CNSeedDrop_Summary

```
knitr::opts_chunk$set(echo = TRUE)
knitr::opts_chunk$set(warning = FALSE)

# Load packages
library(tidyverse)
```

```
## -- Attaching packages ---------------------------------------------------------------------------
```

```
## v ggplot2 3.2.0     v purrr   0.3.2
## v tibble  2.1.3     v dplyr   0.8.3
## v tidyr   0.8.3     v stringr 1.4.0
## v readr   1.3.1     v forcats 0.4.0
```

```
## -- Conflicts ------------------------------------------------------------------------------------
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

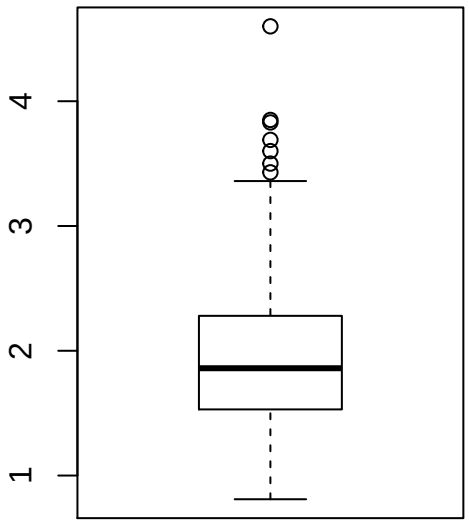
```
library(ggplot2)
library(gridExtra)
```

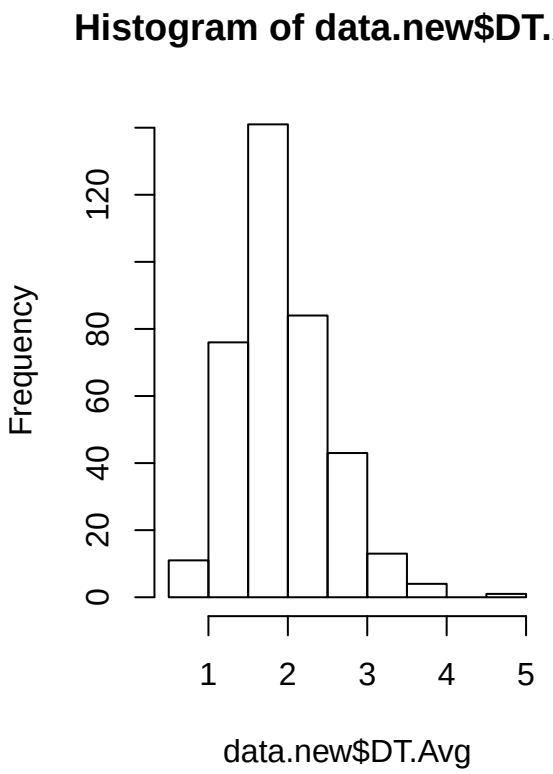
```
##
## Attaching package: 'gridExtra'
```

```
## The following object is masked from 'package:dplyr':
##
##     combine
```

```
#Initialise data
data <- read.csv("SeedDropData.csv")

# Add pappus conical volume and maximum cross-sectional area to data
data %>% mutate(SeedVol = (pi/3)*((SeedWidth/2)^2)*SeedLength,
                SeedCSA = pi*((SeedWidth/2)^2)) -> data

# Create new data set that excludes instances where pappus length, width, or DT are NA
data.new <- data[complete.cases(data[ , 23:25]), ]

# Need unique plot indicators by block - plot 1 and plot 2 are not similar in any way across blocks
data.new$PlotUnique = as.factor(paste(data.new$Block,"_",data.new$Plot))
# use PlantID for position

# Create a mowing y/n flag
data.new$MowYN = ifelse(data.new$Mow == "CTL", 0, 1)
```

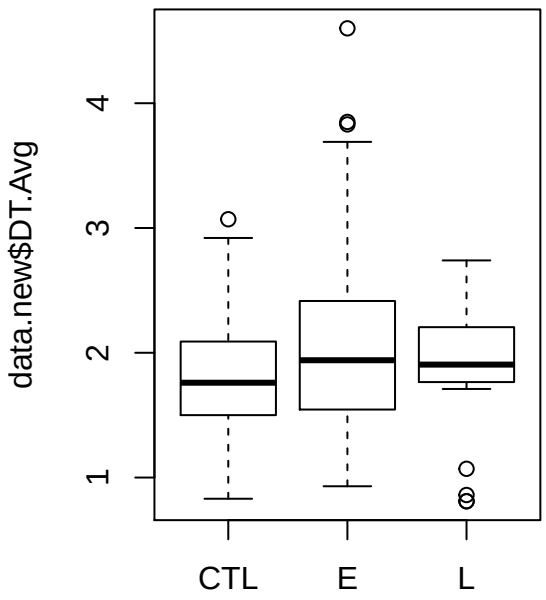
```
# Distribution of average DT
par(mfrow = c(1,2))
boxplot(data.new$DT.Avg)
hist(data.new$DT.Avg)
```

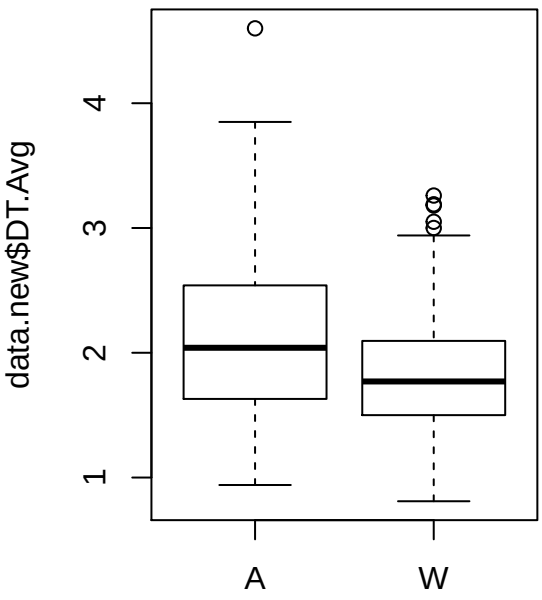




Does terminal velocity vary by treatment?

```
# Warming and mowing vs. average DT
par(mfrow = c(1,2))
boxplot(data.new$DT.Avg ~ data.new$Mow)
boxplot(data.new$DT.Avg ~ data.new$Warming)
```






```
## ANOVA
# mowYN
mod.mowYN = lm(DT.Avg ~ MowYN, data= data.new)
summary(mod.mowYN)
```

```
##
## Call:
## lm(formula = DT.Avg ~ MowYN, data = data.new)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.19971 -0.38971 -0.07685  0.33029  2.59029
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.81685    0.05078  35.781  < 2e-16 ***
## MowYN        0.19287    0.06291   3.066  0.00233 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5789 on 371 degrees of freedom
## Multiple R-squared:  0.02471,    Adjusted R-squared:  0.02208
## F-statistic: 9.399 on 1 and 371 DF,  p-value: 0.00233
```

```
# early vs. late mowing
mod.mow = lm(DT.Avg ~ Mow, data= data.new)
summary(mod.mow)
```

```
##
## Call:
## lm(formula = DT.Avg ~ Mow, data = data.new)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -1.0937 -0.3968 -0.0737  0.3363  2.5763
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.81685    0.05076  35.795  < 2e-16 ***
## MowE         0.20685    0.06407   3.228  0.00136 **
## MowL         0.06524    0.12857   0.507  0.61218
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5787 on 370 degrees of freedom
## Multiple R-squared:  0.02811,    Adjusted R-squared:  0.02286
## F-statistic: 5.351 on 2 and 370 DF,  p-value: 0.005119
```

```
# warming
mod.warm = lm(DT.Avg ~ Warming, data= data.new)
summary(mod.warm)
```

```
##
## Call:
## lm(formula = DT.Avg ~ Warming, data = data.new)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.17028 -0.38097 -0.05097  0.34903  2.48972
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  2.11028    0.04239   49.78  < 2e-16 ***
## WarmingW    -0.31931    0.05848   -5.46 8.74e-08 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.564 on 371 degrees of freedom
## Multiple R-squared:  0.07438,    Adjusted R-squared:  0.07188
## F-statistic: 29.81 on 1 and 371 DF,  p-value: 8.737e-08
```

```
# interaction
mod.int = lm(DT.Avg ~ MowYN + Warming + MowYN:Warming, data= data.new)
summary(mod.int)
```

```
##
## Call:
## lm(formula = DT.Avg ~ MowYN + Warming + MowYN:Warming, data = data.new)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.27868 -0.38504 -0.01413  0.33496  2.38132
##
## Coefficients:
```

```
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)     1.91413    0.06997  27.356  < 2e-16 ***
## MowYN           0.30456    0.08719   3.493 0.000535 ***
## WarmingW       -0.18875    0.09747  -1.937 0.053557 .
## MowYN:WarmingW -0.20489    0.12082  -1.696 0.090748 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5554 on 369 degrees of freedom
## Multiple R-squared:  0.1073, Adjusted R-squared:  0.1001
## F-statistic: 14.79 on 3 and 369 DF,  p-value: 4.107e-09
```

```
anova(mod.int)
```

```
## Analysis of Variance Table
##
## Response: DT.Avg
##                Df  Sum Sq Mean Sq F value    Pr(>F)
## MowYN           1   3.150  3.1503 10.2134  0.001514 **
## Warming         1   9.647  9.6474 31.2775 4.361e-08 ***
## MowYN:Warming   1   0.887  0.8871  2.8761  0.090748 .
## Residuals     369 113.817  0.3084
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

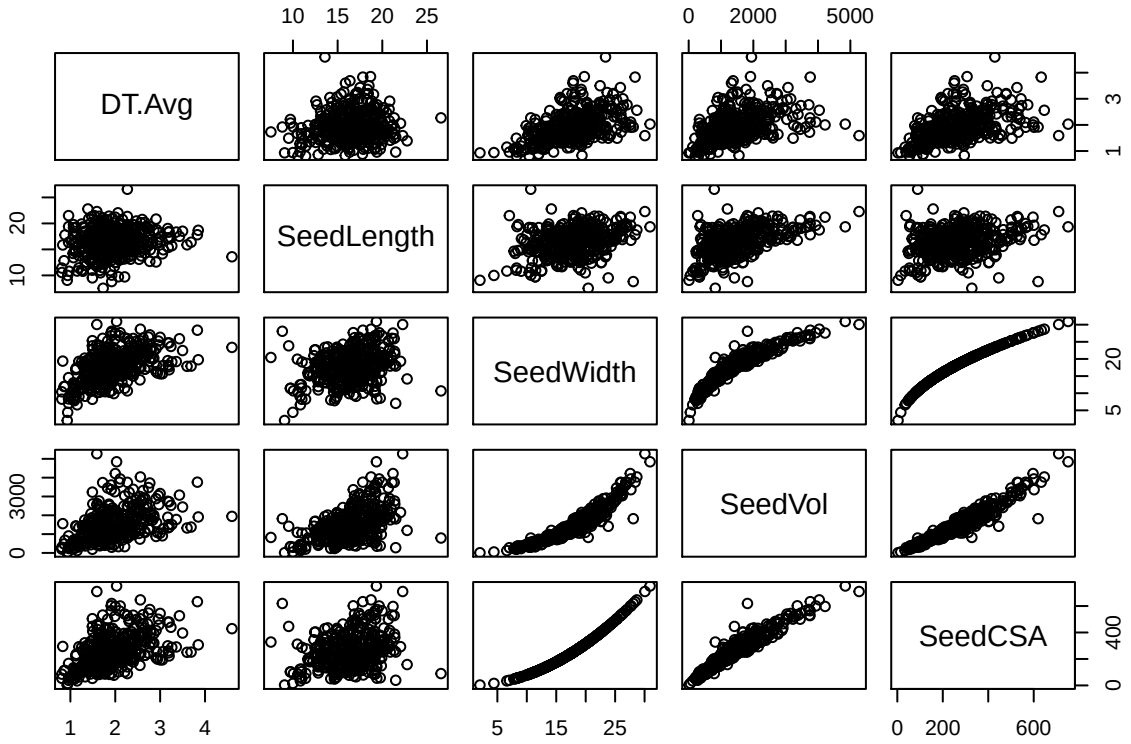
```
#plot(mod.int)
```

Conclusions:

