RESEARCH ON THE GROWTH AND MATURATION OF SEEDLINGS OLDER THAN 3 YEARS IN THE NATURAL HUNGARIAN AND TURKEY OAK REGENERATION AREAS IN THE WESTERN PART OF THE GETIC PLATEAU

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Key words: Hungarian oak, Turkey oak, growth, seedlings, regeneration

ABSTRACT

The research findings indicated the influence of size, position on the axes and zoning on the growth and maturation of Hungarian and Turkey oak seedlings older than 3 years in natural regeneration areas.

The main research outputs run as follows:

- the growth and maturation of Hungarian and Turkey oak seedlings older than 3 years is directly influenced by the size of the group cuts and by the interaction between the group cut size and position on the group cut axis;

- the size, height and diameter of the seedlings depend heavily on the size of the group cuts.

INTRODUCTION

The Hungarian and Turkey oak are among the forest tress deeply affected by the climatic changes of the last decades. The Hungarian and Turkey withering during 1988-1994 characterises all the young tree species irrespective of age (Badea, 2008). The exteme climatic conditions (temperature and rainfall) that affected the natural regeneration process may be softened and remedied through research-driven regeneration methods and techniques in relation to the optimisation of the size, shape and zoning of the group cuts. (Bercea, 2008). The natural regeneration of the two species is a topical issue due to the fact that the Hungarian and Turkey oak are the only basic species to take advantage of the hard compact clay soils in the western part of the Getic Plateau. Furthermore, there are few research papers on this topic. Our research aims to determine how the group cut size, zoning, the position on the group cut axes and their interation influence the natural regeneration of the Hungarian and Turkey oak older than 3 years, with a view to establish the size, shape and orientation of thre group cuts. It underpins the identification of the optimal conditions for the growth of the seedlings to replace the seed trees.

MATERIALS AND RESEARCH METHOD

The sample area covers the western part of the Getic Plateau in the hydrographic basin of the Jiu river. The growth and maturation of the Hungarian and Turkey oak seedlings older than 3 years in group cuts of different sizes and their differentiation within the group cuts oriented to north-south and east-west, in the central part (C), at the midpoints (m), peripheral (P) outer (o) parts of the two axes (Fig. 1), was examined in highly similar sample areas – woodlands. The height, diameter and density of the seedlings were determined.

Measurements were made in 3 group cuts of 0.5 H; 0.75 H; 1.0 H; 1.5 H and 2.0 H at the end of the vegetation season every year. The data were interpreted statistically processed via the ,,Statistica 95" software, the analysis of variance (Table 1), which also generated the following picture:

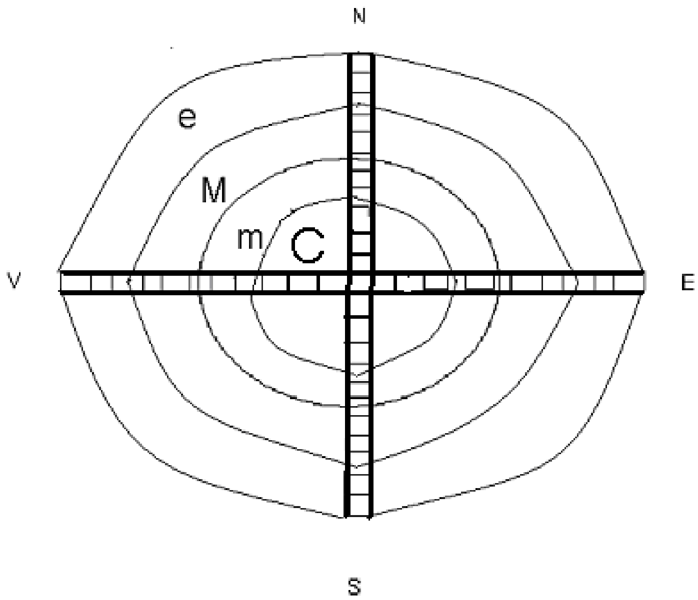

Fig. 1. Sample of permanent plot installed both in group cuts and in regeneration areas

RESEARCH FINDINGS

The maturation of Hungarian and Turkey oak seedlings older than 3 years is directly influenced by the size of the group cut (p = .000000***) and by the interaction between the group cut sized and position on the axis ((p =.049887*). The influence of the group cut on the seedling height in 2006, on the seedling diameter, on the increase of height and diameter during 2004–2006, as well as on the density of seedlings points to "extremely important" (***). In the light of the arguments above, the interaction of the group cut size and axes reads "important" (*).

