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# Evaluation of compost prepared from Prosopis and Alhagi plants as a medium and fertilizer for seedlings, growth and yield of tomato

## ABSTRACT

For clean a agriculture and a safe environment, this study was conducted, which included the preparation of a compost from Prosopis fracta and Alhagi maurorum plants, and evaluation Its as a medium for tomato seedlings production comparing it with peat moss, and as an organic fertilizer in comparison with a number of organic fertilizers - poultry wastes, cow with sheep wastes and spent mushroom compost residues, the results showed the superiority of the prepared compost over the peat moss in the speed and percentage of germination, plant height, and dry vegetative weight of tomato seedlings with a percentage increase of these traits amounted to 27.27%, 8.13%, 52.46% and 33.20%, respectively.. The results of evaluating compost as an organic fertilizer showed that the two treatments of poultry and compost were superior to mushroom residues, the mixture of cow and sheep manure in chlorophyll content, dry vegetative weight and fruit yield, as the chlorophyll content reached 52, 51, 48 and 50 SPAD, the dry vegetable weight of 776, 761, 633 and 643 g plant-1, the total yield of fruits 11.6, 11.1, 6.6 and 8.3 kg plant-1. The results of chlorophyll, dry vegetative weight of plants and total fruit yield of the combination of organic fertilizers - poultry wastes, compost, mushroom residues, and mixture of cow and sheep wastes- with 1/2 amount of chemical fertilizer NPK amount of 66 , 64, 57, 63 SPAD, 1125, 1123, 1076 and 1081 gm plant-1, 15.8, 15.7, 14.9 and 15.3 kg plant-1 respectively.




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## INTRODUCTION

Soils of arid and semi-arid regions suffer from poverty in their content of organic matter, which leads to the deterioration of the physical, chemical and biological properties of these soils, and the availability of large and widespread quantities of thistle leguminous plants *Prosopis farcta* and *Alhagi maurorum*, and for the ease of collecting them at a low cost and converting them into organic matter compost They can be used in clean and organic agricultural as a medium for the production of seedlings and organic fertilizers, and the local markets suffer from severe shortages. The presence of jungles and local plants that are not desirable in agriculture, including *Prosopis farcta* and *Alhagi maurorum*, in large quantities and sufficient for the marketing production of compost to meet the needs of farmers and nursery owners with good quality and competition for imported organic materials that cost the country and farms huge sums such as peat moss, The compost production process is the biological process by which it transforms all organic and composted waste into stable materials that can be stored without any negative environmental impacts ( Tahir Abbas, 2013 ; Mohammed et all, 2018). Ahmed et al., (2006) indicated in their study the effectiveness of compost in improving soil qualities and productivity. Fertilizers of organic wastes and compost are highly effective materials to enhance crop growth and agricultural

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returns resulting from being materials with a high content of nutrients necessary for plants as well as their high ability to retain water and elements. Nutritious and improving soil properties, and making compost from organic materials helps to speed up the preparation of plant nutrients and reduce pollution and the spread of waste (Huang, 2006; Ogundare et all, 2020), Also, compost may be used as an agricultural medium, as it is suitable for seedlings growth of trees and vegetables (Zou et all, 2019 ) . The aim of this study is to evaluate locally manufactured compost from *Prosopis farcta* and *Alhagi maurorum* plants as a medium to produce seedlings by comparing it with commercial peat moss and organic fertilizer by comparing it with the organic fertilizers used locally to produce tomato crop.

**MATERIALS AND WORKING METHODS:**

**The study included compost preparation and two experiments:**

**Compost preparation:**

*Prosopis farcta* and *Alhagi maurorum* plants were collected from the Asdirah region in the Ashur sub-district, al-Sharqat district, in the area between latitudes 35° 26´ 57˝ and 35° 27´ 07˝ and between longitudes 43° 16´ 53˝ and 43° 17´ 06˝ on 7/5/2018, and the wastes were milled with a hay-cutting machine. Calcium carbonate (lime rocks) crushed and urea, and a quantity of soil was spread over the layers of the pile, moistening and stirring with the aim of making compost by the method of aerobic decomposition, the process of decomposition continued for 60 days, Samples were taken randomly from mature compost to determination of electrical conductivity EC and pH in the 1: 5 extract, and compost content of organic carbon, nitrogen, phosphorous, potassium, and the ratio of carbon to nitrogen (C: N) according to what was mentioned in (Page, et al., 1982).

