



COMPARATIVE EXAMINATION OF VARIOUS BLACK LOCUST CLONES (*ROBINIA PSEUDOACACIA* L.)

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Abstract:

Black locust has played a role of great importance in the Hungarian forest management. The main objective of black locust improvement in Hungary is to provide raw material of better and better quality for the wood industry. The researchers are aiming to realise this objective by selective breeding. KEFAG Zrt. has established an experimental area for this reason in 1998, the first evaluation of which is shown in the present study.

Key words:

black locust, *Robinia pseudoacacia*, selective breeding, clones, ERTI, Imre KAPUSI

1. INTRODUCTION

Approx. 20% of the Hungarian forests are covered with black locust, which means a tree stand of approx. 400.000 ha. This significant area is expanding year after year, because the most frequent tree species of the new tree plantations established on the lands taken away from agricultural plant production is also the black locust. Its application in the latest afforestations comes at 50%.

It is therefore obvious, that the forest research in Hungary is paying a great attention of the development of black locust production as well. The main objective of the research projects is to enable the timber production of better and better quality for the wood industry, and to sort out good melliferous species in addition. The improvement of black locust has meant selective breeding in the last decades, which has been realised in two different ways:

- ✓ *individual selection*: sorting out of a couple of trees performing good trunk shape and their vegetative propagation, namely cloning; so came the so called „shipmast locust” clones into existence in the 1960/70's; and in the 80's Imre KAPUSI, researcher of ERTI (Erdészeti Tudományos Intézet – Hungarian Forest Research Institute) sorted out trees performing outstanding height increase from the one year old seedling stands by early selection, which he propagated by vegetative methods at the first step (series 'A'), then he selected trees at the second step from their generative progenies as well, which he further propagated also by vegetative methods (series 'B')
- ✓ *mass selection*: sorting out of stands meeting the nationwide accepted requirements and pronouncing them seed producing stands; black locust seeds can be collected for forestry purposes only in these stands; the quality of the Hungarian black locust plantations has been increased significantly as a result of the consequent selection being performed for approx. 25-30 years.

The shipmast locust clones produced by individual selection – although performing very good trunk shapes – have relatively low thickness increase, are producing poor yield of seeds, their mass propagation is unresolved, require a lot of living labour, are not enough efficient, therefore they are expensive. Subsequently these clones are not spread in Hungary.

The selection made by Imre KAPUSI has been performed based on the youthful fast growth, with the objective to receive clones to be well used in the biomass producing plantations. It turned out during further cultivation that among these clones there are also some performing good trunk shapes and some producing rich yield of seeds.

In recent years there have been more and more attempts in Hungary to combine the two different improvement methods – the individual selection and the mass selection. The experiment established at KEFAG Zrt. belongs also to this category.

2. DESCRIPTION OF THE EXPERIMENT AREA

The experiment plantation of 1,6 ha is located approx. 8 km from Kecskemét, along the main street no. 52, in the Csalánosi Forest Gene Collection.

The soil of the experiment area is *sand with low humus content*. The ground water can be found deeper than 2,0 m, hence *the only source of water* available for the plants is the *precipitation*. The thickness of the productive layer is variable, *max. 80 cm*. Physical soil type is *sand*. The humus content in the productive layer does not achieve 1%. It is alkaline, the water pH value is 8,3-8,5, beneath 90 cm the lime content is significant (17,0%), and already at a depth of 20 cm strong sodium content can be shown in spots (0,011-0,109). There is a spot on the area, where the sodium content reaches such a value, which should already be considered as a soil deficiency. The growth of the trees here is very poor.

