Fourth International Scientific Conference on Environment and Sustainable Development (4th ISCESD), Egypt, Cairo, 24-28 November 2018

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Received on: 23/09/2018
Accepted on: 19/02/2019
Published online: 25/04/2019

Effect of Compost and Humic Acid on Potato Growth and Quality

Abstract- *an experiment was carried out in Karbala on 10/9/2014 using the compost of palm residues at four levels (0, 20, 30, 40) tan.h-1 and the humic acid in three concentrations (0,1.5, 3)ml.L-1 to determine the effect of these factors and their interaction in growth and quality characteristics of potato and find organic fertilizer combination instead of chemical fertilizers. The addition of the compost of the residue palm has a significant and positive effect on all studied traits (Number of branches.plant-1, Plant height, percent of the dry weight of vegetative growth, percent of nitrogen, phosphorus and potassium in tubers, ratio of total soluble solids in tubers, percent of starch in tubers, the market yield of the plant), While not affecting on not valid for the marketing year. Spraying of the humic acid caused a significant increase in all the mentioned characteristics except for the percent of phosphorus in the tubers and the not valid for marketing yield. Interaction between palm waste compost and humic acid had a significant effect on the studied indicators except for the percent of phosphorus in the tubers and the not valid for marketing yield of the plant.*

Keywords- *compost, residue, palm, Humic, potato*

How to cite this article: A.Kh. Mijwel, A.N. Abed Al-Aedha and T.H. Bresim, "Effect of Compost and Humic Acid on Potato Groath and Quality," *Engineering and Technology Journal*, Vol. 37, Part C, No. 1, pp. 145-148, 2019.

1. Introduction

Iraq has large numbers of palm trees whose waste can be exploited to produce an organic compost that can be used to improve soil specifications and agricultural production. Potato is an important and widespread crop grown in Iraq with spring and autumn berries, Iraq can only be satisfied with potatoes if it cares about improving soil and plant yield. Several studies have been conducted to use animal organic fertilizers but are available in limited quantities. The waste of palm organic are produced in large quantities in Iraq. Therefore it can be exploited to improve soil properties and agricultural production.

Organic fertilizer is a direct source of many nutrients elements needed by plants , also improve the physical, chemical and biological properties of soil [1] and improve our water and soil antenna system [2], Organic fertilizers contain water, carbon compounds and nutrients as well as the readiness of these elements to absorb [3]also a source of readiness ammonium in soil [4], adding organic waste or fertilizer is the most important way to improve the soil content of organic matter [5], Organic matter is an important source of food for microorganisms found in soil because they contain cellulose, starch, sugars, proteins and fats[6], Organic matter is composed of a number of nutrients, the most important of which are carbon, hydrogen, nitrogen, oxygen, sulfur, phosphorus and other nutrients[7], Organic matter plays an important role in restoring nutrients to soil [8], Adding compost to soil increases nitrogen uptake and other nutrients due to soil degradation [9]. Humic acid has a positive effect on nutrient uptake by the plant, Spraying with humic acid has effects in increasing vegetative growth, photosynthesis efficiency and leaves the area. The study aims using the large quantities of palm waste in Iraq to produce compost in Agricultural production to improve the plant growth and quality yield and find organic fertilizer combination instead of chemical fertilizers.

2. Materials and Methods

A field experiment was carried out in the field of organic fertilizer preparation project in Karbala in 10-Aug.2014. The land was prepared and divided into sections and cultivated potato tubers Solanum tubersum L. Aladdin variety, order A on Lines 2m long and the distance between another 0.75m and between the plant and another 25 cm. The experiment included two factors : palm remnants compost with Four levels (0,20,40,60)tan.h-1 and humic acid with three levels (0,1.5,3)ml.l-1 . The compost was added by digging a trench below the tubers before planting tubers on two weeks.Spraying humic acid after two weeks of germination with five times. Soil

https://doi.org/10.30684/ etj.37.1C.23
2412-0758/University of Technology-Iraq, Baghdad, Iraq

samples were taken before planting to determine some physical and chemical soil properties as well as palm remnants compost.