**Compost as medium for tomato seedlings:**

**first experiment was conducted to** evaluate the prepared compost as a medium for tomato seedlings production comparing it with peat moss, tomato seeds- Jinan class- were planted in plates containing104 holes, placed after exhausting them with compost and peat moss in plastic houses of the Faculty of Agriculture, Tikrit University , On 28-1-2019, the **percentage of germination** was calculated according to the following equation: germination percentage = (germination seed number) / (total seed number) x 100.

**Germination speed** was estimated according to the formula proposed by Kotowski (1969). Germination speed = (P1 + P2 + …PN) / (The number of days from planting to germination + The number of days between the first and second issue)

Where: P = the number of seeds germinated on that day. N = the number of days from the date of planting.

**Seedlings Height** The height of the seedlings was measured using a tape measure.

**Dry weight of seedlings:** The dray weight of seedlings was determined after drying them in the oven at a temperature of 70 º C for 72 hours.

**Compost as fertilizer for growth and yield of tomato:**

Field experiment was conducted according to RCBD with 11 treatments to evaluate the prepared compost as an organic fertilizer in comparison with a number of organic fertilizers - poultry wastes, cow with sheep wastes and spent mushroom compost residues, for growth and yield of tomato in gypseferous soil, dry Vegetative Weight, the content of leaf of chlorophyll and fruit yield were determined, Table 1 show some of the physical and chemical characteristics of the study soil:

**Experimental design:**

The first experiment was designed according to completely randomized design (CRD), second experiment to randomized completely block design (RCBD), the results were statistically analyzed using SAS program V. 9, the arithmetic means were compered using the least significant difference L.S.D at the 5% probability level to choose the significant differences between of the treatments.

**Results and discussion:**

**Characteristics of the prepared compost**:

The results in table 2 show the superiority of prepared compost in its content of nitrogen and phosphorous over all the organic fertilizers used in the experiment except for poultry manure, this superiority can be attributed to the origin of the components of the prepared compost which is the

Prosopis and Alhagi plants which belongs to the legume family, which fixes nitrogen as shown in table 2.

**Table (1): Physical and chemical properties of the study soil**

| Adjective | Unit | Result |
|---|---|---|
| Bulk density | gm $cm^{-3}$ | 1.7 |
| Texture | gm $kg^{-1}$ | S.C.L |
| pH | - | 7.3 |
| EC | Ds $m^{-1}$ | 4.3 |
| CEC | Meq/100 gm. soil | 6.3 |
| OM | % | 1.2 |
| $CaCO_3$ | gm $kg^{-1}$ | 2.230 |
| $CaSO_4$ | | 45 |
| N | ppm | 25 |
| P | | 5.0 |
| K | | 97 |

**Table (2): some chemical properties of organic fertilizers**

| Subject | pH | EC $ds.m^{-1}$ | N % | P % | K % | C\N | C % | Moisture content % |
|---|---|---|---|---|---|---|---|---|
| Peat moss | 7.2 | 1.04 | 1.32 | 0.54 | 0.35 | 24 | 46 | 6.84 |
| Compost | 7.3 | 2.49 | 1.66 | 0.89 | 0.42 | 22 | 38 | 9.72 |
| mushroom residues | 7.4 | 5.37 | 1.21 | 0.42 | 0.33 | 27 | 49 | 13.94 |
| Poultry | 7.6 | 5.34 | 1.71 | 1.56 | 0.49 | 19 | 35 | 6.84 |
| Caws and sheep | 7.5 | 5.93 | 1.04 | 0.67 | 0.83 | 26 | 47 | 17.68 |
| Prosopis | 7.2 | 2.35 | 194 | 1.44 | 0.67 | 16 | 32 | 7.62 |
| Alhagi | 7.3 | 3.66 | 1.83 | 1.09 | 0.74 | 18 | 36 | 6.92 |

**Percentage and Speed of germination:**

The results in table 3 and figure 1 show that the prepared compost exceeded in percentage and speed of germination of tomato seeds in compost reached 93%, 6.71 seedling $day^{-1}$ seedling day, while the germination rate of tomato seeds planted in the medium of the peat moss was 86%, 5.82 seedling $day^{-1}$, with percentage increase was 27.27%, 15.29 respectively. Thus, the distinction of compost over peat moss in the percentage and speed of tomato seed germination is positively reflected, especially in the cultivation of good, rare and high-priced varieties of seeds, and the reason for this increase may be due to the quality of the compost and its containment of sufficient nutrients to supply the fetus with the nutritional needs necessary for growth.

