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# The Effect of Inoculation Mycorrhiza and Organic Fertilizer and Dab Fertilizer in the Availability NPK for Local Wheat (*Triticum aestivum* L.)

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**Abstract.** A field experiment was carried out in one of the fields of Al-Qadisiyah Governorate, Al-Shafi'iyah district, for the season 2021/2022 using soil (Sandy loam) to study the effect of inoculation mycorrhizal, organic fertilizer and dab fertilizer on Availability NPK of local wheat plants (RCBD) design. The experiment included three factors of inoculation mycorrhizal (G0, G1) and organic fertilizer (0-1-2) tons. ha, and mineral fertilizer (0-50%-100%) and the lsd test was calculation the least significant difference at the 0.05 level, where it showed that there is a significant effect and the superiority of the treatment inoculated with Mycorrhizal fungus on the comparison treatment in nitrogen, phosphorous, potassium, and the average reached (2.229%), (0.298%), (1.475%), as well as the treatment of organic fertilizer (P2) over the control treatment (P0) in nitrogen (2.313%) and the superiority of treatment (P1) in phosphorous (0.321%), and the treatment (P2) in potassium (1.493%). The treatment of mineral fertilizer at the level of 50% was superior in nitrogen, which amounted to (2.116%), and in phosphorous, the treatment exceeded 100% (D2), where it reached an average of (0.310%), and in potassium, the treatment exceeded 100% (D2) (1.478%), while in The case of binary interference between G.

**Keywords.** Mycorrhiza, Organic fertilizer, Dab fertilizer, NPK.

## 1. introduction

The Iraqi agricultural sector faces many problems, foremost of which is the low availability of important elements in the soil as well as the low quality of production, and to increase the quality and quantity of the yield, farmers turned to the application of clean agriculture in order to reduce pollution and natural materials were used, including (organic fertilizers, bio fertilizers) that work on increase the yield.

As well as the fact that chemical fertilizers are of high prices, which increases the cost of agricultural production, and also organic and biological fertilizers are an alternative that farmers resort to to reduce the problems of chemical fertilizers [1], and the mycorrhizal fungus is a group of fungi that form a symbiotic relationship with the roots of plants, where they extend their hyphae and overlap with the roots of other types of plants, which range in number (90-80%), and exchange benefits, that is, transfer water and nutrients from plant to plant[2].

Also, the plant infected with the mycorrhizal fungus has the ability to withstand environmental conditions, including drought, salinity, and because of its symbiotic subsistence, it did not receive



enough studies, but its importance began to increase day after day, because it supports the vegetation cover. Agricultural soils

As for organic fertilizers, they are one of the most important foundations that provide the plant with vital nutrients that enhance its growth and development, such as nitrogen, phosphorous, potassium and the rest of the other elements [3], as well as when adding organic fertilizers to the soil has positive effects, including improving the soil structure and its ability to retain water and nutrients, but it increases the amount of organic matter in the soil, that is, the upper layer of soil that contains carbon [4], and the addition of waste, whether it is (poultry, cows, sheep) to the soil works on the readiness of nutrients by increasing organic carbon content [5].

Fertilizer DAP is one of the most important fertilizers that is a source of nitrogen, phosphorous, ammonium, while N, P are the essential nutritional vitamins required by plants in large quantities because they play an important function in building proteins, and there are different degrees of DAP fertilizer stages that have results. It differs on the leaves of the plant, because it is acidic, i.e. due to the decomposition of ammonium, in which there is nitrogen, which is the main compound in the necessary substances that enter into the construction of the plant [6], and the readiness of NPK elements increases its absorption by the plant and leads to an increase in the activity of the important processes in the plant and this is reflected in the biological processes [7], and in order to form the vegetative part, an increase in the amount of NPK elements is required to meet the requirements for the formation of plant parts, especially grains in the grassy family [8].

The wheat crop (*Triticum aestivum* L) is one of the important crops that has been used as food for humans since thousands of ages. There was a total area planted with wheat in Iraq, where it was planted (6500) years ago, as well as in Egypt (5000-6000) years ago, and in China (1000) years ago [9], where the harvested area in Iraq reached (1.20 million hectares) and the production rate (2.40 million tons), and despite the large cultivated areas, it was insufficient to meet the basic needs, and it was necessary to seek to produce new varieties [7].

