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Influence of Climate, NPK and Organic Humic Acid on Growth traits of *Pinus brutia* Artificial Forest in Kasnazan-Erbil

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ABSTRACT

Growth performance and nutrient levels in needles, litter fall and soil properties in soil depths in Kasnazan Artificial forest in Erbil were studied. Two factors, Climate (Temperature &Precipitation) and (Nutrient content, Organic &NPK) were studied. climate showed non significant effect on height and Diameter (DBH), but it increased %5. p valu e for the growth traits (Height and Diameter) for the seedlings showed non-significant P value ≥ 0.05 during the experiment duration between D_1 the date of starting the experiment and D_2 which is twelve months from start with increment yield (30) cm. In contrast, Fertilizer treatment showed insignificant Whereas available water is the limiting factor for plant growth, significant P value ≤0.05 between control and NPK+H. acid. So, the means of height of seedlings in control were 4.61 m were the mean of NPK+H.acid were 4.95m, no other significant differences were found between the fertilizer type with control and with each other . If the height of trees in NPK were 4.75 m and in H.acid 4.83m which were no sig. with ach and with control teat. and the p value of ANOVA table were ≤0.05 for the diameter trait significant p value found between control and NPK+H.acid ≤0.05 if the mean diameter for control were (13.6 and 15.5 cm)for npk+h.acid. no other significant differences were found between the fertilizer type with control and with each other . It is clear to us that there are differences in the proportion of nutrients in the soil of the regions, but the main factor influencing the process of forest growth is the nitrogen element, which is considered one of the most important problems of plant nutrition in arid and semi-arid areas.

***Keywords*:** Forest Chemical & Physical, Organic and NPK fertilizers, Biometric growth treat of trees.

INTRODUCTION

Pinus brutia Ten. forms a distinctive natural coniferous forest in Kurdistan region in Iraq[1].it grows naturally in the Mediterranean region covering extensive areas in Turkey, Greece, Cyprus, Lebanon Syria and Iraq [2]. and it is extremely drought-tolerant, and can grow in areas with mean annual rainfall as low as 400mm and mean annual temperatures are between (12 & 35) ◦C [3], Precipitation and air temperature are the two most commonly correlated with tree growth, other environmental factors such as soil moisture, light, wind, and relative humidity can also affect the growth, but they are associated with the fluctuations in precipitation and air temperature [4]. *P. brutia* grows on many soil types, but primarily on rendzina soils on soft limestones and marl deposits [5]. Is a light demanding and slow-growing tree species. Seedlings degenerate and mortality increases when the light intensity falls below 55–60% [6]. It is slow-growing, and the tree reaches a height of more than 35 meters. It has a straight stem and few branches. *Pinus brutia* is widely used in afforestation operations in Iraq, whether in natural forest areas or in areas devoid of trees, as its wood is used in various fields, including furniture, box making, coal industry, and others [7], It also has a role in providing indirect services such as protecting soil and water resources, preserving biodiversity, climate change and combating desertification, all of which make it an indispensable forest species [8]. Many researchers have confirmed the physiological role of NPK and humic acid in increasing the leaves content of mineral and chlorophyll , the leaves content of nitrogen, phosphorous, and potassium , The most important major nutrient is Nitrogen (N) which partakes in many compounds in the plant such as amino acids, proteins, chlorophylls, hormones, alkaloids and enzymes. Phosphorus (P) partakes in phospholipids, DNA, RNA and metabolism of fats. Potassium (K) regulates water condition within the plant cell and water loss by transpiration as a catalyst and condensing agent of complex substances through its active properties, and potassium has a main role in plant metabolism such as photosynthesis,

translocation of photosynthates, water relation as well as enzyme activation [9]. Organic-fertilizers play an important role in plant nutrition, as they work to increase the activity of photosynthesis processes, increase the active substances in the plant and increase the plants ability to withstand various stress conditions as well as maintain the required genetic characteristics and also increase Plant resistance to disease [10] and It has properties that enable it to enter plant cells, as well as transfer chemicals and DNA inside the plant, in addition to its contribution to the transfer of compounds to the target parts, whether leaves, roots or the rest of the plant parts [11]. [12]on *Taxodium distichum*., concluded that the seedling height, stem and root diameter, number of leaves and roots, fresh and dry weight of leaves, stems and roots as well as leaf area were increased as a result of the NPK application.[13]found that the biomass increased with a rate of (43-82)% as a result of three addition of urea or neutral fertilizers. Regarding the effect of NPK fertilization on mineral contents.

2- Material and methods

2-1 Natural and climatic characteristics of the study area

2-1-1 Study Area

This study was conducted in the areas surrounding Erbil City within the boundaries of the Kasnazan Forest, the area is located, to latitude 36.2054296 and longitude 44.1423025. The elevations of the areas covered by the study are (616 M). above sea level. Kasnazan Forest area and the surrounding areas are characterized by an abundance of lands with soil suitable for the growth of various types of plants, in addition to lands suitable for agricultural exploitation. Figure (1) is a map of Erbil Governorate. The climate of the areas surrounding Kasnazan depends on the course of various climatic elements and their combined impact on the region. Precipitation in its various forms is an important element of the climate, and the nature of plant growth is determined by it, in addition to other important climatic elements, such as temperature, wind, light, and humidity. These climatic elements are considered among the factors influencing the composition and nature of the soil, its mineral content, and humidity, which are related to the nature and spread of the vegetation cover. The average annual rainfall recorded at the meteorological station in the city of Erbil is (350-500) mm. Based on previous studies over a long period of time, the region is classified as a semi-arid region.

