

References

- Yu, M.H. 1997. Registration of Mi-1 root-knot nematode resistant beet germplasm line. *Crop Sci.* 37:295.
- Yu, M.H. 2001. Registration of M6-1 root-knot nematode resistant sugarbeet germplasm. *Crop Sci.* 41:278-279.
- Yu, M.H., W. Heijbroek, and L.M. Pakish. 1999. The sea beet source of resistance to multiple species of root-knot nematode. *Euphytica* 108:151-155.
- Yu, M.H., L.M. Pakish, and H. Zhou. 2001. An isozyme marker for resistance to root-knot nematode in sugarbeet. *Crop Sci.* 41:1051-1053.

M.H. Yu, USDA-ARS-PWA, U.S. Agric. Res. Stn., Crop Improvement and Protection Research Unit, 1636 East Alisal St., Salinas, CA 93905-3018. Cooperative Investigations by the USDA-ARS and the California Beet Growers Association, Ltd., 2 West Swain Rd., Stockton, CA 95207. Registration by CSSA. Accepted 31 July 2001. *Corresponding author (myu@salinas.ars.usda.gov).

Published in *Crop Sci.* 42:317-318 (2002).

Registration of HiMag Tall Fescue Germplasm

HiMag (Reg. no. GP-79, PI 615587) tall fescue (*Festuca arundinacea* Schreb.) was developed and released by the Missouri Agricultural Experiment Station and the USDA-ARS in 1997. HiMag has relatively high Mg and Ca concentrations and low tetany ratio [K/(Ca + Mg)] expressed as moles of charge.

Parental germplasm for the C₀ cycle of selection for HiMag included 950 plants from 'Kenhy' (Buckner et al., 1977), 831 plants from 'Kentucky-31', and 688 plants from 'Missouri-96' (Asay et al., 1979). All plants were endophyte free [*Neotyphodium coenophialum* (Morgan-Jones and Gams) Glenn, Bacon, and Hanlin comb. nov.]. Parental plants were transplanted to the field near Columbia, MO, in the fall of 1983. The soil was a Mexico silt loam (a fine, montmorillonitic, mesic Udollic Ochraqulf) with a pH of 6.4. Selection was applied against crown rust (caused by *Puccinia coronata* Corda. var. *coronata*), leaving 1011 plants which were harvested in the fall of 1984 and analyzed for elemental concentrations of Mg, Ca, K, and the tetany ratio. Sixty-five plants (11 from Kentucky-31, 54 from Missouri-96, and 0 from Kenhy) were chosen to generate the C₁ cycle of selection. These 65 plants contained 5.0 to 7.0 g kg⁻¹ Mg, 5.0 to 10.2 g kg⁻¹ Ca, 20 to 33 g kg⁻¹ K, and had K/(Ca + Mg) values of 0.61 to 0.99. These were allowed to open-pollinate in the greenhouse during the winter of 1985/86. Harvested seeds were germinated in the greenhouse and seedlings were transplanted to the field in the fall of 1986. During the fall of 1987 approximately 1000 plants were analyzed from the C₁ cycle to determine elemental concentrations of Mg, Ca, K, and the tetany ratio. Forty-six plants chosen for the C₂ contained 4.4 to 6.1 g kg⁻¹ Mg, 5.5 to 8.1 g kg⁻¹ Ca, 17.2 to 30.9 g kg⁻¹ K, and had tetany ratios of 1.06 to 2.13. These were allowed to open-pollinate in the greenhouse in the winter of 1988-1989. Approximately 1000 seedlings were transplanted to the field having areas of Creldon silt loam (Mollic Fragiudalf) and Hobert silt loam (Umbric Fragiqualf) at the Southwest Research Center, located near Mt. Vernon, MO, in the fall of 1989. In the summer of 1990, seed was harvested from these spaced plants and planted into an irrigated Portneuf silt loam soil (Durinodic Xeric Haplocalcid) to establish a seed increase block at Kimberly, ID, in April 1991. In 1992, seed from HiMag was harvested with the following characteristics: 1635 kg ha⁻¹, 400 seeds g⁻¹, 2.5 g 1000 seeds⁻¹, and 302 kg m⁻³.

HiMag forage yields are similar to Missouri-96 and Kentucky-31, and it grows well on both calcareous alkaline and acid soils (Shewmaker et al., 1997; Wilkinson et al., 1997).

HiMag was developed for the purpose of minimizing the effects of grass tetany in cattle (*Bos taurus*) and sheep (*Ovis aries*). Grass tetany is characterized by hypomagnesemia resulting from low Mg concentrations in the herbage or reduced absorption of Mg by the grazing ruminant (Butler, 1963; Kemp et al., 1957; Martens et al., 1983). It has also been demonstrated that the K/(Ca + Mg) ratio should be kept below 2.2 in the herbage being grazed to reduce the hazards of grass tetany (Crawford et al., 1998; Kemp et al., 1957).

