Growing confidence in forestry's future Research Programme

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Promoting growth: from the glasshouse to the nursery and out into the forest

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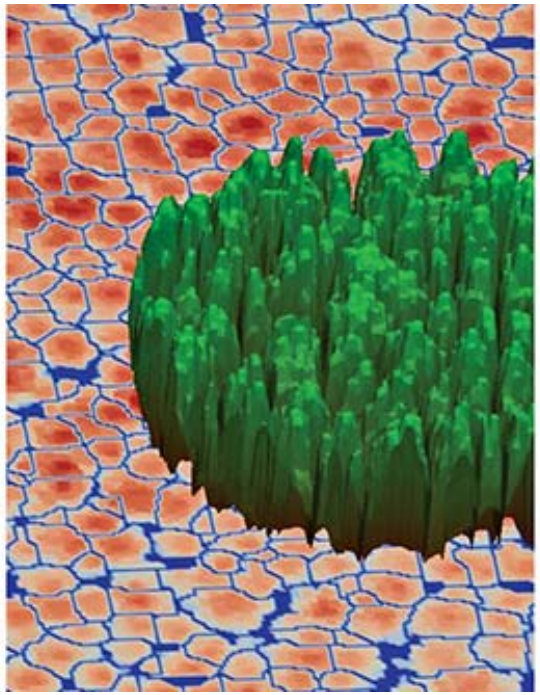

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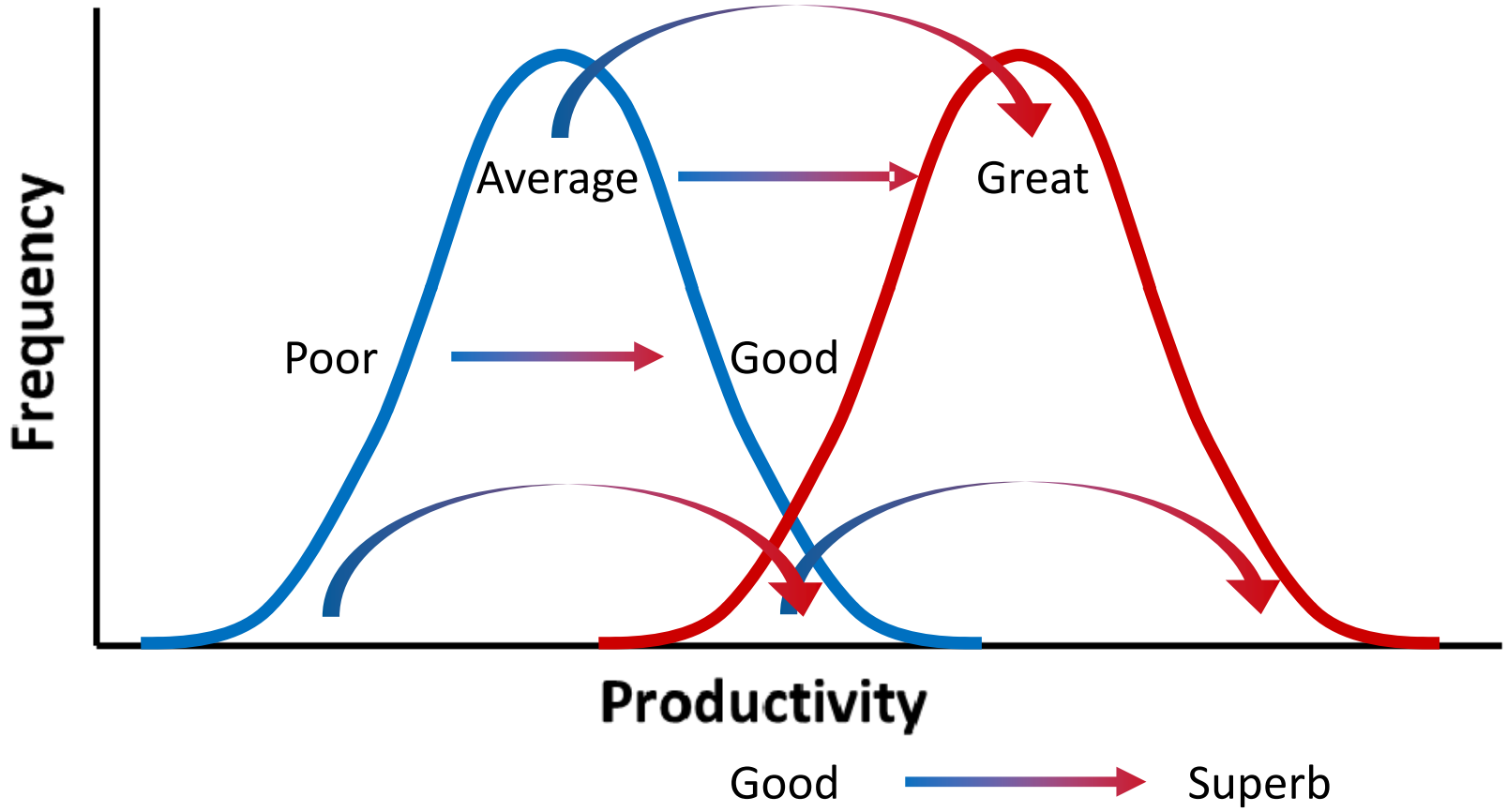
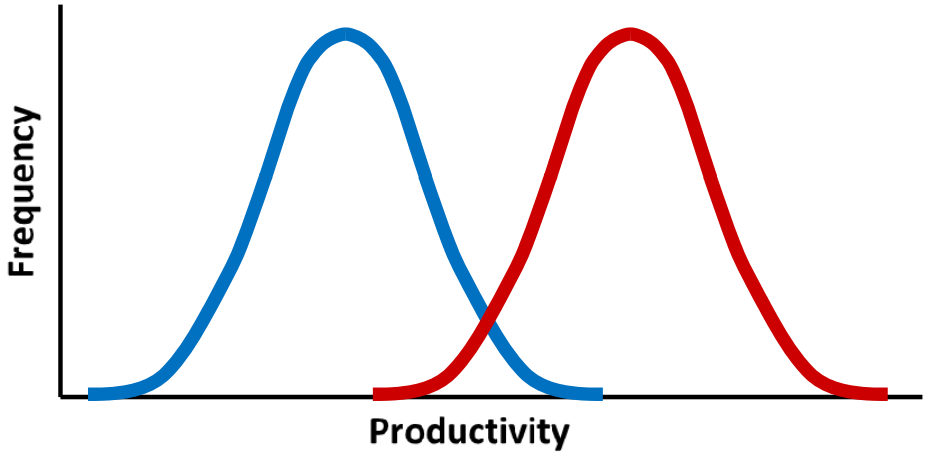
FOREST OWNERS ASSOCIATION

