Tasas de Crecimiento 2

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ENSAYO 2

CREAR UN DATA FRAME CON LOS DATOS RESUMIDOS POR FECHA

Función para la estadistica descriptiva de cada fecha

```
resumir2fat<-function(fat1,
                      fat2,
                      resp,
                      trat,
                      df
){
  nf1<-unique(fat1)
  nf2<-unique(fat2)
  alltrat<-unique(trat)

  medias<-c()
  Desvio_Standar<-c()
  numero<-c()
  ag<-c()

  for (f1 in nf1){
    ag<-c(ag, 'dosis')
    medias<-c(medias, mean(resp[fat1==f1]))
    Desvio_Standar<-c(Desvio_Standar, sd(resp[fat1==f1]))
    numero<-c(numero, sum(with(df, fat1==f1)))
  }

  for (f2 in nf2){
    ag<-c(ag, 'variedad')
    medias<-c(medias, mean(resp[fat2==f2]))
    Desvio_Standar<-c(Desvio_Standar, sd(resp[fat2==f2]))
    numero<-c(numero, sum(with(df, fat2==f2)))
  }
  for (t in alltrat){
    ag<-c(ag, 'tratamientos')
    medias<-c(medias, mean(resp[trat==t]))
    Desvio_Standar<-c(Desvio_Standar, sd(resp[trat==t]))
    numero<-c(numero, sum(with(df, trat==t)))
```

```
  }
  agrupamientos<-c(nf1, nf2, alltrat)
  CV<-(Desvio_Standar/medias)*100
  return(data.frame(ag, agrupamientos, numero, medias, Desvio_Standar, CV))
}
```

Importar los datos de las 4 fechas

```
### Fecha 1
MS30May<-read.csv("MS30May.csv", header=TRUE, sep=",", dec=",")

nv<-c()

for (i in MS30May$Var){
  if (i==1){
    nv<-c(nv, 'PA')
  } else {
    nv<-c(nv, 'PV')
  }
}

MS30May["NV"]<-nv

MS30May["Tratamientos"]<-paste(MS30May$NV, MS30May$Dosis, sep="_") #esto agrega una columna con el nomb

### Fecha 2
MS27Jun<-read.csv("MS27Jun.csv", header=TRUE, sep=",", dec=",")

nv<-c()

for (i in MS27Jun$Var){
  if (i==1){
    nv<-c(nv, 'PA')
  } else {
    nv<-c(nv, 'PV')
  }
}

MS27Jun["NV"]<-nv

MS27Jun["Tratamientos"]<-paste(MS27Jun$NV, MS27Jun$Dosis, sep="_") #esto agrega una columna con el nomb

### Fecha 3
MS06Jul<-read.csv("MS06Jul.csv", header=TRUE, sep=",", dec=",")

nv<-c()

for (i in MS06Jul$Var){
  if (i==1){
    nv<-c(nv, 'PA')
  } else {
    nv<-c(nv, 'PV')
```

```
  }
}

MS06Jul["NV"]<-nv

MS06Jul["Tratamientos"]<-paste(MS06Jul$NV, MS06Jul$Dosis, sep="_") #esto agrega una columna con el nomb

# Fecha 4
MS26Jul<-read.csv("MS26Jul.csv", header=TRUE, sep=",", dec=",")

nv<-c()

for (i in MS26Jul$Var){
  if (i==1){
    nv<-c(nv, 'PA')
  } else {
    nv<-c(nv, 'PV')
  }
}

MS26Jul["NV"]<-nv

MS26Jul["Tratamientos"]<-paste(MS26Jul$NV, MS26Jul$Dosis, sep="_") #esto agrega una columna con el nomb
```

Crear un data frame para los datos de los plantines

```
MSPLE2<-read.csv("Plantines2.csv", header=TRUE, sep=",", dec=",")

nv<-c()

for (i in MSPLE2$Variedad){
  if (i==1){
    nv<-c(nv, 'PA')
  } else {
    nv<-c(nv, 'PV')
  }
}

MSPLE2["NV"]<-nv

MSPLE2<-rbind(MSPLE2, MSPLE2, MSPLE2, MSPLE2)

MSPLE2$Dosis<-c(1,1,1,1,1,1,1,1,
                2,2,2,2,2,2,2,2,
                3,3,3,3,3,3,3,3,
                4,4,4,4,4,4,4,4)
MSPLE2["Tratamientos"]<-paste(MSPLE2$NV, MSPLE2$Dosis, sep="_") #esto agrega una columna con el nombre
```

Obtener la Estadistica descriptiva de la MS Total de cada fecha

```
#fecha 0 -plantines- (obntiene el descriptivo y luego añade una columna con la fecha)
descPT18May<-resumir2fat(MSPLE2$Dosis, MSPLE2$NV, MSPLE2$PT, MSPLE2$Tratamientos, MSPLE2)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-5-18")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descPT18May$FECHA<-fecha



#fecha 1 (ontiene el descriptivo y luego añade una columna con la fecha)
descPT30May<-resumir2fat(MS30May$Dosis, MS30May$NV, MS30May$PesoT, MS30May$Tratamientos, MS30May)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-5-30")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descPT30May$FECHA<-fecha

#fecha 2 (ontiene el descriptivo y luego añade una columna con la fecha)
descPT27Jun<-resumir2fat(MS27Jun$Dosis, MS27Jun$NV, MS27Jun$PesoT, MS27Jun$Tratamientos, MS27Jun)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-6-27")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descPT27Jun$FECHA<-fecha

#fecha 3 (ontiene el descriptivo y luego añade una columna con la fecha)

descPT06Jul<-resumir2fat(MS06Jul$Dosis, MS06Jul$NV, MS06Jul$PesoT, MS06Jul$Tratamientos, MS06Jul)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-6")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descPT06Jul$FECHA<-fecha

#fecha 4 (ontiene el descriptivo y luego añade una columna con la fecha)

descPT26Jul<-resumir2fat(MS26Jul$Dosis, MS26Jul$NV, MS26Jul$PesoT, MS26Jul$Tratamientos, MS26Jul)
```

```
fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-26")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descPT26Jul$FECHA<-fecha
```

Unimos todo en un data frame

```
descPTe2<-rbind(descPT18May, descPT30May, descPT27Jun, descPT06Jul, descPT26Jul)

descPTe2
```

```
##              ag agrupamientos numero    medias Desvio_Standar        CV
## 1         dosis             1      8  0.062250     0.04017729  64.54182
## 2         dosis             2      8  0.062250     0.04017729  64.54182
## 3         dosis             3      8  0.062250     0.04017729  64.54182
## 4         dosis             4      8  0.062250     0.04017729  64.54182
## 5      variedad            PA     16  0.058500     0.05079370  86.82684
## 6      variedad            PV     16  0.066000     0.02007984  30.42400
## 7  tratamientos          PA_1      4  0.058500     0.05678908  97.07536
## 8  tratamientos          PV_1      4  0.066000     0.02244994  34.01507
## 9  tratamientos          PA_2      4  0.058500     0.05678908  97.07536
## 10 tratamientos          PV_2      4  0.066000     0.02244994  34.01507
## 11 tratamientos          PA_3      4  0.058500     0.05678908  97.07536
## 12 tratamientos          PV_3      4  0.066000     0.02244994  34.01507
## 13 tratamientos          PA_4      4  0.058500     0.05678908  97.07536
## 14 tratamientos          PV_4      4  0.066000     0.02244994  34.01507
## 15        dosis             4      8  0.731250     0.20760109  28.38989
## 16        dosis             2      8  0.731250     0.24020453  32.84848
## 17        dosis             3      8  0.563750     0.29456687  52.25133
## 18        dosis             1      8  0.577500     0.42348048  73.32995
## 19     variedad            PV     16  0.755625     0.33986210  44.97762
## 20     variedad            PA     16  0.546250     0.21481387  39.32519
## 21 tratamientos          PV_4      4  0.787500     0.25460754  32.33112
## 22 tratamientos          PV_2      4  0.900000     0.19663842  21.84871
## 23 tratamientos          PV_3      4  0.632500     0.39390143  62.27691
## 24 tratamientos          PA_3      4  0.495000     0.18627936  37.63219
## 25 tratamientos          PV_1      4  0.702500     0.51551754  73.38328
## 26 tratamientos          PA_4      4  0.675000     0.16522712  24.47809
## 27 tratamientos          PA_2      4  0.562500     0.14150972  25.15728
## 28 tratamientos          PA_1      4  0.452500     0.33320414  73.63627
## 29        dosis             4      8  8.271250     4.12943247  49.92513
## 30        dosis             2      8  9.310000     4.07529841  43.77334
## 31        dosis             3      8  9.471250     4.90151999  51.75156
## 32        dosis             1      8  6.251250     3.14511157  50.31172
## 33     variedad            PV     16 10.565625     3.85331194  36.47027
## 34     variedad            PA     16  6.086250     3.08219808  50.64199
## 35 tratamientos          PV_4      4  9.490000     3.54177921  37.32117
## 36 tratamientos          PV_2      4 11.207500     4.66342775  41.60988
```

```
## 37 tratamientos          PV_3      4 12.752500     4.87562902  38.23273
## 38 tratamientos          PA_3      4  6.190000     1.89087281  30.54722
## 39 tratamientos          PV_1      4  8.812500     1.90002412  21.56056
## 40 tratamientos          PA_4      4  7.052500     4.82528324  68.41947
## 41 tratamientos          PA_2      4  7.412500     2.72088680  36.70674
## 42 tratamientos          PA_1      4  3.690000     1.40615314  38.10713
## 43        dosis             4      8 17.122500    11.66474511  68.12525
## 44        dosis             2      8 15.888750     9.06788436  57.07110
## 45        dosis             3      8 16.113750     3.96623945  24.61401
## 46        dosis             1      8 10.873750     7.40870904  68.13389
## 47     variedad            PV     16 14.346250     9.02753925  62.92613
## 48     variedad            PA     16 15.653125     8.06130487  51.49965
## 49 tratamientos          PV_4      4 17.952500    16.27555299  90.65898
## 50 tratamientos          PV_2      4 11.402500     4.74679102  41.62939
## 51 tratamientos          PV_3      4 16.227500     3.82877156  23.59434
## 52 tratamientos          PA_3      4 16.000000     4.69167348  29.32296
## 53 tratamientos          PV_1      4 11.802500     7.94711006  67.33412
## 54 tratamientos          PA_4      4 16.292500     7.12441518  43.72819
## 55 tratamientos          PA_2      4 20.375000    10.75450448  52.78284
## 56 tratamientos          PA_1      4  9.945000     7.91312201  79.56885
## 57        dosis             4      8 29.582500    18.12266832  61.26145
## 58        dosis             2      8 31.006250    18.67837706  60.24068
## 59        dosis             3      8 31.672500    12.64002232  39.90851
## 60        dosis             1      8 20.845000    15.08675010  72.37587
## 61     variedad            PV     16 33.320000    15.52174389  46.58387
## 62     variedad            PA     16 23.233125    15.56140641  66.97939
## 63 tratamientos          PV_4      4 40.407500    20.34101993  50.33971
## 64 tratamientos          PV_2      4 30.322500    20.43198371  67.38225
## 65 tratamientos          PV_3      4 37.127500    10.69840292  28.81531
## 66 tratamientos          PA_3      4 26.217500    13.37868298  51.02959
## 67 tratamientos          PV_1      4 25.422500     8.80322810  34.62770
## 68 tratamientos          PA_4      4 18.757500     6.33249490  33.75980
## 69 tratamientos          PA_2      4 31.690000    19.88327941  62.74307
## 70 tratamientos          PA_1      4 16.267500    19.94284897 122.59320
##         FECHA
## 1  2023-05-18
## 2  2023-05-18
## 3  2023-05-18
## 4  2023-05-18
## 5  2023-05-18
## 6  2023-05-18
## 7  2023-05-18
## 8  2023-05-18
## 9  2023-05-18
## 10 2023-05-18
## 11 2023-05-18
## 12 2023-05-18
## 13 2023-05-18
## 14 2023-05-18
## 15 2023-05-30
## 16 2023-05-30
## 17 2023-05-30
## 18 2023-05-30
## 19 2023-05-30
```

```
## 20 2023-05-30
## 21 2023-05-30
## 22 2023-05-30
## 23 2023-05-30
## 24 2023-05-30
## 25 2023-05-30
## 26 2023-05-30
## 27 2023-05-30
## 28 2023-05-30
## 29 2023-06-27
## 30 2023-06-27
## 31 2023-06-27
## 32 2023-06-27
## 33 2023-06-27
## 34 2023-06-27
## 35 2023-06-27
## 36 2023-06-27
## 37 2023-06-27
## 38 2023-06-27
## 39 2023-06-27
## 40 2023-06-27
## 41 2023-06-27
## 42 2023-06-27
## 43 2023-07-06
## 44 2023-07-06
## 45 2023-07-06
## 46 2023-07-06
## 47 2023-07-06
## 48 2023-07-06
## 49 2023-07-06
## 50 2023-07-06
## 51 2023-07-06
## 52 2023-07-06
## 53 2023-07-06
## 54 2023-07-06
## 55 2023-07-06
## 56 2023-07-06
## 57 2023-07-26
## 58 2023-07-26
## 59 2023-07-26
## 60 2023-07-26
## 61 2023-07-26
## 62 2023-07-26
## 63 2023-07-26
## 64 2023-07-26
## 65 2023-07-26
## 66 2023-07-26
## 67 2023-07-26
## 68 2023-07-26
## 69 2023-07-26
## 70 2023-07-26
```

Grafico Evolución del Peso Total

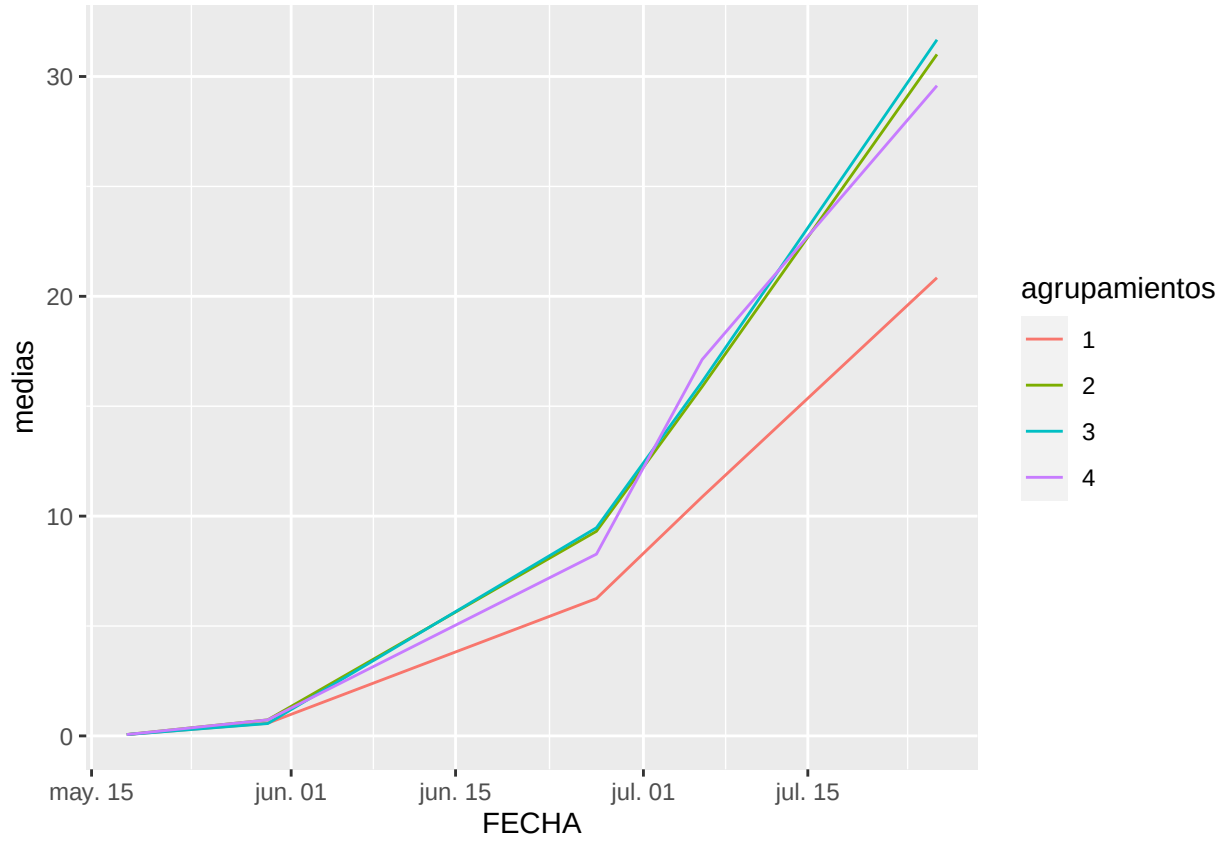
```
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 4.2.3
```

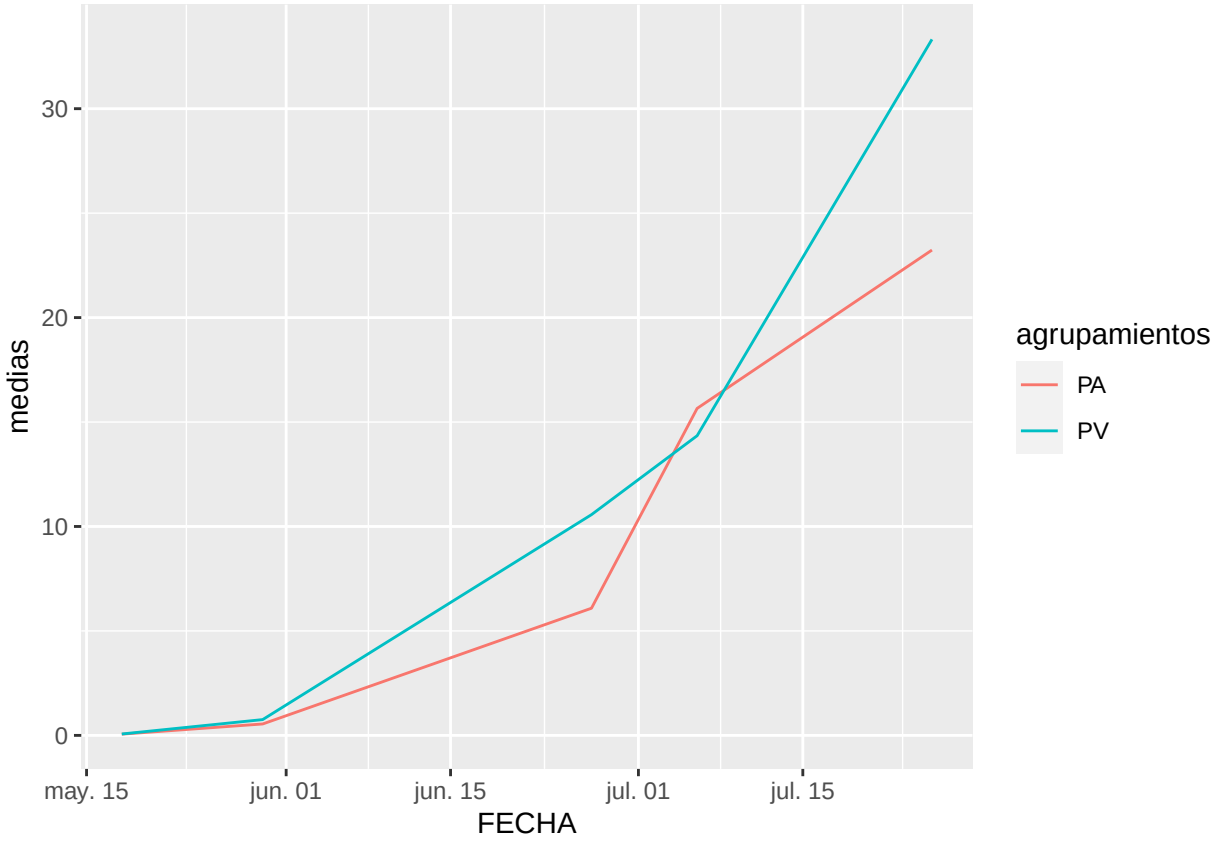
```
library(patchwork)
```

```
## Warning: package 'patchwork' was built under R version 4.2.3
```

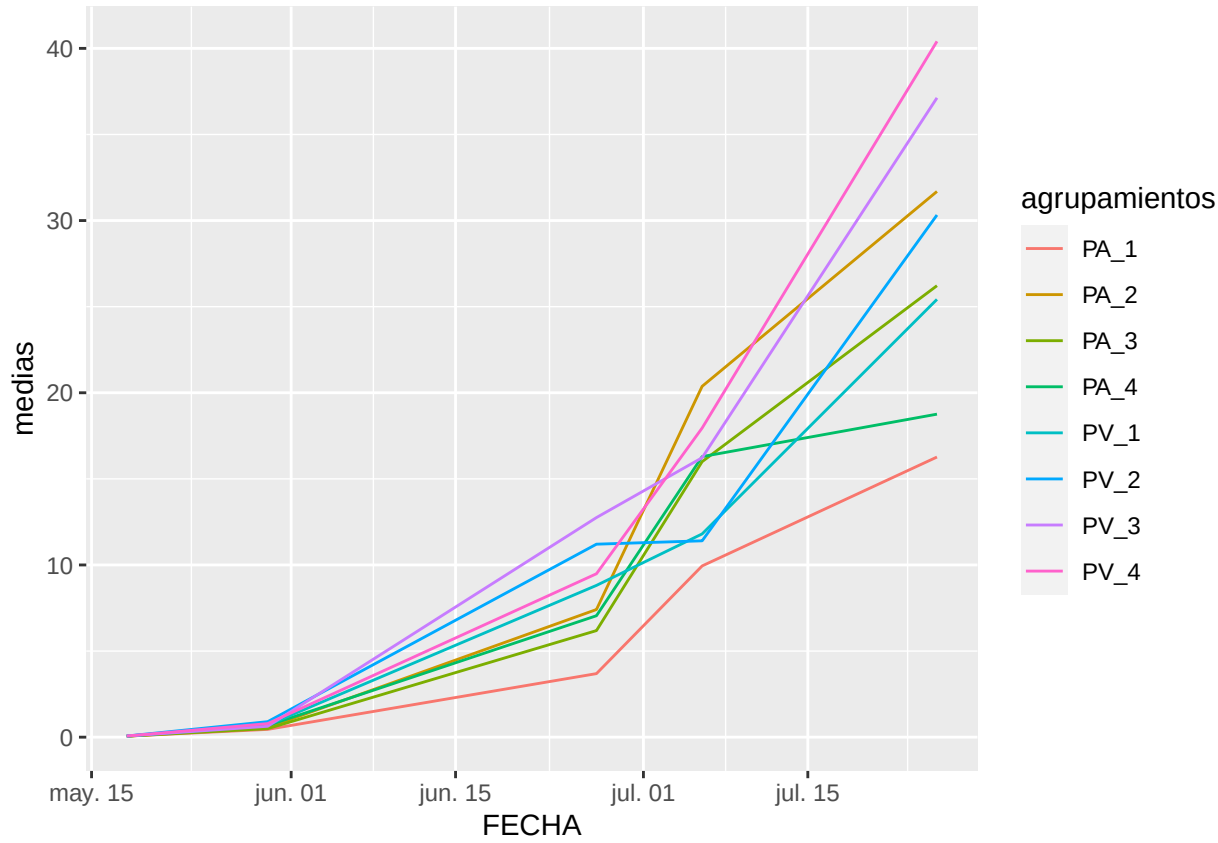
```
g1<-ggplot(data= descPTe2[descPTe2$ag=='dosis',], aes(FECHA, medias, color=agrupamientos))+geom_line()
g2<-ggplot(data= descPTe2[descPTe2$ag=='variedad',], aes(FECHA, medias, color=agrupamientos))+geom_line
g3<-ggplot(data= descPTe2[descPTe2$ag=='tratamientos',], aes(FECHA, medias, color=agrupamientos))+geom_l

g1
```




```
g2
```


30
20
10
0
medias
may. 15
jun. 01
jun. 15
jul. 01
jul. 15
FECHA
agrupamientos
PA
PV

```
g3
```



Tasas de crecimiento ABSOLUTA

```
TCA1<-(descPT30May$medias-descPT18May$medias)/as.integer(difftime(descPT30May$FECHA, descPT18May$FECHA,

TCA2<-(descPT27Jun$medias-descPT30May$medias)/as.integer(difftime(descPT27Jun$FECHA, descPT30May$FECHA,

TCA3<-(descPT06Jul$medias-descPT27Jun$medias)/as.integer(difftime(descPT06Jul$FECHA, descPT27Jun$FECHA,

TCA4<-(descPT26Jul$medias-descPT06Jul$medias)/as.integer(difftime(descPT26Jul$FECHA, descPT06Jul$FECHA,

TCA<-c(TCA1, TCA2, TCA3, TCA4)
fecha<-c(descPT30May$FECHA,
         descPT27Jun$FECHA,
         descPT06Jul$FECHA,
         descPT26Jul$FECHA)
ag<-c(descPT30May$ag,
         descPT27Jun$ag,
         descPT06Jul$ag,
         descPT26Jul$ag)
agrupamientos<-c(descPT30May$agrupamientos,
         descPT27Jun$agrupamientos,
         descPT06Jul$agrupamientos,
         descPT26Jul$agrupamientos)
dfTCA<-data.frame(fecha, ag, agrupamientos, TCA)
```

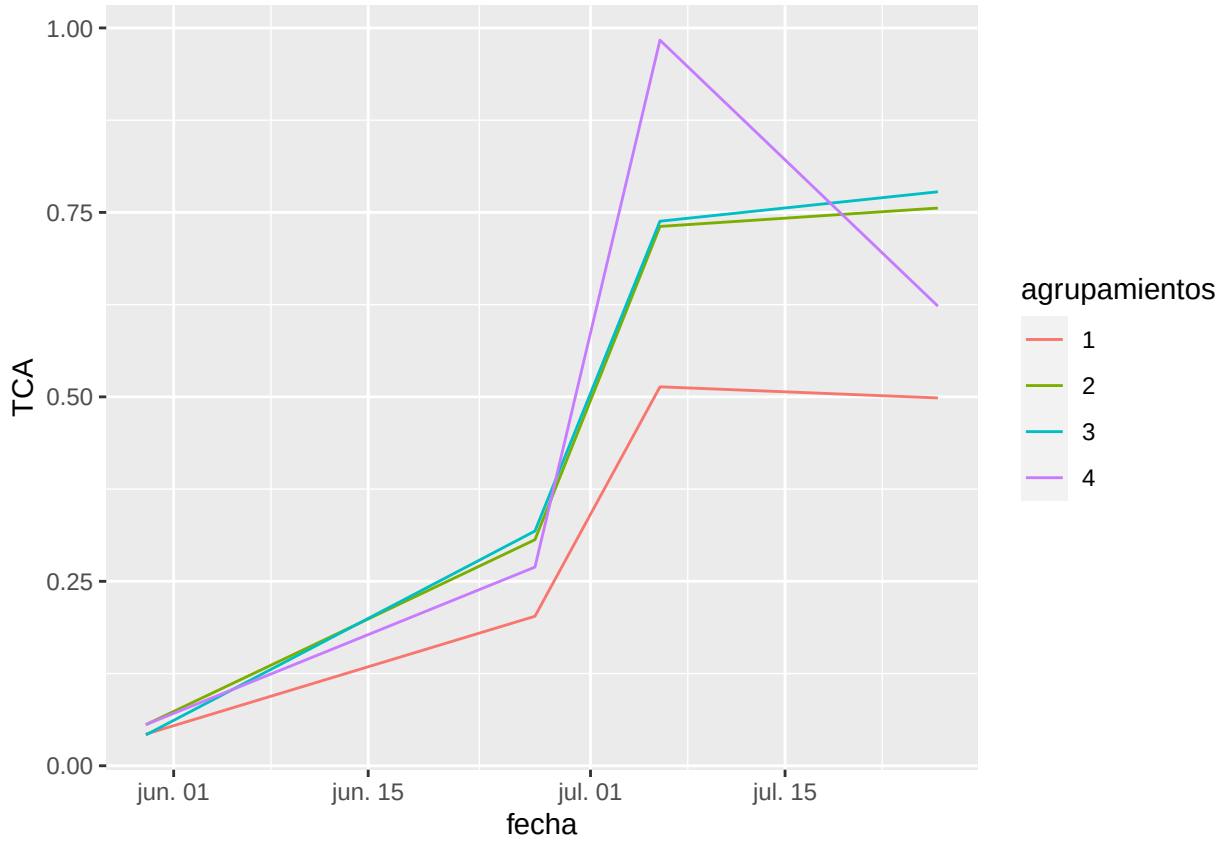
```
dfTCA
```

```
##         fecha           ag agrupamientos        TCA
## 1  2023-05-30        dosis             4 0.05575000
## 2  2023-05-30        dosis             2 0.05575000
## 3  2023-05-30        dosis             3 0.04179167
## 4  2023-05-30        dosis             1 0.04293750
## 5  2023-05-30     variedad            PV 0.05809375
## 6  2023-05-30     variedad            PA 0.04002083
## 7  2023-05-30 tratamientos          PV_4 0.06075000
## 8  2023-05-30 tratamientos          PV_2 0.06950000
## 9  2023-05-30 tratamientos          PV_3 0.04783333
## 10 2023-05-30 tratamientos          PA_3 0.03575000
## 11 2023-05-30 tratamientos          PV_1 0.05366667
## 12 2023-05-30 tratamientos          PA_4 0.05075000
## 13 2023-05-30 tratamientos          PA_2 0.04200000
## 14 2023-05-30 tratamientos          PA_1 0.03220833
## 15 2023-06-27        dosis             4 0.26928571
## 16 2023-06-27        dosis             2 0.30638393
## 17 2023-06-27        dosis             3 0.31812500
## 18 2023-06-27        dosis             1 0.20263393
## 19 2023-06-27     variedad            PV 0.35035714
## 20 2023-06-27     variedad            PA 0.19785714
## 21 2023-06-27 tratamientos          PV_4 0.31080357
## 22 2023-06-27 tratamientos          PV_2 0.36812500
## 23 2023-06-27 tratamientos          PV_3 0.43285714
## 24 2023-06-27 tratamientos          PA_3 0.20339286
## 25 2023-06-27 tratamientos          PV_1 0.28964286
## 26 2023-06-27 tratamientos          PA_4 0.22776786
## 27 2023-06-27 tratamientos          PA_2 0.24464286
## 28 2023-06-27 tratamientos          PA_1 0.11562500
## 29 2023-07-06        dosis             4 0.98347222
## 30 2023-07-06        dosis             2 0.73097222
## 31 2023-07-06        dosis             3 0.73805556
## 32 2023-07-06        dosis             1 0.51361111
## 33 2023-07-06     variedad            PV 0.42006944
## 34 2023-07-06     variedad            PA 1.06298611
## 35 2023-07-06 tratamientos          PV_4 0.94027778
## 36 2023-07-06 tratamientos          PV_2 0.02166667
## 37 2023-07-06 tratamientos          PV_3 0.38611111
## 38 2023-07-06 tratamientos          PA_3 1.09000000
## 39 2023-07-06 tratamientos          PV_1 0.33222222
## 40 2023-07-06 tratamientos          PA_4 1.02666667
## 41 2023-07-06 tratamientos          PA_2 1.44027778
## 42 2023-07-06 tratamientos          PA_1 0.69500000
## 43 2023-07-26        dosis             4 0.62300000
## 44 2023-07-26        dosis             2 0.75587500
## 45 2023-07-26        dosis             3 0.77793750
## 46 2023-07-26        dosis             1 0.49856250
## 47 2023-07-26     variedad            PV 0.94868750
## 48 2023-07-26     variedad            PA 0.37900000
## 49 2023-07-26 tratamientos          PV_4 1.12275000
## 50 2023-07-26 tratamientos          PV_2 0.94600000
```

