

GENETIC DIVERSITY FOR CHLOROPHYLL CONTENT IN SOME COMMON BEAN LANDRACES

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ABSTRACT

The aim of this research was to evaluate the photosynthetic intensity based on chlorophyll content in new leaves in some common bean landraces. In the research were included 32 local populations of common bean collected from all regions of Kosovo. The experiment was carried at Experimental Didactic Farm of the Faculty of Agriculture and Veterinary in Pristina, designed as randomized complete block with three replications, 5 plants for replication. Chlorophyll content was measured by chlorophyll-meter CCM-200. The research results show high significant differences ($P < 0.05$, $P < 0.01$) between common bean landraces in the context of chlorophyll content in new leaves. The highest mean values of total chlorophyll content were registered in the landrace FAGB164 = 24.32 CCI, while the lowest was FAGB180 = 13.86 CCI. The results were calculated statistically using different statistical software such as Minitab 16 and Microsoft Excel.

Keywords: Common bean, chlorophyll, CCI, landrace

1. INTRODUCTION

The common bean is among the most important legumes of human nutrition in Kosovo. It is a good source of proteins, dietary fibers, starch, minerals and vitamins. In Kosovo, common bean is cultivated on 7 505 ha, with an average yield of 0.9 t/ha, with annual consumption of 11.53 kg per capita (Fetahu et al. 2010). The chlorophyll content is one of the main indicators of photosynthetic activity of plants. Pigments such chlorophyll a and b, play an important role in light absorption during photosynthesis (Lobato et al. 2009). Reduction of chlorophyll caused a decrease in the photosynthesis rate of plants.

Regarding the way of CO₂ fixation the common bean *Phaseolus vulgaris* is a C₃ species (Santos et al., 2009), because CO₂ is catalysed into 3- phosphoglylycerate by the enzyme RUBISCO (ribulose-1,5 bisphosphate carboxylase/ oxygenase) (Furbank and Taylor, 1995).

According to the literature data, changes in chlorophyll content between different cultivars, among others refer to the genetic factor Lobato et al., (2009). Therefore the aim of this study was to evaluate the genetic diversity of common bean landraces in the content of total chlorophyll content in the leaves, which simultaneously represents the photosynthetic activity of plants.

2. MATERIAL AND METHODS

The experiments were carried out in the Experimental Didactic Farm of the Faculty of Agriculture and Veterinary in Prishtina. As research material were used 32 common bean landraces originated from different regions of Kosovo (Table 1). The experiment design was a randomized complete block with three replicates. In each replication, five leaves from each plant were analyzed. Leaf chlorophyll content was measured using a hand-held chlorophyll content meter CCM-200 (Opti-Sciences, Inc.).

Table 1: The common bean landraces included in research

No	Accession number	Genus	Species	Latitude (N)	Longitude (E)	Altitude	Collecting site
1	FAGB129	Phaseolus	vulgaris	42° 49' 4.00"	20°56'0.00"	544	Vushtrri
2	FAGB130	Phaseolus	vulgaris	42° 21' 22.28"	20°47' 50.77"	365	Suharekë
3	FAGB134	Phaseolus	vulgaris	43° 02' 49.00"	21°07' 20.00"	744	Podujevë
4	FAGB138	Phaseolus	vulgaris	42° 34' 29.00"	20°54' 38.00"	603	Komoran
5	FAGB141	Phaseolus	vulgaris	42° 42' 17.00"	21°13' 22.00"	688	Prishtinë
6	FAGB150	Phaseolus	vulgaris	42° 36' 49.00"	20°54' 23.00"	603	Drenas
7	FAGB153	Phaseolus	vulgaris	42° 38' 55.00"	21°11' 11.00"	556	Prishtinë
8	FAGB154	Phaseolus	vulgaris	42° 28' 12.00"	20°46' 45.00"	563	Malishevë
9	FAGB156	Phaseolus	vulgaris	42° 10' 51.00"	21°12' 36.00"	853	Kaçanik
10	FAGB159	Phaseolus	vulgaris	42° 35' 01.00"	21°38' 31.00"	481	Kamenicë
11	FAGB164	Phaseolus	vulgaris	42° 49' 10.00"	20°41' 55.00"	875	Istog
12	FAGB170	Phaseolus	vulgaris	42° 39' 52.12"	21°24' 29.36"	957	Prishtinë
13	FAGB175	Phaseolus	vulgaris	42° 43' 44.00"	20°46' 24.00"	585	Skenderaj
14	FAGB178	Phaseolus	vulgaris	42°03'30.00"	20°40'30.00"	1335	Dragash
15	FAGB180	Phaseolus	vulgaris	42°15'27.00"	21°13'45.00"	512	Kaçanik
16	FAGB182	Phaseolus	vulgaris	42°20'30.00"	21°06'35.00"	672	Ferizaj
17	FAGB184	Phaseolus	vulgaris	42°30'23.00"	21°02'16.00"	570	Lipjan
18	FAGB185	Phaseolus	vulgaris	42°26'37.00"	21°19'59.00"	821	Gjilan
19	FAGB187	Phaseolus	vulgaris	42°32'07.00"	20°16'47.00"	665	Pejë

