

VARIABILITY OF THE GENERAL ASPECT OF POLISH LAWN GRASS VARIETIES ON MINERAL SOIL WITH MECHANICALLY DAMAGED UPPER LAYER

W. Harkot, Z. Czarnecki

Department of Grassland, University of Agriculture, ul. Akademicka 15, 20-950 Lublin, Poland

A b s t r a c t. Research carried out on mineral soil with mechanically damaged upper layer proved greater variability of general aspect between species than between varieties within a species. Among the investigated species, the following had higher general aspect values during the whole research period: *Festuca ovina*, *Festuca rubra*, and *Lolium perenne*; while *Agrostis capillaris* and *Agrostis canina* had lower values. Significant differentiation of the general aspect evaluations were observed only in *Festuca* genera variations, whereas evaluations of the general aspect of variations within the rest of the species were close.

Sowing time did not significantly affect differentiation in the evaluation of the general aspect of varieties in *Agrostis*, *Poa*, and *Lolium* genera. However, spring sowing positively affected the general aspect of the *Festuca ovina* varieties and the Terros variety (*F. arundinacea*).

K e y w o r d s: mechanically deformed soil, lawn grass variety.

INTRODUCTION

In recent years, there has been a great growth of attention towards creating and maintaining lawns in Poland [4,6]. Lawns are created during almost an entire vegetation period on different soils, often with damaged upper layer, susceptible to erosion and over-drying [1,4,15,16]. Especially heavy geochemical, hydrological, and chemical deformations take place in the soil of city agglomerations [2,3,8,9]. Intensive geomechanical transformations caused by mixing surface and under-surface genetic soil horizons, as well as accumulation of strewed layers cause deviations in biological activity and high degradation. Those processes often lead to total destruction of natural soils and to creation of anthropogenic soils on which plant growth and development conditions are much more difficult. A very important criterion in terms of evaluating species and varieties in terms of their usefulness as

lawn grass for sodding deteriorated and mechanically transformed soils can be their utility value in stress conditions [4,10-13].

The aim of the research was to evaluate a general aspect of national varieties of lawn grass sowed in two terms on mineral soils with a mechanically damaged upper layer.

MATERIAL AND METHODS

The research was carried out in the years 1996-1998 at the Grassland Experimental Station in Sosnowica. The experiments were set up on light mineral soil using the method of blocks drawn in four repetitions. During field levelling for the experiments, a more fertile, cultivable soil layer had been mechanically damaged. The soil had a neutral reaction (pH in 1M KCl = 6.9), while the contents of available forms of macro-components were: P - 8.2; K - 16.6; Mg - 5.2 mg in 100 g of soil.

The research included all Polish varieties of the 7 species of lawn grass registered in 1996 (*Agrostis canina* L., *A. capillaris* L., *Festuca arundinacea* Schreb, *F. heterophylla* Lam., *F. ovina* ssp. *duriuscula* (L.) Koch., *F. rubra* L. *sensu lato*, *Lolium perenne* L., and *Poa pratensis* L.). Two terms of sowing were used: spring (14 May, 1997) and late summer (23 August, 1996). Mineral fertilization was the same in all objects. Doses of individual mineral components were: prior to sowing N-25; P-22; K-83 kg ha⁻¹, and during the vegetation period N-20, P-40, K-60 kg ha⁻¹. During vegetation in the years of full utilisation, 6-10 cuts were performed.

Utilisation value of the varieties, which proves their usefulness for sodding, was determined basing on the general aspect. Evaluation of the general aspect was carried out on the bases of criteria provided by the Cultivable Plant Variety Research Centre in Słupia Wielka using a 9 scale (9-best grade; 1-worst grade). During the vegetation period, evaluation was carried out once a month. This paper presents results of the general aspect evaluation carried out for species and varieties of lawn grass investigated in 1998 (the year of full grass utilisation in both sowing terms).

