Elsoms Run 1

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This is data analysis notes - more details also see Nursery Trials/Experiments/Run 1/Elsoms Run 1 Results

We grew sitka, birch and pine with different emf at different fertilizer levels to see whether higher fertilizer would influence emf colorization of roots. We obtained media without added fertilizer, asked the supplier the quantities of added fertilizer per litre and then added this back in at 25, 50, 75 and 100% of their usual amounts.

We had a limited selection of emf at the time (due to other commitments in production) and therefore only used heb and pax with birch, sui with pine and sui heb and pax with sitka. Note that there was some query with the heb sequence and on reBLAST it came back as pax - so this experiment may be limited sitka/pax, sitka/sui, birch/pax, pine/sui. Further - note that this is not a trial of responses due to different strains in the library as we would need to trial all strains of interest at the same time.

We also wanted to look at any pellet effect and therefore included the use of an uninoculated blank pellet as well as a no pellet control.

There were 40 trees in each treatment.

Trees were miniplugs planted in early January.

This trial looked at:

1) Whether higher fertilizer levels would affect emf colonization rates on the roots (as quantified by change in height)
2) Any effect of pellet as a fertilizer
3) Any difference in growth of birch/pine/sitka with emf compared to control
4) Any difference in growth for birch and sitka between emf (no rigorous)

Data collected in this run - initial height, final height, mortality

Treatments: Control - no pellet (co), Control with blank pellet (co), heb, pax, sui

Trees, *Betula pendula* (BP), *Pinus sylvestris* (PS), *Picea sitchensis* (SITKA)

Data munging:

Initial height data was collected as frequencies, e.g. number of sitka of 2-3cm, number of 3-4cm, partly due to time constraints measuring individual trees (PG set up this run alone) but in retrospect, since they are so small, this might not be a bad way of recording them. This initial data must first be reshaped into columns of heights.

initial := long_df_i

Final heights also need some re-shaping to a long df, but data was recorded as height per tree

final := long_df_f

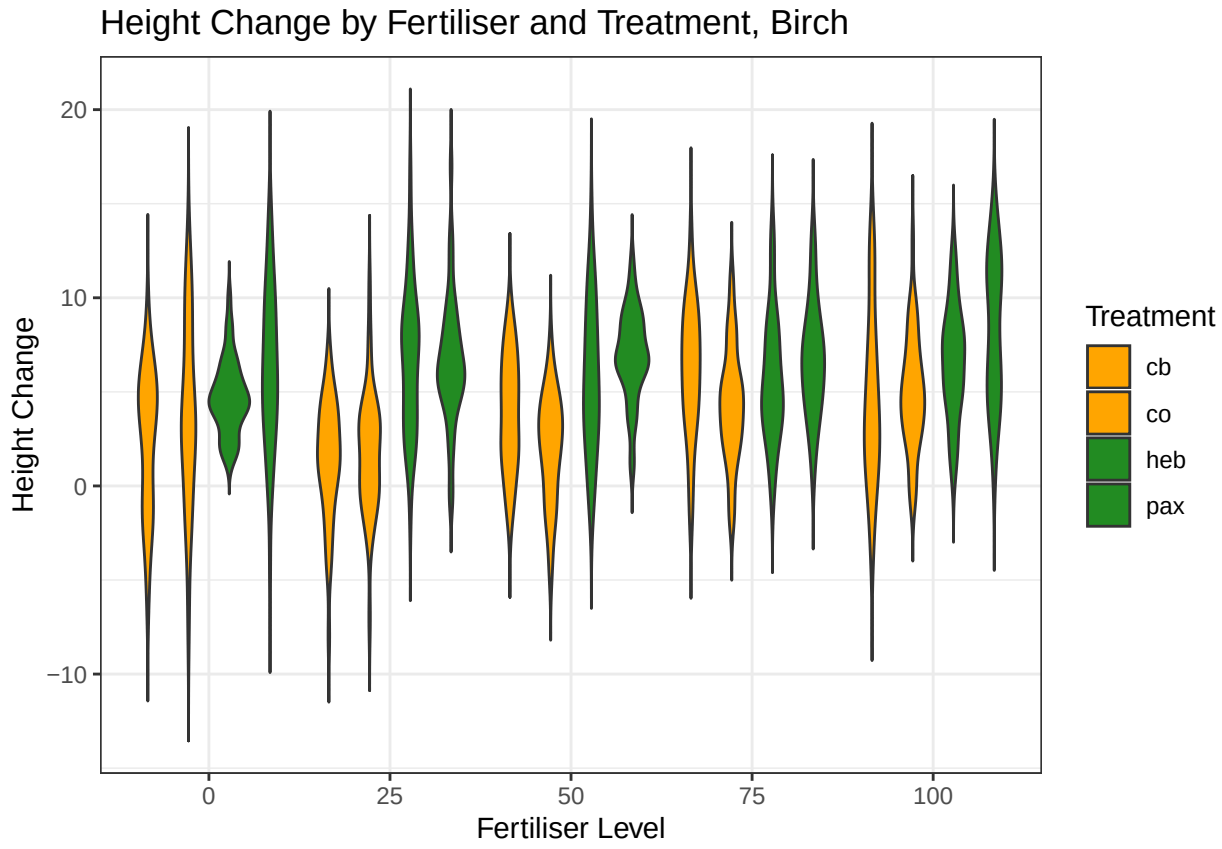
Final part of reshaping combines initial and final data, adds the time point

