NUSANTARA BIOSCIENCE
Vol. 6, No. 2, pp. 152-158
November 2014

ISSN: 2087-3948
E-ISSN: 2087-3956
DOI: 10.13057/nusbiosci/n060208

Qualitative and financial evaluation of public and private forest nurseries; Case study of southern Zagros forests, Iran

MARYAM FAZLOLLAHI MOHAMMADI[1,♥], SEYED MAHDI HESHMATOL VAEZIN[2], VAHID ETEMAD[3], ASGHAR SEPAHVAND[4], ANOSHIRVAN SHIRVANI[5], SOLEIMANI AZAM[6]

[1]Department of Forestry, University of Tehran, Karaj, P.B: 4111, Iran. Tel: +98-261-223044, Fax: +98-0261-2223044,
[♥]email: mfazlollahi83@yahoo.com.
[2]Faculty of Natural Resources, University of Tehran, Karaj, Iran.
[3]Faculty of Natural Resources, University of Tehran, Karaj, Iran.
[4]Lorestan Natural Resources Office, Lorestan,Iran.
[5]Department of Forestry, Faculty of natural resources, University of Tehran, Karaj, Iran.
[6]Department of Forestry, University of Tehran, Karaj, Iran.

Manuscript received: 22 September 2014. Revision accepted: 5 October 2014.

Abstract. *Mohammadi MF, Vaezin SMH, Etemad V, Sepahvand A, Shirvani A, Azam S. 2014. Qualitative and financial evaluation of public and private forest nurseries; Case study of southern Zagros forests, Iran. Nusantara Bioscience 6: 152-158.* This study has examined the efficiency of two nurseries, private and public divisions, based on qualitative and financial evaluation in the Southern Zagros forests of Iran. To achieve this purpose, we selected two species including pistachio (*Pistacia atlantica*) and poplar (*Populus nigra*) in one year period. Results of qualitative evaluation showed that all produced seedlings by private nursery significantly had better features than the public one at the significant level of 0.05. Also, the results of financial evaluation showed that cost price of each poplar seedling at private nursery (0.734 $) was 19.6 times less than public one (14.4 $). The interest rate for pistachio seedling in private sector ranges from 1.9 to 2.2 $, while it ranges from 1.5 to 1.9 $ for poplar seedling. Such researches may help to improve management as well as financial and qualitative efficiency, especially in public nurseries. Future researches will be required to document other aspects of private management on nurseries in seedling products.

Keywords: Cost price, forest plantation, production cost, standard seedling, survival percentage.

INTRODUCTION

In many decades ago, forestation and conservation activities were done less than today's because of non-being used and needless of ecosystems forestation (Liu et al. 2013). Recently, this activity has changed to a key activity in order to survive and improve of disturbed ecosystems, especially in the case of sensitive or fragmented ecosystem in arid and semi-arid regions. It provides needs for woody material and almost it improves by plantation of different native and exotic species as well as intensive wood agronomy practices. For forest planting and improving an artificial forest, we need to produce seedlings with high quality and minimum cost price of production in forest nurseries. To achieve better nurseries management, also we need to elaborate techniques which play an important role at determining seedling's cost price. The process of seedling production is an effective factor on cost price and percentage of seedling's survival than an expected average of forest plantation. Reducing the cost of forest plantation can be helpful with considering limitation of public budget to increase the forest plantation (Hamzehpour et al. 2006).

Mangaoang et al. (2005) reported that there are some potential factors that influence forest plantation such as nursery management, plantation techniques, post plantation activities, pitting methods and so on. Vande and Joseph (2007) have studied the cost price of the seedlings, the root of Loblolly pine (*Pinus taeda*) using multi time manure. Davis and Jacobs (2005) also studied the root feature s and their role in forest plantation and the survival's seedlings to determine the quality of root system and they concluded that root length and diameter of collar were recognized as the most important features in qualitative evaluation of the seedlings in the nursery. Their result showed that seedlings which have better root systems morphologically and physiologically can be cultivated quickly and these seedlings have better growth after wards. Harrison et al. (2008) evaluated forest seedlings production systems in eastern and western Asia nurseries, and found that there are significantly correlation between type of nursery management and production of seedling, particularly in case of seedling quality. The seedlings which produced by the public division, have some problems such as less survival after forest plantation activities in field, while the seedlings which were produced by the private nurseries had another problems, such as financial issues and the seedling's production contracts to provide the financial resources. Kadda et al. (2008) pointed out seedling's high quality depended upon excellent seed provenance and the ways of seedling's plantation in the intensive nurseries. In such nurseries there is a high risk that is related to produce some seedlings with low quality due to increase production costs. Romel et al. (2008) studied 28 nurseries of 97 urban nurseries randomly in Bengal and showed that the

