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EVALUATION OF *DESCHAMPSIA CAESPITOSA* /L./ BEAUV. COMPETITION ABILITY IN MIXTURES WITH MAIN TURFGRASS SPECIES

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Abstract

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Numbers of tillers and weight of aboveground dry mass were evaluated in a field experiment at the Plant breeding station Větrov of Oseva UNI Choceň a. s., Czech Republic (620 m a. s. l., average year temperature 6.9 °C, average year precipitation 642 mm) in mixtures of *D. caespitosa* cv. 'Kometa' with *Poa pratensis* L. cv. 'Harmonie' or with *Lolium perenne* L. cv. 'Filip' during three years of vegetation. The seeding rate was always 40 thous. viable seeds per m^2. The proportion of *D. caespitosa* in the mixtures was 25%, 50% or 75% of the total number of seeds, a monoculture was established too. The sward was mown to 3 cm. *D. caespitosa* was not able to compete with *L. perenne*. The number of its tillers during the experiment ranged up to 3% of total number of tillers of the sward; the weight of aboveground DM was maximally 1.5% of the total aboveground phytomass. It established much better in the mixtures with *P. pratensis*. The total number of both components and the weight of aboveground dry mass was significantly influenced by the year (p-value < 0.000–0.009), by *D. caespitosa* proportion in the seed mixture (p-value = 0.001–0.003) and by the interaction of these factors (p-value = 0.000–0.056). It developed more rapidly in the first year in comparison with *P. pratensis* and reached 31–85% of total amount of tillers in positive correlation to its proportion in the seed mixture, later the competition capacity of *P. pratensis* increased and *D. caespitosa* tillers proportion in the sward was 11–39% in the third year. The trend of the weight of its aboveground dry mass was similar – 21–78% in the first year and 8–36% in the third year in a positive correlation with its proportion in the seed mixture. *D. caespitosa* and *P. pratensis* created bigger tillers in the later years.

Deschampsia caespitosa, *Lolium perenne*, *Poa pratensis*, grass mixture, competition, tillers, aboveground phytomass

Nowadays, alternative turfgrass species are being introduced in mixtures for all kinds of lawns with different utilization – recreational, sport, amenity, functional in cities or along roads and railways. These species are used as additional components beside those conventionally used species such as *Lolium perenne*, *Poa pratensis*, *Festuca rubra*, to enhance the quality of turf, via better corresponding with climate conditions, local environment or low-input turfgrass management. Species that belong to this group are for instance slowly growing *Koeleria macrantha*, *Poa compresa*, *Phleum bulbosum* or *Deschampsia caespitosa*. The last one mentioned, *Deschampsia caespitosa* L. Beauv., is considered by many authors as extremely variable species with high physiological plasticity, such as high tolerance to different soil conditions – pH, water logging and its ability of acclimation on different temperature regimes and solar radiation (DAVY and TAYLOR, 1974). It is also recommended for utilisation in wet and shady areas because of its tolerance to low solar radiation (BRILMAN and WATKINS, 2003), where the vast majority of other turfgrass species is suppressed by moss. It could be used in amenity, recreational lawns with high wear intensity in areas with reduced fertility or sunlight and with

I: *Sowing rates (g.m^{-2})*

***D. caespitosa* ratio in mixtures (% of viable kernels)**	***Deschampsia caespitosa***	***Lolium perenne***	***Poa pratensis***
25	2.6	62.4	7.2
50	5.2	41.6	4.8
75	7.8	20.8	2.4
100	10.4	-	-

higher mowing frequency. Its importance is also highlighted in context of climate fluctuations in past years and similar predictions to the future. However, there are some problems with *D. caespitosa* during the sward establishing and development because of its susceptibility to drought during emergence and bunch type growth habit (competition capacity). There are only three Czech and one Dutch varieties of this species in commercial use and others are in tests. Until now there is not much information and experience available about its development in turfgrass mixtures.

The aim of the experiment was to evaluate the changes in stand composition of one *D. caespitosa* in mixtures with *Poa pratensis* L. and *Lolium perenne* L. in the temperate zone during three years since establishment.