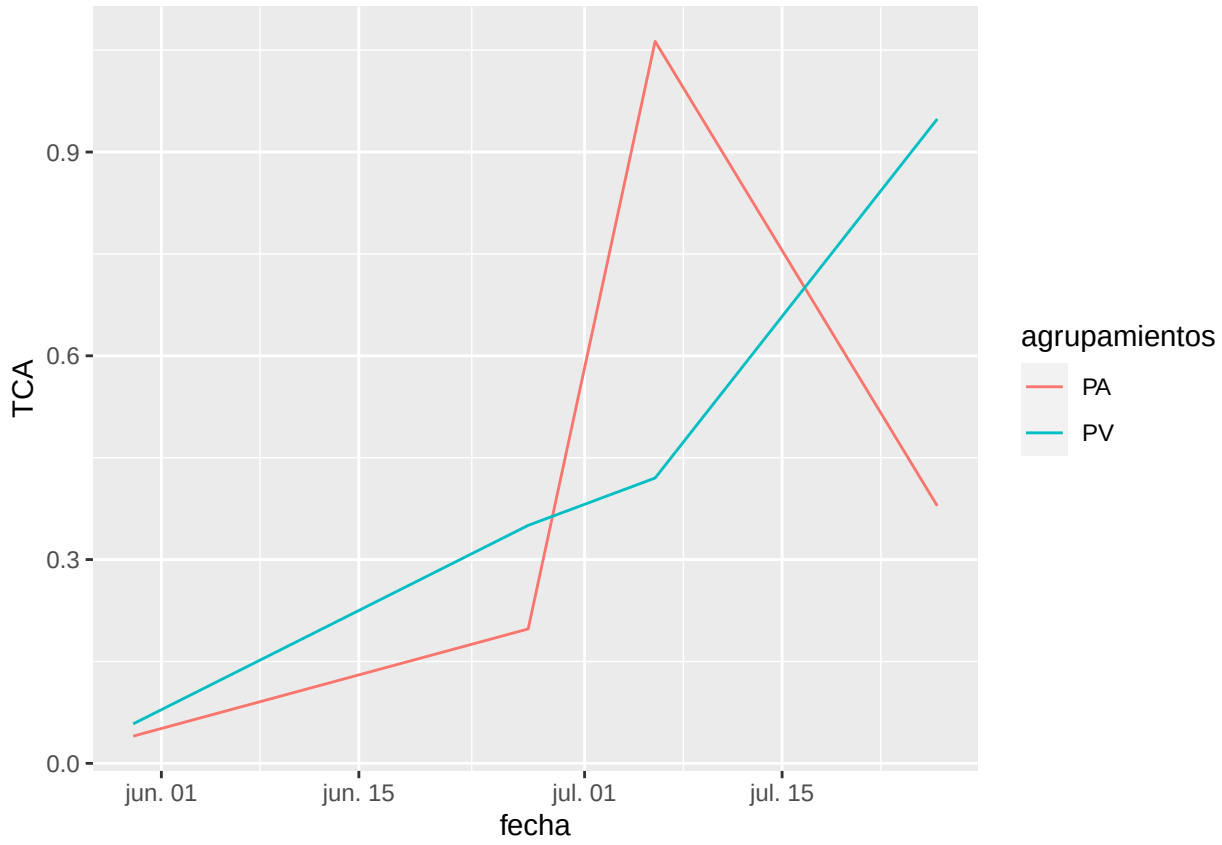
```
## 51 2023-07-26 tratamientos          PV_3 1.04500000
## 52 2023-07-26 tratamientos          PA_3 0.51087500
## 53 2023-07-26 tratamientos          PV_1 0.68100000
## 54 2023-07-26 tratamientos          PA_4 0.12325000
## 55 2023-07-26 tratamientos          PA_2 0.56575000
## 56 2023-07-26 tratamientos          PA_1 0.31612500
```

Graficos con la Tasa de Crecimiento Absoluta

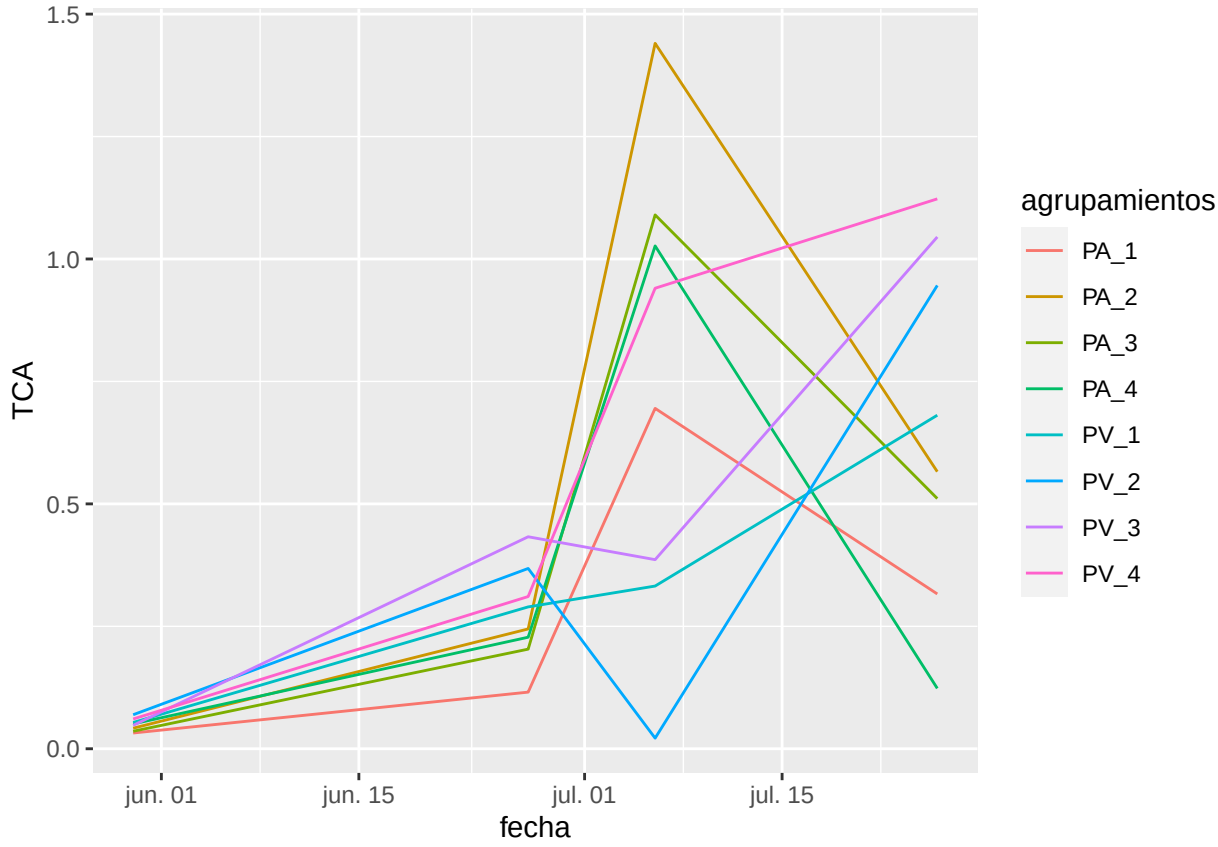
```
library(ggplot2)
library(patchwork)

g1<-ggplot(data= dfTCA[dfTCA$ag=='dosis',], aes(fecha, TCA, color=agrupamientos))+geom_line()
g2<-ggplot(data= dfTCA[dfTCA$ag=='variedad',], aes(fecha, TCA, color=agrupamientos))+geom_line()
g3<-ggplot(data= dfTCA[dfTCA$ag=='tratamientos',], aes(fecha, TCA, color=agrupamientos))+geom_line()

g1
```




```
g2
```


0.9
0.6
0.3
0.0
TCA
jun. 01
jun. 15
jul. 01
jul. 15
fecha
agrupamientos
PA
PV

```
g3
```



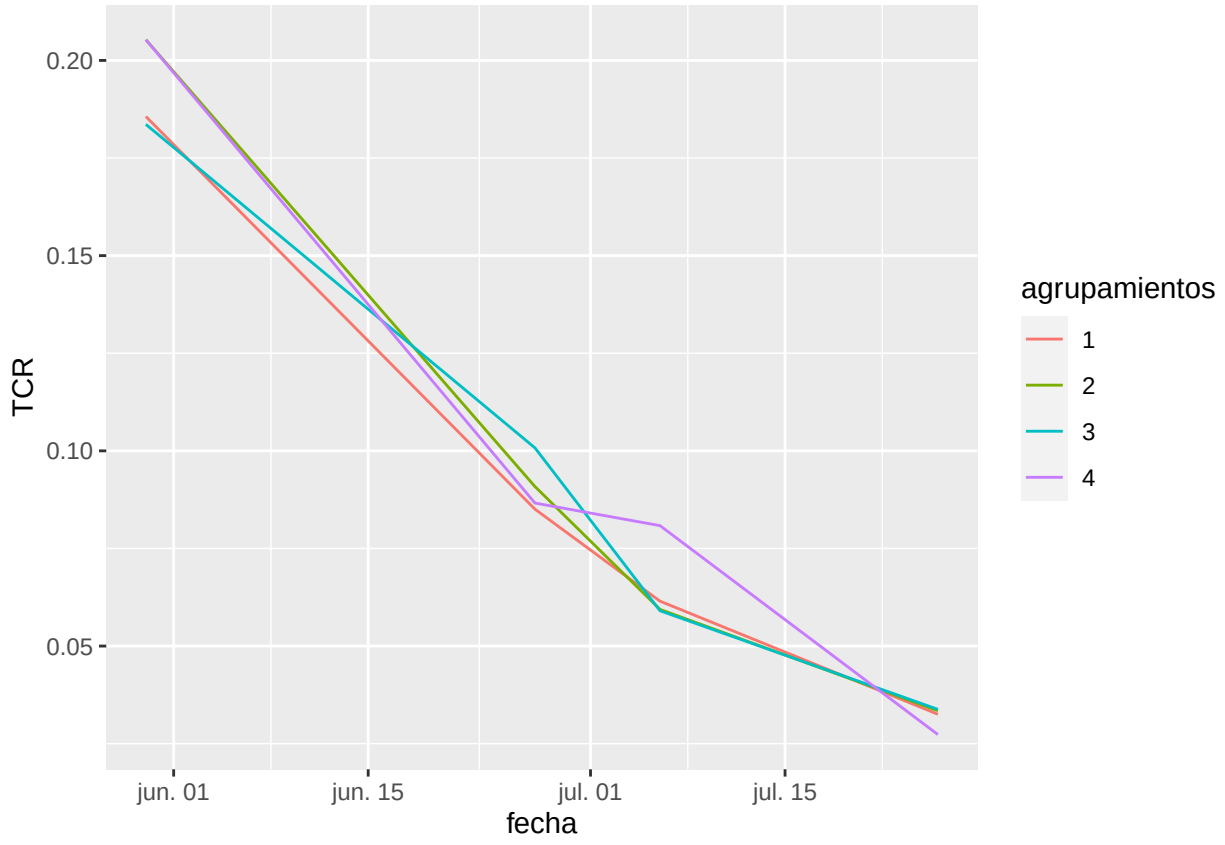
Tasa de Crecimiento RELATIVA

```
TCR1<-(log(descPT30May$medias)-log(descPT18May$medias))/as.integer(difftime(descPT30May$FECHA, descPT18

TCR2<-(log(descPT27Jun$medias)-log(descPT30May$medias))/as.integer(difftime(descPT27Jun$FECHA, descPT30

TCR3<-(log(descPT06Jul$medias)-log(descPT27Jun$medias))/as.integer(difftime(descPT06Jul$FECHA, descPT27.

TCR4<-(log(descPT26Jul$medias)-log(descPT06Jul$medias))/as.integer(difftime(descPT26Jul$FECHA, descPT06.

TCR<-c(TCR1, TCR2, TCR3, TCR4)


dfTCA$TCR<-c(TCR)
```

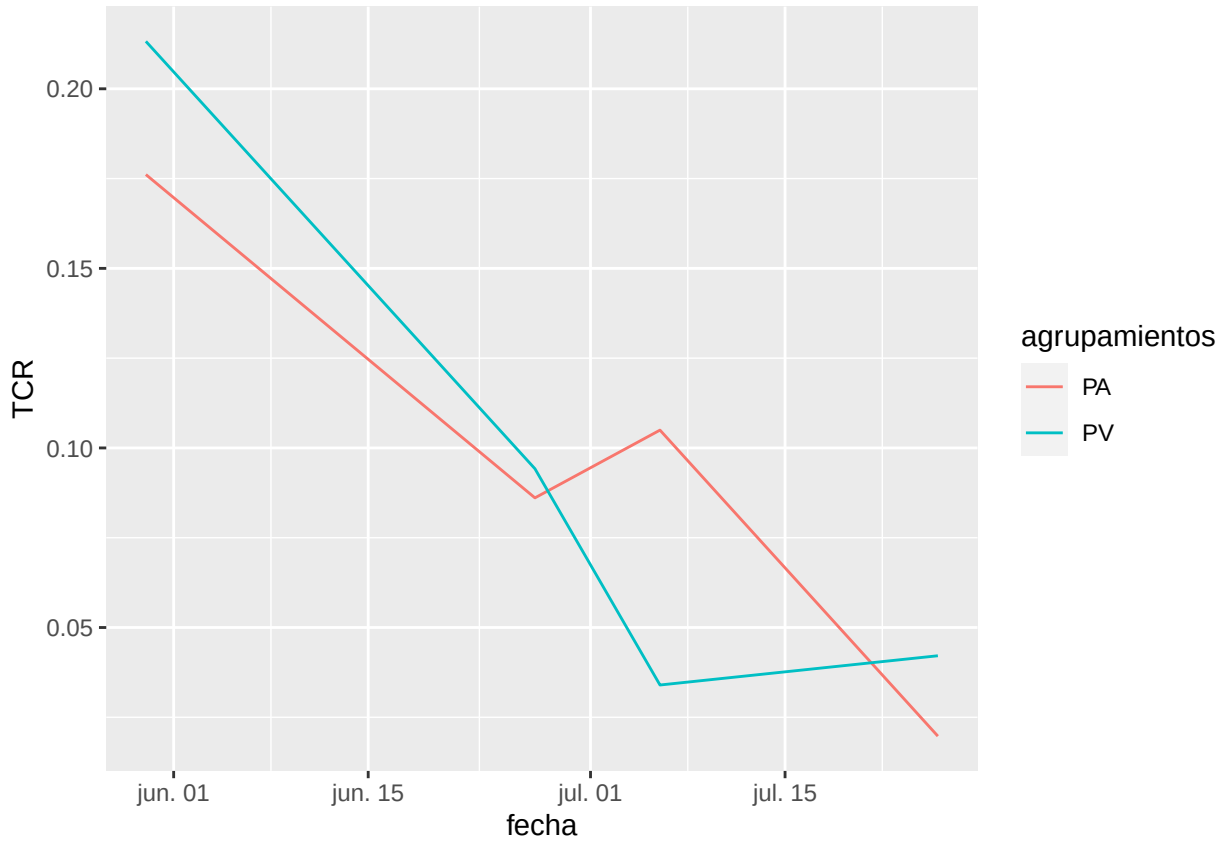
##grafico Tasas de Crecimiento Relativas

```
library(ggplot2)
library(patchwork)

g1<-ggplot(data= dfTCA[dfTCA$ag=='dosis',], aes(fecha, TCR, color=agrupamientos))+geom_line()
g2<-ggplot(data= dfTCA[dfTCA$ag=='variedad',], aes(fecha, TCR, color=agrupamientos))+geom_line()
g3<-ggplot(data= dfTCA[dfTCA$ag=='tratamientos',], aes(fecha, TCR, color=agrupamientos))+geom_line()
```

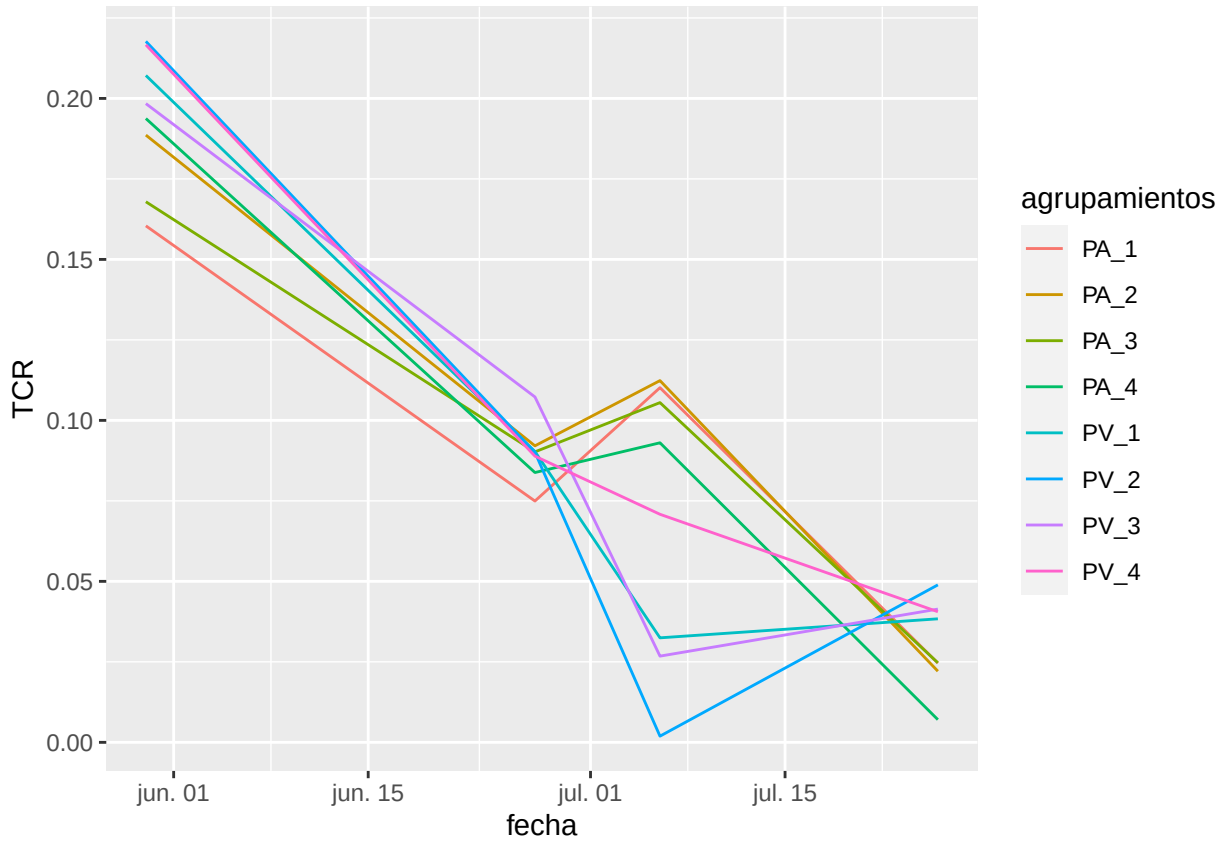
```
g1
```


0.20
0.15
0.10
0.05
TCR
jun. 01
jun. 15
jul. 01
jul. 15
fecha
agrupamientos
1
2
3
4

```
g2
```


0.20
0.15
0.10
0.05
TCR
jun. 01
jun. 15
jul. 01
jul. 15
fecha
agrupamientos
PA
PV

```
g3
```



Calculo de la Tasa de Asimilación Líquida

Incorporar el Area Foliar al Data Frame

```
regModelAF<- function(trat, AS, HM){
  #creamos vectores vacios para guardar cada parametro del modelo: ordenada al origen, pendiente de la
    ord <-c()
    prord<-c()
    pend<-c()
    prpend<-c()
    rsq<-c()
    radj<-c()
    tratamientos<-unique(trat)

    #El ciclo FOR va ir realizando una regresion por CADA TRATAMIENTO y guardando los datos en cada vec

for (i in tratamientos){
  HMT<-HM[trat== i] #PESO HOJAS MEDIDAS DEL TRATAMIENTO I
  AFT<-AS[trat== i] #AREA FOLIAR DE LAS HOJAS MEDIDAS DEL TRATAMIENTO I

  regresion<-summary(lm(AFT~HMT)) #SE EJECUTA LA REGRESION

  ord<-c(ord, regresion$coefficients[1,1]) #guarda el intercept del tratamiento i en un vector
```

```
  prord<-c(prord, regresion$coefficients[1,4]) #guarda el coeficiente de pearson de la ordenada para el
  pend<-c(pend, regresion$coefficients[2,1]) #guarda la pendiente del tratamiento i en un vector
  prpend<-c(prpend, regresion$coefficients[2,4]) #guarda el coeficiente de pearson de la pendienyte en
  rsq<-c(rsq, regresion$r.squared) #guarda el r^2 del modelo al tratamiento i
  radj<-c(radj, regresion$adj.r.squared) #guarda el r^2 ajustado del modelo para el tratamiento i
}

 # creamos un data frame con los vectores

MAF<-data.frame(tratamientos, ord, prord, pend, prpend, rsq, radj)

return(MAF)

}
```

Crear una funcion para obtener el modelo para el area foliar en cada fecha

```
modeloAfFecha2<-regModelAF(MS27Jun$Tratamientos, MS27Jun$AS, MS27Jun$HM)

modeloAfFecha3<-regModelAF(MS06Jul$Tratamientos, MS06Jul$AS, MS06Jul$HM)

modeloAfFecha4<-regModelAF(MS26Jul$Tratamientos, MS26Jul$AS, MS26Jul$HM)
```

Obtener el modelo para cada fecha

```
calcAf<-function(H, trat, MAF){
#Se recorre fila por fila calculando PH*PENDIENA + ORDENADA para obtener un vector con el area foliar

areasF<-c()

for (i in c(1:32)){
  ordenada<-MAF$ord[MAF$tratamientos== trat[i]]
  pendiente<-MAF$pend[MAF$tratamientos== trat[i]]
  pesohojas<-H[i]
  af<-ordenada + pendiente*pesohojas
  areasF<-c(areasF, af)
}
 return(areasF)
}
```

Crear una funcion para calcular el area foliar en cada fecha

```
MS27Jun$A<-calcAf(MS27Jun$HM+MS27Jun$HSM, MS27Jun$Tratamientos, modeloAfFecha2)
```

```
MS06Jul$A<-calcAf(MS06Jul$HM+MS06Jul$HSM, MS06Jul$Tratamientos, modeloAfFecha3)

MS26Jul$A<-calcAf(MS26Jul$HM+MS26Jul$HSM, MS26Jul$Tratamientos, modeloAfFecha4)
```

Agregaer el area foliar a los data frame

Crear los data frames descriptivos del area foliar

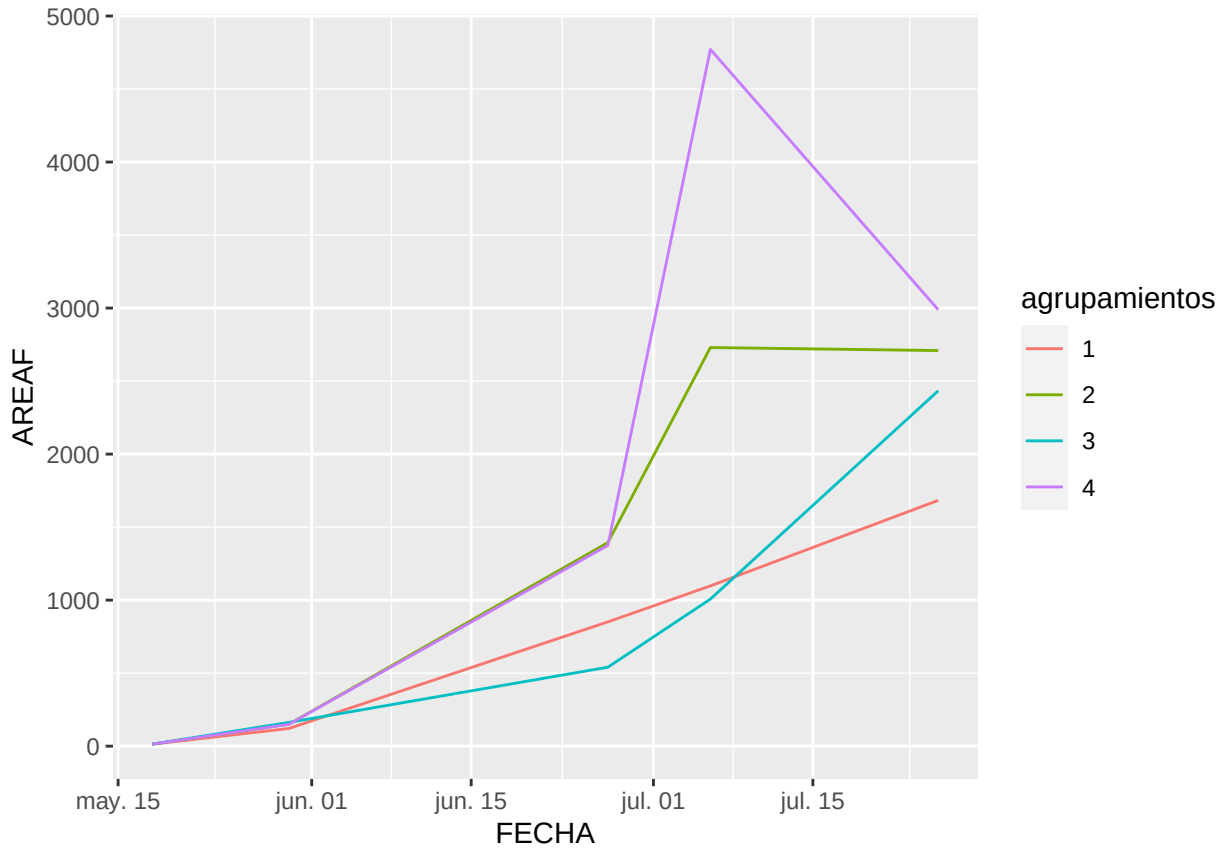
```
descA18May<-resumir2fat(MSPLE2$Dosis, MSPLE2$NV, MSPLE2$A, MSPLE2$Tratamientos, MSPLE2)

descA30May<-resumir2fat(MS30May$Dosis, MS30May$NV, MS30May$A, MS30May$Tratamientos, MS30May)

descA27Jun<-resumir2fat(MS27Jun$Dosis, MS27Jun$NV, MS27Jun$A, MS27Jun$Tratamientos, MS27Jun)

descA06Jul<-resumir2fat(MS06Jul$Dosis, MS06Jul$NV, MS06Jul$A, MS06Jul$Tratamientos, MS06Jul)

descA26Jul<-resumir2fat(MS26Jul$Dosis, MS26Jul$NV, MS26Jul$A, MS26Jul$Tratamientos, MS26Jul)
```

Unirlos al data frame de materia seca

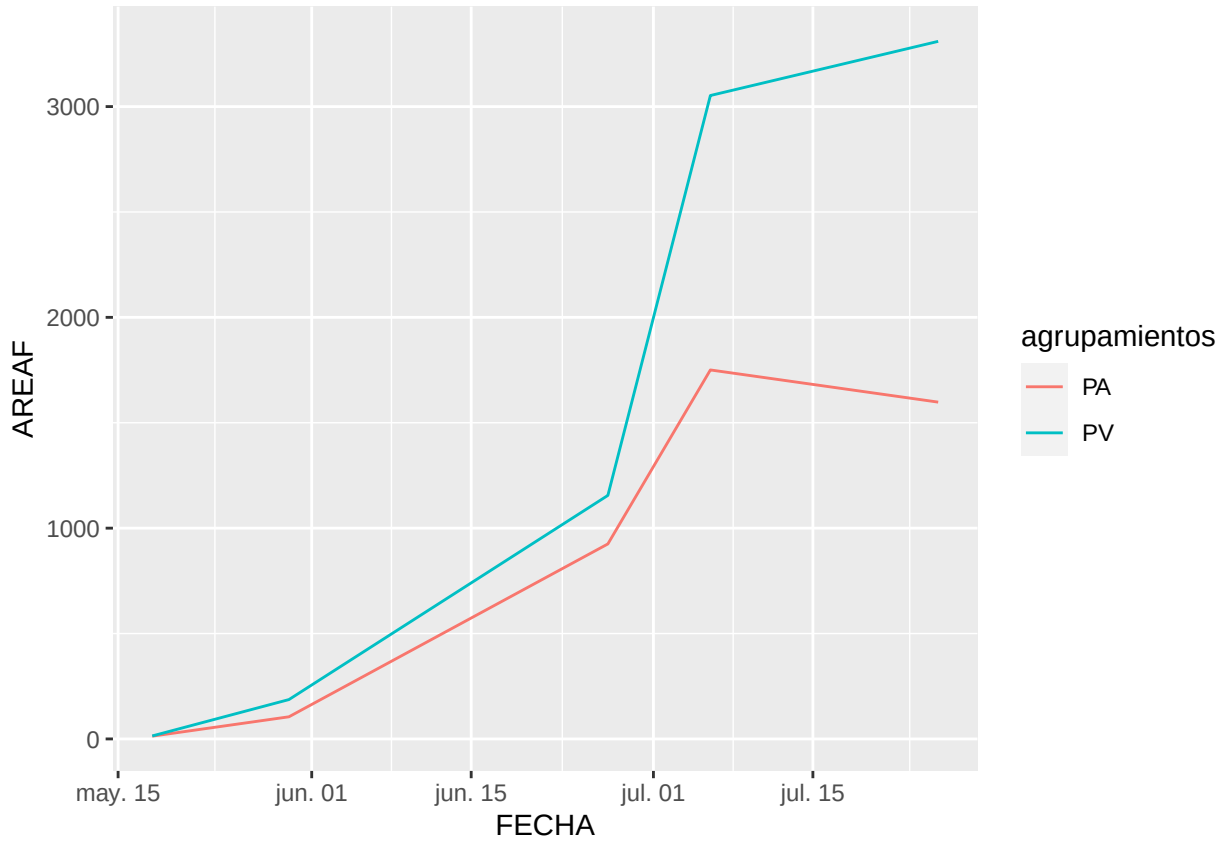
```
descPTe2$AREAF<-c(descA18May$medias,
            descA30May$medias,
            descA27Jun$medias,
            descA06Jul$medias,
            descA26Jul$medias)
```