important and practical costs would depend on land's value, building's infrastructure and labor or the number of labor force. The production costs varied between 10$ to 50$, while seedlings price varied 10$ to 60$ as well.

Recently, based on privatization policy in economic organizations of Iran, the management of many public nurseries has been given to the private division contractually (Rostami-Shahraji 2009; Melo et al. 2013). Therefore, private and public contractual management are extremely involved in producing seedlings, simultaneously. Therefore, there is a little information regard to qualitative and financial evaluations and comparison of cost price in public contractual and private nurseries in worldwide; especially this information is very scarce in under-developed countries which located in arid and semi-arid regions. Thus to fill this scientific gap, presented study designated to introduce and use proper indexes to compare the public and private nursery efficiency, and contribute a method to evaluate and analyze the cost price as well as to determine the quality of the private and public nursery's seedlings to find the best method to produce the main species seedlings which have been generally used at the southern Zagros forests. This study presents a suitable method to compare private and public–contractual management nurseries and provides a condition to improve studies in the future, especially comparing and determining the best management approach to produce the seedlings. Our hypothesis was that the seedlings that produced by private nursery should have better quality and less production cost.

MATERIALS AND METHODS

Description of study site

To conduct this research we selected two nurseries in southern Zagros forests, southwest of Iran, Zagheh (public nursery) and Kalantari (private) nurseries. They are between latitude 48°3' and 48°42' N and longitude 23°29' and 33°12'E, which approximately are 40 km far from Lorestan Province, Iran. Precipitation of the studied sits is 577 mm per annum; its relative moisture is 59.5% with silt clay soil texture. This region enjoys 5 dry months during a vegetative year in spring and summer (Anon. 2006).

Qualitative feature evaluation

All of the evaluation was made during a period from October 2007 to October 2008 based on available data, cultivation time and sell time of seedlings. We selected two of common species which more used in forest plantation e.g. pistachio (more sensible in reproduction) and poplar (less sensible in reproduction) in this region (Jazirehee 2010). It notes that these species were produced in both nurseries in the same specific period (Sepahvand 2008). To qualitative evaluation, five features were measured including collar diameters, seedling height, health of terminal bud (bud condition), length of main root and the number of rootlet. Preliminary calculations were made based on 30 selected seedlings of both species from each nursery to figure out how many seedlings have to measure in final measurements as follows Eq. 1 (Zobeiri 2008).

$$n = \frac{t^2 \times}{E^2} \quad \text{..... (1)}$$

Where, n is the number of required seedlings; t^2 is t student statistic; $S^2_x\%$ is standard deviation; $E^2\%$ is statistic error at 0.05 level. Regard to aforementioned calculations the number of 128 poplar and 79 pistachio seedlings were measured, respectively. After that all produced seedlings were compared to defined standard seedling. In general, there are two specific definitions for defining standard seedling view point of expert's experience in nurseries of Iran as follows: (i) *Biological standard*: This standard is conducted based on the expert's consideration of seedling's production. It is determined based on seedling's shoots and their related treats. (ii) *Market standard*: This standard is determined based on consumer's demand and consists of qualitative features which purchasers demand.

Firstly, we fulfilled a standard definition by seedling features including, diameter of collar, height of seedling, and condition of terminal bud based on minimum and maximum growth of produced seedlings at the last year, the size of seedlings which applicable in the forest plantation activities and the manager experiences of nurseries associated with producing the seedlings. Therefore, the pistachio standard seedling is a seedling with more than 5-mm diameter of collar and over 8-cm height which it has a healthy terminal bud and the poplar standard seedling is a seedling with more than 80-cm height. This definition has obtained with considering important qualitative feature of each species and also experiences of seedling producers. Then based on these definitions, we calculated the percentage of standard seedlings in each nursery. Afterwards classification of standard seedling has been completed with market classification. Parallel to these, the height of seedling was selected as a basis index for poplar seedling and diameter of collar was selected as a basis index for pistachio seedling. Based on this classification collar diameter of the first class pistachio seedling was more than 7-mm and collar diameter of the second class one was between 5-mm and 7-mm. Similarly, height of first class poplar seedling was more than 130-cm and height of the second class one was between 80-cm to 130-cm. At the next step, the seedling's cost price and the interest rate were calculated based on produced standard seedling and it classification for each seedling (Saeed 2008).