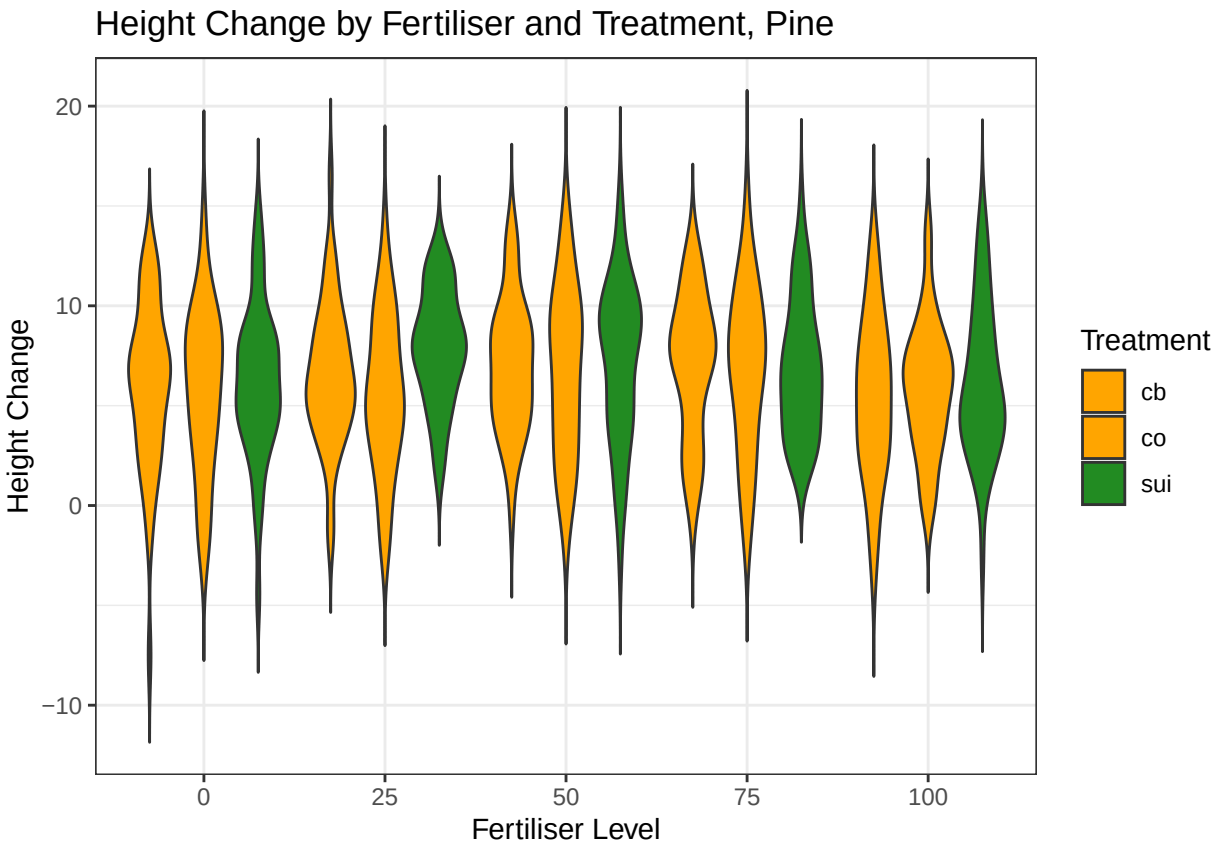
long_df_i & long_df_f:= combined_df

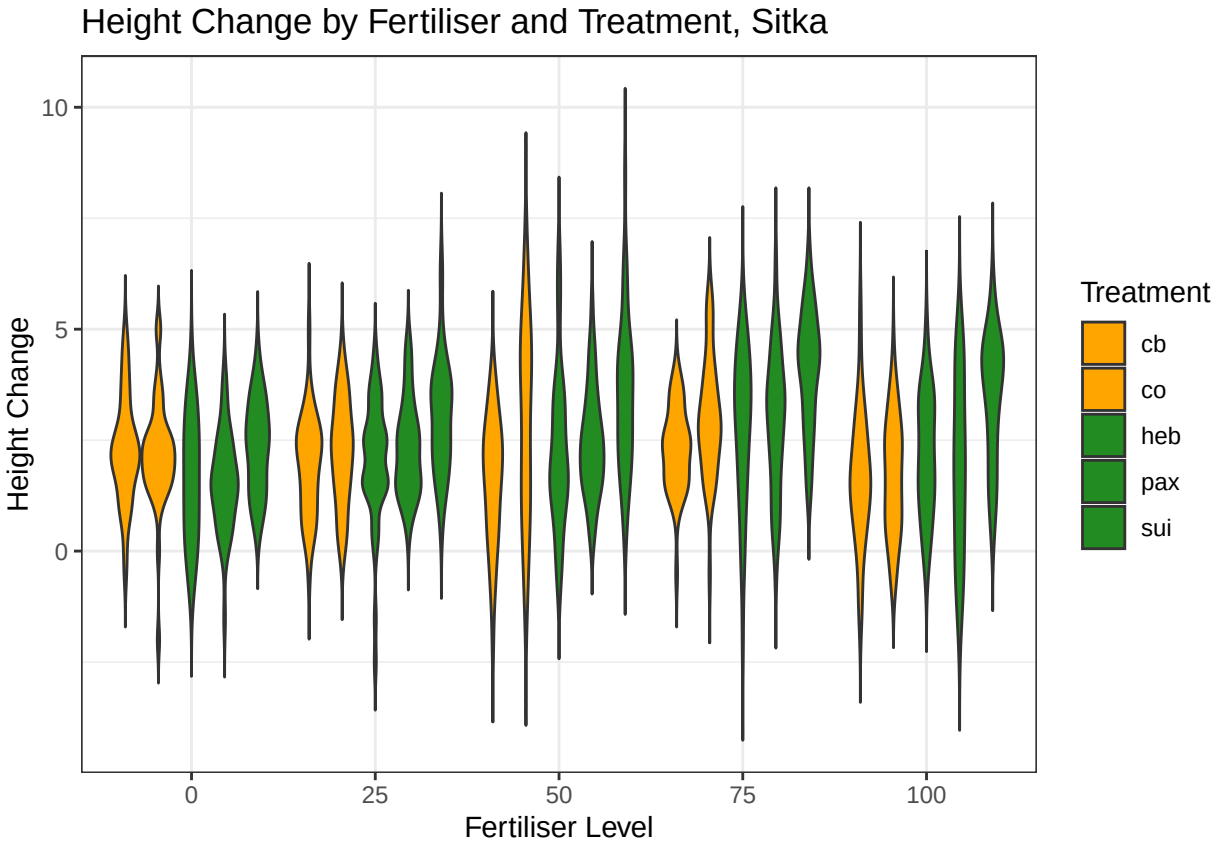
Finally, change in height is calculated as the average of each treatment at each fert level