2-1-2 Experiment set up

A plant survey was conducted in the areas covered by the study to identify Forest types, plant characteristics, their morphology, and plant density using plant survey methods used in many countries based on [14](Braun-Blanquest, 1964). As for forest trees, their numbers were calculated in each square. The area of the square for trees and was 20 x 20 m. Samples were taken from the squares with four replicates for study area.

2-2 Biometric measurement

2-2-1 Height of Trees

A Altimeter of the type Haga was used to calculate the height of trees [15]. It is a device for measuring the height of trees and it is approximately triangular in shape with meters on its base at the top. It is used to measure the height up to 50 meters and it has good accuracy. The height of the trees was measured by taking 5 trees of each treatment in each replicate randomly, then taking the average height of those trees.

2-2-2 Diameter Measurement DBH

Tree diameters were measured using a Haglof Caliper, a Swedish device (Haglof Sweden SS-88200) specifically designed for measuring forest tree diameters. It comes in three sizes (50 cm, 100 cm, and 130 cm).

2-3 Soil and Plant Analysis

Soil samples were collected from four different altitudes and at four locations, Then, the soil was collected from several distant points and from the bases of trees [16]. The soil was collected from the organic layer to a depth of (50 cm) after removing the layer of fallen leaves and was placed in nylon bags and sealed tightly to prevent moisture from escaping. In the laboratory, it was exposed to air to dry completely, after which it was crushed with a piece of wood and sieved through a sieve with holes diameter (2 mm). The following analyses were conducted on the soil.

2-3-1 Soil Chemical analysis

2-3-1-1 Determination of total Nitrogen

The percentage of total Nitrogen in the soil was estimated using the Macro Kjeldahl device according to the method of (Bermner, J.m.) [17].

2-3-1-2 Determination of total Phosphorus

The amount of phosphorus was estimated Colorimetrically by the method of [18] using a spectrophotometer with a wavelength of 720 micrometers after extracting phosphorus from the soil by the method of [19], and using a solution of Na H CO_3 sodium bicarbonate.

2-3-1-3 Determination of total Potassium

Potassium was measured according to the method mentioned in (USDA Hand Book [17] in the soil extract prepared

for measuring its pH.

2-3-1-4 Determination of Hydrogen Ion Activity (pH)

Soil Paste was prepared by adding 50 g of sifted soil to it and distilled water was added to it. The suspension was mixed well until the paste specifications were obtained [20]. It was left for an hour and then the pH was measured using a pH meter (pH – Meter Pye unicam Pw – 9420).

2-3-1-5 Determination of Electrical Conductivity (Ec)

After preparing the soil paste, it were filtered through filter paper using a Bachner Funnel with the help of a vacuum pump. The electrical conductivity of the filtrate (soil extract) was measured using an electrical conductivity meter (Digital Conductivitr Pw-9526).

2-3-1-6 Determination of total Organic Matter in Soil (O.M)

The percentage of organic matter was estimated by the dry ignition method [20].

2-3-1-7 Calculation of Soil Moisture percentage (% M.C)

Soil samples were taken from the field from a depth of (50 cm) and placed in nylon bags and tightly closed to reduce soil moisture loss in the laboratory. The moisture measurement process was carried out using a (Halogen Moisture Meter), where a quantity of soil (5g). was placed in the device because the device contains an electronic balance and it measures the percentage of moisture in the sample by drying the soil until drying is complete. The duration of the drying process depends on the amount of moisture in the soil when the weight is constant.

2-3-2 Soil Physical Analysis (Soil Texture)

The soil texture was determined by the hydrometer method[21], and the proportions were calculated according to the following relationship.

2-3-3 Plant Chemical Analysis

2-3-3-1 Determination of total Nitrogen

For determination of leaf nitrogen (N,P,K) concentrations, dried (70°C, until constant mass) fine Leafs were ground to powder. total N,P,K ppm were determined. The percentage of total Nitrogen in the leafs was estimated using the Macro Kjeldahl device according to the method of (Bermner, J.m.) [17].

2-3-3-2 Determination of total Phosphorus

The amount of phosphorus was estimated Colorimetrically by the method of [18] using a spectrophotometer with a wavelength of (720) micrometers after extracting phosphorus from the soil by the method of [19]. and using a solution of Na H CO_3 sodium bicarbonate.

2-3-3-3 Determination of total Potassium

Potassium was measured according to the method mentioned in [17] in the soil extract prepared for measuring its pH.

2-4 Fertilizer treatments

In this experiment types of Fertilizers used, Chemical NPK (20.20.20), Organic Humic Acid and of Mixture NPK+Humic acid In comparable with control treatment, the trees fertilized with (250g). of grained fertilizers (NPK, Humic acid, NPK+Humic Acid 1;1) every three months, four times per year during the experiment study. The fertilizers add to the soil during the tree base in two directions in (20 cm)depth in a hole then covered with soil to protect it from sunlight drying and oxidation with air oxygen fig. (2,3,4).

