x<-read.table("……/observation.txt",header =T,sep="\t")

View(x)

Specify the order of factor levels for plots and Dunnett comparison

library(dplyr) # install.packages("dplyr")

Data =

mutate(x,

 treatment = factor(treatment, levels=unique(treatment)))

Produce summary statistics

library(FSA) # install.packages("FSA")

Summarize(pine ~ treatment,

 data=Data,

 digits=2)

Fit the linear model and conduct ANOVA

model = lm(pine ~ treatment,

 data=Data)

library(car)

Anova(model, type="II") # Can use type="III"

anova(model) # Produces type I sum of squares

summary(model) # Produces r-square, overall p-value, parameter estimates

Checking assumptions of the model

hist(residuals(model),

 col="darkgray")

plot(fitted(model),

 residuals(model))

### additional model checking plots with: plot(model)

### alternative: library(FSA); residPlot(model)

Tukey comparisons in agricolae package

library(agricolae)

(HSD.test(model, "treatment")) # Means sharing the same letter are not significantly different

library(agricolae)

(LSD.test(model, "Location", # outer parentheses print result

 alpha = 0.05,

 p.adj="none")) # see ?p.adjust for options

Multiple comparisons in multcomp package

Note that “Tukey” here does not mean Tukey-adjusted comparisons. It just sets up a matrix to compare each mean to each other mean.

library(multcomp)

mc = glht(model,

 mcp(treatment = "Tukey"))

mcs = summary(mc, test=adjusted("single-step"))

mcs

### Adjustment options: "none", "single-step", "Shaffer",

 ### "Westfall", "free", "holm", "hochberg",

 ### "hommel", "bonferroni", "BH", "BY", "fdr"

cld(mcs,

 level=0.05,

 decreasing=TRUE)

Graphing the results

Simple box plots of values across groups

boxplot(pine ~ treatment,

 data = Data,

 ylab="pine",

 xlab="treatment")

Simple bar plot of means across groups

### Summarize the data frame (Data) into a table

library(Rmisc)

Data2 = summarySE(data=Data,

 "pine",

 groupvars="treatment",

 conf.interval = 0.95)

Tabla = as.table(Data2$pine)

rownames(Tabla) = Data2$treatment

Tabla

barplot(Tabla,

 ylab="pine",

 xlab="treatment")

**Bar plot of means with error bars across groups**

library(ggplot2)

offset.v = -3 # offsets for mean letters

offset.h = 0.5

ggplot(Data2,

 aes(x = treatment, y = pine,

 ymax=0.12, ymin=0.0)) +

 geom\_bar(stat="identity", fill="gray50",

 colour = "black", width = 0.7) +

 geom\_errorbar(aes(ymax=pine+se, ymin=pine-se),

 width=0.0, size=0.5, color="black") +

 geom\_text(aes(label=c("bc","c","a","bc","ab"),

 hjust=offset.h, vjust=offset.v)) +

 labs(x = " Sample treatment",

 y = "pine") +

 ## ggtitle("Main title") +

 theme\_bw() +

 theme(panel.grid.major.x = element\_blank(),

 panel.grid.major.y = element\_line(colour = "grey80"),

 plot.title = element\_text(size = rel(1.5),

 face = "bold", vjust = 1.5),

 axis.title = element\_text(face = "bold"),

 axis.title.y = element\_text(vjust= 1.8),

 axis.title.x = element\_text(vjust= -0.5),

 panel.border = element\_rect(colour="black")

 )