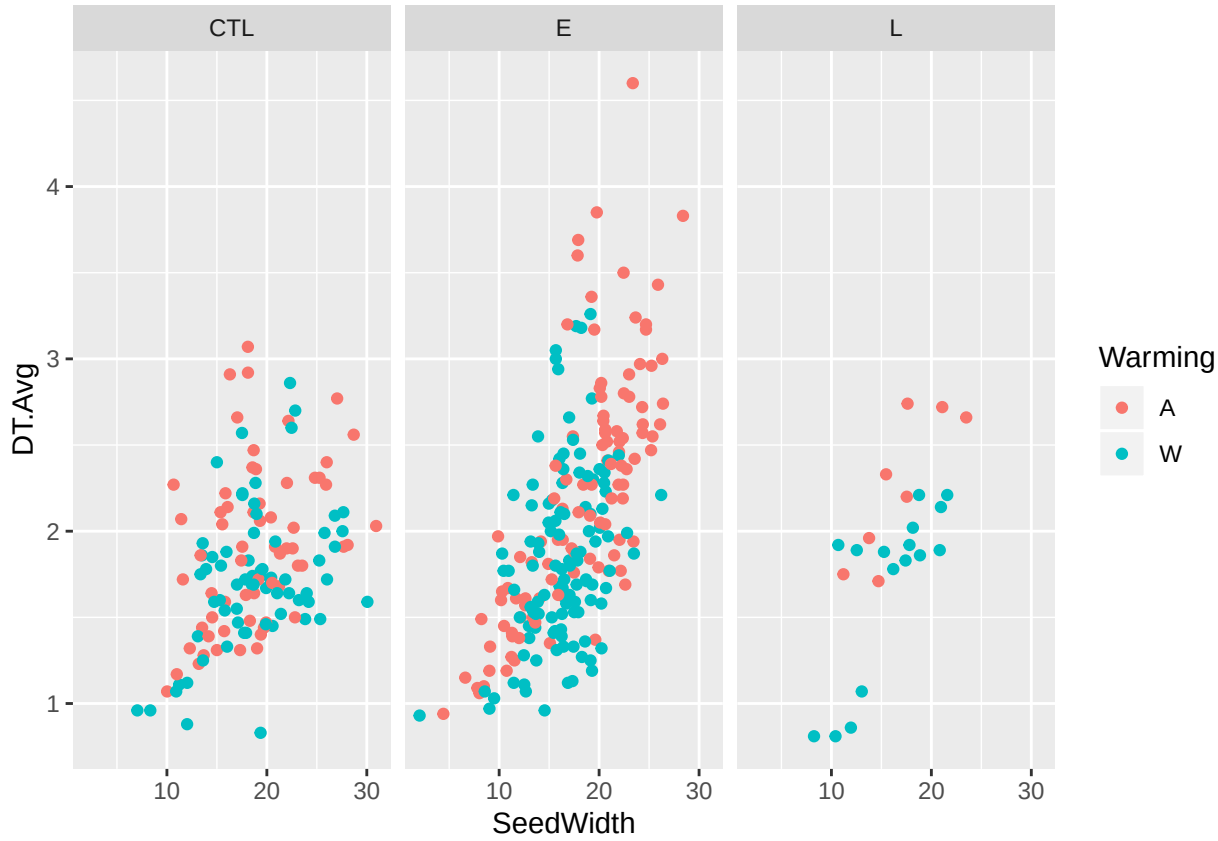
1. Mowing (regardless of timing) significantly increases drop time. This difference appears to be driven by the early mow treatment, but it's not clear whether late mow shows no effect because there is truly no effect or becasue there are too few data. **Question: Group all mowing together into mowing Y/N or exclude late mow data points?**
2. Warming significantly decreases drop time. [Interaction conclusion]

Does terminal velocity predicted by seed shape parameters?

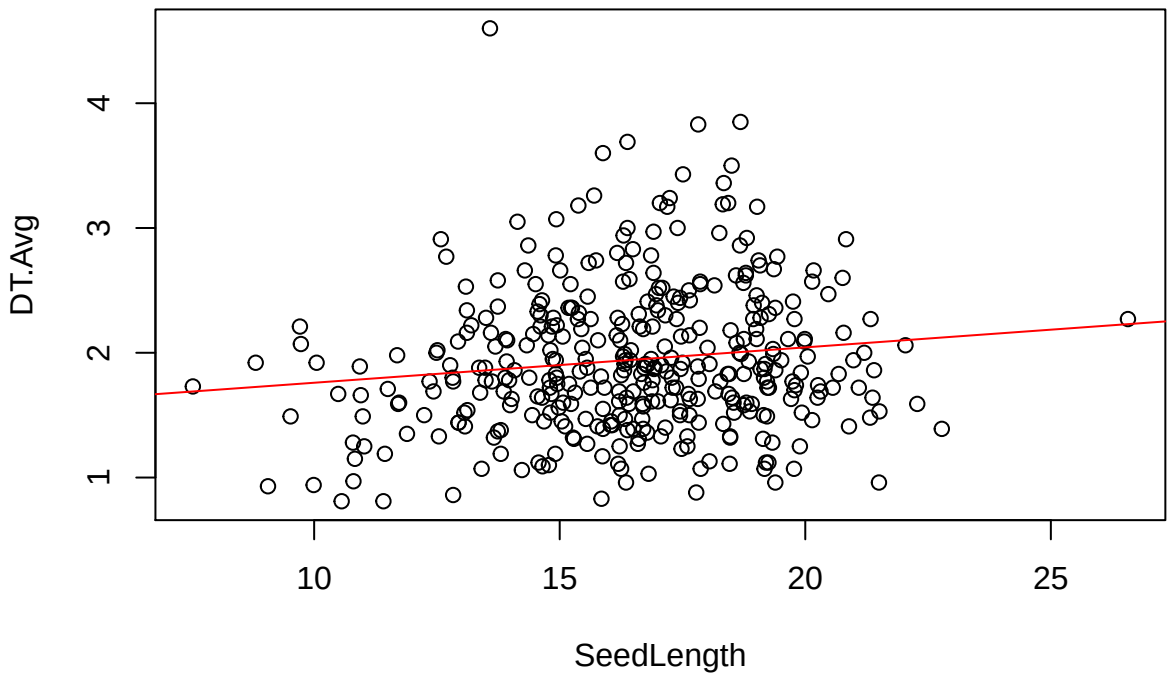
```
# Potential Predictors
pairs(data.new[,c("DT.Avg","SeedLength","SeedWidth", "SeedVol","SeedCSA")])
```




```
# plot DT vs. seed width by treatment
ggplot(data = data.new, aes(x = SeedWidth, y = DT.Avg, color = Warming))+
  geom_point()+
  facet_wrap(data.new$Mow)
```



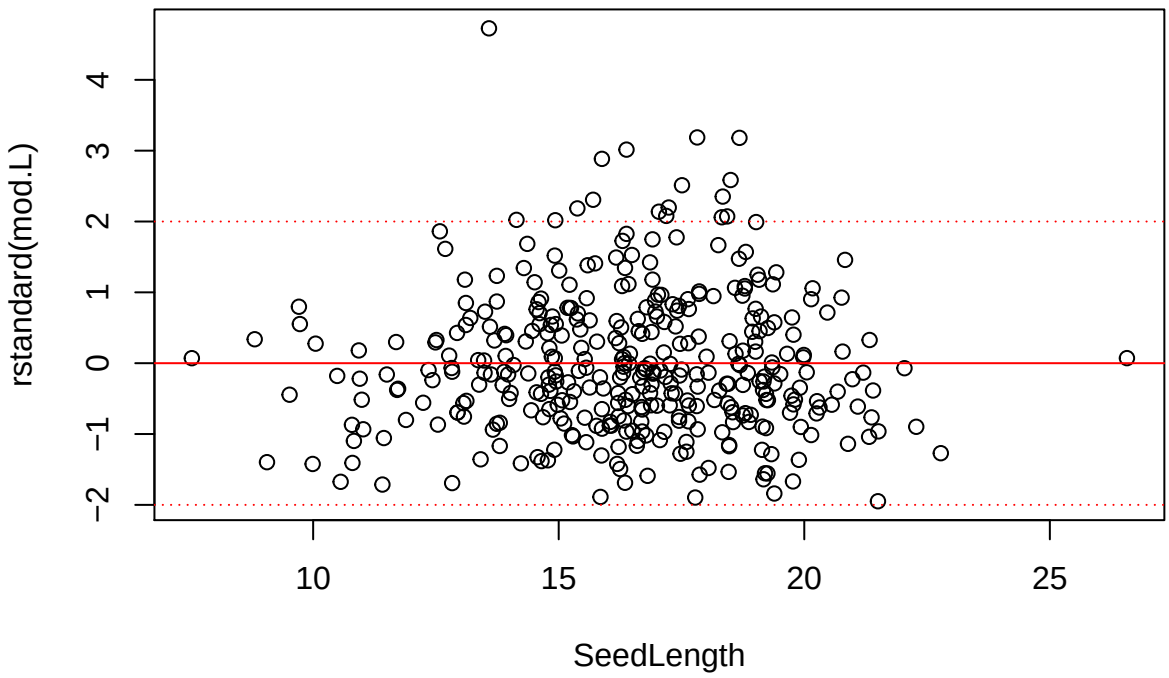

```
# Average DT ~ pappus length
mod.L <- lm(DT.Avg ~ SeedLength, data = data.new)
plot(DT.Avg ~ SeedLength, data = data.new)
abline(mod.L, col = "red")
```



