

Comparison of Diametric, Height and Volume Growths of *Populus Deltoides* and *Populus Euramericana* in Hydromorphic Soils (Case Study: Safrabasteh - Astane Ashrafieh Area)

Keoma Shafiei Sabet¹, Vahid Hemati Khoshkdasht^{*1}

¹Department of Agriculture, Lahijan Branch, Islamic Azad University, Lahijan, Iran

Received: May 14, 2015

Accepted: August 27, 2015

ABSTRACT

In order to compare the growth of *Populus deltoides* and *Populus euramericana* in Hydromorphic Soils, two areas in Eastern Gilan plains (Safrabasteh - Astane Ashrafieh Area) were selected. In each area, three transects (6 transects in total) with 33m × 20m width were randomly selected. The diameter at base as well as height of all *Populus deltoides* and *Populus euramericana* trees in all transects within each area were measured. Then, mean annual diametric, height, cross-section and volume growths of pine species were calculated per hectare (ha). The results showed that mean annual diametric, height, cross-section and volume growths of *Populus deltoides* were respectively as 27.4 millimeter per hectare, 22.7 centimeter per hectare, 2.9 square meter per hectare annually, 23.5 cubic meters per ha per and mean annual diametric, height, cross-section and volume growths of *Populus euramericana* were respectively as 17 millimeter per hectare annually, 20.74 centimeter per hectare and 1.4 square meter per hectare and 14.9 cubic meter per hectare in hydromorphic soils in Safrabasteh Area.

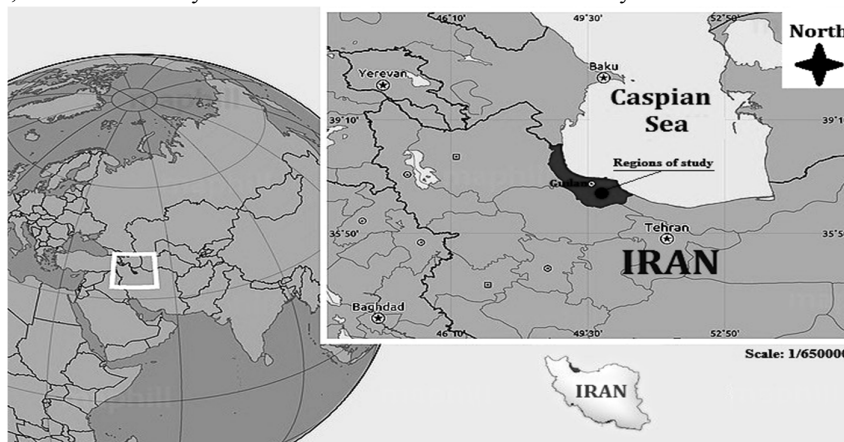
KEY WORDS: growth, *Populus deltoides*, *Populus euramericana*, Hydromorphic Soils

INTRODUCTION

Planting fast-growing trees and wood production are considerably important, especially in areas with potential land use and water resources capabilities. Nowadays, development of pine trees plantation and wood agriculture are pursuit more than ever due to increased production per unit area. Every day, new industries are created to benefit from wood agriculture. For this purpose, production efficiency per unit area should be increased through teaching proper planting and growing techniques to the executives (farmers) and proper dealing with them in relevant areas. Increased wood production and prompt efficiency lead to supply of raw materials in industrial factories and green space development through introduction of improved clones. Further studies should be conducted in the area of increased and continued production of pine planting areas since 20,000 hectares of pine plantations were in northern Iran plains in the past three decades and fast-growing species of pine trees were planted to preserve the pristine forests in Iran. In current circumstances, over 6000 hectares of pine planting areas exist in Gilan, which is the eighth province with the largest pine planting areas in Iran (Gorgi Bahri, 1992). However, considering the serious need for wood-based industries in the province and the emphasis of governmental policies on decreased exploitation of forests, the need to develop pine planting areas is stressed more than ever. As first step, qualitative and quantitative yield results in pine planting areas in the past decade should be studied in different soil profiles in Gilan Province. The present study investigated diametric, height and volume growths of *Populus deltoides* and *Populus euramericana* in hydromorphic soils in Safrabasteh – Astane Ashrafieh Area.

MATERIALS AND METHODS

Safrabasteh is located at 5 km from Northern-Western Astane Ashrafieh in Gilan City near Sefidrood River in Gilan Province at 15 meters above Caspian Sea level with 49° 57' longitude and 37° 19' northern latitude. Mean annual rainfall is 1186 mm, mean annual temperature is 17.5°C (the hottest month: 26.6 °C, the coldest month of the year: 6.8°C), number of rainy days was 108.5, the number of dry months was 3 and the number of frost days was 14.



