The Preparation of Organic Food Solutions and The Possibility of Using Them as An Alternative to Chemical Analyzes Using Hydroponics

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Abstract. The study was conducted during the winter season of 2020 at the College of Agriculture - University of Anbar to study the preparation of organic food solutions from different sources and the possibility of using them as a substitute for chemical solutions under hydroponics of lettuce plants. Treatment of sheep waste extracted with distilled water + 33% of the fertilizer recommendation (SW1), treatment of sheep manure extracted with distilled water + 66% of the fertilizer recommendation (SW2), treatment of sheep manure extracted with KOH + 33% of the fertilizer recommendation (SK1) , Treating sheep manure extracted with KOH + 66% of the fertilizer recommendation (SK2) .Treating the extracted cane waste with distilled water +33% of the fertilizer recommendation (CW1). Treat cane waste extracted with distilled water + 66% of the recommendation (CW2), treat cane waste extracted with KOH + 33% of the fertilizer recommendation (CK1), treat cane waste extracted with KOH + 66% of the recommendation (CK2). Use the design Complete randomization in the distribution of transactions, which included 9 tubes, each tube containing 12 plants (experimental unit). Seedlings of lettuce (Fajr) were planted on 29/8/2019 with a distance of 30 cm between one plant and another.

The results showed the following:
1. The superiority of treatment of cane residues extracted with water with the use of 33% of the fertilizer recommendation was to obtain the highest concentration of nitrogen in the leaves of lettuce plant amounted to 3.1%, and it was noted that the treatment of sheep extracted with water with 66% of the fertilizer recommendation was superior to all
treatments in the concentration of phosphorus in lettuce leaves reached 0.65%, and a significant superiority in the potassium concentration rate was observed when treating sheep manure extracted with potassium hydroxide with 33% of the fertilizer recommendation, which amounted to 7.66%, compared to the comparison treatment (100% of the mineral recommendation), which amounted to 1.9%, 0.27% and 1.96% on the relay.

The results of the statistical analysis indicated the superiority of the treatment of cane waste extracted with water, as it reached the highest concentration of nitrogen at 3.1%, and the treatment of sheep extracted with water exceeded all treatments at the concentration of phosphorus at a level of 0.65%, as the potassium concentration was when treating sheep waste extracted with potassium hydroxide over all treatments. At a rate of 7.66%, the iron concentration rate when treating the extracted cane waste with potassium hydroxide was 0.26%. The results of the zinc concentration indicate a significant increase when treating the extracted sheep waste with potassium hydroxide, as it reached 0.031%. The results of the copper concentration showed a significant increase when the extracted cane wastes were treated with potassium hydroxide, amounting to 0.0034%. The level of manganese when treating sheep waste extracted with water was higher compared to the remaining treatments if it reached 0.0672%.

1. Introduction

One of the most important problems that farmers can face is the deterioration of the soil over time, as its natural composition deteriorates and salts accumulate in it as a result of the continuous use of fertilizers in high concentrations for the purpose of obtaining high production and thus lead to soil salinization in addition to the large spread of diseases and pests and their growth in the soil, which reduces the possibility of Cultivation of the same crops in the soil (1). For these reasons, the researchers directed to provide alternative solutions to the use of traditional agriculture, such as hydroponic systems, in which plants are grown in agricultural media to stabilize and incubate the plant using mineral or organic nutrient solutions. Tomatoes and lettuce, according to climatic zones and growth stage (2 and 3).

The term Hydroponic is defined as plant cultivation systems in nutrient solutions without using soil as an environmental medium in addition to using inert solid environments (4).

Various organic fertilizers constitute an important and basic source of the macro and micro nutrients needed by the plant, which reduce the damage resulting from the use of chemical fertilizers, as it has recently emerged the importance of using liquid organic fertilizers, which are the most important clean alternatives to the nutrients that the plant consumes for growth because it contains organic acids such as Fulvic, humic, amino acids and others. These fertilizers are characterized by their low price, low pollution to the environment and agricultural products, ease of use, and their role in improving the growth and production of plants, as they are easily absorbed by the roots of plants and release their ions, in
addition to their rapid transfer for the plant to benefit from and participate in physiological processes, which provides the plant with the energy it needs to absorb, especially in the critical stages of its growth. (5).

