

# Black locust in the stands of Mănăstire Forest administrated by the Lunca Timișului Forest District

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## Abstract

Black locust (*Robinia pseudoacacia* L.) is a fast-growing, ecologically adaptable species widely used in Romania for reforestation, erosion control, and biomass production. Despite its economic and ecological value, its growth behavior and productivity vary depending on site conditions and competition. This study analyzed the performance of black locust in the Mănăstire Forest, managed by the Lunca Timișului Forest District, located in the Bîrzava meadow basin (Western Plain, Romania). The stands are classified as Group I, functional category 4B – forests surrounding municipalities, towns, and communes, as well as those developed around them. The fundamental natural stands are mainly composed of oak (*Quercus robur*) and ash (*Fraxinus excelsior*), although some stands also include black locust (*Robinia pseudoacacia*). Two stands of similar age and site conditions were compared—one dominated by black locust and the other by ash (*Fraxinus excelsior* L.). Dendrometric parameters, including diameter basal area, and crown dimensions, were measured and statistically analyzed. The results showed that black locust recorded higher mean diameter values in pure stands compare with mixed stands. In mixed stands black locust showed reduced dimensions due to interspecific competition. These findings provide valuable insights for optimizing black locust management and integrating the species into lowland forest ecosystems.

**Keywords:** *Robinia pseudoacacia*, *Fraxinus excelsior*, stand distribution, stand stocking, dendrometric characteristics, site condition

## Introduction

Black locust (*Robinia pseudoacacia* L.) is a fast-growing tree species widely used in forest restoration, erosion control, and biomass production in Romania’s lowland regions [11, 13]. The species is important for improving soil properties, nitrogen fixation and carbon sequestration [4,5,8,16]. Black locust is it important for biodiversity but it also is considered one of the most invasive alien species on the continent and globally [14,15]. In Romania it is not officially regarded like an invasive species [6].

In Romania, black locust (*Robinia pseudoacacia*) was introduced around 17110, with the first plantation established in 1852 in the southwestern region of the country (Băilești–Oltenia) [12]. Today, black locust covers approximately 4% of Romania’s forested land [2,7]. Despite its notable ecological adaptability [3], the species’ distribution and productivity vary depending on site conditions, regeneration methods, and stand age. High-quality timber production is possible only on sites with adequate moisture, good aeration, and nutrient-rich soils. On less favorable sites, black locust should be primarily used for firewood production [3,9].

The present study aims to characterize the structural parameters of black locust stands within Mănăstire forest and to compare them with stands dominated by ash, under similar ecological conditions.

## Material and Method

The research was conducted in forest stands administered by the Lunca Timișului Forest District. The analysis of the distribution of stands containing black locust (*Robinia pseudoacacia* L.) was based on data provided by the forest management plan [1].

Fieldwork was carried out in sub-compartments 45C and 45D of Working Unit VIII Banloc Mănăstire, within the Lunca Timișului Forest District. The stands are located on the plain, in the meadow of the Bârzava River, at an elevation of approximately 90 m above sea level. The soil is classified as stagnic preluvosol, with moderate fertility and a seasonal water deficit during the summer months. The climatic and edaphic conditions are moderately favorable for English oak (*Quercus robur* L.) and European ash (*Fraxinus excelsior* L.).

According to the forest management plan, the stand in sub-compartment 45C is dominated by black locust regenerated from root suckers, whereas the stand in sub-compartment 45D is dominated by ash regenerated from stump shoots. In October 2025, one sample plot was established in each sub-compartment for data collection. Within each plot, field measurements and observations were performed as follows: the diameter at breast height (DBH) of all trees was measured using a Haglöf Sweden AB aluminum caliper; four crown radii per tree were measured at 90° interval; visible tree defects and anomalies were recorded. The collected data were processed and analyzed using Microsoft Excel, where basic statistical parameters (mean values, standard deviations, and correlation coefficients) were computed.

### Results and Discussion

The analysis of data from the forest management plan, together with field observations, highlighted the presence of black locust in all forest stands administered by the Lunca Timișului Forest District. In five out of the eight stands, black locust occurs as the dominant species, representing more than 90% of the stand composition (Table 1).

**Table 1. Black locust stands characteristics**

sub-compartment	Area (ha)	stand composition*	regeneration mode**	age (years)	BL D (cm)	BL H (m)	stand productivity	stand canopy
45 C	1.42	9BL 1DH*	RS	25	18	16	3	0.9
42 D	1.37	9BL 1ASH	SS	25	18	16	3	0.9
46 A	2.20	10 BL	RS	25	18	16	3	1,0
44 B	1.25	10 BL	RS	35	16	15	4	0.8
45 A	0.49	10 BL	SS	35	16	13	4	0.8

\*BL – black locust; DH - Different hardwood

\*\* regenerated by root suckers; SS – regenerated by stool stamps

The site type is classified as 8511 – Forest plain, floodplain oak forest, of medium productivity, humid brown phreatic soil, gleyic or semi-gleyic, with medium to high edaphic potential. The corresponding forest type (TP) is 6123 – Lowland oak forest from the plain region (m).

