Supervivencia

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```
library(survival)
str(lung)
```

```
## 'data.frame':    228 obs. of  10 variables:
##  $ inst     : num  3 3 3 5 1 12 7 11 1 7 ...
##  $ time     : num  306 455 1010 210 883 ...
##  $ status   : num  2 2 1 2 2 1 2 2 2 2 ...
##  $ age      : num  74 68 56 57 60 74 68 71 53 61 ...
##  $ sex      : num  1 1 1 1 1 1 2 2 1 1 ...
##  $ ph.ecog  : num  1 0 0 1 0 1 2 2 1 2 ...
##  $ ph.karno : num  90 90 90 90 100 50 70 60 70 70 ...
##  $ pat.karno: num  100 90 90 60 90 80 60 80 80 70 ...
##  $ meal.cal : num  1175 1225 NA 1150 NA ...
##  $ wt.loss  : num  NA 15 15 11 0 0 10 1 16 34 ...
```

```
library(km.ci)
```

Asignacion:

#Asumir los datos como un cultivo de palma #Time = Tiempo, Variable respuesta: Tiempo de supervivencia #Edad = Age meses de plantación #Hibrido = sexo #Severidad = ph.ecog Severidad en la misma escala #Nitrogeno M 17 n17= meal.cal : Nitrogeno medido en hoja 17 # P17 = wt.losss: Fosforo medido en la hoja 17

#Definiciones preliminares

Elaeis guineensis

```
Supeg<-Surv(SupEG$Tiempo, SupEG$Estado)
```

```
Eg.fit<-survfit(Supeg~1)
summary(Eg.fit)
```

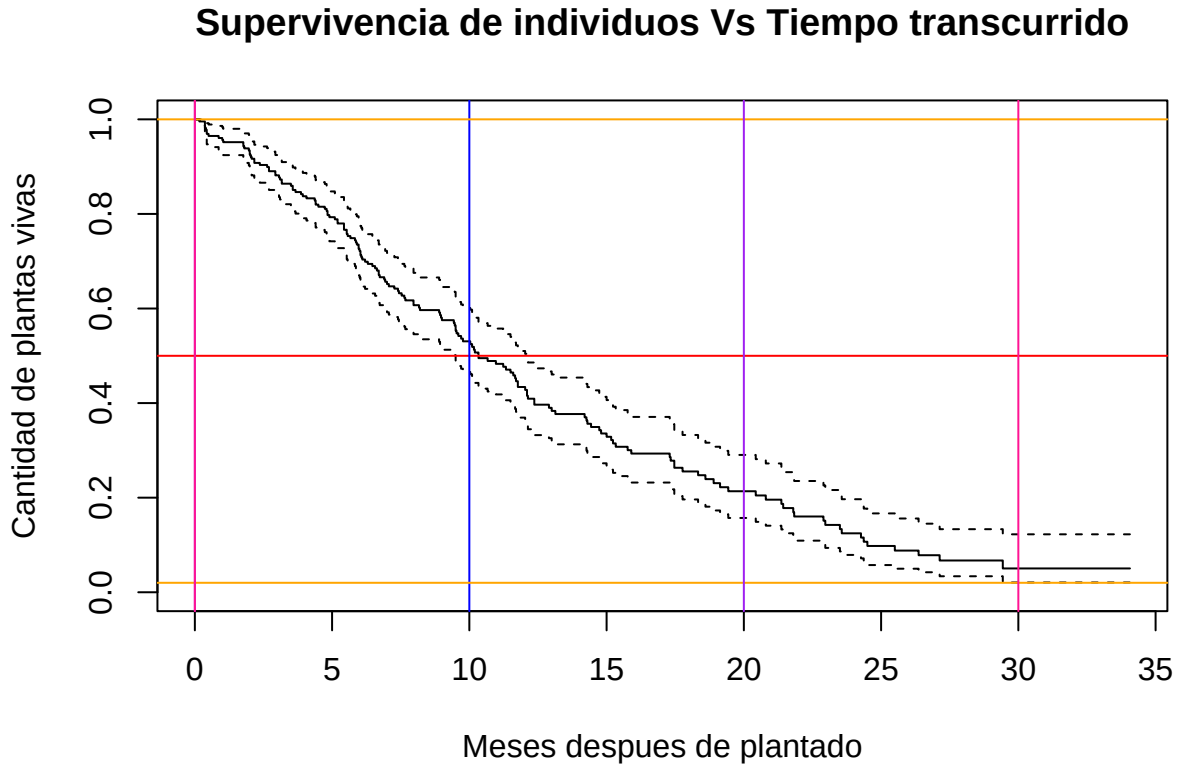
```
## Call: survfit(formula = Supeg ~ 1)
##
##    time n.risk n.event survival std.err lower 95% CI upper 95% CI
##   0.167    228       1   0.9956 0.00438       0.9871        1.000
##   0.367    227       3   0.9825 0.00869       0.9656        1.000
##   0.400    224       1   0.9781 0.00970       0.9592        0.997
##   0.433    223       2   0.9693 0.01142       0.9472        0.992
##   0.500    221       1   0.9649 0.01219       0.9413        0.989
##   0.867    220       1   0.9605 0.01290       0.9356        0.986
##   1.000    219       1   0.9561 0.01356       0.9299        0.983
```

