African Journal of Plant Science Vol. 6(4), pp. 140-149, 27 February, 2012
Available online at http://www.academicjournals.org/AJPS
DOI: 10.5897/AJPS11.291
ISSN 1996-0824 ©2012 Academic Journals

Full Length Research Paper

Effects of soil nutritional status on seedling nursery performance of Arizona cypress (*Cupressus arizonica* var arizonica Greene) and Medite cypress (*Cupressus sempervirens* var. horizantalis (Mill.) Gord)

Fatemeh Ahmadloo[1]*, Masoud Tabari[1], Hamed Yousefzadeh[1], Yahya Kooch[1] and Ahmad Rahmani[2]

[1]Faculty of Natural Resources, Tarbiat Modares University, Tehran, Iran.
[2]Research Institute of Forest and Rangelands, Iran.

Accepted 11 January, 2012

The present research was carried out to determine the influence of different combinations of organic matter as growing media on seed germination, survival, growth, biomass and performance of needle-leaved Arizona cypress (*Cupressus arizonica* var arizonica Greene) and Medite cypress (*C. sempervirens* var. horizantalis (Mill.) Gord) seedlings in Koloudeh nursery, located in Amol city (North of Iran). Seeds were sown in plastic pots as randomized completely block design (RCBD) with four replications at four different soil treatments, including: T1) nursery common soil (control), T2) control soil: cattle manure (5:1), T3) control soil: decomposed litter (5:1), T4) control soil: cattle manure: decomposed litter (5:1:1). The results after one year showed that seedlings of both species grown on T4 obtained better germination percent, survival, shoot height, collar diameter, seedling vigor index and Quality Index (QI). Greatest relative growth rate (RGR) of height and diameter were achieved on organic matter treatments. In most of the studied attributes, response of *C. arizonica* was better than *C. sempervirens*, showing the different biological requirements of these species. From the study, it is concluded that the increased of soil nutrient can be useful in seedling production of both species.

Key words: Biomass, *Cupressus arizonica*, *Cupressus sempervirens*, organic matter, quality index, vigor index.

INTRODUCTION

In recent years the increasingly problems of forests degradation has influenced the researchers and managers to prevent the decrease of these valuable resources. One of the important solutions for restoration of the degraded areas is suitable seedling production in forest nurseries (Koneshlo, 2001). In the other hands, the use of poor planting stock can reduce plantation survival and growth, increase site maintenance costs, and reduce confidence in reforestation (Oliet et al., 2009). Some factors highly affect the quantitative and qualitative production of seedlings in nurseries. The physico-chemical characters of soil - media are the most important effective parameters (Teng and Timmer, 1996; Tabari et al., 2007). Chemical fertilizers are useful for improvement of nutrition contents, soil texture, and plant tissue and higher yield production (Shan et al., 2001; Will et al., 2002). However, due to the environmental limitations and decrease of soil fertility in long term and also economic benefit, organic matter is a better alternative (Malakouti and Homaei, 2004).

In this manner, organic matter with moisture, temperature, respiration and enzymes activity increase influence on seed germination and seedling growth. Seed germination represents an important initial phase in the life cycle of plants (Iqbal et al., 2007). In recent studies, combinations of types of soil in different ratios of nutrient have been evaluated for influencing the seed germination of important forest species (Jos´e Broncano et al., 1998;

*Corresponding author. E-mail: masoudtabari@yahoo.com.

Selivanovskaya and Latypova, 2006). The role of soil status on seed germination and subsequent growth of Deodar cedar (*Cedrus deodara* (Roxb.) G. Don f.) and Blue Pine (*P. wallichiana* A. B. Jacks.) under nursery conditions has been reported by Durgapal et al. (2002). In study combinations of mixtures of growing media (pine bark, sphagnum peat and paper mill sludge with sewage sludge, sewage activated sludge, municipal solid waste and inorganic fertilizer) on maritime pine tree production in a forestry nursery, Mañas et al. (2009) showed that the highest values for germination percentage of maritime pine (*P.pinaster* Ait.) were obtained for 75% pine bark + fertilizer and for sewage sludge treatments. Also the best physical parameter values were obtained in seedlings grown in paper mill sludge + activated sewage sludge + peat and in paper mill sludge + activated sewage sludge + pine bark mixtures.

Also, there are many studies to indicate the effect of organic matter on increase soil fertility (Martinez et al., 2003), survival and growth (Larchevêque et al., 2006; Tabari et al., 2006), biomass (Moreno-Peñaranda et al., 2004) and seedling quality (Mañas et al., 2009). Larchevêque et al. (2006) by using three rates of fresh co-composted sewage sludge and green wastes (control without compost, 20 and 40 kgm−2 of compost) on one-year-tree seedlings of native species Holm Oak (*Quercus ilex L.*), Aleppo pine (*P. halepensis* Mill.) and stone pine (*P. pinea L.*) explained that the compost improved survival of *Q. ilex* and *P. pinea* seedlings, but had no effect on *P. halepensis* and for all species seedling length and radial growth were increased for both rates of amendment. Also, Nourshad and Ghorani (1990) reported that a better treatment for diameter and height growth of loblolly pine (*Pinus taeda L.*) and slash pine (*Pinus elliottii* Engelm.) is perlit, tea wastes, decomposition manure, loam soil and forest decomposed litter (1:1:1:2:1), and for *P. pinea* tea wastes, manure and forest decomposed litter. Proper treatments were found by different researchers such as: a substrate containing 50% woody material and supplemented with organic fertilizer (Vaario et al., 2009) and combination of pine bark and sewage sludge for growing *P. pinea*, Arizona Cypress (*C. arizonica* var arizonica Greene) and norway spruce (*Picea abies* (L.) Karst.) (Guerrero et al., 2002). According to Kiani (2005) findings, there was an increase in root and shoot dry weight of potted and bare rooted *P. taeda* seedlings where substrate was shared as soil, sand, decomposed manure (1:4:2). Jacobs et al. (2005) in studying on outplantings of black walnut (*Juglans nigra* L.), white ash (*Fraxinus americana* L.), and yellow - poplar (*Liriodendron tulipifera* L.) found out that 60 g release fertilizer accelerated the height and diameter growths of seedlings using of 52 and 33% in year 1 and also 17 and 21% in year 2, respectively. Findings O´ Skarsson et al. (2006) indicated that fertilizer application during two years improved survival of Betula pubescens (*Betula pube*scens Ehrh.), Siberian Larch (*Larix sibirica* Ledeb.) and Sitka Spruce (*Picea sitchensis* (Bong.) Carr.) and increased annual height 7 and 15 times for White Birch (*Betula alba* L.) and *L. sibirica*, respectively. Also, enhanced nutrient availability improves relative growth rate, (RGR) due to larger allocation of biomass to foliage and shoot (Portsmuth and Niinemets 2006). Root length/shoot height ratio (RL/SH) and sturdiness quotient (SQ) are important measurements for seedling survival and predict seedling performance (Mañas et al., 2009). Finally, the Dickson quality index (QI) integrates the aspects of total plant mass, the Sturdiness quotient and (RL/SH) ratio. The QI explains plant potential for survival and growth in the field. High index values are better (Olivo and Buduba 2006).

