Statistical Consulting

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```
library(MASS)
library(dplyr)
library(lme4)
library(ordinal)
library(ggplot2)
library(tidyverse)
library(corrplot)
library(caret)
library(ggpubr)
library(e1071)
library(rpart)
library(reshape2)
library(Metrics)
library(pracma)
library(emmeans)
library(multcomp)
```

```
experiment_setup <- read.csv("experiment_setup.csv", sep = ";")
disease_score <- read.csv("disease_score.csv", sep = ";")
```

```
get_cultivar_label <- function(x) {
  experiment_setup[experiment_setup$Cultivar == x,][1,]$Sensitivity
}

disease_score$sensitivity <- unlist(lapply(disease_score$Cultivar, get_cultivar_label))

n <- dim(disease_score)[1]
disease_score <- disease_score[1:(n-3),]
```

```
disease_score$T9.RGR..cm. <- as.numeric(gsub(",", ".", disease_score$T9.RGR..cm.))
disease_score$T9.length..cm. <- as.numeric(gsub(",", ".", disease_score$T9.length..cm.))
disease_score <- disease_score %>%
  filter(!is.na(sensitivity), sensitivity != "")
disease_score <- disease_score %>% filter(T9.length..cm. >= 0, T9.RGR..cm. >= 0)

disease_score_clean <- subset(disease_score, Pathogen != "negative control")
disease_score_clean <- na.omit(disease_score_clean)

disease_score_clean
```

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##      Treatment..1.34.     Cultivar       Pathogen     Soiltype Block.nr.
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## 30                2      Kennedy Microsclerotia         Soil         1
## 31                2      Kennedy Microsclerotia         Soil         1
## 32                2      Kennedy Microsclerotia         Soil         1
## 33                2      Kennedy Microsclerotia         Soil         1
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## 39                2      Kennedy Microsclerotia         Soil         2
## 40                2      Kennedy Microsclerotia         Soil         2
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## 42                2      Kennedy Microsclerotia         Soil         2
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## 46                2      Kennedy Microsclerotia         Soil         3
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## 57                2      Kennedy Microsclerotia         Soil         4
## 58                2      Kennedy Microsclerotia         Soil         4
## 59                2      Kennedy Microsclerotia         Soil         4
## 60                2      Kennedy Microsclerotia         Soil         4
## 61                2      Kennedy Microsclerotia         Soil         4
## 62                3      Kennedy        Conidia         Soil         1
## 63                3      Kennedy        Conidia         Soil         1
## 64                3      Kennedy        Conidia         Soil         1
## 65                3      Kennedy        Conidia         Soil         1
## 66                3      Kennedy        Conidia         Soil         1
## 67                3      Kennedy        Conidia         Soil         1
## 68                3      Kennedy        Conidia         Soil         1
## 69                3      Kennedy        Conidia         Soil         1
## 70                3      Kennedy        Conidia         Soil         2
## 71                3      Kennedy        Conidia         Soil         2
## 72                3      Kennedy        Conidia         Soil         2
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## 77                3      Kennedy        Conidia         Soil         2
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## 79                3      Kennedy        Conidia         Soil         3
## 80                3      Kennedy        Conidia         Soil         3
## 81                3      Kennedy        Conidia         Soil         3
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## 83                3      Kennedy        Conidia         Soil         3
## 84                3      Kennedy        Conidia         Soil         3
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## 85                3      Kennedy        Conidia         Soil         3
## 86                3      Kennedy        Conidia         Soil         4
## 87                3      Kennedy        Conidia         Soil         4
## 88                3      Kennedy        Conidia         Soil         4
## 89                3      Kennedy        Conidia         Soil         4
## 90                3      Kennedy        Conidia         Soil         4
## 91                3      Kennedy        Conidia         Soil         4
## 92                3      Kennedy        Conidia         Soil         4
## 93                3      Kennedy        Conidia         Soil         4
## 126               5      Kennedy Microsclerotia Potting Soil         1
## 127               5      Kennedy Microsclerotia Potting Soil         1
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## 171     6     Kennedy     Conidia Potting Soil     2
## 172     6     Kennedy     Conidia Potting Soil     2
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## 222     8        Myra     Conidia Potting Soil     1
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## 232     8        Myra     Conidia Potting Soil     2
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## 253     8        Myra     Conidia Potting Soil     4
## 285    10        Sira     Conidia Potting Soil     1
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## 288                10         Sira       Conidia Potting Soil         1
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## 374                12      Softone       Conidia Potting Soil         4
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## 491                16     Stallion       Conidia Potting Soil         3
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## 603                20       Alamos       Conidia Potting Soil         1
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## 609              20       Alamos       Conidia Potting Soil         1
## 610              20       Alamos       Conidia Potting Soil         1
## 611              20       Alamos       Conidia Potting Soil         2
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## 731              24 Abbey Purple       Conidia Potting Soil        1
## 732              24 Abbey Purple       Conidia Potting Soil        1
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## 753              24 Abbey Purple       Conidia Potting Soil        3
## 754              24 Abbey Purple       Conidia Potting Soil        3
## 755              24 Abbey Purple       Conidia Potting Soil        4
## 756              24 Abbey Purple       Conidia Potting Soil        4
## 757              24 Abbey Purple       Conidia Potting Soil        4
## 758              24 Abbey Purple       Conidia Potting Soil        4
## 759              24 Abbey Purple       Conidia Potting Soil        4
## 760              24 Abbey Purple       Conidia Potting Soil        4
## 761              24 Abbey Purple       Conidia Potting Soil        4
## 762              24 Abbey Purple       Conidia Potting Soil        4
## 795              26         Carey       Conidia Potting Soil        1
## 796              26         Carey       Conidia Potting Soil        1
## 797              26         Carey       Conidia Potting Soil        1
## 798              26         Carey       Conidia Potting Soil        1
## 799              26         Carey       Conidia Potting Soil        1
## 800              26         Carey       Conidia Potting Soil        1
## 801              26         Carey       Conidia Potting Soil        1
## 802              26         Carey       Conidia Potting Soil        1
## 803              26         Carey       Conidia Potting Soil        2
## 804              26         Carey       Conidia Potting Soil        2
## 805              26         Carey       Conidia Potting Soil        2
## 806              26         Carey       Conidia Potting Soil        2
## 807              26         Carey       Conidia Potting Soil        2
## 808              26         Carey       Conidia Potting Soil        2
## 809              26         Carey       Conidia Potting Soil        2
## 810              26         Carey       Conidia Potting Soil        2
## 811              26         Carey       Conidia Potting Soil        3
## 812              26         Carey       Conidia Potting Soil        3
```

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## 813                26         Carey        Conidia Potting Soil         3
## 814                26         Carey        Conidia Potting Soil         3
## 815                26         Carey        Conidia Potting Soil         3
## 816                26         Carey        Conidia Potting Soil         3
## 817                26         Carey        Conidia Potting Soil         3
## 818                26         Carey        Conidia Potting Soil         3
## 819                26         Carey        Conidia Potting Soil         4
## 820                26         Carey        Conidia Potting Soil         4
## 821                26         Carey        Conidia Potting Soil         4
## 822                26         Carey        Conidia Potting Soil         4
## 823                26         Carey        Conidia Potting Soil         4
## 824                26         Carey        Conidia Potting Soil         4
## 825                26         Carey        Conidia Potting Soil         4
## 826                26         Carey        Conidia Potting Soil         4
## 859                28       Antonov        Conidia Potting Soil         1
## 860                28       Antonov        Conidia Potting Soil         1
## 861                28       Antonov        Conidia Potting Soil         1
## 862                28       Antonov        Conidia Potting Soil         1
## 863                28       Antonov        Conidia Potting Soil         1
## 864                28       Antonov        Conidia Potting Soil         1
## 865                28       Antonov        Conidia Potting Soil         1
## 866                28       Antonov        Conidia Potting Soil         1
## 867                28       Antonov        Conidia Potting Soil         2
## 868                28       Antonov        Conidia Potting Soil         2
## 869                28       Antonov        Conidia Potting Soil         2
## 870                28       Antonov        Conidia Potting Soil         2
## 871                28       Antonov        Conidia Potting Soil         2
## 872                28       Antonov        Conidia Potting Soil         2
## 873                28       Antonov        Conidia Potting Soil         2
## 874                28       Antonov        Conidia Potting Soil         2
## 875                28       Antonov        Conidia Potting Soil         3
## 876                28       Antonov        Conidia Potting Soil         3
## 877                28       Antonov        Conidia Potting Soil         3
## 878                28       Antonov        Conidia Potting Soil         3
## 879                28       Antonov        Conidia Potting Soil         3
## 880                28       Antonov        Conidia Potting Soil         3
## 881                28       Antonov        Conidia Potting Soil         3
## 882                28       Antonov        Conidia Potting Soil         3
## 883                28       Antonov        Conidia Potting Soil         4
## 884                28       Antonov        Conidia Potting Soil         4
## 885                28       Antonov        Conidia Potting Soil         4
## 886                28       Antonov        Conidia Potting Soil         4
## 887                28       Antonov        Conidia Potting Soil         4
## 888                28       Antonov        Conidia Potting Soil         4
## 889                28       Antonov        Conidia Potting Soil         4
## 890                28       Antonov        Conidia Potting Soil         4
## 906                30  80.087.000        Conidia Potting Soil         3
## 907                30  80.087.000        Conidia Potting Soil         3
## 908                30  80.087.000        Conidia Potting Soil         3
## 909                30  80.087.000        Conidia Potting Soil         3
## 910                30  80.087.000        Conidia Potting Soil         3
## 911                30  80.087.000        Conidia Potting Soil         3
## 912                30  80.087.000        Conidia Potting Soil         4
## 913                30  80.087.000        Conidia Potting Soil         4
```

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## 914                30   80.087.000       Conidia Potting Soil         4
## 915                30   80.087.000       Conidia Potting Soil         4
## 916                30   80.087.000       Conidia Potting Soil         4
## 917                30   80.087.000       Conidia Potting Soil         4
## 918                30   80.087.000       Conidia Potting Soil         4
## 950                32   91.023.000       Conidia Potting Soil         1
## 951                32   91.023.000       Conidia Potting Soil         1
## 952                32   91.023.000       Conidia Potting Soil         1
## 953                32   91.023.000       Conidia Potting Soil         1
## 954                32   91.023.000       Conidia Potting Soil         1
## 955                32   91.023.000       Conidia Potting Soil         1
## 956                32   91.023.000       Conidia Potting Soil         1
## 957                32   91.023.000       Conidia Potting Soil         1
## 958                32   91.023.000       Conidia Potting Soil         2
## 959                32   91.023.000       Conidia Potting Soil         2
## 960                32   91.023.000       Conidia Potting Soil         2
## 961                32   91.023.000       Conidia Potting Soil         2
## 962                32   91.023.000       Conidia Potting Soil         2
## 963                32   91.023.000       Conidia Potting Soil         2
## 964                32   91.023.000       Conidia Potting Soil         2
## 965                32   91.023.000       Conidia Potting Soil         2
## 966                32   91.023.000       Conidia Potting Soil         3
## 967                32   91.023.000       Conidia Potting Soil         3
## 968                32   91.023.000       Conidia Potting Soil         3
## 969                32   91.023.000       Conidia Potting Soil         3
## 970                32   91.023.000       Conidia Potting Soil         3
## 971                32   91.023.000       Conidia Potting Soil         3
## 972                32   91.023.000       Conidia Potting Soil         3
## 973                32   91.023.000       Conidia Potting Soil         3
## 974                32   91.023.000       Conidia Potting Soil         4
## 975                32   91.023.000       Conidia Potting Soil         4
## 976                32   91.023.000       Conidia Potting Soil         4
## 977                32   91.023.000       Conidia Potting Soil         4
## 978                32   91.023.000       Conidia Potting Soil         4
## 979                32   91.023.000       Conidia Potting Soil         4
## 980                32   91.023.000       Conidia Potting Soil         4
## 981                32   91.023.000       Conidia Potting Soil         4
## 1014               34  130.857.000       Conidia Potting Soil         1
## 1015               34  130.857.000       Conidia Potting Soil         1
## 1016               34  130.857.000       Conidia Potting Soil         1
## 1017               34  130.857.000       Conidia Potting Soil         1
## 1018               34  130.857.000       Conidia Potting Soil         1
## 1019               34  130.857.000       Conidia Potting Soil         1
## 1020               34  130.857.000       Conidia Potting Soil         1
## 1021               34  130.857.000       Conidia Potting Soil         1
## 1022               34  130.857.000       Conidia Potting Soil         2
## 1023               34  130.857.000       Conidia Potting Soil         2
## 1024               34  130.857.000       Conidia Potting Soil         2
## 1025               34  130.857.000       Conidia Potting Soil         2
## 1026               34  130.857.000       Conidia Potting Soil         2
## 1027               34  130.857.000       Conidia Potting Soil         2
## 1028               34  130.857.000       Conidia Potting Soil         2
## 1029               34  130.857.000       Conidia Potting Soil         2
## 1030               34  130.857.000       Conidia Potting Soil         3
```

```
