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Yield of Red Oak Stands in the Nyírség Forest Region (Eastern-Hungary)

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Abstract. Besides black locust (*Robinia pseudoacacia* L.) and hybrid poplar ssp., red oak (*Quercus rubra* L.) can be considered as the third most important exotic stand-forming tree species in Hungary. Due to its favourite silvicultural and growth characteristics as well as its wood utilization possibilities, the present area occupied by red oak stands amounts to 14000 hectares in the country. Of its growing districts Nyírség (Eastern-Hungary) has a distinguished importance where the area of red oak stands is 2000 hectares. To determine their growth rate and yield as exactly as possible, a local numerical (tabulated) yield table has been constructed on the basis of surveys of a hundred experimental plots. We consider that the data used for constructing the yield table can be favourably used for improvement of the red oak stands management as well.
Key words: red oak (*Quercus rubra* L.); yield table; Hungary

Produção de Povoamentos de Carvalho Americano na Região Florestal da Nyírség (Hungria de Leste)

Sumário. Para além da robinia pseudoacácia (*Robinia pseudoacacia* L.) e híbridos de choupo, o carvalho americano (*Quercus rubra* L.) pode considerar-se como a terceira exótica mais importante formando povoamentos na Hungria. Devido às suas apreciadas características silvícolas e de crescimento, assim como às possibilidades de utilização da madeira, a área actualmente ocupada pelo carvalho americano no país ascende a 14 000 hectares. Considerando os distritos em que cresce, Nyírség (Hungria de Leste) destaca-se, com uma área de 2000 hectares ocupada por povoamentos de carvalho americano. Para determinar com a maior exactidão possível a taxa de crescimento e produção, construiu-se uma tabela de produção local, com base em dados recolhidos em 100 parcelas de estudo. Considera-se que os dados utilizados para a construção da tabela de produção também podem ser úteis para melhorar a gestão dos povoamentos de carvalho americano.
Palavras-chave: carvalho americano (*Quercus rubra* L.); tabela de produção; Hungria

Production de Peuplements de Chêne Rouge dans la Région Forestière de Nyírség (Hongrie de Lest)

Résumé. En dehors du robinier (*Robinia pseudoacacia* L.) et des hybrides de peuplier, le chêne rouge (*Quercus rubra* L.) peut être placé au troisième rang des exotiques constituant des peuplements en Hongrie. Dû à ces caractéristiques sylvicoles, assez appréciées et à sa croissance, ainsi qu'aux possibilités d'utilisation de son bois, les peuplements de chêne rouge occupent à présent 14000 hectares dans le pays. Parmi les districts où il pousse, Nyírség

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(Hongrie de l'Est), avec une superficie de 2000 hectares de peuplements de chêne rouge, est le plus significatif. Pour déterminer le taux de croissance et de production, aussi exactement que possible, on a élaboré une table de production locale, basée sur des données recueillies sur 100 placettes d'étude. On pense également que les données utilisées pour la construction de cette table de production pourront aussi être utiles à l'amélioration de la gestion des peuplements de chêne rouge.
Mots clés: chêne rouge (*Quercus rubra* L.); table de production; Hongrie

Introduction

The red oak (*Quercus rubra* L.) introduced from North America to Europe in the 18th century, which appeared in the middle of the 19th century also in our country (FEKETE, 1881), has adapted in large measure to the site conditions of Hungary. Due to its favourable silvicultural and yield characteristics the area rate of the red oak is continually increasing, and on the basis of data of the State Forest Service (status of first January 2002) they are occupied in it's growing on about 14 thousand hectares in our country. Red oak stands of more important area are found in Baranya, Vas, Zala, Somogy and Szabolcs-Szatmár-Bereg counties (LÁMFALUSSY, 1950).

Of the varieties of the red oak the *Quercus rubra* L. var. *maxima* Sarg (bur red oak) is the most considerable with a view to tree growing, because this latter one takes up the largest area from the red oak stands. Also the *Quercus coccinea* Münch (purple oak) occurs often as admixed tree species in the existent red oak stands.