MATERIALS AND METHODS

The 3 years field experiment was established by seeding on 18th April 2007 at the Plant breeding station Větrov of Oseva UNI Choceň a. s., Czech Republic (620 m a. s. l., average year temperature 6.9 °C, average year precipitation 642 mm, soil group – loamy–sand soil, brown, podzolic and moderately acid soil). *Deschampsia caespitosa*, Czech variety 'Kometa', was sown in monoculture or in two-component mixtures with *Lolium perenne* cv. 'Filip' and *Poa pratensis* cv. 'Harmonie'. The sowing rate of the monoculture or the mixtures was always 40 000 viable seeds per m^2. The proportion of *D. caespitosa* in the mixtures was 25%, 50% or 75% of the total number of seeds. The real sowing rates are stated in table I. Every variant was established with four replications (split plot design, one plot 2 m^2). The sward was mown every 7 to 9 days the mowing height was 3 cm. Last mowing was made approx. in the half of October. The weed and pest management was conducted according to the sward fitness with selective herbicide Bofix. The sward was fertilized frequently once per month with changing combined granulated fertilizer Rasen Floranid (NPKMg 20–5–8–2) and calcium nitrate in total rate of 120 kg N.ha^{-1} per year.

During 2007–2009, 10 samplings were realized (3 times in 2007, 4 times in 2008, 3 times in 2009); a gap at least 45 days was between each following samplings. On average, 5 days before samplings the sward was mown. Three samples were taken by Kopecky rings with diameter 50 mm from each plot (12 samples from each variant). The aboveground phytomass was separated by scissors from the rest, and subsequently, the tillers of particular species were discerned from one another. Then number of shoots was calculated for each species and dried under the temperature 105 °C in oven for 24 hours. The weight of aboveground dry mass (DM) was determined. The total average amount of tillers and dry weight of aboveground phytomass were determined. The data were processed by analysis of variance Anova (LSD $P \leq 0.05$) by the Statgraphics programme, version XV.

RESULTS AND DISCUSSION

The numbers of tillers and the weights of aboveground phytomass in individual samplings during the experiment ranged in dependence on the weather and therefore we evaluated, for better understanding of the swards composition development in time, their year averages. The climate conditions, such as total precipitation and average temperature are in Table IV.

Deschampsia caespitosa (Dc) was not able to compete with *Lolium perenne* (Lp). The number of Dc tillers during the experiment (2007–2009) was negligible under all its rates in seed mixture (excepting the first sampling in 2007) – the average numbers of Dc tillers ranged only up to 3% of total number of tillers of the sward; the weight of aboveground DM was maximally 1.5% of the total aboveground phytomass. *D. caespitosa* was suppressed already in the initial stages of its development, which means during two month after seeding. The low proportion of Dc tillers in the mixture may have been caused initially by extraordinary law precipitations in April 2007 together with high temperatures in April and two following months in comparison with the long term average (Table IV). As a second consequent reason could have been pressure from fast developing *Lolium perenne*.

The **tillers of *L. perenne*** represented 97–99% of total tillers amount and 99% of aboveground DM weight during the experiment (Table II, Graph 2). The number of Lp tillers was decreasing with increasing Dc ratio in seed mixtures, which means with lower Lp seeding rate, but the differences were not significant (p-value for Dc proportion in seed mixture and vegetation year 0.215). In 2007, the highest number of Lp tillers (42 thous.m^{-2}) was found under 25% proportion of Dc in mixture, it was 6 to 16% lower under a higher proportion of Dc. In 2008, the number of Lp tillers ranged between

34–37 thous.m^{-2}. In the third vegetation year, in comparison with the first year, the number of Lp tillers decreased insignificantly by 2–8% regardless to the seed mixture composition.

The total weight of aboveground DM of *L. perenne* (Tab II, Graph 3) was not significantly influenced neither by vegetation year (p-value = 0.643), nor seed composition (p-value = 0.709), nor both the factors interaction (p-value = 0.899). The highest weight of Lp aboveground DM was under all the variants in 2007, but the differences in Lp phytomass weight among all the variants were not significant during the years. In the third vegetation year, the weight of Lp aboveground DM was higher by 10% when Dc proportion in the seeding rate was increased from 25 to 50% (because of suppressing of Dc in the initial stages), but if the proportion of Dc was higher (75%), the sowing rate of Lp was not high enough to replace Dc in the sward – the weight of LP aboveground phytomass was lower by 9% in comparison with the variant with 50% proportion of Dc in seeding mixture.

