

Suitability of narrow-leaved *Festuca* species for turf

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Abstract. Field experiments, designed for assessment of six narrow-leaved species of *Festuca* genus, cultivated for turf in Lithuania, were carried out at the Lithuanian Institute of Agriculture during 2006–2008. The following parameters were estimated in the competitive trials: field germination speed, sward density, sward colour, sward green colour late in the autumn, growth in spring, re-growth after cuts and leaf width. According to the results of majority evaluated traits, the wild populations of *F. pseudovina* Hackel ex Wiesb., *F. ovina* L. and *F. trachyphylla* (Hack.) Krajina species are best suited for turf establishment. Other species, as *F. wolgensis* P. Smirnov., *F. psammophila* (Hack. ex Čelak.) Fritsdch. and *F. sabulosa* (Andersson) H. Lindb. were less suited for turf establishment due to lower stand density and rusty sward late in autumn

Key words: narrow-leaved species, *Festuca*, turf

INTRODUCTION

In Lithuania, like in many European countries of mid-latitude, the most common grass species used for turf establishment are *Poa pratensis* L., *Festuca rubra* L. and *Lolium perenne* L., less frequent – *Agrostis capillaris* L., *A. canina* L., *A. stolonifera* L., *Festuca ovina* L. and *F. arundinacea* Schreb. The Lithuanian varieties currently used for turf establishment are as follows: *Poa pratensis* – ‘Klotė’ and ‘Galvė’, *F. rubra* – ‘Gludas’, *Poa compressa* L. – ‘Smiltė’, *F. lemanii* Bast. – ‘Lėnas’ and *Agrostis stolonifera* – ‘Verknė’ (Kanapeckas, 2005).

During the recent decade, besides the commonly used turf grass species *Poa pratensis*, *Festuca rubra* and *Lolium perenne*, Lithuanian breeders have focused their attention to the narrow-leaved species of *Festuca* genus. Climate warming and increased frequent droughts have been main reason of their choice. These species, which are characterised by narrow, twisted leaves are resistant to drought, grow perfectly on infertile light-textured soils, need minor special management and preserve their ornamentality, which is of special relevance for their planting on rural tourism grounds, roadsides and other amenity areas.

More than 90 narrow-leaved *Festuca* species are known in Europe (Markgraf-Dannenberg, 1980). However, this figure is not constant, since new species are still being discovered (Penksza, 2003, 2005). Some of the former independent species are treated as subspecies or varieties. There are eight narrow-leaved species of *Festuca* genus currently known in Lithuania: *F. ovina*, *F. trachyphylla*, *F. polesica* Zapał, *F. psammophila* (Hack. ex Čelak.) Fritsdch., *F. sabulosa* (Andersson) H. Lindb., *F. rupicola* Heuffel., *F. pseudovina* Hackel ex Wiesb., *F. wolgensis* P. Smirnov. (Krall et

al., 2004; Stukonis & Bednarska, 2007). Although *F. duvalii* (St-Yves) Stohr. and *F. rupicola* Heuffel. are indicated as species growing in Lithuania (Krall et al., 2004), no accessions from these habitats were found during expeditions. Up to now research has been done on the narrow-leaved species of genus *Festuca* to determine their agronomic characteristics and breeding peculiarities.

The objective of the present study was to assess the populations of six narrow-leaved species of *Festuca* genus for the traits and qualities relevant for turf establishment.

MATERIALS AND METHODS

All the 26 wild populations of the 6 narrow-leaved *Festuca* species used in the study were collected in Lithuania's natural habitats: *F. pseudovina* – 2, *F. ovina* – 6, *F. trachyphylla* – 11, *F. wolgensis* – 1, *F. psammophila* – 4 and *F. sabulosa* – 2. Experiments devoted to species assessment for suitability for turf were set up in the plots 2 x 3 m in size, with two replications. The seeds were broadcast-sown in the second half of the summer. The equal number of a fertile seeds was sown in the plots of each individual population and variety. The Lithuanian variety *F. lemanii* 'Lėnas' and a rather common variety in Europe *F. trachyphylla* 'Borvina' were sown for comparison. The plots were separated from each other by rows of cocksfoot. All the species and populations were cut at the same time leaving stubble of 3.0–3.5 cm height. Experiments lasted for three years, including the year of sowing.