Evolucion del Area Foliar con el tiempo

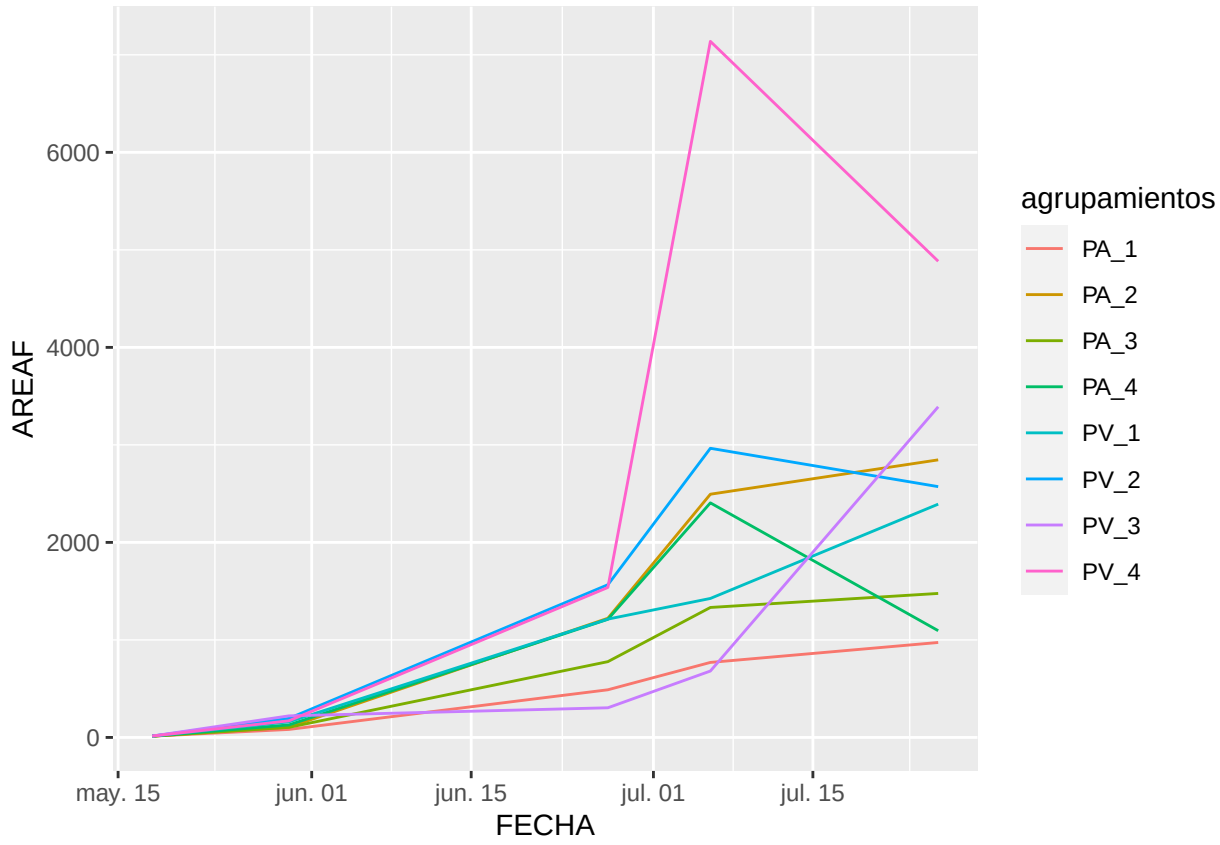
```
library(ggplot2)
library(patchwork)

g1<-ggplot(data= descPTe2[descPTe2$ag=='dosis',], aes(FECHA, AREAF, color=agrupamientos))+geom_line()
g2<-ggplot(data= descPTe2[descPTe2$ag=='variedad',], aes(FECHA, AREAF, color=agrupamientos))+geom_line()
g3<-ggplot(data= descPTe2[descPTe2$ag=='tratamientos',], aes(FECHA, AREAF, color=agrupamientos))+geom_li

g1
```


5000
4000
3000
2000
1000
0
AREAF
may. 15
jun. 01
jun. 15
jul. 01
jul. 15
FECHA
agrupamientos
1
2
3
4

```
g2
```


3000
2000
1000
0
AREAF
may. 15
jun. 01
jun. 15
jul. 01
jul. 15
FECHA
agrupamientos
PA
PV

```
g3
```



Calculo de la TAL

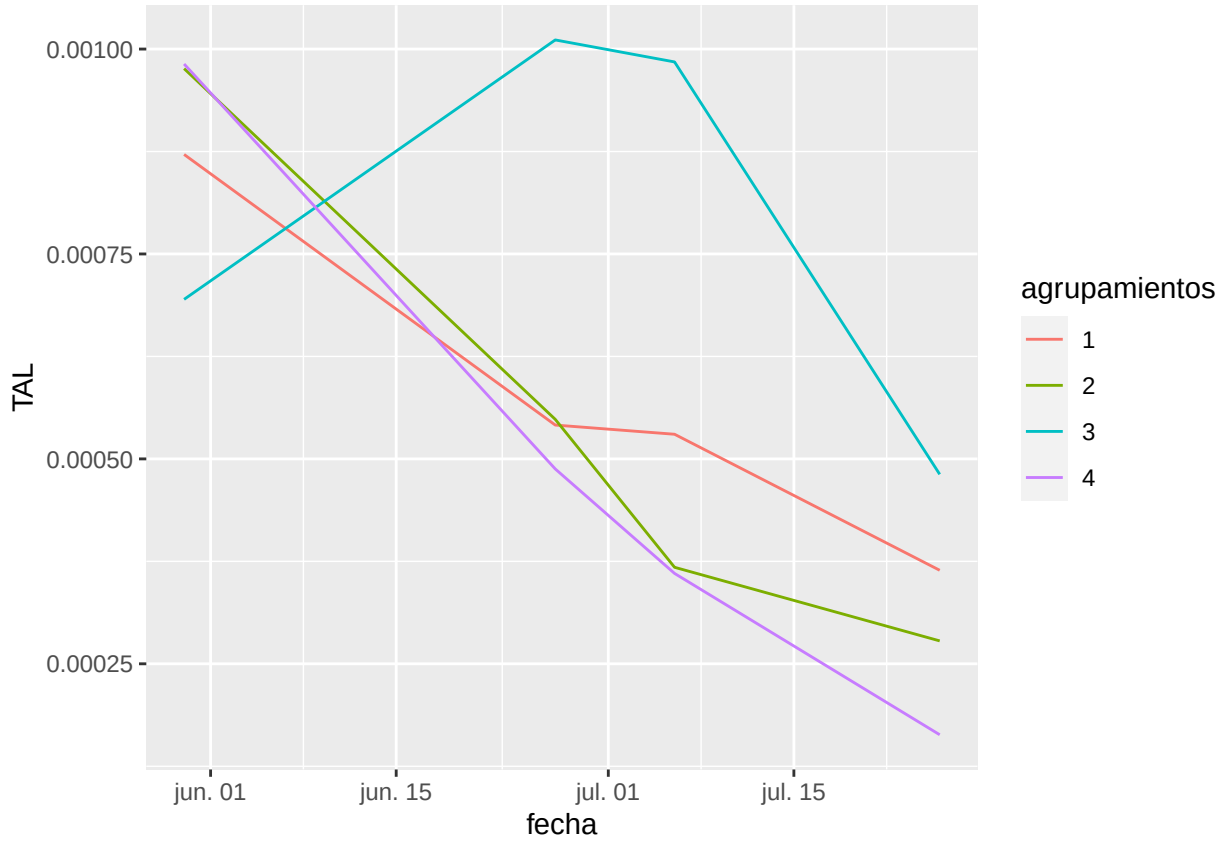
$$TAL=(P2-P1)/(t1-t2)*(lnA2-lnA1)/(A2-A1)$$

```
TAL1<-TCA1*((log(descA30May$medias)-log(descA18May$medias))/(descA30May$medias-descA18May$medias))

TAL2<-TCA2*((log(descA27Jun$medias)-log(descA30May$medias))/(descA27Jun$medias-descA30May$medias))

TAL3<-TCA3*((log(descA06Jul$medias)-log(descA27Jun$medias))/(descA06Jul$medias-descA27Jun$medias))

TAL4<-TCA4*((log(descA26Jul$medias)-log(descA06Jul$medias))/(descA26Jul$medias-descA06Jul$medias))

TAL<-c(TAL1, TAL2, TAL3, TAL4)


dfTCA$TAL<-TAL
```

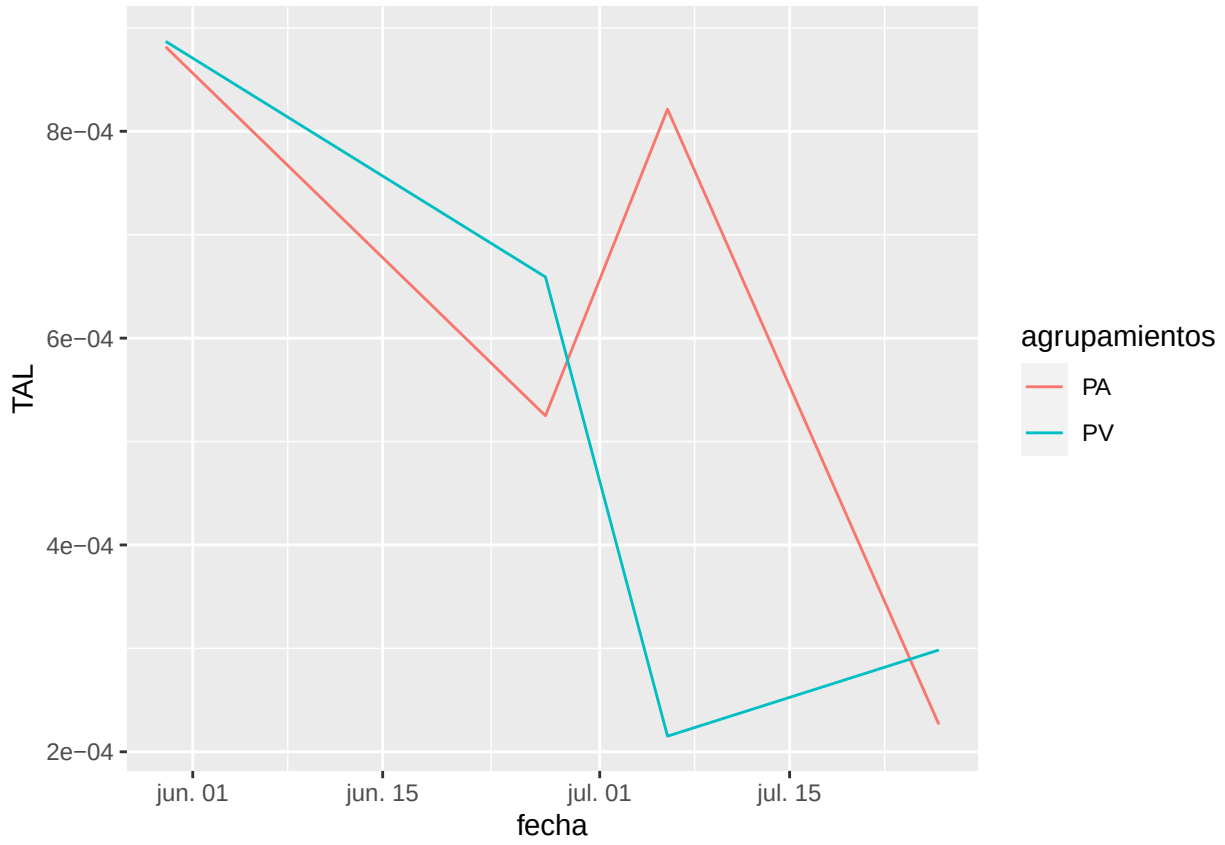
Evolución de la TAL

```
library(ggplot2)
library(patchwork)

g1<-ggplot(data= dfTCA[dfTCA$ag=='dosis',], aes(fecha, TAL, color=agrupamientos))+geom_line()
```

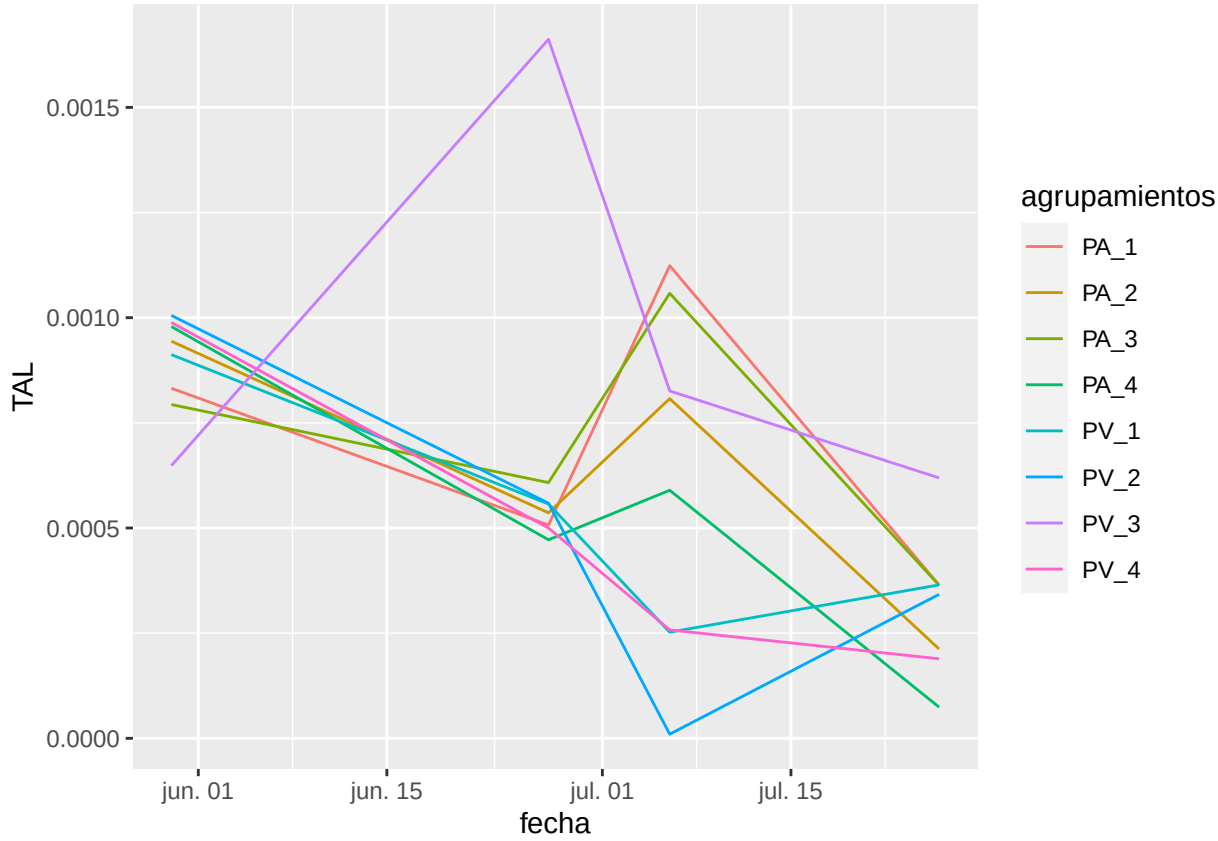
```
g2<-ggplot(data= dfTCA[dfTCA$ag=='variedad',], aes(fecha, TAL, color=agrupamientos))+geom_line()
g3<-ggplot(data= dfTCA[dfTCA$ag=='tratamientos',], aes(fecha, TAL, color=agrupamientos))+geom_line()

g1
```




```
g2
```


8e−04
6e−04
4e−04
2e−04
TAL
jun. 01
jun. 15
jul. 01
jul. 15
fecha
agrupamientos
PA
PV

```
g3
```



Acumulo de Nutrientes

Importar los datos

```
NE2<-read.csv('NutrientesE2.csv', header=T, sep=',', dec=',')

nv<-c()

for (i in NE2$variedad){
  if (i==1){
    nv<-c(nv, 'PA')
  } else {
    nv<-c(nv, 'PV')
  }
}

NE2["NV"]<-nv

NE2["Tratamientos"]<-paste(NE2$NV, NE2$dosis, sep="_") #esto agrega una columna con el nombre del tratam
```

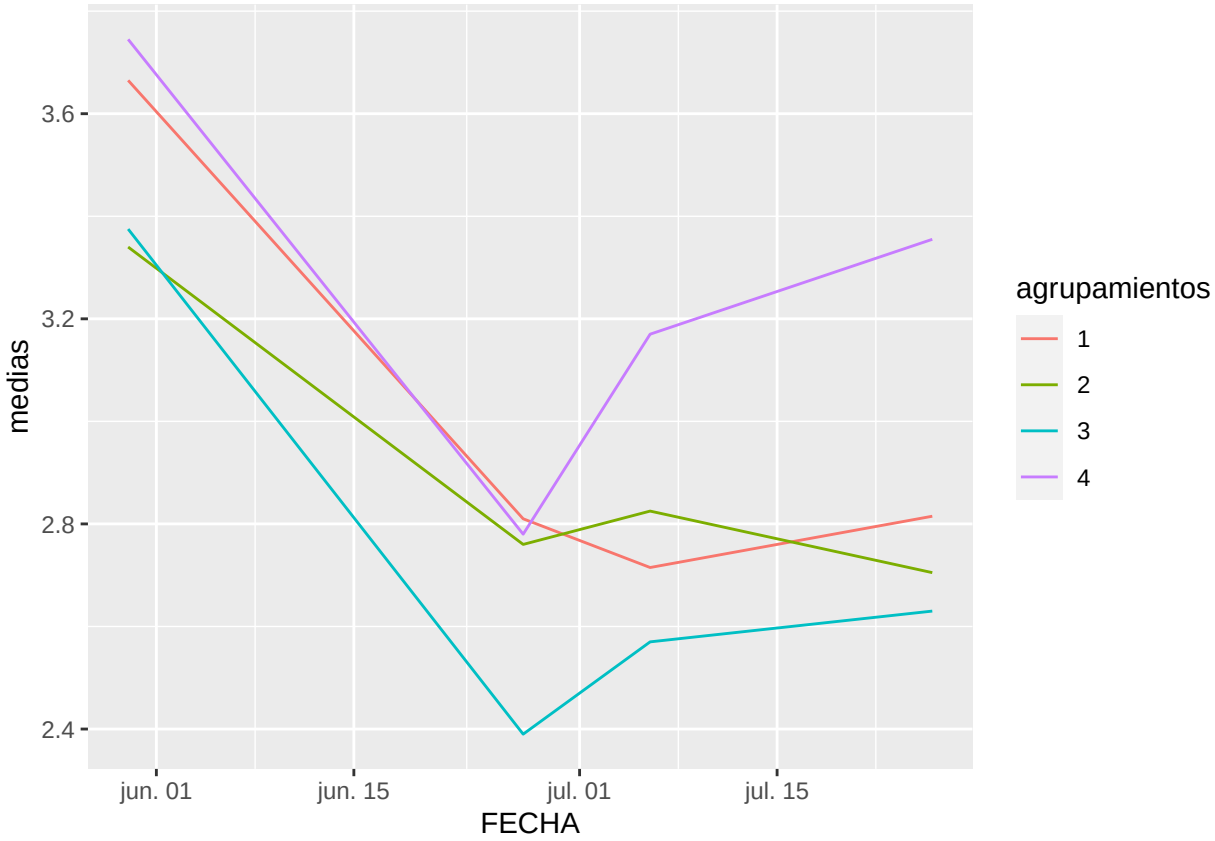
Analisis del Nitrogeno

```r
#Obtener una estadistica descriptiva del nitrogeno para cada fecha

NE2$Medicion<-trimws(NE2$Medicion)

#fecha 1
NF<-NE2[NE2$Medicion =="PRIMERA",]

descN30May<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$N.,
                        NF$Tratamientos,
                        NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-5-30")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descN30May$FECHA<-fecha

#fecha 2

NF<-NE2[NE2$Medicion =="SEGUNDA",]

descN27Jun<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$N.,
                        NF$Tratamientos,
                        NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-6-27")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descN27Jun$FECHA<-fecha

#fecha 3

NF<-NE2[NE2$Medicion =="TERCERA",]

descN06Jul<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$N.,
                        NF$Tratamientos,
                        NF)

fecha<-c()

for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-6")
```

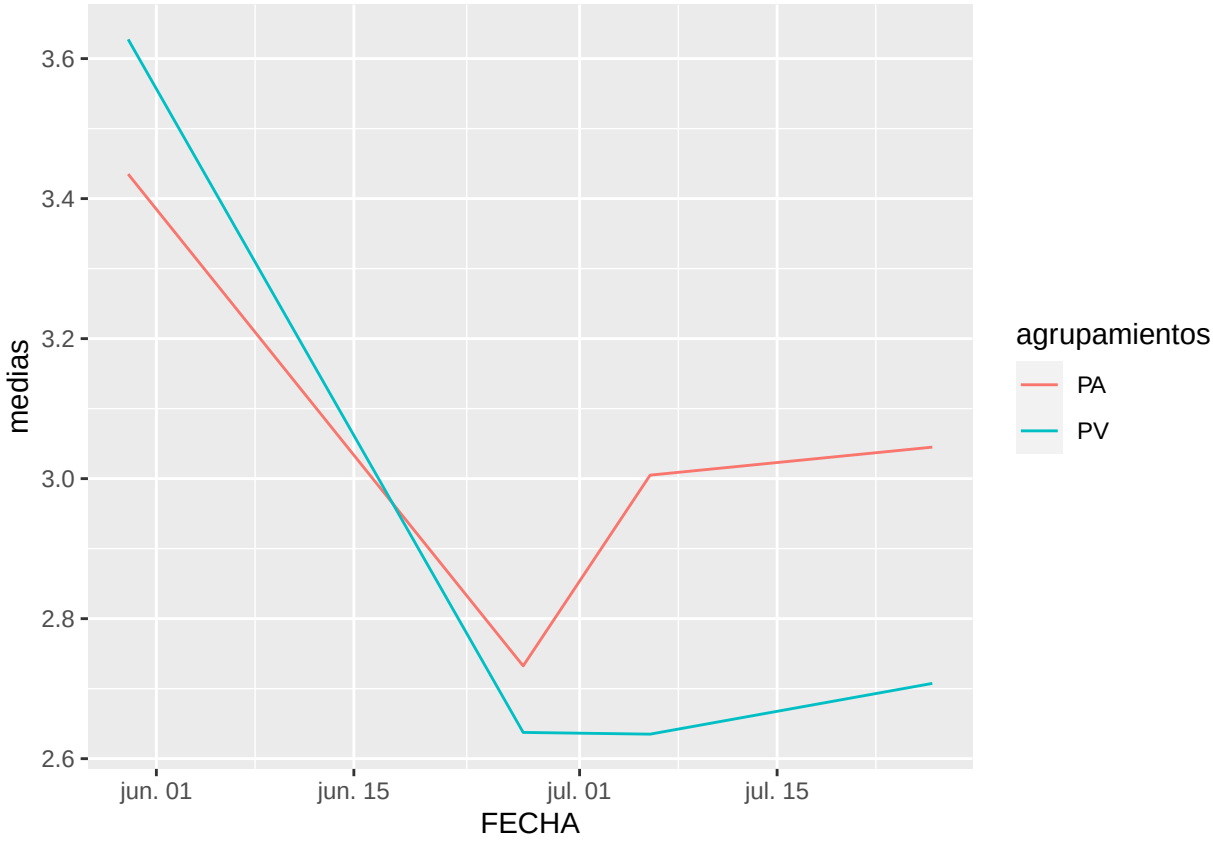
```
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descN06Jul$FECHA<-fecha

#fecha 4
  NF<-NE2[NE2$Medicion =="CUARTA",]

descN26Jul<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$N.,
                        NF$Tratamientos,
                        NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-26")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descN26Jul$FECHA<-fecha

#unir en un data frame

descNE2<-rbind(descN30May,
               descN27Jun,
               descN06Jul,
               descN26Jul)
```

plot concentración de N en el tiempo

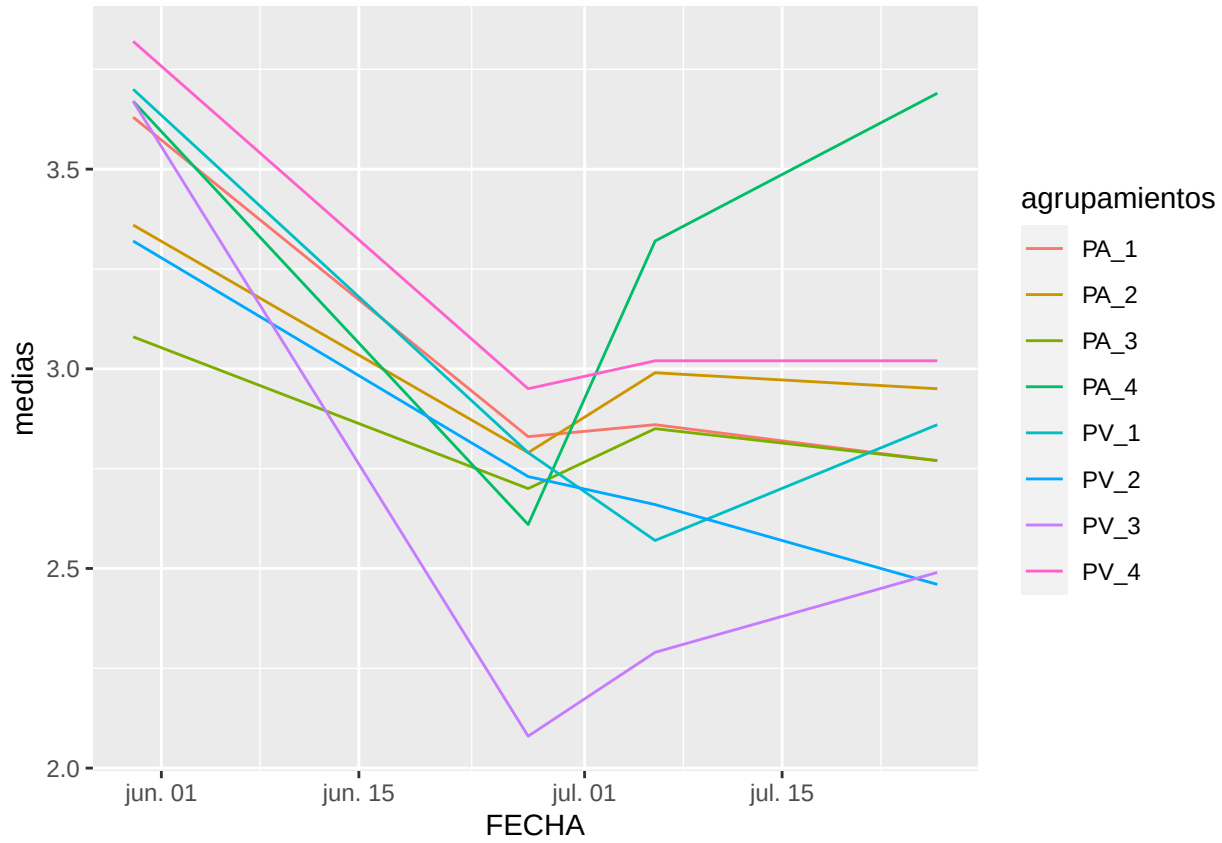
```
library(ggplot2)
g1<-ggplot(descNE2[descNE2$ag=='dosis',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g2<-ggplot(descNE2[descNE2$ag=='variedad',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g3<-ggplot(descNE2[descNE2$ag=='tratamientos',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g1
```


3.6
3.2
2.8
2.4
medias
jun. 01
jun. 15
jul. 01
jul. 15
FECHA
agrupamientos
1
2
3
4

```
g2
```


3.6
3.4
3.2
3.0
2.8
2.6
medias
jun. 01
jun. 15
jul. 01
jul. 15
FECHA
agrupamientos
PA
PV

```
g3
```



acumulacion de N en el tiempo

```
concN<-c(NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,
         descNE2$medias)

descPTe2$Nx100<-concN

descPTe2$Nacu<-descPTe2$Nx100*descPTe2$medias

descPTe2
```

```
##              ag agrupamientos numero    medias Desvio_Standar        CV
## 1         dosis              1      8  0.062250     0.04017729  64.54182
## 2         dosis              2      8  0.062250     0.04017729  64.54182
## 3         dosis              3      8  0.062250     0.04017729  64.54182
## 4         dosis              4      8  0.062250     0.04017729  64.54182
## 5      variedad             PA     16  0.058500     0.05079370  86.82684
## 6      variedad             PV     16  0.066000     0.02007984  30.42400
## 7  tratamientos           PA_1      4  0.058500     0.05678908  97.07536
## 8  tratamientos           PV_1      4  0.066000     0.02244994  34.01507
## 9  tratamientos           PA_2      4  0.058500     0.05678908  97.07536
## 10 tratamientos           PV_2      4  0.066000     0.02244994  34.01507
## 11 tratamientos           PA_3      4  0.058500     0.05678908  97.07536
## 12 tratamientos           PV_3      4  0.066000     0.02244994  34.01507
```