9-Data management and statistical analysis

The data transported to excel file Microsoft program and SPSS program used for statistical analysis. The data analyzed with GLM linear model ANOVA two way full factorial multi variable . first the data checked with Shapiro to check the normality of data, then descriptive statistic calculated to get the means of variable with standard error value. ANOVA two way used to measure the p value. Even the graphs made with SPSS .

Figure (1) is a map of field location Kasnazan in Erbil Governorate.

(3) NPK (4) mixed (NPK+H. Acid) (2) Humic Acid

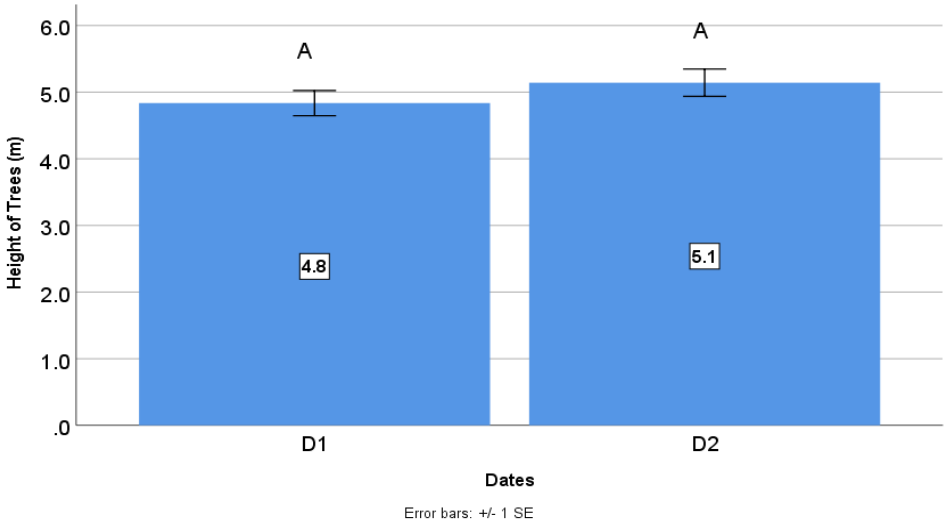
figure. (2,3,4). Fertilizer treatment NPK, Organic H.A and Mix in the field .

Results and Discussions

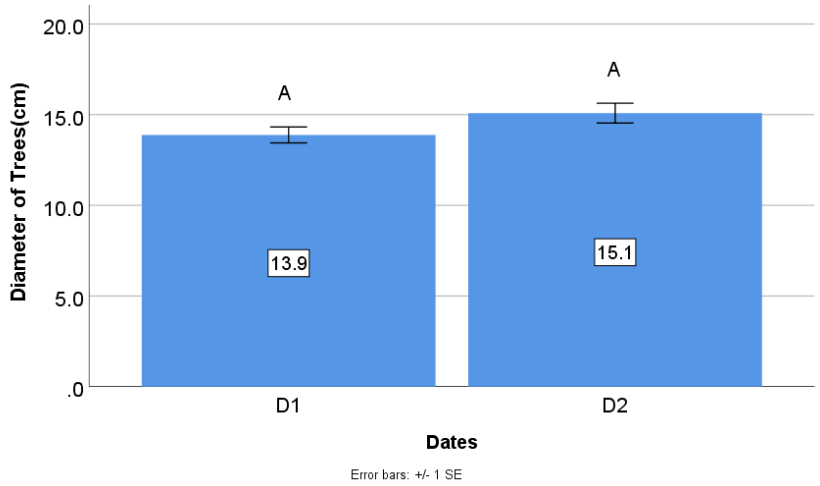
1- Influence of climate in growth traits of *Pinus brutia* seedlings

According to statistical analysis results, the data p value for the growth traits (Height and Diameter) for the seedlings showed non-significant P value ≥ 0.05 during the experiment duration between D_1 the date of starting the experiment and D_2 which is twelve months from start for the growth traits height and Diameter of seedlings (graph 5,6), so the means of height of *Pinus brutia* seedlings in D_1 were (4.8) m were the mean of D_2 were(5.1)m with increment yield (30) cm between D_1 and D_2 during the experiment time period one year but there are increased (5)% than D_1 means that there is growth significant ,for the diameter traits the D_1 mean were (13.9) cm and for D_2 were (15.1) cm, the p value were ≥0.05 which means non significantly of growth traits per time duration first to end of experiment with increment yield (1.2) cm between D_1 and D_2 during the experiment time period one year but there are increased (5)% than D_1 means that there is growth significant. *Pinus brutia* Ten. forms a distinctive natural coniferous forest in Kurdistan region in Iraq[1]. The aim of this study was identifying the spatial distribution and association patterns of *P. brutia* habitat under local climate,kasnazan afforestation area were did during 1999-2001 by FAO organization,the data show us a small increasing n growth traits (5)% per year under local climate 410 mm

