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INFLUENCE OF THE PRIMARY HABITAT OF COCKSFOOT (*DACTYLIS GLOMERATA*) ECOTYPES ON THE CONTENT OF TOTAL PROTEIN AND MACROELEMENTS

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A b s t r a c t. Twenty-five ecotypes from different natural stations were gathered in the collection of Elizówka, Poland, in 1989-1991. Content of calcium, magnesium, total protein, phosphorus and potassium was measured in the dry mass of plants collected during full flowering. On this ground, differences in the potassium content (variation coefficient 48.3%) were observed within the ecotypes. The smallest deviations were found in the total protein content (22.2 %) The ecotypes were significantly differentiated in terms of the investigated components content. It was observed that the objects from weakly fertile habitats were usually poor in total protein and macroelements. Besides, an important correlation between content of nutrients in the plant mass was statistically confirmed.

K e y w o r d s: ecotypes; chemical composition; correlations, habitat.

INTRODUCTION

One of the characteristic features of grass ecosystems is their high biological diversity. Due to excessive management in those areas and environment pollution, botanical composition of these ecosystems is frequently significantly impoverished [1,3,4,8]. Therefore, it is important to gather and assess ecotypes in the collections. It is also a good way to provide diversified genetic material, which can be used for the breeding of new varieties created for a certain purpose.

Cocksfoot is one of the most important grass species sown in grassland, even though it also has some disadvantages such as quick daily decrease of digestion equal to 0.7 % and excessive ability of cumulate high amounts of potassium [2].

The aim of the research was to determine variability range in the content of macroelements in cocksfoot, and to find correlations between them searching for the ecotypes with advantageous phytochemical features.

MATERIAL AND METHODS

Ecotypes were collected as clones in the habitats with low anthropogenic impact, situated on fertile loess and alluvial soils, and non-fertile sandy soils. In July 1988, they were planted in 10 tussocks, 75 x 30 m apart at the Experimental Station in Elizówka, Poland. Variety Bara was the control. In 1989-1991, green mass was collected from each ecotype. Then, the green mass was dried and ground. Total protein, P, K, Ca, and Mg were analysed in the ground samples. Chemical analysis was carried out at the Regional Agrochemical Station in Lublin, Poland. Measurements of the nutrient content for each ecotype were made in three consecutive years in three repetitions. Protein was analysed using the Kjeldahl's method, P - colorimetrically using the vanadium-molybdenum method, K and Ca - using the photoflame method, Mg - using the AAS method.

Collection was created on brown soil derived from loess. The P content was on good level (15-18 mg of P_2O_5), K content was usually low (10-12 mg of K_2O), and the content of magnesium was average (6.2-7.3 mg of MgO/100 g of soil). Reaction of the KCl soil solution ranged from 5.6 to 6.0. The following quantities of fertilisers were used in spring: N - 60; P_2O_5 - 70; K_2O - 120 kg ha^{-1}. In the consecutive years of the research, yearly sums of rainfall were: 470, 541, and 441 mm, while the average yearly temperatures were constantly decreasing, i.e.: 8.9; 8.7; 7.4 ^{o}C, respectively.

Statistical calculations were made at the Computer Centre of the University of Agriculture in Lublin. Calculations were based on the analysis of variance, Tukey's confidence intervals, correlation, and variation coefficients.

RESULTS AND DISCUSSION

Total protein content in cocksfoot was rather low, which could have been related to the relatively late cropping of sprouts during full flowering. None of the individuals collected protein better than the standard Bara variety among the studied ecotypes. However, protein content similar to that of Bara variety was found in hay of the ecotypes from fertile loess and alluvial soils (Table 1). Results by other authors [5,7,9], quote that ecotypes contained rather small quantities of mineral components and only some of them contained significantly smaller amounts than the Bara variety. Only in the cases of potassium and calcium, units richer than the standard were found. It the case of potassium, these were the ecotypes from Snopków and Baszki taken from fertile and compacted soils. In the case of calcium, the

Table 1. Total protein and macroelements content in the dry mass of hay collected from three cuts of *Dactylis glomerata* ecotypes

