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STUDIES REGARDING THE PERFORMANCE OF SOME BLUEGRASS AND RYEGRASS VARIETIES USED IN LAWNS UNDER THE CLIMATIC CONDITIONS IN THE FORREST STEPPE OF NORTH - EAST ROMANIA

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ABSTRACT - The turf varieties sold in Romania are breeded in foreign countries that are different in terms of climatic conditions, and may not always perform as well in conditions of extreme drought and heat that often occurs in the summers of eastern Romania. From this point of view, trial testing of imported turf varieties in this part of the country or another, throughout the country, would be a necessary and positive research especially if it would be achieved before selling these varieties on the romanian market, thus pleasing the quality demands of the public and also helping the breeders to optimize the range of varieties for specific areas. In this research we had the chance to test by trial, for a period of two consecutive years, seven varieties of kentucky bluegrass (KB) and three of perennial ryegrass (PR) breeded in the USA, the world market leader in turfgrass varieties. Field trials were started at a farm located nearby the city of Iasi, in 2005, consisting in randomized plots replicated three times for statistical interpretation of the data. The soil was a chernozem soil type. Each plot had an area of 4 m^2. Seeding rate was 15g m^{-1} for bluegrass varieties and 30g m^{-1} as recommended by the breeding companies. The weather conditions in the area are quite rough for turfgrasses, with 520 mm of rain annualy and an annual mean temperature of 9.6^0C. The evaluation of turgrass overall quality was done using the visual rating scale used by the National Turfgrass Evaluation Program from USA. This organization is well accepted in more than 30 countries around the world, and the rating scale is used by most of the turfgrass breeders. Following results we learned that ryegrass quality is affected by the prolonged lack of water in a higher percentage than bluegrass, by comparing the quality ratings of these two varieties over a period of two years, correlated with the climatic conditions from the same time period. The monthly ratings were used to calculate the annual mean quality rating for each individual variety, and the best quality was observed in the year 2006, for varieties: Nudestiny rated 6.5, Liberator rated 6.2 and

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Impact rated 6.1, all three belonging to *Poa pratensis* species. This study proves the importance of trial testing of imported turf varities because of the following reasons: there are large differences between turfgrass species in terms of turf quality influenced by climatic conditions but also there are differences betwen varieties that belong to the same botanical species, as we have seen in the seven bluegrass varieties studied.

Key words: Turfgrass; *Lolium perenne; Poa pratensis;* Overall quality.

REZUMAT - Studii privind comportarea unor soiuri de graminee perene, utilizate pentru gazon, în condiţiile climatice din silvostepa de nord-est a României. Soiurile de graminee perene pentru gazon, comercializate în România, sunt ameliorate în zone ce au un climat diferit de cel din zona de experimentare şi nu dau întotdeauna cele mai bune rezultate în condiţiile de climă secetoasă şi călduroasă, ce se înregistrează în sezonul estival mai ales în estul şi sudul ţării. Din acest punct de vedere, testarea acestor soiuri în mai multe locaţii din ţară ar fi un proces benefic, mai ales dacă s-ar realiza înainte de comercializarea lor, ajutând şi consumatorii locali, dar şi companiile producătoare, care ar avea astfel şansa să îşi optimizeze gama de soiuri pentru o zonă sau alta. În cadrul acestui studiu a apărut şansa evaluării a şapte soiuri de firuţă şi trei de raigras peren ce provin din SUA, ţara cu cea mai dezvoltată industrie a gazonului din lume. Experienţa a fost înfiinţată în anul 2005, pe un sol de tip cernoziom cambic mezocalcaric, cu parcele randomizate, dispuse în trei repetiţii. Fiecare parcelă a avut o suprafaţă de 4m^2. Norma de semănat a fost de 15g m^{-1} la specia *Poa pratensis* şi de 30g m^{-1} la specia *Lolium perenne*. Clima din zona de experimentare este destul de aspră pentru o cultură pretenţioasă precum gramineele perene pentru gazon, caracterizându-se prin precipitaţii anuale relativ scăzute, media multianuală fiind de 520 mm pe an, iar temperatura medie multianuală de 9,6^{o}C. Evaluarea calităţii gazonului s-a făcut cu ajutorul unei scări de apreciere vizuală, după metoda folosită de către organizaţia naţională americană, care se ocupă cu evaluarea tuturor soiurilor noi sau vechi în SUA. Organizaţia „National Turfgrass Evaluation Program" este recunoscută în peste 30 de ţări, metodele sale de evaluare a calităţii gazonului fiind folosite de către majoritatea marilor producători de seminţe pentru gazon. În urma cercetărilor s-a constatat faptul că soiurile de raigras sunt mai degrabă afectate de lipsa apei decât de alţi factori, după cum se poate observa în evoluţia calităţii acestor soiuri pe parcursul perioadei de vegetaţie, corelată, bineînţeles, cu evoluţia condiţiilor climatice. Analizând media valorilor lunare a calităţii la specia *Poa pratensis*, pentru fiecare soi în parte s-a remarcat un comportament bun, în special la soiurile Nudestiny, Liberator şi Impact. Acest studiu dovedeşte importanţa organizării trialurilor pentru compararea performanţelor soiurilor de graminee pentru gazon, din mai multe considerente: există diferenţe mari între speciile de graminee perene pentru gazon în ceea ce priveşte calitatea gazonului, influenţată de factorii climaterici, dar şi diferenţe relativ mari, chiar şi între soiurile de iarbă ce provin de la aceeaşi specie botanică, după cum s-a constatat la cele şapte soiuri de firuţă luate în studiu.

