The examination of coppice black locust assortment composition

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Abstract. Nowadays, the black locust (Robinia pseudoacacia) is the most current and the most widely used tree species in Hungary. Due to its penetration and the wide variety of application it’s worth to examine, what kind of assortment their with different origins, and in different environmental conditions growing stands offer. In our current article we compare the coppice black locust stands’ assortment composition in different production areas (on humus sand and “kovárvány” brown forest soil). In addition, we present the assortment composition of the curiosity, the also coppice „szacsvay” black locust stand, which we compare to the everyday-produced seedling black locust and the coppice black locust. We provided our research in the area of Nyírerdő Forestry Co. Ltd. During the research we used the final harvest data for the 2010-2016 period. According to the tests it can be said, that the coppice black locust stands, that can be found on the humic sand and on the “kovárvány” brown forest soil, show a significant difference in the choice of distribution.

1. Introduction

The black locust (Robinia pseudoacacia) is in Hungary the most current and the most widely used tree species in Hungary, especially in the Great Hungarian Plain. More than 24% of all forest area is covered by black locust, this means 451 771.95 hectares and 50 829 689.00 m³ tree [8]. The most prominent black locust-producing districts are the Nyírség, Cserhát, hills of Gödöllő, the Bács-Kiskun, Somogy, Vas, Zala county, and the sandy area of the Little Hungarian Plain. Among them, the Nyírség, Bács-Kiskun county and the Northern Part of Somogy have high quality stands.

Its rapid spread in Hungary is due to its good adaptation ability, its frequent and abundant seed production, its excellent seedling ability, its rapid growth, and its relatively large tree production [1]. The change in the black locust area from the first stock data to the present day is shown in Table 1 [2].

As the result of the climate change the annual average temperature increases and along with this the forest climate zones are also „migrating”. Generally speaking, the area ratio of beech forest climate decreases and along with this the area of the forest steppe climate grows. This will lead to a change in the tree species composition, that will reduce the area ratio of beech (Fagus sylvatica) and the black locust can be emphasised, and the groups of poplar.

Thanks to the deep roots of the black locust, it can live on the sandy, salty areas, ties the loose running sand, and it can be used for the afforestation of the bad quality sandy areas [3] [4]. Its wood has a wide variety of recovery options [5] [6].
Table 1. The penetration of black locust from 1885 to the present day

| Year | Area (thousand hectares) | Ratio of area (%) |
|------|--------------------------|-------------------|
| 1885 | 24,2                     | 2,1               |
| 1911 | 109,3                    | 9,7               |
| 1923 | 110,6                    | 10,1              |
| 1963 | 154,2                    | 10,8              |
| 1992 | 268,0                    | 18,3              |
| 2004 | 394,9                    | 22,6              |
| 2015 | 451,8                    | 24,2              |

Its penetration and its multiple utilization justify the providing of that kind of researches, which demonstrate the differences of the assortment composition between the black locust stands of different production areas.

2. Material and methods
We provided our researches in the area of the Nyírerdő Forestry Co. Ltd. During the research we analyzed the final harvests of the period between 2010-2016 [7]. The essential criterion during the selecting of the parcels was to have the chosen stands on soils with the same potential habitat. The black locust occurs in the Nyirség mainly on two genetic soil types, namely on humic sand and on “kovárvány” brown forest soil.

We summarized the datas in case of these two types of soil separately and we projected them to 1 ha, so the resulting m$^3$/ha datas were the basis for the comparative analysis.

3. Results and discussions
3.1. Assortment composition of coppice stands
The area is characterized by the sessile oak, and the turkey climate. The average annual rainfall is approximately 600 mm/year. In general, it can be said that late frosts are common. Basically, we have to separate two main genetic soil types, these are the humic sand soils, and the „kovárvány” brown forest soil. Their hydrolysis is independent of additional water impact, the thickness of the topsoil is medium-deep, and the physical soil type is sand.

In our current article, we compare the coppice black locust stands of different production areas (on humic sand and on „kovárvány” brown forest soil) to each other (Figure 1). The difference in the choice of distribution of the two different production area’s coppice black locust stands is significant. On all cubic meters „kovárvány” brown forest soil there’s 105 m$^3$/ha of them, on humic sand there’s 97 m$^3$/ha of them, so both of them has really weak tree yielding, that’s why this comparison is authentic. But this 8 m$^3$/ha in case of the 2nd class slawlogs must be acknowledged in „kovárvány” brown forest soil stands’ favour. Because on „kovárvány” brown forest soil the trees’ thickness increase is bigger than on the humic sand. Thank to the bigger thickness increase the ratio of the 2nd class slawlogs is bigger on the „kovárvány” brown forest soil, whereas the ratio of the wood pile selection with smaller medium-diameter is bigger.