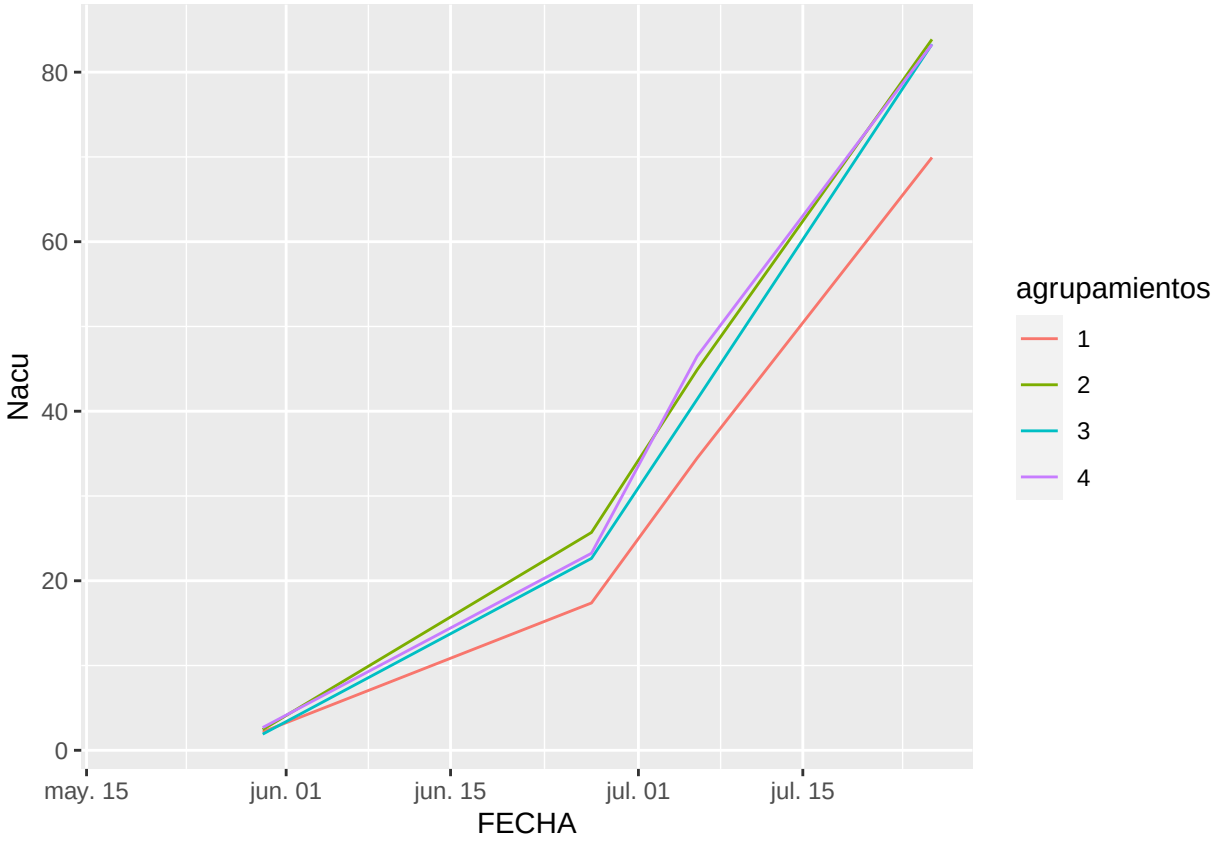
```
## 13 tratamientos          PA_4      4  0.058500     0.05678908  97.07536
## 14 tratamientos          PV_4      4  0.066000     0.02244994  34.01507
## 15        dosis             4      8  0.731250     0.20760109  28.38989
## 16        dosis             2      8  0.731250     0.24020453  32.84848
## 17        dosis             3      8  0.563750     0.29456687  52.25133
## 18        dosis             1      8  0.577500     0.42348048  73.32995
## 19     variedad            PV     16  0.755625     0.33986210  44.97762
## 20     variedad            PA     16  0.546250     0.21481387  39.32519
## 21 tratamientos          PV_4      4  0.787500     0.25460754  32.33112
## 22 tratamientos          PV_2      4  0.900000     0.19663842  21.84871
## 23 tratamientos          PV_3      4  0.632500     0.39390143  62.27691
## 24 tratamientos          PA_3      4  0.495000     0.18627936  37.63219
## 25 tratamientos          PV_1      4  0.702500     0.51551754  73.38328
## 26 tratamientos          PA_4      4  0.675000     0.16522712  24.47809
## 27 tratamientos          PA_2      4  0.562500     0.14150972  25.15728
## 28 tratamientos          PA_1      4  0.452500     0.33320414  73.63627
## 29        dosis             4      8  8.271250     4.12943247  49.92513
## 30        dosis             2      8  9.310000     4.07529841  43.77334
## 31        dosis             3      8  9.471250     4.90151999  51.75156
## 32        dosis             1      8  6.251250     3.14511157  50.31172
## 33     variedad            PV     16 10.565625     3.85331194  36.47027
## 34     variedad            PA     16  6.086250     3.08219808  50.64199
## 35 tratamientos          PV_4      4  9.490000     3.54177921  37.32117
## 36 tratamientos          PV_2      4 11.207500     4.66342775  41.60988
## 37 tratamientos          PV_3      4 12.752500     4.87562902  38.23273
## 38 tratamientos          PA_3      4  6.190000     1.89087281  30.54722
## 39 tratamientos          PV_1      4  8.812500     1.90002412  21.56056
## 40 tratamientos          PA_4      4  7.052500     4.82528324  68.41947
## 41 tratamientos          PA_2      4  7.412500     2.72088680  36.70674
## 42 tratamientos          PA_1      4  3.690000     1.40615314  38.10713
## 43        dosis             4      8 17.122500    11.66474511  68.12525
## 44        dosis             2      8 15.888750     9.06788436  57.07110
## 45        dosis             3      8 16.113750     3.96623945  24.61401
## 46        dosis             1      8 10.873750     7.40870904  68.13389
## 47     variedad            PV     16 14.346250     9.02753925  62.92613
## 48     variedad            PA     16 15.653125     8.06130487  51.49965
## 49 tratamientos          PV_4      4 17.952500    16.27555299  90.65898
## 50 tratamientos          PV_2      4 11.402500     4.74679102  41.62939
## 51 tratamientos          PV_3      4 16.227500     3.82877156  23.59434
## 52 tratamientos          PA_3      4 16.000000     4.69167348  29.32296
## 53 tratamientos          PV_1      4 11.802500     7.94711006  67.33412
## 54 tratamientos          PA_4      4 16.292500     7.12441518  43.72819
## 55 tratamientos          PA_2      4 20.375000    10.75450448  52.78284
## 56 tratamientos          PA_1      4  9.945000     7.91312201  79.56885
## 57        dosis             4      8 29.582500    18.12266832  61.26145
## 58        dosis             2      8 31.006250    18.67837706  60.24068
## 59        dosis             3      8 31.672500    12.64002232  39.90851
## 60        dosis             1      8 20.845000    15.08675010  72.37587
## 61     variedad            PV     16 33.320000    15.52174389  46.58387
## 62     variedad            PA     16 23.233125    15.56140641  66.97939
## 63 tratamientos          PV_4      4 40.407500    20.34101993  50.33971
## 64 tratamientos          PV_2      4 30.322500    20.43198371  67.38225
## 65 tratamientos          PV_3      4 37.127500    10.69840292  28.81531
## 66 tratamientos          PA_3      4 26.217500    13.37868298  51.02959
```

```
## 67 tratamientos          PV_1      4 25.422500     8.80322810  34.62770
## 68 tratamientos          PA_4      4 18.757500     6.33249490  33.75980
## 69 tratamientos          PA_2      4 31.690000    19.88327941  62.74307
## 70 tratamientos          PA_1      4 16.267500    19.94284897 122.59320
##         FECHA      AREAF  Nx100       Nacu
## 1  2023-05-18   13.69567     NA         NA
## 2  2023-05-18   13.69567     NA         NA
## 3  2023-05-18   13.69567     NA         NA
## 4  2023-05-18   13.69567     NA         NA
## 5  2023-05-18   13.18950     NA         NA
## 6  2023-05-18   14.20185     NA         NA
## 7  2023-05-18   13.18950     NA         NA
## 8  2023-05-18   14.20185     NA         NA
## 9  2023-05-18   13.18950     NA         NA
## 10 2023-05-18   14.20185     NA         NA
## 11 2023-05-18   13.18950     NA         NA
## 12 2023-05-18   14.20185     NA         NA
## 13 2023-05-18   13.18950     NA         NA
## 14 2023-05-18   14.20185     NA         NA
## 15 2023-05-30  149.37975 3.6650   2.680031
## 16 2023-05-30  150.63938 3.3400   2.442375
## 17 2023-05-30  162.53975 3.3750   1.902656
## 18 2023-05-30  121.08137 3.7450   2.162737
## 19 2023-05-30  186.79650 3.4350   2.595572
## 20 2023-05-30  105.02362 3.6275   1.981522
## 21 2023-05-30  170.43075 3.6300   2.858625
## 22 2023-05-30  195.44900 3.7000   3.330000
## 23 2023-05-30  221.25650 3.3600   2.125200
## 24 2023-05-30  103.82300 3.3200   1.643400
## 25 2023-05-30  160.04975 3.0800   2.163700
## 26 2023-05-30  128.32875 3.6700   2.477250
## 27 2023-05-30  105.82975 3.6700   2.064375
## 28 2023-05-30   82.11300 3.8200   1.728550
## 29 2023-06-27 1374.91130 2.8100  23.242213
## 30 2023-06-27 1394.16096 2.7600  25.695600
## 31 2023-06-27  540.69669 2.3900  22.636288
## 32 2023-06-27  851.08637 2.7800  17.378475
## 33 2023-06-27 1155.33877 2.7325  28.870570
## 34 2023-06-27  925.08889 2.6375  16.052484
## 35 2023-06-27 1538.00802 2.8300  26.856700
## 36 2023-06-27 1565.90113 2.7900  31.268925
## 37 2023-06-27  304.09243 2.7900  35.579475
## 38 2023-06-27  777.30095 2.7300  16.898700
## 39 2023-06-27 1213.35350 2.7000  23.793750
## 40 2023-06-27 1211.81457 2.0800  14.669200
## 41 2023-06-27 1222.42078 2.6100  19.346625
## 42 2023-06-27  488.81925 2.9500  10.885500
## 43 2023-07-06 4771.77522 2.7150  46.487587
## 44 2023-07-06 2729.75500 2.8250  44.885719
## 45 2023-07-06 1007.03776 2.5700  41.412338
## 46 2023-07-06 1097.29783 3.1700  34.469788
## 47 2023-07-06 3052.39293 3.0050  43.110481
## 48 2023-07-06 1750.53998 2.6350  41.245984
## 49 2023-07-06 7138.07221 2.8600  51.344150
```

```
## 50 2023-07-06 2965.18825 2.5700  29.304425
## 51 2023-07-06  681.05656 2.9900  48.520225
## 52 2023-07-06 1333.01896 2.6600  42.560000
## 53 2023-07-06 1425.25470 2.8500  33.637125
## 54 2023-07-06 2405.47824 2.2900  37.309825
## 55 2023-07-06 2494.32175 3.3200  67.645000
## 56 2023-07-06  769.34096 3.0200  30.033900
## 57 2023-07-26 2988.93284 2.8150  83.274738
## 58 2023-07-26 2709.10436 2.7050  83.871906
## 59 2023-07-26 2433.60668 2.6300  83.298675
## 60 2023-07-26 1682.95862 3.3550  69.934975
## 61 2023-07-26 3309.41404 3.0450 101.459400
## 62 2023-07-26 1597.88721 2.7075  62.903686
## 63 2023-07-26 4883.12028 2.7700 111.928775
## 64 2023-07-26 2571.83235 2.8600  86.722350
## 65 2023-07-26 3390.51849 2.9500 109.526125
## 66 2023-07-26 1476.69488 2.4600  64.495050
## 67 2023-07-26 2392.18502 2.7700  70.420325
## 68 2023-07-26 1094.74539 2.4900  46.706175
## 69 2023-07-26 2846.37637 3.6900 116.936100
## 70 2023-07-26  973.73222 3.0200  49.127850
```

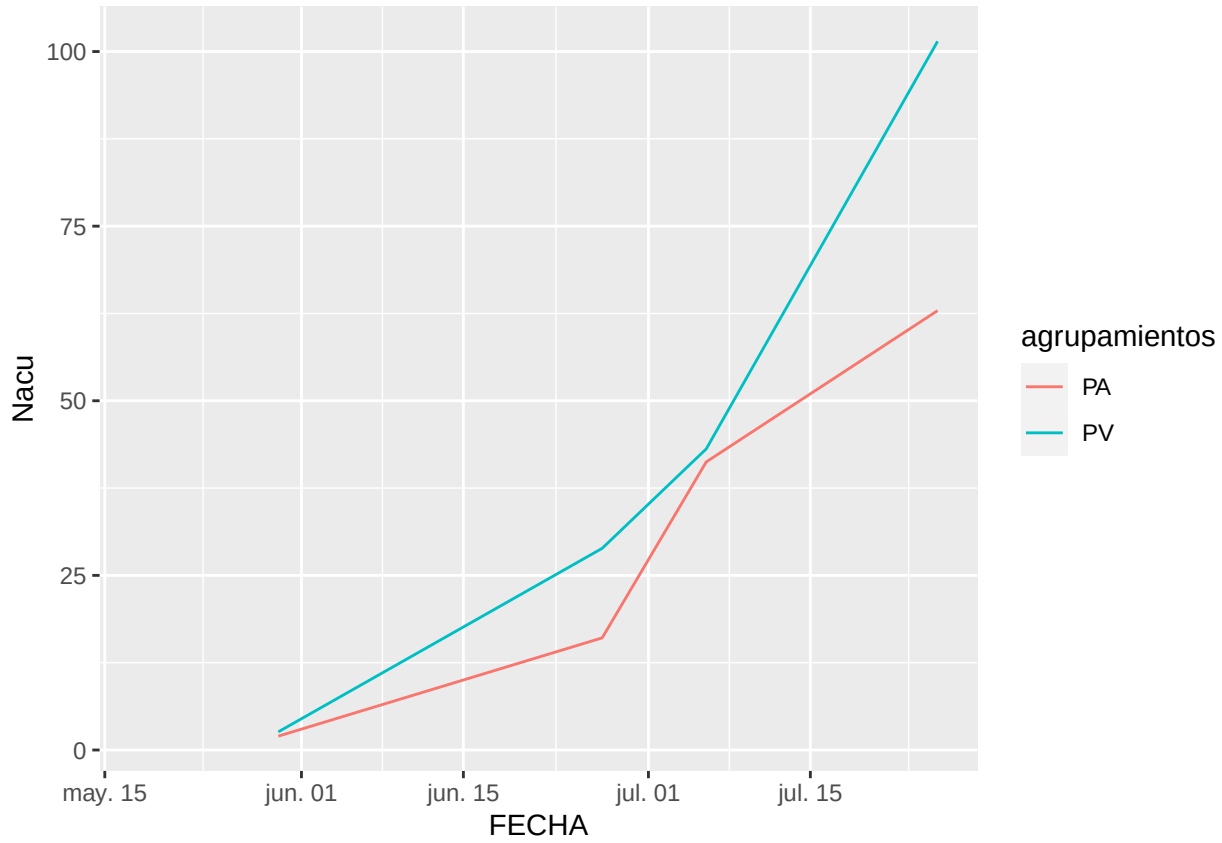
```
g1<-ggplot(descPTe2[descPTe2$ag=='dosis',], aes(FECHA, Nacu, color=agrupamientos))+geom_line()

g2<-ggplot(descPTe2[descPTe2$ag=='variedad',], aes(FECHA, Nacu, color=agrupamientos))+geom_line()

g3<-ggplot(descPTe2[descPTe2$ag=='tratamientos',], aes(FECHA, Nacu, color=agrupamientos))+geom_line()

g1
```

```
## Warning: Removed 4 rows containing missing values (`geom_line()`).
```



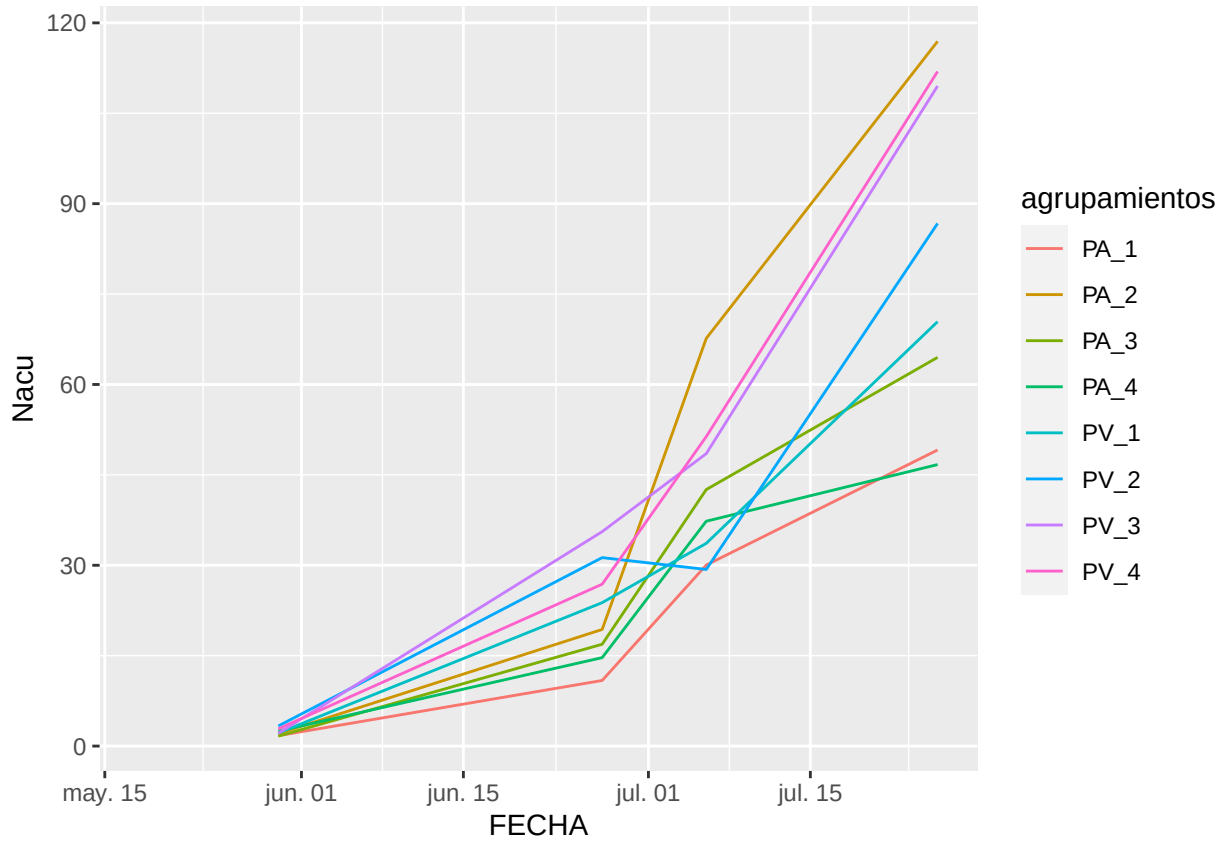

```
g2
```

```
## Warning: Removed 2 rows containing missing values (`geom_line()`).
```




```
g3
```

```
## Warning: Removed 8 rows containing missing values (`geom_line()`).
```



Analisis del Fósforo

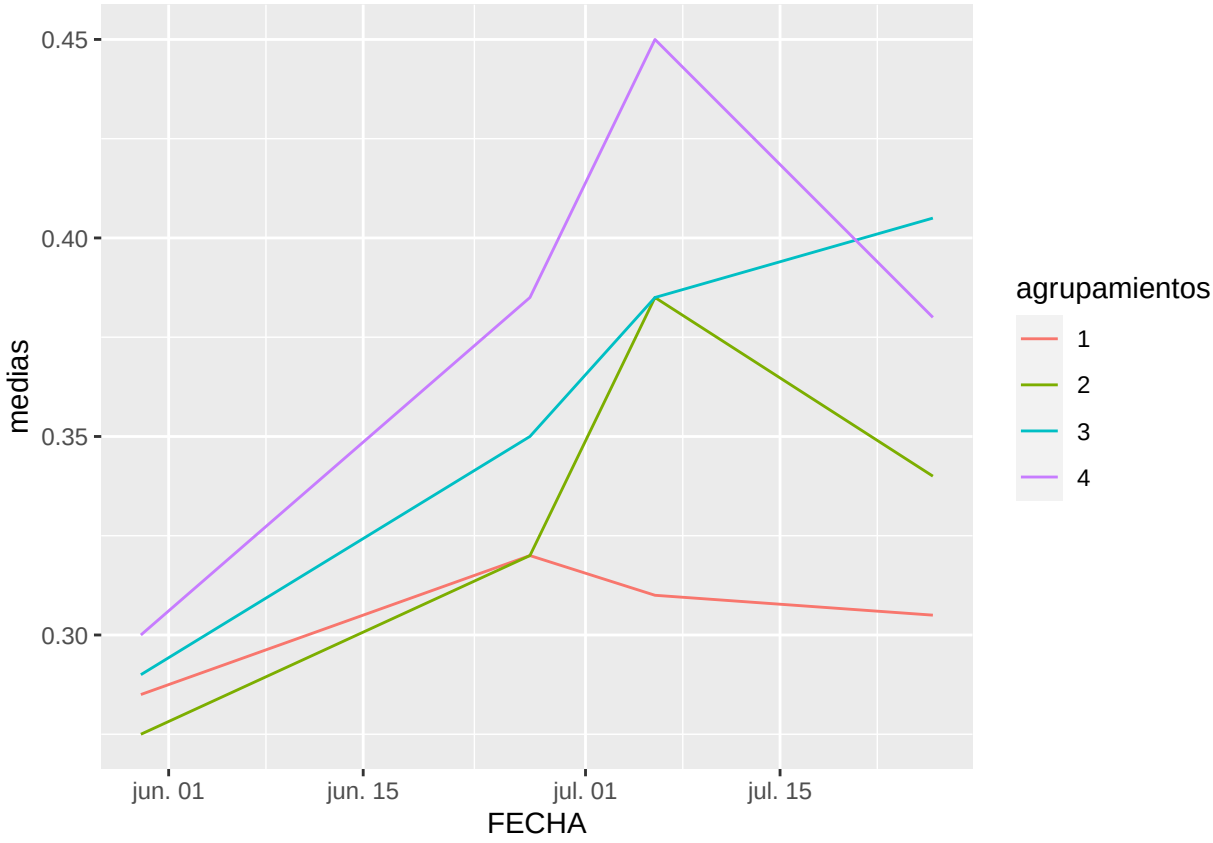
```
#Obtener una estadistica descriptiva del Fósforo para cada fecha

NE2$Medicion<-trimws(NE2$Medicion)

#fecha 1
NF<-NE2[NE2$Medicion =="PRIMERA",]

descP30May<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$P.,
                        NF$Tratamientos,
                        NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-5-30")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descP30May$FECHA<-fecha

#fecha 2
```

```r
NF<-NE2[NE2$Medicion =="SEGUNDA",]

descP27Jun<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$P.,
                        NF$Tratamientos,
                        NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-6-27")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descP27Jun$FECHA<-fecha

#fecha 3

NF<-NE2[NE2$Medicion =="TERCERA",]

descP06Jul<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$P.,
                        NF$Tratamientos,
                        NF)

fecha<-c()

for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-6")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descP06Jul$FECHA<-fecha

#fecha 4
  NF<-NE2[NE2$Medicion =="CUARTA",]

descP26Jul<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$P.,
                        NF$Tratamientos,
                        NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-26")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descP26Jul$FECHA<-fecha

#unir en un data frame
```

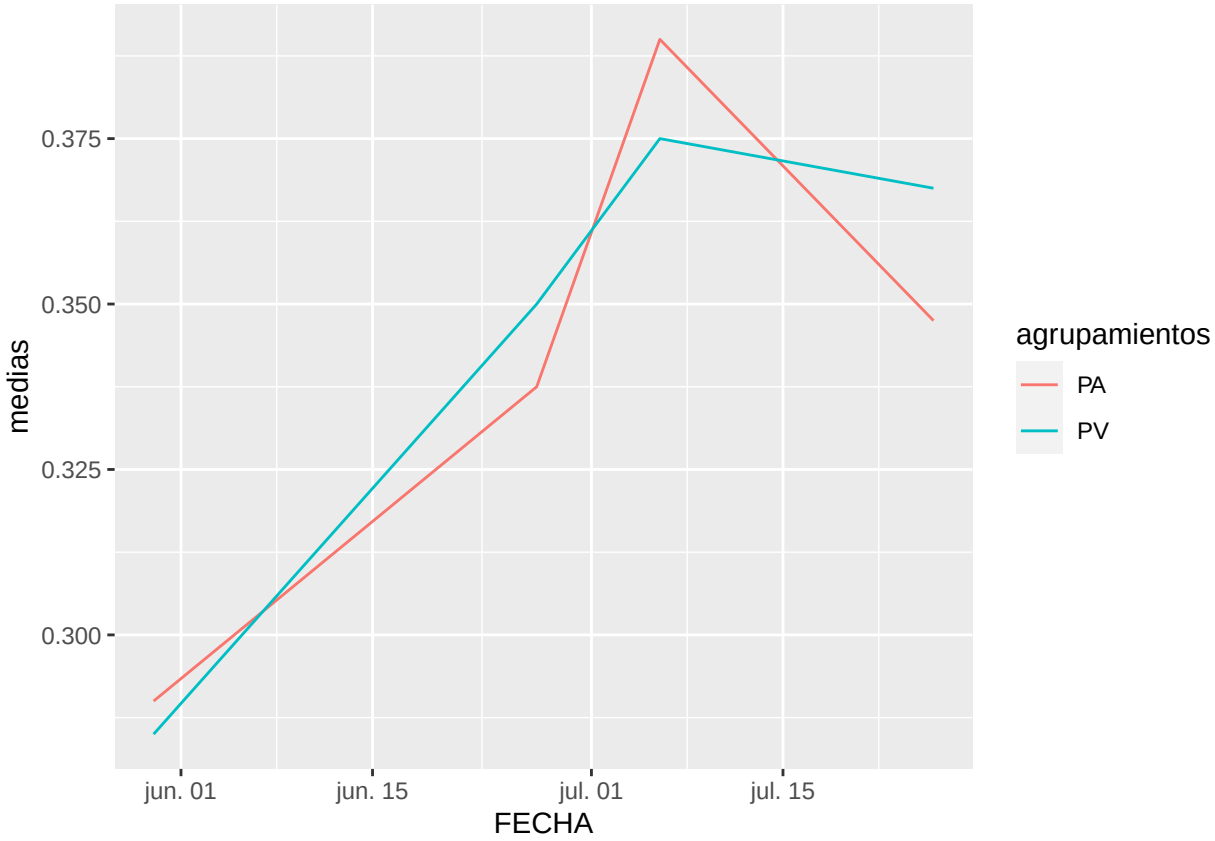
```
descPe1<-rbind(descP30May,
               descP27Jun,
               descP06Jul,
               descP26Jul)
```

plot concentración de N en el tiempo

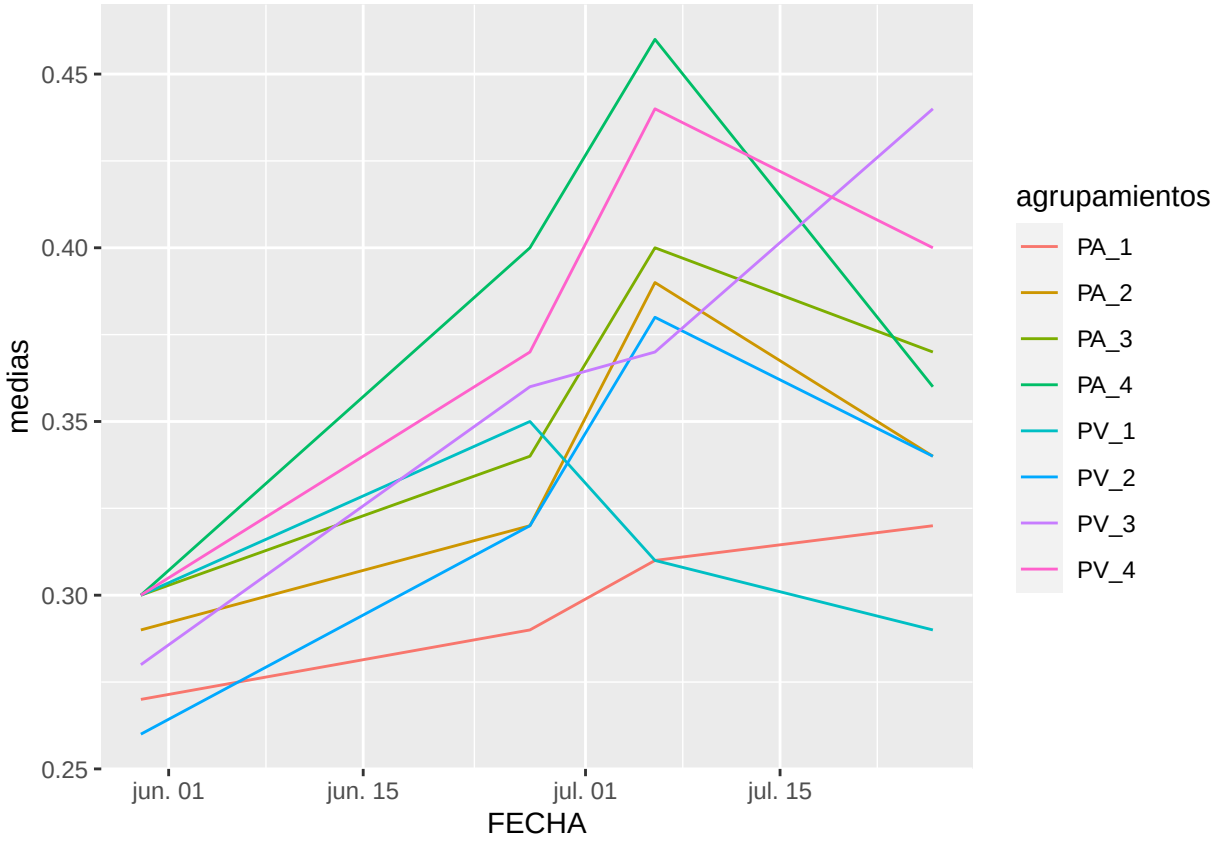
```
library(ggplot2)
g1<-ggplot(descPe1[descPe1$ag=='dosis',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g2<-ggplot(descPe1[descPe1$ag=='variedad',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g3<-ggplot(descPe1[descPe1$ag=='tratamientos',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g1
```




```
g2
```


0.375
0.350
0.325
0.300
medias
jun. 01
jun. 15
jul. 01
jul. 15
FECHA
agrupamientos
PA
PV

```
g3
```



acumulacion de Fósofor en el tiempo

```
concP<-c(NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,
         descPe1$medias)

descPTe2$Px100<-concP

descPTe2$Pacu<-descPTe2$Px100*descPTe2$medias

descPTe2
```

```
##              ag agrupamientos numero    medias Desvio_Standar        CV
## 1         dosis              1      8  0.062250     0.04017729  64.54182
## 2         dosis              2      8  0.062250     0.04017729  64.54182
## 3         dosis              3      8  0.062250     0.04017729  64.54182
## 4         dosis              4      8  0.062250     0.04017729  64.54182
## 5      variedad             PA     16  0.058500     0.05079370  86.82684
## 6      variedad             PV     16  0.066000     0.02007984  30.42400
## 7  tratamientos           PA_1      4  0.058500     0.05678908  97.07536
## 8  tratamientos           PV_1      4  0.066000     0.02244994  34.01507
## 9  tratamientos           PA_2      4  0.058500     0.05678908  97.07536
## 10 tratamientos           PV_2      4  0.066000     0.02244994  34.01507
## 11 tratamientos           PA_3      4  0.058500     0.05678908  97.07536
## 12 tratamientos           PV_3      4  0.066000     0.02244994  34.01507
```

