3 kgN^{-1} third batch	C: N 30: 1 0% RP
T4	70 + %3 kg N^{-1} third batch	C: N 30: 1 10% RP
T5	70 + %3 kg N^{-1} third batch	C: N 30: 1 20% RP

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The use of plastic anvils with dimensions of 30 cm in diameter from the top and 20 cm in diameter from the bottom and 25 cm in height to carry out the experiment, I brought agricultural soil from the agricultural field of the *maize* plant and from the depth 0-30 cm (Table 3), the soil was smoothed and passed through a sieve with a diameter of 4 mm holes.

The anvils were filled at a rate of 10 kg of soil, prepared with 3% of the prepared fertilizer treatments (3 treatments), and commercial peat moss fertilizer was added at a rate of 3% to the soil as a control treatment, and a soil treatment was left without organic addition and prepared with mineral fertilizer at the level of fertilizer recommendation (88 and 210 kg) of superphosphate fertilizer and urea (19% P and 46% N) as a second control treatment, add phosphate fertilizer and the first batch of nitrogen fertilizer before transferring the seedlings (14). The organic or mineral fertilizer treatments were mixed well with the components of the soil in the anvils according to the distribution of the coefficients.

Table 3: Some of the soil characteristics and properties used in the implementation of the experiment to grow and produce the lettuce plant

The value	Measurement	Attribute or attribute	the value	Measurement	Attribute or attribute
224	$Mg.Kg^{-1}$	K	7.57		PH
44.2		Zn	2.76	$ds.m^{-1}$	EC Paste extract
48.8		Mn	165	$g.kg^{-1}$	the sand
39.2		Cu	435		Silt
25.1		Cd	400		Clay
3.70	$g.kg^{-1}$ Fe		22.2	%	$CaCO_3$
0.00	$Log\ cfu\ g^{-1}$	Coliform	0.87	%	OM
2.969		BNF	132	$Mg.Kg^{1-}$	Total nitrogen
1.863		BSP	9.65		Ready phosphorous

The treatments were moistened with the limits of the field capacity and the *lettuce* seedlings produced from the previous experience were transferred both from the same treatment in the previous experiment. The treatments were placed in an appropriate place and arranged according to the design of the CRD with five replications for one treatment on 6\11\2017, the irrigation process continued in the gravimetric method when 50% was lost.

The second batch of nitrogen fertilizer was given to treat the soil after 30 days of planting, and the service process continued for the plant by adding the third batch of nitrogen fertilizer to all treatments after 70 days of planting and the service operations continued until the date of harvest at the age of 110 days for the plant on 1/3/2018. The measurements of plant height, number of total leaves, number of edible leaves, percentage of total leaves, and soft head weight were recorded.

Samples of edible leaves were taken to make the estimates that included chlorophyll percentage, fat percentage, and nutrient concentrations of total Nitrogen, Phosphorous, Potassium, Iron, Manganese, Zinc, Cadmium and Copper. The chlorophyll was estimated in the green soft leaves and the percentage of fat in the leaves and the percentage of Nitrogen, Phosphorus and Potassium in the leaves were estimated after the harvest stage. The first rolled leaves were taken as described by A.O.A.C. (15).

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The total number of microorganisms, nitrogen fixing, Phosphate solvent, and pathogenicity were estimated in all samples of organic wastes prior to fermentation and fermentation products for mixtures (16) and (17). The soil characteristics were also estimated, and the trace elements of Fe, Mn, Zn, Cd and Ni were estimated. And Cu using the method of wet digestion to estimate the total content as stated in (18) with the atomic absorption device.

Results and discussion

The effect of treatments used on germination and production of *lettuce* seedlings

The table (4) shows the effect of prepared fertilizer treatments by recycling organic waste on the germination and production of *lettuce* seedlings compared to commercial peatmoss fertilizer and agricultural soil. All these treatments of organic fertilizers prepared in the study were followed by the treatment of commercial peatmoss, which gave a germination rate of 90.2%, while the germination rate in the treatment of agricultural soil reached 78.3%.