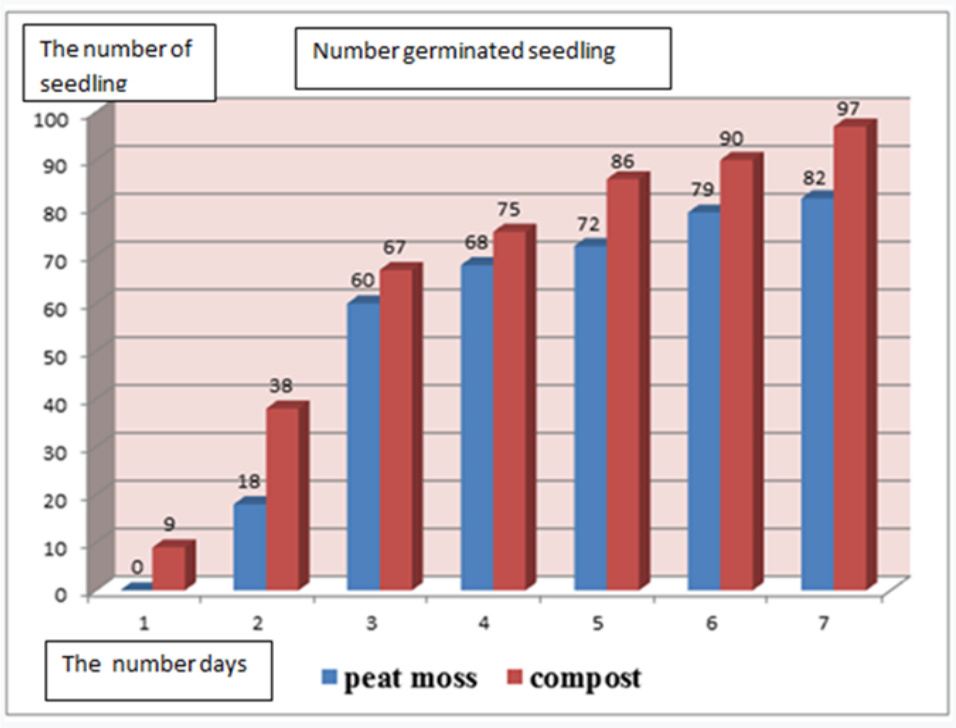


**Figure (1): Number of seeds germinated per day**

**Table (3): Percentage and speed of germination of tomato seed in Compost and Peat moos.**

| Medium | No. day | No. Seeds accepted | Medium | No. day | No. Seeds accepted |
|---|---|---|---|---|---|
| compost | 5 | 9 | Peat moss | 5 | - |
| | 6 | 38 | | 6 | 14 |
| | 7 | 63 | | 7 | 43 |
| | 8 | 75 | | 8 | 68 |
| | 9 | 86 | | 9 | 72 |
| | 12 | 90 | | 12 | 81 |
| | 14 | 97 | | 14 | 89 |
| Total number of seed | 104 | | Total number of seed | 104 | |
| Germination percentage | 93 % | | Germination percentage | 86% | |
| Speed of germination | 6.71 seedlings day$^{-1}$ | | Speed of germination | 5.82 seedlings day$^{-1}$ | |

**Plant Height and dry weight**

The results in Table (4) indicate that the compost was significantly superior to the height of the tomato seedlings 13.31 cm and the dry weight of the seedlings 0.105 gm over the treatment of a peat moss which gave 8.73 cm and 0.036 respectively.

**Table (4): The effect of medium type on seedlings height cm and dry vegetative weight, gm Seedling$^{-1}$**

| Medium type | Plant height is cm | Dry weight gm seedling$^{-1}$ |
|---|---|---|
| Peat moss | 8.73 B | 0.036 B |
| Compost | 13.31 A | 0.105 A |
| L.S. D 0.05 | 2.44 | 0.061 |

Thus, a percentage of the height of tomato seedlings for compost is 52.46% compared to tomato seedlings in the peat moss, the percentage increase in the dry weight of tomato seedlings of the compost medium was 191.66% over the dry weight of tomato seedlings grown in peat moss medium.