Also the weights of individual tillers of both components were interesting – in the third vegetation year the weight of 100 tillers of *L. perenne* was on average 0.69 g, the tillers of D. caespitosa were bigger (1.1g/100 tillers).

The maximum holding capacity of the area in the case of *L. perenne* seems to be approximately 38 thous. tillers per m^2 what was reached with its seeding rate 40 g.m^{-2}. The recommended seeding rates in monoculture are 35–45 g.m^{-2} (BEARD, 1973; TURGEON, 2002), 35–50 g.m^{-2} (PUHALLA *et al.,* 1999). Exceeding the recommended rates can cause a strong intraspecific competition and a high mortality of seedlings and young plants (SLAVÍKOVÁ, 1986; WILEY *et al*., 1969). SOBOTOVÁ *et al*. (2007) document the maximum holding capacity of area 33 thous. tillers per m^2 for a mixture of *Lolium perenne* and *Poa pratensis* (seeding rate 20–24 g.m^{-2}). Too high seeding rates are not economically efficient MADISON (1966), JÓNSDÓTTIROVÁ (1991), ORAL and ACIKGOZ (2001). In the experiments of these authors were found no significant differences after three months in leaf coverage, sward density and quality, when the seeding rates varied from 10–100 g.m^{-2} of seed mixture of *L. perenne*, *P. pratensis* and. *F. rubra*.

D. caespitosa established much better in the mixtures with *P. pratensis*. The total number of tillers of both components (Tab. III, Graf 1), with this botanical composition, was significantly influenced by year (p-value < 0.000), as well as, by Dc proportion in the seed mixture (p-value = 0.001). The interaction of these factors was not significant (p-value = 0.236).

In each year, the highest **total number of tillers** (Tab. III, Graf 3) was on the plots established with the mixture with 25% of Dc. The highest number of Dc tillers was found under all Dc proportions in seed mixtures in 2007. The total number of tillers under all variants (25, 50 and 75% Dc in seed mixture) was decreasing in time (until the third vegetation year by 7–19%); in the third year 40, 37.7 and 38.3 thous. tillers per m^2 were found under particular variants (Dc seed proportions). In the third year, the total number of tillers was lower by 6% when Dc proportion in seed mixture was increased from 25 to 50%, the difference between the total numbers of tillers on the variants with 50 and 75% Dc in seed mixture was only 1.5%.

The number of Dc tillers in mixtures with Pp was significantly influenced by years (p-value < 0.000) (the highest in the first year) and by its proportion in seed mixtures (p-value < 0.000). The interaction of both factors was not significant (p-value = 0.056). The general trend of Dc tillers number during the experiment was decreasing; in the third year there were 4.3, 8.9 and 15.0 thousands of Dc tillers per m^2 (under 25, 50 and 75% of Dc in seed mixture) – it was less by 72, 62 and 59% in comparison with the first year – a negative correlation with Dc proportion in seed mixture. In the third vegetation year, an increased Dc proportion in seed mixture (from 25% to 50%) caused an increased number of its tillers by 108% (by 68% if Dc proportion in seed mixture was increased from 50% to 75).

The proportion of Dc tillers (Table III, Graph 1) in the total number of tillers in individual years was higher with its increased proportion in seed mixture. The general trend of Dc tillers proportion, from the first to the third year, was decreasing (in the same way like the total number of tillers in the swards) from 30% to 11% under 25% of Dc in seed mixture, from 58% to 24% under 50% of Dc in seed mixture and from 85% to 39% under 75% Dc in the seed mixture.

The number of *P. pratensis* tillers (Table III, Graph 2) in mixtures with D. caespitosa was significantly influenced by year (p-value < 0.000), Dc proportion in the seed mixture (p-value < 0.000) and by the interaction of both the factors (p-value = 0.008). In each year, the number of Pp tillers was lower with increasing Dc proportion in the seed mixture (significant differences in the years 2007 and 2008). Evaluating the effect of years, the lowest number of Pp tillers was in the first year regardless the variant. In the third year, there was 35.7 thous. of Pp tillers per m^2 (25% Dc in seed mixture), 28.8 thous. and 23.3 thous. tillers per m^2 (Dc proportion in seed mixture 50 and 75%); which means by 4, 70 and 260% more comparing it to the first year. When the proportion of Dc in seed mixture was increased by 25% the proportion of Pp tillers in the sward was lower by 19% in the third year.