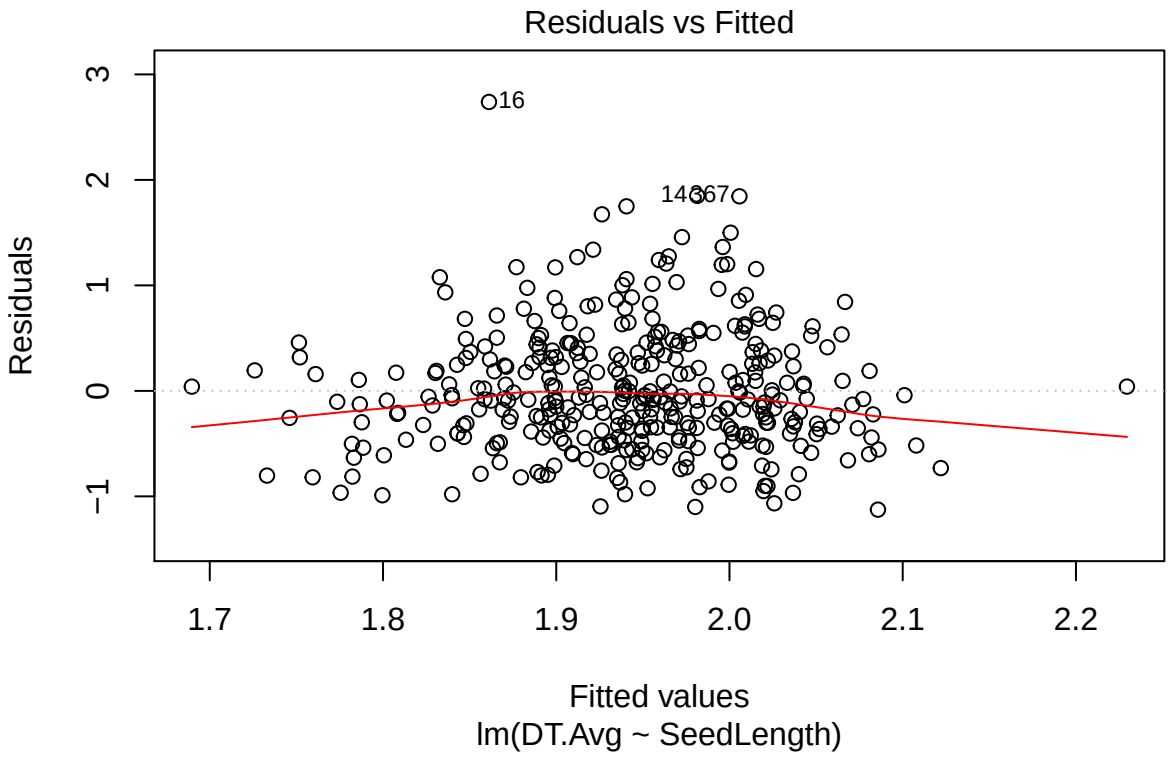

```
summary(mod.L)
```

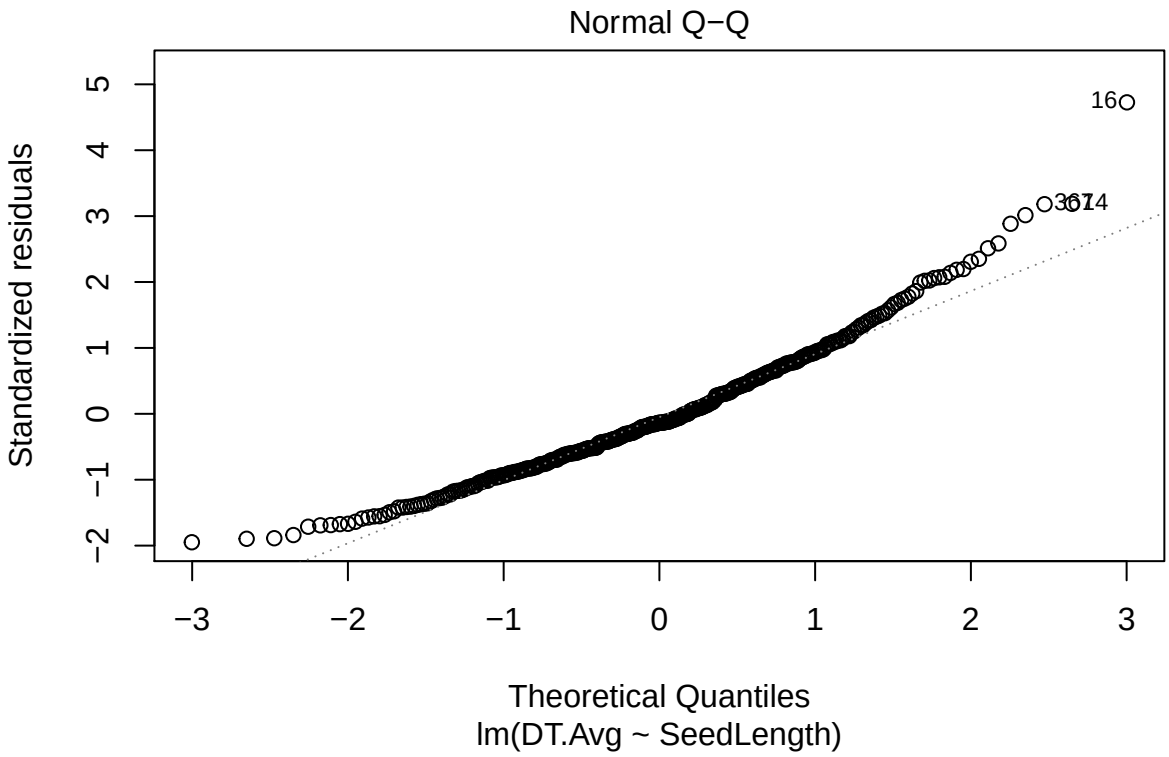
```
##
## Call:
## lm(formula = DT.Avg ~ SeedLength, data = data.new)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.12571 -0.40302 -0.07861  0.34512  2.73883
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.47616    0.18399   8.023 1.37e-14 ***
## SeedLength   0.02835    0.01103   2.569   0.0106 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5811 on 371 degrees of freedom
## Multiple R-squared:  0.01748,    Adjusted R-squared:  0.01483
## F-statistic: 6.601 on 1 and 371 DF,  p-value: 0.01058
```

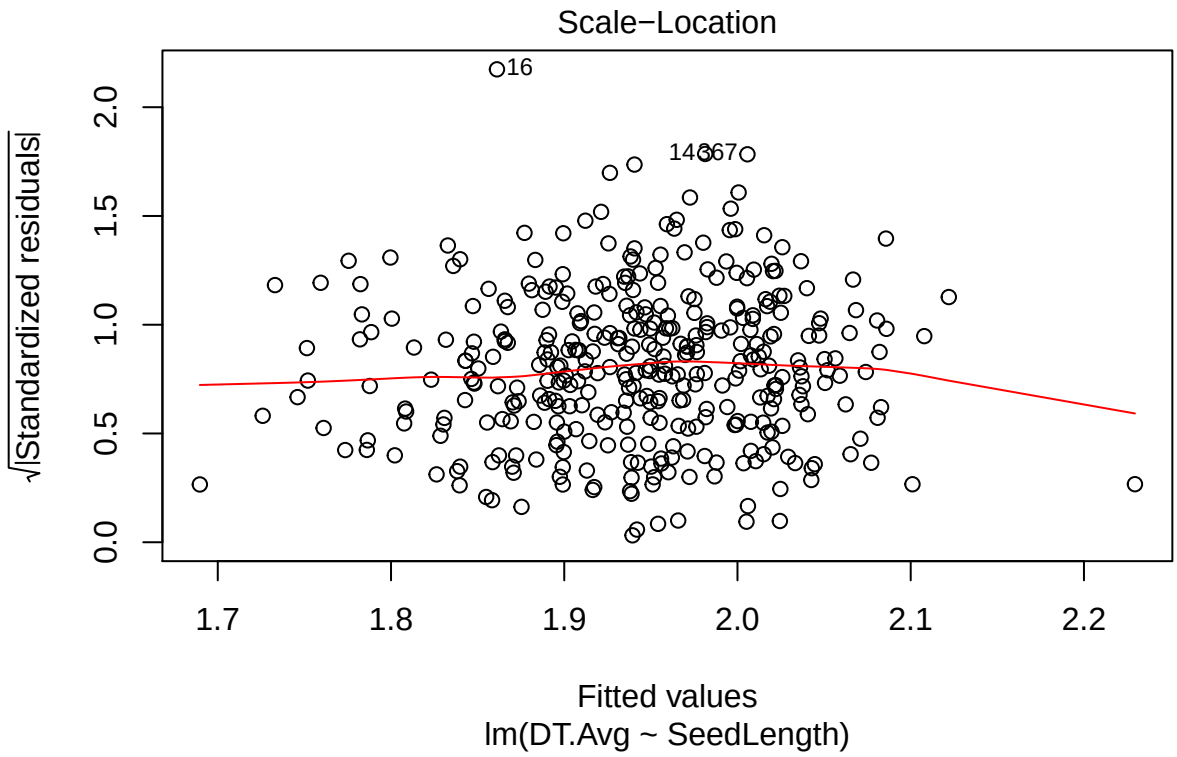
```
plot(rstandard(mod.L) ~ SeedLength, data = data.new)
abline(h = 0, col = "red")
abline(h = c(-2, 2), col = "red", lty = 3)
```

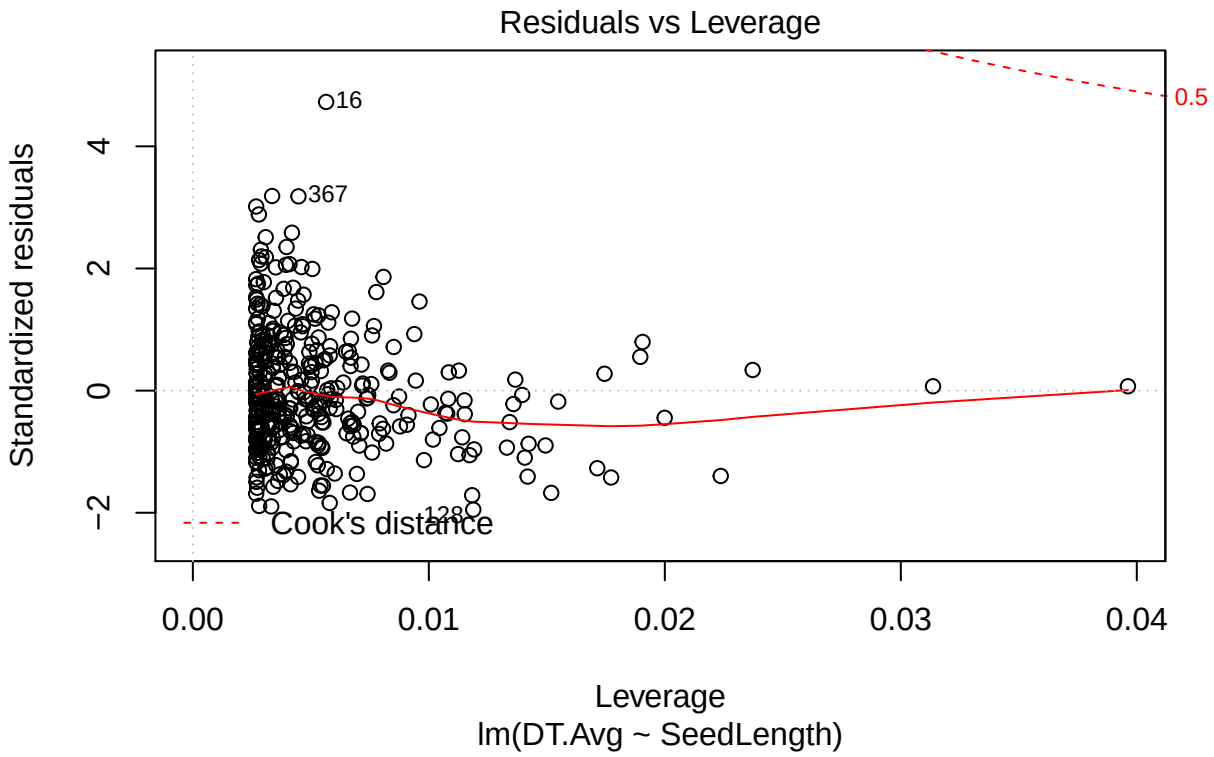



```
plot(mod.L, panel = panel.smooth)
```

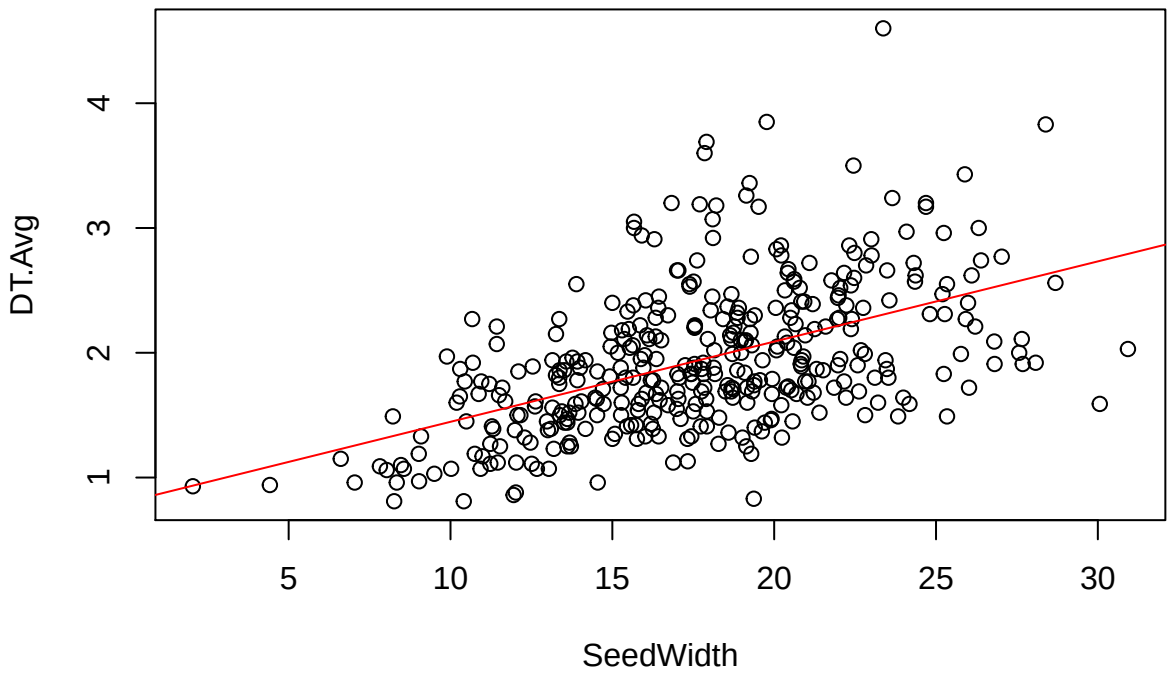

Residuals vs Fitted
Residuals
Fitted values
lm(DT.Avg ~ SeedLength)
16
143
67
3
2
1
0
−1
1.7
1.8
1.9
2.0
2.1
2.2


Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(DT.Avg ~ SeedLength)
16
367
374
−2
−1
0
1
2
3
4
5
−3
−2
−1
0
1
2
3


Scale−Location
16
143
67
√|Standardized residuals|
0.0
0.5
1.0
1.5
2.0
1.7
1.8
1.9
2.0
2.1
2.2
Fitted values
lm(DT.Avg ~ SeedLength)