**Image (1): The difference between two tomato seedlings, one cultivated in the Compost and the second in the peat moss**


**Image (2) The difference in the height of seedlings grown in Compost and Peat moss**

**The superiority of prepared compost over peat moss, It can be attributed to the nutritional content of the prepared compost, Table 2. The results are in line with what Radhi and Hayder,(2011) found**

**Compost as an organic fertilizer**

**The vegetative characteristics of the Tomato:**

**Chlorophyll Leaf SPD:**

The results of Table (5) show that the two treatment of poultry waste with 1/2 recommendation of chemical fertilizer and treatment of compost with 1/2 the amount of chemical fertilizer added in the chlorophyll content of tomato leaves surpassed the treatments of all chemical fertilizer recommendations and the two treatments of cattle and sheep waste added to it 2 / The amount of chemical fertilizer and mushroom residues added to it 1/2 chemical fertilizer, and the results were 66, 64, 62, 63 and 57 SPAD respectively . Whereas the chlorophyll values for the control treatments, poultry and compost, cattle and sheep manure, and mushroom residues, without additives, were 45, 55, 54, 52 and 50 respectively, and thus the percentage increase of the compost treatment was added to it by 1/2 the amount of chemical fertilizer added from the two comparison treatments and one treatment. All chemical fertilizer recommendation 42% and 3.22%. The reason for the superior treatment of poultry and compost residues may be due to the good nitrogen content, as the thistle and brains are part of the leguminous family, The organic compounds responsible for absorbing light energy and converting it into chemical energy are the pigments present in the chloroplasts, which are called chlorophyll pigments, which are responsible for the process of construction or photosynthesis necessary for plant growth and productivity (Suthar, 2009) .

**Table (5): Chlorophyll measured by SPAD device for tomato plants.**

| Transactions | SPAD |
|---|---|
| Control | 45 $^{e}$ |
| Half recommendation | $^{cbd}$54 |
| recommendation | $^{a}$ 62 |
| mushroom residues | 5 $^{d}$ |
| Cows and sheep | 52 $^{cd}$ |
| Poultry | $^{cd}$ 55 |
| Compost | 54 $^{cbd}$ |
| mushroom + half recommendation | 57 $^{b}$ |
| Cows + half recommendation | $^{a}$ 63 |
| Poultry + half recommendation | $^{a}$ 66 |
| Compost + half recommendation | $^{a}$ 64 |

**Dry vegetative Weight:**

Table (6) shows the results of the dry vegetative weight of tomato plants, It clear from the table that the fertilizer treatments are significantly superior to control, It also appear that the two treatments of poultry and compost were superior to the mixture of cow, sheep manure and mushroom residues, in dry vegetative weight when added alone or with half the recommendation of chemical fertilizer NPK, and the results of the dry vegetative weight of tomato plants when adding the organic fertilizers alone were 776, 761, 643 and 633 and when added with half recommendation of chemical fertilizer NPK were 1125, 1123, 1081 and 1076 grams plant respectively, and this applies to what was mentioned in (Amujoyeg, 2007) .

**Table (6): Total dry Weight of tomato plants gm plant$^{-1}$**

| Transactions | Total dry Weight gm plant$^{-1}$ |
|---|---|
| Control | 465 $^{c}$ |
| Half recommendation | 606 $^{cd}$ |
| recommendation | 1083 $^{a}$ |
| mushroom residues | 633 $^{b}$ |
| Cows and sheep | 643 $^{b}$ |
| Poultry | 776 $^{b}$ |
| Compost | 761 $^{b}$ |
| mushroom + half recommendation | 1076 $^{a}$ |
| Cows + half recommendation | 1081 $^{a}$ |
| Poultry + half recommendation | 1125 $^{a}$ |
| Compost + half recommendation | 1123 $^{a}$ |

**Fruits Weight**

It clear from the table 7 that the fertilizer treatments are significantly superior to control, It also appear that the two treatments of poultry and compost were superior to the mixture of cow, sheep manure and mushroom residues, in fruits yield when added alone or with half the recommendation of chemical fertilizer NPK, also the table shows that the highest value for them was in the treatment of poultry plus ½ of the fertilizer recommendation at a rate of 15.8 kg, followed by the compost treatment plus 1/2 the fertilizer recommendation at a rate of 15.7 The value of the average weight of the fruits in the control treatment was 1.7 kg These results are consistent with his findings (Paksoy, 2009) and they are in line with what Al-aamry and adnan (2012) found. The increase is due to the addition of organic fertilizers can be due to the role of organic matter in proving the physical, chemical, fertility and biological properties, as for the superiority of prepared compost, It can be attributed to the origin of the components of the prepared compost which is the Prosopis and Alhagi plants which belongs to the legume family, which fixes nitrogen as shown in table 2

