

EFFECT OF UTILIZATION INTENSITY ON GROWTH OF LAWN CULTIVARS OF KENTUCKY BLUEGRASS (*Poa pratensis* L.)

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Abstract. The aim of this study was to estimate the level of annual and daily growth of lawn plant height of Kentucky bluegrass cultivars depending on the intensity of their utilization and to group bluegrass cultivars into slowly and quickly growing. The basis for the study was the results of cultivar tests conducted by COBORU in 1998-2004 at three Experimental Stations of Cultivar Testing – Lisewo (54°06' N; 18°50' E), Łopuszna (49°29' N; 20°08' E) and Pawłowice (50°28' N; 18°29' E). Two systems of utilization were applied: moderately intensive (Relaks) and extensive (Park). At extensive utilization, annual plant growth values of all the tested cultivars were smaller by 20-30 cm, and average daily growth values by 0.14 cm smaller than with their intensive utilization. The slowly growing cultivars were Alicia, America, Baron, Bartender, Broadway, Limousine, NIB398, Orfeo, RAH498, Samoa and Qantum Leap, and quickly growing – Gol, Mardona, Haga, Sobra and Evora. At the utilization system Relaks, daily growth values of slowly growing cultivars were on average by 25% smaller, and at the Park system, by 35% smaller than those of quickly growing cultivars.

Key words: annual growth of plant height, daily growth of plant height, extensive utilization, lawn cultivars, moderately intensive utilization, slowly growing cultivars

INTRODUCTION

Kentucky bluegrass (*Poa pratensis* L.) is one of the most valuable grasses, which are necessary particularly on sports lawns. Owing to their ability to propagate strongly and to form runners and a large number of vegetative shoots the plants of this species form dense and strong sod. They are resistant to intensive treading and tolerate low and frequent mowing very well [Martyniak 2003].

One of a very essential features determining the value of the lawn cultivar is slow growing of plants after mowing. This is a genetically determined feature, but it also

depends on the climatic conditions and the way of utilization. Fertilization, irrigation and frequent mowing are factors stimulating lawn grass growth [Domański 1992, Prończuk *et al.* 1997]. Mowing, on account of the consumption of fuel and time, is the most expensive treatment in grass surface maintenance [Żurek 2007]. Therefore it is justified to use for lawn mixtures cultivars which grow as slowly as possible, the more so because the feature of slow growing correlates positively with soil surface sodding [Prończuk and Prończuk 2003]. However, the problem is that slower growing cultivars usually form shorter inflorescences with a smaller number of seeds and that is why seeding material of those cultivars is more expensive [Sawicki i Jargiełło 1997, Żyłka and Prończuk 2000, Żyłka 2001, Johnson *et al.* 2003]. Radkowski and Kuboń [2006] report that costs of utilization of a Relaks type lawn are 2-fold larger than those of utilization of an extensive lawn – of Park type.

In the years 1998-2004 in diversified natural conditions of Poland several lawn cultivars of Kentucky bluegrass were studied and registered: Alicia, America, Baron, Bartender, Bila, Broadway, Compact, Conni, Europa, Evora, Jarotka, Limerick, Limousine, Miracle, Niweta, Orfeo, Panduro, Quantum Leap and Sójka [List of cultivars... 2010]. Then the registration of lawn grass cultivars took place on the basis of results of the economic value analyses. Since 2005 lawn grass cultivars have been registered, both in Poland and in other EU countries, have been registered only on the basis of tests for durability, uniformity and identity (DUS).

The aim of this study was:

- to estimate the annual and daily plant growth values of Kentucky bluegrass cultivars depending on the intensity of their utilization,
- to group lawn cultivars of bluegrass into slowly and quickly growing.

The research hypothesis assumed that irrespective of diversified climatic conditions, quickly and slowly growing cultivars of Kentucky bluegrass can be distinguished, and the intensity of utilization has varied effects on the growth rate of quickly and slowly growing cultivars.

