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EFFECT OF MYCORRHIZA FUNGI SPREAD IN SOIL AND PALM ROOTS ON PHOSPHORUS AND POTASSIUM CONTENT OF THREE LOCATION IN BAGHDAD CITY

Manar Kasim Mohammed* and Sumaiya Naeema Hawar

Department of Biology, Collage of Education of Pure Science (Ibn Al-Haitham), University of Baghdad, Baghdad, Iraq.

Abstract

A field survey was conducted for three areas in Baghdad city, including Al-Rabaa, Zafaraniya and Rashidya, for the period of January to June to determine the spread of mycorrhiza fungi in the roots of plant trees planted tissue for two types of Al-Zamiliy and Al-Barhi palms trees. The results showed a different incidence of mycorrhiza infection, as the effect of the variety and location affected the intensity of the mycorrhizal colonies in the root system. As the variety significantly affected the number of dendritants in the root system, the location also had the same significant effect. Samples were also collected from the soil surrounding the affected roots and calculating the content of ready phosphorus and extractable potassium. The results showed that intentionally, there were significant differences in the content of ready-made phosphorus in the soil due to the effect of the variety, where Al-Rabaa location gave the highest rate 12.79 mg/kg. It was also found that the two-way overlap between the item and the location caused a significant increase in the percentage of phosphorus content. The results of the extractable potassium content also showed that the potassium level was affected by the variety and location, as the soil cultivated with the variety Barhi gave a higher profit rate of 253.96 mg/kg. Al-Zafaraniya soil recorded the highest content of 285.11 mg/kg. As for the interface between the variety and the location, we notice the superiority of the cultivated soil in which the variety is Zamili in the Rashidiya location, as it gave a content of 381.57 mg/kg.

Key words: mycorrhiza fungi, palm trees, soil, potassium, phosphorus.

Introduction

The term mycorrhiza was first coined by the German scientist Frank in 1885, the origin of the name in Greek consists of two parts "Myco" and means mushroom and "rhiza" means root. Most plant have co-existing relationships with mycorrhiza fungi, which promote plant growth by providing nutrtients (Frew, 2019). Micro-organisms found in the soil, such as mycorrhiza, are a major link between plant and soil and existing mineral nutrients, so there is growing interst in using them as biofertilizers and mycorrhiza are coexistence organisms that are compulsory coexistence belong to phylum Glymeromycota (Schübler *et al*., 2001).

Many source have indicated that mycorrhiza helps absorb major nutrient such as phosphorus when the level of the ingredient is low in the food media (Sylvia *et al.,* 2001). The mycorrhiza is not only equipped with phosphorus in soil, which suffers from the lack of this element, but it has other benefits where it can absorb other elements such as nitrogen, calcium, potassium, sulfur, manganese, iron, zinc and copper and these elements are transmitted through roots to plant and from the important effects are the absorption of non-moving elements such as zinc, phosphorus and copper (Von, 2007 and Utobo *et al.,* 2011).

The settlement of the mycorrhiza under the bad conditions of some unfertile soil or in dry or satly soils helps to reduce the requirments of plants for phosphorus and other elements and this has a good effect on plants by increasing the absorption of phosphorus and other elements whether ready or not ready and that the use of biofertilizer helps to reduce chemical additives and this increase control over safe food production (Rajaram *et al.,* 2014).

Therefore, the present study aimed to measure the effect of mycorrhizal fungi in the soil of palm trees on

the content of phosphorous and potassium elements therein.

Materiales and Methods

Materiales

KOH (10%) (India, CDH), NH_4OH, Hydrogen peroxide (UK, BDH) (to prepare alkaline peroxide solution), Lactic acid and Glycerine, Fuchsin stain (India, CDH) (to prepare acidic Fuchsin).

Samples collection

Samples of palm roots were collected with samples of the soil surronnding the roots and a distance of 30 cm and depth of 30 cm from three locations of the city of Baghdad, namely Al-Rabaa station, Al-Zafaranya and Al-Rashidya of the Ministry of Agriculture and by three repeats for each palm and placed in nylon bags for use (Alwan *et al.,* 2010).

