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ORIGINAL ARTICLE

EFFECT OF ORGANIC MANURE POW HUMUS, GIBBERELLIC ACID GA_3 ON GROWTH OF *PINUS PINEA* L. SEEDLINGS

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Abstract: This study was carried out in the nursery of the Forestry Department, College of Agriculture and Forestry, University of Mosul, City of Mosul, Iraq. For the period from the beginning of April to December of the year 2020 to study the effect of organic fertilizer at concentrations (0, 1, 2, 3 g / L) and (GA_3) concentrations of gibberellic acid (0, 1, 2 mg / L) on the growth of seedlings *Pinus pinea* L. The obtained results indicated that all the treatments produced a significant improvement in all the measured growth measurements compared to the comparison treatment, and that the spraying with a concentration of 2 g / L organic fertilizer was significantly superior in all the studied characteristics, and the spraying with gibberellic acid, especially at a concentration of 1 Mg / L showed a significant increase in the rates of the studied traits. The interaction (2 g/L organic fertilizer and 1 mg / l gibberellic acid) had a significant effect on all traits as compared to the comparison treatment.

***Key words*:** Organic fertilizer, Gibberellic acid, Pine nuts, Seedlings.

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1. Introduction

The fruiting pine *Pinus pinea* L. is widespread in most of the areas surrounding the Mediterranean and its original natural habitat is not known until now, since humans introduced it to these areas to use its seeds for nourishment from a very long time ago [Nahal (2003)]. Pine is a large tree with a dark green color throughout the year and belongs to the Pinaceae family, and it is a light-loving species that resists temperature changes and prefers light fertile soils and its growth is affected by heavy soils, the tree height reaches 25 meters, its growth is dense and flat, a canopy with branches growing upward, its seedlings are used for afforestation in the inland coastal sand areas and for decoration in gardens and parks. Trees are also planted in order to obtain seeds that are used as food. Trees bear seeds after about fifteen years [Abdullah (1988)]. As for organic fertilization, research has indicated that organic compounds, including humic compounds, have direct and indirect effects on plant growth [AL-Taey *et al.* (2019a), Al-Khafajy *et al.* (2020) and Al-Juthery *et al.* (2020)].

The direct effect of humic compounds on soil fertility is that it increases beneficial micro-organisms assemblies and improving soil composition in addition to increasing the exchange capacity of positive ions and regulating soil pH. On plants, humic compounds have biochemical effects, either on the cell wall or at the level of its membranes or on the cytoplasm and include increasing the rates of photosynthesis and respiration in the plant as well as encouraging the building of proteins and increasing the effectiveness of substances [AL-Taey *et al.* (2019b)]. Hormone-like [Chen *et al.* (2004), Ridha (2019)]. Al-Jubouri (2012) indicated in his study that spraying *Thuja orientalis* L seedlings with organic fertilizer led to a significant increase in the vegetative growth characteristics and that spraying with a concentration of (1 mg / L) gave the best results compared with the comparison treatment.

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Khateeb *et al.* (2011) indicated in a study of the effect of humic acid on the growth and content of chlorophyll and carbohydrates in *Acacia saligna* Labill seedlings by adding to the soil at a concentration of 4 g/bag. The results showed a significant increase in the fresh and dry weight of leaves, stem and roots, and an increase in the chlorophyll content (a and b).

Phytohormones are considered the most important endogenous substances for modulating physiological and molecular responses, a critical requirement for plant survival as sessile organisms. Phytohormones act either at their site of synthesis or elsewhere in plants following their transport [AL-Taey (2017), Hamza and AL-Taey (2020)]. The gibberellins (GAs) are a large group of tetracyclic diterpenoid carboxylic acids. The GAs show positive effects on seed germination, leaf expansion, stem elongation, flower and trichome initiation, and flower and fruit development [AL-Taey (2018) and Mustafa *et al.* (2019)]. **T**he experiment was conducted which aims to know the best concentration of Pow humus, which gives the best results for the characteristics included in the study, as well as determining the best concentration of gibberellic acid (GA_3) , which causes the best results for the studied characteristics.

2. Materials and Methods

This study was carried out in the nursery of the Forest Department, College of Agriculture and Forestry at the University of Mosul for the period from the beginning of April until the end of December of 2020 in order to know the effect of different concentrations of organic fertilizer (pow humus) and different concentrations of gibberellic acid sprayed on the vegetative group. And two main factors were used in the study, the first factor: organic fertilizer concentrations (pow humus) with four concentrations (0, 1, 2, and 3g / L) and the second factor: three concentrations of gibberellic acid (GA_3) are (0, 1 and 2 mg / L). Two-year-old seedlings were used, and height measurements were taken of the seedlings at the beginning of their arrangement and their stacking in the experiment shrines that were planted in cylindrical black plastic bags made of polyethylene with a height of 20 cm and a base diameter of 15 cm. And all the lengths of the seedlings were recorded before starting the treatment and the seedlings were divided into three sectors, and each sector contains all the treatments included in the experiment, and the dates of spraying the concentrations of organic fertilizer were (0, 1, 2, 3 g / L) 1/4/2020 and the concentrations of gibberellic acid (0, 1, and 2 mg / L) on 4/3/2020, and the following characteristics were studied:

The increase in longitudinal growth (cm): It is represented in the difference in the length of the stem before the start of the experiment and at the end of the experiment.

