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Tending operation models for white poplar (*Populus alba* L.) stands growing under sandy soil conditions

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Summary: Integrated research aimed to intensify the practices of afforestation especially of white poplar and grey poplar woods. A new, simplified tending procedure has been developed to substitute earlier models considering the target diameter by right spacing as a tool to achieve adequate quality of logs. The practice-oriented model may help the qualitative improvement of white poplar growing technology in Hungary as well as in Serbia.

Key words: white poplar (*Populus alba* L.), tending operations, growing models

Introduction

White poplar (*Populus alba* L.) and its most important natural hybrid, the grey poplar (*Populus x canescens*), are native tree species in Hungary (Szodfridt- Palotás, 1973; Tóth B. (edit.), 1996; Rédei, 1991) and in Serbia (Guzina, Bozic, 1984; Guzina (edit.), 1986). Due to their favourable silvicultural and growth characteristics, as well as the possibilities for the utilisation of their wood, the area they occupy is increasing continuously. The most important task facing Hungarian and Serbian poplar growers is improving the quality and increasing the quantity of poplar stands for wood production (Pletikapic-Kolevska, 1985; Rédei, 2000; Orlovic – Kovacevic – Pilipovic – Galic, 2003.).

The main economic purpose of plantation forestry is to increase the level of timber production to a degree on which the given sized area and within the limits set by ecological conditions provides the biggest yield and consequently provides the biggest earnings within the shortest period of time, whilst keeping investment and risk are at the lowest possible minimum.

The most important characteristics of plantation forestry can be summed up as follows (Führer-Rédei-Tóth, 2009.):

- the production of target assortments defined in advance in huge quantities and the same quality,
- the application of a relatively closed growing-technology system from forestation to final cutting, of which agricultural intensiveness is partly also a characteristic of (e.g. fast-growing tree species, respectively the mono-cultures, intensive pruning system, etc.) furthermore
- the renovation of forest stands is only possible in an artificial manner.

Apart from the poplar species to be used for plantation forestry black locust, red oak and black walnut can also be

suitable for this type of forest management. Common walnut plantations can be listed here too, but the silvicultural significance of this tree species is negligible.

From among the above listed tree species the models for tending operations and the tables for age-growth space-target diameter models are suitable for production of large, quality wood material as well as mass assortments produced in white poplar stands.

Simplified tending operation model for white poplar stands

White poplar is a fast-growing species. Seedlings quickly emerge from the phase of competition with weeds. In-line and inter-row weeding is required in the first years of plantations established by means of seeding, as is the removal of failed plants. During tending operations it is important to take into consideration the fact that plantations consist of trees of varied genetic make-up (genotype). In terms of the demand for light, it is worth remembering that while poplar reacts extremely strongly to light availability, it also tolerates shade very well.

Table 1. contains a simplified tending operation model for white poplar, for its compilation we used the data of 70 long term expiry yield and experimental tending operation plots. To choose the most suitable planting spacing, it depends on the quality of the planting material and the particular site conditions. The tending cuttings (growth space expansions) must be carried out when the stem number approximately approaches the stem data contained in the table prior to the tending cuttings.

In case of plantations planted in a planting spacing of 3x3 m or 3x2 m, there is no need for cleaning, except if the

saplings are not steady of growth. In case of the initial spacing narrower than that of 3x1m or 2.5x1m, in plantations established with white poplar clones one, respectively two growing space cleanings are recommended.

Tending operation	Number	The improvement cutting		Stem number (pc/acs)		
		Year to be carried out at (age) (year)	At the time of H _m (m) and Yield class		the improvement cutting	
					Before	after
Cleaning	1. 2.	5–10 11–14	6	(I–VI.)	>3000 3000	3000 1300–1800
			8–11	(I–VI.)		
Thinning	1. 2.	15–20 21–25	12–17	(I–V.)	1300–1800 650–1200	650–1200 350–600
			16–23	(I–IV.)		
Final cutting		40		(I–II.)		350–400
		30–35		(III–IV.)		500–600
		25–30 20–25		(V.) (VI.)		800–900 1000–1100

Remarks for the use of the tending model:

During the planning of thinnings, the better the estimated yield class is, the more the lower value of the stem numbers after the tending cutting must be approached.

The white poplars stands in yield classes V–VI. do not make for quality wood production.

Age – growing space – target diameter models for white poplar stands

In plantation forestry, the timing of the growing space expansion has a stressed significance for reaching the given target sortiment production by maintenance of the near optimal stem number per hectare (growth space). The site (ecological) factors define basicly the target sortiments, e.g. whether there is an opportunity for the production of sizeable, quality wood material (panel log, sawlog) or just thinner sized, so-called mass wood sortiments (cutting, pallet and box basic material) paper wood, wood fibre, chippings as well as wooden board basic materials can be produced.

The basic coherence pertaining to the growth space-modelling of the white poplar stands can be demonstrated by the following equation:

$$N=e^{8.75483-0.83879\ln D_{1,3}}$$

where: N= stem number of the remaining stand on 1hectare, D_{1,3}= diameter at breast height (in cm).

The data in Table 2 show that a decisive opportunity for quality, sizeable log production can be available in the white poplar stands classified in yield class I-III. In the white poplar stands in yield class IV – taking the average cutting age of 30 years into account – a target diameter of 18 and 20 cm can be planned with great certainty. The sustainable stem number per 1 hectare depending on the yield class varies between 320 to 560 pieces.

Table 2. Age-target diameter model for white poplar stand suited for quality log production

Planned target diameter (D _{1,3}) (cm)	Factors		
	Yield class	The age (year) necessary for reaching the given diameter (D _{1,3})	Stem number (N) 1-hectare (pc/ha)
18	I.	14	560±5%
18	II.	17	
18	III.	21	
18	IV.	28	515±5%
20	I.	16	
20	II.	18	
20	III.	23	425±5%
20	IV.	32	
25	I.	21	
25	II.	25	365±5%
25	III.	37	
30	I.	28	
30	II.	42	320±5%
35	I.	43	

Table 3. Age-target diameter model white poplar stands suitable for production of mass sortiments

Planned target diameter D _{1,3} (cm)	Factors		
	Yield class	The age (year) necessary for reaching the given diameter (D _{1,3})	Stem number (N) per 1-hectare (pc/ha)
10	IV.	11	920±5%
10	V.	14	
10	VI.	19	
12	IV.	13	790±5%
12	V.	17	
12	VI.	25	
14	IV.	15	690±5%
14	V.	24	
14	VI.	-	
16	IV.	20	620±5%
16	V.	31	
16	VI.	-	

The Table 3 shows that for the production of mass assortments in stands of IV, V yield class and eventually in case of a plannable 10–12 cm target diameter even the white poplars in yield class VI may be suitable.

At the same time in these two latter yield classes, the stands are usually less producing in most case, so these cannot be the subjects of plantation forestry.

In the white poplar stands produced under worse ecological conditions the plannable final-cutting age is also shorter (generally between 25–30 years). The sustainable stem number varies between 620–920 pc/ha depending on the yield class. In these white poplar stands – based on our yield studies – the stem number reduction (thinning) carried out after age 15–17 does not produce significant diameter growth surplus either.

Conclusions

The growing-improvement of plantation-like white poplar management is becoming ever more significant with regard to lowland forestry. This study has also been prepared by taking this fact into account, and by making the novel planning accessories which help advance the increase of value output of the wood material produceable in white poplar stands. We hope that the published models will prove useful for the practice in Hungary and also in Serbia.

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