* Corresponding Author: Vahid Hemati khoshkdasht, Department of Agriculture, Lahijan Branch, Islamic Azad University, Lahijan, Iran. Vahid_hemmaty@yahoo.com

Figure 1: The study area

The plains at Eastern Gilan were visited and two pine planting areas were selected in which *Populus deltoides* and *Populus euramericana* were planted in Safrabasteh Astane Ashrafieh for 17 years. In each area, three transects with 33m × 20m width were randomly designed (Kia Daliri *et al.*, 2004). The soil profiles were described in field. In order to determine some of the physical and chemical properties of soil, 1-kg soil samples were collected from horizons of soil profiles. The samples were transferred to Novin Sajesh Laboratory of Soil, Water and Plant Analysis in Astane Ashrafieh Town. Then, the diameter at base and height of all *Populus deltoides* and *Populus euramericana* species were measured at each transects in every area. Then, mean annual diameter, height, surface area and volume growths of pine species were calculated per unit area (ha). It is worth noting that the two-factor volume table (diameter and height) of the pine trees provided by the Gorgi Bahri (1992) for Safrabasteh Area was used to calculate the volume growth.

RESULTS

Mean diametric growth of *Populus deltoides* and *Populus euramericana* in the study area

The diameter at basal height of all *Populus deltoides* and *Populus euramericana* species in hydromorphic soils were measured in the study area. Then, mean diametric growth of pine trees was calculated. The mean diametric growth at basal height (mm) in both species were compared using non-paired t test, which showed significant difference at 95% confidence level. Thus, mean annual diametric growth of *Populus deltoides* was 27.4 mm per ha while mean annual diametric growth of *Populus euramericana* was 17.4 mm per hectare (Table 1).

Table 1: results of mean analysis of diametric growth of *Populus deltoides* and *Populus euramericana* in Hydromorphic Soils

The studied factor	Degree of freedom	Standard deviation	Standard error	t	Level of significance
Mean diametric growth	9	4.89217	1.54704	-6.723	0.000*

* Significant at 95% confidence level

Mean height growth of *Populus deltoides* and *Populus euramericana* in the study area

The height of all *Populus deltoides* and *Populus euramericana* species were measured in hydromorphic soils in the study area. Mean height growth of pine trees were calculated with respect to age. The mean height growths (cm) were compared in both species using the non-paired t-test, which showed no significant difference at 95% confidence level. Thus, mean annual height growth of *Populus deltoides* was 22.73 cm per hectare while mean annual height growth of *Populus euramericana* was 20.74 cm per hectare (Table 2).

Table 2: results of mean analysis of *Populus deltoides* and *Populus euramericana* in hydromorphic soils

The studied factor	Degree of freedom	Standard deviation	Standard error	t	Level of significance
Mean height growth	9	32.99458	10.43380	0.191	0.853*

* Significant at 95% confidence level

Mean cross-section growth of *Populus deltoides* and *Populus euramericana* in the study area

Mean cross-section growth at base of pine trees were calculated with respect to age in hydromorphic soil in the study area. The mean cross-section growths at base (square meters) in the two species were compared using the non-paired t test, which showed a significant difference at the 95% confidence level. Thus, mean annual cross-section growth at base of *Populus deltoides* was 2.9 square meter per hectare while mean annual cross-section growth at base of *Populus euramericana* was 1.4 square meters per hectare (Table 3).

Table 3: results of mean analysis of cross-section growth at base of *Populus deltoides* and *Populus euramericana* in hydromorphic soils

The studied factor	Degree of freedom	Standard deviation	Standard error	t	Level of significance
Mean cross-section growth at base	9	124.03322	39.22275	-8.898	0.000*

* Significant at 95% confidence level

Mean volume growth of *Populus deltoides* and *Populus euramericana* in the study area

The mean volume growth of pine trees were calculated with respect to age in hydromorphic soil in the study area. The mean volume growths (cubic meters) were compared in the two species using the non-paired t-test, which showed a significant difference at 95% confidence level. Thus, the mean annual volume growth of *Populus deltoides* was 23.5 cubic meters per hectare while mean annual volume growth of *Populus euramericana* was 14.9 cubic meters per hectare (Table 4).

