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Research Article

Effect of IBA and Pine Bark as Media on the Rooting and Growth of *Ficus Nitida*

Osamah Ibrahim Ahmed[1*], Asmaa Mohamed Adil[2] & Aytan Jaleel Jalal[3]

[1]*Collage of Agriculture, University of Kirkuk, Iraq*

[2]*Collage of Agriculture & Forestry, University of Musel, Iraq*

[3]*Master Student, Collage of Agriculture, University of Kirkuk, Iraq*

[*]**Correspondence to:** Dr. Osamah Ibrahim Ahmed, Collage of Agriculture, University of kirkuk, Iraq.

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Abstract

This study investigated the effect of using different concentrations of growth regulators Indole Butyrıc Acıd (IBA) and different types of culture media included (sand, non- treated *pinus brutia* bark, non treated *pinus brutia* bark mixed with sand 1:1, *pinus brutia* treated bark, *pinus brutia* treated bark mixed with sand 1:1, peatmoss (Sphagnum Moss Peat), peatmoss mixed with sand 1:1) on rooting and growth cuttings of *Ficus nitida*.

Length & Diameter of longest root, root's number, percentage of rooting, Roots dry weight, shoot length, shoot diameter, number of leafs, leafs area, shoots dry weight, leaves contents of (Nitrogen, Carbohydrate, Total content of chlorophyll & C / N ratio) as indicators of effects.

The use of the IBA growth regulator has improved most of the root and shoot's growth properties, especially when using the concentration of 2000mg. L^{-1}, especially (length of the longest root, Root diameter, number of secondary roots, dry weight of roots, length & diameter of the longest shoot,

Leaf number, leaf area, total chlorophyll and dry weight), while the concentration of 3000mg. L^{-1} to improve the content of leaves of nitrogen and carbohydrates. The cultivation and growth of cuttings in the Pine bark media significantly increased the average of root length, diameter & rate of Nitrogen in leaves. Using (treated Pine bark + sand 1:1) media caused an increase in the leaf area, Carbohydrates rate in leaves and the ratio of C / N.

The use of non-treated pine bark negatively affected the studied qualities, although improved when mixed with sand, due to the content of the some extract's component types that reduced their growth.

Introduction

In the past four decades, the nursery and protected agriculture sector has significant growth. One of the main reasons for its prosperity has been the changes and innovations that have taken place in the various factors associated with agricultural production, such as irrigation, fertility, use of appropriate alternative and modern growth media and others [1].

Organic alternatives growth media such as peat, tree bark, sawdust, charcoal, coconut and rice husks, sugar, also inorganic medias like perlite, vermiculite and sand are one of the relatively recent trends in this field [2-4]. it should be a good nutrient and water characteristics, good ventilation for their growing root system and light weights [5].

The extent of use of different alternative media varied for several factors Including the effectiveness of the material, availability and cost of processing as well as the side effects on the type of plant or crop cultured, cost of Sphagnum peat moss production has increased by 45%, Vermiculite 38% and Perlite 28% recently some farmers have expressed health concerns about ingredients Circumstances resulting from Vermiculite and Perlite where some of the quarries of Vermiculite were found on Asbestos as a common mineral and were closed in 1990. Perlite dust may be irritating to the eyes and lungs, according to a report by the Occupational Safety and Health Administration [6].

For many years the bark has been seen as a waste of forest production [7]. Today, it is considered one of the most important elements in horticultural, nursery and industrial mixtures, which is one of the most widely used in the United States. According to commercial data in North Carolina, the demand for pellets has increased [8]. They point out that The porosity rate of some pine species ranges from (40-45)% [9]. This helps to retain water and good ventilation as well as to retain fertilizer. Chemically, it has a high ratio of lignin, which is more resistant than cellulose to soil decay Repeated use.

In Iraq, importer peats is usually used in nurseries, mixed in different ratio with clay or sand. Bark also available for a number of tree's type such as Oak, Pine, Eucalyptus, Cypress and other types at low cost, especially in north regions and river banks. Despite the wide spread of eucalyptus species and their containment On the dice in good proportions, they were found to be prohibitive from being used as a plant medium to contain extracts that may be toxic to plants [5].

In order to keep abreast of the modern trend towards the use of bark as an agricultural medium and to identify the positive aspects of this pattern, improving its qualities as well as the economic aspect, this study was conducted with the following objectives.

1. The possibility of using *Pinus buria* bark growing naturally in northern Iraq as a plant medium used in nurseries to growth cuttings of *Ficus nitida.*

2. Use several levels of IBA growth regulator to accelerate the rooting rate of the ornamental brush of the ornamental shrubs.

