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GROWTH AND FOLIAR NUTRIENT ACCUMULATION OF THREE POPLAR CLONES IN NINEVAH PLANTATION

Prof. Dr. Yavuz Şefik ABDULLAH[1)]
Dr. M. Fethi RAMAZAN[1)]

Abstract

Growth and seasonal nutrient concentration, content, and dry matter acumulation for three local clones of poplar (*Populus nigra* IRQ-1, *Populus nigra* "Babylon" IRQ-6 and *Populus* X *euramericana* IRQ-19) were studied between February and October, 1988 in Ninevah Plantation. Three levels of N, P, K fertilizers 0, 18 and 36 gms/seedling were applied twice, at the beginnnig of May and August to the seedlings raised by using stem and root cuttings. The results showed that root cuttings can be considered as sources for establishing plantations. Clonal differences in response to N, P, K fertilizers were evident. *Populus nigra* "Babylon" IRQ-6 respond signficantly to the application of N, P, K at early May. Regression of nutrient content and leaf dry weight indicate high correlations, this relation could be used for predicting the amount of nutrient elements removed with dry matter during harvesting.

1. INTRODUCTION

Hybrid poplar is one of the fast growing species in northern hemisphere (Jobling, 1981) and cultivated on large areas in northern part of Iraq since early 1950 (Abdullah, 1988; Clonaru *et al.*

1) University of Mosul, Hammam Al Alil, Mosul-Iraq

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1975). Its wood used for pulpwood, Lumber, Veneer, matchwood and fire wood, poplar plants used as a shade trees, land fills, spoil banks or borrow pits (Maurice and Demeritt, 1983). Several workers reviewed in detail the literature on the influence of climatic, edaphic factors and fertilizers on the rate of growth and biomass production (Jobling, 1960; Jones and Curlin, 1968, Einspahr and Benson, 1968; Jarvis, 1968, and Dimitrov *et al:,* 1976). Ogar in 1981 reported that if fertilizers applied in proper time they reduce mortality and induced rapid growth of species. Safford and Czapowskyi (1968) found that nitrogen fertilizer increased the growth of *Populus grandidentata, P. tremuloides* in young stand. Nilson and Wasielewski (1977) stated that the productivity of natural tremula poplar increased by using different levels of nitrogen fertilizer.

2. MATERIALS AND METHODS

This study was undertaken on an old Forest Nursery (0.5 ha.) in Ninevah Forest Plantation, Mosul, Iraq. Mosul is located approximately at 36° 19-N Latitude and 43° 09-E Longitude. The climate of the area is semi arid hot tropical (B.s.h.) (Abdullah, 1978) with a mean aunual precipitation of 382 mm. The soil is deep alluvial soil and generally characterized by its predominant soil texture silty loam. The pH ranged from 7.65 to 8.20 with low content of organic matter (0.332 - 1.394 %). In February, 1988 the site was deep ploughed (40 cm) followed by disking. The hybrid poplar clones (*Populus nigra* IRQ-1, *Populus nigra* "Babylon" IRQ-6 and *Populus* X *euramericana* IRQ-19) were selected on the basis of their rapid growth, good fiber quality and their high resistance to the most insect pests. Randomized complete block design was used with four factors, three clones, two planting stock, two periods of fertilizer application with three levels of N, P, K and four replications. Each treatment plot (12 x 6 m) consist of 12 shoot cuttings (20-25 cm length and 12 -15 mm in diameter) 1 + 0 or 12 root cuttings 0 + 1 at 1 x 2 m. Fertilizers were applied as a surface cover treatment to the depth of 8-10 cm, around the seedlings. Each treatment received zero or 18 gms of 5 gms of Urea as a source of Nitrogen + 8 gms of triple superphosphate as a source of phosphorus + 5 gms of potassium sulfate as a source of potassium or 36 gms of the same chemicals. The mixed fertilizers were applied either at early May or at early August for Spring and fall growth respectively. The area was irrigated when soil moisture reached 19-20 % of soil dry Weight. (Soil loss 50 % of available water of field capacity) (Dickmann and Stuart, 1983). Irrigation started from April to early October. Weeds were controlled either by hand, rotovator or by applying glyphosate herbicide. 1152 soil sub-samples were collected just before adding fertilizer and after three months of applying the chemicals for both periods to the depth of 50 cm. A total of 72 samples were oven dried at 40°C to equilibrium and sieved through a 2 mm sieve, the analysed for Nitrogen by Kjeldahl method, for Phosphorus by spectrophotometer, for potassium by hot-flame-photometer and for Calcium and Magnesium by using EDTA-Na_2 (Davidescu and Davidescu, 1982). The detected Nitrogen ranged from 0.0041 to 0.0104 %, Phosphorus ranged from 1 to 6 mg/100 gs of soil, both elements were very low according to the results of both Aldhous (1968) and Wilde (1958). However, Potassium was slightly low to satisfactory level (6.7 to 20.1) mg/100 gs soil accordance with the same results of the preceeding authors. Therefore, the addition of Potassium is to keep high concentration of K in the foliage, since the lafter element acts as a charged

