



REVIEWS

Štefančík, Igor: Rast, štruktúra a produkcia bukových porastov s rozdielnym režimom výchovy – Growth, structure and production of beech stands with different thinning regimes



The National Forest Centre - Forest Research Institute in cooperation with the Agency for support of research and development by the end of 2015 published a scientific monograph written by Igor Štefančík named “*Growth, structure and production of beech stands with different thinning regimes*” in the extent of 148 pages. Graphic design of the monograph, accompanied with illustrative color and black and white 81 images and 68 well-arranged tables successfully carried out L.

Pilná and L. Frič in the Publishing of the National Forestry Centre Zvolen in the edition of 100 copies (ISBN 978-80-8093-202-2). The monograph is dedicated to the memory of Prof. Ing. Ladislav Štefančík, DrSc. (*4. 4. 1929 – † 23. 11. 2002), who was the initiator and leading personality in the research of thinning in beech stands not only in the Slovak Republic and the former Czechoslovakia, but also in Central Europe. He is the author of the original thinning methods – the free crown thinning from above according to Štefančík, which is also included in all modern silviculture textbooks. In addition, this thinning method is already applied in forestry practice for a long time.

This complex scientific monograph is the work of Doc. Ing. Igor Štefančík, CSc., who in the thinning of beech stands follows on the long-term research efforts of Prof. Ing. Ladislav Štefančík, DrSc., which dates back to the 50s of the 20th century. The monograph contains 11 main chapters and a list of references, an English summary and annexes (color photos of the monitored research plots), as is evident from the content: 1. Introduction, 2. Starting points, 3. Objectives of research, 4. Material and Methods, 5. Results, 6. Effect of thinning on quantitative production, 7. Effect of thinning on qualitative production, 8. Discussion, 9. Summary of results of research, 10. Recommendation for forestry practice and 11. Conclusion.

In the **Introduction** it is emphasized that changing natural conditions in the recent decades gave rise to new (innovative) approaches of the forest management. Formulation of their principles is possible thanks to the research on long-term permanent research plots (PRPs) that are an irreplaceable natural laboratory for the management of forest ecosystem based on exact measurements.

In the chapter **Starting points** are presented complex aspects of thinning of forest stands, especially beech stands, which are crucial for their development. This chapter is accentuating that in the thinning of beech stands it is

not only important the methodology of applied treatment, but also the age when it is best to start with thinning, with regard to the habitat and stands conditions. More detailed is presented the already mentioned free crown thinning from above according to Štefančík, which was developed in the 50s of the 20th century.

The aim of the study was to evaluate the long-term development of beech stands on the basis of scientific analysis and synthesis of 8 series of PRPs and a total of 28 sub-PRPs with a different thinning regimes based on: diameter and height structures, the number of trees, the basal area and the volume of timber, selected quantitative parameters of production and the total volume of production, the development of superior quality trees (promising and target trees), growing quality of the stem and crown of trees of the main stand, the quality of the main stand and the overall quality of production. The main aim of all attempts were in addition to compare the results of three different thinning methods (the heavy thinning from below – C grade according to the German forest research institutes from 1902, the free crown thinning from above according to Štefančík and area without thinning regimes), as well as evaluation of development of trees with selection quality by the methods of promising, respectively target trees.

In the chapter **Materials and Methods** it is stated that the base material for the writing of this publication was data from PRPs established between 1958–1984 by Prof. Ing. Ladislav Štefančík, DrSc., in naturally regenerated homogenous beech in Slovakia. All investigated stands were at the time of the experiment establishment in the growth phases of small pole stage to pole stage. Up to the establishment of the series of PRPs, the stands were with almost any planned systematic thinning. Each PRP consists of three to five sub-PRPs which are arranged side by side (along level line) and separates them from each other always at least 15 m wide insulating belt of trees. The area of each sub-PRPs is 0.25 ha (50 × 50 m). On all sub-PRPs all living trees with diameter at breast height 3.6 cm and larger were numbered, measured and classified in terms of the standard parameters of growth, structure and quantitative and qualitative production growth. Within each of PRP is always one sub-PRP left without intervention (control). On other areas within each series effects of various thinning methods are monitored and compared. The results were processed using standard techniques of mathematical and statistical methods.

Crucial chapter the **Results** covers 8 series of PRPs: Koňuš, Jalná, Kalša, Štagiar, Žalobín, Zlatá Idka, Lukov and Cigánka. There the results are given more than 50 years of research experiments based on the years 1958–1984, which contain anywhere up to 12 regular repeated complete biometric measurements and evaluations.

