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The results of breeding perennial grasses: the evaluation of developed *Dactylis glomerata* hybrids

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Introduction

Perennial grasses are high yielding, pest resistant and less demanding in terms of soil (Peeters, 2008), they are the most important source of roughage. Each species has certain valuable features that make it unique among others and which are desirable to be highlighted for ensuring high productivity, good forage quality, plasticity, strength of various stress conditions, as well as winter hardiness, which is particularly important characteristic of northern latitudes. It is the main task of breeders, as far as possible to combine all the aforesaid properties into one breed. In order to create such a universal variety the breeders of perennial grasses carry out hybridisation outside the borders of one species. At present the work with *Festulolium* hybrids is important in order to combine the modesty, hardiness and perennity of fescue with high forage quality characteristic of ryegrass in one variety.

At the Latvia University of Agriculture Research Institute of Agriculture (LLU RIA) in Skriveri the breeding work of perennial grasses has been performed for a long time and during the period of 35 years several varieties of species widely used in forage production have been created, including *Phleum pratense, Lolium perenne, Festuca pratensis,* and *Festulolium* hybrids.

Currently, two directions are topical: the creation of an interspecific hybrids;and the hybridisation and selection of cocksfoot (*Dactylis glomerata*) in order to create a highly productive variety with better palatability and forage quality.

Cocksfoot starts growth early in spring and develops rapidly. It is tolerant enough of shade, drought, and heat (Santen and Sleper, 1996), and can be grown in poor and shallow soils. At high rates of nitrogen, it is among the most productive of the cool-season grasses (Lacefield *et al*., 2003). However, its palatability and digestibility should be improved (Dijk, 1959). The main shortcoming of cocksfoot is its low palatability caused by harshness of the leaves through the presence of silicified dentations. The task of cocksfoot breeders is to create varieties with soft leaves better palatability at the same time maintaining the yield potential of the most productive cultivars. The aim of our studies was to select cocksfoot breeds with softer leaves and determine among them the most productive ones with good forage quality.

Materials and Methods

The breeding work of perennial grasses is carried out at the central part of Latvia (56°37 N and 25°07 E). In order to assess the perspective numbers (breeds) of cocksfoot 18 cultivars and breeds were included in a randomized block design with three replications, seeding rate of 15 kg ha^{-1}. The trial was established in 2011 without cover crop in a sod-podzolic loam soil, pH KCl 5.3, plant available $P_2O_5$167 mg kg^{-1}, K_2O 88.0 mg kg^{-1}, OM content 2.7 g kg^{-1}. After the last cutting in the years of sward use and before sowing NPK (15:30:75), and N 60 three times per year in early spring just after the beginning of vegetation and after the 1st and 2nd cut were used. The 1st cut at the ear emergence; the aftermaths (2nd and 3rd cut) at an average of 30-40 days after the last mowing were done. The softness of cocksfoot leaves was estimated by touch. The forage quality was determined: crude protein from N (Kjeldal method) and digestibility from ADF (gravimetrical method) were calculated; NEL - gravimetrical method and calculation.

Significance of the differences ($P < 0.05$) among the cultivars and breeding numbers was detected by data processing with Microsoft Excel program data subprogram using mathematical and statistical functions.

Results and Discussion

The breeding work resulted in the creation of five perspective breeds with softer leaves. The data of productivity and forage quality of these breeds in the background of cocksfoot varieties widely used in Latvia are summarized in this article. From our experience confirmed by studies carried out elsewhere it is known that leaves softness and forage quality

commonly have negative correlation with dry matter yield (DMY) of cocksfoot. Therefore all efforts should be taken to establish a productive cultivar with soft leaves.

On average in the three years of use the DMY of selected cocksfoot breeds ranged from 7.38 to 9.32 t ha^{-1} (Table 1). The most productive of them (Jum/573 and 11/12/SL) outperformed standard 'Priekulu 30' which is one of the most high-yielding varieties of cocksfoot in Latvia conditions. Unfortunately, it has sharp leaves, which adversely affects palatability; therefore much work is going on to a new form of creation, which would succeed to combine the productivity and leaf softness properties.