```
##   1.033   218      1   0.9518 0.01419      0.9243       0.980
##   1.767   217      2   0.9430 0.01536      0.9134       0.974
##   1.800   215      1   0.9386 0.01590      0.9079       0.970
##   1.967   214      1   0.9342 0.01642      0.9026       0.967
##   2.000   213      2   0.9254 0.01740      0.8920       0.960
##   2.033   211      1   0.9211 0.01786      0.8867       0.957
##   2.067   210      1   0.9167 0.01830      0.8815       0.953
##   2.167   209      2   0.9079 0.01915      0.8711       0.946
##   2.367   207      1   0.9035 0.01955      0.8660       0.943
##   2.633   206      1   0.8991 0.01995      0.8609       0.939
##   2.700   205      2   0.8904 0.02069      0.8507       0.932
##   2.933   203      2   0.8816 0.02140      0.8406       0.925
##   3.067   201      1   0.8772 0.02174      0.8356       0.921
##   3.100   199      1   0.8728 0.02207      0.8306       0.917
##   3.167   198      2   0.8640 0.02271      0.8206       0.910
##   3.500   196      1   0.8596 0.02302      0.8156       0.906
##   3.567   194      2   0.8507 0.02362      0.8056       0.898
##   3.667   192      1   0.8463 0.02391      0.8007       0.894
##   3.867   191      1   0.8418 0.02419      0.7957       0.891
##   3.933   190      1   0.8374 0.02446      0.7908       0.887
##   4.067   189      1   0.8330 0.02473      0.7859       0.883
##   4.367   188      1   0.8285 0.02500      0.7810       0.879
##   4.400   187      2   0.8197 0.02550      0.7712       0.871
##   4.500   185      1   0.8153 0.02575      0.7663       0.867
##   4.733   184      1   0.8108 0.02598      0.7615       0.863
##   4.800   183      1   0.8064 0.02622      0.7566       0.859
##   4.833   182      2   0.7975 0.02667      0.7469       0.852
##   4.900   180      1   0.7931 0.02688      0.7421       0.848
##   5.100   179      1   0.7887 0.02710      0.7373       0.844
##   5.200   178      2   0.7798 0.02751      0.7277       0.836
##   5.433   176      3   0.7665 0.02809      0.7134       0.824
##   5.533   173      2   0.7577 0.02845      0.7039       0.816
##   5.567   171      1   0.7532 0.02863      0.6991       0.811
##   5.667   170      1   0.7488 0.02880      0.6944       0.807
##   5.833   167      1   0.7443 0.02898      0.6896       0.803
##   5.867   165      1   0.7398 0.02915      0.6848       0.799
##   5.900   164      1   0.7353 0.02932      0.6800       0.795
##   5.967   162      2   0.7262 0.02965      0.6704       0.787
##   6.000   160      1   0.7217 0.02981      0.6655       0.783
##   6.033   159      2   0.7126 0.03012      0.6559       0.774
##   6.067   157      1   0.7081 0.03027      0.6511       0.770
##   6.100   156      1   0.7035 0.03041      0.6464       0.766
##   6.200   154      1   0.6989 0.03056      0.6416       0.761
##   6.300   152      1   0.6943 0.03070      0.6367       0.757
##   6.467   149      1   0.6897 0.03085      0.6318       0.753
##   6.567   147      1   0.6850 0.03099      0.6269       0.749
##   6.633   145      1   0.6803 0.03113      0.6219       0.744
##   6.700   144      2   0.6708 0.03141      0.6120       0.735
##   6.733   142      1   0.6661 0.03154      0.6071       0.731
##   6.900   139      1   0.6613 0.03168      0.6020       0.726
##   6.933   138      1   0.6565 0.03181      0.5970       0.722
##   7.000   137      1   0.6517 0.03194      0.5920       0.717
##   7.067   135      1   0.6469 0.03206      0.5870       0.713
##   7.267   134      1   0.6421 0.03218      0.5820       0.708
```