Core goal – doubling forest productivity



What tools do we have to do the job?

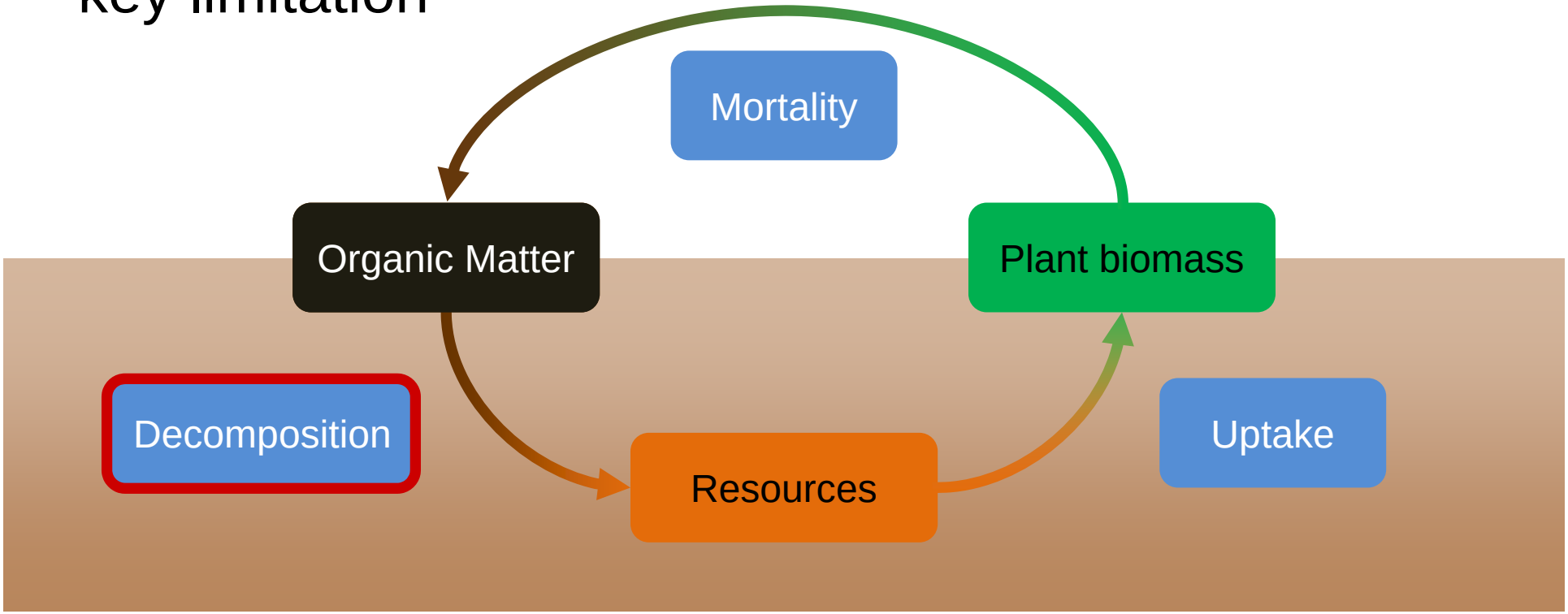
- Improved stand management
- Systems to identify and propagate elite genotypes



- GCFF programme also involves significant research into methods to get greater benefits from nutritional, microbial and regulatory systems

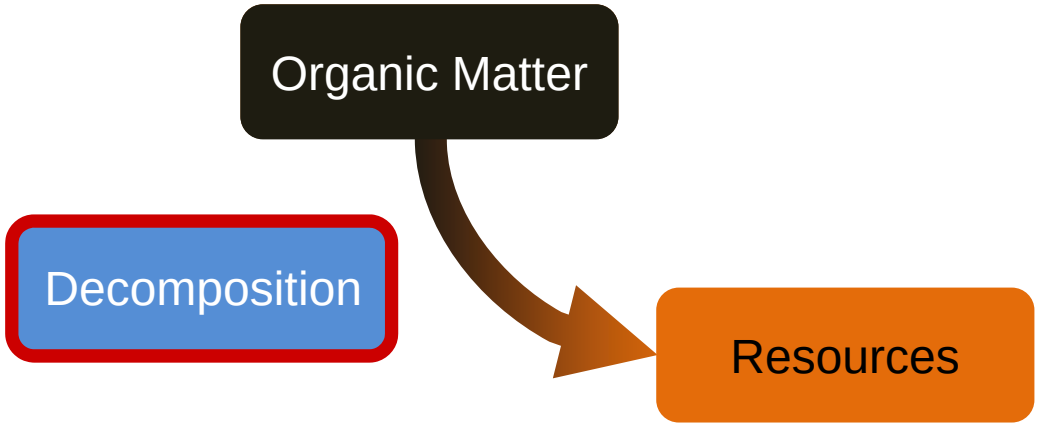
Making more available – stimulating cycling