The total aboveground DM weight of both the components (Table III, Graph 3) was significantly influenced by years (p-value < 0.000), Dc proportion in seed mixture (p-value = 0.003), as well as by the interaction of both the factors (p-value = 0.031). The highest weight of total aboveground DM was in 2009 regardless Dc proportion in the seed mixture (significant under 75% Dc in seed mixture), the lowest in 2007 (significant with 50 and 75% Dc in the

seed mixture). In the third vegetation year the total weight of aboveground DM was 351 g.m^{-2} (25% Dc in seed mixture), 338 and 358 g/m^2 under 50 and 75% Dc in the seed mixture, whereas, comparing with the first year, it increased by 19, 63 and 77%. The weight of total aboveground DM in individual years was lower when Dc proportion in seed mixture was higher (25–75%) in the first and second year, but the differences were not significant.

The **weight of aboveground DM of *D. caespitosa*** in the swards with *P. pratensis* (Tab. III, Graph 1) was significantly influenced by years (p-value = 0.009), Dc proportion in seed mixture (p-value < 0.000), as well as, by the interaction of both the factors (p-value < 0.000). The highest average weight of Dc aboveground DM was in the first year regardless its proportion in the seed mixture. In the third year of vegetation the weight of Dc aboveground DM was 29, 68 and 127 g.m^{-2} (Dc proportion 25, 50 and 75%), which decreased by 54%, 30% and 19% in comparison with the first year. The results show that the weight of Dc aboveground DM decreased the more the lower proportion of its seed was in the seed mixture. *D. caespitosa* in monoculture produced on average by 122% more DM comparing it with the mixture with 75% Dc. In the third year, the weight of Dc aboveground DM was 2.3 times higher when its proportion in the seed mixture was increased from 25% to 50% and by 86% when its proportion in the seed mixture was increased from 50% to 75%. In all the years the weight of Dc aboveground phytomass was higher under its higher proportion in the seed mixture, the differences were significant with average values from three years of vegetation.

The proportion of Dc aboveground phytomass in the total DM was higher under its higher proportion in the seed mixture, but during the time it decreased approximately to a half from the first to the third year in individual variants (Dc proportions in seed mixtures). It shows that the proportion of Dc aboveground phytomass decreased with increasing total aboveground phytomass.

The weight of the aboveground DM of *P. pratensis* (Tab. III, Graph 2) was significantly influenced by years (p-value < 0.000), Dc. proportion in seed mixtures (p-value < 0.000) and by the interaction of both the factors (p-value = 0.029). The general trend of the weight Pp aboveground DM was increasing during the vegetation years. In the third year there were 322, 270 and 231 g.m^{-2} aboveground DM of *P. pratensis* (25, 50 and 75% Dc in seed mixtures) – it increased by 38% in the mixture with 25% of Dc in the seed mixture and nearly 2.5 times or 5 times in the variants with 50% and 75% of Dc in seed mixture.

An increased proportion of Dc in the seed mixture from 25% to 50% caused a lower proportion of Pp DM by 16% and by 14% (when Dc proportion in seed mixture was increased from 50 to 75%) in the third year of vegetation. Similar trend was found in the first and the second year.

The reason of a higher proportion of Dc at the beginning of the experiment could be caused by a slower development of *P. pratensis* and therefore by a relatively moderate competitive environment. According to our previous laboratory experiments (MARTINEK *et al*., 2009) this effect is noticeable already in the phase of germination – the mean germination time of *P. pratensis* was more than five days longer in comparison with *D. caespitosa*. As well as *D. caespitosa* has an advantage in comparison with *P. pratensis* during emerging, because its emergence capacity was significantly higher (by up to 18%) when sown deeper. It has also a shorter mean emergence time (MARTINEK *et al*., 2008) and it develops more rapidly. Our greenhouse experiments showed that *D. caespitosa* produced 6 times more tillers in the first stages of development than *P. pratensis* (but the weight of one its tiller was 3 times lower than with *P. pratensis*). It produced during first 3 months twice more DM (above and belowground) in comparison with *P. pratensis* (SVOBODOVÁ *et al*., 2010).