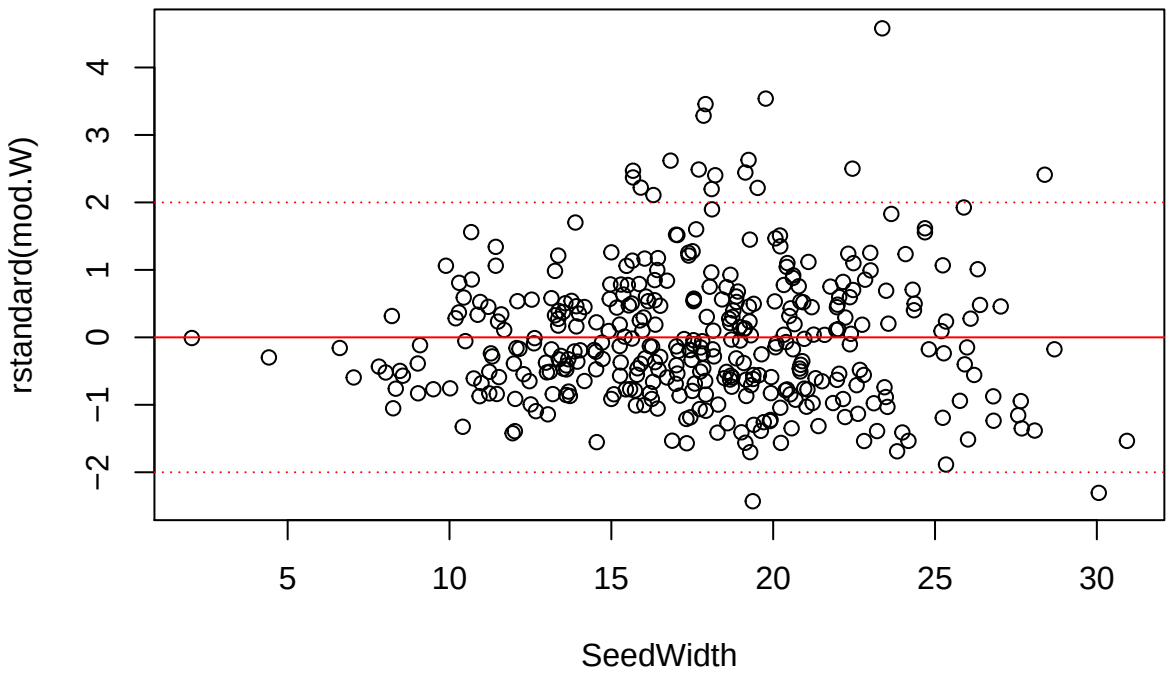

```
# Average DT ~ pappus width
mod.W <- lm(DT.Avg ~ SeedWidth, data = data.new)
plot(DT.Avg ~ SeedWidth, data = data.new)
abline(mod.W, col = "red")
```



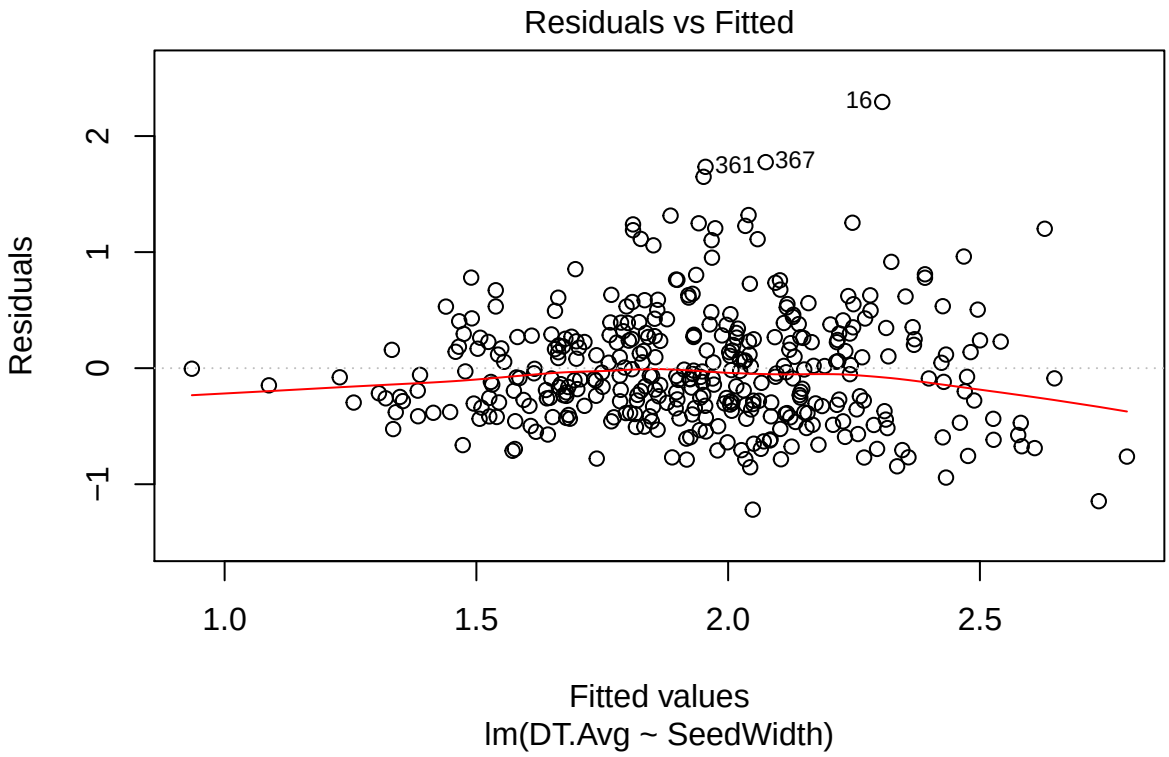

```
summary(mod.W)
```

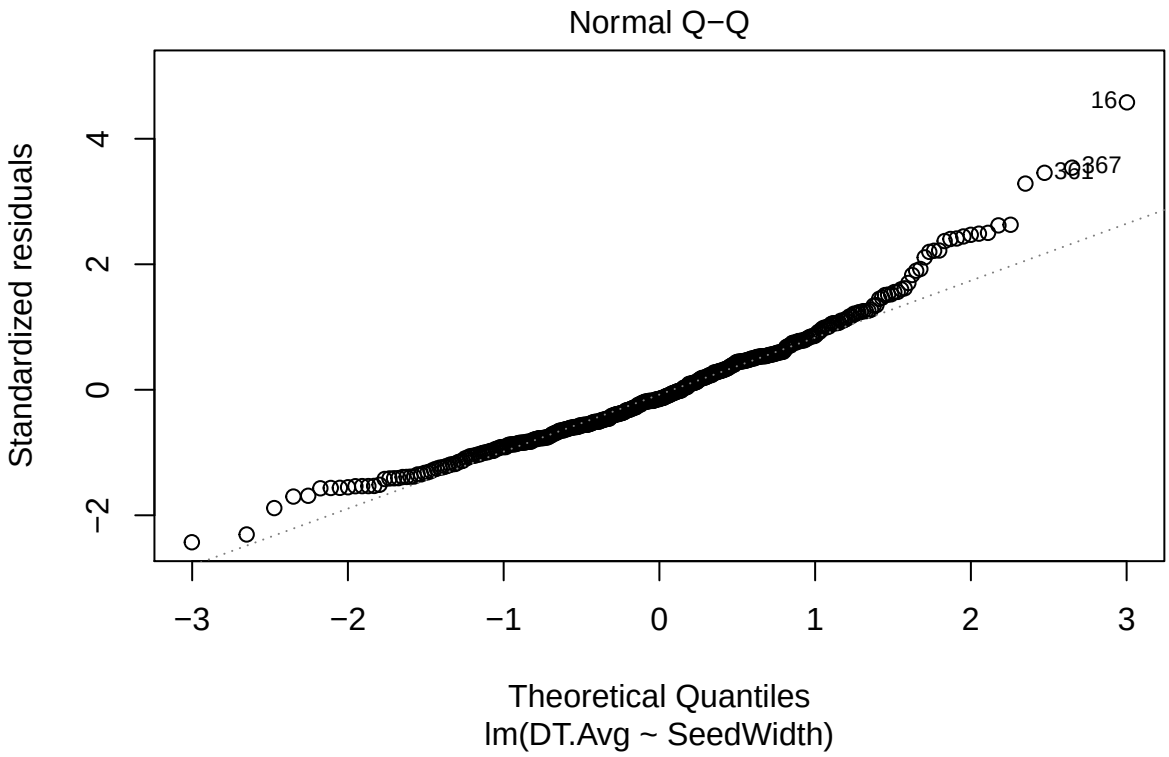
```
##
## Call:
## lm(formula = DT.Avg ~ SeedWidth, data = data.new)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.21893 -0.34594 -0.07393  0.26870  2.29394
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) 0.803773   0.101777   7.897 3.26e-14 ***
## SeedWidth   0.064283   0.005555  11.573  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5025 on 371 degrees of freedom
## Multiple R-squared:  0.2653, Adjusted R-squared:  0.2633
## F-statistic: 133.9 on 1 and 371 DF,  p-value: < 2.2e-16
```

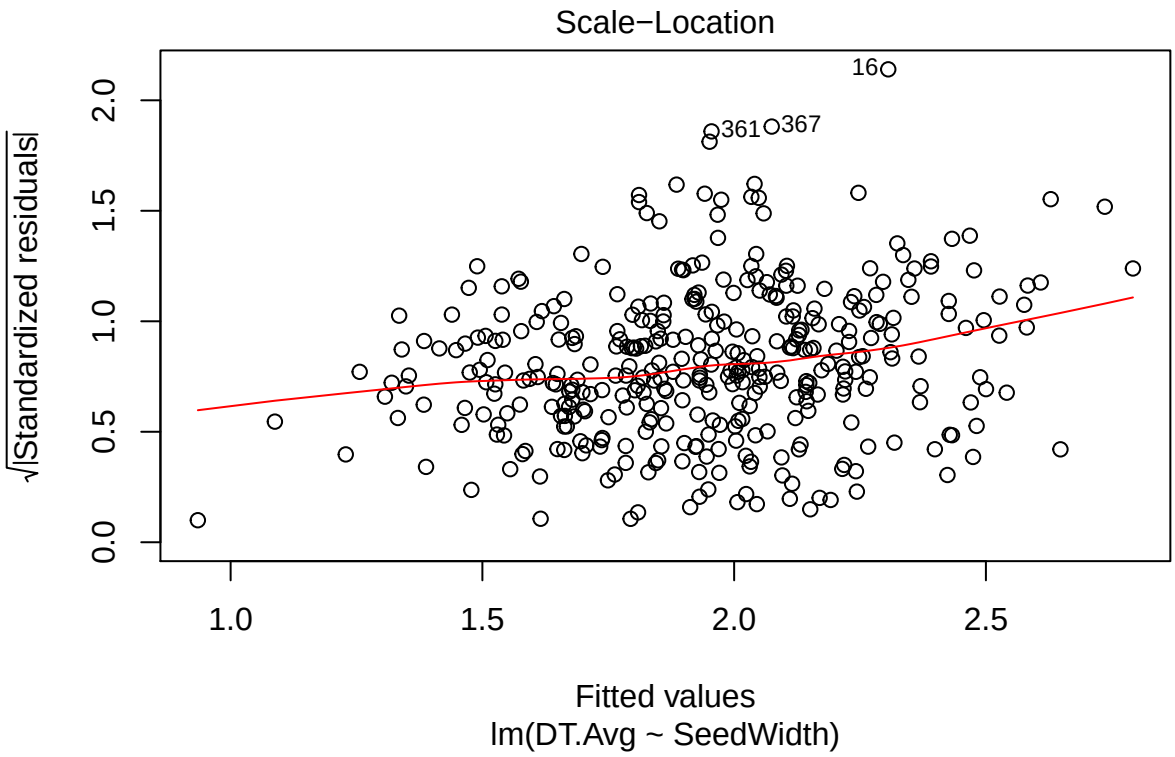
```
plot(rstandard(mod.W) ~ SeedWidth, data = data.new)
abline(h = 0, col = "red")
abline(h = c(-2, 2), col = "red", lty = 3)
```