The maturation of Hungarian and Turkey oak seedlings older than 3 years is less influenced by zoning, by the interaction between group cuts axes and position on the axes, the results of the analysis of variance being unimportant (Table 1).

Overall result of the analysis of triple variance on the characteristic traits of Hungarian and Turkey oak seedlings older than 3 years

Table 1

Independent variables	Degrees of freedom		Degree of importance (p)
	df1	df 2	
1	2	3	4
1 – group cut size	20	518	.000000***
2 – group cut axis	15	431	.325075
3 – position on the axis	15	431	.424886
1x2 – interaction between group cut size and axis	60	734	.049887*
1x3 – interaction between group cut size and position on the axis	60	734	.362120
2x3 - interaction between axis and position on the axis	45	700	.894090
1x2x3 – interaction between group cut size, axis and position on the axis	180	779	.999368

Result of the analysis of triple variance on the charactersitic traits of Hungarian and Turkey oak seedlings older than 3 years in regeneration group cuts

Table 2

Independent variables	Degree of importance (p) of dependent variables: *** - extremely important, ** - highly important, * - important, - unimportant				
	Seedling initial height (H 2006)	Height increase 2006 (IH 2006)	Initial diameter (D 2006	Aggregate diameter increase (ID 2006)	Seedling density (no./mp)
1	2	3	4	5	6
1– group cut diameter (GROUPCUTDIAM)	.000000***	.000000***	.000000***	.000000***	.615474
2 – group cut axis (GROUPCUTAXIS)	.023098*	.546945	.017777*	.042404*	.150007
3 position on axes (POSAXIS)	.184045	.016696*	.392979	.409054	.647034
Interaction 1x2	.691583	.714316	.763988	.772539	.379721
Interaction 1x3	.021441	.011619	.073512	.536997	.415395
Interaction 2x3	.876001	.978663	.703948	.350902	.909774
Interaction 1x2x3	.999913	.999900	.914854	.409381	.869582

Table 2 shows that:

- the size of seedlings and the height and diameter increase are strongly influenced by the group cut size, the degree of importance (p) deriving from the analysis of variance "extremely important” (***).

- the height, diameter and diameter increase of seedlings are influenced by the group cut axes, the degree of importance (p) being "important" (.023098* .017777* .042404*).

- the position of seedlings on the axes (zoning) directly influences the height increase, the degree of importance (p) being "important" (.016696*).

- the interaction between the group cut size and zoning directly influences the height, diameter and height increase of the Hungarian and Turkey oak seedlings, the degree of importance (p) being "important" (.021441 .011619 .073512).

- the other interaction types are unimportant.

Size of Hungarian and Turkey oak seedlings older than 3 years according to the size of the group cuts

The height and height increase of Hungarian and Turkey oak seedlings older than 3 years is directly influenced by the group cut size.

The height of the seedlings older than 3 years (H 2006) shows the highest values in large-sized group cuts, starting from group cuts of 1.0 H up to group cuts of 2.0 H (Fig. 2). In group cuts of 0.5 H and 0.75 H, we encounter the same height. The height increase of Hungarian and Turkey oak seedlings older than 3 years (Fig. 63) is insignificant in group cuts of 0.5 H – 1.0 H, and higher starting from group cuts of 1.5 H, wehereas the highest value belongs to group cuts of 2.0 H.

The curve of the diameter of Hungarian and Turkey oak seedlings older than 3 years (Fig. 3) has the same shape as the height, diameter values being higher starting from group cuts of 1.0 H. The curve of diameter increase is rising, starting from group cuts of 0.5 H to group cuts of 2.0 H. The curve of diameter increase does not have the same shape as the height increase, going lower in group cuts of 1.0 H, 1.5H and 2.0 H.

The height and diameter increase of Hungarian and Turkey oak seedlings older than 3 years depends on the group cut size, the degree of importance (p), deriving from the analysis of variance, being "extremely important", thus, infering that this influence is very likely to happen (99.999999 %).

In the large-sized group cuts, the seedlings reach considerable height and pass from individual growth to gregarious existence, when the height increase is higher than the diameter increase if we keep the proportions.

