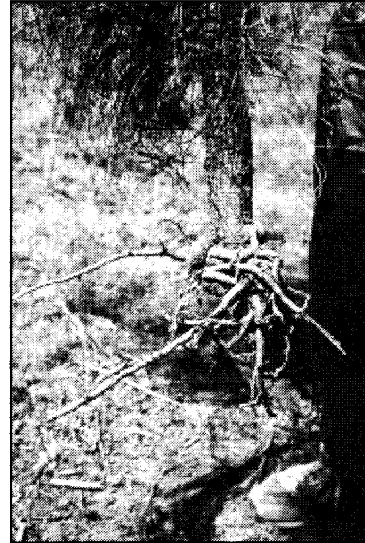


### Improving Polybag Culture for Sustainable Nurseries

Bags made of polyethylene plastic sheeting are the most commonly-used nursery containers in the world because they are inexpensive and easy to ship and store. Unfortunately, polybags generally produce seedlings with poorly formed root systems that spiral around the sides and the bottom of the smooth walled containers (**Figure A**). This problem becomes much worse when seedlings are not outplanted at the proper time and are held-over in the container. Polybags are typically grown side-by-side on the ground, which allows aggressive roots to grow into the soil. Thus, by the time of harvest, many seedlings are seriously rootbound, and do not survive or grow well after outplanting.

Because of this problem with poor root form, many people have advocated that all polybag nurseries should convert to more "high-tech" hard plastic containers that control root spiraling. But, changing only the type of container without adjusting the entire nursery system is just asking for problems. Hard plastic containers are meant to be used with artificial growing media, which is very uniform in quality. This is not the case in developing countries where nurseries typically use forest soil or some type of soil mix for growing media. Peat moss-based growing media are too expensive and difficult to obtain in developing countries, especially in the tropics or semi-tropics. Soil-based mixes are notoriously variable in their ability to supply water, oxygen and mineral nutrients. This variability makes uniform irrigation and fertilization difficult, if not impossible. Irrigation of smaller-volume hard plastic containers must also be frequent and uniform. Most polybag nurseries do not have modern irrigation systems that apply water evenly, and so the containers must be watered by hand. In spite of the common perception, hand watering of small volume containers is more variable than automated irrigation systems. Finally, hard plastic containers must be placed on raised benches that are designed to promote root pruning. All of these restrictions mean that converting to a hard plastic containers is usually not sustainable after the initial development funding and technical support stop.



*Figure A: Polybag containers do not control root spiraling, and so seedlings often become unstable after outplanting.*

Rather than insist that nurseries stop using polybags, I suggest that we work at improving the existing container propagation system wherever converting to hard plastic containers would be operationally or financially impractical. In the last few years, I have been working with nurseries in Mexico in association with CEFORA (Center for Reforestation of the Americas) at New Mexico State University. We have decided to try to develop a "low-tech" sustainable nursery system based around the polybag for nurseries where it is impossible to convert to a modern nursery system. In greenhouse trials, Rich Phillips and John Mexal have demonstrated that high quality seedlings can be grown in polybag containers filled with soil mixes, if everything is done properly. Some of these cultural modifications include:

- Soil-based growing media should be amended with other components to promote aeration and drainage while maintaining a high water-holding ability. Bark, sawdust, and pumice are potential components that are both inexpensive and readily available. CEFORA is

doing research into affordable and practical soil-based growing media for developing countries.

✍ Growing media made from forest soils cannot provide the amount and range of mineral nutrients that is needed for rapid seedling growth. Although most nurseries attempt to correct this problem with fertilizer amendments, these attempts are usually thwarted because the native soils immobilize the nutrients. Fertilizer trials, in combination with the proper growing media, have demonstrated remarkable results, even when the seedlings have been severely stunted for several months (**Figure B**).



**Figure B:** *The pine seedlings on the left half of the container were stunted and chlorotic, like those on the right half, until they received proper fertilization.*

✍ Poly tube containers should be used instead of polybags, if at all possible, because they eliminate much of the root spiraling. Poly tubes will hold soil if they are properly filled and placed on screen-bottomed trays, which can either be homemade or purchased commercially. The tray of containers should be elevated above the ground to promote air pruning of roots.

✍ The widespread technique of transplanting newly-emerged seedlings from germination trays to polybags often results in root deformation. Transplanting the emergents at the proper time and improving the transplanting technique will improve the situation, but switching to

planting germinants would be a better option. Ideally, seed quality can be improved to the point where direct seeding would be feasible with many species.

✍ Where root spiraling has already occurred, the adverse effects can be managed by root pruning prior to outplanting. Either the bottom layer of the polybags can be cut off, or the seedling can be removed from the container, graded, and pruned. The now bareroot seedlings can then be dipped into super absorbent polymer or other water-holding material, and the roots "jelly-rolled" into wet cloth for shipment to the outplanting site.

✍ Finally, container seedlings must be managed as a perishable commodity with a limited "shelf life". This is particularly critical in tropical nurseries where seedlings grow year-round. If seedlings cannot be outplanted when their roots fill the container, then they must be transplanted into a larger container or bareroot bed. Holding-over polybag seedlings is not an option.

The polybag nursery system is not likely to change in the near future, and it's unrealistic to think that we can make the entire world change over to hard plastic containers and artificial growing media. However, by incorporating these few recommendations into the polybag system and working on other improvements, seedling quality and resultant outplanting performance can increase dramatically.

### **Volunteer Nursery Assignments**

Volunteers in Overseas Cooperative Assistance (VOCA), an international people-to-people organization, is seeking volunteers with forest and conservation nursery experience to serve on assignment with local community-based organizations. VOCA is committed to conserving the natural resource base while improving the economic livelihood of rural-based communities. Projects develop from requests for technical assistance submitted by local organizations to VOCA's 24 offices worldwide. The use of VOCA volunteers brings technical expertise into the

community thus enhancing stewardship of available resources. Assignments last from two weeks to three months, averaging one month each. Volunteers contribute their time and expertise while VOCA covers all related expenses including travel, lodging, meals, and work-related costs. To receive an application, call or write Mark Zinsky who is their natural resource specialist:

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