PACKAGING IN KRAFT-POLYETHYLENE BAGS

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Kraft-Polyethylene bag packaging has been evaluated in formal studies started in 1960 and in a later large-scale operation. The Yazoo-Little Tallahatchie Flood Prevention Project in north Mississippi adopted K-P bags after a successful pilot-scale trial with one million seedlings in 1962. Since then, the project has packed, shipped, and stored 60 million seedlings in K-P bags.

The multi-wall K-P bag being used has a 24-inch face width, a 30-inch face height, and an 11.5-inch gusset. It is available in either two or three plys of kraft. In either type, polyethylene (or unithene), which is waterproof but permeable to gases, is applied as a 10-pound laminate to the inner-facing wall of 50-pound kraft. The outer wall is 50-pound wet strength kraft. The bottom is sewed. The 3-ply bag, first used in 1964, has a middle wall of 50-pound wet strength kraft which helps reduce the likelihood of tears and punctures. The most recent bid awarded by the Yazoo-Little Tallahatchie Project for 45 thousand 3-ply bags was 162.55 per thousand.

The open bag forms a rectangular receptacle 22 inches high with a 12- x 24-inch base. Seedlings are packed horizontally. When packed with moss, the roots are overlapped as in standard Forest Service bales. When packed without moss, lots of seedlings can be alternated so that tops overlap roots; this arrangement achieves a uniform package. Four lots of 250 seedlings each were found convenient when seedlings are counted out to planters.

Excess air is expelled and the bag is sealed by sewing the top. Folding the top over the bag and holding it in place with a wrap of heavy twine completes the packing operation. The Y-LT Project sews the top and rolls it on a 2-foot baling stick, then wraps the bag with a 2-foot-wide sheet of heavy paper secured with a steel strap. This refinement results in a smaller, more rigid package and facilitates handling, but is unnecessary in many situations.

The clean dry package of 1,000 seedlings is 12 to 14 inches in diameter and about 30 inches long It weighs 25 to 35 pounds depending upon the size of seedlings and the quantity of moss. Project personnel report that K-P bags reduce back strains, the most common injury during the planting season. Forest Service bales of 2,000 seedlings commonly weigh 60 to 70 pounds and have, on occasion, topped 150 pounds.

Whether or not seedlings are packed with moss depends on the storage facilities and the duration of storage anticipated.

Dormant, well-hardened seedlings packed without moss can be held in cold storage for at least 3 months, or in a warehouse for 3 weeks.

Packing with moss is recommended when seedlings are to be held in a warehouse longer than 3 weeks. Three to 5 pounds of damp moss, well distributed among the roots, is sufficient.

This recommendation is conservative, for year-end survivals of seedlings packed without moss and stored in a warehouse for 3 to 9 weeks have exceeded 90 percent. When decreases in survival have occurred, however, they have been greatest when trees were packed without moss and held in a warehouse for 5 to 9 weeks. Other studies have shown that the physiological condition of seedlings packed without moss may be impaired by 5 to 9 weeks of storage at air temperatures. Their condition was measured by their ability to tolerate root exposure immediately prior to planting.

Moss should be well-drained or wrung out. It should not be completely saturated for if excess water accumulates at the bottom of the bag, the immersed seedlings will decay.

The Forest Service's Ashe Nursery has recently begun icing the vats used to soak moss. This practice, common in northern nurseries, helps prevent the moss from fermenting and keeps seedlings cool.

K-P packages require certain precautions during shipment and subsequent storage. Support, rather than just space for air circulation, should be provided for every four tiers of bags packed with moss and every six tiers of bags packed without moss. If the bags are piled higher, the excessive weight on the lowest layer squeezes water from the moss and abets heating. Spacers between layers of bags are also desirable, especially for long hauls or extended storage.

Seedlings in K-P hags do not require watering or other attention during storage but should be protected from freezing and exposure to the sun. Cold moist storage at temperatures just above freezing is ideal.

The Y-LT Project hauls seedlings in refrigerated cars and stores them in additional rented cars and in a cold storage warehouse. An electric fork lift, metal racks, and pallets holding 20 or 24 K-P bags facilitate handling in the cold storage unit. In the rented cars, shelves support each tier of bags.

While the principle of completely enclosing seedlings in plastic materials is well established, the additional shipping requirements suggest that K-P packaging can be improved. Possibilities are to seal seedlings in corrugated paper boxes constructed with an inner polyethylene laminate or to completely enclose seedlings in a bag of thin polyethylene film and then place the bag in a paper box rigid enough to withstand stacking.

One word of caution. Loblolly seedlings lifted too early (in December or before) are apt to heat during shipment and may deteriorate in

storage regardless of packaging method or type of storage. In north Mississippi, this hazard has been circumvented without shortening the planting season. Planting is delayed until after January 1 and the season extended through March and early-April by lifting seedlings in February and holding them dormant in cold storage.