A Study on Alder plantation (Alnus glutinosa) in Guilan Province, Iran

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ABSTRACT

The success of the planted Alder (Alnus glutinosa) has been investigated in the east of Guilan province. The pure stands with 14 to 29 years old were planted close to 5.8 hectares (2 x 2 m). Studies were carried out on 61 plants and 619 testifier trees about quantity and quality aspects. The circle plots (857 – 961.5 square meters) were laid out with random-systematic method survey. The results indicate that the planted Alder (Alnus glutinosa) had the ability for plantation on Caspian Sea flat area for wood production. The necessity of wood increases day by day in Iranian economy, and trees can solve some of the problem.

Key words: Alder (Alnus glutinosa), Planted trees, Wood, Guilan, Iran Introduction

INTRODUCTION

The total forest area of Iran was estimated approximately 18 million hectares about three decades ago (Amanzade et al., 1999; Dolempez, 1989). Unfortunately, tremendous proportions of those forests have been destroyed. The main native species of trees in Iranian forests are Beech (Fagus orientalis), Hornbeam (Carpinus betulus), and Oak (Quercus castanefolia). These species contain 32.72 %, 31.17 % and 8.44 % of the total volume respectively, for a combined total of 72.33% (Dolempez, 1989). The use of exotics for reforestation has traditionally been very limited. Alder as an endemic species has been planted on a large scale in flat of Guilan province (Parsapajohe, 1991). The aim of this article is to review the plantation of Alder, in order to present a background that is useful for an ecological evaluation of the Alder plantation in Iranian flat forests.

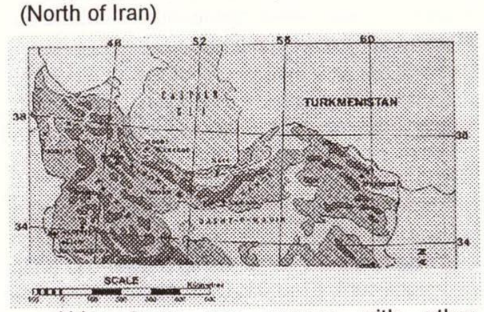
MATERIALS AND METHODS

Study zone

This Study was conducted on artificial forest in the east of Guilan province. This stand with 5.8 hectares is located in 37,3 to 37,17 latitudes and 49,53 to 50,28 longitudes. The pure and the mixed stand of Alder planted in 2x2 m (fig.1).

Mean annual precipitation and temperature are approximately 1261.2 mm and 15.9 c. The climate is moist. The Alder is generally planted on coastal, brown and acid forest soils (Alizade, 1997). Soils in this area are usually sandy well drained a zonal and also loamy poor- drained zonal (Oliver, 2000). The

Fig.1 Location of experimental stations (North of Iran)



Alder trees can appear with other association, for example Querco-boxetum, Querco-carpinetum, and Parrotio-carpinetum.

Data for planted Alder were collected in the winter of 2002. The circle plots (from 857 to 961.5 square meters) were laid out with random- systematic method survey in Rodesar and Siacal, tally inventory (100 %) were done in Chaboksar and Shalman. Studies had been carried out on 51 sample plots (306 trees) in Rodesar and Siacal and all of the trees in Chaboksar and Shalman for quantity and quality points of view. The volumes of six testifier trees were calculated with this formula (Amani et al., 1996; Zobeiri, 1993).

V=G.H.F

Where:

V= Volume of tree, G=Basal area, H= height of tree, F= form factor (0.5)

For these six trees, the diameter, the height, the bottom bole warp, the number of secondary branches, the healthy of crown and bole, the symmetric of crown, the plumb line and the situation of bole axial were measured (Zobeiri, 1993).

RESULTS

The planted Alder were surveyed and the diameter distribution in 5-centimeter classes was calculated. The situation of the stand's diameter is presented in tables 1 and 3. The diameter distribution curve shows positive skew ness (fig.3). The diameter distribution of four stands were tested with x2 (chi square), (α= 0.05). Rodesar, Shalman and Siacal showed an abnormal distribution. Chaboksar showed normal distribution.

Table1 The diameter distribution in four site (2002).