As for the year (2019), the total production in Iraq was estimated at (4343,000 tons), as well as a source of amino acids, protein, vitamins and dietary fiber [10]. The Thesis aims to study the following points:-

- The Effect of *Glomus mosseae* on the growth and yield of local
- The Effect of the interaction between fertilizer DAP and cow manure on the growth and yield of local.
- The Effect of *Glomus mosseae*, Cow manure and fertilizer DAP and the interaction between them on the growth and yield of local.

## 2. Materials and Methods

The experiment was carried out in an agricultural field belonging to one of the agricultural fields in Al-Shafi'iyah district during the winter agricultural season (2021-2022), where the soil texture was (Sandy Loam), and all operations were performed before planting in terms of tilling, plowing, smoothing and leveling, as well as they were divided into experimental units, as each experimental unit's area is 16 m (4 x 4 m) and a factorial experiment was applied by designing randomized complete sectors (RCBD), where it was three replicates, as each replicate contains 18 experimental units, in addition to that, random samples were taken from the field soil with a depth of (0-30 cm) and all soil analysis was conducted before planting.

Where the Mycorrhizal inoculation was added at two levels (G0 (no addition), (G1 added) and three levels of organic manure (cow waste) (0-1-2 tons. ha<sup>-1</sup>) and three levels of dab fertilizer (0-50%-100%) of the fertilizer recommendation, which contains the percentages of elements (P<sub>2</sub>O<sub>5</sub> 46%) and (18%N), as well as potassium sulfate containing (K<sub>2</sub>O 47%) was added in one batch before planting, and urea containing (N 46%) was added in three batches, the first before planting, and the second batch after 45 A day of planting, and the third batch is in the flowering stage. The data were statistically analyzed and the arithmetic averages were compared using the (LS D) test, the least significant difference at the level of (0.05).

The studied characteristics were studied, which are:-

Five leaves of the plant were taken from each experimental unit and washed with distilled water and dried in the electric oven at 65 °C, after that they were ground and sieved with a sieve with a diameter of 2 mm, and then they were digested as concentrated solutions were added to the plant samples weighing 0.2 g and left until obtaining After that, the following estimates were made:

- Determination of nitrogen in plants:- The digested samples were taken, and nitrogen in plants was estimated using a steam distillation apparatus (Micro kjeldahl) according to [11].
- Estimation of phosphorous in plants: the digested samples were taken and the percentage of phosphorous was estimated using a device (Spectro photometer [12].
- Estimation of potassium in plants:- Where the digested samples were taken and the percentage of potassium was estimated using the photoluminescent device (Flame photometer) [13].

**Table 1.** Physical and chemical soil analyzes before planting.

Unit	the value	Adjective	
-	7.5	pH	
ds. m <sup>-1</sup>	2.8	Ec	
gm kg soil <sup>-1</sup>	7.0	O. M organic matter	
CmoIc L <sup>-1</sup>	10.25	CEC	
gm kg soil <sup>-1</sup>	Sandy loam	texture	
	619.8	Clay	
gm kg soil <sup>-1</sup>	231.9	Sand	Soil Separators
	148.9	Silt	
	10.50	N	
	9.59	P	Ready ions
Amalgam kg soil <sup>-1</sup>	115.57	K	
	15.4	Ca	
	14.07	Mg	Positive dissolved ions
	15.30	Na	
	Nil	CO <sub>3</sub>	
mmol liter <sup>-1</sup>	5.24	HCO <sub>3</sub>	Negative dissolved ions
	19.12	SO <sub>4</sub>	
CFU gm of dry soil	1.93×10 <sup>3</sup>	holistic fungi	

### 3. Results and Discussion

#### 3.1. The Percentage of Nitrogen in the Plant

Table No. (2) shows that inoculation with a fungus *G. mosseae* had a significant effect as it reached the highest mean when treatment (G1) amounted to (2.229)%, compared with the average of no addition treatment (G0), which reached (1.960)%, due to the fact that the fungus *G. mosseae* had a significant effect. *mosseae* has an important function in increasing the density of root hairs, and for this reason, it increases nitrogen uptake and its preparation for the plant, and this is consistent with [14] The table also shows that organic fertilization had a significant effect, as it reached the highest average treatment (P2) and its average was (2.313) % at the level of (2 tons. hectares<sup>-1</sup>), compared with the control

treatment (P0), which averaged (1.889) %, and the reason for this is because organic fertilizers have an important role in increasing the ability of soil to retain water This provides complete freedom of nitrogen movement and thus leads to an increase in nitrogen uptake by the plant and this is consistent with the results[15].

