

Benefits of Small-Prill Controlled-Release Fertilizer in Container Production

Nabil Khadduri

Nabil Khadduri, Nursery Scientist, Webster Forest Nursery, Washington Department of Natural Resources, PO Box 47014, Olympia, WA 98504; E-mail: nabil.khadduri@dnr.wa.gov.

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Abstract: Microprill fertilizer granules (<1.0 mm width) were incorporated into soilless media at a 2 lb/yd³ (1.2 k/m³) rate and compared with an operational standard of 6 lb/yd³ (3.6 k/m³) incorporation of a standard-size prill (>2.4 mm/0.09 in width). Micro prill counts per cell averaged 5.0, 7.8 and 9.4 times higher than standard-sized prill counts for 2, 10 and 15 cu in (207A, 415D and 515A) Stuewe styroblock containers (Stuewe & Sons, Inc 2014), respectively. Coefficients of variation of micro prills per cell were 3 times lower across container sizes compared with standard-sized prills per cell. These results demonstrate the potential for micro prills to improve crop uniformity through decreased fertilizer variability. A separate study evaluated the effectiveness of iron sulfate prills in inhibiting moss and liverwort establishment on a bark and peat-based medium. Standard-sized prills of 90- and 180-day release patterns were top dressed at rates of 25 lb and 50 lb per 1,000 ft² (122 and 244 kg per 1,000 m²) along with an untreated control. After 12 weeks, the 50 lb (244 kg) rate of 180-day release had the lowest moss coverage at 24% compared to 57% coverage for the untreated control. A second trial compared 75 lb per 1,000 ft² (366 kg per 1,000 m²) top-dressing of three iron sulfate controlled release fertilizer products (standard size prills of 90- and 180-day release patterns and a mini-sized prill of 90-day release pattern) and an untreated control. After 12 weeks, the combined moss and liverwort coverage was 78% for the untreated control, while the mini-size prill treatment was significantly lowest at 7% coverage. These trials demonstrate that controlled-release iron sulfate can prevent moss and liverwort establishment when applied at an adequate rate using a mini-sized product that allows for even product distribution.

Key Words: container fertilization, iron sulfate, moss, liverwort

Introduction

Most container seedling growers now incorporate controlled-release fertilizer into their soil media in order to provide a consistent background level of nutrition. This is especially important during cool, wet periods, when irrigation, and therefore water-soluble fertilizer, is withheld. Longer controlled-release formulations allow for continued nutrient availability from the fertilizer prills even after the plug has been outplanted (Jacobs and others 2003). Other benefits of controlled-release fertilizer incorporation include improved fertilizer-use efficiency and the associated environmental benefits of targeted nutrient application, labor savings from minimizing batching and application involved in fertigation, and reduced pest buildup associated with surface nutrient application.

Despite these benefits, some growers complain about losing control when applying controlled-release fertilizers (Landis and others 1989). Even with advances in fertilizer durations and release patterns, growers reduce the ability to manipulate key leverage points such as using a specific period of nutrient starvation to help initiate the hardening process. In addition, whereas water soluble fertilizer feeds provide readily available

nutrients in a desired balance, controlled-release fertilizers tend to release nutrients more variably (Haase and others 2007). For example, from the same prill, nitrogen tends to release faster than potassium, which in turn releases faster than phosphorus (Jacobs 2005). Finally, poor prill distribution in the soil media can increase crop variability. This problem is accentuated in small containers. One way to improve prill distribution is to incorporate micro (i.e. small-sized) prills.

Nomenclature for Prill Sizes

It is useful to understand some nomenclature about prill sizes as described on fertilizer products. Size guide number (SGN) is a measure of the prill width in millimeters x 100. So, a fertilizer with a SGN of 180 contains granules with an average diameter of 1.80 mm (Samples and others 2011).

The terms that generally correlate with prill sizes are described in table 1.

In the following studies smaller-sized prills were compared against standard-sized prills with the goal of increasing prill distribution and therefore crop performance.

Table 1: Terms Describing Prill Sizes

Prill Description	SGN (Size Guide Number)	Average Size (mm)
Standard/Regular	>240	>2.40
Midi/Midgrade	195 to 220	1.95 to 2.20
Mini	145	1.45
Nano	100 to 150	1.00 to 1.50
Micro	<100	<1.00

Study #1: Does Incorporating Smaller Prills into Media Improve Prill Distribution?