The rates at which soil microbes and soil animals release mineral nutrients from organic matter is a key limitation



Biostimulation based research

- Exploring possible options to enhance microbial activity
- Some issues around side effects on plants

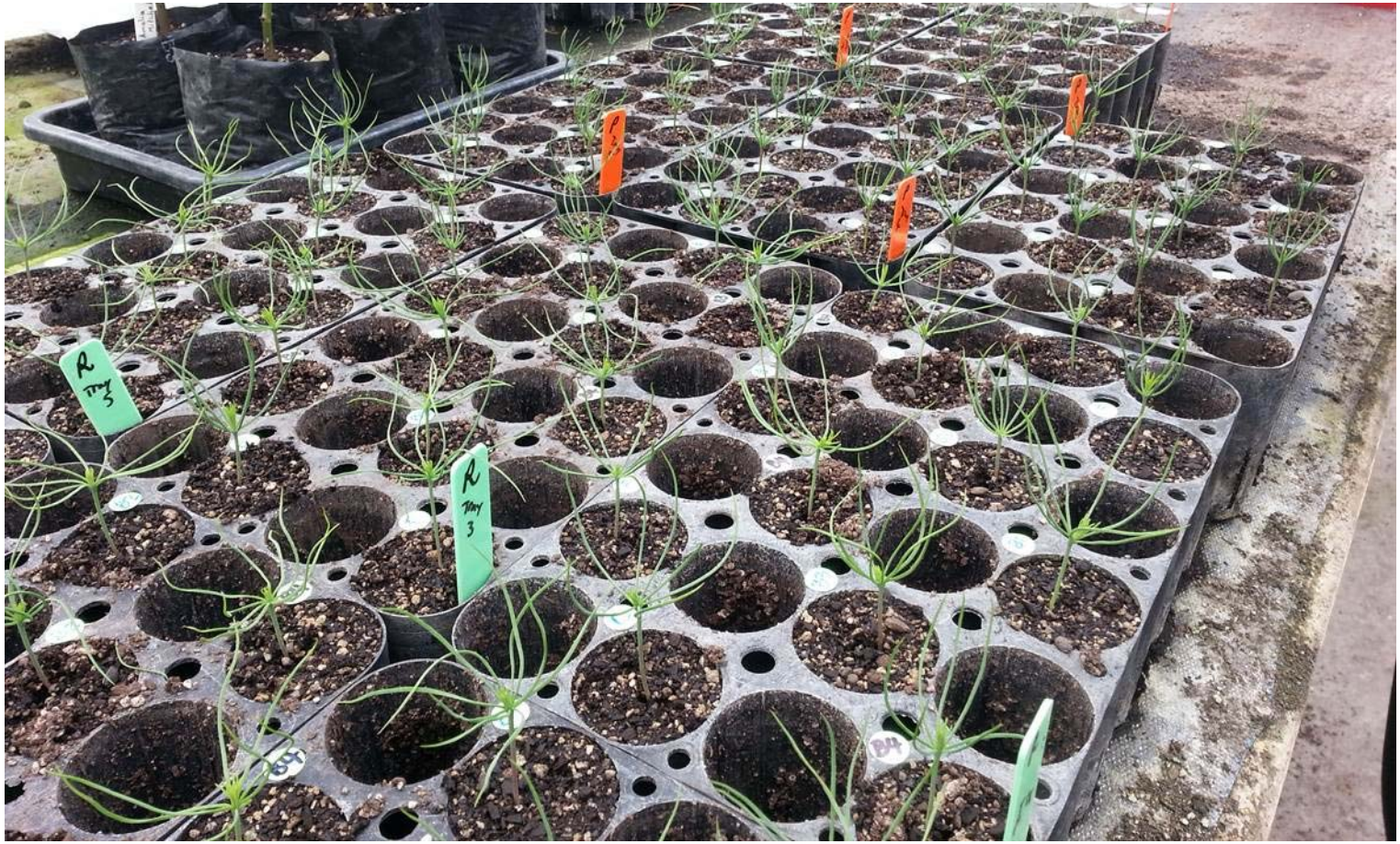


- Selected candidate and carried out seedling trial to examine growth and nutritional impacts
- Used recently germinated maritime and radiata pine seedlings in glasshouse environment

Biostimulant trial – design

- Raised seed in sand / organic matter mix, forcing reliance on nutrient supply from organic matter due to low mineral content
- Waited until we had sufficient germination from both species to begin trial (few days lag period) then applied treatments
  - Control (distilled water)
  - Three levels of urea
  - Four levels of biostimulant