Financial evaluation

Financial evaluation consists of comparing the cost price of produced seedling and its interest rate for each produced seedling of private and public nurseries based on the seedling's quality. Afterwards, fixed costs (rental and capital costs) and its variable cost (production and maintenance costs) were calculated. Then, poplar and pistachio seedlings costs were determined by level per number ratio. After calculating cost price of the two species, we calculated the cost price of each pistachio and poplar seedling at both private and public nurseries. Then the seedling's cost price was compared to market price. At the next step, risky period to pistachio and poplar seedlings was limited between 2 to 4 years. Then survival percentage

of poplar and pistachio seedlings and expected average of forest plantation were calculated by equation 2 as follows (Saeed 2008).

$$E(B) = AC_0 + P \times . \quad \text{..... (2)}$$

Where E (B) is expected average of forest plantation in a hectare for a seedling; AC_o is cost price of seedling's production, planting and maintaining for a seedling; P is the seedling's survival possibility at a risky period (the number of dry seedling/the total number of seedlings) and AC_1 is cost price of new seedling and forest plantation costs for a seedling.

The classification of average cost for each poplar and pistachio seedling was calculated by equation 3 as follows in two nurseries (Saeed 2008).

$$P = \sum_{i=1}^{n} S_i \quad \text{..... (3)}$$

Where P: The average cost of classified seedlings; i is the class of seedling; n is the number of class; S_i is the proportion of each class in production and P_i is the cost of each class.

Then the average cost of each classified seedling was calculated by using of dividing average cost to percentage of each classified seedling. Finally, we calculated the interest rate of each seedling from subtraction of average price and average cost. All price are presented in $ US at: 1 $: 1000 RLS.

Statistical analysis

Responses of features to the qualitative and financial evaluations were analyzed using the one-way analysis of variance (ANOVA) procedure of SPSS 17.0 for Windows. Normal distribution and homogeneity of variances for each collective were tested using the Kolmogorov–Smirnov test and the Levene's test. For significant main effects and their interactions, means were separated using Duncan's multiple-range (HSD). For variables with unequal variances, Dunnett's T3 test was used to determine if there were significant treatment differences. Levels of significance are indicated as follows: * = $p < 0.05$, ** = $p < 0.01$, and ns = Non significant.

RESULTS AND DISCUSSION

Qualitative evaluation

Results of ANOVA indicated that there was a significant difference at the 0.01 level among independent variable (such as same climate condition, soil and etc.) for any measured variable of pistachio seedlings. The effect of nursery management varied significantly in all variables at the 0.05 level except length of main root (Table 1).

Parallel to these, results of ANOVA test showed that was a significant difference at the 0.01 level among independent variable for any measured variable of pistachio seedlings. The effect of nursery management varied significantly in all variables at the 0.05 level for both private and public nurseries (Table 1). After doing analysis of the variance, Duncan test was made to compare qualitative feature's mean at two nurseries. Comparing the diameter and height of poplar and pistachio seedlings at two nurseries showed that collar diameter and height mean of private nursery's seedlings were greater than public one, significantly. The main root mean comparison of poplar seedling's also showed that the private nursery's poplar seedlings had higher main root mean than the public one significantly, but in terms of pistachio species, private and public nurseries hadn't significant difference. Rootlet's mean comparison of poplar seedlings' showed that the private nursery's poplar seedlings had more rootlets mean compared to the public one significantly, but pistachio seedling produced by the public nursery had more rootlet mean compare to the private one significantly (Table 1)

Financial evaluation

The production of these nurseries within this period were pot and bare root seedlings. After analyzing total fixed and variable costs of nursery, devoted cost to pistachio and poplar seedlings at this period were obtained by comparison of area (to calculate cost of land rent) and number (to calculate other costs) (Gregorio 2004), then the nurseries efficiency was calculated. This includes percentage of standard seedlings which was calculated from dividing total cost on total produced standard seedlings (Table 2).