In the course of determining the ecological demand of the red oak it is necessary to consider the ecological characteristics of its original home land and of its spreading of Europe, in accordance with the fact that it is the tree species of the balanced climate region of Atlantic character. It cannot tolerate the frost pocket and the late freeze. It shows a fast growth on the airy and free from lime soils, which are in good fertile power and have a favourable water regime (JÁRÓ, 1957). The red oak avoids the calciferous and excessively acid soils, as well as the moist and too dry ones. In our country it achieves the best growth on the meadow forest soil of acid sands, where the groundwater is moving and it is not too deep. It shows good growth on the rusty brown forest soil and on the brown forest soil of deep tilth. It cannot be grown in inundation areas of low ground level and on flood plains. The red oak avoids the stagnant water and the accompanying gley.

Out of its general silvicultural characteristics it should be emphasized, that the red oak is a fast-growing species, which in the seedling and sapling age rises quickly from the weed competition. In the first years of the forestations established by sowing or seedling it must perform the in-line and interrow weeding, as well as the cutting back of injured plants.

During of its tending operations it is important to take into consideration, that its populations consist of specimens of varied genetic value (genotypic), its early-bursting and late-bursting, both more light-demanding and more shade-tolerating specimens can be found in the red oak stands. From the point of view of its light-demand the fact deserves attention, that while it endeavours extremely

strongly to the light, on the other hand it tolerates excellently the shade too. Due to the typical colour of the foliage and bark the red oak is one of our tree species of most high aesthetic value.

Other tree species can hardly keep up with its quick growth on an appropriate site, so we are tending it in a pure stand. It forms a straight, slender, cylindrical and to a height of 8-10 metres branch-free stem. The red oak produces a well closing, favourably differentiated stand structure in consequence of the great genetic diversity of single trees (SZAPPANOS, 1978). It utilizes well the leaks of the tending cuttings. In this manner, because of its quick height growth, the systematic, individual selective method can be favourably combined at the more frequent stem number reduction. The integrated system of its silvicultural treatment is not completely elaborated, because at present we have only very few red oak stands of harvest rotation age (at about 70 years). The newly compiled and subsequently mentioned yield table can be among others the basis of elaborating the tending models for red oak stands.

As mentioned in the foregoing, the Nyírség forest region has a determined importance from point in view of the national red oak production. Based on a publication by MR. TÁCSIK (1985), the first red oak forestations were established in the 1920s years in the Nyírség region. From the second half of the 1950's years the rate of red oak forestation has considerably risen, and it reached yearly 30 hectares in the last three decades.

In the area of the Nyírerdő Joint-Stock Company (Nyíregyháza) red oak stands can be found on about 2 thousand hectares. Growing stock is 393 thousand cubic metres. The considerable red oak afforestation of the last decades is indicated by the fact, that the 75% (according to the area), respectively the 58% (according to the growing stock) of red oak stands belongs to age classes for 1–29 years. The average growing stock/ha is 197 cubic metres; on the other hand it is noteworthy, that this value is 322 cubic metres/ha in the stands belonging to age classes of 30–69 years.

The local red oak yield table compiled to the area of the Nyírség forest region, as regards its nature, is the first in the history of the national red oak research. The course of the compilation, which can be programmed, makes possible enlarging the information content of the yield table and also changing its form and content.

Place and method of study

Place of study

The local red oak yield table was constructed from data gathered on 100 sampling plots (cc. 500–1000 m^2) located in red oak stands in the area of the Nyírerdő Joint-Stock Company (EW–48°, NS –22°).

Method of study

In the course of tree stand surveys the key stand characteristics were measured, and then, on the basis of data collected, were calculated such major stand structure features as the average height, breast height diameter, volume, basal area and stem number given separately for the main, secondary and total crops per hectare. For calculations Sopp's volume table (SOPP, 1974) was applied.