Cuvinte cheie: gazon; *Lolium perenne*; *Poa pratensis*; calitate.

INTRODUCTION

Most turfgrass varieties marketed in Romania come from companies from abroad which generally breed and grow those varieties in areas with cooler and wetter climate compared with the climate in our country, often

characterized by extremely hot and dry summers. Drought is becoming more common in recent years in our country due to global climate change, while seeking new varieties more resistant to heat and drought has taken on increased importance (Aronson *et. al.*, 1987; Christians, 2004; Demiroglu et al., 2010).

Among the cool season grasses, there are two species with remarcable drought resistance: *Festuca arundinacea* and *Poa pratensis.* The second one, is the subject of study in this research, by seven varieties breeded in the USA, which we evaluated for several years. Another grass species studied here, namely *Lolium perenne*, represents the most commonly used cool season grass in Romania, but also in many european countries, which unlike the drought resistant bluegrass, has big demands for constant water supply during the growing season (Billick, 1973).

Establishment is an important indicator of turf quality and the two species could not be more different regarding this aspect. Perennial ryegrass has a major advantage over bluegrass with a fast germination and a very good establishment. For this reason using ryegrass for lawns establishment offers better results even if seedbed preparation has not been performed at the best parameters or there is a danger of weed infestation.

The bluegrass, on the other hand, has poor establishment or better said a slow establishment. The cause of this deficiency could be poor seed germination or a high latency of seeds. Bluegrass has an advantage over ryegrass by the presence of strong underground rhizomes that helps to regain the loss of ground cover resulted from injury or climatic stress factors and also offers resistance to heavy traffic and soil compaction. This morphological feature of bluegrass reduces the slow establishment drawback of the species thus including it in mixtures with turf type turfgrasses (perennial ryegrass, tall fescue) or even using it in pure stand on sports fields would bring increased ground cover and persistency.

Although the two species are quite different in many things, they are often put together to achieve a lawn with good establishment but also an increased resistance to climatic or anthropic stress factors. Due to the fact that these two species are seldom sold separately, the possibility to test a relative high number of bluegrass and ryegrass varieties and compare the two species one to another constitutes a rare oportunity that should not be missed, especially if these varieties are breeded in a region outside Europe.

Most of the turf varieties sold in Romania come from countries such as: Netherlands, Denmark, France and Germany. Although these countries have a rich tradition in breeding turfgrasses and they have a generous portofolio of varieties marketed in Romania, it would be very interestning to see how species and varieties breeded in regions outside

Europe perform in the climatic conditions from our country, as we had the oportunity to do within this research, where seven bluegrass varieties and three ryegrass varieties that performed quite well in the transition zone in the USA were tested in climatic conditions from our country. The transition zone in the USA has a very similar climate to that from the forest steppe in the east of Romania.