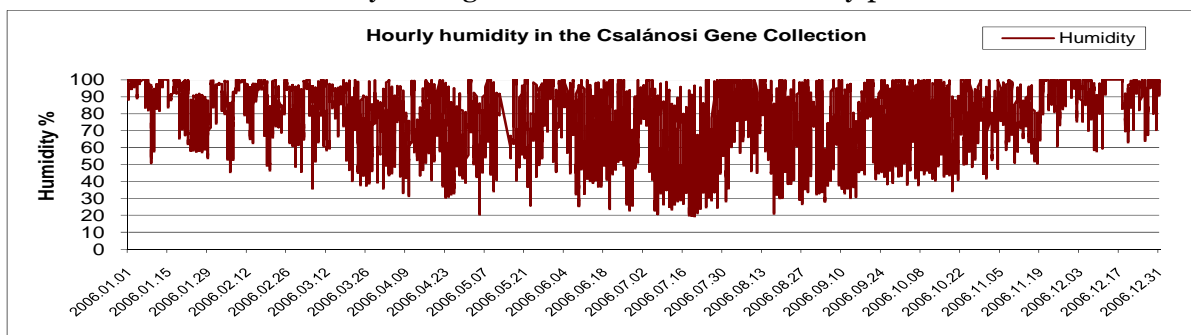


Diagram 1. Hourly relative air humidity values in the Csalánosi Gene Collection

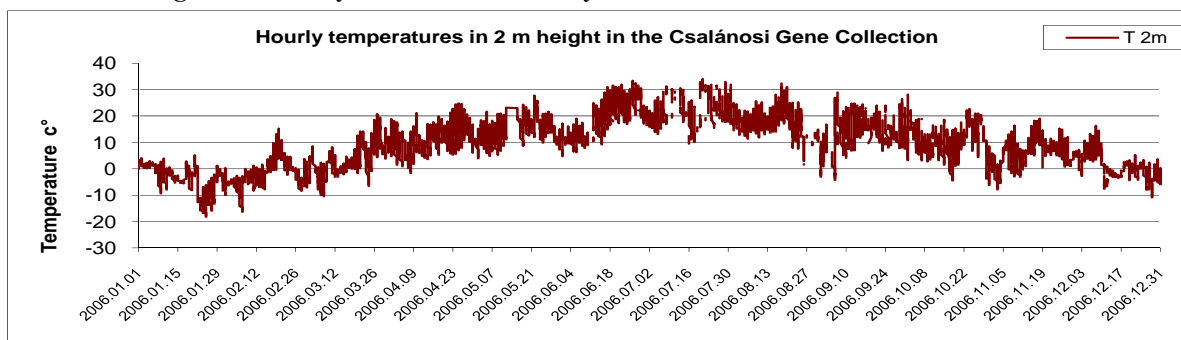


Diagram 2. Hourly temperature changing in the Csalánosi Gene Collection

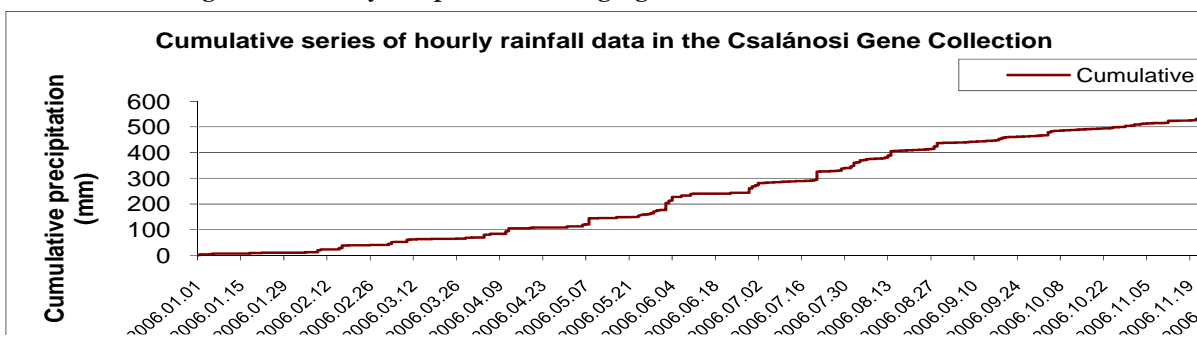


Diagram 3. Precipitation changing based on summarized hourly data in the Csalánosi Gene Collection

The experiment area is located under extremely continental climate. The yearly rainfall is 560 mm, from which approx. 300 mm falls to the vegetation period (diagram 3). The air humidity is extremely low, it is under 50% in June, and values about 20%-30% occur as well (diagram 1). The prevailing wind direction is northwest. The average temperature in January amounts to -3,24°C, and in June +21,92°C (diagram 2).