merged_df = average change in heights grouped by tree/emf/fert

Inital exploration - box plots of change in heights



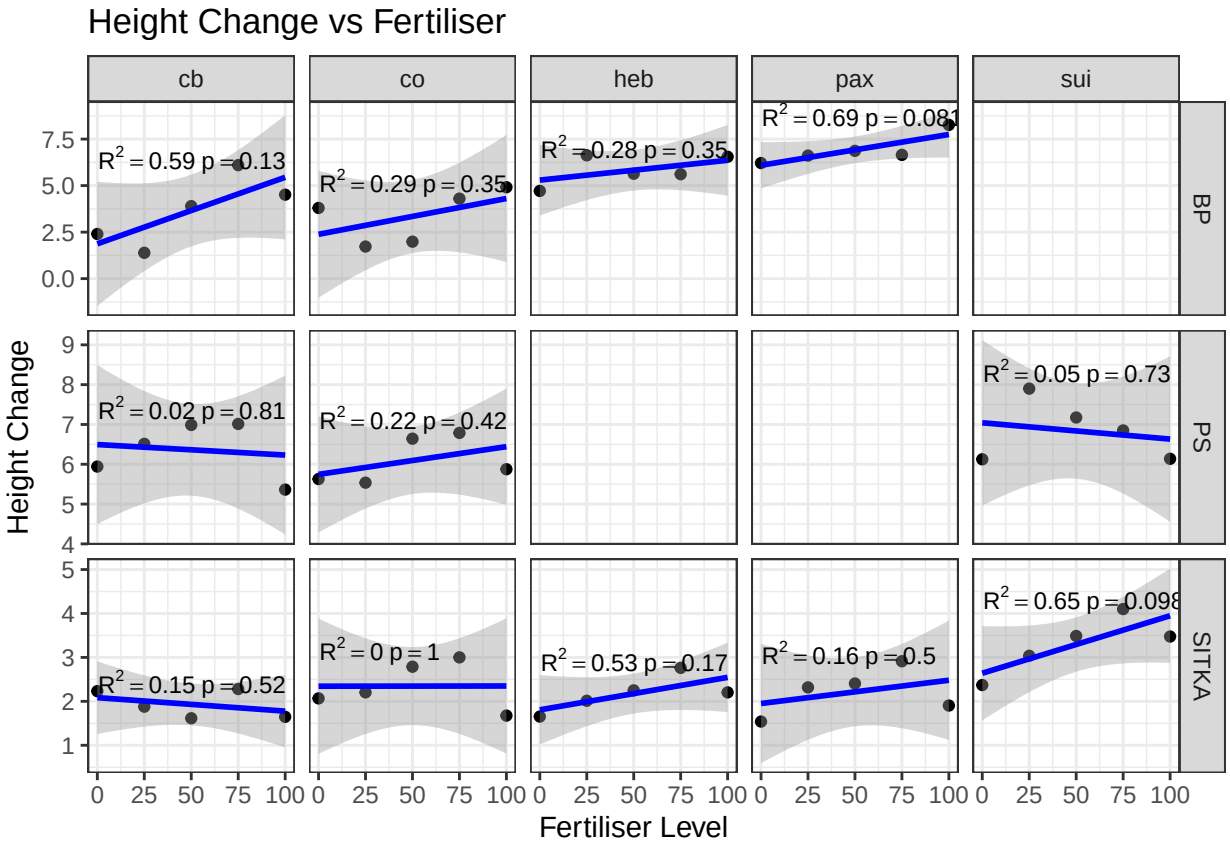

Height Change by Fertiliser and Treatment, Pine
Height Change
20
10
0
−10
0
25
50
75
100
Fertiliser Level
Treatment
cb
co
sui



Initial exploration suggests birch and sitka had greater change in height than controls, but this is less clear for pine. The blank pellet does not appear to have had any affect.

1) Does fertilizer affect growth?

