

EVALUATION OF WATERLOGGING TOLERANCE IN EIGHT CLOVER SPECIES

Gerald R. Smith and I. J. Pemberton

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

Summary

Forage legumes vary in their ability to tolerate waterlogged soil conditions. Some clovers, such as white clover (*Trifolium repens* L.) and Persian clover (*T. resupinatum* L.) are well known to be productive under wet soil conditions. A greenhouse assay was used to evaluate the relative waterlogging tolerance of eight clover species. The most severe reductions in root growth were noted when plants were grown for 35 days with no flooding and then exposed to waterlogged conditions. Based on root growth, the clovers were ranked for tolerance (best to worse) to waterlogging as follows: Persian = white = berseem (*T. alexandrinum* L.) > ball (*T. nigrescens* Viv.) = red (*T. pratense* L.) = arrowleaf (*T. vesiculosum* Savi.) > crimson (*T. incarnatum* L.) = rose (*T. hirtum* All.)

Introduction

Clover roots are often damaged by low soil oxygen conditions imposed by flooding or waterlogging stress. Waterlogging occurs most frequently on sites with a combination of poor surface and internal drainage (level clay soils, bottomland areas, etc.). Heavy winter rain can cause waterlogging under a wide range of soil conditions but duration and severity of the flooding is dependent on the weather pattern. Waterlogging tolerance of white clover has been evaluated in detail and reductions in plant survival and forage production noted when exposed to flooding for 20 days or more. Rose clover has reported to be more susceptible to waterlogging stress than other annual clovers. More information is needed on the relative waterlogging tolerance of clovers currently used in East Texas.

The objectives were to evaluate waterlogging tolerance of crimson, arrowleaf, rose, red, white, ball, Persian, and berseem clover.

Procedure

Individual plants were grown in a sand-vermiculite (1:1.5) mix amended with P, K and lime and contained in plastic growth cells (1 x 1 x 5.5 in). Germinated seed of each clover entry (plus *Rhizobium* inoculum) were planted in a randomized block design with two replications of six plants. A factorial arrangement of treatments included ten clover entries and three flooding treatments. Flooding treatments were: CK = no flooding, harvest at 70 days; T0 = flooded, harvest at 70 days; T5 = flooded after 35 days, harvest at 70 days. In the flooding treatments the 5.5 in. growth cells were submerged in 5 in. of water. After 70 days of growth under greenhouse conditions, root growth was measured and expressed as a percent (100 = root growth to bottom of growth cell). Top growth was harvested, dried and dry weight per plant calculated.

Results and Discussion

Root growth of Persian and berseem clovers were not affected by the flooding treatments but rooting of crimson and rose clovers was severely reduced by waterlogging stress (Fig. 2). Root growth of ball, white, arrowleaf and red clovers under flooding conditions was 75 to 50% of non-flooded controls. Root growth of crimson, rose and red clovers was damaged more when flooding was delayed (T5 treatment) compared to continuous (T0 treatment). Under continuous flooding root growth of crimson, rose, and red clovers exhibited some adaptation to the waterlogging stress. Top growth response of the clovers to flooding followed the same pattern as root growth (Fig. 1).

Persian, berseem and white clovers are best choices to plant on wet, poorly drained sites. These clovers will grow and be productive under waterlogging conditions. Based on this study, ball clover is also adapted to wet sites but may show reductions in top growth under severe flooding conditions. Arrowleaf and red clover tolerate flooding better than crimson or rose clover but suffer large reductions in root growth and forage production. Crimson or rose clover should not be planted on sites that can become severely waterlogged or flooded.

Figure 1. Top growth of eight clover species as a percent of non-flooded control in two flooding treatments. T0 = continuous flooding, harvest at 70 days. T5 = flooded after 35 days, harvest at 70 days.