In the experimental nursery (Koloudeh, located in Amol, Mazandaran province, north of Iran), deficiency in nutrient and organic matter of soil is a problem for seedling production (Rahmani et al., 2006). On the other hand, the seedling morphological characteristics before planting highly affect the seedling growth during the first years after out planting (Tsakaldimi, 2006). Based on the aforementioned, present research plans to remove aforementioned problems by adding the different combinations of organic matter in soil - media and to evaluating effect of soil on germination, survival, growth indices and seedlings performance in *C. arizonica* and Medite cypress (*C.sempervirens* var. horizantalis (Mill.) Gord) species having a widespread application in plantations and city green areas and also determining of the most suitable organic matter composition with soil and so the best species in reply to different treatments study.

MATERIALS AND METHODS

Study area

The study was carried out in Koloudeh nursery, located in a distance of 10 k far from Amol city, Mazandaran province, Iran (52° 17′ E, 36° 34′ N, 6 m a.s.l). The annual average precipitation is 830 mm, the annual average minimum temperature 6.6°C and the annual average maximum temperature 27.2°C.

Research method

Seeds of Arizona cypress (*C. arizonica* var arizonica greene) and Medite cypress (*C.sempervirens* var. horizantalis (Mill.) Gord) species with equally in size and weight were supplied from the Caspian Forests Seed Center in Mazandaran, Amol. The characteristics of seeds are shown in Table 1. Viability percentage of seed lot was determined using the tetrazolium chloride (TZ) staining technique. Moisture content of the seeds was specified based on three replicate samples of approximately 10 g seeds per lot by drying seed at 103±2°C for 17±1 h. As a measure of the cleanness of seed, pure seed was separated from impure seed and separately weighed and purity percentage obtained. To determine the number of seeds per unit weight, two or more random samples are taken from the seedlot. Four different soil treatments were supplied (Table 2). The design was set up as completely randomized block design (CRBD) with four replications for each treatment and with 20 polybags (15 × 15 × 20 cm) for each

Table 1. The characteristics of seeds.

Species	Seed provenance	Latitude	Longitude	Mean precipitation (mm)	Viability (%)	Purity (%)	Moisture (%)	Number (per Kg)
C. arizonica	Gorgan, Iran	36° 41´ N	54° 20´ E	649	26	87	13.5	128700
C. sempervirens	Gorgan, Iran	36° 41´ N	54° 20´ E	649	33	97	13.1	145306

Table 2. Soil component bulk ratio used in the experiment.

Treatment	Loam soil	Sand	Bran	Cattle manure	Decomposed litter
Nursery soil (control) (T1)	3	1	1	-	-
Control soil: cattle manure (T2)	3	1	1	1	-
Control soil: decomposed litter (T3)	3	1	1	-	1
Control soil: cattle manure: decomposed litter (T4)	3	1	1	1	1

Table 3. Chemical characteristics mean of soil treatments, cattle decomposed manure and forest decomposed litter.

Treatment	T1	T2	T3	T4	Cattle decomposed manure	Forest decomposed litter
C (%)	2.28	3.84	2.64	5.16	4.44	5.88
Organic matter (%)	3.92	6.6	4.54	8.88	7.64	10.11
N (%)	0.04	0.13	0.08	0.23	0.94	0.75
C/N	64.33	28.65	31.52	22.73	4.72	7.89
EC (dS/m)	0.19	0.27	0.26	0.22	0.22	0.24
K (mg/kg)	27.5	76	44	90.5	87.8	78
Ca (mg/kg)	35.35	36.15	39.52	49.5	57.05	45.7
Mg (mg/kg)	29	42	32	39.7	48.3	50
P (mg/kg)	11.76	14.7	25.2	50.4	26.1	23.2
pH	8.28	8.08	8.01	7.97	7.30	7.58

(T1): Nursery soil (control), (T2): Control soil: cattle manure, (T3): Control soil: decomposed litter, (T4): Control soil: cattle manure: decomposed litter.

replication and a total of 320 polybags for each one of species.

Ten seeds were sown in a polybag on March 21 (2007) with regarding to viability. Analysis of soil treatments with four replications (Table 3) were carried out at the laboratory of Tarbiat Modares University, College of Natural Resources, Noor, Iran. Seeds were dusted with fungicide (Thiram, 0.002). Seed germination began in the first of April in both of species in all the soil treatments. Germination was recorded every 3 days for 37 days. Visible radical growth was used to define germination. Germination percent was determined by using Equation 1.

$$\text{Germination} = \frac{\text{Number of germinating seeds}}{\text{Number of seeds initiated}} \times 100 \qquad (1)$$

After completion of field germination only one seedling (best one) per polybag was maintained to record the initial growth parameters. Proper cares, including artificial watering, weed removal each 10 day (manual), and root pruning of seedlings (twice during the growth period) were carried out regularly.