Diameter class (cm)	Siacal N/ha	Chaboksr N/ha	Rodesar N/ha	Shalman N/ha
15	196.8	-	203.66	248
20	88.8	-	186.66	304
25	56.4	-	103	288
30	11.2	48	39	72
35	0.8	148	10.33	16
40	-	184	5.66	-
45	-	92	0.66	-
50	-	68	1.66	-
55	-	8	-	-

The nonlinear relationship between D (diameter in D.B.H) and H (height of tree) was significant. (P=0.01) D=X, H=Y

$Y=-0.0000920\ X^2+0.170789\ X+10.74787$	Rodesar	$r=0.9182^{**}$ $R^2=0.8432$
$Y=0.00006923\ X^2+0.026646\ X+13.105078$	Chaboksar	$r=0.7530^{**}$ $R^2=0.5671$
$Y=-0.000786\ X^2+0.9471\ X+2.328979$	Shalman	$r=0.7432^{**}$ $R^2=0.8621$
$Y=-0.011732\ X^2+0.708371\ X+5.964171$	Siacal	$r=0.9431^{**}$ $R^2=0.8895$

Fig.2 The diameter distribution curves

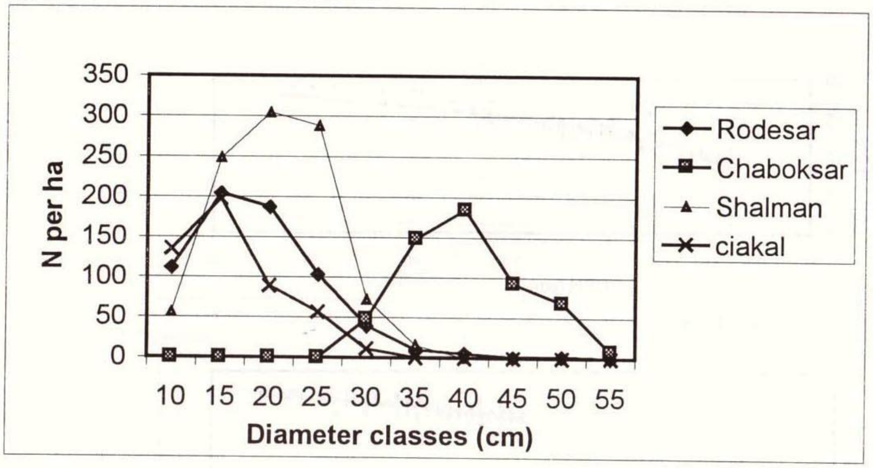


Table 2 The statistic aspects of the diameter in four stands

Aspects	Siacal	Chaboksar	Rodesar	Shalman
Mean diameter	15.94	40.43	18.65	20.87
Mode class (cm)	15	40	15	20
Median (cm)	15.27	39.61	17.92	20.59
Standard deviation (cm)	±5.27	±5.93	±6.4	±5.51
Variance (cm)	27.85	35.26	41.04	30.41
CV (%)	33.09	14.68	34.34	26.41
Pierson index	0.12	0.13	0.11	0.05
Diameter increment (cm)	1.06	1.34	0.93	0.83
Age	15	30	20	25

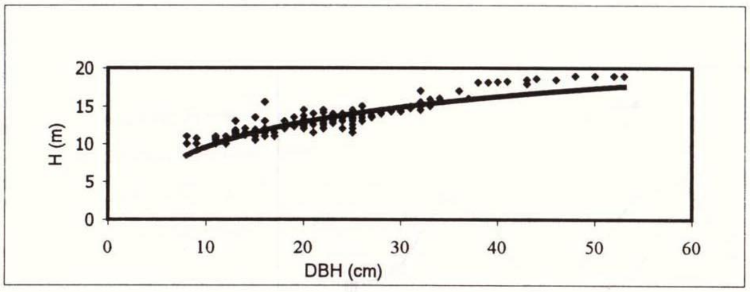
Table 3 The statistic aspects of the height and volume in four stands

Aspects	Siacal	Chaboksar	Rodesar	Shalman
Age (year)	15	30	20	25
Mean height (m)	13.92	14.45	14.83	15.21
Top height (m)	14.68	14.78	15.62	15.92
Height increment (m)	0.93	0.48	0.74	0.61
Volume increment (sylve)	4.5	16.91	6.66	10.16
The survival (%)	19.56	22	26	39.36
H/D	87.32	35.76	79.51	72.87

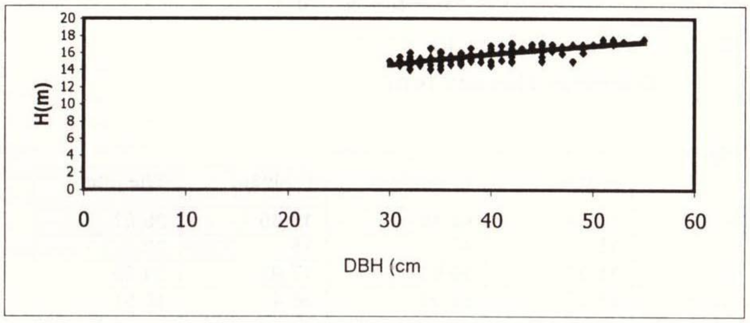
The volume of testifier trees were analyzed with V=G.H.F formula and the relationship between D (The diameter) and V (The volume of tree) were significant (P=0.01).