Cost prices of standard seedlings were 3 times more than cost price of ordinary seedlings in public nursery and it was 0.65 times greater in private nursery. In fact, although the percentage of standard seedlings was higher, cost price will decrease with increasing seeding production. The cost price of each poplar seedling at Zagheh nursery (14.4$) was 19 times greater than cost price of each poplar seedling at Kalantari nursery (0.734$). Also the cost price of each pistachio seedling at Zagheh nursery was almost 2.6 times greater than private one (1.6$). Also, the comparison of the each seedling's interest rate after classifying showed that interest rate for each pistachio seedling at private nursery (2.2$) was more than pistachio seedling at public one (1.9$). Similarly, the interest rate for each poplar seedling at private nursery (1.9$) was more than public one (1.5$) (Table 3).

To calculate the expected average cost of forest plantation (Table 4), survival percentage of cultivated poplar and pistachio seedlings was calculated by comparison of survival seedlings with total cultivated seedlings (Gregorio 2007). Survival percentage of public sector's seedlings is a little more than private nursery's seedlings. Survival percentage of produced pistachio and poplar seedlings in public nursery is more than the private one, but the expected average cost of plantation in the case of poplar and pistachio seedlings was greater based on area and the number of seedlings in public nursery. Although percentage of private nursery's standard seedlings were higher, we expected the survival percentage of these seedlings be higher than public one, but the results were inverse totally, and this may be because of the seedlings' quality (Table 4).

Table 1. Analysis of variance (ANOVA) for different nursery management for pistachio and poplar seedlings

Source of variance	Variable	Degree of freedom	Mean of squares		Significance	
			Pistachio	Poplar	Pistachio	Poplar
Independent variable	Diameter of collar	1	760.753	111168.1	0.000**	0.000**
	Height	1	2129.341	1065359	0.000**	0.000**
	Length of main root	1	3886.643	19495.14	0.000**	0.000**
	Number of rootlet	1	896.018	7.69E+08	0.000**	0.000**
Effect of nursery management	Diameter of collar	1	10.806	5880.014	0.01*	0.01*
	Height	1	51.881	15394.61	0.01*	0.01*
	Length of main root	1	0.061	2209	0.805^{ns}	0.01*
	Number of rootlet	1	153.889	9.96	0.01*	0.01*

Note: * = $p < 0.05$, ** = $p < 0.01$, and ns = Non significant.

Table 2. Efficiency of poplar and pistachio production in public and private nursery

Nursery species	T.P		N.S.S		C.S with S.P and P.S.S ($)		A.F.C ($)		A.V.C ($)		T.C ($)		P.G.S		P.S.S	
	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr	Pu	Pr
Pistachio	10000	7500	2158	5695	20.4	2.2	1562.3	223.6	42584.8	12342.8	44147.2	12566.4	21	75	22	75
Poplar	3000	81500	2490	81500	17.3	0.734	3782.9	3650.7	39455.3	56247.1	43238.2	59897.9	82	100	100	100

Note: Pu = public; Pr = private. T.P= number of produced seedlings; N.S.S= number of standard seedling; C.S with S.P and P.S.S= cost price with calculating of survival percentage and percentage of standard seedling ($); A.F.C= annual fixed cost ($); A.V.C= annual variable cost ($); T.C= Total cost ($); P.G.S= percentage of grown seedlings; P.S.S= percentage of standard seedlings.

Table 3. Comparison of cost price of all and standard seedlings

Species	Nursery	N.G.S	N.S.S	C.P of G.S ($)	C.P of S.S ($)
Pistachio	Private	7500	5696	1.6	2.2
Pistachio	Public	10000	2158	4.4	20.4
Poplar	Private	81500	81500	0.7	0.7
Poplar	Public	3000	2490	14.4	17.3

Note: N.G.S= number of grown seedlings; N.S.S= number of standard seedlings; C.P of G.S= cost price of grown seedlings ($) and C.P of S.S= cost price of standard seedlings ($).