Along the seed germination and seedling growth, fungicides were applied to soil disinfectant. Growth parameters (height and collar diameter) were measured four times (September, November, January and March). Shoot height (H) (stem) and root diameter (D) were calculated with accuracy of 0.1 cm and 0.1 mm, respectively (Iqbal et al., 2007) and (R/S) and (SQ) (Equation 2) was assessed based on Thompson (1985). The relative growth rate of height, (RGR_H, mm cm^{-1} d^{-1}) and relative growth rate of diameter, (RGR_D, µm mm^{-1} d^{-1}) was calculated by using equations 3 and 4 according to Ostos et al. (2008).

$$SQ = \frac{H}{D} \qquad (2)$$

$$RGR = \frac{LnH_2 - LnH_1}{t_2 - t_1} \qquad (3)$$

$$RGR = \frac{LnD_2 - LnD_1}{t_2 - t_1} \qquad (4)$$

Where H_2 and H_1 are seedlings height (cm) in last and first measurement, respectively; D_2 and D_1 diameter (mm) in last and first measurement, respectively; $t_2 - t_1$ (days) are last and first sampling dates, respectively and Ln is natural logarithm. Twelve

Table 4. Correlation coefficients of Pearson (r) between nutrient content of soil with seed germination and seedling characteristics of *C. arizonica* and C. *sempervirens* seedlings.

Parameter	*C. arizonica*					*C. sempervirens*				
	N (%)	P	K	Ca	Mg	N (%)	P	K	Ca	Mg
		Concentration (mg/kg)					Concentration (mg/kg)			
Germination (%)	0.674**	0.605*	0.585*	0.158ns	0.48ns	0.691**	0.615*	0.391ns	0.124ns	0.365ns
Survival (%)	0.712**	0.502*	0.748**	0.178ns	0.534*	0.595*	0.65**	0.581*	0.264ns	0.458ns
Shoot height (SH) (cm)	0.617*	0.667**	0.619*	0.294ns	0.29ns	0.649**	0.671**	0.556*	0.189ns	0.497ns
Diameter (D) (mm)	0.782**	0.557*	0.825**	0.252ns	0.522*	0.812**	0.658**	0.764**	0.179ns	0.692**
Root length (RL) (cm)	0.08ns	0.19ns	0.057ns	0.045ns	-.017ns	0.222ns	-.079ns	0.308ns	0.011ns	0.245ns
Vigor Index	0.67**	0.725**	0.609*	0.301ns	0.402ns	0.792**	0.623**	0.747**	0.136ns	0.688ns
S, shoot dry weight (g)	0.767**	0.717**	0.774**	0.32ns	0.467ns	0.544*	0.62*	0.512*	0.369ns	0.309ns
R, root dry weight (g)	0.728**	0.678**	0.738**	0.252ns	0.491ns	0.54*	0.484ns	0.565*	0.472ns	0.185ns
Quality index (QI)	0.832**	0.69**	0.854**	0.281ns	0.582*	0.661**	0.569*	0.68**	0.477ns	0.334ns
Seedling dry biomass increment (%)	0.671**	0.5*	0.717**	0.132ns	0.417ns	0.275ns	0.383ns	0.292ns	0.011ns	0.256ns

*Significant at the 0.05 level; ** Correlation is significant at the 0.01 level; ns: non significant.

months after seed sowing, three seedlings were randomly chosen in each combination of treatment (species-soil). After separating root system and shoot (stem + needle), seedlings were put in oven and dried at 70°C for 48 h and then weighed (Cobb et al., 2008). Survival rate following the seedlings counting was determined in March 2008. Seedling quality index (QI) (Dickson et al., 1960), vigor index and total dry biomass increment (%) (Dhindwal et al., 1991; Iqbal et al., 2007) were calculated by using formula 5, 6 and 7, as follows:

$$\text{The seedling quality index (QI)} = \frac{\text{Total seedling dry weight}}{[\text{height (cm) /diameter (mm) + shoot dry weight (g) / root dry weight (g)}]} \quad (5)$$

$$\text{Vigor index} = \text{Germination (\%)} \times \text{Seedling total length} \quad (6)$$

$$\text{Total dry biomass increment (\%)} = \frac{\text{Total dry weight of the treatment} - \text{Total dry weight of the control treatment}}{\text{Total dry weight of the control treatment}} \times 100 \quad (7)$$

The total nitrogen soil was estimated using the Micro-Kjeldhal method (Zarinkafsh, 1993). The total phosphorous soil was determined by Vanado-Molybdate phosphoric yellow colorimetric procedure. Potassium, calcium and magnesium soil were determined using an atomic absorption spectrophotometer after wet digestion of a 1 g sample with triple acid mixture (10 ml of HNO_3, 4 ml of $HClO_4$, and 1 ml of HCl) (Zarinkafsh, 1993) .

Data analysis

Data were statistically analyzed using SPSS software program (Ver.15 for Windows). Distribution was tested for normality by Kolmogorov - Smirnov, and homogeneity of variances tested by Levene test. One - Way - ANOVA was used to determination the effect of soil treatments on germination, survival, growth indices and biomass. Wherever the treatment effect was significant, Duncan multiple range test (p = 0.05) was carried out to compare the means. Growth indices as well as biomass of seedlings between two species in the same soil treatment were analyzed by t-test. Pearson correlation was conducted for finding the relationship between determined indices in *C. arizonica* and *C. sempervirens* seedlings.

RESULTS

Relationship between parameters

Generally, there was a positive significant correlation among elements concentrations of N, P and K with all determined growth indices except root length. The same correlation was between Mg and diameter and quality index (QI) of Arizona cypress (*C. arizonica* var arizonica Greene) seedlings (Table 4). The significant correlation was found among elements concentrations of N and K with all determined indices except root length and seedling dry biomass increment (%) of Medite Cypress(*C. sempervirens* var. horizantalis (Mill.) Gord) seedlings. There was no significant correlation between P

Table 5. Analysis of variance for effect of soil treatment on germination, survival and growth indices of *C. arizonica* and *C. sempervirens* seedlings.

