PAPERPOT BIODEGRADABILITY EXPERIENCE IN MINNESOTA

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The Japanese paperpot system was designed for sugar beet production in an effort to extend the growing period before outplanting. The system has since been adapted to growing forest tree seedlings. It has been widely used in Scandinavia, the Mediterranean countries, and most recently in Canada. Use in the United States has been rather limited in comparison to other containerized seedling systems that have been developed.

Paperpots have some very real advantages. One of these is the limited space required for storage. The flat paperpot sets that open up in honeycomb fashion for loading and seeding maximize use of storage space. The only possible drawback is the requirement of dry storage.

Another important advantage is that the strength of the paper allows a relatively long production period (8 to 10 months) without the paper breaking down. Yet, at the end of that period the paper affords an enclosed package that makes handling somewhat easier than a soil-root plug.

A third major advantage frequently cited is that the paper enclosing the soil-root mass is biodegradable and is designed to break down following outplanting. Ideally, the roots penetrate the paperpot walls and develop normally. Rate of breakdown will vary depending upon rated paper life and soil characteristics encountered where outplanted.

Observations are being reported in the literature that even after 3 to 5 years in the field, the paper surrounding the root system on paperpot seedlings is still relatively intact. For example, Bergmann' documented nearly intact paper and poor root development on paperpot plantings on pine sites in Sweden after four growing seasons. He also pointed out the importance of planting the containers deep enough so none of the paper protrudes above the ground. Improper planting creates a wick action and tends to dry the paper up to the point of it being impenetrable by seedling roots.

Results from the paperpot planting described in this paper add to the growing concern about biodegradability of the paper after planting.

In 1974, a feasibility study with paperpot seedlings was established at the University of Minnesota Cloquet Forestry Center in northern Minnesota. Plantings were made with two sizes of paperpots (FH 315 and FH 415) during various time periods throughout the growing season (June to early September). Red pine (*Pinus resinosa* Ait.) and Jack pine (*Pinus banksiana* Lamb.) were planted on a well-drained Omega loamy sand site. The topography in this area is nearly level and there are no serious erosion problems. The primary objective of the study was to monitor survival and growth in relationship to the different planting periods. After the 1977 growing season, a number of the trees were carefully extracted and the root systems examined.

It should be noted that this planting was the first ever done with paperpots in Minnesota. Contrary to later recommendations, some of the paperpot seedlings were planted too shallow and the paper was left exposed above the soil surface. (fig. 1). Examination of the extracted paperpots indicated very slow degradation of the paper irrespective of planting procedure. Seedlings grown in paperpots that were planted properly, as well as those planted improperly, showed little root penetration of the paper sidewalls after four growing seasons. With lateral root development restricted, the majority of the roots were developing from the bottom of the paperpot (figs. 2 and 3).

Actually, root development from the bottom of the paperpot rather than the sides can be advantageous for seedling sur-

[1] Bergmann, Fritz. 1973. Some important facts considering planting with rooted forest plants. For. Chron. 52(6):266-273. Translated by R. A. Hellenius, Ret.

vival. Maximum root development in a zone least susceptible to surface moisture stress is preferred, especially in northern Minnesota where mid-growing season droughts are frequently encountered. It is yet too early to speculate on how the failure of the paper to degrade, and the somewhat deformed root system will affect growth of the seedlings. The seedlings that were extracted and examined had good crown development and were growing adequately considering that the second growing season after they were planted was one of the driest on record in northern Minnesota.

Deformed roots are certainly nothing new on planting stock. The frequency of the "hockey-stick" root system on transplants is a prime example. Also, many seedlings that are jammed into the small slit made by a planting bar frequently develop an abnormal root system. However, anything that can increase survival and growth of plantations, including elimination of poorly developed root systems, should be used. It is important that the potential problems with lack of paper degradation of paperpots be recognized.

Figure 1.—*Improperly planted paperpot seedlings with paper extending above soil surface.*

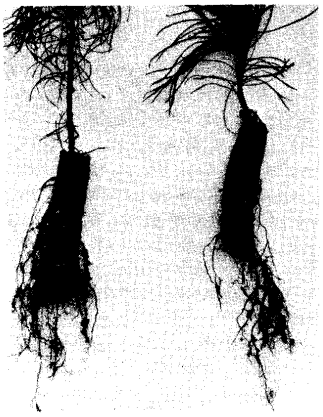

Figure 2.—*Root development and lack of paperpot deterioration on seedlings planted with paper extending above soil surface.*

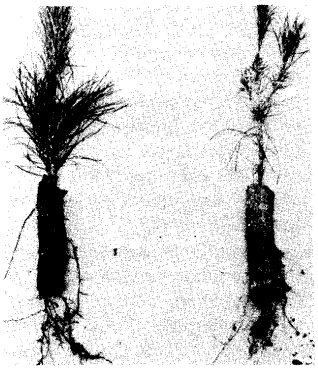

Figure 3.—*Root development and lack of paperpot deterioration on seedlings planted without paper extending above soil surface.*