explained that the use of organic materials extracted from plants (humic + fulvic) with solutions for hydroponics of lettuce plants led to an improvement in the yield and components of the plant compared with the treatment to which the extract was not added (6). Whereas, the use of fulvic acid extract (4.6 mg L-1 of dissolved organic carbon) gave the best and most significant results compared to the control group (Hoagland's solution only). In addition, all treatments gave a low content of heavy metals.

added that the addition of liquid organic fertilizers to minimum Alinky seedlings with concentrations of 1 and 2 ml twice in each season had an effect in increasing growth indicators significantly, especially at a concentration of 2 ml, where the diameter of the main stem reached (2.21 mm), and the leaf area (64.33 cm2) Leaves dry weight (3.21 gm leaf-1) (7).

Lettuce (Lactuca sativa L.), which belongs to the compound family Asteraceae, is one of the important winter vegetable crops grown in Iraq and the world alike, due to its high nutritional value and frequent consumption. Where every 100 gm of lettuce contains 95% water, and 1 gm of protein, 3 gm of carbohydrates, 22 mg of calcium, 25 mg of phosphorous, and 540 IU of vitamin A (8).

Since the lettuce plant is one of the plants whose leaves are eaten, so it needs to be fertilized in abundance, and the use of chemical fertilizers leads to health problems for humans and also pollutes the environment, and thus resort to the use of organic fertilizers, which leads to the production of healthy plants with good nutritional content, so our study aims to.

1. Knowing the best type and method for extracting organic waste (sheep and cane waste).
2. Studying the best appropriate level of chemical fertilizers by overlapping with organic extracts.
3. Recycling of plant and animal waste and using it as an environmentally safe organic fertilizer for plants and humans.

2. Materials and methods
The study was conducted at the College of Agriculture - University of Anbar to determine the possibility of using the organic matter extract from sheep waste (Sheep waste) and cane waste (Reed Waste) to reduce the quantities of mineral fertilizers under the hydroponics system and to study the effect of these humic acids on lettuce growth and production, as follows:

Decomposition of organic waste, extraction of sheep and cane waste, and study of its chemical properties.

Two types of organic waste were collected, they are sheep waste and cane waste, which were obtained from the fields of the College of Agriculture - University of Anbar. The organic waste was air dried, each one separately, and impurities, rock pieces and gravel were removed from it, then it was cut and crushed by an electric grinder and prepared for the decomposition process.

Both sheep and cane residues were subjected to an aerobic decomposition process using 100 kg of each type of waste, placed on polyethylene pieces and 2% nitrogen was added using urea (46%N). Phosphorous was also added at 0.5% P from triple super phosphate fertilizer (20% P) and moistened continuously in a spray form, covered with a piece of polyethylene, and the process of stirring every 4 to 5 days until a degree of decomposition was reached at which the material was diagnosed with pain and low temperature. The reaction temperature inside the heap ranged from 65°C to 45°C by following its variation daily using a thermometer as a guide to reach the end of the reaction. After that, the decomposing organic waste was brushed to air dry for three days, a sample of each type of organic waste was taken to conduct some chemical analyzes (Table 1).
Table 1. Some chemical properties of the organic waste used in the study

| Type of organic waste | Electrical conductivity (dS.m⁻¹) | Reaction degree (pH) | Nitrogen total (gm kg⁻¹) | Phosphorus (gm kg⁻¹) | Potassium (gm kg⁻¹) | C/N Ratio | Zn (gm Kg⁻¹) | Fe (gm Kg⁻¹) | Mn (gm Kg⁻¹) | Cu (gm Kg⁻¹) |
|-----------------------|-------------------------------|---------------------|-------------------------|---------------------|---------------------|-----------|-------------|-------------|-------------|-------------|
| Sheep waste           | 21.6                          | 7.34                | 1.47                    | 0.55                | 19.9                | 17.50     | 0.026       | 1.348       | 0.114       | 0.008       |
| Reed waste            | 13.12                         | 7.11                | 2.17                    | 0.36                | 1.18                | 24.64     | 0.023       | 0.807       | 0.154       | 0.002       |

The organic extracts were collected from the organic waste according to the method approved by (3) using a potassium hydroxide solution KOH (0.1 M) or distilled water in a ratio of 1:10 (dissolved organic waste: KOH or distilled water). The solutions were mixed in a vibrator for 24 hours after that. Filtered using a piece of cloth and then filter paper, and the following diagram shows the process of extracting the organic waste used in the study from the waste and the measurements and analyzes that were made.

