PERENNIAL RYE (*Secale cereanum*) BREEDING IN HUNGARY, AT UNIVERSITY OF DEBRECEN

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Abstract

In this paper we give account of our important perennial rye trials.

Perennial rye as a new culture crop has some problems which make more difficult the growth technology. The most important from these is that germination of seeds is compared to winter rye very few (50-70). We found correlation between the rev and the germination ability, but it wasn't any correlation between harvesting in one step and two steps.

In the Research Centre of Nyíregyháza we started a development of a new forage mixture with perennial rye and perennial papilionaceae (alfalfa, bird's-foot trefoil). The two plants with different fodder value in the mixture are complementary to each other from the point of view of dietetics; the mixture produce great mass fodder with digestible fiber and high quantity of crude protein. In second year perennial rye produced 30-35 t/ha green mass, but the mixed stand yielded 78-85 t/ha green mass. We didn't find relevant differences between total green yields or dry-matter products of mixed treatments, but the proportion of two components differed remarkably.

Key words: *Secale cereanum*, hybrid, Secale cereale, Secale montanum

INTRODUCTION

Perennial rye (*Secale cereanum*) is a stable hybrid of the winter rye (*Secale cereale L.*) and the perennial wild rye (*Secale montanum Guss*.). Crossings in the genus *Secale* were made already at the end of the XIX century to study crossability, relationship, influence on cytological parameters, etc. (Kotvics, 1963). Later the objectives of plant breeding (e.g. increasing the winter and drought resistance, developing resistance to biotic and abiotic factors, increasing the protein content) get more importance. Many researchers found it interesting to make a new perennial rye crop. The aim was to develop a hybrid, which all over its botanical importance unites the best qualities of winter rye and perennial rye in form of a perennial, highly productive, highly tolerant crop with good fodder value, which can be grown also on weak habitats. The hybrid was developed in several countries. Kotvics G. made the first plants in Hungary, which were useful for the plant breeding, in the 1950's (Kotvics, 1970.).

Kruppa J. developed the variety "Kriszta" from this material at the Research Centre of Nyíregyháza (University of Debrecen), which got the state allowance in 1998. Another perennial rye variety was created from the same origin in Hungary, at Research Institute in Kompolt. Diploid and tetraploid varieties were made in Germany from similar crossings (Reimann-Philipp, 1995).

Perennial rye is a new crop of the disadvantageous fields, and it has some problems of its growth technology: the germination of the seeds is often not good, about 50-70% (likely because of their form they are sensitive for trash), the spikes are often fragile, etc. These problems can be solved on the one hand through plant breeding, on the other hand through improvement the growth technology – and this latter way seems to be faster.

There aren't too much possibilities of utilization of weak acid sandy soils. In our opinion we can get from the same area on these soils more valuable fodder if we produce perennial rye mixed with perennial papilionaceae.

MATERIALS AND METHODS

Perennial rye variety of our experiments was 'Kriszta'. Owing to its high green productivity, low seed productivity and perennial type it is utilized as a green fodder, as grazing land or grass-land. This variety can be in culture 3-5 years, after this time the stand grows thinner and thinner, and get weedy. Its seed-production is about 500-1000 kg pro year. The plant is 150-180 cm high, thousand-kernel weight: 12-15 g

It can be sown with 3-3.5 million seeds in September and in the springtime in March, too. Its drought resistance is very good, this perennial crop adapts well to the disadvantageous soil and weather conditions, so it can be sown also on weak habitats, loose sandy soils. It covers the fields the whole year. Attributable to this, to the fast shooting and excellent stooling (the number of its shoots can reach the 100) perennial rye is instrumental in protecting the loose sandy soils from erosion and deflation – it fixes the surface of the land. Expectedly its role will extend in the game farming too, because it is exceedingly suitable to winter pasture: it can be grazed also in winter and it tillers fast early in spring.