Table 1: Dry matter yield of *Dactylis glomerata* cultivars (2012-2014)

Cultivar/ Breed	On average in the 2nd and 3rd year of use, t ha^{-1}		Total of two mowings, t ha^{-1}		Aftermath yield, %	On average, t ha^{-1} (2012-2014)
	1st cut	2nd cut	2nd year of use	3rd year of use		
Priekuļu 30 (a)	$3,47^{BDEF}$	2,13	$5,86^{D}$	$5,34^{B}$	57	$8,16^{BFg}$
Amba (b)	$2,83^{acgh}$	$1,90^{g}$	5,62	$3,82^{acgh}$	62	$7,42^{acgh}$
Aukštole (c)	$3,54^{BDEF}$	$2,06^{g}$	$6,20^{DF}$	$5,00^{B}$	58	$7,95^{Bg}$
D/570 (d)	$2,57^{acgh}$	2.18	$4,86^{acgh}$	$4,64^{g}$	68	$7,66^{g}$
Con/519 (e)	$2,91^{acgh}$	2,30	5,72	$4,70^{g}$	65	$7,97^{g}$
444/518 (f)	$2,87^{acgh}$	$2,00^{g}$	$5,08^{cgh}$	$4,66^{g}$	61	$7,38^{agh}$
Jum/573 (g)	$3,56^{BDEF}$	$2,58^{BCF}$	$6,52^{DF}$	$5,76^{BDEF}$	62	$9,32^{ABCDEFH}$
11/12/SL (h)	$3,50^{BDEF}$	2,14	$6,08^{DF}$	$5,2^{B}$	57	$8,30^{BFg}$
$LSD_{0.05}$	0,48	0,48	0,96	0,96		0,62

Cocksfoot, unlike many other grasses has good regrowth capacity; the total yield is equally distributed over the year (Dijk, 1959). If soil fertility is low, a large proportion of the total production of orchardgrass occurs in spring, whereas with proper fertility and split applications of nitrogen, aftermath production may contribute from 35% to 55% of total production (Lacefield *et al.,* 2003). Our trial results show that aftermath yield (total of the 2nd and 3rd mowing) ranged from 57 to 68 % (Table 1).

Table 2: The forage quality of cocksfoot swards

Cultivar	**Crude protein, %**				**Digestibility, %**			
	the 1^{st} cut	the 2^{nd} cut	the 2^{nd} year of use	the 3^{rd} year of use	the 1^{st} cut	the 2^{nd} cut	the 2^{nd} year of use	the 3^{rd} year of use
Priekuļu 30 (a)	16.16	16.13	15.06	17.22H	62.88	63.75	63.26	63.38
Amba (b)	14.19c	18.34^{CDGH}	15.22	17.31H	61.61	63.94	61.45	64.1
Aukštole (c)	16.47B	15.00b	15.34	16.13	61.17	64.1	61.55	63.72
D/570 (d)	15.78	15.97b	15.25	16.5	62.32	64.91	62.24	64.99
Con/519 (e)	14.78	16.03	14.06	16.75	61.81	63.83	61.48	64.16
444/518 (f)	15.46	16.6	15.25	16.81	61.59	64.46	62.01	64.05
Jum/573 (g)	14.22	15.72b	13.91	16.03	62.03	64.51	63.11	63.43
11/12/SL (h)	14.88	15.22b	15.41	14.69ab	61.46	64.74	62.32	63.89
$LSD_{0.05}$	2.27	2.27	2.27	2.27	2.24	2.24		2.24

Crude protein (CP) content in general was satisfactory, it ranged within 14.22 – 16.47 % for the 1st cut and 15.22 – 18.34 % for 2nd cut (Table 2), where CP content in general tend to be higher, although it varies by breeds, suggesting that the CP depends on the variety development stage and and the quantity of leaves in the mixture.

DM digestibility for all swards can be valued as good, it was above 60 % (61.17 - 64.99 %). Significant differences among breeds and cultivars in terms of protein content and DM digestibility were not found. For the highest quality hay, cocksfoot should be harvested in spring during late boot to early flowering stage. Beyond this stage, digestibility decreases at the rate of about ½ % per day (Lacefield *et al*., 2003). Dry matter yield, digestibility and NEL of cocksfoot were mostly influenced by mowing, while CP content – by the harvest year and variety.

Conclusion

Within three-year period breeding numbers Jum/573 and 11/12/SL stood out for softer leaves and higher average DMY level, which could be used in the further breeding work for creation of a new variety.

References

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