Table 1: Some physical and chemical properties of soil before planting

pH	EC $ds.m^{-1}$	O.M $gm.kg^{-1}$	%N available $mg.kg^{-1}$	%P available $mg.kg^{-1}$	%K available $mg.kg^{-1}$	Sand $gm.kg^{-1}$	Silt $gm.kg^{-1}$	clay $gm.kg^{-1}$
7.6	3.2	7.24	8.5	13.2	270	350	260	390

Table 2: Some chemical properties of palm remnants compost

Mn %	Zn %	Fe %	Na %	Mg %	Ca %	K %	P %	C:N %	N organic %	C organic %	pH	EC $Ds.m^{-1}$
0.013	0.055	0.42	0.62	0.58	2.39	0.80	0.95	19	2.30	43.7	7.04	**2.66**

*Samples were analyzed at the Abu Ghraib Research Center

The studied traits were: the number of branches per plant, plant height, the percent of nitrogen in the tubers is estimated by the Kjeldahl method (micro-Kjeldahl) , the percent of phosphorus in the tubers is quantitatively estimated using the spectrum instrument(spectrophotometer) , the percent of potassium in the tubers is estimated by the flame device(flame photometer), the percent of total soluble solids (TSS) in tubers, the percent of starch in tubers, The yield tubers of the marketing and not valid for marketing year (gm). Using the Randomized Complete Block Design by factorial experiment distributing, results were analyzed by the least significant difference in level 5%.

3. Results

Effect of compost of palm remnants positively and significantly in plant branches,plant height,percent of nitrogen in tubers,percent of Phosphorus in tubers,percent of potassium in tubers, Percentage of total soluble solids in tubers, starch in tubers and marketable yield and did not have a significant effect in the not valid for marketing yeald.The level of 60 tan. h-1 was the best level and gave the best results in all studied traits . The effect of humic acid was significant and positive in all studied traits except not valid for marketing yield and phosphorus percent in tubers, The level of 3 ml.l-1 was the best level and gave the best results in all studied traits table(3).

Table 3: Effect of compost and humic acid in studied traits

Treatments	Number of branches	Plant height	%N in tubers	%P in tubers	%K In Tubers	%TSS In Tubers	%Starch In tubers	Marketable yield	Nonmarketable yield
Compost	*	*	*	*	*	*	*	*	**Ns**
Humic acid	*	*	*	*	*	*	*	*	**Ns**
Interaction CxH	*	*	*	NS	*	*	*	*	**Ns**

* Ns,* not significant or significant at p<0.05, ANOVA

ANOVA Table 4 Showed a significant and positive effect of the interaction between the palm waste compost and humic acid. The concentration of 3 ml.l-1 has a significant effect on plant height 29 cm,nitrogen percent 1.93,starch percent %11.07,marketing yield 421.88 gm.plant-1. The concertation of 1.5 ml.L-1 has a significant effect on total soluble solids (TSS) %4.83, starch percent 11.44 %, comparison with control (spry only with water). There was no significant effect of concentrations 3 and 1.5 ml .l-1 in number of branches , percent of P and K in tubers ,and non markting yield. Effect of level 60 tan.h-1 of the compost of palm residues significantly in traits number of branches pe BN/d the 3 ml humic acid was given best results in traits: number of branches,plant height ,percent of N, percent of K, percent of TSS, percent of starch and markting yield per plant(3.87, 37 cm,2.65.4.29, 6. 13.46,755.8)resbectively. There no have a significant effect for interaction on the percent of phosphorus and no markting yield per plant.