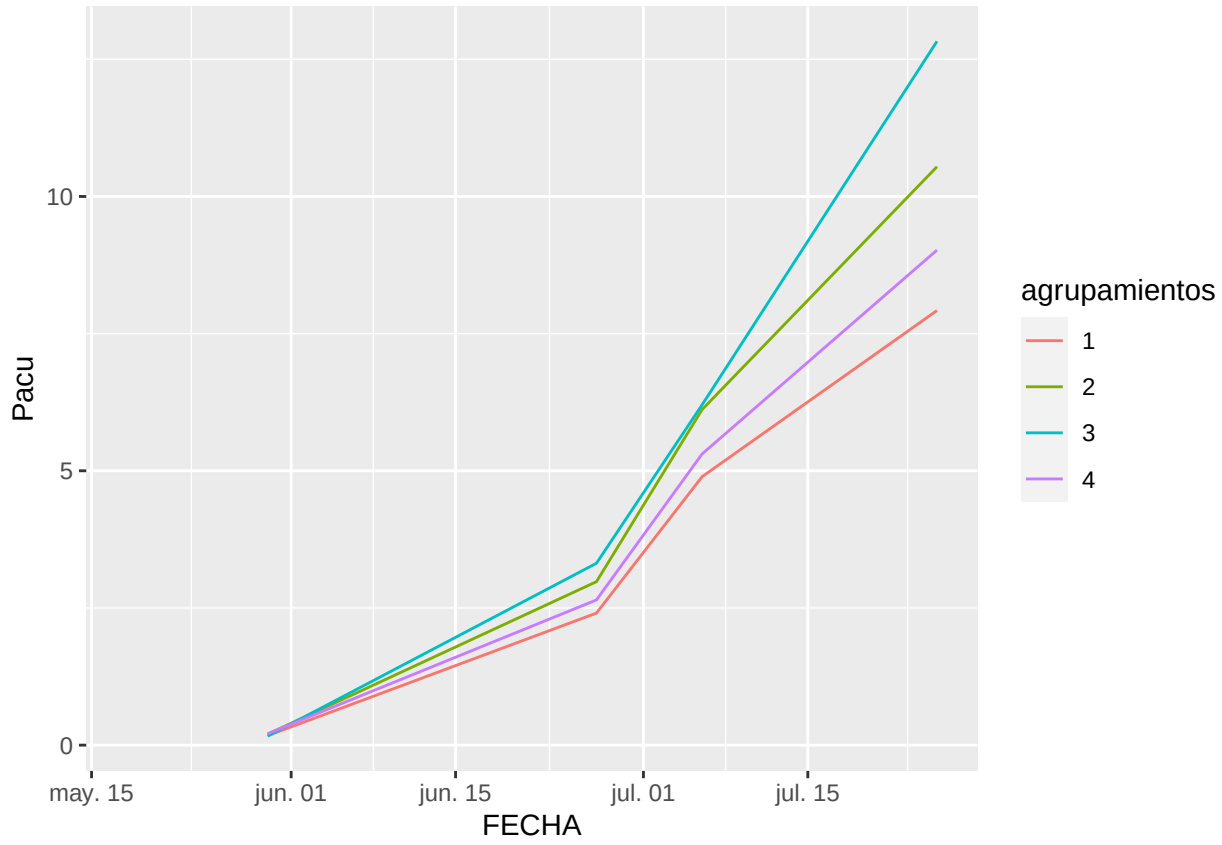
```
## 13 tratamientos          PA_4      4  0.058500     0.05678908  97.07536
## 14 tratamientos          PV_4      4  0.066000     0.02244994  34.01507
## 15        dosis             4      8  0.731250     0.20760109  28.38989
## 16        dosis             2      8  0.731250     0.24020453  32.84848
## 17        dosis             3      8  0.563750     0.29456687  52.25133
## 18        dosis             1      8  0.577500     0.42348048  73.32995
## 19     variedad            PV     16  0.755625     0.33986210  44.97762
## 20     variedad            PA     16  0.546250     0.21481387  39.32519
## 21 tratamientos          PV_4      4  0.787500     0.25460754  32.33112
## 22 tratamientos          PV_2      4  0.900000     0.19663842  21.84871
## 23 tratamientos          PV_3      4  0.632500     0.39390143  62.27691
## 24 tratamientos          PA_3      4  0.495000     0.18627936  37.63219
## 25 tratamientos          PV_1      4  0.702500     0.51551754  73.38328
## 26 tratamientos          PA_4      4  0.675000     0.16522712  24.47809
## 27 tratamientos          PA_2      4  0.562500     0.14150972  25.15728
## 28 tratamientos          PA_1      4  0.452500     0.33320414  73.63627
## 29        dosis             4      8  8.271250     4.12943247  49.92513
## 30        dosis             2      8  9.310000     4.07529841  43.77334
## 31        dosis             3      8  9.471250     4.90151999  51.75156
## 32        dosis             1      8  6.251250     3.14511157  50.31172
## 33     variedad            PV     16 10.565625     3.85331194  36.47027
## 34     variedad            PA     16  6.086250     3.08219808  50.64199
## 35 tratamientos          PV_4      4  9.490000     3.54177921  37.32117
## 36 tratamientos          PV_2      4 11.207500     4.66342775  41.60988
## 37 tratamientos          PV_3      4 12.752500     4.87562902  38.23273
## 38 tratamientos          PA_3      4  6.190000     1.89087281  30.54722
## 39 tratamientos          PV_1      4  8.812500     1.90002412  21.56056
## 40 tratamientos          PA_4      4  7.052500     4.82528324  68.41947
## 41 tratamientos          PA_2      4  7.412500     2.72088680  36.70674
## 42 tratamientos          PA_1      4  3.690000     1.40615314  38.10713
## 43        dosis             4      8 17.122500    11.66474511  68.12525
## 44        dosis             2      8 15.888750     9.06788436  57.07110
## 45        dosis             3      8 16.113750     3.96623945  24.61401
## 46        dosis             1      8 10.873750     7.40870904  68.13389
## 47     variedad            PV     16 14.346250     9.02753925  62.92613
## 48     variedad            PA     16 15.653125     8.06130487  51.49965
## 49 tratamientos          PV_4      4 17.952500    16.27555299  90.65898
## 50 tratamientos          PV_2      4 11.402500     4.74679102  41.62939
## 51 tratamientos          PV_3      4 16.227500     3.82877156  23.59434
## 52 tratamientos          PA_3      4 16.000000     4.69167348  29.32296
## 53 tratamientos          PV_1      4 11.802500     7.94711006  67.33412
## 54 tratamientos          PA_4      4 16.292500     7.12441518  43.72819
## 55 tratamientos          PA_2      4 20.375000    10.75450448  52.78284
## 56 tratamientos          PA_1      4  9.945000     7.91312201  79.56885
## 57        dosis             4      8 29.582500    18.12266832  61.26145
## 58        dosis             2      8 31.006250    18.67837706  60.24068
## 59        dosis             3      8 31.672500    12.64002232  39.90851
## 60        dosis             1      8 20.845000    15.08675010  72.37587
## 61     variedad            PV     16 33.320000    15.52174389  46.58387
## 62     variedad            PA     16 23.233125    15.56140641  66.97939
## 63 tratamientos          PV_4      4 40.407500    20.34101993  50.33971
## 64 tratamientos          PV_2      4 30.322500    20.43198371  67.38225
## 65 tratamientos          PV_3      4 37.127500    10.69840292  28.81531
## 66 tratamientos          PA_3      4 26.217500    13.37868298  51.02959
```

```
## 67 tratamientos          PV_1      4 25.422500     8.80322810  34.62770
## 68 tratamientos          PA_4      4 18.757500     6.33249490  33.75980
## 69 tratamientos          PA_2      4 31.690000    19.88327941  62.74307
## 70 tratamientos          PA_1      4 16.267500    19.94284897 122.59320
##         FECHA      AREAF  Nx100       Nacu  Px100       Pacu
## 1  2023-05-18   13.69567     NA         NA     NA         NA
## 2  2023-05-18   13.69567     NA         NA     NA         NA
## 3  2023-05-18   13.69567     NA         NA     NA         NA
## 4  2023-05-18   13.69567     NA         NA     NA         NA
## 5  2023-05-18   13.18950     NA         NA     NA         NA
## 6  2023-05-18   14.20185     NA         NA     NA         NA
## 7  2023-05-18   13.18950     NA         NA     NA         NA
## 8  2023-05-18   14.20185     NA         NA     NA         NA
## 9  2023-05-18   13.18950     NA         NA     NA         NA
## 10 2023-05-18   14.20185     NA         NA     NA         NA
## 11 2023-05-18   13.18950     NA         NA     NA         NA
## 12 2023-05-18   14.20185     NA         NA     NA         NA
## 13 2023-05-18   13.18950     NA         NA     NA         NA
## 14 2023-05-18   14.20185     NA         NA     NA         NA
## 15 2023-05-30  149.37975 3.6650   2.680031 0.2850  0.2084063
## 16 2023-05-30  150.63938 3.3400   2.442375 0.2750  0.2010938
## 17 2023-05-30  162.53975 3.3750   1.902656 0.2900  0.1634875
## 18 2023-05-30  121.08137 3.7450   2.162737 0.3000  0.1732500
## 19 2023-05-30  186.79650 3.4350   2.595572 0.2900  0.2191312
## 20 2023-05-30  105.02362 3.6275   1.981522 0.2850  0.1556813
## 21 2023-05-30  170.43075 3.6300   2.858625 0.2700  0.2126250
## 22 2023-05-30  195.44900 3.7000   3.330000 0.3000  0.2700000
## 23 2023-05-30  221.25650 3.3600   2.125200 0.2900  0.1834250
## 24 2023-05-30  103.82300 3.3200   1.643400 0.2600  0.1287000
## 25 2023-05-30  160.04975 3.0800   2.163700 0.3000  0.2107500
## 26 2023-05-30  128.32875 3.6700   2.477250 0.2800  0.1890000
## 27 2023-05-30  105.82975 3.6700   2.064375 0.3000  0.1687500
## 28 2023-05-30   82.11300 3.8200   1.728550 0.3000  0.1357500
## 29 2023-06-27 1374.91130 2.8100  23.242213 0.3200  2.6468000
## 30 2023-06-27 1394.16096 2.7600  25.695600 0.3200  2.9792000
## 31 2023-06-27  540.69669 2.3900  22.636288 0.3500  3.3149375
## 32 2023-06-27  851.08637 2.7800  17.378475 0.3850  2.4067312
## 33 2023-06-27 1155.33877 2.7325  28.870570 0.3375  3.5658984
## 34 2023-06-27  925.08889 2.6375  16.052484 0.3500  2.1301875
## 35 2023-06-27 1538.00802 2.8300  26.856700 0.2900  2.7521000
## 36 2023-06-27 1565.90113 2.7900  31.268925 0.3500  3.9226250
## 37 2023-06-27  304.09243 2.7900  35.579475 0.3200  4.0808000
## 38 2023-06-27  777.30095 2.7300  16.898700 0.3200  1.9808000
## 39 2023-06-27 1213.35350 2.7000  23.793750 0.3400  2.9962500
## 40 2023-06-27 1211.81457 2.0800  14.669200 0.3600  2.5389000
## 41 2023-06-27 1222.42078 2.6100  19.346625 0.4000  2.9650000
## 42 2023-06-27  488.81925 2.9500  10.885500 0.3700  1.3653000
## 43 2023-07-06 4771.77522 2.7150  46.487587 0.3100  5.3079750
## 44 2023-07-06 2729.75500 2.8250  44.885719 0.3850  6.1171688
## 45 2023-07-06 1007.03776 2.5700  41.412338 0.3850  6.2037937
## 46 2023-07-06 1097.29783 3.1700  34.469788 0.4500  4.8931875
## 47 2023-07-06 3052.39293 3.0050  43.110481 0.3900  5.5950375
## 48 2023-07-06 1750.53998 2.6350  41.245984 0.3750  5.8699219
## 49 2023-07-06 7138.07221 2.8600  51.344150 0.3100  5.5652750
```

```
## 50 2023-07-06 2965.18825 2.5700  29.304425 0.3100  3.5347750
## 51 2023-07-06  681.05656 2.9900  48.520225 0.3900  6.3287250
## 52 2023-07-06 1333.01896 2.6600  42.560000 0.3800  6.0800000
## 53 2023-07-06 1425.25470 2.8500  33.637125 0.4000  4.7210000
## 54 2023-07-06 2405.47824 2.2900  37.309825 0.3700  6.0282250
## 55 2023-07-06 2494.32175 3.3200  67.645000 0.4600  9.3725000
## 56 2023-07-06  769.34096 3.0200  30.033900 0.4400  4.3758000
## 57 2023-07-26 2988.93284 2.8150  83.274738 0.3050  9.0226625
## 58 2023-07-26 2709.10436 2.7050  83.871906 0.3400 10.5421250
## 59 2023-07-26 2433.60668 2.6300  83.298675 0.4050 12.8273625
## 60 2023-07-26 1682.95862 3.3550  69.934975 0.3800  7.9211000
## 61 2023-07-26 3309.41404 3.0450 101.459400 0.3475 11.5787000
## 62 2023-07-26 1597.88721 2.7075  62.903686 0.3675  8.5381734
## 63 2023-07-26 4883.12028 2.7700 111.928775 0.3200 12.9304000
## 64 2023-07-26 2571.83235 2.8600  86.722350 0.2900  8.7935250
## 65 2023-07-26 3390.51849 2.9500 109.526125 0.3400 12.6233500
## 66 2023-07-26 1476.69488 2.4600  64.495050 0.3400  8.9139500
## 67 2023-07-26 2392.18502 2.7700  70.420325 0.3700  9.4063250
## 68 2023-07-26 1094.74539 2.4900  46.706175 0.4400  8.2533000
## 69 2023-07-26 2846.37637 3.6900 116.936100 0.3600 11.4084000
## 70 2023-07-26  973.73222 3.0200  49.127850 0.4000  6.5070000
```

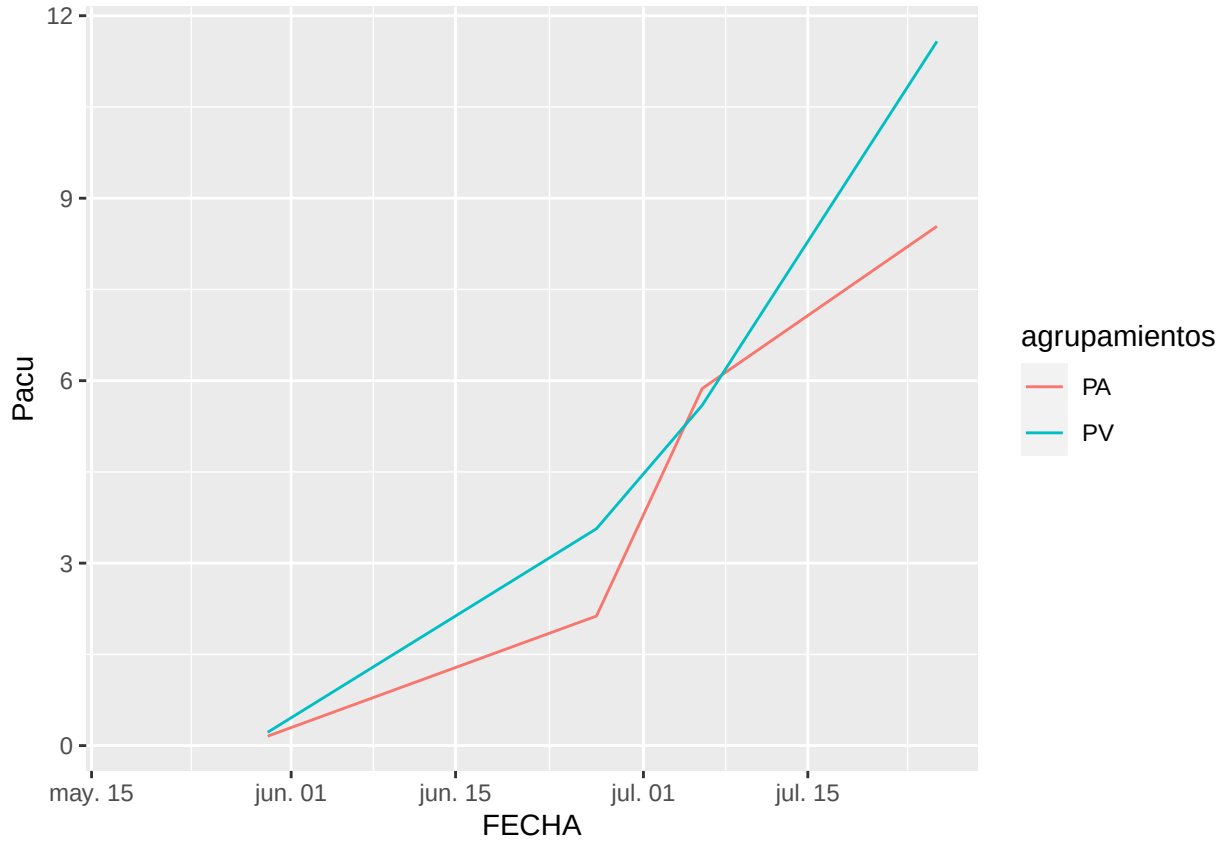
```
g1<-ggplot(descPTe2[descPTe2$ag=='dosis',], aes(FECHA, Pacu, color=agrupamientos))+geom_line()

g2<-ggplot(descPTe2[descPTe2$ag=='variedad',], aes(FECHA, Pacu, color=agrupamientos))+geom_line()

g3<-ggplot(descPTe2[descPTe2$ag=='tratamientos',], aes(FECHA, Pacu, color=agrupamientos))+geom_line()

g1
```

```
## Warning: Removed 4 rows containing missing values (`geom_line()`).
```



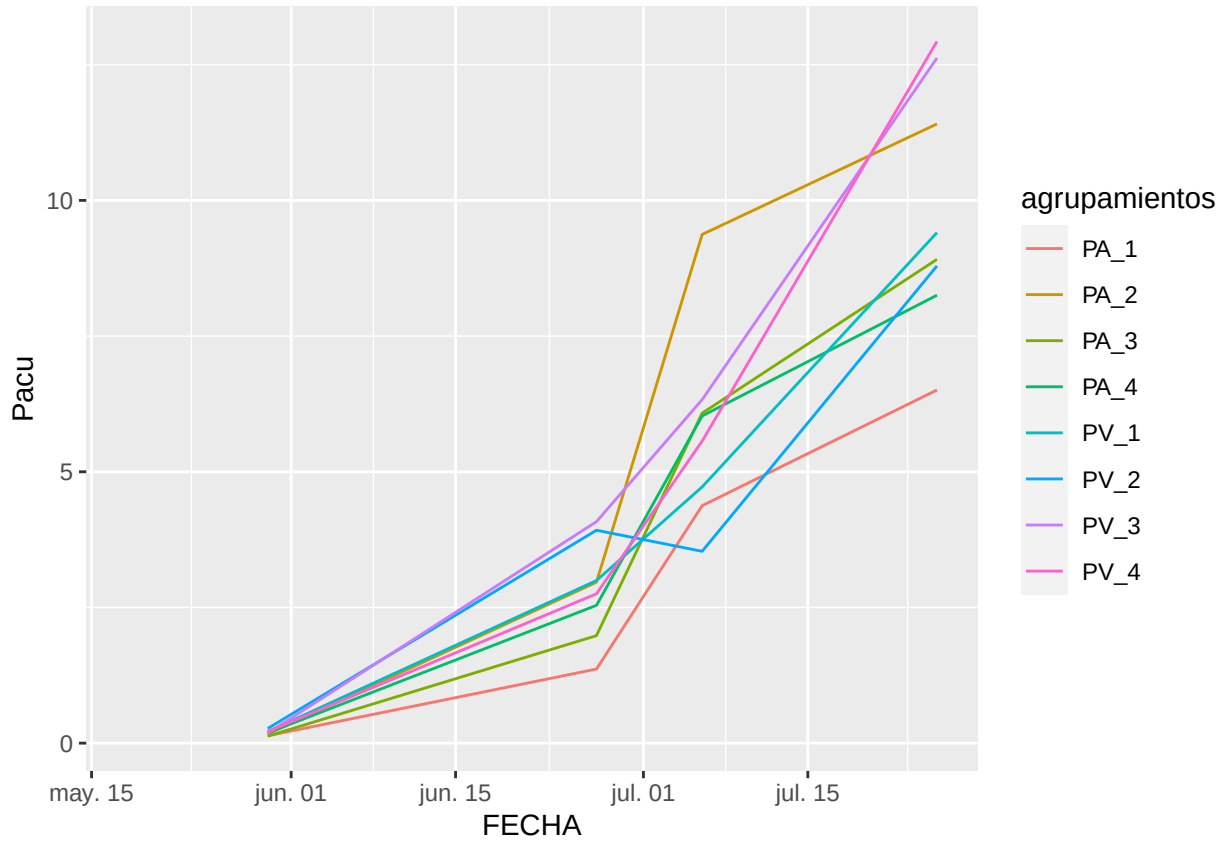

```
g2
```

```
## Warning: Removed 2 rows containing missing values (`geom_line()`).
```




```
g3
```

```
## Warning: Removed 8 rows containing missing values (`geom_line()`).
```



Analisis del Potasio

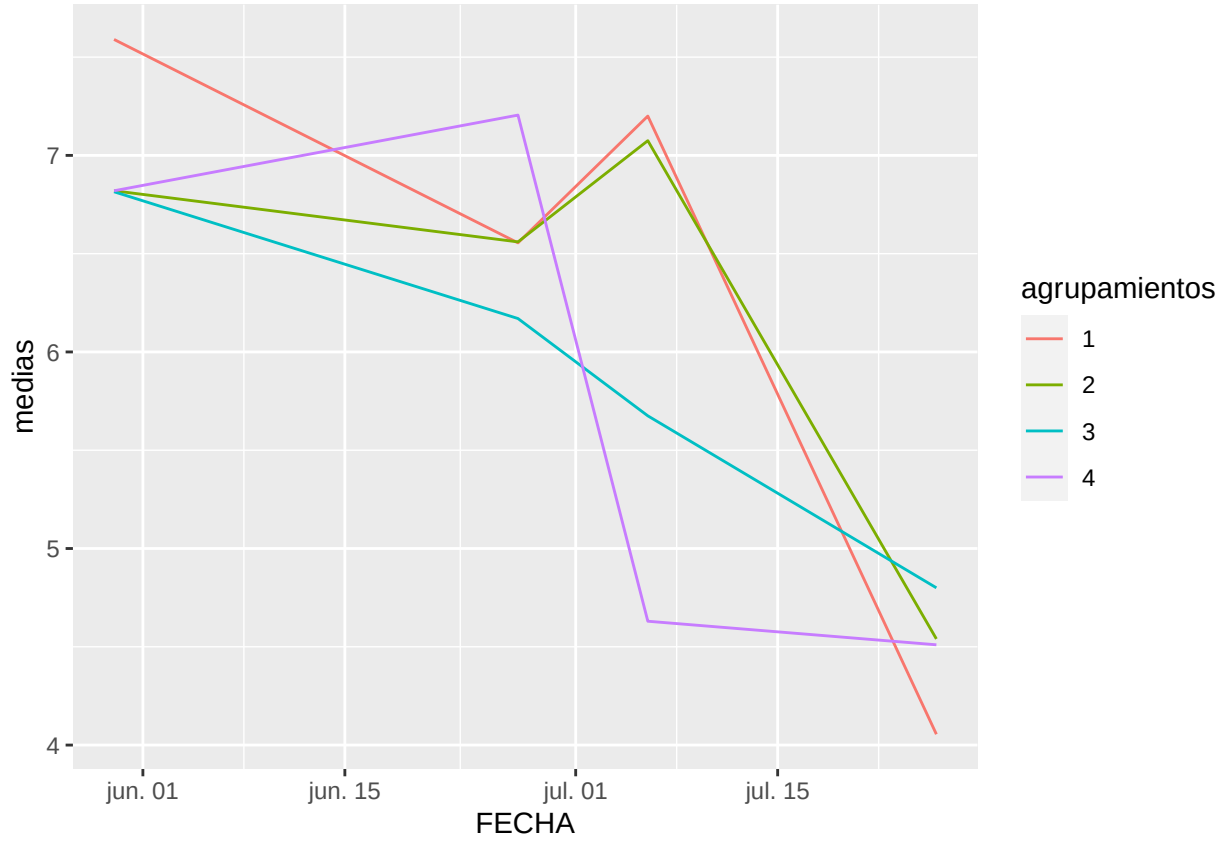
```
#Obtener una estadistica descriptiva del nitrogeno para cada fecha

NE2$Medicion<-trimws(NE2$Medicion)

#fecha 1
NF<-NE2[NE2$Medicion =="PRIMERA",]

descK30May<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$K.,
                        NF$Tratamientos,
                        NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-5-30")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descK30May$FECHA<-fecha

#fecha 2
```

```r
NF<-NE2[NE2$Medicion =="SEGUNDA",]

descK27Jun<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$K.,
                        NF$Tratamientos,
                        NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-6-27")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descK27Jun$FECHA<-fecha

#fecha 3

NF<-NE2[NE2$Medicion =="TERCERA",]

descK06Jul<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$K.,
                        NF$Tratamientos,
                        NF)

fecha<-c()

for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-6")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descK06Jul$FECHA<-fecha

#fecha 4
  NF<-NE2[NE2$Medicion =="CUARTA",]

descK26Jul<-resumir2fat(NF$dosis,
                        NF$NV,
                        NF$K.,
                        NF$Tratamientos,
                        NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-26")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descK26Jul$FECHA<-fecha

#unir en un data frame
```

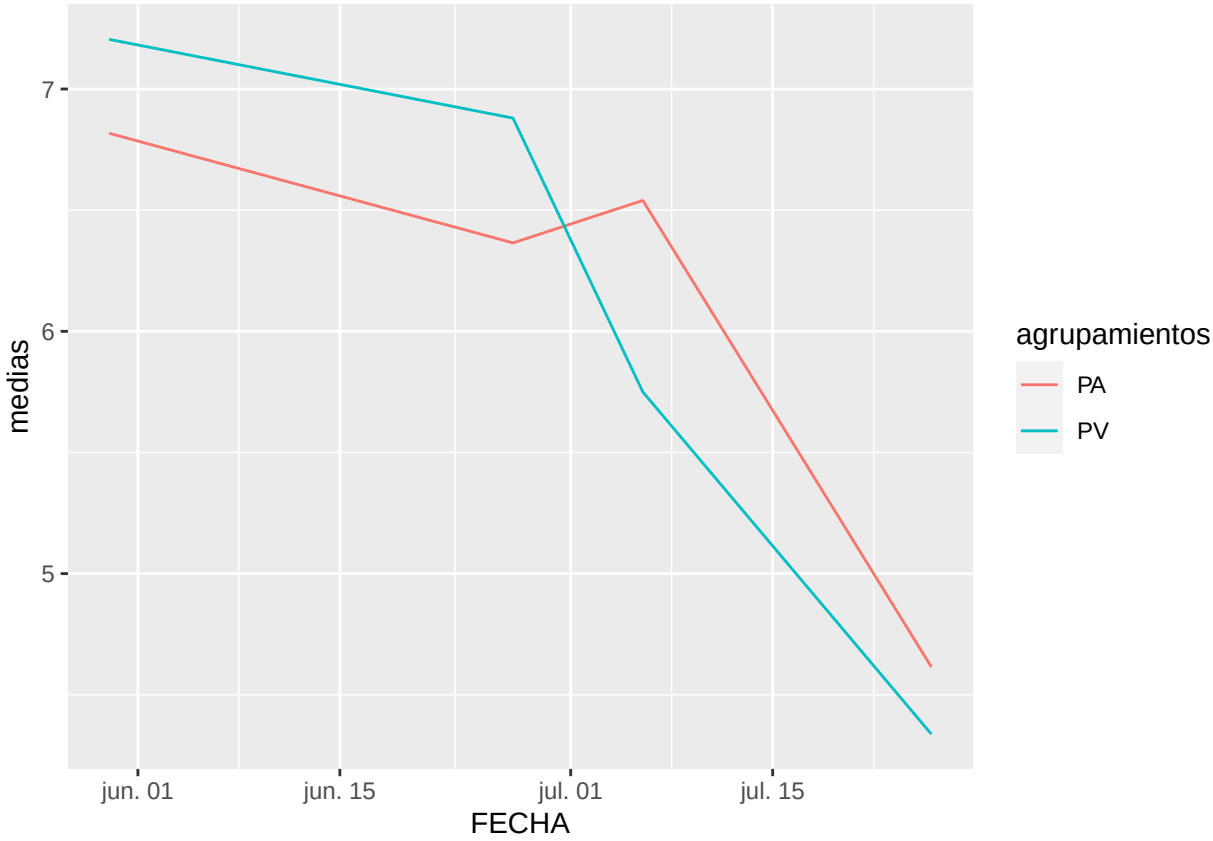
```
descKe1<-rbind(descK30May,
               descK27Jun,
               descK06Jul,
               descK26Jul)
```

plot concentración de Potacio en el tiempo

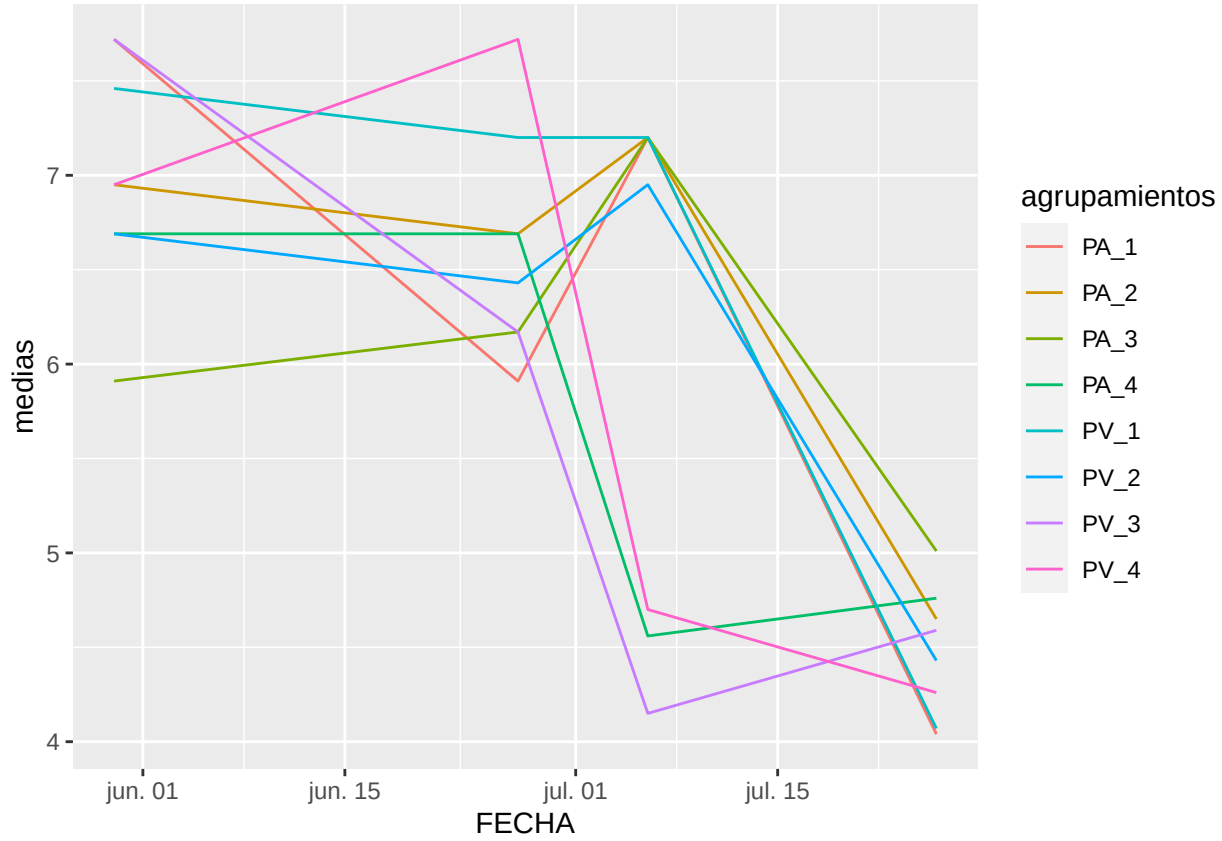
```
library(ggplot2)
g1<-ggplot(descKe1[descKe1$ag=='dosis',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g2<-ggplot(descKe1[descKe1$ag=='variedad',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g3<-ggplot(descKe1[descKe1$ag=='tratamientos',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g1
```




```
g2
```


7
6
5
medias
jun. 01
jun. 15
jul. 01
jul. 15
FECHA
agrupamientos
PA
PV

```
g3
```



acumulacion de Potacio en el tiempo

```
concK<-c(NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,
         descKe1$medias)

descPTe2$Kx100<-concK

descPTe2$Kacu<-descPTe2$Kx100*descPTe2$medias

descPTe2
```

```
##              ag agrupamientos numero    medias Desvio_Standar        CV
## 1         dosis              1      8  0.062250     0.04017729  64.54182
## 2         dosis              2      8  0.062250     0.04017729  64.54182
## 3         dosis              3      8  0.062250     0.04017729  64.54182
## 4         dosis              4      8  0.062250     0.04017729  64.54182
## 5      variedad             PA     16  0.058500     0.05079370  86.82684
## 6      variedad             PV     16  0.066000     0.02007984  30.42400
## 7  tratamientos           PA_1      4  0.058500     0.05678908  97.07536
## 8  tratamientos           PV_1      4  0.066000     0.02244994  34.01507
## 9  tratamientos           PA_2      4  0.058500     0.05678908  97.07536
## 10 tratamientos           PV_2      4  0.066000     0.02244994  34.01507
## 11 tratamientos           PA_3      4  0.058500     0.05678908  97.07536
## 12 tratamientos           PV_3      4  0.066000     0.02244994  34.01507
```

