

A Study on Hazelnut (*Corylus avellana*) Growth Conditions in Various Geographical Directions in Natural Ecosystems (Case Study: Ardabil Province Fandoqlu forests)

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ABSTRACT: The following research studies hazelnut (*Corylus avellana*) growth conditions in various geographical directions in natural ecosystems in a case study from Ardabil Province Fandoqlu forests. To achieve this, habitat range was determined on 1:100000 map through initial circulation forest and studying forest areas. By preparing slope, direction and altitude maps and integrating them in GIS software, land unit maps were provided and finally, 4 land units in hazelnut habitat were determined to study. 16 sample plots were randomly harvested and in each sample plot quantitative parameters (number of hazelnut species group shoot per hectare, number of legs in each group shoot, diameter at breast height group shoot) were measured. Research results suggested that hazelnut species were deployed in geographical directions if north, south and west along with areas without any directions in Fandoqlu forests. North direction is the best geographical direction for growing hazelnut in Ardabil Province Fandoqlu forests.

Keywords: Hazelnut habitat, Geographical direction, Ardabil province fandoqlu forests

INTRODUCTION

Environmental factors determine habitat characteristics and have significant role in controlling plants distribution and deployment. Geographical direction is among effective environmental factors in various plant species deployment. Species present different behaviors based on their geographical direction in various habitat conditions. Agakhani (2006) mentioned the increase in diameter in acacia trees in two directions of east and north. Aminpur et al. (2007) reported the highest diameter and height growth of conifer species in south bound hillside. Mannetje (2001) claimed that geographical direction is among the most effective factors on conifer species.

Hazelnut (*Corylus avellana* L.) is a shrub or tree from Betulaceae family, Corylaceae family and *Corylus* genus. (Erdogan, 2000) Hazelnut is among the first species which migrated to northern Europe in the ice age in 17 to 18 thousand BC. In seven thousand and five hundred years to eight thousand BC hazelnut had a wide habitat in Europe.

However, its habitat has been decreased since 5500 BC due to human activities. The oldest existing knowledge on hazelnuts dates back to the year 2838 BC. (Darab Zand, 2000) There are certain botanical differences between various hazelnut species. There is a huge genetic diversity in hazelnut and most of the existing cultivars are the results of natural selection by human. (Lagersted, 1975; Mehlenbacher, 1991)

Hazelnut forests could be observed in Arasbaran, Astara, Talesh, Dinochal, Tarom and Zanzan in between step and forest and in Goli Daq forest could be locally observed. It is believed that this species could be found in Hzar Jarib heights. (Sabeti, 1994)

In his research on hazelnut ecological conditions, Hande (1969) claimed that hazelnut is a light-friendly species and due to the existence of other trees, it cannot enter forest.

Joni k (1975) claimed that hazelnut is among plants which could grow in a wide range of climate conditions and in low-laying areas. Niinoment (1998) studied the effects of

light on phenology and morphology of hazelnut aerial shoots. This research suggests that climate conditions are among main factors in flowering hazelnut species. Rogr et al. (2001) compared the rooting period in hazelnut trees displaced from spring to fall. The research indicated that trees roots which are displaced in fall are activated in the first year.

Methodology

Fandoqlu forest is the genetic and growth origin of hazelnut with an area of 207.94 km² which is located between longitude of E 48° 25' 30" and E 48° 45' and latitude of N 38° 5' 30" and N 38° 30' in Ardabil province of Iran in naming County.

The understudy region is frosty for about 136 days per year and has a cold, humid and moderate weather in the rest of the year. The annual rainfall is 378.9mm with a minimum of 312.5mm and maximum of 509mm. The significant point is the influence of thick fog entering from Gilan Province through the year. Hence, it could be claimed that the actual annual rainfall is higher than the released statistics. (GHasemi agbash, 2006) The understudy region climate was studied based on Emberget method. According to this method, the climate in this region is of cold and semi-arid climate. Also, ombrothermic curves studies in this region indicated that the arid period in this region starts from May and ends by September and the rest of the year is considered to be among humid period.

To achieve this, the understudy region was completely studied through circulation forest. Hazelnut natural habitat range was determined on 1:100000 topographic map. By preparing slope, direction and altitude layers and integrating them in GIS software, land unit maps were provided. The jungle area under study was around 16km² and having the land units' maps, the inventory was done in these levels. Sampling was random and due to the high density of legs, 16 4-are sample plots in square shape were harvested. Parameters such as number of hazelnut group shoot, number of legs in each group shoot, diameter at breast height group shoot, (diameters higher than 3cm), height of group shoot, slope, direction, altitude, Associated species and topsoil (depth 20 -0 cm) were measured. Data were analyzed through SPSS software by ANOVA and Duncan's test at 95percent.

RESULTS AND DISCUSSION

Region's Geographical Directions

Fandoqlu Region is located in various geographical directions and the jungle areas are located in north and south hillsides. These jungles have a lesser distribution in Ardabil province through west direction and hardly have east direction distribution.

Quantitative Parameters of Hazelnut in Various Geographical Directions Number of group shoot in Various Geographical Directions

Results suggest that the mean number of hazelnut group shoot is on the north direction (1285 group shoot per hectare) and the least number of group shoot is relate to south direction with 610 group shoot per hectare. Regions without direction and west direction had 858 and 850 group shoot per hectare, receptively and had the second and third ranks (Figure. 1).

Number of Legs in Hazelnut group shoot in Various Geographical Directions

Mean number of legs in each group shoot is 10.48 legs. The highest mean of number of legs was at south direction with 13.16 and the least number of legs were at west direction with 7.43 legs in group shoot(Figure. 2).

