

Purposes:

- Use both scalar and matrix notation to contrast the two primary types of linear models used in plant breeding.
- Describe what is meant by shrinkage predictions
- Describe and contrast BLUEs and BLUPs
- Gain experience in application of mixed linear models
- Utilize BLUP values to reduce costs while maintaining confidence in selections

Keywords: Multi-Environment Trial (MET), Variance due to GxE interactions, interactions due to heterogeneous variance, interactions due to changes in rank

Useful R commands

- `rm()`
- `attach()`
- `factor()`
- `lm()`
- `lmer()`
- `aov()`
- `summary()`
- `sink()`

Reading:

Chapter 12: Multi Environment Trials - Linear Mixed Models

Bernardo, sections 11.1 – 11.4 and 11.7.

Due to budget considerations, you have been asked to reduce the number of plots for an experiment to 1/2 of the initial plots and still obtain useful information for selection, including GxE, on all 49 unrelated lines, using a sample of ten environments (see MET ds5.csv). We will assume that the ten environments of DS3 are from a set of locations that are representative of the targeted population of environments.

Your team has proposed to accomplish the reduction in plots by evaluating all 49 + check in single rep per location environments:

- Reduce the number of plots by ½ by eliminating the second replication of data from all environments. Name this subset of data “MET ds5 0.5.csv”

Questions:

1. Provide a general linear model for data represented in both MET ds5.csv and MET ds5 0.5
2. Implement your general linear model and report the resulting estimates of variance components. Be sure to include interpretive statements in your report.
3. Obtain estimates of the line means (lsmeans) for all of the lines from each of the data sets.
4. Provide a mixed model for yield in both MET ds5.csv and MET ds5 0.5.
5. Implement your mixed models on both data sets and report the resulting estimates of variance components. (see “BLUP with lme.R”). Compare these with the estimates using the GLM Be sure to include interpretive statements in your report.
6. Obtain BLUP values for all of the lines in both data sets, then provide a brief report that compares both sets of BLUPs and lsmeans [hints: estimate differences or generate a scatter plot of the predicted values from DS3 on one axis vs the predicted values of DS3 0.5 on the other, or calculate the correlation between the sets of estimates and predictions or regress one set on the other or...]. Be sure to include interpretive statements in your report.