In one of our experiments we analyzed the relationship between the germination and some harvest and thresh methods: we studied the effect of the set of threshing machine and combine (rev) on germination ability. We harvested perennial rye in two ways: one-step-harvesting and two-steps-harvesting (threshing one weak after mowing). Several standards were threshed by hand. The germination was carried out accordingly to the cereal standard.

In our other experiment we started the development of a new forage mixture with two components (lucerne (*Medicago sativa L.*) or bird's-foot trefoil (*Lotus corniculatus L.*) and perennial rye (*Secale cereanum*)). According to our previous experiments we established that for this mixture lucerne is suitable, bird's-foot trefoil is suppressed by perennial rye.

In a forage mix experiment we prepared 7 different mixes with perennial rye (variety Kriszta) and alfalfa (variety Klaudia) and we compared the mixtures with two standard treatments (perennial rye alone in 1,8 and 2,7 million plant per hectare doses). According to previous experiments, we choose perennial rye doses of 0.4, 0.7, 0.8, 1.4 million plant/ha, and 2.5, 3.2, 5.6 million alfalfa plant/ha. The small parcels of this experiment were sown on acid sandy soil (pH_{KCl}=4,35, KA=28, H%=0,78) in Kisvárda in March of 2002. We mowed the parcels four times a year and weighed the green and dry mass product. We compared the products of the components by mowing and the results of the mixed sowing and separately–rows sowing.

RESULTS

The results of germinating study are shown in Figure 1.

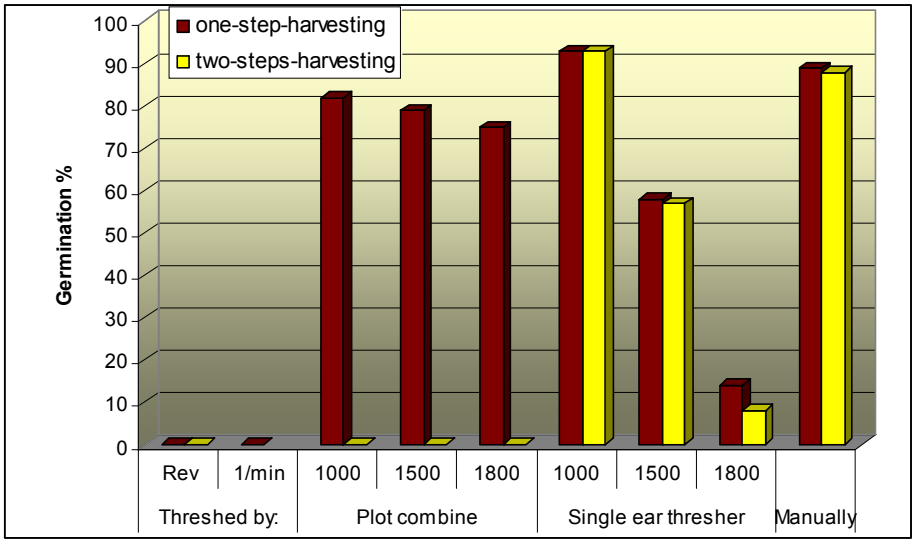

Figure 1. Effects of harvest methods on germination ability of perennial rye

In cases of either threshing methods we found correlation between the rev and the germination ability. By the plot combine threshing and also by the single ear thresher we found that the lowest rev eventuates the best results (82,3 and 92,5 %), which don't differ significantly from the control threshed by hand (89,0 %). The disadvantage of low rev is that after

threshing a lot of seeds stay in the ears. The difference between the two mechanical methods follows probably from the length of threshing-time: the ears stay much shorter in the threshing drum of plot combine than in the single ear thresher.

Between the one step and two steps harvesting methods on the score of germination we didn't find any significant differences.

In the forage mix experience the productivity was considerably low in the year of sow, the green yield suffice for grazing. From the second year the relation of perennial rye and papilionaceae changed as follows: in the first growth the perennial rye was presented by 40-60 % in the green mass, this value later decrease and the fourth growth we could harvest only alfalfa. Because of the frequent mowing technology (which adapts to alfalfa) the forage mix can utilize for three years, then the perennial rye get thinner. After this the area can utilized as alfalfa seed producer field. In second year perennial rye produced 30-35 t/ha green mass (6,8-7 t/ha/year dry mass), but the mixed stand yielded 78-85 t/ha green mass (15,7-16,5 t/ha/year dry mass – Table 1.).

