e-GRO Alert

Ornamentals

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Starving the Competition: A Smarter Way to Fertilize Your Plants

Strategic fertilizer placements can be adopted to manage weeds in containerized ornamental production

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Weeds rapidly thrive in the nursery and greenhouse environments due to availability of high humidity, soil moisture, and fertility (Image 1 and 2). They compete with ornamental plants for soil/growing medium, water, nutrients, space, and oxygen within the container, ultimately reducing the quality and market value of ornamental crops. Beyond resource competition, certain aggressive weeds can produce allelopathic compounds, which refers to chemical secretions that actively inhibit the root development of the surrounding ornamental species. Not many herbicides are labeled for use in the greenhouse environment and hand weeding is a laborious and time-consuming task. This necessitates adopting cultural practices that can help to suppress weed growth in containerized production systems.

Image 1: Weeds growing inside greenhouse conditions along the overhead irrigation system. Photo credits: Debalina Saha, MSU Horticulture.

Traditional gardening practice of fertilizing containerized ornamental plants involves mixing controlled release fertilizers (CRFs) with the soil (incorporation) or sprinkle it on top (top-dressing) (Image 3). This generally promotes weed germination in the top-soil of containers. However, to reduce the amount and time spent on pulling weeds, it might be time to rethink exactly where the nutrients are applied. By simply changing the placement of fertilizer, plants can get a massive head start while leaving weeds behind.

Alternative (sub-surface) methods of fertilizer placement that can influence weed management include:

1. **Dibbling:** It involves placing the CRF in a concentrated pocket directly below the root zone at a depth of few inches (Image 3). It delivers nutrients directly near the crop roots while starving surface-dwelling weeds. Utilizing dibbling technique also allows growers to tailor the nutrient delivery to the specific growth rate of the liner, ensuring that the fertilizer release curve perfectly matches the plant's physiological demand.

2. **Sub-dressing:** It involves applying the CRF in a uniform layer a few inches below the soil surface during the potting process (Image 3). It also ensures that the deep-reaching roots have exclusive access to nutrition as they expand. It not only suppresses weeds but also reduces nutrient leaching during irrigation events, as the fertilizer is buffered by a larger volume of substrate above it.

Both these methods increase the nutrient availability to crops and allow the plants to have a competitive advantage. The weed seeds which are often small and have limited energy reserves, fail to establish a strong enough root system to reach the buried fertilizer. This also directly minimizes the need for herbicide use for weed control. Ultimately, these cultural practices represent a move toward Integrated Pest Management (IPM). By simply changing where we feed our plants, we reduce chemical dependency, and produce a cleaner, more competitive product.

Several rounds of greenhouse studies were conducted at Michigan State University to assess liverwort growth, reproduction, and its competitiveness with containerized ornamental plants in response to strategic placement of a CRF Osmocote [17-5-11 (8 to 9 months)] fertilizer. Known scientifically as *Marchantia polymorpha*, this weed creates a dense, carpet-like mat across the soil surface of container plants. This mat obstructs water and nutrients from reaching the plant's roots thus, inhibiting plant growth (Image 4). It grows by developing a flat thalloid structure and the lower surface of the thallus consists of rhizoids and scales, that assist in moisture and nutrient absorption and anchoring it to the growing medium. The life cycle of liverwort consists of sporophytic (sexual) and gametophytic (vegetative) stages.

Image 2: weeds growing in greenhouse, under the benches and in walkways. ©Debalina Saha, MSU Horticulture.

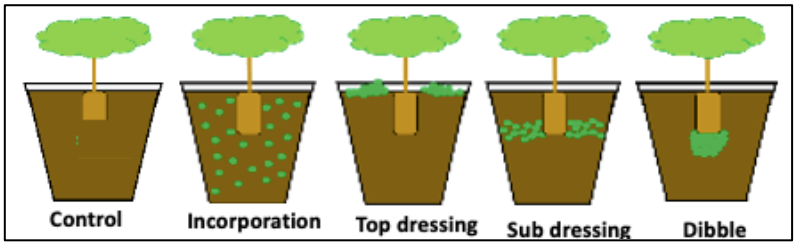

Image 3: Different methods of fertilizer placement (from left to right: Control or no fertilizer, Incorporation, top-dressing, sub-dressing, dibble). Photo credits: Debalina Saha, MSU Horticulture.