Based on a detailed analysis of partial results from individual series PRPs and sub-PRPs were formulated following key results:

- After repeated tending, the thickest individuals (with the highest mean diameter d_g) were on PRPs with the heavy thinning from below and the free crown thinning from above according to Štefančík and thinnest (with the smallest d_g) on the control PRPs.
- The sub-PRPs tended by the free crown thinning according to Štefančík showed the best diameter structure with the highest values of diameter differentiation indices ($TM_d > 0.5$) indicated even high differentiation. The worst diameter structure with the lowest values ($TM_d < 0.3$) characterized by small differentiation were found on sub-PRPs managed by heavy thinning from below.
- The highest values of the mean height (h_g) were found on sub-PRPs with heavy thinning from below and the lowest on all sub-PRPs with the free crown thinning according to Štefančík and control sub-PRPs (without tending). The highest values of height differentiation indices (TM_h) were found always on sub-PRPs with the free crown thinning according to Štefančík (medium to high differentiation) and the lowest on all sub-PRPs managed by heavy thinning from below (small differentiation).
- After repeated tending, the lowest number of trees (N) was found on sub-PRPs with heavy thinning from below (224 to 464 trees ha^{-1}) at stand age from 83 to 105 years (except for PRP Žalobín). On the contrary, the highest N (435 to 1,012 trees ha^{-1}), as well as basal area (G) was found on control sub-PRPs (42.7 – 48.0 $m^2 ha^{-1}$). The sub-PRPs tended by the free crown thinning according to Štefančík showed the lowest G (30.5 – 39.7 $m^2 ha^{-1}$). Merchantable volume was found the lowest on sub-PRPs with the free crown thinning according to Štefančík (468 – 614 $m^3 ha^{-1}$) and the highest on both control sub-PRPs (582 – 846 $m^3 ha^{-1}$) and sub-PRPs with heavy thinning from below (609 – 779 $m^3 ha^{-1}$).
- Total mean annual merchantable volume increment was found the highest on 4 PRPs with heavy thinning from below (10.3 to 10.9 $m^3 ha^{-1} year^{-1}$) and the lowest on 5 control sub-PRPs (6.8 to 10.2 $m^3 ha^{-1} year^{-1}$). Sub-PRP managed by the quality group selection thinning was characterized by the value of 9.8 $m^3 ha^{-1} year^{-1}$, but on PRPs Štagiar it was ranged from 7.1 to 8.1 $m^3 ha^{-1} year^{-1}$.
- The highest number of target (crop) trees was registered on all sub-PRPs managed by the free crown thinning according to Štefančík (68 to 184 trees ha^{-1}) and the lowest on most of control sub-PRPs. It was 190 trees per hectare on the sub-PRP with the quality group selection thinning. On PRP Štagiar it ranged from 156 to 200 trees ha^{-1} at stand age of 68 years.
- The quantitative parameters of target trees (basal area, merchantable volume, current annual periodical diameter increment) achieved the highest values on sub-PRPs managed by the free crown thinning according to Štefančík, with the proportion from 37 to 75% out of basal area of the main stand and/or 39 to 77% out of the merchantable volume of the main stand. On sub-PRPs managed by the quality group selection thinning it was 92% and 93% and/or on PRP Štagiar ranged from 26 to 35% and 29 to 39%, respectively.
- The silvicultural quality of trees at crown level of the stand (1st and 2nd growth class) was found always better in comparison to suppressed level of the stand (3rd to 5th growth class). The worst silvicultural quality of stem was registered on control sub-PRPs (without tending), contrary to sub-PRPs managed by the free crown thinning according to Štefančík and the quality group selection thinning, where the best quality was registered.

Based on a synthesis of acquired knowledge from long-term monitoring and evaluation of PRPs, guiding principles of thinning in beech stands were developed and recommendations generalized for their use in forestry practice, which certainly contribute not only to an increase in the quantity of timber production, but especially the quality of production.

In the **Conclusion** of the monograph it is stated that after more than 50-years of systematic research, heavy thinning from below still comes slightly better (stand age 83–105 years) with respect to total volume production compared to the free crown thinning from above according to Štefančík. However, effective near-natural silviculture of beech stands should be aimed at the quality of production and in this the free crown thinning from above according to Štefančík is the best suited thinning treatment in the conditions of pure beech stands in Slovakia.

This monograph, which summarizes quite exceptional long-term (over 50 years) experimental material, will certainly well serve to managers and employees in forest management, dealing with issues of silviculture. It will also be an inspiration and a repository of knowledge for scientists, whose research addresses various aspects of thinning. However, it will also be used as a teaching tool to forestry faculties in the field of silviculture. Thanks and appreciation for this monograph belong not only to the author Doc. Ing. Igor Štefančík, CSc. and his father Prof. Ing. Ladislav Štefančík, DrSc., but also to the publisher - National Forestry Centre Zvolen and the sponsor – Agency to support research and development.

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