## 1031              34  130.857.000        Conidia Potting Soil         3
## 1032              34  130.857.000        Conidia Potting Soil         3
## 1033              34  130.857.000        Conidia Potting Soil         3
## 1034              34  130.857.000        Conidia Potting Soil         3
## 1035              34  130.857.000        Conidia Potting Soil         3
## 1036              34  130.857.000        Conidia Potting Soil         3
## 1037              34  130.857.000        Conidia Potting Soil         3
## 1038              34  130.857.000        Conidia Potting Soil         4
## 1039              34  130.857.000        Conidia Potting Soil         4
## 1040              34  130.857.000        Conidia Potting Soil         4
## 1041              34  130.857.000        Conidia Potting Soil         4
## 1042              34  130.857.000        Conidia Potting Soil         4
## 1043              34  130.857.000        Conidia Potting Soil         4
## 1044              34  130.857.000        Conidia Potting Soil         4
## 1045              34  130.857.000        Conidia Potting Soil         4
##      Plant.nr. T3.disease..0.1. T4.disease....leaves. T5.disease....
## 30         33                0                     0             10
## 31         34                0                     0              0
## 32         35                0                     0              0
## 33         36                0                     0              0
## 34         37                0                     0              0
## 35         38                0                     0              0
## 36         39                0                     0              0
## 37         40                0                     0              0
## 39         42                0                     0              0
## 40         43                0                     0              0
## 41         44                0                     0              0
## 42         45                0                     0              0
## 43         46                0                     0              0
## 44         47                0                     0              0
## 45         48                0                     0              0
## 46         49                0                     5            100
## 47         50                0                     0              0
## 48         51                0                     0            100
## 49         52                0                     0              5
## 50         53                0                     0              0
## 51         54                0                     0              0
## 52         55                0                     0              0
## 53         56                0                     0              0
## 54         57                0                     0              0
## 55         58                0                     0              0
## 56         59                0                     0              0
## 57         60                1                     0              0
## 58         61                0                     0              0
## 59         62                0                     0              0
## 60         63                0                     0              0
## 61         64                0                     0              0
## 62         65                0                     0              0
## 63         66                0                     0              0
## 64         67                0                     1             10
## 65         68                0                     0             10
## 66         69                0                     0              5
## 67         70                0                     0              0
## 68         71                0                     0              0
```

```
## 69          72          0           0           0
## 70          73          0           2           5
## 71          74          0           0           5
## 72          75          1           0           5
## 73          76          0           0           0
## 74          77          0           0           5
## 75          78          0           0           0
## 76          79          0           0           0
## 77          80          1           2           5
## 78          81          0           0          20
## 79          82          0           0           5
## 80          83          0           1           5
## 81          84          0           0           5
## 82          85          0           0           0
## 83          86          0           0           5
## 84          87          0           0           5
## 85          88          0           0           5
## 86          89          0           0          25
## 87          90          0           0           5
## 88          91          0           0          10
## 89          92          0           0           0
## 90          93          0           0           0
## 91          94          0           0           0
## 92          95          0           0           0
## 93          96          0           0           0
## 126        129          0           4          25
## 127        130          0           5          25
## 128        131          0           4          15
## 129        132          0           0          10
## 130        133          0           0           5
## 131        134          0           0           5
## 132        135          0           0           0
## 133        136          0           0           5
## 134        137          0           0           5
## 135        138          0           0           0
## 136        139          0           0          15
## 137        140          0           0          10
## 138        141          0           0           5
## 139        142          0           0          10
## 140        143          0           0           5
## 141        144          0           0           5
## 142        145          0           0           0
## 143        146          0           0           5
## 144        147          0           0           5
## 145        148          0           0           0
## 146        149          0           0           5
## 147        150          0           0           0
## 148        151          0           0           0
## 149        152          0           0           0
## 150        153          0           0           5
## 151        154          0           0           0
## 152        155          0           0           0
## 153        156          0           0           0
## 154        157          0           0           0
```

```
## 155        158                0                  0                  0
## 156        159                0                  0                  5
## 157        160                0                  0                  0
## 158        161                0                  0                 25
## 159        162                0                  0                 20
## 160        163                0                  0                 20
## 161        164                0                  2                 60
## 162        165                0                  0                 30
## 163        166                0                  0                 20
## 164        167                0                  0                  5
## 165        168                0                  0                  5
## 166        169                0                  0                  0
## 167        170                0                  0                  0
## 168        171                0                  0                  5
## 169        172                0                  9                 65
## 170        173                0                  0                 30
## 171        174                0                  0                  5
## 172        175                0                  1                  5
## 173        176                0                  2                 15
## 174        177                0                  0                 35
## 175        178                0                  2                 60
## 176        179                0                  1                 75
## 177        180                0                  2                 50
## 178        181                0                  0                 20
## 179        182                0                  0                 15
## 180        183                0                  0                 70
## 181        184                0                  0                 50
## 182        185                0                  0                 60
## 183        186                0                  0                 10
## 184        187                0                  0                  5
## 185        188                0                  0                  5
## 186        189                0                  0                  5
## 187        190                0                  0                  5
## 188        191                0                  0                 15
## 189        192                0                  0                  5
## 222        225                0                 12                 50
## 223        226                0                  7                 45
## 224        227                1                 16                 60
## 225        228                1                  8                 55
## 226        229                0                 11                 60
## 227        230                0                  3                 40
## 228        231                0                  7                 60
## 229        232                1                  6                 50
## 230        233                0                  5                 50
## 231        234                0                  5                 60
## 232        235                0                  2                 60
## 233        236                0                  5                 60
## 234        237                0                  5                 65
## 235        238                0                  7                 60
## 236        239                0                  6                 65
## 237        240                0                  1                 25
## 238        241                0                  3                 60
## 239        242                0                  2                 60
## 240        243                0                  5                 70
```

```
## 241        244                1                  3                 75
## 242        245                0                  4                 75
## 243        246                0                  7                 60
## 244        247                0                  2                 70
## 245        248                0                  5                 70
## 246        249                0                  4                 70
## 247        250                0                  3                 70
## 248        251                1                  2                 70
## 249        252                0                  3                 75
## 250        253                0                  3                 75
## 251        254                0                  1                 65
## 252        255                0                  2                 65
## 253        256                1                  2                 60
## 285        289                0                  0                 20
## 286        290                0                  0                 25
## 287        291                0                  0                 85
## 288        292                0                 10                 90
## 289        293                0                  4                 60
## 290        294                0                  1                 65
## 291        295                0                  0                 90
## 292        296                0                 12                 90
## 293        297                0                  0                 40
## 294        298                0                  0                 60
## 295        299                0                  0                 60
## 296        300                0                  0                 60
## 297        301                0                  2                 60
## 298        302                0                  5                 80
## 299        303                0                  3                 85
## 300        304                0                  0                 20
## 301        305                0                  0                 70
## 302        306                0                  2                 80
## 303        307                0                  2                 85
## 304        308                0                  3                 85
## 305        309                0                  6                 85
## 306        310                0                  4                 85
## 307        311                0                  7                100
## 308        312                0                  1                 80
## 309        313                0                  2                 65
## 310        314                0                  0                 70
## 311        315                0                  1                 75
## 312        316                0                  2                 80
## 313        317                0                  5                 70
## 314        318                0                  1                 70
## 315        319                0                  2                 80
## 316        320                0                  2                 75
## 349        353                0                  1                 25
## 350        354                0                  4                 20
## 351        355                0                  4                 25
## 352        356                0                  4                 30
## 353        357                0                  5                 40
## 354        358                0                  3                 25
## 355        359                0                  3                 30
## 356        360                0                  0                 10
## 357        361                0                  1                 40
```

```
## 358        362                0                  0                  0
## 359        363                0                  1                  5
## 360        364                0                  0                 20
## 361        365                0                  1                 15
## 362        366                0                  0                 30
## 363        367                0                  1                  5
## 364        368                0                  0                 10
## 365        369                0                  2                 20
## 366        370                0                  2                 30
## 367        371                0                  0                 10
## 368        372                0                  0                  5
## 369        373                0                  2                 20
## 370        374                0                  1                 25
## 371        375                0                  0                 20
## 372        376                0                  1                 25
## 373        377                0                  0                 30
## 374        378                0                  1                 70
## 375        379                0                  0                 15
## 376        380                0                  0                 20
## 377        381                0                  1                 15
## 378        382                0                  0                 30
## 379        383                0                  0                 10
## 380        384                0                  0                  0
## 413        417                0                  0                  0
## 414        418                0                  0                  0
## 415        419                0                  0                  5
## 416        420                0                  0                  0
## 417        421                0                  0                  0
## 418        422                0                  0                  0
## 419        423                0                  0                  5
## 420        424                0                  0                  0
## 421        425                0                  0                  0
## 422        426                0                  0                  0
## 423        428                0                  0                  0
## 424        429                0                  0                  0
## 425        430                0                  0                  0
## 426        431                0                  0                  5
## 427        432                0                  0                  0
## 428        433                0                  0                  0
## 429        434                0                  0                  0
## 430        435                0                  0                  5
## 431        436                0                  0                  5
## 432        437                0                  0                 10
## 433        438                0                  0                  0
## 434        439                0                  0                  0
## 435        440                0                  0                  5
## 436        441                0                  0                  0
## 437        442                0                  0                  0
## 438        443                0                  0                  0
## 439        444                0                  0                  0
## 440        445                0                  0                  0
## 441        446                0                  0                  0
## 442        447                0                  0                  5
## 443        448                0                  0                  0
```

```
