

Improvement of persistence in perennial ryegrass (*Lolium perenne* L.) under the specific environmental conditions of Bavaria as an example of an integrated concept at the Bavarian Research Center for Agronomy

Stephan Hartmann, Bavarian Research Center for Agronomy, Freising

Abstract

The Efforts of the Bavarian Research Center for Agronomy to improve persistence in perennial ryegrass (*Lolium perenne* L.) under the specific environmental conditions of Bavaria are presented as an example how complex problems are solved in an integrated concept at this institution.

Introduction

Perennial ryegrass (*Lolium perenne* L.) is one of most important forage grasses in the temperate zone (RIEDER 1983, HOFFMANN, 1985). Well adapted varieties are of great importance for the sustainable and economically efficient use of major parts of grassland in Bavaria [SCHELLER 1993, SCHELLER 1995, RIEDER 1999]. Persistence is a complex character implying the ability to survive all the interacting factors of a specific environment [THOMSON and WRIGHT 1971]. In Bavaria persistence means in most cases excellent winter hardiness. About 1.200 t of seed for grassland are sold per year in Bavaria. About a third of the mixtures contains a higher portion of perennial ryegrass. To meet the rising requirements for dairy nutrition, the market for these mixtures will increase.

Strategy mix of the Bavarian Research Center for Agronomy to solve the problem

Facing the trend presented above, the Bavarian Research Center for Agronomy (LBP) developed a concept depending on three parts:

1. Short term approach
Ranking all cultivars currently available on the market according to their results in our tests of persistence under the specific environmental conditions in Bavaria
2. Medium-term approach
A special breeding program at the Bavarian Research Center for Agronomy in order to close the gap from varieties with sufficient persistence in the Bavarian environment, in the spectrum available on the market.
3. Long-term approach
Our contribution to get a more detailed description of the complex feature persistence.

Short term approach: Ranking all cultivars currently available on the market

Already 25 years ago the LBP started testing every variety in the German National List of plant varieties for persistence. To get a result in an acceptable time, the trials were realized in rough climate regions of Bavaria. Therefore already after four winters we can present reliable results for ranking cultivars. These results are published by presentations in the field, mass printings and the internet (<http://www.stmlf.bayern.de/lbp/info/psa/gras/index.html>).

The difference in persistence between all listed and recommended cultivars increased between 1983 and 1999 as shown in figure 1 (even though, only varieties passed through the trials and also available on the market are recommended). The percentage of seed mixtures containing only recommended varieties has increased to about 50% of the Bavarian market.

