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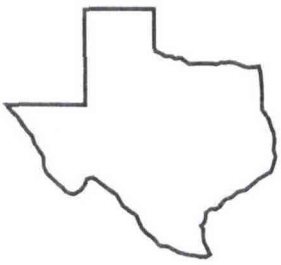

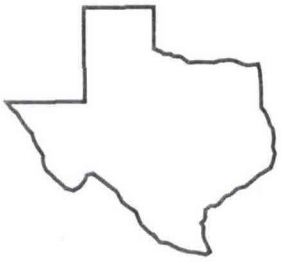

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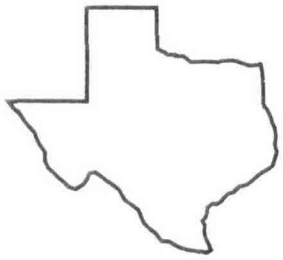

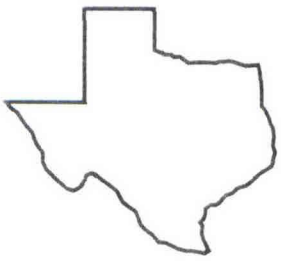

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DECLINE OF ARROWLEAF CLOVER INFECTED WITH BEAN YELLOW MOSAIC VIRUS

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Background. Our previous work with arrowleaf clover has been aimed at improving the virus disease tolerance of this species. We have been successful in eliminating the lethal wilt gene (reaction) from arrowleaf clover, as well as improving the yield of selected populations under disease pressure due to bean yellow mosaic virus (BYMV). Typically, we evaluated arrowleaf clover seedlings in the greenhouse during the fall and winter months. Virus-infected seedlings expressed typical green and yellow mosaic patterns on leaves and stunted growth. During subsequent field studies, we observed a marked difference in the types of symptoms arrowleaf clover plants expressed if they became infected during the spring months. Leaves of some spring-infected plants turned bright red during the growing season; plants ceased growth and eventually died. Our objectives were to determine if this reddening reaction was indicative of reduced plant vigor, as estimated by survival rates, flowering, and seed production. We also investigated starch levels in red plants, and compared the results to those from non-red and healthy plants. Abnormal starch levels may indicate that the plant is unable to transport and/or use its carbohydrate (food) supply, resulting in poor growth and seed production.

Research Findings. The three arrowleaf clover varieties Amclo, Yuchi, and Meechee were evaluated and compared to our virus-tolerant line, Cycle 6. Once virus symptoms appeared, plants were classified as "red" or "green". The incidence of reddening was lower for Cycle 6 plants (27 percent), compared to Amclo, Yuchi, and Meechee plants (35, 41, and 41 percent, respectively). All of the Cycle 6 plants survived at least until full flower, while 45 percent of infected Meechee plants died. Amclo and Yuchi suffered minor stand losses before full flower, 2 and 11 percent, respectively. Red, virus-infected plants began flowering approximately 2 to 5 days later than green plants or healthy plants. Cycle 6 plants were the exception: diseased plants flowered at the same time as healthy plants. In general, live seed yields from green plants were 10-fold greater than yields from red plants (average 17.0 vs 1.7 grams live seed per plant). Again, Cycle 6 plants were the exception. Red Cycle 6 plants produced an average of 8 grams of live seed per plant. Figure 1 shows changes in starch levels in red, green, and healthy plants over the growing season. Diseased, red plants had higher than normal starch levels, especially in late spring. Diseased, green plants also showed elevated levels, but not nearly as high. Healthy plants maintained the lowest starch levels.

Application. The severe reddening symptom seen in arrowleaf clover infected with BYMV indicates the plant contains higher than normal starch levels, will suffer slightly delayed flowering and very poor seed production in the field. Regrowth after grazing may also be very poor because the plants cannot mobilize their food reserves.

Our breeding program has successfully developed an arrowleaf clover line which exhibits excellent survival rates, normal flowering, and significantly greater seed yields under disease pressure from bean yellow mosaic virus.

FIG.1 STARCH CONTENT OF ARROWLEAF CLOVER INFECTED WITH BEAN YELLOW MOSAIC VIRUS