Construction of the yield table

The numerical (tabulated) yield table of normative nature presents data given to six yield classes (base age: 50 years) including the most important stand structural and yield features expressing in terms of main crop, secondary crop (which can be removed in tending process) and the total crop of stands. The data are given from 5 to 70 years in breaking down of 5 years.

The yield table was constructed using the following formulas and coefficients:

1. Age of stand (A)

2. The average height of the main crop (mc), weighted by the basal area expressed in %:

$H_{mc}\ \% = 1.19619\ [\ 1\text{-}e^{-0.038963 \times A}\ ]^{1.16495}$

3. D_{mc} = the average diameter (at breast height) of the main crop:

$D_{mc} = 1.44498 + 0.47232 \times H_{mc} + 0.02017 \times H^2_{mc}$

4. V_{mc} = the volume of the main crop:

$V_{mc} = B_{mc} \times HF_{mc}$

where HF_{mc} = form-height quotient,

$HF_{mc} = 2.27002 + 0.43222 \times H_{mc}$

5. BA_{mc} = basal area of the main crop:

$$BA_{mc} = \frac{D^2_{mc} \times \pi}{4 \times 10000} \times N_{mc}$$

6. N_{mc} = stem number of the main crop:

$N_{mc} = e^{9.80220 - 1.12607 \times \ln Dmc}$

7. H_{rc} = main height of the crop to be removed (rc) weighted by the basal area:

$H_{rc} = 3.71090 - 0.08443 \times H_{mc} + 0.02787 \times H^2_{mc}$

8. D_{rc} = the diameter at breast height of the crop to be removed:

$D_{rc} = 1.07719 + 0.21482 \times H_{mc} + 0.01523 \times H^2_{mc}$

9. V_{rc} = the volume of the crop to be removed: $V_{rc} = B_{rc} \times HF_{mc}$

$HF_{mc} = 2.27002 + 0.43222 \times H_{mc}$

10. BA_{rc} = the basal area of the crop to be removed

$$BA_{rc} = \frac{D^2_{rc} \times \pi}{4 \times 10000} \times N_{rc}$$

11. N_{rc} = stem number of the crop to be removed:
(calculated from the stem number reduction of the main crop every fifth year)

12. H_{tc} = main height of the total crop (tc) weighted by the basal area:

$H_{tc} = -0.37324 + 1.00148 \times H_{mc}$

13. D_{tc} = the diameter at breast height of the total crop

$$D_{tc} = \sqrt{\frac{G_{tc} \times 10000}{N_{tc} \times \pi}} \times 2$$

14. V_{tc} = volume of the total crop:

$V_{tc} = V_{mc} + V_{rc}$

15. BA_{tc}= basal area of the total crop:

$BA_{tc} = BA_{mc} + BA_{rc}$

16. N_{tc}= stem number of the total crop:

$N_{tc} = N_{mc} + N_{rc}$

The yield table is also given in graphic forms (1.a-e Fig.) and presented data for the main stand structure data mentioned above.

Utilization of the new yield table

The published yield table, which is the first one for the region, can be utilizable in the following fields:

- appraisal of statistical nature of the red oak stands,
- harvest scheduling of red oak stands, implementing the volume estimations,
- elaborating or further developing the silvicultural (tree growing) models for red oak stands,
- elaborating and explaining the guidelines of the local tree species policy, and
- national analysis related to the growing of red oak stands.

