STUDY REGARDING THE HEIGHT OF THE ACACIA SEEDLINGS ON THE BASIS OF THEIR VARIETY

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Abstract

The height of the plants constitutes a distinctive property for each species or variety which lives in an interdependent or isolated space, this characteristic being strongly influenced both by the pedo-climatic factors and by the interdependence of the species among themselves.

In experiment from Bârzeşti, between the two acacia varieties used in the study, Robinia pseudoacacia, rectissima variety and Robinia pseudoacacia, oltenica variety, there were visible differences regarding the seedlings' diameter at the base ring, following the first two years of vegetation after setting in. Furthermore, the two acacia varieties differed obviously in regards to seedlings' diameter at the base ring both at the end of the first year as well as at the end of the second year of vegetation after planting.

The experiments performed on the two varieties in the range 2010-2013 highlight the variety of acacia that adapts best to the local conditions in the study area.

Key words: acacia height, acacia

INTRODUCTION

The results obtained in Bârzeşti, in the first four years of vegetation after planting, in regards to the height growth of the acacia seedlings from the two tested varieties, are concordant with the ones from the scholarly literature which state that, in general, the vigour of the *oltenica* variety is lower than that of the *rectissima* variety (Bârlănescu et al,, 1966; Budău, Timofte, 2012). Obviously, between the two varieties there are real distinctions at least from two points of view regarding the plants' height:

- in the seedlings' height growth speed after planting;
- in the dynamic of the yearly average growths of this character.

If, however, one takes into account the yearly average height growths of the brush's height, including the ones from year 0 (nursery), the differences between the two varieties are no longer so poignant. Furthermore, in year IV after planting, the *oltenica* variety has yearly average growths of the plants that are superior to those recorded by the *rectissima* variety, which suggests that, in fact, the two analysed varieties are very alike in regards to the achievement of the phenotypic expression of this character and the possible differences between the two varieties may be owed to the specific interaction between each genotype and the experimentation years.

MATERIAL AND METHODS

The research was carried out in Arad county, Bârzeşti locality, near the Codru Moma mountain chain, during 2010-1013.

The acacia seedlings, upon planting, had the age of one year displaying, practically, very close size values in the two varieties, for the height of the stem and the thickness of it at the base ring.

The performed measurements on all the seedlings, before planting, confirmed their classification in the quality classes I and II, from the point of view of the stems' height and of their average diameter at the base ring.

The two acacia varieties differed visibly in regards to the seedlings' height at the end of each of the four years of vegetation after planting.

The primary data, recorded per 50 individuals from each acacia variety used in the study, show that in the *rectissima* variety, the seedlings' height at the end of the first year of vegetation after planting, varied between 1.57 – 2.78 m, with a variability coefficient of this character of 10,8 % (average variability).

RESULTS AND DISCUSIONS

In the *oltenica* variety, the variability limits of the seedlings' heights, following the first year after planting, were less extensive, between 1.31 – 2.26 m, with a variability coefficient (20.6 %, large variability) twice greater than the one recorded in the *rectissima* variety.

In the second year after planting, the seedlings' height, in the *rectissima* variety, was ranging between 3.00 – 4.91 m, with a variability coefficient of this character of 21.4 %, which places the variability of the respective character in the "large" class. In the *oltenica* variety, the variability limits of the seedlings' height, following the second year of vegetation after planting, were closer, (2.54 – 3.92), with a variability coefficient resembling the one recorded in this variety in the previous year (s% = 18.6).

In the third year after planting, in the *rectissima* variety, the average height of the brush ranged between 4.96 and 7.12 m, with a variability coefficient of this character of 27.3 %, which places the variability of the respective character in the "large" class. In the *oltenica* variety, the variability limits of the seedlings' height, following the third year of vegetation after planting, were larger (3.61– 6.55), with a variability coefficient (s% = 23.6) very close in terms of significance to the one recorded in the *rectissima* variety.

