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## SOME RESULTS OF ECOLOGICAL SELECTION OF LAWN GRASSES

НЕКОТОРЫЕ РЕЗУЛЬТАТЫ ЭКОЛОГИЧЕСКОЙ СЕЛЕКЦИИ  
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Рассматриваются результаты экологического испытания селекционных образцов двух видов овсяницы луговой *F. rubra* и *F. arundinaceae*. Исследования проводились по единой методике на трех площадках, различающихся по климатическим и почвенным условиям: юг Среднерусской возвышенности (Белгородская область), Геленджик и поселок Новомихайловский (Краснодарский край). В испытание были включены 18 селекционных образцов *F. rubra* и девять селекционных образцов *F. arundinaceae*. В результате комплексной оценки изучаемых форм выделены селекционные образцы с высокой декоративностью и побегообразованием.

**Ключевые слова:** экологическое сортоиспытание; количество побегов на единицу площади; годичный прирост побегов; *F. rubra*; *F. arundinaceae*.

In the article the results of ecological tests of breeding samples of two species of lawn fescue *F. rubra*, *F. arundinaceae* are considered. The studies were carried out according to a single methodology in three ecological points: the south of the Srednerusskaya Upland (Belgorod region), Gelendzhik, and Novomikhailovsky settlement (Krasnodar region). Eighteen breeding specimens of *F. rubra* and nine breeding specimens of *F. arundinaceae* were included in the test. Ecological points differed in climatic and soil conditions. As a result of the complex evaluation of the studied forms, breeding numbers with high ornamental value and the ability to shoot.

**Keywords:** ecological variety trials; number of shoots per unit area; annual shoot growth; *F. rubra*; *F. arundinaceae*.

**Introduction.** Lawn grasses are an essential component of urban landscapes [1–

3]. In this regard, the selection of grasses to create sustainable lawns in a variety of en-

vironmental conditions is of particular importance [4]. The most effective technique to achieve the sustainability of their ornamental grasses, satisfying the aesthetic senses of people is the selection work with perennial grasses [5–7].

Red fescue and tall fescue are widespread perennial grasses that are nowadays not only good pasture forage plants, but are also widely used in green construction to create lawns. They are found in a variety of climatic and soil conditions, in flood, lowland, dry meadows, in thin forests, up to the upper mountain belt of the Caucasus. Their range of cultivation covers practically the whole European part of Russia and considerable areas of Siberia and the Far East. Red fescue and reed fescue are widely recognized as lawn crops. They are the most promising species for the creation of highly decorative lawns of a wide ecological range [8–10].

The breeding and seed production of *F. rubra*. and *F. arundinaceae* have been studied by many domestic and foreign scientists [11; 12].

The Cretaceous south of the Central Russian Upland is considered by leading researchers as a centre of genetic diversity and a secondary anthropogenic microgenetic centre of synanthropic vegetation formation [13; 14].

The region is rich in species and forms of wild relatives of cultivated plants, which due to geological and climatic features of the territory have high drought tolerance [15; 16]. Such specific conditions include high soil carbonation, which leads to its physiological dryness; unstable moisture; weak watering of the territory; high degree of indented gullies and ravines with writing chalk outcrops, etc. [17; 18].

The aim of the work was to study ornamental and shootability in new breeding specimens of *F. rubra* and *F. arundinaceae*, created on the basis of original material obtained in the Cretaceous south of the Central Russian Upland, at different ecological points.

**Materials and methods.** Experiments were carried out in 2018–2025 at three ecological sites using the same methodology [19; 20]. Breeding numbers of *F. rubra* and *F. arundinaceae* were sown in breeding nurseries in Belgorod district of Belgorod region in the experimental field of the breeding and seed production enterprise "IP S.A. Mavrodin"; in breeding plots in Gelendzhik and in the urbantype settlement Novomikhailovsky, Tuapse district, Krasnodar Territory. Plot sizes 3.35 m × 0.3 m. Repeatability is fourfold. Plot placement is randomized.

Ecological evaluation of 18 specimens of red fescue (four varieties included in the State Register of Breeding Achievements, and 14 breeding specimens), standard — variety Rossinante (Denmark). We studied 10 specimens of red fescue (four varieties included in the State Register of Breeding Achievements and six breeding specimens), standard variety Meandre (Germany).

The shoot-forming ability was studied in accordance with the requirements of the methods [21; 22]. The total number of shoots per 1 m<sup>2</sup> was determined annually by direct counting. The number of formed shoots was counted 3 times during the growing season in conditions of Gelendzhik, Novomikhailovsky settlement and Belgorod district by determining the difference between the average number of shoots in the previous and subsequent

years, the average annual increase in the number of shoots was determined.

