Plantable containers are a class of containers that do not have to be removed prior to installing plants in the landscape, as described in Part I of this series, UT Extension Publication “W 337-A: Compostable, Plantable and Other Containers for Nursery Crop Production.” They are made from natural materials, often byproducts of other agricultural enterprises. Plantable containers made from spaghnum peat and wood pulp fiber (Jiffypot), coconut coir fiber (ITML Horticultural), wood pulp (Fertilpot), paper (Ellepot), cow manure (CowPots), bioplastic sleeve (SoilWrap) and rice hulls (NetPot) are available commercially. Other materials are being tested, and it is likely that new plantable containers will be on the market soon.

Plantable containers are a viable alternative to traditional plastic containers and should be considered for adoption on a wider scale. Recent research has demonstrated that producing a competitive and attractive product is attainable in a plantable container. Additionally, plantable containers can hasten the installation process and simplify planting and cleanup for landscape professionals. Plants installed into the landscape in plantable containers generally perform as well as those grown in plastic containers when supplied with adequate water. In some cases, plants in plantable containers outperformed those from plastic containers after installation.
Economics

Plantable containers are likely to be economically viable for many growers, as the increased cost of the container and production can be offset by increased sales prices. However, every container varies in its cost and how it influences the cost of production. Each producer must therefore evaluate the costs and benefits of plantable containers for their individual business and market.

Using plantable pots will affect production costs due to changes in container cost (increase or decrease) and any changes in container size that influence substrate, fertilizer and other inputs. Plantable containers, just like their plastic counterparts, vary widely in price depending on the market, supplier and volume purchased. For example, 4-inch JiffyPots (round) were priced at 12.2 cents per unit (1,100 count), CowPots (square) at 11.5 cents (450 count), a coir pot (round) at 20.4 cents (1,032 count), a square plastic container at 15.1 cents (500 count) and a round plastic container at 9.6 cents (1,300 count) from the same supplier. Other likely increases include water use, shipping costs, potential crop loss due to damaged containers, and the loss of the ability to reuse the containers.

Any additional production costs, including a potentially higher container cost, may be recouped at the point of sale as consumers are willing to pay more for “green” containers. However, peat, manure and, to a lesser extent, coir containers support mold and algal growth, making them less attractive to some consumers. The level of mold and algal growth varies with production time and nursery/greenhouse conditions. It should be noted that slotted rice hull, bioplastic wrap (SoilWrap) and straw containers are resistant to mold growth even in long-term (12-week) greenhouse production. However, manufacturers recognize the impact of mold and algae on consumer perception and are beginning to develop containers that are resistant to the growth of micro-organisms.

Professional landscape installers might be willing to pay more for plantable containers due to the time savings associated with not having to remove and dispose of the container during installation, in addition to other benefits. In a recent study, groundcovers produced in plantable containers were installed in the landscape 20 percent faster than those in plastic. Additional savings can occur from eliminating the need for transportation time, lost man hours during transit, and waste fees related to the disposal of the plastic pots.
Production Costs

Plantable containers have porous sidewalls and, therefore, with faster drying rates, require more frequent and/or greater volume irrigation applications. Water costs are typically a small percentage (approximately 1 percent) of the total cost of production. However, this factor may be a concern if relying on municipal water, if water prices or cost to pump increase, or in arid parts of the country where water scarcity is an ongoing production constraint. The higher requirements for water are based on overhead irrigation. Using ebb-and-flow irrigation can bring water consumption to levels equivalent to those in plastic container production systems. Alternatively, using shuttle trays that cover the sides of the container reduce water loss through sidewalls and also help safely transport fragile containers. Slotted rice hull containers and bioplastic sleeves can produce larger plants than traditional petroleum-based plastic containers, allowing plants to be grown to marketable size sooner. However, some plantable containers used in an automated greenhouse production system can result in slower processing time during mechanical pot filling. Also, rough biocontainers such as peat pots and wood fiber pots take longer to de-nest than plastic containers and could slow down production. Rice hull pots perform similarly to plastic in this regard.

With the exception of slotted rice hull pots, some plantable containers are more fragile and may result in broken (unsellable) containers during transport.