Table (4) the effect of the treatments used in the production of seedlings of the *lettuce* plant.

The maturing period is a day	Seedling height is cm	Germination%	Transaction code	Transactions
15	6.4	78.3	1	Rivers soil
12	8.0	90.2	2	With commercial use
10	9.8	93.2	3	Mixture C:N 30:1 0% RP
10	10.6	96.5	4	Mixture C:N 30:1 10% RP
10	10.2	94.4	5	Mixture C:N 30:1 20% RP
Ns	0.86	2.21	LSD 0.05	

The highest growth rate of seedlings reached between 10.6 and 9.8 cm during the minimum growth period of 10 days from the transactions bearing the numbers (5,4 and 3), which were distinguished by the best germination rate.

The commercial peatmoss treatment followed them with an average height of 8.0 cm seedlings within 12 days, while the agricultural soil treatment achieved an average seedling height of 6.4 cm within 15 days. The prepared biological organic fertilizers that were used in preparing the *lettuce* seedlings have a positive role in the growth and development of the seedling height and the number of leaves because it contains nutrients such as Nitrogen, Phosphorus and growth regulators as well as Potassium and Trace elements as it becomes ready for absorption after it has been mined by the action of microorganisms, and these elements.

In many biological and physiological processes that stimulate cell division and elongation and the synthesis of cell membranes that lead to an increase in vegetative growth, and the results we obtained may also be attributed to the role of their components of substances that directly affect the various biological processes of plants, and their behavior is similar to the behavior of hormones. Phytophthora, meaning that they can be considered as stimuli for plant growth, increase the rate of plant growth and provide the best conditions for cell division (19).

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The effect of the treatments used on some morphological characteristics and the yield of the *lettuce* plant

Table (5) data show that there is a significant superiority for the rates of head height in the organic fertilizers prepared locally with peatmoss fertilizer over the treatment of mineral fertilizer, as the rate of head height ranged between 35.2 and 42.3 cm, and the highest significant rate of head height was reached in the two treatments 42.3 and 40.9 cm. (T4 and T3), while the minimum average head height was 30.5 cm for the fertilizer recommendation treatment.

The average number that showed in table (5) of total leavesin the head for locally prepared fertilizer transactions and the treatment of peatmoss ranged between 34.6 and 39.2 cm for leave, and the two treatments T4 and T5 were distinguished by the average number of 39.2 and 38.5 leaves, respectively, compared to the treatment of fertilizer and commercial peatmoss (29.5). And 32.6 leaves), but it did not differ significantly from T3 treatment. Also, it was found from Table (5) that the highest significant rate for the number of edible leaves was 34.4 and 32.5 leaves, with a percentage of the total leaves 87.4% and 84.4% in the two transactions T4 and T5 respectively, followed by treatment T3 at a rate of 31.5 leaves and a percentage of the total leaves 87.2% , And the average number of edible leaves in the commercial pumice transaction was 27.5 leaves, with a percentage of the total leaves 79.4%, while the average number of edible leaves in the treatment of fertilizer recommendation was 21.4, with a percentage of the total leaves 75.9%.

Table (5) showed that the highest significant mean for the total head weight was 990.7 g for treatment (T5), followed by a T4 treatment with an average weight of 960.4 g, followed by a T3 treatment with an average weight of 875.5 g, as these parameters exceeded Significantly, the treatment of peatmoss (T2) and the recommendation of fertilizer (T1), which had an average head weight of 854.3 and 700.5 g, respectively.