RESULTS AND DISCUSSION

Results of observations on the general aspect of the investigated lawn grass species and varieties sowed in two terms on the mineral soil with a mechanically damaged upper layer are presented in Table 1. The investigated grass species had similar variability of general aspect evaluation during the vegetation period: *Festuca ovina* (2.5 to 7.0); *Festuca rubra* (2.8 to 7.5); *Festuca heterophylla* (3.5 to

Table 1. General aspect (9^o grade) of the studied grass species and varieties in a year of full performance (means for four replications): a - spring sowing, b - summer sowing

Varieties	Observation dates													
	27 April		16 June		15 July		7 August		16 Sept.		16 Oct.		6 Nov.	
	a	b	a	b	a	b	a	b	a	b	a	b	a	b
<i>Festuca ovina ssp. duriuscula</i> (L) Koch														
Espro	4.5	5.8	6.0	5.5	6.5	6.0	5.5	4.5	6.0	6.0	6.0	5.5	6.0	5.5
Witra	3.3	5.0	5.5	4.5	4.0	5.0	5.0	3.5	6.5	6.0	6.5	6.0	7.0	6.0
Sima	3.0	3.0	4.8	3.0	4.5	4.0	3.5	2.5	4.3	4.0	5.5	4.0	5.5	4.5
Niko	3.3	3.0	4.0	2.8	3.5	3.5	5.0	3.5	5.0	4.5	4.5	5.0	4.5	5.0
LSD(p≤0.05)	n.s.	1.9	n.s.	2.6	2.2	2.0	n.s.	n.s.	1.7	n.s.	n.s.	n.s.	1.9	n.s.
<i>Festuca rubra</i> L.														
Areta	3.5	5.5	4.5	3.5	3.5	4.0	3.0	2.8	5.0	5.0	5.0	5.5	5.0	5.5
Jagna	3.3	4.5	4.8	4.0	3.0	2.8	3.0	3.0	4.0	3.5	4.5	4.5	4.5	4.5
Leo	3.8	5.0	4.8	4.5	3.0	3.5	3.0	3.0	5.5	4.5	5.5	5.0	5.5	4.5
Nimba	4.5	7.0	5.8	6.0	5.5	6.0	3.5	4.0	4.8	6.0	6.5	6.5	7.5	5.8
<i>Festuca heterophylla</i> Lam.														
Sawa	4.5	7.5	3.5	4.0	5.3	5.0	4.5	5.0	5.0	6.0	6.0	5.5	8.0	3.8
<i>Festuca arundinacea</i> Scrib.														
Terros	4.5	4.8	6.0	5.5	4.5	3.5	5.0	5.0	6.0	5.0	6.0	5.0	6.0	4.0
LSD(p≤0.05)	n.s.	2.8	n.s.	n.s.	2.2	1.9	1.4	1.2	n.s.	n.s.	n.s.	n.s.	3.0	n.s.
<i>Agrostis capillaris</i> L.														
Igeka	3.3	3.5	3.5	4.5	4.0	3.5	3.0	3.0	3.3	3.0	3.5	3.5	3.8	3.3
Niwa	3.3	4.0	3.0	4.8	3.5	5.0	3.0	3.0	4.0	3.0	4.5	4.5	4.3	3.5
Boni	3.3	4.5	4.0	4.3	6.0	5.5	3.0	3.0	3.5	4.5	4.5	4.0	4.5	4.3
<i>Agrostis canina</i> L.														
Nina	3.0	3.0	2.8	2.8	5.0	4.5	3.0	3.0	4.8	3.0	5.5	4.5	5.0	4.3
LSD(p≤0.05)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	1.1	n.s.	n.s.	n.s.	n.s.
<i>Poa pratensis</i> L.														
Alicja	3.8	5.3	4.5	4.3	4.5	5.0	4.5	5.0	5.0	5.0	4.0	4.0	4.5	3.5
Gol	3.5	4.0	5.8	4.8	4.5	4.0	4.5	3.5	6.3	4.0	5.5	3.5	5.5	3.3
LSD(p≤0.05)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.
<i>Lolium perenne</i> L.														
Gazon	5.3	4.5	5.3	5.0	4.5	4.0	5.0	5.0	6.0	5.5	5.5	5.0	5.5	4.8
Nira	3.5	5.5	5.5	5.0	4.0	5.5	4.0	5.0	5.5	6.5	5.5	5.0	5.5	5.5
Niga	4.3	4.5	4.3	4.5	5.0	5.0	5.0	4.0	5.5	5.0	5.0	5.0	5.0	4.8
Inka	4.3	5.3	4.3	4.8	3.5	3.5	5.0	4.5	5.5	6.0	5.0	5.5	5.5	6.0
Stadion	3.3	5.5	4.0	5.0	3.5	4.5	4.5	6.0	4.5	6.0	5.0	6.0	5.0	4.5
LSD(p≤0.05)	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.	n.s.

