Automatic report for a Completely Randomized Design (CRD)

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# 1. Model specification and data description

Data from 4 Treatments have been evaluated using a completely randomized design. The statistical model is

$$y\_{ij}=μ+τ\_{i}+ϵ\_{ij}$$

where

* $y\_{ij}$ is the observed response with Treatment $i$ and replication $j$.
* $μ$ is the mean response over all Treatments and replications.
* $τ\_{i}$ is the effect for Treatment $i$.
* $ϵ\_{ij}$ is the error term.

In this model we assume that the errors are independent and have a normal distribution with common variance, that is, $ϵ\_{ij}∼N(0,σ\_{ϵ}^{2})$.

# 2. Analysis for trait rice\_grain\_moisture\_content\_1000\_grain\_percent\_1

## 2.1. Exploratory analysis

It is always good to have some visualization of your data. Below a histogram and a boxplot are shown.

# Keep a copy of full data
mydata.full <- mydata
# Get means for subsampling
mydata <- st4gi::docomp("mean", trait, c(treatment, experimental.unit), dfr = mydata)

par(mfrow = c(1, 2))
hist(mydata$trait)
boxplot(mydata$trait)



Since the number of Treatments in your experiment is not so large, we can plot the data for each Treatment:

st4gi::msdplot(trait, treatment, mydata, conf = 1, pch = 4)



## 2.2. ANOVA

You have fitted a linear model for a CRD. The ANOVA table for your model is:

model <- aov(trait ~ treatment, data = mydata)
# Anova table
at <- anova(model)
at

Analysis of Variance Table

Response: "rice\_grain\_moisture\_content\_1000\_grain\_percent\_1"
 Df Sum Sq Mean Sq F value Pr(>F)
treatment 3 2.375 0.79167 0.3333 0.8032
Residuals 4 9.500 2.37500

The coefficient of variation for this experiment is 6.073%. The p-value for Treatments is 0.8032 which is not significant at the 5% level.

## 2.3. Assumptions

Don’t forget the assumptions of the model. It is supposed that the errors are independent with a normal distribution and with the same variance for all the Treatments. The following residuals plots can help you evaluate this:

par(mfrow = c(1, 2))
plot(model, which = 1)
plot(model, which = 2)



Any trend in the residuals in the left plot would violate the assumption of independence while a trend in the variability of the residuals –for instance a funnel shape– suggests heterogeneity of variances. Deviation from the theoretical normal line on the right plot is a sign of lack of normality.

## 2.4. Treatment means

Because the effect of Treatments was not significant in the ANOVA, multiple comparison tests are not presented. The means of your Treatments are:

tapply(mydata$trait, mydata$treatment, mean, na.rm = TRUE)

 B1\_/\_Basin\_irrigation B1\_/\_Surface\_irrigation B2\_/\_Border\_irrigation
 25.5 24.5 25.5
B2\_/\_Surface\_irrigation
 26.0

## 2.5. Variance components

Below are the variance components for this model, under the assumption that Treatments are random. Here the model is fitted using REML.

model <- lme4::lmer(trait ~ (1|treatment), data = mydata)
vc <- data.frame(lme4::VarCorr(model))
vc[, c(1, 4, 5)]

boundary (singular) fit: see ?isSingular

 Variance Std.Dev.
treatment 0.000000 0.00000
Residual 1.696429 1.30247