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Growth and Survival Response of Potted *Cupressus sempervirens* Seedlings to Different Soils

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Abstract: In February 2001, one-year bareroot cypress (*Cupressus sempervirens* var. *horizontalis*) seedlings were replanted in plastic pot in a lowland nursery located in southern coast of the Caspian Sea (north of Iran). Soils of pots consisted of 1:1 sand:clay (A), pure sand (B), 2:1 sand:clay (C), 1:1:1 sand:clay:organic matter (D), 1:1:2 sand:clay:organic matter (E). In each soil treatment a high value of survival and growth was appeared in July and progressively decreased till November. In each month the seedlings grown on rich soils (D and E) had mostly greater growth and survival than on infertile soils. At the end of the first growing season seedling vitality differed significantly among the soils but did not differed notably in soil A with those in other soils. Survival rate was highest in the rich soils (D and E). Stem length as well as collar diameter performed the least growth on the poor soils (B and C). Like other characteristics measured, survival responded better to soils containing organic matter (D and E). It is concluded that generally characteristics of cypress seedling are suited by adding organic matter to sandy soils. This is while that poor nutrient available soil such as soil A produces a proper growth for cypress seedling, too.

Key words: Cypress (*Cupressus sempervirens* var. *horizontalis*), growth, seedlings, soil, survival

INTRODUCTION

The main objective of each plantation project is to suit the growth and establishment of seedlings. In this regard, good elaboration of inhibiting factors of planting sites and careful understanding of ecological requirements of species are unavoidable (Krasowski and Elder, 2000). In plantations, growth and survival increase and the costs decrease when high-quality seedling is yielded in nursery (Wightman *et al*., 2001). Generally, soil is a determining factor in life cycle of conifer seedlings (Korani, 1991; Sheikh-Khan *et al*., 1980, cited by Shahini, 1996). For example, peat with 70% organic matter, compared to low-fertile soils, produces greater growth for some pines (Schwan, 1994). In medium of sand:clay:sphagnum (1:1:3), *Cupressus sempervirens* shows a better growth after second growing season (Hassan *et al*., 1994). However, some cypress species including Japanese cypress (*Chamaecyparis obtusa*) is grown on low fertility sites, contrary to Japanese cedar (*Cryptomeria japonica*) which grown on the richer sites (Sasaki *et al*., 1994; Yamashita *et al*., 2004).

Generally, few investigations have been reported about the effect of soil on conifers in the north of Iran. *C. sempervirens* is one of the forth-fold native coniferous species in Iran and has a unique role in restoration of the deforested areas, particularly in the Mediterranean climatic zones. Regarding to the importance of seedling production, research on soil type in order to improve the qualitative and quantitative characteristics of this species in nursery is necessary. We hypothesized that the best survival and growth rates of cypress seedling could be obtained in more fertile soils. In addition, poor nutrient available soil could be also an acceptable soil for raising cypress seedling.

MATERIALS AND METHODS

The study site was a lowland nursery located in southern coast of the Caspian Sea (north of Iran), Noor town (36°34′ N and 51°59′ E, -20 m a.s.l.). Mean annual precipitation was 1100 mm, mean annual temperature and mean max. temperature of the warmest month were 16.4 and 30°C, respectively. Dry days (xerothermique index)

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Table 1: Discoloration degree of *C. sempervirens* seedlings, based on UN/ECE and UE (Anonymous, 1998)

Foliage discolored	Discoloration degree	Vitality grade
Up to 10%	None	4
10-25%	Slight	3
25-60%	Moderate	2
>60%	Severe	1

of the year were determined 55 days. Based on Emberger (1932) classification, climate of the study site, with Q_2 = 143.6 (index of precipitation and temperature) and m = 3.7°C (Mean minimum temperature of the coldest month) is moist with mild winters.