Parameter	*C. arizonica*		*C. sempervirens*	
	F	P-value	F	P-value
Germination (%)	7.181	0.005*	24.214	0.000*
Survival (%)	15.27	0.000*	6.823	0.006*
Shoot height (SH) (cm)	4.62	0.023*	5.48	0.013*
Diameter (D) (mm)	25.50	0.000*	38.95	0.000*
Root length (RL) (cm)	0.07	0.975^{ns}	0.73	0.549^{ns}
Length total seedling (cm)	1.53	0.257^{ns}	12.27	0.001*
SQ	0.20	0.895^{ns}	0.51	0.678^{ns}
RL/SH	1.93	0.177^{ns}	1.59	0.242^{ns}
Vigor index	4.83	0.02*	24.41	0.000*

* Signifiant différences ($P < 0.05$) (^{ns}): Non signifiant différences ($p > 0.05$).

Table 6. Germination, survival and growth traits and vigor index of one-year old potted seedlings of both species produced in four growing soil media.

Parameter	*C. arizonica*				*C. sempervirens*			
	(T1)	(T2)	(T3)	(T4)	(T1)	(T2)	(T3)	(T4)
Germination (%)	19.13 (1.2)^{b}	21.88 (0.55)^{a}	22.88 (0.55)^{a}	24(0.61)^{a}	22.25 (1.03)^{c}	28.38 (0.69)^{b}	29.75 (0.25)^{ab}	31.13 (0.97)^{a}
Survival (%)	79.38(2.2)^{b}	92.5(1.33)^{a}	91.25(1.25)^{a}	93.75(0.81)^{a}	79.38(1.75)^{b}	91.25(1.25)^{a}	91.25(0.81)^{a}	94.38(1.13)^{a}
Shoot height (SH) cm)	17.91(2.46)^{b}	28.35(2.18)^{a}	27.5(0.94)^{a}	30.51(3.91)^{a}	16.71(1.6)^{b}	21.53(2.51)^{ab}	23.74(1.87)^{a}	27(1.11)^{a}
Diameter (D) (mm)	3.06(0.18)^{b}	4.59(0.18)^{a}	4.34(0.17)^{a}	4.82(0.12)^{a}	3.04(0.08)^{c}	4.41(0.16)^{b}	4.52(0.08)^{b}	4.93(0.18)^{a}
Root length (RL) (cm)	21.07(4.49)	20.4(2.56)	20.21(3.71)	22.17(1.98)	23.46(3)	27.7(2.04)	25.41(0.99)	25.68(1.38)
Length total seedling (cm)	38.98(4.56)	48.74(4.35)	47.71(3.71)	52.68(5.8)	40.16(1.64)	49.2(1.77)	49.15(1.67)	52.68(0.83)
SQ	5.81(0.51)	6.24(0.63)	6.37(0.39)	6.29(0.7)	5.46(0.39)	4.86(0.45)	5.28(0.5)	5.48(0.17)
RL/SH	1.25(0.34)	0.72(0.06)	0.74(0.14)	0.74(0.05)	1.49(0.3)	1.35(0.19)	1.09(0.1)	0.96(0.08)
Vigor index	744.53(96.6)^{b}	1060.95(74.76)^{a}	1086.07(60.84)^{a}	1263.39(141.12)^{a}	890.36(34.2)^{c}	1399.68(84.39)^{b}	1463.06 (59.03)^{ab}	1641.38 (72.35)^{a}

Values in parenthesis are standard error.Within the same column the means followed by different letters are statistically different ($P < 0.05$), according to Duncan test. (T1): Nursery soil (control), (T2): Control soil: cattle manure, (T3): Control soil: decomposed litter, (T4): Control soil: cattle manure: decomposed litter.

with root length, root dry weight and seedling dry biomass increment (%). Also Mg element was only correlated with diameter. Element Ca was not significantly correlated with all indices under study in both species (Table 4).

Germination, survival and growth parameters

Both species significantly ($p<0.05$) varied in germination, survival, shoot height (SH) (cm), diameter (D) (mm) and vigor index in different soil treatments (Table 5). Generally, most of these characters had greater rate in soils consisting organic matter (Table 6). Furthermore, relative growth rates (RGR) of height and diameter showed decreasing process in during time for each soil

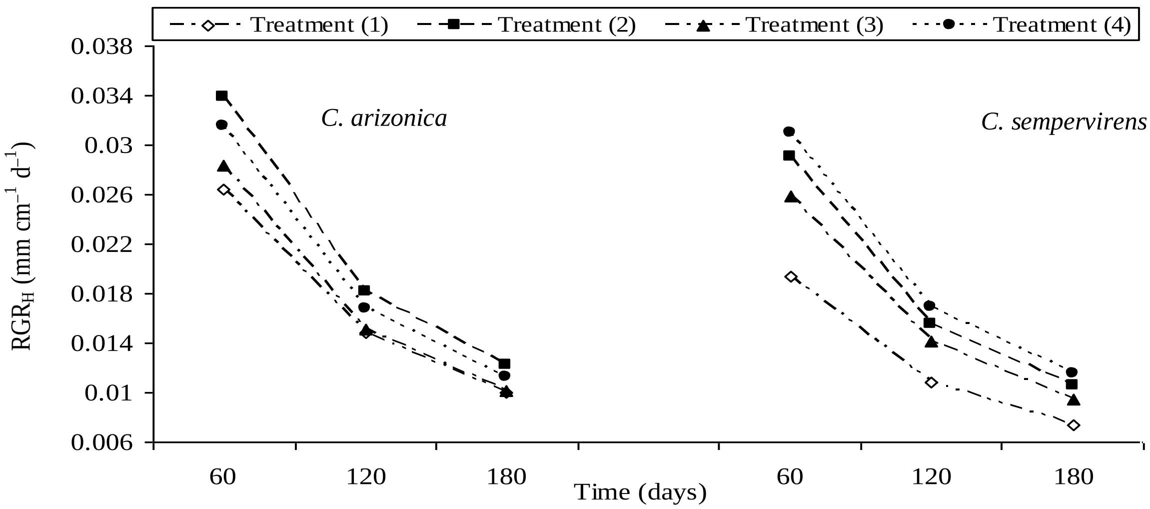

Figure 1. Relative growth rate of height, (RGR_H, mm cm^{-1} d^{-1}) for investigated species in different growing media.

