Script_04.R

jairo

2025-09-25

```r
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# 18/09/2025
# SEMANA 7

# SCRIPT 4

datos <- read.csv("crop.csv", header =  T)
datos
```

```
##    density block fertilizer    yield
## 1        1     1          1 177.2287
## 2        2     2          1 177.5500
## 3        1     3          1 176.4085
## 4        2     4          1 177.7036
## 5        1     1          1 177.1255
## 6        2     2          1 176.7783
## 7        1     3          1 176.7463
## 8        2     4          1 177.0612
## 9        1     1          1 176.2749
## 10       2     2          1 177.9672
## 11       1     3          1 176.6013
## 12       2     4          1 177.0305
## 13       1     1          1 177.4795
## 14       2     2          1 176.8741
## 15       1     3          1 176.1144
## 16       2     4          1 176.0084
## 17       1     1          1 176.1083
## 18       2     2          1 178.3574
## 19       1     3          1 177.2624
## 20       2     4          1 176.9188
## 21       1     1          1 176.2390
## 22       2     2          1 176.5731
## 23       1     3          1 176.0393
## 24       2     4          1 176.8179
## 25       1     1          1 176.1606
## 26       2     2          1 177.2264
## 27       1     3          1 175.9385
## 28       2     4          1 177.1649
## 29       1     1          1 175.3608
## 30       2     2          1 177.2770
## 31       1     3          1 175.9454
## 32       2     4          1 175.8828
## 33       1     1          2 176.4793
```

```
## 34       2     2          2 176.0443
## 35       1     3          2 177.4125
## 36       2     4          2 177.3608
## 37       1     1          2 177.3855
## 38       2     2          2 176.9758
## 39       1     3          2 177.3798
## 40       2     4          2 177.9980
## 41       1     1          2 176.4349
## 42       2     2          2 176.9333
## 43       1     3          2 175.9835
## 44       2     