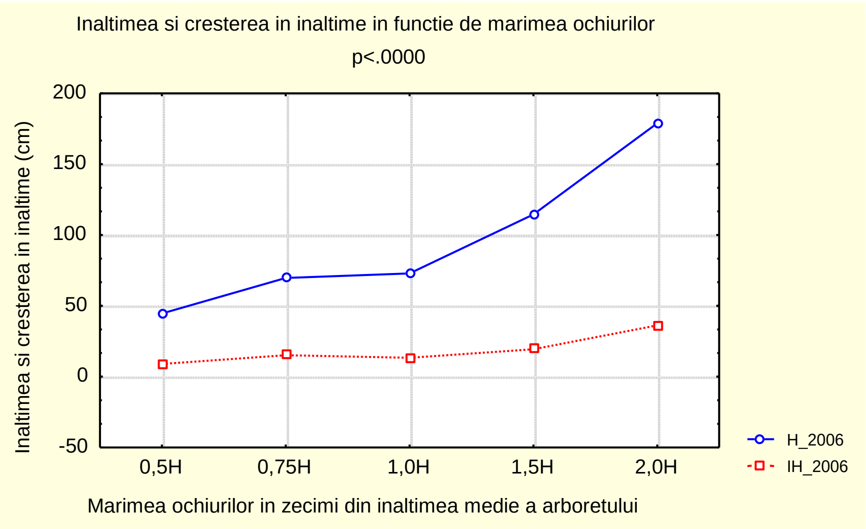

Fig.2. Height and height increase of seedlings older than 3 years according to group cut size

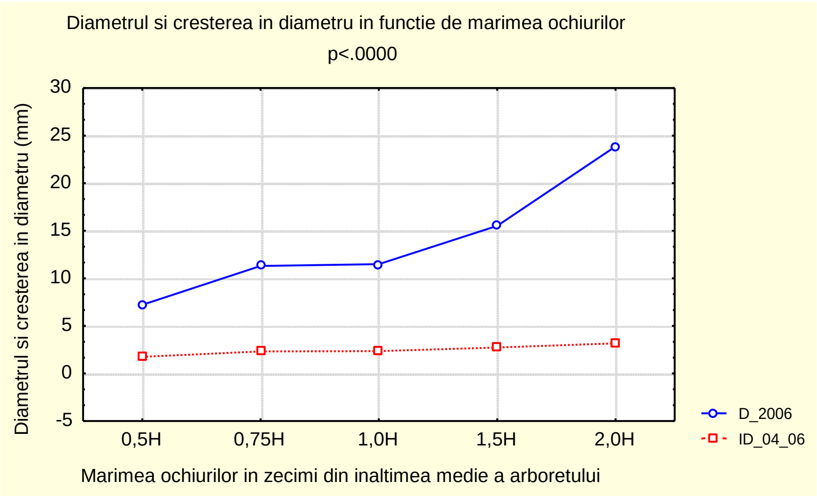

Fig. 3. Diameter and diameter increase of seedlings older than 3 years according to group cut size

Size of Hungarian and Turkey oak seedlings older than 3 years according to the group cut axis

Hungarian and Turkey oak seedlings older than 3 years showed significant values of the static parameters with respect to the seedlings height, diameter and diameter increase (Table 2).

The highest values of height and diameter are recorded on the axis centre - south (S), followed the axis centre - north (N) and centre - east (E), whereas the lowest values are on the axis centre – west (V) – See fig. 4, 5.

