STRUCTURAL CHANGES OF MIXED SEEDLINGS OF HUNGARIAN OAK (*QUERCUS FRAINETTO*) AND TURKEY OAK (*QUERCUS CERRIS*) TREES FOLLOWING THE WOODLAND STAGE

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ABSTRACT

The ecosystem processes follow the woodland stage in the mixed Hungarian and Turkey oak stand, as a result of the inter- and intra-specific competition, depending on the thickness variable and competition for resources. The forestry-related interventions will take place according to the evolution stage of the trees, priority being given to the sampling out of young trees and seedlings.

INTRODUCTION

Recent research has indicated that the response of the two species to the climatic changes of the last decades differs with respect to the intensity of the mass wilting phenomenon during the dry seasons and, more particularly, with respect to the frequency rate of fructification. During the dry seasons of 1988-2004, the Hungarian oak and Turkey oak samples were affected in a proportion of 45.5 %, and 30.6%, respectively (Badea, 2003). The research and observations conducted during this period point out that the Hungarian oak underwent physiological decline impacting negatively on the frequency and intensity of fructification up to this date (Bercea, 2007, 2009, 2013). Literature indicates that until 2007 the frequency rate of the Hungarian oak (*Quercus frainetto*) ranged between 5-7 years, the research carried out in the Western part of the Getic Plateau (1999-2007) show a frequency of 8-13 years, and the timeframe starts from 1955 (Bercea, 2009). The Turkey oak trees (*Quercus cerris*)) were less dramatically affected by climatic changes and continued to bear fruit every 2-5 years. At this point, it is worth discussing the ecology and the economic value of the two species. Both species are sub-termophilic and the only ones taking advantage of the heavy clay soils (Preluvisols and Luvisols). The area of the Turkey oak trees includes that of the Hungarian oak trees, globally and regionally (The Getic Plateau). The areas where the Hungarian and Turkey oak mix are located, as a rule, at the foot of the slopes, to the northern parts where soils are rich in water or on the plateaux with deep soils. The Turkey oak is less affected by late freezing and spreads out to the northern slopes to the detriment of the Hungarian oak, and the faster early growth results in the elimination of the Hungarian oak. The long dry seasons during the indicated period and the close alternation of dry and rainy seasons as well as the high and lasting temperatures during July and August strongly impacted on the Hungarian oak, which experienced a more visible physiological decline in comparison to the Turkey oak. The most serious problems are related to natural regeneration as it is common knowledge that both species rely on natural seed regeneration. Under the circumstances, The Turkey oak spreads out to the detriment of the Hungarian oak. Our research aims at the structural changes following the woodland stage so as to establish the intervention mode resulting in the structural and qualitative improvement of the mixed seedlings of the Hungarian and Turkey oak. The research equally aims at the change from the sinuous seedling to the continuous one through the harmonisation of height within the former group cuts by regeneration and progressive cutting of the mixed Hungarian and and Turkey oak groups.

MATERIALS AND RESEARCH METHODS

The research was conducted in sample areas of permanent specimens planted at the start of the regeneration process, which have been the topic of numerous scientific papers published since 2005. The research was carried out in sample areas located in phytoclimatic average conditions for Hungarian and Turkey oak trees in the widespread forests in the western part of the Getic Plateau, in Simian, Strehaia, Filiaşi, Melinesti, Drăgăşani (Bercea , 2007). In the forest of Macrea, the sample unit 82 M (ua) of the R&D Unit II Argetoaia (U.P.), Filiaşi Woodland, Hungarian and Turkey oak trees are mixed in equal proportion stands. The location of the sample areas was chosen after a long period of observation of the wilting of the Hungarian and Turkey oak trees since 1989, and permanent monitoring of the wilting phenomenon has been carried out in these sample areas. The wiltering rate of the Hungarian oak trees is 15% higher than in the case of the Turkey oak trees. The gaps due to the the removal of the wilted or wilting trees were filled with already existing seedlings of the 1994 low fructification of Hungarian and Turkey oak trees, contributing to the establishment of young stands following the regeneration cuts of the last two decades.

Upon the completion of the regeneration process and of the woodland stage, we continued research in the young stands through measurements and determination of the main characteristic features of young stands: group diameter, height, pruning height, length and crown diameter. Measurements and observations were performed in the former regeneration cuts when applying progressive cutting on two sample areas of two-meter width, one to the south and the other to the east-west. The results of the measurements and observations were shown in tables for each species and for the whole stand. Tables were processed using Excel and plotted using the same software.

