New Technology Development In Water Treatment

Granular activated carbon technology is showing promise for removing agrichemicals from water, according to university and USDA-ARS research.

Figure 2. Granular activated carbon particles (8 x 30 mesh-size).

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ARE agrichemical residues causing a drag on your crop growth? Many growers capture and reuse irrigation water in ponds or flood-irrigation tanks. Agrichemical residues can potentially build up over time in water and affect irrigation of future crops. An example of a persistent chemical is paclobutrazol, which has a half-life of around six months in water. Paclobutrazol is the active ingredient in plant growth regulators Bonzi, Downsize, Paczol, and Piccolo.

Although paclobutrazol is usually applied in the parts per million (ppm) range, research by the University of Florida (UF) in the 1990s showed that irrigating with levels as low as 5 parts per billion (5 ppb) of paclobutrazol can seriously impact the growth of sensitive crops. This biologically active concentration is very dilute: 1000 ppb = 1 ppm, and 5 ppb is only 0.005 ppm. Paclobutrazol concentration in water can be tested by some horticulture analytical laboratories (for example, at **WatersAg.com**).

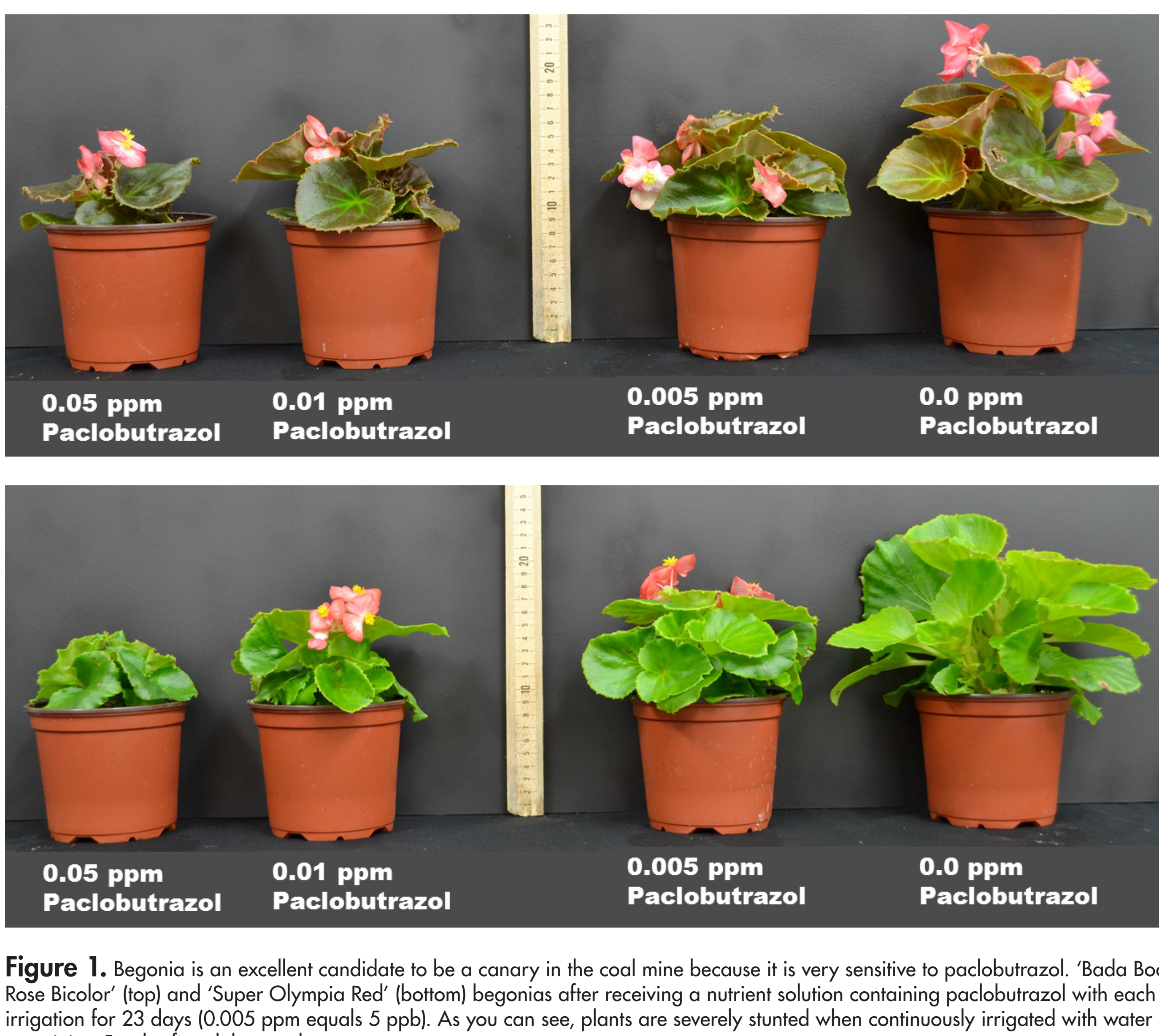

Figure 1. Begonia is an excellent candidate to be a canary in the coal mine because it is very sensitive to paclobutrazol. 'Bada Boom Rose Bicolor' (top) and 'Super Olympia Red' (bottom) begonias after receiving a nutrient solution containing paclobutrazol with each irrigation for 23 days (0.005 ppm equals 5 ppb). As you can see, plants are severely stunted when continuously irrigated with water containing 5 ppb of paclobutrazol.

Granular Activated Carbon Promising For Paclobutrazol Removal

The research team at UF, USDA-ARS, and the University of Connecticut measured paclobutrazol in runoff collected in catchment ponds or tanks

Figure 3. A research-sized GAC filtration system being tested at the University of Florida. Multiple filters can be turned on or off to vary the filtration level.

Figure 4. A GAC filter being tested in a commercial location. A pre-filter takes out suspended particles. GAC packed into rapid-sand filters then removes agrichemical residues.

during periods of spring chemical use. In our survey, 76% of runoff samples were above the 5 ppb biologically active level.

An effective method to remove paclobutrazol and other agrichemicals is granular activated carbon (GAC, Figure 2). A GAC filter is essentially a rapid-sand filter (which many growers are already familiar with) that is filled with GAC rather than sand or glass. Pre-filtration is required to avoid clogging the pores, along with periodic back-flushing. Agrichemicals become adsorbed to carbon particles as irrigation water passes through the filter. Eventually, the carbon needs to be replaced when all adsorption sites become loaded with chemical. Residual level of agrichemicals can be tested periodically to monitor when the carbon needs replacement.

We are researching granular activated carbon (GAC) technology using a small-scale, 6-liter per minute, research system (Figure 3). Initial results found more than 95% removal of a 50 ppb paclobutrazol solution. The most effective filtration level was a 2:1 ratio of GAC filter volume to flow rate (equivalent to 200 gallons of filter volume for a 100 gallon/minute flow rate) using 8 x 30 mesh-sized particles.

The University of Connecticut and UF are also working with industry collaborators on paclobutrazol removal. Grower results using GAC at a commercial scale (Figure 4) have been excellent. We also found that ozone removed more than half of the paclobutrazol from return water at a grower installation.

More Research To Come On Granular Activated Carbon Technology

GAC technology is low cost relative to most other water treatments, simple to use, and highly effective. Our research will refine management guidelines, including knowing when to replace the carbon, monitoring the effect of variables such as pH and carbon type, and cost analysis. Stay posted for more information. We are excited about the potential impact of this technology to help growers successfully recycle irrigation water.

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