precipitation with annual mean in temperature 24 ◦C in April and 25◦C in may , 35◦C in June,31◦C in September and 23◦C in October with lowest degree in January 11 ◦C . *P. brutia* generally occurs in climate of hot and dry summers and mild and rainy winters. *P. brutia* occur most abundantly in the semi-arid and sub-humid zones [22]. *P. brutia* has stricter rainfall requirements than *P. halepensis*, being absent from the arid bioclimatic zone and rare in the lower semi-arid zone, but wide spread in the humid zone [23]. *P. brutia* occurs where mean annual temperatures are between 12 ◦C and 35 ◦C and mean annual precipitation is between 400mm. availability, and a whole host of climatic factors [9]. Precipitation and air temperature are the two most commonly correlated with tree growth, other environmental factors such as soil moisture, light, wind, and relative humidity can also affect the growth, but they are associated with the fluctuations in precipitation and air temperature [24]. growth traits per time duration first to end of experiment and this is due to its suitability climatic conditions in terms of average temperatures and humidity for growing *Pinus brutia* seedlings and this is consistent with the results of [25]. It was stated that the appropriate temperature range is between (15–28) °C enhancement the growth of seedlings because it has a role in increasing photosynthesis which the optimum temp degree are between (20-25) °C [26]and the suitable temperature increased the activity of root and stomatal conductivity to increase the uptake of water and nutrient from the soil [27].and increase the gas exchange CO_2 and O_2 assimilation to produce glucose sugar which then convert to biomass and these compatible with [28].for growth of plant in optimum environment in correlations with cell physiology and biology.



Figure(5): means of Height of seedlings in day of starting the experiment(D1) and the day of ending (D2), Significant differences between treatments are indicated by different letters *(Anova, p<0.05)*



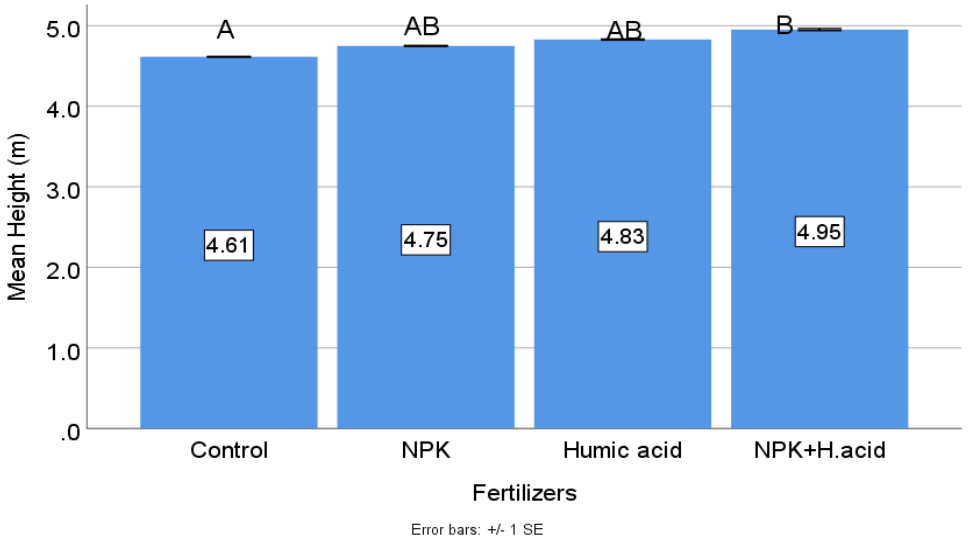
Figure(6): means Diameter of seedlings in day of starting the experiment(D1) and the day of harvest(D2), Significant differences between treatments are indicated by different letters *(Anova, p<0.05)*

Table (1) Metrological Characteristics for Kasnazan District during 1/7/2024 to 30/6/2025										
Soil Temperature 50 cm	Wind speed M/Sec	Sunshine Hrs./Day	Precipitation (mm)	Moisture Air(%)			Temperature C			Info Months
				Min	Max	Avg.	Min	Max	Avg.	
23.5	157.7	2.5	46	14.4	78.5	32.7	17.2	34.2	25.7	May
28.6	165.0	2.9	0.0	8.7	17.3	12.9	30.2	38.8	35.9	June
30.4	179.8	2.8	0.0	10.0	19.6	14.8	33.9	39.1	36.8	July
30.9	180.0	2.4	0.0	11.2	21.7	14.8	33.0	36.5	36.7	August
27.3	183.9	2.0	2.5	12.1	38.0	21.4	25.8	36.9	31.4	September
22.0	164.3	1.4	4.0	14.9	34.6	21.8	14.7	29.2	23.4	October
16.4	181.3	1.1	10.6	22.3	42.5	32.4	8.1	22.2	15.3	November
11.0	194.0	0.8	25.8	25.9	78.0	51.4	6.5	14.8	11.2	December
11.9	166.6	0.7	67.3	45.1	94.9	72.1	7.5	15.4	11.0	January
11.9	153.5	1.1	122.3	19.9	94.7	62.5	7.7	17.0	11.5	February
14.1	159.0	1.5	72	28.0	95.7	52.5	12.0	23.5	15.0	March
20.3	146.9	2.1	61	13.7	65.4	34.3	17.8	30.0	24.0	April