## 475        481                0                  0                  5
## 476        482                0                  2                 15
## 477        483                0                  0                 20
## 478        484                0                  0                 20
## 479        485                0                  0                 30
## 480        486                0                  0                 40
## 481        487                0                  0                 30
## 482        488                0                  0                 20
## 483        489                0                 12                 80
## 484        490                0                  3                 70
## 485        491                0                  3                 50
## 486        492                0                  3                 45
## 487        493                0                  3                 50
## 488        494                0                  1                 25
## 489        495                0                  1                 10
## 490        496                0                  1                 10
## 491        497                0                  0                 10
## 492        498                0                  0                 40
## 493        499                0                  0                 55
## 494        500                0                  0                 60
## 495        501                0                  0                 45
## 496        502                0                  0                 50
## 497        503                0                  0                 50
## 498        504                0                  0                 45
## 499        505                0                  0                 45
## 500        506                0                  0                 40
## 501        507                0                  0                 45
## 502        508                0                  0                 45
## 503        509                0                  0                 50
## 504        510                0                  0                 45
## 505        511                0                  0                 45
## 506        512                0                  0                 45
## 539        545                0                  0                 10
## 540        546                0                  0                  0
## 541        547                0                  0                  0
## 542        548                0                  0                  0
## 543        549                0                  0                  0
## 544        550                0                  0                 50
## 545        551                0                  0                  0
## 546        552                0                  0                 10
## 547        553                0                  0                  5
## 548        554                0                  0                 10
## 549        555                0                  0                  5
## 550        556                0                  0                  5
## 551        557                0                  0                  0
## 552        558                0                  0                  5
## 553        559                0                  0                  5
## 554        560                0                  0                  5
## 555        561                0                  0                  0
## 556        562                0                  0                  0
## 557        563                0                  0                  0
## 558        564                0                  0                  0
## 559        565                0                  0                  0
## 560        566                0                  0                  0
```

```
## 561        567                0                  0                  0
## 562        568                0                  0                  0
## 563        569                0                  0                  5
## 564        570                0                  0                  0
## 565        571                0                  0                 25
## 566        572                0                  0                  5
## 567        573                0                  0                 15
## 568        574                0                  0                  0
## 569        575                0                  0                  5
## 570        576                0                  0                 35
## 603        609                0                  0                  0
## 604        610                0                  0                  5
## 605        611                0                  0                  0
## 606        612                0                  0                  0
## 607        613                0                  0                 10
## 608        614                0                  0                  5
## 609        615                0                  0                  0
## 610        616                0                  0                 10
## 611        617                0                  0                  5
## 612        618                0                  0                  0
## 613        619                0                  0                  0
## 614        620                0                  0                  0
## 615        621                0                  0                  0
## 616        622                0                  0                  0
## 617        623                0                  0                  0
## 618        624                0                  0                  0
## 619        625                0                  0                  5
## 620        626                0                  0                  0
## 621        627                0                  0                 10
## 622        628                0                  0                  0
## 623        629                0                  0                 10
## 624        630                0                  0                  0
## 625        631                0                  0                  0
## 626        632                0                  0                  0
## 627        633                0                  1                  5
## 628        634                0                  0                  5
## 629        635                0                  0                  0
## 630        636                0                  0                  0
## 631        637                0                  0                  5
## 632        638                0                  0                 10
## 633        639                0                  1                 10
## 634        640                0                  2                 25
## 667        673                0                  6                 50
## 668        674                0                  0                 25
## 669        675                0                  4                 40
## 670        676                0                  3                 50
## 671        677                0                  1                  5
## 672        678                0                  1                  5
## 673        679                0                  5                 50
## 674        680                0                  0                  0
## 675        681                0                  7                 15
## 676        682                0                 13                 90
## 677        683                0                 14                 40
## 678        684                0                 16                 75
```

```
## 679        685                0                  17                90
## 680        686                0                   0                 5
## 681        687                0                  17                90
## 682        688                0                  11                55
## 683        689                0                   0                40
## 684        690                0                   0                35
## 685        691                0                   0                25
## 686        692                0                   1                70
## 687        693                0                   0                65
## 688        694                0                   1                60
## 689        695                0                   0                15
## 690        696                0                   0                35
## 691        697                0                   0                85
## 692        698                0                   0                80
## 693        699                0                   0                90
## 694        700                0                   0                90
## 695        701                0                   0                75
## 696        702                0                   0                80
## 697        703                0                   0                60
## 698        704                0                   0                55
## 731        737                0                   0                 5
## 732        738                0                   0                 0
## 733        739                0                   0                 0
## 734        740                0                   0                 0
## 735        741                0                   0                 0
## 736        742                0                   0                 0
## 737        743                0                   0                 0
## 738        744                0                   0                 0
## 739        745                0                   0                 0
## 740        746                0                   0                 0
## 741        747                0                   0                 0
## 742        748                0                   0                 0
## 743        749                0                   0                 0
## 744        750                0                   0                 0
## 745        751                0                   0                 0
## 746        752                0                   0                 0
## 747        753                0                   0                 5
## 748        754                0                   0                 0
## 749        755                0                   0                 0
## 750        756                0                   0                 0
## 751        757                0                   0                 0
## 752        758                0                   0                 0
## 753        759                0                   0                 0
## 754        760                0                   0                 0
## 755        761                0                   0                 5
## 756        762                0                   0                 5
## 757        763                0                   0                 0
## 758        764                0                   0                 0
## 759        765                0                   0                 0
## 760        766                0                   0                 0
## 761        767                0                   0                 0
## 762        768                0                   0                 0
## 795        801                0                   0                 5
## 796        802                0                   0                 5
```

```
## 797        803                0                  6                 15
## 798        804                0                  0                 10
## 799        805                0                  2                  5
## 800        806                0                  2                 10
## 801        807                0                  2                  5
## 802        808                0                  2                 10
## 803        809                0                  0                 15
## 804        810                0                  0                 10
## 805        811                0                  0                 15
## 806        812                0                  0                  5
## 807        813                0                  0                  5
## 808        814                0                  0                 10
## 809        815                0                  0                  5
## 810        816                0                  0                  5
## 811        817                0                  2                 25
## 812        818                0                  0                  0
## 813        819                0                  0                 15
## 814        820                0                  0                  5
## 815        821                0                  0                  0
## 816        822                0                  2                 10
## 817        823                0                  0                 10
## 818        824                0                  0                 10
## 819        825                0                  0                  0
## 820        826                0                  0                 40
## 821        827                0                  2                 50
## 822        828                0                  0                  5
## 823        829                0                  0                  5
## 824        830                0                  0                  5
## 825        831                0                  1                 15
## 826        832                0                  0                  5
## 859        865                0                  0                  0
## 860        866                0                  0                  0
## 861        867                0                  0                  0
## 862        868                0                  0                  0
## 863        869                0                  0                  0
## 864        870                0                  0                  0
## 865        871                0                  0                  0
## 866        872                0                  0                  0
## 867        873                0                  0                  5
## 868        874                0                  0                  0
## 869        875                0                  0                  0
## 870        876                0                  0                  5
## 871        877                0                  0                  5
## 872        878                0                  0                 10
## 873        879                0                  0                 10
## 874        880                0                  0                  0
## 875        881                0                  0                  0
## 876        882                0                  0                  0
## 877        883                0                  0                  0
## 878        884                0                  0                  0
## 879        885                0                  0                  0
## 880        886                0                  0                  0
## 881        887                0                  0                  0
## 882        888                0                  0                  0
```

```
## 883       889              0                0              0
## 884       890              0                0              0
## 885       891              0                0              0
## 886       892              0                0              0
## 887       893              0                0              0
## 888       894              0                0              0
## 889       895              0                0              0
## 890       896              0                0              0
## 906       914              0                0              0
## 907       915              0                0              0
## 908       917              0                0              0
## 909       918              0                0              0
## 910       919              0                0              0
## 911       920              0                0              0
## 912       921              0                0              0
## 913       922              0                0              0
## 914       923              0                0              0
## 915       924              0                0              0
## 916       926              0                0              0
## 917       927              0                0              0
## 918       928              0                0              0
## 950       961              0                0              0
## 951       962              0                0              0
## 952       963              0                0              0
## 953       964              0                0              0
## 954       965              0                0              0
## 955       966              0                0              0
## 956       967              0                0              0
## 957       968              0                0              0
## 958       969              0                0              5
## 959       970              0                0              0
## 960       971              0                0              0
## 961       972              0                0              0
## 962       973              0                0              5
## 963       974              0                0              0
## 964       975              0                0              0
## 965       976              0                0              0
## 966       977              0                0              0
## 967       978              0                0              0
## 968       979              0                0              0
## 969       980              0                0              5
## 970       981              0                0              0
## 971       982              0                0              0
## 972       983              0                0              0
## 973       984              0                0              0
## 974       985              0                0              0
## 975       986              0                0              0
## 976       987              0                0              0
## 977       988              0                0              0
## 978       989              0                0              0
## 979       990              0                0              0
## 980       991              0                0              0
## 981       992              0                0              0
## 1014     1025              0                0              0
```