Islation and staning the roots

After drying the soil by air the roots were isolated and stained with the acidic fuchsin dye to ensure that the roots were infected with only mycorrhiza accordinge to (Kormanik *et al.,* 1980). The root samples were placed on a glass slide and examined under a light microscope for the purpose of recording microscopic settlement, of the mycorrhiza, the density of the colonies and the abundance of dendritants. Data were entered into the Excel system to calculate the settlement percentage and according to the following equations (Trouvelot *et al.,* 1986).

1. The percentage of mycorrizal infection in the root system (Murphy *et al.,* 1962).

$$\text{Percentage of frequency (F\%)} = \frac{\text{Number of radical pieces infected with mycorrhiza}}{\text{Total number of root pieces}} \times 100$$

2. The density of the mycorrhiza colonies in the radical system (M%)

$$= \frac{n1 + 5n2 + 30n3 + 70n4 + 95n5}{\text{Total number of roots pieces}}$$

3. The density of the mycorrhizal colonies in the root pieces (m%)

$$= \frac{M\% \times \text{Total number of roots pieces}}{\text{The number of mycorrhiza pieces}}$$

4. Number of dendritants in the mycorhhizal parts to root pieces (a%)

$$= \frac{10\ mA1 + 50\ mA2 + 100\ mA3}{100}$$

5. The dendritants provided in the root system A% = a%× $\frac{M\%}{100}$

Check the content of the soil of ready phosphorus and recoverable potassium and complement the following:

1. Measuring ready phosphorous according to its method (Murphy *et al.,* 1962).

2. Measuring the recoverable potassium content according to its method (Page *et al.,* 1982).

Results and Discussion

Percentage of frequency

The results shown in table 1, showed that there were no significant differences in the percentage of frequency due to the effect of the variety, we also notice from the results of the table a significant superiority of site impact. Al-Rabaa site gave the highest frequency of 95.83%, then Al-Zafaraniya followed with frequency of 81.48%, while Al-Rashidiya site gave the lowest frequency ratio with the lowest frequency of 78.6%. It was also found that the bilateral interference between the variety and the site caused a significant increase to the perecentage of the frequency. The Zamili varites in the Al-Rabaa site gave the highest rate 100%, while Barhi gave in the lowest perecentage of Al-Rashidia site reaching 62.96%.

Density of the mycorrhiza colonies in the radical system

It is noted from table 2, that the density of colonies, the mycorrhiza colonies in the root system was affected by the variety, as the Zamili variety gave the highest density of 44.02% while the variety Barhi was given the lowest percentage of 27.20%, while the results were noted, the density of the mycorrhiza colonies in the root system at the site was affected, giving Al-Rabaa site a high of 64.34%, then followed by a significant difference of the location of Al-Zafaraniya with a rate of 35.70%, compared to the Rhashidiya site, which gave the lowest rate of 17.68% variety. As for the effect of the overlap between the site. The results of table 2, show the superiority of the Zamili variety at the Al-Rabaa site by giving it the highest perecentage of the density of the

Table 1: Effect of the variety, location and the interference between them in the perecentage of frequency.

Variety rate	Location			Variety
	Al-Rashidiya	Al-Zafaraniya	Al-Rabaa	
81.17 a	62.96 b	88.89 ab	91.66 ab	Barhi
89.61 a	94.75 ab	74.07 ab	100.00 a	Zamili
	78.86 b	81.48 b	95.83 a	Location rate

*The averages of each group followed by letters indicate the presence of significant differences between them at probability level 0.05 accoring to the Duncan polynomial test.

Table 2: The effect of the variety, location and overlap between them on the density of mycorrhiza colonies in the root syetem.