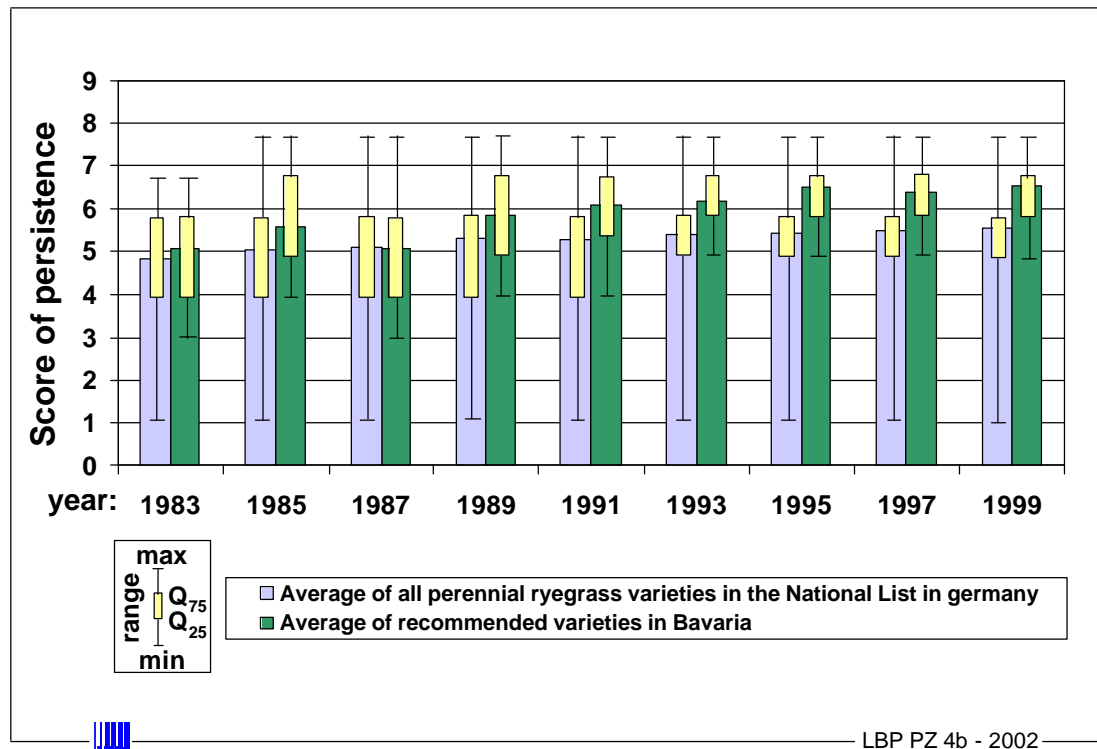


Figure 1: Difference in persistence between all listed and recommended varieties between 1983 and 1999 in Bavaria

Medium-term approach: Special breeding program at the Bavarian Research Center for Agronomy

Considering the current situation on the market of forage-seed [ANGENENDT 2000], it can be expected that also in the future only a few commercial efforts will be taken to breed for cultivars that are specifically adapted to the Bavarian environment.

The second part of the concept consists of our own breeding program at the Bavarian Research Center for Agronomy (relying on Bavarian ecotypes) in order to close this gap in our spectrum of available cultivars. First registered varieties out of our breeding program clearly show the genetic potential of persistence of varieties adapted to this region as shown in figure 2.