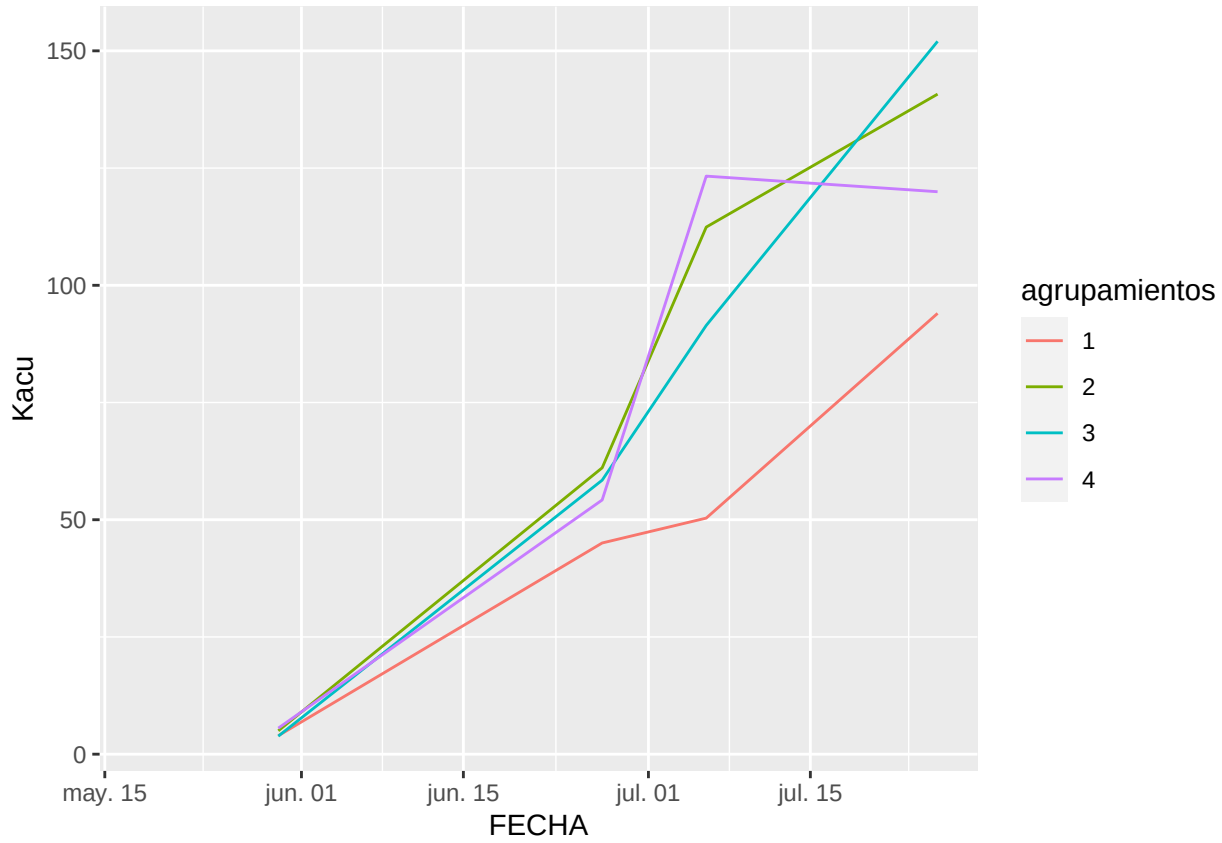
```
## 13 tratamientos          PA_4      4  0.058500     0.05678908  97.07536
## 14 tratamientos          PV_4      4  0.066000     0.02244994  34.01507
## 15        dosis             4      8  0.731250     0.20760109  28.38989
## 16        dosis             2      8  0.731250     0.24020453  32.84848
## 17        dosis             3      8  0.563750     0.29456687  52.25133
## 18        dosis             1      8  0.577500     0.42348048  73.32995
## 19     variedad            PV     16  0.755625     0.33986210  44.97762
## 20     variedad            PA     16  0.546250     0.21481387  39.32519
## 21 tratamientos          PV_4      4  0.787500     0.25460754  32.33112
## 22 tratamientos          PV_2      4  0.900000     0.19663842  21.84871
## 23 tratamientos          PV_3      4  0.632500     0.39390143  62.27691
## 24 tratamientos          PA_3      4  0.495000     0.18627936  37.63219
## 25 tratamientos          PV_1      4  0.702500     0.51551754  73.38328
## 26 tratamientos          PA_4      4  0.675000     0.16522712  24.47809
## 27 tratamientos          PA_2      4  0.562500     0.14150972  25.15728
## 28 tratamientos          PA_1      4  0.452500     0.33320414  73.63627
## 29        dosis             4      8  8.271250     4.12943247  49.92513
## 30        dosis             2      8  9.310000     4.07529841  43.77334
## 31        dosis             3      8  9.471250     4.90151999  51.75156
## 32        dosis             1      8  6.251250     3.14511157  50.31172
## 33     variedad            PV     16 10.565625     3.85331194  36.47027
## 34     variedad            PA     16  6.086250     3.08219808  50.64199
## 35 tratamientos          PV_4      4  9.490000     3.54177921  37.32117
## 36 tratamientos          PV_2      4 11.207500     4.66342775  41.60988
## 37 tratamientos          PV_3      4 12.752500     4.87562902  38.23273
## 38 tratamientos          PA_3      4  6.190000     1.89087281  30.54722
## 39 tratamientos          PV_1      4  8.812500     1.90002412  21.56056
## 40 tratamientos          PA_4      4  7.052500     4.82528324  68.41947
## 41 tratamientos          PA_2      4  7.412500     2.72088680  36.70674
## 42 tratamientos          PA_1      4  3.690000     1.40615314  38.10713
## 43        dosis             4      8 17.122500    11.66474511  68.12525
## 44        dosis             2      8 15.888750     9.06788436  57.07110
## 45        dosis             3      8 16.113750     3.96623945  24.61401
## 46        dosis             1      8 10.873750     7.40870904  68.13389
## 47     variedad            PV     16 14.346250     9.02753925  62.92613
## 48     variedad            PA     16 15.653125     8.06130487  51.49965
## 49 tratamientos          PV_4      4 17.952500    16.27555299  90.65898
## 50 tratamientos          PV_2      4 11.402500     4.74679102  41.62939
## 51 tratamientos          PV_3      4 16.227500     3.82877156  23.59434
## 52 tratamientos          PA_3      4 16.000000     4.69167348  29.32296
## 53 tratamientos          PV_1      4 11.802500     7.94711006  67.33412
## 54 tratamientos          PA_4      4 16.292500     7.12441518  43.72819
## 55 tratamientos          PA_2      4 20.375000    10.75450448  52.78284
## 56 tratamientos          PA_1      4  9.945000     7.91312201  79.56885
## 57        dosis             4      8 29.582500    18.12266832  61.26145
## 58        dosis             2      8 31.006250    18.67837706  60.24068
## 59        dosis             3      8 31.672500    12.64002232  39.90851
## 60        dosis             1      8 20.845000    15.08675010  72.37587
## 61     variedad            PV     16 33.320000    15.52174389  46.58387
## 62     variedad            PA     16 23.233125    15.56140641  66.97939
## 63 tratamientos          PV_4      4 40.407500    20.34101993  50.33971
## 64 tratamientos          PV_2      4 30.322500    20.43198371  67.38225
## 65 tratamientos          PV_3      4 37.127500    10.69840292  28.81531
## 66 tratamientos          PA_3      4 26.217500    13.37868298  51.02959
```

```
## 67 tratamientos          PV_1      4 25.422500     8.80322810  34.62770
## 68 tratamientos          PA_4      4 18.757500     6.33249490  33.75980
## 69 tratamientos          PA_2      4 31.690000    19.88327941  62.74307
## 70 tratamientos          PA_1      4 16.267500    19.94284897 122.59320
##         FECHA      AREAF  Nx100       Nacu  Px100       Pacu  Kx100       Kacu
## 1  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 2  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 3  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 4  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 5  2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 6  2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 7  2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 8  2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 9  2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 10 2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 11 2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 12 2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 13 2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 14 2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 15 2023-05-30  149.37975 3.6650   2.680031 0.2850  0.2084063 7.5900   5.550187
## 16 2023-05-30  150.63938 3.3400   2.442375 0.2750  0.2010938 6.8200   4.987125
## 17 2023-05-30  162.53975 3.3750   1.902656 0.2900  0.1634875 6.8150   3.841956
## 18 2023-05-30  121.08137 3.7450   2.162737 0.3000  0.1732500 6.8200   3.938550
## 19 2023-05-30  186.79650 3.4350   2.595572 0.2900  0.2191312 6.8175   5.151473
## 20 2023-05-30  105.02362 3.6275   1.981522 0.2850  0.1556813 7.2050   3.935731
## 21 2023-05-30  170.43075 3.6300   2.858625 0.2700  0.2126250 7.7200   6.079500
## 22 2023-05-30  195.44900 3.7000   3.330000 0.3000  0.2700000 7.4600   6.714000
## 23 2023-05-30  221.25650 3.3600   2.125200 0.2900  0.1834250 6.9500   4.395875
## 24 2023-05-30  103.82300 3.3200   1.643400 0.2600  0.1287000 6.6900   3.311550
## 25 2023-05-30  160.04975 3.0800   2.163700 0.3000  0.2107500 5.9100   4.151775
## 26 2023-05-30  128.32875 3.6700   2.477250 0.2800  0.1890000 7.7200   5.211000
## 27 2023-05-30  105.82975 3.6700   2.064375 0.3000  0.1687500 6.6900   3.763125
## 28 2023-05-30   82.11300 3.8200   1.728550 0.3000  0.1357500 6.9500   3.144875
## 29 2023-06-27 1374.91130 2.8100  23.242213 0.3200  2.6468000 6.5550  54.218044
## 30 2023-06-27 1394.16096 2.7600  25.695600 0.3200  2.9792000 6.5600  61.073600
## 31 2023-06-27  540.69669 2.3900  22.636288 0.3500  3.3149375 6.1700  58.437612
## 32 2023-06-27  851.08637 2.7800  17.378475 0.3850  2.4067312 7.2050  45.040256
## 33 2023-06-27 1155.33877 2.7325  28.870570 0.3375  3.5658984 6.3650  67.250203
## 34 2023-06-27  925.08889 2.6375  16.052484 0.3500  2.1301875 6.8800  41.873400
## 35 2023-06-27 1538.00802 2.8300  26.856700 0.2900  2.7521000 5.9100  56.085900
## 36 2023-06-27 1565.90113 2.7900  31.268925 0.3500  3.9226250 7.2000  80.694000
## 37 2023-06-27  304.09243 2.7900  35.579475 0.3200  4.0808000 6.6900  85.314225
## 38 2023-06-27  777.30095 2.7300  16.898700 0.3200  1.9808000 6.4300  39.801700
## 39 2023-06-27 1213.35350 2.7000  23.793750 0.3400  2.9962500 6.1700  54.373125
## 40 2023-06-27 1211.81457 2.0800  14.669200 0.3600  2.5389000 6.1700  43.513925
## 41 2023-06-27 1222.42078 2.6100  19.346625 0.4000  2.9650000 6.6900  49.589625
## 42 2023-06-27  488.81925 2.9500  10.885500 0.3700  1.3653000 7.7200  28.486800
## 43 2023-07-06 4771.77522 2.7150  46.487587 0.3100  5.3079750 7.2000 123.282000
## 44 2023-07-06 2729.75500 2.8250  44.885719 0.3850  6.1171688 7.0750 112.412906
## 45 2023-07-06 1007.03776 2.5700  41.412338 0.3850  6.2037937 5.6750  91.445531
## 46 2023-07-06 1097.29783 3.1700  34.469788 0.4500  4.8931875 4.6300  50.345463
## 47 2023-07-06 3052.39293 3.0050  43.110481 0.3900  5.5950375 6.5400  93.824475
## 48 2023-07-06 1750.53998 2.6350  41.245984 0.3750  5.8699219 5.7500  90.005469
## 49 2023-07-06 7138.07221 2.8600  51.344150 0.3100  5.5652750 7.2000 129.258000
```

```
## 50 2023-07-06 2965.18825 2.5700  29.304425 0.3100  3.5347750 7.2000  82.098000
## 51 2023-07-06  681.05656 2.9900  48.520225 0.3900  6.3287250 7.2000 116.838000
## 52 2023-07-06 1333.01896 2.6600  42.560000 0.3800  6.0800000 6.9500 111.200000
## 53 2023-07-06 1425.25470 2.8500  33.637125 0.4000  4.7210000 7.2000  84.978000
## 54 2023-07-06 2405.47824 2.2900  37.309825 0.3700  6.0282250 4.1500  67.613875
## 55 2023-07-06 2494.32175 3.3200  67.645000 0.4600  9.3725000 4.5600  92.910000
## 56 2023-07-06  769.34096 3.0200  30.033900 0.4400  4.3758000 4.7000  46.741500
## 57 2023-07-26 2988.93284 2.8150  83.274738 0.3050  9.0226625 4.0550 119.957037
## 58 2023-07-26 2709.10436 2.7050  83.871906 0.3400 10.5421250 4.5400 140.768375
## 59 2023-07-26 2433.60668 2.6300  83.298675 0.4050 12.8273625 4.8000 152.028000
## 60 2023-07-26 1682.95862 3.3550  69.934975 0.3800  7.9211000 4.5100  94.010950
## 61 2023-07-26 3309.41404 3.0450 101.459400 0.3475 11.5787000 4.6150 153.771800
## 62 2023-07-26 1597.88721 2.7075  62.903686 0.3675  8.5381734 4.3375 100.773680
## 63 2023-07-26 4883.12028 2.7700 111.928775 0.3200 12.9304000 4.0400 163.246300
## 64 2023-07-26 2571.83235 2.8600  86.722350 0.2900  8.7935250 4.0700 123.412575
## 65 2023-07-26 3390.51849 2.9500 109.526125 0.3400 12.6233500 4.6500 172.642875
## 66 2023-07-26 1476.69488 2.4600  64.495050 0.3400  8.9139500 4.4300 116.143525
## 67 2023-07-26 2392.18502 2.7700  70.420325 0.3700  9.4063250 5.0100 127.366725
## 68 2023-07-26 1094.74539 2.4900  46.706175 0.4400  8.2533000 4.5900  86.096925
## 69 2023-07-26 2846.37637 3.6900 116.936100 0.3600 11.4084000 4.7600 150.844400
## 70 2023-07-26  973.73222 3.0200  49.127850 0.4000  6.5070000 4.2600  69.299550
```

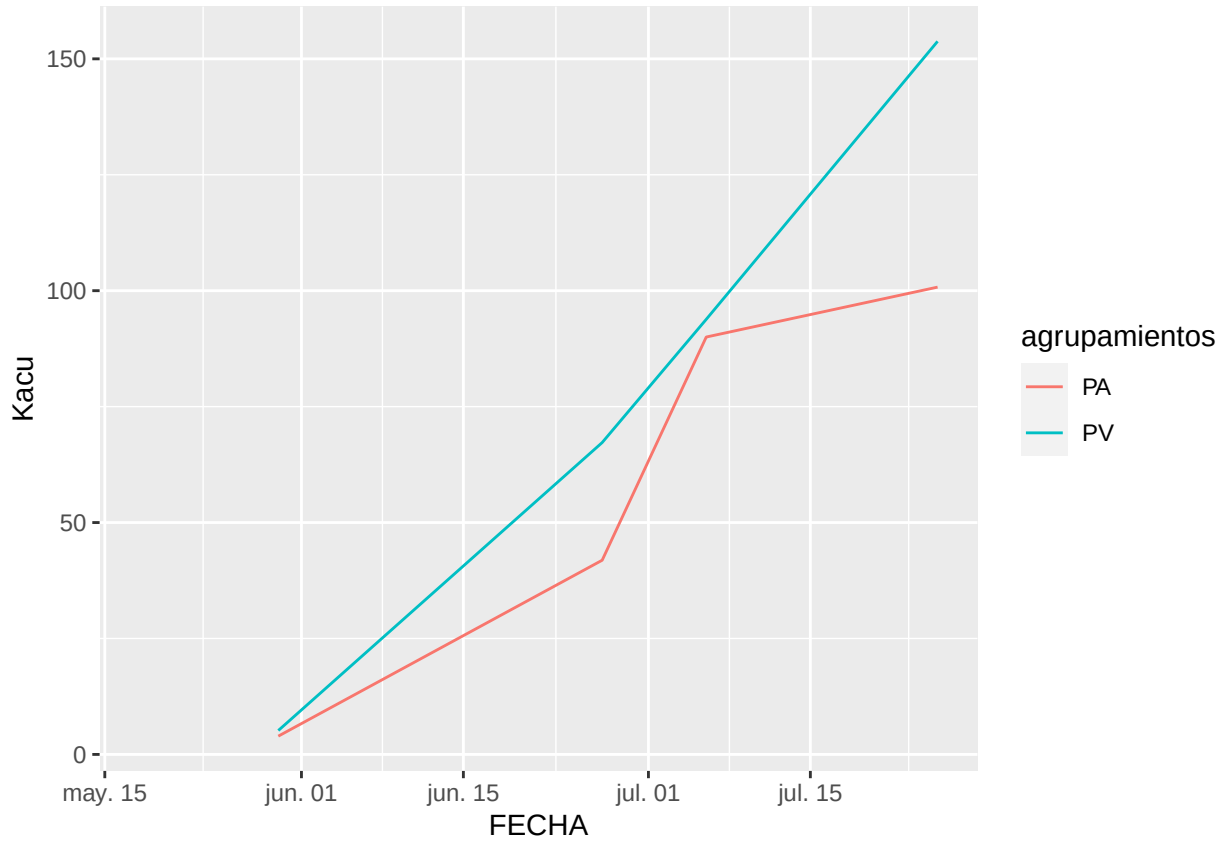
```
g1<-ggplot(descPTe2[descPTe2$ag=='dosis',], aes(FECHA, Kacu, color=agrupamientos))+geom_line()

g2<-ggplot(descPTe2[descPTe2$ag=='variedad',], aes(FECHA, Kacu, color=agrupamientos))+geom_line()

g3<-ggplot(descPTe2[descPTe2$ag=='tratamientos',], aes(FECHA, Kacu, color=agrupamientos))+geom_line()

g1
```

```
## Warning: Removed 4 rows containing missing values (`geom_line()`).
```



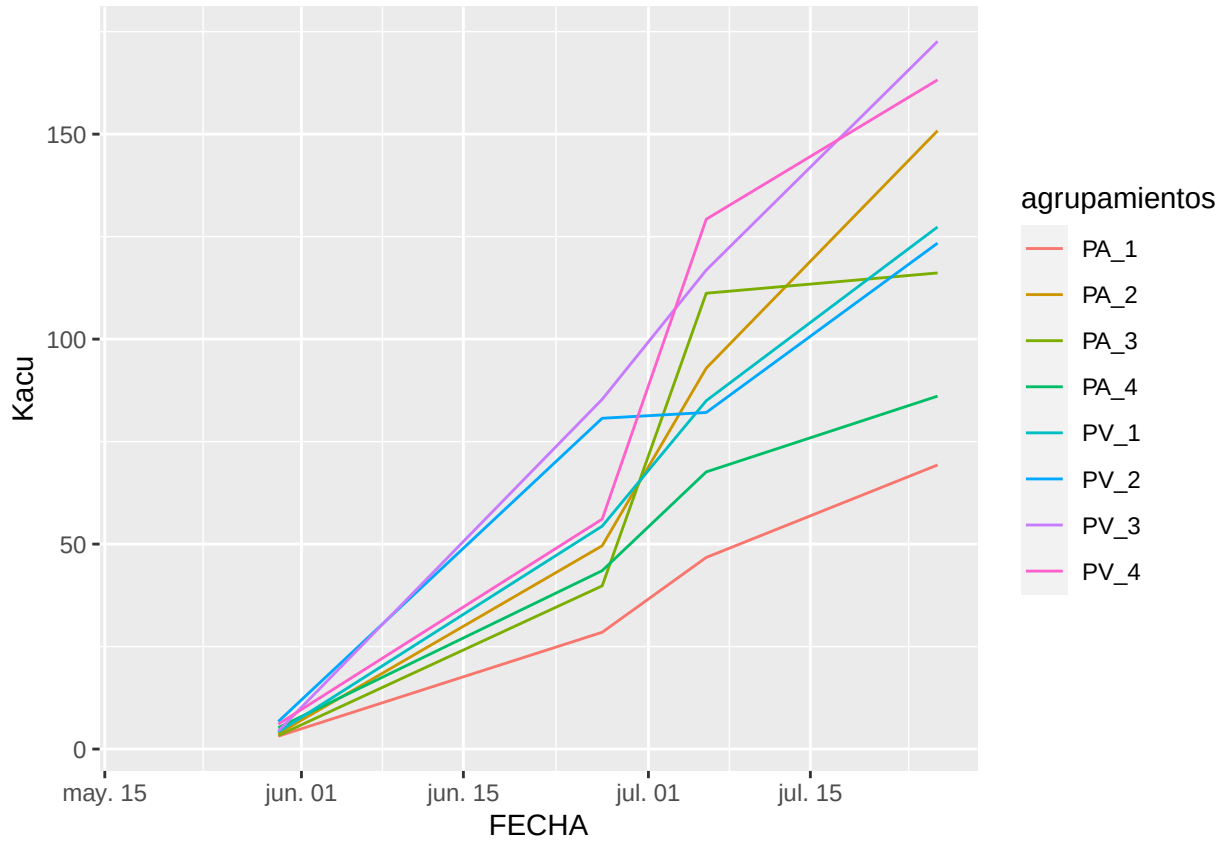

```
g2
```

```
## Warning: Removed 2 rows containing missing values (`geom_line()`).
```




```
g3
```

```
## Warning: Removed 8 rows containing missing values (`geom_line()`).
```



Analisis del Calcio

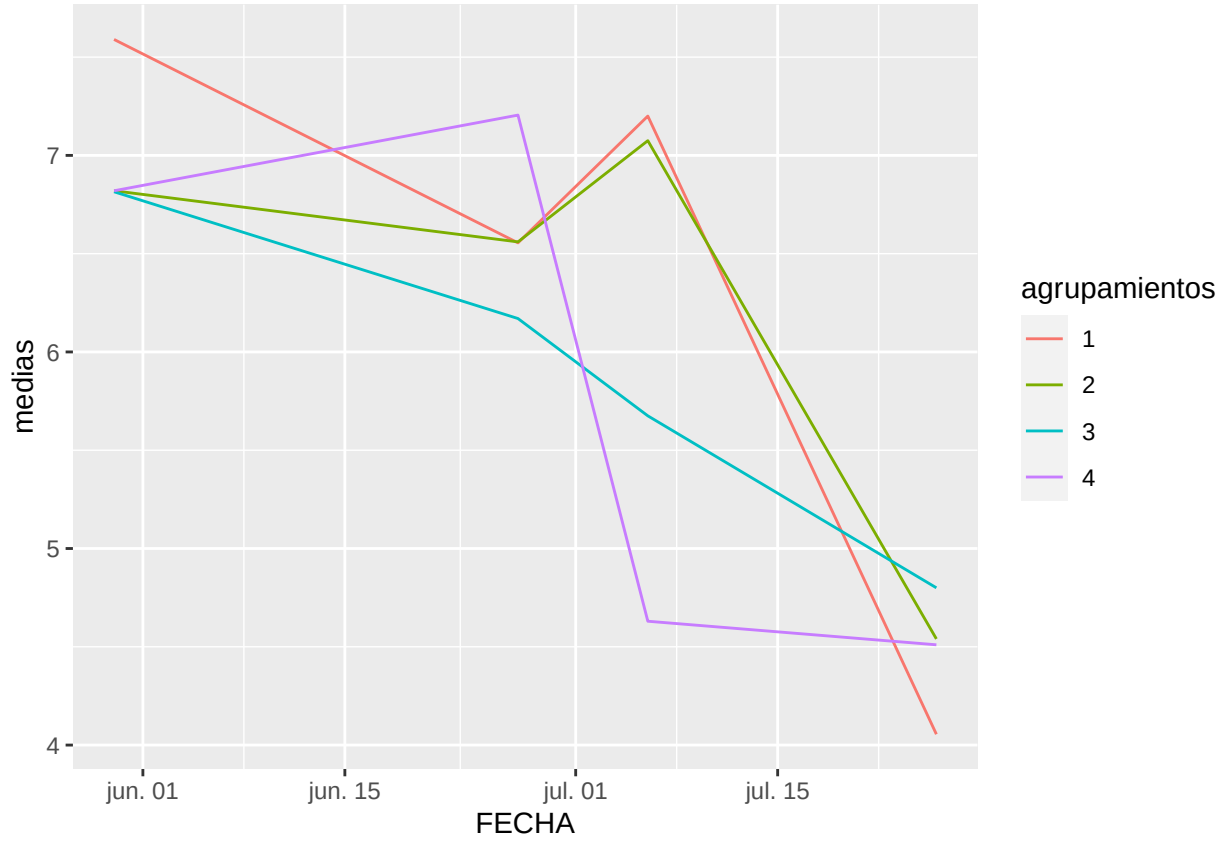
```
#Obtener una estadistica descriptiva del nitrogeno para cada fecha

NE2$Medicion<-trimws(NE2$Medicion)

#fecha 1
NF<-NE2[NE2$Medicion =="PRIMERA",]

descCa30May<-resumir2fat(NF$dosis,
                         NF$NV,
                         NF$Ca.,
                         NF$Tratamientos,
                         NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-5-30")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descCa30May$FECHA<-fecha

#fecha 2
```

```
NF<-NE2[NE2$Medicion =="SEGUNDA",]

descCa27Jun<-resumir2fat(NF$dosis,
                         NF$NV,
                         NF$Ca.,
                         NF$Tratamientos,
                         NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-6-27")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descCa27Jun$FECHA<-fecha

#fecha 3

NF<-NE2[NE2$Medicion =="TERCERA",]

descCa06Jul<-resumir2fat(NF$dosis,
                         NF$NV,
                         NF$Ca.,
                         NF$Tratamientos,
                         NF)

fecha<-c()

for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-6")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descCa06Jul$FECHA<-fecha

#fecha 4
  NF<-NE2[NE2$Medicion =="CUARTA",]

descCa26Jul<-resumir2fat(NF$dosis,
                         NF$NV,
                         NF$Ca.,
                         NF$Tratamientos,
                         NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-26")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descCa26Jul$FECHA<-fecha

#unir en un data frame
```

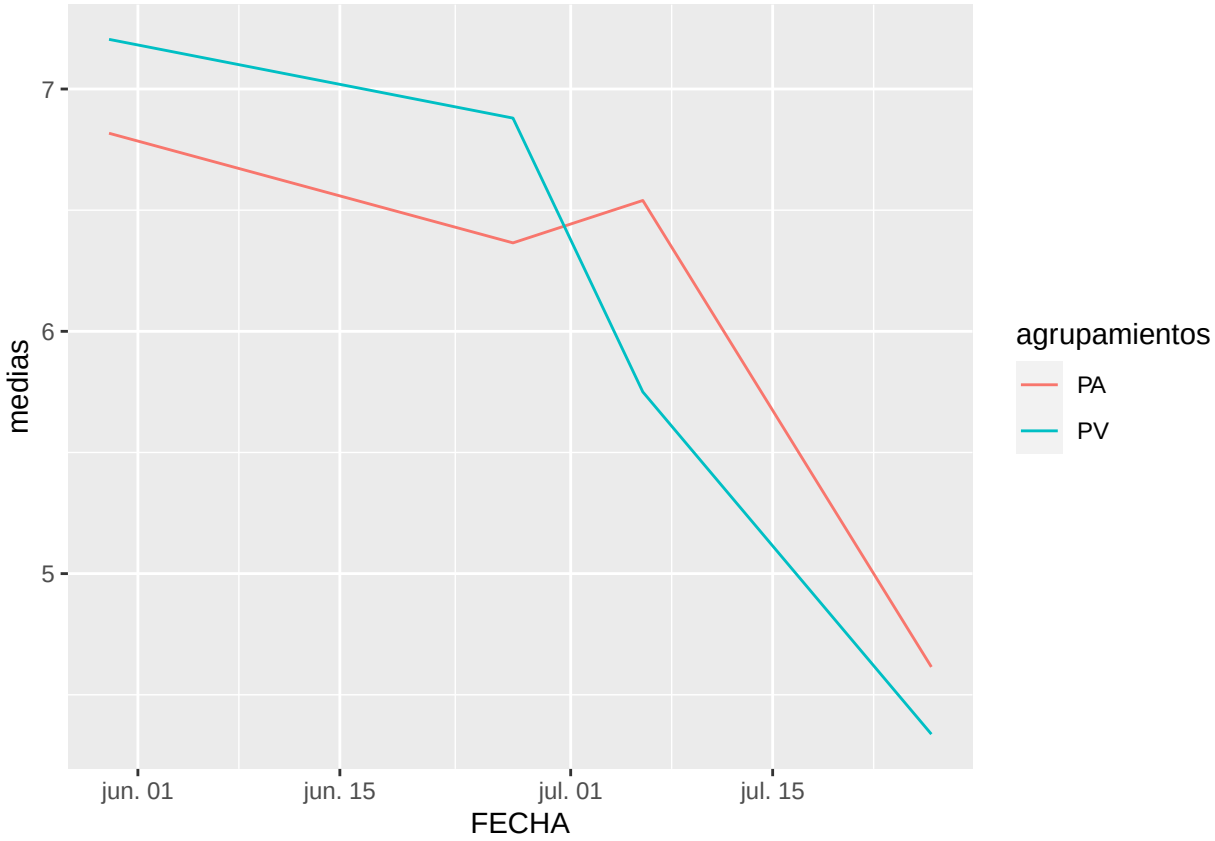
```
descCae1<-rbind(descCa30May,
                descCa27Jun,
                descCa06Jul,
                descCa26Jul)
```

plot concentración de Calcio en el tiempo

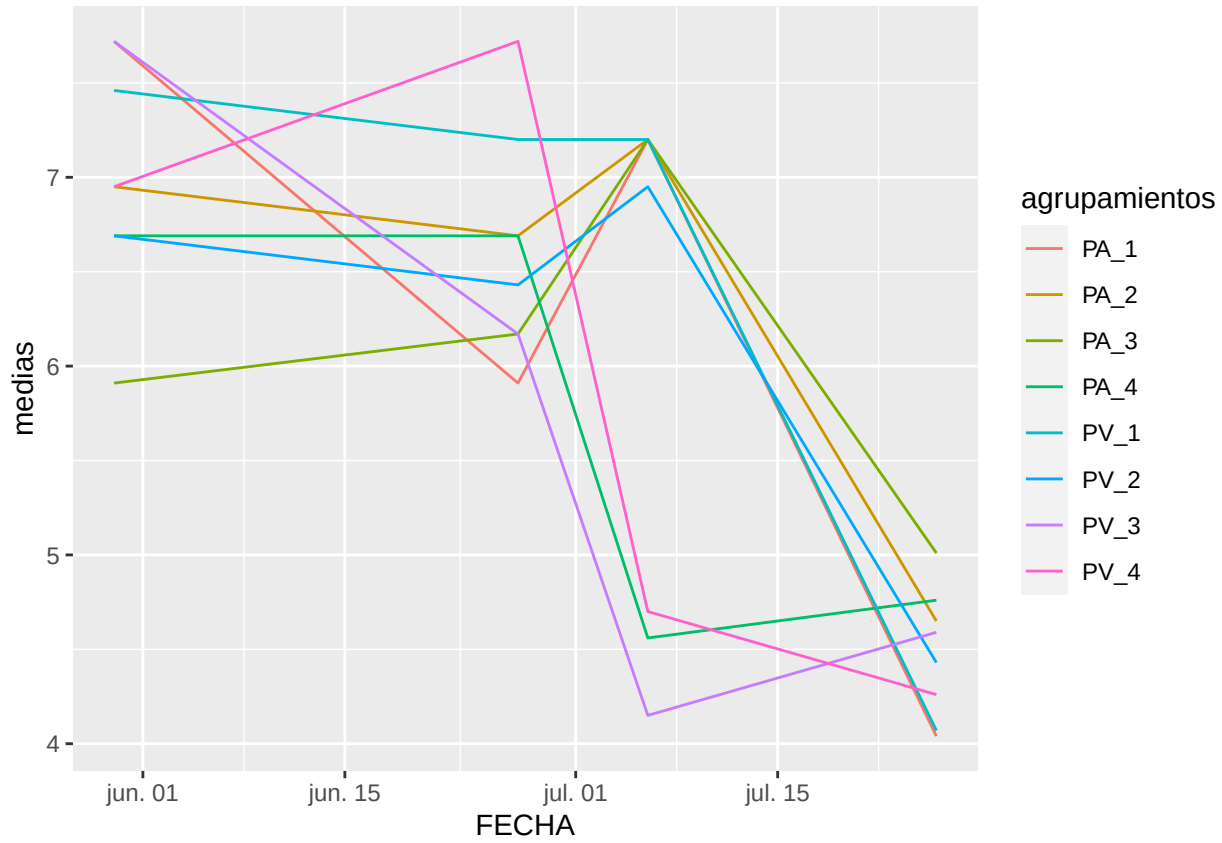
```
library(ggplot2)
g1<-ggplot(descKe1[descCae1$ag=='dosis',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g2<-ggplot(descKe1[descCae1$ag=='variedad',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g3<-ggplot(descKe1[descCae1$ag=='tratamientos',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g1
```




```
g2
```


