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Rethinking Weed Control in the Nursery©

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INTRODUCTION

The only weed management tools in container plant production (other than a few herbicides for grass weed control) are preemergence herbicides and hand weeding. Labor for hand weeding is becoming more and more expensive and difficult to find. It may be more important now than ever to find ways to manage weeds efficiently. Recent estimates show that weed control costs can exceed $10,000 per ha ($4,000 per ac.) (Mathers, 2003). These costs typically include herbicide costs, application costs, and hand weeding costs. These estimates often do not include the opportunity cost that is lost when labor is diverged from profit generating tasks (potting, propagating, etc.) to hand weeding - a profit reducing task.

Here I will describe five common themes I have observed in the most consistently clean nurseries I have visited. These methods are supported by research, but more importantly, have all been proven successful (and economical) in the real world. You should reconsider some aspects of your current weed program.

HANDWEEDING FREQUENTLY IS SUPERIOR TO HANDWEEDING LESS

The goal of improving a weed control program should be to reduce hand weeding. However, the goal should be to reduce the time spent weeding, not the frequency. Research has shown that weeding every 2 weeks reduces labor costs by an average of 36% (and some much more). This was compared with weeding only every 8 weeks, or just before herbicides are reapplied (Barker and Neal, 2016). Several nurseries have adopted this approach and significantly reduced their hand-weeding costs. More frequent weeding works in several ways to reduce the total time (and cost) of weeding overall. First, and most importantly, weeds do not have time to produce seed in two weeks. This reduces the overall weed pressure throughout the rest of the season. This allows subsequent herbicide applications to be more effective because the "seed bank" is very low. Weeding this frequently also allows crews to skip over very small weeds and only focus on weeding plants that may go to seed within the next two weeks. More information on this practice including how to implement this method has been previously published (Barker and Neal, 2016).

ENFORCE STRICT SANITATION

Proper sanitation is discussed in many different Integrated Pest Management (IPM) guides. In terms of weed management, the main principles to follow include:

- Hand weed frequently.
- Do not recycle potting media. Many growers do this to reduce costs but savings on potting media can easily be lost by heavy weed pressure (and possibly disease issues). If someone is determined to recycle soil, solarization is one way to significantly reduce weed pressure (Steed, 2015). If that is not an option or is not feasible, at least do not use this potting soil on

herbicide sensitive plants because preemergence herbicides will be needed and needed often, and you do not want to limit your options. Using this soil in larger containers may also allow the use of directed postemergence herbicide applications that will be useful as weed pressure is likely to be very high. This is not a recommended practice but if someone must use old or recycled soil, these steps may help mitigate some of the negative impacts.

- Spot-spray and utilize preemergence herbicides in non-crop areas (walkways, aisles, ditches, etc.). Weeds in non-crop areas will inevitably move into the crop if they are not controlled. Non-selective herbicides such as glyphosate (or possibly glufosinate if glyphosate resistant weeds are present) can be used to control most weeds. Ultra-low volume sprayers can be utilized for applying glyphosate in these areas. These sprayers reduce the amount of water needed to make the application and allow workers to cover more ground quickly. Preemergence herbicides such as flumioxazin or indaziflam are also effective in these areas and provide broad-spectrum weed control.
- Clean pots before reusing them. Pressurized water, heated water or steam can be used to reduce weed seed presence and/or viability.
- Moving liners and other plants in the greenhouse off the ground. Tables are expensive and not feasible in all cases, but simply moving plants in the greenhouse up on benches can help prevent weed growth in the crop. This also allows the use of postemergence herbicides or indaziflam (a preemergence herbicide) to be used on the floor underneath the benches.
- Start with weed-free liners and keep liners weed free prior to potting.
- Prevent pot blow-over. Blown over pots can create several issues – first, the herbicide barrier in the top portion of the soil is broken, so weeds have greater opportunity to take over after a

pot has been blown over. Secondly, spilled soil in production areas is an ideal place for weed seeds to germinate.