The data were processed mathematically using the error of the mean, standard deviation, and coefficient of variation [23].

**Results and discussion.** The most important trait that distinguishes lawn cultivars is their ability to form shoots, that is

their annual growth rate of new shoots. This indicator is responsible for the ornamental value of grass stands [23].

The best species in terms of annual shoots growth in Gelendzhik were selected samples FR 1-6, FR 1-26 and FR 2-22, which exceeded the standard by 23.2%, 26.0% and 28.3% (Table 1).

**Table 1. Number of shoots formed on average in one year in breeding samples and varieties of red fescue in different environmental conditions, pcs. (m<sup>2</sup>)-1**

Breeding number	Gelendzhik	Novomikhailovsky	Belgorod district	M	Cv, %
Rossinant (standard)	3685	4501	3768	3985	11.3
FR 1-6	4540	4698	4064	4434	7.4
FR 1-10	3498	4454	3945	3965	12.1
FR 1-15	3968	4165	3893	4008	3.5
FR 1-26	4642	5121	4104	4622	11.0
FR 1-32	3930	4479	4096	4168	6.7
FR 2-1	3648	4448	3947	4014	10.1
FR 2-7	3910	4465	3926	4100	7.7
FR 2-10	3903	4563	3982	4149	8.7
FR 2-21	3619	4419	4034	4024	9.9
FR 2-22	4727	5067	4085	4626	10.8
FR 2-28	4038	4478	4190	4235	5.3
FR 3-4	4175	4861	4003	4346	10.4
FR 3-9	3604	4325	4005	3978	9.1
FR 3-22	4189	4793	3913	4298	10.5
FR 3-27	3545	4458	3945	3983	11.5
FR 3-33	3503	4324	3971	3933	10.5
FR 3-34	3942	4517	4137	4199	7.0
On average	3948	4563	4000	4170	8.2
LSD05	495.6				

In conditions of Novomikhailovsky settlement the best in terms of annual shoot growth were breeding numbers FR 1-26 and FR 2-22, which exceeded the standard by 13.8% and 12.6%, respectively. In the Belgorod region all breeding numbers exceeded the standard for this indicator by 3.8–11.2%.

The study of reed fescue showed that on average for the three years of research in Gelendzhik, the best in annual shoot growth were the selected samples of reed fescue FA 1-15, FA 1-1, and FA 1-36, which exceeded the standard by 18.0%, 6.3%, and 4.4% respectively (Table 2).

**Table 2. Number of shoots formed on average in one year in breeding samples and cultivars of reed fescue in different ecological conditions, pcs. (m<sup>2</sup>)-1**

Breeding number	Gelendzhik	Novomikhailovsky	Belgorod	M	Cv, %
Meandre (standard)	2585	2842	2642	2690	110.3
1	2747	2566	2728	2680	81.2
5	2647	2636	2921	2734	131.8
10	2364	2620	2653	2545	129.3
13	2685	2866	2852	2801	82.0
15	3049	3086	3050	3062	17.2
18	1939	1786	2731	2152	414.0
22	2595	2895	2807	2766	126.0
36	2699	2729	2731	2720	14.5
26	2523	2811	2459	2598	152.9
On average	2583	2684	2757	2675	71.3
LSD05	222.7				

In absolute number of shoots per unit area were also the best numbers FA 1-1, FA 1-15 and FA 1-36, exceeding the standard for this indicator by 6.6–15.7%.

Under the conditions of Novomikhailovsky settlement the indicator in breeding samples varied in the range from 1787 pcs. (m<sup>2</sup>)-1 (number FA 1-18) to 3610 pcs. (m<sup>2</sup>)-1 (number FA 1-15). The best in terms of annual shoot growth was the breeding sample FA 1-15, which exceeded the standard by 243.0 pc. (m<sup>2</sup>)-1 (8.6%). In absolute number of shoots per unit area most of the three breeding numbers FA 1-13, FA 1-15, FA 1-22 in the end were at or exceeded the standard by 56.8–468.0 pcs. (m<sup>2</sup>)-1.

Under the conditions of Novomikhailovsky settlement the indicator in breeding samples varied in the range from 1787 pcs. (m<sup>2</sup>)-1 (number FA 1-18) to 3610 pcs. (m<sup>2</sup>)-1 (number FA 1-15). The best in terms of annual shoot growth was the breeding sample FA 1-15, which exceeded

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In Belgorod district of Belgorod region breeding samples showed an increase in the number of shoots on average in one year in the range from 2459 pcs. (m<sup>2</sup>)-1 (FA number 1-26) to 3051 pcs. (m<sup>2</sup>)-1 (number FA 1-15). On average over three years, breeding numbers FA 1-5, FA 1-13 and FA 1-15 significantly exceeded the standard by 8.0–15.4%. FA 1-10 was in line with the standard, while FA 1-26 was inferior by 183.0 pc. (m<sup>2</sup>)-1 (6.9%).

