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RESPONSE OF SOME TRAITS OF POTATO (*SOLANUM TUBEROSUM* L.) TO THE ADDITION OF THE GROUND PALM REMNANTS COMPOST AND FOLIAR WITH HUMIC ACID

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ABSTRACT

Palm remnants are the most abundant organic material in Iraq, Can be exploited to produce an organic compost to supplement agricultural production rather than chemical fertilizers. So an experiment was carried out in Karbala in Aug. 2014,The compost palm residues was used in four levels 0,20,40,60 tan.h^{-1} and humic acid in three levels 0, 1.5, 3 ml.L^{-1} to know the effect of these factors and their interaction in some potato traits *Solanum tuberosum* L. Allaalddin variety, order A. The added levels of compost remnants palm and humic acid was increased significantIn soil content of organic matter, the percent of NPK elements in plant leaves, dry mater in tubers and total yield .The overlap between the compost remnants palm 60 tan. H^{-1} and humic acid 3 ml.L^{-1} was given best results Significantly higher than the comparison treatment In the soil content of the organic matter and the percent of nitrogen in the leaves and the percent of the dry matter of the tubers and total yield of tubers

Key words : compost, humic, remnants , palm, potatoes

Introduction

Researchers are working on new technologies for clean agriculture and pollution reduction through the use of natural materials such as organic fertilizers rather than chemical fertilizers. Organic fertilizers consider improve factor for the total physical, chemical and biological properties in the soil (Murawska *et al*., 1995), its Improve the ecosystem in soil and its texture (Chen *et al*., 2004). The role of soil organic matter can be summarized by processing plant with nutrients and increasing the exchange capacity of positive ions CEC, Increasing stability of soil, reduce it surface drift and the pollutants of heavy metals by adsorption of these elements, Organic matter works to absorb heat and thus accelerate seeds germination in cold soils, increase soil regulatory capacity. The optimum use of organic fertilizer causes increased soil organic matter, improves soil build-up and increases water and air permeability (Hassanpanah and Azimi, 2012). Organic matter plays an important role in restoring nutrients to soil (Wei *et al*., 2012). Merghan (1998) found that organic manure significantly affected the use of the same level of nitrogen from mineral fertilizers. Moliavko (2001) explain in ability the success of Agriculture and the production of an economic crop of potato tubers using organic fertilizer for its role in improving the properties of physical, chemical and biological in soil and gives better quality. Humic acid is one of the main components of humus matter, which is a major component of organic matter (Anonymous, 2010). Humic increase the aggregations of micro-organisms in the rhizosphere that provides the supporting elements of the plant(Awad, 2002). 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 area (Chorbani *et al*., 2010). 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.

Material and Methods

A field experiment was carried out in the field of organic fertilizer preparation project in Karbala in 1-Aug, 2014. The land was prepared and divided into sections and cultivated potato tubers *Solanum tuberosum* 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 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

The studied traits were: Soil organic matter as reported to (Page *et al*., 1982). The percent of nitrogen in the leaves is estimated by Kjeldahl method (micro-kjeldahl), the percent of phosphorus is quantitatively estimated using the spectrum instrument (spectrophotometer), the percent of potassium is estimated by the flame device (flame photometer), Percent of dry matter in tubers and total yield of tubers. Using the Randomized Complete Block Design by factorial experiment distributing, the experiment was analyzed according to the least significant difference at level 0.05.

Results

Compost levels significantly and positively affected in all studied traits, The 60 tan.h^{-1} level was the best level, it shows significantly superiority as compared with other levels of soil organic matter, it showed increasing in percent of nitrogen, phosphorus and potassium in the leaves, dray matter in tubers and total yield and gave a percent increase of 52.17%, 30%, 31%, 8.33%, 76.25% as compared with the control treatment respectively (Table 3). Humic acid significantly increased all studied traits and gave the level 3 mg.l^{-1} higher organic matter in soil, also the same level of the humic acid in the traits: percent of nitrogen, phosphorus and potassium in the leaves, dray matter in tubers and total yield and gave a percent increase of 28.06%, 21.7%, 22.75%, 12.36%, 33.18% as compared with the control treatment respectively (Table 3)