The mentioned results show that *P. pratensis* allows a better development to *D. caespitosa* in the early stages after the sward establishing; however, it starts to be more competitive in the end of the first vegetation year or in the second year (according its proportion in the mixture). The increased competitive ability of *P. pratensis* in the third year could be also caused by its bigger tillers (0.94 g per 100 tillers) in comparison with *D. caespitosa* (0.75 g per 100 tillers). An increasing competition of *P. pratensis* in mixtures with *L. perenne* (even with the proportion 10% of *P. pratensis* in the seed mixture) after four year of vegetation was found SOBOTOVÁ *et al*. (2006). FUSTEC *et al.* (2005) describes similar results.

CONCLUSIONS

The results showed that *Deschampsia caespitosa* is able to compete and to be a good component of lawn swards with *Poa pratensis* in proportion of 75% of viable seed (30 thous. per m^2) in total seeding rate 40 thous. per m^2 (approx. 10 g.m^{-2}). A higher proportion of *Deschampsia caespitosa* in mixture with *Lolium perenne* did not result well in this experiment because the sowing rate of *L. perenne* was too high in all the variants.

II: *Number of tillers (pcs.m^{-2}) and weight of aboveground dry phytomass (g.m^{-2}) of D. caespitosa (Dc) and L. perenne (Lp)*

Proportion of Dc in seeding rate (%)	Year	Number of tillers (pcs.m^{-2})				Weight of aboveground DM (g.m^{-2})			
		Dc	Lp	Total	% Dc	Dc	Lp	Total	% Dc
25	2007	156	41 797	41 953	0.4	0.6	253	254	0.2
	2008	42	34 119	34 161	0.1	0.1	234	234	0.1
	2009	226	38 457	38 683	0.6	2.6	248	250	1.0
50	2007	368	39 108	39 476	0.9	1,0	255	256	0.4
	2008	11	37 749	37 760	0.0	0,1	244	244	0.0
	2009	0	38 301	38 301	0.0	0	273	273	0.0
75	2007	1 217	35 116	36 334	3.4	3.1	260	263	1.2
	2008	127	35 541	35 669	0.4	0.4	253	253	0.1
	2009	439	33 687	34 126	1.3	3.6	249	252	1.4
100	2007	45 463	-	45 463	100	233	-	233	100
	2008	31 889	-	31 889	100	291	-	291	100
	2009	30 262	-	30 262	100	318	-	318	100
Average	25	141	38 124	38 266		1.6	245	246	
	50	126	38 386	38 512		0.2	257	258	
	75	594	34 781	35 376		2.1	254	256	
	100	35 871		35 871		281		281	
Average	2007	11 801	38 674	40 807		60	256	252	11 801
	2008	8 017	35 803	34 870		73	244	256	8 017
	2009	7 732	36 815	35 343		81	257	273	7 732
p-value									
Year		-	0.155	0.000	-	-	0.643	0.150	-
Proportion of Dc in seeding rate		-	0.042	0.087	-	-	0.709	0.089	-
Interaction		-	0.215	0.004	-	-	0.899	0.091	-
Dmin.									
Year		-	4 292	3 663	-	-	46	33	-
Proportion of Dc in seeding rate		-	4 293	4 230	-	-	47	38	-
Interaction		-	7 436	7 328	-	-	81	67	-