Shuttle trays made with plant-based PLA are available through Ball Seed.

Plantable containers cannot be reused, so producers who generally reuse containers experience an opportunity cost when choosing a container that can’t be reused. For nursery producers who typically reuse their containers, buying new containers each season adds an additional cost. However, using a new plantable or compostable container eliminates the need for sanitizing used containers and greatly reduces the risk of pathogen contamination.
Plant Growth

Alternative containers have a variety of characteristics that can be used as tools to improve production. Container type can affect plant growth through the effects of porous sidewalls (i.e., greater water use, cooler root zone temperature and reduced root circling) and by supplying nitrogen to the plants as they decompose.

While these factors are important to consider when adopting alternative containers, most studies show that the overall impact on plant growth is normally small. Recently, coir (coconut fiber), manure, peat, bioplastic sleeve (SoilWrap), slotted rice hull, straw and wood fiber (as well as some compostable containers) were evaluated during the production of impatiens and lavender in Arkansas, Illinois, Kentucky and West Virginia. Straw containers and the bioplastic sleeve were the only containers that outperformed plastic in terms of plant growth, and significant growth differences were only observed in the production of lavender. All of the other containers matched plastic in terms of plant growth.

One characteristic that most plantable containers have is porous sidewalls (or in

Figure 1. Slotted containers (photo credit: Robert Geneve)
Water Use

Plantable containers with porous sidewalls generally have higher water use than plastic containers. Due to water loss through the sidewall, plantable containers can require two to three times the water to produce an equivalent product. Using the same watering regime as with plastic containers can result in smaller plants and can increase the time needed to produce the crop.

Not all plantable containers require the same amount of water. Petunias in the greenhouse in wood fiber (Fertil) containers used the most water, and the bioplastic sleeve used the least. The greenhouse study using petunias found that the nine biocontainers and the plastic control fell into five categories in terms of water use. In descending order, these were (1) wood fiber; (2) manure and straw; (3) coir, peat and slotted rice hull; (4) bioplastic sleeve; and (5) plastic, bioplastic and solid rice hull. It is worth noting that the only containers that performed as well as plastic containers (group 5) were compostable containers (bioplastic and solid rice hull).

When using plantable containers with porous sidewalls, measures can be taken to reduce water consumption such as using shuttle trays or a more moisture retentive substrate. For example, placing a peat container in a shuttle tray reduced the average daily water requirements of vinca grown in a greenhouse from 0.6 gallons to 0.4 gallons. A reduction in water requirements with shuttle trays was observed for all container types, but the largest effects were on plants in containers with highly porous sidewalls, such as peat, manure, straw, coir and plantable wood.
fiber (Fertil). Using a shuttle tray will not bring the water requirements to the level of a plastic container. Water requirements for wood fiber and manure (the most porous containers) were still 1.9 times that of plastic, but were a measureable improvement.

In another example, 1-gallon containers of bioplastic, solid rice hull, slotted rice hull, paper and coconut fiber irrigated with an ebb-and-flood system had similar water requirements. Note: Solid rice hull and bioplastic are compostable, not plantable. Using shade and windbreaks are other possible ways to reduce water use by porous containers.

**Strength During Production and Transport**

Plantable containers are designed to degrade in the soil when they are installed, which makes them susceptible to deterioration during production. Care should be taken to match estimated container durability with the production needs of the product. Rice hull NetPots (aka slotted rice hull) do not deteriorate very quickly and rely partially on slots to make them plantable. They maintain their structural integrity during production of at least 15 weeks. The slotted rice hull containers also have a less resilient binder than the solid rice hull containers, which aids in field decomposition. Peat and manure containers that have been well watered and in production for several weeks are especially susceptible to damage during shipping and are not suitable for long-term crop production. In a 12-week production of lavender, peat, manure and wood fiber containers were found to be unsuitable due to mold and weakness. Ebb-and-flood irrigation accelerates the degradation of some biocontainers and was found to reduce the strength of Kord Fiber Grow and the Western Pulp containers to slightly higher than peat and manure containers after seven weeks in the greenhouse. In a 15-week ebb-and-flood production of cyclamen plants, peat, manure and rice straw would not be appropriate due to low strength and high levels of mold/algae. This type of irrigation affects the wetness of the container, which in turn affects the container’s strength and longevity.

