ANOVA-1-Factor-o-unifactorial.R

Usuario

2025-09-18

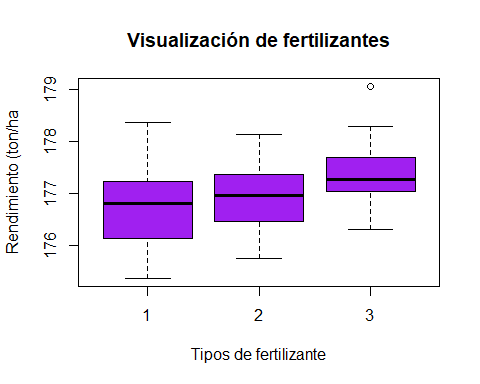
#ANOVA 1 Factor o unifactorial  
 #Ana Gabriela Gauna Rodríguez   
#18/09/2025  
  
#Análisis de varianza  
#Productividad  
read.csv("crop.csv",header=T)

## 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

crop <-read.csv("crop.csv",header=T)  
  
crop$density <- as.factor(crop$density)  
crop$block <- as.factor(crop$fertilizer)  
summary(crop)

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

#Boxplot  
boxplot(crop$yield~crop$fertilizer,  
 col="purple",  
 main="Visualización de fertilizantes",  
 xlab = "Tipos de fertilizante",  
 ylab = "Rendimiento (ton/ha")



tapply(crop$yield,crop$fertilizer,mean)

## 1 2 3   
## 176.7570 176.9332 177.3562

tapply(crop$yield,crop$fertilizer,var)

## 1 2 3   
## 0.4691199 0.3295526 0.3589464

#Prueba de normalidad de datos todos juntos  
shapiro.test(crop$yield)

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

#por separado  
#Prueba de normalidad de datos para cada fertilizante   
#combinado subset y shapiro  
shapiro.test(subset(crop$yield,crop$fertilizer=="1"))

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

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

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

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

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

#homogeneidad de varianza Bartlett  
bartlett.test(crop$yield~crop$fertilizer)

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

#ANOVA unifactoreal   
crop.aov <- aov(crop$yield~crop$fertilizer)  
#ANOVA dos factores o por bloques  
crop.aov <- aov(crop$yield ~ crop$fertilizer+crop$density+crop$block)  
summary(crop.aov)

## Df Sum Sq Mean Sq F value Pr(>F)   
## crop$fertilizer 1 5.743 5.743 17.175 7.57e-05 \*\*\*  
## crop$density 1 5.122 5.122 15.316 0.000174 \*\*\*  
## crop$block 1 0.325 0.325 0.971 0.326923   
## Residuals 92 30.765 0.334   
## ---  
## Signif. codes: 0 '\*\*\*' 0.001 '\*\*' 0.01 '\*' 0.05 '.' 0.1 ' ' 1

crop$fertilizer <- factor(crop$fertilizer)  
#LSD diferencia mínima en las medias  
qt(0.975,93)

## [1] 1.985802

sqrt((2\*0.38595)/32)\*qt(0.975,93)

## [1] 0.3084192

tapply(crop$yield,crop$fertilizer,mean)

## 1 2 3   
## 176.7570 176.9332 177.3562

#diferencia de medias F1 vs F2  
176.7570-176.9332

## [1] -0.1762

# diferencia de medias F2 vs F3  
176.9332-177.3562

## [1] -0.423

# diferencia de medias F1 vs F3  
176.7570-177.3562

## [1] -0.5992

#Prueba de Tukey diferencia mínima que se require  
sqrt((2\*0.38595)/32)\*qtukey(0.95,nmeans = 3,df=93)

## [1] 0.5231524

#tukeyhsd tiene el complemento hsd no tiene tukey solo   
TukeyHSD(crop.aov)