balance cation for the transport of anions (Salisbury and Ross, 1979). Foliage samples collected from 12 samplings for each treatment by late July, for the treatments received chemicals in early May, and by late October for the treatments received chemicals in early August. Samples were dried at 70°C for 24 hours and sieved through a-20 mesh screen, then the samples digested by concentrated H_2SO_4 + 30 % of H_2O_2. Total Nitrogen estimated by Kjeldahl method, Phosphorus by spectrophotometer, Potassium by hot-flame-photometer, Calcium and Magnesium by EDTA-Na_2 (Davidescu and Davidescu, 1982). Dry weight were obtained by harvesting and samplings before leaf fall, survival percentage, plant height and diameter at 1.0 m height were measured for all samplings, analysis of variance, Duncan multiple range test and regression analysis were used to determine the efect of planting stock, time fertilizer application, different levels of chemicals and their interactions on the growth, nutrient concentration and dry matter accumulation.

3. RESULTS AND DISCUSSION

Table (1) shows that *Populus nigra* "Babylon" IRQ-6 clone gave better result in most of the characters studied except shoot dry weight and Phosphorus conc., this may indicate that even through the first two clones have similar genetic base they have different affinity for the elements (Ogar, 1981). As shown in Table (2), Nitrogen, Phosphorus and Potassium (applied as mixed fertilizers) increased significantly the growth of hybrid poplar 0 + 1 stock, the magnitude of 12 out of 17 characters were greater in root cuttings than those of shoot cuttings. These results indicate the importance of root cuttings for the establishment of successful plantation and it is in agreement with the finding of Randall and Krinard (1977) who suggested that the mean height of one-year old root cutting (253 cm) of *Populus deltoides* were significantly greater than that of all stem cuttings (213.4 cm) during the first growing season. The response to fertilizer could be exhibited by 1 + 0 stock suggest that cuttings may effectively utilize fertilizer in their second growing season (Kondziolka and Streit, 1988). As shown in Table (3) fertilizers applied in early May gave the best results for plant height, diameter and N, P, K concentrations, except for Ca and Mg concentrations. Table (4) shows that the levels of N, P, K fertilizers increased significantly plant height, diameter, LAI, shoot and root dry weights and Ca and Mg concentrations, where the concentrations of Nitrogen, Phosphorus and Potassium decreased in the third level as compared with the control. This may be due to the direct effect of rapid seasonal growth implying dilution as mentioned by (Armson, 1977 and Timmer and Stone, 1978), and also in agreement with (Jarrel and Beverly, 1981) finding for the yield crop and average concentration of the element. There was no evidence for the hypothesis of foliar dilution of Calcium and Magnesium during the periods associated with rapid foliar dry weight accumulation. This suggests that the relative amounts of Ca dnd Mg absorbed during these periods paralleled the changes in foliar dry weight accumulation. Table (5) shows that interaction of clonex planting stock significantly affect plant height, diameter, N, P, Ca and Mg. There were differences between 1 + 0 and 0 + 1 stocks within three clones. However, root cuttings were the best in growth rate, Nutrient content, clone x planting stock induced higher concentration of N, P in the foliage of *Populus nigra* "Babylon" IRQ-6 clone. Table (6) represents the significant effect of clone x time of adding fertilizer interactions on most characters, plant height, diameter, LAI. Clone *Populus nigra* "Babylon" was superior among the others when fertilizer applied at early May, concentrations of N, P and their accumulation increased for the same period where

the concentrations of Ca and Mg decreased, but their content increased according to their high leaf dry weight. Significant clone x fertilizer levels interactions was manifested for plant height, diameter, shoot dry weight and root shoot weight ratio. The growth increased by increasing fertilizer level. Contentrations of N, P, Ca in the foliage increased for all clones. The interactions also induced a more rapid rate of decline for foliage Magnesium in all clones (Table 7). Planting stock x time of adding fertilizer interactions shows significant effect on diameter, root shoot weight ratio and N, P, K, Ca and Mg concentrations for all clones. Spring application with root cuttings showed the best results (Table 8). Table (9) shows significant effect planting stock x fertilizer levels on diameter, shoot and root dry weights, P, Mg concentrations and their content in the foliage. Diameter increased for both planting stock, the maximum dry weight obtained at the third level. Phosphorus concentration increased as the fertilizer increased where the maximum Mg concentration occured at the second level for shoot cuttings and in the zero level for root cuttings.