Image 4: Liverwort (*Marchantia polymorpha*) growing like mat on the container surface of hosta plants under greenhouse condition. Photo credits: Debalina Saha, MSU Horticulture

In the study, CRF was sub-dressed or dibbled at depths of 1, 2 or 3 inches. All the containers were inoculated with liverwort gemmae (asexual spores) and the percent of the container surface covered by liverwort thalli was estimated bi-weekly (Image 4). It was found that not only did the surface coverage of liverwort declined with the strategic placements of dibbling and sub-dressing, but the weed's ability to reproduce, both sexually and asexually, was significantly reduced. On the other hand, incorporation and top-dressing of fertilizer promoted liverwort growth and surface coverage was recorded higher (over 90%) in these placements.

The second half of the study was carried out to investigate these methods with greenhouse plants – Begonia and Dracaena. Compared to the traditional methods, top-dressing and incorporation, burying the fertilizer at 3 inches significantly reduced liverwort surface coverage and biomass while simultaneously boosting the growth index and overall appearance of the ornamental plants. Therefore, strategically placing the nutrients deep in the pot can give the plants a competitive edge as well as improve the quality of ornamental plants while leaving the weeds deprived of nutrients.

These methods of fertilizer placement have also been reported to improve establishment and growth, and result in superior plant quality of other ornamental plants. Dibbling and sub-dressing have also helped to control weeds including, hairy bittercress, eclipta, large crabgrass and spotted spurge in various other studies. However, sub-dressing is recommended over dibbling for the safety of sensitive ornamental plants. This is because, in dibble, the fertilizer is placed in direct vicinity of entire root ball of the ornamental which can cause injury to sensitive species. Whereas, in sub-dressing the fertilizer is placed in a layer and can be safer.

By transitioning to precision placement, nurseries can significantly lower their cost-per-pot by reducing the frequency of labor-intensive weeding cycles throughout the growing season. This strategic shift in fertilizer application also aligns with modern sustainability goals by minimizing the chemical footprint of the greenhouse and reducing the potential for nitrogen leaching and runoff. Ultimately, enhancing the competitive vigor of the crop through strategic feeding reduces the recovery time needed after transplanting, leading to faster bench turnover and increased annual profitability. This makes the strategic fertilizer placement a valuable addition to good production practices in containerized ornamental production systems.

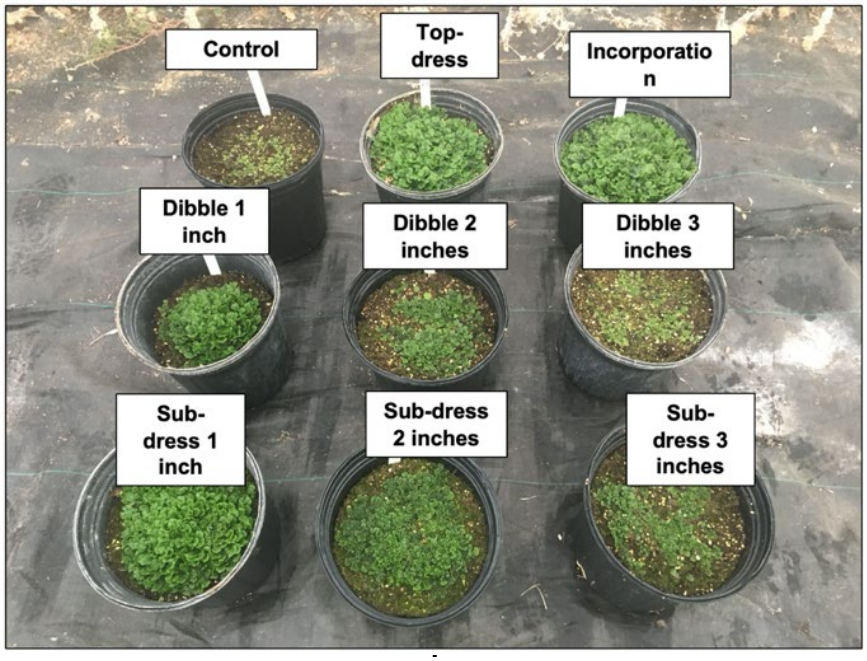

Image 4: Dibble 3 inches and Sub-dressing 3 inches showing significantly reduced liverwort growth in comparison to top-dress and incorporation which showed more than 90% liverwort coverage. Photo credits: Debalina Saha, MSU Horticulture.

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