RESEARCH FINDINGS AND INTERPRETATION

Observations in the permanent sample surfaces show the sinuous profile of the young trees due to the progressive cutting treatment described in the literature (Florescu, 2004).Following the woodland stage, the ecosystem processes started, manifested by the active growth in height and vertical differentiation of specimens according to a more favourable position in the stand or less exposure to direct light. The vertical differentiation of specimens was highlighted by measuring the height of the Hungarian and Turkey oak trees in 2 sample areas perpendicular to the north-south and east-west (Fig. 1, 3).

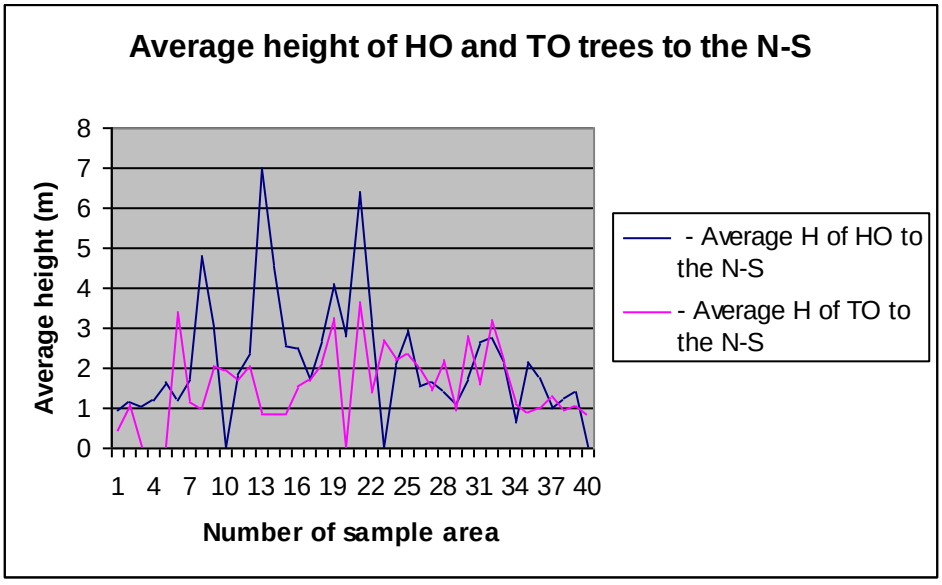

Fig. 1 Average height of Hungarian and Turkey oak trees to the north-south

Figure 1 indicates the vertical differentiation of the Hungarian and Turkey oak trees planted before the regeneration process within the ten-year harvest-regeneration plan, in the middle of the regeneration stand which was the regeneration core.

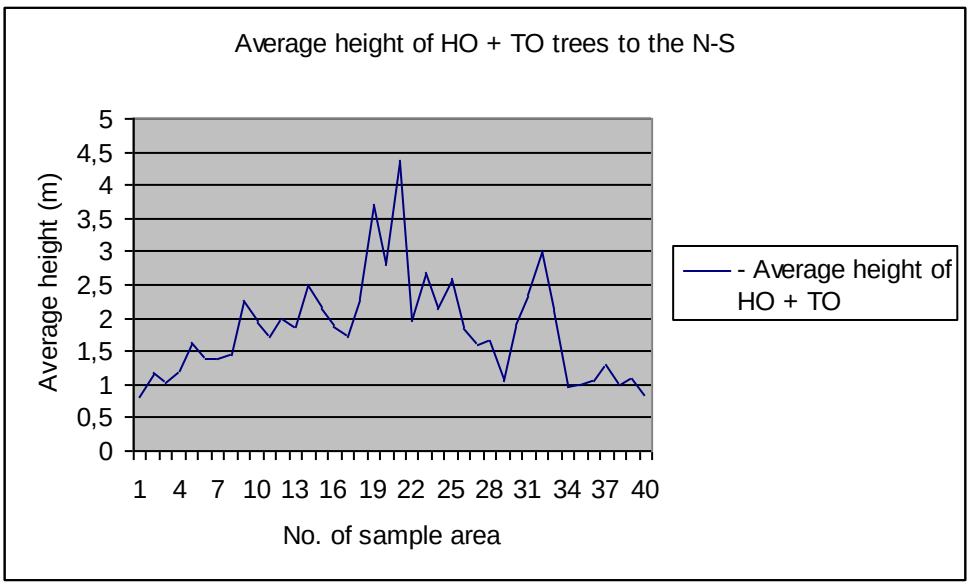

Fig. 2 ***Average height of Hungarian and Turkey oak trees to the north-south***

Diagram 2 shows that the average height of of the Hungarian and Turkey oak trees in the north-south sample area is larger in the middle of the former regeneration stand, in correlation with the planting of seedlings and the subsequent regeneration cuts.

