
Perennial ryegrass herbage, dry matter yield and other parameters in relation to plant disease incidence

S. Nekrošas

Lithuanian Institute of Agriculture
LT-5051, Akademija Kėdainiai distr.,
Lithuania

Contemporary breeding of novel perennial ryegrass varieties is primarily focused on disease resistance. Breeding efforts have resulted in the new perennial ryegrass varieties 'Sodré' and 'Žvilgė', which are far less affected by leaf spots and rusts compared with the old variety 'Veja'. A cross between Italian ryegrass and meadow fescue has resulted in the intergeneric *Festulolium* variety 'Punia', which is immune to rusts and very little affected by leaf spots. All the newly developed varieties were notable for lower disease susceptibility, high herbage and dry matter yield, satisfactory overwinter survival and regrowth after cuts.

Further breeding of this grass has resulted in the promising breeding lines 1429, 1497, 1894, which were little affected by rusts and leaf spots compared with the other perennial ryegrass varieties tested in our experiments. They were higher-yielding, demonstrated a better overwinter survival and regrowth after cuts, and the breeding lines 1429 and 1894 were noted for better digestibility compared with the investigated varieties. Breeding lines 1429 and 1894 were transferred to the State Variety Testing.

Key words: rusts, leaf spots, perennial ryegrass

INTRODUCTION

Breeding of perennial ryegrass varieties is aimed at high yielding capacity, forage quality and resistance to adverse climatic conditions of our country. Much attention is paid to disease susceptibility [1].

Perennial ryegrass is subject to many diseases, of which the most dangerous are rusts caused by *Puccinia* and *Uromyces* fungi, and various leaf spots among which helminthosporiosis caused by the fungi of the genus *Helminthosporium* is most widespread [2, 3].

Fungi not only feed on the nutrients accumulated by plants, but also reduce their assimilating surface and wither leaves, which consequently results in the deterioration of forage quality [4], reduction in herbage, dry matter and seed yield [5–7], and a marked decline in ornamental properties of lawns [8].

In the process of perennial ryegrass breeding we have developed the new varieties 'Sodré' and 'Žvilgė' and promising breeding lines which are far less affected by fungal diseases compared with the old variety 'Veja'. The fescue and ryegrass hybrid varie-

ty 'Punia' developed by us is noted for a special resistance to fungal diseases [9].

MATERIALS AND METHODS

Perennial ryegrass competitive variety trials involving testing of promising breeding lines and their comparison with the varieties registered in Lithuania are established in the perennial grass breeding crop rotation dominated by calcareous gleyic medium heavy brown soil. Perennial ryegrass is sown at the end of May – beginning of June after black fallow without a cover crop and is used for two years. $N_{150}P_{60}K_{90}$ fertilisation is applied. Nitrogen fertiliser is given each year of herbage use in several applications: in spring N_{60} , and after the first and second cut N_{45} .

The following parameters are determined in these trials: herbage and dry matter yield, chemical composition, digestibility, disease infestation, overwinter survival, regrowth after cuts. Disease incidence, overwinter survival and regrowth are estimated on a 9-point scale. While estimating disease occurrence, 9

points denote that plants are very heavily affected and 1 point shows weak infestation. In the assessment of overwinter survival, 9 points show very good and 1 point a very poor overwinter survival. In the assessment of regrowth after cuts, 9 means very rapid and 1 very slow regrowth.

The experimental data were processed by the method of dispersion analysis [10].

RESULTS AND DISCUSSION

In the development of new perennial ryegrass varieties, much attention is paid to plant disease susceptibility. While screening plants for hybridisation it was very important that they were as much as possible disease-free. Later, while investigating the newly developed breeding lines in the breeding and clone nurseries, the healthiest plants were screened again for further breeding.