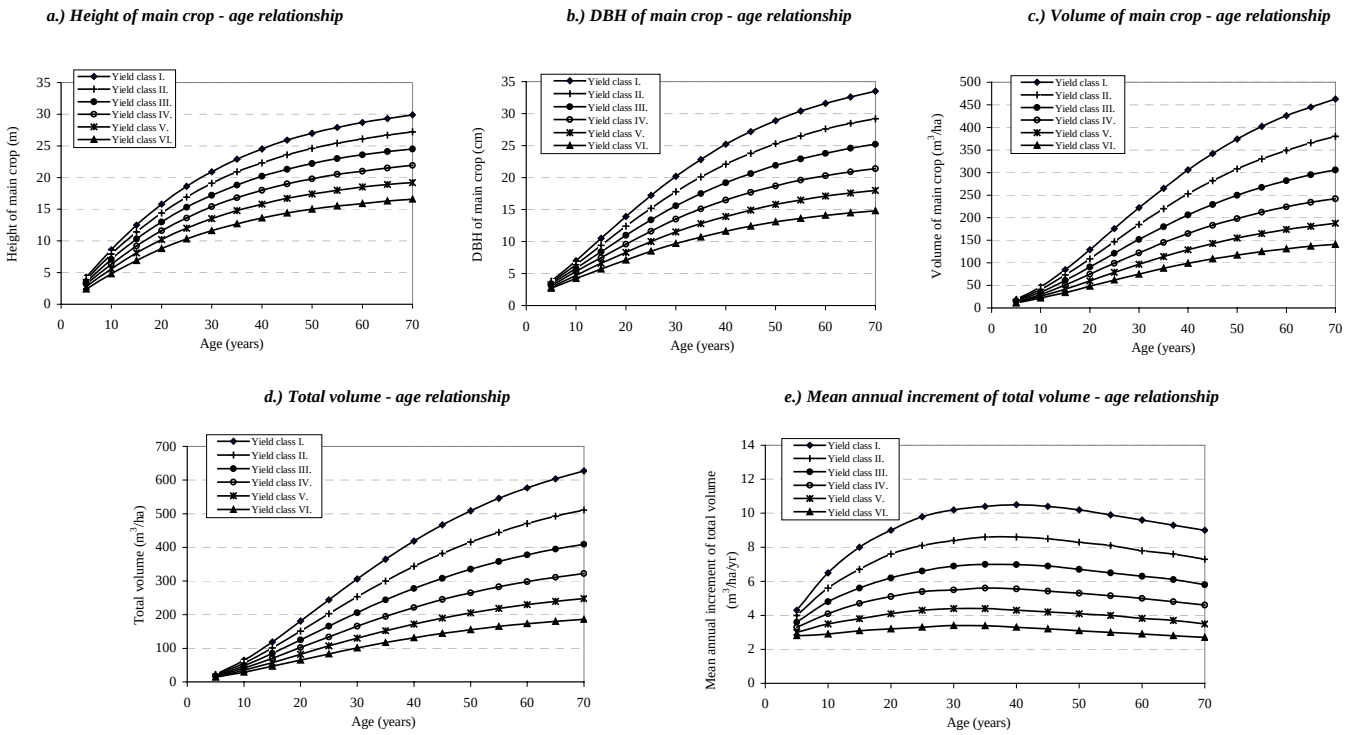

Figure 1- a–e - Red oak stand structure factors in function of age

Yield table for red oak stands (Nyírség)