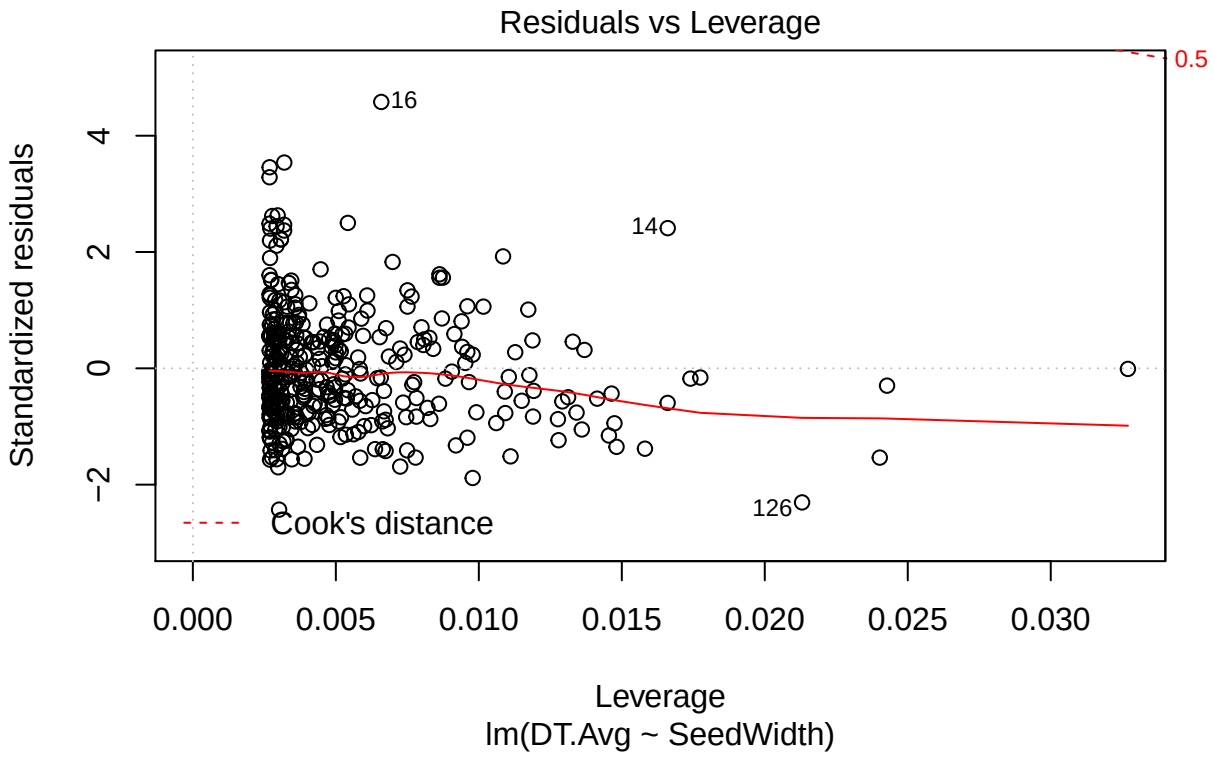



```
plot(mod.W)
```

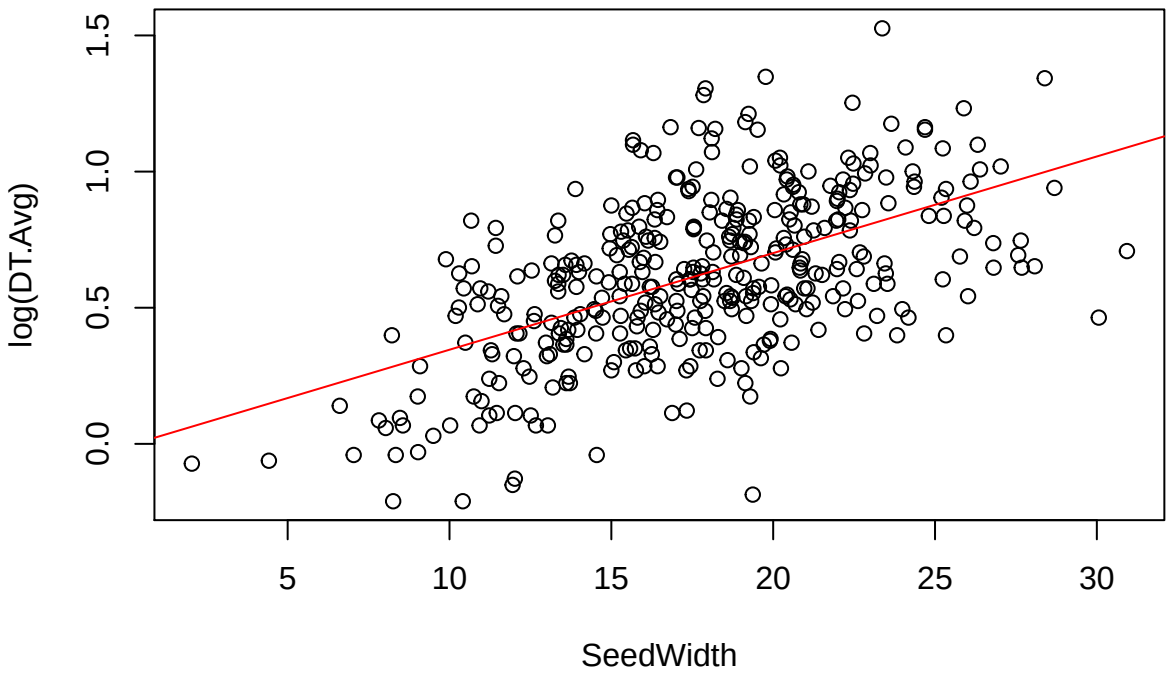

Residuals vs Fitted
Residuals
Fitted values
lm(DT.Avg ~ SeedWidth)
16
361
367
2
1
0
−1
1.0
1.5
2.0
2.5


Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(DT.Avg ~ SeedWidth)
16
267
301
−3
−2
−1
0
1
2
3
−2
0
2
4


Scale−Location
16
361
367
√|Standardized residuals|
0.0
0.5
1.0
1.5
2.0
1.0
1.5
2.0
2.5
Fitted values
lm(DT.Avg ~ SeedWidth)



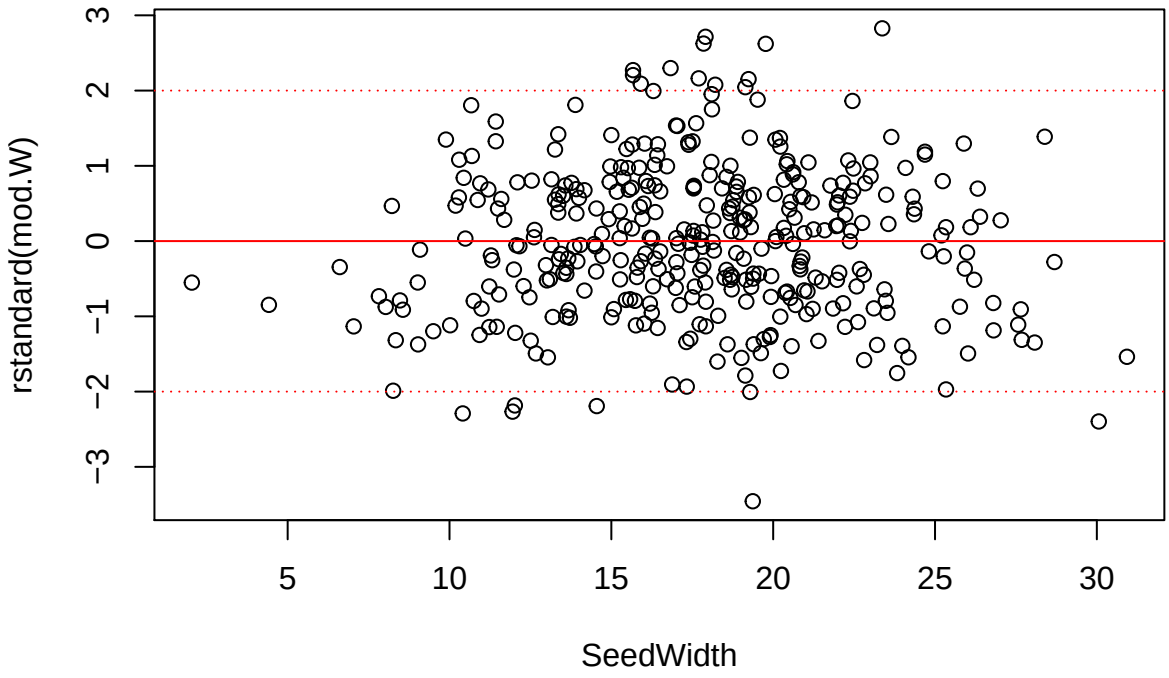

```
# Log-transformed average DT ~ pappus width
mod.W <- lm(log(DT.Avg) ~ SeedWidth, data = data.new)
plot(log(DT.Avg) ~ SeedWidth, data = data.new)
abline(mod.W, col = "red")
```



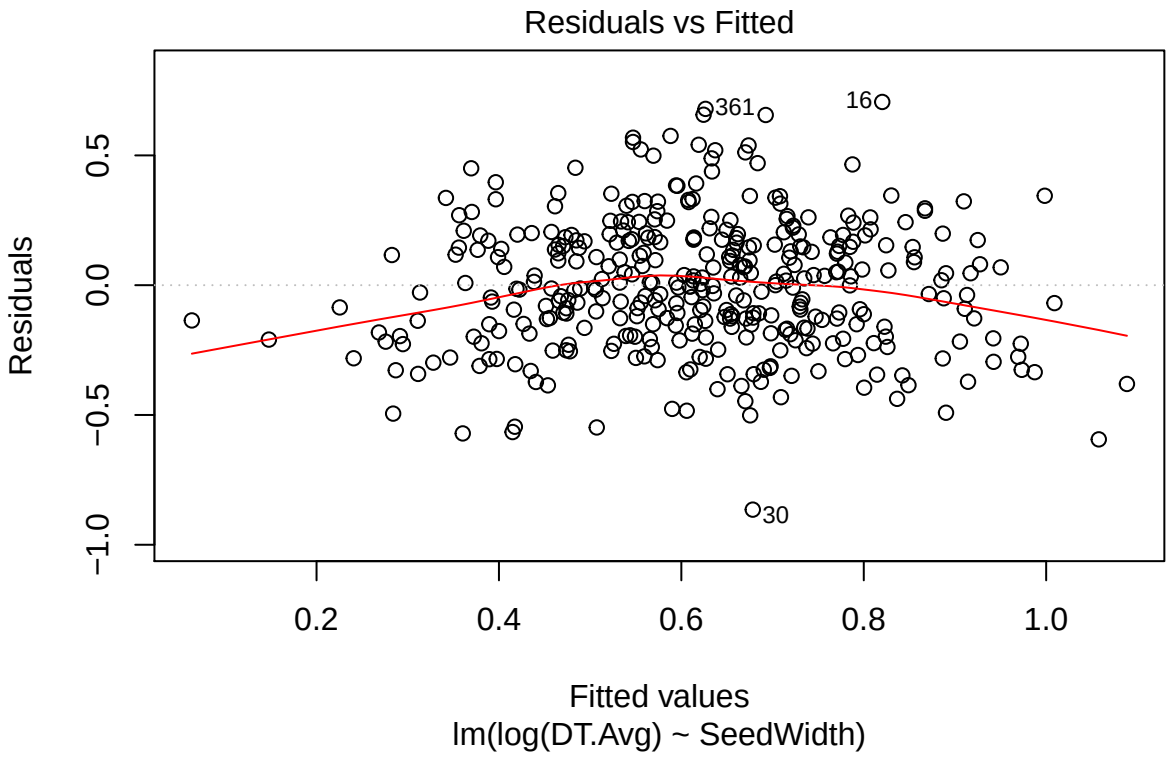

```
summary(mod.W)
```

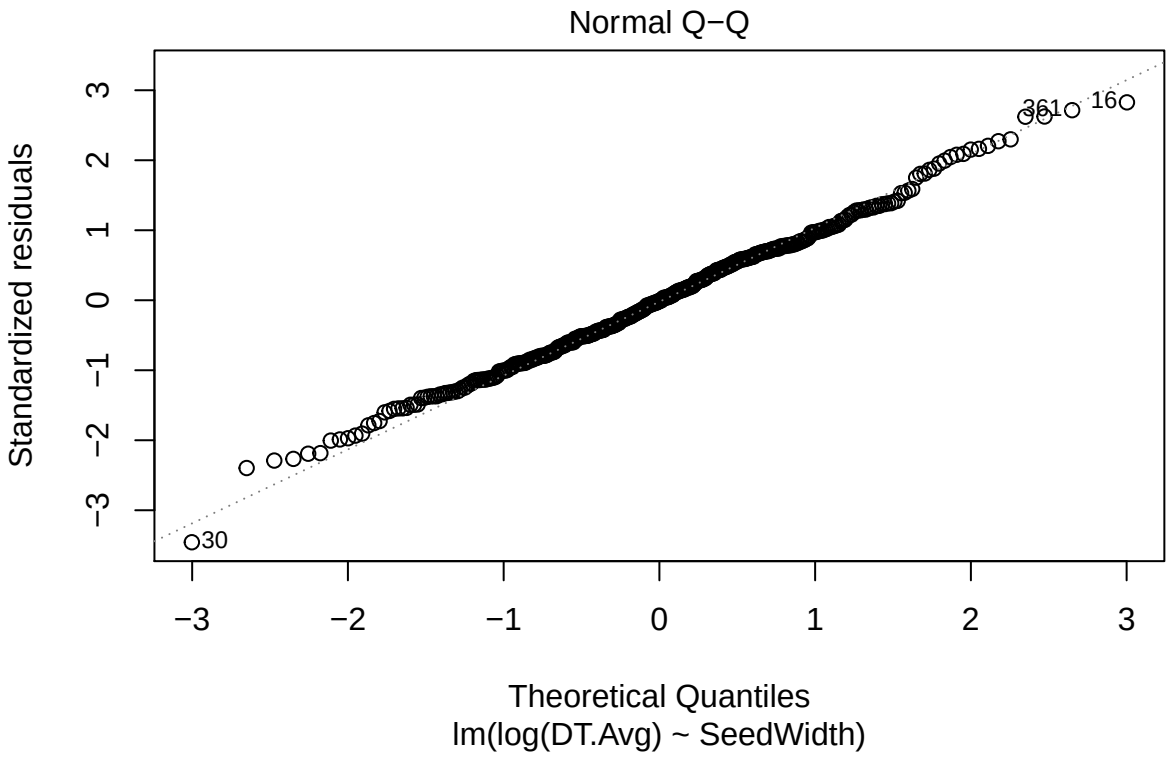
```
##
## Call:
## lm(formula = log(DT.Avg) ~ SeedWidth, data = data.new)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -0.86464 -0.18224 -0.00303  0.17262  0.70579
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept) -0.009110   0.050732   -0.18    0.858
## SeedWidth    0.035489   0.002769   12.82   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.2505 on 371 degrees of freedom
## Multiple R-squared:  0.3069, Adjusted R-squared:  0.3051
## F-statistic: 164.3 on 1 and 371 DF,  p-value: < 2.2e-16
```