Table (10) shows significant effect of the interactions of time of adding fertilizer x fertilizer levels on plant diameter and for N, P, K, Ca and Mg. Diameter increased at high level when fertilizer applied at early May. The nutrient elements N, P, K and their content increased significantly for the second and the third levels as compared with the control. Ca concentration decreased in the second and third level for both periods. The interactions of clone x planting stock x time of adding fertilizer shows significant effect on N, P and Ca concentrations and the accumulation of P, K and Mg. N and P concentrations were increased for all clones with root cutting when the fertilizer applied for Spring growth, maximum accumulation for P and Mg occurred at the same treatments. Ca concentration and Mg accumulation occurred in root cuttings for the second application of fertilizers as shown in Table (11). The interactions of clone x planting stock x fertilizer levels show a significant effect on plant height, shoot dry weight, root shoot weight ratio, N concentrtaion and the accumulation of all nutrients studied. The clone *Populus nigra* "Babylon" IRQ-6 cultivated by root cuttings with the third level was the best among the others for all characters studied. The interactions of clone x time of adding fertilizer x fertilizer level show significant effect on diameter, N and P concentrations. The clone *Populus* X *euramericana* IRQ-19 at early May with the third level gave the best result for diameter and P concentration, where *Populus nigra* "Babylon" IRQ-6 clone with the third level application at early May gave the highest value for N concentration.

The interactions of planting stock x time of adding fertilizer x fertilizer levels, showed significant effect on diameter N and P concentrations and Mg accumulation, the highest value obtained in the clone *Populus nigra* "Babylon" IRQ-6 with the third level when fertilizer applied at early May for the first three characters. Maximum Mg accumulation obtained in the clone *Populus* X *euramericana* IRQ-19 with the third level of application at early August. The interactions of the four factors studied show significant effect on diameter, N, P, K, and Mg concentrations as well as the accumulation of P, K and Mg. The best treatment for all characters is the clone *Populus* X *euramericana* propagated by root cuttings with the third application at early May. A relation between leaf dry weight and nutrient content per hectar, high correlation obtained for all three clones with different levels of fertilizer except for P in the first clone with the third level and K in the second clone with the third level. The results indicate that foliar elemental contents are strongly related to foliar dry weight.

Table 1 : The effect of clones on growth and nutrient concentration, accumulation (Duncan M.R.T.)
Tablo 1 : Klon çeşitlerinin büyüme ve fidanlarda element birikmesine etkisi

Characteristics Nitelikler	Clone IRQ-1	Clone IRQ-6	Clone IRQ-19
Plant height (m) (Fidan boyu)	1.543 c	2.014 a	1.729 b
Plant dia. at 1.0 m height (cm)	0.849 b	1.034 a	1.047 a
Leaf Area Index (Yaprak alanı indeksi)	1.168 c	2.719 a	1.743 b
Shoot dry weight (gm) (Gövde kuru ağır.)	182.851 c	191.709 b	232.420 a
Root dry weight (gm) (Kök kuru ağır.)	78.392 b	87.570 a	87.452 a
Root shoot ratio (Kök gövde oranı)	0.431 b	0.457 a	0.382 c
N. conc. %	1.522 b	1.580 a	1.507 b
N-absorbed by leaves kg/ha.	4.561 c	6.219 a	5.485 b
P. conc. %	0.198 a	0.192 b	0.189 b
P-absorbed by leaves kg/ha.	0.598 c	0.752 a	0.693 b
K-absorbed by leaves kg/ha.	4.624 c	6.059 a	5.550 b
Ca conc. %	1.885 a	1.899 a	1.663 b
Ca-absorbed by leaves kg/ha.	5.538 c	7.326 a	5.998 b
Mg. conc. %	0.258 b	0.272 a	0.270 a
Mg-absorbed by leaves kg/ha.	0.753 c	1.056 a	0.972 b

Table 2 : The effect of planting stock on growth and nutrient conc., accumulation (Duncan M.R.T.)
Tablo 2 : Fidan çeşitlerinin büyüme ve fidanlarda element birikmesine etkisi

Characteristics Nitelikler	Shoot cutting Gövde çeliği	Root cutting Kök çeliği
Plant height (m) (Fidan boyu)	1.701 b	1.822 a
Plant diameter (cm) (Fidan çapı)	0.932 b	1.021 a
Shoot dry weight (gm) (Gövde kuru ağır.)	191.613 b	212.974 a
Root dry weight (gm) (Kök kuru ağır.)	81.338 b	87.605 a
N %	1.509 b	1.564 a
N. kg/ha.	5.231 b	5.613 a
P %	0.171 b	0.215 a
P. kg/ha.	0.593 b	0.768 a
K %	1.487 b	1.573 a
K. kg/ha.	5.166 b	5.656 a
Ca %	1.777 b	1.854 a
Ca. kg/ha.	6.068 b	6.506 a