MATERIAL AND METHODS

In this testing trial were evaluated seven Kentucky bluegrass (KB) varieties and four perennial ryegrass (PR) varieties, all of them breeded in USA, except one ryegrass variety, namely Mara, which is a romanian variety. The field trial was established in the year 2005 on a chernozem soil type, using a design consisting in randomized plots replicated three times. Each experimental plot has an area of 4 m^2. We used a seeding rate of 15g m^{-2} for *Poa pratensis* and 30g m^{-2} for *Lolium perenne*. The seeding method adopted was manual spreading of grass seeds, as this is the recommended procedure for experimental plots of a smaller size. Starter fertilization included $N_{20}P_{20}$ fertilizer with a rate of 200 kg ha^{-1}. Phosphorus included in the fertilizer is an important mineral necessary for young seedlings as the grasses cannot absorb easily this element from the soil complex as they germinate (Burt and Christians, 1990). Later fertilization consisted in timely application of ammonium nitrate (2-3 applications per year) at a rate of 100 kg ha^{-1} per application for the replacement of exported nitrogen and to preserve a dark green color, good density and resilient turf (Bunderson *et al.,* 2009; Petrovic *et al.,* 2005; Razmjoo *et al.,* 1966; Richardson *et al.,* 2010). The average nitrogen consumption on turf ranges between 100-150 kg ha^{-1} N a.i. per year and the climatic conditions in this experiment recommended us to use the minimum nitrogen fertilization.

The assessment of turf quality has been performed using a visual rating scale, recommended by the National Turfgrass Evaluation Program from USA. This organization is recognized in well over 30 countries all over the world, its methods of evaluating the turfgrass quality being adopted by the majority of breeding companies (Morris, 2006).

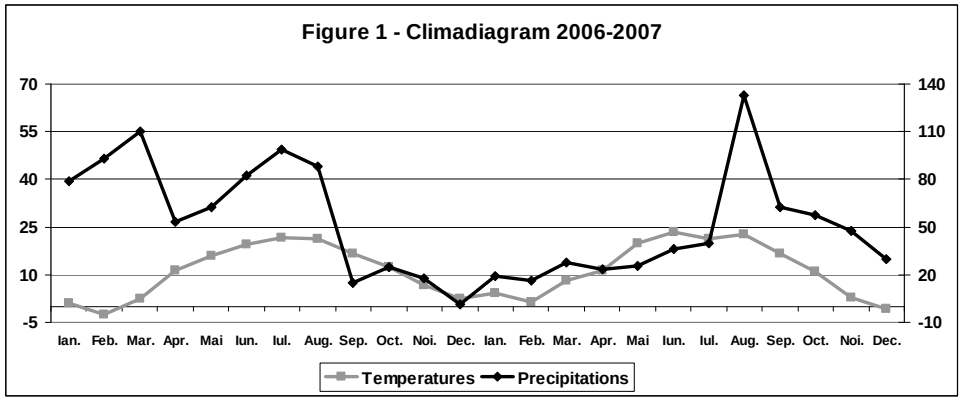
Many quality indicators are evaluated such as: establishment, ground cover, turf density, disease resistance, drought tolerance, **overall quality** of turf etc. In this scientific paper will only be presented overall quality ratings over a period of two consecutive years. The data on turf quality was processed statistically by calculating limit differences.

RESULTS AND DISCUSSION

Field observations of the american varieties lasted two years, starting with the year 2006 and continuing in 2007. The observations began after the first cut in the spring for each year. There was a single rating for overall turf quality granted for each month and the rating process extended for a period of six months each year, which represents the active vegetation period in this region, when turf may be cut. Each monthly rating is based on visual observations of turf quality taken two times, first on the half of each month and the second at the end of the same month at the field trial in Ezăreni farm, in order to

capture as complete as possible the influence of climatic conditions from each particular month and the reaction of american varieties towards the climatic conditions.