Prepare the nutrient solution:
Nutrient salts were used to prepare the nutrient solution for feeding lettuce from the seedling stage to the harvest stage (9), as the nutritional salts were dissolved in distilled water as follows:

A. solution
Neutral compound fertilizer (N:P:K+TE+15:5:35): 120 g.L⁻¹ distilled water
Magnesium sulfate: 40g.L⁻¹ distilled water
Minor Ingredients: 6.75 g.L⁻¹ distilled water
TE: Magnesium Mgo: 100 mg kg⁻¹
Iron Fe: 100 mg kg⁻¹
Zn: 100 mg kg⁻¹
Manganese Mn: 100 mg kg⁻¹
Boron B: 100 mg kg⁻¹

B. solution
Calcium Nitrate: 190 g.L⁻¹ distilled water
Chelated iron: 10g.L⁻¹ distilled water (10).
Then the mineral fertilizer was prepared at a ratio of 1 liter per 1000 liters of water for the studied treatments.

Experiment Parameters:
The study parameters were prepared as follows:
Treatment of the nutrient solution (mineral only) as the comparison treatment (C).
Treatment of sheep manure extracted with distilled water + 33% of the fertilizer recommendation (SW1).
Treatment of sheep manure extracted with distilled water + 66% of the fertilizer recommendation (SW2).
Treating the extracted sheep's manure with KOH + 33% of the fertilizer recommendation (SK1).
Treating sheep manure extracted with KOH + 66% of the fertilizer recommendation (SK2).
Treating the extracted cane waste with distilled water + 33% of the fertilizer recommendation (CW1).
Treating the extracted cane waste with distilled water + 66% of the fertilizer recommendation (CW2).
Treating the extracted cane waste with KOH + 33% of the fertilizer recommendation (CK1).
Treating the extracted cane waste with KOH + 66% of the recommended fertilizer (CK2).

2.1. Execution of the experiment and cultivation:
The hydroponic system was installed on flat land, as a device for agriculture was designed manually. The device was 2 meters high and 360 cm long. It used plastic tubes for cultivation with a diameter of 4 inches and a length of 420 cm. The tubes were perforated with a diameter of 3 inches and a distance between one plant and another 30 cm to contain 12 Plants in each tube of 9 tubes (one tube per treatment). Each tube is fitted with an electric plunger to ensure that the nutrient solution that was used in the cultivation is stirred and rotated around the roots and to prevent the sedimentation of the elements. The cups used for growing seedlings are perforated from the sides and bottom to allow the roots to extend and the solutions to enter around the roots. The end of the large tube leads to large tanks that contain treatment solutions, which are supplied to these tanks whenever there is a shortage of solutions. The purpose of turning the solution in this way is to provide the roots with the oxygen necessary to perform vital activities.

Lettuce seeds (Fajr) were planted on August 29, 2019 in one of the private nurseries in Abu Ghraib in plastic plates in the middle of the peat moss. And operating the device, lettuce seedlings were distributed to each tube (treatment) to include each repeater 3 seedlings of lettuce, according to the transactions and according to the complete random design RCD, which included the distribution of tubes and seedlings within the treatments. The system was also operated 2-3 times per day and the reaction degree of the solution (pH) was controlled in the range of 5.8-8.4 on a daily basis by adding nitric acid to the nutrient solution tank gradually.

2.2. Statistical analysis
The data of the study were analyzed by the method of analysis of variance (ANOVA) within the complete random design (RCD) and the mean of the coefficients were compared using the L.S.D test at the 5% probability level according to the Genestat Education program.