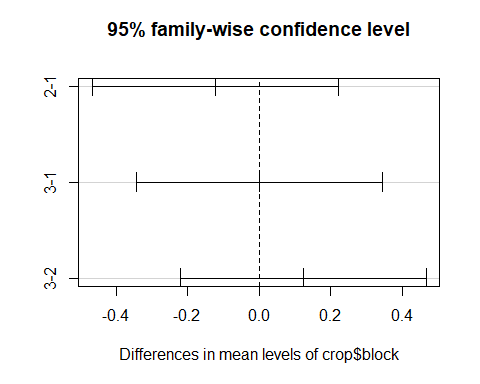
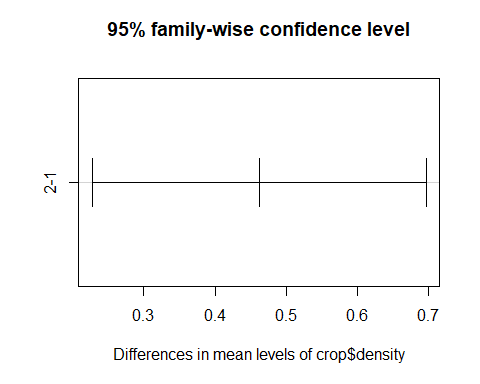
## Warning in replications(paste("~", xx), data = mf): non-factors ignored:  
## crop$fertilizer

## Warning in TukeyHSD.aov(crop.aov): 'which' especificó algunos no-factores que  
## se eliminarán

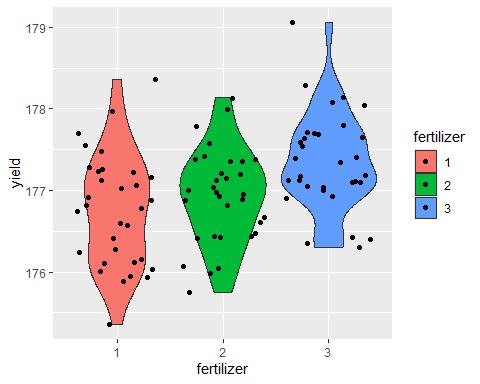
## Tukey multiple comparisons of means  
## 95% family-wise confidence level  
##   
## Fit: aov(formula = crop$yield ~ crop$fertilizer + crop$density + crop$block)  
##   
## $`crop$density`  
## diff lwr upr p adj  
## 2-1 0.461956 0.2275205 0.6963916 0.0001741  
##   
## $`crop$block`  
## diff lwr upr p adj  
## 2-1 -0.1233941 -0.4677878 0.2209997 0.6707894  
## 3-1 0.0000000 -0.3443938 0.3443938 1.0000000  
## 3-2 0.1233941 -0.2209997 0.4677878 0.6707894

plot(TukeyHSD(crop.aov))

## Warning in replications(paste("~", xx), data = mf): non-factors ignored:  
## crop$fertilizer  
## Warning in replications(paste("~", xx), data = mf): 'which' especificó algunos  
## no-factores que se eliminarán



#gráfica de violin con boxplot  
library(ggplot2)  
ggplot(crop,aes(x=fertilizer,y=yield,fill =  
 fertilizer))+  
 geom\_violin()+  
 geom\_jitter()



#geom\_boxplot()  
theme\_light()