4          2 177.0341
## 45       1     1          2 176.4368
## 46       2     2          2 176.0677
## 47       1     3          2 177.1210
## 48       2     4          2 177.1977
## 49       1     1          2 176.6037
## 50       2     2          2 177.2082
## 51       1     3          2 177.1488
## 52       2     4          2 176.8191
## 53       1     1          2 176.9991
## 54       2     2          2 178.1346
## 55       1     3          2 176.4292
## 56       2     4          2 176.6683
## 57       1     1          2 176.8959
## 58       2     2          2 177.7795
## 59       1     3          2 176.4145
## 60       2     4          2 176.8789
## 61       1     1          2 177.5807
## 62       2     2          2 176.9573
## 63       1     3          2 175.7475
## 64       2     4          2 177.3526
## 65       1     1          3 177.1042
## 66       2     2          3 178.0796
## 67       1     3          3 176.9034
## 68       2     4          3 177.5403
## 69       1     1          3 177.0327
## 70       2     2          3 178.2860
## 71       1     3          3 176.4054
## 72       2     4          3 176.4308
## 73       1     1          3 177.3963
## 74       2     2          3 176.9256
## 75       1     3          3 177.0550
## 76       2     4          3 177.3442
## 77       1     1          3 177.1284
## 78       2     2          3 177.1683
## 79       1     3          3 176.3539
## 80       2     4          3 179.0609
## 81       1     1          3 176.3005
## 82       2     2          3 177.5934
## 83       1     3          3 177.1152
## 84       2     4          3 177.7945
## 85       1     1          3 177.0040
## 86       2     2          3 178.0369
## 87       1     3          3 177.7014
```

```
## 88       2     4          3 177.6328
## 89       1     1          3 177.6523
## 90       2     2          3 177.1004
## 91       1     3          3 177.1880
## 92       2     4          3 177.4053
## 93       1     1          3 178.1416
## 94       2     2          3 177.7106
## 95       1     3          3 177.6873
## 96       2     4          3 177.1182
```