The same tendency was maintained in 2013 as well (year IV after planting), the height growths of the brush, in the two varieties, displaying larger values of the variability coefficients (33.1% in *rectissima* and 29.6 in *oltenica*) which suggests that the respective varieties do not differentiate in terms of their reaction to the pedo-climatic conditions of the experimental years, expressed by the values of the variability coefficients of the plants' heights***.

This resemblance of the two varieties, in terms of the height variability of the tested acacia seedlings, in each of the four years of vegetation, after planting, is explainable if one takes into account the fact that one worked with large rows, and the planting conditions were identical for the two varieties used in the study. Furthermore, many authors (Bașinoiu Corina, 2006; Niculescu Mariana, 2008), including those who identified and proposed the designation of „oltenica" for this new variety (Bârlănescu et al,, 1966), state that, in fact, the *oltenica* variety is originating from *rectissima*, in relation to which, most often, the descriptions of the characteristics of sylvan interest in *oltenica* are reported.

In table 1, one displays the synthesis results regarding the influence of the acacia variety on the average height of the brush at the end of the first four years of vegetation after planting.

Table 1

The influence of the acacia variety on the average height of the brush at the end of the first four years of vegetation after planting, Bârzeşti, 2010-2013

Variant designation	Average height (m) of the seedlings at the end of the years				±d (m) At the end of year IV	Difference significance
	2010	2011	2012	2013		
Rectissima	1.94	4.05	6.18	8.02	-	-
Oltenica	1.83^{o}	3.71^{oo}	5.29^{oo}	7.38^{oo}	- 0.65	oo
LSD 5 % =	0.10	0.12	0.15	0.19		
LSD 1 % =	0.23	0.28	0.33	0.44		
LSD 0.1 % =	0.73	0.88	1.07	1.41		

From the table 1 (col. 2) one finds that the observations performed directly on seedlings were confirmed by the statistical analysis of the results. Concretely, the difference in the seedlings' average height, at the end of the first year of vegetation after planting, was of 0.11 m, in favour of the *rectissima* variety. This difference proved significant, which confers a statistically proven credibility to the results obtained in the first year after planting in the field, with regard to the seedlings' average height in the two varieties.

The data displayed in column 3 of the table 1 indicate the same way of manifestation of the analysed character and at the end of year II after planting. Furthermore, at the end of year II after planting, the difference between the seedlings' average height, in the two varieties, grows to 0.34 m (distinctly significant).

A similar situation was recorded in the year 2012 as well (year III after planting) when the difference in height growth of the brush was the largest in favour of the *rectissima* variety, with a value (0.89 m) statistically ensured this time as well at distinctly significant level.

At the end of the fourth year after planting in the experimental field (2013), the average height of the brush displayed, again, significantly and distinctly greater values in the *rectissima* variety (8.02 m) compared to those of the *oltenica* variety (7.38 m), which, at a first analysis, would allow us to state that the *rectissima* variety has, certainly, a much greater height growth speed than the o*ltenica* variety.

Because after planting the seedlings were not cut at 3-5 cm above ground level but left with the stem formed in year 0 in the nursery, a much more accurate and correct appraisal of the growths in year I after planting, in the two tested acacia varieties, can be done by deducting from the height values, at the end of the respective year, the initial value of the seedlings' height upon planting. Likewise, in order to accurately establish the height growth pertaining to years II, III and IV after planting, one must deduct from the average value obtained at the end of the respective year the value of the seedlings' height recorded at the end of the previous year. The yearly growths calculated according to this reasoning are displayed in the table 2.

The data regarding the yearly average growths of the seedlings' height for the two acacia varieties, at the end of each of the four years of vegetation, reveal the fact that, in the first year after planting, the average growth of the seedlings' height was not too large (1,19 – 1,26 m), between the two varieties the seedlings' height differences at the end of the first year being insignificant (±d = 0.07< $DL_{5\%}$). It is very likely that the planting of the seedlings in the experience pretty late in the spring of 2010 (the second decade of April) also negatively influenced their height growth in the first year of vegetation in the field.