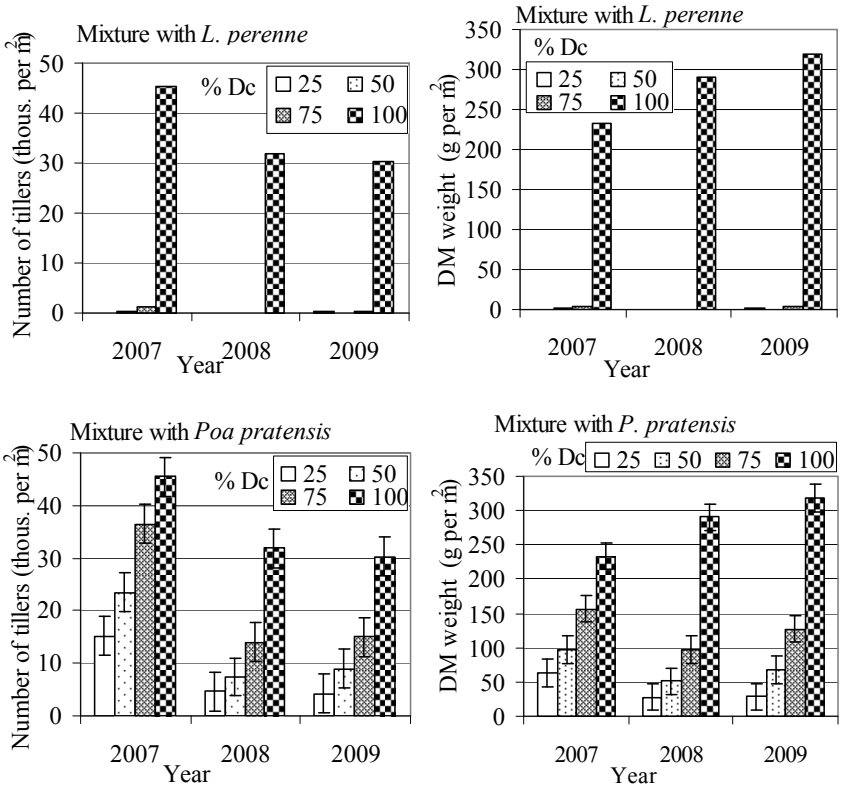
III: *Number of tillers (pcs.m^{-2}) and weight of aboveground dry phytomass (g.m^{-2}) of D. caespitosa and P. pratensis*

Proportion of Dc in seeding rate (%)	Year	Number of tillers (pcs. m^{-2})				Weight of aboveground phytomass (g.m^{-2})			
		Dc	Pp	Total	% Mt	Dc	Pp	Total	% Dc
25	2007	15 117	34 380	49 497	30,5	63	233	296	21,4
	2008	4 628	39 288	43 917	10,5	28	301	328	8,4
	2009	4 275	35 725	40 000	10,7	29	322	351	8,3
50	2007	23 425	16 999	40 424	57,9	97	110	207	46,9
	2008	7 378	32 611	39 989	18,4	51	262	314	16,4
	2009	8 903	28 804	37 707	23,6	68	270	338	20,0
75	2007	36 489	6 454	42 944	85,0	156	45	202	77,5
	2008	14 023	23 599	37 622	37,3	97	193	290	33,5
	2009	15 046	23 255	38 301	39,3	127	231	358	35,5
100	2007	45 463	-	45 463	100	233	-	233	100
	2008	31 889	-	31 889	100	291	-	291	100
	2009	30 262	-	30 262	100	318	-	318	100
Average	25	8 007	36 464	44 471		40	285	325	
	50	13 235	26 138	39 373		72	214	286	
	75	21 853	17 769	39 622		127	156	283	
	100	35 871		35 871		281		281	
Average	2007	30 124	19 278	44 582		137	129	235	30 124
	2008	14 480	31 833	38 354		117	252	306	14 480
	2009	14 622	29 261	36 568		136	274	341	14 622
p-value									
Year		0.000	0.000	0.000	-	0.009	0.000	0.000	-
Proportion of Dc in seeding rate		0.000	0.000	0.001	-	0.000	0.000	0.003	-
Interaction		0.056	0.008	0.426	-	0.000	0.029	0.031	-
D-min									
Year		3 675	4 486	4 119	-	19	37	29	-
Proportion of Dc in seeding rate		4 243	4 487	4 756	-	22	36	34	-
Interaction		7 349	7 769	8 238	-	39	63	59	-