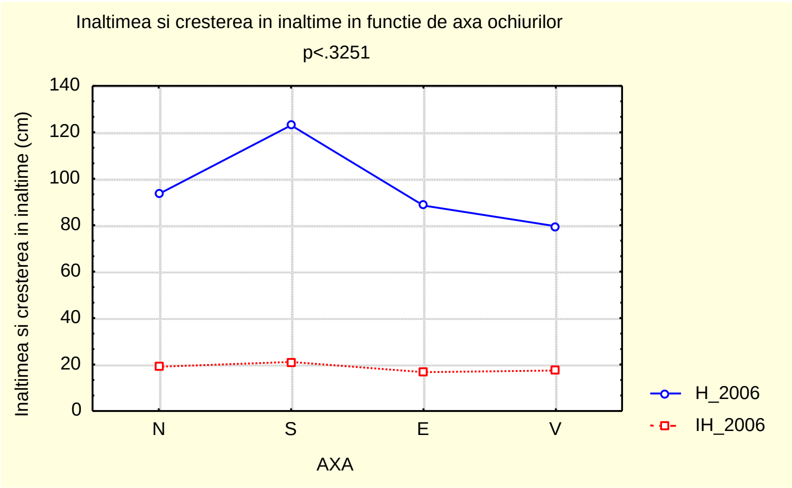

Fig. 4 Height and height increase of seedlings older than 3 years according to the group cuts axis (N, S, E, W)

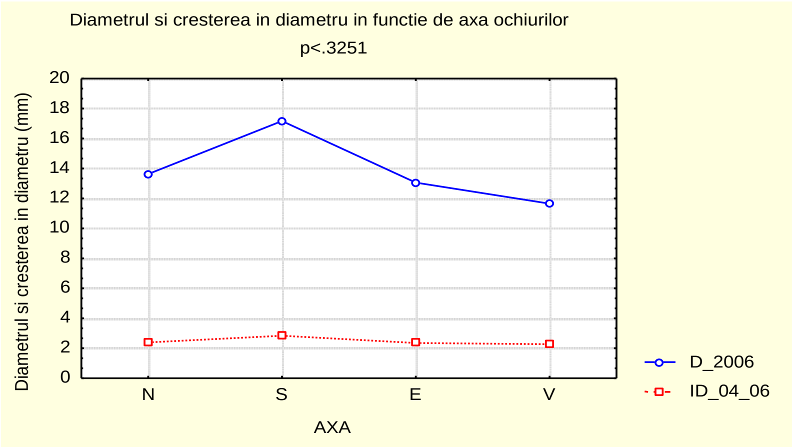

Fig. 5. Diameter and diameter increase of seedlings older than 3 years according to the group cut axis (N, S, E, W)

The height and diameter increase is almost levelled down and steady on all directions, showing a rising tendency on the axis centre - south, while falling on the axis centre - east (E) – see Fig. 4, 5.

The degree of importance deriving from the analysis of variance (Table 2) is "important" (*).

Size of Hungarian and Turkey oak seedlings older than 3 years according to zoning

The influence of zoning is extremely important with respect to height increase in the case of Hungarian and Turkey oak seedlings older than 3 years (Table 2, Fig. 6).

In the central part (C) and at the midpoint (m) of the group cuts, seedlings older than 3 years show the highest values in point of height.

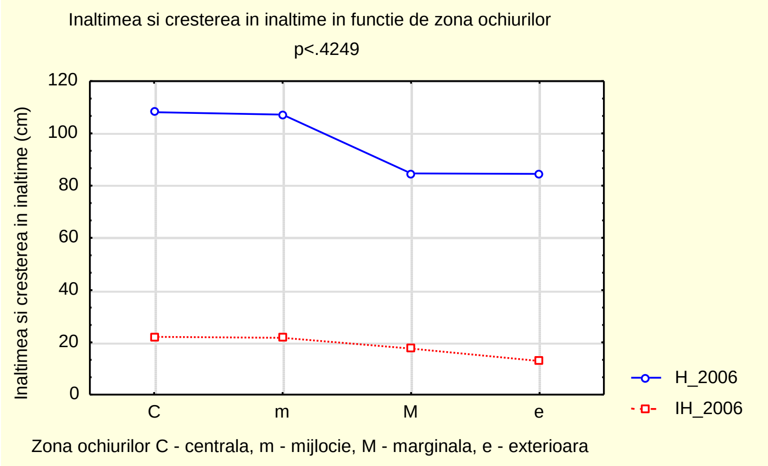

Fig. 6. Height and height increase of seedlings older than 3 years according to zoning

Size of Hungarian and Turkey oak seedlings older than 3 years according to the interaction between group cut size and zoning

The interaction between group cut size and zoning impacts on the height, height increase and diameter of seedlings (Table 2).

The height of seedlings older than 3 years depends on the interaction between the group cut size and position on the axes. In the central part of the group cut, height is higher in large-sized group cuts, being on the rise from group cuts of 0.5 H to group cuts of 2.0 H. At the midpoint (m) and at the periphery (P), there is a rising tendency from small-sized group cuts to large-sized ones, whereas in the outer circle (o), height has a constant value, irrespective of the size of the group cuts.