Table 2

The influence of the acacia variety on the yearly growths of the seedlings' heights, in the first four years after planting, Bârzeşti, 2010-2013

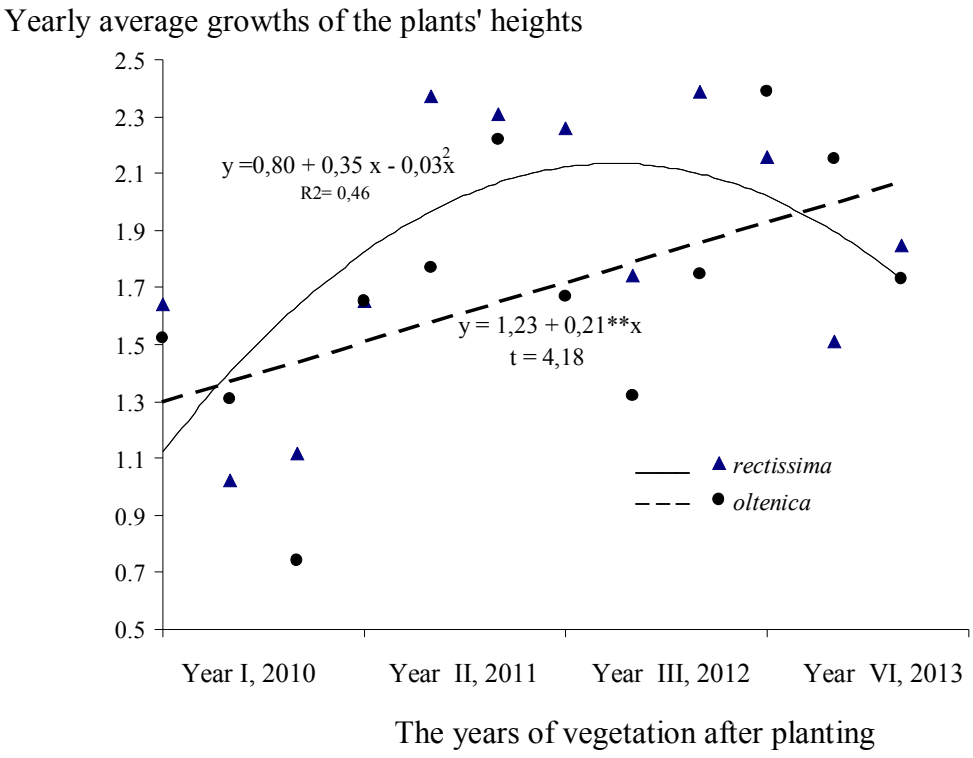
Variant designation	Yearly growth (m) of the seedlings at the end of the years				Yearly average growths (m)	±d (m) Yearly averages	Difference significance
	2010	2011	2012	2013			
Rectissima	1.26	2.11	2.13	1.94	1.86	-	-
Oltenica	1.19	1.88^{o}	1.58^{oo}	2.09$^{=}$	1.66	- 0.20	-

On the contrary, in the second year of vegetation, the yearly growths of the average height, in the seedlings of the two varieties, were much larger than in the previous year (1.88 – 2.11 m) the *rectissima* variety growing, on average, 23 cm taller than the *oltenica* variety, and in the third year the yearly growth the difference is of 0.55 m in favour of the *rectissima* variety, in both cases the values of the differences being statistically insured for $P_{1\%,}$.

At the end of the fourth year after planting, the data regarding the yearly growths averages in the two varieties display a completely different situation compared to the one recorded in the two previous years. This time, the largest values of the yearly growths were recorded in the *oltenica* variety (2.09 m), at a significant difference compared to the ones displayed by the *rectissima* variant (1.94 m), a fact which suggests that the two varieties record maximum values of the yearly height growths at different times.

On average for the first four years of vegetation, the *rectissima* variety grows 1.84 m/year, while in the *oltenica* variety the yearly average growth is 1.69 m (table 2, col , 6), the difference between the yearly average growths of the two varieties being insignificant ($\pm d = 0.15 < DL_{5\%} = 0.34$). These results indicate that the two acacia varieties have, in the first four years after planting, practically equal yearly average growths of the plants' heights, but the periods of maximum growth is recorded at different times by each variety: in the years II -III after planting, in the *rectissima* variety and beginning with year IV after planting, in the *oltenica* variety.