Table 3 : Duncan Multiple range test showing effect of time of adding fertilizer on some of characters studied.
Tablo 3 : Gübre verme zamanının fidanların bazı niteliklerine etkisi

Characteristics Nitelikler	Spring application İlkbahar aplikasyonu	Autumn application Sonbahar aplikasyonu
Plant height (m) (Fidan boyu)	1.842 a	1.681 b
Plant diameter (cm) (Fidan çapı)	1.050 a	0.903 b
N %	1.563 a	1.510 b
N - kg/ha.	5.594 a	5.250 b
P %	0.204 a	0.182 b
P - kg/ha.	0.734 a	0.628 b
K %	1.607 a	1.452 b
K - kg/ha.	5.754 b	5.068 a
Ca %	1.717 b	1.914 a
Ca. kg/ha.	6.069 b	6.506 a
Mg %	0.254 b	0.280 a
Mg - kg/ha.	0.892 b	0.962 a

Table 4 : Durcan Multiple range test showing effect of three levels of fertilizer on some characters studied.
Tablo 4 : Üç muhtelif dozun fidanların bazı niteliklerine etkisi

Characteristics Nitelikler	Zero level Sıfır doz	Second level İkinci doz	Third level Üçüncü doz
Plant height (m) (Fidan boyu)	1.513 c	1.705 b	2.067 a
Plant diameter (cm) (Fidan çapı)	0.850 c	0.977 b	1.103 a
Leaf Area Index (Yaprak alanı ind.)	1.069 b	1.249 ab	1.436 a
Shoot dry weight (gm)	172.072 c	203.435 b	213.373 a
Root dry weight (gm)	74.135 c	84.958 b	94.321 a
N %	1.634 a	1.555 b	1.421 c
N - kg/ha.	6.438 a	5.431 b	4.397 c
P %	0.207 a	0.206 a	0.166 b
P - kg/ha.	0.810 a	0.719 b	0.514 c
K %	1.688 a	1.566 b	1.335
K - kg/ha.	6.613 a	5.486 b	4.134 c
Ca %	1.708 b	1.742 b	1.996 a
Ca. kg/ha.	6.697 a	6.012 b	6.152 b
Mg %	0.239 c	0.268 b	0.293 a

Table 5 : Duncan Multiple range test showing the effect of interaction of clone x planting stock on some characters studied.

Tablo 5 : Klon x Fidan çeşiti etkileşiminin fidanların bazı niteliklerine etkisi

Characteristics Nitelikler	a_1b_1	a_1b_2	a_2b_1	a_2b_2	a_3b_1	a_3b_2
Plant height (m) Fidan boyu	cd 1.576	d 1.510	b 1.932	a 2.095	cd 1.595	b 1.863
Plant diameter (cm) Fidan çapı	e 0.820	d 0.877	c 0.956	a 1.112	b 1.021	a 1.073
N %	c 1.491	b 1.552	ab 1.569	a 1.591	c 1.467	b 1.547
P %	b 0.186	a 0.211	c 0.171	a 0.213	d 0.158	a 0.220
P - kg/ha.	c 0.563	b 0.632	b 0.665	a 0.839	c 0.552	a 0.834
Ca %	b 1.833	a 1.937	b 1.833	a 1.965	c 1.666	c 1.659
Mg %	b 0.258	b 0.258	b 0.254	a 0.291	a 0.291	b 0.250
Mg - kg/ha.	c 0.760	c 0.746	b 0.987	a 1.124	b 0.993	b 0.952

Table 6 : Duncan Multiple range test showing the effect of interactions of clone x time of adding fertilizer on some characters studied.

Tablo 6 : Klon x Gübre verme zamanı etkileşiminin fidanların bazı niteliklerine etkisi

Characteristics Nitelikler	a_1c_1	a_1c_2	a_2c_1	a_2c_2	a_3c_1	a_3c_2
Plant height (m) Fidan boyu	d 1.667	e 1.419	a 2.115	b 1.912	cd 1.746	cd 1.711
Plant diameter (cm) Fidan çapı	c 0.948	d 0.750	a 1.126	c 0.942	a 1.078	b 1.016
Leaf Area Index	cd 1.170	d 1.165	a 2.950	ab 2.488	cd 1.442	b 2.045
Shoot dry weight Gövde kuru ağırlığı gm.	c 189.540	d 176.163	c 189.577	c 193.641	b 221.840	a 243.001
Root dry weight Kök kuru ağırlığı gm.	c 78.726 c	c 78.058 bc	b 84.283 a	a 90.858 c	ab 87.048 b	ab 87.855 d
N %	1.506	1.538	1.632	1.528	1.550	1.465
N - kg/ha.	d 4.786	e 4.337	a 6.660	b 5.779	c 5.337	b 5.633
P %	ab 0.202	b 0.195	a 0.211	c 0.173	b 0.200	c 0.178
P - kg/ha.	c 0.644	d 0.551	a 0.859	c 0.645	b 0.699	c 0.687
K %	b 1.582	c 1.482	b 1.590	c 1.479	a 1.649	d 1.680
Ca %	d 1.666	a 2.104	c 1.840	a 1.396	d 1.645	d 1.680
Ca - kg/ha.	d 5.236	c 5.840	a 7.375	a 7.277	cd 5.596	b 6.400
Mg %	d 0.237	b 0.279	d 0.237	a 0.308	b 0.287	c 0.254
Mg - kg/ha.	c 0.742	c 0.764	b 0.959	a 1.152	b 0.976	b 0.969