When HiMag was compared with 'Au Triumph' (Pedersen et al., 1983), Kentucky-31, 'Martin', and 'Mozark', it was found to have 22% more Mg, 18.5% more Ca, and 9% more P (Crawford et al., 1998). The mean tetany ratio was 1.34 for HiMag and 1.65 for the other three cultivars. Blood serum levels of Mg in grazing cattle were inconsistent (Crawford et al., 1998). Blood serum levels from steers grazing HiMag in the fall were 8% higher than the three check cultivars, but were not different compared to the checks in the spring. For grazing cows during the fall, blood serum Mg for HiMag was not different from the check cultivars, but approached significance ($P = 0.09$) during the spring calving season. For most grazing seasons, the check cultivars and HiMag consistently had tetany ratios below 2.2. Animal grazing preference for HiMag was less than for endophyte-free cultivars of Kenhy and Kentucky-31, similar to 'Barcel' and 'Stargrazer', and greater than Missouri-96 and Mozark (Shewmaker et al., 1997). Sheep and goat (*Capra hircus*) preference rankings for HiMag hay were similar to cattle rankings of grazed tall fescue cultivars (Burns et al., 2001). HiMag contains moderately high concentrations of soluble carbohydrates leading to its desirable palatability (Mayland et al., 2000). We conclude that HiMag is a good germplasm source for altering certain mineral concentrations in tall fescue.

Small quantities (100 g) of seed of HiMag are available to breeders and geneticists. Written requests should be addressed to the corresponding author. Recipients of the seed are asked to make appropriate recognition of the source of HiMag if it is used in the development of a new cultivar, germplasm, or genetic stock.

D.A. SLEPER,* H. F. MAYLAND, R.J. CRAWFORD, JR., G.E. SHEWMAKER, AND M.D. MASSIE

References

- Asay, K.H., and D.A. Sleper. 1979. Registration of 'Missouri-96' tall fescue. *Crop Sci.* 19:563.
- Buckner, R.C., P.B. Burrus, II, and L.P. Bush. 1977. Registration of 'Kenhy' tall fescue. *Crop Sci.* 17:672-673.
- Burns, J.C., D.S. Fisher, and H.F. Mayland. 2001. Preference of sheep and goats among hay of eight tall fescue cultivars. *J. Anim. Sci.* 79:213-224.
- Butler, E.J. 1963. The mineral element content of spring pasture in relation to the occurrence of grass tetany and hypomagnesemia in dairy cows. *J. Agric. Sci. (Cambridge)* 60:329-340.
- Crawford, R.J., Jr., M.D. Massie, D.A. Sleper, and H.F. Mayland. 1998. Use of an experimental high-magnesium tall fescue to reduce grass tetany in cattle. *J. Prod. Agric.* 11:491-496.
- Kemp, A., and M.L. t'Hart. 1957. Grass tetany in grazing milk cows. *Neth. J. Agric. Sci.* 5:4-17.
- Martens, H., and Y. Rayssiguier. 1983. Magnesium metabolism and hypomagnesemia. p. 447-466. *In* Y. Ruchebusch and P. Thivend (ed.) Digestive physiology and metabolism in ruminants. MTP Press, Lancaster, England.
- Mayland, H.F., G.E. Shewmaker, P.A. Harrison, and N.J. Chatterton. 2000. Nonstructural carbohydrates in tall fescue cultivars: Relationship to animal preference. *Agron. J.* 92: (in press).
- Pedersen, J.F., R.L. Haaland, C.S. Hoveland, C.D. Berry, S.P. Schmidt, and R.R. Harris. 1983. Registration of 'AU Triumph' tall fescue. *Crop Sci.* 23:182.

Shewmaker, G.E., H.F. Mayland, and S.B. Hansen. 1997. Cattle grazing preference among eight endophyte-free tall fescue cultivars. *Agron. J.* 89:695-701.

Wilkinson, S.R., and H.F. Mayland. 1997. Yield and mineral concentration of HiMag compared to other tall fescue cultivars grown in the Southern Piedmont. *J. Plant Nutr.* 20:1317-1331.

D.A. Sleper, Dep. of Agronomy, Univ. of Missouri-Columbia, Columbia, MO 65211; R.J. Crawford and M.D. Massie, Univ. of Missouri-Columbia, the Southwest Research Center, Mt. Vernon, MO 65712; H.F. Mayland, USDA-ARS, Kimberly, ID 83341; and G.E. Shewmaker, Univ. of Idaho, Twin Falls, ID 83303. Registration by CSSA. Accepted. *Corresponding author (sleperd@missouri.edu).

Published in *Crop Sci.* 42:318-319 (2002).



[Faint, illegible text, likely bleed-through from the reverse side of the page]

[Faint, illegible text, likely bleed-through from the reverse side of the page]