2.3. Paper analyses.
Plant samples were taken at harvest from the middle leaves of the head, the leaves were washed with distilled water, then dried aerobically, then dried at a temperature of (60-65) C until the weight was stable, and they were ground with a ceramic mortar and mixed to homogenize and kept in paper bags to be ready for laboratory analysis.
The concentration of leaves from the elements (nitrogen, phosphorous, potassium, iron, zinc, copper and manganese) was estimated by taking 0.2 g of dry plant sample powder and digested using concentrated sulfuric acid and pyrochloric according to the method mentioned in (11).
The identified nutrients were then estimated by the following methods:
1. Nitrogen was estimated using the (Micro Kjeldahl) device according to the method mentioned in (12).
2. Total phosphorous was estimated using ammonium molybdate and it was measured using a spectrophotometer at a wavelength of 882 nm according to the method mentioned in (3).
3. Potassium was determined by a flame photometer according to the method proposed by (13).
4. The microelements were estimated by atomic absorption device.
5. The plant residues after decomposition were also analyzed by the same methods above.
3. Results and Discussion

3.1. Nitrogen Concentration (%)
The results shown in Figure 1 indicate the effect of the types of mineral and organic food solutions from sources, concentrations and extraction methods on the concentration of nitrogen element in the leaves of the lettuce plant. The results showed that the treatment of cane residues extracted with water (CK1) was significantly superior to all the different treatments (sheep manure extract and manure residue extract), whether extracted with water or potassium hydroxide, had the highest nitrogen concentration of 3.1%, with an increase of 66.84%, compared to the control treatment (100% of the fertilizer recommendation), which had the lowest nitrogen concentration of 1.9%.

![Image of Figure 1: Effect of the type of organic food solutions, percentages and extraction methods on the nitrogen concentration of lettuce leaves]

This is what the results indicated with (14) that the use of different concentrations of mineral nutrient solutions leads to better absorption of the nutrients nitrogen, phosphorous, potassium, iron and magnesium, and the different concentrations of nutrients that make up the nutrient solutions play a major role in the growth and yield of the plant, where the absorption of nutrients affects Nutrients in optimal quantities on plant growth. And the increase in the chlorophyll content of the leaves leads to an increase in the nutrients nitrogen, phosphorous and potassium in the leaves.

3.2 Phosphorous concentration (%)
The results of Figure 2 show the effect of different types of mineral and organic food solutions from different sources, concentrations and extraction methods on the concentration of phosphorous in the leaves of the lettuce plant, where the results showed a significant superiority of the treatment of sheep manure extracted with water (SW2) significantly on all different treatments (sheep manure extract and cane manure extract) whether extracted with water or potassium hydroxide, which reached the highest level of 0.65% with an increase of 140.74% compared to the comparison treatment (100% of the fertilizer recommendation), which reached the lowest rate of 0.27%.
Figure (2) Effect of the type of organic food solutions, proportions and extraction methods on the phosphorous concentration of lettuce leaves

Many results from studies showed that organic fertilization provides the macro and micro nutrients that the plant needs, as sheep manure extract contains some macronutrients in different proportions, which are directly absorbed by the plant’s vegetative system and a role in increasing the concentration of phosphorous in the plant because of these nutrients’ functions Vitality and physiology inside the plant increase the absorption of phosphorus and increase its concentration inside the plant, and this is what was indicated by (15, 16).

3.3. Potassium concentration %

Figure 3 shows the effect of different types of mineral and organic food solutions from different sources, concentrations and extraction methods on the concentration of potassium SK1 in the leaves of lettuce plant. Reeds) both extracted with water and potassium hydroxide, which obtained the highest level of 7.66 with an increase of 290.81% compared to the control treatment (100% of the fertilizer recommendation), which reached the lowest potassium concentration rate of 1.96%.

Figure (3) Effect of the type of organic food solutions, proportions and extraction methods on potassium concentration of lettuce leaves.
The reason for the increase in the concentration of nitrogen, phosphorous and potassium is due to the role of fertilizers in increasing the vital activities and the process of transpiration and carbon metabolism, and then increasing the efficiency of the plant in absorbing water and nutrients and then increasing the absorption of nitrogen, phosphorous and potassium, which is a carrier of carbohydrates and activator of many enzymes as well as the role The effectiveness of other elements of nitrogen, phosphorous and micro-nutrients in increasing the efficiency of the plant to absorb this nutrient and forming a strong plant capable of performing its vital actions well. These results agreed with the findings of (17, 18), The results also agreed with what was obtained by (19) that spraying sheep manure extract on the leaves led to an increase in potassium content in the plant. In addition, spraying the organic extract containing amino acids is easily liberated and enters the cytoplasm, causing an increase in the process of carbon metabolism as a result of its entry into the composition of many enzymes of this process and its release to nitrogen, which enters the formation of chlorophyll pigments, thus activating the plant and increasing its ability and efficiency to absorb elements, which leads to its presence in Leaves like potassium (20).

