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Title: Modeling seed germination over time to decide when to regenerate seed lots in long-term storage

Abstract: Long term seed storage facilities are intended to preserve germplasm for future use. Seeds of many species lose germinability over time. At some point, germination is sufficiently low (85%, 50% or some other threshold) that the seed lot is regenerated by growing individuals and collecting new seed. Current practice is to test germination approximately every five years. Every five years may not be frequent enough if a seed lot loses germination quickly, but it wastes seed and testing time if a seed lot loses germination slowly.

We have developed a model to predict seed germination over time for a collection of related seed lots, e.g. multiple accessions of maize. It is fit to 2883 seed lots, each measured 3 to 7 times. The model is a random coefficients model that uses information from well studied seed lots to improve the prediction of less well studied lots. I will describe the model, explain best linear unbiased predictors (BLUPs), and illustrate why they provide better predictions of future germination. The model provides both predictions of the germination at a future time and predictions of the time when germination crosses a pre-specified threshold. This second prediction can inform when next to test a seed lot. We develop a decision rule that accounts for the uncertainty in the predictions. I will explain Receiver-Operating-Characteristic (ROC) curves and how they can be used to choose when to regrow a seed lot.