Table 7 : Showing the effect of interaction of clone x fertilizers level on some of the characters studied.
Tablo 7 : Klon x Gübre dozu etkileşiminin fidanların bazı niteliklerine etkisi (Dunkan M.R.T.).

Characteristics Nitelikler	a_1d_1	a_1d_2	d_1d_3	a_2d_1	a_2d_2	a_2d_3	a_3d_1	a_3d_2	a_3d_3
Plant height (m) Fidan boyu	f 1.275	f 1.363	b 1.990	de 1.708	b 2.068	a 2.265	e 1.557	de 1.684	c 1.945
Plant diameter (cm) Fidan çapı	f 0.677	e 0.858	c 1.011	d 0.950	bc 1.019	a 1.133	d 0.921	bc 1.055	a 1.165
Shoot dry weight (gm) Gövde kuru ağırlığı	f 162.094	e 181.856	c 204.604	f 168.658	ed 190.072	c 216.098	ed 185.465	b 238.379	a 273.417
Root shoot ratio Kök, gövde oranı	bc 0.435	cd 0.419	bc 0.438	a 0.457	a 0.467	ab 0.448	de 0.406	ef 0.380	f 0.360
N %	e 1.436	d 1.512	b 1.618	d 1.483	bc 1.581	a 1.676	f 1.344	c 1.570	bc 1.607
P %	d 0.168	ab 0.211	a 0.217	d 0.176	abc 0.204	c 0.195	e 0.154	bc 0.202	ab 0.210
Ca %	b 1.968	bc 1.895	cd 1.791	a 2.072	d 1.781	co 1.843	c 1.947	e 1.552	e 1.489
Ca - kg/ha.	f 4.786	e 5.485	cd 6.343	b 7.098	bc 6.917	a 7.963	bc 6.574	e 5.635	de 5.785
Mg %	a 0.306	cd 0.250	e 0.128	ab 0.287	bc 0.268	c 0.262	ab 0.287	ab 0.287	de 0.237
Mg - kg/ha.	d 0.749	d 0.726	d 0.784	bc 0.981	b 1.039	a 1.146	bc 0.967	b 1.030	c 0.920

Table 8 : The effect of interactions of planting stock x time of adding fertilizer on some characters studied (Duncan M.R.T.)

Tablo 8 : Fidan çeşidi x Gübre verme zamanı etkileşiminin fidanların bazı özelliklerine etkisi

Characteristics Nitelikler	b_1c_1	b_1c_2	b_2c_1	b_2c_2
Plant diameter (cm) Fidan çapı	b 0.985	d 0.880	a 1.116	c 0.925
Root shoot ratio Kök, gövde oranı	b 0.416	a 0.444	b 0.423	b 0.411
N %	b 1.512	b 1.506	a 1.613	b 1.514
N - kg/ha.	b 5.213	b 5.249	a 5.975	b 5.250
P %	c 0.178	d 0.165	a 0.231	b 0.199
P - kg/ha.	c 0.614	c 0.572	a 0.853	b 0.683
K %	b 1.504	bc 1.469	a 1.710	c 1.436
K - kg/ha.	b 5.170	b 5.162	a 6.338	b 4.974
Ca %	c 1.703	b 1.851	c 1.731	a 1.976
Mg %	b 0.266	b 0.269	c 0.241	a 0.291

Table 9 : The effect of interaction of planting stock x fertilizer level on some characters studied (Duncan M.R.T.)

Tablo 9 : Fidan çeşiti x gübre dozu etkileşiminin fidanları bazı niteliklerine etkisi.

Characteristics Nitelikler	b_1d_1	b_1d_2	b_1d_3	b_2d_1	b_2d_2	b_2d_3
Plant diameter Fidan çapı (cm)	d 0.838	c 0.922	b 1.037	d 0.861	b 1.033	a 1.169
Shoot dry weight Gövde kuru ağırlığı (gm)	d 167.997	c 190.870	b 215.974	d 176.147	b 216.001	a 246.773
Root dry weight Kök kuru ağırlığı (gm)	d 73.699	c 81.134	b 89.180	d 74.571	b 88.782	a 99.462
P %	d 0.152	c 0.184	c 0.178	c 0.180	b 0.227	a 0.237
P - kg)ha.	e 0.467	c 0.630	c 0.683	d 0.561	b 0.807	a 0.937
Mg %	a 0.300	b 0.279	d 0.225	ab 0.287	c 0.258	c 0.254
Mg - kg/ha.	b 0.919	b 0.950	b 0.871	b 0.879	b 0.914	a 1.029

Table 10 : The effect of interaction of time of adding fertilizer x fertilizer levels on some characters (Duncan M.R.T.)