3.4. Iron concentration %

Figure 4 shows the effect of different types of mineral and organic food solutions from different sources, concentrations and extraction methods on the concentration of iron in the lettuce leaves. An increase in the level of iron was observed with significant differences when treating cane residues extracted with potassium hydroxide (CK1) on all different treatments (waste extract Sheep and cane residues extract (whether extracted with water or potassium hydroxide), where the highest rate of iron element was 0.26 and an increase of 271.00% compared to the comparison treatment (100% of the fertilizer recommendation), which reached the lowest value of 0.07% iron concentration.

![Figure (4) Effect of the type of organic food solutions, proportions and extraction methods on the iron concentration of lettuce leaves.](image)

The increase in iron element is attributed to the activity of vegetative and root growth resulting from the addition with the nutrient solution, which led to an increase in the absorption of this element and then its transfer to the stored parts (21) . indicated that the use of the nutrient solution with the appropriate concentrations gave a significant increase in dry weight, leaf area, and yield and The best
absorption of the nutrients nitrogen, phosphorous, potassium, iron and magnesium by the leaves compared with the rest of the solutions (22).

3.5. Zinc concentration %

Figure 5 indicates the effect of different types of mineral and organic nutrient solutions from different sources, concentrations and extraction methods on the concentration of zinc in lettuce leaves. Where there was a significant increase in the level of zinc when treating sheep manure extracted with potassium hydroxide (SK1) over all different treatments (sheep manure extract and cane manure extract), whether extracted with water or potassium hydroxide, reaching 0.031% with an increase of 158.55% compared to the control treatment (100% of the fertilizer recommendation), which reached the lowest value for the average zinc concentration in the leaves, which was 0.012%.

![Zinc concentration graph]

Zinc activates some enzymatic reactions in the plant. It is also related to vital processes and helps in elongating the stem of the plant and stimulating the work of the growth regulator (23).

3.6. Copper concentration %

Figure 6 shows the effect of different types of mineral and organic nutrient solutions from different sources, concentrations and extraction methods on the concentration of copper in lettuce leaves. A significant superiority was observed between the treatments, and its maximum was observed when cane residues extracted with potassium hydroxide (CK1) over all different treatments (sheep manure extract and cane manure extract) whether extracted with water or potassium hydroxide, reaching 0.0034 with an increase of 2500.51% compared to the control treatment (100%). From the fertilizer recommendation, which reached the lowest rate of copper concentration at 0.00097%.
Figure (6) Effect of the type of organic food solutions, proportions and extraction methods on the copper concentration of lettuce leaves.

It is involved in photosynthesis and has a role in the synthesis of proteins, nucleic acids and carbohydrates.

3.7. Manganese concentration %

Figure 7 indicates the effect of different types of mineral and organic food solutions from different sources, concentrations and extraction methods on the concentration of manganese in lettuce leaves. There were significant differences in the level of manganese among all different treatments (sheep manure extract and cane manganese extract), whether extracted with water or potassium hydroxide, and the maximum was when treating sheep manganese waste extracted with water (SW2) as it reached 20.067% with an increase of 165.61% compared to the control treatment (100% of the fertilizer recommendation), which reached its lowest value in this capacity, 0.0253%.

Figure (7) Effect of the type of organic food solutions and percentages and their extraction methods on the manganese concentration of lettuce leaves.
The results of the study agreed with the findings of (24), who showed that the use of organic fertilization leads to an increase in the absorption of nutrients phosphorous, potassium, calcium, magnesium, manganese, zinc, which led to an increase in the nutritional production of the plant and thus an improvement in dry matter weight.

4. Conclusion
- The necessity of using mineral fertilizers with or without the extract of organic waste due to the plant's need for high concentrations of nutrients.
- Organic acids extracted from sheep manure and cane manure can be used as liquid organic fertilizer in hydroponics, which reduces the use of chemical nutrient solutions.

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