The climate in this region is quite harsh for a demanding crop such as turfgrasses, with relatively low annual rainfall of 520 mm, and a mean annual temperature of 9.6^0C. The analyzes on climatic conditions of 2006-2007 period shows big differences between the two years, as the first one was more favorable with a high amount of rain and a fair distribution over the summer months. In the second part of this year, starting with September, a prolonged period of drought has set in, which lasted until august 2007, as it can be seen in the climadiagram *(Fig. 1).*



As expected, the quality of most of the turf varieties was better in the favorable year compared with the dry year, the difference in rainfall between the two years pointing out which varieties were better adapted to drought.

The highest quality of bluegrass varieties was observed in june 2006, but not in july despite the increased rain, one of the reasons that decreased quality was the appearance of leaf rust disease on bluegrass but not on ryegrass. The bluegrass varieties that were rated lowest in july and august are the ones that were more affected by rust. Some varieties like Boutique, Chicago and Liberator had a high decrease as soon as july, as they were the first varieties attacked by rust, while varieties Wildwood and Impact had a higher decrease in august *(Table 1).*

The ryegrass varieties, including Mara (romanian variety) had a growing quality from may to july under the influence of increasing rainfall. The ryegrass varieties are affected more by the presence / abscence of water as we could observe from the evolution over the entire year, correlated with the evolution of climatic conditions. Thus, after the first three months we

observed an increasing quality of ryegrass correspondent to the dynamics of rain and in the next three months a decreasing quality correspondent to the drought setting in the second part of the year. In these conditions the best quality of ryegrass varieties was recorded at the end of the favorable period, in july and the lowest quality in october, the last month evaluated in 2006. Analyzing the monthly average ratings of quality for individual bluegrass varieties, we noticed a good quality for the majority, but especially for Nudestiny and Liberator with ratings above 6 for five monts out of six, in nonirrigated conditions, which is a very good result. The remaining bluegrasses had also a good performance in 2006. The three american ryegrass varieties were rated lower than most of the bluegrasses especially in the dry part of the year, confirming the sensibility to the water shortages (Dunn and Diesburg, 2004), but we have to say that compared to the romanian variety Mara, their quality was a bit better. The best ryegrass variety was Barlenium with an average rating for 2006 of 5.6 while the control (Mara) was rated 4.2 for the same time period *(Table 1).*

Table 1 - Turfgrass overall quality ratings for the year 2006

Entry	Quality ratings (1 – poor, 9 – very good)						
	May	June	July	August	September	October	mean
Nuglade (KB)	6.3	6.7	6.3	5.3	5.7	5.3	5.9
Nudestiny (KB)	6.7	7.3	7.0	6.3	6.0	5.7	6.5
Liberator (KB)	6.7	7.0	6.0	6.0	6.0	5.7	6.2
Chicago (KB)	6.0	6.3	5.3	4.7	5.7	4.3	5.4
Wildwood (KB)	6.0	6.3	7.0	5.3	5.7	4.3	5.8
Boutique (KB)	6.0	7.0	5.0	4.3	5.7	5.3	5.5
Impact (KB)	6.3	7.7	7.7	4.7	5.7	4.7	6.1
Mach 1 (PR)	7.0	5.3	6.3	4.3	5.0	5.0	5.5
Premier II (PR)	5.3	5.3	6.0	4.7	5.0	4.3	5.1
Barlenium (PR)	5.7	5.7	6.3	5.0	5.0	5.7	5.6
Mara (PR) - control	3.3	4.0	5.0	4.7	4.7	3.7	4.2
LSD 0.05	1.1	1.5	1.0	1.0	1.5	0.6	0.7

In these conditions the differences between american ryegrass varieties and Mara had statistical significance (LSD 0.05) including the annual mean ratings, except for the ratings from September. The climatic conditions in the following year were quite different. The drought period from the end of the year 2006 is continued in 2007 for no less than six months, which represents a serious stress for turfgrasses (Veronesi, 1997; Waltz and Carrow, 2008). Only the most resistant varieties could survive. Once more we noticed the drought resistance of american bluegrass varieties compared to ryegrass

varieties, but other than that we also observed the strong comeback of bluegrass quality when climatic conditions recovered from drought. The loss in density and ground cover of rhizome lacking ryegrass varieties were too severe during the droughty period, which meant a drop of overall quality ratings, and a poor recovery *(Table 2)*. Two american varieties were rated 3.1 (Premier II and Barlenium), a third one was rated 3.7 (Mach1), while the control (Mara) was rated 4.2.

