ModBuckBRIXBoth.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")

bucksug15 <- read.csv("nectar analysis/data files/bucksugar15.csv", header = T)
bucksug16 <- read.csv("nectar analysis/data files/bucksugar16.csv", header = T)
bucksugboth <- rbind(bucksug15,bucksug16)
rm(bucksug15)
rm(bucksug16)

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

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

```
##          year
## treatment 2015 2016
##         C  208  142
##         H  208  154
```

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

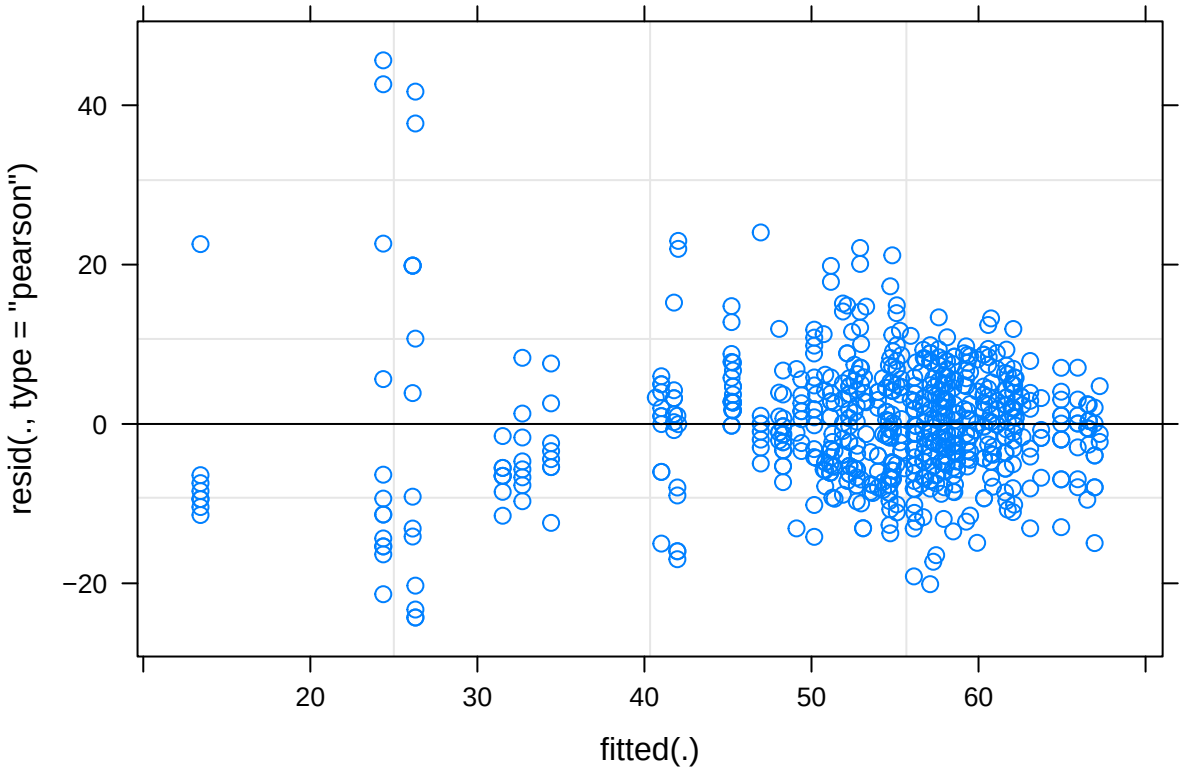
```
##       2015     2016
## C 45.91827 56.78169
## H 55.27885 57.53896
```

```
# modBRIX.plot <- lmer(BRIX ~ treatment * year + (1|plot/quad), data = bucksugboth)
# ran this model on Adam's suggestion, but there's almost no difference between this and the original m

modBRIX <- lmer(BRIX ~ treatment * year + (1|plot) + (1|year:date), data = bucksugboth)
summary(modBRIX)
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: BRIX ~ treatment * year + (1 | plot) + (1 | year:date)
##    Data: bucksugboth
##
## REML criterion at convergence: 5064.2
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.0380 -0.6238 -0.0163  0.5302  5.7077
##
## Random effects:
##  Groups    Name        Variance Std.Dev.
##  year:date (Intercept) 87.19    9.338
##  plot      (Intercept) 10.47    3.236
##  Residual              63.92    7.995
## Number of obs: 712, groups:  year:date, 20; plot, 12
##
## Fixed effects:
##                     Estimate Std. Error t value
## (Intercept)           45.421      2.963  15.329
## treatmentH             8.735      2.034   4.294
## year2016              10.472      4.475   2.340
## treatmentH:year2016   -6.301      1.244  -5.064
##
## Correlation of Fixed Effects:
##             (Intr) trtmnH yr2016
## treatmentH  -0.343
## year2016    -0.530  0.034
## trtmnH:2016  0.085 -0.248 -0.144
```

```
plot(modBRIX)
```




```
#inflBRIX <- influence(modBRIX, obs = T)
#plot(inflBRIX, which = "cook", main = "Buckwheat BRIX")

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

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

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

```
##  treatment year prediction       SE    df
##  C         2015   45.42079 2.963138 25.37
##  H         2015   54.15561 2.964571 25.41
##  C         2016   55.89237 3.841271 22.89
##  H         2016   58.32644 3.833765 22.71
##
## 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         50.65658 2.600066 26.21 45.31415 55.99900
##  H         56.24103 2.598055 26.13 50.90190 61.58016
##
## 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 49.78820 2.783874 21.92 44.01359 55.56280
##  2016 57.10941 3.690419 20.16 49.41523 64.80358
##
## 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    -5.58445 1.973997 9.89  -2.829  0.0181
##
## Results are averaged over the levels of: year
```

```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 -7.321205 4.428824 17.9  -1.653  0.1157
##
## Results are averaged over the levels of: treatment
```

```r
int.BRIX <- pairs(BRIX.grid, by = "year")
int.BRIXtable <- update(int.BRIX, by = NULL)
int.BRIXtable
```

```
##  contrast year  estimate       SE    df t.ratio p.value
##  C - H    2015 -8.734824 2.034188 11.16  -4.294  0.0012
##  C - H    2016 -2.434076 2.104633 12.74  -1.157  0.2687
```

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

```
##  df1    df2      F p.value
##    1 687.04 25.643  <.0001
```

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

```
## Analysis of Deviance Table (Type III Wald chisquare tests)
##
## Response: BRIX
##                   Chisq Df Pr(>Chisq)
## (Intercept)    234.9663  1  < 2.2e-16 ***
## treatment       18.4385  1  1.755e-05 ***
## year             5.4746  1     0.0193 *
## treatment:year  25.6432  1  4.107e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```