Figure 3 indicates the vertical differentiation in the eastern sample area of Turkey oak trees due to their planting on the brighter side of the stand at the first opening cut.

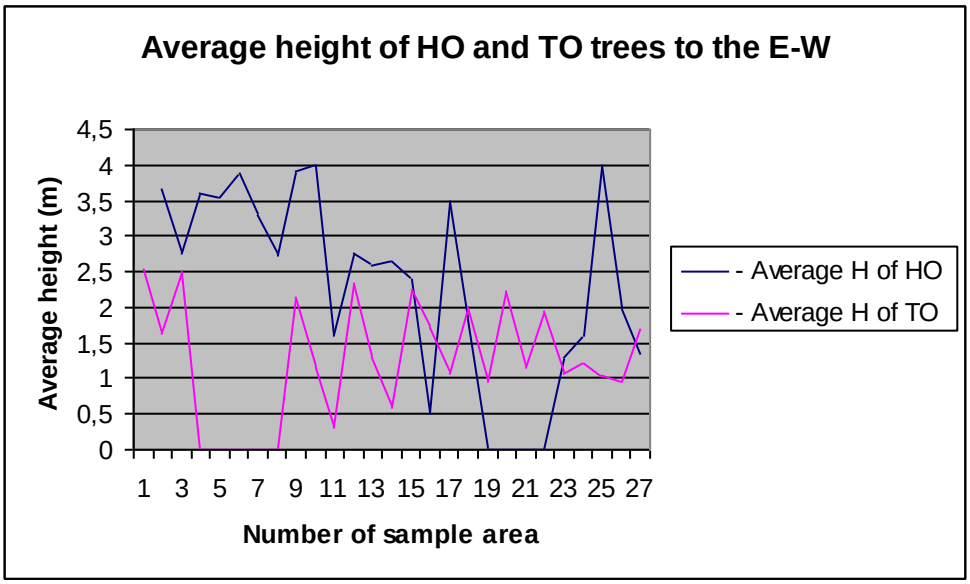

Fig. 3 ***Average height of Hungarian and Turkey oak trees to the east-west***

The differentiation of the young trees in the regeneration stand, in the stage of thicket, saplings and poles, mixed with sticks, was revealed through measurements of the crown diameters (Fig. 4, 5).

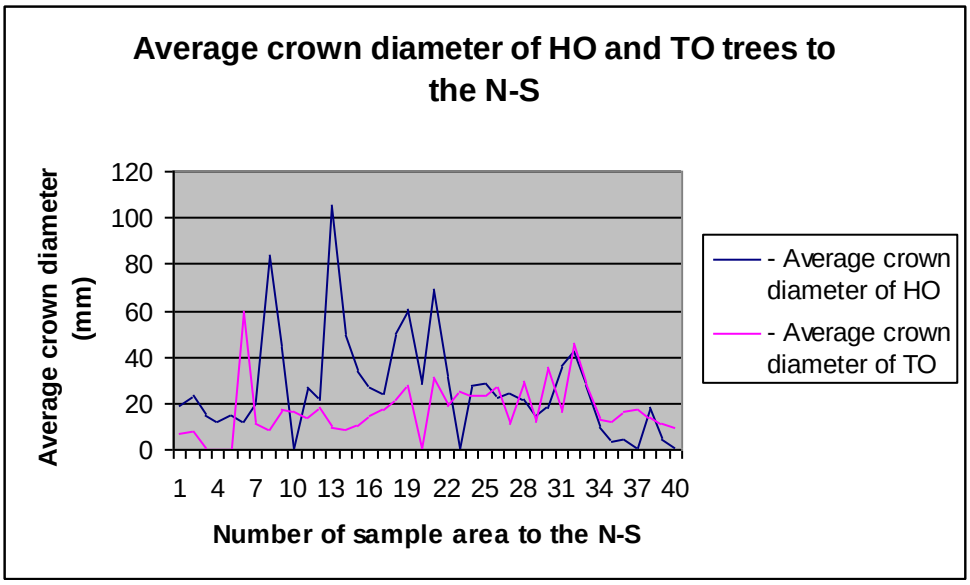

Fig. 4 Average crown diameter of Hungarian and Turkey oak trees to the north-south

The distribution of the diameter size to the north-south is comparable to that of the height in the same direction.