In the process of perennial ryegrass breeding, the varieties 'Sodré' (registered in 1992) and 'Žvilgė' (1996) were developed, whose leaf spot infection amounts to 0.9 point and rust infection to 0.7

and 0.6 points, *i.e.* are significantly lower as compared to the old variety 'Veja' (Table 1). The new varieties also produced a considerably higher herbage and dry matter yield both in the first and second years of herbage use and according to averaged data of two years of use. Herbage and dry matter yield of the variety 'Sodré' was in all cases statistically significantly higher (Table 2). Intergeneric crosses between Italian ryegrass and meadow fescue have resulted in the variety 'Punia' (1998), which was completely free of rust and the leaf spot severity amounted to less than one point. Compared with the old variety 'Veja', herbage yield increase of 'Punia' was 24.2 t ha⁻¹ and of dry matter 5.0 t ha⁻¹. Compared with the perennial ryegrass variety 'Sodré', which performed best in the trials, the yield increase was 16.4 and 3.4 t ha⁻¹, respectively. 'Punia' demonstrated an excellent overwinter survival and regrowth after cuts, as well as high forage quality.

Further perennial ryegrass breeding efforts resulted in the development of the promising perennial ryegrass breeding lines 1894, 1429, 1497, which were far less affected by rust (0.7 to 1.1 points) and

Table 1. Comparison of major characters and traits of perennial ryegrass varieties and promising breeding lines

| Variety, line | Disease incidence (points) | | Digestibility % | Crude protein % | Overwinter survival (points) | Regrowth after cuts (points) |
|-------------------|----------------------------|-------|-----------------|-----------------|------------------------------|------------------------------|
| | leaf spots | rusts | | | | |
| Veja | 3.5 | 1.6 | 66.7 | 9.6 | 6.2 | 6.6 |
| Žvilgė | 2.6 | 1.0 | 67.8 | 10.9 | 6.8 | 7.2 |
| Sodré | 2.6 | 0.9 | 75.7 | 9.6 | 6.7 | 7.4 |
| 1429 | 2.4 | 0.8 | 77.2 | 10.2 | 6.9 | 7.7 |
| 1497 | 2.0 | 0.5 | 70.8 | 10.0 | 6.9 | 7.8 |
| 1894 | 2.1 | 0.8 | 78.3 | 10.3 | 7.2 | 7.7 |
| Punia | 0.8 | 0.0 | 67.4 | 10.4 | 8.4 | 8.6 |
| LSD ₀₅ | 0.82 | 0.38 | | | 0.52 | 0.41 |

Table 2. Herbage and dry matter yield of perennial ryegrass varieties and promising breeding lines in the competitive variety trials

| Dotnuva, 1999–2000 | | | | | | | | |
|--------------------|----------------------------------|----------------------|---------|----------------|-------------------------------------|----------------------|---------|----------------|
| Variety, line | Herbage yield t ha ⁻¹ | | | | Dry matter yield t ha ⁻¹ | | | |
| | 1999 1st year of use | 2000 2nd year of use | Average | Yield increase | 1999 1st year of use | 2000 2nd year of use | Average | Yield increase |
| Veja | 44.0 | 35.6 | 39.8 | – | 10.6 | 8.7 | 9.6 | – |
| Žvilgė | 50.6 | 40.9 | 45.8 | 6.0 | 11.6 | 9.7 | 10.6 | 1.0 |
| Sodré | 52.3 | 42.9 | 47.6 | 7.8 | 12.2 | 10.2 | 11.2 | 1.6 |
| 1429 | 52.5 | 42.9 | 47.7 | 7.9 | 12.5 | 10.4 | 11.4 | 1.8 |
| 1497 | 52.8 | 45.3 | 49.0 | 9.2 | 12.5 | 10.8 | 11.6 | 2.0 |
| 1894 | 51.6 | 45.1 | 48.4 | 8.6 | 12.0 | 10.8 | 11.4 | 1.8 |
| Punia | 68.8 | 59.3 | 64.0 | 24.2 | 15.6 | 13.6 | 14.6 | 5.0 |
| LSD ₀₅ | 4.68 | 6.23 | 5.79 | | 1.12 | 1.50 | 1.34 | |