**Table (7): Total Yield tomato kg fruit plant$^{-1}$**

| Treatments | Total Yield Kg fruit plant$^{-1}$ |
|---|---|
| Control | 1.7 $^{e}$ |
| Half recommendation | 6.6 $^{d}$ |
| recommendation | 12.4 $^{bc}$ |
| mushroom residues | 6.5 $^{d}$ |
| Cows and sheep | 8.3 $^{d}$ |
| Poultry | 11.6 $^{C}$ |
| Compost | 11.1 $^{c}$ |
| mushroom + half recommendation | 14.9 $^{ba}$ |
| Cows + half recommendation | 15.3 $^{a}$ |
| Poultry + half recommendation | 15.8 A |
| Compost + half recommendation | 15.7A |

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# تقييم السماد العضوي المحضر من نباتي الشوك والعاقول وسطاً وسماداً لإنتاج الشتلات ونمو وحاصل الطماطه

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**الكلمات المفتاحية:**
كمبوست، بيت موس، وسط، سماد. شتلات الطماطه، حاصل الطماطة

**الخلاصة**

من اجل الزراعة النظيفة والبيئة الأمنه، جمعت نباتات الشوك والعاقول غير المرغوبة بها لتحضير الكمبوست بطريقة التخمير الهوائية وتقييمه وسطاً لأنتاج شتلات الطماطة بمقارنته مع البتموس، وسماء لأنتاج محصول الطماطة بمقارنة مع عدد الأسمدة العضوية -سماد الدواجن سماد خليط الابقار والأغنام و سماد مخلفات الفطر الغذائي – أظهرت النتائج تفوق الكمبوست المحضر من نباتي الشوك والعاقول في نسبة وسرعة الانبات ، وارتفاع النبات و الوزن الجاف لشتلات الطماطة بمقارنته مع البتموس بزيادة مئوية مقدارها 8.13 % و15.29 % و 52.46 % و 33.20 % على التتابع, اما التجربة الثانية أُجريت في تربة حقول كلية الزراعة – جامعة تكريت لتقيم الكمبوست سماداً عضوياً بمقارنته مع الأسمدة العضوية ( مخلفات الفطر وخليط من مخلفات الأبقار والأغنام ومخلفات الدواجن ), والسماد الكيمياوي ( N, P, K ), تضمنت التجربة معاملات اضيف فيها الكمبوست المحضر والأسمدة العضوية والكيمياوية لوحدها ومعاملات توليفيه اضيفت فيها الأسمدة العضوية مع 1/2 كمية السماد الكيمياوي NPK وبثلاث مكررات, واظهرت النتائج تفوق المعاملات المسمدة معنويا على معاملة المقارنة في كل الصفات المدروسة، كذلك تبين تفوق معاملتي الدواجن والكمبوست على وخليط مخلفات الابقار والأغنام ومخلفات الفطر في محتوى الكلوروفيل والوزن الخضري الجاف وحاصل الثمار سواء أضيفت لوحدها او مع نصف توصية السماد الكيمياوي اذ بلغ محتوى الكلوروفيل 55 و 54 و 50 و 48 SPAD والوزن الخضري الجاف للنبات 776 و 761 و 643 و 633 غم والحاصل الكلي للنبات 11.6 و 11.1 و 8.3 و 6.5 كغم ثمرة نبات $^{-1}$ للأسمدة العضوية لوحدها, وكانت نتائج الكلوروفيل والوزن الخضري الجاف للنباتات والحاصل الكلي للثمار لتوليفة الاسمدة العضوية المكونة من مخلفات الدواجن + 1/2 كمية الاسمدة الكيمياوية المضافة والكمبوست + 1/2 كمية الاسمدة الكيمياوية المضافة ومخلفات الفطر ومخلفات الابقار مضاف الى كل منها 1/2 كمية السماد الكيمياوي المضاف 66 و 64 و 60 و 63 SPAD و 1125 و 1123 و 1076 و 1081 غم نبات$^{-1}$ و 15.8 و 15.7 و 14.9 و 15.3 كغم ثمرة نبات$^{-1}$ على التتابع.