In February 2001, some 1-year bareroot *Cupressus* seedlings in 30 (±2.5) cm length and 4 (±0.4) mm collar diameter produced in a preliminary investigation were replanted in plastic pots of 20×20×40 cm. Soil in pots consisted of 1:1 sand:clay (A), pure sand (B), 2:1 sand:clay (C), 1:1:1 sand:clay:organic matter (D), 1:1:2 sand:clay:organic matter (E). The research was conducted for one year. Only one weeding (in June) but no irrigation was made during the study period.

Collar diameter and stem length were measured at intervals of two months (late March to late November). Vitality quality (foliage coloration) of needles, according to UN/ECE and UE (Anonymous, 1998) classification (Table 1), was recorded in late August. Seedlings were counted every two months and survival rate determined in late November.

The experiment of design was as randomized complete design, with three replicates of 28 units (seedlings) for each medium. For comparison of means a Tukey-HSD test was analyzed among five soil treatments. Statistical analyses were performed using the SAS software. The p-value was set at 0.05 of probability level.

RESULTS

Survival: Measurements showed that in beginning of the first growing season (March) all seedlings replanted in February were alive. A high survivorship for all treatments appeared in July but gradually declined till November. In each month the seedlings growing on rich soils (D and E) had higher survival rate when compared with those on infertile soils (Fig. 1). By comparing means, it was also revealed that at the end of the first growing season, pure sand (B) and sandy-clay (C) soils remained the poorest survivorship for seedlings (Table 2). Survival in soil (A) was not significantly different with those in soils B, C and D. Indeed, the highest survival rates (90.5 and 85.7%) were occurred in soils E and D, respectively.

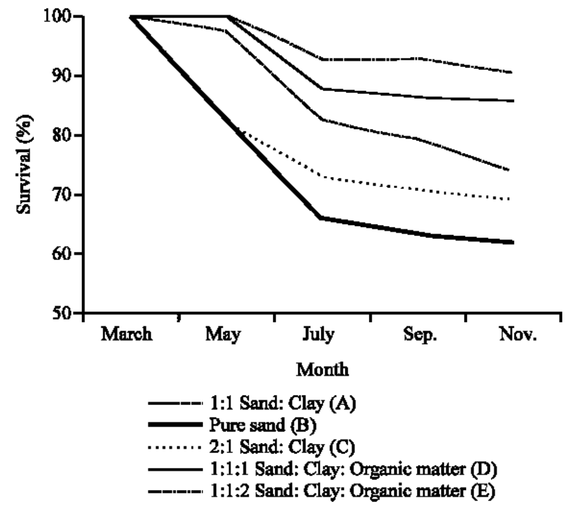

Fig. 1: Survival (%) of *C. sempervirens* seedlings at different soils, occurred in different months of the 1st growing season

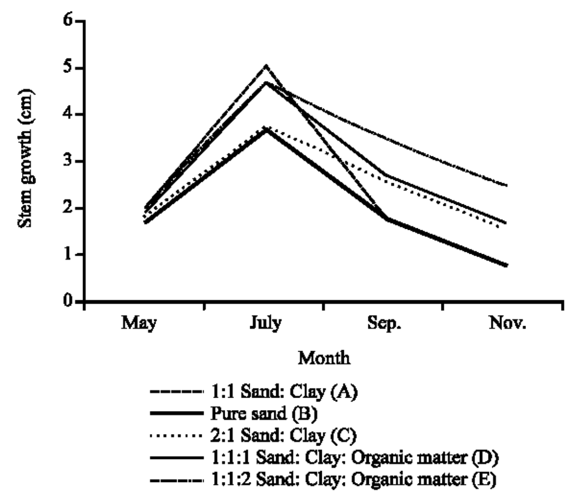

Fig. 2: Stem growth (cm) of *C. sempervirens* seedlings at different soil types, occurred in different months of the 1st growing season