```r
summary(datos)
```

```
##     density        block        fertilizer     yield
##  Min.   :1.0   Min.   :1.00   Min.   :1    Min.   :175.4
##  1st Qu.:1.0   1st Qu.:1.75   1st Qu.:1    1st Qu.:176.5
##  Median :1.5   Median :2.50   Median :2    Median :177.1
##  Mean   :1.5   Mean   :2.50   Mean   :2    Mean   :177.0
##  3rd Qu.:2.0   3rd Qu.:3.25   3rd Qu.:3    3rd Qu.:177.4
##  Max.   :2.0   Max.   :4.00   Max.   :3    Max.   :179.1
```

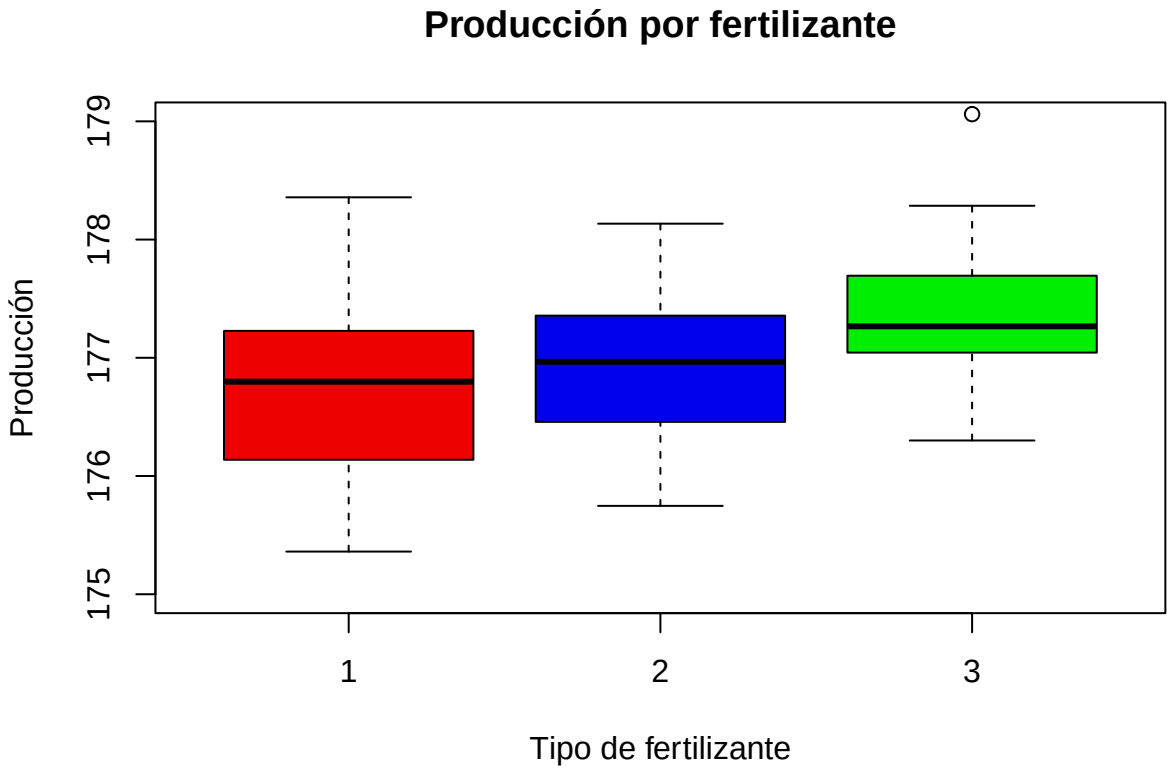
```r
# Las variables estan en numeros integrales y hay que modificar a factores
# Ya que el experimento hara la comparación por factores

datos$density <- as.factor(datos$density)
datos$block <- as.factor(datos$block)
datos$fertilizer <- as.factor(datos$fertilizer)

summary(datos)
```

```
##  density block  fertilizer     yield
##  1:48    1:24   1:32       Min.   :175.4
##  2:48    2:24   2:32       1st Qu.:176.5
##          3:24   3:32       Median :177.1
##          4:24              Mean   :177.0
##                            3rd Qu.:177.4
##                            Max.   :179.1
```

```r
boxplot(datos$yield ~ datos$fertilizer,
        main = "Producción por fertilizante",
        col= c("red2","blue2", "green2"),
        ylab = "Producción",
        xlab = "Tipo de fertilizante",
        ylim = c(175, 179))
```




```
library(vioplot)
```

```
## Cargando paquete requerido: sm
```

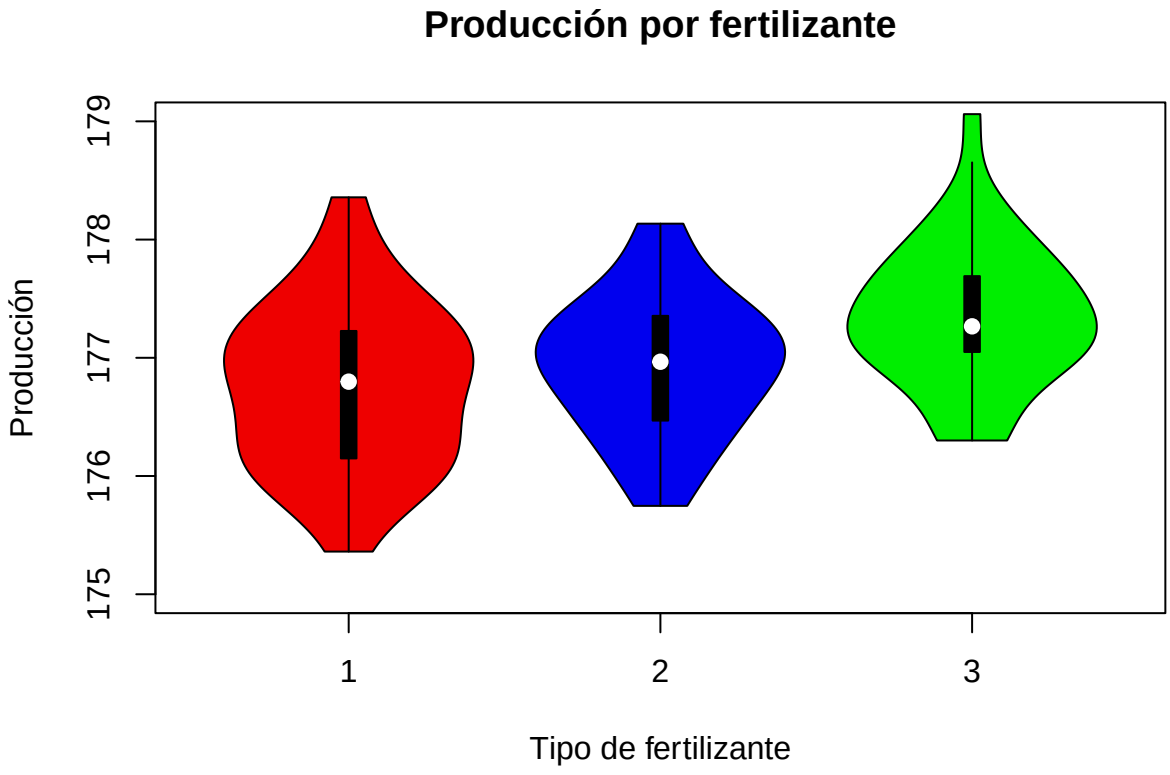
```
## Package 'sm', version 2.2-6.0: type help(sm) for summary information
```

```
## Cargando paquete requerido: zoo
```

```
##
## Adjuntando el paquete: 'zoo'
```

```
## The following objects are masked from 'package:base':
##
##     as.Date, as.Date.numeric
```

```
vioplot(datos$yield ~ datos$fertilizer,
        main = "Producción por fertilizante",
        col= c("red2","blue2", "green2"),