Another obvious distinction between the two varieties is represented by the way in which the yearly average growths evolve, in the first four years after planting in the field. If one calculates and represents graphically the regression of the average growths of the plants' heights compared to the year of vegetation after planting in the field, in the two varieties (fig,1.) one notices that, in the *rectissima* variety, the evolution over time of this character is represented by a parable, the regression equation being of the 2nd degree (quadratic regression). On the contrary, in the *oltenica* variety, the regression of the average growths of the plants' heights, compared to the year of vegetation after planting in the field, is linear and positive, the regression equation being of the 1st degree.



Fig, 1. The regression of the yearly average growths of the plants' heights compared to the year of vegetation after planting in the field, in two acacia varieties, B□rzeşti, 2010 – 2013

Taking into account that in both varieties the regression coefficients are significant (in cv. *rectissima* b = 0,35* and c = 0,03* and in cv. *oltenica* t = 4.18 so b = 0.21**) one may calculate, with the help of the regression equations, the expected average height of the brush in the years V and VI after planting in the field. The results of these calculations are displayed in the table 2.

The data displayed in the table 3 were obtained by starting from the premise that the way of evolution of the yearly average growth of the plants' heights, observed in the first four years of vegetation after planting in the field in the two acacia varieties is maintained unchanged in the following two years of vegetation. It is obvious that this premise displays a high level of approximation, because the majority of the researchers who dealt with acacia (Drăcea, 1926; 2008; Bârlănescu et al, 1966; Budău and Timofte, 2012) are of the opinion that, in the same species, the height growth is very pronounced until year IV-V of vegetation, after which the yearly growth rates drop significantly. For these reasons we shall only consider the preliminary results for year V of vegetation to be credible. Admitting, thus, that for yet another year, the way of evolution of the yearly height growth of the brush's plants is maintained identically with the one observed in the first four years of vegetation, we can expect in year V of vegetation (2014) for the average height of the brush to be practically equal in the two acacia varieties.

Table 3

The expected average heights of the brush, in the years V and VI after planting in the field, in the *rectissima* and *oltenica* varieties calculated on the basis of the regression equation

Variant designation	Expected average height (m) of the brush at the end of years V and VI of vegetation			±d (m) At the end of year VI
	2013	2014	2015	
rectissima	8.02	9.44	10.58	-
oltenica	7.38^{oo}	9.32	10.73	0.15

On the basis of these results one can state that, although after the first four years after planting in the field the *rectissima* variety grows in height significantly more than the *oltenica* variety, it is expected that, in the following 1-2 years of vegetation, the heights of the two varieties will get very close to each other, up to equalization.

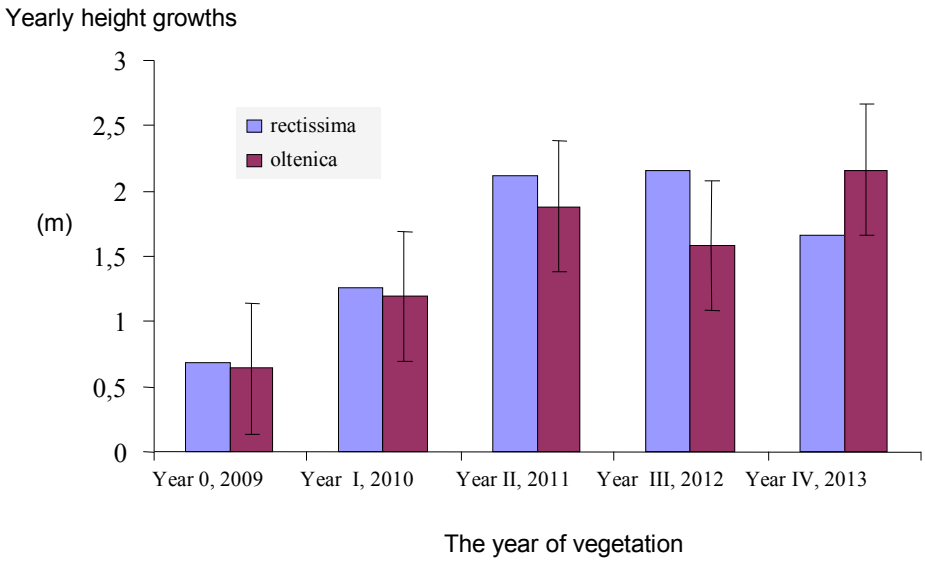
Table 4 displays the analysis of the variance for the series of experiences of type v × years regarding the yearly height growths of the two tested acacia varieties, data which suggest some interesting remarks, namely:

- data variability, for the discussed character, is certainly determined mainly by the differences between the two tested varieties ($F_{calc,} > F_{P5\%}$) and, to a much lesser extent (but significantly), by the interaction variants × years ($F_{calc,} > F_{P5\%}$);
- in Bârzeşti, the four experimental years (2010 – 2013) displayed different favourability degrees for the height growth of the seedlings of the two acacia varieties, fact illustrated by the increased value of the years' variance ($s^2 = 33,58$);
- because in certain experimental years there were significant height growth differences between the two varieties, but not constantly in favour of one of them, one can state that the height growth differences of the seedlings of the *rectissima* and *oltenica* varieties are not, in this case, the result of the real distinctions between the two tested acacia varieties and their interaction with the conditions of the experimental years. This is seen very clearly in the graphical representation (fig. 2) of the yearly growths, including the ones from year 0 (nursery).

Table 4

The table of variances for the plants' height in the series of experiences of the type v x years

Variability cause	SPA	GL	s^2	Test F	
				Compared to s^2_E	Compared to $s^2_{v\times a}$
Total	114.32	23			
Blocks	4.13	8			
Years	100.74	3	33.58		
Variants	6.47	1	6.470	50.15 > 5.32; 11.26	12.76>10.13
Variants × years	1.62	3	0.507	4.19 >4.07	
Error	1,36	8	0.129		



Fig, 2. The yearly average height growths of the acacia seedlings, (Calafat and Secuieni, 2009; Bârzeşti, 2010 – 2013)

CONCLUSIONS

The variability of the data, for the seedlings' height, is certainly determined mainly by the differences in the two tested varieties ($F_{calc.} > F_{P1\%}$) and, to a much lesser extent (but significantly), by the interaction variants × years ($F_{calc.} > F_{P5\%}$); ($F_{calc.} > F_{P5\%}$);

At the end of the fourth year after planting in the experimental field (2013), the average height of the brush displayed distinctly and significantly larger values in the *rectissima* variety (8.02 m) compared to the *oltenica* variety (7.38 m), which, at a first analysis, would allow us to state that the *rectissima* variety certainly has a much higher growth speed than the *oltenica* variety.

The results obtained by us indicate the fact that the two acacia varieties have, in the first four years after planting, practically equal yearly average growths of the plants' height, but the maximum growth periods are recorded at different times by each variety: in the years II - III after planting, in the *rectissima* variety and beginning with the years III - IV after planting, in the *oltenica* variety.

An obvious distinction between the two varieties is represented by the way in which the yearly average growths evolve, in the first four years after planting in the field. In the *rectissima* variety, the evolution over time of this character is represented by a parable, the regression equation being of the 2nd degree (quadratic regression), while in the *oltenica* variety, the regression of the average growths of the plants' heights, compared to the year of vegetation after planting in the field, is linear and positive, the regression equation being of the 1st degree.

On the basis of the extrapolation of the regression equations for the plants' average height growths compared to the year of vegetation after planting, one can state that, although after the first four years after planting in the field the *rectissima* variety grows in height significantly more than the *oltenica* variety, it is expected that, in the following 1-2 years of vegetation, the heights of the two varieties will get very close to each other, up to equalization.

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