MATERIAL AND METHODS

The basis for this study was the results of cultivar experiments carried out by the Research Centre for Cultivar Testing (COBORU) in 1998-2004 at three Experimental Stations of Cultivar Testing – Lisewo (54°06' N; 18°50' E), Łopuszna (49°29' N; 20°08' E) i Pawłowice (50°28' N; 18°29' E).

Experiments were established and carried out in accordance with the methods of economic value analyses of turf grasses developed by Domański [1998]. Two series of experiments were established each time – the first being three-year or two-year (the year of establishment and two production years or one production year). At each Station two-factorial experiments were established in the randomized complete block design. The area of a plot amounted to 1 m². The first factor were the utilization methods – Relaks (referred to as moderately intensive) and Park (referred to as extensive), and the factor were lawn cultivars of Kentucky bluegrass. The experiments were carried out in three replications.

Utilization methods differed in preparation of the substrate and the number of cultivation treatments in the establishment year and in the production years. The substrate for the plots in the Park system was a natural site and for Relaks – a natural

site enriched with pear of composted soil. The sowing rate was 6-7 g seeds per 1 m². Cultivation treatments in the year of establishment and in production years were presented in Table 1.

Table 1. Range of cultivation treatments depending on utilization system
Tabela 1. Zakres zabiegów pielęgnacyjnych w zależności od sposobu użytkowania

Treatment – Zabieg	Park	Relaks
Irrigation Nawadnianie	in the year of establishment w roku siewu	in the year of establishment and in the production years – w roku siewu i w latach użytkowania
Fertilization Nawożenie	in the year of establishment and in the production years – w roku siewu i w latach użytkowania	in the year of establishment and in the production years – w roku siewu i w latach użytkowania
Height of mowed plants Wysokość koszonych roślin	12 cm	8 cm
Mowing height in production years Wysokość koszenia w latach użytkowania	6 cm	4 cm
Rolling Wałowanie	no – nie	in the production years, if necessary – w latach użytkowania, jeśli było konieczne
Verticulation Wertykulacja	no – nie	in the production years w latach użytkowania
Weed and pest control Zwalczanie chwastów i szkodników	in the year of establishment w roku siewu	in the year of establishment and in the production years – w roku siewu i w latach użytkowania

Mineral fertilization in both utilization systems was applied according to the following scheme: pre-sowing 22 kg P·ha⁻¹ and 83 kg K·ha⁻¹, in the production years 2 times: 45 in spring and 9-15 kg P·ha⁻¹ in autumn (October), as well as 70-80 kg K·ha⁻¹ in spring and 33-66 kg K·ha⁻¹ in autumn. In the year of establishment for both utilization systems 45 kg·ha⁻¹ N was used in two rates. In the production years in the Park system, the nitrogen rate was 60 kg·ha⁻¹, and in the Relaks system 240 kg·ha⁻¹ N.

The indicator of the mowing date was the plant height of the standard cultivar (Alicia). The height was measured with a rigid rule at five points, diagonally through the plot (to an accuracy of 0.5 cm). Measurements were made in three replications for each cultivar immediately before mowing. In the growing seasons from 13 to 16 mowings were made in the Relaks system and from 6 to 10 mowings in the Park system.

Annual growth was calculated as a sum of measurements of plant height made before each mowing (reduced by the height of stubble). Daily growth was calculated as a quotient of annual growth values and the number of growing days counted from the day of starting growth in the given series and in the given year to the day of the last mowing. The results of growing of the cultivars in the production years are the average from both series.

Statistical analyses of growing differences between cultivars were made separately for each series of the study. Analyses of variance of the total growth from three or two production years were made, treating the localities as replications. Significance of differences was assessed with Tukey's test at a probability of 95%. Calculations were made using the statistical program ANALWAR-5.2.FR.