In the sowing year, the plots were assessed for field germination speed, sward density and colour, intensity of greenness late in the autumn. In the second and third years of herbage growth, assessments were made for resumption of early growth in spring, height before cuts, sward density, leaf colour and width, greenness late in the autumn. Herbage height before cuts was measured in 5 places of the plot and data were transferred to the points: very low – up to 4 cm – 9 point, very high – up to 10 cm – 1 point. Leaf width was measured in 5 places of the plot and data transferred to the points: very narrow leaves – up to 1 mm – 9 points, slightly wider – up to 2 mm – 8 points. Other traits were characterized visually by points. Visual assessments were based on a 1–9 point system, where 1 – the lowest and 9 – the highest value of the trait or characteristic (Tyler, 1987).

In the sowing year the date when the ground was completely covered by plants (estimated from a 3–4 meter distance) was registered. Sward colour was estimated in a cloudy day in September. The intensity of greenness was determined late in the autumn after more severe frosts. In the second and third years of grass growth herbage height before cuts was established. Sward density was estimated in spring (at the beginning of vegetation), in mid summer and autumn (at the beginning of October), 2–3 days after cut.

Sward colour was established in spring after the first cut, in mid summer and in autumn (at the beginning of October), 2–3 days after cut. Leaf width was measured in mid summer. Complex assessment was obtained when all the given points were multiplied by coefficient of significance introduced for individual traits: field germination speed – 1; sward density – 1.5; sward colour – 1.1; greenness late in the

autumn – 1.3, resumption of early growth in spring – 1.3, re-growth after cut – 1.5, leaf width – 1.1.

Coefficient of significance was estimated by author depends on importance of individual traits for turf (Stukonis, 2009). The data were processed by the statistical methods using the software package ‘Selekcija’ (Tarakanovas & Raudonius, 2003).

RESULTS AND DISCUSSION

Field germination speed. Rapidly and evenly germinated grasses exhibited better suppression of weeds and more rapid soil cover. Field germination of wild populations of the narrow-leaved species of *Festuca* genus was very diverse (Table 1).

Table 1. Assessment of relevant traits of *Festuca* narrow-leaved species for turf (in points), 2008.

Trait	<i>Festuca</i> species							
	<i>ovina</i>	<i>trachy- phylla</i>	<i>psammo- phila</i>	<i>pseud- ovina</i>	<i>sabu- losa</i>	<i>wol- gensis</i>	<i>lemanii</i> Lėnas	<i>trachy- phylla</i> Borvina
Field germination speed	5.9	7.0	6.0	9.0	6.0	7.0	8.0	9.0
Sward density	8.2	8.1	7.5	9.0	5.0	7.0	9.0	8.5
Sward colour ¹	g	b-g, g	B-g	G-g	g-s	g	b-g	b-g
Sward greenness late in autumn	5.8	5.9	4.5	4.0	4.0	4.0	8.0	7.0
Resumption of growth in spring	6.3	8.2	7.2	9.0	5.0	9.0	8.0	8.0
Leaf width	9.0	8.0	8.0	9.0	8.0	9.0	9.0	8.0

Note: ¹g – green; b-g – bluish green; g-g – greyish green; g-s – green with silver tint. Sward colour was established in mid summer

The standard varieties ‘Lėnas’ and ‘Borvina’ showed quick field germination estimated by 8 and 9 points, respectively. Very quick field germination (9 points) was noted for *F. pseudovina*. The slowest field germination (5.9–6 points) was exhibited by *F. ovina*, *F. psammophila*, and *F. sabulosa*. Unevenness of germination was influenced by the adverse weather conditions. There was no rain after sowing; therefore the most even germination was exhibited by the species that had emerged before topsoil dried up.