Variety rate	Location			Variety
	Al-Rashidiya	Al-Zafaraniya	Al-Rabaa	
34.46 b	29.1 bc	25.67 bc	48.42 b	Barhi
44.02 a	42.10 b	9.70 c	80.28 a	Zamili
	17.68 b	35.70 b	64.34 a	Location rate

*The averages of each group followed by letters indicate the presence of significant differences between them at probability level 0.05 accoring to the Duncan polynomial test.

mycorrhiza colonies in the radical system of 80.28%, while the Zamili variety in the Zafaraniya site gave the lowest rate of 9.70%.

Density of mycorrhiza colonies in pieces of roots

The results of table 3, indicated theat the variety significantly affected the density of the colonies of mycorrhiza in peices of root as it reached 45.67% in the Zamili variety, while the density of the colonies in the pieces of roots was 37.78% in the Barhi variety.

As for the influence of the location on this trait, it was found that the Al-Rabaa site had the highest ratio of 64.59% and then followed it with a significant difference of the Rashidiya site, as it gave 41.76% and the Zafaraniya site gave the lowest perecentage of the density of the colonies in the pieces of roots at 18.81%.

With regard to the overlop between the variety and the location the results of table 3, are noted above the Zamili variety at the Al-Rabaa location as it gave the highest density of the colonies of the mycorrhiza in the pieces of the roots, while the same item gave the lowest percentage in the location of Zafaraniya a ratio of 12.08%.

Number of dendritants in the root system

The results of table 4, show that the varieties had a significant effect (at the probability level 0.05) in increases the number of dendritants in the root system. As the variety Barhi yielded the highest average number of

Table 3: The effect of the variety and location and overlap between them in the density of mycorrhiza colonies in the pieces of the roots.

Variety rate	Location			Variety
	Al-Rashidiya	Al-Zafaraniya	Al-Rabaa	
37.78 b	38.89 bc	25.55 bc	48.92 b	Barhi
75.67 a	44.65 b	12.08 c	80.28 a	Zamili
	41.76 b	18.81 b	64.59 a	Location rate

*The averages of each group followed by letters indicate the presence of significant differences between them at probability level 0.05 accoring to the Duncan polynomial test.

Table 4: The effect of the variety and location and overlap between them on the number of dentritants in the root system.

Variety rate	Location			Variety
	Al-Rashidiya	Al-Zafaraniya	Al-Rabaa	
2.97 a	1.31 b	0.10 c	7.52 c	Barhi
2.53 b	0.72 c	0.07 d	6.81 a	Zamili
	1.01 b	0.08 b	7.16 a	Location rate

*The averages of each group followed by letters indicate the presence of significant differences between them at probability level 0.05 accoring to the Duncan polynomial test.

dendritant 2.47%, while the Zamili variety gave the lowest average number of dendritant to 2.53% dendritent.

As for the number of dendritants in the root system, the sites influence increased as the Al-Rabaa location gave the highest rate of dendritants at 7.16% dendritant, then followed by a significant difference in Rashidiya location as it gave a number of dendritants of 1.01% dendritant. While Al-Zafaraniya location gave the lowest average number of dendritants in the root system of 0.08% dendritant, which did not differ significantly with the Rashidiya location. As for the effect of interference between the variety and the location, it is noticed from the results of table 4, the superiority of the Barhi and Zamili variety in the Al-Rabaa location by giving them the highest average number of dendritants in the root system, reached 7.52, 6.81 dendritant respectively. While the Zamili variety in the Zafaraniya location gave the lowest rate of 0.07 dendritant.

Torrey, 1976 stated that a biological agent that has on the formation of spores, which is the change in the production of substances resulting from plant photosynthesis, as well as other factors such as the quantity and type of root secretious (Jakobsdon and Nielsen, 1983) and levels of root hormones (Gemma and Koske, 1989).

Studies have indicated that there is a positive relationship between the number of spores and the

Table 5: The effect of the variety, location and overlap between them in the content of the extractable potassium.