The distribution of the diameters of the Hungarian and oak trees to the east-west is highly similar (Fig. 5).

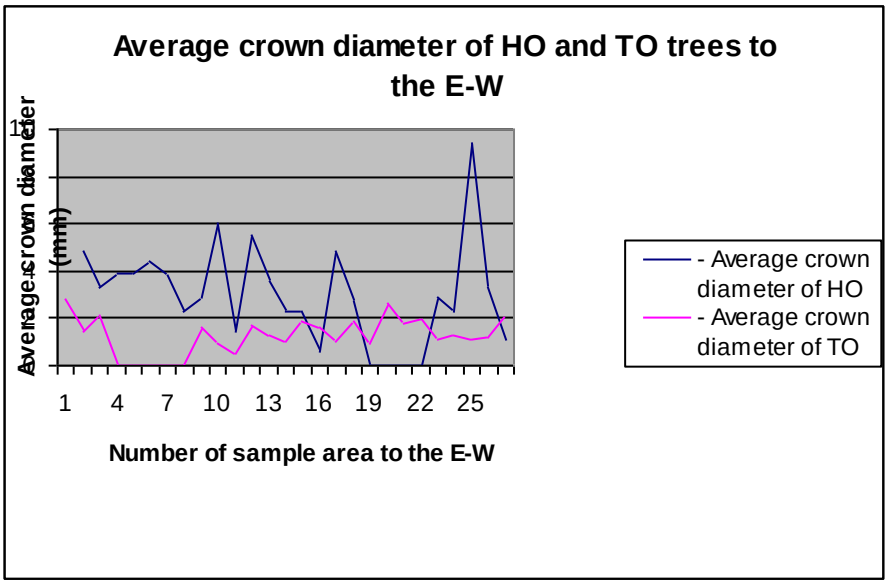

Fig. 5 Average crown diameter of Hungarian and Turkey oak trees to the east-west

By measuring the length of the crown, the vertical differentiation and the gradual uniformisation of heights in the former regeneration stands become obvious. In the stands with a larger crown length, it was noticed that the specimens planted later in the new stand were less tall (Fig. 6, 7).

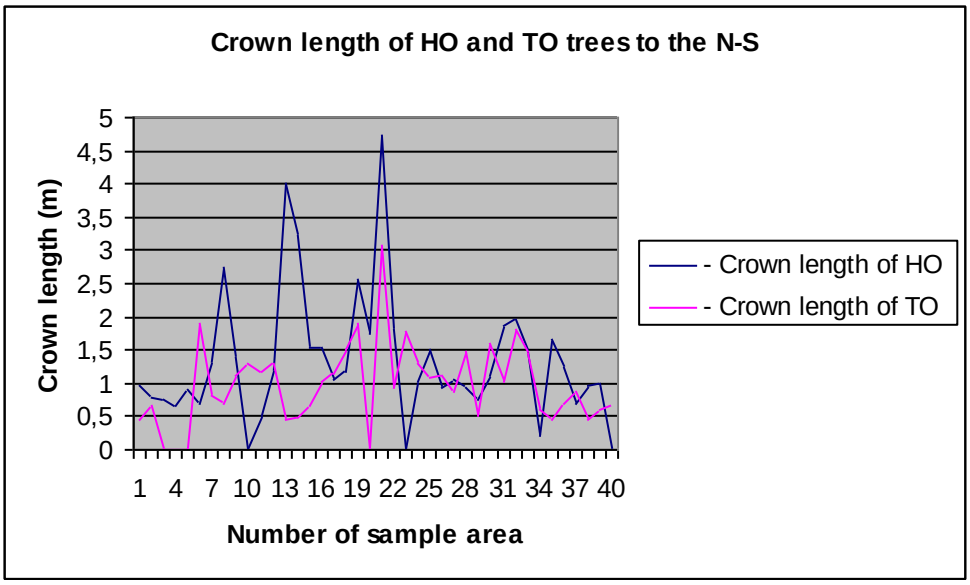

Fig. 6 Crown length of Hungarian and Turkey oak trees to the north-south

Figure 6 shows that the crown length of the Hungarian oak trees to the north-south is higher in the middle of the former regeneration stand, whereas the crown length of the Turkey oak trees is larger in the middle of the former regeneration stand towards the outer area.