Biostimulant trial – layout



Biostimulant trial – initial response

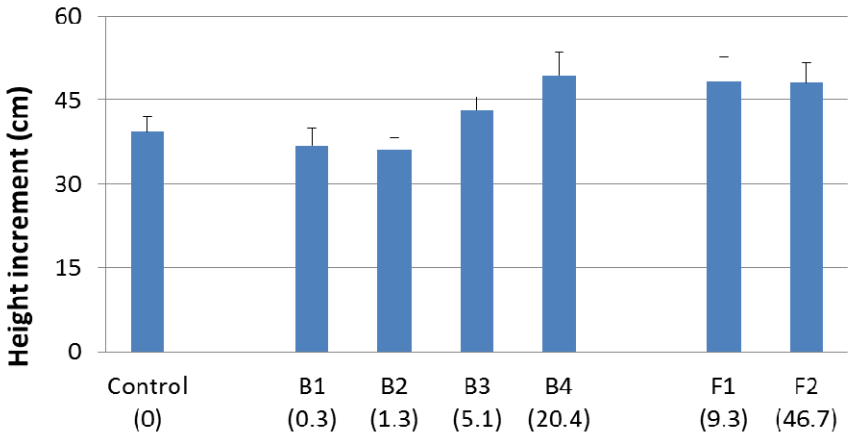
- The biostimulant did not cause any death at any application rate for either species – only minor impacts at highest rates
- Conversely, highest rate of urea application killed every seedling it was applied to in 48 hours
- After three weeks, still no substantial negative effects due to application of the biostimulant
  - Prompted the establishment of a secondary trial to find out just how much was needed to inhibit or kill the seedlings