Weather conditions in the years of the study

More severe thermal conditions in comparison with other stations prevailed in Łopuszna (Table 2). Thermal conditions in Pawłowice and Lisewo were similar, although in Pawłowice average annual temperatures and temperatures in the period from the beginning of April to the end of October were by 0.4°C higher than in Lisewo. The highest variability of thermal conditions in the growing season (April – October) in the years of the study occurred in Pawłowice.

Table 2. Average daily air temperature at Stations of Cultivar Testing, °C
Tabela 2. Średnia dobowa temperatura powietrza w Stacjach Oceny Odmian, °C

Year Rok	Łopuszna		Pawłowice		Lisewo	
	annual roczna	April – October kwiecień – październik	annual roczna	April – October kwiecień – październik	annual roczna	April – October kwiecień – październik
1998	5.3	11.8	8.5	13.9	8.0	13.3
1999	6.5	12.1	8.8	14.3	8.8	14.0
2000	6.8	12.0	9.6	14.7	9.3	13.9
2001	5.6	11.8	8.3	14.0	8.0	13.8
2002	6.3	11.7	9.5	15.9	8.8	14.4
2003	6.0	12.4	8.5	14.3	8.1	13.6
2004	5.9	11.6	8.4	13.9	8.0	13.3
Mean Średnia	6.1	11.9	8.8	14.2	8.4	13.8

The most favourable moisture conditions for grass growing were in Łopuszna. Only in 2003 precipitation was noticeably lower here, on the level comparable to the precipitation occurring in the other two stations (Table 3). The lowest total precipitation values during the growing season were recorded in Pawłowice in 1999 and 2003 and in Lisewo in 2000. However, average total precipitation values, both annual and from the growing season, were similar in both stations.

Table 3. Total precipitation at Stations of Cultivar Testing, mm
Tabela 3. Suma opadów w Stacjach Oceny Odmian, mm

Year Rok	Łopuszna		Pawłowice		Lisewo	
	annual roczna	April – October kwiecień – październik	annual roczna	April – October kwiecień – październik	annual roczna	April – October kwiecień – październik
1998	787	503	602	432	557	381
1999	723	562	514	321	634	486
2000	842	545	663	404	548	329
2001	986	779	694	539	688	482
2002	829	651	583	428	574	421
2003	590	418	482	347	517	432
2004	818	566	568	355	626	447
Mean Średnia	796.4	574.9	586.6	403.7	592.0	425.4

RESULTS

Average annual growth values of Kentucky bluegrass plants, irrespective of the utilization system for the series established in the period from 1998 to 2001, ranged from 49.9 to 53.7 cm (Table 4a-d). For series established in 2002 and 2003 these growth values were considerably lower and amounted to 28.4 and 36.1 cm, respectively (Table 4e-f).

Table 4. Annual growth values of Kentucky bluegrass cultivars depending on utilization systems, cm
Tabela 4. Roczne przyrosty odmian wiechliny łąkowej w zależności od sposobu użytkowania, cm