$Y=0.005085\ d^2-0.0119059\ d+0.139811$ Rodesar $r=0.9987^{**}$ $R^2=0.9954$
$Y=0.007066\ d^2-0.0277586\ d+0.404737$ Chaboksar $r=0.9976^{**}$ $R^2=0.9954$
$Y=0.000989\ d^2-0.0069404\ d+0.0203796$ Shalman $r=0.9965^{**}$ $R^2=0.9931$
$Y=0.008488\ d^2-0.007684\ d+0.040871$ Siacal $r=0.9935^{**}$ $R^2=0.9870$

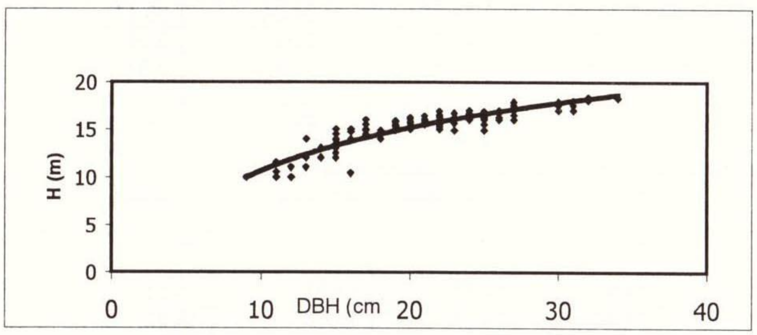
Fig.3 The relationship between D and H in four stands