Biostimulant trial – initial negative impacts

Dead seedling from high fertiliser

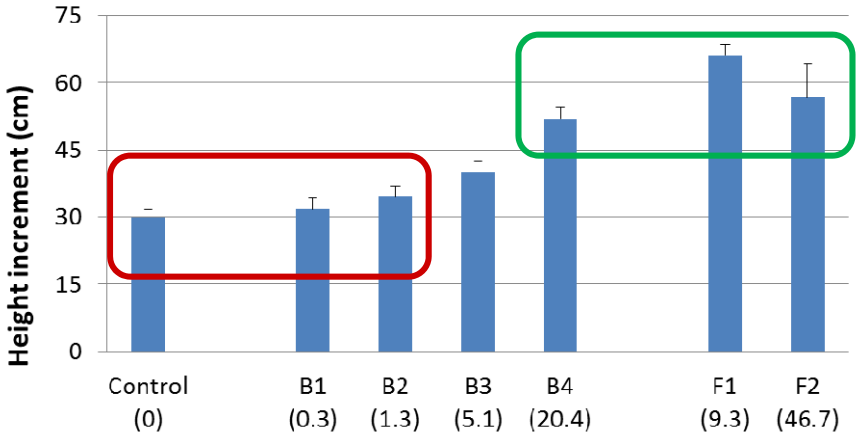
Needle damage with high biostimulant

Biostimulant trial – height growth

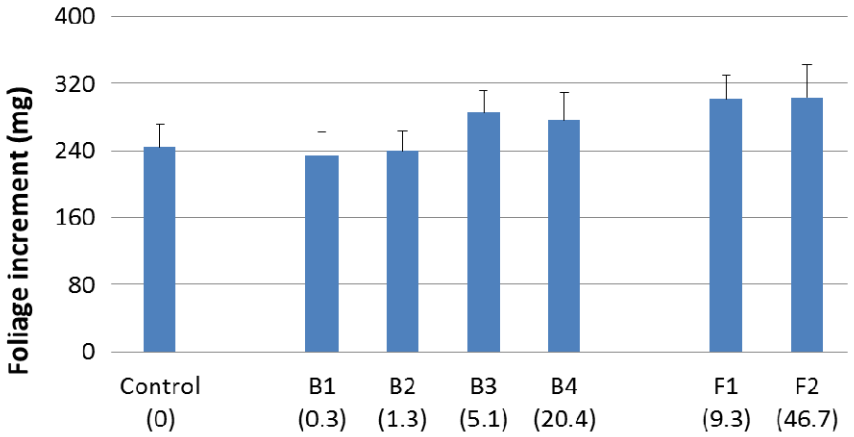


No height effect for maritime pine

Radiata pine height growth affected

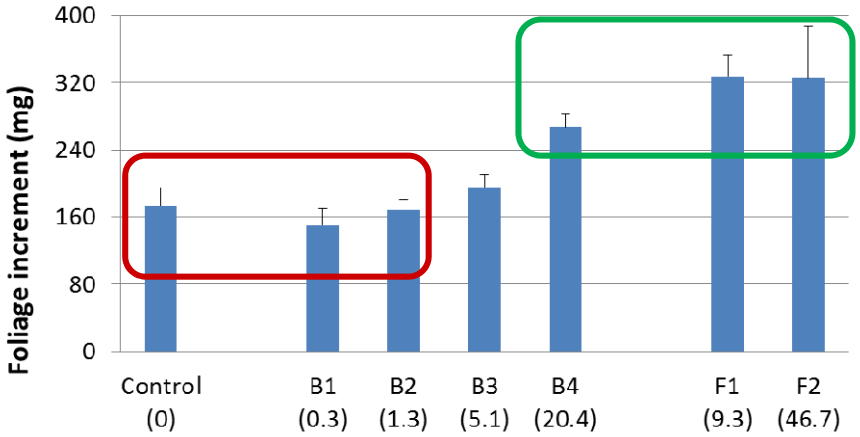


Biostimulant trial – foliage growth



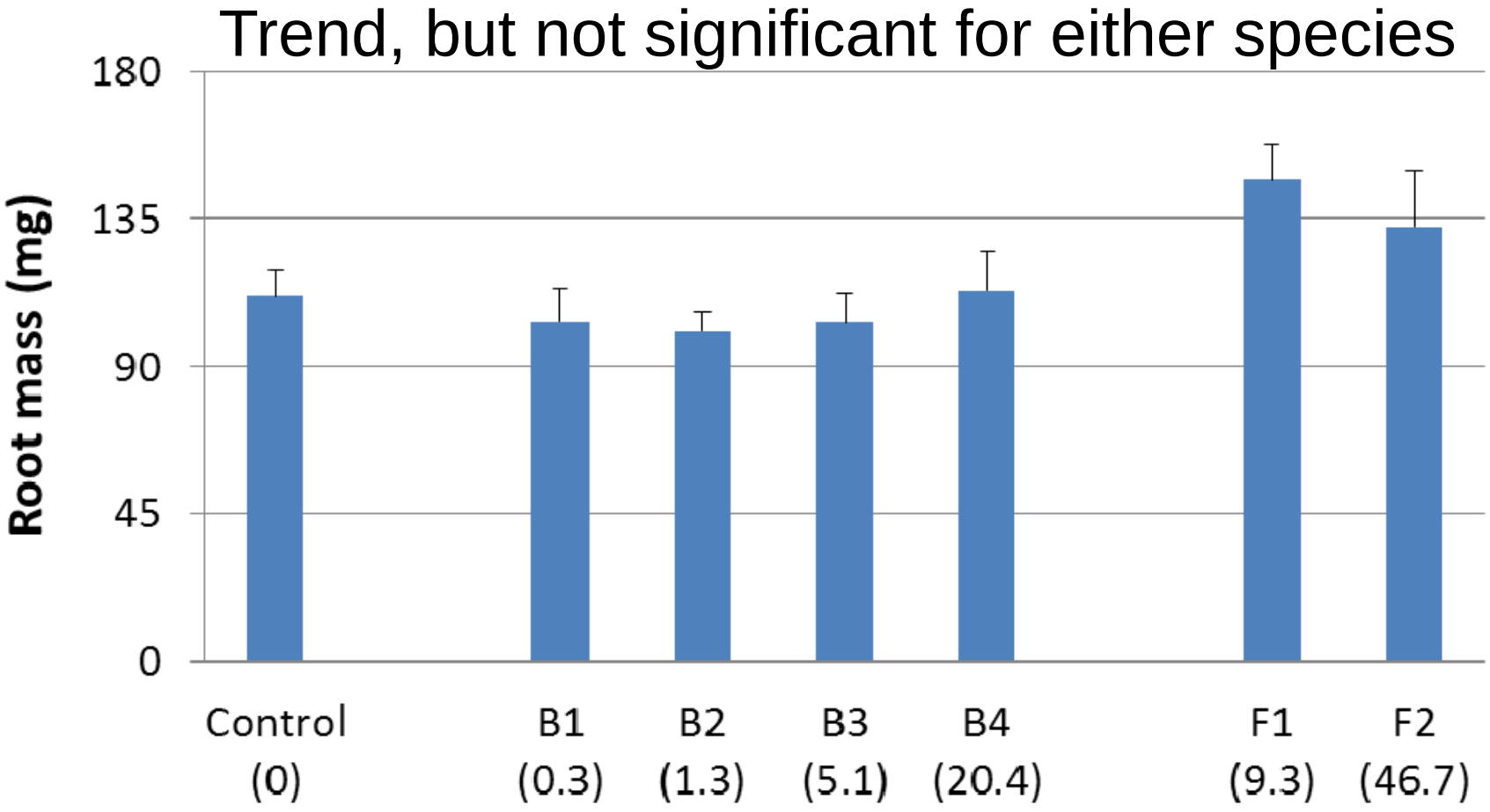
No foliar mass effect for maritime pine

Radiata pine foliar mass growth affected

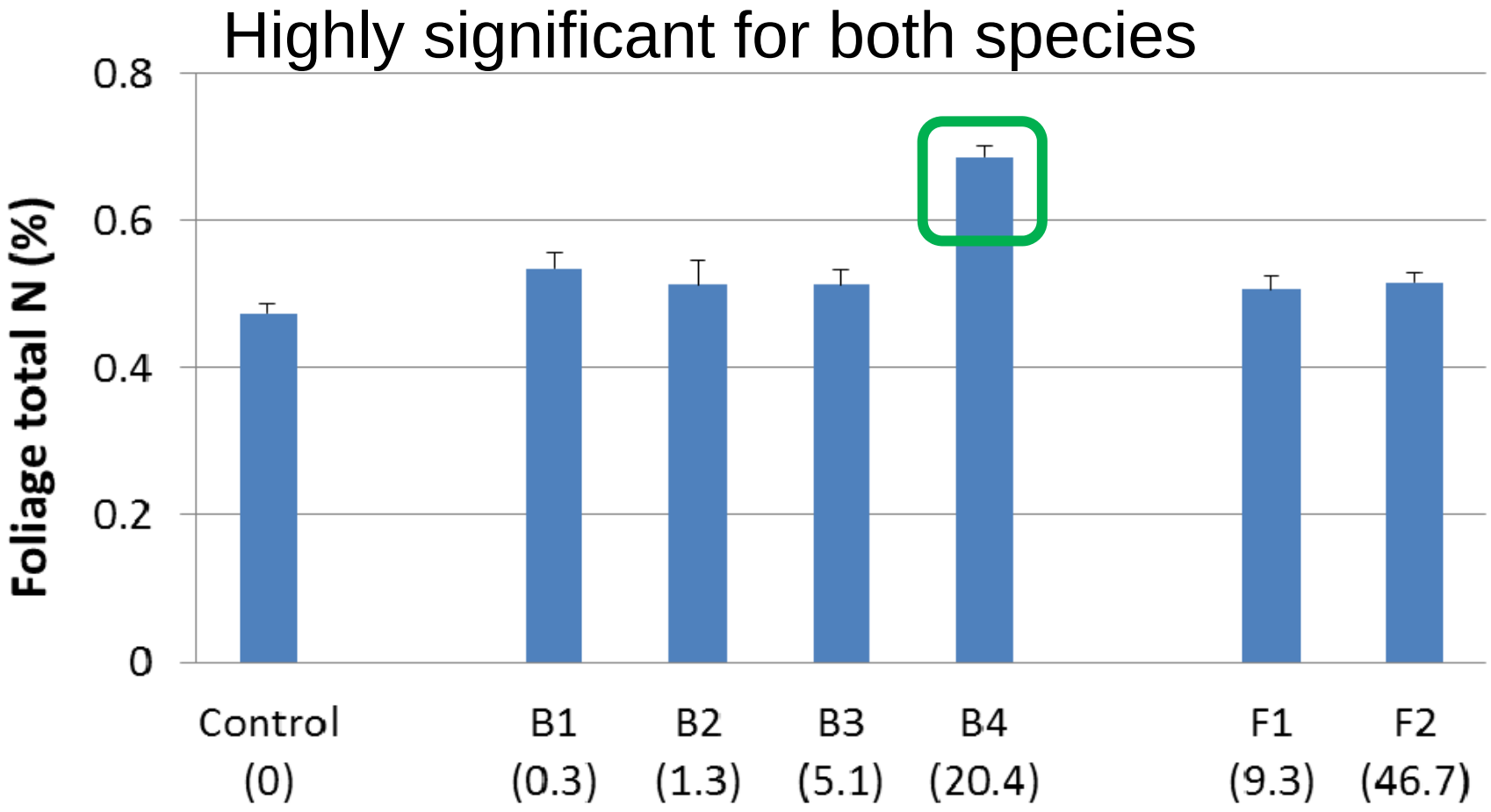


Biostimulant trial – mass differences

