



Spring Newsletter 2016

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Fresh Beginnings

*As days grow longer
and soil grows warmer
billions come to life.*

*Seeds prepared
will find their fate
as life renews anew.*



Since 2004 Phenotype Screening Corporation has been providing state-of-the-art technology that gives our clients the power of the whole picture. We help our clients understand how their treatments impact both above-ground and below-ground plant development.

PSC Expanding Life Sciences Lab Space

We are proud to announce that we are increasing our life sciences lab space by 2,000 sq. ft. This will allow us to better meet growing demand for the evaluation of "biological" based treatments. We have been evaluating biologicals almost ex-

clusively for the past four years and continue to develop and improve experiment protocols and methods for testing biological formulations applied as a seed treatment, soil drench or foliar spray.

PSC Introduces New Measurement for Foliar Spray Studies

Below are images from which we calculate the foliar-overhead-spray-intercept-area of two maize plants. The spray is typically applied when



75% of the plants are at vegetative development stage V3. We use these types of images to study the impact of leaf area on product uptake.

PSC to Host Small-Sample-Size Statistics Seminar / Workshop

We are in the early planning phases of organizing a seminar/workshop on small sample size statistics at our facility in Knoxville, TN; "Small Sample Size Biological Experiments; How to Assure Business Value." We believe such a workshop will be of tremendous value to our existing and future clients. We'd love to hear from you on topics you'd like to see covered and on speakers you'd like to hear from. The next section of our Newsletter discusses some of the motivation for organizing such a seminar.

What's Happened to Statistics?

Statistics has been in the news a lot lately and it hasn't been pretty. The American Statistical Association issued a first of its kind warning to the scientific community earlier this month on the misuse of the p-value. "Scientific conclusions and business or policy decisions should not be based

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only on whether a p-value passes a specific threshold.”⁽¹⁾

The Open Science Collaboration effort to reproduce 100 influential peer-reviewed studies with significant results ($p < .05$) found only 36% of the replications had significant results.⁽²⁾ It has been estimated that nearly 50% of published scientific articles have at least one statistical error.⁽³⁾

This controversy has been brewing a while. *ScienceNews* (Siegfried, 2010) wrote: “It’s science’s dirtiest secret: The ‘scientific method’ of testing hypotheses by statistical analysis stands on a flimsy foundation.”

These discussions have definitely gotten our attention at Phenotype Screening Corporation. We provide the best data we can at a price accepted by our clients. We have a formal procedure for developing a written research plan with each client. We cover when and how we will make each measurement. We cover how we will germinate and how we will select seedlings for inclusion into our trials. At the conclusion of every experiment we go over the results with our clients and discuss potential improvements in protocols, methods and measurements.

A key part of our research plan discussions is how many samples will make up each treatment comparison set. The discussion of sample size provides the greatest differentiator between our clients. We have had a client who insisted that any more than three plants per treatment for a comparison study is a waste of money. At the other extreme was an insistence on 132 plants with six replicates.

We believe our role in these discussions is to clarify the objectives of each trial and lead a conversation about the expectation that the research objectives can be met based upon a negotiated sample size.

There are formalisms such as Statistical Power

Analysis to guide in sample size decisions to meet specific objectives but such methods can require a priori knowledge that is not always available. In the end an informed intuitive decision may be the best we can achieve.

Working with “biologicals” and evaluating their performance introduces additional complexities. We have the double whammy of the inherent variations among individual seeds and the inherent variations in individual or collective microorganisms superimposing themselves on our results.

Future Newsletters will further discuss issues in small-sample-size experiments and we welcome comments from our readership which we will include with attribution in our discussions.

(1) Statisticians issue warning over misuse of P values, *Nature*, Volume:531, 151 (10 March 2016) doi:10.1038/nature.2016.19503

(2) Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, 349 (6251), aac4716. Doi: 10.1126/science.aac4716

(3) Normality Tests for Statistical Analysis: Guide for Non-Statisticians, *Int. J. Endocrinol Metab.* 2012; 10 (2):486-489. DOI:10.5812/ijem3505

Spring & Summer Trial Dates

Our experiment trial dates for 2016 remain on track for trials in Discovery Laboratory #1. We have not yet released the dates nor the themes for our new Discovery Laboratory #2 trials.

Discovery Laboratory #1 Trial Dates

- * Cold Germination and Emergence Trial — April 11 through May 27
- * Optimal Temperature Growth Trial — June 6 through July 22
- * Environmental Stress Trial — August 1 through September 16