Table (5) the effect of the used treatments on the average of some morphological characteristics and the yield of the *lettuce* plant

Head weight g	The number of sheets header			Head height is cm	code	Transactions
	Valid%	Valid	the college			
700.5	75.9	21.4	29.5	30.5	T1	Mineral fertilizer recommendation
854.3	79.4	27.5	34.6	35.2	T2	Peatmoss Local
875.5	87.2	31.5	36.1	37.4	T3	C: N 30:1 0% RP
960.4	87.7	34.4	39.2	40.9	T4	C: N 30:1 10% RP
990.7	84.4	32.5	38.5	42.3	T5	C: N 30:1 20% RP
25.52	6.13	3.20	4.16	3.32	LSD 0.05	

The effect of treatments used on the average of some physiological characteristics of the *lettuce* plant

The data in Table (6) showed a significant superiority for all the rates of locally prepared organic fertilizers and commercial peatmoss treatments compared to the

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recommendation for fertilizer treatment, as the chlorophyll ranged between 0.512 $mg.g^{-1}$ from T4 treatment and 0.501 $mg.g^{-1}$ for peat moss, while it reached in the recommendation treatment. Fertilizer 0.432 $mg.g^{-1}$.

No significant differences were found between the rates of chlorophyll ratios resulting from the prepared fertilizer treatments or with the rate of peat moss treatment. It was also found in Table (6) that the highest percentage of the estimated fat concentration in the edible leaves ranged between 3.04% and 2.89% for the T4 and T2 treatments, and significant differences were found in the rates of the fat percentage achieved in the locally prepared organic fertilizers and peatmoss treatments compared to what was found in Fertilizer recommendation treatment 1.98%.

Table (6) the effect of the treatments used on the average of some physiological characteristics of the *lettuce* plant.

K%	P%	N%	Fats%	Chlorophyll mg^{-1}	Code	Transactions
1.88	0.49	1.55	1.98	0.432	T1	Mineral fertilizer recommendation
2.68	0.60	1.85	2.89	0.501	T2	Local peatmoss
2.65	0.64	2.05	2.95	0.502	T3	C: N 30:1 0% RP
2.80	0.82	2.08	3.04	0.512	T4	C: N 30:1 10% RP
2.88	0.89	2.00	2.98	0.505	T5	C: N 30:1 20% RP
0.21	0.05	0.14	0.22	0.041	LSD 0.05	

It was also found that the highest Nitrogen concentration was 2.08% in the T4 treatment leaves, as it significantly exceeded the average Nitrogen content of 1.85% in the T2 treatment leaves and the average Nitrogen ratio of 1.55% in the fertilizer recommendation treatment leaves. All the locally prepared fertilizer treatments and the peat moss treatment achieved a significant increase in the nitrogen ratio compared to its percentage in the fertilizer recommendation treatment leaves. Also, it was found in Table (6) that the highest rate of 0.89% and 0.82% of the percentage of Phosphorus concentration was achieved in the T5 and T4 treatment leaves, achieving a significant superiority over the average Phosphorus concentration ratio in the T3 0.64% treatment leaves and the 0.60% treatment of peatmoss and the average Phosphorus concentration ratio 0.49% in the fertilizer recommendation transaction leaves.

It was also found that the Phosphorus concentration in the peatmoss treatment leaves was significantly higher than the Phosphorus percentage in the soil treatment leaves, with an increase of 22.4%. The results of measuring the Potassium concentration in Table (6) indicate that the highest Potassium concentration of 2.88% and 2.80% was found in the T5 and T4 treatment leaves, and a significant superiority over the average Potassium concentration (1.88%, 2.68% and 2.65%) in the T1, T2 and T3 treatment leaves on The succession, and all the locally prepared fertilizer treatments and peatmoss fertilizer achieved significant superiority with the Potassium concentration in the plant leaves compared to what happened from the fertilizer recommendation, with an increase ranging between 50% and 33.6%.

The effect of the used coefficients on the content of Fe, Zn, Mn, Cu and Cd leaves.