20	FAGB189	Phaseolus	vulgaris	42°54'32.18"	20°59'48.69"	1019	Mitrovicë
21	FAGB190	Phaseolus	vulgaris	42°16'32.84"	21°14'55.37"	544	Kaçanik
22	FAGB191	Phaseolus	vulgaris	42°15'35.72"	21°24'4.10"	1009	Viti
23	FAGB194	Phaseolus	vulgaris	42°19'28.80"	21°27'34.70"	708	Viti
24	FAGB195	Phaseolus	vulgaris	42°18'1.93"	21°22'6.27"	563	Viti
25	FAGB202	Phaseolus	vulgaris	42°24'8.147"	20°31'.39.41"	330	Rahovec
26	FAGB203	Phaseolus	vulgaris	42°15'13.878"	21°2'9.34"	793	Shterpcë
27	FAGB204	Phaseolus	vulgaris	42°26'4.42"	20°16'.16.341"	460	Gjakove
28	FAGB205	Phaseolus	vulgaris	42°38'4.963"	20°32'.42.5"	384	Klinë
29	FAGB206	Phaseolus	vulgaris	Market	Market	Market	Prishtinë
30	FAGB207	Phaseolus	vulgaris	42°41'32.496"	21°5'.40.477"	554	Obiliq
31	FAGB208	Phaseolus	vulgaris	42°38'58.646"	20°22'.47.92"	453	Pejë
32	FAGB209	Phaseolus	vulgaris	42°26'26.02"	21°0'.47.339"	597	Shtime

The chlorophyll content was measurement in the newly formed leaves, 7 days after germination. The chlorophyll meter detector with diameter of 0.71 mm is placed on the upper side of the leaf, while the chlorophyll content values are read on a digital display. Chlorophyll content was analyzed in each leaf separately, but in the end it is estimated the average value for a leaf chlorophyll content.

3. RESULTS AND DISCUSSION

The research results relating to the chlorophyll content in the leaves of common bean landraces are shown in Tables 2 and 3, and Figures 1 and 2.