a) series 1998-2000 – seria 1998-2000							
Utilization system Sposób użytkowania	Gol	Alicia	Barvictor	Limousine	Mean Średnia		
Relaks (R)	76.8	70.9	68.0	56.6	68.1 A*		
Park (P)	47.7	37.9	37.8	33.6	39.3 B		
Mean – Średnia	62.3	54.4	52.9	45.1	53.7		
Difference – Różnica (R – P)	29.1	33.0	30.2	23.0	28.8		
b) series 1999-2002 – seria 1999-2002							
Utilization system Sposób użytkowania	Gol	NIB398	RAH498	Alicia	Mean Średnia		
Relaks (R)	69.8	57.5	55.6	53.5	59.1 A		
Park (P)	49.2	44.3	42.6	26.7	40.7 B		
Mean – Średnia	59.5	50.9	49.1	40.1	49.9		
Difference – Różnica (R – P)	20.6	13.2	13.0	26.8	18.4		
c) series 2000-2002 – seria 2000-2002							
Utilization system Sposób użytkowania	Gol	Mardona	Alicia	Baron	Mean Średnia		
Relaks (R)	75.9	69.2	61.0	58.7	66.2 A		
Park (P)	41.9	36.3	32.1	26.0	34.1 B		
Mean – Średnia	58.9 a*	52.7 ab	46.5 bc	42.3 c	50.1		
Difference – Różnica (R – P)	34.0	32.9	28.9	32.7	32.1		
d) series 2001-2004 – seria 2001-2004							
Utilization system Sposób użytkowania	Gol	Haga	Sobra	Samoa	Broadway	Alicia	Mean Średnia
Relaks (R)	72.7	64.3	79.4	55.0	53.1	46.7	61.8 A
Park (P)	60.9	57.1	40.8	32.3	30.7	31.0	42.1 B
Mean – Średnia	66.8 a	60.7 ab	60.1 ab	43.6 bc	41.9 c	38.8 c	52.0
Difference – Różnica (R – P)	11.8	7.2	38.6	22.7	22.4	15.7	19.7
e) series 2002-2004 – seria 2002-2004							
Utilization system Sposób użytkowania	Orfeo	Qantum Leap	Bartender	Alicia	Limousine	Mean Średnia	
Relaks (R)	45.8	43.7	41.3	42.8	39.5	42.6 A	
Park (P)	18.8	18.0	17.5	19.1	16.4	18.0 B	
Mean – Średnia	30.5	29.1	27.5	28.5	26.3	28.4	
Difference – Różnica (R – P)	27.0	25.7	23.8	23.7	23.1	24.7	

f) series 2003-2004 – seria 2003-2004

Utilization system Sposób użytkowania	Evora	Bariris	Lipatos	America	Alicia	Limousine	Mean Średnia
Relaks (R)	57.4	50.1	49.6	43.9	38.0	39.5	46.4 A
Park (P)	29.2	29.0	28.9	23.0	25.9	18.8	25.8 B
Mean – Średnia	43.3 a	39.6 ab	39.3 ab	33.5 bc	32.0 bc	29.2 c	36.1
Difference – Różnica (R – P)	28.2	21.1	20.7	20.9	12.1	20.7	20.6

* values marked with different capital letters vertically and with small letters horizontally differ significantly
– wartości oznaczone różnymi dużymi literami w pionie, a małymi w poziomie różnią się istotnie

In each series of the study a significant difference in plant growth was indicated resulting from the utilization system. Average annual growth values from all the series were 57.4 cm for the Relaks system and 33.3 cm for the Park system, which means that they were lower by 42%. The largest difference between utilization systems was recorded in the series 2000-2002 (32.1 cm), and the smallest in the series 1999-2002 (18.4 cm). Comparison of data from all the series does not indicate that in the years when annual growth values were great the differences resulting from the utilization system were large as well. In the series 1999-2002 and 2001-2004 average annual growth values were 49.9 and 52.0 cm, respectively, and differences between Relaks and Park systems were the smallest then – 18.4 and 19.7 cm. In the series 2002-2004, in turn, when average annual growth values were the smallest (28.4 cm), the difference resulting from the utilization system was 24.7 cm.

Statistically significant differences between cultivars were shown in three series of the study. In the series 2000-2002 three homogeneous groups were distinguished – the first, most intensively growing group included the cultivars Gol and Mardona, the second Mardona and Alicia, and the third, the slowest growing, Alicia and Baron. In the series 2001-2004, the first, most intensively growing homogeneous group was composed of the cultivars Gol, Haga and Sobra, the second Haga, Sobra and Samoa, and the third Samoa, Broadway and Alicia. In the series 2003-2004 the cultivar Gol was not considered, but the tested cultivars could be also divided into three homogeneous groups: the most intensively growing – Evora, Bariris and Lipatos, growing slower – Bariris, Lipatos, America and Alicia and growing the slowest – America, Alicia and Limusine. In the series 1998-2000 and 1999-2002, although differences between cultivars were relatively large, they proved to be statistically non significant. In the series 2002-2004 and 2003-2004 all the tested cultivars grew slowly.