n.s. - not significant differences.

8.0); *Festuca arundinacea* (3.5-6.0); *Agrostis capillaris* (3.0-6.0); *Agrostis canina* (2.8-5.5); *Poa pratensis* (3.3-6.3); and *Lolium perenne* (3.3-6.5). Important variability of the evaluations of the general aspect evaluation was observed only between the varieties *Festuca ovina* and *Festuca rubra*. The term of sowing did not significantly affect the general aspect of lawn grass species and varieties.

Among the *Festuca ovina* varieties, the highest general aspect evaluations during the whole vegetation period were those of Espro (4.5-6.0) and Witra (3.3-7.0) varieties. Research carried out by other authors [12,13] indicate that sheep fescue of the Sima variety develops well in difficult soil conditions and is especially recommended for maintaining highly degraded areas. Our research indicate that the Espro variety is more useful for sodding mechanically transformed soils. Evaluations of the general aspect of the *F. ovina* varieties sowed in the Spring term (a) were higher than of those sowed in the late summer term (b).

From among the rest of *Festuca genera* varieties, *Festuca heterophylla* of the Sawa variety (3.5-8.0) and *Festuca rubra* of the Nimba variety (3.5-7.5) had the highest general aspect evaluations. Also, research carried out at the Cultivable Plant Variety Research Centre [5,7] and the Institute for Plant Breeding and Acclimatisation [14] prove that the Nimba variety is well distinguished in the lawns of red fescue varieties by the best general aspect evaluations. Many-year experimental research of Patrzalek [10-12] carried out in dumps of coal mine wastes indicate great contribution of red fescue of the Nimba variety to the process of biological recultivation of those dumps. Evaluations of the general aspect of the Terros variety (*Festuca arundinacea*) were somewhat lower and during the vegetation period they ranged from 3.5 to 6.0. Jagna and Areta (*F. rubra*) varieties had the lowest evaluations of the general aspect (2.8 to 5.5). A positive influence of the Spring sowing term on the general aspect of the Terros variety was visible during the entire vegetation period. However, no clear reaction of the rest of the varieties of the *Festuca genera* on the sowing term was stated.

General aspect evaluations of the varieties within genera *Agrostis*, *Poa*, and *Lolium* were not significantly different, but during the whole vegetation period, *Lolium perenne* varieties had a little higher evaluations of that feature than the *Agrostis* genus.

CONCLUSIONS

1. Research carried out on the mineral soil with a mechanically damaged upper layer showed greater general aspect variability between species than between

varieties within a species. The highest evaluations of the general aspect during a vegetation period were for the varieties of *Festuca* (2.8-8.0) and *Lolium* (3.3-6.5) genera, while the lowest were for the varieties of *Agrostis* (2.8-6.0) and *Poa* (3.3-5.8) genera.

2. An important variability in the general aspect evaluation was observed only among varieties of the *Festuca* genus, whereas general aspect evaluations of varieties within the rest of the species were close in value.

3. The spring sowing term positively influenced a general aspect of *Festuca ovina* and Terros varieties (*F. arundinacea*). No clear reaction of the varieties within *Agrostis*, *Poa* and *Lolium* genera to the sowing term was observed.

4. Varieties Espro (*Festuca ovina*), Nimba (*F. rubra*), Terros (*Festuca arundinacea*), Alicja (*P. pratensis*), as well as Gazon and Niga (*Lolium perenne*), due to the stability of their general aspect evaluations during the vegetation period (especially in July and August) and lower susceptibility to the sowing term, can be used for sodding the soils with a mechanically transformed upper layer.