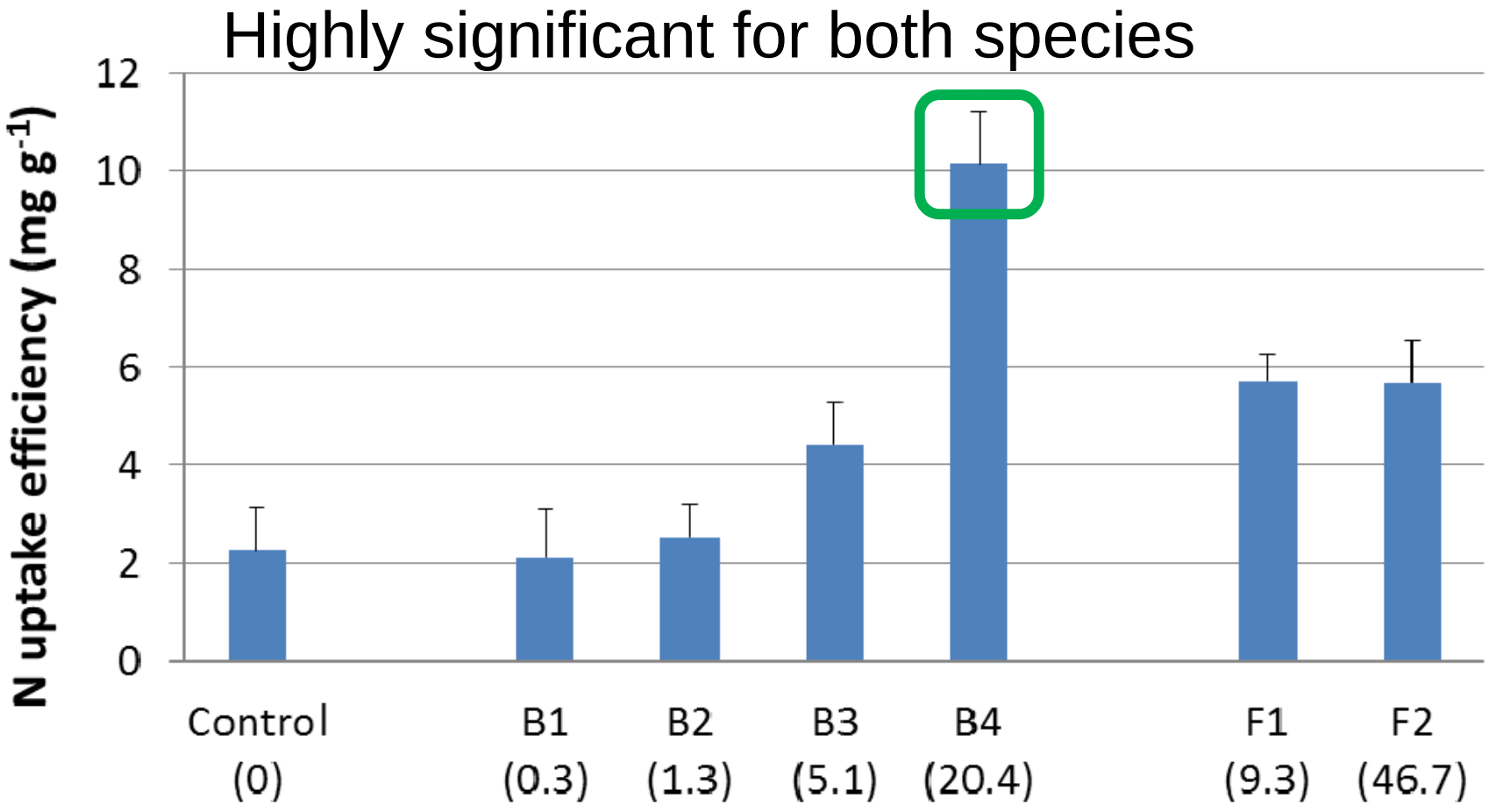
Biostimulant trial – root mass results



Biostimulant trial – foliar N concentration



Biostimulant trial – N uptake per root mass



Biostimulant inhibition trial – design

- Used 4 week old maritime and radiata pine seedlings that were not used in main trial
- Dosed with greater amounts of the biostimulant
  - 0% (control), 100%, 150%, 200% and 400% of the B4 application rate
  - 1/3 of seedlings received 1 dose (at week 4); 1/3 received 2 doses (at weeks 4 and 6); final 1/3 received 3 doses (at weeks 4, 6 and 8)