**Conclusion.** Under the landscape conditions of the Cretaceous South of the Central Russian Upland, red fescue and reed fescue ecotypes with high productive bushiness and shoot-forming ability are formed. These ecotypes can be used as starting material for the creation of lawn

varieties. The study of these breeding forms in different ecological locations has shown their stability and high potential.

Under the conditions of the Black Sea coast of Western Caucasus, three *F. rubra* cultivars have exceeded the standard by 12.5–30.4% in shoot number, and by 23.2–

28.3% in annual shoot increment. *F. rubra*: breeding specimen FR 1-6 and two breeding varieties FR 1-26 and FR 2-22. Among the accessions *F. arundinaceae* the selection numbers FA 1-1, FA 1-15 and FA 1-36 exceeded the standard in number of shoots per unit area by 6.6–15.7%, in annual shoot increment by 4.4–18.0%.

## Литература

1. Shearman R.C. 2006. Fifty Years of Splendor in the Grass. *Crop Science*. 46:2218–2229.
2. Russi L., Annicchiarico P., Martiniello P., Tomasoni C., Piano E., Veronesi F. 2004. Turf quality and reliability in varieties of four turfgrass species in contrasting Italian environments. *Grass and Forage Science*. 59(3). 233–239.
3. Christians Nick E., Patton Aaron J., Law Quincy D. 2016. *Fundamentals of Turfgrass Management* (New-York: John Wiley & Sons). 408.
4. Косолапов В.М., Чернявских В.И., Костенко С.И. Развитие современной селекции и семеноводства кормовых культур в России. – Вавиловский журнал генетики и селекции. 2021. – Т. 25, № 4. –С. 401–407.
5. Šurinová M., Münzbergová Z., Hadincová V., Vandvik V. 2019. Temperature And Precipitation, But Not Geographic Distance, Explain Genetic Relatedness Among Populations In The Perennial Grass *Festuca Rubra*. *Journal of Plant Ecology*. 12 (4). 730–741.
6. Balkenhol N., Waits L.P., Dezzani R.J. 2009. Statistical approaches in landscape genetics: an evaluation of methods for linking landscape and genetic data. *Ecography*. 32. 818–830.
7. Forester B.R., Jones M.R., Joost S., et al. 2015. Detecting spatial genetic signatures of local adaptation in heterogeneous landscapes. *Molecular Ecology*. 25(1). 104–120.
8. Lipińska H., Harkot W., Czarnecki Z., Kornas R., Stamirowska-Krzaczek E., Lipiński W. 2018. The effect of decomposing biomass of the grasses *Festuca arundinacea*, *F. ovina*, and *F. rubra* on the species composition and quality of lawns *Acta Agrobotanica*. 71(4). 1–14.
9. Ostapets T. 2020. Comparative Characteristics of Main Morphological Indication and Type of Inheritance of Leaf Plate Color In Species *Festuca Glauca*, *Festuca Rubra*, *Festuca Ovina* Norwegian *Journal of Development of the International Science*. 51-2. 15–17.
10. Onipchenko V.G., Rozhin A.O., Smirnov V.E., Akhmetzhanova A.A., Elumeeva T.G., Khubieva O.P., Dudova K.V., Soudzilovskaia N.A., Cornelissen J.H.C. 2020. Do patterns of intra-specific variability and community weighted-means of leaf traits correspond? An example from alpine plants. *Botanica Pacifica. A journal of plant science and conservaton*. 9(1). 53–61.
11. Cherniavskih V.I., Dumacheva E.V., Marinich M.N., Sajfutdinova L.D. 2021. The Role of Perennial Grasses in the Accumulation of Organic Matter in Soil-Saving Agriculture. *IOP Conference Series: Earth and Environmental Science*. 901(1). 012056.
12. Kosolapov V.M., Cherniavskih V.I., Dumacheva E.V., Marinich M.N. 2021. The Population of *Festuca Arundinaceae* Sherb. The Cretaceous South of the Middle Russian Uplands As A Starting Material for the Selection of Grass Bearing Varieties. *IOP Conference Series Earth and Environmental Science*. 901(1). 012004.
13. Dumacheva E.V., Cherniavskih V.I., Markova E.I., Klimova T.B., Vishnevskaya E.V. 2015. Spatial pattern and age range of cenopopulations *Medicago L.* in the conditions of gullying of the southern part of the Central Russian Upland. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 6(6). 1425–1429.