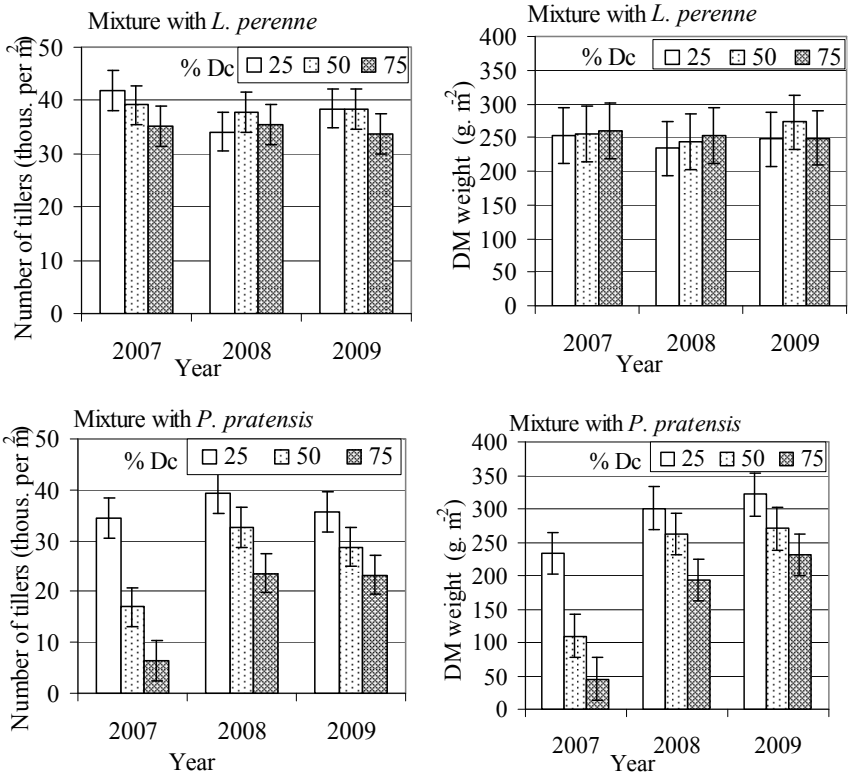
IV: *Total precipitation (mm) and average temperature (°C) during the experiment and a long term average (1961–1990)*

Month	Total precipitation (mm)				Average temperature (°C)			
	Average*	2007	2008	2009	Average*	2007	2008	2009
1	33.9	42.6	32.4	9.3	–3.3	2.2	0.4	–4.7
2	34.0	29.2	20.2	45.7	–1.7	2.1	1.9	–2.2
3	38.5	44.8	56.8	67.3	1.9	4.7	2.2	2.1
4	49.4	5.1	39.5	45.4	6.5	10.7	7.2	12.2
5	77.0	71.4	44.7	101.0	11.4	13.6	13.3	12.6
6	86.8	62.8	51.0	71.8	14.5	17.3	16.4	13.7
7	81.5	96.0	63.1	112.6	16.2	17.5	17.1	16.6
8	75.5	83.2	69.8	38.8	15.9	16.9	16.9	18.3
9	51.7	116.4	21.7		12.4	10.6	11.4	
10	41.7	32.1	26.8		7.4	6.7	7.8	
11	42.6	48.2	38.2		1.8	0.3	3.6	
12	36.0	23.0	28.7		–1.6	–1.7	–0.5	