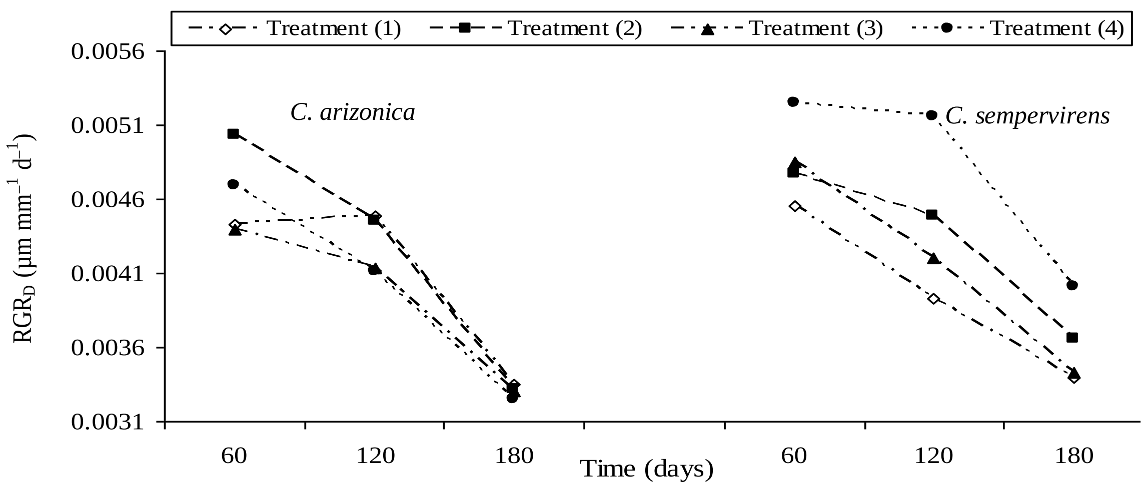

Figure 2. Relative growth rate of diameter, (RGR_D, µm mm^{-1} d^{-1}) for investigated species in different growing media.

treatment. The greatest RGR_H in each measurement time belonged to 2 and 4 treatments in both species and the lowest amount was observed in control treatment (Figure 1). The greatest RGR_D allocated to *C. sempervirens* species in control treatment but it declined duration time (Figure 2).

Biomass parameters

Soil treatment affected *S*, shoot dry weight (g), R, root dry weight (g), total dry weight (g), R/S and Quality Index (QI) of *C. arizonica* and quality index (QI) of *C. sempervirens* (Table 7). Whereas most of parameters in *C. arizonica* had the highest values on soil treatment 4 and the lowest values on soil control (Table 8). In *C. sempervirens* increase of organic matter raised the Quality index (QI).

DISCUSSION

In this study, high correlation was observed among some nutritional elements as N and P in both species with seed germination and followed improvement growth indices. Similar instances were also found by Durgapal et al. (2002) whereas combination of soil organic matter improved the seed germination and subsequent growth of Cedrus deodara (*Cedrus deodara* (Roxb.) G. Don f.) and Blue Pine (*P. wallichiana* A. B. Jacks.) under nursery conditions.

On the other hand, one of the early events during seed germination is mobilization of seed reserves due to enzymes activity because it supplies substrates for functioning of different metabolic processes, including respiration and various anabolic pathways, which are essential for growth of embryonic axes (Bishnoi et al.,

Table 7. Analysis of variance affected by soil treatment for biomass parameters in *C. arizonica* and *C. sempervirens* seedlings.

Seedlings	Variance	*S*, shoot dry weight (g)	R, root dry weight (g)	Total dry weight (g)	R/S	Quality index (QI)	Total dry biomass increment (%)
C. arizonica	F	8.12	6.84	7.86	3.56	17.66	4.62
	p-value	0.003*	0.006*	0.004*	0.047*	0.000*	0.023*
C. sempervirens	F	2.78	2.89	3.42	0.15	5.68	0.64
	p-value	0.086ns	0.079ns	0.052ns	0.926ns	0.012*	0.600ns

* Signifiant ($p < 0.05$); (ns): Non signifiant.

Table 8. Biomass traits in one-year old potted *C. arizonica* and *C.sempervirens* seedlings produced in four growing soil media.

Parameter	*C. arizonica*				*C. sempervirens*			
	(T1)	(T2)	(T3)	(T4)	(T1)	(T2)	(T3)	(T4)
S, shoot dry weight (g)	1.51(0.27)c	5.32 (0.74)ab	4.1(0.47)b	6.34 (1.14)a	1.57 (0.36)	2.36 (0.58)	2.57 (0.35)	3.17(0.2)
R, root dry weight (g)	0.63(0.12)b	1.89(0.26)a	1.46(0.18)a	2.07(0.35)a	0.78 (0.16)	1.25 (0.19)	1.31(0.22)	1.59(0.21)
Total dry weight (g)	2.13(0.39)b	7.21(1)a	5.54(0.64)a	8.41(1.49)a	2.35 (0.48)	3.61 (0.75)	3.89(0.48)	4.76(0.37)
R/S	0.41(0.03)a	0.36(0.01)ab	0.36(0.01)ab	0.33(0.01)b	0.56 (0.09)	0.57 (0.07)	0.53(0.08)	0.5(0.05)
Quality index (QI)	0.26(0.04)c	0.78(0.06)ab	0.6(0.06)b	0.88(0.09)a	0.32 (0.07)b	0.52 (0.06)a	0.52(0.04)a	0.63(0.05)a
Total dry biomass increment (%)	0	2.76(0.9)a	1.8(0.6)ab	3.2(0.8)a	0	1.3(1.2)	1.3(1)	1.5(0.7)

Within the same column the means followed by different letters are statistically different ($P < 0.05$), according to Duncan test.
(T1): Nursery soil (control), (T2): Control soil: cattle manure, (T3): Control soil: decomposed litter, (T4): Control soil: cattle manure: decomposed litter. Values in parenthesis are standard error.