Tablo 10 : Gübre verme zamanı x gübre dozu etkileşiminin fidanların bazı niteliklerine etkisi.

Characteristics Nitelikler	c_1d_1	c_1d_2	c_1d_3	c_2d_1	c_2d_2	c_2d_3
Plant diameter (cm) Fidan çapı	d 0.896	b 1.073	a 1.183	e 0.803	d 0.882	c 1.023
N %	e 1.399	b 1.591	a 1.698	d 1.443	c 1.518	b 1.569
P %	d 0.170	b 0.216	a 0.227	d 0.162	c 0.196	c 0.188
K %	e 1.366	b 1.676	a 1.780	f 1.305	d 1.457	c 1.596
K - kg/ha.	d 4.424	b 6.078	a 6.759	f 3.844	d 4.894	c 6.467
Ca %	a 1.958	c 1.618	c 1.576	a 2.034	b 1.867	b 1.840
Ca - kg/ha.	b 6.357	b 5.845	b 6.004	b 5.947	b 6.179	a 7.390
Mg - kg/ha.	b 0.893	b 0.929	b 0.855	v 0.904	b 0.935	a 1.045

Table 11 : Effect of clone x planting stock x time of adding fertilizer interaction on some characters studied (Ducan M. R. T.).
Tablo 11 : Klon x Fidan Çeşiti x Gübre Verme Zamanı etkileşiminin fidanların bazı niteliklerine etkisi (Dunkan M.R.T.).

Characteristics Nitelikler	$a_1b_1c_1$	$a_1b_1c_2$	$a_1b_2c_1$	$a_1b_2c_2$	$a_2b_1c_1$	$a_2b_1c_2$	$a_2b_2c_1$	$a_2b_2c_2$	$a_3b_1c_1$	$a_3b_1c_2$	$a_3b_2c_1$	$a_3b_2c_2$
N %	f 1.428	cde 1.555	bcd 1.584	e 1.521	bc 1.598	de 1.540	a 1.666	e 1.516	e 1.511	f 1.423	bc 1.509	e 0.195
P %	d 0.189	d 0.182	b 0.214	bc 0.207	d 0.189	e 0.152	a 0.233	d 0.194	e 0.155	e 0.160	a 0.246	cd 0.195
P - kg/ha.	cd 0.622	e 0.505	bcd 0.666	d 0.598	b 0.741	d 0.590	a 0.977	bc 0.700	e 0.480	cd 0.623	a 0.917	b 0.751
K - kg/ha.	de 4.840	e 4.187	cd 5.234	e 4.236	c 5.763	c 5.827	a 7.316	cd 5.356	d 4.934	cd 5.473	b 6.463	cd 5.331
Ca %	d 1.527	a 2.138	bc 1.805	a 2.069	b 1.861	bc 1.805	bc 1.819	a 2.111	c 1.722	d 1.611	d 1.569	bc 1.749
Mg - kg/ha.	de 0.804	e 0.716	e 0.680	de 0.811	cd 0.909	b 1.065	bc 1.010	a 1.239	bc 0.972	bc 1.013	bc 0.979	bcd 0.925

IRAK NİNEVAH PLANTASYONUNDA ÜÇ KAVAK KLONUNDA BÜYÜME VE YAPRAKLARINDA ELEMENT BİRİKMESİ

Prof. Dr. Yavuz Şefik ABDULLAH
Dr. M. Fethi RAMAZAN

Kısa Özet

Bu çalışmada üç yerli Kavak Klonunda (Populus nigra IRQ-1, P. nigra (Babylon) IRQ-6 ve P. x euramericana IRQ-19) büyüme, mineral element konsantrasonu kuru material birikintisi araştırılmaktadır.

IRAK Ninevah plantasyonunda kök ve gövde çeliklerinden üretilen fidanlara üç değişik gübre (N, P, K) ve üç değişik doz halinde (0,18 ve 36 gr) olarak iki ayrı mevsimde ilave edilmiştir.

Araştırma sonucunda, kök çeliklerinden elde edilen fidanlar yukarıda belirtilen klonlar için tesis edilen plantasyonlarda kullanılabilir. Klonlar arasında gübreleme farklılık göstermiştir. Populus nigra (Babylon) IRQ-6 ise erken Mayıs N, P, K gübrelemede belirgin değişiklik göstermiştir. Ayrıca mineral element ve yaprak kuru ağırlığı yüksek korelasyonlar ortaya koymuştur. Bu ilişki fidanların ne kadar mineral element aldığını gösteren bir erken gösterge olarak kullanılabilir.