Table 4. Calculating the expected average cost of forest plantation of poplar and pistachio seedlings at private and public nurseries

Species	Nursery	Cultivate distance (m)	Survival percentage	E (B) according to S ($)	E (B) ha ($)
Pistachio	Public	5×5	29.87	185.5	74208
Pistachio	Private	5×5	14.3	190.5	76224
Poplar	Public	0.8×0.8	90.2	252.3	394234.7
Poplar	Private	2×2	73.36	253.9	638090

Note: E (B) according to N.S= Expected average cost of forestation according to the seedling's number ($) and E (B) ha= Expected average cost of forestation per hectare ($).

Table 5. Average cost of classified seedlings, interest rate for every classified seedling and average price of classified seedlings at two nurseries

Species	Nursery	Class	Market's price ($)	Average price of classified seedling ($)	The seedling's percentage according to the related grade	Average cost of classified seedling ($)	interest rate for every classified seedling ($)
Pistachio	Public	1	2.5	-	-	-	-
		2	2	2	100	0.02	1.9
Poplar	Public	1	2	0.5	26	0.02	0.5
		2	1.5	1.1	74	0.015	1
Pistachio	Private	1	2.5	1.2	49	0.025	1.2
		2	2	1	51	0.02	1
Poplar	Private	1	1.5	1.8	91	0.02	1.8
		2	2	0.135	9	0.015	0.125

Table 6. Calculating the interest rate of poplar and pistachio at public and private nurseries

Species and nursery	Terminal bud health	Cost price of standard seedling ($)	Market's price ($)	The percentage of interest rate
Public poplar	99.21	17.3	1.5	-1.05
Private poplar	76.6	0.734	1.5	0.051
Public pistachio	92.4	20.4	2	-0.922
Private pistachio	84.81	2.2	2	0.01

That is why, seedling's purchase price and cultivation costs (Ac_0) of pistachio and poplar seedlings were 1.4 and 1.3 times greater than forest plantation costs respectively, and on the other hand cost price of public nursery's poplar and pistachio seedlings were 19 and 2.6 times greater than private one, respectively. So, more survival percentage of produced seedlings by the public nursery isn't as much as to compensate more cost price of it than private one. The results of this study showed that the expected average costs of forest plantation had an inverse relationship with survival percentage of poplar and pistachio seedlings, it means if survival percentage increases, the expected average cost of forestation will decrease.

Seedling's standard evaluation

Among 128 measured poplar seedlings in Zagheh nursery, 83% were standard, while, within 79 pistachio seedlings, only 21.60% were standard seedlings according to our standard seedling definitions. The same measurements were made in Kalantari nursery and showed that all of poplar seedlings were standard, while by about 76% of pistachio seedlings were standard. The results of classification based on two defined indexes for each pistachio and poplar seedlings showed that 100% of poplar seedlings at public nurseries were in the second class while, by about 26% of pistachio seedlings that were in first class and the rests of them were in the second class. Also in private nursery among standard produced seedlings, by about 91% of poplar seedlings were in the first class and among produced poplar seedlings only 49% of them were in the first class (Table 5).

The average price of each classified seedling in private and public nurseries was calculated by using contributed formula in material and methods. It calculated from dividing average cost on percentage of each related class to the number of total standard seedlings (Table 5).

In the next step, interest rate for each seedling was calculated from subtraction the average cost from the average price of each classified seedling. Results showed that the interest rate for each pistachio seedling at private nursery (2.2 $) was greater than the public one (1.9 $), similarly the interest rate for each produced poplar seedling at private nursery (1.9 $) was greater than the produced poplar seedlings at public one (1.5 $). These results were similar to the results of these seedlings' cost price and showed that more cost price leaded to less interest rate for each seedling (Table 6).

Terminal bud evaluation

The results of this study showed that by about 84.81% of pistachio seedlings of Kalantari nursery had healthy terminal buds (among 79 seedlings), while by about 76.60% of poplar seedlings had healthy (among 128 seedlings). In Zagheh nursery only 92.40% of pistachio seedlings and 99.21% of poplar seedlings have healthy terminal buds (Table 6).

