Dehydration Effects on Germination of Live Oak Seed[1]

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Abstract

Mature live oak, *Quercus virginiana* Mill., acorns were collected from four trees in Dallas, Texas, dried at 35°C (95°F) to 0 to 30% weight loss, and allowed to germinate. Drying reduced germination, but the relationship of percent germination to weight loss varied from tree to tree. In general, the smallest acorns had the lowest germination rate. Drying time was closely related to percent weight loss in all seeds. Results suggest that growers should select live oaks with larger seeds which have demonstrated high germinability.

Index words: *Quercus virginiana* Mill., acorn, viability, germplasm, sexual propagation

Introduction

Conventional seed storage techniques have been unsuccessful when applied to live oak (*Quercus virginiana* Mill.) (7) and other white oaks (9, 10). Seeds of many oaks and other woody plants which have inherently high water and carbohydrate content lose essential salts (electrolytes) when dried, causing consequential metabolic disorders and loss of viability (1, 2, 3, 4, 8).

The tendency for seeds of most *Quercus* species, including the live oak, to germinate while in storage or while still attached to the tree, a condition called vivipary, further makes it impractical for growers to maintain a repository of stored seed for any significant length of time. As a result, nurserymen who grow live oak trees are forced to plant acorns immediately following harvest.

Because live oaks are wind-pollinated and highly heterozygous under natural conditions, obvious morphological differences can be found among individual trees in branching habit, height, leaf shape, and leaf color. More subtle variations are expressed in susceptibility to insects (5), response to fertility (Hipp and Simpson, unpub. data), and rooting of cuttings (6). Development of procedures enabling growers to store seeds from select trees would represent a significant contribution to the nursery industry. Determining the extent of the combined influences of the genetic sources of seeds and the effects of drying on seed viability could be an important step toward that end. Thus, laboratory experiments were conducted to determine the interacting effects of tree source and dehydration on germination of live oak seeds.

Materials and Methods

Seven hundred acorns were collected from the branches of each of four live oak trees in Dallas, Texas, in October, 1985. The seeds were immediately transported to the laboratory at the Texas A&M University Research and Extension Center, weighed, and separated (by tree source) into groups of 25 seeds. Mean initial seed weights (by tree source) were 1.7, 2.1, 2.5, and 2.7 g.

All acorns except the control groups from each tree, which were allowed to germinate immediately, were placed in a commercial dryer (Stabil-Therm®, Blue M Electric Co., Blue Island, IL) at 35°C (95°F). Four groups of 25 acorns from each tree source were randomly removed from the dryer at weight losses of 5, 10, 15, 20, 25, and 30%, then placed in polyethylene bags containing moist peat moss, and allowed to germinate in the laboratory. The acorns were examined in 14 days, and germination was based on radicle emergence of at least 1.3 cm (0.5 inch). Untransformed and arcsin transformed data for the completely randomized design experiment were analyzed using SAS (SAS Institute, Inc., Cary, NC) general linear models procedures.

Results and Discussion

The relationship between percent germination and weight loss by seed had significant ($P<0.0001$) linear, quadratic and cubic components, but did not have significant quartic components (Fig. 1). The trees from which acorns were collected significantly ($P<0.0001$) affected germination, but the relationship of percent germination to weight loss was slightly different ($P<0.0001$) among trees. In general, the smallest acorns had the lowest germination, but the largest acorns also had somewhat reduced germination. This suggests that acorns as small as 1.7 g may have reduced germinability, although data from an experiment designed specifically to measure the effects of acorn size on germination would be needed to substantiate this. Consequently, results indicate that the precise effects of drying on germination may be somewhat seed-source dependent, although drying significantly retarded germination among all tree sources.