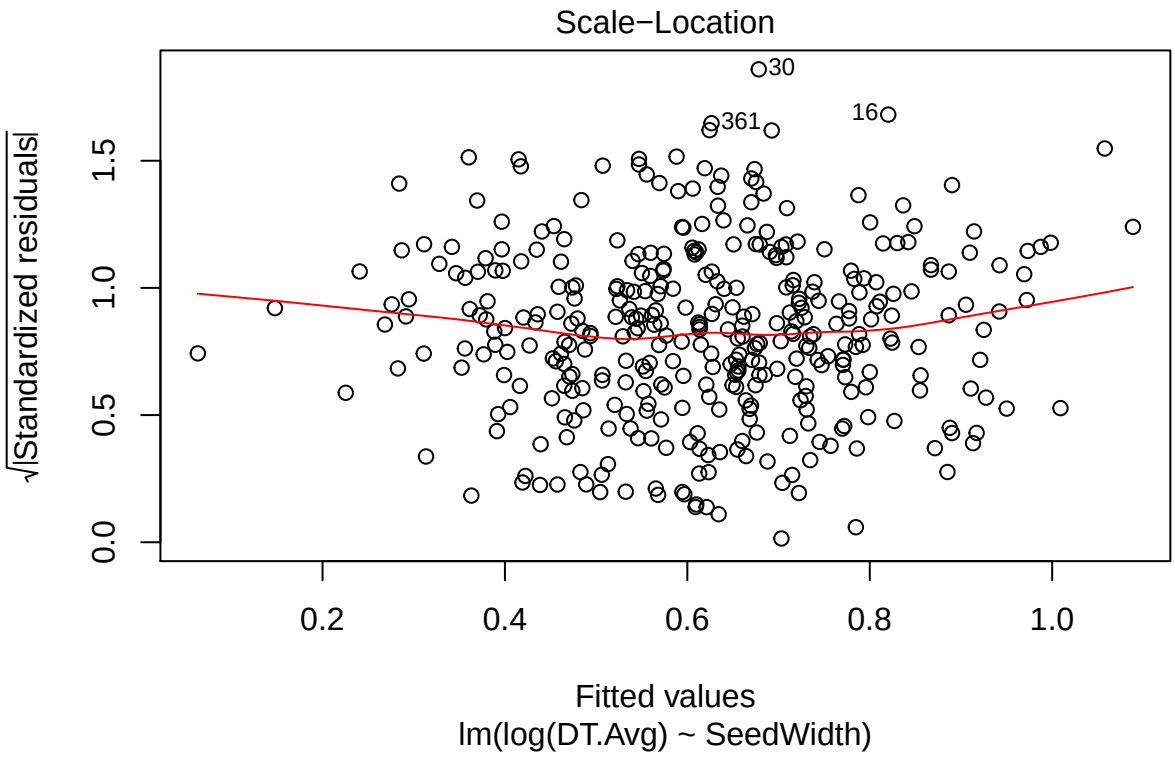
```
plot(rstandard(mod.W) ~ SeedWidth, data = data.new)
abline(h = 0, col = "red")
abline(h = c(-2, 2), col = "red", lty = 3)
```

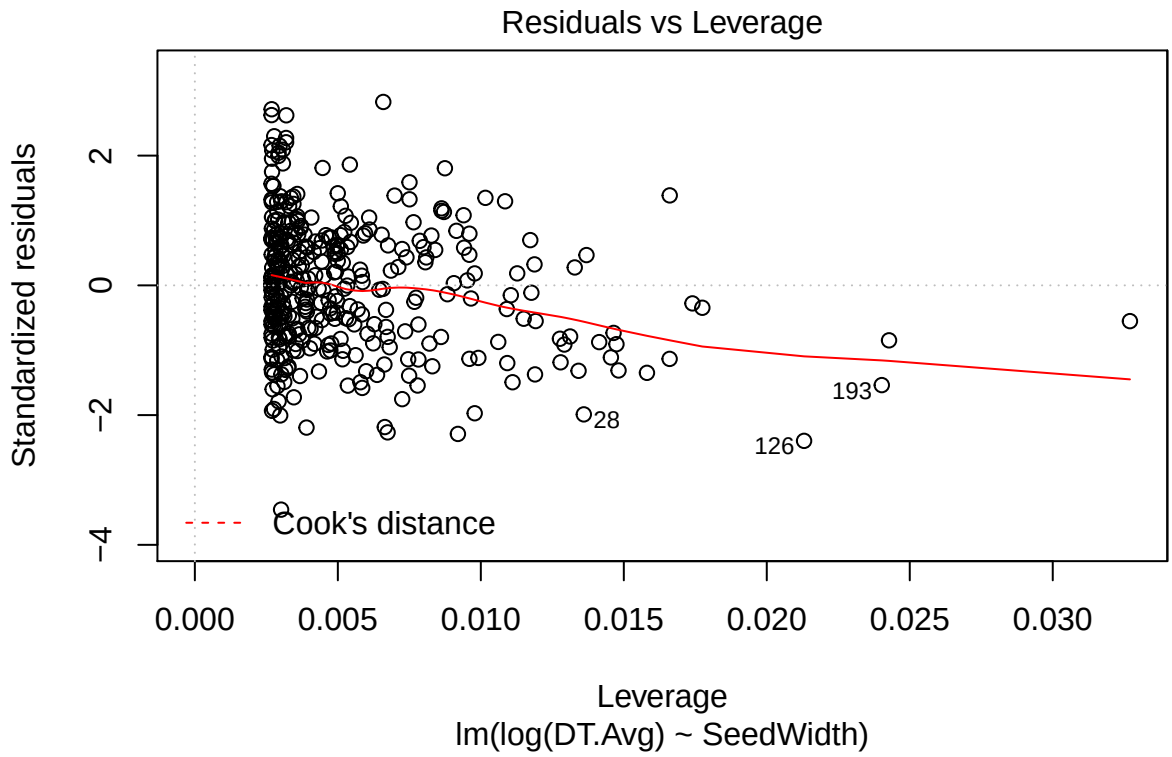



```
plot(mod.W)
```

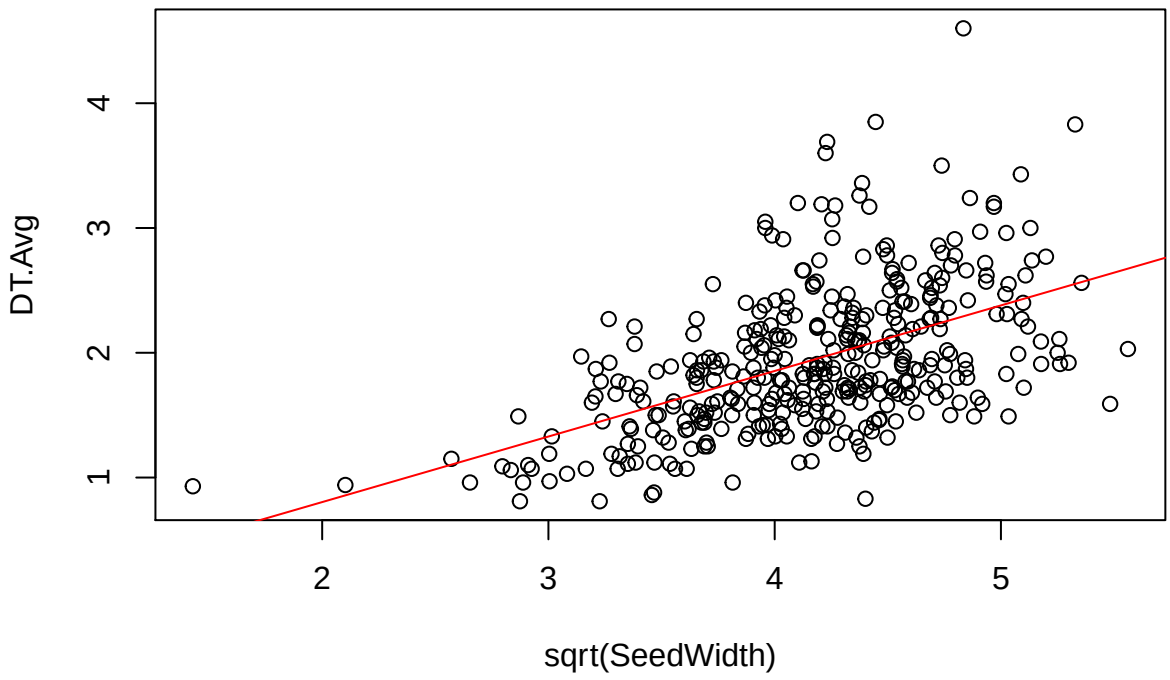

Residuals vs Fitted
361
16
30
Residuals
0.5
0.0
−0.5
−1.0
0.2
0.4
0.6
0.8
1.0
Fitted values
lm(log(DT.Avg) ~ SeedWidth)


Normal Q−Q
Standardized residuals
Theoretical Quantiles
lm(log(DT.Avg) ~ SeedWidth)
30
361
16


Scale−Location
30
361
16
√|Standardized residuals|
0.0
0.5
1.0
1.5
0.2
0.4
0.6
0.8
1.0
Fitted values
lm(log(DT.Avg) ~ SeedWidth)



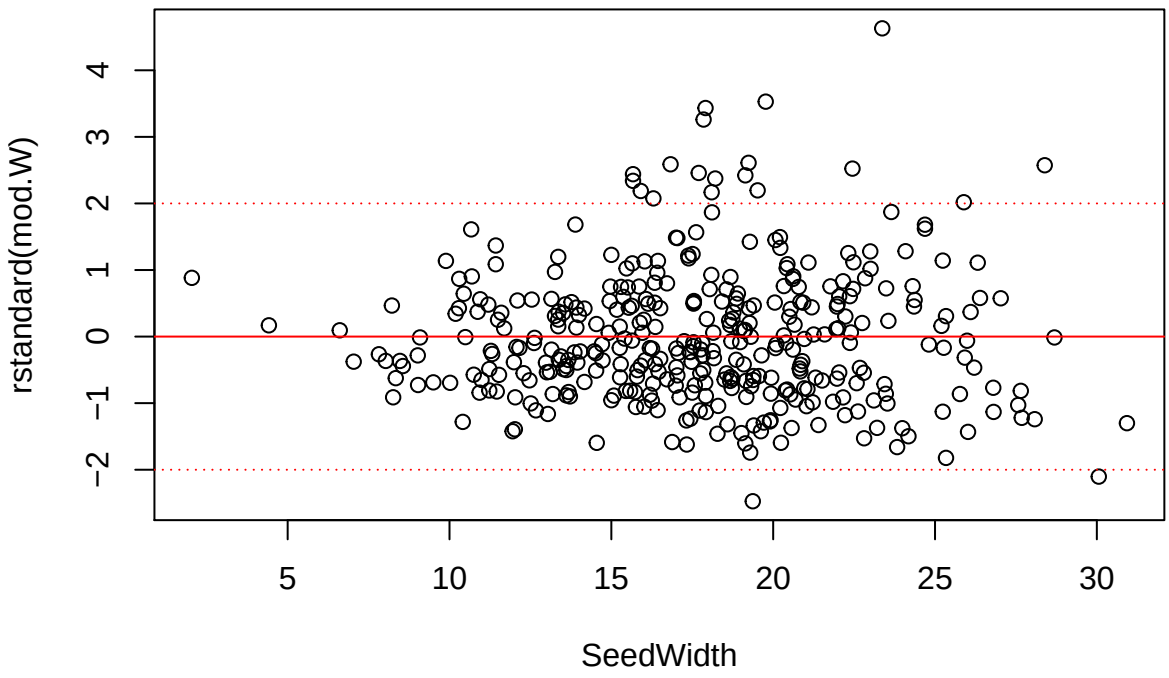

```r
# Square-root average DT ~ pappus width
mod.W <- lm(DT.Avg ~ sqrt(SeedWidth), data = data.new)
plot(DT.Avg ~ sqrt(SeedWidth), data = data.new)
abline(mod.W, col = "red")
```