14. Dumacheva E.V., Cheriavskih V.I. 2013. Particular qualities of micro evolutionary adaptation processes in cenopopulations *Medicago L.* on carbonate forest-steppe soils in European Russia. *Middle East Journal of Scientific Research*. 17(10). 1438–1442.
15. Cheriavskih V.I., Sidelnikov N.I., Dumacheva E.V., Borodaeva Z.A., Glubsheva T.N., Gorbacheva A.A., Vorobyova O.V., Korolkova S. 2019. Biological Resources of Natural Forage Grassland of the Cretaceous South of the European Russia. *EurAsian Journal of BioSciences*. 13(2). 845–849.
16. Kosolapov V.M., Cheriavskih V.I., Zarudny V.A., Mazur K., Konieczna A., Dumacheva E.V., Dumachev D.V., Tseiko L. 2022. Observations on the Productivity of Breeding Specimens of *Urtica dioica L.* from European Russian Ecotopes in Comparison with the Breeding Variety under Field Crop Conditions *Agronomy*. 12(1) 76.
17. Lisetskiy F.N., Peresadko V.A., Lukin S.V., Petin A.N. 2005. Atlas «Natural Resources and Ecological State of the Belgorod region» (Belgorod: Belgorod Regional Printing House). 180.
18. Kukharuk N.S., Smirnova L.G., Kalugina S.V., Polschina M.A., Chernyavsky V.I. 2017. The state of gray forest soils, conditioned by microclimatic variability, in the south of the forest-steppe of the Central Russian Upland. *International Journal of Green Pharmacy*. 11(3). 626–630.
19. Guidelines For The Conduct Of Tests For Distinctness, Homogeneity and Stability. TG/39/6 Original: German/allemand/deutsch Date/Datum. 1984. 11-07 Retrieved from: [https://www.upov.int/edocs/tgdocs/en/tg039\\_06.pdf](https://www.upov.int/edocs/tgdocs/en/tg039_06.pdf).
20. Guidelines For The Conduct Of Tests For Distinctness, Homogeneity and Stability. TG/67/5 Original: English Date: 2006. 04-05 International Union For The Protection Of New Varieties Of Plants Geneva Retrieved from: <https://www.upov.int/edocs/tgdocs/en/tg067.pdf>.
21. Lavrenko E.M., Korchagina A.A. 1972. Field geobotany. Methodical management. Section: Botany-Geobotanic/ under commonly (Moscow: Russian Academy of Sciences of the USSR). 336.
22. Методические указания по изучению коллекции многолетних кормовых трав. – Ленинград: ВАСХНИИ. 1973. 37.
23. Dospekhov B.A. 2012. Method of field experiment (with the basics of statistical processing of research results). Moscow : Book on Demand. 352.

## References

1. Shearman RC. 2006. Fifty Years of Splendor in the Grass. *Crop Science*. 46. 2218–2229.
2. Russi L, Annicchiarico P, Martiniello P, Tomasoni C, Piano E, Veronesi F. 2004. Turf quality and reliability in varieties of four turfgrass species in contrasting Italian environments. *Grass and Forage Science*. 59(3). 233–239.
3. Christians Nick E, Patton Aaron J, Law Quincy D. 2016 *Fundamentals of Turfgrass Management* (New-York: John Wiley & Sons). 408.
4. Kosolapov VM, Cheriavskih VI, Kostenko SI. 2021. Fundamentals for forage crop breeding and seed production in Russia. *Vavilovskii Zhurnal Genetiki i Seleksii*. 25(4). 401–407.
5. Šurinová M, Münzbergová Z, Hadincová V, Vandvik V. 2019. Temperature And Precipitation, But Not Geographic Distance, Explain Genetic Relatedness Among Populations In The Perennial Grass *Festuca Rubra*. *Journal of Plant Ecology*. 12 (4). 730–741.
6. Balkenhol N, Waits LP, Dezzani RJ. 2009. Statistical approaches in landscape genetics: an evaluation of methods for linking landscape and genetic data. *Ecography*. 32. 818–830.
7. Forester BR, Jones MR, Joost S, et al. 2015. Detecting spatial genetic signatures of local adaptation in heterogeneous landscapes. *Molecular Ecology*. 25(1). 104–120.
8. Lipińska H, Harkot W, Czarnecki Z, Kornas R, Stamirowska-Krzaczek E, Lipiński W. 2018. The effect of decomposing biomass of the grasses *Festuca arundinacea*, *F. ovina*, and *F. rubra* on the species composition and quality of lawns. *Acta Agrobotanica*. 71(4). 1–14.
9. Ostapets T. 2020. Comparative Characteristics of Main Morphological Indication and Type of