1 ha

Age	Main crop					Secondary crop					Total crop					Total removed wood		Total volume		
	average		Volume	Basal area	Stem number	average		Volume	Basal area	Stem number	average		Volume	Basal area	Stem number			Volume	Mean increment	Annual increment
	H	D				H	D				H	D								
	H_{mc}	D_{mc}	V_{mc}	B_{mc}	N_{mc}	H_{rc}	D_{rc}	V_{rc}	B_{rc}	N_{rc}	H_{tc}	D_{tc}	V_{tc}	B_{tc}	N_{tc}			V_{tc}		
yr	*m*	*cm*	m^3	m^2		*m*	*cm*	m^3	m^2		*m*	*cm*	m^3	m^2		m^3	%	m^3	m^3/yr	m^3/yr
I. Yield class																				
5	4,3	3,8	19	4,6	3964	3,9	2,3	3	0,6	1587	3,9	3,5	22	5,3	5551	3	12,3	22	4,3	0,0
10	8,6	7,0	47	7,8	2007	5,1	4,1	15	2,5	1957	8,3	5,8	62	10,4	3964	18	27,7	65	6,5	8,6
15	12,5	10,5	85	11,1	1280	7,0	6,1	17	2,2	727	12,1	9,2	101	13,2	2007	34	28,9	119	8,0	10,9
20	15,8	13,9	129	14,2	930	9,3	8,3	17	1,9	350	15,4	12,6	146	16,1	1280	52	28,6	181	9,0	12,3
25	18,6	17,2	176	17,0	734	11,8	10,3	17	1,6	196	18,2	16,0	193	18,7	930	69	28,1	244	9,8	12,7
30	20,9	20,2	222	19,6	613	14,2	12,3	16	1,4	121	20,6	19,1	238	21,0	734	85	27,6	306	10,2	12,4
35	22,9	22,8	265	21,8	533	16,4	14,0	15	1,2	80	22,6	21,9	280	23,0	613	100	27,3	365	10,4	11,7
40	24,5	25,2	306	32,8	478	18,4	15,5	13	1,0	55	24,2	24,3	319	24,8	533	113	27,0	419	10,5	10,7
45	25,9	27,2	342	25,4	438	20,2	16,8	12	0,9	40	25,5	26,5	354	26,3	478	125	26,8	467	10,4	9,6
50	27,0	28,9	374	26,8	409	21,7	18,0	10	0,7	29	26,7	28,3	384	27,6	438	135	26,6	509	10,2	8,5
55	27,9	30,4	402	28,0	387	23,1	19,0	5	0,6	22	27,6	29,9	411	28,6	409	144	26,4	546	9,9	7,4
60	28,7	31,6	426	29,0	370	24,2	19,8	8	0,5	17	28,4	31,2	433	29,5	387	152	26,3	577	9,6	6,3
65	29,3	32,6	445	29,8	356	25,2	20,5	7	0,5	14	29,0	32,3	452	30,2	370	159	26,3	604	9,3	5,3
70	29,9	33,5	463	30,5	346	26,0	21,1	5	0,3	10	29,5	33,2	468	30,9	356	164	26,2	627	9,0	4,6
II. Yield class																				
5	3,9	3,6	17	4,3	4267	3,8	2,2	3	0,7	1802	3,5	3,2	20	5	6069	3	13,1	20	4,0	0,0
10	7,9	6,4	41	7,2	2227	4,8	3,7	13	2,2	2040	7,5	5,3	53	9,4	4267	15	27,0	56	5,6	7,2
15	11,4	9,4	73	10,1	1443	6,4	5,5	13	1,9	784	11,0	8,3	86	11,9	2227	29	28,2	101	6,7	9,0
20	14,4	12,4	109	12,8	1059	8,3	7,3	14	1,6	384	14,0	11,3	123	14,4	1443	42	27,9	151	7,6	10,0
25	16,9	15,2	147	15,3	841	10,3	9,1	14	1,4	218	16,6	14,2	160	16,7	1059	56	27,5	203	8,1	10,3
30	19,1	17,8	185	17,5	706	12,2	10,7	13	1,2	135	18,7	16,9	197	18,8	841	69	27,1	253	8,4	10,1
35	20,9	20,1	220	19,5	616	14,1	12,2	12	1,0	90	20,5	19,2	232	20,5	706	80	26,8	300	8,6	9,5
40	22,3	22,1	253	21,2	554	15,7	13,5	11	0,9	62	22,0	21,4	263	22,1	616	91	26,5	344	8,6	8,7
45	23,6	23,8	282	22,6	509	17,2	14,6	9	0,8	45	23,2	23,2	291	23,4	554	100	26,3	382	8,5	7,7
50	24,6	25,3	308	23,9	476	18,5	15,6	8	0,6	33	24,3	24,3	316	24,5	509	108	26,1	416	8,3	6,8
55	25,4	26,5	330	24,8	450	19,6	16,4	7	0,5	26	25,1	26,1	337	25,4	476	116	26,0	445	8,1	5,8
60	26,1	27,6	349	25,7	431	20,6	17,1	6	0,4	19	25,8	27,2	355	26,2	450	122	25,8	471	7,8	5,1
65	26,7	28,5	366	26,5	416	21,4	17,7	5	0,4	15	26,4	28,2	371	26,8	431	127	25,7	493	7,6	4,3
70	27,2	29,2	380	27,1	404	22,0	18,2	4	0,3	12	26,9	29,0	384	27,4	416	131	25,7	511	7,3	3,6