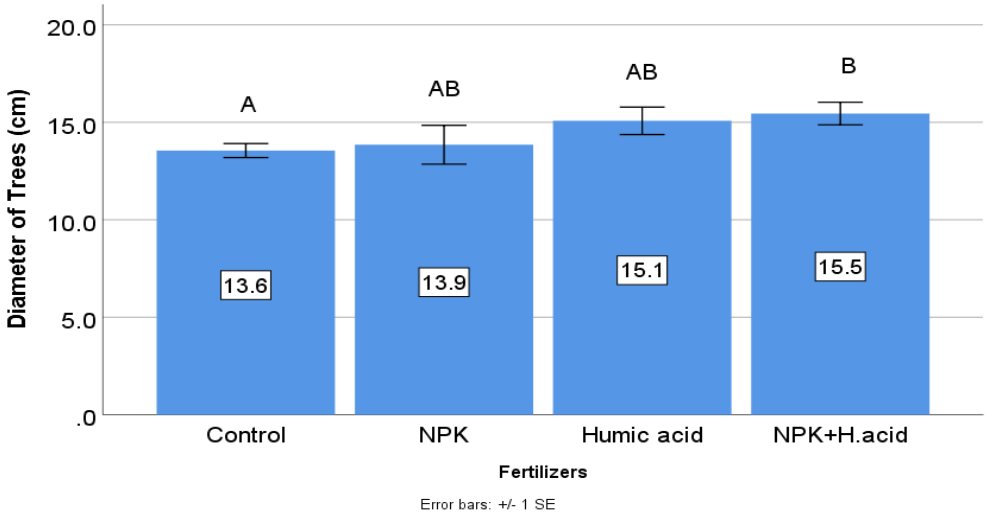
2- Influence of Fertilizers on growth traits of *Pinus brutia* Seedlings

According to statistical analysis results, the data value for the growth trait (Height) for the seedlings showed significant P value ≤0.05 between control and NPK+H. acid. So, the means of height of seedlings in control were 4.61 m were the mean of NPK+H.acid were 4.95m, no other significant differences were found between the fertilizer type with control and with each other Fig. (7). If the height of trees in NPK were 4.75 m and in H.acid 4.83m which were no sig. with ach and with control teat. and the p value of ANOVA table were ≤0.05 for the diameter trait significant p value found between control and NPK+H.acid ≤0.05 if the mean diameter for control were 13.6 cm and 15.5 cm for npk+h.acid. no other significant differences were found between the fertilizer type with control and with each other Fig. (8). If the diameter of trees in NPK were 13.9 cm and in H.acid 15.1cm which were no sig. with ach and with control treat. About nutrients conc. in leaves results, according to statistical analysis, the data value for the growth trait (chemical content nutrients) for the leaf of seedlings showed significant P value ≤0.05 between Control and NPK+H.acid.and control with Npk &H.acid So, the means of Nitrogen content of seedlings in control were % 0.23 were the in NPK+H.acid treat %1.21, in NPK %0.69 and in H.acid %0.76. About phosphor (P) showed significant P value ≤0.05 between control and and all fert.type.no dif. between npk and H.acid So, the means of phosphor content in control were 14.2ppm and 25.6ppm in NPK , 31ppm in H.acid, 47.2 ppm in h.acid .About potassium (K) the results showed significant P value ≤0.05 between control,NPK and h.acid+npk . no dif. between npk with h.acid So the means of potassium content of seedlings in control were 23.1 ppm were the mean of NPK were 160.2ppm and 170ppm in h.acid, 360 ppm in npk+h.acid. table2.the correlation even did between nitrogen,phosphur conc. In leafs and the growth trait height, the results show highly positive correlation between N. conc. And height of seedlings p≤0.05 and R^2 Linear= 0.952. in phosphors p≤0.05 and R^2 Linear= 0.958. figures (9,10,11,12). availability of macro nutrients which are very important to growth of seedlings physiologically and producing of biomass [29]. Nitrogen plays an important role in seedling growth It also regulates the plant's absorption of potassium In addition, phosphorus is included in the composition of many Proteins that act as enzymes for many activities It is vital to the plant and is also involved in the synthesis of acids Amino, nuclear, and chlorophyll molecules. This is consistent with the results [30]. in addition to Nitrogen, phosphorus and potassium improve seedling growth Acacia. So the Humic acid fertilizer treatment get the higher Biometric data (height) and (diameter) then NPK treatment while Control get the lowest value

