Participatory development of a forage grass cultivar

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Introduction Perennial forage grasses exist in both nature and agriculture as a highly heterogeneous mixture of genotypes. Extreme environments, fluctuating environments, and severe managements can impose selection pressures that will result in loss of unadapted genotypes. Mortality of unadapted genotypes leads to dominance of fewer highly adapted genotypes which may be useful as superior germplasm in other similar environments.

Materials and methods Parents of 'Spring Green' festulolium were selected as survivors from old research plots in mixture with lucerne (*Medicago sativa* L.) and from an old pasture near Spring Green, WI. Plants were sent to Oregon where they were selected for resistance to rust (*Puccinia graminis* Pers.) and seed was produced for testing and cultivar multiplication. Individual plants of Spring Green, Tandem, and Kemal festulolium were tested for freezing tolerance in a growth chamber for 3 d at -11°C after a 35-d hardening period. Survival of individual plants and individual tillers within surviving plants was counted after 30 d of recovery in the glasshouse. The three cultivars were planted in field trials in 1997 at 14 locations ranging from the northcentral to the eastern USA. Forage yield and survival were determined in 1998 and 1999.

Results Spring Green had higher plant and tiller survival compared to both of its parents in the freezing test (Table 1). This improved cold tolerance led to greater survival under field conditions with the improvement being more pronounced for locations that had the harshest winter conditions. Forage yield Spring Green over two years was also higher than Kemal festulolium, which made up 50% of the pedigree of Spring Green.

Table 1 Mean performance of Spring Green festulolium relative to its two commercial parent cultivars. Data adapted from Casler *et al*. (2002)

Cultivar	Plant survival at -11°C %	Tiller survival at -11°C %	Forage yield t/ha	Survival at all locations# %	Survival at six locations# %
Spring Green	56	48	3.91	65	52
Tandem	33	41	3.98	56	37
Kemal	3	25	3.74	61	43
LSD (0.01)	19	15	0.10	3	4

Survival was measured at 14 field locations. Six of these locations were classified in USDA hardiness zones 2 to 5, with the most severe winter conditions

Discussion and conclusions Natural selection of surviving festulolium plants under harsh field conditions resulted in progeny populations with improved freezing tolerance compared to their parents. This improved freezing tolerance translated into improved survival under field conditions, most noticeably at the locations with the coldest winter temperatures. Thus, there is considerable natural variability for freezing tolerance within festulolium germplasm and this variation can be used to make genetic improvements that can be captured under realistic field conditions. Spring Green festulolium represents a relatively new paradigm in the development of forage grass cultivars for the USA, the direct involvement of a forage producer throughout the development and marketing phases of the process. Peter Pitts was largely responsible for identification of one of the more important selection plots, for obtaining grant funding to conduct much of this research, and for identifying commercial markets for the new cultivar. Over 500,000 kg of seed have been sold during the past five years, making this a highly successful cultivar. Over 100,000 kg of certified organic seed was produced in 2004.

Reference

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