USE NON-CHEMICAL CONTROLS WHERE NEEDED

Some common ornamental species are notoriously sensitive to preemergence herbicide applications (e.g. hydrangea, herbaceous perennials, etc.). Crops that cannot be treated with preemergence herbicides often become “hot spots” or areas where weed growth is concentrated and prolific. Loose-fill organic mulch is much more expensive than herbicides, but much cheaper than handweeding. Large particle, well-drained mulch materials such as pine bark nuggets, rice hulls, and other can be used to significantly reduce weed growth (Altland et al., 2016; Richardson et al., 2012). In many cases, these mulch materials can outperform herbicides and require only one application.

Fertilizer placement has also been used as a very effective way to manage weeds without herbicides. Fertilizers are most often top-dressed or incorporated, and while dibbling is effective for weed management, dibbling is associated with some crop safety concerns and is not as commonly practiced. Subdressing or layering fertilizers is a method used by some growers to eliminate the negative effects of dibbling, but also utilize the advantages of strategic fertilizer placement. When fertilizers are subdressed or layered, the pot is filled halfway at potting, fertilizer is applied in a single layer, and then the rest of the potting soil is added along with the liner. This results in a 2 to 4 in. (or greater) layer of potting soil that contains no fertilizer, thus no fertilizer is available to weeds germinating on the soil surface. In research at the University of Florida, growth and seed production of common container weed species was reduced by over 90% in several studies and other research has shown no negative impacts on crop growth (Broschat and Moore, 2003).

SELECT THE BEST HERBICIDES AND ROTATE THROUGHOUT THE YEAR

Currently there are around 25+ preemergence herbicide products labeled for over-the-top use in container plant production. Unfortunately, these herbicides are different combinations with just a few different modes of action (MOA) - including Weed Science Society of America's herbicide MOA groups 3, 14, 15, 21, and 29 (Senseman, 2007).

With most herbicides, growers are limited to around 2 to 3 applications per year, but herbicide applications every 8 to 10 weeks throughout the year (or growing season, dependent upon climate) is recommended, meaning that multiple herbicides will be needed. There are no "magic bullet" herbicides and all herbicides have weak areas - thus, several herbicides will be needed in a preemergence herbicide program. These products should be rotated throughout the year, utilizing herbicides with different MOA, when they are most effective, and achieving the best return on investment.

Avoiding back-to-back or sequential applications of the same herbicide can reduce chances of phytotoxicity and improve weed control. A list of common preemergence herbicides including their MOA and general weeds they control are included in Table 1. Weed efficacy guides, such as the 2017 Southeastern U.S. Pest Management Guide for Nursery Crops (Neal et al., 2017) can be used to reference which herbicides are most effective on different weeds throughout the year, and determine which crops these herbicides can be applied.

The first priority (assuming the herbicide is safe for the crop) should be selecting a herbicide that is highly effective on the most troublesome weed during a particular time of year. As several herbicides are likely effective, the next step would be to select the best option that controls both the most troublesome weed and the second or third most troublesome weed(s). For the next application, a herbicide with similar efficacy but a different MOA could be chosen. This

process is repeated throughout the year until a preemergence herbicide program is developed for the year. Some of the most successful nurseries may utilize 4 or 5 (or more) different preemergence herbicide products, using each to take advantage of the products strengths such as crop safety or efficacy of key weed species during different times of year. Example rotations have been published previously (Neal et al., 2017) but many different herbicide combinations can be used successfully depending upon local conditions.

MAKE WEED CONTROL A PRIORITY

The most consistently clean nurseries all make weed management a top priority. They understand how much weed control failures cost and take necessary steps to prevent failures from happening. Many common weed species in nurseries can begin producing seeds within three weeks. So, within a month, a second generation of weeds are beginning to germinate. Weed populations will increase exponentially until action is taken. As there are few options, prevention is always the best course of action.

Literature Cited

Altland, J.E., Boldt, J.K., and Krause, C.R.(2016). Rice hull mulch affects germination of bittercress and creeping woodsorrel in container plant culture. Amer. J. Plant Sci. 7:2359-2375.