Growth and vitality: At the end of the first growing season, stem growth on each soil reached to its maximum in late July and appeared with a decreasing trend till November (Fig. 2). Stem length was the least in soils B and C (Table 2). No substantial difference of stem length could be found in soils D and E, such as in soils D and A. In general, this term was greater on soil E than on soil A. Like stem growth, collar diameter growth rose in late July and dropped by the end of the period (Fig. 3). Collar diameter was greatest in nutrient available supplies (D and E). Compared with soil B, soil A produced a bigger

Table 2: Average values of *C. sempervirens* seedlings in different soil occurred in months of the 1st growing season

Soil type	Survival (%)	Stem length (cm)	Collar diameter (mm)	Vitality quality (grade)
1:1 Sand:Clay (A)	73.8±10.7bc	47.0±3.3b	6.4±0.6b	1.6±0.5ab
Pure sand (B)	61.9±11.5c	41.3±1.8c	5.6±0.1c	0.9±0.6b
2:1 Sand:Clay (C)	69.0±10.8c	42.8±2.2c	5.9±0.4bc	1.4±0.5b
1:1:1 Sand:Clay:Organic matter (D)	85.7±9.0ab	49.6±4.0ab	7.3±0.6a	2.2±0.7a
1:1:2 Sand:Clay:Organic matter (E)	90.5±7.4a	52.5±2.4a	7.6±0.5a	2.4±0.5a

-Within columns, values followed by different letter(s) are significantly different at $p \leq 0.05$

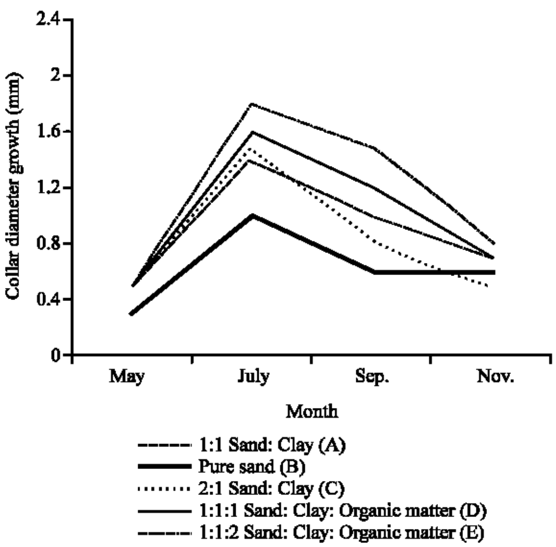

Fig. 3: Collar diameter growth (mm) of *C. sempervirens* seedlings at different soil, occurred in different months of the 1st growing season

collar diameter. No significant difference of this term could be detected between soil B and soil C (Table 2). Vitality quality (foliage coloration) seemed to be of better status in rich soils (D and E) than in poor soils (B and C). Soil A exhibited an intermediate vitality grade from this viewpoint (Table 2).

DISCUSSION

By the current study it appears that at the end of the study period, stem length as well as collar diameter is smallest on high sand soils (B and C). This is in agreement with findings of Tabari *et al.* (2005), who present that in 1-year-old (1+0) *C. sempervirens* seedling shoot growth advances when sand added to sandy-clay substrate. In the current research, the same as findings of Parde (1952, cited by Rezaei, 1992) and Hassan *et al.* (1994), it is revealed that in *Cupressus* seedling low growth is observed on infertile and sandy soils and high growth on rich soils. Accordingly, Sheikh-Khan (1980, cited by Shahini, 1996) confirms the positive role of NPK on increase of growth and Korani (1991, on *Pinus taeda*) reports the increased growth on high-nutritional soils. It should be also cited that other genus of cypress (*Chamaecyparis obtuse*) can be found on low fertility sites where the N availability is low (Yamashita *et al.*, 2004). Generally, it has been accepted that among the nutrient elements, nitrogen (N) is one of the most important nutrients in regulating the forest productivity on many sites (Reich *et al.*, 1997) and its interaction with soil water may be an important factor of higher productivity (Enoki *et al.*, 1996).