        ylab = "Producción",
        xlab = "Tipo de fertilizante",
        ylim = c(175, 179))
```




```
tapply(datos$yield, datos$fertilizer, mean)
```

```
##        1        2        3
## 176.7570 176.9332 177.3562
```

```
tapply(datos$yield, datos$fertilizer, sd)
```

```
##         1         2         3
## 0.6849233 0.5740668 0.5991214
```

```
tapply(datos$yield, datos$fertilizer, var)
```

```
##         1         2         3
## 0.4691199 0.3295526 0.3589464
```

```
# Prueba de normalidad

shapiro.test(datos$yield)
```

```
##
##  Shapiro-Wilk normality test
##
## data:  datos$yield
## W = 0.989, p-value = 0.6135
```

```
# Prueba de normalidad

shapiro.test(subset(datos$yield, datos$fertilizer == "1"))
```

```
##
##  Shapiro-Wilk normality test
##
## data:  subset(datos$yield, datos$fertilizer == "1")
## W = 0.97914, p-value = 0.7743
```

```
shapiro.test(subset(datos$yield, datos$fertilizer == "2"))
```

```
##
##  Shapiro-Wilk normality test
##
## data:  subset(datos$yield, datos$fertilizer == "2")
## W = 0.98329, p-value = 0.8875
```

```
shapiro.test(subset(datos$yield, datos$fertilizer == "3"))
```

```
##
##  Shapiro-Wilk normality test
##
## data:  subset(datos$yield, datos$fertilizer == "3")
## W = 0.95878, p-value = 0.2542
```

```
# No hay diferencias significativas, los datos son normales

# Prueba homogeneidad de varianzas

# VAR.TEST ES PARA DOS FACTORES, DOS GRUPOS CON VARIANZAS
# var.test(datos$yield ~ datos$fertilizer)

bartlett.test(datos$yield ~ datos$fertilizer)
```

```
##
##  Bartlett test of homogeneity of variances
##
## data:  datos$yield by datos$fertilizer
## Bartlett's K-squared = 1.0622, df = 2, p-value = 0.5879
```

```
# No hay diferencias entre las varianzas

datos.aov <- aov(datos$yield ~ datos$fertilizer)
summary(datos.aov)
```

```
##                  Df Sum Sq Mean Sq F value Pr(>F)
## datos$fertilizer  2   6.07  3.0340   7.863  7e-04 ***
## Residuals        93  35.89  0.3859
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# + para comparar dos variables
