FIELD DAY REPORT - 1993

Texas A&M University Agricultural Research and Extension Center at Overton

Texas Agricultural Experiment Station
Texas Agricultural Extension Service

Overton, Texas

May 28, 1993

Research Center Technical Report 93-1

BREEDING ARROWLEAF CLOVER FOR TOLERANCE TO BEAN YELLOW MOSAIC VIRUS

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Background. Cool-season forage legumes, such as clovers, are susceptible to many different virus diseases. Because no cultural practices exist to eliminate a virus disease once the plant becomes infected, breeding clovers for tolerance or resistance to viruses is an important means of control. Arrowleaf clover is an important forage and winter annual cover crop in the southeastern United States, including Texas. Forage production and persistence of arrowleaf clover can be limited by virus diseases, the most serious of which is caused by bean yellow mosaic virus (BYMV). Aphids feeding on arrowleaf clover transmit the virus from one plant to another. Significant populations of aphids can appear in late February or early March, and can infect 100% of an arrowleaf clover plot by April or May. Typical BYMV symptoms include yellowing and mosaic of the leaves, leaf puckering, reduced flowering, and stunting of plant growth. Up to 20% of the plants die, displaying a "lethal wilt" symptom. Plant death, stunted growth, and fewer flowers will result in poor forage yields and reduced seed production or reseeding capability. Symptoms may be more difficult to observe in a grazed field, but regrowth will characteristically be poor or nonexistent.

Research Findings. We have conducted five cycles (generations) of selection for tolerance to BYMV in arrowleaf clover from 1986 through 1991. Six-week-old seedlings were inoculated with BYMV and evaluated in the greenhouse. Seedling dry weights and virus disease ratings were used to estimate the level of virus tolerance of each plant. The most tolerant 1 to 4% in each cycle were saved, and used to produce seed for the next cycle. Comparisons were made with the susceptible arrowleaf clover cultivars 'Yuchi', 'Meechee', and 'Amclo'. In 1991 and 1992, field evaluations were also conducted to compare Cycle 3 and Cycle 5 with the three cultivars. Seedlings were transplanted to the field in November 1991, and inoculated with BYMV either in November 1991 (fall), March 1992 (spring), or not inoculated (healthy controls). Results from these greenhouse and field evaluations indicated that significant improvements in virus tolerance were achieved with each cycle of selection. In the field, survival of virus-infected Cycle 3 and Cycle 5 plants was excellent (<5% dead) while the three arrowleaf cultivars suffered large stand losses (19 to 71% dead plants). The lethal wilt symptom was eliminated after 1 cycle of selection. Flowering was reduced only 5 to 10% for infected Cycle 5 plants. Flowering among Cycle 3 plants was reduced 23%. Flowering among the cultivars was reduced an average of 18

to 64%. Table 1 shows the dry matter production of Cycle 5, Cycle 3, Yuchi, Amclo and Meechee. For all cultivars, yields were lowest when plants became virus-infected early in the growing season (fall), compared to healthy controls. Cycle 5 and Cycle 3 yields were higher than yields of the standard cultivars in the fall treatment. Cycle 3 and Cycle 5 exhibited an intermediate and superior level of tolerance to BYMV, respectively.

Application. Five cycles of selection in arrowleaf clover have resulted in a population possessing superior tolerance to BYMV. The lethal wilt symptom was eliminated from the population. Field survival, flowering, and dry matter production under disease pressure have been greatly improved when compared to the currently available arrowleaf cultivars Yuchi, Amclo, and Meechee. These traits will ensure a successful crop of arrowleaf clover, whether for grazing, hay, or seed production. This improved arrowleaf clover will be used for the development of a new, virus-tolerant cultivar.

Table 1. Dry matter production of arrowleaf clover plants inoculated with bean yellow mosaic virus (1991-92 field study).

	Dry matter yield (grams/plant)		
Cultivar	Fall-inoculated	Spring-inoculated	Healthy controls
Cycle 5	163	227	349
Cycle 3	139	202	356
Yuchi	120	234	498
Amclo	98	158	347
Meechee	81	177	426