Discussion

Qualitative evaluation

As noted, there are several indexes for the seedlings' quality, and we considered five indexes in this study. Also, poplar seedling's classification by using height index, and pistachio seedling's classification by using diameter of collar index showed that the first class seedlings at private nursery were more than the public one. This result is relevant to comparison result of defined standard seedling' percentage in these nurseries, and this showed that produced seedlings in private nursery are better than produced seedlings in public one in the terms of defined standard and classification. Comparison of collar diameter's mean and seedlings height with regard to the type of species and nursery showed that the pistachio and poplar seedlings of private nursery (Kalantari nursery) had higher height and collar diameter mean compare to the public one. That was why; it had more regular supervisions and regular irrigation. So, private nursery had more regular management compare to public one. Evidences and personal visits confirmed these results. Also, comparison of main root's length mean showed that the private nursery's poplar seedlings had higher main root mean compare to the public one and that was why more considerations and cares. These results were similar to the results of Davis and Jacobs (2008) who pointed out the length of root and diameter of collar were the most important features in the seedling's qualitative evaluation. Therefore, private and public's pistachio seedlings didn't show a significant difference in the terms of growth, because these more considerations didn't influence on pistachio seedlings. Also we can conclude that the time of evaluation had been little or in other words we studied the seedlings at a limited time and it wasn't enough. The results of the numbers of rootlets mean showed that private nursery's poplar seedlings had more rootlet compare to the public one. It may be explained by more attentions at this nursery, but public nursery's pistachio seedlings (Zagheh nursery) had more rootlets mean compare to private one. It originated from pistachio seedling's rooting, the origin of seeds or slight differences at soil texture. These results are in line with Carandang et al. (2006) and Kadda et al. (2008) findings who concluded that high seedling's quality extremely depended on the superior provenance seeds and forest plantation techniques. In this discussion we referred to the irrigation system of nursery, on time weeding and space of plantation. This result showed that we can produce more qualified seedlings if we pay more attention to necessary affair of seedling production such as regular irrigation, eradicating weedy and so on.

Financial evaluation

The interest rate for each poplar seedling at the private nursery (1.9$) was more than the public one (1.5$). It seemed that the difference between interest rate for each seedling and the cost price of produced seedling at two nurseries can be explained by some factors as follows: (i) *Managing the nursery area*. Bare root seedlings need more area than pot seedlings; thus, they require much more ground rental cost, subsequently (Carrillo-Garcia et al. 1999). The space that each a poplar seedling needs, and its ground rental cost in public nursery is more than private one. These results were similar to the results of Romel et al. (2008). They concluded that important and effective

costs on investments according to the ground rental cost, building infrastructure and labor are different. (ii) *Managing the equipments and machines (fixed cost).* A part of the cost price's difference of seedling production and the interest rate for each seedling was related to difference between fixed costs (fixed cost) compare to total costs at two nurseries (Rantala et al. 2003; Howell and Harrington 2004; Rode et al. 2014). Fixed costs of pistachio seedlings were 3% of the total costs at public nursery, while it was 1.17% at private one. Similarly cost of poplar seedlings was 8% of the total costs at public nursery, and it was 6% at private nursery. It showed that, fixed costs had more portions of the total costs at public nursery (Wasswa 2010). Mainly, more parts of fixed costs originated from the capital costs of machines or equipments which weren't used at public nursery. (iii) *The percentage of grown seedlings.* The results of percentage of grown poplar and pistachio seedlings' comparison at these nurseries showed that the percentage of the grown pistachio seedlings were 75% at private nursery and were 22% at the public one. The percentages of the grown poplar seedlings were 100% at private and public nurseries. As we know, the percentage of the grown pistachio seedlings was less than one third because of unsuitable management of seedlings production and maintenance, at public nursery than the private one. Then, decreasing and producing percentage of grown seedlings leaded to increase of seedling's cost price and also decrease of the interest rate for each seedling at public nursery compared to private one (Nobre and Rodriguez 2014). (iv) *Percentage of standard seedlings.* The results of the percentage of standard poplar and pistachio seedlings' comparison at two nurseries showed that the percentage of standard pistachio seedlings at private and public nurseries were 75% and 21%, respectively, and the percentage of standard poplar seedlings at private and public nurseries was 100% and 82%, respectively. Results showed that produced seedlings at private nursery had better features than public one in terms of. Decrease of production and the percentage of standard and first class seedlings may lead to the increase of seedling's cost price and decrease of interest rate for each seedling at public nursery than private one.

