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)
rm(balssug15)
rm(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
```

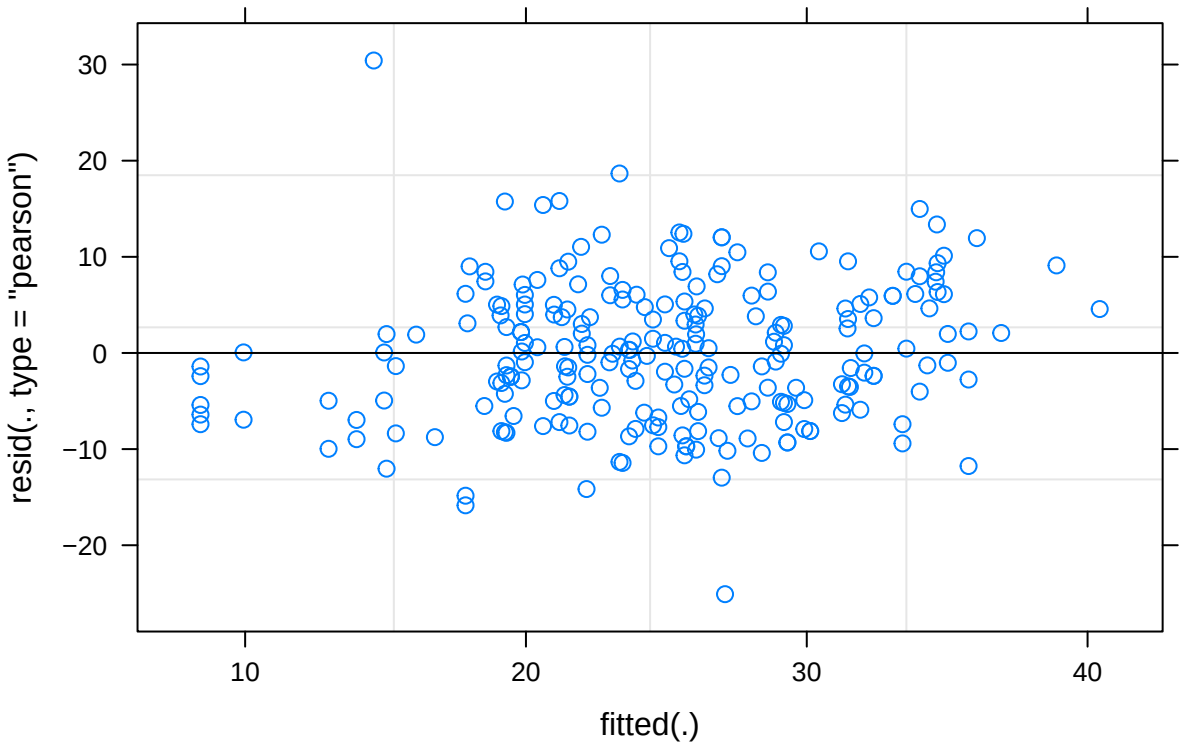
```
cellMean <- with(balssugboth, tapply(BRIX, list(treatment, year), mean))
cellMean
```

```
##       2015     2016
## C 16.56667 25.41250
## H 24.25000 28.08451
```

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

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: BRIX ~ treatment * year + (1 | plot/plant) + (1 | year:date)
##    Data: balssugboth
##
## REML criterion at convergence: 1674.6
##
## Scaled residuals:
##     Min      1Q  Median      3Q     Max
## -3.2631 -0.6907 -0.0105  0.6510  3.9563
##
## Random effects:
##  Groups     Name        Variance Std.Dev.
##  plant:plot (Intercept)  5.046   2.246
##  year:date  (Intercept) 39.732   6.303
##  plot       (Intercept)  7.617   2.760
##  Residual               59.121   7.689
## Number of obs: 237, groups:  plant:plot, 51; year:date, 13; plot, 11
##
## Fixed effects:
##                     Estimate Std. Error t value
## (Intercept)           19.702      3.140   6.274
## treatmentH             5.968      2.694   2.215
## year2016               8.089      4.220   1.917
## treatmentH:year2016   -3.975      2.474  -1.607
##
## Correlation of Fixed Effects:
##             (Intr) trtmnH yr2016
## treatmentH  -0.504
## year2016    -0.637  0.253
## trtmnH:2016  0.367 -0.619 -0.387
```

```
plot(modBRIX, main = "Balsam BRIX")
```




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

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

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

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

```
##  treatment year prediction       SE    df
##  C         2015   19.70205 3.140178 16.04
##  H         2015   25.67008 2.931326 12.38
##  C         2016   27.79060 3.286351  9.04
##  H         2016   29.78385 3.280077  8.95
##
## 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         23.74632 2.424477 12.97 18.50729 28.98535
##  H         27.72696 2.390795 11.65 22.50049 32.95343
##
## 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 22.68606 2.722428 10.03 16.62297 28.74915
##  2016 28.78722 3.082062  7.29 21.55787 36.01657
##
## 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    -3.980639 2.158972 10.63  -1.844  0.0932
##
## 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 -6.101161 3.910834 7.06   -1.56  0.1624
##
## 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 -5.968031 2.694499 24.03  -2.215  0.0365
##  C - H    2016 -1.993247 2.263094 12.93  -0.881  0.3945
```

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

```
##  df1    df2     F p.value
##    1 127.25 2.582  0.1106
```

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

```
## Analysis of Deviance Table (Type III Wald chisquare tests)
##
## Response: BRIX
##                  Chisq Df Pr(>Chisq)
## (Intercept)    39.3653  1  3.515e-10 ***
## treatment       4.9058  1    0.02677 *
## year            3.6736  1    0.05528 .
## treatment:year  2.5819  1    0.10809
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```