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|plant), data = balssugboth)

BRIX.grid <- ref.grid(modBRIX)
```

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

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

```
##  treatment year prediction       SE     df
##  C         2015   16.93742 2.035855 100.30
##  H         2015   24.03119 1.511231  77.73
##  C         2016   25.04838 1.295561  57.50
##  H         2016   28.31484 1.316272  74.80
##
## 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         20.99290 1.271696 55.77 18.44516 23.54064
##  H         26.17301 1.114668 38.95 23.91829 28.42774
##
## Results are averaged over the levels of: year
## Degrees-of-freedom method: satterthwaite
## Confidence level used: 0.95
```

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

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

```
##  year   lsmean        SE    df lower.CL upper.CL
##  2015 20.48430 1.2677271 91.49 17.96630 23.00231
##  2016 26.68161 0.9234514 65.54 24.83764 28.52558
##
## Results are averaged over the levels of: treatment
## Degrees-of-freedom method: satterthwaite
## Confidence level used: 0.95
```

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

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

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

```
##  contrast  estimate       SE    df t.ratio p.value
##  C - H    -5.180111 1.691063 47.43  -3.063  0.0036
##
## Results are averaged over the levels of: year
```

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

```
##  df1   df2     F p.value
##    1 47.43 9.383  0.0036
```

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

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

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

```
##  contrast     estimate       SE     df t.ratio p.value
##  2015 - 2016 -6.197304 1.435303 183.68  -4.318  <.0001
##
## Results are averaged over the levels of: treatment
```

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

```
##  df1    df2      F p.value
##    1 183.68 18.643  <.0001
```

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

```
## year = 2015:
##  contrast  estimate       SE    df t.ratio p.value
##  C - H    -7.093766 2.535454 91.49  -2.798  0.0063
##
## year = 2016:
##  contrast  estimate       SE    df t.ratio p.value
##  C - H    -3.266456 1.846903 65.54  -1.769  0.0816
```

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

```
##  contrast year  estimate       SE    df t.ratio p.value
##  C - H    2015 -7.093766 2.535454 91.49  -2.798  0.0063
##  C - H    2016 -3.266456 1.846903 65.54  -1.769  0.0816
```

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

```
##  df1    df2     F p.value
##    1 183.68 1.778  0.1841
```

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

```
## Analysis of Deviance Table (Type III Wald chisquare tests)
##
## Response: BRIX
##                  Chisq Df Pr(>Chisq)
## (Intercept)    69.2151  1  < 2.2e-16 ***
## treatment       7.8278  1  0.0051447 **
## year           12.7064  1  0.0003644 ***
## treatment:year  1.7776  1  0.1824412
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```