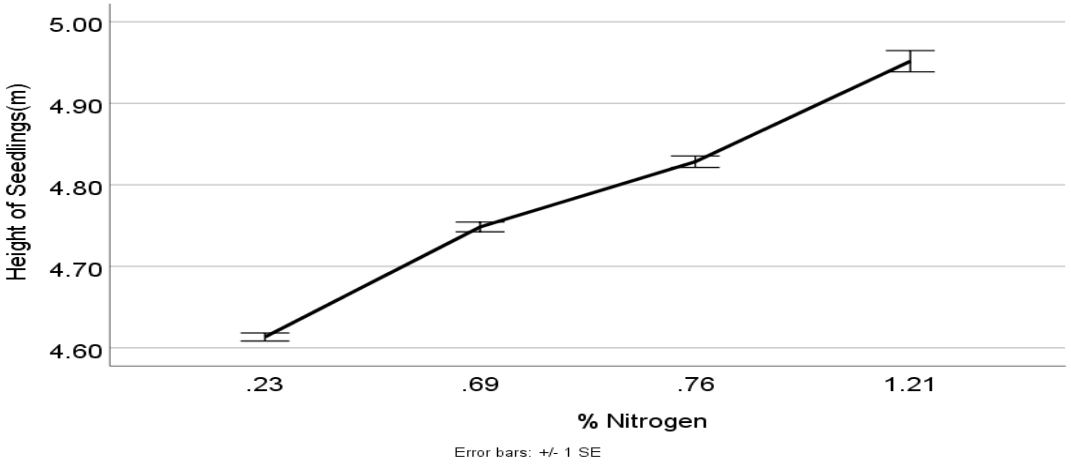
fig.(7,8). even Humic acid treatment were higher leaf chemical concentration on macro nutrients than NPK and control table(2).the results of this research were compatible with the results of [31].when they fertilize olive seedlings with humic acid and NPK in compare with control and they found that The obtained results revealed that treatment 4ml. humic substance was the most effective one compared with the other treatments. Since this treatment gave the best results concerning percentage of plant height increment, leaves number per plant, stem diameter, also it increased leaves dry weight percentage comparing with the control. However [30]find the same results when they fertilize *Stranvaesia davidiana* L. and they find that organic fertilizer increased the plant height by 0.42 cm to 9.59 cm and basal diameter by 0.01 cm to 0.05 cm, compared with the control group. Organic fertilizer had the maximum effect on seedling growth. The total growth of basal diameter and chlorophyll content was 1.58 cm and 39.53, respectively. Basal diameter were the most critical index in seedling reproduction. Even our results are agreement with [32]when they fertilized *pawlownia tomentosa* seedlings with humic acid and NPK in comparable with control, the application of NPK fertilizer caused a significant increase in the most important studied characteristics such as morphological and physiological properties of *Paulownia tomentosa* seedlings. The production of *Castanea mollissima* seedlings can be improved by adding the adequate levels of NPK fertilizer. And even compatible with [9] when they found that chemical fertilization with compound fertilizers NPK especially at a concentration of 250 mg NPK.L^{-1} achieved a significant increase in the percentage of nitrogen, phosphorous, and potassium in the petioles of the leaves, the concentration of chlorophyll and the percentage of protein in the leaves. the results certificate that peat moss were increase the growth traits of seedlings because the role of peat moss in improving the soil fertility nutrients and increasing the availability of nutrient elements and continuously availability in soil and in result increased the growth of seedlings [33]. even the results show that all growth traits (Height , Diameter, have a significant correlation with Nitrogen and phosphurs conc. In leafs were p value were ≤ 0.05 fig.(9,10,11,12). Therefore, fertilization usually enhances root respiration, and the root tissue nitrogen concentration increases with the addition of nitrogen fertilizer, which may be the underlying reason for the observed increase in root respiration with fertilization [34]. So it is better to use chemical fertilizer for Afforestation seedlings programmes especially organic fertilizer and NPK fertilizer which enhance the growth of seedlings significantly. Our results show that NPK+H. acid fert. treat get a higher value growth traits hight and diameter of trees than other treats which is compatable with [35]. on some growth characteristics of *Pinus brutia* seedlings. when they found that The interaction between the two fertilizers N.P.K organic (20:20:20) and mineral N.P.K (20:20:20) was significantly superior by giving the highest average growth of all studied traits, as it gave 30,7 cm, 4.2 mm, 61cm, 5.8 mm, 36.1 g and 15.8, respectively. These results support with what was mentioned [36], that nano fertilizers enhance metabolic processes as well as enhance anabolic activities that lead to increased apical growth. This explains the increase in the longitudinal growth of seedlings treated with foliar spraying with nano-fertilizer compared to the effect of spraying with mineral fertilizer. As indicated by [37], that the use of nano-fertilizers is a promising and effective way through which to increase and improve plant growth in general. It is clear from the results of the increase in the diametrical growth that the nano fertilizer is superior in its effect on increasing the diametrical growth of seedlings compared to the effect of the mineral fertilizer. This is because the nano-fertilizers have smaller diameters than the pores of the plant cell wall, and therefore these nanoparticles easily permeate through the plant cell wall and reach the plasma membrane [38]. This was also confirmed by [39], who indicated that ordinary or conventional fertilizers cannot easily penetrate through the plant cell wall because the diameters of their particles are larger than the size of the pores of the plant cell wall.



Figure(7) mean Height Seedlings of *Pinus brutia* Ten. under three different Fertilizer treatments (control, NPK, Humic acid & NPK+H.acid) Significant differences between treatments are indicated by different letters *(Anova, $p<0.05$,)*



Figure(8) mean Diameter (DBH) Seedlings of Pinus brutia Ten. under three different Fertilizer treatments (control, NPK, Humic acid & NPK+H.acid) Significant differences between treatments are indicated by different letters *(Anova, $p<0.05$)*



Figure(9) mean Height Seedlings of *Pinus brutia* Ten. under different Nitrogen fert. treatments (control, NPK, Humic acid & NPK+H.acid) *(Anova, p<0.05)*