Age	Main crop					Secondary crop					Total crop					Total removed wood		Total volume		
	average		Volume	Basal area	Stem number	average		Volume	Basal area	Stem number	average		Volume	Basal area	Stem number			Volume	Mean increment	Annual increment
	H	D				H	D				H	D								
	H_{mc}	D_{mc}	V_{mc}	B_{mc}	N_{mc}	H_{rc}	D_{rc}	V_{rc}	B_{rc}	N_{rc}	H_{tc}	D_{tc}	V_{tc}	B_{tc}	N_{tc}			V_{tc}		
yr	*m*	*cm*	m^3	m^2		*m*	*cm*	m^3	m^2		*m*	*cm*	m^3	m^2		m^3	%	m^3	m^3/yr	m^3/yr
III. Yield class																				
5	3,5	3,4	16	4,1	4608	3,8	2,0	3	0,7	2070	3,2	3,0	18	4,8	6678	3	14,0	18	3,6	0,0
10	7,1	5,8	35	6,6	2485	4,5	3,4	10	1,9	2123	6,7	4,9	45	8,5	4608	13	26,4	48	4,8	6,0
15	10,3	8,4	61	9,1	1639	5,8	4,9	11	1,6	846	9,9	7,4	72	10,7	2485	23	27,6	85	5,6	7,3
20	13,0	11,0	91	11,5	1216	7,3	6,4	11	1,4	423	12,6	10,0	102	12,9	1639	34	27,4	125	6,2	8,1
25	15,3	13,4	121	13,7	974	8,9	7,9	11	1,2	242	14,9	12,5	132	14,9	1216	45	26,9	166	6,6	8,3
30	17,2	15,6	152	15,6	822	10,5	9,3	10	1,0	152	16,9	14,8	162	16,6	974	55	26,5	206	6,9	8,0
35	18,8	17,5	180	17,3	720	12,0	10,5	9	0,9	102	18,5	16,8	189	18,2	822	64	26,2	244	7,0	7,5
40	20,2	19,2	206	18,7	649	13,3	11,6	8	0,8	71	19,8	18,6	214	19,5	720	72	26,0	278	6,9	6,8
45	21,3	20,6	229	20,0	598	14,5	12,5	7	0,6	51	20,9	20,1	236	20,6	649	79	25,8	308	6,9	6,1
50	22,2	21,9	250	21,0	560	15,6	13,4	6	0,5	38	21,9	21,4	256	21,6	598	86	25,6	335	6,7	5,4
55	23,0	22,9	267	21,9	531	16,5	14,0	5	0,4	29	22,6	22,6	273	22,4	560	91	25,5	358	6,5	4,6
60	23,6	23,8	282	22,6	508	17,2	14,6	5	0,4	23	23,3	23,5	287	23,0	531	96	25,4	378	6,3	3,9
65	24,1	24,6	295	23,3	491	17,9	15,1	4	0,3	17	23,8	24,3	299	23,6	508	100	25,3	395	6,1	3,4
70	24,5	25,2	306	23,8	477	18,4	15,5	3	0,3	14	24,2	25,0	309	24,0	491	103	25,2	409	5,8	2,8
IV. Yield class																				
5	3,2	3,1	14	3,8	4994	3,7	1,9	3	0,7	2453	2,8	2,8	17	4,5	7447	3	15,4	17	3,3	0
10	6,3	5,3	30	6,0	2792	4,3	3,1	8	1,6	2202	6,0	4,4	38	7,7	4994	11	25,9	41	4,1	4,9
15	9,2	7,5	51	8,2	1878	5,3	4,3	8	1,3	914	8,8	6,6	60	9,6	2792	19	27,0	70	4,7	5,9
20	11,6	9,6	75	10,3	1411	6,5	5,6	8	1,2	467	11,2	8,8	83	11,4	1878	27	26,8	102	5,1	6,4
25	13,6	11,6	99	12,1	1140	7,7	6,8	8	1,0	271	13,3	10,9	107	13,1	1411	35	26,4	134	5,4	6,5
30	15,4	13,5	122	13,7	968	9,0	8,0	8	0,9	172	15,0	12,8	130	14,6	1140	43	26,0	166	5,5	6,2
35	16,8	15,1	145	15,2	852	10,1	9,0	7	0,7	116	16,4	14,5	152	15,9	968	50	25,7	195	5,6	5,8
40	18,0	16,5	165	16,4	771	11,2	9,9	6	0,6	81	17,6	16,0	171	17,0	852	56	25,5	221	5,5	5,3
45	19,0	17,7	183	17,5	712	12,1	10,6	5	0,5	59	18,6	17,2	188	18,0	771	62	25,3	245	5,4	4,7
50	19,8	18,7	198	18,3	667	13,0	11,3	5	0,5	45	19,5	18,3	203	18,8	712	67	25,2	265	5,3	4,1
55	20,5	19,6	212	19,1	634	13,7	11,9	4	0,4	33	20,1	19,3	216	19,4	667	71	25,0	283	5,1	3,6
60	21,0	20,3	224	19,7	608	14,3	12,3	4	0,3	26	20,7	20,1	227	20,0	634	74	24,9	298	5,0	3,0
65	21,5	20,9	234	20,2	588	14,8	12,7	3	0,3	20	21,2	20,7	237	20,5	608	77	24,8	311	4,8	2,6
70	21,9	21,4	242	20,7	572	15,2	13,1	3	0,2	16	21,5	21,3	245	20,9	588	80	24,8	322	4,6	2,2