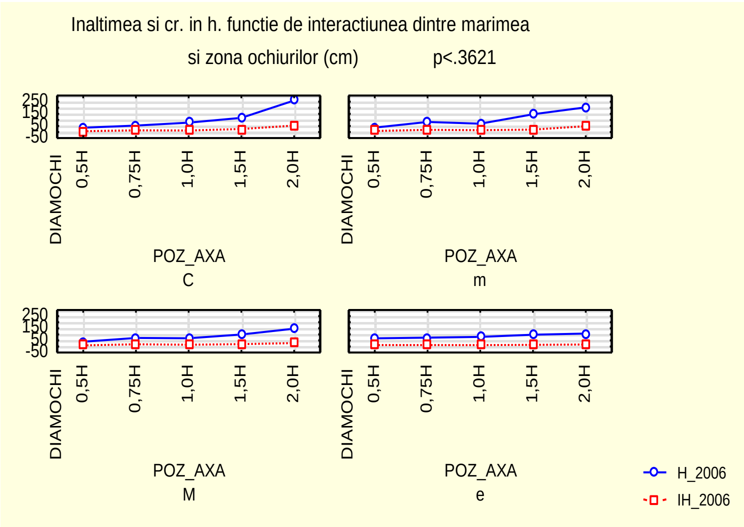

Fig. 7. Height and height increase of seedlings older than 3 years according to the interaction between the group cut size and zoning C- central, m - midpoint, P – periphery, o – outer circle

There is height increase from the small-sized group cuts to the large-sized ones, but it does not follow a rising curve of height, tending to become flat.

The diameter of seedlings older than 3 years is influenced by the interaction between the group cut size and position on the axes (zoning). Accordingly, larger diameter is recorded in group cuts of 2.0 H and of 1.5 H in the central parts (C), at the midpoints (m) and at the periphery (P).

The influence of the interaction betwen the group cut size and position on the axes (zoning) with reference to Hungarian and Turkey oak seedlings older than 3 years does not impact on the seedling diameter and diameter increase. The vast majority of seedlings older than 3 years pass to gregarious existence, and height increase becomes crucial due to competion during this maturation stage.

Density of Hungarian and Turkey oak seedlings older than 3 years

If in the first 3 years of existence, the density of seedlings is determined by the group cut size and zoning, in the coming years density is relatively constant, depending solely on the mutual interaction of the seedlings now in the gregarious stage. Before 3 years old the elimination of seedlings occurs due to the negative effect of ecological factors, later on their elimination being caused by the struggle for water, light and warmth.

CONCLUSIONS

The growth and maturation of Hungarian and Turkey oak seedlings older than 3 years is directly influenced by the group cut size and by the interaction between the group cut size and zoning. The influence of the group cut size on the seedling height, diameter, height increase and diameter increase as well as on the seedlings density is extremely important. The interaction between the group cut size and axes is important.

The growth and maturation of Hungarian and Turkey oak seedlings older than 3 years is little influenced by zoning, by the interaction between the group cut size and zoning, between group cut axes and zoning or by the interaction between group cut size, axis and zoning, due to the changes of the characteritic traits of the seedlings. Hungarian and Turkey oak seedlings older than 3 years become firmly rooted and pass to the collective existence at a fast pace, which means another type of rule-governed behaviour as compared to the first 3 years of existence. The group cut size and the interaction between group cut size and axes are independent variables which will continue to influence the size and growth of seedlings until the complete removal of seed trees.

The evolution of characteristic traits according to the group cut size, axes and zoning clearly indicate that progressive clearcut is more effective in the natural regeneration of the Hungarian and Turkey oak. The optimal size of group cuts is based on the compromise between higher values of seedling size and growth in the first years of existence, on the one hand, and the necessary density to stop regeneration as soon as possible, on the other hand.

The optimal size to secure the balance between the size and growth of the seedlings, on the one hand, and their density, on the other hand, ranges from 0.75 to 1.0 of the average height of the seed trees (H) in the case of the Hungarian oak, and from 1.0 to 1.5 of the average height of the seed trees (H) in the case of the Turkey oak. The group cuts will widen to the south and west.

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