Diameter of the main stem (mm): The diameter of the stem was measured at a distance of 2 cm from the point of connection of the root to the stalk and by means of a precise measuring machine (Vernier foot).

Dry weight of the leaves and branches (g): The leaves and branches of the seedlings were dried in an electric oven at a degree of 70°C. Until the weight is fixed and the measurement is taken.

Dry weight of the stalk: The main stem of the seedlings was dried in an electric oven at a degree of 70°C until the weight was fixed and the measurement was taken

Dry weight of the root group (g): The root group was dried in an electric oven at a degree 70°C until the weight was proven. Measurement was taken, and the study was carried out with a complete randomized sector design (RCBD) with two factors: organic fertilizer and gibberellic acid and three iterations for each of them, thus creating an experiment consisting of 4 × 3. The number of treatments is 12 treatments, and the number of experimental units used in the experiment is 36 experimental units and each unit. Experiment consists of 7 seedlings. The total number of seedlings is 252. The data of each characteristic were analyzed statistically according to the design of the experiment and using the computer and the program [SAS (1996)] for statistical analysis. The arithmetic parameters were compared with the Duncan's Multiple Range Test at a probability level (0.05) for the studied factors and the interactions between them.

3. Results

Increase in leg length

The results in Table 1 show that there are significant differences between the treatments for the characteristic of the increase in leg length, as the results showed that the effect of organic fertilizer 2 g / L gave the highest rate of increase in leg length of (54.33 cm)

Table 1: The effect of spraying with organic fertilizer and gibberellic acid on the growth of *Pinus pinea* L. seedlings for the increase in stem length.

	GA_3 Acid Concentrations mg /L				The Effect of Organic
		0	1	2	Fertilizer Concentrations
Concentrations Compost Organicg / L	0	25.33h	43.33 c	33.33 d	34.00 c
	1	34.66d	51.00 b	51.00 b	45.55 b
	2	49.00b	62.00 a	52.00b	54.33 a
	3	37.66 d	50.33 b	44.66 c	44.22 b
The Effect of GA_3 Concentrations		36.66 c	51.66 a	45.25b	

Table 2: The effect of spraying with compost and gibberellic acid on the growth of *Pinus pinea* L. seedlings of the main stem diameter row.

	GA_3 Acid Concentrations mg /L				The Effect of Organic
		0	1	2	Fertilizer Concentrations
Concentrations Compost Organicg / L	0	4.12h	5.88 c	5.10 h-o	5.03 d
	1	5.15h-o	6.74 b	6.49 bc	6.12 b
	2	6.11 c d	8.19 a	6.80b	7.03 a
	3	5.00 o	6.42 b	5.45 h	5.62 c
The Effect of GA_3 Concentrations		5.09 c	6.80 a	5.96 b	

Table 3: The effect of spraying with organic fertilizer and gibberellic acid on the growth of *Pinus pinea* L. seedlings as a dry weight of leaves and branches.

	GA_3 Acid Concentrations mg /L				The Effect of Organic
		0	1	2	Fertilizer Concentrations
Concentrations Compost Organicg / L	0	5.12h	9.27 c-h	8.10 h	7.50d
	1	9.00 h	14.15 b	14.07 b	12.40 b
	2	10.89 cd	18.03 a	14.43b	14.45 a
	3	8.18 h	11.63 b	9.85 c-h	9.88 c
The Effect of GA_3 Concentrations		8.30 c	13.27 a	11.61 b	

compared with the comparison treatment, which gave 34 cm. The organic fertilization and GA3 increased the stem length of Pine seedlings.

The results of the same table indicate the presence of significant differences for the effect of gibberellic acid for the same characteristic, as they showed that the concentration of 1 mg / L gave the highest significant value of 51.66 cm compared with the comparison treatment, which gave the lowest value 36.66 cm with respect to the characteristic of the increase in leg length. Between organic fertilizer and gibberellic acid, the interaction (2 gram/L organic fertilizer and 1 mg/ L gibberellic acid) gave the highest significant value 62 cm compared with the comparison treatment, which gave the lowest value of 25.33 cm.