```
##   7.400    132       1   0.6372 0.03231       0.5769       0.704
##   7.433    130       1   0.6323 0.03243       0.5718       0.699
##   7.533    126       1   0.6273 0.03256       0.5666       0.694
##   7.633    125       1   0.6223 0.03268       0.5614       0.690
##   7.667    124       1   0.6172 0.03280       0.5562       0.685
##   7.967    121       2   0.6070 0.03304       0.5456       0.675
##   8.167    117       1   0.6019 0.03316       0.5402       0.670
##   8.200    116       1   0.5967 0.03328       0.5349       0.666
##   8.900    112       1   0.5913 0.03341       0.5294       0.661
##   8.933    111       1   0.5860 0.03353       0.5239       0.656
##   8.967    110       1   0.5807 0.03364       0.5184       0.651
##   9.000    108       1   0.5753 0.03376       0.5128       0.645
##   9.433    104       1   0.5698 0.03388       0.5071       0.640
##   9.467    103       1   0.5642 0.03400       0.5014       0.635
##   9.500    101       2   0.5531 0.03424       0.4899       0.624
##   9.533     99       1   0.5475 0.03434       0.4841       0.619
##   9.600     98       1   0.5419 0.03444       0.4784       0.614
##   9.700     97       1   0.5363 0.03454       0.4727       0.608
##   9.767     94       1   0.5306 0.03464       0.4669       0.603
##  10.033     91       1   0.5248 0.03475       0.4609       0.597
##  10.100     89       1   0.5189 0.03485       0.4549       0.592
##  10.167     87       1   0.5129 0.03496       0.4488       0.586
##  10.200     86       1   0.5070 0.03506       0.4427       0.581
##  10.333     85       2   0.4950 0.03523       0.4306       0.569
##  10.667     82       1   0.4890 0.03532       0.4244       0.563
##  10.967     81       1   0.4830 0.03539       0.4183       0.558
##  11.233     79       1   0.4768 0.03547       0.4121       0.552
##  11.333     78       1   0.4707 0.03554       0.4060       0.546
##  11.500     77       1   0.4646 0.03560       0.3998       0.540
##  11.600     76       1   0.4585 0.03565       0.3937       0.534
##  11.667     75       1   0.4524 0.03569       0.3876       0.528
##  11.700     74       1   0.4463 0.03573       0.3815       0.522
##  11.767     73       2   0.4340 0.03578       0.3693       0.510
##  12.033     70       1   0.4278 0.03581       0.3631       0.504
##  12.100     69       2   0.4154 0.03583       0.3508       0.492
##  12.133     67       1   0.4092 0.03582       0.3447       0.486
##  12.367     65       2   0.3966 0.03581       0.3323       0.473
##  12.900     60       1   0.3900 0.03582       0.3258       0.467
##  13.000     59       1   0.3834 0.03582       0.3193       0.460
##  13.133     58       1   0.3768 0.03580       0.3128       0.454
##  14.200     55       1   0.3700 0.03580       0.3060       0.447
##  14.267     54       1   0.3631 0.03579       0.2993       0.440
##  14.300     53       1   0.3563 0.03576       0.2926       0.434
##  14.433     52       1   0.3494 0.03573       0.2860       0.427
##  14.733     51       1   0.3426 0.03568       0.2793       0.420
##  14.800     50       1   0.3357 0.03561       0.2727       0.413
##  15.000     48       1   0.3287 0.03555       0.2659       0.406
##  15.167     47       1   0.3217 0.03548       0.2592       0.399
##  15.233     46       1   0.3147 0.03539       0.2525       0.392
##  15.333     44       1   0.3076 0.03530       0.2456       0.385
##  15.767     43       1   0.3004 0.03520       0.2388       0.378
##  15.900     42       1   0.2933 0.03508       0.2320       0.371
##  17.300     39       1   0.2857 0.03498       0.2248       0.363
##  17.333     38       1   0.2782 0.03485       0.2177       0.356
```

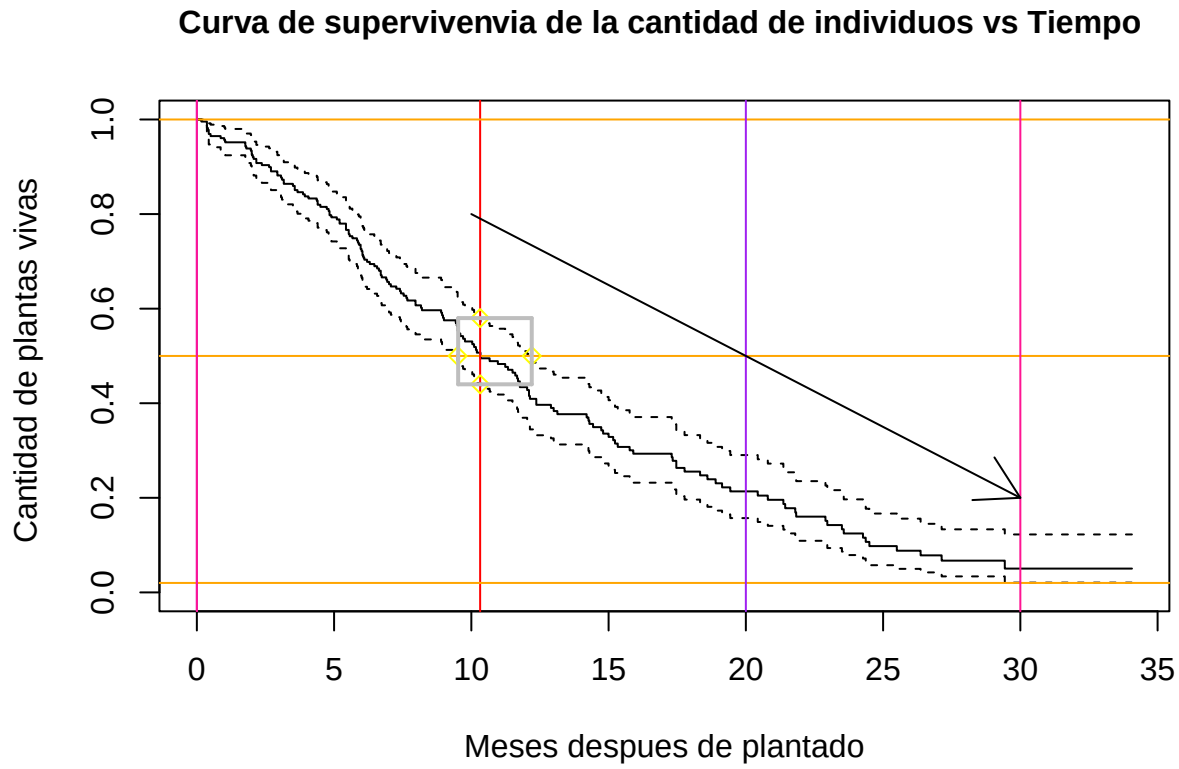
```
##  17.467     37       2   0.2632 0.03455       0.2035        0.340
##  17.767     34       1   0.2554 0.03439       0.1962        0.333
##  18.333     32       1   0.2475 0.03423       0.1887        0.325
##  18.600     30       1   0.2392 0.03407       0.1810        0.316
##  18.900     28       1   0.2307 0.03391       0.1729        0.308
##  19.133     27       1   0.2221 0.03371       0.1650        0.299
##  19.433     26       1   0.2136 0.03348       0.1571        0.290
##  20.433     24       1   0.2047 0.03325       0.1489        0.281
##  20.800     23       1   0.1958 0.03297       0.1407        0.272
##  21.367     22       1   0.1869 0.03265       0.1327        0.263
##  21.433     21       1   0.1780 0.03229       0.1247        0.254
##  21.800     20       1   0.1691 0.03188       0.1169        0.245
##  21.833     19       1   0.1602 0.03142       0.1091        0.235
##  22.900     18       1   0.1513 0.03090       0.1014        0.226
##  22.967     17       1   0.1424 0.03034       0.0938        0.216
##  23.500     16       1   0.1335 0.02972       0.0863        0.207
##  23.567     15       1   0.1246 0.02904       0.0789        0.197
##  24.267     14       1   0.1157 0.02830       0.0716        0.187
##  24.367     13       1   0.1068 0.02749       0.0645        0.177
##  24.500     12       1   0.0979 0.02660       0.0575        0.167
##  25.500     10       1   0.0881 0.02568       0.0498        0.156
##  26.367      9       1   0.0783 0.02462       0.0423        0.145
##  27.133      7       1   0.0671 0.02351       0.0338        0.133
##  29.433      4       1   0.0503 0.02285       0.0207        0.123
```