# * interacción


# LSD DETERMINAR EL VALOR Diferencia Mínima Significativa

qt(0.975, 93)
```

```
## [1] 1.985802
```

```r
sqrt((2*0.3859)/32) * qt(0.975, 93)
```

```
## [1] 0.3083992
```

```r
tapply(datos$yield, datos$fertilizer, mean)
```

```
##        1        2        3
## 176.7570 176.9332 177.3562
```

```r
# F1 vs F2

176.9332 - 176.7570 # NO SUPERA EL VALOR DE LSD 0.3083992
```

```
## [1] 0.1762
```

```r
# EL valor entre las medias, debe ser mayor que el LSD para que sean diferentes

# F2 vs F3

176.9332 - 177.3562 # SUPERA EL VALOR DE LSD 0.3083992
```

```
## [1] -0.423
```

```r
# F1 vs f3

176.7570 - 177.3562  # SUPERA EL VALOR DE LSD 0.3083992
```

```
## [1] -0.5992
```

```r
# LSD ES MAS ROBUSTA PARA LA COMPARACIÓN DE LAS DIFERENCIAS

sqrt((2*0.3859)/32) * qtukey(0.95, nmeans = 3, df = 93)
```

```
## [1] 0.5231185
```

```r
0.3083992 # 300 kilos de dif con LSD mas sensible
```

```
## [1] 0.3083992
```

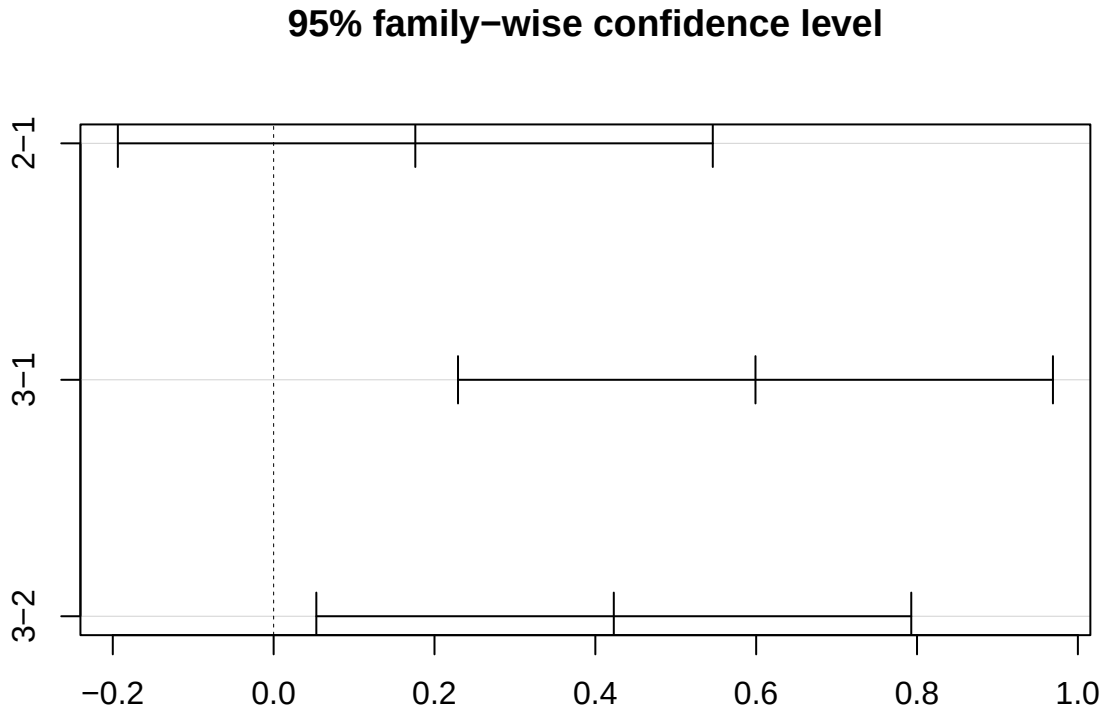
```r
0.5231185 # 500 kilos de dif con Tukey menos sensible
```

```
## [1] 0.5231185
```

```r
TukeyHSD(datos.aov)
```

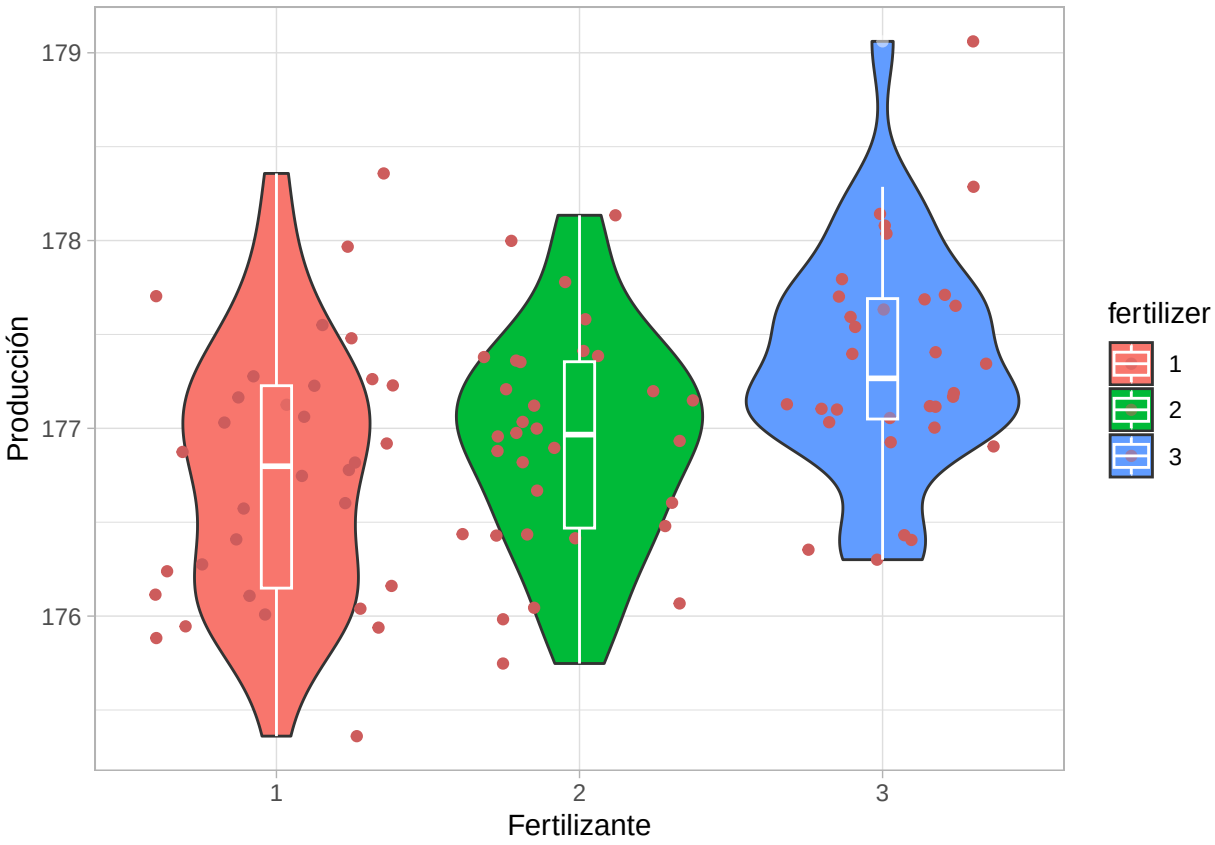
```
##   Tukey multiple comparisons of means
##     95% family-wise confidence level
##
## Fit: aov(formula = datos$yield ~ datos$fertilizer)
##
## $`datos$fertilizer`
##          diff         lwr       upr     p adj
## 2-1 0.1761687 -0.19371896 0.5460564 0.4954705
## 3-1 0.5991256  0.22923789 0.9690133 0.0006125
## 3-2 0.4229568  0.05306916 0.7928445 0.0208735
```

```r
plot(TukeyHSD(datos.aov))
```




```
library(ggplot2)

ggplot(datos, aes(x = fertilizer, y = yield, fill= fertilizer))+
  geom_violin()+
  geom_jitter(col = "indianred")+
  geom_boxplot(width=0.1, col = "white", alpha=0.5)+
  theme_light()+
  labs(x = "Fertilizante",
       y = "Producción")
```


179
178
177
176
Producción
1
2
3
Fertilizante
fertilizer
1
2
3