leaf spots (1.1 to 1.5 points) than the old variety 'Veja'. These breeding lines were less susceptible to rust and leaf spots compared even with the latest perennial ryegrass varieties 'Sodré' and 'Žvilgė' (Table 1). The averaged two-year experimental data showed that the herbage yield of these breeding lines was by 0.1 to 1.4 t ha⁻¹ and of dry matter by 0.2–0.4 t ha⁻¹ higher than in the best-performing perennial ryegrass variety 'Sodré' (Table 2). The above-mentioned breeding lines showed a better overwinter survival and regrowth after cuts than all other perennial ryegrass varieties studied. In respect to crude protein, these breeding lines slightly lagged behind the variety 'Žvilgė', however, they surpassed the varieties 'Veja' and 'Sodré'. Breeding lines 1429 and 1894 were characterised by a very good digestibility, which was by 10.5 and 11.6% higher than that of the old variety 'Veja' and by 1.5 and 2.6% higher than of the best-performer in the trials – perennial ryegrass variety 'Sodré' (Table 1).

The breeding line 1429 was transferred to the State Variety Testing in 2000 and the breeding line 1894 in 2002.

Intergeneric hybridisation has a promising future, since the obtained hybrids are characterised by high productivity, disease resistance, excellent regrowth and satisfactory overwinter survival.

Received 30 September 2002

References

1. Nekrošas S. LŽI mokslo darbai. 2001; 75: 226–37.
2. Dabkevičius Z. Varpinių žolių ligos ir kenkėjai. Vilnius, 1984: 1–39.
3. Dabkevičius Z. 1991 m. užbaigtų tiriamųjų darbų trumpi pranešimai. 1992; 82–5.
4. Wilkins PW. Euphitica 1991; 52(3): 201–14.
5. Potter LR. Plant Pathol 1987; 36(4): 455–461.
6. Reheul D, Ghesquiere A. Plant Breeding 1996; 115(6): 465–9.
7. Самарцова ВА, Шикальчик НВ. Защита растений 1987; 12: 41–6.
8. Fermain TW, Haley JE, Wessels K, Wilkinson HT. Turfgrass Manag 1996; 1(4): 63–79.
9. Nekrošas S. Žemės ūkio mokslai. 2000; 4: 51–6.
10. Tarakanovas P. Statistinių duomenų apdorojimo programų paketas "Selekcija". Akademija, 1999; 1–57.

S. Nekrošas

DAUGIAMEČIŲ SVIDRIŲ ŽOLĖS SAUSŪJŲ MEDŽIAGŲ DERLIAUS IR KITŲ RODIKLIŲ PRIKLAUSOMYBĖ NUO AUGALŲ LIGOTUMO

S a n t r a u k a

Kuriant naujas daugiamečių svidrių veisles didelis dėmesys kreipiamas į augalų ligotumą. Selekcijos metu buvo sukurtos naujos daugiamečių svidrių veislės 'Sodré' ir 'Žvilgė', kurios gerokai mažiau sirgo dėmėtligė ir rūdimis, lyginant su senąja veisle 'Veja'. Sukryžminus gausiažiedes svidres su tikraisiais eraičiniais sukurta tarpgentinių hibridų veislė 'Punia', kuri buvo atspari rūdimis ir labai mažai sirgo dėmėtligė. Visos naujai sukurtos veislės buvo atsparesnės ligoms, be to, pasižymėjo dideliu žolės ir sausųjų medžiagų derliumi, gerai žiemojo ir atžėlė po pjūčių.

Toliau vykdant šių žolių selekciją, buvo sukurti perspektyviniai 1429, 1497, 1894 numeriai, mažiau pažeisti rūdžių ir dėmėtligės, lyginant su visomis bandyme tirtomis daugiamečių svidrių veislėmis. Jie buvo derlingesni, geriau žiemojo ir atžėlė po pjūčių, o 1429 ir 1894 numeriai pasižymėjo dar ir geresniu virškinamumu, lyginant su tirtomis veislėmis. 1429 ir 1894 numeriai perduoti valstybiniais veislių tyrimams.