Sward density. Sward density is one of the three major traits determining the general appearance (ornamentality) of turf. Denser turf is more wear tolerant and less prone to high weed incidence. Sward density directly depends on the grass species capacity to form dense sward. Individual *Festuca* species and their populations were distinguished by this trait. Dense sward (8–9 points) was formed by *F. ovina*, *F. trachyphylla*, *F. pseudovina* species (Table 1). The highest sward density was noted for the Lithuanian variety ‘Lėnas’. Lower sward density (7–5 points) was recorded for the populations of

F. wolgensis and *F. sabulosa* species respectively. According to this trait, the most similar sward density had populations of *F. trachyphylla* and *F. ovina*.

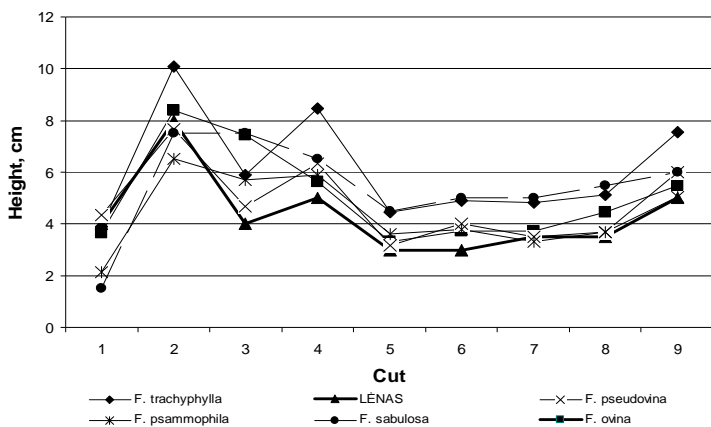
Sward colour. According to this trait, the tested species can be divided into two groups. Leaf colour of the first group was green and differed only in the intensity of colour. This group includes *F. ovina* and *F. wolgensis*. Leaf colour of the second group was characterised by a more or less intensive tint (Table 1). The plants of *F. sabulosa* populations had silver tint. *F. pseudovina* leaf colour was light green with grey tint. Its individual plants vary slightly according to colour intensity. It was established that plant colour of this species was more dependent on air temperature. In spring and late autumn plants were greener, in summer they assumed greyish blue tint and during drought they turned brown (plants partly entered into dormancy). This is explained by the fact that the main area of distribution of this species is forest steppe zone, where droughts are frequent during the summer period. Of all the species growing in Lithuania, *F. psammophila* had the most intensive and most distinct bluish tint colour. In autumn and spring (when temperatures are lower) the plants were greener, and in summer they turned to the most intensive bluish tint. *F. trachyphylla* populations were characterised by the greatest variability of leaf colour. Their colour ranged from completely green to dark bluish. Nearly each tested population had a specific tint (greyish, bluish, silvery etc.). The plants of this species, like those of *F. psammophila*, could change leaf colour during the vegetation season, but in autumn and spring the plants of this species were greener.

Sward green colour in late autumn. The suitability of grasses for turf is partly determined by their ability to form green turf from early spring to late autumn. This is of special relevance late in autumn. It mainly depends on susceptibility of species and individual populations to leaf diseases. The tested narrow-leaved *Festuca* species were rather resistant to diseases (*Puccinia*, *Helminthosporium* and *Septoria*). The species of *F. sabulosa*, *F. wolgensis* and *F. pseudovina* were found to be most susceptible to diseases and were the first to turn brown in the autumn (Table 1). The plants of most populations of *F. ovina* and *F. trachyphylla* species remained green longer in the autumn.

Leaf width. According to this trait, the tested narrow-leaved *Festuca* species were rather similar. Most of them had narrower leaves than the majority of the main turf species. Very narrow leaves (9 points) were characteristic to *F. ovina*, *F. pseudovina*, *F. wolgensis*, slightly wider leaves (8 points) were specific to *F. psammophila*, *F. sabulosa* and *F. trachyphylla* species (Table 1).