To see whether there is a relationship between change in height and fertilizer levels, use linear model

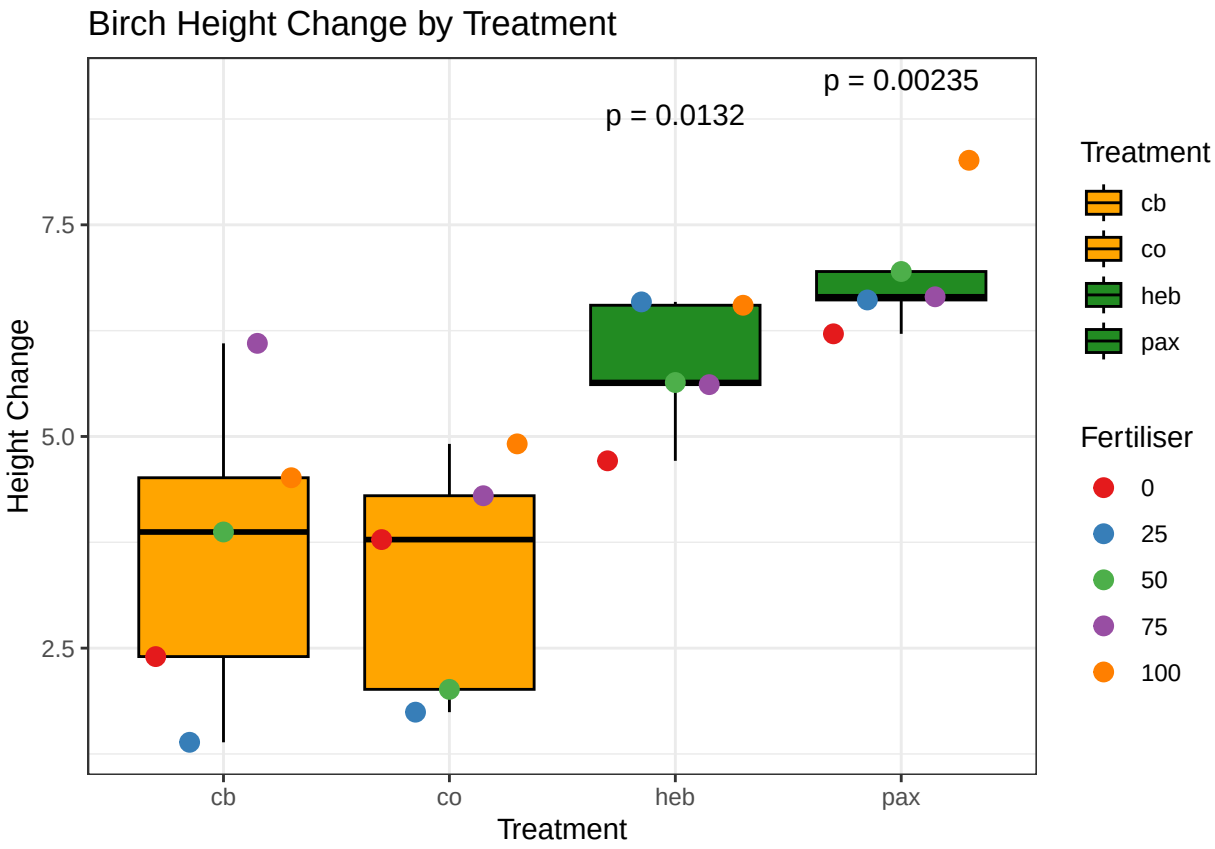


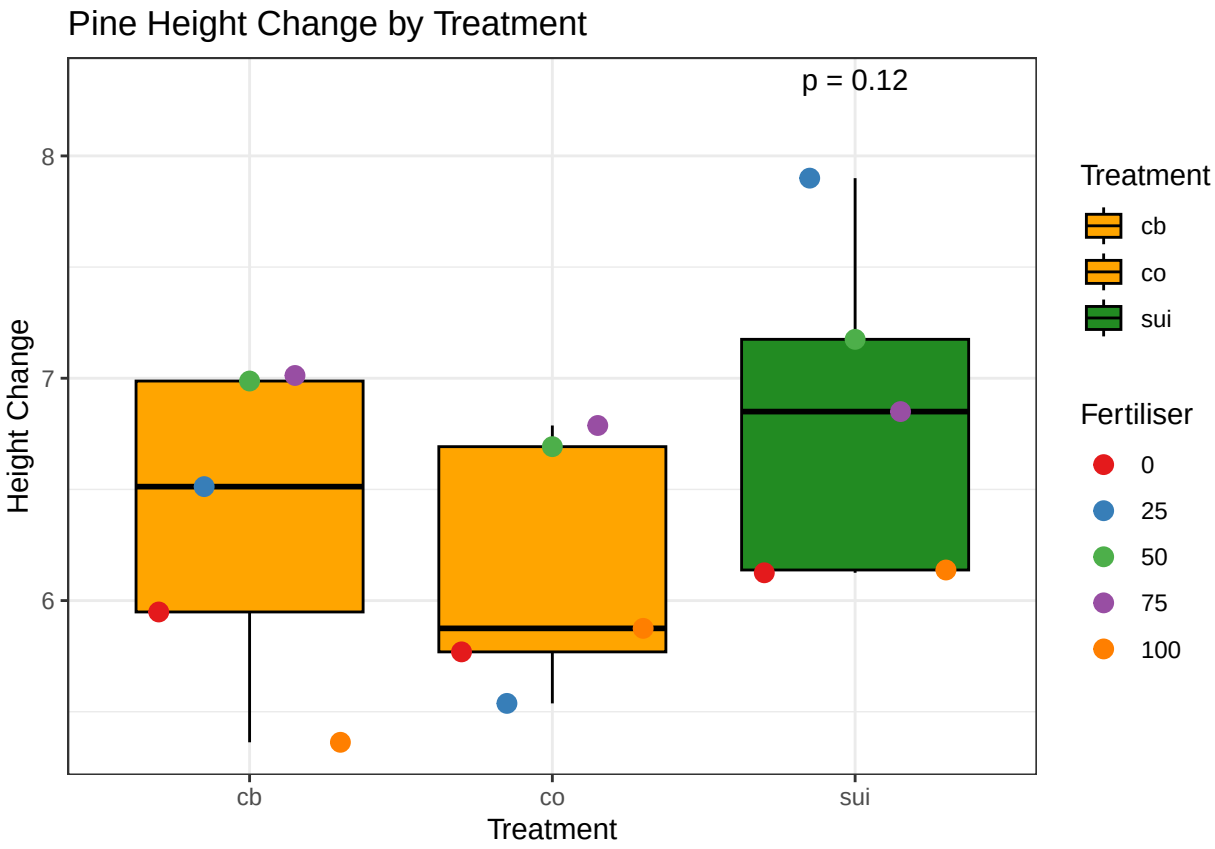
The linear model suggests no correlation between fertilizer and change in height. Although for cb/BP treatment the slope and $R^2 = 0.59$ looks like a correlation, $p = 0.128$ suggest it is weak. Similarly for pax/BP there is a weak correlation ($p = 0.08$). Any correlation is not consistent between treatments.