Materials and Methods

This study was carried out in the Glass house - Department of Horticulture and Garden Engineering\ Faculty of Agriculture\ University of Kirkuk, for the period (1Sep. 2016 to 1Apr. 2017). IBA with different concentrations (0, 1000, 2000, 3000) mg. L^{-1} was used as a catalyst for the one-year cutting of *Ficus nitida* with a length of (15 - 10) cm and a diameter of about 0.27cm and seven type of agriculture media (sand S, Non-treated Pine bark NTB, treated Pine bark TB, mix S: NTB 1:1size, mix S:TB 1:1size, peat PT and sandy lome SL) were used to study it's effect on Ficus cutting rooting and growth.

Culture Medium

Bark

Bark collected from *Pinus brutia's* trees growing in Banimakam forest area north of Iraq. The samples were collected between (0.5 - 1.5) m from the main tree stem, air dried for one week at laboratory, then cut into small pieces (1-2) cm in length by using a wood cutter. Then it was minced into small minutes and ready to be used as a seed medium. Due to it is content from extraction which are used in many industries [10], two types of pine bark were used: non-treated and treated bark (the content was extracted with hot water 1h for several time). Then samples were taken randomly from two types for chemical analysis (table1).

Table 1: *Bark Chimical Component %*

Chemical content		Non-treated bark	Treated Bark
Extract	Ethanol-benzine	4.3	3.4
	Hot water	4.7	1.4
Lignin		39.3	39.4
Holocellulose		47.8	52.7
Ash		3.9	3.1
PH		5.5	5.3

Sand

Sand were prepared from the quarries located on the edge of the Lower Zab River north of Kirkuk. washed with water to remove dust and left to dry for use. Soil samples were analyzed (table 2).

Table 2: *Sand Analysis %*

Type	Unit	Result
Sand	%	94
Silt	%	4
Clay	%	2
Texture	-	Sand lome
PH	-	7.58
Ec	ds.m	0.05
Organic matter	%	0.77
N	Ppm	1.18
P	Ppm	0.1
K	Ppm	40

Peat

Obtained from domestic certified markets (Dutch origin).

Preparation

Plastic pots (20L.) were prepared. Five equal holes done in the base of the containers for the discharge of the excess water. A layer of medium-sized stone thickness of 1.5cm^2 was laid as a base layer to help drain the water and with a thickness of 2cm.

The containers were filled with the agricultural media and according to the experiment plan which includes seven levels (sand S, Non-treated bark NTB, treated bark TB, mix S: NTB 1:1size, mix S: TB 1:1size, peat PT, Sandy lome SL) container was filled with 18cm height, the containers surrounded by PVC black sheet In order to provide darkness that helps rooting as well as absorption of heat to be ready for planning the cutting (picture1).

Picture 1: *Experimental units & cutting rooting of Ficus nitida*

Attributes Studied

For the purpose of measurements, the method adopted by [11].

Properties of Roots

The length of the longest root (cm), mean diameter of the longest root (mm), number of secondary roots, percentage of rooting (%), Dry weight of the root mass (g.cutting^{-1}).

Properties of Shoots

Average length of modern growth (cm), the average diameter of the branch (mm), the average number of modern leaves formed (cm^2), determination of leaf content of total chlorophyll, dry weight of the total vegetative (g)

Determination of leaf content of nitrogen and carbohydrates:

Determination of Nitrogen content (%), determination of carbohydrate content (%), Ratio of carbohydrates to nitrogen C / N.

Statistical Analysis of Data

The analysis of the variance of the study results was carried out using the SAS program [12]. The Duncan test was performed to compare the averages of the various coefficients at the 5% probability level, according to [13].

Results and Discussion

As for the effect of the agricultural media, it was observed from Table (3) that the highest root length was

obtained in the cultivated cutting in the treated bark which reached 14.77cm significantly higher than that of the other cultivars. Followed by the cutting planted in the mixed agriculture media (sand with treated bark 1:1) to gave a good value for the root length of the total 14.94cm. The root diameter was increased to 0.46mm when the non treated bark was used as a media.

The largest number of secondary roots could be obtained from using of the sand amounting to 35.66, it may be due to contain sand enough food to increase the number of secondary roots (table 2) as well as good ventilation.