Mutual operation of the experimental factors was not proved, but a difference in growth depending on the utilization system for each cultivar was presented in tables. The smallest and largest difference in annual growth was found in the series 2001-2004 and it was 7.4 cm – the cultivar Haga and 38.6 cm – the cultivar Sobra. When comparing the results of all the series, it is difficult to indicate regularities. The most frequently, the differences in cultivar growth after changing their utilization system were within the range from 20 to 30 cm. The standard cultivar Alicia responded to a change in the utilization system with a difference in growth from 12.1 cm (series 2003-2004) to 33.0 cm (series 1998-2000). The most intensively growing cultivar Gol had a similar response.

Average daily growth values of the lawn cultivars of Kentucky bluegrass were within the range from 0.22 to 0.41 cm (Table 5a-f). The average of all the series for the Relaks system was 0.36 cm, and for the Park system 0.22 cm. In each series, the differences resulting from the utilization system were statistically significant.

Table 5. Daily growth values of Kentucky bluegrass cultivars depending on utilization system, cm
 Tabela 5. Dobbowe przyrosty odmian wiechliny łąkowej w zależności od sposobu użytkowania, cm

a) series 1998-2000 – seria 1998-2000							
Utilization system Sposób użytkowania	Gol	Alicia	Barvictor	Limousine	Mean Średnia		
Relaks	0.46	0.43	0.41	0.34	0.41 A*		
Park	0.28	0.22	0.22	0.20	0.23 B		
Mean – Średnia	0.46	0.43	0.41	0.34	0.41		
b) series 1999-2002 – seria 1999-2002							
Utilization system Sposób użytkowania	Gol	NIB398	RAH498	Alicia	Mean Średnia		
Relaks	0.42	0.35	0.33	0.32	0.42 A		
Park	0.30	0.19	0.18	0.16	0.30 B		
Mean – Średnia	0.36 a*	0.27 b	0.26 b	0.24 b	0.36		
c) series 2000-2002 – seria 2000-2002							
Utilization system Sposób użytkowania	Gol	Mardona	Alicia	Baron	Mean Średnia		
Relaks	0.42	0.38	0.34	0.32	0.36 A		
Park	0.22	0.21	0.17	0.14	0.18 B		
Mean – Średnia	0.32 a	0.29 a	0.25 b	0.23 b	0.27		
d) series 2001-2004 – seria 2001-2004							
Utilization system Sposób użytkowania	Gol	Haga	Sobra	Samoa	Broadway	Alicia	Mean Średnia
Relaks	0.47	0.41	0.50	0.35	0.34	0.31	0.40 A
Park	0.41	0.37	0.27	0.21	0.20	0.19	0.27 B
Mean – Średnia	0.44 a	0.39 a	0.38 a	0.28 b	0.27 b	0.25 b	0.33
e) series 2002-2004 – seria 2002-2004							
Utilization system Sposób użytkowania	Alicia	Orfeo	Qantum Leap	Bartender	Limousine	Mean Średnia	
Relaks	0.32	0.34	0.32	0.31	0.3	0.32 A	
Park	0.22	0.20	0.21	0.19	0.19	0.20 B	
Mean – Średnia	0.27	0.27	0.27	0.25	0.24	0.26	
f) series 2003-2004 – seria 2003-2004							
Utilization system Sposób użytkowania	Evora	Bariris	Lipatos	America	Alicia	Limousine	Mean Średnia
Relaks	0.34	0.30	0.30	0.27	0.23	0.24	0.28 A
Park	0.18	0.18	0.18	0.14	0.16	0.12	0.16 B
Mean – Średnia	0.26 a	0.24 ab	0.24 ab	0.20 bc	0.19 c	0.18 c	0.22