Variety rate	Location			Variety
	Al-Rashidiya	Al-Zafaraniya	Al-Rabaa	
253.96 a	155.61 bc	338.11 a	26.17 ab	Barhi
193.06 b	381.57 c	232.11 abc	208.50 bc	Zamili
	147.09 b	285.11 a	238.33 a	Location rate

*The averages of each group followed by letters indicate the presence of significant differences between them at probability level 0.05 accoring to the Duncan polynomial test.

percentage of mycorrhiza infection due to the size of the increase in fungal colony. The layer the size, the higher the incidence and at the same time it is reflected in the composition of the spores, so the reason for the difference in the number of spores by different months and the host plant can be attibuted to the different percentage of injection (Koske and Halvorson, 1981 and Anderson *et al.,* 1984).

The reason for the increase in the number of spores for biofertilizer is the effective role of mycorrhiza fungi and their ability to coxist and grow in the largest area of plant roots and increase the perecentage of mycorrhiza infection to the roots in accordance with (Al-Fahdawi, 2016).

Effect of the variety, location and overlap between them in the content of the extractable potassium

Table 5, show that the extractable potassium content was affected by the variety, as the cultivated soil of the variety Barhi gave the highest percentage of potassium content in 253.96 while the cultivated soil gave the Zamili variety the lowest percentage of potassium content of 193.06.

As for the effect of the location on potassium content it was found that there were significant differences, as the top soil Al-Zafaraniya reached the highest content 285.11, followed by Al-Rabaa location, which gave a content of 238.33, while the Rashidiya location gave the lowest content of potassium, reaching 147.09.

As for the interference between the variety and the location it is noted from the results of table 5, that the higher content of the cultivated soil in the Zamili variety of potassium at the Rashidiya location was given the highest extractable the potassium content of 381.57 while the variety Barhi was given with a profit in the Rashidiya location the lowest perecentage of 155.61.

The reason for the increase in ready potassium is due to the excretion of oxalate on the surface of the roots that contain mycorrhizal fungi and under conditions of potassium deficiency and replaces potassium in the clay minerals layer and this lead to a biological weathering of the minerals because the mycorrhizal fungi have the ability to dissolve mineral compounds through acid analysis such as the secretion of organic acids such as oxalic acid, citric acid, nutrients, reductions and oxidation (Salman, 2011) and this confirmed by (Al-Khaliel, 2010) and (Khan and Zaidi, 2007).

Table 6: The effect of the variety, location and overlap between them in the content of the phosphours content.

Variety rate	Location			Variety
	Al-Rashidiya	Al-Zafaraniya	Al-Rabaa	
8.07 a	3.36 b	5.84	12.55 a	Barhi
7.25 a	4.22 b	6.98 b	13.02 a	Zamili
	3.79 b	6.41 b	12.79 a	Location rate

*The averages of each group followed by letters indicate the presence of significant differences between them at probability level 0.05 accoring to the Duncan polynomial test.

Effect of the variety, location and their interaction on phosphorous content in the soil

The results showed in table 6, that were no significant differences in the content of phosphorous ready in the soil, as a result of the effect of the variety we also notice from the results of the table a significant superiority due to the impact of the location on the content of ready-made phosphorous.

Al-Rabaa location gave the highest percentage of phosphorous content of 12.79 followed by the Al-Zafaraniya location with a content of 6.41, while the Rashidiya location gave the lowest percentage of phosphorous content of 3.79.

It was also found that the interaction of the due between the variety and location caused a significant increase to the percentage of phosphorous content. The variety Zamili in the Al-Rabaa location gave the highest rate of 13.02, while the variety Bahri in Rashidiya location gave lowest rate of 3.36.

The reason of increasing of concentration of phosphorous is due to the ability of mycorrhiza to absorb phosphorous present in the soil in an incomplete manner by extending the fungal hypha to far distances from the roots and the secretion of some organic materials that can dissolve complex compounds and this leads to increased phosphorous in the soil. The fungus of mycorrhiza secrets the enzyme of phosphatase, which is found in the hypha and vesicles and this helps to dissolve phosphorous from different sources and increases the readiness for the plant and this corresponds to what is said (Khan and Zaidi, 2007 and Rahman *et al.,* 2010).

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