Among the analyzed stands, three stands with a total area of 3.94 ha are pure black locust stands, while the remaining two stands, covering 2.79 ha, are almost pure. The stands are 25 years old (24%) and 35 years old (76%). The higher age values can be explained by their inclusion in Group I, functional category 4B – forests surrounding municipalities, towns, and communes, as well as those developed around them, and their classification within Production Subunit “O” – lands proposed for removal from the state-owned public forest fund.

With regard to the dendrometric characteristics of the stands, higher mean diameter and height values were recorded in the 25-year-old stands. These results correspond to a medium productivity class for the younger stands, compared to lower productivity classes for the 35-year-old stands.

No significant correlation could be established between productivity class and regeneration mode (stump shoots versus root suckers), nor between productivity class and stand composition. However, differences were observed in stand density: older stands (35 years) showed a lower density (0.8) compared to the younger 25-year-old stands (0.9–1.0), which belong to productivity class 3.

To highlight the structural characteristics of black locust, stand density (expressed as the number of trees per hectare), mean diameter, and basal area were analyzed within an experimental plot established in a black locust stand (subcompartment 45 C). The obtained values were compared with those from another experimental plot established in a stand (sub-compartment 45 D) where ash (*Fraxinus excelsior* L.) was the dominant species (Tables 2 and 3).

In the experimental plot located in sub-compartment 45C, black locust represents approximately 97% of the total number of trees and nearly 100% of the basal area. In contrast, in sub-compartment 45D, black locust accounts for only 37% of the total number of trees but only 23% of the basal area. When mixed with ash, black locust exhibits smaller dimensions, reflecting the competitive influence of ash under these site conditions.

**Table 2. Stocking and basal area**

Sub-compartment	No of tree per ha	Of which				Basal area m <sup>2</sup> ha <sup>-1</sup>	Of which			
		black locust		Other hardwood*			black locust		Other hardwood*	
		No	%	No	%		m <sup>2</sup> ha <sup>-1</sup>	%	m <sup>2</sup> ha <sup>-1</sup>	%
Plot 45 C	1700	1650	97	50	3	64.75	59,50	100	0,25	-
Plot 45 D	1350	500	37	850	63	50.62	11.57	23	39.05	77

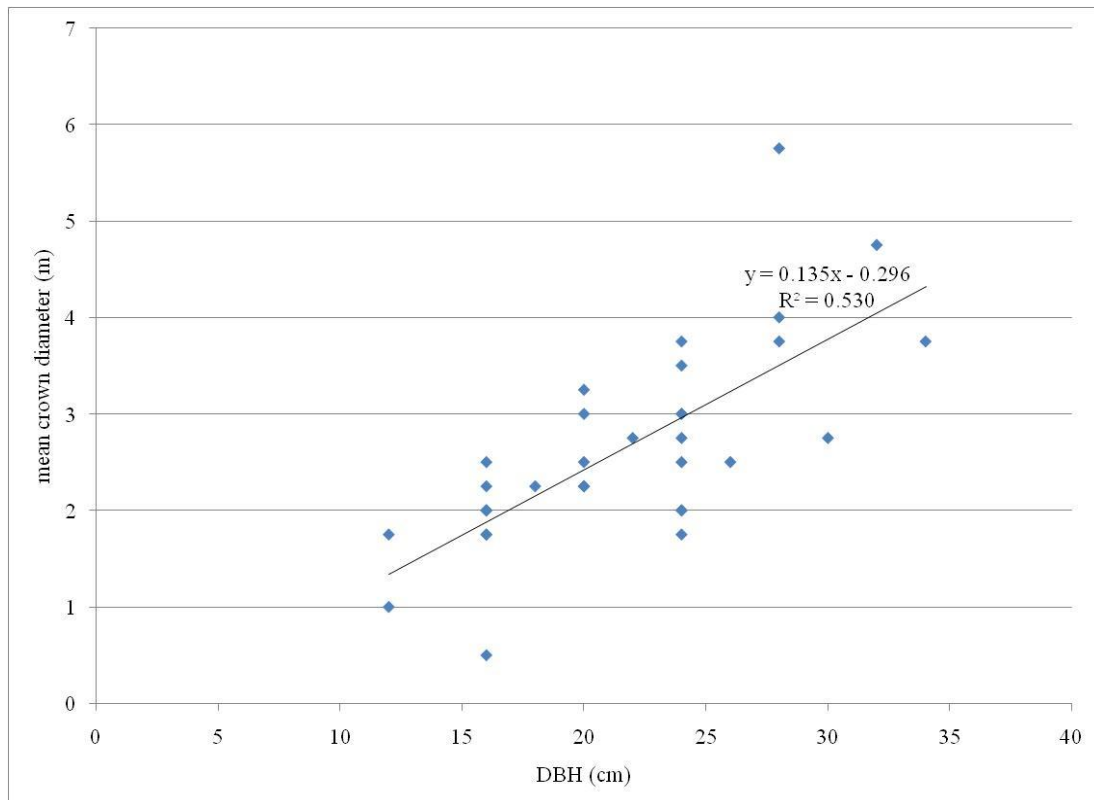
\* Mostly ash

**Table 3. Arithmetic mean diameter**

Sub-compartment	Arithmetic mean diameter ± SD		
	All trees	Black locust	Other hardwood*
Plot 45 C	21.24 ± 5.95	21.64 ± 5.56	-
Plot 45 D	20.92 ± 7.61	16.60 ± 4.62	22.71 ± 7.35