In order to function as intended, most plantable containers must allow roots to penetrate the side and/or bottom of the containers quickly when installed in the landscape. Most plantable containers enable this root penetration by degrading quickly once installed in the landscape. This is especially true for containers made from peat and cow manure. They are the weakest and are better for short production cycles. In one test, 27 percent of pressed manure pots and 35 percent of peat pots were damaged during shipping compared to less than 9 percent of coir, straw, bioplastic (compostable, not plantable), wood fiber (also compostable) and plastic containers. Reusable shuttle trays are helpful to protect the containers, especially when wet, and would likely result in lower damage rates. Slotted rice
hull and bioplastic wrap maintained their strength during petunia production.

The absorptive nature of many of these containers also affects their shipping weight. Unlike a plastic container, a peat, manure, paper or coconut fiber container absorbs water into its walls in addition to substrate moisture, therefore increasing overall container weight (Figure 2). For example, a wet coir container can weigh 47 percent more than a dry coir container. This may result in higher shipping costs. Furthermore, these containers dry more quickly, and substrate drying during transport could require that retailers adjust irrigation scheduling or create separate zones based on container type.

Knowledge Is Power

There is always a steep learning curve when adopting new production materials and practices. The information provided here will give interested growers an advantage when choosing to use plantable containers. It is likely that new types of plantable containers will be developed soon, and the information provided here will help growers anticipate performance based on containers made of similar materials described in this series while also appreciating that differences are possible. For more information on compostable and recycled containers, see UT Extension publication “W 337-B: Compostable and R³ Containers for Nursery Crop Production.”

Figure 2. Plantable container that has absorbed water
Are Plantable Containers Actually Plantable?

Plantable containers only work if they are actually plantable — the container must allow roots to establish in the surrounding soil for the plant to thrive in the landscape. So ... are these containers actually plantable? The short answer is “yes.” Several studies in a range of soil types and weather conditions have demonstrated that plantable containers generally do not hinder plant establishment for all plant types tested, including vegetable transplants, annual bedding plants and perennials. A study conducted with ‘Sunpatiens Compact Magenta’ new guinea impatiens, ‘Luscious Citrus’ lantana and ‘Senorita Rosalita’ cleome found that the container did not hinder the plant’s establishment; however, plants grown in coir and straw containers were generally slightly smaller in 2012 but had equal growth in 2011. Coir containers allowed roots to pass through them when planted in the field, but they did not break down quickly. Plantable coir containers rely on the plant’s roots to penetrate the pot during landscape establishment. The amount of decomposition and thus root restriction likely varies between soil type and plant species. In a study using geraniums, impatiens and vinca, container type had no effect on vinca establishment in the landscape, but coir pots hindered the establishment and growth, to a small degree, of geraniums and impatiens.

Soil type, pH, soil microbial activity, plant species and plant growth affect how quickly the container breaks down in the landscape. Soil moisture appears to affect container breakdown significantly. After five months in the landscape in Mississippi, container breakdown was two times greater with 19.8 inches of rainfall than with 9.4 inches, despite ample supplemental irrigation throughout the season. Several trials have shown that plants grown and installed in plantable containers provide an attractive high-quality plant in the landscape.

Plantable containers offer nursery and greenhouse growers the ability to increase the sustainability of their business while meeting consumer demands for high-quality, environmentally friendly products. Many plantable containers are available that meet or exceed the performance of traditional plastic containers and provide time-saving advantages for landscape contractors. Recent research shows that consumers are willing to pay a price premium for green products and that alternative containers can survive the rigors of production and provide a profitable, high-quality end product to retailers, landscapers and end consumers.
For more information on specific containers and their strengths and constraints, see “W 337-D: Comparison of Alternative Nursery Containers.”

For an overview of alternative containers see “W 337-A: Compostable, Plantable and Other Containers for Nursery Crop Production.”
References and Resources


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