```
## 1015      1026                0                    0              15
## 1016      1027                0                    1              10
## 1017      1028                0                    0               0
## 1018      1029                0                    0               0
## 1019      1030                0                    1              40
## 1020      1031                0                    0              35
## 1021      1032                0                    2              15
## 1022      1033                0                    1              10
## 1023      1034                0                    0              20
## 1024      1035                0                    1              20
## 1025      1036                0                    1              25
## 1026      1037                0                    0               0
## 1027      1038                0                    0               5
## 1028      1039                0                    0               0
## 1029      1040                0                    0              15
## 1030      1041                0                    0               0
## 1031      1042                0                    0               0
## 1032      1043                0                    0              55
## 1033      1044                0                    0              20
## 1034      1045                0                    0              55
## 1035      1046                0                    0              10
## 1036      1047                0                    0              10
## 1037      1048                0                    0              60
## 1038      1049                0                    0              70
## 1039      1050                0                    0              75
## 1040      1051                0                    0              40
## 1041      1052                0                    0              40
## 1042      1053                0                    0              80
## 1043      1054                0                    0              65
## 1044      1055                0                    0              70
## 1045      1056                0                    0              70
##      T5.affected..0.1. T6.disease.... T6.affected..0.1. T7.disease....
## 30                   1              0                  0               5
## 31                   0              0                  0               0
## 32                   0              5                  0              20
## 33                   0              5                  0              25
## 34                   0              0                  0               0
## 35                   0              0                  0               0
## 36                   0              0                  0              15
## 37                   0              0                  0               0
## 39                   0              0                  0               5
## 40                   0              0                  0               0
## 41                   0              0                  0               5
## 42                   0              0                  0               5
## 43                   0              0                  0               0
## 44                   0              0                  0               5
## 45                   0              0                  0               0
## 46                   1            100                  1             100
## 47                   0              0                  0               5
## 48                   1            100                  1             100
## 49                   0             15                  1              15
## 50                   0              5                  0              15
## 51                   0              0                  0              10
## 52                   0              0                  0               0
```

## 53	0	0	0	15
## 54	0	0	0	40
## 55	0	5	0	55
## 56	0	0	0	0
## 57	0	5	0	5
## 58	0	0	0	0
## 59	0	0	0	5
## 60	0	0	0	0
## 61	0	0	0	50
## 62	0	5	0	5
## 63	0	0	0	15
## 64	1	15	1	40
## 65	1	40	1	60
## 66	0	5	0	50
## 67	0	5	0	30
## 68	0	0	0	5
## 69	0	0	0	0
## 70	0	5	0	60
## 71	0	10	1	65
## 72	0	5	0	70
## 73	0	10	1	50
## 74	0	5	0	60
## 75	0	15	1	55
## 76	0	10	1	60
## 77	0	10	1	55
## 78	1	30	1	60
## 79	0	35	1	75
## 80	0	15	1	30
## 81	0	15	1	20
## 82	0	5	0	30
## 83	0	15	1	50
## 84	0	15	1	60
## 85	0	10	1	40
## 86	1	25	1	50
## 87	0	5	0	50
## 88	1	15	1	50
## 89	0	0	0	15
## 90	0	10	1	40
## 91	0	0	0	50
## 92	0	0	0	50
## 93	0	0	0	30
## 126	1	40	1	50
## 127	1	45	1	70
## 128	1	55	1	55
## 129	1	60	1	60
## 130	0	60	1	60
## 131	0	5	0	5
## 132	0	20	1	30
## 133	0	10	1	15
## 134	0	5	0	15
## 135	0	0	0	5
## 136	1	25	1	25
## 137	1	15	1	30
## 138	0	15	1	40

## 139	1	15	1	50
## 140	0	15	1	40
## 141	0	10	1	45
## 142	0	0	0	10
## 143	0	5	0	10
## 144	0	5	0	20
## 145	0	0	0	0
## 146	0	5	0	20
## 147	0	0	0	20
## 148	0	0	0	30
## 149	0	0	0	40
## 150	0	10	1	80
## 151	0	0	0	10
## 152	0	10	1	10
## 153	0	10	1	10
## 154	0	0	0	0
## 155	0	10	1	10
## 156	0	10	1	10
## 157	0	0	0	5
## 158	1	30	1	45
## 159	1	40	1	45
## 160	1	40	1	75
## 161	1	70	1	90
## 162	1	45	1	60
## 163	1	20	1	55
## 164	0	30	1	40
## 165	0	30	1	40
## 166	0	0	0	20
## 167	0	0	0	5
## 168	0	25	1	70
## 169	1	65	1	80
## 170	1	30	1	75
## 171	0	5	0	30
## 172	0	10	1	40
## 173	1	15	1	45
## 174	1	75	1	75
## 175	1	70	1	70
## 176	1	85	1	85
## 177	1	65	1	75
## 178	1	25	1	70
## 179	1	25	1	55
## 180	1	90	1	95
## 181	1	50	1	75
## 182	1	75	1	75
## 183	1	20	1	70
## 184	0	20	1	40
## 185	0	5	0	30
## 186	0	10	1	40
## 187	0	25	1	25
## 188	1	25	1	50
## 189	0	15	1	60
## 222	1	80	1	90
## 223	1	85	1	85
## 224	1	75	1	85

```
## 225  1  65  1  90
## 226  1  70  1  80
## 227  1  65  1  85
## 228  1  70  1  85
## 229  1  60  1  75
## 230  1  70  1  70
## 231  1  60  1  70
## 232  1  60  1  70
## 233  1  65  1  65
## 234  1  65  1  80
## 235  1  60  1  85
## 236  1  65  1  80
## 237  1  40  1  70
## 238  1  65  1  80
## 239  1  70  1  85
## 240  1  70  1  85
## 241  1  75  1  80
## 242  1  75  1  85
## 243  1  65  1  80
## 244  1  75  1  85
## 245  1  70  1  75
## 246  1  70  1  70
## 247  1  70  1  70
## 248  1  70  1  75
## 249  1  75  1  75
## 250  1  75  1  75
## 251  1  65  1  75
## 252  1  65  1  65
## 253  1  60  1  60
## 285  1  20  1  60
## 286  1  55  1  85
## 287  1  85  1  95
## 288  1  90  1  90
## 289  1  75  1  85
## 290  1  85  1  90
## 291  1  90  1  95
## 292  1  90  1  90
## 293  1  60  1  80
## 294  1  80  1  85
## 295  1  60  1  75
## 296  1  60  1  80
## 297  1  80  1  85
## 298  1  80  1  85
## 299  1  85  1  90
## 300  1  20  1  70
## 301  1  90  1  95
## 302  1  90  1  95
## 303  1  90  1  95
## 304  1  85  1  80
## 305  1  90  1  90
## 306  1  90  1  95
## 307  1  100  1  100
## 308  1  90  1  90
## 309  1  65  1  90
```

```