Age	Main crop					Secondary crop					Total crop					Total removed wood		Total volume		
	average		Volume	Basal area	Stem number	average		Volume	Basal area	Stem number	average		Volume	Basal area	Stem number			Volume	Mean increment	Annual increment
	H	D				H	D				H	D								
	H_{mc}	D_{mc}	V_{mc}	B_{mc}	N_{mc}	H_{rc}	D_{rc}	V_{rc}	B_{rc}	N_{rc}	H_{tc}	D_{tc}	V_{tc}	B_{tc}	N_{tc}			V_{tc}		
yr	*m*	*cm*	m^3	m^2		*m*	*cm*	m^3	m^2		*m*	*cm*	m^3	m^2		m^3	%	m^3	m^3/yr	m^3/yr
V. Yield class																				
5	2,8	2,9	12	3,6	5433	3,7	1,8	3	0,7	2964	2,4	2,6	15	4,3	8397	3	17,1	15	3,0	0
10	5,6	4,7	26	5,5	3160	4,1	2,7	6	1,3	2273	5,2	4,0	32	6,8	5433	9	25,7	35	3,5	3,9
15	8,1	6,6	42	7,3	2174	4,8	3,8	6	1,1	986	7,7	5,8	49	8,5	3160	15	26,6	57	3,8	4,6
20	10,2	8,3	60	9,1	1657	5,7	4,8	6	1	517	9,8	7,7	67	10,0	2174	22	26,4	82	4,1	4,9
25	12,0	10,0	79	10,6	1352	6,7	5,8	6	0,8	305	11,6	9,4	85	11,4	1657	28	26,0	107	4,3	4,9
30	13,5	11,5	97	12,0	1156	7,6	6,7	6	0,7	196	13,1	10,9	103	12,7	1352	33	25,6	130	4,3	4,7
35	14,8	12,8	114	13,2	1023	8,5	7,6	5	0,6	133	14,4	12,3	119	13,8	1156	39	25,3	152	4,4	4,4
40	15,8	13,9	129	14,2	929	9,3	8,3	5	0,5	94	15,5	13,5	134	14,7	1023	43	25,0	172	4,3	4,0
45	16,7	14,9	143	15,1	860	10,1	8,9	4	0,4	69	16,3	14,6	147	15,5	929	47	24,9	190	4,2	3,5
50	17,4	15,8	155	15,8	809	10,7	9,4	3	0,4	51	17,1	15,5	158	16,1	860	51	24,7	205	4,1	3,1
55	18,0	16,5	165	16,4	770	11,2	9,9	3	0,3	39	17,7	16,2	168	16,7	809	54	24,6	219	4,0	2,7
60	18,5	17,1	174	16,9	740	11,7	10,3	3	0,2	30	16,1	16,9	176	17,2	770	56	24,4	230	3,8	2,3