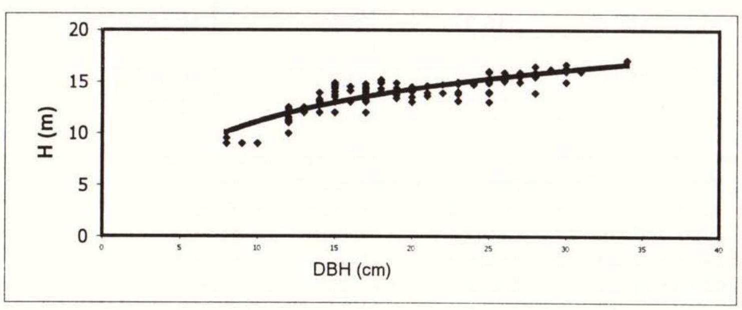
Rodesar



Chaboksar

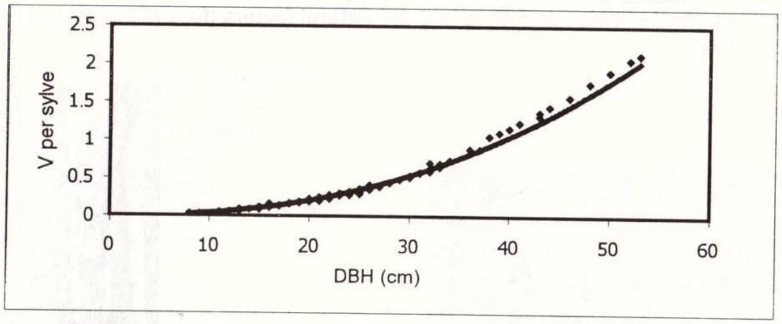


Shalman

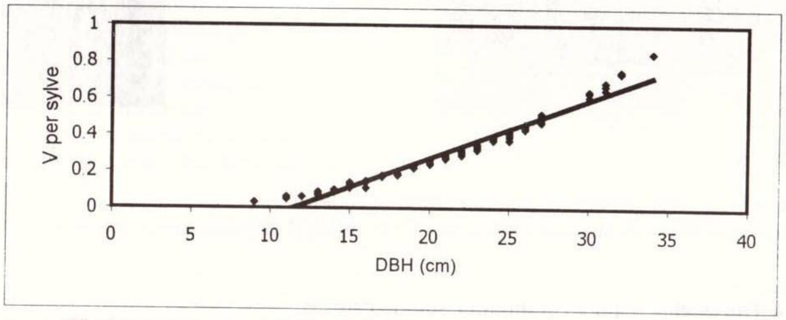


Siacal

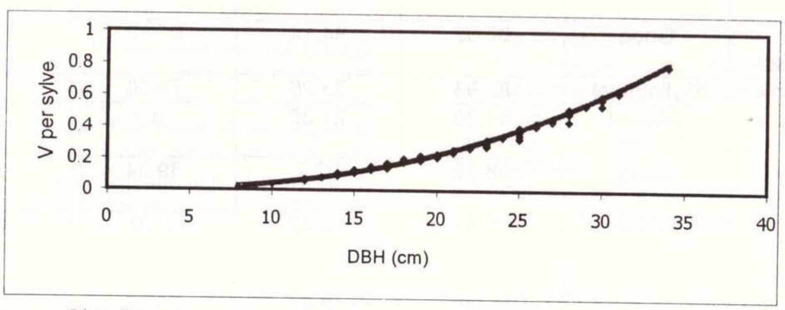
Fig.4 The relationship between D and V in four stands



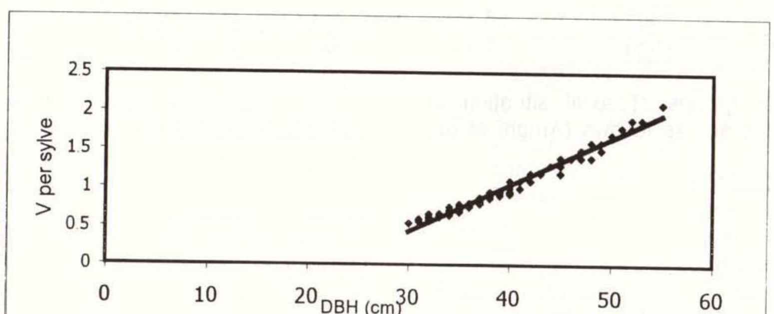
Chaboksar



Shalman



Siacal



Rodesar

The survival percent of trees were 19.56 to 39.36 %. The main reasons for the low survival percent in trees are the irregular cutting and the natural factors (for example freezing, wind and competition) (Fig5).

Fig.5 The low survival percent in planted stand of Alder

The quality aspects were studied on testifier trees, table 4 showed these aspects in four stands.

Table 4 The quality aspects in the four stands (%)

Aspects	Situation	Siacal	Chaboksar	Rodesar	Shalman
Bole healthiness	Good	96.83	94.14	97.12	97.83
Type of bole	Cylindrical	82.93	73.26	76.06	82.92
Type of bole warp	Without	51.29	21.38	15.1	3.25
Crown healthiness	Good	98.72	92.7	89.34	96.75
Type of crown symmetric	Good	17.83	16.42	5.79	4.76
The number Of secondary branch	0-1	1.92	2.4	29.05	26.83
	2-4	1.92	4.9	21.9	27.6
	4<	96.16	92.7	49.05	45.57
Plumb line	Right	79.48	58.37	47.77	54.47

The four groups of axial situation in testifier trees are as follows (Amani et al., 1996):

A-One axial trees

B-Biaxial trees

C-Triaxial trees

D-Polyaxial trees

The quality and quantity aspects indicated good situation compared with natural Alder in forest and about 66.78 to 91.03 (%) of the testifier trees were in group A. Increments of volume in these four stands were 9.55 sylve, but natural Alder had 8.77 sylve (Oliver, 2000).

DISCUSSION

The resistance of Alder against difficult conditions like stuffiness of lack air for roots (Ground water level) makes this species very important for plantation under those conditions (wood farming). This study showed that, after 15 to 30 years period, planted Alder had the ability for plantation on Caspian Sea flat area and competition with other species. Of course the quality and quantity results showed that the Alder trees had a good condition:

The mean annual increment in Alder was 1.04 cm but planted Maritime pine in the same condition was 0.99 cm.

The mean annual height increment in Alder was 0.69 m but Maritime pine was 0.51 m.

The mean annual volume increment in Alder was 9.55 sylve but Maritime pine was 2.6 sylve.

This study showed that, the tolerance of H/D in four stands were under 80, the planted Alder could be treated with thinning program. This study showed that, the mean crown symmetric percent in Alder was 12.17 to 51.22 (%) but young Beech trees was 94.67 (Taheri Abkenar, 1999).

The increase of sea level and the ground water level in recent years destroyed the natural and artificial forest, but Alder has been successful. The Alder in this paper is necessary to be tested in the other flat area in north of Iran (Sajadi and Yosefy,1995; Sardabi, 1998; Amanzade et al., 1999).

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