EVALUATION OF DIFFERENTIAL SELECTION AND GENETIC GAIN IN COMPARATIVE CULTURE BEECH BAIA SPRIE-CĂRBUNARU-MARAMUREŞ

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Abstract

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.

In this way has creating the premises of reproduction forestry materials for enlarging of export with its. This way is available because these premises counting the environment's conservation and durable development principles al global level, which has promoted national strategies and a substantial growing of forest areas.

Key words: diversity, genetic gain, average populations, standard deviation

INTRODUCTION

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.

MATERIAL AND METHOD

In the comparative culture of descent installed at Cărbunaru, Baia Sprie forest management unit, in the Maramureş County, where the study material was composed of 26 descents of beech (*Fagus sylvatica* L.), representative for 8 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 Schalembeck, Germany.

The culture's area of settlement was in the H2 zone – The Ciceului Hills, with a cold and wet climate where the biggest area is represented by the beech hills, subareas H 240-Beech hills - main area species: beech, altitude range 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, Doniță şi colaboratorii, 1976; Enescu, 1977; Andra 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 (**Complet 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, 2009**).

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 Cărbunaru, is shown in (Table 1).

Table 1

Beech sourses (*Fagus sylvatica* L.) wich are testing in comparative culture BAIA SPRIE –CĂRBUNARU - MARAMUREŞ

Number of sourse	Country	Beech sourse	Latitude (N)	Longitude (E)	Altitude (m)
11	France	F.D. des Charmettes	45°15'	03°00'	-
18	France	F.D. de Ligny en Barrois	48°37'	05°16'	300
23	France	F.D. de Villafans	48°15'	07°15'	-
26	Denmark	Glorup	-	-	-
28	Sweden	Ryssberget	56°05'	14°36'	90
36	Germany	Osterholz-Scharembeck	53°17'	10°28'	28
40	Germany	Borenden	51°30'	09°50'	375
44	Germany	Oberhaus	51°70'	10°50'	9
51	Germany	Eitorf 1502/2629	50°30'	07°30'	305
66	Germany	Dillenburg	50°44'	08°02'	500
69	Germany	Büdingen Abt. 762*	50°17'	09°07'	198
73	Germany	Sinntal Abt. 414*	50°19'	09°38'	465
77	Germany	Eisenach	50°59'	10°19'	-
80	Germany	Ebeleben	51°17'	10°45'	-
92	Germany	Elmstem-Sii Appenthal	51°30'	09°50'	375
93	Germany	Montabaur	49°50'	08°00'	313
94	Germany	Etteiben	48°12'	07°55'	445
99	Germany	Ehingen	48°24'	09°30'	620
104	Germany	Zwiesel	49°01'	13°14'	755
129	Slovakia	Smolenice	48°22'	17°22'	420
130	Slovakia	Trenčin	48°58'	18°01'	510
135	Slovakia	Medzilaborce-Koskovce	49°17'	21°50'	-
137	Slovenia	Postojna	45°45'	14°19'	1100
144	Ukraine	Rachiv	-	-	-
150	Romania	Sovata (25)	46°35'	25°00'	1015
PL	Romania	Cărbunaru	47°35'	24°04'	640

*** - standard, PL – local sourse**

RESULTS AND DISSCUSIONS

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 arc sin $\sqrt{x}$, the rest of the results being processed by means of statistical mathematics (**Ciobanu, 2003; Enescu, Doniţă, Bândiu şi colaboratorii, 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 150-Sovata (25), 135-Medzilloborce-Koskovce, 51-Eitorf 1502/2629, 44-Oberhaus, PL-Cărbunaru, 130-Trenčin, 80-Ebeleden, 94-Etteiben, 28-Ryssberget, 144-Rachiv, 77-Eisenach and 40-Borenden.

For diameter were selected based on origins 150-Sovata (25), 129-Smolinice, 51-Eitorf 1502/2629, 44-Oberhaus, 23-F.D. de Villarfans, PL-Cărbunaru, 92-Elmsten-Sű Appenthal, 80-Ebeleden, 99-Ehingen, 137-Postojna, 69-Bűdingen Abt. 762 and 26-Glorup.