Regarding the arithmetic mean diameter, the average values for all trees are relatively similar in the two experimental plots; however, significant differences appear when analyzing black locust separately. Larger diameters were recorded in the stand where black locust is the dominant species (45C), while smaller diameters were observed in the mixed stand (45D), where ash prevails. These trends are consistent with the results obtained for basal area, confirming the superior growth performance of black locust in pure stands compared to mixed ones.

The correlation between DBH and crown diameter was analyzed for all trees in the experimental plot (Figure 1 and 2). The regression analysis revealed a moderate positive relationship in plot 45 C where black locust is dominant and a weaker positive correlation in plot 45 D, a mixed stand. The lower coefficient of determination in plot 45 D suggest greater variability in crown size for a given DBH, which could be attributed likely to interspecific competition and the resulting structural heterogeneity within the stand.



**Figure 1. Correlation DBH-mean crown diameter in all trees in sub-compartment 45C**

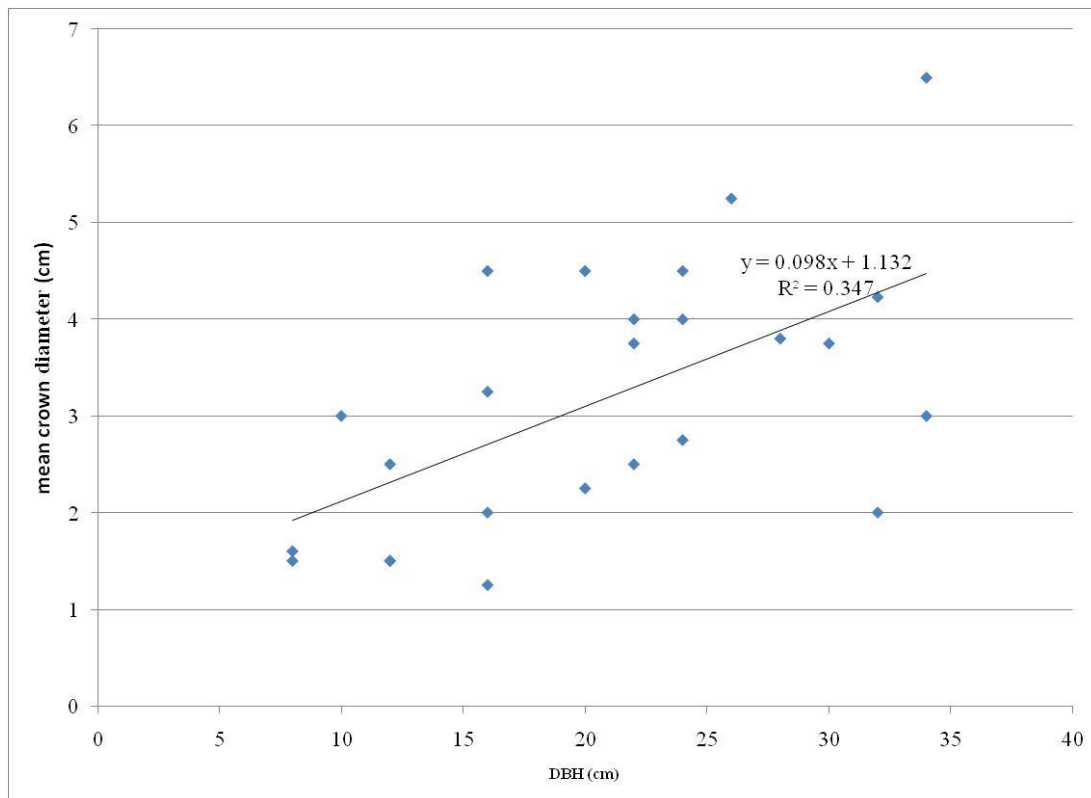


Figure 2. Correlation DBH-mean crown diameter in all trees in sub-compartment 45D

### Conclusions

The study highlights the significance presence of black locust in Mănăstire forest stands administrated by the Lunca Timișului Forest District. Black locust forms pure or near pure stands in several compartments.

Although no direct correlation was found between productivity class and regeneration type or stand composition, 25 years black locust stands show higher productivity and structural parameters than 35 years stands.

When mixed with ash, black locust performs smaller dimensions, reflecting the competitive influence of ash under these site conditions.

The weaker positive correlation between DBH and crown diameter in the mixed stand compare with the almost pure stand could be attributed to interspecific competition within the stand.

The results underscore the growth potential of black locust in the Mănăstire forest site, characterized by moderate fertility and seasonal water deficit.

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