1. GİRİŞ

Kavak melezlerinin fidanları Irak'ın kuzeyinde 1950'den beri kullanılmaktadır (Abdullah 1988). Klimatik, Edafik faktörlerin ve gübrelemenin bu türün büyüme hızına, (biomass) kitle ağırlığı ve verimliliğine büyük etki yaptığı birçok araştırıcı tarafından belirtilmiştir (Jobling 1960, Jarvis 1968, Dimitrov *et al* 1976, Nilson and Wasielewiski 1977 and Ogar 1981).

Araştırma Irak'ta Ninevah plantasyonunda yapılmıştır. Ninevah plantasyonu 36°19' Kuzey enlem derecesi ile 43°09' Doğu boylam derecesi arasında bulunmaktadır. Yıllık yağış miktarının ortalaması 332 mm, toprak türü killibalçık, pH 7.6-8.2'dir. Bu araştırmada üç Kavak melezi Populus nigra IRQ-1, P. nigra (Babylon) IRQ-6 ve P. x euramericana IRQ-191, iki değişik fidan türü (kök ve gövde çeliklerinden elde edilen fidanlar), iki gübreleme zamanı (İlkbahar ve Sonbahar) ve üç gübreleme çeşidi (N, P, K)'nden olmak üzere üç ayrı doz (0.18 ve 36 gr) kullanılmıştır. Her deneme dört defa tekrarlanmıştır. Sulama ise toprak rutubeti kuru ağırlığının (% 19-20) sine indiği zaman yapılmıştır ve sulama Nisan-Ekim ayları boyunca devam etmiştir. Toprakörneklerinin analizinde Nitrogen için Kjeldahl metodu, Fosfor için Spectrophotometir ve Potasyum için Hat-Flamephotometer. Kalisyum Magnisyum EDTA - Naz (Davidescu and Davidescu 1982) kullanılmıştır. Yaprak örnekleri Mayıs ayında gübrelenen fidanlardan Temmuz sonunda, Ağustos ayında gübrelenen fidanlardan Ekim'in sonunda toplanmıştır. Yaprak örnekleri) 70°C'de 24 saat müddetle kurutulmuş ve 20'lik eleklerden geçirildikten sonra H_2SO_4 + 30 % H_2O_2'da eritilmiştir. Fidan tutma yüzdesi, fidan çapı ve boyu ölçülmüştür. Fidan çeşidi, gübre türü, dozlar ve kullanma zamanının etkilerini belirtmek için Variyasyon analizi, Dunkan, M.R.T. ve Regresyon analizleri yapılmıştır.

2. BULGULAR

Tablo (1) den anlaşılabileceği gibi Pupulus nigra "Babylon" IRQ-6 Klonu gövde kuru ağırlığı ve Fosfor konsantrasyonu dışında bütün niteliklerde en iyi sonuçlar vermiştir. Tablo (2) de gösterildiği gibi kök çeliklerinden elde edilen fidanlar bu iki nitelikte gövde çeliklerden elde edilen fidanlardan üstün sonuçlar vermiştir. Dolayısıyla kök çeliklerinden elde edilen fidanlar Ninevah plantasyonun koşullarındaki Kavak plantasyonların tesisinde önerilmelidir.

Tablo (3) ten anlaşılabileceği gibi Mayıs başında gübreleme, fidan boyu, çapı, N.P.K konsantrasyonu niteliklerinde üstünlük gösterilmiştir.

Tablo (6) da görüldüğü gibi Klon x gübreleme zamanın arasındaki etkileşim hemen hemen bütün nitelikleri etkilemiştir. Fidan boyu, çapı ve yaprak indeksi Populus nigra "Babylon"da erken Mayıs gübrelemede büyük signifikasyon (bir anlamlılık) göstermiştir. Fidan büyümesi gübre dozunun artması ile artmıştır (Tablo 7).

Tablo (8) de fidan çeşidi x gübre verme zamanı arasındaki etkileşim fidan çapı, kök/kök oranı ve N.P.K ve Magnisyon konsantrasyonu her üç klonda anlamlılık göstermiştir. Erken Mayıs ayında ilave edilen gübre bilhassa kök çelikleriyle elde edilen fidanlarda en iyi sonuçları vermiştir. Oysa fidan çeşidi x gübre dozu arasındaki etkileşim ancak fidan çapına, gövde ve kök ağırlığına ve P.M.Ca konsantrasyonuna ve yapraktaki miktarına anlamlılıkla etki gsötermiştir (Tablo 9).

