ModBuckVolBoth.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")

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)
rm(buckvol16)
rm(buckvol15)

buckvolboth$lnvol <- log(buckvolboth$volume)
buckvolboth$year <- as.factor(year(buckvolboth$date))

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

```
##          year
## treatment 2015 2016
##         C  233  190
##         H  227  186
```

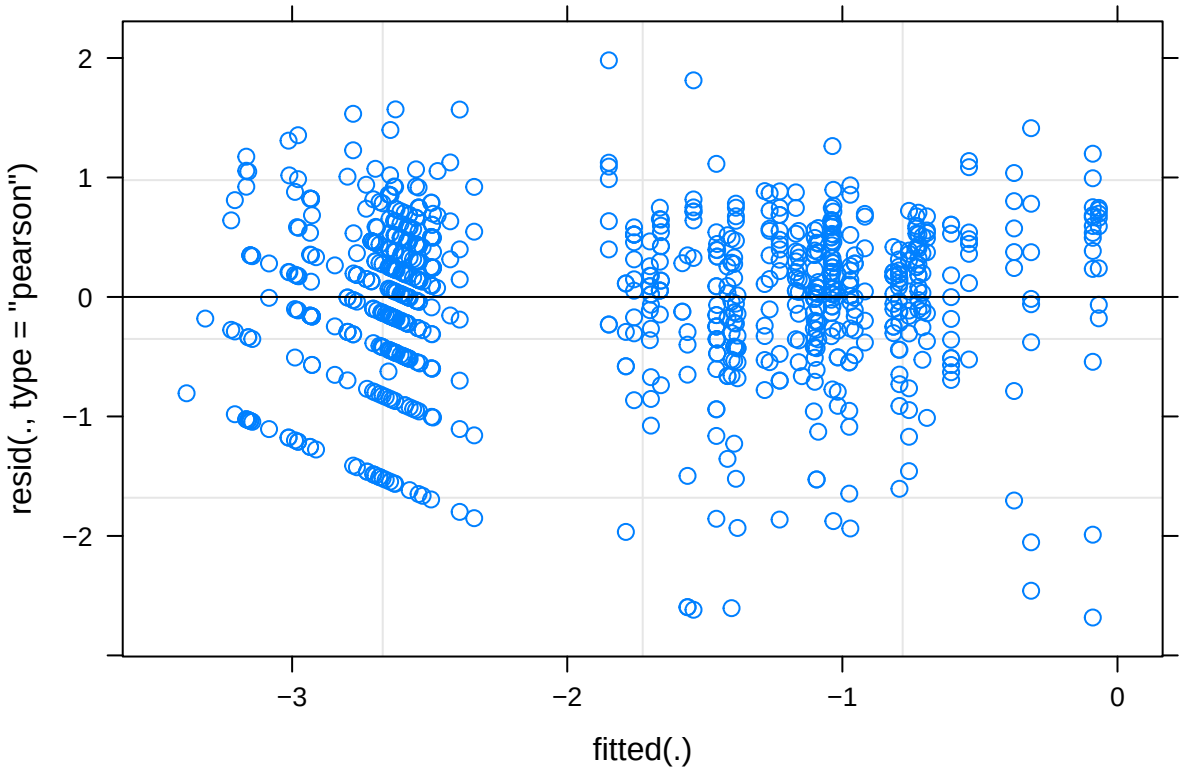
```
cellMean <- with(buckvolboth, tapply(volume, list(treatment, year), mean))
cellMean
```

```
##        2015       2016
## C 0.5409932 0.08847687
## H 0.3687381 0.08072662
```

```
modlnvol <- lmer(lnvol ~ treatment * year + (1|plot) +(1|year:date), data = buckvolboth)
summary(modlnvol)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: lnvol ~ treatment * year + (1 | plot) + (1 | year:date)
##    Data: buckvolboth
##
## REML criterion at convergence: 1800.4
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.9368 -0.4804  0.1384  0.6647  2.9060
##
## Random effects:
##  Groups    Name        Variance Std.Dev.
##  year:date (Intercept) 0.14091  0.3754
##  plot      (Intercept) 0.01335  0.1155
##  Residual              0.46440  0.6815
## Number of obs: 836, groups:  year:date, 20; plot, 12
##
## Fixed effects:
##                     Estimate Std. Error t value
## (Intercept)         -0.97282    0.12294  -7.913
## treatmentH          -0.28989    0.09267  -3.128
## year2016            -1.74941    0.18878  -9.267
## treatmentH:year2016  0.23121    0.09541   2.423
##
## Correlation of Fixed Effects:
##             (Intr) trtmnH yr2016
## treatmentH  -0.374
## year2016    -0.554  0.114
## trtmnH:2016  0.171 -0.460 -0.249
```

```
plot(modlnvol)
```




```
#inflvol <- influence(modlnvol, obs = T)
#plot(inflvol, which = "cook", main = "Buckwheat volume")

lnvol.grid <- ref.grid(modlnvol)
```

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

```
summary(lnvol.grid)
```

```
##  treatment year prediction        SE    df
##  C         2015 -0.9728157 0.1229371 23.02
##  H         2015 -1.2627084 0.1232501 23.21
##  C         2016 -2.7222238 0.1582371 21.20
##  H         2016 -2.7809106 0.1584612 21.30
##
## Degrees-of-freedom method: satterthwaite
```

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

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

```
pairs(lnvol.treat)
```

```
##  contrast  estimate         SE   df t.ratio p.value
##  C - H    0.1742897 0.08244981 6.26   2.114  0.0771
##
## Results are averaged over the levels of: year
```

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

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

```
pairs(lnvol.year)
```

```
##  contrast    estimate        SE    df t.ratio p.value
##  2015 - 2016 1.633805 0.1828192 17.22   8.937  <.0001
##
## Results are averaged over the levels of: treatment
```

```
int.vol <- pairs(lnvol.grid, by = "year")
int.voltable <- update(int.vol, by = NULL)
int.voltable
```

```
##  contrast year   estimate         SE    df t.ratio p.value
##  C - H    2015 0.28989266 0.09267261 10.03   3.128  0.0107
##  C - H    2016 0.05868676 0.09777022 12.27   0.600  0.5593
```

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

```
##  df1   df2     F p.value
##    1 809.7 5.873  0.0156
```

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

```
## Analysis of Deviance Table (Type III Wald chisquare tests)
##
## Response: lnvol
##                  Chisq Df Pr(>Chisq)
## (Intercept)    62.6174  1   2.51e-15 ***
## treatment       9.7852  1   0.001759 **
## year           85.8759  1  < 2.2e-16 ***
## treatment:year  5.8726  1   0.015378 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```