## <theme> List of 144  
## $ line : <ggplot2::element\_line>  
## ..@ colour : chr "black"  
## ..@ linewidth : num 0.5  
## ..@ linetype : num 1  
## ..@ lineend : chr "butt"  
## ..@ linejoin : chr "round"  
## ..@ arrow : logi FALSE  
## ..@ arrow.fill : chr "black"  
## ..@ inherit.blank: logi TRUE  
## $ rect : <ggplot2::element\_rect>  
## ..@ fill : chr "white"  
## ..@ colour : chr "black"  
## ..@ linewidth : num 0.5  
## ..@ linetype : num 1  
## ..@ linejoin : chr "round"  
## ..@ inherit.blank: logi TRUE  
## $ text : <ggplot2::element\_text>  
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## ..@ face : chr "plain"  
## ..@ italic : chr NA  
## ..@ fontweight : num NA  
## ..@ fontwidth : num NA  
## ..@ colour : chr "black"  
## ..@ size : num 11  
## ..@ hjust : num 0.5  
## ..@ vjust : num 0.5  
## ..@ angle : num 0  
## ..@ lineheight : num 0.9  
## ..@ margin : <ggplot2::margin> num [1:4] 0 0 0 0  
## ..@ debug : logi FALSE  
## ..@ inherit.blank: logi TRUE  
## $ title : <ggplot2::element\_text>  
## ..@ family : NULL  
## ..@ face : NULL  
## ..@ italic : chr NA  
## ..@ fontweight : num NA  
## ..@ fontwidth : num NA  
## ..@ colour : NULL  
## ..@ size : NULL  
## ..@ hjust : NULL  
## ..@ vjust : NULL  
## ..@ angle : NULL  
## ..@ lineheight : NULL  
## ..@ margin : NULL  
## ..@ debug : NULL  
## ..@ inherit.blank: logi TRUE  
## $ point : <ggplot2::element\_point>  
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## ..@ shape : num 19  
## ..@ size : num 1.5  
## ..@ fill : chr "white"  
## ..@ stroke : num 0.5  
## ..@ inherit.blank: logi TRUE  
## $ polygon : <ggplot2::element\_polygon>  
## ..@ fill : chr "white"  
## ..@ colour : chr "black"  
## ..@ linewidth : num 0.5  
## ..@ linetype : num 1  
## ..@ linejoin : chr "round"  
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## $ geom : <ggplot2::element\_geom>  
## ..@ ink : chr "black"  
## ..@ paper : chr "white"  
## ..@ accent : chr "#3366FF"  
## ..@ linewidth : num 0.5  
## ..@ borderwidth: num 0.5  
## ..@ linetype : int 1  
## ..@ bordertype : int 1  
## ..@ family : chr ""  
## ..@ fontsize : num 3.87  
## ..@ pointsize : num 1.5  
## ..@ pointshape : num 19  
## ..@ colour : NULL  
## ..@ fill : NULL  
## $ spacing : 'simpleUnit' num 5.5points  
## ..- attr(\*, "unit")= int 8  
## $ margins : <ggplot2::margin> num [1:4] 5.5 5.5 5.5 5.5  
## $ aspect.ratio : NULL  
## $ axis.title : NULL  
## $ axis.title.x : <ggplot2::element\_text>  
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## ..@ face : NULL  
## ..@ italic : chr NA  
## ..@ fontweight : num NA  
## ..@ fontwidth : num NA  
## ..@ colour : NULL  
## ..@ size : NULL  
## ..@ hjust : NULL  
## ..@ vjust : num 1  
## ..@ angle : NULL  
## ..@ lineheight : NULL  
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## $ axis.title.x.top : <ggplot2::element\_text>  
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## ..@ face : NULL  
## ..@ italic : chr NA  
## ..@ fontweight : num NA  
## ..@ fontwidth : num NA  
## ..@ colour : NULL  
## ..@ size : NULL  
## ..@ hjust : NULL  
## ..@ vjust : num 0  
## ..@ angle : NULL  
## ..@ lineheight : NULL  
## ..@ margin : <ggplot2::margin> num [1:4] 0 0 2.75 0  
## ..@ debug : NULL  
## ..@ inherit.blank: logi TRUE  
## $ axis.title.x.bottom : NULL  
## $ axis.title.y : <ggplot2::element\_text>  
## ..@ family : NULL  
## ..@ face : NULL  
## ..@ italic : chr NA  
## ..@ fontweight : num NA  
## ..@ fontwidth : num NA  
## ..@ colour : NULL  
## ..@ size : NULL  
## ..@ hjust : NULL  
## ..@ vjust : num 1  
## ..@ angle : num 90  
## ..@ lineheight : NULL  
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## $ axis.title.y.left : NULL  
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## ..@ face : NULL  
## ..@ italic : chr NA  
## ..@ fontweight : num NA  
## ..@ fontwidth : num NA  
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## ..@ size : NULL  
## ..@ hjust : NULL  
## ..@ vjust : num 1  
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## ..@ angle : NULL  
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## ..@ margin : NULL  
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## ..@ fontweight : num NA  
## ..@ fontwidth : num NA  
## ..@ colour : NULL  
## ..@ size : NULL  
## ..@ hjust : NULL  
## ..@ vjust : num 1  
## ..@ angle : NULL  
## ..@ lineheight : NULL  
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## ..@ angle : NULL  
## ..@ lineheight : NULL  
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## ..@ fontwidth : num NA  
## ..@ colour : NULL  
## ..@ size : NULL  
## ..@ hjust : num 1  
## ..@ vjust : NULL  
## ..@ angle : NULL  
## ..@ lineheight : NULL  
## ..@ margin : <ggplot2::margin> num [1:4] 0 2.2 0 0  
## ..@ debug : NULL  
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## ..@ size : NULL  
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## ..@ angle : NULL  
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## $ axis.ticks.y.right : NULL  
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## $ axis.ticks.r : NULL  
## $ axis.minor.ticks.x.top : NULL  
## $ axis.minor.ticks.x.bottom : NULL  
## $ axis.minor.ticks.y.left : NULL  
## $ axis.minor.ticks.y.right : NULL  
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## $ axis.minor.ticks.r : NULL  
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## $ axis.ticks.length.x : NULL  
## $ axis.ticks.length.x.top : NULL  
## $ axis.ticks.length.x.bottom : NULL  
## $ axis.ticks.length.y : NULL  
## $ axis.ticks.length.y.left : NULL  
## $ axis.ticks.length.y.right : NULL  
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## $ axis.minor.ticks.length.y.right : NULL  
## $ axis.minor.ticks.length.theta : NULL  
## $ axis.minor.ticks.length.r : NULL  
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## $ axis.line.x.bottom : NULL  
## $ axis.line.y : NULL  
## $ axis.line.y.left : NULL  
## $ axis.line.y.right : NULL  
## $ axis.line.theta : NULL  
## $ axis.line.r : NULL  
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## ..@ linejoin : NULL  
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## $ legend.spacing.y : NULL  
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## $ legend.key.width : NULL  
## $ legend.key.spacing : NULL  
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## ..@ vjust : NULL  
## ..@ angle : NULL  
## ..@ lineheight : NULL  
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## $ legend.byrow : NULL  
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## $ legend.justification.bottom : NULL  
## $ legend.justification.left : NULL  
## $ legend.justification.right : NULL  
## $ legend.justification.inside : NULL  
## [list output truncated]  
## @ complete: logi TRUE  
## @ validate: logi TRUE