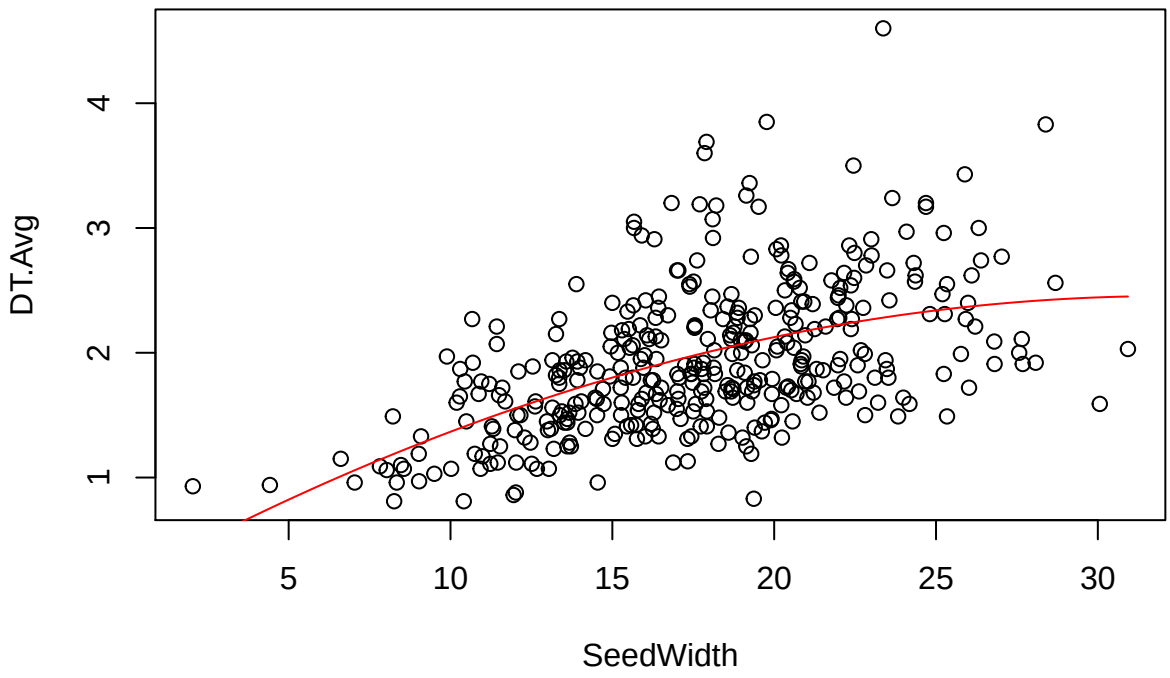

```
summary(mod.W)
```

```
##
## Call:
## lm(formula = DT.Avg ~ sqrt(SeedWidth), data = data.new)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.23470 -0.34549 -0.07214  0.26617  2.30774
##
## Coefficients:
##                 Estimate Std. Error t value Pr(>|t|)
## (Intercept)     -0.24758    0.18751   -1.32    0.188
## sqrt(SeedWidth)  0.52538    0.04455   11.79   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5 on 371 degrees of freedom
## Multiple R-squared:  0.2727, Adjusted R-squared:  0.2707
## F-statistic: 139.1 on 1 and 371 DF,  p-value: < 2.2e-16
```

```
plot(rstandard(mod.W) ~ SeedWidth, data = data.new)
abline(h = 0, col = "red")
abline(h = c(-2, 2), col = "red", lty = 3)
```




```
# Average DT ~ pappus width only (w/ quadratic term)
mod.W2 <- lm(DT.Avg ~ SeedWidth + I(SeedWidth^2), data = data.new)
plot(DT.Avg ~ SeedWidth, data = data.new)
curve(predict(mod.W2, newdata = data.frame(SeedWidth = x)), add = T, col = "red")
```




```
summary(mod.W2)
```

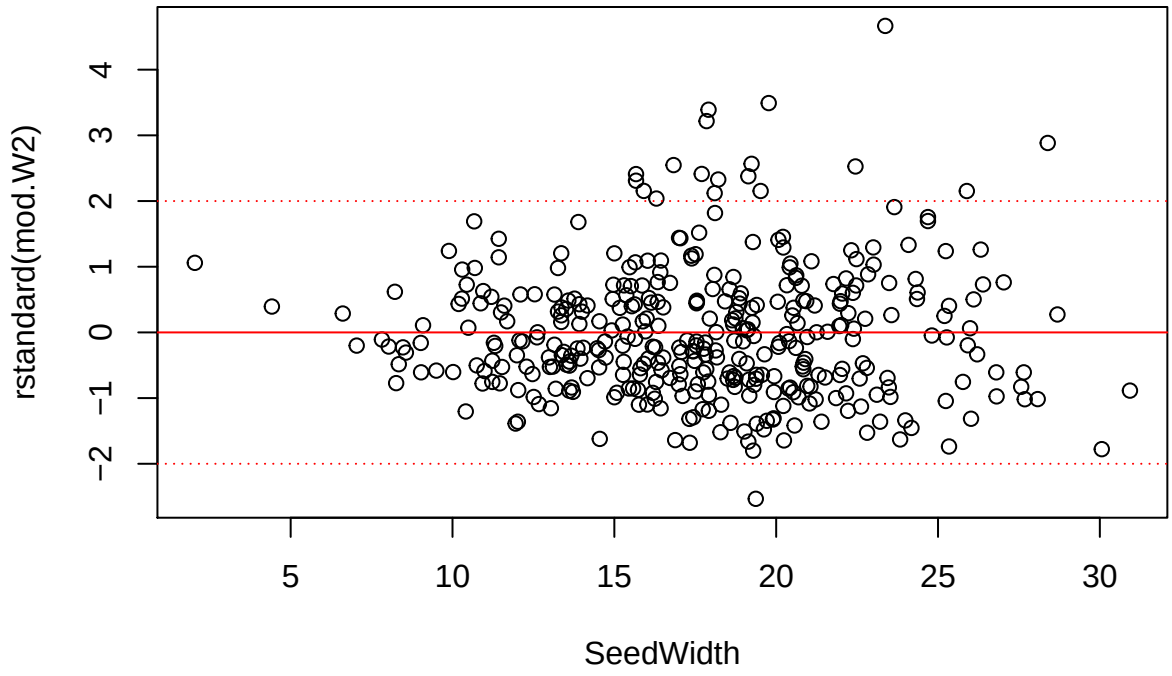
```
##
## Call:
## lm(formula = DT.Avg ~ SeedWidth + I(SeedWidth^2), data = data.new)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.26051 -0.34955 -0.06896  0.25893  2.31826
##
## Coefficients:
##                  Estimate Std. Error t value Pr(>|t|)
## (Intercept)     0.1688639  0.2615306   0.646  0.51889
## SeedWidth       0.1418079  0.0299689   4.732 3.17e-06 ***
## I(SeedWidth^2) -0.0021993  0.0008357  -2.632  0.00885 **
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.4985 on 370 degrees of freedom
## Multiple R-squared:  0.2788, Adjusted R-squared:  0.2749
## F-statistic:  71.5 on 2 and 370 DF,  p-value: < 2.2e-16
```

```
anova(mod.W, mod.W2)
```

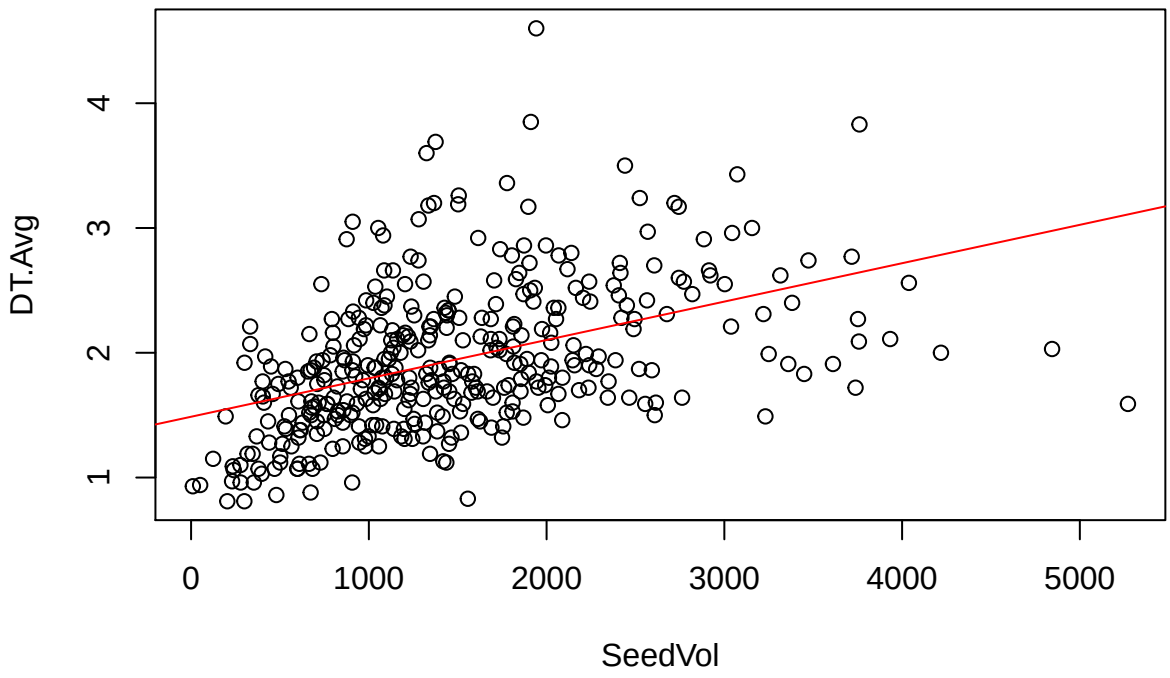
```
## Analysis of Variance Table
##
## Model 1: DT.Avg ~ sqrt(SeedWidth)
```

```
## Model 2: DT.Avg ~ SeedWidth + I(SeedWidth^2)
##   Res.Df    RSS Df Sum of Sq      F  Pr(>F)
## 1    371 92.738
## 2    370 91.960  1   0.77791 3.1299 0.07769 .
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```r
plot(rstandard(mod.W2) ~ SeedWidth, data = data.new)
abline(h = 0, col = "red")
abline(h = c(-2, 2), col = "red", lty = 3)
```



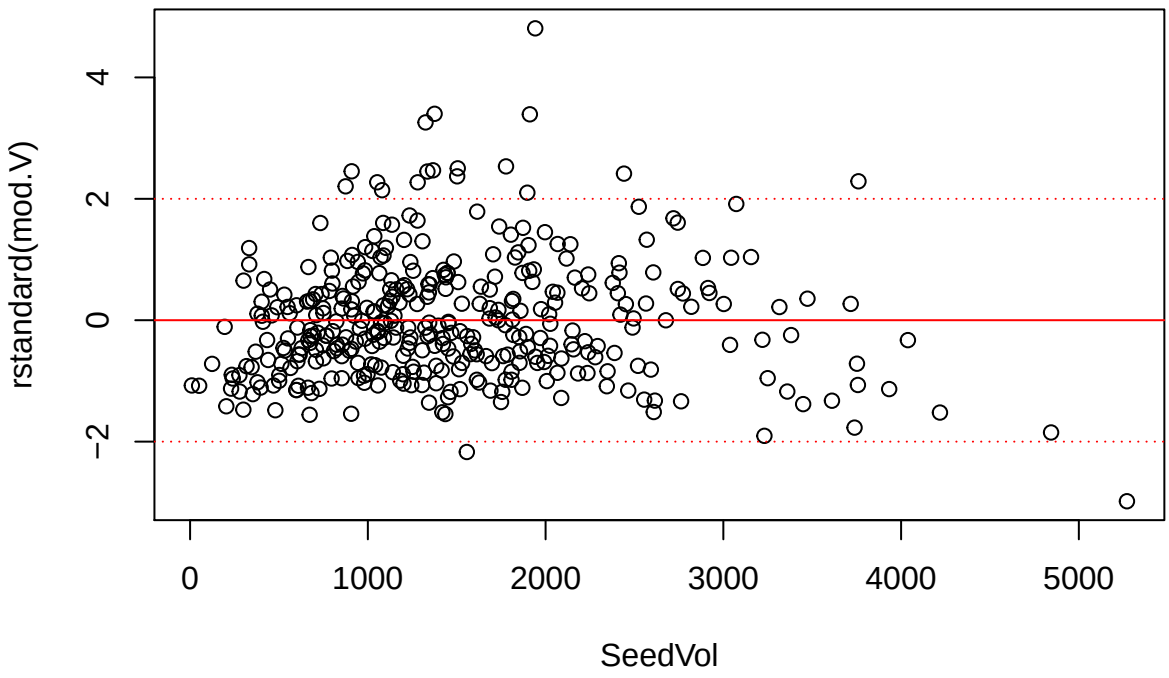

```r
# Average DT ~ pappus conical volume
mod.V <- lm(DT.Avg ~ SeedVol, data = data.new)
plot(DT.Avg ~ SeedVol, data = data.new)
abline(mod.V, col = "red")
```



