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Breeding for Resistance to Iron-Deficiency Chlorosis in Arrowleaf Clover

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Summary

Current arrowleaf clover cultivars are very susceptible to iron (Fe)-deficiency chlorosis when grown on high pH calcareous soils. During the winter of 1988-89, seed produced from plants following one and two cycles of selection for resistance to Fe-deficiency chlorosis were evaluated in the greenhouse at TAES-Beeville utilizing an Austin silty clay soil (pH 7.9). This test indicated that seedlings produced from plants following two cycles of selection were 20% less chlorotic ($P<.001$) than those following one cycle of selection.

KEYWORDS: Calcareous soils/*Trifolium vesiculosum* Savi.

Introduction

Available cultivars of arrowleaf clover (*Trifolium vesiculosum* Savi) exhibit symptoms of iron (Fe)-deficiency chlorosis when grown on high pH, calcareous soil (Gildersleeve and Ocumpaugh 1988). Arrowleaf clover is a very drought tolerant cool-season annual legume which has the potential to be grown further west in Texas than current cultivars are adapted. Following the development of a greenhouse procedure for screening clover seedling (Gildersleeve 1987), we have been screening for resistant plants of arrowleaf clover. Several populations were screened (Gildersleeve et al. 1988), but existing variety or breeding lines appeared to have no more than about 2.5 to 8 percent resistant plants. Therefore, we initiated a selection and breeding program to develop a line of arrowleaf clover with increased resistance to high pH induced chlorosis. The results presented indicate our progress to date.

Procedures

In the winter of 1986-87 and 1987-88 greenhouse selections were made from populations of arrowleaf clover at TAES-Beeville utilizing a procedure developed by Gildersleeve (1987) to select Fe-chlorosis resistant seedlings. Resistant seedlings were taken to TAES-Overton for crossing and seed production. In the winter of 1988-89, seed from two populations following one or two cycles of selection were grown in the greenhouse in an Austin silty clay soil (pH 7.9) for an additional cycle of selection.

A total of 294 seedlings each of Population A (cycle 1) and Population B (cycle 2) were compared. Clover seedlings were grown in "supercell" cone-tainers. The seedlings were first scored on a 1 to 5 scale, where 1=no chlorosis and 5=severe chlorosis, when most seedlings had at least two trifoliolate leaves (Jan. 18, 1989). On that date, the base of the cones were placed into tubs of distilled water to saturate the soil and increase the intensity of chlorosis expression. Plants were maintained in this high water status soil for 4 weeks. Chlorosis scores were determined after 2 and 4 weeks of saturations. The results of the three chlorosis scoring were statistically analyzed using the T-Test procedure of PC-SAS (Version 6.01).

Results and Discussion

The frequency of occurrence of plants within each chlorosis score classification are depicted in Figure 1. Chlorosis was evident at the initial scoring with the mean score of 2.36 and 2.09, for Populations A and B, respectively ($P<0.001$). Mean scores of each population and the difference in mean score between the two populations continued to increase to 2.80 versus 2.07 at 2 weeks and 3.64 versus 2.59 at 4 weeks after saturation, respectively.

By the final scoring, there were 121 plants that scored a 1 or 2 (green) from Population B compared to only 15 plants from Population A. Likewise, there were 170 plants that scored 4 or 5 (yellow) from Pop A compared to only 35 from Population B that scored 4. There were no plants from Population B that scored 5 at the final rating.

The material that expressed no chlorosis after 28 days in saturated calcareous soil was sent back to Overton to produce cycle 2 and cycle 3 seed. It is anticipated that after another cycle or two of selection that sufficient progress will have been made for a potential cultivar or germplasm release.

Literature Cited

1. Gildersleeve, R. R. 1987. Screening *Trifolium* spp. for susceptibility to iron-deficiency chlorosis. Ph. D. dissertation. Texas A&M University, College Station.
2. Gildersleeve, R. R. and W. R. Ocumpaugh. 1988. Variation among *Trifolium* species for resistance to iron-deficiency chlorosis. J. of Plant Nut. 11:727-737.
3. Gildersleeve, R. R., W. R. Ocumpaugh, and G. R. Smith. 1988. Genetic variation in arrowleaf and crimson clovers for susceptibility to iron-deficiency chlorosis. p. 241-245. *In*: 1988 Forage and Grassland Conference, Baton Rouge, LA 11-14 April 1988. American Forage & Grassland Council.

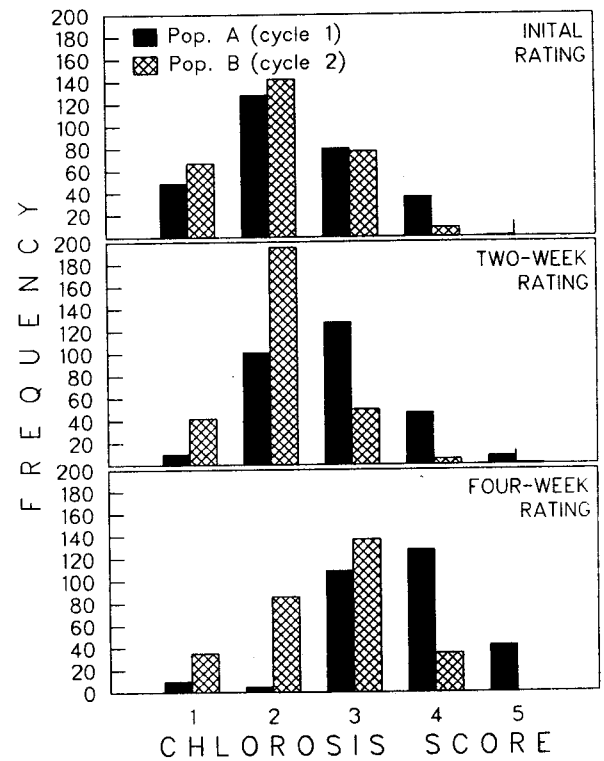

Figure 1. Frequency of occurrence of arrowleaf clover seedlings of Populations A and B in the five chlorosis classes prior to saturation (initial)and after 2 and 4 weeks in saturated Austin silty clay soil (1=green, 5=yellow).