Spring growth and re-growth after cuts. Herbage growth rate is one of the most important biological characteristics in turfgrass evaluation. Grass grows most intensively in spring but the growth rate slows down in summer. However, at the end of summer or beginning of autumn it becomes more vigorous again. The tested *Festuca* species and their populations differed remarkably in the expression of growth intensity (Fig. 1). At the beginning of vegetation, the most intensive growth rate was recorded for the earliest species – *F. pseudovina* and *F. trachyphylla*, slightly lower for *F. ovina*, and the slowest for *F. psammophila* and *F. sabulosa*. Along with the advancement of the season the growth rate of all studied species increased rapidly, reaching maximum at the end of May. In summer, when the weather was warm and dry, growth rate declined and equalised in all the species, except for *F. sabulosa*, which had initiated its growth latest in spring. Increased soil moisture content at the end of summer led to

improved herbage re-growth after cuts in *Festuca* species and populations, being the most intensive in *F. pseudovina* and *F. trachyphylla*.



$LSD_{0,05} = \text{I cut} - 0.15; \text{II} - 0.21; \text{III} - 0.21; \text{IV} - 0.15; \text{V} - 0.23; \text{VI} - 0.15; \text{VII} - 0.15; \text{VIII} - 0.14; \text{IX} - 0.18$

Figure 1. Re-growth of narrow-leaved *Festuca* species after cuts.

Complex assessment of turf suitability. Having assessed the species and populations according to individual characteristics and traits it is still difficult to judge about the species suitability for turf since not all traits are equally relevant for turf quality. Therefore different coefficients were introduced for their complex assessment. The data of complex assessment of narrow-leaved *Festuca* species are presented in Table 2.

Table 2. Complex assessment (in points) of narrow-leaved species of genus *Festuca* for turf suitability, 2008.

Trait / coefficient of significance	<i>Festuca</i> species							
	<i>ovina</i>	<i>trachyphylla</i>	<i>psammophila</i>	<i>pseudovina</i>	<i>sabulosa</i>	<i>wolgensis</i>	<i>lemanii</i>	<i>trachyphylla</i> Lénas Borvina
Field germination speed / 1.0	5.9	7.0	6.0	9.0	6.0	7.0	8.0	9.0
Sward density / 1.5	12.5	12.4	11.3	13.5	7.5	10.5	13.5	12.8
Sward colour / 1.1	8.8	7.7	5.5	5.5	6.6	8.4	9.4	8.8
Sward greenness late in autumn / 1.3	7.3	7.7	5.9	5.2	5.2	5.2	10.4	9.1
Resumption of growth in spring / 1.3	8.3	10.3	9.2	11.7	6.5	11.7	10.4	10.4
Sward re-growth between cuts / 1.5	11.4	10.1	11.3	11.3	10.5	9.0	12.0	10.5
Leaf width / 1.1	9.9	8.8	8.8	9.9	8.8	9.9	9.9	8.8
Total	64.1	64.0	58.0	66.1	51.1	61.7	73.6	69.4

Of the assessed species and populations the standard cultivars ‘Lénas’ and ‘Borvina’ received the highest total score. According to complex assessment for turf

suitability the tested species can be ranked in the following sequence: *F.pseudovina* > *F.ovina* > *F. trachyphylla* > *F. wolgensis* > *F. psammophila* > *F. sabulosa*.

In summary of the research carried out during 2006–2008, we can maintain that the most suitable species for turf establishment were *F. pseudovina*, *F. ovina* and *F. trachyphylla*.

CONCLUSIONS

1. The wild populations of narrow-leaved *Festuca* species were less suitable for turfgrass establishment compared with the standard cultivars *F. lemanii* ‘Lénas’ and *F. trachyphylla* ‘Borvina’.

2. *F. pseudovina*, *F. ovina* and *F. trachyphylla* species were found to be best suited for turf establishment for such an important variety characteristic as field germination speed, sward density, sward colour, sward green colour late in the autumn, resumption of growth in spring, re-growth after cuts and leaf width.

3. *F. wolgensis*, *F. psammophila* and *F. sabulosa* are less suited for turf establishment due to lower stand density and rusty sward late in autumn.

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