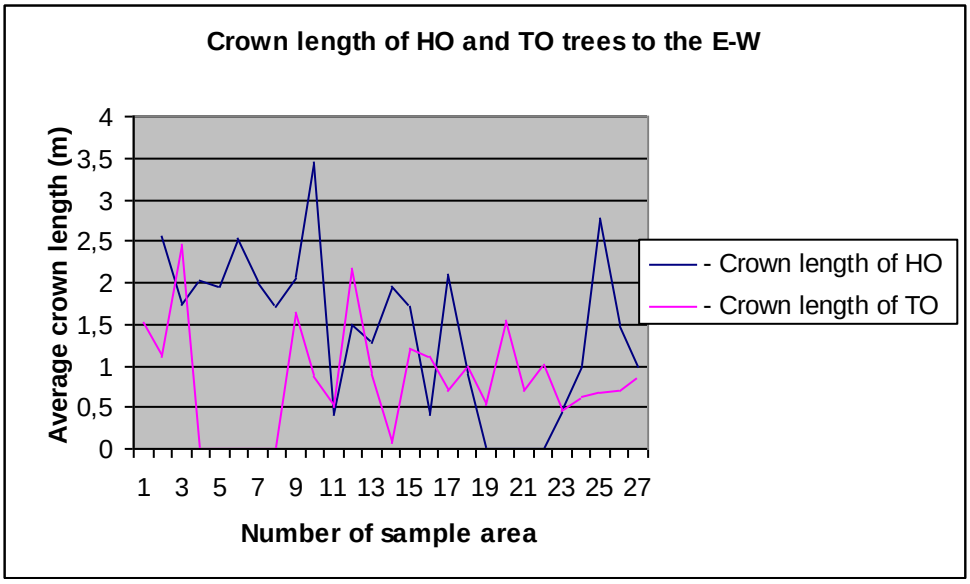

Fig. 7 Crown length of Hungarian and Turkey oak trees to the east-west

Figure 7 indicates that the crown length of the Hungarian oak trees is larger in the eastern outer area and smaller towards the middle and western area, and the crown height of the Turkey oak trees is larger in the eastern area, smaller in the middle, and larger again in the western area.

Measurements of the pruning height to the north-south and east-west revealed ecosystem level processes taking place in young stands shortly following the woodland stage. Natural pruning indicates that the transition from the thicket phase to saplings and poles, and it is highlighted by the pruning height of sample tree to the north-south and east-west (Fig. 8).

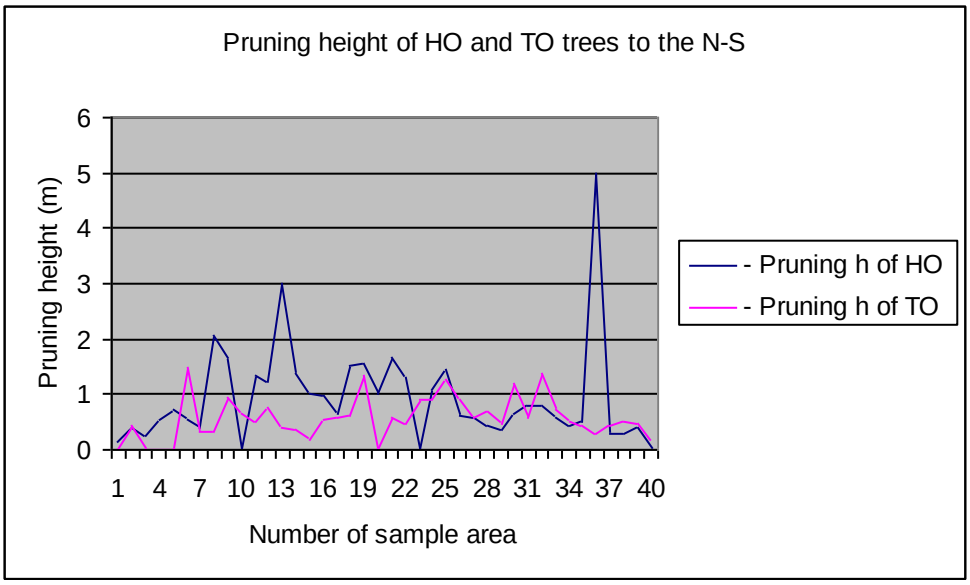

Fig. 8 Pruning height of Hungarian and Turkey oak trees to the north-south

Figure 8 presents the pruning height of the Hungarian and Turkey oak trees to the north-south; thus, the pruned stem of the Hungarian oak trees is larger to the north and central area as well as in the southern part of the former regeneration stand. The Turkey oak tree have stem portions less pruned than the Hungarian oak ones. The pruning height of the Turkey oak trees is larger in the middle and the southern part of the former regeneration stand.