7
6
5
medias
jun. 01
jun. 15
jul. 01
jul. 15
FECHA
agrupamientos
PA
PV

```
g3
```



acumulacion de Calcio en el tiempo

```
concK<-c(NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,
         descCae1$medias)

descPTe2$Cax100<-concK

descPTe2$Caacu<-descPTe2$Cax100*descPTe2$medias

descPTe2
```

```
##              ag agrupamientos numero    medias Desvio_Standar        CV
## 1         dosis              1      8  0.062250     0.04017729  64.54182
## 2         dosis              2      8  0.062250     0.04017729  64.54182
## 3         dosis              3      8  0.062250     0.04017729  64.54182
## 4         dosis              4      8  0.062250     0.04017729  64.54182
## 5      variedad             PA     16  0.058500     0.05079370  86.82684
## 6      variedad             PV     16  0.066000     0.02007984  30.42400
## 7  tratamientos           PA_1      4  0.058500     0.05678908  97.07536
## 8  tratamientos           PV_1      4  0.066000     0.02244994  34.01507
## 9  tratamientos           PA_2      4  0.058500     0.05678908  97.07536
## 10 tratamientos           PV_2      4  0.066000     0.02244994  34.01507
## 11 tratamientos           PA_3      4  0.058500     0.05678908  97.07536
## 12 tratamientos           PV_3      4  0.066000     0.02244994  34.01507
```

```
## 13 tratamientos          PA_4      4  0.058500     0.05678908  97.07536
## 14 tratamientos          PV_4      4  0.066000     0.02244994  34.01507
## 15        dosis             4      8  0.731250     0.20760109  28.38989
## 16        dosis             2      8  0.731250     0.24020453  32.84848
## 17        dosis             3      8  0.563750     0.29456687  52.25133
## 18        dosis             1      8  0.577500     0.42348048  73.32995
## 19     variedad            PV     16  0.755625     0.33986210  44.97762
## 20     variedad            PA     16  0.546250     0.21481387  39.32519
## 21 tratamientos          PV_4      4  0.787500     0.25460754  32.33112
## 22 tratamientos          PV_2      4  0.900000     0.19663842  21.84871
## 23 tratamientos          PV_3      4  0.632500     0.39390143  62.27691
## 24 tratamientos          PA_3      4  0.495000     0.18627936  37.63219
## 25 tratamientos          PV_1      4  0.702500     0.51551754  73.38328
## 26 tratamientos          PA_4      4  0.675000     0.16522712  24.47809
## 27 tratamientos          PA_2      4  0.562500     0.14150972  25.15728
## 28 tratamientos          PA_1      4  0.452500     0.33320414  73.63627
## 29        dosis             4      8  8.271250     4.12943247  49.92513
## 30        dosis             2      8  9.310000     4.07529841  43.77334
## 31        dosis             3      8  9.471250     4.90151999  51.75156
## 32        dosis             1      8  6.251250     3.14511157  50.31172
## 33     variedad            PV     16 10.565625     3.85331194  36.47027
## 34     variedad            PA     16  6.086250     3.08219808  50.64199
## 35 tratamientos          PV_4      4  9.490000     3.54177921  37.32117
## 36 tratamientos          PV_2      4 11.207500     4.66342775  41.60988
## 37 tratamientos          PV_3      4 12.752500     4.87562902  38.23273
## 38 tratamientos          PA_3      4  6.190000     1.89087281  30.54722
## 39 tratamientos          PV_1      4  8.812500     1.90002412  21.56056
## 40 tratamientos          PA_4      4  7.052500     4.82528324  68.41947
## 41 tratamientos          PA_2      4  7.412500     2.72088680  36.70674
## 42 tratamientos          PA_1      4  3.690000     1.40615314  38.10713
## 43        dosis             4      8 17.122500    11.66474511  68.12525
## 44        dosis             2      8 15.888750     9.06788436  57.07110
## 45        dosis             3      8 16.113750     3.96623945  24.61401
## 46        dosis             1      8 10.873750     7.40870904  68.13389
## 47     variedad            PV     16 14.346250     9.02753925  62.92613
## 48     variedad            PA     16 15.653125     8.06130487  51.49965
## 49 tratamientos          PV_4      4 17.952500    16.27555299  90.65898
## 50 tratamientos          PV_2      4 11.402500     4.74679102  41.62939
## 51 tratamientos          PV_3      4 16.227500     3.82877156  23.59434
## 52 tratamientos          PA_3      4 16.000000     4.69167348  29.32296
## 53 tratamientos          PV_1      4 11.802500     7.94711006  67.33412
## 54 tratamientos          PA_4      4 16.292500     7.12441518  43.72819
## 55 tratamientos          PA_2      4 20.375000    10.75450448  52.78284
## 56 tratamientos          PA_1      4  9.945000     7.91312201  79.56885
## 57        dosis             4      8 29.582500    18.12266832  61.26145
## 58        dosis             2      8 31.006250    18.67837706  60.24068
## 59        dosis             3      8 31.672500    12.64002232  39.90851
## 60        dosis             1      8 20.845000    15.08675010  72.37587
## 61     variedad            PV     16 33.320000    15.52174389  46.58387
## 62     variedad            PA     16 23.233125    15.56140641  66.97939
## 63 tratamientos          PV_4      4 40.407500    20.34101993  50.33971
## 64 tratamientos          PV_2      4 30.322500    20.43198371  67.38225
## 65 tratamientos          PV_3      4 37.127500    10.69840292  28.81531
## 66 tratamientos          PA_3      4 26.217500    13.37868298  51.02959
```

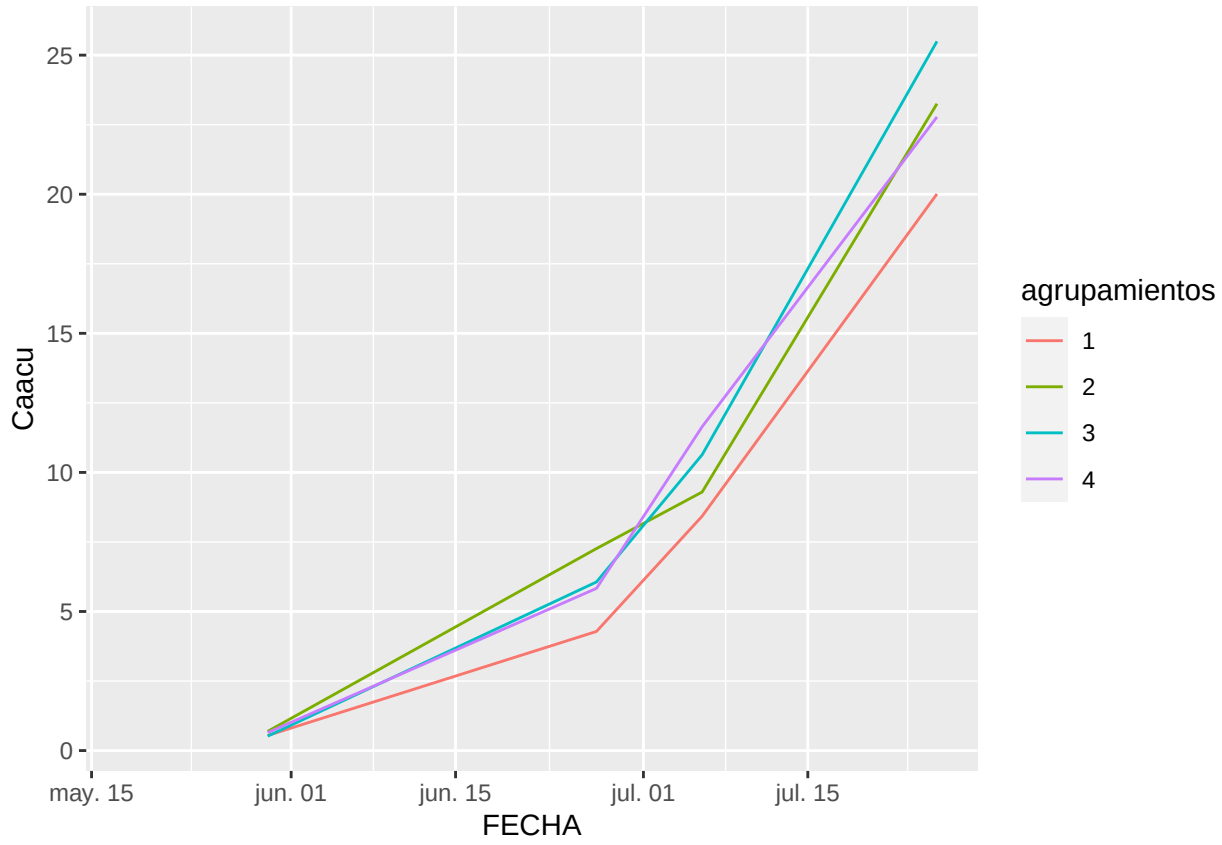
```
## 67 tratamientos          PV_1      4 25.422500     8.80322810  34.62770
## 68 tratamientos          PA_4      4 18.757500     6.33249490  33.75980
## 69 tratamientos          PA_2      4 31.690000    19.88327941  62.74307
## 70 tratamientos          PA_1      4 16.267500    19.94284897 122.59320
##         FECHA      AREAF  Nx100       Nacu  Px100       Pacu  Kx100       Kacu
## 1  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 2  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 3  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 4  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 5  2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 6  2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 7  2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 8  2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 9  2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 10 2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 11 2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 12 2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 13 2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 14 2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 15 2023-05-30  149.37975 3.6650   2.680031 0.2850  0.2084063 7.5900   5.550187
## 16 2023-05-30  150.63938 3.3400   2.442375 0.2750  0.2010938 6.8200   4.987125
## 17 2023-05-30  162.53975 3.3750   1.902656 0.2900  0.1634875 6.8150   3.841956
## 18 2023-05-30  121.08137 3.7450   2.162737 0.3000  0.1732500 6.8200   3.938550
## 19 2023-05-30  186.79650 3.4350   2.595572 0.2900  0.2191312 6.8175   5.151473
## 20 2023-05-30  105.02362 3.6275   1.981522 0.2850  0.1556813 7.2050   3.935731
## 21 2023-05-30  170.43075 3.6300   2.858625 0.2700  0.2126250 7.7200   6.079500
## 22 2023-05-30  195.44900 3.7000   3.330000 0.3000  0.2700000 7.4600   6.714000
## 23 2023-05-30  221.25650 3.3600   2.125200 0.2900  0.1834250 6.9500   4.395875
## 24 2023-05-30  103.82300 3.3200   1.643400 0.2600  0.1287000 6.6900   3.311550
## 25 2023-05-30  160.04975 3.0800   2.163700 0.3000  0.2107500 5.9100   4.151775
## 26 2023-05-30  128.32875 3.6700   2.477250 0.2800  0.1890000 7.7200   5.211000
## 27 2023-05-30  105.82975 3.6700   2.064375 0.3000  0.1687500 6.6900   3.763125
## 28 2023-05-30   82.11300 3.8200   1.728550 0.3000  0.1357500 6.9500   3.144875
## 29 2023-06-27 1374.91130 2.8100  23.242213 0.3200  2.6468000 6.5550  54.218044
## 30 2023-06-27 1394.16096 2.7600  25.695600 0.3200  2.9792000 6.5600  61.073600
## 31 2023-06-27  540.69669 2.3900  22.636288 0.3500  3.3149375 6.1700  58.437612
## 32 2023-06-27  851.08637 2.7800  17.378475 0.3850  2.4067312 7.2050  45.040256
## 33 2023-06-27 1155.33877 2.7325  28.870570 0.3375  3.5658984 6.3650  67.250203
## 34 2023-06-27  925.08889 2.6375  16.052484 0.3500  2.1301875 6.8800  41.873400
## 35 2023-06-27 1538.00802 2.8300  26.856700 0.2900  2.7521000 5.9100  56.085900
## 36 2023-06-27 1565.90113 2.7900  31.268925 0.3500  3.9226250 7.2000  80.694000
## 37 2023-06-27  304.09243 2.7900  35.579475 0.3200  4.0808000 6.6900  85.314225
## 38 2023-06-27  777.30095 2.7300  16.898700 0.3200  1.9808000 6.4300  39.801700
## 39 2023-06-27 1213.35350 2.7000  23.793750 0.3400  2.9962500 6.1700  54.373125
## 40 2023-06-27 1211.81457 2.0800  14.669200 0.3600  2.5389000 6.1700  43.513925
## 41 2023-06-27 1222.42078 2.6100  19.346625 0.4000  2.9650000 6.6900  49.589625
## 42 2023-06-27  488.81925 2.9500  10.885500 0.3700  1.3653000 7.7200  28.486800
## 43 2023-07-06 4771.77522 2.7150  46.487587 0.3100  5.3079750 7.2000 123.282000
## 44 2023-07-06 2729.75500 2.8250  44.885719 0.3850  6.1171688 7.0750 112.412906
## 45 2023-07-06 1007.03776 2.5700  41.412338 0.3850  6.2037937 5.6750  91.445531
## 46 2023-07-06 1097.29783 3.1700  34.469788 0.4500  4.8931875 4.6300  50.345463
## 47 2023-07-06 3052.39293 3.0050  43.110481 0.3900  5.5950375 6.5400  93.824475
## 48 2023-07-06 1750.53998 2.6350  41.245984 0.3750  5.8699219 5.7500  90.005469
## 49 2023-07-06 7138.07221 2.8600  51.344150 0.3100  5.5652750 7.2000 129.258000
```

```
## 50 2023-07-06 2965.18825 2.5700  29.304425 0.3100  3.5347750 7.2000  82.098000
## 51 2023-07-06  681.05656 2.9900  48.520225 0.3900  6.3287250 7.2000 116.838000
## 52 2023-07-06 1333.01896 2.6600  42.560000 0.3800  6.0800000 6.9500 111.200000
## 53 2023-07-06 1425.25470 2.8500  33.637125 0.4000  4.7210000 7.2000  84.978000
## 54 2023-07-06 2405.47824 2.2900  37.309825 0.3700  6.0282250 4.1500  67.613875
## 55 2023-07-06 2494.32175 3.3200  67.645000 0.4600  9.3725000 4.5600  92.910000
## 56 2023-07-06  769.34096 3.0200  30.033900 0.4400  4.3758000 4.7000  46.741500
## 57 2023-07-26 2988.93284 2.8150  83.274738 0.3050  9.0226625 4.0550 119.957037
## 58 2023-07-26 2709.10436 2.7050  83.871906 0.3400 10.5421250 4.5400 140.768375
## 59 2023-07-26 2433.60668 2.6300  83.298675 0.4050 12.8273625 4.8000 152.028000
## 60 2023-07-26 1682.95862 3.3550  69.934975 0.3800  7.9211000 4.5100  94.010950
## 61 2023-07-26 3309.41404 3.0450 101.459400 0.3475 11.5787000 4.6150 153.771800
## 62 2023-07-26 1597.88721 2.7075  62.903686 0.3675  8.5381734 4.3375 100.773680
## 63 2023-07-26 4883.12028 2.7700 111.928775 0.3200 12.9304000 4.0400 163.246300
## 64 2023-07-26 2571.83235 2.8600  86.722350 0.2900  8.7935250 4.0700 123.412575
## 65 2023-07-26 3390.51849 2.9500 109.526125 0.3400 12.6233500 4.6500 172.642875
## 66 2023-07-26 1476.69488 2.4600  64.495050 0.3400  8.9139500 4.4300 116.143525
## 67 2023-07-26 2392.18502 2.7700  70.420325 0.3700  9.4063250 5.0100 127.366725
## 68 2023-07-26 1094.74539 2.4900  46.706175 0.4400  8.2533000 4.5900  86.096925
## 69 2023-07-26 2846.37637 3.6900 116.936100 0.3600 11.4084000 4.7600 150.844400
## 70 2023-07-26  973.73222 3.0200  49.127850 0.4000  6.5070000 4.2600  69.299550
##    Cax100      Caacu
## 1      NA         NA
## 2      NA         NA
## 3      NA         NA
## 4      NA         NA
## 5      NA         NA
## 6      NA         NA
## 7      NA         NA
## 8      NA         NA
## 9      NA         NA
## 10     NA         NA
## 11     NA         NA
## 12     NA         NA
## 13     NA         NA
## 14     NA         NA
## 15 0.8850  0.6471562
## 16 0.9450  0.6910312
## 17 0.9200  0.5186500
## 18 0.9400  0.5428500
## 19 0.9450  0.7140656
## 20 0.9000  0.4916250
## 21 0.9400  0.7402500
## 22 0.8300  0.7470000
## 23 0.9700  0.6135250
## 24 0.9200  0.4554000
## 25 0.8800  0.6182000
## 26 0.9600  0.6480000
## 27 0.9900  0.5568750
## 28 0.8900  0.4027250
## 29 0.7050  5.8312313
## 30 0.7800  7.2618000
## 31 0.6400  6.0616000
## 32 0.6850  4.2821063
```

```
## 33 0.6525  6.8940703
## 34 0.7525  4.5799031
## 35 0.6500  6.1685000
## 36 0.7600  8.5177000
## 37 0.7100  9.0542750
## 38 0.8500  5.2615000
## 39 0.6100  5.3756250
## 40 0.6700  4.7251750
## 41 0.6400  4.7440000
## 42 0.7300  2.6937000
## 43 0.6800 11.6433000
## 44 0.5850  9.2949187
## 45 0.6600 10.6350750
## 46 0.7750  8.4271563
## 47 0.7100 10.1858375
## 48 0.6400 10.0180000
## 49 0.7700 13.8234250
## 50 0.5900  6.7274750
## 51 0.6600 10.7101500
## 52 0.5100  8.1600000
## 53 0.6000  7.0815000
## 54 0.7200 11.7306000
## 55 0.8100 16.5037500
## 56 0.7400  7.3593000
## 57 0.7700 22.7785250
## 58 0.7500 23.2546875
## 59 0.8050 25.4963625
## 60 0.9600 20.0112000
## 61 0.8550 28.4886000
## 62 0.7875 18.2960859
## 63 0.7500 30.3056250
## 64 0.7900 23.9547750
## 65 0.7300 27.1030750
## 66 0.7700 20.1874750
## 67 0.8100 20.5922250
## 68 0.8000 15.0060000
## 69 1.1300 35.8097000
## 70 0.7900 12.8513250
```

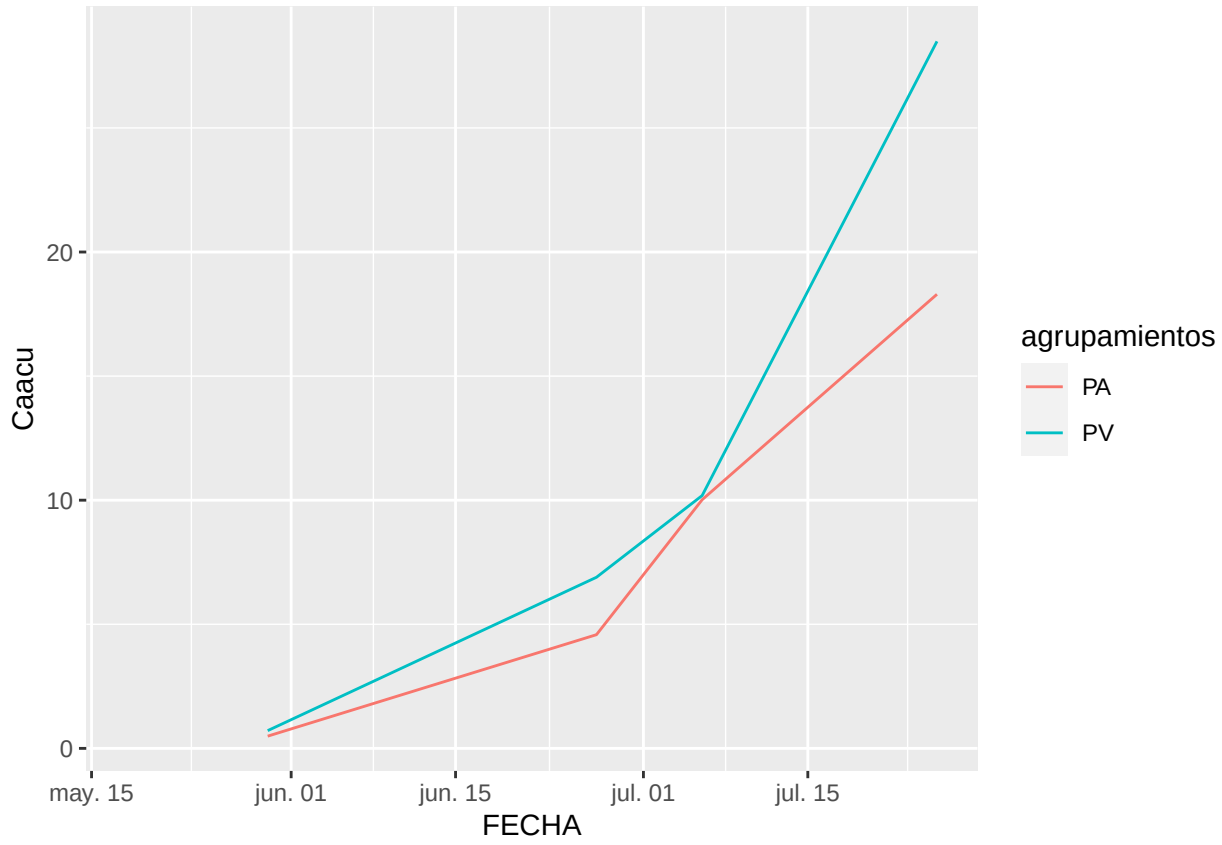
```
g1<-ggplot(descPTe2[descPTe2$ag=='dosis',], aes(FECHA, Caacu, color=agrupamientos))+geom_line()

g2<-ggplot(descPTe2[descPTe2$ag=='variedad',], aes(FECHA, Caacu, color=agrupamientos))+geom_line()

g3<-ggplot(descPTe2[descPTe2$ag=='tratamientos',], aes(FECHA, Caacu, color=agrupamientos))+geom_line()

g1
```

```
## Warning: Removed 4 rows containing missing values (`geom_line()`).
```



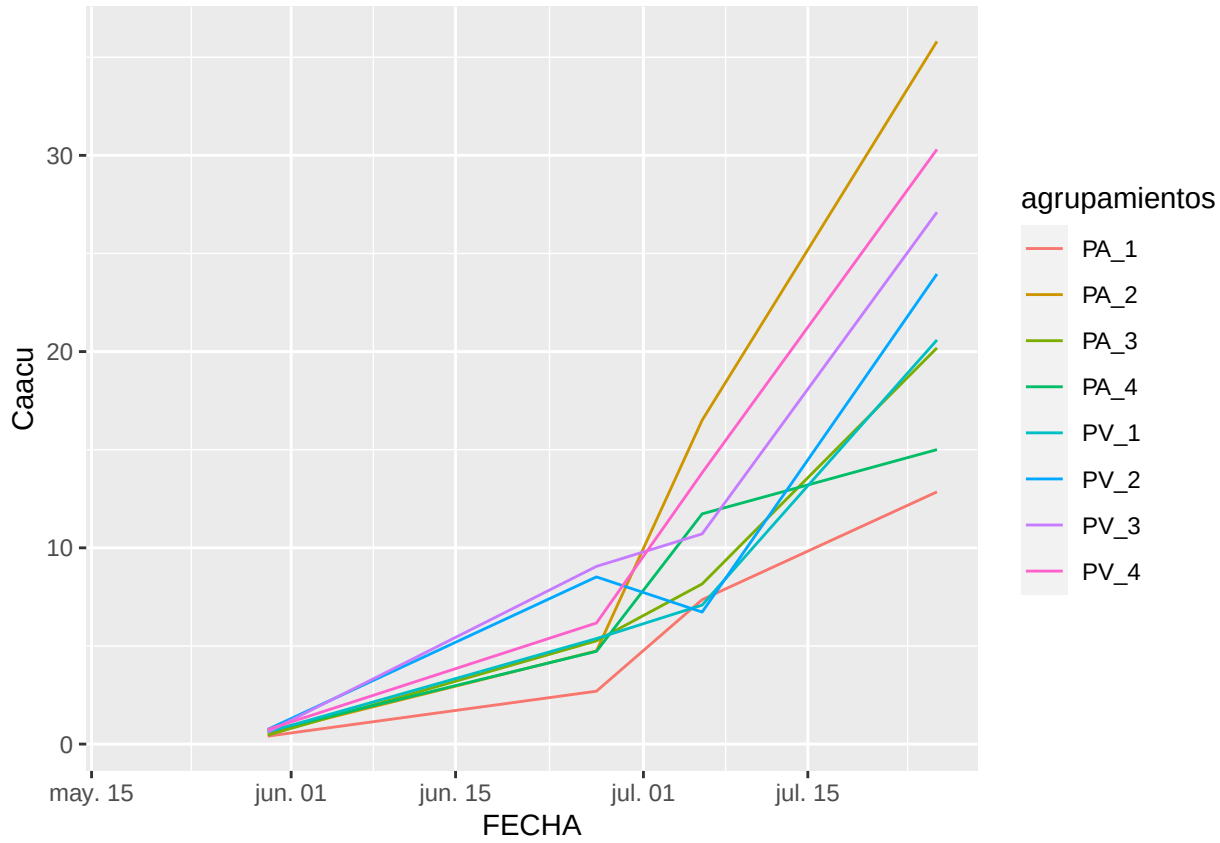

```
g2
```

```
## Warning: Removed 2 rows containing missing values (`geom_line()`).
```




```
g3
```

```
## Warning: Removed 8 rows containing missing values (`geom_line()`).
```



Analisis del Magnesio

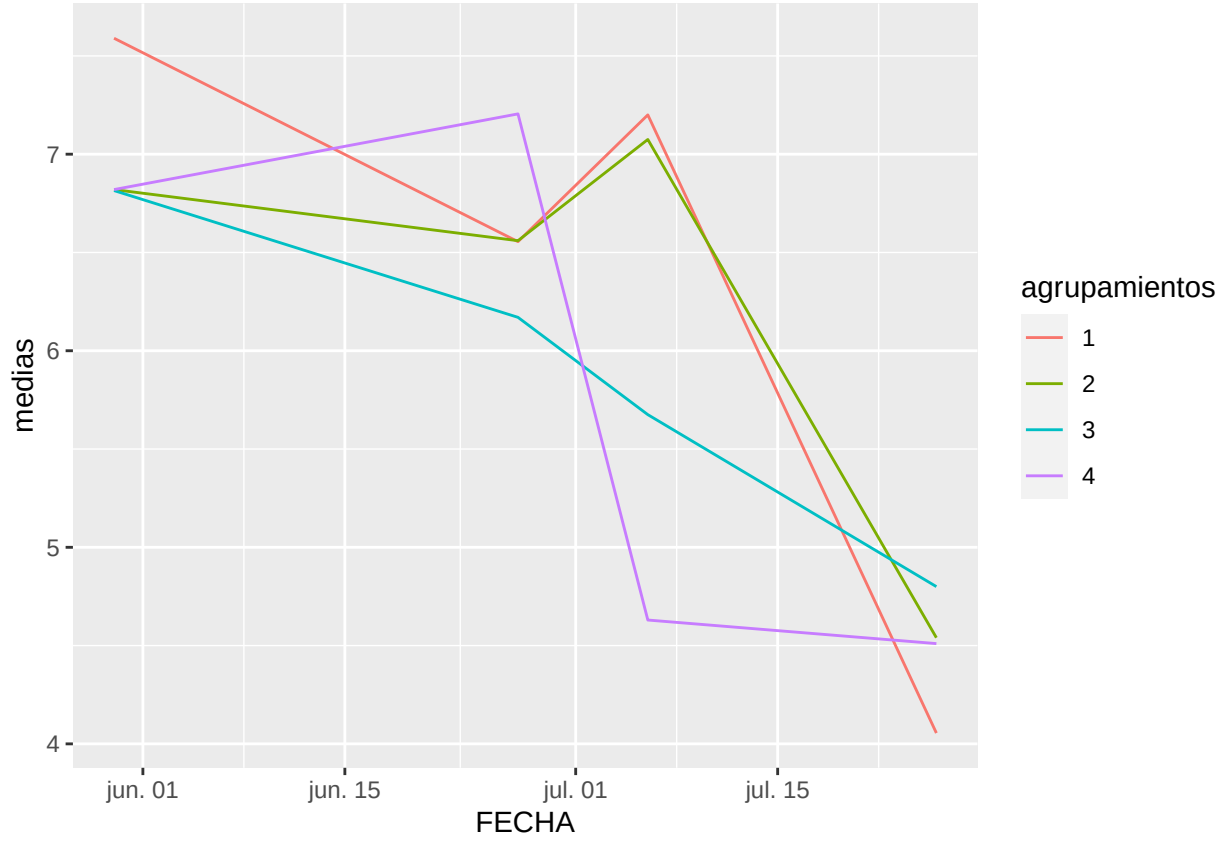
```
#Obtener una estadistica descriptiva del nitrogeno para cada fecha

NE2$Medicion<-trimws(NE2$Medicion)

#fecha 1
NF<-NE2[NE2$Medicion =="PRIMERA",]

descMg30May<-resumir2fat(NF$dosis,
                         NF$NV,
                         NF$Mg.,
                         NF$Tratamientos,
                         NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-5-30")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descMg30May$FECHA<-fecha

#fecha 2

NF<-NE2[NE2$Medicion =="SEGUNDA",]
```

```
descMg27Jun<-resumir2fat(NF$dosis,
                         NF$NV,
                         NF$Mg.,
                         NF$Tratamientos,
                         NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-6-27")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descMg27Jun$FECHA<-fecha

#fecha 3

NF<-NE2[NE2$Medicion =="TERCERA",]

descMg06Jul<-resumir2fat(NF$dosis,
                         NF$NV,
                         NF$Mg.,
                         NF$Tratamientos,
                         NF)

fecha<-c()

for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-6")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descMg06Jul$FECHA<-fecha

#fecha 4
  NF<-NE2[NE2$Medicion =="CUARTA",]

descMg26Jul<-resumir2fat(NF$dosis,
                         NF$NV,
                         NF$Mg.,
                         NF$Tratamientos,
                         NF)

fecha<-c()
for (i in c(1:14)){
  fecha<-c(fecha, "2023-7-26")
}
fecha<-as.Date(fecha, format="%Y-%m-%d")

descMg26Jul$FECHA<-fecha

#unir en un data frame

descMge1<-rbind(descMg30May,
```