* values marked with different capital letters vertically and with small letters horizontally differ significantly
 – wartości oznaczone różnymi dużymi literami w pionie, a małymi w poziomie różnią się istotnie

The results in four series allow a division of cultivars into slowly and quickly growing (Table 5b, c, d, f). The slowly growing cultivars include: NIB398, RAH498, Alicia, Baron, Samoa, Broadway, America and Limousine. The group of quickly growing cultivars includes: Gol, Mardona, Haga, Sobra and Evora. The cultivars Bariris and Lipatos constitute an intermediate group between the slowly and quickly growing cultivars. In the series 2002-2004 (Table 5e) average daily growth values of all the cultivars were small, and the cultivars tested only in this series (Orfeo, Qantum Leap and Bartender) grew on the level comparable with the cultivars Alicia and Limousine.

In the series of the study where significant differences between slowly and quickly growing cultivars were found, average daily growth values of both groups were compared at their moderately intensive and extensive utilization. It was proved that at moderately intensive utilization daily growth values of quickly growing cultivars were on average 0.40 cm, and those of slowly growing cultivars 0.30 cm, which means that they were smaller by 25% (Fig. 1). At extensive utilization daily growth values of quickly growing cultivars were on average 0.31 cm, and those of slowly growing 0.20 cm, which means that they were smaller by 35% (Fig. 2).

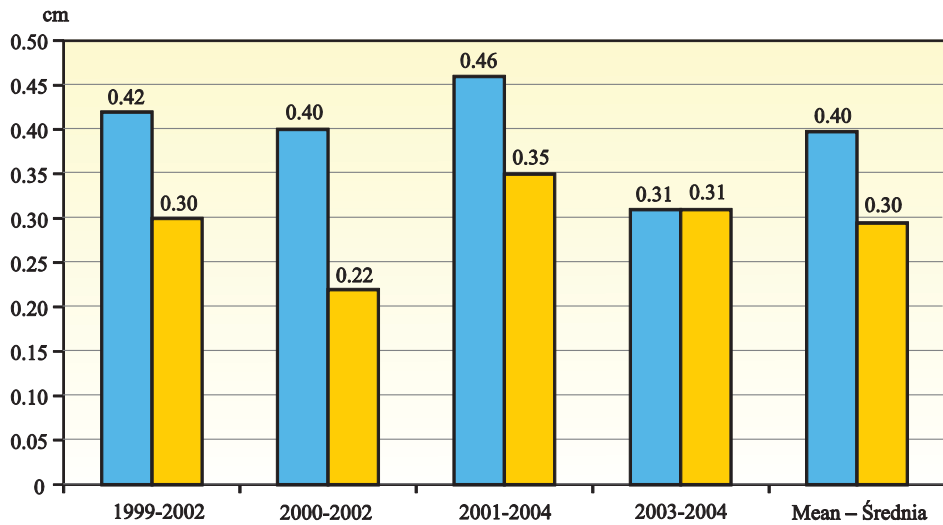


Fig. 1. Average daily growth values of quickly growing (blue colour) and slowly growing (yellow colour) cultivars utilized moderately intensively

Rys. 1. Średnie dobowe przyrosty odmian szybko odrastających (kolor niebieski) i wolno odrastających (kolor żółty) użytkowanych średnio intensywnie