Barker, A. and Neal, J.C. (2016). Frequent hand weeding saves money. Accessed 10 Oct. 2018. <https://content.ces.ncsu.edu/frequent-hand-weeding-saves-money>.

Broschat, T. and Moore, K.K. (2003). Influence of fertilizer placement on plant quality, root distribution, and weed growth in container-grown tropical ornamental plants. HortTechnology 13:305-308.

Mathers, H. (2003). Novel methods of weed control in containers. HortTechnology 13:28-31.

Neal, J.C., Chong, J.C., and Williams-Woodward, J. (eds.). (2017). The 2017 Southeast pest management guide for nursery crops and landscape plantings. Southern IPM Center. Accessed 9 Sept. 2018. <https://content.ces.ncsu.edu/southeastern-us-pest-control-guide-for-nursery-crops-and-landscape-plantings>.

Richardson, B., Gilliam, C.H., Fain, G.B., and Wehtje, G.R. (2008). Container nursery weed control with pinebark mini-nuggets. J. Environ. Hort. 26:144-148.

Senseman, S.A.(2007). Herbicide Handbook, 9th edition. Weed Science Society of America. Lawrence, KS. 458 p

Steed, S. (2013). Large scale recycling of used potting media with solarization. SARE Project OS13-075 Final Report. Accessed 10 Oct. 2018. <https://projects.sare.org/sare_project/os13-075/>.

Table 1. Common Preemergence Herbicides Utilized in Ornamental Plant Production.

Active ingredient	Trade name[z]	MOA Group[y]	Weeds controlled[x]
dithiopyr	Dimension 2EW	3	Grasses and a few broadleaves
oryzalin	Oryzalin Pro, Surflan	3	Grasses and a few broadleaves
pendimethalin	Corral, Pendulum 2G, Pendulum AquaCap, Pin-dee, etc.	3	Grasses and a few broadleaves
prodiamine	Barricade, Prodiamine, RegalKade	3	Grasses and a few broadleaves
trifluralin	Treflan, Trifluralin, Preen	3	Grasses and a few broadleaves
flumioxazin	Broadstar, SureGuard	14	Broadleaves and grasses
oxadiazon	Oxadiazon, Ronstar	14	Broadleaves and grasses
oxyfluorfen	Galigan, Goal	14	Broadleaves and grasses
dimethenamid-p	Tower	15	Grasses, sedge suppression, broadleaves
s-metolachlor	Pennant Magnum	15	Grasses, sedge suppression, some broadleaves
isoxaben	Gallery	21	Broadleaves and a few grasses
indaziflam	Marengo SC, Marengo G	29	Broadleaves and grasses
benefin + oryzalin	XL 2G	3 + 3	Grasses and some broadleaves
pendimethalin + dimethenamid-p	FreeHand	3 + 15	Grasses and broadleaves
trifluralin + isoxaben	Quali-Pro TI, Snapshot	3 + 21	Grasses and broadleaves
prodiamine + isoxaben	Gemini, Gemini G	3 + 21	Grasses and broadleaves
dithiopyr + isoxaben	Fortress	3 + 21	Grasses and broadleaves
oxadiazon + prodiamine	RegalStar II	14 + 3	Grasses and broadleaves
oxyfluorfen + oryzalin	Rout	14 + 3	Grasses and broadleaves
oxyfluorfen + pendimethalin	OH2	14 + 3	Grasses and broadleaves
oxyflourfen + prodiamine	Biathlon	14 + 3	Grasses and broadleaves
oxyflourfen + trifluralin	Granular Herbicide 75	14 + 3	Grasses and broadleaves
oxyflourfen + oxadiazon	OO-Herbicide, Two OX E-Pro, Regal OO	14 + 14	Grasses and broadleaves

[z]Trade names are included for educational purposes only and do not indicate an endorsement. Similar products may be available with the same active ingredient and/or formulation and would be suitable.

[y]MOA = mode of action group. Modes of action were adopted from Senseman, 2007.

[x]Weeds controlled only shows broad classifications of weeds. Detailed information is available on product labels and in pest management guides (Neal et al. 2017).