HERBICIDE PERFORMANCE PARAMETERS

Find out how substrate age affects preemergence herbicides.

BY **CHRIS MARBLE** AND **BRIAN E. JACKSON**

(Figure 2) Overview of pine bark aging experiment at bark processor.

(Figure 1) Typical windrow used to age pine bark for 6 weeks to over one year. Pile size is critical in overall bark management strategies.

Weed control is often one of the costliest production inputs for container nurseries. We all know that customers are going to want weed-free pots, but probably more important is the fact that weeds can reduce crop growth by more than 50%, extending production times and reducing profitability. All of these reasons make having a good weed management program very important for container growers.

Since there are not many postemergence herbicides that can be used in containers, most growers turn to preemergence herbicides and hand weeding for the bulk of their weed management program. When preemergence herbicides do not work as well as they have in previous years, it is important to understand why. It is common to receive calls from growers who had poor results with an herbicide, but it is a little more difficult to figure out why when the main culprits (calibration, timing, etc.) are ruled out. Interestingly, a common question that came up was what effect does pine bark age have on preemergence herbicide performance? Aged pine bark is the one of the most common organic substrate components in the U.S., with bark from loblolly or longleaf pines being the most prominent in the southeastern U.S. With all that is known about using pine bark substrates, research has not thoroughly evaluated the role of bark age of various crop production parameters. Since very little was known on the topic of bark age and herbicide performance, we conducted a series of experiments, supported by the Horticultural Research Institute, to find out.

Pine bark aging process

Before discussing our experiments and results, it is important to first understand how the aging process affects pine bark. Pine bark aging is not composting (no nitrogen is added) but is conducted similarly in that bark is piled up in windrows, wetted during dry weather and turned periodically to prevent excessive heat buildup and allow for consistent aging of the whole pile (Figure 1). Pine bark (or other barks) may be aged anywhere from six weeks to one year depending upon availability, product demand and/or grower preferences. A detailed

(Figure 3) Pine bark used in experiments that had been aged following detailed protocols and guidelines for 0 (top left), 4 (top right), 8 (bottom left) or 12 months (bottom right).

Photos by Brian Jackson

description of the aging process and what effects it has on pine bark have been detailed before: nurserymag.com/article/nm1014-pine-bark-variations-differences. Here, we will just focus on the fact that aged bark usually has more fines (typically considered less than 0.5 mm in size), a higher white wood content and usually has a higher water holding capacity (due to the higher percentage of fines).

To further understand the role of pine bark age (aging) on nursery crop production practices, a long-term study was implemented to quantify the changes in the physical, chemical and hydrological properties of longleaf pine bark over the course of one year of aging. Fresh longleaf pine bark (within days of being removed from freshly harvested trees) was hammer-milled and placed in three piles of approximately 250 cubic yards each, with dimensions of approximately 55 x 33 x 10.5 ft. These were treated as replications. Piles were sampled initially, then turned every four to six weeks using a front-end loader, and subsequently sampled after turning for a period of 12 months. At each sample date, subsamples were taken from different locations on each pile to account for variation within the pile and to reduce possible errors due to stratification of constituents and conditions within the piles. These subsamples were combined into one representative sample per pile and tested in herbicide efficacy trials.

Will substrate age affect preemergence herbicides?

The first experiment we conducted evaluated three herbicides including dimethenamid-P (Tower), isoxaben (Gallery SC), and prodiamine (Barricade) on pine bark (previously screened to 0.38 inch) that had either been aged for 0, 4, 8 or 12 months (Figures 2 and 3). The weed species we evaluated included bittercress (*Cardamine flexuosa*), oxalis (*Oxalis stricta*) and large crabgrass (*Digitaria sanguinalis*). We wanted to pair up the weeds with herbicides that usually work very well for control and chose Tower to test oxalis, Gallery for bittercress, and crabgrass for prodiamine. We applied the herbicides at a range of rates from as low as 0.125× the label rate up to 2× the label rate to see if there was any difference in performance and to figure out what rate was needed to achieve acceptable control on each substrate.

Weed counts, biomass, and other data were taken over a 10-week period. While we saw a few differences in substrates at very low rates, we observed consistent weed control across all four substrates when labeled rates were applied. We also looked to see if leaching (downward movement of the herbicide) was affected by substrate age but again, we saw no differences and minimal leaching as would be expected, since these herbicides do not tend to leach significantly.