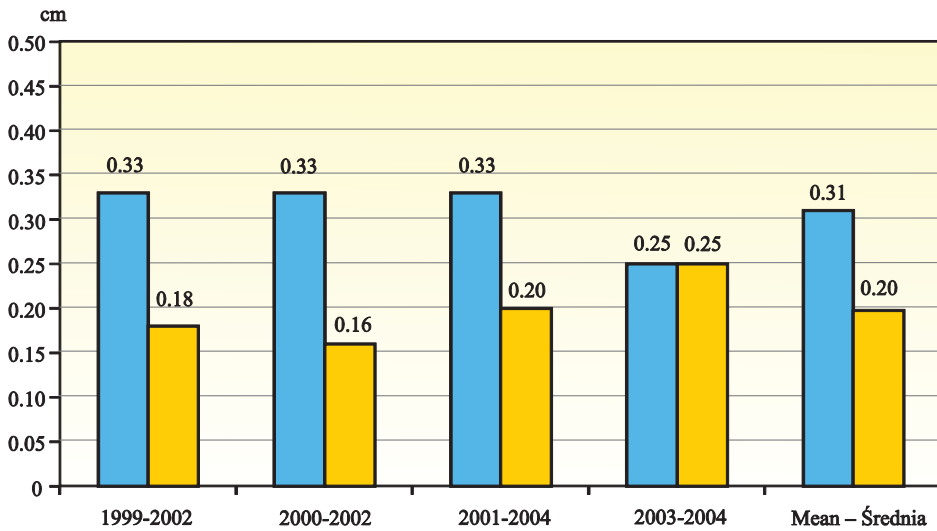


Fig. 2. Average daily growth values of quickly growing (blue colour) and slowly growing (yellow colour) cultivars utilized extensively

Rys. 2. Średnie dobowe przyrosty odmian szybko odrastających (kolor niebieski) i wolno odrastających (kolor żółty) użytkowanych ekstensywnie

DISCUSSION

Grass plant growing is only one of many features significant in the assessment of lawn cultivars. Because of their multitude, it is possible to divide cultivars of Kentucky bluegrass into even more than ten different categories, depending on the needs [Huff 2010]. However, the growth height is the only measurable feature, thus independent of the subjective assessment of the person making the research.

Purchasers of lawn mixtures are interested not only in mixtures intended for decorative, recreation and sports purposes, but they more often look for mixtures intended for extensive utilization. This results from needs of developing degraded areas, parks, roadsides, but also from economic and ecological determinants. However the concept of extensive lawn is not explicitly defined in the literature and extensive utilization is usually regarded as such a system where cultivation treatments are reduced to several mowings in the growing season and a nitrogen fertilization of 20-60 kg·ha⁻¹. Many authors claim that Kentucky bluegrass is not suitable for extensive utilization, since it tolerates periodic water shortage and nutrition deficiency poorer than other grasses. Turf becomes thinner then and the lawn gradually loses its aesthetic qualities [Żurek 2004, 2007]. In the present study, the number of mowings of plots utilized extensively was higher than it indicates from other studies. Czarnecki and Harkot [2003] made measurements of growing of perennial ryegrass lawn cultivars. Average daily growth values of plants of this species were two- or three times higher than the growth values of Kentucky bluegrass determined in the present study.

The presented results are current, since except for the cultivars Gol (crossed off the register) and NIB 398 and RAH 498 (not registered), all the tested cultivars can be found in the Community Union Catalogues [Common catalogue... 2010]. The presented

model of statistical calculations constituted a strict criterion for the division of cultivars into slowly and quickly growing. In spite of the fact that the experiments substantially differed in the climatic conditions, slowly and quickly growing cultivars were separated in most series. It is notable that Limousine – one of the most valuable cultivars in Europe was tested in as many as three series and in each of them its annual and daily growth values were smaller than those of other cultivars. In the USA the cultivars America, Limousine and Quantum Leap were classified as intensive or very intensive, and the cultivar Haga as extensive. The cultivar Limousine was additionally referred to as aggressive (plants forming dense, compact turf, quickly and strongly covering the soil) and Quantum Leap and America as “compact” – short plants with a compact habit, useful for very low mowing [Minner 2009].