## 310   1  70  1  85
## 311   1  75  1  85
## 312   1  85  1  90
## 313   1  75  1  95
## 314   1  75  1  90
## 315   1  80  1  85
## 316   1  80  1  80
## 349   1  40  1  40
## 350   1  20  1  45
## 351   1  25  1  45
## 352   1  35  1  50
## 353   1  40  1  55
## 354   1  35  1  45
## 355   1  30  1  30
## 356   1  30  1  50
## 357   1  40  1  60
## 358   0  10  1  25
## 359   0   5  0  10
## 360   1  25  1  50
## 361   1  15  1  40
## 362   1  30  1  40
## 363   0   5  0  20
## 364   1  15  1  40
## 365   1  30  1  50
## 366   1  30  1  75
## 367   1  80  1  95
## 368   0  10  1  30
## 369   1  35  1  50
## 370   1  35  1  40
## 371   1  25  1  45
## 372   1  30  1  65
## 373   1  45  1  45
## 374   1  70  1  70
## 375   1  15  1  65
## 376   1  20  1  50
## 377   1  20  1  50
## 378   1  45  1  50
## 379   1  20  1  25
## 380   0   0  0  10
## 413   0   0  0  10
## 414   0   5  0   5
## 415   0   5  0  10
## 416   0   0  0   0
## 417   0   5  0  10
## 418   0   0  0   0
## 419   0   5  0   5
## 420   0   0  0   0
## 421   0   0  0   0
## 422   0  10  1  15
## 423   0   0  0   0
## 424   0   0  0   0
## 425   0   0  0  10
## 426   0   5  0  10
## 427   0   0  0   0
```

```
## 428   0   0   0   0
## 429   0   0   0   0
## 430   0   5   0   5
## 431   0   5   0  10
## 432   1   5   0   5
## 433   0   5   0   5
## 434   0   0   0   0
## 435   0   5   0  15
## 436   0   0   0   0
## 437   0   0   0   0
## 438   0   0   0   0
## 439   0   0   0   0
## 440   0   0   0   5
## 441   0   0   0   0
## 442   0   5   0   5
## 443   0   0   0   0
## 475   0  50   1  50
## 476   1  50   1  60
## 477   1  40   1  55
## 478   1  25   1  25
## 479   1  30   1  50
## 480   1  40   1  50
## 481   1  50   1  55
## 482   1  30   1  30
## 483   1  70   1  75
## 484   1  60   1  65
## 485   1  50   1  65
## 486   1  15   1  40
## 487   1  50   1  50
## 488   1  50   1  70
## 489   1  30   1  50
## 490   1  25   1  50
## 491   1  10   1  50
## 492   1  50   1  65
## 493   1  55   1  60
## 494   1  60   1  60
## 495   1  45   1  55
## 496   1  55   1  70
## 497   1  50   1  55
## 498   1  50   1  60
## 499   1  45   1  75
## 500   1  45   1  85
## 501   1  45   1  60
## 502   1  45   1  50
## 503   1  50   1  50
## 504   1  45   1  50
## 505   1  45   1  55
## 506   1  45   1  50
## 539   1  25   1  25
## 540   0   0   0   0
## 541   0   0   0   0
## 542   0   0   0   0
## 543   0   0   0   0
## 544   1  50   1  60
```

```
## 545   0   0   0   40
## 546   1   10  1   20
## 547   0   5   0   10
## 548   1   10  1   10
## 549   0   5   0   10
## 550   0   5   0   60
## 551   0   10  1   60
## 552   0   10  1   10
## 553   0   30  1   55
## 554   0   20  1   30
## 555   0   15  1   40
## 556   0   20  1   20
## 557   0   20  1   30
## 558   0   20  1   20
## 559   0   5   0   10
## 560   0   5   0   30
## 561   0   5   0   20
## 562   0   5   0   30
## 563   0   5   0   20
## 564   0   5   0   5
## 565   1   25  1   35
## 566   0   5   0   30
## 567   1   25  1   30
## 568   0   0   0   10
## 569   0   5   0   5
## 570   1   40  1   40
## 603   0   0   0   0
## 604   0   5   0   5
## 605   0   5   0   15
## 606   0   0   0   20
## 607   1   10  1   10
## 608   0   5   0   20
## 609   0   0   0   0
## 610   1   10  1   20
## 611   0   5   0   5
## 612   0   0   0   5
## 613   0   0   0   5
## 614   0   0   0   0
## 615   0   0   0   0
## 616   0   5   0   5
## 617   0   5   0   10
## 618   0   0   0   5
## 619   0   5   0   5
## 620   0   0   0   0
## 621   1   10  1   15
## 622   0   0   0   5
## 623   1   15  1   25
## 624   0   5   0   5
## 625   0   0   0   10
## 626   0   0   0   0
## 627   0   5   0   5
## 628   0   5   0   5
## 629   0   5   0   5
## 630   0   5   0   5
```

```
## 631   0   5   0   5
## 632   1  10   1  10
## 633   1  15   1  20
## 634   1  25   1  20
## 667   1  50   1  55
## 668   1  25   1  80
## 669   1  55   1  55
## 670   1  65   1  65
## 671   0  15   1  15
## 672   0  10   1  40
## 673   1  50   1  50
## 674   0   0   0  30
## 675   1  20   1  30
## 676   1  90   1  90
## 677   1  40   1  40
## 678   1  75   1  75
## 679   1  90   1  90
## 680   0   5   0   5
## 681   1  70   1  70
## 682   1  55   1  60
## 683   1  45   1  45
## 684   1  45   1  45
## 685   1  20   1  25
## 686   1  70   1  80
## 687   1  65   1  65
## 688   1  60   1  60
## 689   1  15   1  35
## 690   1  35   1  35
## 691   1  85   1  85
## 692   1  80   1  80
## 693   1  90   1  90
## 694   1  90   1  90
## 695   1  75   1  75
## 696   1  80   1  80
## 697   1  65   1  65
## 698   1  55   1  55
## 731   0   5   0   5
## 732   0   0   0  15
## 733   0   0   0   0
## 734   0   0   0  10
## 735   0   0   0   0
## 736   0   0   0   0
## 737   0   0   0   0
## 738   0   0   0   5
## 739   0   0   0   0
## 740   0   0   0   0
## 741   0   0   0   5
## 742   0   0   0   0
## 743   0   0   0   0
## 744   0   0   0   0
## 745   0   0   0   5
## 746   0   0   0   0
## 747   0  15   1  45
## 748   0   0   0  35
```

## 749	0	0	0	30
## 750	0	0	0	0
## 751	0	0	0	10
## 752	0	0	0	15
## 753	0	0	0	5
## 754	0	0	0	5
## 755	0	5	0	10
## 756	0	5	0	20
## 757	0	0	0	0
## 758	0	0	0	0
## 759	0	0	0	5
## 760	0	0	0	0
## 761	0	0	0	5
## 762	0	0	0	10
## 795	0	20	1	40
## 796	0	20	1	20
## 797	1	30	1	60
## 798	1	15	1	25
## 799	0	10	1	30
## 800	1	15	1	50
## 801	0	10	1	40
## 802	1	10	1	50
## 803	1	20	1	60
## 804	1	15	1	50
## 805	1	15	1	50
## 806	0	10	1	35
## 807	0	30	1	35
## 808	1	25	1	40
## 809	0	5	0	20
## 810	0	20	1	20
## 811	1	40	1	40
## 812	0	5	0	5
## 813	1	25	1	40
## 814	0	15	1	45
## 815	0	0	0	5
## 816	1	10	1	15
## 817	1	10	1	25
## 818	1	10	1	15
## 819	0	5	0	5
## 820	1	45	1	45
## 821	1	50	1	65
## 822	0	5	0	5
## 823	0	5	0	25
## 824	0	5	0	5
## 825	1	50	1	60
## 826	0	5	0	30
## 859	0	5	0	10
## 860	0	10	1	25
## 861	0	0	0	0
## 862	0	15	1	15
## 863	0	0	0	0
## 864	0	0	0	0
## 865	0	5	0	10
## 866	0	5	0	5

```
## 867    0    5    0    15
## 868    0    0    0     5
## 869    0    5    0     5
## 870    0    5    0    10
## 871    0    5    0    10
## 872    1   10    1    10
## 873    1   10    1    10
## 874    0    5    0    10
## 875    0    0    0    10
## 876    0    0    0    10
## 877    0    0    0    10
## 878    0    0    0     0
## 879    0    5    0    15
## 880    0    0    0    15
## 881    0    0    0     5
## 882    0    0    0     5
## 883    0   10    1    20
## 884    0   15    1    35
## 885    0   10    1    15
## 886    0    5    0     5
## 887    0    5    0     5
## 888    0    5    0     5
## 889    0    5    0    15
## 890    0    5    0    10
## 906    0    0    0     0
## 907    0    0    0     0
## 908    0    0    0     0
## 909    0    0    0     0
## 910    0    0    0     0
## 911    0    0    0     0
## 912    0    0    0     0
## 913    0    0    0     0
## 914    0    0    0     0
## 915    0    0    0     0
## 916    0    0    0     0
## 917    0    0    0     0
## 918    0    0    0     0
## 950    0    0    0     0
## 951    0    0    0    10
## 952    0    0    0     0
## 953    0    0    0     0
## 954    0    5    0     5
## 955    0    0    0     0
## 956    0    0    0     0
## 957    0    0    0     0
## 958    0    5    0     0
## 959    0    0    0     5
## 960    0    0    0     5
## 961    0    0    0     0
## 962    0    5    0     5
## 963    0    0    0     0
## 964    0    0    0     0
## 965    0    0    0     0
## 966    0    0    0     0
```