Biostimulant inhibition trial – results

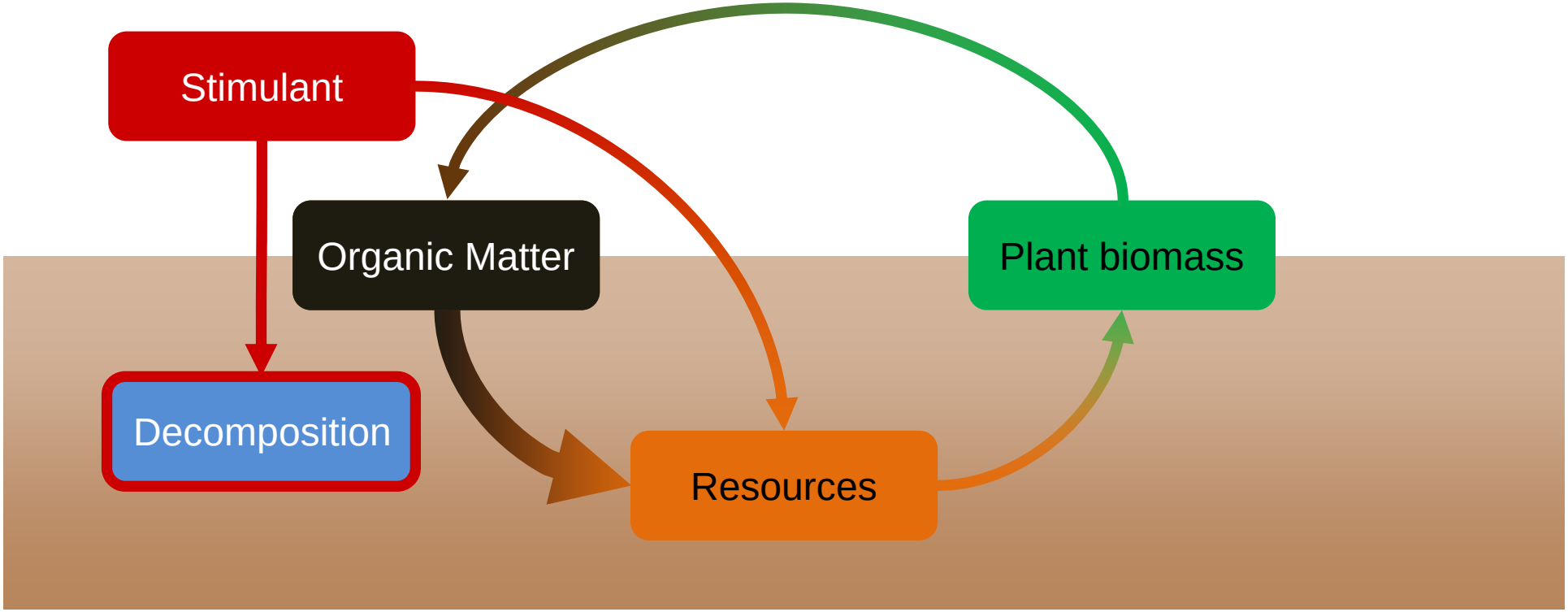
- Usually there would be a plot or picture of something here, but in this case, nothing to show – no death, no inhibition, no significant negative effects for any level of application
- Only effect evident was some needle damage in the maritime pine – but not substantial, and not at the same level as in the main trial
- Most likely the slightly older seedlings were more tolerant of any toxic effects

Biostimulant trials – summary

- Generally positive results that support further research with this biostimulant
- Reinforced by other useful properties – substantially less soluble than urea, but still clearly enhancing plant nutrition
- However, no evidence that any impact on nutrition is due to stimulation of organic matter decomposition – did not see a non-additive nutritional effect

Additive or stimulatory?

Need to have proof that any effect on nutrient uptake is greater than the nutrients contained in the stimulant itself