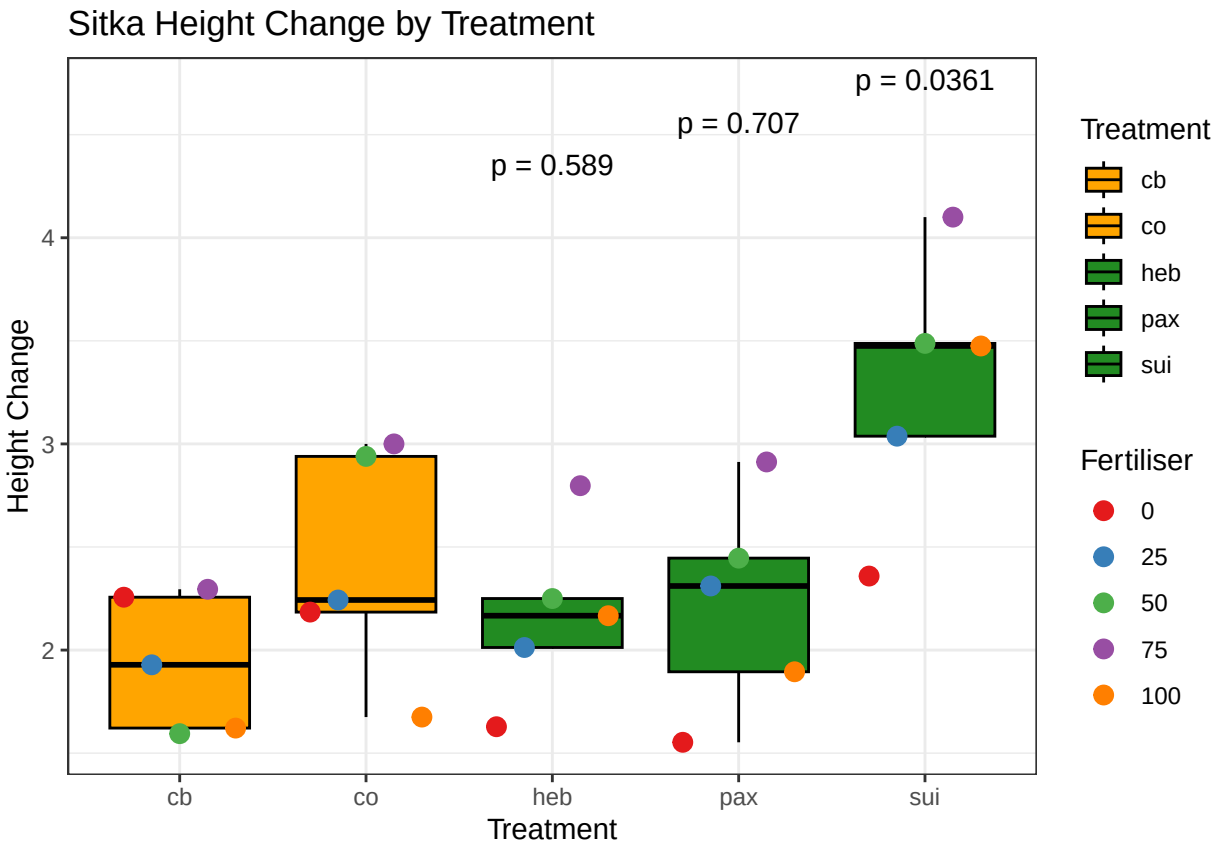
The lack of correlation may be due to improper mixing of fertilizer back in to the media. The added chemicals were granular and hence it was impossible to ensure full homogenization. Therefore, this data may be inconclusive.

The final part of this analysis would be to observe roots, but so far we have not had time/people to do that. Therefore it could be that case that physical colonization is different, but it has not translated in a change in height.

Since the impact of fertilizer on growth appears non-significant - all the data will be combined to create a larger data set such that each treatment had 5 repeats.


Birch Height Change by Treatment
p = 0.00235
p = 0.0132
Height Change
7.5
5.0
2.5
cb
co
heb
pax
Treatment
Treatment
cb
co
heb
pax
Fertiliser
0
25
50
75
100


Pine Height Change by Treatment
p = 0.12
Height Change
8
7
6
cb
co
sui
Treatment
Treatment
cb
co
sui
Fertiliser
0
25
50
75
100



The plots combine the fertilizer treatments into a repeat, so that there are 5 reps of each emf/tree treatment. The coloured points on the charts show the average change in height for that fertilizer level. That is, the average of 40 trees per fertilizer level, The box plots visualize all data for each treatment combined, that is 200 trees in total per combined treatment. The p values are t test compare to co

Birch shows change in height for pellet compared to controls. There is a significant change in height of ~3.75cm over the growing period

Pine shows no significant difference in change in height. This could be for several reasons. i) The pine at Elsoms is already colonized by something, we need to examine the roots to see what it is - might be highly colonized by a sui to start with. ii) With the trays on the matting, roots had grown out of the trays and into the mats and were highly intermixed. Difficult to say that these were separate treatments

Sitka shows significant ($p = 0.0498$ compared to co) but very small change in height of around 1.5cm for sui, but not for pax or heb. This may be because sui is better at promoting growth in these conditions. Height change may be small because plants were harvested before the typical late season flush Blank pellet had no affect in any treatment

Note that for all birch and sitka, the heb/pax response was the same, further indicating that this heb could be a pax.

Also note - no difference between co and cb.