Production of Drought-Adapted Intermountain Native Plants Through Low-Cost, In-Ground Containers for Emerging Western Markets

Roger Kjelgren (Utah – Research & Education Grant)

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From left, these drought-tolerant plants are penstemon palmeri, Rocky Mountain columbine and Rocky Mountain penstemon

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Situation:

In the West, irrigated landscapes consume 50-70% of culinary water. Water supplies may not keep pace with rising demand from a growing population, prompting cities and states to develop conservation programs.

Many western cities facing water shortages are encouraging conservation through low-water-use landscaping, or xeriscaping. This entails using plants, typically native, adapted to local soil moisture and rainfall conditions. The supply of native, drought-adapted plants, in sizes suitable for landscapes, is limited, especially in the Intermountain West, home to some of the fastest growing cities in the country.

Such plants are difficult and expensive to grow under conventional nursery production systems, either in fields or in above-ground containers. However, a hybrid between those two systems, called pot-in-pot production, may be well suited to effectively producing native plants in the Intermountain region.

Trees planted in pots are installed at Chelsea Nursery in Colorado.

Objectives:

1. Compare growth of above-ground container versus pot-in-pot (PIP) production of Intermountain West (IMW) native perennial wildflowers

2. Conduct a controlled study and cost analysis comparing production time using expensive, high-end artificial media versus local materials (shredded bark, compost, field soil) for native wildflowers and shrubs

3. Apply a scaled-up PIP system to a wholesale nursery that grows IMW native plants using local materials for artificial media

Pots are being installed at the Utah State University Greenville Farm.

Actions:

Study 1

This study evaluated the efficiency of six IMW native herbaceous ornamental perennials in a PIP system versus a conventional above-ground (CAG) system. (PIP plants are grown with a 1-gallon socket pot buried to the rim, with the plant container inserted into the socket pot. A piece of weed fabric is placed between the socket pot and the production container to prevent plants from rooting into the surrounding soil.)

The two-year study (2003 and 2004) had two four-week production cycles. Plants, arranged in randomized block split-plot design, were grown in a medium composed of 50% composted bark, 40% screened pumice and 10% peat moss and sprinkle irrigated.

Species: Aquilegia caurelea (2003) and Polemonium foliosissiumun (2004), both high-elevation, cool-habitat species; Mirabilis multiflora (2003), Penstemon palmeri (2003) and Sphaeralcea grossularifolia (2004), low-elevation, hot-habitat species; and Penstemon strictus (2004) a mid-elevation species.

Study 2

Compare growth, production time and costs of IMW native perennial and shrub species in a PIP system under drip and sprinkler irrigation and three different growing media:

- a commercial organic artificial media, Ecomix, composed of 40% composted bark, 30% peat moss and 30% fired clay or pumice
- a local mix of 33% sandy loam field soil, 33% general compost from the local landfill and 33% composted fine wood chips (2001)
- a local mix of 50% fired clay from a local source and 50% composted bark

Study 3

At a commercial nursery in Colorado, the growth of three tree species – single leaf ash, big tooth maple and mountain mahogany – was compared in PIP painted with a copper compound to cause root tip abortion versus pots lined with weed fabric that causes root tip abortion within the fabric weave.

Results:

Study 1

Plants produced in the PIP system generally performed better than those in the CAG system. The PIP system had lower root-zone temperatures, which meant less water loss and faster top growth than in the CAG system, and increased stomatal conductance, which meant increased photosynthesis, and also increased plant growth. Also, for the somewhat less hardy M. multiflora, PIP improved winter survival.

Study 2

There were no significant growth differences under drip or sprinkler irrigation. However, plants grown in the more expensive commercial organic medium performed better than either of the two local growing media. This suggests that Ecomix, or some other type of organic medium, remains the most economical option for growing the highest quality plant material.

Study 3

Both growth and stomatal conductance measures showed that trees in copper-painted pots performed significantly better than those in fabric-lined containers, as the latter tended to impede drainage and limit growth.

Researchers assess pot-in-pot plant status.

Data are collected at the pot plot.

Potential Benefits:

The insulating properties of the PIP system improved production of IMW native perennial wildflowers, particularly higher elevation species, by increasing growth and reducing winter damage.

Enhanced growth in PIP production could be translated into more production cycles (thus, revenue per season), potentially offsetting higher PIP installation costs, probably most effectively in a smaller nursery.

The owners of the Colorado nursery reported that PIP is a viable commercial production method:

- It used less water than conventional overhead irrigation and increased growth.
- The plants don't blow over in windy weather.
- The plants, being in the ground, need no special overwintering protection.

Two wholesale growers, one in Utah and the other in Colorado (Chelsea Nursery), have successfully adopted the pot-in-pot method, and another in Oregon is considering it