University of West Hungary
Faculty of Forestry

PhD Thesis

Latest Results of the Development of Hybrid Poplar Cultivation

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1. THE SIGNIFICANCE OF THE TOPIC

In our country the cultivation of hybrid poplars is greatly disputed both professional and social groups, although neither the local nor the global economy can renounce their claims on lumber produced this way. We need to emphasise that this resource becomes even more important in the 21st century since it can be produced without causing environmental pollution, its processing does not require much energy. What is more important that it does not cause pollution once processed either.

The most important aim of cultivation is to realise the highest profit as possible, this can be resolved by optimalizing the quantity and quality of lumber produced in a particular region. Despite the fact that the goal is to achieve the highest profit the farmer attains important general weals since the pressure for native logging can be significantly reduced by producing lumber in an industrial way.
The industrial cultivation can be a partial solution for environmental issues as they grow quickly and seizes carbon. As such, they can carry an important role in fighting against climate changes.

We have to accept that effective and intensive cultivation – in the appropriate situation and at the right places – is significant and socially required. The circumstances in Hungary make it possible to carry on this type of lumber production, of course without expelling the natural sylviculture.

The actuality of the topic is emphasised by the fact that it is recorded in our National Forestry Program as a distant goal.

2.   SETTING OF OBJECTIVES

The best solution to raise the efficiency of a particular production type is to increase the level of farming technology at the regions where we applied the way of cultivation so we can produce more products. The goal of the author is to assist the rise of the level of hybrid poplar cultivation technology and to achieve higher profit in farming.

The economic environment has changed along with the EU membership and this demands a complete overview of the situation of hybrid poplar cultivation. We have to discover the strength and weakness of this type of sylviculture. From the aspect of the future of hybrid poplar cultivation it is vital to search for the best opportunities to answer the challenges.

It is also important from the thesis point of view to discover the connections between the process flow of hybrid poplar cultivation technologies and the profitability of the action. Unfortunately, we may still face opinions that state we can regard the plantations as planted or sylvicultural forest, it doesn't matter. To fight against this view we need to ensure that our planted forest cannot be handled as natural grown forests since the profit will decrease and this action is clearly a mistake.

As a consequence of the changes in the technology system of hybrid poplar cultivation it was important to introduce new forest-production models. It is explained by the fact that our country misses the practical pieces of information which is needed to give guidance for applying the methods according to object selections or object spreads. Changes among the breeds revoked to cultivation and the experimental comparison system of hybrid poplars managed by the Forest Research Institute allows us to evaluate the yield in the different regions. It is important that the farmer considers the lumber productivity foremost when choosing breed.

In our days, plantations and cultivation in floodplains appears to be in an irreconcilable contrast. Given that these regions are the most optimally from the hybrid poplar cultivation point of view, we need to disclose the opportunities to harmonize interests in farming, flood-prevention and conservation.

3.   RESEARCH METHODOLOGY

The dissertation is based on the experimental system of circa 700 hectare managed by the Experimental Station of Forest Research Institute in Püspökladány. The system is located at the major regions of hybrid poplar cultivation in Hungary which spreads throughout the lowlands.

The lumber stand assumptions based on 25 experiments in 5-year period and the statistical analysis of data provided the quality and quantity of information that is required to confirm the tasks set in the object. The researcher recorded accurately the features of trees (breed, height, diameter at chest) at all cases during evaluation of the experimental areas. He calculated the average tree capacity according to the aggregate results of measurements in the experimental parcels. He multiplied the average tree capacity with the prime number of the particular hectare which resulted the tree capacity per region.

However, the result refers to the theoretical forest of average trees, the methodology used is necessary for us to be able to perform scientific comparison on lumber stands in various regions.

The author performed age-ring and trunk analysis in order to broaden the scope of research and to adjust and update the data gained at the experimental parcels. However, this methodology is typically a kind of unique tree research, by analysing the necessary amount of trunks we can gain valuable coherencies about the development of the lumber. During the research the author performed a widespread analysis of 247 age-rings and 11 trunks originated from the planted hybrid poplars at the experimental regions. The research was performed in two ways: by analysing sample discs from tilted cut tables and cuts from the full length of the trees using one-meter long gaps between.

The author used penetrometer measurements as research methodology for evaluation of ground compaction and ground development technologies. The process of measuring ground resistance by using penetrometer is the most frequently applied methodology to study ground compaction, the position of pan levels and spatial changes of the soil physical condition. Given that there is a close connection between penetration resistance and the moisture of soil, during the research the author used an instrument that allowed him to be able to measure both features till the depth of 120 centimetres.

4. RESULTS

The author provides an overview of situation and issues of the domestic hybrid poplar production. He reveals the opportunities of this cultivation method including the one of river-flats which is the most disputed technology in our days. In connection with this last he suggests a regional compromise for applied breeds, production technology and the number of plants.

The dissertation describes experiments of cultivation techniques according to which we can clearly state that we should avoid handling hybrid poplar plantations the same way as natural bred forests. As per the dissertation we can only expect the desired results of our plantation if we execute all actions accurately and in the best quality and keep technology disciplines.

The author highlights in his experiments that the most important is from a forestry point of view to care about the quality of soil preparation. Moreover, it is proven that the hybrid poplar forests planted by using complete soil preparation technology have an advantage in accession compared to those without it. At the same time, he describes through and example in the Nyírség that if we overdo plaining it causes problems on forestry.