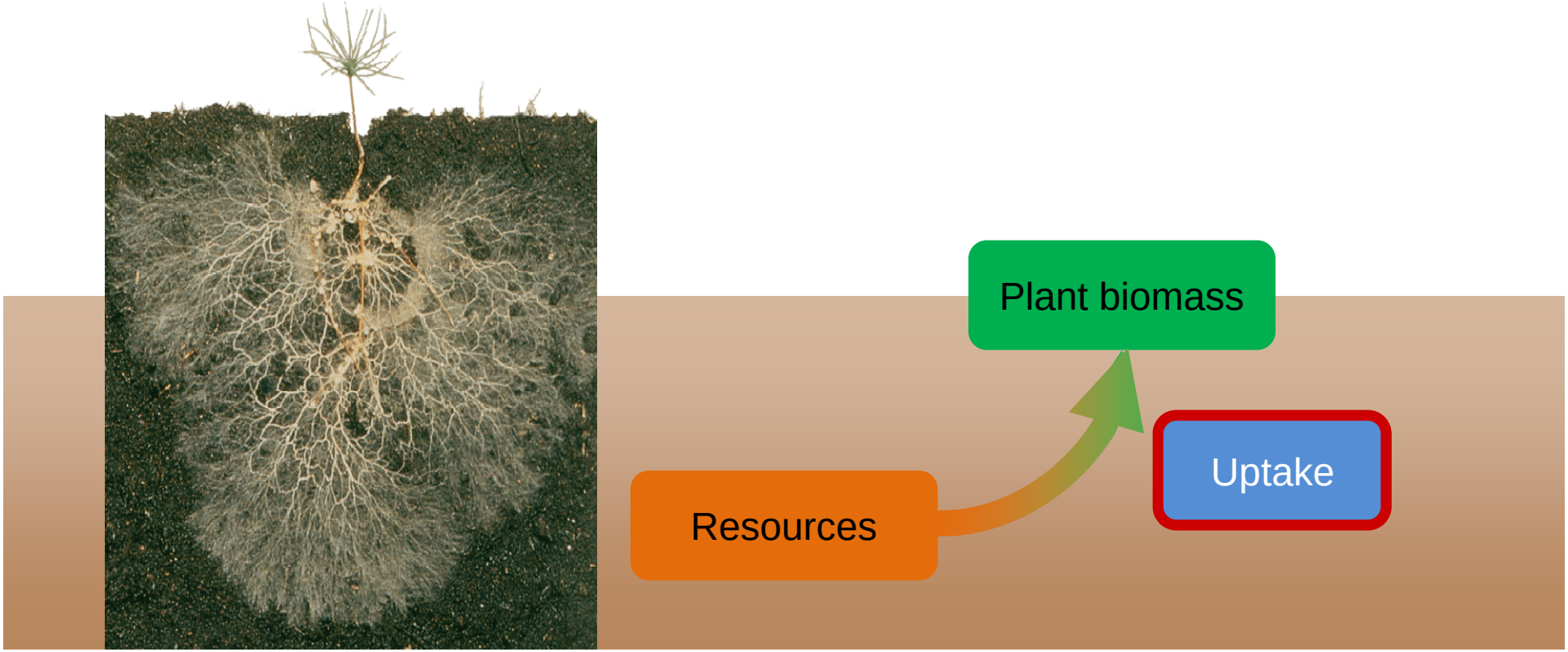


Biostimulant trials – next steps

- Examine biostimulant application on operational basis in nursery and field settings
- Provide more time for any stimulatory effects on cycling to manifest clearly
- Also provides opportunity to examine the relative environmental credentials of this material
- Lastly, why am I not telling you what this “stimulant” is called?
  - Basically, I want to make sure it holds up in the field before it gets used anywhere

Making more available – enhancing uptake

So if we can make more resources available in soil, how can we help trees acquire them?



Nursery mycorrhiza trial – history

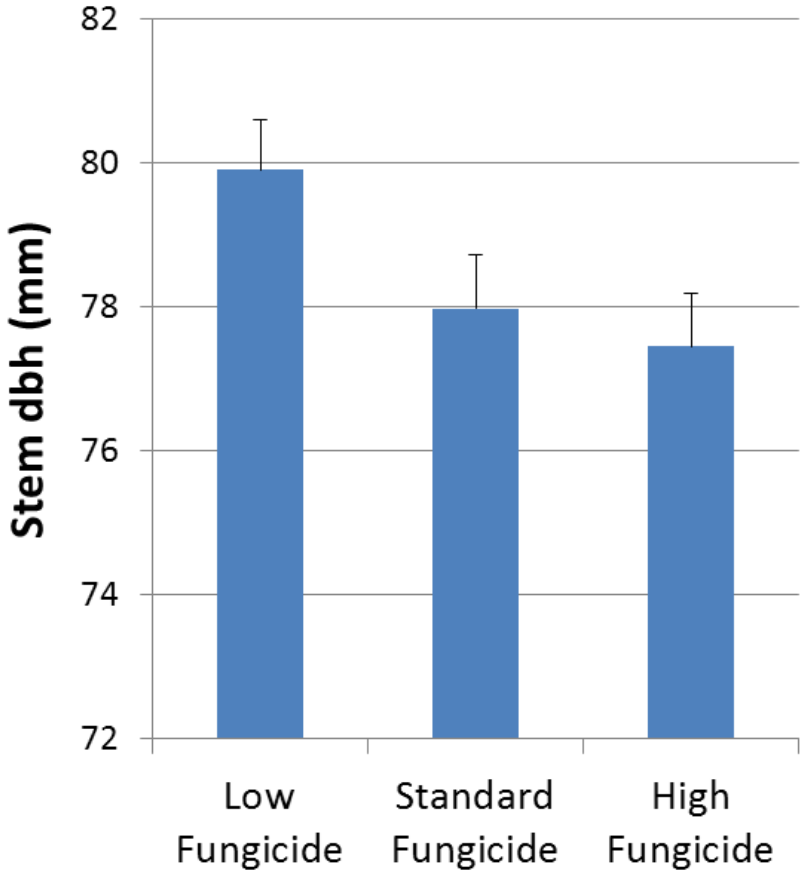
- Altered chemical use in Te Ngae nursery
- Found significant effects on beneficial mycorrhizal species
- Tracked effects on performance of 2600 trees taken from nursery to Kaingoroa

Nursery mycorrhiza trial – past field data

- Decreased chemical use in nursery halved mortality
- Decreased fungicide use increased growth rates in the field for at least 2 years
- Unsure of how long this legacy effect of treatment in the nursery will persist

Nursery mycorrhiza trial – recent field data

- Remeasured in 2014, five years after planting
- Differences in mortality rates remain the same
- Effect of fungicide use on growth persists – but gap not widening



Nursery mycorrhiza trial – conclusions

- Appears that any legacy effects of the nursery treatments have ceased, but certainly influenced early performance in the field
- Evidence suggests this difference in performance is related to the mycorrhiza the seedlings took with them to the field site
- Likely that this trial will no longer be regularly measured, but new trials across multiple sites will be established this year, using better techniques

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