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

	Organic matter in soil gm.kg^{-1}	%N in leaves	%p in leaves	%K in leaves	%dry mater in tubers	Total yield Tan.h^{-1}
Compost	*	*	*	*	*	*
Humic acid	*	*	*	*	*	*
Interaction CxH	*	*	N.S	N.S	*	*

NS,* not significant or significant at $p < 0.05$, ANOVA

Table 4 showed that the interaction between the compost level of 60 tan.h^{h-1} and the level of humic acid 3ml.l^{-1} gave the best results for soil content of organic matter 30.37 gm.kg^{-1} as compared with control treatment 6.5 gm.kg^{-1}, percent of nitrogen, phosphorus and potassium in the leaves, dray matter in tubers and total yield that gave 3.07%, 0.34%, 5.5%, 19.44%, 40.68 tan.h^{-1} compared to the comparison treatment (Without any additions) 1.7%, 0.2%, 3.03%, 15.46%, 16.94 tan.h^{-1} respectively.

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

Compost tan.h^{-1}	Humic acid ml.L^{-1}	Organic matter in soil gm.kg^{-1}	%N in leaves	%p in leaves	%K in leaves	%dry mater in tubers	Total yield Tan.h^{-1}
0	0	6.5	1.7	0.2	3.03	15.46	16.94
	1.5	8.07	1.92	0.24	3.97	17.32	17.66
	3	10.93	1.98	0.23	4.36	16.9	23.01
20	0	18.39	1.8	0.23	3.71	15.67	22.11
	1.5	21.64	2.08	0.26	4.46	16.83	26.74
	3	23.04	2.22	0.24	4.67	17.26	30.42
40	0	22.15	2.08	0.23	4.46	17.1	25.19
	1.5	27.34	2.47	0.27	4.67	17.1	29.15
	3	27.77	2.78	0.3	5.1	18.94	30.12
60	0	24.07	2.24	0.24	4.81	18.43	29.15
	1.5	29.87	2.78	0.26	5.23	17.8	31.58
	3	30.37	3.07	0.34	5.50	19.44	40.68
LSD 0.05		1.91	0.217	N.S	N.S	1.15	3.9

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

Discussion

An addition of ground palm remnants compost caused a clear increase in soil content of organic matter. It due to the amounts added to the soil that caused the activity of the microorganisms, which play an important role in the decomposition of compost, 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. Hartwigson and Evans, 2000; Hafez, 2003 explained Humic acid caused increasing organic matter in the soil. Bakayoka, 2011; Hao, 2008 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 micro-organisms enzymes, led to increased elements absorption by the plant and then increase their percent in the leaves. Organic fertilizer works to increasing soil retention of water, improve their ventilation led to increased microorganism and increased nitrogen, phosphorus and potash release in the metalization process of organic matter, then absorption and transfer of leaves. The humic acid and Fulvic acid

produced by the decomposition of organic matter lead to the dissolution of the primary metals and compounds insoluble phosphates. The phosphorus will be released and absorbed by the plant. 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 (Bakyoka *et al*., 2009). 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 (Amara and Mourad, 2013)they showed increasing total yield of potato when added organic fertilizer. increasing elements of nitrogen, phosphorus and potassium due to of humic acid role in the development of the root system and improve the absorption of elements or its role in reducing the loss of nitrogen by volatilization, As a result of the action of the enzyme Urease and increase the percent of nitrogen in the leaves. Humic acid also improves the enzymatic system and respiration efficiency in roots, this providing the energy exploited by the root in active absorption, It also prevents the stabilization of phosphorus in the soil through the composition of homophospho complex, it easy absorption by roots and moves to leaves. The amino group of humic acid also adsorbed phosphorus ions and it increase its absorption by the plant, Humic acid also works to increase cellular membrane uptake. This increases the absorption of potassium and increases the percent of dry matter in the tubers and thus increases the total yield.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 (Mahdavi *et al*., 2015).

Conclusion

The 60-tan.h^{-1} level of palm remnants compost showed the best results in improving studied traits also the level 3 ml.l^{-1} humic acid. The interaction between the two levels achieved the best results in improving the studied traits. The experiment showed the possibility of using the palm remnants compost instead of the chemical fertilizer.

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