The total value of humic sand stock (calculated at 2016 prices) is 2.09 million HUF/ha, while the total amount of stocks on the “kovárvány” brown forest soil is 2.20 million HUF/ha. We would also like to remark that in the examined forest parts, on „kovárvány” brown forest soil there is much more black locust with rotten root, than on humic sand, for this reason we haven’t found an explanation yet.
Figure 1. Origin of sprouted black locust population assortment on humic sand soil and on “kovárvány” brown forest soil (m³/ha)

3.2. The „Szacsvay” black locust assortment composition
The Nyírerdő Forestry Co. Ltd has one of the best black locust areas, both in quality and also in volume per plot. Perhaps these areas and forests mean the standard for black locust cultivation. In 2013, the last forest block (Nyíracsád 60/l) was harvested from the well-known „szacsvay” black locust. This black locust tends to be called szacsvay black locust after being accepted as an independent black locust species. Its extraordinary facilities can’t only be found in genetics but also in its unique climatic conditions and in the condition of its producing area. The area has a humid climate with an annual average of 650 mm precipitation. The production area is a “kovárvány” brown forest soil, which has a really high humus content, on the other hand there’s about 2 to 3 meters from the surface of the ground there’s a watertight layer that prevents water from leaking, so it’s always within reach for the roots. The speciality of this black locust is, that it combines the good qualities of the shipmast locust and the commercial black locust, so it produces an excellent height growth as the shipmast locust and an excellent thickness growth as the commercial black locust. We have to mention, that this tree stand was cut up at the age of 71, which means two cutting rotations in case of the commercial black locust. The reason for leaving it for so long, is that produced an excellent height growth. In 1982 it was declared as seedling stand.
Another speciality of this forest is, that this is coppice.
It’s worth looking at the stock features how they’re changing over the years. This is shown in Table 2. Its choice of distribution was also remarkable as shown in Table 3.
| Table 2. The population details of Nyírcsád 60/I |
|-----------------------------------------------|
| stand’s features            | unit of measure | 1958 | 1972 | 1982 | 1992 | 2001 | 2013 |
| age     | year   | 16   | 30   | 40   | 50   | 60   | 71   |
| height  | m      | 15.8 | 22   | 24   | 28   | 32   | 32   |
| diameter| cm     | 14   | 22   | 34   | 36   | 42   | 43   |
| yield class |   | I.   | I.   | I.   | I.   | I.   | I.   |
| canopy closure | %  | 80   | 90   | 70   | 80   | 70   | 65   |
| density  | %      | 90   | 100  | 87   | 88   | 85   | 87   |
| wood stock on 1 ha | m³  | 134  | 297  | 292  | 370  | 440  | 447  |
| mean annual increment | m³/ha  | 8.4  | 18   | 19   | 22   | 26   | 28   |
| current growth | m³/ha | 8.6  | 11   | 11   | 8    | 12.2 | 12   |

| Table 3. Assortment composition of Nyírcsád 60/I |
|-----------------------------------------------|
| Assortments                                           | m³/ha | %|
| black locust in pole bark                           | 0.241 | 0.07 |
| black locust pilewood barked                        | 2.353 | 0.69 |
| black locust sawmilling industry log I.            | 66.024 | 19.40 |
| black locust sawmilling industry log II.           | 18.088 | 5.31 |
| black locust sawmilling industry log                | 39.700 | 11.66 |
| black locust’s cutting                              | 42.459 | 12.47 |
| black locust in vine stake raw material bark       | 3.047 | 0.90 |
| black locust vine pole barked                       | 1.245 | 0.37 |
| black locust thick firewood                         | 167.235 | 49.13 |
| total                                               | 340.392 | 100.00 |

From the choice of distribution it can be seen, that the class I. black locust sawlogs are about 20%, which is extremely high. All sawlogs are almost 37%. If we look at the complete set of the subcompartment, you can see that from the long thin assortments (pole, pilewood) there was only a small amount of them in the forest, only a few m³, less than 1% of the assortments. Compared to other coppice subcompartments, we can experience a big difference among them, because these coppice forests produce mainly these two assortments from the industrial assortments. In this case this can be attributed to the age of the stand, because at the age of 71 the black locust is quite dry and from the upper, thinner part of the trees not the above mentioned assortments but firewood can be assorted. We’ve chosen an average number of seedling- and coppice stands, and we compared it to the szacsvay black locust’s assortment composition (Figure 2).
For the sake of authenticity, we removed the black locust thin firewood assortment (twig) from these two chosen subcompartments’ assortment composition, because it’s not included in the szacsavay black locust’s assortment composition, on the other hand, we used a percentage comparison, because in case of this big timber volume it makes no sense to compare the cubic meters. It’s interesting to monitor these distributions, because the szacsavay black locust subcompartment (Nyírcsád 60/I) is a coppice, but if we compare it to the Nyíregyháza-Oros 301/F subcompartment’s assortment composition, which is also a coppice, but it was a black locust stand on humic sand, we can’t recognize the assortment composition of the previous offshoots, because here is the absolute lack of the thin industrial wood assortments. If we compare the szacsavay black locust to the Nyírtura 2/H subcompartment, which is seedling and can be found on „kovárvány” brown forest soil, then we can see better matching distributions, but it shows up here too how much better the szacsavay black locust is.

4. Conclusion
The topic of our article was to compare the assortment composition of the coppice black locust stands in case of different production areas. There’s a significant difference in the assortment composition of the black locust stands in the examined two production areas.
The reason for this is that because of the higher nutrient source on the “kovárvány” brown forest soil the thickness increase of the trees is greater than on the humous sand. Thanks to the greater thickness increase the ratio of the II. sawlog is greater on the „kovárvány” brown forest soil, whereas on humous sand the ratio of the pilewood selection with smaller diameter is greater. We got the above mentioned result in case of the simple coppiced stands, in case of multiple coppicing there’s a high degree of deterioration, as a result of which the assortment composition worsens.

5. References

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