1993). Similar instances were also found by Sheikh and Abdul Matin (2007) on Shisham (*Dalbergia sissoo* Roxb. seed germination. The highest germination percentage resulted in cow-dung mixture soil medium might be due be due to it helps to develop and maintain good soil structure and porosity, water holding capacity, aeration, permeability and contribute in raising cation exchange capacity (CEC) of the soil.

High correlation among some nutritional elements as N, P and K soil with survival and growth indices in present study for both species may be due to positive effect of soil nutritional elements increase on improvement of growth and biomass seedling (Oliet et al., 2009). This finding on seedling is in line with Puértolas et al. (2003) on *Pinus* spp., Navarro et al. (2006) on *Abies pinsapo* and Luis et al. (2009) on *Pinus canariensis*. Also Trubat et al. (2008) showed that survival was highly dependent on the species and the nutritional conditions. As no significant correlation between Ca and Mg concentration and survival was detected, our data suggest that, in this study, the role of Ca and Mg may be less important than that of other variables. In fact, increased organic matter in soil as plant hormone-like activity has caused plant stimulation for nutrient absorption, enzymatic and metabolism activity increase in plant and has an influence on protein synthesis and performance better (Zhao and Qing, 2009). So, the changing rate of nutrient and resource availability has caused higher absorption of C by plant and can have a significant influence on the photosynthetic efficiency of needles (Jose et al., 2003).

Photosynthetic efficiency is also dependent on the amount of incident light. Light availability can interact with soil resource availability in influencing seedling physiology and growth (Jose et al., 2003). Similarly, Kaakenin et al. (2004) reported significant correlation (p<0.05) between organic matter of soil with growth and biomass in Norway spruce (*Picea abies* (L.) H.Karst) seedlings whereas the increas of nutrient content of plant tissue (NPK) was caused the increase of growth and biomass. On the other hand, organic matters are effective in make favorable conditions for plant performance as suitable aeration and water content regime (Shibu et al., 2006).

In this study non significant correlation were observed in soil Ca content in both species with growth indices and biomass that is probably due to the fact that Ca is not as mobile as Mg in plants and thus it is being accumulated in older plant tissues (Mankovska et al., 2004). Significant correlation Mg with diameter and Quality index exhibited that probably seedlings need to this element is more than Ca. Root length is effective in absorption of Mg (Barker and Pilbeam, 2007). But in the present study there is no significant correlation between soil organic matter and root length; therefore, the lack of Mg correlation with measured indices could be explained.

Non significant correlation between root length (cm) and soil organic matter may be due to sufficient nutrient in root zone preventing the development of root system (Agren and Franklin, 2003; Oliet et al., 2004). Also a less nutrient availability could comparatively enhance root growth (Ostos et al., 2008). However, environmental factors such nutrient may affect may be the growth and physiology of roots, but seem to more heavily influence growth of older seedlings (Lavender, 1984). Also it was thought to be due to microbial presence or its activity in the growth media during one year period. In contrast, in previous studies carried out on Holm Oak (*Quercus ilex L.*) *and* stone pine (*P. pinea L.*) (Larchevêque et al., 2006) organic fertilization increased root growth because of nutrient supply. It seems that difference with findings of the present research is probably due to two years period of experimentation. Also, the absence of growth may be associated with the environmental conditions with cold weather.

Generally, organic matter with improvement of the physical, chemical and biological properties of soils such as acceleration of microorganism's microbial processes and of absorbable nutrient for plants and enhances soil aeration and it influence on seed germination and seedling growth can provide suitable conditions for seedling production (Malakouti and Homaei, 2004). In the present, RL/SH and SQ ratios under nutrient supply of soil conditions for both species was not significant and is probably due to the organic matter that can increase water and nutrients absorption and return carbon and nutrient contents to a balance and more favorable state for storage (Caravaca et al., 2002). Also the ‘functional equilibrium’ between root and shoot growth varies widely between species and is strongly modified by internal and external factors (Ostos et al., 2008). Also, a high RL/SH value can indicate low foliage development and therefore negatively influence the photosynthesis process within the plant (Mañas et al., 2009). RGR is ecologically important because it is one of the primary variables influencing plant structure. Environmental factors can provoke changes in RGR (Meziane and Shipley, 1999).

Our study demonstrates in warm months and rate of light increase, RGR improvement is due to light and nutrient availability that can affect growth and larger allocation of biomass in seedling (Portsmuth and Niinemets, 2006).

So clearly, in this survey the environmental factors as soil, species and time in RGR_H are more effective than those in RGR_D. This response is normal, because seedlings in primary growing stages are beneficial to higher growth in height than in diameter (Selivanovskaya and Latypova, 2006). The greatest relative growth rate obtain in organic matter treatments show that organic matters are effective on physiological potential of growth. The patterns with RGR and nutrient supply are the same as reported previously by Ostos et al. (2008). Larger seedlings generally have a greater photosynthetic active surface in terms of needle biomass. Thus, they have a higher net carbon gain through a higher photosynthetic surface. Enhanced carbon gain increases root biomass which may increase the survival rate. Increase in biomass is due to accumulation of nutrient proportionally more intense in the first phases of plant life (Harmand et al., 2004). Total dry biomass Increment (%) in organic matter treatments than control in *C. arizonica* and significant correlation with N, P and K elements to indicate that soil nutrient is effective in plant dry biomass production (Iqbal et al., 2007).

