



# What's next for the "Repeating Crumley" experiments?

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I have all this growth rate data from the [RC experiments](#). And Steve and I were trying to ascertain whether those results achieved what we wanted to achieve. It is clear that Crumley et al were wrong in 1950 about 99% D2O growth, the tobacco seeds will not grow in 99% D2O despite what they say. Otherwise their data set seems pretty repeatable with an obvious stagger between DI, 33% D2O, and 66% D2O.

But then the experiments seemed to evolve. I added deuterium depleted water to the mix and eventually added D2O/DDW mixtures as well. Some results are obvious (like 33% D2O in DDW is slower growing than pure DDW or even DI water), while others are more convoluted (Do seeds growing in 99.9% DDW grow any differently than seeds in DI water?).

Steve and I tried to analyze this today and the results are quite interesting. When looking purely at the germination rates (number of seeds that sprouted / number of seeds unsprouted) it is tough to make any conclusive claim outside of differences between D2O mixes. By this I mean there is no confidence in any evidence that may say that DI seeds grow faster than DDW seeds.

We also looked at the value of the germination rate. In each sample there is some number of seeds that sprout and some number of seeds that never sprout. In some trials the number of seeds the don't sprout in DDW are lower than those in the DI samples. But in other trials the reverse is true. So we don't think that there is anything reliable in this analysis (for now). **But what about between the pure and the D2O mixes?**

In conversation, I mentioned that the germination rates don't reveal all that much about the system. It's kind of black and white. The seeds either sprout or they don't and we are kinda just looking at the distribution of sprouting over time (does that make sense?). But to me the growth rates of the seeds are very telling. By day 10 all the seeds that will sprout have and no more information can be gained, but the lengths at this time are all very different and remain that way over time.

So we set up an experiment.

I showed Steve the slideshows that I setup from [RC4](#), and kept them blind. Steve looked through and wrote down his thoughts and then I showed him which images belonged to which sample. Not only was it obvious what each sample was (via guessing), but it also appeared that the growth rates after germination were very different.

For part 2 of the experiment I showed Steve pictures (blinded) from [Day 11](#) and [Day 4](#) of the last batch of experiments (RC5). He wrote down notes on each image and then guessed which image belonged to which sample. It was clear again that there were differences between the water mixture sets (D2O in DI/DDW). There were also some differences between the DI and DDW sets but these were less

obvious, and also kinda surprising (1% D2O in DDW had longer growth than DI water seeds).

The gist of the experiments is that there is way more than meets the eye, but right now I/we have no way to best measure these differences. The next step would be to study small concentrations of D2O around the range of natural water concentrations, but can those images reveal anything? Is there more to the germination rate stuff than what we're seeing? How can I improve my data collection techniques? Would more time points be helpful?

Right now my mind is kinda blown from thinking about how best to proceed so if you have anything to say then say it below and I'll join after I get a bit of recharge. In the meantime I'm going to make some time-lapses of the latest set of images and we'll try the blind again with those "movies" tomorrow.