

GENETIC GAIN AND DIFFERENTIAL SELECTION IN COMPARATIVE CULTURE BEECH ALEȘD-POIANA FLORILOR-BIHOR

Lazăr Andra Nicoleta*, Timofte Adrian Ioan*

* University of Oradea, Faculty of Environmental Protection, 26 Gen. Magheru St., 410048
Oradea, Romania, e-mail: ienciuandra@yahoo.com

Abstract

Being aware of genetic variations is a fundamental condition for any long-term preservation of forest ecosystems and production stability, because its size and model determine the ability of tree species to adapt on a long-term basis to the variation of environmental conditions in time and space.

The present researches resemble the tremendously plasticity and the high beech genetic diversity, a quite "young" species, so that is was born the idea that it is important to be established which beech origins are most indicated for extreme spas, which origins produce high quality wood, which have the best growth, have the highest frost resistance, which of them have the highest recreational and landscape value or any other social use.

Key words: genetic gain, selection differential, beech sources, forking.

INTRODUCTION

The performed research carries deep implications regarding forest engineering and it represents the basis of a modern silviculture, one that is intensive, multifunctional and of great economical and biological efficiency, given that the social and protection functions are highly amplified.

The extremely complex mechanisms that underlie forest bio-production and bio-protection cannot be grasped and studied in order to be used for amelioration anywhere but in slightly damaged ecosystems of natural forests.

One of the consequences of the most valuable populations represents the strategy plan of genetically resources utilization for export. It is known that in Romania exist centres of extremely valuable genes, with remarkable growing performances in different sides from Europe.

MATERIAL AND METHOD

In the comparative culture of descent installed at Poiana Florilor, Aleșd forest management unit, in the Bihor County, where the study material was composed of 31 descents of beech (*Fagus sylvatica* L.), representative for 17 European countries, from almost the entire natural area of the species, including Romania, the seedling plants used in the setting up of the culture were two years old and came from the nursery of the Institute of Forest Genetics in Schalembek, Germany.

The culture's area of settlement was in the G 2 – Mountains Apuseni, Mountains Pădurea climatic conditions are characterized by higher moisture, still pretty hot climate that fosters the spread of mountain beech forests, the under-area G 240 – hill beech forests – the main species in the area: beech, height interval: 500-700 m, while the experimental appliance for the culture was a 3x4 rectangular railing, with three repetitions, completely randomized, each unitary lot covering 10x10 m, and being made up of 50 plants placed on five rows with a 2 meter distancing in between and 1 meter distance within the row (Enescu et al., 1976; Enescu, 1977; Ienciu, Savatti, 2004).

For each analysed characters there were calculated the main statistical parameters: the medium, the standard deviation, minimum and maximum values, the amplitude variation, variance and variance coefficient (Ceapoiu, 1968).

The facts' analyse was performed after the STATISTICA program (Compleat Statistical System, StatSoft, Inc., 1991).

For the graphics' marking there were used computer graphic programs from STATISTICA and Excel.

Genetic gain was calculated after the formula: $\Delta G = ih^2cv$, where i is selection intensity or differential selection, h^2 coefficient of heritability and cv is the phenotypic coefficient of variation (Mateescu, 2005; Wade, 2007).

For population was estimated heritability narrowly defined as the ratio of genetic variance to phenotypic variance against targets (Kent, Weir, 2009).

Selection differential is given by the average population/trees, selected by the character ($\overline{X}_s$) and the media gave the same character for all basic tree populations ($\overline{X}_B$).

Selection differential was calculated absolute values for all characters or units of standard deviation. When calculating absolute differential selection formula was used: $i = \overline{X}_s - \overline{X}_B$ (Schneider, 2011).

Since the expression in absolute terms does not allow comparison of genetic gain gains character with other characters of the same basic sampling, selection differential expressed in standard deviation units, according to equation $i = (\overline{X}_s - \overline{X}_B) / \sigma$.

Expressed as, differential selection is independent of the unit for different characters.

The localization of the beech sources, which are studied for the comparative culture of Poiana Florilor, is shown in Table 1.

Table 1

Beech sources (*Fagus sylvatica* L.) which are testing in comparative culture
ALEȘD –POIANA FLORILOR - BIHOR