The maximum value in both species for QI is in control soil: cattle manure: decomposed litter treatment (T4). This implies that the plant experiences high development, while the aerial and radical parts are balanced (Oliet et al., 2009). Plants developed in organic matter treatments have the greatest values for QI in other studies (Olivo and Buduba, 2006; Mañas et al., 2009). This suggests good potential for survival and growth in the field.

Conclusions

In general, from the present investigation it can be concluded that germination, survival, growth and biomass of *C. arizonica* and *C. sempervirens* were enhanced by using the organic matter treatments: the control soil: cattle manure: decomposed litter treatment seemed to be more effective than other organic matter treatments for production of quality seedling. This research indicates that organic matter can be a suitable growth medium component, depending on the amount of cattle manure and decomposed litter used, the plant growthing requirement, and the specific physical characteristics desired in the growth media. This is while, other organic components like, homestead - organic wastes, agricultural wastes, bio - fertilizers, sugarcane wastes, pine bark, and coconut fiber may advance the quality and quantity of seedling production.

REFERENCES

Agren GI, Franklin O (2003). Root. shoot ratios, optimization and nitrogen productivity. Ann. Bot. London, 92(6): 795 – 800.

Barker AV, Pilbeam DJ (2007). Handbook of Plant nutrition. Taylor& Francis. New York, p. 613.

Bishnoi NR, Sheroran IS, Singh R (1993). Effect of cadmium and nickel on mobilization of food reserves and activities of hydrolytic enzymes in germinating pigeon pea seeds. Biol. Plantarium, 35(4): 583–589.

Caravaca F, Garcia C, Hernandez MT, Roldan A (2002). Aggregate stability changes after organic amendment and mycorrhizal inoculation in the afforestation of a semiarid site with *Pinus halepensis*. Appl. Soil. Ecol., 19(3): 199–208.

Thompson BE (1985). Seedling morphological evaluation - what you can tell by looking. In: Duryea ML (ed) Evaluating Seedling Quality: Principles, Procedures and Predictive Abilities of Major Tests. Forest Research Laboratory, Oregon State University, Corvallis, pp. 59-71.

Cobb WR, Will RE, Daniels RF, Jacobson MR (2008). Aboveground biomass and nitrogen in four short-rotation woody crop species growing with different water and nutrient availabilities. Forest Ecol. Manag., 255(12): 4032–4039.

Dhindwal AS, Lather BPS, Singh J (1991). Efficacy of seed treatment on germination, seedling emergence and vigor of cotton (*Gossypium hirsutum*) genotypes. Seed Sci. Res., 19: 59–61.

Dickson A, Leaf AL, Hosner JF (1960). Quality appraisal of white spruce and white pine seedling stock in nurseries. Forest Chron., 36: 10-13.

Durgapal A, Pandey A, Palni LMS (2002). The use of rhizosphere soil for improved establishment of conifers at nursery stage for application in plantation programmers. J. Sustainable For., 15(3): 57-73.

Guerrero F, Gasco JM, Hern – andez - Apaolaza L (2002). Use of pine bark and sewage sludge compost as components of substrates for *P. pinea* and *C. arizonica* production. J. Plant Nutr., 25 (1): 129–141.

Harmand JM, Njiti CF, Bernhard-Reversat F, Puig H (2004). Aboveground and belowground biomass productivity and nutrient accumulation in tree improved fallows in the dry tropics of Cameroon. Forest Ecol. Manag.,188: 249–265.

Iqbal GMA, Huda SMS, Sujauddin M, Hossain MK (2007). Effects of sludge on germination and initial growth performance of *Leucaena leucocephala* seedlings in the nursery. J. For. Res., 18(3): 226-230.

Jacobs DF, Salifu KF, Seifert JR (2005). Growth and nutritional response of hardwood seedlings to control - release fertilization at out planting. Forest Ecol. Manag., 214(1-3): 28-39.

Jos´e Broncano M, Riba M, Retana J (1998). Seed germination and seedling performance of two Mediterranean tree species, holm oak (*Quercus ilex* L.) and Aleppo pine (*P. halepensis* Mill.): A multifactor experimental approach. Plant Ecol., 138: 17–26.

Jose S, Merritt S, Ramsey CL (2003). Growth, nutrition, photosynthesis and transpiration responses of longleaf pine seedlings to light, water and nitrogen. Forest Ecol. Manag., 180(1-3): 335–344.

Kaakenin S, Joikkonen A, Livonen S, Vapaavuori E (2004). Growth, allocation and chemistry of *Picea abies* seedlings affected by nutrient supply during second growing season. Tree Physiol., 24(6): 707-719.

Kiani B, Sharaji Rostami T, Taheri F (2005) Studying ability rhizogenesis *Pinus taeda* seedlings in bare root and potting condition. Iran. J. Nature Resour., 58(2): 333-338.

Koneshlo H (2001). Afforestation in dry arid. Institute of Forests and Rangelands Publishing, Tehran. Iran, p. 516.

Larchevêque M, Ballini C, Korboulewsky N, Montes N (2006). The use of compost in afforestation of Mediterranean areas: Effects on soil properties and young tree seedlings. Sci. Total Environ., 369: 220–230.

Lavender DP (1984). Production of Bare root Seedlings, Plant Physiology and Nursery Environment: Interactions Affecting Seedling Growth, Forest Nursery Manual for Forest Research Laboratory. Oregon State University, Corvallis, p. 386.

Luis VC, Puértolas J, Climent J, Peters J, González-Rodríguez ÁM, Morales D, Jiménez, MS (2009). Nursery fertilization enhances survival and physiological status in Canary Island pine (Pinus canariensis) seedlings planted in a semiarid environment. Eur. J. Forest Res., 128(3): 221–229.

Malakouti MJ, Homaei M (2004). Soil fertility of arid and semi-arid regions (Difficulties and Solutions). Tarbiat Modares University Press, Tehran, Iran, p. 482.

Mañas P, Castro E, Heras JDL (2009). Quality of maritime pine (*P. pinaster* Ait.) seedlings using waste materials as nursery growing media. New Forest, 37(3): 295-311.