Managing the production amount

Another part of cost price's difference of seedling production and interest rate for each seedling at two nurseries originated from the total production amounts. At public nursery during one year period, 3000 poplar seedlings were produced while at private nursery the numbers of produced seedlings were 81500. Then, at private nursery total costs are divided to more produced seedlings and this leads to decrease the poplar seedlings cost price, and also increase the interest rate for each poplar seedling. Also, the number of whole produced pistachio seedlings at public and private nurseries was 10000 and 7500, respectively. Thus, public nursery has more production. In general, unsuitable management is one of the most important factors that increase seedling cost price at public nursery than private one (Van Steenis 2013). Therefore, the interest rate has calculated considering poplar and pistachio seedlings' cost price and the price of these seedlings at the market (Table 5). The interest rate of public nursery for both species was negative but the interest rate for both species at private nursery was positive at the significant level of 0.05.

The produced seedlings by private nursery had better qualitative features than the public one. But, produced seedlings by public nursery (poplar: 90.2% and pistachio: 29.87%) had more survival percentage than the private one (poplar: 73.36% and pistachio: 14.3%). These results showed that although, the produced seedlings by private nursery had more quality than the public one but, these seedlings showed another results at forest plantation site. These results were inconsistent to the results of Harrison et al. (2008). They concluded that after cultivating the seedlings which produced by public nursery; they had less survival percentage. On the other hand produced seedlings by private nursery faced lack resources and depended on the contracts which are related to the seedlings production in order to provide the financial resources. But this may be because of faced condition after cultivating such as, environmental conditions, better management and better resistance of public nursery's standard seedlings (Herbohn 2011).

The results of expected average cost of afforestation showed that the expected average cost of forest plantation had a contrary relation to survival percentage of cultivated seedlings. We usually consider seedlings, while plantation cost is more important than cost price. When we need afforestation/or forest plantation and produce new seedlings twice, this is more significant because of drying cultivated seedlings. Then, afforestation costs after cultivating, and survival percentage of seedling are very important (Harrison et al. 2008). These results were adjusted to the results that obtained by Kadda et al. (2008). They concluded that there were high risks which were related to produce low quality seedlings at nurseries. It originated from possible reduction of inputs and methods that leaded to increase the quality and decrease the production costs. Then the expected average cost of plantation and survival percentage of seedlings were very important factors in seedlings selection. With regard to the relation between cost price of seedling production, seedlings quality, and expected average cost of plantation, if cost price is high, necessarily it doesn't means that it is non–economic, in other words, determining factors including quality, survival percentage and the interest rate for each seedling is necessary, too. Then it seems that the best indices to compare the plantation of private and public sectors are as follow: (i) *The interest rate of each seedling.* Also, the calculation of this index includes evaluation of morphological quality, too (being standard and classification). This index has a significant efficiency at production, cost reduction, marketing and selling seedlings. When we use it, we can compare the revenues and management of costs at private and public nurseries, similarly. (ii) *Function in plantation site.* This index is the expected average cost of plantation which real quality of seedling that is evaluated by it. This index is very suitable for planning and shows that which nurseries type must be developed. If we use it we will decrease the social,

production and plantation costs as well as cost price of seedling. (iii) *Qualitative index.* This index is measurement of qualitative features and doing significant test.

In conclusion, results of qualitative evaluation showed that all produced seedlings by private nursery significantly had better features than the public one at the significant level of 0.05. Parallel to this, the results of financial evaluation showed that cost price of each poplar seedling at private nursery was 19.6 times less than public one .These results have obtained from these nurseries' data as a sample of private and public nurseries and it may not be attained by other public and private nurseries. Also further studies require to reveal the relation between the seedling's quality and survival percentage and also in order to evaluate the production and maintenance effect on the seedling's quality.

REFERENCES

Anon. 2006. Multipurpose Forestry Plan of Ivandarreh and Shool Abad, Green Jahad Co., Iran.

Carandang WM, Tolentino JEL, Roshetko J. 2006. Smallholder tree nursery operations in southern Philippines—supporting mechanisms for timber tree domestication. For Trees Livelihoods 16(1): 71-83.

Carrillo-Garcia Á, La Luz D, León JL, Bashan Y, Bethlenfalvay GJ. 1999. Nurse plants, mycorrhizae, and plant establishment in a disturbed area of the Sonoran Desert. Restor Ecol 7 (4): 321-335.