Table 4: results of mean volume growth analysis of *Populus deltoides* and *Populus euramericana* in hydromorphic soil

The studied factor	Degree of freedom	Standard deviation	Standard error	t	Level of significance
Mean volume growth	9	65.84069	20.82066	-2.082	0.037*

* Significant at 95% confidence level

DISCUSSION AND CONCLUSION

The results showed that *Populus deltoides* grow better than such hybrid species as *Populus euramericana* in Safrabasteh at Astane Ashrafiyeh Area under the same environmental conditions. Dickman *et al.* (1983) also reported acidic reaction (pH) of the studied soils between 5.5 and 7.5, which is an optimal pH for growth of pines. In addition, optimal nutritional content of the soil for growth of this species, the drainage and moisture retention capacity were also at acceptable levels. The water table was available to the roots during the growing season, which strengthens the roots of pine trees. The results also showed that pine trees grow properly in clay loam, sandy clay loam with varying nitrogen content at surface areas from 15% to 30%. Berg (1977) claims that *Populus x.euroamericana* grow properly in the coastal plains of Netherlands when the optimum organic nitrogen content exceeds 4%. He showed that delay in growth of *Populus euramericana* is due to unsuitable soil texture, lack of potassium and low pH. In this study, diametric growth was measured between 1.81cm and 2.32cm in hydromorphic soils in Eastern Gilan while diametric growths were measured between 2.2cm and 2.5cm by Sajadi (2000) in plain of Asalem Gilan and Damavandi Kamali (2009) in Gorgan Plain. Diametric growth of pine trees was slightly smaller in the present study compared to what was reported by Sajadi (2000) and Damavandi Kamali (2009). However, no significant difference was observed between height growths. Nevertheless, Groninger (2000) reported 9.3cm height growth of *Populus deltoides* at the same age range in Mississippian plain soils, which is about half the size of height growth of *Populus deltoides* in northern Iran. Overall, it can be concluded that *Populus deltoides* grow better in hydromorphic soils in Safrabasteh Area compared to brown forest soils. Furthermore, annual volume growth of 11-year-old *Populus euramericana* species reached 55 cubic meters per hectare in Turkey with 4 × 4 planting distance. Moreover, annual volume growth of 11-year-old *Populus euramericana* species reached 50 cubic meters per hectare in Italy and Mediterranean northern shores (Norouzi, 2000). Thus, it may be stated that large volume growth (as the one in Italy and Turkey) is not possible in hydromorphic and brown forest soils in plains and abandoned forests at downstream northern regions of the country with 4 × 4 m planting distance and increased utilization period (25 to 20 years) as well as staged thinning (Norouzi, 2000).

REFERENCES

1. Damavandi Kamali, A., 2000, importance of pines and industrial need to fast-growing species in Golestan Province, abstracts of articles in the first seminar on reforestation with fast-growing species in northern part of the country F. Kelarabad, Mazandaran, p. 72
2. Gorgi Bahri, E. 1992. Table of pine volume I-214, Proceedings of forest and grassland Research Institute of Forests and Rangelands, No. 82, pp. 25-32
3. Kiadaliri, Sh, Tabari, M, Sarmadian, F and Ziabari, S. 2004. Effect of soil type on certain quantitative and qualitative properties of *Populus euramericana*, Research and Construction Journal, No. 62, pp. 45-50.
4. Nourouzi, Shaban Ali, 200. Economic analysis of pine planting in Mazandaran Province, abstracts of articles in the first seminar on reforestation with fast-growing species in northern part of the country F. Kelarabad, Mazandaran, p. 72
5. Yousef Sajjadi, Alireza 2000, fast-growing pine species suitable for agroforestry projects, abstracts of articles in the first seminar on reforestation with fast-growing species in northern part of the country F. Kelarabad, Mazandaran, p. 72
6. Burg, J, Vanden. 1977. Growth of the Euramerican Poplar and Nitrogen Content of Soil Organic Matter, Medede Lingen, -Rijk Instituut Voor Onderzoek in de Bos en Landschapsbouw "De Dorschkamp". Unda, No. 166, reprint from *Populier* 14(3): 55-58.
7. Dickmann D. I. and Stuart K. W. 1983. The Culture of Poplar in Eastern North America, Department of Forestry, Michigan State University, East Lansing, Michigan. P.168.
8. Groninger, J. W.; Aust, W. M.; Miva, M. and Stanturf, J. A. 2000. Growth Predictions for tree Species Planted on Marginal Soybean Lands in the Lower Mississippi Valley. *Journal of Soil and Water Conservation*, First quarter, 91-95