Table No. (2) shows that mineral fertilization has a significant effect on the nitrogen content in the plant, as it reached the highest average in the treatment of (D1) averaged (2.116)%, and the lowest average reached in the treatment of (D0) (2,084), and this is due to the increase in phosphorous uptake by the plant and this is consistent with[16]

The table also shows that the binary interaction between fungus *G. mosseae* and dab fertilizer There is a significant effect in the interaction where the treatment (G1 + D1) was superior, which reached the highest average of (2.237) % compared with the control treatment (G0 + D0), which reached the lowest average (1.944) %, and this may be the reason for this This leads to the increase in the nutritional needs as well as the micro-organisms that lead to an increase in the nitrogen element in the plant, As for the bilateral interaction between organic fertilizers and mineral fertilizers, there was a significant effect, where the treatment of (P2 + D1), which averaged (2.347)%, and the reason for this is that the fertilizer works to provide good conditions and increase the absorption of water and nutrients, as well as working to improve soil fertility by the roots of the plant and this is consistent with the results [17], as well as the table shows that the overlap The triple between the fertilizers had a significant effect, where the treatment (G1P2D1) was superior, which averaged (2.563)%, compared with the control treatment (G0P0D0), which averaged (1.752)%.

**Table 2.** Shows the effect of mycorrhizal inoculation, compost and dab fertilizer on plant nitrogen content (%).

G*P	dab fertilizer			Cow manure	Fungi <i>Glomus mosseae</i>
	D2	D1	D0		
1.797	1.840	1.798	1.752	P0	
2.005	1.955	2.054	2.006	P1	G0
2.077	2.027	2.130	2.074	P2	
1.981	1.980	2.021	1.943	P0	
2.157	2.155	2.127	2.188	P1	G1
2.550	2.546	2.563	2.539	P2	
0.024	LSD G*P		0.042	LSD G*P*D	
	G*D				
medium fungi	D2	D1	D0	Fungi	
1.960	1.941	1.994	1.944	G0	
2.229	2.227	2.237	2.223	G1	
0.014	LSD G		0.024	LSD G*D	
	P * D				
average residue	D2	D1	D0	Cow manure	
1.889	1.910	1.910	1.848	P0	
2.081	2.055	2.091	2.097	P1	
2.313	2.287	2.347	2.307	P2	
0.017	LSD		0.030	LSD P*D	
	2.084	2.116	2.084	Dab fertilizer averages	
	0.017			LSD D	

### 3.2. The Percentage of Phosphorous in the Plant

Table No. (3) shows that fertilization with a fungus *G. mosseae* has a significant effect as the highest mean was reached in treatment (G1), which averaged (0.298)%, while the lowest average was reached in the no-addition treatment (G0) (0.280)%, and this is due to the extension of the fungus hyphae to the farthest distance from the rhizosphere And its ability to secrete the enzyme phosphatase, which leads to the secretion of organic acids and phosphorous in the plant, and this is consistent with [18,19].

The table also shows that organic fertilization has a significant effect as it cancels the highest average in the treatment (P1) (0.321) % and the lowest average in the treatment (P0) (0.268) %, and the reason is due to the fact that organic fertilizers have the ability to reduce the fixation of phosphorous element and this leads to an increase in its absorption and the activity of enzymes that work to regulate the rate of photosynthesis as well as its effectiveness on Increasing phosphorous in plants

The table also shows that the mineral fertilizer has a significant effect, as it reached the highest average treatment (D2) (0.310) % and the lowest average when treating (D0) (0.256) %, and the reason for this is due to the increase in the percentage of phosphorous in the plant and also works to encourage nitrogen absorption in the vegetative part of the plant and this is consistent with [20,21].

The binary interaction between fungus *G. mosseae* and mineral fertilizer had a significant effect, where the treatment (G1D2) outperformed, where it reached an average of (0.322)% and the lowest average of treatment (G0D0) (0.257)%, and the reason for this is that the fungus *G. mosseae* has the ability to dissolve and increase the plant with phosphorous and this agrees with [22] .

As for the interaction between organic fertilizers and mineral fertilizers, there was a significant effect, as the treatment outperformed (P1D2) averaged (0.340)%, and the lowest average was (0.235)% in the treatment (P0D0), and this is due to the fact that organic fertilization has the ability to improve soil fertility and increase its growth for the vegetative part of the plant, as well as mineral fertilization works to increase plant absorption of elements food and the speed of its dissolution, and this is consistent with [23].