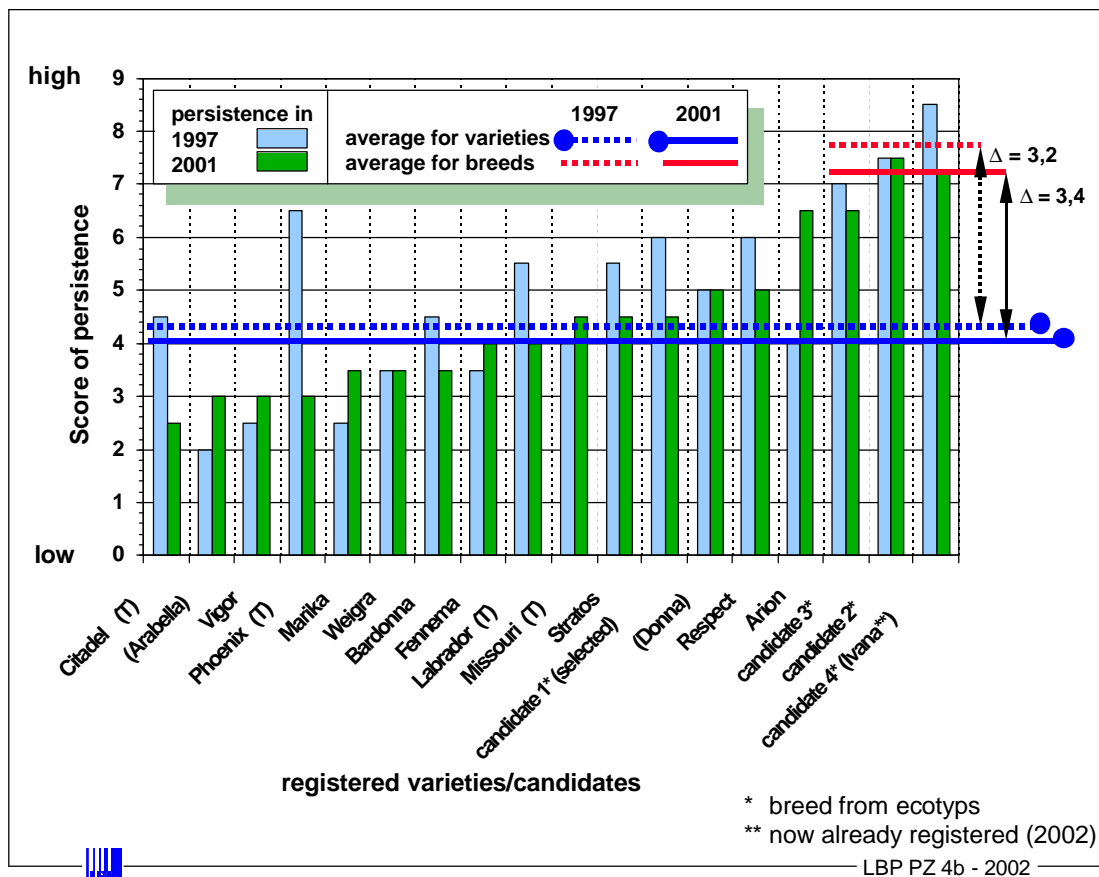


Figure 2: Persistence score of varieties and candidates after three (1997) and seven years (2001); (trials started 1994 in Hötzelndorf and Buchen am Auerberg)

Long-term approach: Improving the efficiency of breeding by a better description and understanding of the complex feature “persistence”

The third part of our concept is focused on the development of a detailed description of the complex feature “persistence”. In addition, the methods of selection should be improved in order to increase the efficiency of breeding for persistence as a consequence. To improve efficiency of breeding for persistence it is necessary to estimate the relevance of its components. As example for our work in this part, some actual results are presented (figure 3).

In autumn 1998 individual plants were taken from variety persistence trials 7 winters after seeding. Plants from seeds of these varieties were also grown for comparison. Both were cloned and planted in identical arrangements in Pulling and Kempten/Spitalhof.

Populations of 15 varieties could be evaluated. The comparison of populations before and after natural selection shows the influence of natural selection.

For example, our studies revealed no effect of rust resistance and day of heading on persistence in the higher regions of Bavaria.

In the long run this will lead to significant changes in our new breeding programs and in the recommendation of cultivars for this area.

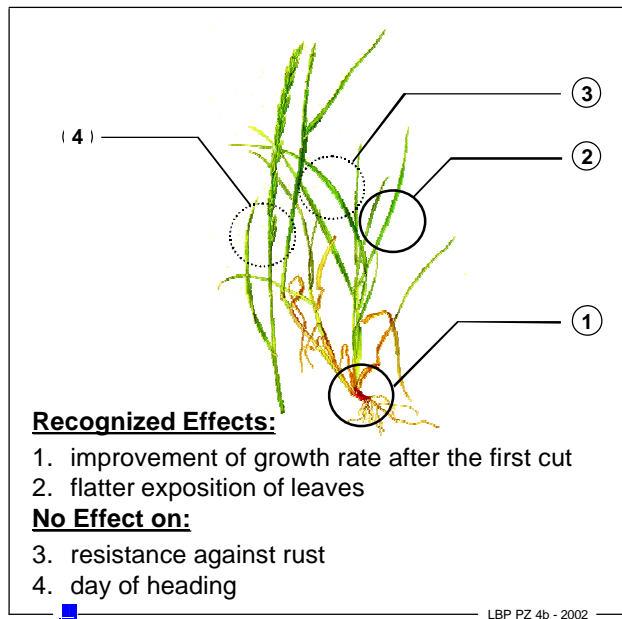


Figure 3: Effects of natural selection in higher regions of Bavaria on other features in perennial ryegrass

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