Materials and Methods

The first study was conducted at Webster Nursery (WA State Department of Natural Resources) in Olympia, Washington. Standard-size prills (greater than or equal to 2.4 mm width) of controlled release fertilizer were incorporated into a 80% peat/20% perlite soilless media at an operational standard rate of 6 pounds per cubic yard. For comparison, micro-sized prills (less than or equal to 1 mm width) were incorporated into soilless media at a rate of 2 lb/yd³ (1.2 k/m³). Prill counts were taken of media samples (whole containers) before and after operational filling into 2, 10, and 15 cu in styroblock containers (207A, 415D and 515A) Stuewe styroblock containers (Beaver Plastics). Twenty containers per treatment/container size combination were evaluated.

Results and Discussion

No significant differences in prill counts between pre- and post-container filling were found, indicating nursery operational practices did not confound prill counts. Even at the 1/3 rate of micro prill incorporation, micro prill counts per cell averaged 5.0, 7.8 and 9.4 times higher than standard-sized prill counts for the 2, 10 and 15 cu in (207A, 415D and 515A) containers, respectively (figure 1). Coefficients of variation of micro prills per cell were 3 times lower across container sizes than standard-sized prills per cell (figure 2).

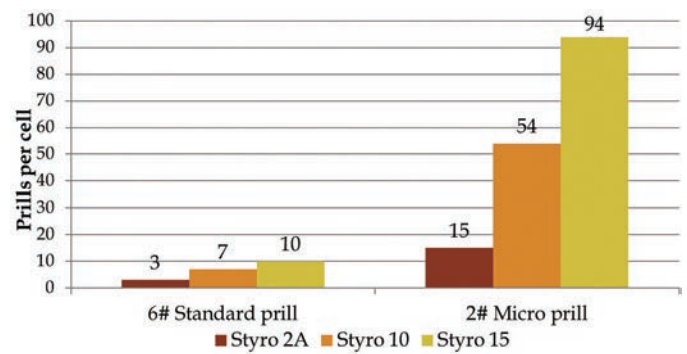


Figure 1. Micro prill counts per cell averaged 5.0, 7.8 and 9.4 times higher than standard-sized prill counts for the 2, 10 and 15 cu in (207A, 415D and 515A Stuewe styroblock) containers, respectively.

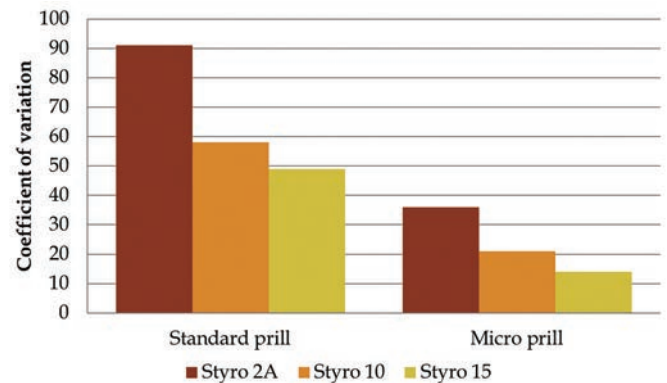


Figure 2. Coefficients of variation of micro prills per cell were 3 times lower across container sizes than standard-sized prills per cell.

Summary

Three times better distribution at 1/3 rate of incorporation demonstrates the potential for micro prills to improve crop uniformity through decreased fertilizer variability.

Study #2, Trial #1: Can Top-dressing with Iron Sulfate Prills Control Moss and Liverwort?

Materials and Methods

At the Meridian Seed Orchard greenhouse (Washington Department of Natural Resources) near Lacey, WA, a separate study was conducted to evaluate the effectiveness of top-dressed controlled release iron sulfate prills in inhibiting moss and liverwort establishment on a bark and peat-based medium growing 2-year-old Douglas-fir grafted seedlings. In the first trial, rates of 25 lb and 50 lb per 1,000 ft² (122 and 244 k per 1,000 m²) were top-dressed with standard-sized prills of 90- and 180-day release patterns respectively, along with an

untreated control. Materials were applied to styro 60 cu in (1015A) containers (Beaver Plastics), covering a surface area of 12.56 in² (81 cm²) per container. Twenty-one containers per application rate/release pattern combination were evaluated for percentage moss and liverwort surface coverage at 6 and 12 weeks after treatment. Seedlings were inspected for signs of phytotoxicity at week 12.

