Wetting Agents And Gels—Where They Have A Purpose

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A series of experiments were conducted over a period of 7 years to determine the benefits of using wetting agents and hydrogels in horticultural substrates. A summary of observations, results, and conclusions of these studies are presented in this paper.

INTRODUCTION

Water shortages and attempts to reduce waste-water runoff may require nurserymen to adjust substrate components and mixing, as well as cultural practices such as irrigation, and fertilization. Materials that increase water retention in containers might help growers reduce irrigation frequency or the volume of irrigation required during each irrigation.

MATERIALS AND METHODS

A synthetic moisture-extender gel (Terra-Sorb AG) and a wetting agent (Aqua-Gro) were evaluated in two separate studies. The effects of these additives on water-air relationships, nutrient levels in container substrates, plant nutrient levels, and plant growth were measured (Bilderback, 1989). In the first study, *Pyracantha coccinea*, *Ilex* 'Nellie R. Stevens,' and *Rhododendron* 'Hinodegiri' were potted into pine bark alone. In the second study, *P. koidzumii*, *Cotoneaster dammeri* 'Skogholm', and *R.* 'Sunglow' were potted in a mix of 4 pine bark : 1 sand (v/v).

Control plants in pine bark with sand and pine bark alone were compared with wetting agent and hydrogel treatments. Dolomitic limestone and Sta-Green ProStart 13-6-6 with minors were incorporated in all substrates at a rate of 8 lb/yd^3. At potting, TerraSorb was incorporated at a rate of 2 lb/ yd^3. Aqua-Gro granular was incorporated at 1.5 lb/yd^3. and monthly using 700 ml of Aqua-Gro L (2500 ppm) as a drench over containers that received the wetting agent. One teaspoon of Sta-Green Nursery Special 12-6-6 was applied to the surface of each container each month beginning 1 month after initiation of the studies. Containers were irrigated by Dramm ring trickle irrigation with 700 to 1000 ml each irrigation applied at 1- to 6-day intervals. Moisture retention characteristics, nutrient levels, (Wright, 1987), top and root dry weight, and tissue nutrient levels were measured.

A third study was conducted in the horticultural substrates laboratory at North Carolina State University on the hydrogel to resolve discrepancies related to moisture characteristics in substrates in the previous studies.

RESULTS

The hydrogel held more water in the containers but less water was available than in other treatments.

Hydrogel did not affect nutrient retention. The wetting agent increased the amount of water available to plants in the bark medium but decreased the amount of water available to plants in the bark and sand mix.

The wetting agent reduced the nutrient levels in both media. In the bark medium, both materials contributed to greater shoot growth of *P. coccinea*, *I.* 'Nellie Stevens' and *R.* 'Hinodegiri'. In the bark and sand mix, the amendments increased root growth for all plants but did not affect shoot growth.

Irrigation frequency had a significant effect on plant growth and nutrient levels. In the bark and sand mix, drought-sensitive species such as *P. koidzumii* and *C. dammeri* 'Skogholm' grew less with each decrease in irrigation frequency.

In the bark medium, growth of 6 'Nellie R. Stevens' and 6 'Hinodegiri' was not affected until irrigation was reduced to 4- or 6-day intervals. Although both amendments did improve plant growth somewhat compared with control plants, the treatments did not compensate for less frequent irrigation.

Two possible physical explanations for variable results when using hydrogels in potting media are (1) inconsistent incorporation of dry granules during blending and (2) reduced hydration of hydrogels in media.

When hydration of hydrogel cubes in distilled water was compared to hydration of hydrogel cubes in pine bark medium, results indicated that pine bark contained substances that reduced water uptake. Although this explanation provided some insight into the reduced hydration, it did not account for the increased growth responses seen in the plant container studies. Further investigation showed that standard physical property techniques to determine moisture content of potting media were not adequate for measuring water content of media containing hydrogels. Standard techniques assume that tension is maintained uniformly in samples during moisture content measurement.

Study three results indicated that the moisture gradient between the hydrogel cube and the surrounding medium is broken during measurement. The cubes contained moisture that was not accounted for during measurement. Our results indicated that hydrogel cubes achieved approximately 55% hydration by weight when incorporated in a pine bark and sand medium but approximately 92% to 95% of this volume would be available at tensions exerted by plant roots.

Hydrogel cubes apparently served as an oasis for roots of established plants that grow into the cubes. However, newly planted liners would likely derive little benefit unless they were in direct contact with the hydrogel.

CONCLUSIONS

Wetting agents appear to be useful in nursery production. In the container studies, wetting agents increased available water content in the pine bark. This result indicates that more thorough wetting occurs in the medium with the use of the wetting agent.

If fresh pine bark or pine bark that lacks 20% to 30% fine particles (<0.5 mm) is used as a potting medium and no other fine particle component such as sand or peat moss is included in the mix, rapid movement of water, or channelling, through the container may occur. Even with frequent irrigation newly planted nursery crops may suffer in very coarse potting media. Use of a wetting agent could be beneficial under these conditions by enhancing lateral movement of water and reducing the infiltration rate of water through the container.

Wetting agents may also be useful for nurserymen that store pine bark at the nursery so they have a ready source for potting. Dry pockets frequently develop in pine bark inventory piles.

Many nurserymen are currently evaluating the use of cycled irrigation. Considerable research is also being conducted to compare leaching of interval applications of water with the amount leached each time. Interval or cycled irrigation creates a wetting front in containers between irrigation intervals. Leaching does not occur as with one extended irrigation application. After each irrigation interval is completed, limited free drainage occurs; and water moves laterally across the container. The medium above the wetting front is wet more thoroughly. Sand or other fine particle components have a similar effect. Wetting agents could enhance this flow even more, but presently no such studies have been reported.

Further study may show hydrogels to have greater value as nursery irrigation practices change in the future.

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