Table 3: *Effect of Agriculture Circles on Roots & Shoots Properties*

Growth properties		Agriculture media						
		S	**NTB**	**S:NTB**	**TB**	**S:TB**	**SL**	**S:SL**
Root system	Length cm	12.19	10.22	12.92	14.76	14.94	13.87	10.74
	Diameter mm	0.41	0.46	0.45	0.43	0.44	0.40	0.38
	secondary root's number	35.66	17.65	26.13	24.95	25.85	14.25	28.66
	Rooting %	93.33	66.58	66.66	65.83	71.66	76.66	79.16
	Dry Weight g	0.57	0.24	0.29	0.30	0.32	0.22	0.23
Shoot system	Length cm	11.40	5.84	6.54	5.18	6.41	5.91	6.28
	Diameter mm	3.21	2.53	2.67	2.7	2.66	2.66	2.61
	Leave number	6.10	3.16	3.35	3.75	4.16	5.52	4.57
	Leaves area cm^2	5.21	4.76	4.18	3.95	4.73	4.52	4.03
	Total chlorophyll	39.06	39.07	40.42	38.31	36.03	40.61	31.78
	Dry Weight (g)	0.72	0.36	0.53	0.48	0.57	0.50	0.38
	N %	6.445	6.766	6.533	6.250	6.218	6.448	6.650
	C %	1.42	1.37	1.295	1.370	1.541	1.375	1.478
	N/C %	0.21	0.20	0.19	0.21	0.24	0.20	0.22

Rooting % was increased too by using non treated & treated bark mixed with the sand to reached to (66.6, 71.66) respectivly, while the sand medium alone gave the highest amount of rooting (93.33%). Sand alone gave the highest amount of dry weight to provide adequate food in the middle.

The vegetative properties were mostly increased when sand was used for the same reason. The content of nitrogen, carbon and C/N % was increased by the use of the treated and non-treated bark with sand due to the good content of C and N in their content of chemical compounds.

As for the effect of different concentrations of IBA on the root system properties (table 4), a difference in values was observed with different concentrations. In general, there was an increase in the characteristics of root length, number of secondary roots, rooting % and dry weight.

Table 4: *Effect of IBA on Roots & Shoots Properties*

Growth properties		Concentration regular growth IBA mg.l^{-1}			
		0	**1000**	**2000**	**3000**
Root system	Length cm	13.18	12.5	13.45	12.09
	Diameter mm	0.48	0.45	0.41	0.36
	secondary root's number	16.16	24.72	30.28	27.78
	Rooting %	70.95	76.19	74.76	76.9
	Dry Weight g	0.31	0.31	0.33	0.28
Shoot system	Length cm	6.82	6.53	7.11	6.71
	Diameter mm	2.72	2.76	2.85	2.56
	Leave number	3.86	4.34	5.04	4.25
	Leaves area cm^2	4.51	4.20	4.70	4.51
	Total chlorophyll	37.73	37.78	38.46	37.62
	Dry Weight (g)	0.52	0.51	0.56	0.42
	N %	6.371	6.450	6.503	6.566
	C %	1.426	1.405	1.371	1.427
	N/C %	0.22	0.21	0.20	0.21

The IBA plays a role in the attraction of carbohydrates and compounds involved in the rooting process of the base of the cuttıng. The roots are formed by the interaction of IBA with oxins or the formation of spin roots due to the role of oxin in the stimulation of enzymes [14], The IBA also increases cell division and cellular elongation in active mesenchymal cells, increases the synthesis rate of RNA and activates the enzymes needed for chemical reactions to secure the necessary materials for cell division and helps to digest stored carbohydrates needed for radical eruptions and root formation [15] and that the reason for increasing dry weight of the roots is due to the increase in the number of roots and lengths, and this is confirmed by [16].

In Shoot properities, 2000mg/L concetration was significant higher in all properites except C% and N/C%.

In general, for the levels of growth regulator IBA, it was observed that the highest concentration did not show sporadic results and this is consistent with the pathway of the researcher [17].

Conclusions

Cultivation of the *Ficus nitida* plant in the sand led to the improvement of most characteristics of roots and vegetative growth Except for the average length of the longest root and diameter and the content of leaves of total chlorophyll, whose values have improved when mixed with percentages of the bark.

Treatment of the Ficus cutting with IBA at a concentration level of 2000mg. L^{-1}. has improved most of the characteristics of root and vegetable growth, significantly to (The mean length of the longest root,

Root diameter, number of secondary roots, dry weight of root total, The mean length of the longest shoot, diameter, Leaf number, leaf area, total chlorophyll and dry weight), while the concentration of 3000Mg. L^{-1} to improve the content of leaves of nitrogen and carbohydrates.

Recommendations

Based on the results and benefits obtained, and for better results, this study recommends:

1. Study the effect of other types of agro-media mixed with different proportions of sand for better results.
2. Select other types of plants to study their susceptibility to the studied factors.

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