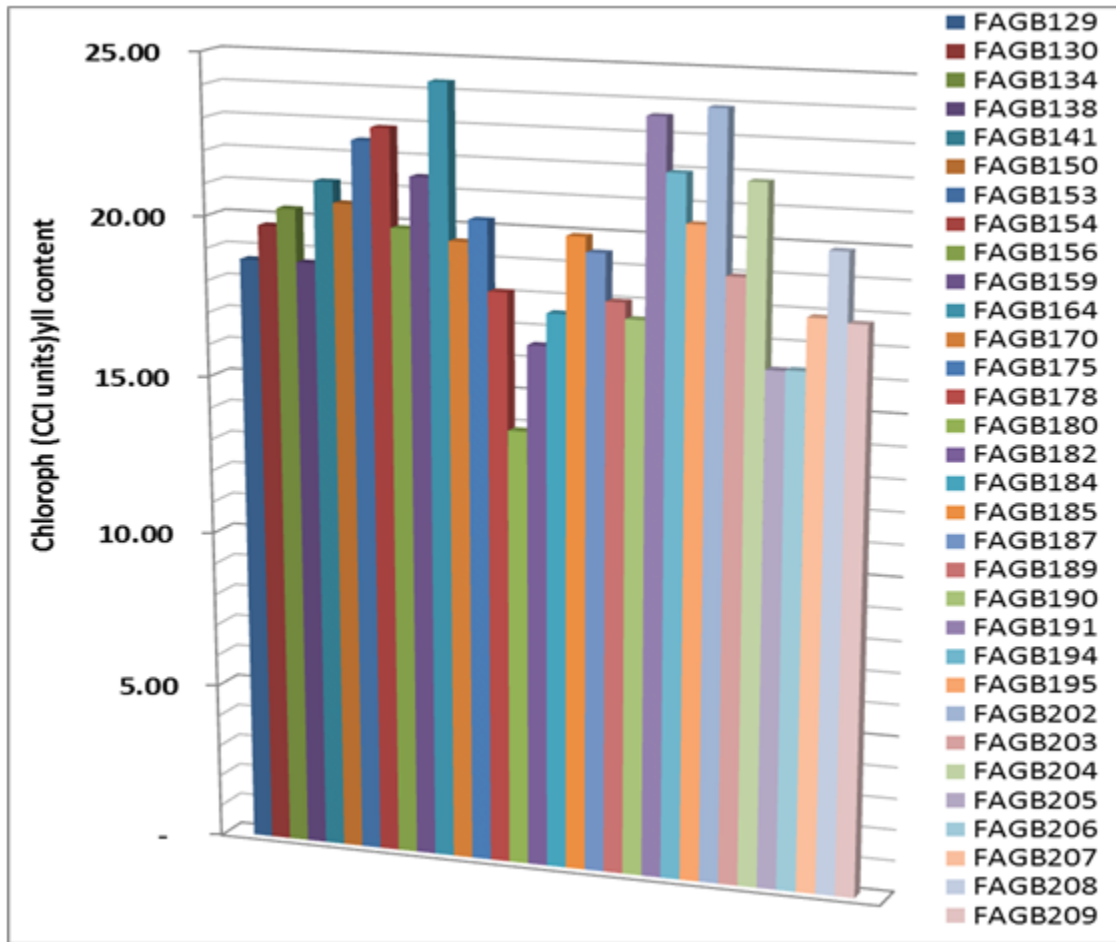


Fig. 1: Different values of chlorophyll content among different common beans landraces collected in different localities of Kosovo



Fig. 2: Field measurements of chlorophyll content by chlorophyll meter instrument

The table 2 show the maximal and minimal mean values of the leaf chlorophyll content, while in the table 3 was shown the variance among common bean landraces regarding the chlorophyll content. Based in the table 2, the higher mean values for chlorophyll content had the landrace FAGB164 = 24.32 CCI, while the lowest one the landrace FAGB180 = 13.86CCI, with a high significant difference between them (table 3). Our research results for various chlorophyll content in different landraces are consistent with data from other authors (Lobato et al 2009), who found different results of photosynthetic pigments content in some different bean populations, with higher genetic variation.

Table 2: The common bean landraces included in research

<i>Source of Variation</i>	<i>SS</i>	<i>df</i>	<i>MS</i>	<i>F</i>	<i>P-value</i>	<i>F crit</i>
Between Groups	724.9694	31	23.38611	7.437408	1.32E-14	1.570857
Within Groups	301.8614	96	3.14439			
Total	1026.831	127				

4. CONCLUSION

Based in the research results could be concluded as follow:

Among common bean landraces from different regions of Kosovo exist a wide genetic diversity regarding the leaf chlorophyll content;

The highest mean values of total chlorophyll content were registered in the landrace FAGB164 = 24.32 CCI, while the lowest was FAGB180 = 13.86 CCI and

Chlorophyll content index could be used as a good indicator to evaluate the genetic diversity among common bean landraces

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