Figure 1. Small or light-colored tree seeds pose a challenge to sow uniformly into containers because they can be difficult to distribute evenly and are hard to see after being placed into growing containers. Photo by Jacob Witcraft, 2024.

Coating Seeds Using DayGlo Thermoplastic Pigments To Improve Sowing Distribution and Uniformity

Jacob Witcraft, Lori Mackey, and Nabil Khadduri

Webster Forest Nursery Greenhouse Manager, Washington State Department of Natural Resources, Olympia, WA; Research Specialist, University of Idaho Franklin H. Pitkin Forest Nursery, Moscow, ID; Western Nursery Specialist, U.S. Department of Agriculture, Forest Service, Olympia, WA

Abstract

The uniform sowing of tree seeds into containers is crucial to ensure that the desired number of seedlings is produced for each respective growing season. However, very small, dark-colored, or light-brown seeds can make uniform sowing challenging. For over 20 years, the Washington State Department of Natural Resources' Webster Forest Nursery used tempera paints to remedy this issue, though the paints do not greatly increase the visibility of the seeds. A sowing trial using DayGlo brand A/AX thermoplastic pigments proved successful in increasing seed visibility. Additionally, nursery staff reported more uniform sowing and increased productivity when policing lot changes.

Introduction

The low visibility of certain seeds—especially from tree species that produce very small seeds, such as western hemlock (*Tsuga heterophylla*) and Sitka spruce (*Picea sitchensis*)—makes it difficult to evenly distribute those seeds into containers. Light-brown and darker colored seeds can look very similar to the color of growing medium, making them difficult to see (figure 1). To remedy these issues, the staff at the Washington State Department of Natural Resources' Webster Forest Nursery (Webster) have used tempera paints to color seeds for increased visibility.

Tempera paints are powdered and meant to be mixed with water, but instead Webster dusted the seeds with the powder. Unfortunately, there were some drawbacks to this method of colorization. The paint colors are faint; although they increased seed visibility, it was not as much as desired. The powdered paints also tended to clump if there was too much moisture on the seeds, which clogged

the needles on the vacuum needle seeder. Tempera paints have also been reported to occasionally clog vacuum drum seeders (Rhoades 2024, Stevens 2024).

After attending a conference and networking with the University of Idaho's Franklin H. Pitkin Forest Nursery (Pitkin), Webster became aware of an alternative to coloring seeds. For nearly 25 years, Pitkin has used A/AX thermoplastic AX-11-5 Aurora Pink pigment due to its high visibility and ease of adherence to both conifer and hardwood seeds, whether dry or damp. This pigment provides vivid colorization that persists throughout the growing season on the seed coat, allowing for prolonged visibility throughout the germination process.

Methods

For the 2024 sowing season, at the suggestion of Lori Mackey, a research specialist with the Pitkin Nursery, Webster staff trialed Pitkin's method of colorizing seeds using DayGlo brand A/AX thermoplastic pigments. (Pitkin uses approximately 0.25 tsp (1.06 g) of powder stirred into a bowl of 0.5 lb (0.22 kg) of seeds to color the seeds prior to machine or hand sowing.) Mackey donated some of their nursery's AX-11-5 Aurora Pink pigment, and DayGlo provided free samples of AX-17-N Saturn Yellow and AX-15-N Blaze Orange (figure 2).

Before testing this coloring method on the smallest and most delicate seeds, Webster staff conducted a germination test of western hemlock seeds treated and untreated with the pigment. Their results showed no significant difference in germination between the colorized and the control seeds.

Webster staff used the pigments to colorize seeds of western hemlock, Engleman spruce (*Picea engelmannii*), Sitka spruce, western white pine (*Pinus monticola*), Douglas-fir (*Pseudotsuga menziesii* var. *menziesii*), and lodgepole pine (*Pinus contorta*). For each seed batch, a 1-qt (0.94-L) bucket was filled halfway full of seeds and less than 0.5 tsp (2.09 g) of pigment was placed on top of the seeds. A lid was placed on the bucket, and the seed and pigment were gently mixed. The extremely fine pigment effectively coated the seeds. There were no issues with the pigments clogging the needles on the Bouldin & Lawson (McMinnville, TN) vacuum needle seeder (figure 3). The bright colors made it much easier to verify the correct number of seeds were being placed in each cavity (figure 4).

Results

The three different colors made switching between seed lots very visual, and it was easy to ensure lots were not mixed up (figure 5). Webster contract workers shared that the colors helped them police lot changes and, overall,

Figure 2. DayGlo manufactures a range of daylight fluorescent pigments. As per the company website, the "A and AX series pigments are thermoplastic, fluorescent pigments recommended for a wide range of applications where resistance to strong solvents is not needed, including paper coatings, vinyl coated fabric, A-type gravure inks, paints, screen inks, and vinyl plastisols and organisols" (DayGlo Color Corp. [N.d.]). Photo by Jacob Witcraft, 2024.