3. DESCRIPTION OF THE EXPERIMENT

The plantation is able to serve more purposes at the same time:

- a) shows the various black locust clones selected in Hungary, gives an opportunity for the phenotypical comparison of them;
- b) makes the free pollination possible between various clones, and allows the production of generative descendants with a higher genetical value from the seed that yields resulting:
 - ba) from separately collected seeds of selected trees – *4 years ago we harvested the seeds of some 'A' and 'B' clones, the separately produced seedlings were planted in the forest, but their evaluation has not been done yet;*
 - bb) from seeds fallen onto the ground and mixed within the stand, by the seeds collecting technology applied in practice – *this kind of seed harvest has not been done yet in this stand.*

We have planted the black locust clones resulting from the earlier individual selection in the plantation, individually identifying every tree. The odd trees in every third row were from the series 'A' and 'B' by KAPUSI, a total of 39 different clones. The rows and individuals in between were 7 different clones from the old shipmast locust clones of ERTI. Therefore, in this arrangement the KAPUSI-clones have been surrounded by shipmast locust clones from all sides. In order to ensure efficient pollination, we have settled about 50 colonies of bees next to the experiment plantation.

The planting spacings have been 2,5 x 2,5 m. Before planting ploughing has been performed at a depth of 60 cm. The KAPUSI-clones have had covered roots, while the clones of ERTI have been purchased from the nursery of NYÍRERDŐ Zrt. in Máriapócs as bare root seedlings. The planting were performed manually, in holes of approx. 30x30x30 cm, in the second half of May 1998. The root taking has been 95%, no substitution has taken place. The rows have been hoed two times and there have been done inter-row harrowing with disk-harrow two times on the plantation in the first year of breeding. From the second year of breeding on there have only been inter-row hoeing done. In the 3 year of breeding a trunk forming pruning has been performed, this has been especially necessary in the case of the KAPUSI-clones.

4. RESEARCH METHOD AND THE INSTRUMENTS USED FOR MEASUREMENTS

In the autumn 2007, at the end of the vegetation period we have measured the diameter at chest height and the height of each tree. The diameter was measured with a measuring tape, of which we could read off the diameter directly correct to a millimetre. For measuring the tree height we have used a means using instrument type SUUNTO.

Comparison of the various black locust clones based on the measured attributes

We have calculated the *minimum, maximum and average* values of the measured attributes, and we have represented them on a collective graph.

Analysis of black locust clones according to the increase in height

Diagram 4 compares the height increase of the various clones based on the minimum, maximum and average height, and on the distribution. We have displayed the first ten of this mass of facts based on the average height in the chart no.1.

Analysis of the black locust clones according to thickness increase

Diagram 5 compares the diameter increase of the various clones based on the *average, minimum, and maximum* diameter, and on the *distribution*. We have displayed the first ten of this mass of facts based on the average diameter in the chart no.2.

Chart no. 1. Sequence of the various black locust clones based on average height in the Csalánosi Gene Collection

Number	Clone sign	Average height (m)
1.	A59	11,00
2.	A90	9,60
3.	A94	9,10
4.	B16	9,10
5.	A95	8,80
6.	A41	8,50
7.	D2	8,20
8.	SZAA	8,00
9.	B88	7,90
10.	B86	7,80

Chart no. 2. Sequence of the various black locust clones based on average diameter in the Csalánosi Gene Collection

Number	Clone sign	Average diameter (cm)
1.	B88	12,4
2.	A94	11,4
3.	A59	11,3
4.	ZAA	10,6
5.	A41	10,4
6.	B86	10,3
7.	NYGA	10,1
8.	B16	10,0
9.	A95	9,80
10.	A90	9,40