Cultivars were assessed on the basis of averages from two or three production years, which partially allowed elimination of the effect of weather, diversified in the years. Throughout the research period, only one, extremely untypical season happened (2003), when both in Łopuszna and in Pawłowice precipitation totals were very low. Probably this is why in the last two series (2002-2004 and 2003-2004) annual and daily growth values of plant height were considerably smaller in comparison with the growth in earlier series.

Measurements and calculations of average daily growth values of plant height are laborious and expensive, but the present study indicated that they constitute a more precise criterion for cultivar division into slowly and quickly growing than summary daily growths. It is known that a decrease in utilization intensity slows down plant growth after mowing. According to the authors, the most essential information resulting from the present study is that at moderately intensive utilization, daily growth values of slowly growing cultivars were by 22%, and at extensive utilization by 32% smaller than those of quickly growing cultivars.

Such wide results concerning the response of cultivars of different species composing lawn mixtures to different utilization systems have not been published. However, it can be assumed that the range is different but the direction of response the same as for Kentucky bluegrass cultivars. Therefore if the users care about reducing the costs of lawn utilization, they should choose slowly growing cultivars, although their seeding material would be more expensive. Moreover, those cultivars will also provide good substrate sodding [Harkot and Czarnecki 2000, Prończuk and Prończuk 2003].

CONCLUSIONS

1. Moderately intensive utilization of Kentucky bluegrass resulted in annual growths of plant height larger by 20-30 cm, and average daily growth larger by 0.14 cm than at their extensive utilization.

2. The cultivars differ in growing intensity after mowing. Slowly growing cultivars include: Alicia, America, Baron, Bartender, Broadway, Limousine, NIB398, Orfeo, RAH498, Samoa and Qantum Leap, and the quickly growing Gol, Mardona, Haga, Sobra and Evora.

3. Cultivars slowly growing after moving, irrespective of the utilization system, are always characterized by smaller values of plant height growth than the quickly growing cultivars. In the presented study, at moderately intensive utilization (the Relaks system) daily growth values of slowly growing cultivars were on average by 25% smaller, and at the extensive system (Park) by 35% smaller than those of quickly growing cultivars.

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WPLYW INTENSYWNOŚCI UŻYTKOWANIA NA ODRASTANIE TRAWNIKOWYCH ODMIAN WIECHLINY ŁĄKOWEJ (*Poa pratensis* L.)

Streszczenie. Celem badań było określenie poziomu rocznych i dobowych przyrostów wysokości roślin trawnikowych odmian wiechliny łąkowej w zależności od intensywności ich użytkowania oraz pogrupowanie odmian wiechliny na wolno i szybko odrastające. Podstawę opracowania stanowiły wyniki doświadczeń odmianowych prowadzonych przez COBORU w latach 1998-2004 w trzech Stacjach Doświadczalnych Oceny Odmian – Lisewie (54°06' N; 18°50' E), Łopusznej (49°29' N; 20°08' E) i Pawłowicach (50°28' N; 18°29' E). Stosowano dwa sposoby użytkowania: umiarkowanie intensywny (Relaks) i ekstensywny (Park). Przy ekstensywnym użytkowaniu roczne przyrosty roślin wszystkich testowanych odmian były o 20-30 cm, a średnie dobowe przyrosty o 0.14 cm mniejsze niż przy ich użytkowaniu intensywnym. Odmianami wolno odrastającymi były Alicia, America, Baron, Bartender, Broadway, Limousine, NIB398, Orfeo, RAH498, Samoa i Qantum Leap, a szybko odrastającymi – Gol, Mardona, Haga, Sobra i Evora. Przy sposobie użytkowania Relaks dobowe przyrosty odmian wolno odrastających były średnio o 25% mniejsze, a przy sposobie Park – o 35% mniejsze niż odmian szybko odrastających.

Słowa kluczowe: dobowe przyrosty wysokości roślin, odmiany gazonowe, odmiany wolno odrastające, roczne przyrosty wysokości roślin, użytkowanie ekstensywne, użytkowanie umiarkowanie intensywnie

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