Diameter at Breast Height in Various Geographical Directions

Results suggest that the mean diameter at breast height in understudy region was 3.27cm. The highest diameter at breast height was in west direction (with a diameter of 3.74) and the lowest diameter at breast height was in without direction regions (with a diameter of 2.12). South and north direction with an mean diameter of 3.65cm and 3.6cm, respectively, had the second and third ranks(Figure. 3).

Height of group shoot in Various Geographical Directions

Considering the results, the mean height of group shoot in understudy region is 3.29 meters. The highest mean is on the west direction with 3.64 meters and north direction with 3.32 meters height and without direction with 3.18 meters height had the second and third ranks, respectively. South direction with a height of 3.03 meters had the lowest mean (Figure. 4).

One of the effective factors in hazelnut habitat in the studied region is the geographical direction. In Fandoqlu habitat, hazelnut is deployed in north, south west geographical direction, along with without direction. Considering the mean of number group shoot of per hectare as a determining feature for proper habitat conditionsfor hazelnut in Fandoqlu Region, north direction, with the highest number of group shoot per hectare, is introduced as the most proper location. Moreover, north direction has lesser number of legs in each group shoot due to high density of group shoot

South and west directions have thicker legs due to the more sunlight and lesser density. Also, research results indicated that there is no significant difference between various geographical directions on group shoot height. In their studies at Pardisan natural Park, Kord et al. (2010) claimed that geographical direction affects the diameter at breast height and height in Robinia pseudoacacia and

diameter at breast of Cupressus arizonica. Brand (2001) claims that conifers have better quantitative features in eastern hillsides.

Statistical comparison of hazelnut parameters in various geographical directions suggests that the difference on number of leg in group shoot, diameter at

breast height and group shoot height were significant at 5percent. Duncan’s categorization results at 5 percent indicated that number of legs in group shoot, diameter at breast height and group shoot height were categorized in 3 groups.(table1,2).

Table 1. Analysis of variance (ANOVA) the hazelnut parameters geographical directions

Characteristic	Source of Variations	df	Mean Square
Number group shoot	Between Groups	3	390611.111 ^{ns}
	Within Groups	12	545055.556
Height group shoot	Between Groups	3	38.075 ^{**}
	Within Groups	580	0.889
Diameter at Breast Height in Various	Between Groups	3	7.105 ^{**}
	Within Groups	1139	0.499
Number of Legs in Hazelnut group shoot	Between Groups	3	2135.455 ^{**}
	Within Groups	580	101.193

* and **: Significant at $p < 0.05$ and < 0.01 , respectively

Table 2. Duncan's test the geographical directions

Genotypes	Characters		
	Height group shoot	Diameter at Breast Height in Various	Number of Legs in Hazelnut group shoot
NORTH	2.5631 c	3.6418 ab	14.6557 b
SOUTH	3.0738 b	3.5802 b	12.2296 b
WEST	3.6479 a	3.7533 a	17.8447 a
FLAT	3.7745 a	3.2360 c	7.1275 c

Differences between averages of each column which have common characters are not significant at probability level of 5%

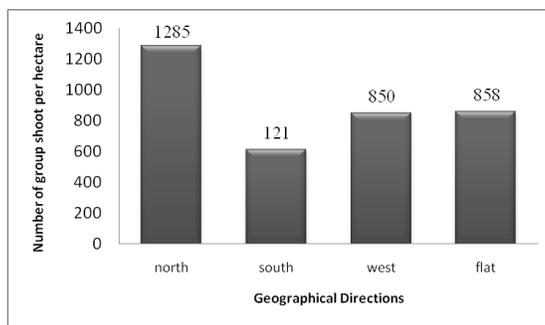


Figure 1. Mean comparison number of group shoot in various geographical directions

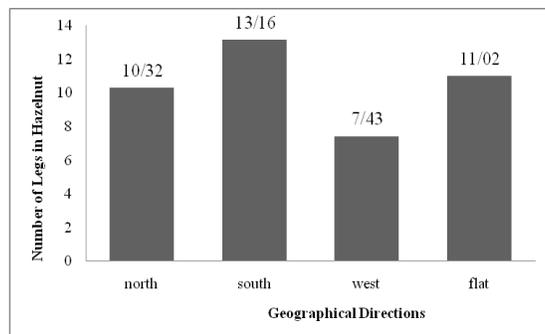


Figure 2. Mean comparison number of legs in hazelnut group shoot in various geographical Ddirections

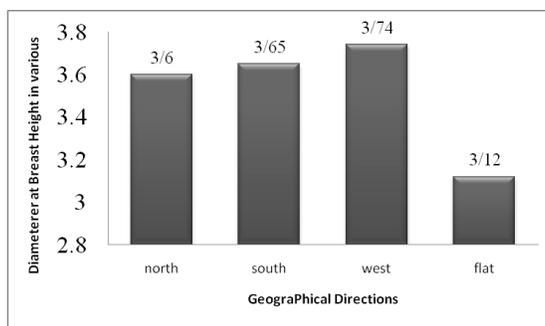


Figure 3. Mean comparison diameter at breast h in various geographical directions

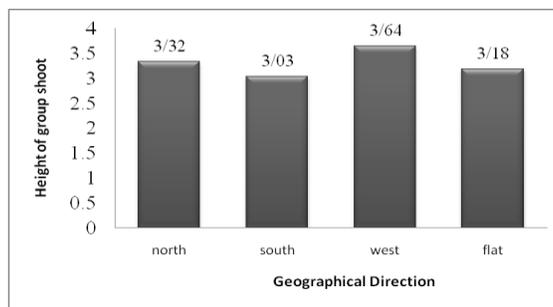


Figure 4. Mean comparison the mean height of group shoot in various geographical directions

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