Greenhouse evaluation of labtested seed: a feedback loop





Nabil Khadduri (nabil.khadduri@dnr.wa.gov) Challenges to Our Future Tree Seed Supply Tree Seed Working Group Workshop June 27, 2022



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WADNR Seed Center

Greenhouses and Seed Extraction Plant

Webster Forest Nursery

WADNR Webster Forest Nursery



70% Douglas-fir seedlings

2-3 million plugs/year

6 million bareroot/year

Additional spp.: W redcedar W hemlock W larch Ponderosa pine W white pine True firs Sitka spruce Interior DF Red alder

Nursery adjacent to Seed Center

Cold storage

\$10MM seed inventory



Seed processing and lab testing

Space efficiency vs. seed use efficiency



Greenhouse space is expensive...



...but so is this!



Why do lab and greenhouse germ results differ?

Lab testing

- Controlled environment
 - 8hr/16 hr day night, 30C/20C
 - Only seedborne pathogens
 - Germination: radicle extension 4x length of coat
 - 4 reps of 100 seed (8 x 50)

Greenhouse evaluation

- Semi-controlled environment
 - Temperature and irrigation variation
 - Additional pest pressures
 - Germination called later
 - Media, seed depth can vary
 - Smaller sample sizes outside of trials







Nursery germ capacity usually lower than lab

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Methods to improve operational germination

- Sanitation treatments (hydrogen peroxide, sodium hypochlorite)
- Running water rinse (pre- and/or post-strat)







Methods to improve operational germination

- Targeting moisture content
- Extended stratification
- Delayed dryback
- Mid-strat high-grading
- Thermal priming





Case study: improving western hemlock nursery germ to closer match lab tests

- Eliminated chemical treatment (resin vesicle species)
- Extended stratification
- Thermal priming





Low vigor in WH, more susceptible to range of issues

Western hemlock strat duration **lab** trial: extended strat increased germ speed

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Extended strat increased germ speed and total germ in greenhouse



Growing Degree Days (5^oC-based)

Thermal priming increased germ speed in gh

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n = 59 US and Canadian respondents during 2020 webinar live poll



Sometimes nursery germ higher than lab



Lab results: non-sanitized 28-day strat

Rep 7 into germ chamber



Visible fungus already developing during strat

Rep 7 after 3 weeks



Heavy fungus buildup

Lab results: sanitized 28-day strat

Rep 7 into germ chamber



Plated after strat, no visible fungus development on seeds

Rep 7 after 3 weeks



Minimal fungus development



Sometimes falldown expresses after germination





Failure to thrive in WRC, not disease or salt-burn related



Post-thinning lodging in true fir



Stunted radicle



Kolotelo

Seed inventory management decisions

- Older lots losing vigour
- Lots where lab test does not predict poor nursery performance
- Sometimes we just use what we have because that's all we have





Take home messages

- In the reforestation pipeline, from seed production to post-planting, the greatest opportunity to improve seed use efficiency is at the nursery
- A nursery can best improve seed use efficiency when ongoing communication exists with its seed supplier
- Even in a vertically integrated program with neighboring facilities, we still work to improve communication to help ensure future seed supply



Haase and Dumroese 2021