The results in Table (7) showed that the highest rates of 189, 180.5, 176.8 and 175.2 mg $Fe.kg^{-1}$ of elemental iron were found in T5, T4, T3 and T2 leaves respectively, as it significantly outperformed the average iron concentration of 162.1 mg $Fe.kg^{-1}$. In soil treatment leaves, as shown in Table (7), the average concentration of zinc, which ranged between 54.6 and 53.2 mg $Zn.kg^{-1}$ in locally prepared fertilizer treatment leaves equipped with Phosphate rock T5 and T4, exceeded its average concentration in the adult T3, T2 and T1 treatments. 45.2, 50.6 and 51.6 mg $Zn.kg^{-1}$, respectively. It was also found in Table (7) that the average concentration of manganese in the leaves ranged between 46.0 and 45.3 mg Mn $.kg^{-1}$.

In the leaves of the two treatments T5 and T4, and it was significantly superior to all other treatments, and all the locally prepared treatments and the peatmoss surpassed the average Mn concentration in the leaves. Fertilizer recommendation treatment of 30.4 mg $Mn.kg^{-1}$.

Table (7) Effect of treatments on Fe, Zn, Mn, Cd and Cu content in $mg.kg^{-1}$

Cu	Cd	Mn	Zn	Fe	Code	Transactions
8.3	1.20	30.4	45.2	1162.	T1	Recommendation Mineral fertilizer
11.5	1.25	42.2	50.6	175.2	T2	Local peatmoss
11.8	1.34	42.6	51.6	176.8	T3	C: N 30: 1 0% RP
12.8	1.66	45.3	53.2	180.5	T4	C: N 30: 1 10% RP
13.6	1.68	46.6	54.6	189.0	T5	C: N 30: 1 20% RP
2.32	0.20	2.43	21.2	12.43	LSD 0.05	

Table (7) showed that the highest average cadmium concentration of 1.68 and 1.66 mg $Cd.kg^{-1}$ was found in the T5 and T4 treatment leaves significantly superior to the concentration rates of 1.34, 1.25 and 1.20 mg $Cd.kg^{-1}$ in the T3, T2 and T1 treatment leaves respectively. Table (7) also showed that the average copper concentration ranged between 13.6 and 11.5 mg $Cu.kg^{-1}$ in the leaves resulting from locally prepared fertilizer treatments and the fertilizer recommendation, and significantly agreed on the treatment of the fertilizer recommendation of 8.30 mg $Cu.kg^{-1}$.

The results showed that the use of locally prepared organic fertilizers from the recycling of solid organic waste for homes and reinforced from phosphate rock, which were used in the experiment, gave a yield with good quality characteristics in terms of weight rate, number and percentage of edible leaves in addition to their content of fats that gain flavor and desire to consume.

The obtaining of these results enhanced the plant's content of balanced nutrients due to the content of fertilizers used that contributed to providing the plant's needs in the quantities it needs throughout the growth period, which prevents stress processes on the plant, and this is what was observed from the increase in the percentage of chlorophyll in the plant that led to an increase in the amount of nutrients.

Manufactured as a result of the increased efficiency of the photosynthesis process, which provided the raw materials needed to build cells (20). The results also confirmed that the added organic fertilizers have a positive role in the growth and development of plant height and vegetative weight because they contain nutrients such as Nitrogen, Phosphorus and Potassium in addition to other elements, and their content of humic acids, which contributes to preserving the readiness of the elements in the soil for a longer period and increases its readiness for absorption after mineralization by action Microbiology.

The ability of the used compost can be attributed to provide nutrients to the plant continuously with the growth stages, because the prepared organic fertilizer has a low C:N ratio that encourages the activity of micro-organisms that play an important role in the excretion and production of plant growth stimulating compounds, and chelating compounds in addition to dissolving Phosphorous, Potassium and other elements found in soil minerals or in the compost itself after adding fertilizer to the soil (21).

The content of these prepared fertilizers from these elements, and its containment of various types of nitrogen fixing microorganisms and dissolving phosphates, which have other roles in increasing the readiness of nutrients in the soil through the excretion of growth regulators, chelates and organic acids, and then increasing the readiness of nutrients and their absorption by the plant (21 and 22).

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