```
## 967                  0              0                  0              0
## 968                  0              0                  0              0
## 969                  0              5                  0              5
## 970                  0              0                  0              0
## 971                  0              0                  0              0
## 972                  0              0                  0              0
## 973                  0              0                  0              0
## 974                  0              0                  0              0
## 975                  0              0                  0              0
## 976                  0              0                  0              0
## 977                  0              0                  0              0
## 978                  0              0                  0              0
## 979                  0              5                  0              5
## 980                  0              5                  0              5
## 981                  0              0                  0              0
## 1014                 0             60                  1             85
## 1015                 1             50                  1             80
## 1016                 1             20                  1             35
## 1017                 0              0                  0              0
## 1018                 0              0                  0              5
## 1019                 1             35                  1             75
## 1020                 1             40                  1             70
## 1021                 1             40                  1             60
## 1022                 1             15                  1             40
## 1023                 1             50                  1             50
## 1024                 1             50                  1             65
## 1025                 1             60                  1             65
## 1026                 0              0                  0              0
## 1027                 0             10                  1             35
## 1028                 0              0                  0              0
## 1029                 1             20                  1             75
## 1030                 0             10                  1             50
## 1031                 0              5                  0             25
## 1032                 1             55                  1             75
## 1033                 1             20                  1             75
## 1034                 1             60                  1             80
## 1035                 1             10                  1             10
## 1036                 1             10                  1             20
## 1037                 1             60                  1             60
## 1038                 1             70                  1             75
## 1039                 1             75                  1             75
## 1040                 1             40                  1             70
## 1041                 1             40                  1             60
## 1042                 1             85                  1             85
## 1043                 1             70                  1             80
## 1044                 1             75                  1             80
## 1045                 1             70                  1             80
##      T7.affected..0.1. T8.disease.... T8.mate.disease..0.3. T8.affected..0.1.
## 30                   0             20                     1                1
## 31                   0              5                     1                0
## 32                   1             40                     3                1
## 33                   1             25                     2                1
## 34                   0              0                     0                0
## 35                   0              0                     0                0
```

```
## 36   1   65   1   1
## 37   0   10   1   1
## 39   0   25   1   1
## 40   0    0   0   0
## 41   0   30   1   1
## 42   0   25   1   1
## 43   0    0   0   0
## 44   0   15   1   1
## 45   0    0   0   0
## 46   1  100   3   1
## 47   0   60   1   1
## 48   1  100   1   1
## 49   1   20   1   1
## 50   1   95   3   1
## 51   1   25   1   1
## 52   0   40   1   1
## 53   1   50   1   1
## 54   1   70   1   1
## 55   1   70   1   1
## 56   0    5   1   0
## 57   0   10   3   1
## 58   0   15   1   1
## 59   0   60   1   1
## 60   0    0   1   0
## 61   1   80   1   1
## 62   0   15   1   1
## 63   1   20   1   1
## 64   1   40   3   1
## 65   1   65   3   1
## 66   1   60   1   1
## 67   1   65   2   1
## 68   0   35   1   1
## 69   0   30   1   1
## 70   1   60   1   1
## 71   1   70   1   1
## 72   1   75   2   1
## 73   1   70   2   1
## 74   1   70   1   1
## 75   1   70   1   1
## 76   1   75   1   1
## 77   1   65   2   1
## 78   1   70   2   1
## 79   1   80   2   1
## 80   1   55   2   1
## 81   1   55   1   1
## 82   1   55   2   1
## 83   1   60   1   1
## 84   1   80   1   1
## 85   1   55   1   1
## 86   1   70   1   1
## 87   1   80   1   1
## 88   1   85   1   1
## 89   1   80   1   1
## 90   1   60   1   1
```

```
## 91   1  80  2  1
## 92   1  60  1  1
## 93   1  50  1  1
## 126  1  75  1  1
## 127  1  80  3  1
## 128  1  75  1  1
## 129  1  70  1  1
## 130  1  65  1  1
## 131  0   5  1  0
## 132  1  30  1  1
## 133  1  15  1  1
## 134  1  25  2  1
## 135  0   5  1  0
## 136  1  40  1  1
## 137  1  55  1  1
## 138  1  65  1  1
## 139  1  65  1  1
## 140  1  65  1  1
## 141  1  75  1  1
## 142  1  50  1  1
## 143  1  70  1  1
## 144  1  65  1  1
## 145  0   0  0  0
## 146  1  50  1  1
## 147  1  55  2  1
## 148  1  65  1  1
## 149  1  55  1  1
## 150  1  85  3  1
## 151  1  45  3  1
## 152  1  25  1  1
## 153  1  15  2  1
## 154  0  15  3  1
## 155  1  25  2  1
## 156  1  30  3  1
## 157  0  50  3  1
## 158  1  65  3  1
## 159  1  60  3  1
## 160  1  90  3  1
## 161  1  95  3  1
## 162  1  60  3  1
## 163  1  60  3  1
## 164  1  40  3  1
## 165  1  40  3  1
## 166  1  50  2  1
## 167  0  20  1  1
## 168  1  75  3  1
## 169  1  90  3  1
## 170  1  75  3  1
## 171  1  50  3  1
## 172  1  40  2  1
## 173  1  65  2  1
## 174  1  80  2  1
## 175  1  85  2  1
## 176  1  90  3  1
```

```
## 177  1  80  3  1
## 178  1  75  2  1
## 179  1  80  1  1
## 180  1  95  2  1
## 181  1  80  2  1
## 182  1  80  2  1
## 183  1  70  3  1
## 184  1  70  3  1
## 185  1  65  3  1
## 186  1  60  2  1
## 187  1  50  2  1
## 188  1  75  3  1
## 189  1  70  1  1
## 222  1  90  3  1
## 223  1  90  3  1
## 224  1  85  3  1
## 225  1  95  3  1
## 226  1  80  3  1
## 227  1  90  3  1
## 228  1  90  3  1
## 229  1  75  3  1
## 230  1  80  3  1
## 231  1  85  3  1
## 232  1  85  3  1
## 233  1  85  3  1
## 234  1  85  3  1
## 235  1  85  3  1
## 236  1  80  3  1
## 237  1  70  3  1
## 238  1  90  3  1
## 239  1  85  3  1
## 240  1  85  3  1
## 241  1  80  3  1
## 242  1  90  3  1
## 243  1  80  3  1
## 244  1  75  3  1
## 245  1  80  3  1
## 246  1  80  3  1
## 247  1  75  3  1
## 248  1  65  3  1
## 249  1  80  3  1
## 250  1  80  3  1
## 251  1  85  3  1
## 252  1  85  3  1
## 253  1  80  3  1
## 285  1  70  3  1
## 286  1  95  3  1
## 287  1  95  3  1
## 288  1  90  3  1
## 289  1  90  3  1
## 290  1  95  3  1
## 291  1  95  3  1
## 292  1  95  3  1
## 293  1  80  3  1
```

```
## 294   1   90   3   1
## 295   1   85   3   1
## 296   1   80   3   1
## 297   1   95   3   1
## 298   1   90   3   1
## 299   1   95   3   1
## 300   1   80   3   1
## 301   1   95   3   1
## 302   1   95   3   1
## 303   1  100   3   1
## 304   1   90   3   1
## 305   1   95   3   1
## 306   1   95   3   1
## 307   1  100   3   1
## 308   1   90   3   1
## 309   1   90   3   1
## 310   1   90   3   1
## 311   1   90   3   1
## 312   1   95   3   1
## 313   1   95   3   1
## 314   1   95   3   1
## 315   1   90   3   1
## 316   1   95   3   1
## 349   1   50   2   1
## 350   1   55   2   1
## 351   1   60   2   1
## 352   1   50   3   1
## 353   1   55   3   1
## 354   1   55   2   1
## 355   1   50   2   1
## 356   1   75   2   1
## 357   1   65   2   1
## 358   1   75   1   1
## 359   1   25   1   1
## 360   1   80   2   1
## 361   1   45   1   1
## 362   1   50   1   1
## 363   1   25   1   1
## 364   1   60   2   1
## 365   1   80   3   1
## 366   1   75   3   1
## 367   1   95   3   1
## 368   1   35   3   1
## 369   1   55   3   1
## 370   1   60   2   1
## 371   1   60   3   1
## 372   1   80   3   1
## 373   1   60   3   1
## 374   1   90   3   1
## 375   1   80   3   1
## 376   1   50   2   1
## 377   1   60   3   1
## 378   1   60   3   1
## 379   1   40   3   1
```

```
## 380   1  10  1  1
## 413   1  10  1  1
## 414   0  10  1  1
## 415   1  15  1  1
## 416   0   0  0  0
## 417   1  10  1  1
## 418   0   0  0  0
## 419   0   5  2  0
## 420   0   0  0  0
## 421   0   0  0  0
## 422   1  15  2  1
## 423   0   0  0  0
## 424   0   0  0  0
## 425   1  10  2  1
## 426   1  10  1  1
## 427   0   0  0  0
## 428   0   0  0  0
## 429   0   0  0  0
## 430   0   5  1  0
## 431   1  25  3  1
## 432   0   5  3  0
## 433   0  10  3  1
## 434   0   0  0  0
## 435   1  15  3  1
## 436   0   0  0  0
## 437   0   0  0  0
## 438   0   0  0  0
## 439   0   0  0  0
## 440   0   5  1  0
## 441   0   0  0  0
## 442   0   5  1  0
## 443   0   0  0  0
## 475   1  60  3  1
## 476   1  65  3  1
## 477   1  55  3  1
## 478   1  40  3  1
## 479   1  65  3  1
## 480   1  75  3  1
## 481   1  75  3  1
## 482   1  65  3  1
## 483   1  75  3  1
## 484   1  80  3  1
## 485   1  85  3  1
## 486   1  40  3  1
## 487   1  55  3  1
## 488   1  70  3  1
## 489   1  55  3  1
## 490   1  70  3  1
## 491   1  55  3  1
## 492   1  80  3  1
## 493   1  60  3  1
## 494   1  65  3  1
## 495   1  75  3  1
## 496   1  80  3  1
```

```
## 497    1    65    3    1
## 498    1    70    3    1
## 499    1    75    3    1
## 500    1    85    3    1
## 501    1    60    3    1
## 502    1    50    3    1
## 503    1    50    3    1
## 504    1    50    3    1
## 505    1    60    3    1
## 506    1    50    3    1
## 539    1    50    2    1
## 540    0     0    0    0
## 541    0     5    1    0
## 542    0     0    0    0
## 543    0    10    1    1
## 544    1    65    3    1
## 545    1    40    1    1
## 546    1    30    2    1
## 547    1    20    1    1
## 548    1    10    1    1
## 549    1    10    1    1
## 550    1    60    1    1
## 551    1    60    1    1
## 552    1    65    2    1
## 553    1    70    2    1
## 554    1    50    2    1
## 555    1    75    1    1
## 556    1    65    1    1
## 557    1    70    3    1
## 558    1    35    2    1
## 559    1    35    1    1
## 560    1    40    1    1
## 561    1    35    1    1
## 562    1    40    1    1
## 563    1    30    1    1
## 564    0     5    1    0
## 565    1    55    2    1
## 566    1    55    1    1
## 567    1    50    1    1
## 568    1    10    1    1
## 569    0    20    1    1
## 570    1    50    2    1
## 603    0     0    0    0
## 604    0    10    2    1
## 605    1    20    2    1
## 606    1    20    2    1
## 607    1    10    2    1
## 608    1    20    3    1
## 609    0     0    0    0
## 610    1    20    3    1
## 611    0     5    1    0
## 612    0     5    1    0
## 613    0     5    1    0
## 614    0     0    0    0
```

## 615	0	0	0	0
## 616	0	5	1	0
## 617	1	10	3	1
## 618	0	15	3	1
## 619	0	5	1	0
## 620	0	0	0	0
## 621	1	15	2	1
## 622	0	5	2	0
## 623	1	25	2	1
## 624	0	5	1	0
## 625	1	10	1	1
## 626	0	0	0	0
## 627	0	5	1	0
## 628	0	5	2	0
## 629	0	5	2	0
## 630	0	5	2	0
## 631	0	5	3	0
## 632	1	10	2	1
## 633	1	20	3	1
## 634	1	20	3	1
## 667	1	55	3	1
## 668	1	75	3	1
## 669	1	80	3	1
## 670	1	70	2	1
## 671	1	40	2	1
## 672	1	60	3	1
## 673	1	60	3	1
## 674	1	60	2	1
## 675	1	40	2	1
## 676	1	80	2	1
## 677	1	50	2	1
## 678	1	65	2	1
## 679	1	70	3	1
## 680	0	5	1	0
## 681	1	70	2	1
## 682	1	70	2	1
## 683	1	50	3	1
## 684	1	45	2	1
## 685	1	45	2	1
## 686	1	80	3	1
## 687	1	65	3	1
## 688	1	60	3	1
## 689	1	45	3	1
## 690	1	35	2	1
## 691	1	65	2	1
## 692	1	70	2	1
## 693	1	90	2	1
## 694	1	90	2	1
## 695	1	75	2	1
## 696	1	80	3	1
## 697	1	65	2	1
## 698	1	70	3	1
## 731	0	20	1	1
## 732	1	25	1	1

```