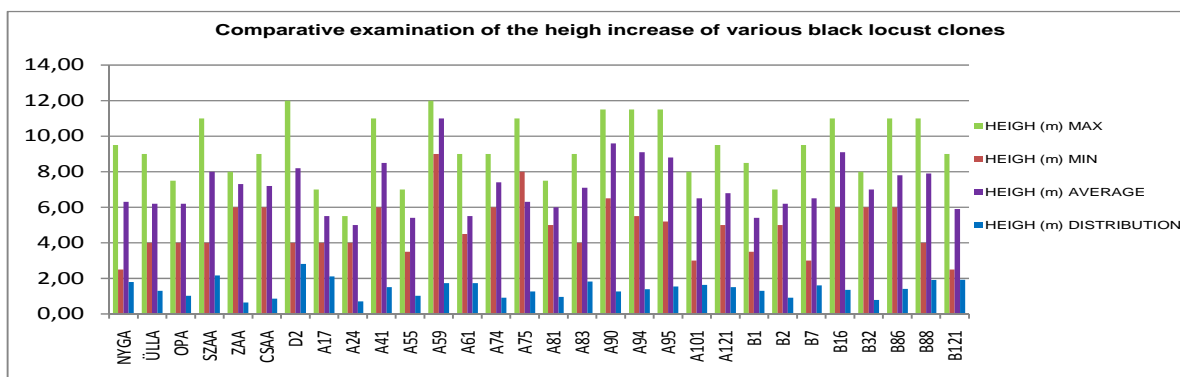


Diagram 4. Comparison of the height increase of the various black locust clone in the Csalánosi Gene Collection

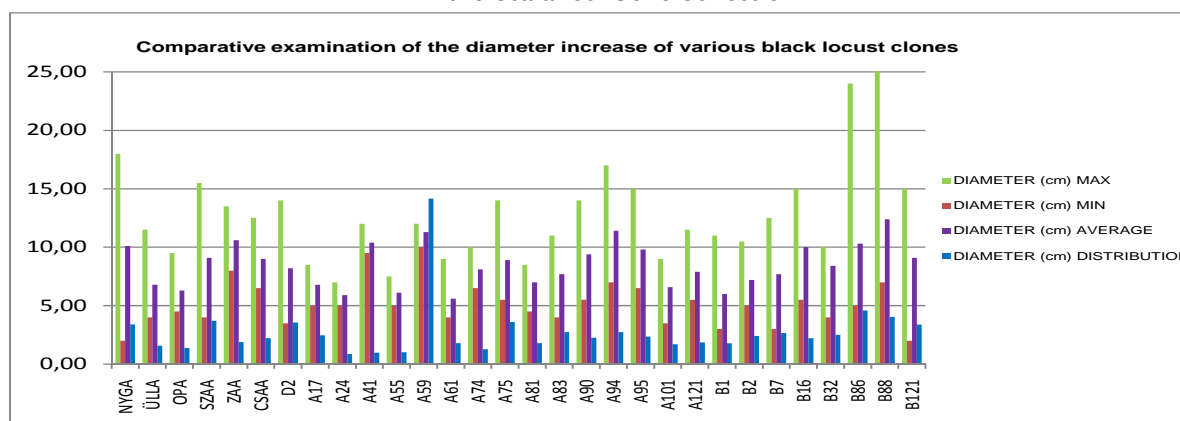


Diagram 5 Analysis of the diameter increase of various black locust clones in the Csalánosi Gene Collection

Six from the 10 best clones selected on the basis of average diameter and average height are present in both rankings. The below list represents the summarized ranking based on the average placing: 1. A59; 2. A94; 3. A41; 4. A90; 5. B16; 6. A95.

5. SUMMARY – EVALUATION

- ✚ On the presented poor producing area, which is a general black locust producing area on the sand-soil between the Danube and the Tisza, according to the relative early evaluation the old shipmast locust clones of ERTI have shown a poorer growth in total, than the recently selected KAPUSI-clones.
- ✚ The selection principle at the latter ones was the youthful large wood volume production. But these clones meet not only this requirement; these are as well suitable for quality timber production, which is shown by the straight cylindrical trunk running through the crown of the tree. Good quality clean timber can be produced with a little additional work by pruning the trunks at the age of 3-5 years of the stand.
- ✚ Among the six best clones ranked on the basis of the placing from the 10 best growing clones according to average diameter and average height we can find not even one from the old ERTI clones.

Efficient propagation can only be performed by collecting and sowing the seeds produced in the seed producing plantations. Seed producing plantations are practically to be established from the first best six clones on the sand-soil between the Danube and the Tisza.

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