In the present research survival, as well as foliage coloration (vitality quality), is not substantially different in soil A with those in soils B and C. However, on poor soils (B and C) seedlings represent lower survivorship and foliage coloration than on fertile soils (D and E). On soil A, both characteristics play an intermediate role.

Generally, as appeared in this investigation, all parameters poorly responded to poor soils (B and C). Indeed, these characteristics, particularly growth, are often of more suitable conditions on rich soils (D and E). This implies that nutrient available soils are more favorable than sandy soils to grow *C. sempervirens* seedling. However, regarding to the similar effects of nutrient available soils (D and E) on seedling characteristics measured, employment of soil D is preferable and more economic, due to the lower proportion of organic matter. Alternatively, infertile soil of A can be suited for this purpose, too.

The results obtained from this study are valid for this specific site and may not be generalized due to lake of replicated periods or sites. However, it can be also suggested that additional investigations to be made to present the results in other sites and in following periods.

REFERENCES

Anonymous, 1998. Forest Condition in Europe Countries. Results of the 1997 Crown Condition Survey. Technical Report Prepared by Federal Research Center for Forestry and Forest Products, pp: 140.

Emberger, L., 1932. Sur une formule climatique et ses applications en botanique. La Meteorologie, No. 92-93, Paris, France.

Enoki, T., H. Kawaguchi and G. Iwatsubo, 1996. Topographic variations of soil properties and stand structure in a Pinus thunbergii plantation. Ecol. Res., 11: 299-309.

Hassan, H.A., S.M. Mohamed, E.M. Abo-El-Ghaite and H.H. Hammed, 1994. Physiological studies on *Cupressus sempervirens* L. Seedling in response to growing media. Ann. Agric. Sci. Moshtohor, Egypt, 1: 497-509.

Korani, M., 1991. The results of *Pinus taeda* growth at different soil compounds. Shafarood Forest Service, Forest and Range Organization of Iran, Bulletin, pp: 110-114.

Krasowski, M.J. and R.J.F. Elder, 2000. Opportunities for improvements to reforestation success. Extension note 43. Ministry of Forest Research Program.

Reich, P.B., D.F. Grigal, J.D. Aber and S.T. Gower, 1997. Nitrogen mineralization and productivity in 50 hardwood and conifer stands on diverse soils. Ecology, 78: 335-347.

Rezaei, A., 1992. Ecological study of natural stands of *Cupressus sempervirens* in north of Iran, M.Sc. Thesis, Gorgan University, Iran, pp: 220.

Sasaki, S., H. Yagi, K. Ohba, S. Asakawa, A. Harada, T. Fujimori, T. Andoh and T. Maeda, 1994. Zouringaku (Silviculture). Kawashima Shoten, Tokyo, pp: 240 (In Japanese).

Schwan, T., 1994. Planting depth and its influence on survival and growth. A literature review with emphasis on jack pine, black spruce and white spruce. Tech. Rep. TR-01.

Shahini, G.H., 1996. Seedling production with composts of Azola and left-over plants, M.Sc. Thesis, Tarbiat Modarres University, Iran, pp: 153.

Tabari, M., M.R. Poormajidian and A.R. Alizadeh, 2005. Effect of soil, irrigation and weeding on survival and growth of *Cupressus sempervirens*. Pajouhesh-va-Sazandegi, pp: 70.

Wightman, K.E., T. Shear, B. Goldfarb and J. Haggar, 2001. Nursery and field establishment techniques to improve seedling growth of three Costa Rican hardwoods. New Forests, 22: 75-96.

Yamashita, T., N. Kasuyab, S. Nishimurac, H. Takedad, 2004. Comparison of two coniferous plantations in central Japan with respect to forest productivity, growth phenology and soil nitrogen dynamics. Forest Ecol. Manage., 200: 215-226.