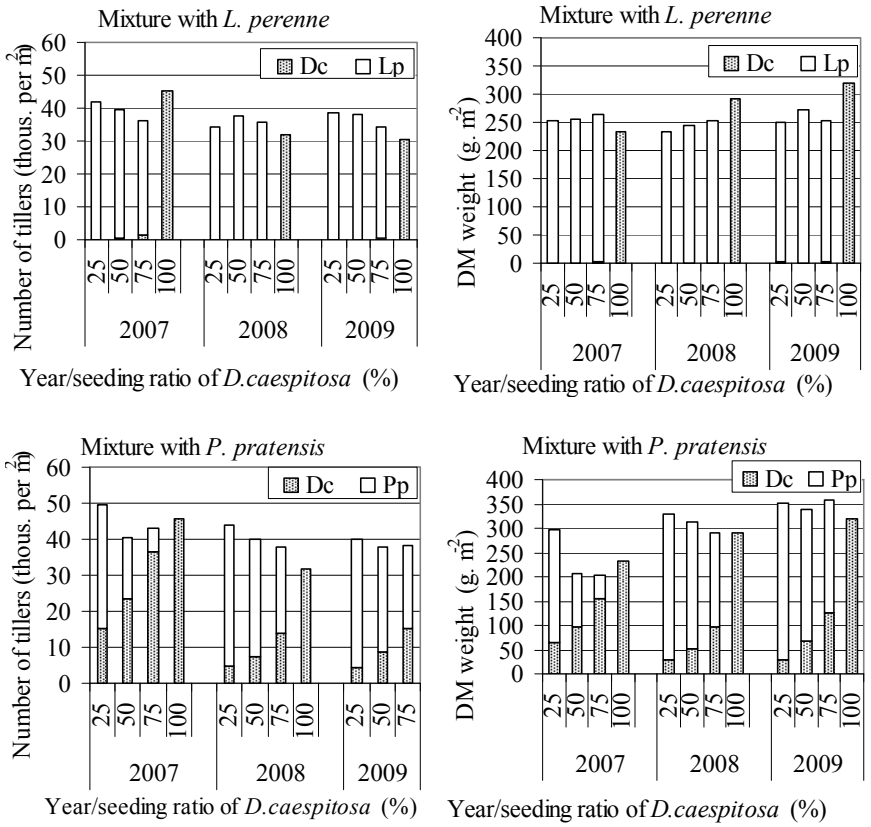
* long term average 1961–1990



1: *Number of tillers (thous. pcs.m^{-2}) and aboveground DM weight (g.m^{-2}) of D. caespitosa ($D_{min.}$ for interaction of years and variants of D. caespitosa proportion in the seed mixture)*



2: *Number of tillers (thous. pcs. m^{-2}) and aboveground DM weight (g.m^{-2}) of accompanying species ($D_{min.}$ for interaction of years and variants of D. caespitosa proportion in the seed mixture)*



3: *Total number of tillers (thous. pcs. m^{-2}) and total aboveground DM weight (g.m^{-2})*

SUMMARY

The aim of the field experiment (four replications) at the Plant breeding station Větrov of Oseva UNI Choceň a. s., Czech Republic (620 m a. s. l., average year temperature 6.9 °C, average year precipitation 642 mm) was to evaluate the changes in stand composition of *D. caespitosa* cv. 'Kometa' in mixtures with *Poa pratensis* L. cv. 'Harmonie' and *Lolium perenne* L. cv. 'Filip' during three years of vegetation. The sowing rate was always 40 thous. viable seeds per m^2. The proportion of *D. caespitosa* in the mixtures was 25%, 50% or 75% of the total number of seeds, a monoculture was established too. The sward was mown to 3 cm. Numbers of tillers and weight of aboveground dry mass were evaluated during 3 years (10 times sampling). The data were processed by analysis of variance Anova (LSD $P \leq 0.05$) by the Statgraphics programme, version XV.

D. caespitosa was not able to compete with *L. perenne*. The number of its tillers during the experiment ranged up to 3% of total number of tillers of the sward; the weight of aboveground DM was maximally 1.5% of the total aboveground phytomass. *D. caespitosa* was suppressed already in the initial stages of its development, which means during two month after seeding.

D. caespitosa established much better in the mixtures with *P. pratensis*. The total number of both components and the weight of aboveground dry mass was significantly influenced by the year (p-value < 0.000–0.009), by *D. caespitosa* proportion in the seed mixture (p-value = 0.001–0.003) and by the interaction of these factors (p-value = 0.000–0.056). It developed more rapidly in the first year in comparison with *P. pratensis* and reached 31–85% of total amount of tillers in positive correlation to its proportion in the seed mixture. Later on, the competition capacity of *P. pratensis* increased and *D. caespitosa* tillers proportion in the sward was 11–39% in the third year. The trend of the weight of its aboveground dry mass was similar – 21–78% in the first year and 8–36% in the third year in a positive correlation with its proportion in the seed mixture. The decrease of *D. caespitosa* proportion in the sward was in a correlation with the total number of tillers and total weight of aboveground phytomass of the swards. The tillers of *D. caespitosa* and *P. pratensis* were bigger in the later years (from 0.42 to 0.7–0.8 g/100 tillers of *D. caespitosa* and from 0.7 to 0.95 g/100 tillers of *P. pratensis*).

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