```r
plot(Eg.fit,xlab="Meses despues de plantado",ylab="Cantidad de plantas vivas")
title("Supervivencia de individuos Vs Tiempo transcurrido")
abline(h = 0.5, col='red')
abline(v = 10, col='blue')
abline(h = c(0.02, 1), col='orange')
abline(v = c(0, 20), col='purple')
abline(v = c(0, 30), col='deeppink')
```

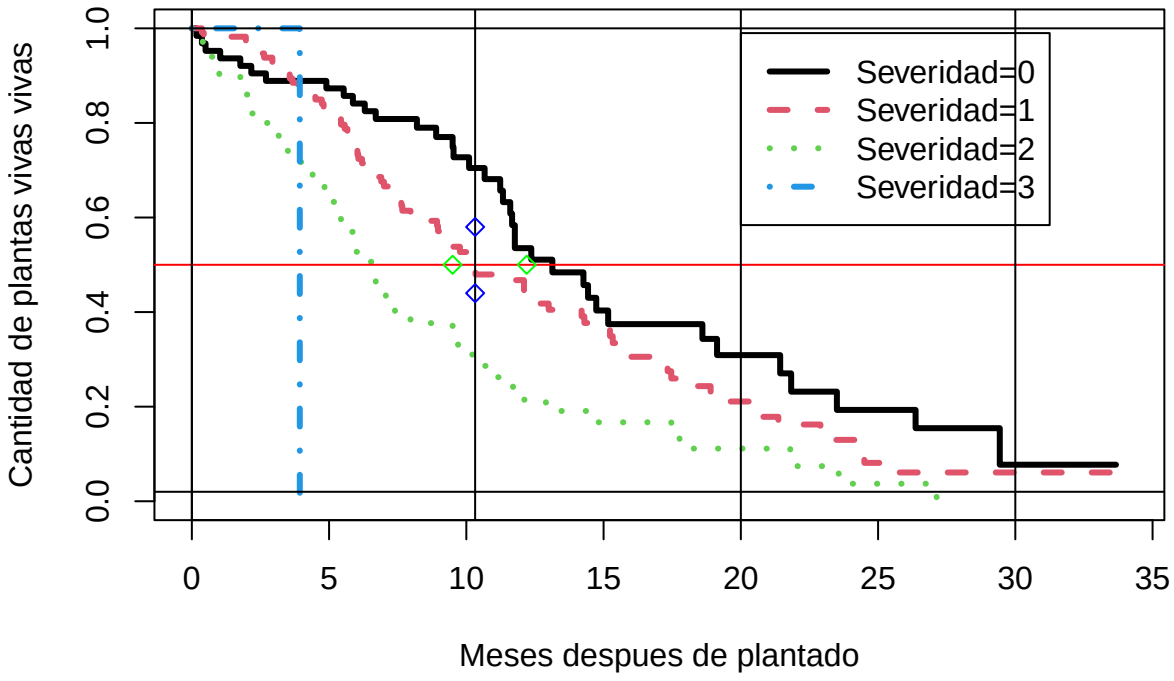



```
plot(Eg.fit,xlab="Meses despues de plantado",ylab="Cantidad de plantas vivas ")
title("Curva de supervivenvia de la cantidad de individuos vs Tiempo ", cex.main = 1 )
abline(h = 0.5, col='orange')
abline(v = 10.32, col='red')
abline(h = c(0.02, 1), col='orange')
abline(v = c(0, 20), col='purple')
abline(v = c(0, 30), col='deeppink')
points(c(10.32, 10.32), c(0.44, 0.58), pch =23, col='yellow')
points(c(9.5, 12.2), c(0.5, 0.5), pch =23, col='yellow')
segments(x0 = 9.52,
         x1 = 12.2,
         y0 = 0.44,
         y1 = 0.44,
         lwd = 2,
         col = "grey")
segments(x0 = 9.52,
         x1 = 12.2,
         y0 = 0.58,
         y1 = 0.58,
         lwd = 2,
         col = "grey")
segments(x0 = 9.52,
         x1 = 9.52,
         y0 = 0.44,
         y1 = 0.58,
         lwd = 2,
         col = "grey")
segments(x0 = 12.2,
         x1 = 12.2,
```

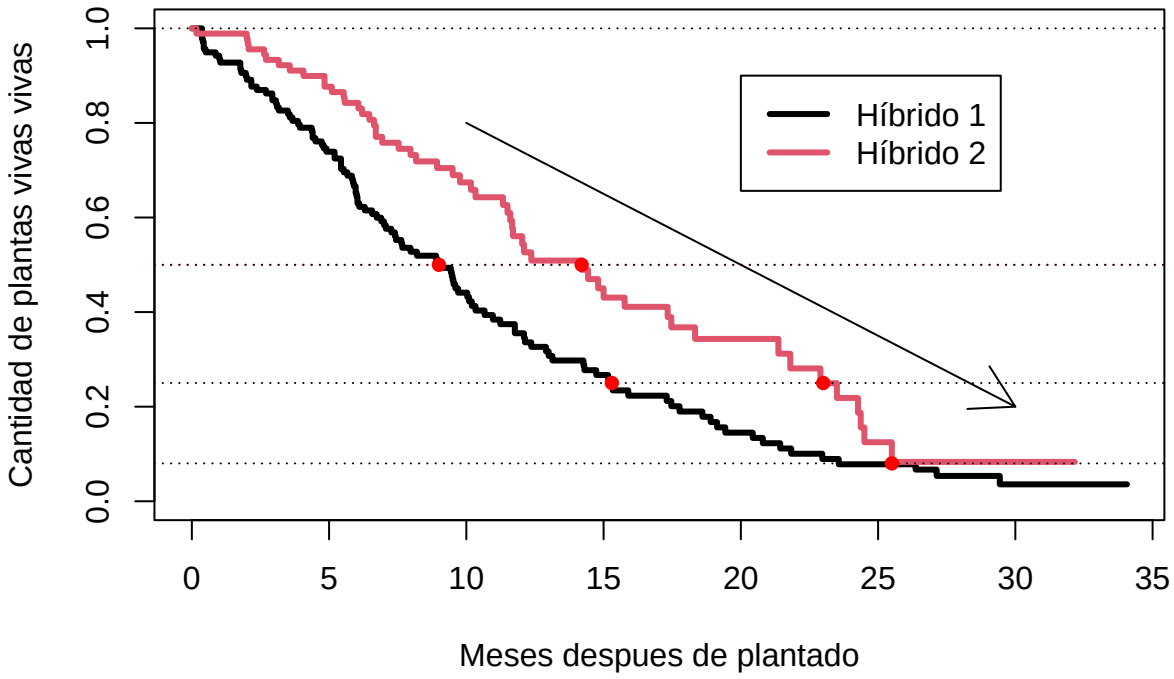
```
          y0 = 0.44,
          y1 = 0.58,
          lwd = 2,
          col = "grey")
arrows(x0 = 10,
       x1 = 30,
       y0 = 0.8,
       y1 = 0.2)
```