Table 2 - Turfgrass overall quality ratings for the year 2007

Entry	Quality ratings (1 – poor, 9 – very good)						
	May	June	July	August	September	October	mean
Nuglade (KB)	3.0	4.7	4.0	5.7	6.3	6.7	5.1
Nudestiny (KB)	3.7	4.0	3.3	6.0	6.3	5.7	4.8
Liberator (KB)	3.7	4.0	3.7	6.0	6.3	5.7	4.9
Chicago (KB)	2.3	4.0	2.7	5.7	5.0	5.0	4.1
Wildwood (KB)	2.7	3.7	3.3	5.3	3.7	3.7	3.7
Boutique (KB)	2.7	5.7	4.3	5.7	7.0	6.0	5.2
Impact (KB)	3.7	4.3	3.7	5.3	5.3	5.0	4.5
Mach 1 (PR)	2.7	3.3	2.7	5.3	4.0	4.0	3.7
Premier II (PR)	2.0	2.0	2.0	5.0	3.7	3.7	3.1
Barlenium (PR)	2.0	2.0	2.0	5.0	3.7	3.7	3.1
Mara (PR) - control	4.7	4.0	3.3	4.7	4.0	4.3	4.2
LSD 0.05	1.5	1.9	1.4	0.7	1.2	1.0	0.7

Quite different from ryegrasses, the bluegrass varieties benefited from the increased drought tolerance and the strong rhizomes to achieve a good ground cover, density and quality recovery (Fitzpatrick and K. Guillard, 2004; Githinji, 2009; Hunt and Dunn, 1993; Johnson, 2003; Richardson, 2008). In the first three months of the year 2007 that were evaluated, the quality was quite low especially for the PR varieties. As soon as the climatic conditions recovered in august we observed a strong recovery of bluegrass and a weak recovery of ryegrass (Macolino *et al.,* 2004; Maitre *et al.,* 2004). Thus, we observed an acceptable quality of four bluegrass varieties, namely Nuglade, Boutique, Nudestiny and Liberator which were rated from 5.7 to 6.7 in october *(Table 2)*. The harsh climatic conditions at the end of 2006 and the first half of 2007 were too severe, so neither of the varieties achieved an annual rating above 6, but the recovering capabilities of the bluegrass demonstrated the adaptability to the local climatic conditions.

CONCLUSIONS

This research demonstrates the importance of organizing testing trials for imported turfgrass varieties for the following reasons: the existence of high differences among cool season grasses in terms of turf quality as

influenced by climatic conditions; the existence of relatively high differences even among varieties that belong to the same botanical species as we observed with the seven bluegrass varieties.

The species *Lolium perenne* achieved a good quality in the period that followed the establishment, the variety Mach 1 being rated the highest of all studied varieties, in may 2006. Over a longer period although, when climatic conditions vary largely, and wet weather alternates with prolonged drought, as it happened in the two consecutive years of experimentation, the quality of ryegrass varieties declines continuously.

The species *Poa pratensis* has a better resistance to climatic stress compared with *Lolium perenne*, but also a better recovering energy when climatic conditions become favorable again.

The seven bluegrass varieties demonstrated over a two year period that they could adapt to the local climatic conditions in the north-east of Romania.

The three american ryegrass varieties achieved superior quality compared to the romanian variety, in the year that followed establishment, under favorable weather, but under the heat and prolonged drought that followed, they proved to be less adapted than the romanian variety and suffered a bigger loss of quality.

REFERENCES

Aronson I.J., J. Gold, J. Hull, 1987 - Cool-Season Turfgrass Responses to Drought Stress. Crop Sci. 27: 1261-1266.

Billick J.C., 1973 - Turf management. Columbus : Ohio Agricultural Education, Curriculum Materials Service.

Bunderson L.D., Johnson P. G., Kopp K. L., Van Dyke A., 2009 - Tools for Evaluating Native Grasses as Low Maintenance Turf. Horttechnology, vol. 19, issue 3, 626-632.