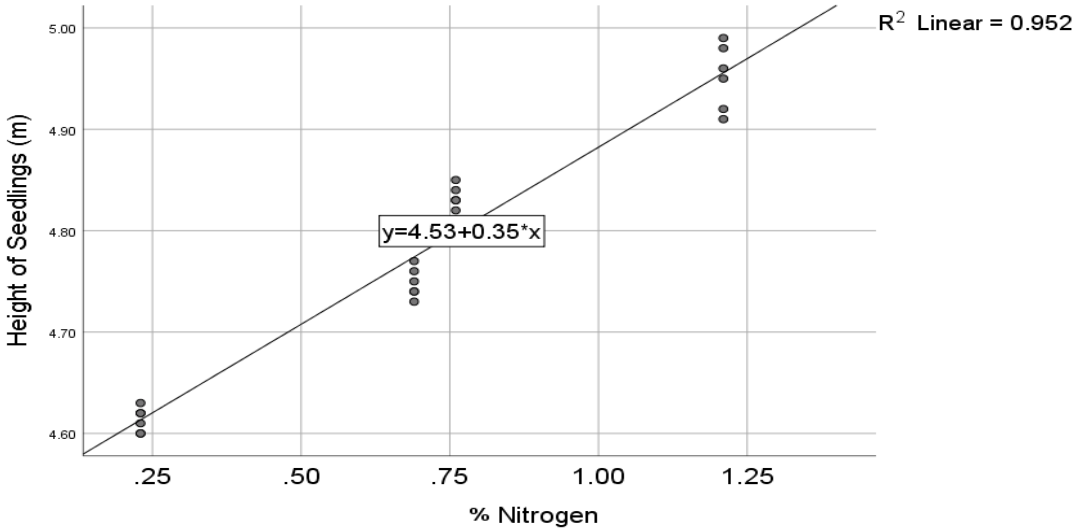
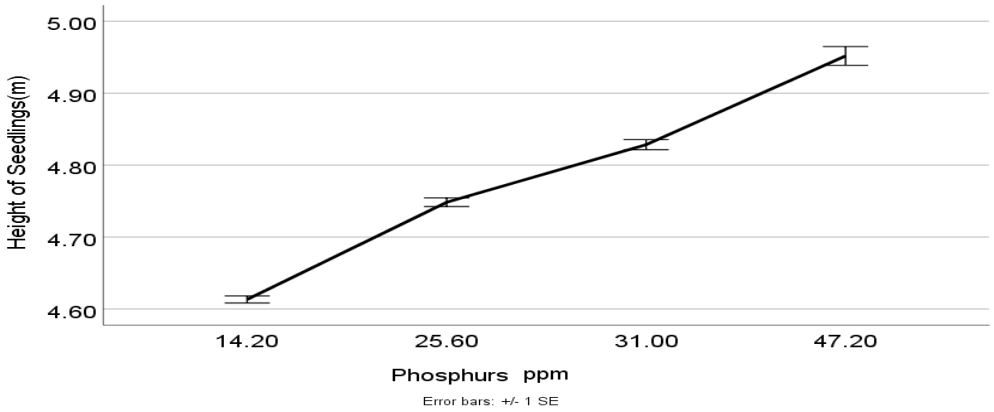


Figure (10) pearson corelation between mean height of seedling and Nitrogen conc. In leaf of *Pinus brutia* p<0.05)



Figure(11) mean Height of Seedlings of *Pinus brutia* Ten. under different Phosphur fert. treatments (control, NPK, Humic acid & NPK+H.acid) *(Anova, p<0.05)*

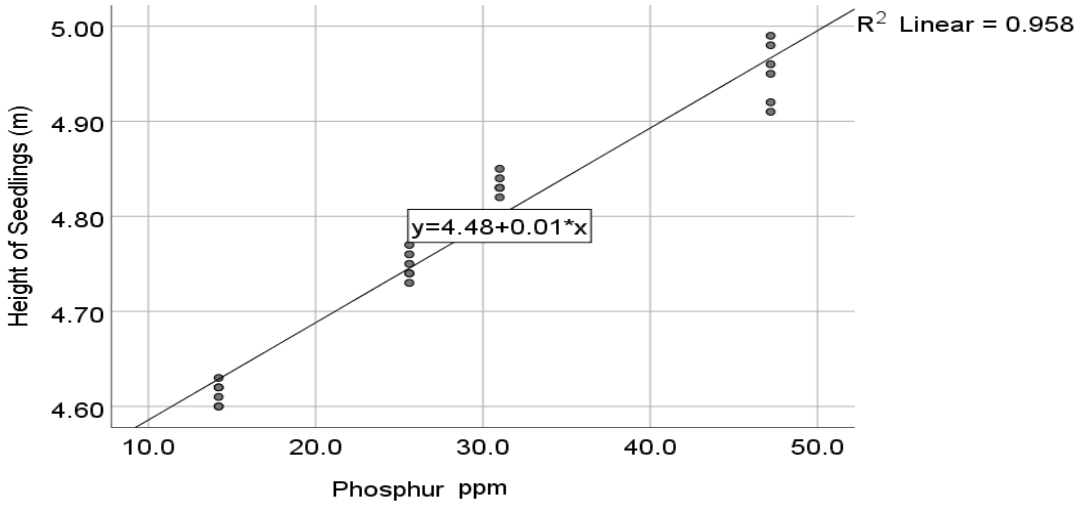


Figure (12) pearson corelation between mean height of seedling and Phosphur conc. In leaf of *Pinus brutia* p<0.05)