```
Eg.fit.strata<-survfit(Supeg~Severidad,SupEG)
plot(Eg.fit.strata, lty = 1:4,col=1:4,xlab="Meses despues de plantado",ylab="Cantidad de plantas vivas
     lwd=3)
title("Supervivencia de la palma por daño causado por la severidad ")
legend(20, .99, c("Severidad=0", "Severidad=1","Severidad=2","Severidad=3"), lty = 1:4,col=1:4, lwd=3)
abline(h = 0.5, col = 'red')
abline(v = 10.32, col='black')
abline(h = c(0.02, 1), col='black')
abline(v = c(0, 20), col='black')
abline(v = c(0, 30), col='black')
points(c(10.32, 10.32), c(0.44, 0.58), pch =23, col='blue')
points(c(9.5, 12.2), c(0.5, 0.5), pch =23, col='green')
```

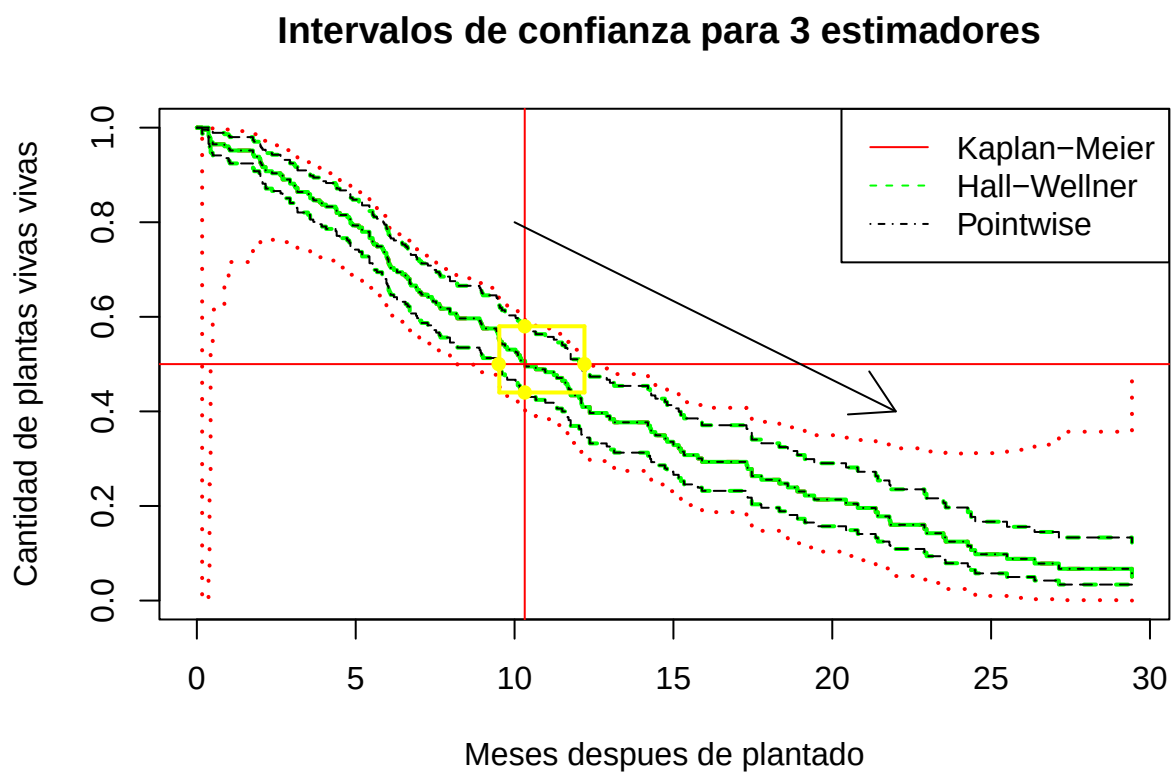



```
Eg.fit.strata<-survfit(Supeg~Hibrido,SupEG)
plot(Eg.fit.strata, col=1:2, xlab = 'Meses despues de plantado',ylab ="Cantidad de plantas vivas vivas"
title("Supervivencia de la palma segun tipo de hibrido ")
legend(20, .9, c("Híbrido 1", "Híbrido 2"), col=1:2, lwd=3)
abline(h = 0.5, col='red',lty = 3:3)
abline(h = 0.25, col=1:2, lwd=1,lty = 3:3)
abline(h = 0.08, col=1:2, lwd=1,lty = 3:3)
abline(h = c(0.5, 1), col='black',lty = 3:3)
points(c(9, 14.2, 15.3, 23, 25.5  ), c(0.5, 0.5, 0.25, 0.25, 0.08), pch =16, col='red')
arrows(x0 = 10,
       x1 = 30,
       y0 = 0.8,
       y1 = 0.2)
```

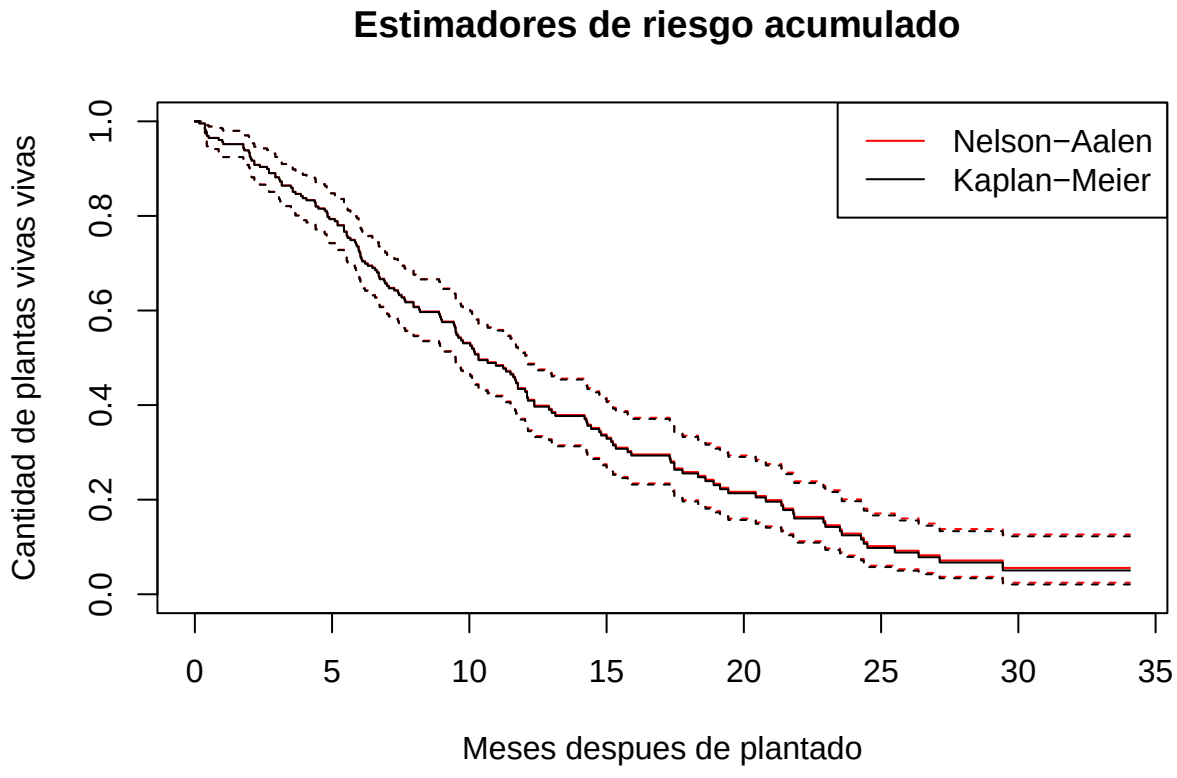