Head leg diameter

The results of Table 2 show that there are significant differences between the concentrations of organic fertilizer on this characteristic, as the concentration of 2 grams / L gave the highest significant value of 7.03 cm if compared with the comparison treatment, which gave the lowest significant value of 5.03 cm. While the results indicated that the concentrations of gibberellic acid differed significantly between them, as the concentration of 2 mg/L gave the highest rate for this characteristic (6.80 cm) in comparison with the comparison treatment, which gave the lowest rate of 5.09 cm. It was evident through the interaction between the concentrations of organic fertilizer and the concentrations of gibberellic acid that

Table 4: The effect of sprinkling with organic manure and gibberellic acid on the growth of *Pinus pinea* L. seedlings due to the dry weight of the main stem.

		GA_3 Acid Concentrations mg /L			The Effect of Organic Fertilizer Concentrations
		0	1	2	
Concentrations Compost Organicg / L	0	2.05 i	3.78 o-z	2.05 i	2.69 d
	1	4.00 o	6.03 c	4.00 o	5.09 b
	2	4.65 h	9.81 a	4.65 h	7.08 a
	3	3.19 c	5.23 d	3.19 c	3.95 c
The effect of GA_3 concentrations		3.47 c	6.21 a	3.47 c	

Table 5: The effect of sprinkling with organic manure and gibberellic acid on the growth of *Pinus pinea* L. seedlings due to the dry weight of the roots.

		GA_3 Acid Concentrations mg /L			The Effect of Organic Fertilizer Concentrations
		0	1	2	
Concentrations Compost Organicg / L	0	1.50 o	2.26 d h	1.95 h o	1.90 d
	1	2.10 h o	3.13 b c	3.10 b c	2.78 b
	2	2.78 c d	5.55 a	3.56 b	3.96 a
	3	1.90 h o	2.94 b c	2.10 h o	2.31 c
The effect of GA_3 concentrations		2.07 c	3.47 a	2.67 b	

the interaction of 2 g / L organic fertilizer and 1 mg / L gave the highest value (8.19 cm) compared with the rest of the other interactions, which gave fewer values and the lowest value appeared when compared to the two-way interaction as it reached 4.12 cm.

Dry weight of leaves and branches

The results of Table 3 showed that there were significant differences between the concentrations of organic fertilizer for this characteristic, as the concentration of 2 g/L gave the highest rate of (14.45 g) when compared with the comparison treatment, which gave the lowest rate of (7.50 g). As for gibberellic acid, the concentration of 1 mg/L gave the highest significant value of 13.29 g when compared with the comparison treatment, which gave the lowest value of 8.30 g. As for the overlap between the concentrations of organic fertilizer and gibberellic acid, the results indicate that there are significant differences between the interactions, as the interaction gave (2 g / L organic fertilizer and 1 mg / + gibberellic acid) the highest rate of 18.03 g compared with the comparison treatment, which gave the lowest rate of 5.12g.

Table 4 for the Duncan's test indicates the presence of significant differences between manure concentrations in the dry weight characteristic of the stalk. Where the concentration (2g / L organic fertilizer) recorded the highest rate for this characteristic, reaching (7.08g), and was significantly superior to that of the lowest rate of achievement for this characteristic when the zero concentration comparison treatment was (2.69g). As for the significant effect of gibberellic acid concentrations, according to Duncan's test on the dry weight of the leg showed that the concentration (2 mg / L gibberellic acid) was significantly superior to the rest of the other concentrations, and it achieved the highest rate for this characteristic of (6.21 grams) for the lowest rate achieved for this characteristic when the comparison treatment was 3.47 grams. In the case of the effect of the bilateral interaction of the dry weight of the leg, we note that there are significant differences between the interactions, as the interaction (2 g/L organic fertilizer and 1 mg/L gibberellic acid) gave the highest rate for this characteristic of 9.81 g compared to the lowest rate achieved for this characteristic when treating the comparison was 2.05g.

Dry weight of the roots

It appears through Table 5 that there are significant differences between the effect of organic fertilizer concentrations on the dry root weight characteristic of the Duncan method, as the concentration of 2 g/L organic fertilizer was significantly superior to the rest of the other concentrations and gave the highest rate

for this characteristic of 3.96 g when compared with the comparison treatment which gave 1.90 gm. As for the effect of the concentrations of gibberellic acid, it was found that the concentration of 1 mg/L gave the highest rate 3.47 g compared with the comparative treatment, which gave the lowest rate 2.07 g.

And from Duncan's test for a comparison between the arithmetic means of the bilateral interaction between (organic fertilizer concentrations and gibberellic acid concentrations) and their effect on the dry weight characteristic of the roots. It was found that there are significant differences between the interactions, and the interaction was given 2 g/L organic fertilizer and 1 mg/L gibberellic acid. The highest rate for this characteristic was 5.55 g and the lowest rate achieved by the comparison coefficient was 1.50.

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