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NEW SWEETCLOVERS FOR TEXAS

G. R. Smith, G. W. Evers and I. J. Pemberton

Background. Annual white sweetclover (*Melilotus alba* Desr.) is a forage legume that has been used for pasture, hay and soil improvement and is very well adapted to the blackland and prairie soils of the Southern Great Plains that extend through central Texas. Sweetclover was used through most of Texas prior to the 1950's when inexpensive nitrogen fertilizer reduced the use of all forage legumes. Animal health concerns related to dicoumarol toxicity also contributed to the decline of sweetclover as a hay crop. Livestock that ingest sweetclover hay or silage containing dicoumarol may die due to uncontrolled internal or external bleeding. Dicoumarol is a blood-thinning agent formed from the organic compound coumarin by fungal metabolism in moldy sweetclover hay or spoiled sweetclover silage. Coumarin is a natural compound found in sweetclover. A single partially dominant gene controls the presence of coumarin and the potential for dicoumarol contamination but no low coumarin cultivars of annual sweetclover have ever been developed. Denta is a low coumarin cultivar of biennial white sweetclover. Because of the biennial trait, Denta is poorly adapted to Texas but will be used as a parent in a crossing program to transfer the low coumarin gene into annual sweetclover cultivars for Texas.

Emerald is an annual white sweetclover with fine stems, multiple stemmed crown morphology similar to alfalfa and a wide range in maturities. Because of this unique stem growth trait Emerald sweetclover is an excellent forage type and will be used as a genetic source for the multi-stem trait.

The goal of this research project is rapid development of multiple cultivars of annual sweetclover to match specific Texas needs and environments. Improvements will include reduction of coumarin to eliminate sweetclover bleeding disorder in livestock and development of fine-stemmed types to improve forage quality.

Research Findings: Hand crosses and bee cage crosses were made in March, April and May 2001 between Denta and Emerald sweetclover. Seed were harvested only from the Denta plants to make use of the coumarin gene (*cu cu*) as a genetic marker. Seed from both hand crosses and bee cages were germinated and seedlings were transplanted to the greenhouse in Oct. 2001. The seedlings were grown for 60 days and tested for coumarin content. Actual hybrids between Denta and Emerald were identified by the presence of coumarin. From three hundred thirty-eight hand crosses, thirty-six hybrids were identified. Forty-seven hybrids were identified from bee cage crosses. All hybrids were self-pollinated in the greenhouse and F2 seed produced

in the spring and summer of 2002. About 240,000 F2 seed were produced from hybrids between Denta and seven different maturity groupings of the Emerald parent.

F2 seedlings from each maturity group were germinated and transplanted to the greenhouse in Sept. 2002. Fifteen hundred seedlings from each of seven maturity groups, for a total of 10,500 plants, were evaluated. Emerald and Denta seedlings were also planted for use as checks. Our objective was to initiate a simultaneous screen for low coumarin (*cu cu*), fine stem or multiple stem trait (*ff*) and annual growth habit (*AA*).

Based on a preliminary study, we developed a screening technique to identify the multiple stem trait in young (6 to 8 weeks of age) sweetclover seedlings. The growth of secondary stems from the axillary bud of the unifoliate leaf and from the axillary buds of the cotyledons was used as a positive signal for the potential development of the multi-stem trait. About 2700 (25.7%) sweetclover plants were identified with the potential to express the multiple stem trait. Each seedling was then evaluated for coumarin content and those testing positive were discarded. Four hundred and ninety-one (4.6%) sweetclover seedlings were identified with the trait combination of multiple stem crowns and low coumarin. Artificial lighting was used beginning in early November, 2002 to extend the daylength and force early flowering. By mid December 2002 about 25% of the F2 selections were flowering. In February 2003 another 250 plants were discarded due to severe powdery mildew infection and/or general low vigor. Flowers on each plant were hand rolled to assure pollination.

Seed (F3) was produced on 193 plants from late spring to mid summer 2003 with seed yields ranging from 0.5g to 5.0g per plant. About 25 plants were noted that did not flower. These surviving plants are probably biennials and should flower in 2004.

Application: New sweetclover cultivars are being developed for Texas. These new sweetclovers will not cause bleeding disorders in livestock, will produce high quality grazing and hay due to fine stems and the multiple stemmed trait, and will have variable maturities for different locations and uses.