Table 4: Effect the interaction between Compost and Humic acid in studied traits

Compost Tan.h^{-1}	Humic acid ml.l^{-1}	Number of branches per. plant	Plant height Cm	%N in tubers	%P in tubers	%K In tubers	%TSS In tubers	% Starch In Tubers	Marketable yield Gm	Nonmarketable yield gm
	0	2.10	22.43	0.95	0.18	2.62	3.10	7.78	6.18	**311.62**
	1.5	2.00	22.67	1.28	0.21	2.67	4.83	11.44	8.44	**322.75**
	3	2.33	29.00	1.93	0.22	2.68	3.73	11.07	9.65	**421.88**
0										
	0	2.20	26.00	1.07	0.21	2.64	4.33	9.98	13.74	**400.75**
	1.5	2.77	31.67	2.62	0.23	2.69	4.50	11.01	13.08	**488.18**
	3	2.70	32.00	1.39	0.24	2.86	5.67	11.39	10.74	**559.68**
20										
	0	2.50	28.00	1.23	0.21	2.96	4.67	11.35	12.20	**460.10**
	1.5	2.80	32.17	1.87	0.26	3.07	5.50	11.25	11.37	**535.26**
	3	3.33	36.00	2.26	0.27	3.37	5.67	12.88	12.34	**552.43**
40										
	0	2.70	34.83	1.66	0.22	3.21	5.33	10.65	12.25	**534.42**
	1.5	3.30	34.83	1.99	0.27	3.00	5.33	11.86	7.84	**584.37**
	3	3.87	37.00	2.65	0.29	4.29	6.00	13.46	9.17	**755.80**
60										
LSD 0.05		0.44	3.38	0.79	Ns	0.55	0.85	1.02	NS	**38.35**

*The interaction was analyzed with least squares means at the 5% and means were separated with LSD

4. Discussion

Addition of ground palm remnants compost caused a clear increase in most studied traits. An increase in the number of branches can be attributed to Increase soil retention with water and provide a favorable environment for the growth of buds which caused an increase in the number of branches. Increase plant height may be due to the fact that compost elements nutrients, including nitrogen, which stimulates the plant to produce oxygen, which promotes cellular division and elongation of cells thus increasing plant height, The increase in nitrogen, phosphorus and potassium due to the increase of organic matter in the soil led to improved fertility of the soil and increase the readiness of the elements and thus increase their absorption and transfer of leaves and tubers, The increase in starch and TSS Because of the role of organic matter in improving the properties of physical soil and fertility, this leads to increased absorption of nutrients and increase photosynthesis and the production of carbohydrates, including starch. The amount of improvement in all studied traits and for the mentioned reasons led to the improvement of plant growth and thus increased the marketing yield of the plant. Humic acid also has an indirect role in increasing soil organic matter and promoting plant growth and increasing Vegetative and root expansion, increasing the activity of enzymes, increasing activity of microorganisms in Rhizosphere. [10,11] explained Humic acid caused increasing organic matter in the soil. [12, 13] showed the addition of organic waste to soil increased the organic matter and microorganism activity. increased soil organic matter caused improved soil fertility characteristics related to nutrient availability due to increased activity and quantity Soil microorganisms enzymes, led to increased elements absorption by the plant, and then increase their percent in the leaves. Organic matter also increases soil biomass and releases carbon dioxide which produces carbonic acid with water, resulting in reduced soil pH and increased solubility of precipitated phosphate compounds, thus release potassium and phosphorus, Increased CEC for soil this increases the retention and release of positive ions such as potassium, preventing it from stabilizing and increasing its availability and thus moving to the leaves[12] As a result of the availability of nutrients and increase its these have been positively reflected in plant growth and photosynthesis, and the manufacturing of carbohydrates and proteins in the leaves and their transfer to tubers, it is due to the increasing the dry matter in the tubers and increasing the weight and number and increase the total yield. These results are according with[14]they showed increasing total yield of potato when added organic fertilizer. The interaction between the palm remnants compost and humic acid work together to improve the studied traits, thus increasing the yield for the above reasons. This is according to [15]. The above results are confirmed by both [16,17,18,19,14].

5. Conclusion

The palm residue compost can be used as organic fertilizer to improve soil qualities and agricultural production. Humic acid has a role in improving the quality and yield characteristics of potatoes. The interaction between the palm residue compost and humic acid has improved the studied traits. The interaction between the level of compost 60 tan h-1 and the level of humic acid 3 ml.l-1 gave the best results in the studied traits.

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