BIODEGRADABLE CONTAINERS

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The concept of biodegradable containers to grow trees is not new. For example the Tar Paper Pot (1936) and the Jiffy Pot (1957) 1/ among many others are all biodegradable.

The Forest Service in Region 3 recently has been examining several different kinds of containers that would fall into the biodegradable class of containers. Some of these include Frame° BR-8, Keyes Fiber Tree Start and Union Carbide containers. Of all these different kinds of containers, we would like to limit this talk to Union Carbide containers. Much of the preliminary work on the material in this container, polycaprolactone, has already been done. If you are interested in persuing the chemistry and degradation work, this was given in an earlier symposium 2/ that was held in Denver in 1974 and for that reason we will avoid digressing into that area.

Of the containers that we have been testing, the Union Carbide container made of polycaprolactone seems to hold the most promise at this time. These containers are hex-shaped tubes which can be made to deteriorate at various rates. The containers are 52 inches high with a hole in the bottom about 4 inch in diameter. The containers are thin and pliable. Other specifications are given in Table I.

There are presently studies being conducted with this product in the Northwest, Southeast as well as in the Southwest. The project about which we want to talk today started approximately a year ago. Representatives of the Forest Service and Union Carbide met to formulate a plan of study of Union Carbide Biodegradable Containers with Union Carbide agreeing to provide about ten thousand containers. There were four different sizes

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1/Mention of trade names is solely to identify materials and does not imply endorsement by the U.S. Department of Agri.

2/Barnett, James P., Principal Silviculturist, Southern Forest Experiment Station, USDA Forest Service, Pineville, Louisiana, 71360, Paper presented at North American Containerized Forest Tree Seedling Symposium, Denver, Colorado, August 26-29, 1974, Pages 124-128.

The third formulation upon removal from its box remained intact with no root egression and almost no fracturing of the container. This particular formulation held together quite well as it was handled and placed in holes for planting. The only problem we had with this third formulation was that the containers nested so closely that they had a tendency to stick together.

Another problem was observed when some of the containers were torn apart to look at arrangement of the roots. The small hole, about one quarter inch diameter, in the bottom of the container had filled up with roots early in the growing period leaving no room for the later roots to egress. The later roots upon reaching the bottom coiled up in a dense mat.

The planting was finished in the third week of July with the intent that sometime in mid-October, we would return to the site to sample the trees for survival, container degradation and root egress into the soil. If the results of this inspection is favorable, Union Carbide plans on making some adjustments in container shape to compensate for some of the problems noted in the study. Some of the changes in shape presently being considered are to increase hole size in the bottom of the container to allow for greater root egression and to place a rib on the side of the container to prevent complete contact between containers in boxes which will alluviate the sticking problem.

Depending on the data collected in this and other studies, Union Carbide will begin assessing the advisability of production of this container commericially. Samples of the new improved style should be available in the spring of 1978 for testing by interested parties.

TABLE I

Specifications of UCC Biodegradable Containers Available for Testing3/

Container Code	Container Width[a]	Nesting Density[b]	Volume[c]
UCC-1.1	1.143 in.	165	4.39 cu.in.
UCC-1.3	1.313	127	6.04
UCC-1.5	1.500	101	8.12
UCC-1.6	1.625	82	9.64
UCC-2.0	2.000	54	14.22

a) Diameter of circle circumscribing the hexagon.
b) Number of containers per square foot.
c) Volume measured for a 6" long container with bottom.

3/Copied, Table 2.3, Courtesy Union Carbide Corporation.

and three different chemical formulations. The Forest Service for their part agreed to provide the growing medium, the tree seed (Ponderosa Pine) and the greenhouse culturing for six months. At the end of the growing period, the Forest Service would also provide fenced planting sites near Cloudcroft, New Mexico for the final phase of the study.

During the six months period the trees were in the greenhouse, every six weeks certain containers with their trees were taken from the greenhouse and distructively examined to determine the container degredation rate, stem diameter and height of the tree. These particular containers prior to the on set of the study were weighted and numbered so the difference between the initial weight and the degraded weight could be determined. Other comparisons of tree growth were made depending on nesting density and container size.

During the growing period in the greenhouse, the trees responded to the growing conditions about the same as the other trees being grown for the different National Forests. The trees being grown for the National Forests were grown in a variety of kinds and sizes of containers from stryo 2 1 8 through Ray Leach Super Cells. About the only problem incountered during the greenhouse period was a small bug that ate the plastic container. This bug which normally eats organic matter seemed to prefer the plastic over the pest moss.

After six months time in the greenhouse, the trees were approxiamatly five inches tall and the stems about 1/16 to 3/32 inch diameter which compared favorably with tree growth in other Styles of containers. Shortly after this the trees were transported to the planting sites near Cloudcroft where they were planted in rows four feet apart in a random pattern so the results could later be analyzed statistically.

At the site as the trees were removed from the boxes it was found that two of the formulations had degraded to the point that it was hard to remove them from the boxes. One of the formulations had degraded to the point that the container walls were completely coming apart. Root egress had tied all the containers together that were in a box. When attempting to remove a single tree, the container fell completely apart and separating the intertwined roots tore the remainder of the roots and medium apart. This particular container appeared to be more suitable for a two to three month growing cycle.

The second formulation that had degraded beyond an acceptable point had some fracturing of the container and some root egression tying the containers together. The results on try- to remove from its box was that it would come out intact about fifty percent of the time, with the remainder of the time, portions of the container falling off and the subsequent loss of some of the growing medium. This container appearently would be useful for a growing period of four to five months.