IMPACT OF VIRUS RESISTANCE ON WHITE CLOVER PERSISTENCE AND PRODUCTIVITY

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ABSTRACT
The objective of this study was to compare the virus-resistant white clover (*Trifolium repens* L.) germplasm SRVR with virus-susceptible cultivars for productivity and persistence under clipping in several different environments. Four cultivars and SRVR were broadcast-seeded in the field at Mississippi State, MS in the fall of eight different years. Dry matter yields were taken for 2-4 years after seeding using mowers for defoliation. Virus-resistant SRVR had greater dry matter yields than all four cultivars in the second year, greater than three of four cultivars in the third year, and greater than two of four cultivars in the fourth year. Relative yields at the final harvest of each study and white clover ground cover were greater for SRVR than for the other white clover cultivars. Multiple virus resistance in SRVR improved white clover productivity and persistence under clipping.

KEYWORDS
White clover, virus resistance, disease, dry matter yield, persistence

Acronyms: SRVR, southern regional virus resistant; PSV, peanut stunt virus; CYVV, clover yellow vein virus; AMV, alfalfa mosaic virus

INTRODUCTION

White clover is susceptible to many different viruses that occur in the United States. The most prevalent viruses in the southeastern U.S. are PSV, CYVV, and AMV (Barnett and Gibson, 1975). The SRVR germplasm was the first source of multiple virus resistance in white clover with resistance to PSV, CYVV, and AMV (Gibson *et al.*, 1989). Studies have shown that SRVR has good resistance to PSV and CYVV (Pederson and McLaughlin, 1988; Taylor *et al.*, 1995), but is susceptible to some AMV isolates (Larsen and Pederson, 1996). All white clover cultivars grown in the southeastern U.S. are susceptible to all three viruses (McLaughlin and Pederson, unpublished data). The objective of this study was to determine the impact of multiple virus resistance in SRVR on white clover persistence and productivity under clipping in several different environments in comparison with virus-susceptible cultivars.

MATERIALS AND METHODS

White clover was broadcast seeded on a prepared seedbed at 3.4 kg ha^{-1} in 2 x 4m plots and rolled to compress the soil about the seeds following seeding. The experimental design was a randomized complete block with four replications. The five white clover entries used were SRVR, 'Regal', 'Osceola', 'California Ladino', and 'Louisiana S-1'. Plots were seeded in September of eight different years (1983-84, 1988-89, 1991-94) at Mississippi State, MS, on a Freestone fine sandy loam (1984), Savannah fine sandy loam (1993), or Catalpa silty clay (all other years). Initial harvests were usually made in April and continued at 4 wk intervals when the clover reached a height of 20-25 cm. Plots were harvested to a 7 cm height using a rotary mower with catch baskets. A 500g subsample was taken from each plot in one replicate and dried at 65°C for 48 hr to determine forage dry matter. Number of harvests per year varied greatly depending on the climate during the growing season. Dry matter yields were taken for 2-4 years as long as appreciable white clover stands remained in most plots. In three of eight years, visual estimates of percentage white clover ground cover were taken in the spring following the final harvest.

RESULTS AND DISCUSSION

During the first year of growth, there was little difference between the large-type cultivars and SRVR for dry matter yield (Table 1). This was expected as previous studies have shown that with adequate fertility and seedbed preparation, few factors other than climatic extremes will greatly affect first year white clover growth (Pederson *et al.*, 1991). The intermediate-type Louisiana S-1 had 22-24% less dry matter yield than the large-type entries. Virus incidence was not determined in most of the trials; however, by the end of the first year of the 1983 trial, viruses had infected many of the plants. The four cultivars averaged 43% PSV, 26% CYVV, and 48% AMV infection while SRVR averaged 0% PSV, 5% CYVV, and 58% AMV infection (McLaughlin and Pederson, unpublished data). In the second year, SRVR had 17-27% greater dry matter yields than all other entries (Table 1). Four of the eight trials were terminated at the end of the second year due to inadequate white clover stands remaining in many plots. In the third year, SRVR had 25-32% greater dry matter yields than all entries except Osceola (Table 1). Only one trial was maintained into a fourth year of growth and SRVR had 27 and 29% greater dry matter yields than Regal and California Ladino, respectively. These data support other studies in which SRVR had greater dry matter yields than Regal in the second year at Kentucky and in the third year at Mississippi State (Taylor *et al.*, 1995).

For each of the eight studies, yields were taken from the last harvest made before the trials were terminated as a measure of relative persistence of the entries. This final harvest was at the end of the second year for four studies, at the end of the third year for three studies, and at the end of the fourth year for one study. Averaged over the eight final harvests, SRVR had 25-34% more dry matter yield than the white clover cultivars. Also, visual ground cover estimates taken in the spring following termination of three trials showed that SRVR plants covered almost half of the plot area while plants of the cultivars covered only 8-25% of the plot area (Table 1).

The virus pressure and management imposed on these plots was different from that normally found in pastures. In a pasture, white clover is grown with grasses that intermingle virus host plants (white clover) with nonhosts (grasses) affecting aphid behavior and legume virus transmission. Mowers used in this study likely facilitated movement of mechanically-transmitted viruses while the movement of viruses via animal grazing and trampling in a pasture is unknown. Further study is needed under grazing to further quantify the effect that virus resistance will have on white clover persistence and productivity.

Under the clipping management imposed in these studies, SRVR had greater productivity and persistence than the white clover cultivars commonly grown in the southeastern U.S. Multiple virus resistance should be incorporated into white clover cultivars to improve the productivity and persistence of white clover in U.S. pastures.

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Table 1
Average dry matter yield, relative yield at the final harvest, and percentage clover ground cover of five white clover entries

	Dry matter yield, kg ha^{-1}					
	First year	Second year	Third year	Fourth year	Relative yield (%) at final harvest	% Clover ground cover
SRVR	6390	3803	4011	2699	100	49
Regal	6488	3020	3002	1973	71	10
Osceola	6440	3152	3237	2199	74	25
California Ladino	6368	3019	2844	1926	75	8
Louisiana S-1	5234	2758	2708	2078	66	8
LSD 0.05	445	336	860	722	12	7
No. harvests[z]	5.4	3.4	4.0	3.0	-	-
No. trials[y]	8	8	4	1	8	3

[z] Average number of harvests taken each year.
[y] Number of trials used to compute average dry matter yield, relative yield at final harvest, and % clover ground cover.