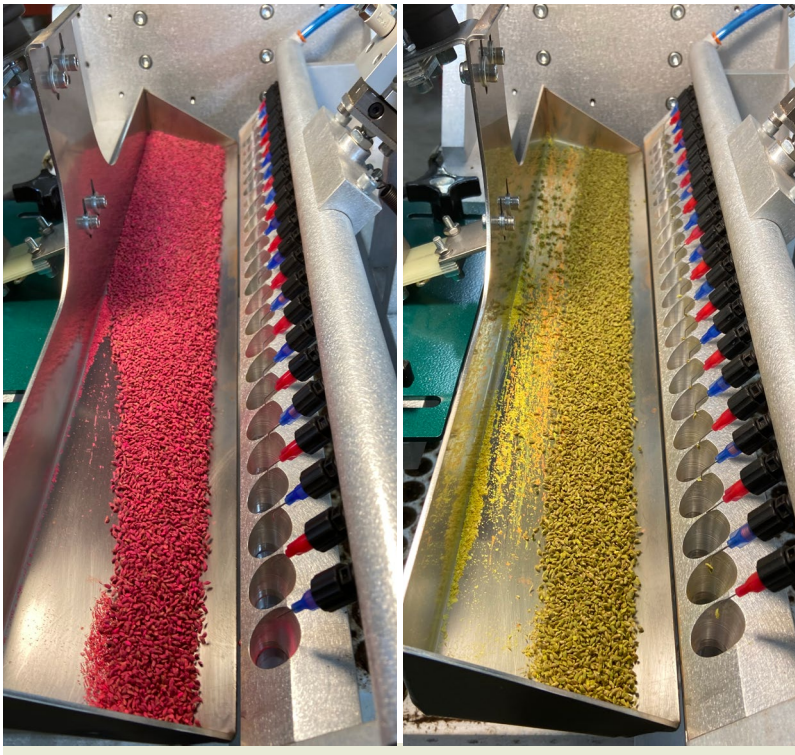

Figure 3. Prior to being sown, the seeds were processed through the vacuum needle seeder, and the additional pigment did not clog the needles. Photo by Jacob Witcraft, 2024.

Figure 4. Following sowing, the coated seeds were very visible against the planting medium. Nursery workers reported that applying colors to the different seed lots made them easier to track. Photo by Lori Mackey, 2024.

greatly expedited seed checking. Webster staff found that all the colors tested performed exponentially better than the tempera paints. The orange and pink were both very vibrant colors that provided the needed contrast against the media. While the yellow worked much better than previous treatments or no color at all, Webster staff found that contrasting on the brown seeds made the color more of a greenish hue, which was not as bright as the orange or pink (figure 6).

The brighter colors helped Webster staff achieve a much more uniform distribution of seeds than sowing without colorization. The germination class counts of Sitka spruce in 240-cell containers increased more than 10 percent over the previous two growing seasons, and

Figure 5. Contrasting colors facilitated seed lot changes. Photo by Nabil Khadduri, 2024.

western hemlock germination classes increased by around an average of 5 percent.

For another sowing trial, the pigments were used to colorize seeds not typically colored due to their size, presence of resin vesicles, or seed color. Webster tested the colors on noble fir (*Abies procera*), grand fir (*A. grandis*), Pacific silver fir (*A. amabilis*) western redcedar (*Thuja plicata*), ponderosa pine (*Pinus ponderosa*), and western larch (*Larix occidentalis*) and found no ill effects on the germination or growth of any of the seeds. These results correspond to practiced applications of the pigment used at Pitkin (figure 7).

Discussion

Given the success of this trial, Webster will adopt the use of DayGlo brand A/AX thermoplastic pigments for the sowing of all seeds. The cost of these A/AX thermoplastic pigments was an estimated 50 times what the tempera paints cost for a similar weight of product. However, staff can likely use 10 times less of the pigments than the tempera paints, and the productivity savings outweigh the purchase cost.

A question remains whether the impressive visibility and longevity of the product will increase bird or other forms of animal predation. In this first season of use, Webster reports little to no loss. One seed coating website claims that bright colors may actually deter predation, particularly from birds, though this claim lacks substantiation (Summit Seed Coatings 2023). This is counter to findings that natural variation in seed coat colors serve as camouflage in native soils to limit predation (Porter 2013).

Figure 6. Difference in color between the AX-15-N Blaze Orange (left) and the AX-17-N Saturn Yellow (right) on western white pine seeds. Photo by Jacob Witcraft, 2024.

Address correspondence to:

Jacob Witcraft, Webster Forest Nursery Greenhouse Manager, Washington State Department of Natural Resources, Olympia, WA; email: jacob.witcraft@dnr.wa.gov; Lori Mackey, Research Specialist, University of Idaho Franklin H. Pitkin Forest Nursery; email: lmackey@uidaho.edu; Nabil Khadduri, Western Nursery Specialist, U.S. Department of Agriculture, Forest Service, Olympia, WA; email: nabil.khadduri@usda.gov

References

DayGlo Color Corp. [N.d.] A/AX Thermoplastic Pigments. https://www.dayglo.com/products/pigments/aax-thermoplastic-pigments/. (Accessed 25 July 2024)

Porter, S.S. 2013. Adaptive divergence in seed color camouflage in contrasting soil environments. New Phytologist. 197(4): 1311–1320. https://doi.org/10.1111/nph.12110.

Rhoades, E.O. 2024. Personal communication. Southern nursery specialist, USDA Forest Service, Athens, GA, emily.rhoades@usda.gov.

Stevens, T. 2024. Personal communication. Weyerhaeuser, retired, Rochester, WA.

Summit Seed Coatings. 2023. What goes into seed coatings? Seed coating materials and what they do. https://summitseedcoatings.com/blog/seed-preparation/what-goes-into-seed-coatings-seed-coating-materials-and-what-they-do/. (Accessed 25 July 2024)

Figure 7. Applications of the pigment to the seeds of true firs, western redcedar, ponderosa pine, and western larch have had no negative effect on the germination or growth of these seeds. Photo by Lori Mackey, 2024.