#ANOVA 1 Factor o unifactorial

#Ana Gabriela Gauna Rodríguez

#18/09/2025

#Análisis de varianza

#Productividad

read.csv("crop.csv",header=T)

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

crop$density <- as.factor(crop$density)

crop$block <- as.factor(crop$fertilizer)

summary(crop)

#Boxplot

boxplot(crop$yield~crop$fertilizer,

col="purple",

main="Visualización de fertilizantes",

xlab = "Tipos de fertilizante",

ylab = "Rendimiento (ton/ha")

tapply(crop$yield,crop$fertilizer,mean)

tapply(crop$yield,crop$fertilizer,var)

#Prueba de normalidad de datos todos juntos

shapiro.test(crop$yield)

#por separado

#Prueba de normalidad de datos para cada fertilizante

#combinado subset y shapiro

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

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

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

#homogeneidad de varianza Bartlett

bartlett.test(crop$yield~crop$fertilizer)

#ANOVA unifactoreal

crop.aov <- aov(crop$yield~crop$fertilizer)

#ANOVA dos factores o por bloques

crop.aov <- aov(crop$yield ~ crop$fertilizer+crop$density+crop$block)

summary(crop.aov)

crop$fertilizer <- factor(crop$fertilizer)

#LSD diferencia mínima en las medias

qt(0.975,93)

sqrt((2\*0.38595)/32)\*qt(0.975,93)

tapply(crop$yield,crop$fertilizer,mean)

#diferencia de medias F1 vs F2

176.7570-176.9332

# diferencia de medias F2 vs F3

176.9332-177.3562

# diferencia de medias F1 vs F3

176.7570-177.3562

#Prueba de Tukey diferencia mínima que se require

sqrt((2\*0.38595)/32)\*qtukey(0.95,nmeans = 3,df=93)

#tukeyhsd tiene el complemento hsd no tiene tukey solo

TukeyHSD(crop.aov)

plot(TukeyHSD(crop.aov))

#gráfica de violin con boxplot

library(ggplot2)

ggplot(crop,aes(x=fertilizer,y=yield,fill =

fertilizer))+

geom\_violin()+

geom\_jitter()

#geom\_boxplot()

theme\_light()