```
a<-km.ci(Eg.fit, conf.level=0.95, tl=NA, tu=NA, method="loghall")

plot(a, lty=2, lwd=2,xlab = 'Meses despues de plantado',ylab ="Cantidad de plantas vivas vivas", col =
lines(Eg.fit, lwd=2, lty=1, col = 'green')
lines(Eg.fit, lwd=1, lty=4, conf.int=T, col = 'black')
linetype<-c(1, 2, 4)
title("Intervalos de confianza para 3 estimadores ")
legend(x = "topright", .9, c("Kaplan-Meier", "Hall-Wellner", "Pointwise"),
       lty = linetype,
       col = c('red', 'green', 'black'))

abline(h = 0.5, col ='red')
abline(v = 10.32, col ='red')
points(c(10.32,10.32), c(0.44,0.58), pch = 16, col='yellow') #Probabilidad de supervivencia
points(c(280,360), c(0.5,0.5), pch = 16, col='yellow') # Tiempo
points(c(9.5, 12.2), c(0.5, 0.5), pch =16, col='yellow')
segments(x0 = 9.52,
         x1 = 12.2,
         y0 = 0.44,
         y1 = 0.44,
         lwd = 2,
         col = "yellow")
segments(x0 = 9.52,
         x1 = 12.2,
         y0 = 0.58,
         y1 = 0.58,
         lwd = 2,
         col = "yellow")
segments(x0 = 9.52,
```

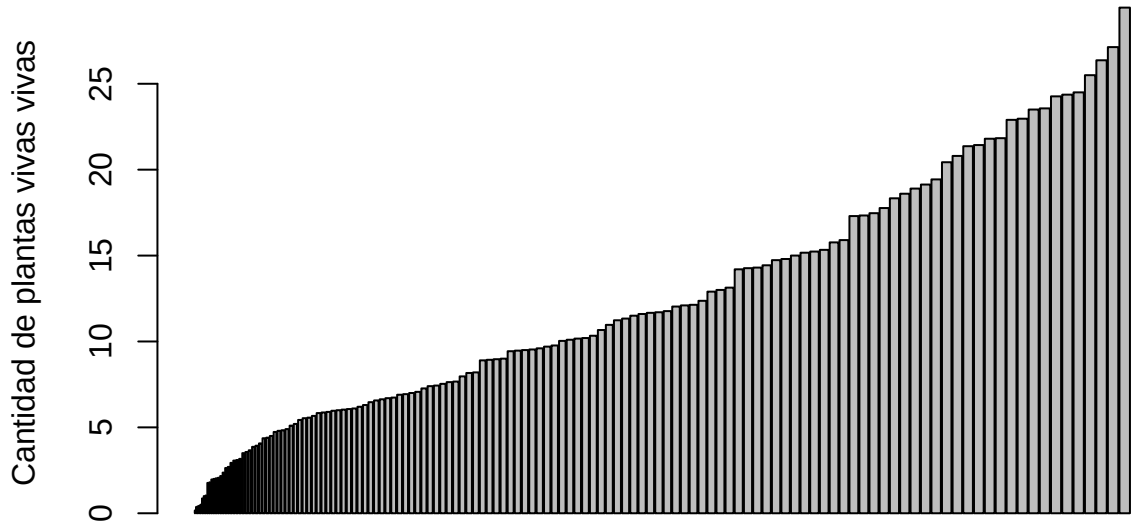
```
         x1 = 9.52,
         y0 = 0.44,
         y1 = 0.58,
         lwd = 2,
         col = "yellow")
segments(x0 = 12.2,
         x1 = 12.2,
         y0 = 0.44,
         y1 = 0.58,
         lwd = 2,
         col = "yellow")
arrows(x0 = 10,
       x1 = 22,
       y0 = 0.8,
       y1 = 0.4)
```



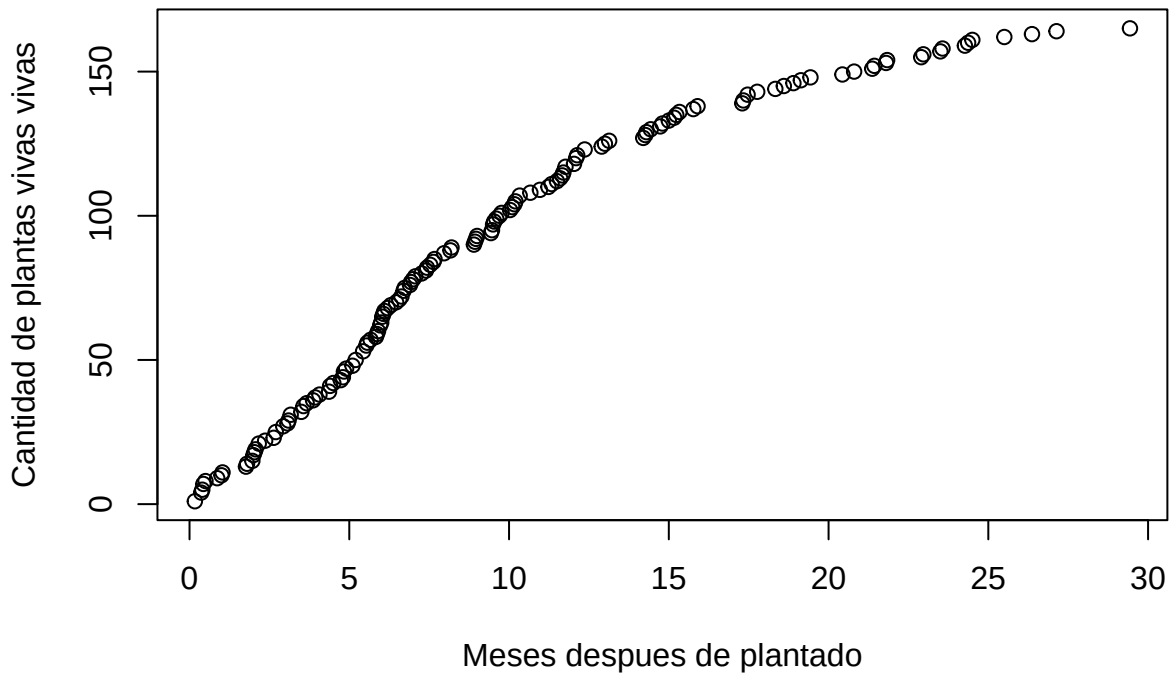