Mankovska B, Godzik B, Badea O, Shparyk Y, Moravcik P (2004). Chemical and morphological characteristics of key tree species of the Carpathian Mountains. Environ. Pollut., 130(1): 41–54.

Martinez F, Cuevas G, Calvo R, Walter I (2003). Biowaste effects on soil and native plants in semiarid ecosystem. J. Environ. Qual., 32 (2): 472–479.

Meziane D, Shipley B (1999). Interacting components of interspecific relative growth rate: constancy and change under differing conditions of light and nutrient supply. Funct. Ecol., 13(5): 611–622.

Moreno-Peñaranda R, Lloret F, Alcañiz JM (2004). Effects of sewage sludge on plant community composition in restored limestone quarries. Restor. Ecol., 12(2): 290–296.

Navarro RM, Retamosa MJ, Lopez J, Campo AD, Ceaceros C, Salmoral L (2006). Nursery practices and field performance for the endangered Mediterranean species *Abies pinsapo* Boiss. Ecol. Eng. 27: 93-99.

Nourshad M, Ghorani M (1990). Research Projects selection the best soil mixture in order to container seedlings production. Afforestation and Park Bureau Press, Mazandaran, p. 57.

O´ Skarsson H, Sigurgeirsson A, Raulund - Rasmussen K (2006). Survival, growth, and nutrition of tree seedlings fertilized at planting on Andisol soils in Iceland: Six-year results. Forest Ecol. Manag., 229(1-3): 88–97.

Oliet JA, Planelles R, Artero F, Valverde R, Jacobs DF, Segura ML (2009). Field performance of *P. halepensis* planted in Mediterranean arid conditions: relative influence of seedling morphology and mineral nutrition. New Forest, 37(3): 313-331.

Oliet JA, Planelles R, Segura ML, Artero F, Jacobs DF (2004). Mineral nutrition and growth of containerized *Pinus halepensis* seedlings under controlled-release fertilizer. Sci. Hortic. Amsterdam, 103(1): 113-129.

Olivo VB, Buduba CG (2006). Influence of six substrates in *Pinus ponderosa* grown in containers under greenhouse conditions. Bosque, 27(3): 267–271.

Ostos JC, Lopez - Garrido R, Murillo JM, Lopez R (2008). Substitution of peat for municipal solid waste- and sewage sludge-based composts in nursery growing media: Effect on growth and nutrition of the native shrub *Pistacia lentiscus* L. Bioresource Technol., 99 (6): 1793–1800.

Portsmuth A, Niinemets U (2006). Interacting controls by light availability and nutrient supply on biomass allocation and growth of *Betula pendula* and *B. pubescens* seedlings. Forest Ecol. Manag., 227 (1-2): 122–134.

Puértolas J, Gil L, Pardos JA (2003). Effects of nutritional status and seedling size on field performance of *P. halepensis* planted on former arable land in the Mediterranean basin. Forestry, 76(2): 159–168.

Rahmani A, Khoshnevis M, Nourshad M (2006). Effects of different fertilizers on growth of Acer seedlings in two nurseries at Caspian region of Iran. J. Pajouhesh & Sazandegi, 19(4): 143-149 (In Persian).

Selivanovskaya SYU, Latypova VZ (2006). Effects of composted sewage sludge on microbial biomass, activity and pine seedlings in nursery forest. Waste Manage, 26(11): 1253-1258.

Shan J, Morris LA, Hendrick RL (2001). The effects of management on soil and plant carbon sequestration in slash pine plantations. J. Appl. Ecol., 38(5): 932-941.

Sheikh AH, Abdul MMd (2007). Seed Morphology and Germination Studies of *Dalbergia sissoo* Roxb. at Nursery Stage in Bangladesh. J. Agric. Biol. Sci., 3(1): 35-39.

Shibu ME, Leffelaar PA, Van Keulen H, Aggarwal PK (2006).

Quantitative description of soil organic matter dynamics - A review of approaches with reference to rice-based cropping systems. Geoderma., 137(1-2): 1–18.
Tabari M, Pourmadjidian MR, Alizadeh AR (2006). Effect of soil, irrigation and weeding on production of cypress (*Cupressus sempervirens* L.) seedling in shahrposht nursery, Nowshahr. J. pajouhesh & Sazandgi., 70: 65-69. (In Persian)
Tabari M, Saeidi HR, Alavi-Panah K, Basiri R, Poormadgidian MR (2007). Growth and survival response of potted *Cupressus sempervirens* seedlings to different soils. Pakistan J. Biol. Sci., 10(8): 1309-1312.
Teng Y, Timmer VR (1996). Modeling nitrogen and phosphorus interactions in intensively managed nursery soil-plant systems. Can. J. Soil Sci., 76(4): 523-530.
Trubat R, Cortina J, Vilagrosa A (2008). Short-term nitrogen deprivation increases field performance in nursery seedlings of Mediterranean woody species. J. Arid Environ., 72(6): 879-890.
Tsakaldimi M (2006). Kenaf (*Hibiscus cannabinus* L.) core and rice hulls as components of container media for growing (*P. halepensis* M.) seedlings. Bioresource Technol., 97(14): 1631–1639.
Vaario LM, Tervonen A, Haukioja K, Haukioja M, Pennanen T, Timonen S (2009). The effect of nursery substrate and fertilization on the growth and ectomycorrhizal status of containerized and outplanted seedlings of *Picea abies*. Can. J. Forest Res., 39(1): 64–75.
Will RE, Munger GT, Zhang Y, Borders BE (2002). Effects of annual fertilization and complete competition control on current annual increment, foliar development, and growth efficiency of different Aged (*Pinus taeda*) stands. Can. J. Forest Res., 32(10): 1728-1740.
Zarinkafsh M (1993). Soil survey, methods of assessment, morphologic and analysis for soil, water & plant. Tehran University Publications, Tehran. Iran, p. 342.
Zhao C, Liu Q (2009). Growth and photosynthetic responses of two coniferous species to experimental warming and nitrogen fertilization. Can. J. Forest Res., 39(1): 1-11.