Tablo (10) dan anlaşılabileceği gibi fidan çapı, dozun yükselmesi ile artmıştır ve bilhassa erken Mayıs gübrelemesinde, klon x fidan çeşidi x gübreleme zamanı arasındaki etkileşim sonucu N.P and Ca konsantrasyonuna ve P.K and Mg birikmesinde anlamlılık göstermiştir (Tablo 11).

KAYNAKLAR

ABDULLAH, A.A., 1978. *Studies on the effect of spacing and date of planting poplar cuttings on plant growth in alluvial soils of Ninevah Plantation, M.Sc. thesis. University of Mosul, IRAQ.*

ABDULLAH, Y.S., 1988. *Principles of silviculture, 2nd edition, University of Mosul, 336 pp.*

ALDHOUS, B.A., 1968. *Maintenance of fertility in Forest nurseries, Forestry Commission research and development paper No. 68, London.*

ARMSON, K. A., 1977. *Forest Soils, Univ. Tor. Press, Toronto, 390 pp.*

CLONARU, a.; S. OCSKAY AND N.M. SAEED, 1975. *Index of poplar, willow and plan clones, provenances and half-sibs grown at the Forest Experiment Station Dibis. IRAQ. IPC. Fifteenth session.*

DAVIDESCU, D. AND DAVIDESCU, 1982. *Evaluation of fertility by plant and soil analysis. Bascus Press. London, 560 pp.*

DICKMANN, D. I. AND K. W. STUART, 1983. *The culture of Poplars in eastern north America. Michigan State University, Michigan, 168 pp.*

DIMITROV, H.M.; DIMITROVA, DENEV AND D. KOLAROV, 1976. *Effect of the resources of Nitrogen, Phosphorus and Potassium in the soil on the growth of saplings of certain poplar clones. Corahestop, Naeuka, 13, No. 3, 34-39 (quoted from Abstr. of Bulg. Science Lite. Series A.*

EINSPAHR, D.W. AND M.K. BENSON, 1968. *Management of aspen on 10-20 year plantation. J. For. 66: 557-560.*

JARRELL, W.M. AND R.B. BEVERLY, 1981. *The dilution effect in plant nutrition studies, Advances in Agronomy. Vol. 34: 197-221 pp.*

JARVIS, J.M., 1968. *Silviculture and management of natural poplar stands. In Growth and Utilization of Poplars in Canada. For. and Rural Dev. For. Branch Dept. No. 1250: 257 pp.*

JOBLING, J. 1960. *Establishment methods for poplars. For. Comm. For. Res. 43. London, 16 pp.*

JOBLING, J. 1981. *Poplar cultivation, Research information note, issued by the Forestry Comm. Res. and Dev. Div. Farnham Surrey, 6 pp.*

JONES, C.H. AND J.W. CURLIN, 1968. *The role of fertilizers in improving the hardwoods of Tennessee Valley in forest fertilization theory and practice. Tenn. Valley Authority Muscle Shoals. Alabama, 306 pp.*

KONDZIOLKA, D. AND M. STREIT, 1988. *Fertilization of hybrid poplar and a coarse-textured site in eastern Ontario, FRDA Brookville Ontario, Canada, FF No. 1-88.*

MAURICE, E. AND JR. DEMERITT, 1983. *Planting and care of hybrid poplar. USDA, Forest Service, Northeastern Forest Exp. Station NE. INF-48.*

NILSON, L. O. AND D. WASIELEWSKI, 1987. *Influence of fertilization in a natural Populus tremula stand, Scand. J. For. Res. 2: 343-348.*

OGAR, G.E. 1981. *Effects of spacing and NK fertilizers on dry matter accumulation and nutrient contents of two-year-old Populus X euramericana. cv. I-45/51 and cv. robusta DN 17, Ph. D. thesis, University of Toronto, Canada, 1981.*

RANDALL, W.K. and R.M. KRINARD, 1977. *First-year growth and survival of long cotton-wood cuttings, USDA, For. Serv. Res. Note SO-222-SO. For. Exp. Stn. New Orleans, LA.*

SAFFORD, L.O. AND M.M. CZAPOWSKYI, 1986. *Fertilizer stimulates growth and mortality in a young Populus-Betula stand: 10-year results, Can. J. For. Res. 16: 807-813 pp.*

SALISBURY, F.B. AND C.W. ROSS, 1979. *Plant physiology. Wadsworth Publ. Co. Inc., Belmont, California, 422 pp.*

TIMMER, V.R. AND E.L. STONE, 1978. *Comparative foliar analysis of young balsam for fertilized with Nitrogen, Phosphorus, Potassium and Lime. Soil Sci. Soc. Am. J. 42: 125-129.*

WIDE, S.A., 1958. *Forest Soils. Their properties and relation to silviculture. The Ronald Press Company, New York, 537 pp.*