Davis SA, Jacobs FD. 2005. Quantifying root system quality of nursery seedlings and relationship to out planting performance. New Forests 30(2-3): 295-311.

Gregorio N. 2004. The social and economic factors affecting the role that nurseries play in efficient forestry development in Leyte, The Philippines. [Ph.D. Dissertation]. University of Queensland, Australia.

Gregorio N. 2007. Improving the Effectiveness of the Forest Nursery Industry in Leyte Province, the Philippines. [Ph.D. Dissertation]. School of Natural and Rural Systems Management, University of Queensland, Australia..

Hamzehpour M, Bordbar SK, Jokar L, Abasi AR 2006. Evaluation the Possibility of Reclamation of pistachio Forests by Direct Cultivating the Seeds and Seedling. Iran For Poplar Manag 14 **(**3): 207-203.

Harrison S, Gregorio N, Herbohn J. 2008. A critical overview of forestry seedling production policies and practices in relation to smallholder forestry in developing countries. Small Scale For **7:** 207-223.

Herbohn J, Gregorio N, Harrison S, Vanclay J, Bosch A. 2011. Enhancing Tree Seedlings via Economic and Policy Changes in the Philippine Forest Nursery Sector. ACIAR Project ID ASEM/2006/091. Australian Centre for International Agricultural Research, Australia.

Howell KD, Harrington TB. 2004. Nursery practices influence seedling morphology, field performance, and cost efficiency of containerized cherrybark oak. Southern J Appl For 28 (3): 152-162.

Jazirehee MH. 2010. Forestation in arid regions. Tehran University Press, Tehran, Iran.

Kadda AS, Venus AM, Danilo LB, Rosa ME. 2008. Operational effectiveness of centralized nursery for small-scale forestry in Sancarlos city, Negros Occidental, Philippines. Small Scale For 7: 319-331.

Liu L, Tang H, Caccetta P, Lehmann EA, Hu Y, Wu X. 2013. Mapping afforestation and deforestation from 1974 to 2012 using Landsat time-series stacks in Yulin District, a key region of the Three-North Shelter region, China. Environ Monit Assess 185 (12): 9949-9965.

Mangaoang E, Cedamon O, Edwin D, Pasa AE. 2005. Cost-effective systems for seedling production and tree farm establishment. Ann Trop Res 27 (1): 11-18.

Melo FPL, Pinto SRR, Brancalion PHS, Castro PS, Rodrigues RR, Aronson J, Tabarelli M. 2013. Priority setting for scaling-up tropical forest restoration projects: Early lessons from the Atlantic Forest Restoration Pact. Environ Sci Pol 33: 395-404.

Nobre SR, Rodriguez LC. 2014. Integrating Nursery and Planting Activities. In: The Management of Industrial Forest Plantations. Springer, Netherlands.

Rantala J, Vaatainen K, Kiljunen N, Harstela P. 2003. Economic evaluation of container seedling packing and disinfection machinery. Silva Fennica 37 (1): 121-127.

Rode R, Leite HG, Silva MLD, Ribeiro CAÁS, Binoti DHB. 2014. The economics and optimal management regimes of eucalyptus plantations: A case study of forestry outgrower schemes in Brazil. For Pol Econ 44: 26-33.

Romel A, AdbulHalim Md, Mahbubul A. 2008. State of urban nurseries in Bangladesh: A case study from the north-eastern region. Small Scale For 7: 275-283.

Rostami-Shahraji T. 2009. Forest nursery management and seedlings production. Varasteh Press, Iran.

Saeed A. 2008. Fundamental of Practical Economics in Forest Management, Tehran University Press, Iran.

Sepahvand A. 2008. Plan of Zagheh forest nursery. Natural Resources Office of Lorestan Province, Iran.

Van Steenis E. 2013. Calculating Optimum Sowing Factor: A Tool to Evaluate Sowing Strategies and Minimize Seedling Production Cost. National Proceedings of Forest and Conservation Nursery Associations–2012.

Vande H, Joseph M. 2007. Production of conifer barteroot seedling using controlled release fertilizer. Native Pl J 8: 288-293.

Wasswa MJ. 2010. The Effects of Transaction Costs on Community Forest Management in Unganda. African Books Collective, Political Science.

Zobeiri M. 2008. Forest Inventory, Tehran University Press, Tehran, Iran.