```
aalen.fit<- survfit(coxph(Supeg~1), type="aalen")
sum_aalen.fit = summary(aalen.fit)

plot(aalen.fit,xlab = 'Meses despues de plantado',ylab ="Cantidad de plantas vivas vivas", col="red",lwd
title("Estimadores de riesgo acumulado ")
lines(Eg.fit, lwd=1, lty=1)
legend("topright", .9,
       c("Nelson-Aalen", "Kaplan-Meier"),
       lty=c(1,1),
       col=c("red", "black"))
```




```
barplot(sum_aalen.fit$time, cumsum(sum_aalen.fit$n.event),xlab = 'Tiempo al evento: evento de interes.'
```



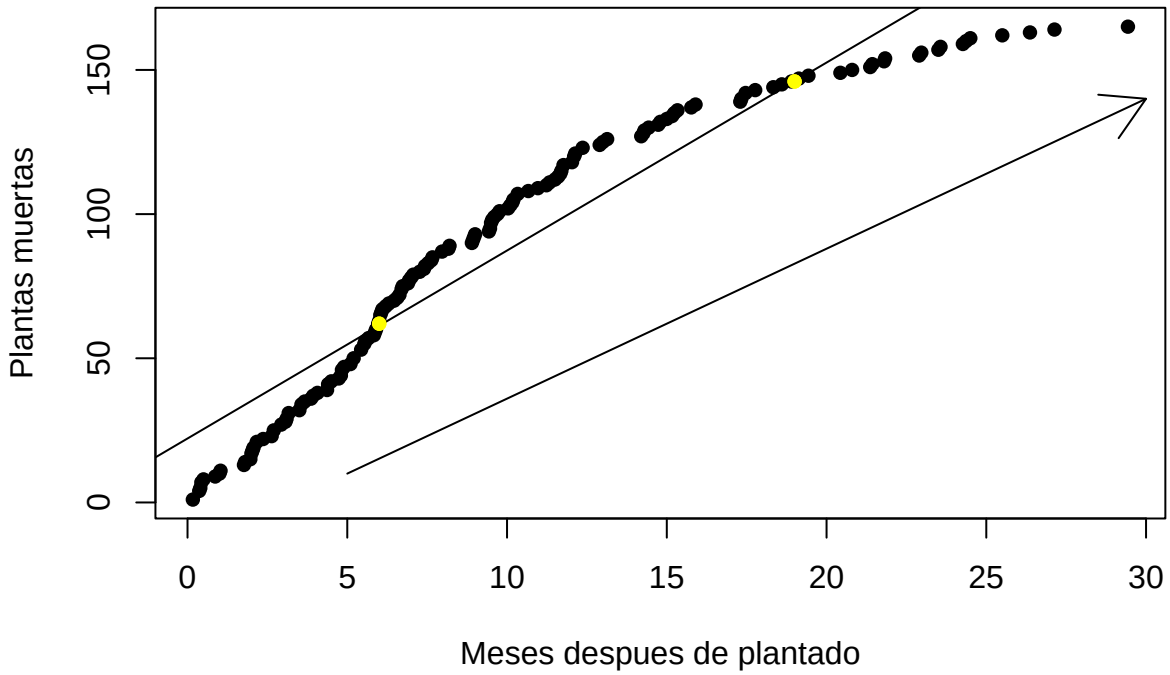

```
plot(sum_aalen.fit$time, cumsum(sum_aalen.fit$n.event),xlab = 'Meses despues de plantado',ylab ="Cantida
title("Curva de muertes acumuladas en funcion del Tiempo")
```




```
mod_suv = lm(cumsum(sum_aalen.fit$n.event) ~ sum_aalen.fit$time)
summary(mod_suv)
```

```
##
## Call:
## lm(formula = cumsum(sum_aalen.fit$n.event) ~ sum_aalen.fit$time)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -49.044 -11.535   4.049  12.868  20.208
##
## Coefficients:
##                     Estimate Std. Error t value Pr(>|t|)
## (Intercept)          22.1780     2.1715   10.21   <2e-16 ***
## sum_aalen.fit$time    6.5187     0.1773   36.76   <2e-16 ***
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 14.43 on 137 degrees of freedom
## Multiple R-squared:  0.908,  Adjusted R-squared:  0.9073
## F-statistic:  1352 on 1 and 137 DF,  p-value: < 2.2e-16
```