Table (2) (Fine) leaf chemical traits of the species *Pinus brutia* leaf chemical traits are total nitrogen% (N) , Phosphor ppm(P) and Potassium ppm(K) concentrations and Ec. Significant are indicated by different capital letters (mean; Tukey test, p<0.05 .

sample	pH	EC (Ds/m)	% N	(P) ppm	(K) ppm	O.M %	% Sand	% Silt	% Clay	Soil texture
Soil field	6.12	0.5	0.3	18.1	36.4	1.1	10.7	45.2	44.1	Silty clay loam

Table (3) (Fine) Soil chemical traits of the field Kasnazan district, chemical traits are total nitrogen (N) , Phosphor (P) and Potassium (K) concentrations, pH, EC (Ds/m), organic matter % and soil texture

Species	date	Fertilizer	Total Nitrogen (N) %	Phosphor (P) ppm	Potassium (K)ppm	pH	Electric conductivity Ec
Pinus brutia Ten.	1 /7/2025	Control	0.23 A	14.2 A	23.1 A	6.9	0.63
		H. acid	0.76 B	31 B	170 B	5.7	3.5
		NPK	0.69 B	25.6 B	160.2 B	6.1	2.9
		NPK+ Humic acid	1.21 C	47.2 C	360 C	5.3	4.87

Table (4) Soil moisture content in field during the seasons according to dry soil

sample	Summer	Autumn	Winter	Spring
Soil (10-30) cm	% 5.6	10.3%	% 29.1	% 14.3

Conclusions and Recommendations

Conclusions

1-It is clear to us that there are differences in the proportion of nutrients in the soil of the regions, but the main factor influencing the process of forest growth is the nitrogen element, which is considered one of the most important problems of plant nutrition in arid and semi-arid areas.
2- low conc. Of carbon in kasnazan artificial forest soil 1.1%
3- slow growth of *Pinus brutia* under local climate in erbil.
4- fertilizers increase the growth especially mixed NPK+H. Acid (1:1)

Recommendations

1-According to the results we recommend to use chemical fertilizer for producing seedlings and Afforestation programmes especially NPK fertilizer which enhance the growth of seedlings significantly even because our land is mostly has a deficiency on nitrogen.
2- we recommend to use a mix of NPK+Organic H.acid (1:1).
3- we recommend to Irrigate the trees in the summer months to increase the growth.

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تأثير المناخ و عناصر NPK وحامض الهيوميك العضوي على صفات نمو غابة *(Pinus brutia Ten.)* الاصطناعية في كسنزان-أربيل

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الخلاصة

تمت دراسة أداء النمو ومستويات المغذيات في الإبر وخصائص التربة في أعماق التربة في غابة كسنزان الاصطناعية في أربيل. تمت دراسة عاملين، المناخ (درجة الحرارة، هطول الأمطار) ***.*** محتوى المغذيات، الأسمدة العضوية و ***NPK.***أظهر المناخ تأثيرًا غير معنوي على الارتفاع وقطر ارتفاع الصدر ***(DBH)*** ، ولكنه زاد بنسبة 5٪ خلال فترة الدراسة البالغة 12 شهرًا. أظهرت القيمة الاحتمالية لصفات النمو (الارتفاع والقطر) للشتلات قيمة احتمالية غير معنوية $\leq$ 0.05 خلال مدة التجربة بين ***D1*** تاريخ بدء التجربة و ***D2***وهو اثني عشر شهرًا من البداية، لذا كان متوسط ارتفاع شتلات الصنوبر البروتي في ***D1 (4.8)*** م وكان متوسط ***D2 (5.1)*** م مع زيادة في الغلة (30) سم. على النقيض من ذلك، أظهر الأسمدة قيمة ***P*** مهمة في حين أن المياه المتاحة هي العامل المحدد لنمو النبات، وقيمة ***P*** كبيرة $\geq$ 0.05 بين التحكم و ***NPK + H. acid.*** لذا، كان متوسط ارتفاع الشتلات في التحكم 4.61 م وكان متوسط ***NPK + H. acid 4.95*** ، ولم يتم العثور على أي اختلافات كبيرة أخرى بين نوع السماد مع التحكم ومع بعضها البعض. إذا كان ارتفاع الأشجار في ***NPK 4.75*** م وفي ***H. acid 4.83*** م والتي لم تكن ذات دلالة إحصائية. مع كل ومع التحكم. وكانت قيمة ***P*** لجدول ***ANOVA $\leq$ 0.05*** لصفة القطر، وجدت قيمة ***P*** كبيرة بين التحكم و ***NPK + H. acid $\leq$ 0.05*** إذا كان متوسط القطر للتحكم 13.6 سم و 15.5 سم لـ ***NPK+H. acid.*** لم يتم العثور على أي اختلافات كبيرة أخرى بين نوع السماد مع التحكم ومع بعضها البعض. ومن الواضح لنا أن هناك اختلافات في نسبة العناصر الغذائية في تربة المناطق، إلا أن العامل الرئيسي المؤثر في عملية نمو الغابات هو عنصر النيتروجين، الذي يعتبر من أهم مشاكل تغذية النبات في المناطق القاحلة وشبه القاحلة.

الكلمات المفتاحية: بيئة وفسيولوجيا ألاشجار، الاسمدة العضوية والكيميائية ، صفات نمواليبومتري الاشجار.