The dissertation provides a proof confirmed by measurements that it is vital to perform the necessary soil analysis before planting. It states that we cannot make an exception even in a situation that we apply special planting technologies such as deep planting. The table of yield data allows us to filter those soil regions where the efficient hybrid poplar production is limited (so called hybrid poplar boundary regions) or not existing.

By analysing the market tendencies of lumber in the last 30 years it states that during the production cycles we need to focus on increasing the rate of good-quality and dense industrial lumber since the demand for this selection is a solvent and durable.

It appoints that there is a direct proportion between the average diameter at chest height and the available volume of ground. Therefore, we need to change the plantation network from the currently applied 3m×3m or 4m×4m to a wider solution in order to achieve good-quality lumber production unless our aim is to create a major dendromass or production of a particular lumber-selection. It declares that the economic lumber production is not possible at hybrid poplar forests that are smaller than 12-16 meters in the current market conditions. It describes based on the analysis that it is possible to determine the production regions as a maximum network of 36 square meters. By applying the technology we might need to go without the pre-usage lumber volume, but our trees can grow until final production without disturb so by the end of the production cycle the lumber will be good quality and proper for timber-saw industry. To be able to support his results, the author describes that even in the early ages (3 years) the breeds can have major competition between each other that effects negatively the lumber production which cannot be balanced in wider growing regions either.

The author summarized the result to develop the forestry models and the simplification tables of the different plantation network hybrid poplars.

The author used statistic methodology to prove that the most important question around establishing plantations which is the clone and breed selection.

He mentions the breed 'Pannónia' as an example for the extreme and dangerous plantations nowadays. He shows that it is possible to create plantations with the currently used breed selection which complies with the particular regions and promises higher economic profit.

He emphasises and determines that the farmers need to be taught about their opportunities, at the same time he points out that the forestry research has a task to improve the breed sorts, to have the breed selection recognized and to revoke the new clones to the experiment.

By using the base data gathered during his analysis on lumber structure the author established a model which allows him to study the coherence between the age, growing region and targeted diameter.

The advantage of this table is that those are easy to apply and the targeted diameters can be determined for any ages. The author described a detailed case maps in the dissertation that is used to create his model along with the his own research by optimizing it for two basic selection group. He determined the economically profitable margin of the production of the selection groups which shall be 18 m^3 per hectare per year average breeding according to him. He also emphasised that the lowest margin of economic hybrid poplar production must be set as 10 m^3 per hectare per year average breeding. The risk of hybrid poplar cultivation at the weaker growing regions is so high that we need to consider planting other breeds or using the region for other purposes.

5. THESIS

1. The author has systematized the main aspects of plantation forestry, has indicated the possibilities within, and has given an analysis on the general principles of hybrid poplar cultivation. The detailed analysis of the current situation of Hungarian hybrid poplar cultivation has been executed, covering its discrepancies. The author has indicated that the hybrid poplar cultivation has been displaced of the optimal regions in practise. At the same time the possibilities of improving cultivation are described:

    o adherence of cultivation technologies fitting with the particular region

    o intervention to ensure the conditions of cultivation at weak-bearing regions (irrigation, nutrient-supplying)

    o involvement of new, agricultural regions that do not fall under natural reservations

2. The author has systematized and has supported with experimental details that it is vital to comply with the hybrid poplar cultivation technologies. The effects of market tendencies has attracted attention by means of the detailed economic analysis, principally to the fact that stable demand for large range of selection increases the predictability of cultivation. It shows that the change of supporting systems influences directly and greatly the economic hybrid poplar cultivation (mainly because of the fact that farmers lack capital), but the sensitivity it causes can be used to realise political objectives.

3. The author describes the system of hybrid poplar cultivation at the Scientific Institute of Forestry. He selected and applied the most appropriate statistical analysis methodology for evaluate the experiments. He confirmed the effect of complete soil preparation technology on the

efficiency of production, this effect is absolutely positive. In the right conditions of soil, if we apply end-usage planting network we can achieve a bigger population of lumber than in a plantation which needs to be thinned several times during the cycle. The author empirically confirmed that the detailed, preliminary soil exploration cannot be avoided even when applying special deep planting technology.

4. The author examined the overall efficiency of the hybrid poplars at the different plantations, these poplars are in the experimental system of the Science Institute. He created a guideline for good and intermediate soil conditions according to the results. He determined the scope of good and intermediate lumber production according to his researches, based on the model tables of hybrid poplar production. The good is 18 m^3 per hectare per year; the intermediate is 10 m^3 per hectare per year. He declares and confirms that hybrid poplar standings below this limit cannot be counted as efficient, and cannot be categorized as plantation.

5. The author created simplified breeding models and age target-diameter data series based on the research and the age-ring and trunk analysis which can be applied on the hybrid poplars that are eligible for good quality lumber and selection productions. He summarized the processes of hybrid poplar cultivation technologies and he established a simplified numeric model of forest production.

6. The author described in details the connection points between tree plantation and the river-flat based farming, including their conflicts which raise difficulties of farming at the special regions. He created a suggestion for handling the difficulties and establishment of an efficient system based on rational compromise and the exploration of the cause and effect relationship. The base of the suggestion is the establishment of a forestry cultivation technology that can be applied for the particular needs of regions at river-flats.

6. THE AUTHOR'S PUBLICATIONS IN THIS TOPIC

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