Moistening and Heating Improve Germination of Two Legume Species

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Highlight

Germination of Lespedeza cuneata and Desmodium pauciflorum seeds from eastern Oklahoma was increased by heating them under moist conditions. Seeds of Desmodium sessiliflorum from the same area germinated well without treatment. Moistening and heating did not increase germination of Lespedeza virginica and L. capitata; mechanical scarification was very successful with seeds of these species.

Cushwa et al. (1968) found that moistening and heating increased germination of Cassia nictitans L. seeds collected in Florida. The study described here was done to determine whether similar treatment would improve germination of five common legumes found in the prairies of eastern Oklahoma. The species selected for testing were: Desmodium sessiliflorum (Torr.) T. & G., D. pauciflorum (Nutt.) DC., Lespedeza virginica (L.) Britt., L. cuneata (Dumont) G. Don, and L. capitata Michx.

Methods

Seeds were collected from standing plants near Stillwater, Oklahoma, in February 1970. They were cleaned and grouped. 60 were assigned to heat treatment at a temperature of 40, 60, 80, or 100°C for 1, 2, 4, 8, 16, or 32 minutes.

To provide ample moisture, each group of seeds was placed in a folded paper towel, which was moistened and covered with aluminum foil. The package was placed in an oven set at the prescribed temperature. A thermometer was inside the packet, and the timing interval was begun when the temperature in the center of the packet reached the specified level. Controls were also placed in foil packets and moistened, but they were not heated. Each treatment was applied to one group of 60 seeds.

Following treatment seeds were placed in Petri plates on moistened filter paper blotters and germinated seeds were counted at intervals of 3, 6, 9, 12, 16, 27, and 33 days.

Results

The rate of seed germination was not affected by any treatment. Most seeds that germinated did so from 3 to 6 days after the tests began, and in all species germination was essentially complete after 16 days.

Heating L. cuneata seeds to 60, 80, and 100°C increased germination (Fig. 1). It only took 1 minute at 80 or 100°C to stimulate germination, but required 4 minutes at 60°C to cause an increase. No germination occurred after 32 minutes at 100°C. Tempera-

Fig. 1. Response of Lespedeza cuneata to moistening and heating.

These differences may be due to small errors of measurement on the adjacent rangeland resulting from upward water fluxes.

Nonweighing lysimeters similar to one proposed by Van Bavel and Stirk (1967) would eliminate both the problem of upward water movement and percolation through the profile. In conjunction with the neutron method, these lysimeters would be a useful tool for determining ET over short time intervals.

Literature Cited


The importance of leaf area determinations in the plant sciences has stimulated the use of a great variety of techniques for measurement of leaf area (Marshall, 1968). Light interception techniques have been used most extensively for fast yet accurate determinations of leaf area. A large number of such photoelectric planimeters have been devised (Marshall, 1968). Most photoelectric planimeters follow the same basic design. Leaves are held in a horizontal position on a stage and illuminated from above with a defuse light source. The amount of light intercepted by these leaves is measured by a photoelectric sensor located below the stage. Components of such a devise are housed in a light-proof enclosure. Since most planimeters have been designed to accommodate large leaves, a large evenly-illuminated stage is paramount. To achieve this, it has been necessary to use substantial distances between the light source, the stage and the sensor (Donovan et al., 1958); collimating and condensing lenses (Miller et al., 1956; Davis et al., 1966); or an optical cone (Kramer, 1937). These modifications have resulted in extremely large and complex planimeters which are often expensive and limited to laboratory use. Small portable photoelectric planimeters have been devised, but these have not been refined to the point where errors can be reduced to an acceptable level (Voisey and Kloek, 1964).

Desert range species are particularly suited for use in a small-stage photoelectric planimeter. A large number of these small leaves can be conveniently placed on a rather small stage and most species have leaves which are completely opaque. We describe here a small stage, inexpensive, portable and precise photoelectric planimeter, which is particularly suited for western range species.

Methods and Materials

Construct a small light-tight housing (30 x 30 x 60 cm) of a suitable material such as 6 mm (¼ inch) plywood with a small access door (Fig. 1). Paint the inside of this housing with a flat black paint and provide the access door with a rubber light-tight seal. A small 25 watt a-c bulb provides an excellent source of illumination if line power is available. A small 6 or 12 d-c automotive bulb could also be employed when line current is not available. Mount this lamp on a small plate and use a series of bolts with wing nuts or a similar mounting scheme to adjust the height of the plate. Because of the low amount of heat produced by such a bulb, no ventilation is required in the housing as is usually needed in most other photoelectric planimeters (Davis et al., 1966; Kramer, 1937; Miller et al., 1956). The illumination sensor used in this particular planimeter is a 4.9 cm (1.9 inches) diam. photovoltaic cell (Model HR-1247, Centralab Instruments Co., El Monte, California). The output from this photovoltaic cell is measured with a microammeter. The stage is located immediately above the light sensor and consists of a piece of frosted glass painted with black paint except for a 4.9 cm diam. area immediately above the photocell. Spread the leaves on this 4.9 cm diam. stage and cover the leaves with a piece of frosted glass to hold the leaves flat and to insulate an even illumination field. If necessary, a series of screen filters can be placed between the stage and the lamp to reduce and defuse the light. This photoelectric planimeter can be constructed for less than $100.

Highlight

A small and inexpensive photoelectric planimeter is described. This planimeter is particularly suited for the precise determination of leaf area for many western range species.

A Portable Small-Stage Photoelectric Planimeter for Leaf Area Measurements

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