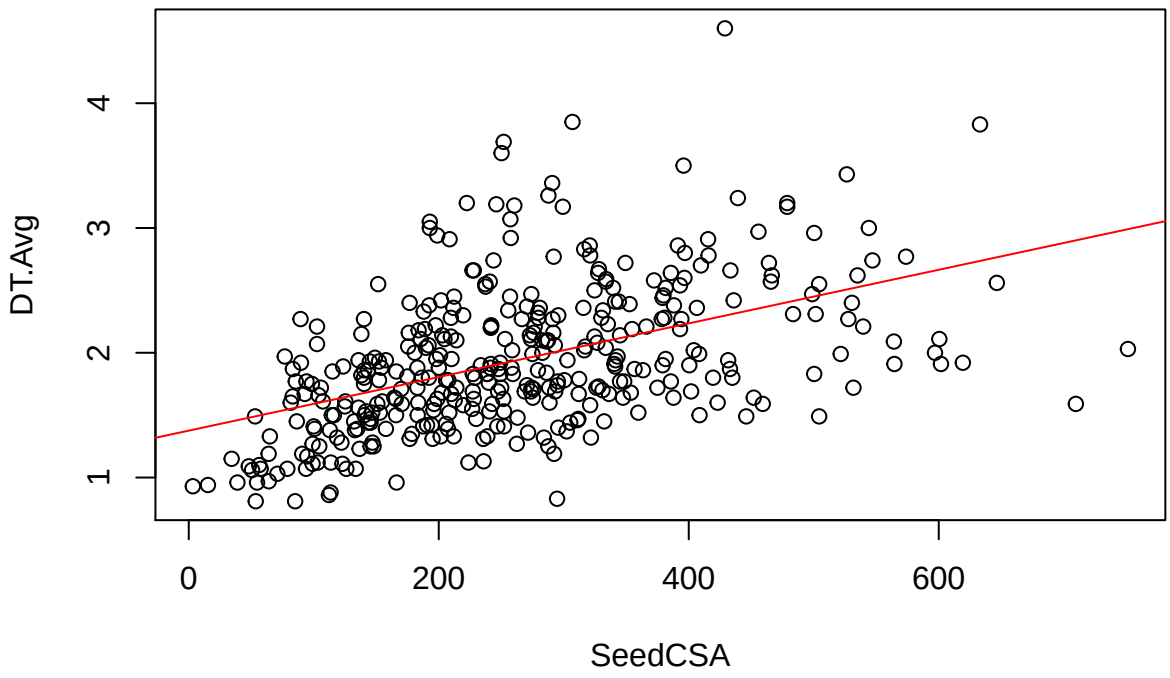

```
summary(mod.V)
```

```
##
## Call:
## lm(formula = DT.Avg ~ SeedVol, data = data.new)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.51863 -0.37137 -0.06468  0.27644  2.51545
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1.487e+00  5.439e-02  27.343   <2e-16 ***
## SeedVol     3.076e-04  3.185e-05   9.658   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.524 on 371 degrees of freedom
## Multiple R-squared:  0.2009, Adjusted R-squared:  0.1988
## F-statistic: 93.28 on 1 and 371 DF,  p-value: < 2.2e-16
```

```
plot(rstandard(mod.V) ~ SeedVol, data = data.new)
abline(h = 0, col = "red")
abline(h = c(-2, 2), col = "red", lty = 3)
```



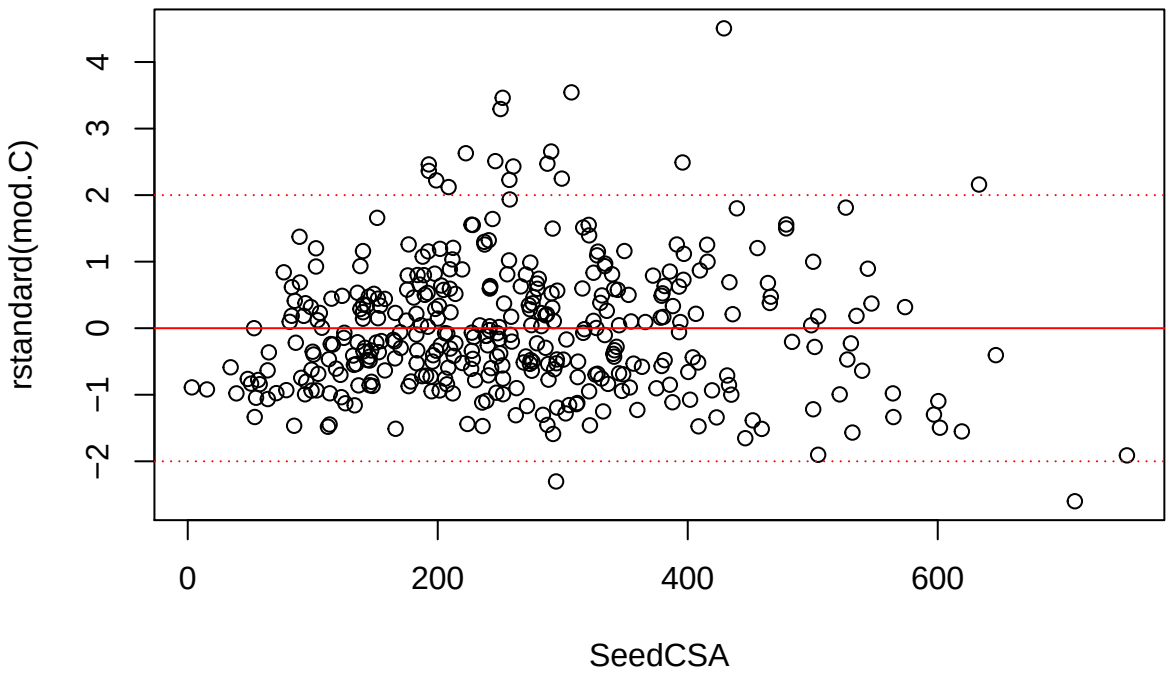

```
# Average DT ~ pappus max circular CSA
mod.C <- lm(DT.Avg ~ SeedCSA, data = data.new)
plot(DT.Avg ~ SeedCSA, data = data.new)
abline(mod.C, col = "red")
```




```
summary(mod.C)
```

```
##
## Call:
## lm(formula = DT.Avg ~ SeedCSA, data = data.new)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.31084 -0.36313 -0.05802  0.29448  2.30240
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 1.3759000  0.0593291   23.19   <2e-16 ***
## SeedCSA     0.0021487  0.0002012   10.68   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5127 on 371 degrees of freedom
## Multiple R-squared:  0.2351, Adjusted R-squared:  0.233
## F-statistic:   114 on 1 and 371 DF,  p-value: < 2.2e-16
```

```
plot(rstandard(mod.C) ~ SeedCSA, data = data.new)
abline(h = 0, col = "red")
abline(h = c(-2, 2), col = "red", lty = 3)
```




```
# Average DT ~ pappus width and length
summary(lm(DT.Avg ~ SeedLength + SeedWidth, data = data))
```

```
##
## Call:
## lm(formula = DT.Avg ~ SeedLength + SeedWidth, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.22288 -0.34793 -0.07354  0.27495  2.27674
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.863936   0.168424   5.130  4.7e-07 ***
## SeedLength  -0.004483   0.009994  -0.449    0.654
## SeedWidth    0.065049   0.005817  11.182  < 2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.503 on 370 degrees of freedom
##   (20 observations deleted due to missingness)
## Multiple R-squared:  0.2656, Adjusted R-squared:  0.2617
## F-statistic: 66.92 on 2 and 370 DF,  p-value: < 2.2e-16
```

```
summary(lm(DT.Avg ~ SeedWidth + SeedLength, data = data))
```

```
##
```

```
## Call:
## lm(formula = DT.Avg ~ SeedWidth + SeedLength, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.22288 -0.34793 -0.07354  0.27495  2.27674
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  0.863936   0.168424   5.130  4.7e-07 ***
## SeedWidth    0.065049   0.005817  11.182  < 2e-16 ***
## SeedLength  -0.004483   0.009994  -0.449    0.654
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.503 on 370 degrees of freedom
##   (20 observations deleted due to missingness)
## Multiple R-squared:  0.2656, Adjusted R-squared:  0.2617
## F-statistic: 66.92 on 2 and 370 DF,  p-value: < 2.2e-16
```

```
summary(lm(DT.Avg ~ SeedWidth + SeedLength + SeedWidth:SeedLength, data = data))
```

```
##
## Call:
## lm(formula = DT.Avg ~ SeedWidth + SeedLength + SeedWidth:SeedLength,
##     data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.22876 -0.35217 -0.06607  0.27079  2.25172
##
## Coefficients:
##                       Estimate Std. Error t value Pr(>|t|)
## (Intercept)           0.547959   0.484377   1.131  0.25868
## SeedWidth             0.083834   0.027616   3.036  0.00257 **
## SeedLength            0.014981   0.029707   0.504  0.61437
## SeedWidth:SeedLength -0.001142   0.001641  -0.696  0.48698
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5034 on 369 degrees of freedom
##   (20 observations deleted due to missingness)
## Multiple R-squared:  0.2666, Adjusted R-squared:  0.2606
## F-statistic: 44.71 on 3 and 369 DF,  p-value: < 2.2e-16
```

```
# Average DT ~ warming and mowing treatments
mod.WM <- lm(DT.Avg ~ Mow + Warming + Mow:Warming, data = data)
summary(mod.WM)
```

```
##
## Call:
## lm(formula = DT.Avg ~ Mow + Warming + Mow:Warming, data = data)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
```

```
## -1.27566 -0.39450 -0.02566  0.35140  2.38434
##
## Coefficients:
##               Estimate Std. Error t value Pr(>|t|)
## (Intercept)    1.91413    0.06964  27.485  < 2e-16 ***
## MowE           0.30153    0.08793   3.429 0.000673 ***
## MowL           0.34462    0.20747   1.661 0.097527 .
## WarmingW      -0.18875    0.09701  -1.946 0.052424 .
## MowE:WarmingW -0.18328    0.12246  -1.497 0.135328
## MowL:WarmingW -0.52846    0.24363  -2.169 0.030699 *
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5528 on 377 degrees of freedom
##   (10 observations deleted due to missingness)
## Multiple R-squared:  0.1292, Adjusted R-squared:  0.1177
## F-statistic: 11.19 on 5 and 377 DF,  p-value: 4.525e-10
```

```
anova(mod.WM)
```

```
## Analysis of Variance Table
##
## Response: DT.Avg
##              Df  Sum Sq Mean Sq F value    Pr(>F)
## Mow           2   5.221  2.6106  8.5441  0.000235 ***
## Warming       1  10.212 10.2122 33.4229 1.557e-08 ***
## Mow:Warming   2   1.662  0.8308  2.7190  0.067233 .
## Residuals   377 115.191  0.3055
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# Average DT ~ warming and early mowing treatment
data.new.2 <- subset(data.new, Mow != "L")
mod.WM2 <- lm(DT.Avg ~ Mow + Warming, data = data.new.2)
summary(mod.WM2)
```

```
##
## Call:
## lm(formula = DT.Avg ~ Mow + Warming, data = data.new.2)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -1.24043 -0.37667 -0.04667  0.33333  2.41957
##
## Coefficients:
##             Estimate Std. Error t value Pr(>|t|)
## (Intercept)  1.97340    0.05821  33.902  < 2e-16 ***
## MowE         0.20703    0.06219   3.329 0.000965 ***
## WarmingW    -0.30376    0.06016  -5.049  7.2e-07 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 0.5617 on 346 degrees of freedom
## Multiple R-squared:  0.09556,    Adjusted R-squared:  0.09033
## F-statistic: 18.28 on 2 and 346 DF,  p-value: 2.843e-08
```

```r
anova(mod.WM2)
```

```
## Analysis of Variance Table
##
## Response: DT.Avg
##            Df  Sum Sq Mean Sq F value    Pr(>F)
## Mow         1   3.490  3.4905  11.064 0.0009747 ***
## Warming     1   8.043  8.0425  25.493 7.196e-07 ***
## Residuals 346 109.157  0.3155
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```