Number of source	Country	Beech source	Latitude (N)	Longitude (E)	Altitude (m)
01	Franța	Perche	52°03'	12°25'	140
02	Franta	Bordure Man.	49°32'	00°46'	80
04	Franța	Sud Massif	44°09'	02°35'	850
06	Franta	Plateaux du	46°48'	05°50'	600
11	Luxemburg	Heinerscheid	46°01'	06°07'	1150
13	Belgia	Soignes	50°50'	04°25'	110
14	Olanda	Aarnik	51°56'	06°44'	45
17	Marea Britanie	Westfield (2002)	57°40'	03°25'	10
19	Marea Britanie	BE95 (4010)	50°55'	01°09'	150
23	Suedia	Torup	55°34'	13°12'	40
29	Germania	Dillenburg (RE)	50°42'	08°18'	520
31	Germania	Urach (BW)	48°28'	09°27'	760
34	Elveția	Oberwil	47°10'	07°27'	570
35	Austria	Hinterstader	47°32'	14°06'	1250
36	Austria	Eisenerz	47°32'	14°51"	110
37	Italia	Val di Sella	46°01'	13°30'	1150
39	Polonia	Jaworze 178 F	49°50'	19°10'	450
40	Polonia	Tarnava 81 C	49°28'	22°20'	540
43	Polonia	Jawornik 92 b	49°15'	22°49'	320
48	Cehoslovacia	Jablonec N.N.	50°48'	15°14'	760
49	Cehoslovacia	Brumov- Sidonie	49°03'	18°13'	390
51	Cehoslovacia	Harni Plana-Ce	48°51'	14°00'	990
52	Ungaria	Magyaregregy	46°13'	18°21'	400
53	Slovenia	Postojna Masun.	45°38'	14°23'	1000
54	Slovenia	Idrija – DJ 2, 14	46°00'	13°54'	930
57	Bulgaria	Gramaticovo	42°04'	26°28'	200
58	Bulgaria	Maglij	42°38'	25°21'	570
64	Cehoslovacia	Nizbor	50°00'	14°00'	480
67	Polonia	Bilowo 115, 116	54°20'	18°10'	250
69	Polonia	Sucha	49°40'	19°20'	400
72	România	Bihor – Iz buc	46°36'	22°09'	-

* - standard, PL – local source

RESULTS AND DISCUSSION

Measuring and observations took place 8 years after planting and concerned the following features: survival (%), total height (cm), base diameter (cm) and forking (indices).

The values measured in percents were transformed in $\arcsin \sqrt{x}$, the rest of the results being processed by means of statistical mathematics (Ciobanu, 2003; Enescu et al., 1998).

Calculate selection differential required to establish origins selected from those tested and then calculating the average premiums.

The selection criterion was usually the media selected for a specific character origins exceed the overall average of all origins studied.

In doing so, the overall height were selected origins 36-Eisenerz, 39-Jaworze 178 F, 4-Sud Massif, 72-Bihor Izbuc, 34-Oberwill, 58-Maglij, 48-Jablonec N.N., 1-Perche, 31-Urach (BW), 40-Tarnava 81 C, 51-Harni Plana-Ce, 52-Magyaregregy, 37-Val di Sella and 69-Sucha.

For diameter were selected based on origins 36-Eisenerz, 39-Jaworze 178 F, 4-Sud Massif, 72-Bihor Izbuc, 34-Oberwill, 58-Maglij, 1-Perche, 17-Westfield (2002), 31-Urach (BW), 40-Tarnava 81 C, 51-Harni Plana-Ce, 54-Iduja-DJ 2,14, 52-Magyaregregy, 37-Val di Sella, 67-Bilowo 115,116 and 69-Sucha.

If forking origins were selected 36-Eisenerz, 48-Jablonec N.N., 52-Magyaregregy, 49-Brumav-Sidonie, 37-Val di Sella, 67-Bilowo 115,116, 57-Gramaticovo, 29-Dillenburg (RE), 69-Sucha and 14-Aarnik.

It was found that both in absolute terms and in units of standard deviation, differential selection varies from one character to another, it is all the greater as studied character has a larger amplitude variation (Table 2).

Table 2

Differential selection for comparative cultural origins beech ALEŞD-POIANA
FLORILOR-BIHOR selected for different types of characters

No.	Character	Differential selection	
		Absolute terms	In units of standard deviation
1.	Total height	13,67	0,25
2.	Base diameter	1,6	0,48
3.	Forking	0,08	0,30

If you compare the differential gap selection unit type is found that the highest intensity of selection was registered in diameter at the base, being the 0,48.

Weakest selection intensity was recorded for total height it was 0.25, and for forking it was slightly higher, namely 0,30.

For selected beech origins of genetic gain was calculated for different characters (Table 3).

It is noted that for some characters genetic gain is too high, as for example the total height and diameter at the base.

Small values of genetic gain for this character is probably due to the small age comparative culture, increases in height at this age is not too large.

This finding was expected because of the very low age of comparative culture, a more accurate estimate of genetic gain can be usually later in life,

allowing a more accurate assessment of the behavior of beech provenances tested in culture.

Table 3

Genetic gain for different types of characters in beech origins of comparative culture
ALEȘD-POIANA FLORILOR-BIHOR

No.	Character	Genetic gain (ΔG)
1.	Înălțimea totală	1,93*
2.	Diametrul la bază	0,16
3.	Înfurcirea	18,20

*) In units indicated for each character

CONCLUSIONS

It was found that differential selection varies from one character to another and that increases in absolute performed based on selection of the best origins are even higher as regarded character has a larger amplitude. Highest selection intensity was recorded only for forking on the comparative culture.

It was found that in the case of provenances of beech comparative culture Alesd-Poiana Florilor genetic gain obtained for diameter was small due to the young age of the culture, in contrast to reveal a strong forking. The classifications of origins were different by the characters and this is not necessarily made by geographic criterion, because the origins from the same geographical zone apart from different groups in many situation.

However, one important aspect of this evaluation is that Romanian origin 72-Bihor Izbuc was located in the top nominees with significant origins for both the base diameter and the overall height.

Generally, the Romanian origins are group together with other origins from Europe south-east, but some of them presents propinquities with some origins from west.

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