If forking origins were selected 150-Sovata (25), 135-Medzilaborce-Koskovce, 129-Smalenice, 51-Eitorf 1502/2629, 23-F.D. de Villafans, 92-Elmsten-Sű Appenthal, 18-F.D. de Ligny en Barrois, 99-Ehingen, 28-Ryssberget, 11-F.D. de Charmethes, 69-Bűdingen Abt. 762 and 40-Borenden.

It was found that both in absolute terms and in units of standard deviation, 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 the character is considered larger amplitude variation (Table 2).

Table 2

Differential selection for comparative cultural origins beech BAIA SPRIE-CĂRBUNARU-MARAMUREŞ selected for different types of characters

No.	Character	Differential selection	
		Absolute terms	In units of standard deviation
1.	Total height	18,97	0,61
2.	Base diameter	0,3	1,5
3.	Forking	0,09	0,52

This finding is even more evident if we compare selection differentials in units of standard deviation.

In fact, this latter mode of expression also express selection differentials and selection intensity applied, which in relation to the above criteria, ranging from 1.5 which was the highest intensity of selection and diameter was recorded for the basis until 0.52 which was the lowest intensity of selection and was recorded for forking.

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.

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.

Noteworthy genetic gain was reported for the base diameter, growth of timber that would get the obvious. It should be borne in mind that the

genetic gain values are given in the units in which each character was evaluated.

Table 3

Genetic gain for different types of characters in beech origins of comparative culture BAIA SPRIE-CĂRBUNARU-MARAMUREŞ

No.	Character	Genetic gain (ΔG)
1.	Înălțimea totală	0,12*
2.	Diametrul la bază	18,69
3.	Înfurcirea	9,88

*) **In units indicated for each character**

Had they converted into percentages would be much higher, but even so a gain of 18.69 cm in diameter is important as these young comparative cultures, which can probably be bigger as they get older.

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 for diameter based on the comparative culture.

It was found that in the case of provenances of beech comparative culture Baia Sprie-Cărbunaru is remarkable genetic gain and diameter at the base, growth of timber that would get when using these provenances of beech forest is very significant in practice.

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.

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.

REFERENCES

1. Ceapoiu, N., 1968, Metode statistice aplicate în experiențele agricole şi biologice, Editura Agrosilvică, Bucureşti, 550 p.
2. Ciobanu, D., 2003, Genetică ecologică - Selecția unor populații naturale valoroase de pin silvestru din Carpații Orientali şi Carpații de curbură, apte pentru cultură în stațiuni corespunzătoare din zonă, Editura Infomarket, Braşov, 133 p.
3. Enescu, V., Doniță N., Bândiu C. şi colaboratorii, 1998, Zonele de recoltare a semințelor forestiere în R. S. România, Redacția de propagandă tehnică agricolă, Bucureşti, 61 p.
4. Enescu, V., 1977, Genetica forestieră – Principii şi aplicații, Editura Ceres, Bucureşti, 334 p.

5. Enescu, V., Doniță, N. şi colaboratorii, 1976, Zonele de recoltare a semințelor forestiere în R. S. România, Editura Ceres, Bucureşti, 31 p. + 1 anexă.
6. Andra Ienciu, Savatti, M., 2004, Aspects regarding the existent correlations among different phenotipic characters studied on some natural beech stands (*Fagus sylvatica* L.) in the Western part of Romania, "3rd International Symposium – Prospects for the 3rd Millennium Agriculture", Buletinul U.S.A.M.V, vol. 61, Cluj-Napoca, pp.145-149, 489 p.
7. Kent H., Weir B. S., 2009, Genetics in geographically structured populations: defining, estimating and interpreting FST, Nat Rev Genet. 10(9):639–650.
8. Mateescu G. D., 2005, Optimization by using evolutionary algorithms with genetic acquisitions, Romanian Journal of Economic Forecasting, no.2, pp.15-17.
9. Schneider P. M., 2009, Expansion of the European Standard Set of DNA Database Loci - the Current Situation. Profiles in DNA.;12(1):6-7.
10. STATISTICA - Complet Statistical System – StatSoft - Inc., 1991.
11. Wade M.J., 2007, The co-evolutionary genetics of ecological communities, Nat. Rev. Genet. 8 (3): 185–95.