

## SEED SIZES EFFECTS ON FIRST-AND SECOND-YEAR PECAN AND HYBRID PECAN GROWTH

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There has been considerable information published on the effect of seed size on growth of various agricultural crops (1, 3, 6) and, generally, in forest tree species size of seed and first-year growth have been positively correlated (2, 5, 7, 9, 10). However, one study with improved varieties of pecan (*Carya illinoensis*) (Wangenh.) (K. Koch) indicated that seed size (weight) had no influence on germination or seedling vigor (4).

In wild populations of pecan there is a large amount of tree-to-tree variation in seed size (fig. 1). If seed size has an effect on seedling growth during the first or second year, this might enable the nurseryman to produce larger 1-0 seedlings simply by preselecting and planting the largest seed. This study was designed to test the size-seedling growth relationship of forest-grown pecan.

### Methods and Procedures

Pecan seeds of various sizes were collected from 35 native pecan trees within a 50-mile radius of Baton Rouge, La. Considerable size variation was encountered among individual trees. Also included in the study were 15 seeds from each of two trees identified as the hybrid *C. X lecontei* Little (*C. illinoensis* X *aquatica*) (8). The hybrid seeds were larger than those of the wild pecan and were included in this

study to obtain further information on this hybrid.

A total of 200 seeds were visually checked for soundness, and length, width, and weight were determined for each seed. Seeds were numbered individually, placed in cold storage (2° to 5°C) for 120 days, and planted in the nursery at Louisiana State University, Baton Rouge, in May 1974. Planted seed locations were mapped to identify individual seeds for seed size—seedling growth evaluations.

The seed beds received the normal nursery schedule of hand weeding and watering. At the end of the growing season (November 1974) heights of all seedlings were measured to the nearest centimeter. The seedlings were allowed to grow for another year in the nursery beds (second growing season). In November 1975, height was again measured.

A multiple regression analysis was used to determine the effect of seed size (a composite variable with components of length, width, and weight) on seedling growth the first year, and to determine if there was a residual effect into the second year.

### Results and Discussion

The effect of seed size on first-year height growth of pecans and hybrids was positive and highly significant ( $P > 0.01$ ). The effect of seed size on

A seed size-seedling height growth study with pecan showed a measurable and significant increase in average first-year growth associated with larger seed size (especially weight).

second-year height growth was positive but nonsignificant. When the three size components (weight, length, and width) were analyzed separately, only weight was significantly correlated with height in the first year.

When only the *C. illinoensis* were analyzed, the effect of seed size on first-year height was positive and significant ( $P > 0.05$ ). The size components weight and length were significant ( $P > 0.05$ ) in the first year. The effect on second year was positive but nonsignificant.

The effect of seed size on growth of the *C. X lecontei* hybrids was nonsignificant for both years, and none of the three size components were significant.



**Figure 1.**—Example of variation in seed size for forest-grown pecan (*Carya illinoensis*).

Although the size of the seed was significantly related to height growth the first year, the  $R^2$  values were low. In the analysis combining both native and hybrid seeds, an  $R^2$  value of 0.21 was obtained. This indicates that 21 percent of the variation in height growth was due to the size of the seed. The remaining variation should be due to other genetic and environmental variation and to experimental error. In practice, the selection of a parent pecan tree on the basis of phenotype and subsequent grading of its seed by size should enable the nurseryman to produce larger 1-0 seedlings.

The relationship between seed size and seedling growth of the hybrid *C. X lecontei* suggests that these progenies possess heterosis or hybrid vigor for early growth. Hybrid seedling height growth in both the first- and second-year was much better than that of native pecan seedlings (table 1), but no significant correlation between seed size and seedling growth was found.

When the data for pecan and the hybrid are compared, an increase in mean height growth at the end of the second growing season of 15.52 cm for the hybrids and 10.09 cm for the pecans is noted. If second-year growth is primarily genetically controlled and seed effects are no longer significant, these data may be indicative of heterosis.

If *C. X lecontei* seedlings are heterotic, then there is a potential use of these seedlings for reforestation and as grafting root stock for commercial pecan nurseries. However, much more research must be done on the grafting compatibility and wood properties of the hybrid. Also, there may be a problem of partial inviability of the hybrid because only a small percentage of hybrid seed germinated (8).

The production of seedlings that are both large and vigorous is important both to the forester who will outplant at the end of the first growing season and to the horticulturist who intends to graft a commercial nut variety on native root stock. Seedling size is critical from the standpoint of survival and the ability to withstand competition from other seedlings, grasses, and weeds. In pecan orchard culture, the objective of producing large, vigorous seedlings is to facilitate earlier grafting. If seedlings could be grown large enough to graft in

the first year, about 2 years could be gained, and the care and expense of keeping seedlings during that time could be eliminated.

The most important relationship found in this experiment is that there is a measurable and significant increase in average first-year seedling height growth associated with larger seed size (especially weight). Since this relationship accounts for only a moderate percentage of the total variation in seedling size, phenotypic selection and progeny testing should result in further genetic gains in juvenile growth.

**Table 1.**—Mean sizes of seed and seedlings

	Seed Size			Seedling Height	
	Length	Width	Weight	Year 1	Year 2
	(cm)	(cm)	(gm)	(cm)	(cm)
Pecans and hybrids	2.96	1.59	3.09	15.55	26.50
Hybrids	3.41	2.18	4.74	22.89	38.41
Pecans	2.88	1.48	2.78	14.18	24.27

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