DOES LONGLEAF PINE CONE PRODUCTION CORRELATE WITH SEED PRODUCTION, SIZE, AND GERMINATION RATE?

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EXTENDED ABSTRACT

Fire-dependent longleaf pine (*Pinus palustris*) ecosystems in the Southeastern United States require viable seed sources for successful natural regeneration. Most studies focus on cone production as a relatively easy-to-measure variable. However, there is little understanding of whether cone production is a reliable proxy for both seed production and seed viability, which may be decoupled at high cone production levels. Identifying relationships between cone production, seed production, seed size, and germination rate should provide managers and landowners better information to predict the success of natural regeneration efforts more accurately in their longleaf pine stands. The objectives of our study were to 1) determine the relationship between cone production and seed production across individual mature longleaf pine trees, 2) determine whether cone production and seed size characteristics are related across mature longleaf pine trees, and 3) determine whether seed germination rates vary as a function of cone production across mature longleaf pine trees.

To better understand cone-seed relationships, we conducted two rounds of longleaf pine seed collection from trees representing a gradient of cone production during seedfall (mid-October to early December) (Boyer 1963). In 2021, we collected seeds from 10 trees in a longleaf pine stand at The Jones Center at Ichauway (Newton, GA) using ten 0.25-m^2 seed traps placed under each tree. In 2022, we collected seeds in the same stand at The Jones Center at Ichauway and in one stand each at Blackwater River State Forest (Milton, FL) and Eglin Air Force Base (Fort Walton Beach, FL). The 2022 collections were also from 10 trees in each stand, but we used three 3-m^2 seed traps placed under each tree (fig. 1). We tallied seeds to determine seed production and measured seed length, width, and mass to explore seed size trends and their relationship to cone production and seed

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Figure 1—Seed traps placed under a longleaf pine tree at The Jones Center at Ichauway, Newton, GA, in 2022. (Photo courtesy of Rachel Nation)

viability. We also conducted germination trials with the collected seeds in a growth chamber under controlled conditions (20 °C, 16:8 hour light:dark) (AOSA 1993).

Overall, we found that the density of total seeds, developed seeds (wing with seed present), and undeveloped seeds (wing with no signs of viable seed present) all increased with increasing cone production before declining, following a quadratic model. Total seed density increased with cone production reaching a maximum of 120 total seeds collected per square meter trap area at 100 cones per tree before declining with further increases in cone counts. Density of developed seeds also increased with cone production reaching a maximum of 80 developed seeds collected per square meter trap area at 110 cones per tree before declining with higher cone counts. Undeveloped seed density increased with cone production reaching a maximum of 40 undeveloped seeds collected per square meter trap area at 100 cones per tree before declining with higher cone counts.

There were no significant relationships between any of the seed size metrics (seed length, seed width, total length, wing width, total mass, and seed mass) and cone production. We observed that the relationship between probability of germination and seed mass followed a logistic pattern. In addition, we found no definite relationship between cone production and seed germination in longleaf pine seeds.

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