## 733   0   5   1   0
## 734   1  10   1   1
## 735   0   0   0   0
## 736   0   0   0   0
## 737   0  10   1   1
## 738   0  15   1   1
## 739   0   0   0   0
## 740   0   0   0   0
## 741   0   5   1   0
## 742   0   0   0   0
## 743   0   0   0   0
## 744   0   0   0   0
## 745   0   5   1   0
## 746   0   0   0   0
## 747   1  55   3   1
## 748   1  35   1   1
## 749   1  45   2   1
## 750   0   5   1   0
## 751   1  10   1   1
## 752   1  20   3   1
## 753   0   5   1   0
## 754   0  15   1   1
## 755   1  15   1   1
## 756   1  20   1   1
## 757   0   0   0   0
## 758   0   5   1   0
## 759   0  10   1   1
## 760   0   0   0   0
## 761   0  10   1   1
## 762   1  15   1   1
## 795   1  50   3   1
## 796   1  30   3   1
## 797   1  60   3   1
## 798   1  35   2   1
## 799   1  50   3   1
## 800   1  65   3   1
## 801   1  60   3   1
## 802   1  55   2   1
## 803   1  70   3   1
## 804   1  50   3   1
## 805   1  50   3   1
## 806   1  35   3   1
## 807   1  35   3   1
## 808   1  45   3   1
## 809   1  20   3   1
## 810   1  20   3   1
## 811   1  55   3   1
## 812   0   5   3   0
## 813   1  40   3   1
## 814   1  45   3   1
## 815   0   5   1   0
## 816   1  15   3   1
## 817   1  50   3   1
## 818   1  50   3   1
```

```
## 819   0   5   1   0
## 820   1  45   3   1
## 821   1  65   3   1
## 822   0   5   3   0
## 823   1  25   3   1
## 824   0   5   3   0
## 825   1  60   3   1
## 826   1  30   2   1
## 859   1  10   1   1
## 860   1  25   1   1
## 861   0   5   1   0
## 862   1  25   2   1
## 863   0   5   1   0
## 864   0  20   1   1
## 865   1  15   1   1
## 866   0  20   1   1
## 867   1  15   1   1
## 868   0   5   1   0
## 869   0   5   1   0
## 870   1  20   1   1
## 871   1  10   2   1
## 872   1  30   2   1
## 873   1  15   1   1
## 874   1  15   1   1
## 875   1  10   2   1
## 876   1  15   3   1
## 877   1  10   2   1
## 878   0   0   0   0
## 879   1  15   3   1
## 880   1  15   3   1
## 881   0  15   2   1
## 882   0  10   2   1
## 883   1  25   3   1
## 884   1  35   2   1
## 885   1  15   2   1
## 886   0   5   3   0
## 887   0   5   3   0
## 888   0  10   1   1
## 889   1  20   1   1
## 890   1  25   1   1
## 906   0   0   0   0
## 907   0   0   0   0
## 908   0   0   0   0
## 909   0  10   1   1
## 910   0   0   0   0
## 911   0   0   0   0
## 912   0   0   0   0
## 913   0   0   0   0
## 914   0   0   0   0
## 915   0   0   0   0
## 916   0   0   0   0
## 917   0   0   0   0
## 918   0   0   0   0
## 950   0   0   0   0
```

```
## 951    1   10   3   1
## 952    0    0   0   0
## 953    0    0   0   0
## 954    0    5   1   0
## 955    0    5   1   0
## 956    0    0   0   0
## 957    0    0   0   0
## 958    0    0   0   0
## 959    0    5   1   0
## 960    0    5   1   0
## 961    0    0   0   0
## 962    0    5   3   0
## 963    0    0   0   0
## 964    0    0   0   0
## 965    0    0   0   0
## 966    0    0   0   0
## 967    0    0   0   0
## 968    0    5   3   0
## 969    0    5   2   0
## 970    0    0   0   0
## 971    0    0   0   0
## 972    0    0   0   0
## 973    0    0   0   0
## 974    0    0   0   0
## 975    0    0   0   0
## 976    0    0   0   0
## 977    0    0   0   0
## 978    0    0   0   0
## 979    0    5   3   0
## 980    0    5   3   0
## 981    0    0   0   0
## 1014   1   85   2   1
## 1015   1   80   3   1
## 1016   1   35   3   1
## 1017   0    0   0   0
## 1018   0    5   1   0
## 1019   1   85   3   1
## 1020   1   80   3   1
## 1021   1   75   3   1
## 1022   1   40   3   1
## 1023   1   50   3   1
## 1024   1   65   3   1
## 1025   1   75   2   1
## 1026   0    0   0   0
## 1027   1   35   1   1
## 1028   0    0   0   0
## 1029   1   75   2   1
## 1030   1   55   3   1
## 1031   1   25   2   1
## 1032   1   75   3   1
## 1033   1   90   3   1
## 1034   1   95   3   1
## 1035   1    5   1   0
## 1036   1   20   3   1
```

```
## 1037                1             80                    3                1
## 1038                1             75                    3                1
## 1039                1             90                    3                1
## 1040                1             70                    2                1
## 1041                1             70                    2                1
## 1042                1             85                    3                1
## 1043                1             85                    3                1
## 1044                1             90                    3                1
## 1045                1             90                    3                1
##      T9.disease.... T9.mate.disease..0.3. T9.affected..0.1. T5.length..cm.
## 30               50                     1                 1          73,22
## 31                5                     1                 0           72,6
## 32               40                     3                 1          70,31
## 33               25                     2                 1          52,38
## 34               15                     2                 1           53,6
## 35                5                     1                 0          63,18
## 36               65                     1                 1          62,29
## 37               10                     1                 1          66,91
## 39               40                     1                 1          61,12
## 40               10                     1                 1          66,98
## 41               60                     1                 1
## 42               60                     1                 1           62,8
## 43               10                     1                 1          62,63
## 44               40                     1                 1          62,78
## 45                5                     1                 0          61,34
## 46              100                     3                 1          57,23
## 47               70                     1                 1          59,97
## 48              100                     3                 1          50,11
## 49               20                     2                 1          35,85
## 50               95                     3                 1          61,45
## 51               25                     2                 1          23,95
## 52               40                     1                 1          50,25
## 53               50                     1                 1          53,26
## 54               70                     2                 1          57,25
## 55               70                     1                 1          60,88
## 56               40                     1                 1          69,86
## 57               10                     3                 1          78,37
## 58               40                     2                 1          72,86
## 59               60                     1                 1          73,38
## 60               10                     1                 1          72,03
## 61               80                     1                 1          70,56
## 62               70                     1                 1          70,25
## 63               45                     1                 1          67,94
## 64               65                     3                 1          65,44
## 65               80                     3                 1          66,65
## 66               60                     1                 1          65,51
## 67               65                     2                 1          70,17
## 68               50                     1                 1          66,43
## 69               60                     1                 1          69,91
## 70               65                     2                 1          64,58
## 71               80                     1                 1          66,63
## 72               85                     2                 1          66,96
## 73               75                     2                 1          61,55
## 74               80                     1                 1          61,03
```

```
## 75   85   1   1   58,57
## 76   85   1   1   55,14
## 77   85   2   1   64,37
## 78   85   3   1   58,57
## 79   90   2   1   59,67
## 80   70   2   1   56,82
## 81   75   1   1   63,87
## 82   75   2   1   65,25
## 83   65   2   1   67,26
## 84   85   2   1    61,6
## 85   85   1   1   63,81
## 86   80   2   1    57,7
## 87   80   1   1   66,06
## 88   90   1   1   65,53
## 89   90   2   1   63,54
## 90   70   1   1   61,24
## 91   90   2   1   51,48
## 92   70   2   1   64,73
## 93   70   2   1   61,75
## 126  85   2   1   75,75
## 127  95   3   1   70,28
## 128  90   2   1   65,62
## 129  85   2   1   63,84
## 130  80   2   1   70,64
## 131  15   1   1    67,9
## 132  65   1   1   75,92
## 133  30   1   1   72,91
## 134  35   2   1   76,33
## 135   5   1   0   69,19
## 136  80   1   1   75,55
## 137  75   1   1   62,46
## 138  80   1   1   64,28
## 139  80   2   1   60,12
## 140  75   2   1   61,52
## 141  80   1   1   63,57
## 142  55   1   1   61,71
## 143  80   2   1   65,46
## 144  75   2   1   63,26
## 145  10   0   1   69,18
## 146  55   2   1   67,08
## 147  55   2   1   64,28
## 148  75   2   1   62,74
## 149  75   2   1   64,32
## 150  85   3   1    72,3
## 151  50   3   1    72,6
## 152  35   3   1   75,17
## 153  25   3   1   75,84
## 154  20   3   1   78,06
## 155  25   3   1    73,3
## 156  50   3   1   70,64
## 157  50   3   1   76,48
## 158  90   3   1   74,51
## 159  80   3   1   78,12
## 160  95   3   1   77,36
```

```
## 161          95           3            1          70,77
## 162          70           3            1          63,86
## 163          70           3            1          59,56
## 164          50           3            1          58,68
## 165          40           3            1           68,9
## 166          60           3            1          64,25
## 167          30           2            1          66,51
## 168          80           3            1          68,78
## 169          90           3            1          73,22
## 170          80           3            1          66,28
## 171          85           3            1          61,72
## 172          85           3            1          63,39
## 173          85           2            1          62,25
## 174          90           2            1           62,4
## 175          90           2            1          59,51
## 176          95           3            1          49,57
## 177          95           3            1          61,04
## 178          95           2            1          58,15
## 179          90           2            1          49,77
## 180          95           3            1          59,47
## 181          90           2            1             62
## 182          85           3            1          68,18
## 183          70           3            1          64,35
## 184          70           3            1          58,79
## 185          70           3            1          73,69
## 186          60           2            1          78,66
## 187          80           3            1          72,12
## 188          80           3            1           75,5
## 189          80           2            1          65,63
## 222          95           3            1          69,96
## 223          90           3            1          72,42
## 224          90           3            1          68,17
## 225          95           3            1          55,67
## 226          90           3            1          54,88
## 227          95           3            1          60,67
## 228          95           3            1          56,99
## 229          85           3            1          61,58
## 230          90           3            1          59,67
## 231          95           3            1          61,68
## 232          90           3            1           59,4
## 233          95           3            1           44,4
## 234          90           3            1          50,15
## 235          95           3            1          50,02
## 236          95           3            1          45,09
## 237          90           3            1          53,64
## 238          90           3            1          49,09
## 239          85           3            1          48,42
## 240          85           3            1          48,55
## 241          85           3            1          55,99
## 242          90           3            1          56,68
## 243          85           3            1          54,21
## 244          80           3            1          56,57
## 245          85           3            1          56,34
## 246          90           3            1          51,46
```