65	18,9	17,6	181	17,4	716	12,1	10,6	2	0,2	24	18,6	17,4	183	17,6	740	58	24,4	240	3,7	1,9
70	19,2	18,0	188	17,7	697	12,4	10,8	2	0,2	19	18,9	17,8	189	17,9	716	60	24,3	248	3,5	1,6
VI. Yield class																				
5	2,4	2,7	11	3,4	5937	3,7	1,7	3	0,8	3742	2,0	2,3	14	4,2	9679	3	19,7	14	2,8	0,0
10	4,8	4,2	22	5,0	3610	3,9	2,5	5	1,1	2327	4,4	3,6	26	6,1	5937	8	25,9	29	2,9	3,0
15	6,9	5,7	34	6,5	2548	4,5	3,3	5	0,9	1062	6,6	5,1	39	7,4	3610	12	26,5	47	3,1	3,5
20	8,8	7,1	48	7,9	1974	5,1	4,1	5	0,8	574	8,4	6,6	53	8,7	2546	17	26,2	65	3,2	3,7
25	10,3	8,5	62	9,2	1628	5,8	4,9	4	0,7	346	10,0	8,0	66	9,8	1974	21	25,7	83	3,3	3,7
30	11,6	9,7	75	10,3	1404	6,5	5,6	4	0,6	224	11,3	9,2	79	10,9	1628	26	25,3	101	3,4	3,5
35	12,7	10,7	88	11,3	1250	7,1	6,3	4	0,5	154	12,4	10,3	91	11,7	1404	29	25,0	117	3,3	3,2
40	13,6	11,6	99	12,1	1141	7,7	6,8	3	0,4	109	13,3	11,3	102	12,5	1250	32	24,7	131	3,3	2,9
45	14,4	12,4	109	12,8	1060	8,3	7,3	3	0,3	81	14,0	12,1	112	13,1	1141	35	24,5	144	3,2	2,6
50	15,0	13,1	117	13,4	1000	8,7	7,7	2	0,3	60	14,6	12,8	120	13,7	1060	38	24,4	155	3,1	2,2
55	15,5	13,6	125	13,9	954	9,1	8,1	2	0,2	46	15,2	13,4	127	14,1	1000	40	24,2	165	3,0	1,9
60	15,9	14,1	131	14,3	918	9,4	8,4	2	0,2	36	15,6	13,9	133	14,5	954	42	24,1	173	2,9	1,6
65	16,3	14,5	137	14,7	870	9,7	8,6	2	0,2	28	15,9	14,4	138	14,8	918	43	24,0	180	2,8	1,4
70	16,6	14,8	141	15,0	867	10,0	8,8	1	0,1	23	16,2	14,7	142	15,1	890	45	24,0	186	2,7	1,2

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