As for the triple interaction, which gave a significant effect, the treatment outperformed (G1P1D1) in the phosphorous content in the plant, which averages (0.364)%. As for the comparison treatment (G0P0D0), which averages (0.216)%.

**Table 3.** Shows the effect of mycorrhizal inoculation, organic fertilizer and Dab fertilizer on plant phosphorous content (%)

G*P	dab fertilizer			Cow manure	Fungi <i>Glomus mosseae</i>
	D2	D1	D0		
0.248	0.266	0.262	0.216	P0	
0.300	0.325	0.295	0.280	P1	G0
0.292	0.304	0.298	0.275	P2	
0.287	0.326	0.281	0.255	P0	
0.341	0.355	0.364	0.305	P1	G1
0.265	0.284	0.309	0.204	P2	
0.014	LSD G*P		0.025	LSD G*P*D	
	G*D				
medium fungi	D2	D1	D0		Fungi
0.280	0.299	0.285	0.257		G0
0.298	0.322	0.318	0.255		G1
0.008	LSD G		0.014	LSD G*D	
	P * D				
average residue	D2	D1	D0		Cow manure
0.268	0.296	0.271	0.235		P0
0.321	0.340	0.330	0.293		P1
0.279	0.294	0.304	0.239		P2
0.010	LSD		0.017	LSD P*D	
	0.310	0.301	0.256	Dab fertilizer averages	
	0.010			LSD D	

### 3.3. The Percentage of Potassium in the Plant

Table No. (4) shows that fertilization with a fungus *G. mosseae* has a significant effect as it reached the highest average when the addition treatment (G1) (1.475)% and the non-additive treatment (G0) averaged (1.438) %, and the reason is due to the increased ability of the fungi to dissolve and absorb nutrients, including potassium, and this agrees With [24] .

As for the organic fertilization, it had a significant effect, as it reached the highest average in the treatment of (P2) (1.493%), and the reason for this is that organic fertilization works to provide the plant with nutrients and their absorption by the plant, and this is consistent with [25].

The table also shows that mineral fertilizer has a significant effect, with the highest average in the treatment of (D2) (1.478) %, and the lowest average in the treatment (D0) (1.428) %, and the reason for this is due to the increase in the readiness of the nutrients that work on the absorption of elements by the plant as well as the increase in the vegetative total and this is consistent with [26,27]. The binary interaction between fungi *G. mosseae* and mineral fertilizer had a significant effect, as the highest average in the treatment (G1D2) (1.494)%, and the lowest average in the control treatment (G0D0) (1.402)%, and the reason for this is that the fungus *G. mosseae* works to dissolve the mineral fertilizer and transfer The vegetation cover with the nutrients that make up potassium, and this is consistent with [28,29], As well as the interaction between organic fertilizer and mineral fertilizer has a significant effect, as it reached the highest average in the treatment of (P2D2) (1.516) %, and the lowest average in the treatment (P0D0) (1.332) %, and this is due to the fact that the interaction between organic fertilizers and mineral fertilizers has the ability to increase nutrients as it is of great importance in providing appropriate conditions and increasing the nutrient readiness of the plant The triple interaction had a significant effect, the treatment outperformed (G1P2D2) in the potassium content in the plant, which reached the highest average (1.524)%, while the lowest average was in the comparison treatment (G0P0D0), which amounted to (1.270)%,

**Table 4.** Shows the effect of mycorrhizal inoculation, organic fertilizer and Dab fertilizer on potassium content in plants (%).

G*P	dab fertilizer			Cow manure	Fungi <i>Glomus mosseae</i>	
	D2	D1	D0			
1.351	1.388	1.396	1.270	P0		
1.485	1.489	1.488	1.479	P1	G0	
1.479	1.508	1.470	1.458	P2		
1.424	1.446	1.432	1.394	P0		
1.494	1.510	1.513	1.460	P1	G1	
1.507	1.524	1.490	1.506	P2		
0.013	LSD G*P		0.023	LSD G*P*D		
		G*D				
medium fungi	D2	D1	D0	Fungi		
1.438	1.462	1.451	1.402	G0		
1.475	1.494	1.478	1.453	G1		
0.0076	LSD G		0.013	LSD G*D		
		P * D				
average residue	D2	D1	D0	Cow manure		
1.388	1.417	1.414	1.332	P0		
1.490	1.500	1.501	1.469	P1		
1.493	1.516	1.480	1.482	P2		
0.0093	LSD		0.0162	LSD P*D		
	1.478	1.465	1.428	Dab fertilizer averages		
		0.0093			LSD D	

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