Pentane Flotation for Separating Full and Empty Longleaf Pine Seeds

Note by B. F. McLemore

Abstract. Full and empty seeds of *Pinus palustris* Mill. can be separated with high precision by flotation in *n*-pentane, which is not harmful to viability. While this method is probably best suited for small lots of seed, it can also be used for large ones.

THE BUOYANCY of longleaf seed exceeds that of most other pines, and the literature contains no report of a liquid with a suitable specific gravity for separating full and empty seed. Loblolly pine seed can be sorted in water, shortleaf and sand pine in 95 percent ethyl alcohol, and slash pine in a 1:1 mixture of ethyl alcohol and water.

Pentane is a saturated or paraffin hydrocarbon with five carbon atoms. Of the three structural isomers, *n*-pentane (normal pentane) has the highest boiling point and is easiest to handle. Its specific gravity at 25° C is 0.62, and its boiling point of 36° C is substantially higher than related compounds with fewer carbon atoms.

In trials at Alexandria, La., *n*-pentane gave excellent separation on several lots of dewinged longleaf seed that had been stored at moisture contents of less than 10 percent. With most lots, about 1 or 2 percent of the seeds stayed suspended in the liquid, or hung just below the surface as shown in Figure 1. In such "hangers" the cavity within the seedcoat was not completely filled, and germination averaged about 10 percentage points less than for seeds that sank.

Full seeds sank just as readily with wings attached as when dewinged. Empty seeds with holes in their seedcoats also sank.

Several lots of seed were soaked in pentane for periods ranging up to 4 hours, although 2 minutes is ample for fractionating small lots.

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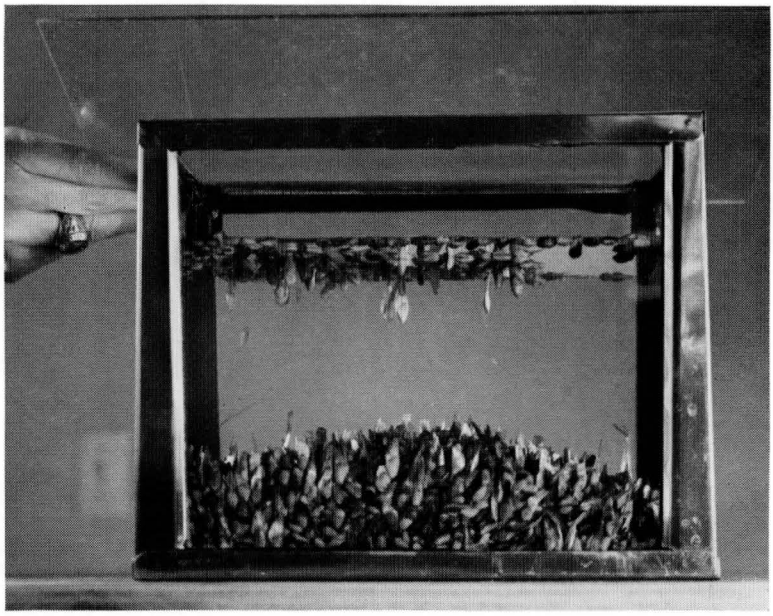

FIGURE 1. *Longleaf seeds that have sunk are 100 percent sound; those floating are 100 percent empty. The few seeds hanging just beneath the surface are sound, but their viability is slightly less than that of the seeds on the bottom.*

Viability was unharmed, even by the 4-hour soak. In fact, seeds that were soaked in pentane consistently germinated two or three days earlier than the control lots. Results of one test are summarized here:

Length of pentane soak	*Germination in 9 days*	*Final germination*
	percent	
0 (Control)	26	94
30 minutes	60	95
2 hours	46	91
4 hours	50	95

The speed-up in germination may be due to the action of pentane in dissolving gums and resins in the seedcoat, and hence increasing permeability to oxygen and moisture.

The pentane method will have practical application for separating full and empty seeds in small lots, such as may be obtained from one to several cones in controlled pollinations. More than 35,000 seeds, representing 57 lots from a pollination study, were separated in less than one day.

Although long-term data are not available, seeds probably can be returned to storage after separation, provided they are first thoroughiy aired. Nevertheless, it is recommended that seeds be sown immediately. Because of the volatility of pentane, seeds dry within a matter of seconds.

As pentane is highly flammable, commensurate precautions should be taken. Storage should be in a sealed container in a cool place. A refrigerator is undesirable, because if the container develops a leak the vapor will accumulate within a tightly enclosed area and may cause an explosion when the door is opened. A vapor space should be left above the liquid level in sealed containers to permit expansion. Since pentane is volatile at room temperatures, care must be taken to prevent excessive inhalation of the fumes. It is recommended that empty seeds be floated off out-of-doors or under a hood in the laboratory. Prolonged contact with the skin should be avoided.