Winter Hardiness of Birdsfoot Trefoil Strains and Varieties

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The use of birdsfoot trefoil (Lotus corniculatus L.) as a permanent pasture legume is dependent in part on its ability to survive winter injury. In Minnesota and other northern areas where birdsfoot trefoil might be grown, there appears to be some doubt as to the winter hardiness and persistence of this legume. For this reason, studies were made on the relative winter hardiness of birdsfoot trefoil strains and varieties.

Winterkilling may be the result of several factors. Levitt (7) has reviewed much of the work done on the physiology of winter hardiness. Among the factors for winterkilling most often listed and studied are varieties, food reserves, heaving, ice sheet injury, diseases and chemical makeup of the plant as influenced by soil fertility. Important studies of these factors, particularly as related to legumes, have been reported by many workers (1, 2, 3, 4, 5, 6, 10, 11, 14, 15, 16, 17, 18). The stage of development of plants and their resistance to cold injury was studied by Tysdal and Pieters (16) and Peltier and Tysdal (12). Several workers have observed differentials in winter killing among varieties and strains within a species. Aamodt, et al. (1) noted differences among strains of white clover. Brink, et al. (2) studied alfalfa strains and found significant differences among them.

The investigations presented here include artificial hardening and freezing of different varieties grown in the greenhouse, and observations made on winter killing of varieties grown in the field. These artificial treatments were used to compare tissue hardness of different varieties and to supplement studies made in the field since winter killing varies considerably from year to year.

**MATERIALS AND METHODS**

**Greenhouse Experiment**

Plants were grown in the greenhouse to different stages of development, artificially hardened, and frozen in a walk-in type freezer. Ranger alfalfa and Ladino clover were used for comparison with birdsfoot trefoil in this experiment. Ranger alfalfa is sufficiently hardy to survive the severe winters of Minnesota. Ladino clover has been observed to be more susceptible to freezing injury than birdsfoot trefoil, but less so than Ranger alfalfa.

The seedlings were grown in 6-inch clay pots, and enough seed was used to give at least 30 seedlings per pot for the earlier treatments and at least 10 seedlings per pot for the later treatments. A greenhouse potting soil consisting of an equal mixture of soil, sand, and manure was used. All pots were steam sterilized before planting. The seed was treated with sulfur to prevent damping off. The seeds were carefully scattered in the pots and kept at least 3/2 inch away from the sides of the pots to avoid unequal freezing injury near the outside. The seeds were covered with 1/4 inch of lightly packed soil. A generous supply of appropriate fertilizer was then made on top of the soil and washed down to the seedlings with later waterings. The seedlings were regularly watered to insure optimum growth. The temperature was kept at about 22° C. except on sunny days when the temperature was higher. Artificial light was used in the experiments to start them late in March when the sun was adequate.

After 2 weeks of growth, the seedlings in each pot were transplanted to approximately 20 to 30 plants per pot. Hardening of plants and freezings as described later were made 14, 24, 36, and 44 days after transplanting. Each variety was grown and the pots were randomly arranged in blocks. Seedlings for all treatments were made on May 6, and the hardening and freezing treatments were prescribed number of days of growth in the greenhouse.

When the prescribed number of days of growth had elapsed, the seedlings were transferred to a hardening chamber for 14 days. In the hardening chamber the temperature was maintained at 3° C. Fluorescent lights about 20 inches above the seedlings were continuously used. Water was needed. Very little or no growth was observed in the hardening chamber.

After hardening, the pots were transferred to the freezing chamber for 12 hours at -10° C. Before freezing, notes were taken on the height of plant, number of trifoliolate leaves and number of plants per pot. After freezing, the pots were returned to their original position in the greenhouse and the number of plants was recorded 10 days later.

**Field Experiments**

Two separate studies were made of the survival of birdsfoot trefoil varieties in the field. One study was conducted where five varieties of trefoil and Ranger alfalfa were seeded on June 20, 1951. Each plot consisted of 6 rows, 20 feet long, and replicated 6 times. Four-hundred pounds of 0-20-10 fertilizer were applied before seeding. The alfalfa varieties and Ranger alfalfa were seeded with a 1-row garden planter at a rate of 5 and 12 pounds per acre, respectively.

On May 6, 1952, the percent survival of each variety was calculated from the plants remaining alive. Plants were tagged and counted. The percent survival was calculated from the plants remaining alive.