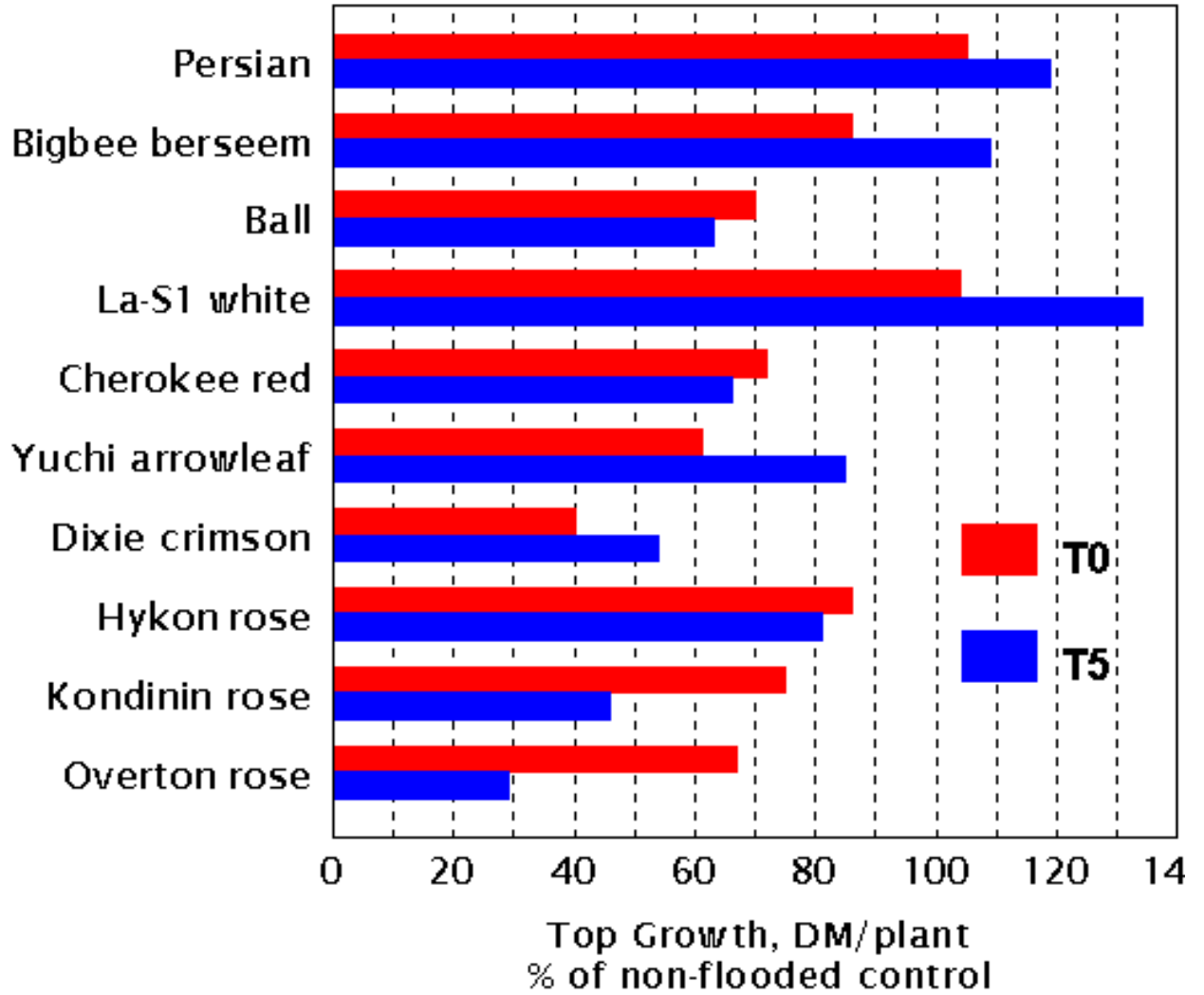


Figure 2. Root growth of eight clover species as a percent of non-flooded control in two flooding treatments. T0 = continuous flooding, harvest at 70 days. T5 = flooded after 35 days, harvest at 70 days.

