

# ModBalsMassBoth.R

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*Thu Nov 24 20:42:22 2016*

```
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   28   80
##           H   54   71
```

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

```
##           2015           2016
## C 0.09401065 0.04865045
## H 0.10265737 0.05275608
```

```
modmass <- lmer(mass ~ treatment * year + (1|plant), data = balssugboth)
mass.grid <- ref.grid(modmass)
```

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

```
summary(mass.grid)
```

```
## treatment year prediction      SE    df
## C           2015 0.09880479 0.012612065 97.80
## H           2015 0.10414677 0.009310685 70.59
## C           2016 0.04724487 0.007822351 51.79
## H           2016 0.05333785 0.007972659 69.02
##
## Degrees-of-freedom method: satterthwaite
```

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

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

```
## treatment    lsmean      SE    df  lower.CL  upper.CL
## C           0.07302483 0.007779929 52.65 0.05741782 0.08863184
## H           0.07874231 0.006742734 34.80 0.06505100 0.09243362
##
## Results are averaged over the levels of: year
## Degrees-of-freedom method: satterthwaite
## Confidence level used: 0.95
```

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

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

```
##   year    lsmean      SE    df  lower.CL  upper.CL
## 2015 0.10147578 0.007838256 86.96 0.08589628 0.11705527
## 2016 0.05029136 0.005584632 59.75 0.03911947 0.06146325
##
## Results are averaged over the levels of: treatment
## Degrees-of-freedom method: satterthwaite
## Confidence level used: 0.95
```

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

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

```
pairs(mass.treat)
```

```
## contrast      estimate      SE    df t.ratio p.value
## C - H      -0.005717474 0.01029523 43.72  -0.555  0.5815
##
## Results are averaged over the levels of: year
```

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

```
## df1  df2    F p.value
##    1 43.72 0.308  0.5815
```

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

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

```
pairs(mass.year)
```

```
## contrast      estimate      SE    df t.ratio p.value
## 2015 - 2016 0.05118442 0.008902864 175.34   5.749  <.0001
##
## Results are averaged over the levels of: treatment
```

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

```
## df1  df2    F p.value
##    1 175.34 33.053  <.0001
```

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

```
## year = 2015:
## contrast      estimate      SE    df t.ratio p.value
## C - H      -0.005341975 0.01567651 86.96  -0.341  0.7341
##
## year = 2016:
## contrast      estimate      SE    df t.ratio p.value
## C - H      -0.006092973 0.01116926 59.75  -0.546  0.5874
```

```
int.masstable <- update(int.mass, by = NULL)
int.masstable
```

```
## contrast year      estimate      SE    df t.ratio p.value
## C - H      2015 -0.005341975 0.01567651 86.96  -0.341  0.7341
## C - H      2016 -0.006092973 0.01116926 59.75  -0.546  0.5874
```

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

```
## df1    df2      F p.value
##    1 175.34 0.002  0.9664
```

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

```
## Analysis of Deviance Table (Type III Wald chisquare tests)
##
## Response: mass
##           Chisq Df Pr(>Chisq)
## (Intercept)  61.3739  1  4.72e-15 ***
## treatment      0.1161  1  0.7332820
## year          13.3995  1  0.0002517 ***
## treatment:year  0.0018  1  0.9663573
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```