

# ModBalsBRIXBoth.R

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```
library(ggplot2)
library(lme4)
```

```
## Loading required package: Matrix
```

```
library(nlme)
```

```
##
## Attaching package: 'nlme'

## The following object is masked from 'package:lme4':
##
##      lmList
```

```
library(lsmeans)
```

```
## Warning: package 'lsmeans' was built under R version 3.2.5

## Loading required package: estimability

## Warning: package 'estimability' was built under R version 3.2.5
```

```
library(lubridate)
```

```
## Warning: package 'lubridate' was built under R version 3.2.5

##
## Attaching package: 'lubridate'

## The following object is masked from 'package:base':
##
##      date
```

```
library(multcompView)
```

```
## Warning: package 'multcompView' was built under R version 3.2.5
```

```
library(car)
```

```
## Warning: package 'car' was built under R version 3.2.5
```

```
setwd("D:/Iowa State University/Debinski Lab/Nectar data/MAL")

balssug15 <- read.csv("nectar analysis/data files/balssugar15.csv", header = T)
balssug16 <- read.csv("nectar analysis/data files/balssugar16.csv", header = T)
balssugboth <- rbind(balssug15, balssug16)

balssugboth$year <- as.factor(year(balssugboth$date))

cellN <- with(balssugboth, table(treatment, year))
cellN
```

```
##           year
## treatment 2015 2016
##           C   30   80
##           H   56   71
```

```
cellMean <- with(balssugboth, tapply(BRIX, list(treatment, year), mean))
cellMean
```

```
##           2015      2016
## C 16.56667 25.41250
## H 24.25000 28.08451
```

```
modBRIX <- lmer(BRIX ~ treatment * year + (1|plot/plant), data = balssugboth)
BRIX.grid <- ref.grid(modBRIX)
```

```
## Loading required namespace: lmerTest
```

```
summary(BRIX.grid)
```

```
## treatment year prediction      SE    df
## C           2015   16.87223 2.172402 41.81
## H           2015   23.87850 1.798424 16.91
## C           2016   25.34263 1.562783 14.20
## H           2016   28.30834 1.652303 12.62
##
## Degrees-of-freedom method: satterthwaite
```

```
lsmeans(BRIX.grid, "treatment")
```

```
## NOTE: Results may be misleading due to involvement in interactions
```

```
## treatment  lsmean      SE    df lower.CL upper.CL
## C           21.10743 1.553236 13.56 17.76578 24.44908
## H           26.09342 1.499606  8.50 22.67036 29.51648
##
## Results are averaged over the levels of: year
## Degrees-of-freedom method: satterthwaite
## Confidence level used: 0.95
```

```
lsmeans(BRIX.grid, "year")
```

```
## NOTE: Results may be misleading due to involvement in interactions
```

```
##   year   lsmean      SE    df lower.CL upper.CL
## 2015 20.37537 1.410112 28.07 17.48719 23.26354
## 2016 26.82549 1.137145 13.35 24.37543 29.27554
##
## Results are averaged over the levels of: treatment
## Degrees-of-freedom method: satterthwaite
## Confidence level used: 0.95
```

```
BRIX.treat <- lsmeans(BRIX.grid, "treatment")
```

```
## NOTE: Results may be misleading due to involvement in interactions
```

```
pairs(BRIX.treat)
```

```
## contrast estimate      SE    df t.ratio p.value
## C - H      -4.98599 2.159018 10.69  -2.309  0.0420
##
## Results are averaged over the levels of: year
```

```
pairs.treat <- pairs(BRIX.treat)
test(pairs.treat, joint = T)
```

```
## df1 df2    F p.value
##   1 10.69 5.333 0.0420
```

```
BRIX.year <- lsmeans(BRIX.grid, "year")
```

```
## NOTE: Results may be misleading due to involvement in interactions
```

```
pairs(BRIX.year)
```

```
## contrast estimate      SE    df t.ratio p.value
## 2015 - 2016 -6.45012 1.37901 146  -4.677  <.0001
##
## Results are averaged over the levels of: treatment
```

```
pairs.year <- pairs(BRIX.year)
test(pairs.year, joint = T)
```

```
## df1 df2    F p.value
##   1 146 21.878 <.0001
```

```
int.BRIX <- pairs(BRIX.grid, by = "year")
int.BRIX
```

```
## year = 2015:
## contrast estimate      SE    df t.ratio p.value
## C - H      -7.006263 2.820223 28.07  -2.484  0.0192
##
## year = 2016:
## contrast estimate      SE    df t.ratio p.value
## C - H      -2.965717 2.274290 13.35  -1.304  0.2143
```

```
int.BRIXtable <- update(int.BRIX, by = NULL)
int.BRIXtable
```

```
## contrast year estimate      SE    df t.ratio p.value
## C - H      2015 -7.006263 2.820223 28.07  -2.484  0.0192
## C - H      2016 -2.965717 2.274290 13.35  -1.304  0.2143
```

```
test(pairs(int.BRIXtable), joint = T)
```

```
## df1 df2      F p.value
##    1 146 2.146  0.1451
```

```
Anova(modBRIX, type = 3)
```

```
## Analysis of Deviance Table (Type III Wald chisquare tests)
##
## Response: BRIX
##              Chisq Df Pr(>Chisq)
## (Intercept)  60.3205  1  8.060e-15 ***
## treatment     6.1717  1   0.01298 *
## year          15.3534  1   8.916e-05 ***
## treatment:year  2.1463  1   0.14292
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```