- Inheritance of Leaf Plate Color In Species. *Festuca Glauca, Festuca Rubra, Festuca Ovina Norwegian Journal of Development of the International Science*. 51-2. 15–17.
10. Onipchenko VG, Rozhin AO, Smirnov VE, Akhmetzhanova AA, Elumeeva TG, Khubieva OP, Dudova KV, Soudzilovskaia NA, Cornelissen JHC. 2020. Do patterns of intra-specific variability and community weighted-means of leaf traits correspond? An example from alpine plants. *Botanica Pacifica. A journal of plant science and conservaton*. 9(1). 53–61.
  11. Cherniavskih VI, Dumacheva EV, Marinich MN, Sajfutdinova LD. 2021. The Role of Perennial Grasses in the Accumulation of Organic Matter in Soil-Saving Agriculture. *IOP Conference Series: Earth and Environmental Science*. 901(1) .012056.
  12. Kosolapov VM, Cherniavskih VI, Dumacheva EV, Marinich MN. 2021. The Population of *Festuca Arundinaceae* Sherb. The Cretaceous South of the Middle Russian Uplands As A Starting Material for the Selection of Grass Bearing Varieties. *IOP Conference Series Earth and Environmental Science*. 901(1). 012004.
  13. Dumacheva EV, Cherniavskih VI, Markova EI, Klimova TB, Vishnevskaya EV. 2015. Spatial pattern and age range of cenopopulations *Medicago L.* in the conditions of gulying of the southern part of the Central Russian Upland. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 6(6). 1425–1429.
  14. Dumacheva EV, Cheriavskih VI. 2013. Particular qualities of micro evolutionary adaptation processes in cenopopulations *Medicago L.* on carbonate forest-steppe soils in European Russia. *Middle East Journal of Scientific Research*. 17(10).1438–1442.
  15. Cherniavskih VI, Sidelnikov NI, Dumacheva EV, Borodaeva ZA, Glubsheva TN, Gorbacheva AA, Vorobyova OV, Korolkova S. 2019. Biological Resources of Natural Forage Grassland of the Cretaceous South of the European Russia. *EurAsian Journal of BioSciences*. 13(2). 845–849.
  16. Kosolapov VM, Cherniavskih VI, Zarudny VA, Mazur K, Koniieczna A, Dumacheva EV, Dumachev DV, Tseiko L. 2022. Observations on the Productivity of Breeding Specimens of *Urtica dioica L.* from European Russian Ecotopes in Comparison with the Breeding Variety under Field Crop Conditions *Agronomy*. 12(1). 76.
  17. Lisetskiy FN, Peresadko VA, Lukin SV, Petin AN. 2005. *Atlas «Natural Resources and Ecological State of the Belgorod region»*. Belgorod. Belgorod Regional Printing House. 180.
  18. Kukharuk NS, Smirnova LG, Kalugina SV, Polschina MA, Chernyavsky VI. 2017. The state of gray forest soils, conditioned by microclimatic variability, in the south of the forest-steppe of the Central Russian Upland. *International Journal of Green Pharmacy*. 11(3). 626–630.
  19. *Guidelines For The Conduct Of Tests For Distinctness, Homogeneity and Stability. TG/39/6 Original: German/allemand/deutsch Date/Datum 1984 11-07 Retrieved from: [https://www.upov.int/edocs/tgdocs/en/tg039\\_06.pdf](https://www.upov.int/edocs/tgdocs/en/tg039_06.pdf).*
  20. *Guidelines For The Conduct Of Tests For Distinctness, Homogeneity and Stability. TG/67/5 Original: English Date: 2006. 04-05. International Union For The Protection Of New Varieties Of Plants Geneva Retrieved from: <https://www.upov.int/edocs/tgdocs/en/tg067.pdf>.*
  21. Lavrenko EM, Korchagina AA. 1972 *Field geobotany. Methodical management. Section: Botany-Geobotanic/ under commonly*. Moscow: Russian Academy of Sciences of the USSR. 336.
  22. Metodicheskie ukazaniya po izucheniyu kollekcii mnogoletnikh kormovykh trav. 1973. Leningrad. VASKHNIL. 37.
  23. Dospekhov BA. 2012. *Method of field experiment (with the basics of statistical processing of research results)*. Moscow. Book on Demand. 352.