Ecotypes acc. to origin			Macroelements (% d.m.)				
			N	P	K	Ca	Mg
1. Brzeziny		X	7.20x	0.22	1.65	0.32	0.14
2. Ludwików		Y	8.13	0.23	1.56	0.33	0.14
3. Jacek		X	6.50x	0.19x	1.36x	0.33	0.14
4. Serniki		X	7.30	0.25	1.62	0.37xx	0.13
5. Nowa Wola		X	7.16x	0.22	1.67	0.33	0.13
6. Kaznów		X	6.77x	0.19x	1.67	0.32	0.15
7. Tarło		X	6.73x	0.22	1.54	0.37xx	0.13
8. Izabelin		X	7.30	0.21	1.83	0.34	0.14
9. Białka		X	7.07x	0.22	1.44x	0.37xx	0.13
10. Rudnik		Y	7.67	0.21	1.55	0.33	0.13
11. Zalesie		X	7.33	0.19x	1.56	0.27	0.11x
12. Dąbrówka		X	7.20x	0.22	1.81	0.31	0.13
13. Kamionka		X	7.30	0.23	1.56	0.34	0.14
14. Snopków		Y	7.63	0.24	1.86xx	0.32	0.13
15. Nasutów		Y	7.57	0.24	1.64	0.31	0.14
16. Wandzin		X	6.87x	0.21	1.48	0.30	0.12x
17. Kozłówka		X	7.40	0.24	1.55	0.34	0.14
18. Michów		X	7.20x	0.23	1.62	0.31	0.14
19. Lisów		X	6.30x	0.19x	1.51	0.31	0.12x
20. Baszki		Y	7.53	0.21	1.88xx	0.32	0.13
21. Krupy		X	6.40x	0.22	1.45x	0.35	0.13
22. Kunów		X	6.50x	0.20x	1.49	0.28	0.12x
23. Rudno		X	6.83x	0.23	1.57	0.37xx	0.14
24. Dys		Y	7.57	0.23	1.51	0.35	0.14
25. Bara***			7.80	0.24	1.66	0.31	0.14
Mean from years	1989		7.17	0.15	0.98	0.41	0.15
	1990		5.56	0.18	1.21	0.19	0.09
	1991		8.78	0.32	2.62	0.38	0.17
Mean total 1989-1991			7.17	0.22	1.60	0.33	0.14
Variability coefficient (%)			22.2	36.8	48.3	33.7	29.7
LSD (P=0.05)	ecotypes		0.60	0.04	0.19	0.05	0.02
	years		0.54	0.02	0.15	0.04	0.01

a - ecotype originating from weakly fertile soil; b - ecotype originating from fertile soil; x - substantially less than standard; xx - substantially more than standard; *** - standard variety.

objects were from Serniki, Tarło, Białka, and Rudno, from the regions of non-fertile sandy soils.

There was a significant difference between the contents of the investigated components in the plant mass during all study years. That could have been caused probably by the climatic conditions, which could have influenced not only the components uptake from soil but also a delay or acceleration of development stages decisive for fodder quality. It is worth emphasising that in 1990, the first cut was gathered two weeks later than in other years because flowering was delayed. Such circumstances resulted in extremely low content of protein, calcium, and magnesium in the plants. Mengel and Kirkby [6] pointed out the fact that when calcium is short, the magnesium level is high.

Among the investigated nutrients, the highest variability coefficient was that of potassium (48.3 %) while the lowest of total protein (22.2 %). Important relations were observed between the investigated chemical elements. They can be seen in the calculated correlation coefficients presented in Table 2.

Table 2. Relations between chemical components in the dry mass of *Dactylis glomerata* hay characterised by correlation coefficients

Macroelements	X1	X2	X3	X4
Y -N	0.7215**	0.7228**	0.6816**	0.8327**
X1 - P		0.9282**	0.2784*	0.5123**
X2 - K			0.2966**	0.5549**
X3 - Ca				0.8413**
X4 - Mg				-

* significant at p = 0.05; ** significant at p = 0.01.

CONCLUSIONS

1. Hay from most of the cocksfoot ecotypes contained chemical components at a level of significance close to the standard variety. Total protein was an exception as 13 ecotypes contained lower quantities than the Bara variety.

2. Some of the most interesting ecotypes are those from Jacek, Białka, and Krupy. They contained less potassium than the standard. The objects from Serniki, Tarło, Białka, and Rudno which contained more calcium than the Bara variety, were also interesting.

3. Ecotypes from fertile loess and alluvial soils had the content of the investigated components that was not significantly different from the standard variety.

More differentiated material was found among the objects collected from less fertile sandy soils.

4. Relations between the investigated chemical components were proved by significant correlation coefficients.

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