Acorn Size Effects Seedling Size at the Penn Nursery

Robert P. Karrfalt

Robert P. Karrfalt is Director, USDA Forest Service National Tree Seed Laboratory, Purdue University, 195 Marstellar Drive, West Lafayette, IN 47907; telephone: 765.494.3607; e-mail: rkarrfalt@fs.fed.us

In: Dumroese, R. K.; Riley, L. E.; Landis, T. D., tech. coords. 2005. National proceedings: Forest and Conservation Nursery Associations—2004; 2004 July 12–15; Charleston, NC; and 2004 July 26–29; Medford, OR. Proc. RMRS-P-35. Fort Collins, CO: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station.

Keywords: *Quercus rubra, Quercus alba,* seedling grades

Introduction

The Pennsylvania Department of Conservation and Natural Resources Penn Nursery, located in Spring Mills, PA, was 1 of 4 nurseries participating in a study to determine the effect of acorn sizing on production of northern red oak (*Quercus rubra* L.) and white oak (*Q. alba* L.). It is hypothesized that larger acorns would produce larger seedlings. Therefore, by sizing acorns, it will be possible to produce more uniform beds of seedlings, tailor production schedules to acorn size, and reduce cull percentages.

Penn Nursery was the only nursery of the 4 involved in this series of experiments in which the white oak experiment was successfully carried out. The white oak survived poorly in the one other nursery where it was planted, as did the red oak in that same nursery. The results from the 2 nurseries where survival was good were reported previously (Karrfalt 2003). At the Penn Nursery, oak is a 2+0 crop. This prevented reporting the Penn results earlier with the results from the other 2 nurseries.

Materials and Methods

In the other surviving experiments (Karrfalt 2004), the root volume, fresh weight, diameter, and height of the seedlings were, on the average, all well correlated to the acorn size. Because all 4 seedling measurements were providing equal information on the relationship of seedling quality to acorn size, it was decided that only seedling height and diameter would be measured at the Penn Nursery. Seedling diameter and seedling height are the typical measurements used to evaluate seedling grades; therefore, these 2 measurements would have immediate translation for the current grading procedures. In addition, the red oak was top-clipped at the Penn Nursery, which precluded the measuring of seedling heights on that species.

One mixed lot of acorns for both red and white oak were sized by hand with round hole perforated metal screens arranged in a 2-full-size step series. The screen sizes used were 36, 38, 40, 42, 44, 46, 48, 50, 52, 54, and 56 for the red oak and 30, 32, 34, 36, 38 for the white oak. Each size fraction was mixed to assure uniformity.

Results

Figure 1 shows the regression line for plot means of seedling diameter against acorn size for the white oak. Figure 2 shows the same for seedling height. These plots demonstrate that, in general, the larger the acorn size, the larger the seedling for white oak in this crop. The regression for both seedling diameter and height against acorn size was highly significant. The relationship was greatly increased by simply dropping the 3 smallest plots from the 2 largest acorn sizes. With all the data, acorn size explained 21% of the variation in seedling diameter and, after dropping the 6 poorest performing plots, acorn size explained 56% of the variation.

Figure 3 shows the regression line for plot means against acorn size for red oak. This regression was not statistically significant. When dropping the lowest 3 plot values in all acorn sizes, the regression was significant, although acorn size still only explained 14% of the variation in seedling diameter.

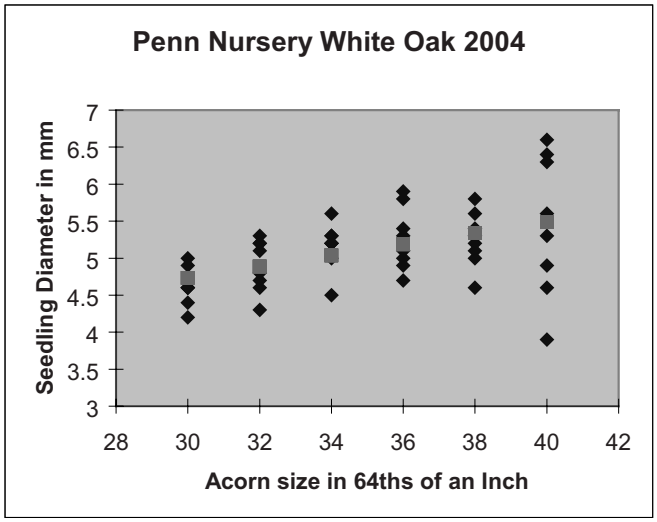

Figure 1—White oak seedling diameter plotted against acorn size as a function of screen openings.