```
plot(sum_aalen.fit$time, cumsum(sum_aalen.fit$n.event),xlab="Meses despues de plantado",ylab="Plantas mu
abline(mod_suv)
points(c(6, 6), c(62, 62), pch =16, col='yellow')
points(c(19, 19), c(146, 146), pch =16, col='yellow')
arrows(x0 = 5,
       x1 = 30,
       y0 = 10,
       y1 = 140)
```




```
survdiff(Supeg~Severidad,SupEG)
```

```
## Call:
## survdiff(formula = Supeg ~ Severidad, data = SupEG)
##
## n=227, 1 observation deleted due to missingness.
##
##                N Observed Expected (O-E)^2/E (O-E)^2/V
## Severidad=0   63       37   54.153    5.4331    8.2119
## Severidad=1 113       82   83.528    0.0279    0.0573
## Severidad=2  50       44   26.147   12.1893   14.6491
## Severidad=3   1        1    0.172    3.9733    4.0040
##
##  Chisq= 22  on 3 degrees of freedom, p= 7e-05
```

```
survdiff(Supeg~Hibrido,SupEG, rho = 0)
```

```
## Call:
## survdiff(formula = Supeg ~ Hibrido, data = SupEG, rho = 0)
##
##              N Observed Expected (O-E)^2/E (O-E)^2/V
## Hibrido=1 138      112     91.6      4.55      10.3
## Hibrido=2  90       53     73.4      5.68      10.3
##
##  Chisq= 10.3  on 1 degrees of freedom, p= 0.001
```

```
survdiff(Supeg~Hibrido,SupEG, rho = 1)
```

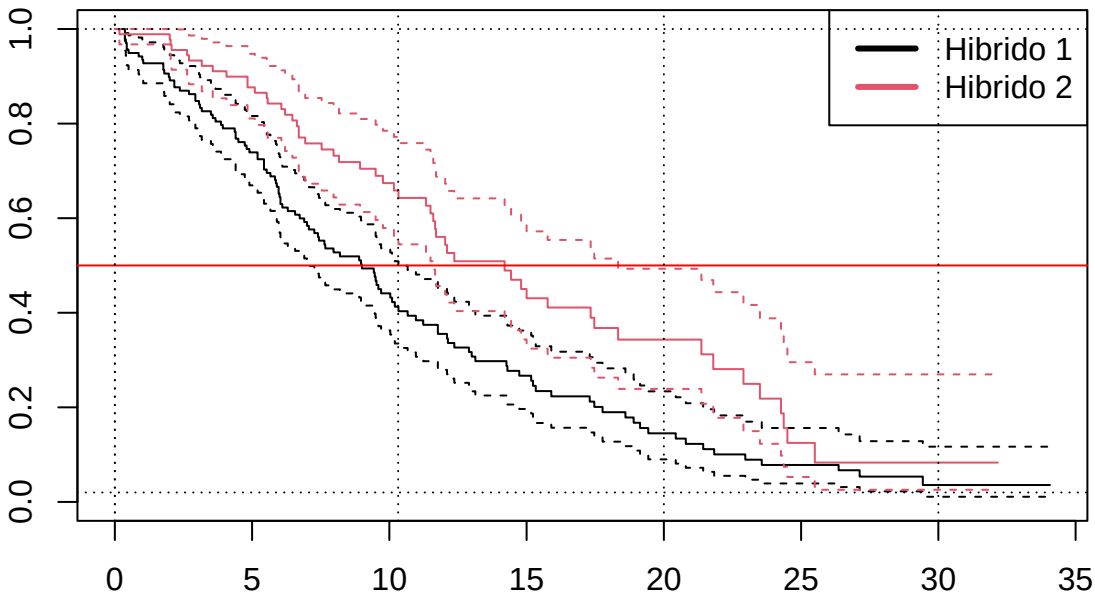
```
## Call:
## survdiff(formula = Supeg ~ Hibrido, data = SupEG, rho = 1)
##
##              N Observed Expected (O-E)^2/E (O-E)^2/V
## Hibrido=1 138     70.4     55.6      3.95      12.7
## Hibrido=2  90     28.7     43.5      5.04      12.7
```

```
##
##  Chisq= 12.7  on 1 degrees of freedom, p= 4e-04
```

```
survdiff(Supeg~Hibrido + Severidad,SupEG)
```

```
## Call:
## survdiff(formula = Supeg ~ Hibrido + Severidad, data = SupEG)
##
## n=227, 1 observation deleted due to missingness.
##
##                           N Observed Expected (O-E)^2/E (O-E)^2/V
## Hibrido=1, Severidad=0 36       28   33.051     0.772     0.986
## Hibrido=1, Severidad=1 71       54   43.318     2.634     3.636
## Hibrido=1, Severidad=2 29       28   14.416    12.799    14.128
## Hibrido=1, Severidad=3  1        1    0.172     3.973     4.004
## Hibrido=2, Severidad=0 27        9   21.101     6.940     8.020
## Hibrido=2, Severidad=1 42       28   40.210     3.707     4.999
## Hibrido=2, Severidad=2 21       16   11.731     1.553     1.693
##
##  Chisq= 32.9  on 6 degrees of freedom, p= 1e-05
```

```
Eg.fit.strata<-survfit(Supeg~Hibrido,SupEG)

plot(Eg.fit.strata, conf.int = 0.95,
     col=1:2, xlab = 'Meses despues de plantado', lwd=1)
title("Tasa de supervivencia por híbrido y tipo de estimador")
legend("topright", .9, c("Hibrido 1", "Hibrido 2"), col=1:2, lwd=3)
# abline(v = 400)
abline(h = 0.5, col = 'red')
abline(v = 10.32, col='black',lty = 3)
abline(h = c(0.02, 1), col='black',lty = 3)
abline(v = c(0, 20), col='black',lty = 3)
abline(v = c(0, 30), col='black',lty = 3)
```




```
# points(c(10.32, 10.32), c(0.44, 0.58), pch =23, col='blue')
# points(c(9.5, 12.2), c(0.5, 0.5), pch =23, col='green')
```

```
par.wei<-survreg(Supeg~1,dist="w")
par.wei
```

```
## Call:
## survreg(formula = Supeg ~ 1, dist = "w")
##
## Coefficients:
## (Intercept)
##    2.633707
##
## Scale= 0.7593936
##
## Loglik(model)= -592.7   Loglik(intercept only)= -592.7
## n= 228
```