Table 1

Yield in the second year of forage mix experiment, Kisvárda 2004

Treatments		Sowing method	Product of green yield t/ha			Product of dry-matter t/ha		
			P. rye	Alfalfa	Total	P. rye	Alfalfa	Total
1.	P. rye 1,8 Mp/ha		30,93	-	**30,93**	6,87	-	**6,87**
2.	P. rye 2,7 Mp/ha		33,42	-	**33,42**	7,07	-	**7,07**
3.	P. rye 1,4 + Alfalfa 3,2 Mp/ha	mixed	15,18	69,34	**84,52**	2,88	13,41	**16,30**
4.	P. rye 1,4 + Alfalfa 5.6 Mp/ha	mixed	17,42	64,28	**81,70**	3,31	12,73	**16,03**
5.	P. rye 0,7 + Alfalfa 3,2 Mp/ha	mixed	9,07	72,88	**81,95**	1,74	13,41	**15,15**
6.	P. rye 0,7 + Alfalfa 5,6 Mp/ha	mixed	11,25	72,88	**84,13**	2,04	14,02	**16,07**
7.	P. rye 0,4 + Alfalfa 3,2 Mp/ha	mixed	11,10	73,57	**84,67**	2,16	14,20	**16,36**
8.	P. rye 0,4 + Alfalfa 5,6 Mp/ha	mixed	8,00	78,90	**86,90**	1,57	14,95	**16,52**
9.	P. rye 0,8 + Alfalfa 2,5 Mp/ha	Separate-ly rows	21,99	56,78	**78,77**	4,45	11,30	**15,74**

We didn't find relevant differences between total green yield or dry-matter products of mixed treatments, but the proportion of two components

differed remarkably (product of perennial rye was 17,96 % in the 3. treatment and 9,2 % in the 8. treatment).

Our experiment proved that perennial rye is adapted to mixing with alfalfa. The new forage mixture is able to produce considerable green yield from the second year either on acid sandy soil. The two forage crop gave more yield in the experiment when they mixed than they sowed in separately rows (which is hardly can be implemented in the practice).

DISCUSSIONS

To bring this new plant species into use it's essential to solve the problem of seed-production. The primary method of this could be the right set of thrashing parameters of combine-harvester.

Perennial rye can play a role in forage-mixture, mixed with perennial papilionaceae. The new forage mixture has the follow environmental and economic advantages:

- The two plants with different fodder value in the mixture are complementary to each other from the point of view of dietetics; the mixture produce great mass fodder with digestible fiber and high quantity of crude protein.
- Because of the lack of fodder on pastures in summer it is necessary to eat hay or apply additional feeding at this time. The mixture with perennial rye can produce pasturable green mass from spring to autumn.
- If the mixture is utilized by grazing, the surplus of green yield in spring and autumn can be utilized by making hay or silage, which can make use of feeding in winter.
- The influence of this new mixture from papilionaceae and gramineae is advantageous for the soil. Alfalfa has deep taproot, that reduces the compactness of soil and it can collect nitrogen from the air. The fibrous root system of perennial rye contributes to development of favorable structure of surface soil.
- It is advantageous from the point of water balance of soil, that perennial rye and alfalfa utilize the water from different bed owing to they different root-system and they don't enter into competition with each other.
- The forage mixture can profitably be utilized for three-five years, it depends on the soil and intensity of utilization, so the expense of planting is divided among some years and the maintenance cost is low.
- This mixture can play great part in soil protective agriculture, because the perennial culture overgrow the surface of the soil during the whole year and it affords possibility of ecological farming.

- The new forage crop association makes the sustainable farming possible for a long time, which is given financial assistance by the European Union (Sipos 2006/B).

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