Drying time was related ($P<0.0001$) to percent weight loss in a quadratic fashion, and a prediction equation closely fit all seed sources tested (Fig. 2). This close relationship between drying time and percent weight loss among all acorns further emphasizes that only freshly sown live oak seeds should be expected to exhibit maximal viability. The data indicate that germination declined rapidly after about

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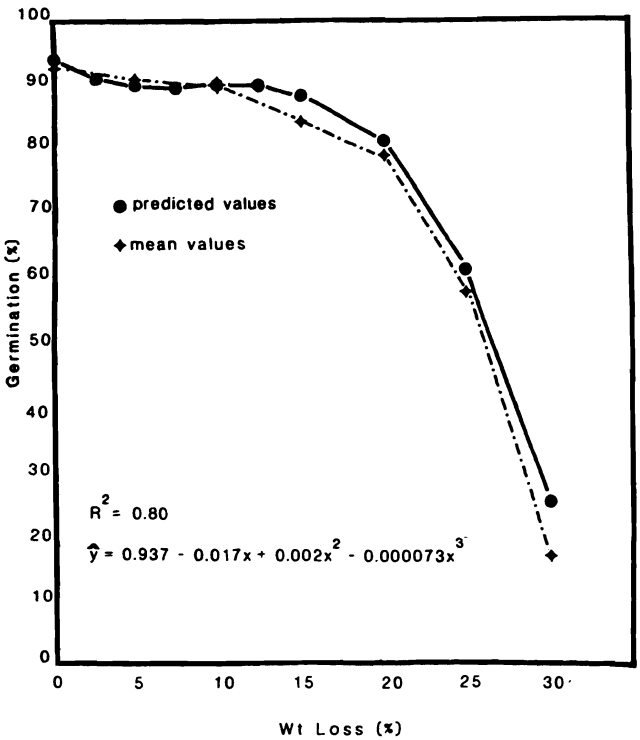

Fig. 1. Predicted and actual mean values of acorns that germinated after drying at 35°C (95°F) for 0–30% weight losses. Computed values were derived from the prediction equation.

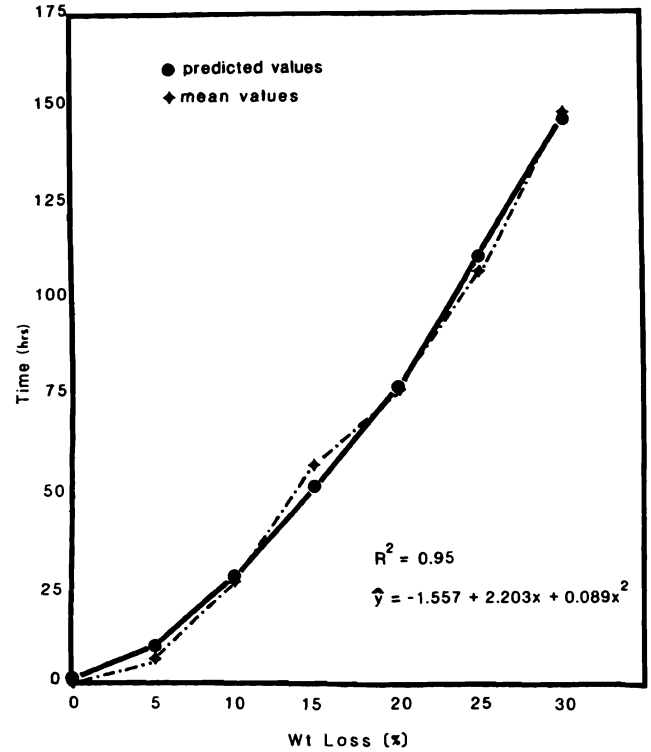

Fig. 2. Predicted and actual mean values of drying time of acorns to achieve weight losses of 0–30%.

20% weight loss (Fig. 1), which might occur in about three days (Fig. 2).

Significance to the Nursery Industry

Among all seed sources, drying interfered with live oak seed germination, possibly to a lesser extent with larger seeds than smaller ones. Growers should therefore consider collecting seeds directly from the extended branches when mature and not from the ground where acorns may have lain for extended periods of time. In the present study, nontreated seeds freshly collected from the trees (the control group acorns) yielded >95% germination. The differences in response by seed sources suggest that growers should select trees that traditionally have yielded larger seeds that germinated at high rates.

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