Results and Discussion

Six weeks after treatment, moss coverage (no liverwort present) was 39% for the untreated control, 21% and 19% for the 25 lb (122 kg) rate of 90- and 180-day release, and 12% and 11% for the 50 lb (244 kg) rate of 90- and 180-day release. After 12 weeks, the 50 lb (244 kg) rate of 180-day release had the lowest moss coverage at 24% compared to 57% coverage for the untreated control (figure 3). No phytotoxicity was observed 12 weeks following application.

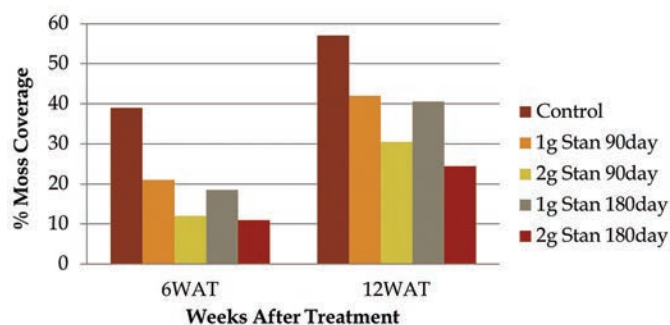


Figure 3. Moss coverage 6 and 12 weeks after treatment. After 12 weeks, the 50 lb rate of 180-day release had the lowest moss coverage at 24% compared to 57% coverage for the untreated control.

Study #2, Trial #2: Can Top-Dressing With Small-Size Iron Sulfate Prills Improve Moss and Liverwort Control?

Materials and Methods

A second trial compared a higher rate of 75 lb per 1,000 ft² (366 kg per 1,000 m²) top-dressing of three iron sulfate controlled release fertilizer products; standard size prills of 90- and 180-day release patterns, a mini-sized prill (1.45mm average size) of 90-day release pattern and an untreated control. Twenty-one containers per application rate/release pattern combination were evaluated for percentage moss and liverwort surface coverage at 6 and 12 weeks after treatment. 2-year-old Douglas-fir grafted seedlings were inspected for signs of phytotoxicity at week 12.

Results and Discussion

Six weeks after treatment, combined moss and liverwort coverage for the untreated control was 45%, standard-size prills of 90- and 180-day release both showed 10% coverage, while the mini-sized prill was significantly lowest at 5% coverage. After 12 weeks, the combined moss and liverwort coverage rose to 78% for the untreated control, while the mini-size prill remained significantly lowest at 7% coverage (figure 4). No phytotoxicity was observed 12 weeks following application.

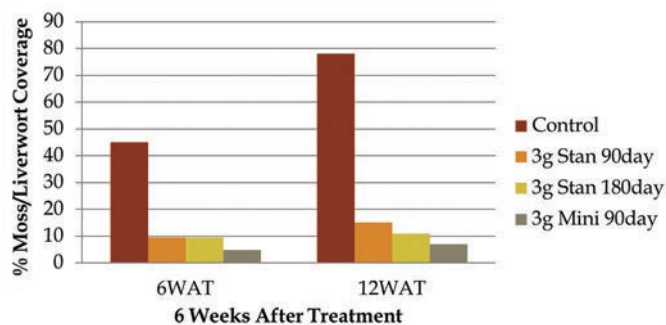


Figure 4. Combined moss and liverwort coverage 6 and 12 weeks after treatment. After 12 weeks, the combined moss and liverwort coverage rose to 78% for the untreated control, while the mini-size prill remained significantly lowest at 7% coverage.

These trials suggest the best way to use controlled-release iron sulfate to prevent moss and liverwort establishment is to get good coverage, achieved by applying both an adequate rate as well as a mini-sized product that allows for even product distribution. Note that the product was applied to Douglas-fir, an iron-loving species.

Summary Study #2, Trials 1 and 2

Whether incorporating into media or top-dressing, smaller-size prills offer the promise of improved fertilizer distribution, ultimately providing the grower another tool to improve crop uniformity.

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