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LOW COUMARIN SWEETCLOVER FOR TEXAS

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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 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 dicoumarol toxicity 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 can be used as a parent in a crossing program to transfer the low coumarin gene into annual sweetclover. 'Hubam' sweetclover, which was grown in the 1940's and 1950's, has a large woody main stem that is not palatable to livestock. 'Emerald' is a fine-stemmed cultivar of annual sweetclover with morphology similar to alfalfa. Emerald sweetclover has improved digestibility compared to Hubam and will be used as a genetic source of the fine-stemmed trait.

Improving an old, well-adapted forage legume like annual sweetclover will provide many economic benefits to Texas. The goal of this research is rapid development of multiple cultivars of annual sweetclover to match specific Texas climates. Improvements will include reduction of coumarin to eliminate sweetclover bleeding disorder in livestock, development of fine-stemmed types to improve forage quality, and maintenance of high nitrogen fixation rates to reduce the need for nitrogen fertilization in livestock and farming systems.

Hand crosses and bee cage crosses were made in March, April, and May 2001 between Denta and Emerald sweetclover. The eight Denta plants used as parents were 18 months old and were forced to flower using 16 hours of daylength in a growth chamber. The Emerald plants began to flower at 5 months of age and flowered over a range of 60 days. Seed were harvested only from the Denta plants to make use of the low 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

29

content. Actual hybrids between Denta and Emerald were identified by the presence of low coumarin.

Research Findings. From three hundred thirty-eight hand crosses, thirty-six hybrids were identified. Forty-seven hybrids were identified from bee cage crosses. Denta x Emerald hybrids were made with the Emerald parents expressing the range of flowering from mid-March to mid-May (Table1). All hybrids will be self-pollinated in the greenhouse and F2 families will be evaluated in the greenhouse and field in 2002-2003. In one season we hope to do a simultaneous screen for low coumarin (*cu cu*), fine stem trait (*f f*) and annual growth habit (*A A*). Plants expressing annual growth habit will have to be progeny tested in the F3 generation to identify lines that breed true for this trait.

Application. New varieties of annual sweetclover developed from this project will have low coumain and higher nutritive value and be well adapted to Central Texas where few clover species can be grown.

Table 1. Sweetclover hybrids.

Sweetclover cross	n	Emerald parent flowering Date
D10 x E7[1]	1	March 15
D10 x E8	2	March 15
D8 x E12	7	March 15
D9 x E27	1	March 30
D11 x E31	5	March 30
D6 x E40	1	April 18
D5 x E41	1	April 18
D6 x E43	12	April 18
D11 x E56	5	May 2
D11 x E57	1	May 2
D2 x (E13, E14 or E16)	25	May 15
D3 x (E13, E14 or E16)	22	May 15

[1]D=Denta parent, E=Emerald parent.