Burt M.G., N.E. Christians, 1990 - Morphological and growth characteristics of low and high maintenance Kentucky bluegrass cultivars. Crop. Sci. 30: 1239-1243.

Christians N., 2004 - Fundamentals of Turfgrass Management. John Wiley and Sons Inc. ISBN 0-471-45478-8.

Demiroglu G., H. Geren, B. Kir, R. Avcioglu, 2010 - Performances Of Some Cool Season Turfgrass Cultivars In Mediterranean Environment: II. *Festuca arundinacea* Schreb., *Festuca ovin*a L., *Festuca rubra spp. rubra* L., *Festuca rubra spp. trichophylla* Gaud and *Festuca rubra spp. commutata* Gaud. Turkish Journal of Field Crops, Volume: 15 Issue: 2, 180-187.

Dunn J., K. Diesburg, 2004 - Turf management in the Transition Zone. John Wiley and Sons Inc. ISBN 0-471-47609-9.

Fitzpatrick R.J.M., K. Guillard, **2004** - Kentucky bluegrass Response to Potassium and Nitrogen Fertilization. Crop Sci. 44:1721-1728.

Githinji L.J.M., J.H. Dane, R.H. Walker, 2009 - Water-use patterns of tall fescue and hybrid bluegrass cultivars subjected to ET-based irrigation scheduling. Irrigation Science Volume: 27 Issue: 5, 377-391.

Hunt K.L., J.H. Dunn, 1993 - Compatibility of kentucky bluegrass and perennial ryegrass with tall fescue in Transition zone turf mixtures. Agronomy Journal J 85:211-215.

Johnson P.G., 2003. The influence of frequent or infrequent irrigation on turfgrasses in cool-arid west. USGA Turfgrass and Environmental Research Online 2(6): 1-8.

Macolino S., M. Lucon, M. Scotton, A. Altissimo, U. Ziliotto, 2004 - Effect of simulated traffic on some turf quality parameters in construction systems of soccer pitches. SHS Acta Horticulturae 661 - International Conference on Turfgrass Management and Science for Sports Fields, ISSN - 0567-7572

Maitre J.P., D. Marchal, I. Besse, 2004 - Ground cover response to mowing height of turfgrass monocultures and binary mixtures. SHS Acta Horticulturae 661, International Conference on Turfgrass Management and Science for Sports Fields, ISSN - 0567-7572.

Morris K., 2006 - The National Turfgrass Research Initiative. USGA Turfgrass and Environmental Research Online 2 (12): 1-10.

Petrovic A.M., D. Soldat, J. Gruttadaurio, J. Barlow, 2005 - Turfgrass growth and quality related to soil and tissue nutrient content. ITSR, vol. 10.

Razmjoo K., T. Imada, J. Suguira, S. Kaneko, 1996 - Effect of nitrogen rates and mowing heights on color, density, uniformity, and chemical composition of creeping bentgrass cultivars in winter. Journal of Plant Nutrition, Volume 19, Issue 12 December 1996 ,1499 – 1509.

Richardson M.D., Douglas E. Karcher, K.W. Hignight, Debra Rush, 2008 - Drought Tolerance and Rooting Capacity of Kentucky Bluegrass Cultivars. Crop Sci. 48:2429–2436.

Richardson M.D., K.W., Hignight, 2010 - Seedling Emergence of Tall Fescue and Kentucky Bluegrass, as Affected by Two Seed Coating Techniques. Horttechnology, Volume: 20, Issue: 2, 415-417.

Veronesi F., M. Falcinelli, B. Lucaroni, L. Russi, 1997 - Within species variation in cool season grasses grown for turf in Central Italy (*Lolium perenne - Poa pratensis - Festuca rubra - Festuca arundinacea* – Umbria*)*. Rivista di Agronomia, ISSN 0035-6034,127-134.

Waltz F.C., R.N., Carrow, 2008 - Applied turfgrass water-use efficiency/ conservation: Agronomic practices and building cooperation between industry trade associations and regulatory authorities Proceedings Of The Iind International Conference On Turfgrass Science And Management For Sports Fields Acta Horticulturae Issue: 783, 239-245.