REFERENCES

1. **Brzywczy-Kunińska Z., Rutkowska B.:** Collection of the grass species and their ecotypes suitable for sodding special areas. Zesz. Probl. Post. Nauk Roln., 90, 55-58, 1969.
2. **Czarnowska K.:** Soil and plants in urban environment. Zesz. Probl. Post. Nauk Roln., 418, 111-115, 1995.
3. **Czerwiński Z., Prac J.:** Kierunki przekształceń gleb Warszawy pod wpływem czynników antropogenicznych i systematyka gleb terenów zurbanizowanych. [In:] Problemy ochrony i kształtowania środowiska przyrodniczego na obszarach zurbanizowanych. Wyd. SGGW-AR, Warszawa, 28-34, 1990.
4. **Domański P.:** System of testings and evaluation of turf grasses in Poland. Biul. IHAR, 183, 251-263, 1992.
5. **Domański P.:** Trawy darniowe: kostrzewa czerwona, kostrzewa owcza, mietlica pospolita, wiechlina łąkowa, życica trwała. Synteza wyników doświadczeń odmianowych. Seria 1991. COBORU, Słupia Wielka, 18, 1995.
6. **Domański P.:** Tereny trawiaste w Polsce - zainteresowanie społeczne, stan wiedzy i perspektywy. [In] Garden Arts in Municipal Landscape (eds Drapella-Hemensdorfer A., Gospodarczyk F., Wojtyszyn B.). Oficyna Wydawnicza Politechniki Wrocławskiej, 173-182, 1997.
7. **Domański P.:** Trawy darniowe: kostrzewa czerwona, wiechlina łąkowa, życica trwała. Synteza wyników doświadczeń odmianowych. Seria 1994. COBORU, Słupia Wielka, 21, 1998.
8. **Drozd J.:** Soils of municipal areas and methods of their fertility improvement. [In] Garden Arts in Municipal Landscape (eds Drapella-Hemensdorfer A., Gospodarczyk F., Wojtyszyn B.). Oficyna Wydawnicza Politechniki Wrocławskiej, 167-172, 1997.
9. **Drozd J.:** Środowisko glebowe na terenach zieleni miejskiej. Konf. Nauk. "Miasto-ogród 100 lat rozwoju idei", TARAGRA 1998. Dolnośląskie Wydawnictwo Naukowe, 29-34, 1998.
10. **Patrzalek A.:** Wzrost i rozwój niektórych traw i roślin motylkowatych na zwałowiskach odpadów węgla kamiennego "Smolnica. Arch. Ochr. Środ., 1, 183-197, 1984.
11. **Patrzalek A.:** Zdolność darniotwórcza mieszanek traw i motylkowatych wysiewanych na zwałowiskach odpadów węgla kamiennego oraz ich wpływ na wietrzenie gruntu. Arch. Ochr. Środ., 3-4, 157-170, 1984.

12. **Patrzalek A.:** Marketing of Polish grass varieties for coal mines refuse banks. Biul. IHAR, 199, 185-192, 1996.
13. **Patrzalek A., Łyszczarz J.:** The growth and development of grass mixtures containing *Phacelia tanacetifolia* cultivar Stala as supplementary crop on biologically reclaimed hill banks built from carbon waste rock grounds. Łąkarstwo, 1, 173-183, 1998.
14. **Prończuk S., Prończuk M., Żyłka D.:** Methods of synthetic evaluation of turfgrasses. Zesz. Probl. Post. Nauk Roln., 451, 125-133, 1997.
15. **Rutkowska B., Brzywczy-Kunińska Z.:** Investigation of varieties and ecotypes of grasses suitable for municipal needs. Zesz. Probl. Post. Nauk Roln., 90, 67-71, 1969.
16. **Wysocki C.:** Studies on functioning of lawns in urban areas (Warsaw example). Prace Nauk., SGGW, Warszawa, 96, 1994.