It is important to note that these experiments were conducted using pine bark that was processed to pass through a 3/8-inch screen. While physical properties were largely similar among the different ages, bark that was aged 8 or 12 months had a higher percentage of fines (and greater water holding capacity) compared with bark that had been aged 0 or 4 months. In other experiments looking at only particle size, we have observed that as particle size increases, weed germination and growth will decrease. This is simply due to greater water holding capacity of the finer particle substrates and because weeds won't germinate if they are stuck on a large bark particle, or don't have access to water, similar to reasons why mulch is so effective as a weed control tool (Figure 4). Herbicide leaching also tends to increase as particle size increases. In reality, the bark substrate particle sizes needed to see a significant decrease in weed growth (screened to have all particles larger than 0.25 or 0.38 inches) would not be very conducive for optimal growth of the crop being grown either.

What about other production practices?

Another part of this project funded by the Horticulture Research Institute was to determine what impact fertilizer placement had on herbicide performance. For these experiments, we looked at a range of herbicides applied to containers filled with a pine bark substrate that was fertilized with controlled release fertilizers that had been either top dressed, incorporated into the substrate prior to potting, or were subdressed (which is placing the fertilizer in a single layer about 2 inches

(Figure 4) Bittercress (*Cardamine flexuosa*) and oxalis (*Oxalis stricta*) seeds stuck on large bark particles. Note that the weeds germinate in between the cracks and crevices of the large particles.

Photo by Chris Marble

below the container surface). While the herbicides tended to perform fairly similarly regardless of fertilizer placement, what was interesting was the weed growth in the containers not treated with any herbicide. Spotted spurge (*Euphorbia maculata*), eclipta (*Eclipta prostrata*) and crabgrass growth was 80 to 90% less in subdressed containers compared with containers that had fertilizer top dressed or incorporated. Essentially, what happened was the seeds were able to germinate, but the seedlings had no access to the nutrients due to the subdressing depth and remained very small over a 12-week period (Figure 5). This was promising as subdressing could potentially be used to reduce weed growth in herbicide sensitive plants.

Photo by Chris Marble

(Figure 5) Pots that had been subdressed to a depth of 3 inches. Small eclipta seeds germinated but their thin white roots did not grow to the fertilizer layer over a 16-week period. Thicker dark tan roots were the roots of ligustrum that had been transplanted into the pots.

Reasons for poor herbicide performance

If substrate age and fertilizer placement are not playing a major role in herbicide

performance, what might be causing variations in performance from year to year? There are many possible explanations, but we will just focus on the most common. First, check to ensure the applicators are applying the correct rate. Calibration errors are the most common reason why I see poor results from preemergence herbicides, especially with granular products that can be more difficult to apply. Making sure the correct rate of a particular herbicide is being applied is critical. Recommended rates for granular products are going to range around 100 to 200 lbs. per acre depending upon the herbicide, so calibrating for each herbicide you use is important. Secondly, did the pots already contain weeds? Waiting too long after potting (more than 3 or 4 days), skipping applications or missing weeds during hand weeding are going to reduce control. While most suppliers keep bark inventories and areas around the facility very

(Figure 6) Proper bark storage onsite at a grower. Bark is stored on concrete pads with accessible irrigation and partitions separating different types of substrates being used.

Photo by Brian Jackson

clean (Figure 6), some may have weed problems that could rear their head at your nursery. Applying a pre-emergence herbicide soon after potting could help alleviate this issue if it occurs with a current shipment. It is also important to pick herbicides that are effective for your particular weed spectrum and regularly rotate modes of action. The 2017 Southeast Pest Management Guide (http://bit.ly/SE-Nursery-Pest-Control) contains a comprehensive list of efficacy rankings for different herbicides and what ornamentals they can be used on (among a lot of other great information for other pests). Sanitation is also critical whether that be around bark piles, roadways, aisles, ditches (Fig. 7 Weeds near bark piles). Lastly, weather can play a big role. Frequent and high rainfall can reduce the longevity of these herbicides and could require sequential applications to be made a little earlier than expected in some cases.

While herbicides will likely perform similarly regardless of substrate age, pine bark aging can have a significant effect on air space, water-holding capacity and total porosity, which can affect irrigation, needed amendments, etc. Bark properties can even change from the same suppliers depending upon the time of year and from batch to batch, so routine testing would still be recommended. NM

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Photo by Brian Jackson

(Figure 7) Weeds anywhere near a bark pile are bad news, whether it is at a nursery or at a bark supplier.