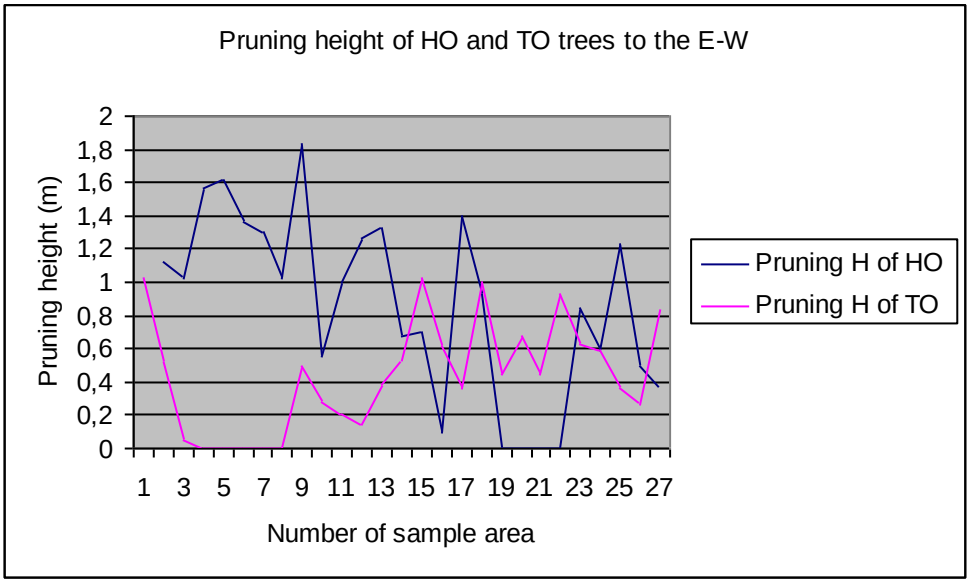

Fig. 9 Pruning length of Hungarian and Turkey oak trees to the east-west

The pruning height of the Hungarian oak trees is larger in the middle and the eastern area, whereas the pruning height of the Turkey oak trees is larger in the middle and the southern part as shown by the diagram of the pruning height of the Turkey and Hungarian oak trees to the east-west.

In the areas of larger pruning height, a harmonised rate of growth in height of the different sample trees is noticed. In these areas, competition is fierce, each sample showing the natural tendency to reach higher peaks, dominant ones so as to remove neighbouring specimens . At this point, practitioners should intervene in the woodland to sort out the species to be removed from the ones of low economic and forestry value, in

line with the goals of forest management, and to remove the inadequate samples of valuable species that would affect the productivity and the value of the wood at the age of exploitability.

CONCLUSIONS

The research findings are reflected in a number of conclusions of particular practical application in the management of mixed stands of Hungarian and Turkey oak trees:

- the average height of specimens of mixed of Hungarian and Turkey oak trees is larger in the central area of the former regeneration stand;
- the general shape of the height curve is increasing, starting from the outer areas to the middle of the former regeneration stand;
- the curve of the diameters of the young stand is similar to that of the height curve;
- the outer areas of the former regeneration stand are at the thicket stage;
- the central and, partly, the outer areas are at the saplings and rod stage, mixed with sticks of the young wood;
- the crown length is larger in the case of Hungarian oak trees compared to that of the Turkey oak trees;
- the transition from the thicket stage to the saplings and poles stage is highlighted by natural pruning ;
- natural pruning is stronger in Hungarian oak specimens that are planted before the Turkey oak ones;

In order to ensure the rational management of these stands, the following works are mandatory:

- care work, cleaning in the central and outer area, where priority is given to the removal of Hungarian oak trees grown from young wood with long non-pruned crowns;
- in the central and outer areas, some of the young trees should be removed.

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