ModBuckVolBoth.R

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Thu Nov 24 20:41:18 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
```

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

buckvol15 <- read.csv("nectar analysis/data files/buckvol15.csv", header = T)
buckvol16 <- read.csv("nectar analysis/data files/buckvol16.csv", header = T)
buckvolboth <- rbind(buckvol15,buckvol16)

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

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

```
##          year
## treatment 2015 2016
##         C  229  190
##         H  226  186
```

```r
cellMean <- with(buckvolboth, tapply(volume, list(treatment, year), mean))
cellMean
```

```
##        2015       2016
## C 0.5224432 0.08847687
## H 0.3653227 0.08072662
```

```r
modvol <- lmer(volume ~ treatment * year + (1|plot), data = buckvolboth)

volume.grid <- ref.grid(modvol)
```

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

```r
summary(volume.grid)
```

```
##  treatment year prediction         SE    df
##  C         2015 0.51833586 0.02792622 15.18
##  H         2015 0.36527429 0.02809660 15.39
##  C         2016 0.08383739 0.02930176 18.16
##  H         2016 0.07469236 0.02944999 18.48
##
## Degrees-of-freedom method: satterthwaite
```

```r
lsmeans(volume.grid, "treatment")
```

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

```
##  treatment    lsmean         SE    df  lower.CL  upper.CL
##  C         0.3010866 0.02514329  9.95 0.2450231 0.3571502
##  H         0.2199833 0.02527194 10.08 0.1637336 0.2762330
##
## Results are averaged over the levels of: year
## Degrees-of-freedom method: satterthwaite
## Confidence level used: 0.95
```

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

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

```
##  year     lsmean         SE    df   lower.CL  upper.CL
##  2015 0.44180508 0.01980715 15.29 0.39965597 0.4839542
##  2016 0.07926488 0.02077195 18.32 0.03567952 0.1228502
##
## Results are averaged over the levels of: treatment
## Degrees-of-freedom method: satterthwaite
## Confidence level used: 0.95
```

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

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

```
pairs(volume.treat)
```

```
##  contrast  estimate         SE    df t.ratio p.value
##  C - H    0.0811033 0.03564907 10.01   2.275  0.0461
##
## Results are averaged over the levels of: year
```

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

```
##  df1   df2     F p.value
##    1 10.01 5.176  0.0461
```

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

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

```
pairs(volume.year)
```

```
##  contrast     estimate         SE     df t.ratio p.value
##  2015 - 2016 0.3625402 0.01940973 822.18  18.678  <.0001
##
## Results are averaged over the levels of: treatment
```

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

```
##  df1    df2       F p.value
##    1 822.18 348.878  <.0001
```

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

```
## year = 2015:
##  contrast    estimate         SE    df t.ratio p.value
##  C - H    0.153061571 0.03961430 15.29   3.864  0.0015
##
## year = 2016:
##  contrast    estimate         SE    df t.ratio p.value
##  C - H    0.009145033 0.04154389 18.32   0.220  0.8282
```

```
int.voltable <- update(int.vol, by = NULL)
int.voltable
```

```
##  contrast year    estimate         SE    df t.ratio p.value
##  C - H    2015 0.153061571 0.03961430 15.29   3.864  0.0015
##  C - H    2016 0.009145033 0.04154389 18.32   0.220  0.8282
```

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

```
##  df1    df2      F p.value
##    1 822.18 13.744  0.0002
```

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

```
## Analysis of Deviance Table (Type III Wald chisquare tests)
##
## Response: volume
##                  Chisq Df Pr(>Chisq)
## (Intercept)    344.507  1  < 2.2e-16 ***
## treatment       14.929  1  0.0001116 ***
## year           252.326  1  < 2.2e-16 ***
## treatment:year  13.744  1  0.0002095 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```