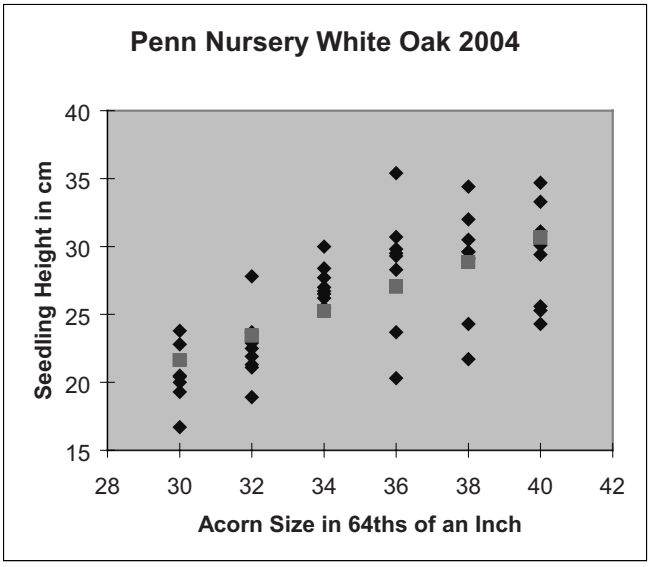

Figure 2—White oak seedling height plotted against acorn size as a function of screen openings.

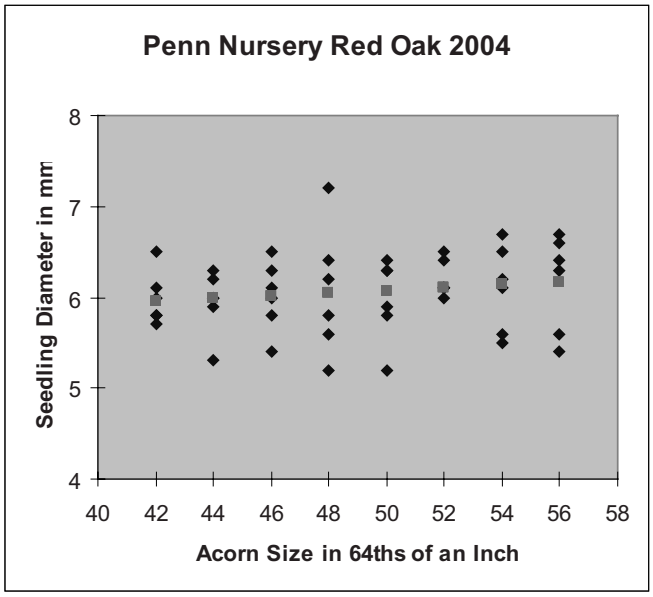

Figure 3—Red oak seedling diameter plotted against acorn size as a function of screen openings.

Conclusions

The Penn Nursery experiment basically agrees with the results reported previously by Karrfalt (2003)—larger acorns will produce larger seedlings. The strength of the relationship was not as evident here, especially for red oak. The growing season at the Penn Nursery is approximately 90 days, and the soils are heavier and shallower than at the Indiana Department of Natural Resources Jasper-Pulaski Nursery and Wisconsin Department of Natural Resources Wilson Nursery reported in 2003. These more limited growing conditions could have limited the seedlings from expressing their full potential, which might have led to smaller differences in seedling size. Oak seedling size was influenced by acorn sizing at the Penn Nursery and is, therefore, one tool a nursery manager can use to manage the size of oak seedlings.

References

Karrfalt RP. 2004. How acorn size influences seedling size and possible seed management choices. In: Riley LE, Dumroese RK, Landis TD, technical coordinators. National proceedings: Forest and Conservation Nursery Associations—2003. Fort Collins (CO): USDA Forest Service, Rocky Mountain Research Station. Proceedings RMRS-P-33. p 117-118.