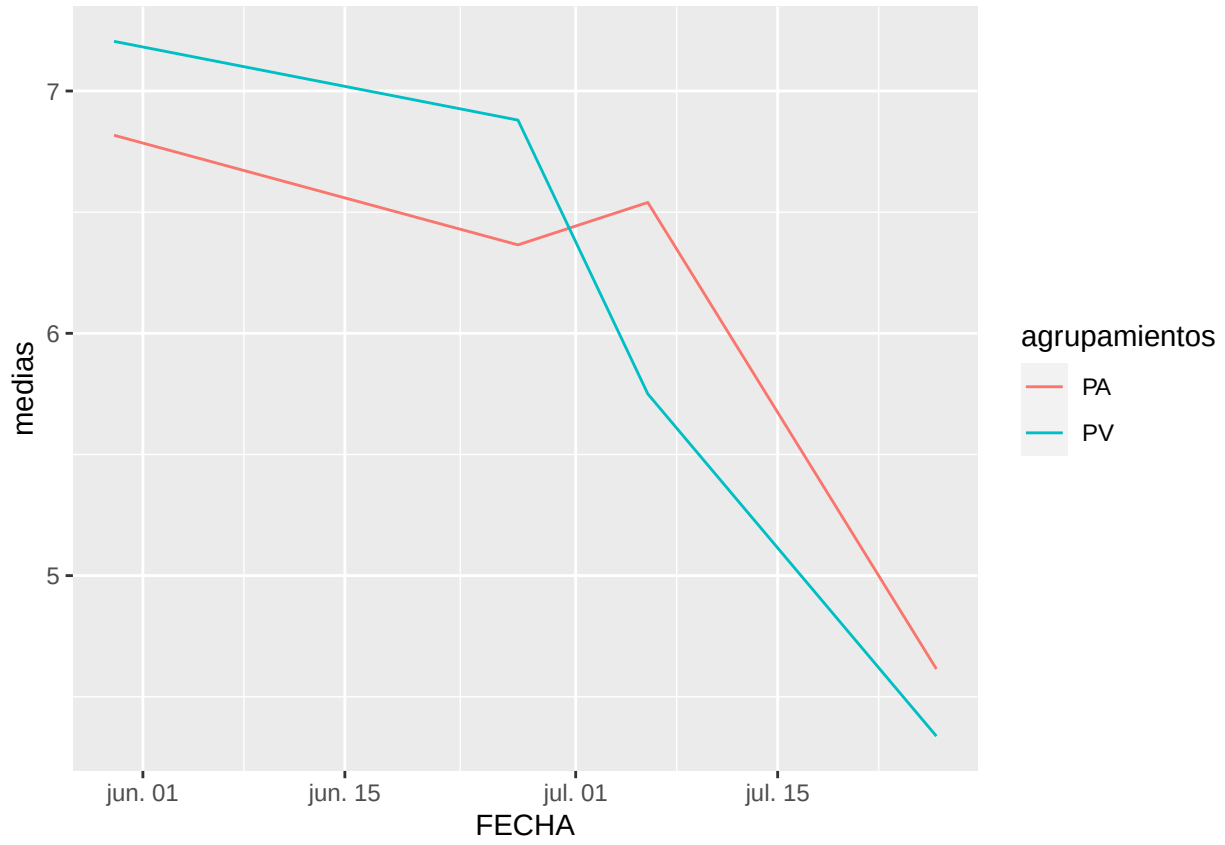
```
                descMg27Jun,
                descMg06Jul,
                descMg26Jul)
```

plot concentración de Magnesio en el tiempo

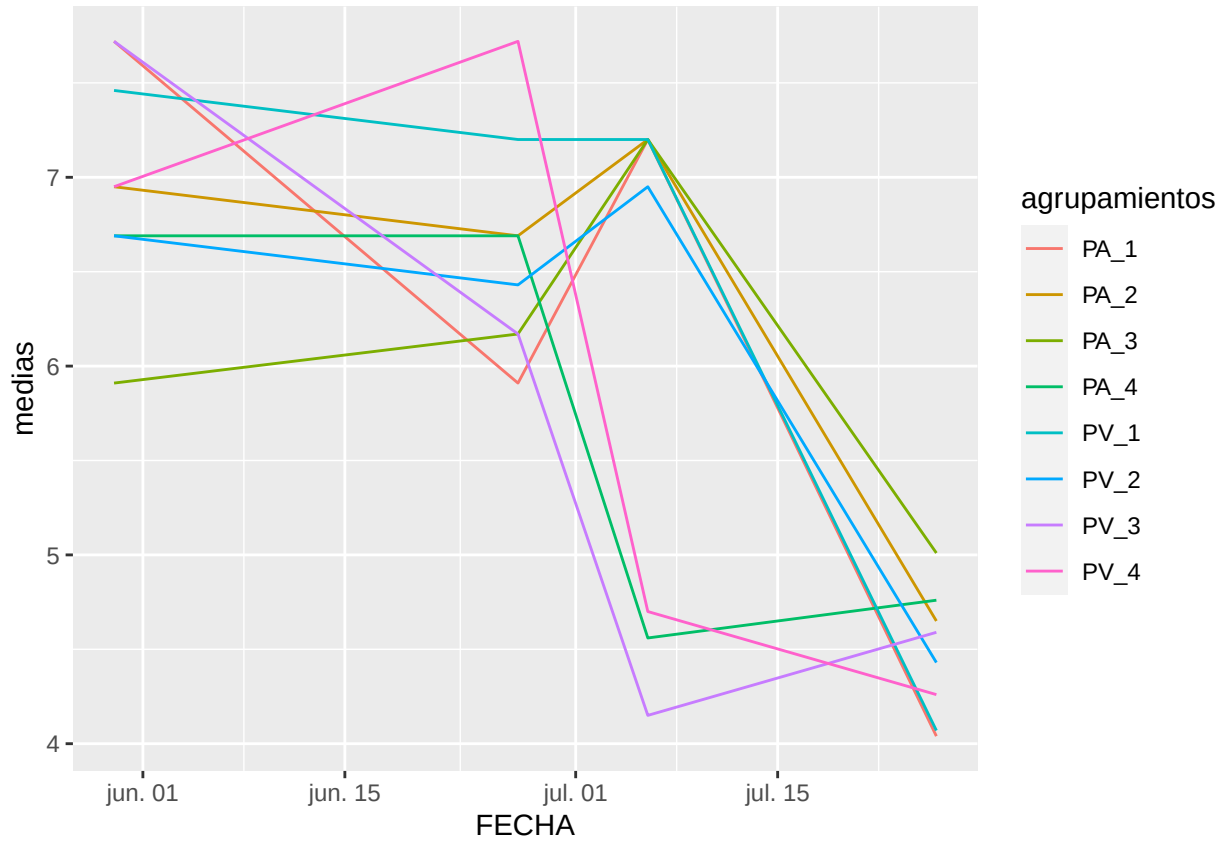
```
library(ggplot2)
g1<-ggplot(descKe1[descMge1$ag=='dosis',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g2<-ggplot(descKe1[descMge1$ag=='variedad',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g3<-ggplot(descKe1[descMge1$ag=='tratamientos',], aes(FECHA, medias, color=agrupamientos))+geom_line()

g1
```




```
g2
```


7
6
5
medias
jun. 01
jun. 15
jul. 01
jul. 15
FECHA
agrupamientos
PA
PV

```
g3
```



acumulacion de Magnesio en el tiempo

```
concMg<-c(NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA,
          descKe1$medias)

descPTe2$Mgx100<-concMg

descPTe2$Mgacu<-descPTe2$Mgx100*descPTe2$medias

descPTe2
```

```
##              ag agrupamientos numero    medias Desvio_Standar        CV
## 1         dosis              1      8  0.062250     0.04017729  64.54182
## 2         dosis              2      8  0.062250     0.04017729  64.54182
## 3         dosis              3      8  0.062250     0.04017729  64.54182
## 4         dosis              4      8  0.062250     0.04017729  64.54182
## 5      variedad             PA     16  0.058500     0.05079370  86.82684
## 6      variedad             PV     16  0.066000     0.02007984  30.42400
## 7  tratamientos           PA_1      4  0.058500     0.05678908  97.07536
## 8  tratamientos           PV_1      4  0.066000     0.02244994  34.01507
## 9  tratamientos           PA_2      4  0.058500     0.05678908  97.07536
## 10 tratamientos           PV_2      4  0.066000     0.02244994  34.01507
## 11 tratamientos           PA_3      4  0.058500     0.05678908  97.07536
## 12 tratamientos           PV_3      4  0.066000     0.02244994  34.01507
```

```
## 13 tratamientos          PA_4      4  0.058500     0.05678908  97.07536
## 14 tratamientos          PV_4      4  0.066000     0.02244994  34.01507
## 15        dosis             4      8  0.731250     0.20760109  28.38989
## 16        dosis             2      8  0.731250     0.24020453  32.84848
## 17        dosis             3      8  0.563750     0.29456687  52.25133
## 18        dosis             1      8  0.577500     0.42348048  73.32995
## 19     variedad            PV     16  0.755625     0.33986210  44.97762
## 20     variedad            PA     16  0.546250     0.21481387  39.32519
## 21 tratamientos          PV_4      4  0.787500     0.25460754  32.33112
## 22 tratamientos          PV_2      4  0.900000     0.19663842  21.84871
## 23 tratamientos          PV_3      4  0.632500     0.39390143  62.27691
## 24 tratamientos          PA_3      4  0.495000     0.18627936  37.63219
## 25 tratamientos          PV_1      4  0.702500     0.51551754  73.38328
## 26 tratamientos          PA_4      4  0.675000     0.16522712  24.47809
## 27 tratamientos          PA_2      4  0.562500     0.14150972  25.15728
## 28 tratamientos          PA_1      4  0.452500     0.33320414  73.63627
## 29        dosis             4      8  8.271250     4.12943247  49.92513
## 30        dosis             2      8  9.310000     4.07529841  43.77334
## 31        dosis             3      8  9.471250     4.90151999  51.75156
## 32        dosis             1      8  6.251250     3.14511157  50.31172
## 33     variedad            PV     16 10.565625     3.85331194  36.47027
## 34     variedad            PA     16  6.086250     3.08219808  50.64199
## 35 tratamientos          PV_4      4  9.490000     3.54177921  37.32117
## 36 tratamientos          PV_2      4 11.207500     4.66342775  41.60988
## 37 tratamientos          PV_3      4 12.752500     4.87562902  38.23273
## 38 tratamientos          PA_3      4  6.190000     1.89087281  30.54722
## 39 tratamientos          PV_1      4  8.812500     1.90002412  21.56056
## 40 tratamientos          PA_4      4  7.052500     4.82528324  68.41947
## 41 tratamientos          PA_2      4  7.412500     2.72088680  36.70674
## 42 tratamientos          PA_1      4  3.690000     1.40615314  38.10713
## 43        dosis             4      8 17.122500    11.66474511  68.12525
## 44        dosis             2      8 15.888750     9.06788436  57.07110
## 45        dosis             3      8 16.113750     3.96623945  24.61401
## 46        dosis             1      8 10.873750     7.40870904  68.13389
## 47     variedad            PV     16 14.346250     9.02753925  62.92613
## 48     variedad            PA     16 15.653125     8.06130487  51.49965
## 49 tratamientos          PV_4      4 17.952500    16.27555299  90.65898
## 50 tratamientos          PV_2      4 11.402500     4.74679102  41.62939
## 51 tratamientos          PV_3      4 16.227500     3.82877156  23.59434
## 52 tratamientos          PA_3      4 16.000000     4.69167348  29.32296
## 53 tratamientos          PV_1      4 11.802500     7.94711006  67.33412
## 54 tratamientos          PA_4      4 16.292500     7.12441518  43.72819
## 55 tratamientos          PA_2      4 20.375000    10.75450448  52.78284
## 56 tratamientos          PA_1      4  9.945000     7.91312201  79.56885
## 57        dosis             4      8 29.582500    18.12266832  61.26145
## 58        dosis             2      8 31.006250    18.67837706  60.24068
## 59        dosis             3      8 31.672500    12.64002232  39.90851
## 60        dosis             1      8 20.845000    15.08675010  72.37587
## 61     variedad            PV     16 33.320000    15.52174389  46.58387
## 62     variedad            PA     16 23.233125    15.56140641  66.97939
## 63 tratamientos          PV_4      4 40.407500    20.34101993  50.33971
## 64 tratamientos          PV_2      4 30.322500    20.43198371  67.38225
## 65 tratamientos          PV_3      4 37.127500    10.69840292  28.81531
## 66 tratamientos          PA_3      4 26.217500    13.37868298  51.02959
```

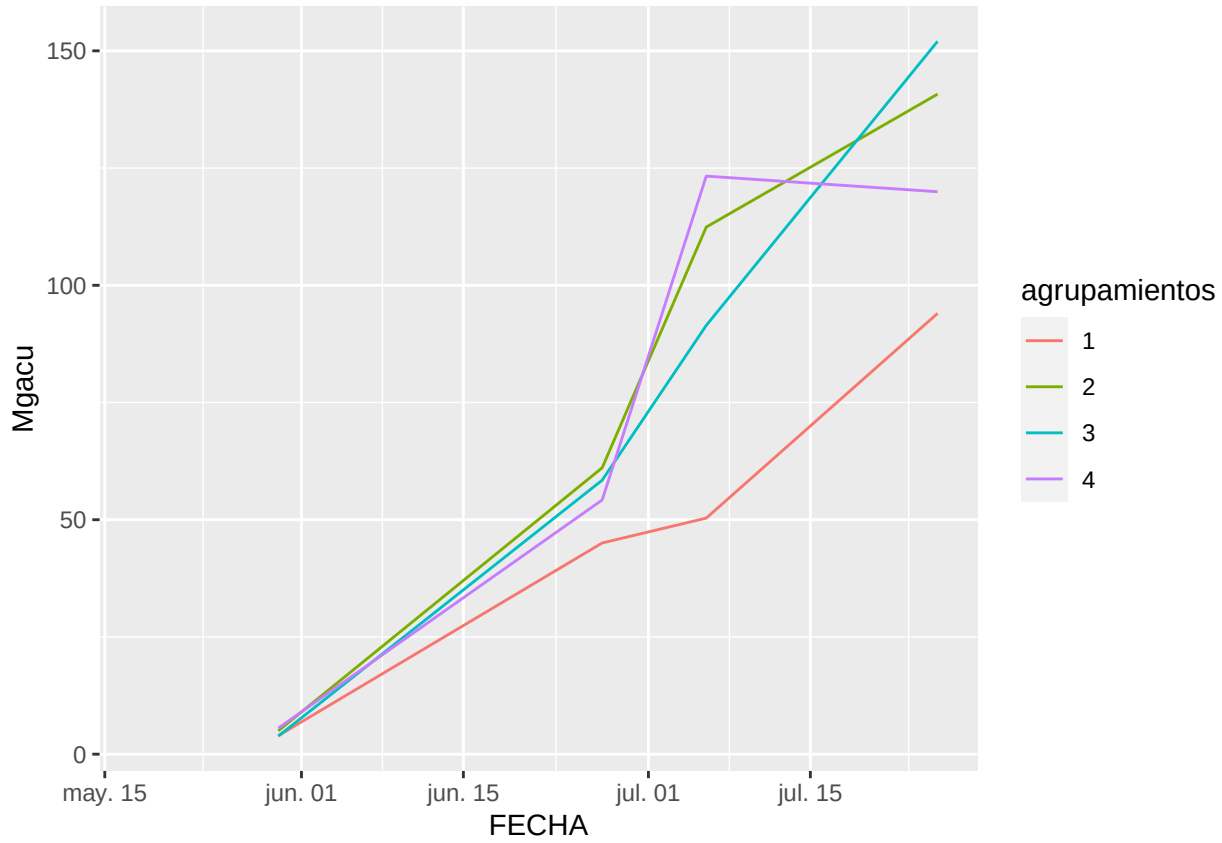
```
## 67 tratamientos          PV_1      4 25.422500     8.80322810  34.62770
## 68 tratamientos          PA_4      4 18.757500     6.33249490  33.75980
## 69 tratamientos          PA_2      4 31.690000    19.88327941  62.74307
## 70 tratamientos          PA_1      4 16.267500    19.94284897 122.59320
##         FECHA      AREAF  Nx100       Nacu  Px100       Pacu  Kx100       Kacu
## 1  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 2  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 3  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 4  2023-05-18   13.69567     NA         NA     NA         NA     NA         NA
## 5  2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 6  2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 7  2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 8  2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 9  2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 10 2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 11 2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 12 2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 13 2023-05-18   13.18950     NA         NA     NA         NA     NA         NA
## 14 2023-05-18   14.20185     NA         NA     NA         NA     NA         NA
## 15 2023-05-30  149.37975 3.6650   2.680031 0.2850  0.2084063 7.5900   5.550187
## 16 2023-05-30  150.63938 3.3400   2.442375 0.2750  0.2010938 6.8200   4.987125
## 17 2023-05-30  162.53975 3.3750   1.902656 0.2900  0.1634875 6.8150   3.841956
## 18 2023-05-30  121.08137 3.7450   2.162737 0.3000  0.1732500 6.8200   3.938550
## 19 2023-05-30  186.79650 3.4350   2.595572 0.2900  0.2191312 6.8175   5.151473
## 20 2023-05-30  105.02362 3.6275   1.981522 0.2850  0.1556813 7.2050   3.935731
## 21 2023-05-30  170.43075 3.6300   2.858625 0.2700  0.2126250 7.7200   6.079500
## 22 2023-05-30  195.44900 3.7000   3.330000 0.3000  0.2700000 7.4600   6.714000
## 23 2023-05-30  221.25650 3.3600   2.125200 0.2900  0.1834250 6.9500   4.395875
## 24 2023-05-30  103.82300 3.3200   1.643400 0.2600  0.1287000 6.6900   3.311550
## 25 2023-05-30  160.04975 3.0800   2.163700 0.3000  0.2107500 5.9100   4.151775
## 26 2023-05-30  128.32875 3.6700   2.477250 0.2800  0.1890000 7.7200   5.211000
## 27 2023-05-30  105.82975 3.6700   2.064375 0.3000  0.1687500 6.6900   3.763125
## 28 2023-05-30   82.11300 3.8200   1.728550 0.3000  0.1357500 6.9500   3.144875
## 29 2023-06-27 1374.91130 2.8100  23.242213 0.3200  2.6468000 6.5550  54.218044
## 30 2023-06-27 1394.16096 2.7600  25.695600 0.3200  2.9792000 6.5600  61.073600
## 31 2023-06-27  540.69669 2.3900  22.636288 0.3500  3.3149375 6.1700  58.437612
## 32 2023-06-27  851.08637 2.7800  17.378475 0.3850  2.4067312 7.2050  45.040256
## 33 2023-06-27 1155.33877 2.7325  28.870570 0.3375  3.5658984 6.3650  67.250203
## 34 2023-06-27  925.08889 2.6375  16.052484 0.3500  2.1301875 6.8800  41.873400
## 35 2023-06-27 1538.00802 2.8300  26.856700 0.2900  2.7521000 5.9100  56.085900
## 36 2023-06-27 1565.90113 2.7900  31.268925 0.3500  3.9226250 7.2000  80.694000
## 37 2023-06-27  304.09243 2.7900  35.579475 0.3200  4.0808000 6.6900  85.314225
## 38 2023-06-27  777.30095 2.7300  16.898700 0.3200  1.9808000 6.4300  39.801700
## 39 2023-06-27 1213.35350 2.7000  23.793750 0.3400  2.9962500 6.1700  54.373125
## 40 2023-06-27 1211.81457 2.0800  14.669200 0.3600  2.5389000 6.1700  43.513925
## 41 2023-06-27 1222.42078 2.6100  19.346625 0.4000  2.9650000 6.6900  49.589625
## 42 2023-06-27  488.81925 2.9500  10.885500 0.3700  1.3653000 7.7200  28.486800
## 43 2023-07-06 4771.77522 2.7150  46.487587 0.3100  5.3079750 7.2000 123.282000
## 44 2023-07-06 2729.75500 2.8250  44.885719 0.3850  6.1171688 7.0750 112.412906
## 45 2023-07-06 1007.03776 2.5700  41.412338 0.3850  6.2037937 5.6750  91.445531
## 46 2023-07-06 1097.29783 3.1700  34.469788 0.4500  4.8931875 4.6300  50.345463
## 47 2023-07-06 3052.39293 3.0050  43.110481 0.3900  5.5950375 6.5400  93.824475
## 48 2023-07-06 1750.53998 2.6350  41.245984 0.3750  5.8699219 5.7500  90.005469
## 49 2023-07-06 7138.07221 2.8600  51.344150 0.3100  5.5652750 7.2000 129.258000
```

```
## 50 2023-07-06 2965.18825 2.5700  29.304425 0.3100  3.5347750 7.2000  82.098000
## 51 2023-07-06  681.05656 2.9900  48.520225 0.3900  6.3287250 7.2000 116.838000
## 52 2023-07-06 1333.01896 2.6600  42.560000 0.3800  6.0800000 6.9500 111.200000
## 53 2023-07-06 1425.25470 2.8500  33.637125 0.4000  4.7210000 7.2000  84.978000
## 54 2023-07-06 2405.47824 2.2900  37.309825 0.3700  6.0282250 4.1500  67.613875
## 55 2023-07-06 2494.32175 3.3200  67.645000 0.4600  9.3725000 4.5600  92.910000
## 56 2023-07-06  769.34096 3.0200  30.033900 0.4400  4.3758000 4.7000  46.741500
## 57 2023-07-26 2988.93284 2.8150  83.274738 0.3050  9.0226625 4.0550 119.957037
## 58 2023-07-26 2709.10436 2.7050  83.871906 0.3400 10.5421250 4.5400 140.768375
## 59 2023-07-26 2433.60668 2.6300  83.298675 0.4050 12.8273625 4.8000 152.028000
## 60 2023-07-26 1682.95862 3.3550  69.934975 0.3800  7.9211000 4.5100  94.010950
## 61 2023-07-26 3309.41404 3.0450 101.459400 0.3475 11.5787000 4.6150 153.771800
## 62 2023-07-26 1597.88721 2.7075  62.903686 0.3675  8.5381734 4.3375 100.773680
## 63 2023-07-26 4883.12028 2.7700 111.928775 0.3200 12.9304000 4.0400 163.246300
## 64 2023-07-26 2571.83235 2.8600  86.722350 0.2900  8.7935250 4.0700 123.412575
## 65 2023-07-26 3390.51849 2.9500 109.526125 0.3400 12.6233500 4.6500 172.642875
## 66 2023-07-26 1476.69488 2.4600  64.495050 0.3400  8.9139500 4.4300 116.143525
## 67 2023-07-26 2392.18502 2.7700  70.420325 0.3700  9.4063250 5.0100 127.366725
## 68 2023-07-26 1094.74539 2.4900  46.706175 0.4400  8.2533000 4.5900  86.096925
## 69 2023-07-26 2846.37637 3.6900 116.936100 0.3600 11.4084000 4.7600 150.844400
## 70 2023-07-26  973.73222 3.0200  49.127850 0.4000  6.5070000 4.2600  69.299550
##    Cax100      Caacu Mgx100      Mgacu
## 1      NA         NA     NA         NA
## 2      NA         NA     NA         NA
## 3      NA         NA     NA         NA
## 4      NA         NA     NA         NA
## 5      NA         NA     NA         NA
## 6      NA         NA     NA         NA
## 7      NA         NA     NA         NA
## 8      NA         NA     NA         NA
## 9      NA         NA     NA         NA
## 10     NA         NA     NA         NA
## 11     NA         NA     NA         NA
## 12     NA         NA     NA         NA
## 13     NA         NA     NA         NA
## 14     NA         NA     NA         NA
## 15 0.8850  0.6471562 7.5900   5.550187
## 16 0.9450  0.6910312 6.8200   4.987125
## 17 0.9200  0.5186500 6.8150   3.841956
## 18 0.9400  0.5428500 6.8200   3.938550
## 19 0.9450  0.7140656 6.8175   5.151473
## 20 0.9000  0.4916250 7.2050   3.935731
## 21 0.9400  0.7402500 7.7200   6.079500
## 22 0.8300  0.7470000 7.4600   6.714000
## 23 0.9700  0.6135250 6.9500   4.395875
## 24 0.9200  0.4554000 6.6900   3.311550
## 25 0.8800  0.6182000 5.9100   4.151775
## 26 0.9600  0.6480000 7.7200   5.211000
## 27 0.9900  0.5568750 6.6900   3.763125
## 28 0.8900  0.4027250 6.9500   3.144875
## 29 0.7050  5.8312313 6.5550  54.218044
## 30 0.7800  7.2618000 6.5600  61.073600
## 31 0.6400  6.0616000 6.1700  58.437612
## 32 0.6850  4.2821063 7.2050  45.040256
```

```
## 33 0.6525  6.8940703 6.3650  67.250203
## 34 0.7525  4.5799031 6.8800  41.873400
## 35 0.6500  6.1685000 5.9100  56.085900
## 36 0.7600  8.5177000 7.2000  80.694000
## 37 0.7100  9.0542750 6.6900  85.314225
## 38 0.8500  5.2615000 6.4300  39.801700
## 39 0.6100  5.3756250 6.1700  54.373125
## 40 0.6700  4.7251750 6.1700  43.513925
## 41 0.6400  4.7440000 6.6900  49.589625
## 42 0.7300  2.6937000 7.7200  28.486800
## 43 0.6800 11.6433000 7.2000 123.282000
## 44 0.5850  9.2949187 7.0750 112.412906
## 45 0.6600 10.6350750 5.6750  91.445531
## 46 0.7750  8.4271563 4.6300  50.345463
## 47 0.7100 10.1858375 6.5400  93.824475
## 48 0.6400 10.0180000 5.7500  90.005469
## 49 0.7700 13.8234250 7.2000 129.258000
## 50 0.5900  6.7274750 7.2000  82.098000
## 51 0.6600 10.7101500 7.2000 116.838000
## 52 0.5100  8.1600000 6.9500 111.200000
## 53 0.6000  7.0815000 7.2000  84.978000
## 54 0.7200 11.7306000 4.1500  67.613875
## 55 0.8100 16.5037500 4.5600  92.910000
## 56 0.7400  7.3593000 4.7000  46.741500
## 57 0.7700 22.7785250 4.0550 119.957037
## 58 0.7500 23.2546875 4.5400 140.768375
## 59 0.8050 25.4963625 4.8000 152.028000
## 60 0.9600 20.0112000 4.5100  94.010950
## 61 0.8550 28.4886000 4.6150 153.771800
## 62 0.7875 18.2960859 4.3375 100.773680
## 63 0.7500 30.3056250 4.0400 163.246300
## 64 0.7900 23.9547750 4.0700 123.412575
## 65 0.7300 27.1030750 4.6500 172.642875
## 66 0.7700 20.1874750 4.4300 116.143525
## 67 0.8100 20.5922250 5.0100 127.366725
## 68 0.8000 15.0060000 4.5900  86.096925
## 69 1.1300 35.8097000 4.7600 150.844400
## 70 0.7900 12.8513250 4.2600  69.299550
```

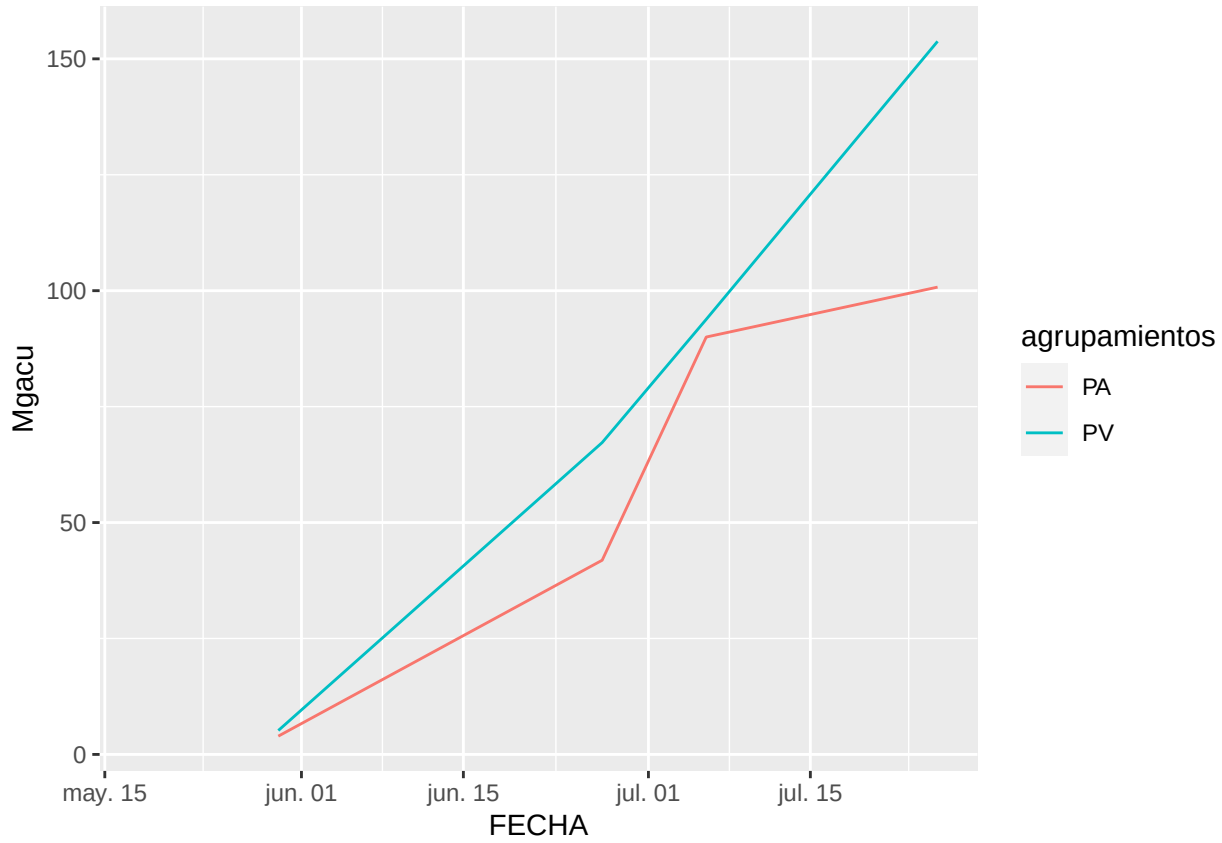
```
g1<-ggplot(descPTe2[descPTe2$ag=='dosis',], aes(FECHA, Mgacu, color=agrupamientos))+geom_line()

g2<-ggplot(descPTe2[descPTe2$ag=='variedad',], aes(FECHA, Mgacu, color=agrupamientos))+geom_line()

g3<-ggplot(descPTe2[descPTe2$ag=='tratamientos',], aes(FECHA, Mgacu, color=agrupamientos))+geom_line()

g1
```

```
## Warning: Removed 4 rows containing missing values (`geom_line()`).
```



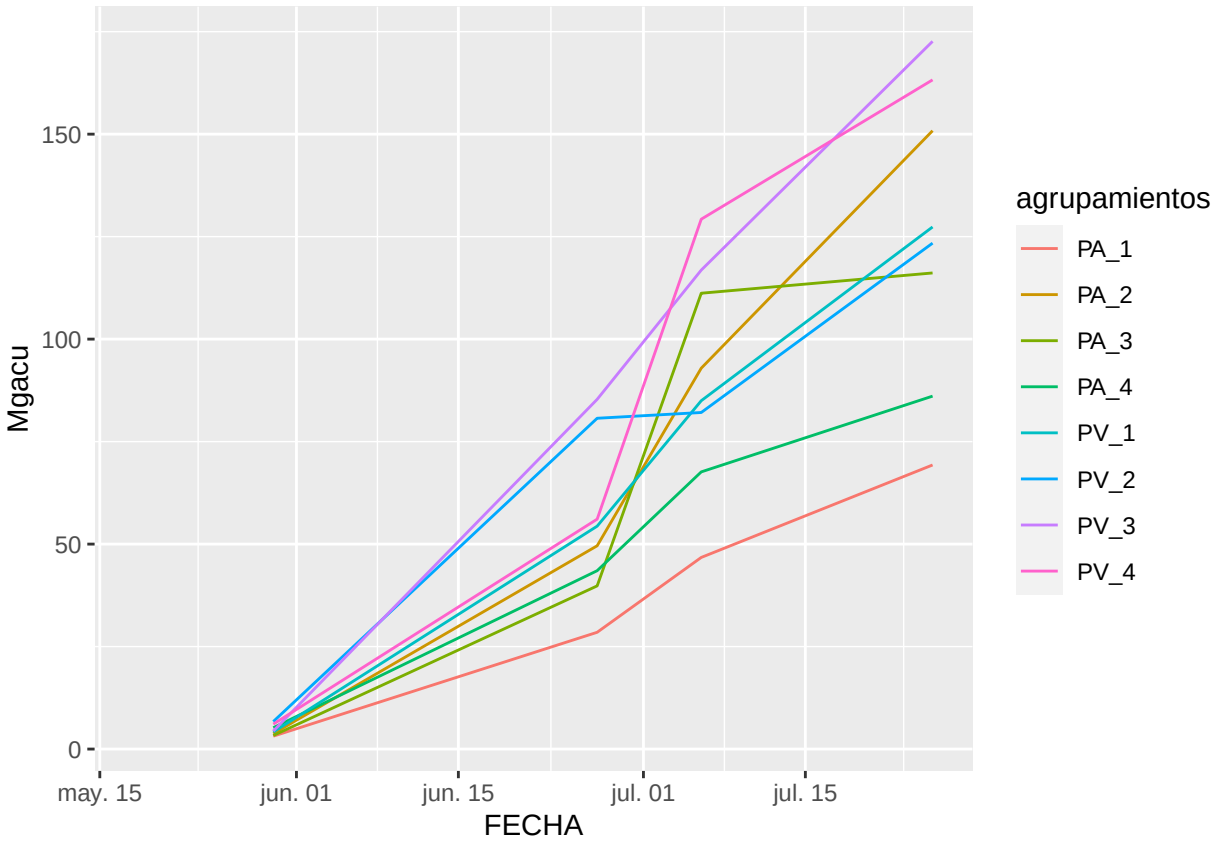

```
g2
```

```
## Warning: Removed 2 rows containing missing values (`geom_line()`).
```




```
g3
```

```
## Warning: Removed 8 rows containing missing values (`geom_line()`).
```


150
100
50
0
Mgacu
may. 15
jun. 01
jun. 15
jul. 01
jul. 15
FECHA
agrupamientos
PA_1
PA_2
PA_3
PA_4
PV_1
PV_2
PV_3
PV_4