SWITCHGRASS EMERGENCE THROUGH NON-POROUS SOIL SEALING COMPOUNDS

In semi-arid and arid regions of the world, many grass seeding failures occur annually. The rapid loss of moisture from the seed micro-environment before seeds can germinate causes a significant percentage of these failures. There are several possible means of preventing moisture loss. Nonporous materials capable of being sprayed or poured retard moisture loss and increase the percentage of grass seeding successes. In some procedures, nonporous materials are placed on the soil above the seed; to establish the grass stand, the seedlings must emerge through these materials. In other instances, the materials are placed between the planted rows, with a strip left uncovered to provide a path for seedling emergence; it is desirable that no weedy plants penetrate the material between the planted rows. Therefore, it is necessary to predict the probable influence of nonporous materials on seedling emergence of both desirable grasses and weedy plants.

This note presents the relationship between the ultimate emergence of switchgrass and the hardness of the surface seal. It also proposes a method of predicting probable seedling emergence through the seals.

Experimental Procedure

Wax compounds of differing rigidities were prepared by mixing varying proportions of petroleum wax and petroleum jelly. Mixtures were heated to $30^\circ$ F. above their melting points, stirred, poured into $\frac{3}{4}$-inch diameter molds, and allowed to harden. On wax subsamples, needle penetration was determined by the American Society of Testing Materials procedure D 1321-61T. Results of this testing procedure are reported as a wax penetration number. The number is the tenths of millimeters that a standard pointed needle will penetrate in 5 seconds under an applied load of 100 grams. Deviations from this standard ASTM procedure were used in this experiment as follows: (1) testing occurred at $80^\circ \pm 2^\circ$ F. in air, and (2) a 2-inch diameter seamless soil can was used as the test specimen container.

Wax surface crusts of $\frac{1}{8}$-inch melted thickness were used. Nonuniform shrinkage occurred as the crusts hardened. Generally, the harder waxes shrank radially and vertically to greater extents than did the softer waxes; therefore, the crust thicknesses were slightly less with hard waxes than with soft ones. Quadruplet samples were used.

One-quart cans were used for planting containers, each can holding 1240 grams of loose, screened, oven-dried Amarillo fine sandy loam. In each can, 25 seeds (85% germination) of switchgrass (Panicum virgatum L. var. Blackwell) were planted about $\frac{1}{4}$-inch deep. Fifty grams of water were added to moisten the soil to approximate field capacity. Physical properties of this soil have been published. Bulk density of the soil was about 1.5 g. per cm.

A molded wax surface crust was placed on the soil surface. Slight pressure was exerted to insure contact between the wax and soil. The crust was trimmed to the can's edge with melted wax softer than the outer crust used.

For aeration, a $\frac{3}{8}$-inch inside diameter glass tube was installed through the wax crust, and a $\frac{1}{4}$-inch hole was drilled in the side near the bottom of each can. Holes were plugged with rubber stoppers, but once each day they were removed and air was forced through the soil for a period of not less than 30 seconds. Moisture status was monitored periodically. The moisture loss averaged 4 grams per can for the germination period, which represented less than 3% of the added water.

During the period of seedling emergence, the cultures were kept in a growth chamber maintained at $80^\circ \pm 2^\circ$ F. The counting period continued until further seedling emergence ceased. A few plants died after the end of the counting period. These were not included in the daily totals of emerged plants. The few plants that emerged through the crust but emerged through the softer sealing wax were not included in the totals of emerged plants.

Results and Discussion

The relationship between seedling emergence and wax penetration number—an empirical measure of hardness—is presented in Figure 1. Within the range of hardness that was tested, there appears to be a linear dependence of seedling emergence upon wax penetration number. Switchgrass emergence occurred when the wax penetration number was 27.5 or less. Percentage of seedling emergence increased as the penetration number increased. About 60% emergence occurred with a penetration number of 30 or less.

\[ WAX \text{ PENETRATION NUMBER} \]

\[ 0 \quad 10 \quad 20 \quad 30 \quad 40 \quad 50 \quad 60 \quad 70 \quad 80 \]

Translated from the Soil and Water Conservation Research Laboratory, U.S. Department of Agriculture, by permission of the Director.

1 Contribution from the Soil and Water Conservation Research Laboratory, U.S. Department of Agriculture, by permission of the Director.


3 About 60% emergence occurred with a penetration number of 30 or less.