```
## 247   85   3   1   54,13
## 248   90   3   1   47,53
## 249   80   3   1   70,88
## 250   90   3   1   63,43
## 251   95   3   1   62,33
## 252   95   3   1    63,6
## 253   95   3   1   63,55
## 285   75   3   1    58,1
## 286   95   3   1   52,33
## 287  100   3   1   53,39
## 288   90   3   1   46,35
## 289   90   3   1   42,63
## 290   95   3   1    23,7
## 291   95   3   1   40,37
## 292   95   3   1   43,35
## 293   90   3   1   42,36
## 294   95   3   1    42,6
## 295   95   3   1   40,76
## 296   95   3   1   43,18
## 297   95   3   1   44,92
## 298   95   3   1    46,9
## 299   95   3   1   44,27
## 300   80   3   1   41,99
## 301   95   3   1   43,17
## 302   95   3   1   42,42
## 303  100   3   1   43,02
## 304   90   3   1   47,66
## 305   95   3   1   49,16
## 306   95   3   1   47,35
## 307  100   3   1   48,51
## 308   95   3   1   47,17
## 309   90   3   1   47,17
## 310   90   3   1   23,89
## 311   90   3   1   43,69
## 312   95   3   1   48,75
## 313   95   3   1   53,44
## 314   95   3   1   50,78
## 315   95   3   1   53,06
## 316   95   3   1   54,16
## 349   75   2   1   70,87
## 350   80   3   1   75,59
## 351   75   2   1   74,25
## 352   75   3   1   59,65
## 353   75   3   1   55,91
## 354   70   2   1   59,35
## 355   70   2   1   57,47
## 356   80   2   1   55,47
## 357   65   2   1   49,97
## 358   75   1   1   54,06
## 359   60   1   1   54,83
## 360   80   3   1   60,59
## 361   70   2   1   59,93
## 362   70   2   1    55,9
## 363   50   1   1   58,07
```

```
## 364   60   3   1   54,24
## 365   80   3   1    54,9
## 366   90   3   1   50,73
## 367   95   3   1   50,31
## 368   70   3   1   46,96
## 369   75   3   1   59,26
## 370   85   3   1   58,57
## 371   80   3   1   64,04
## 372   90   3   1   67,76
## 373   75   3   1   68,11
## 374   95   3   1   63,36
## 375   80   3   1   65,23
## 376   50   3   1   63,15
## 377   95   3   1   61,38
## 378   90   3   1   60,73
## 379   50   3   1   57,71
## 380   10   1   1   61,67
## 413   25   1   1   69,12
## 414   20   2   1   67,67
## 415   20   1   1   65,18
## 416    0   0   0   66,41
## 417   15   2   1    66,1
## 418    0   0   0   60,89
## 419    5   2   0   62,24
## 420    0   0   0   56,96
## 421    0   0   0   59,19
## 422   15   3   1   54,93
## 423    0   0   0   60,92
## 424    0   0   0   62,39
## 425   10   2   1   64,84
## 426   10   3   1   64,88
## 427    0   0   0   62,82
## 428    0   0   0   65,02
## 429    0   0   0   64,26
## 430    5   1   0   57,35
## 431   25   3   1   64,43
## 432    5   3   0    65,9
## 433   10   3   1    66,6
## 434    5   1   0   72,22
## 435   15   3   1   68,98
## 436    0   0   0    65,9
## 437    0   0   0   63,56
## 438    0   0   0   64,51
## 439    0   0   0   65,74
## 440    5   1   0   63,28
## 441    0   0   0   66,55
## 442    5   1   0   63,67
## 443    0   0   0   65,65
## 475   70   3   1   50,21
## 476   70   3   1   53,25
## 477   55   3   1   50,39
## 478   40   3   1   40,13
## 479   65   3   1   41,21
## 480   80   3   1   40,69
```

```
## 481          80           3           1          46,11
## 482          85           3           1          44,52
## 483          75           3           1          42,02
## 484          80           3           1          43,42
## 485          85           3           1          42,61
## 486          40           3           1          41,44
## 487          65           3           1           44,3
## 488          70           3           1          41,89
## 489          55           3           1           35,8
## 490          70           3           1          41,34
## 491          65           3           1          40,86
## 492          90           3           1           43,1
## 493          65           3           1           40,5
## 494          70           3           1          48,99
## 495          80           3           1          43,01
## 496          80           3           1           42,6
## 497          80           3           1          42,85
## 498          75           3           1          50,98
## 499          75           3           1          44,32
## 500          85           3           1           55,7
## 501          70           3           1          42,26
## 502          80           3           1          43,17
## 503          85           3           1          42,82
## 504          65           3           1          46,08
## 505          75           3           1          43,68
## 506          60           3           1           47,7
## 539          50           2           1          74,74
## 540           5           0           0          69,58
## 541          30           1           1          60,19
## 542          10           0           1          64,34
## 543          40           1           1          64,46
## 544          40           3           1          69,18
## 545          80           2           1          65,12
## 546          40           2           1          74,16
## 547          60           1           1          65,87
## 548          60           1           1          67,59
## 549          40           3           1          62,09
## 550          70           2           1          59,47
## 551          60           3           1          59,23
## 552          70           3           1          61,09
## 553          85           3           1          56,61
## 554          70           3           1          56,26
## 555          75           2           1          55,22
## 556          65           1           1          57,55
## 557          70           3           1          56,95
## 558          50           2           1          67,32
## 559          40           1           1          60,89
## 560          60           1           1          59,25
## 561          50           2           1          61,94
## 562          45           2           1          66,48
## 563          70           1           1          67,36
## 564          15           1           1          62,63
## 565          55           2           1          56,68
## 566          70           1           1           66,7
```

```
## 567   75   1   1   61,18
## 568   15   1   1   65,97
## 569   40   1   1   67,74
## 570   70   2   1   64,96
## 603    0   0   0    65,6
## 604   10   2   1   64,06
## 605   20   3   1   66,76
## 606   20   3   1   53,37
## 607   10   3   1    49,2
## 608   20   3   1   59,27
## 609    0   0   0   60,73
## 610   20   3   1    62,9
## 611    5   1   0   61,44
## 612    5   1   0   62,49
## 613    5   1   0   52,64
## 614    5   1   0   50,43
## 615    0   0   0   51,07
## 616   10   1   1   59,42
## 617   15   3   1   57,73
## 618   15   3   1   57,85
## 619    5   1   0   57,78
## 620   25   0   1   59,09
## 621   20   2   1    57,3
## 622   10   2   1   57,93
## 623   35   3   1   59,68
## 624   10   1   1   56,77
## 625   10   1   1   58,16
## 626    0   0   0   64,92
## 627    5   2   0   60,92
## 628   10   2   1   59,37
## 629    5   2   0   57,05
## 630    5   2   0   57,34
## 631    5   3   0   55,19
## 632   15   2   1   60,11
## 633   30   3   1    58,8
## 634   30   3   1   59,33
## 667   70   3   1   57,12
## 668   85   3   1   54,86
## 669   80   3   1   54,28
## 670   75   3   1   45,01
## 671   60   3   1   52,81
## 672   70   3   1    48,3
## 673   70   3   1   45,52
## 674   65   2   1   48,32
## 675   40   3   1   47,65
## 676   80   3   1    46,1
## 677   50   3   1   50,47
## 678   65   3   1    44,1
## 679   70   3   1   40,26
## 680   15   1   1   42,98
## 681   75   2   1    50,7
## 682   70   2   1   41,01
## 683   65   3   1    54,8
## 684   60   3   1    55,7
```

```
## 685  45  3  1   58,7
## 686  85  3  1  45,36
## 687  70  3  1  52,74
## 688  70  3  1  50,54
## 689  50  3  1  42,24
## 690  50  2  1  48,93
## 691  65  3  1   49,2
## 692  70  2  1  47,76
## 693  90  3  1  45,31
## 694  90  3  1  51,24
## 695  80  3  1  48,63
## 696  85  3  1  41,86
## 697  65  3  1  46,45
## 698  70  3  1   45,4
## 731  20  1  1  75,12
## 732  25  2  1  72,41
## 733   5  1  0  70,53
## 734  10  1  1  66,62
## 735   0  0  0  63,03
## 736   0  0  0  61,91
## 737  10  1  1  57,36
## 738  15  1  1  65,22
## 739   0  0  0  61,27
## 740   0  0  0  61,53
## 741   5  1  0  66,75
## 742   0  0  0  57,14
## 743   0  0  0  59,09
## 744   0  0  0  61,48
## 745   5  1  0  67,95
## 746   0  0  0  63,47
## 747  65  3  1  61,37
## 748  35  1  1  61,86
## 749  50  2  1  64,38
## 750  10  1  1  66,03
## 751  10  1  1   69,1
## 752  30  3  1  69,35
## 753   5  2  0  67,59
## 754  15  1  1  65,48
## 755  15  1  1  63,59
## 756  30  1  1  67,59
## 757   0  0  0  66,69
## 758   5  1  0  61,72
## 759  15  1  1  62,46
## 760   0  0  0  64,99
## 761  20  1  1   68,2
## 762  20  1  1  66,49
## 795  70  3  1  78,68
## 796  50  3  1  68,78
## 797  65  3  1  80,18
## 798  55  2  1  70,52
## 799  60  3  1  69,82
## 800  70  3  1  71,67
## 801  60  3  1  64,89
## 802  55  2  1   73,5
```

```
## 803          70          3           1          71,11
## 804          75          3           1          77,29
## 805          60          3           1           74,1
## 806          65          3           1          71,38
## 807          60          3           1          66,11
## 808          50          3           1          71,05
## 809          25          3           1          68,82
## 810          50          3           1          69,17
## 811          75          3           1          75,34
## 812          30          3           1          71,41
## 813          40          3           1           69,8
## 814          50          3           1          75,26
## 815           5          1           0          69,66
## 816          20          3           1          78,63
## 817          50          3           1          79,13
## 818          50          3           1          78,14
## 819           5          1           0          80,53
## 820          60          3           1          76,49
## 821          65          3           1          71,53
## 822          10          3           1          54,13
## 823          35          3           1          73,47
## 824           5          3           0          58,15
## 825          65          3           1          75,89
## 826          40          3           1          78,02
## 859          10          2           1          80,69
## 860          30          3           1          77,69
## 861           5          1           0           83,7
## 862          25          2           1          75,81
## 863           5          1           0           71,1
## 864          25          1           1           77,6
## 865          15          1           1           68,1
## 866          20          1           1          75,18
## 867          20          1           1          71,88
## 868           5          1           0          64,06
## 869           5          3           0          62,59
## 870          25          2           1          70,31
## 871          20          3           1          74,83
## 872          35          3           1          69,31
## 873          20          2           1          71,37
## 874          20          2           1           68,9
## 875          10          2           1          67,43
## 876          20          3           1          64,22
## 877          10          2           1          71,56
## 878           0          0           0          72,87
## 879          25          3           1          73,29
## 880          25          3           1          73,41
## 881          15          2           1          74,37
## 882          10          2           1          66,47
## 883          35          3           1          61,23
## 884          35          2           1          67,21
## 885          20          3           1          73,48
## 886          10          3           1          65,65
## 887          10          3           1          69,89
## 888          10          1           1          71,27
```

## 889	20	1	1	70,36
## 890	30	1	1	72,16
## 906	0	0	0	55,65
## 907	0	0	0	56,75
## 908	0	0	0	49,71
## 909	10	1	1	56,08
## 910	0	0	0	66,78
## 911	0	0	0	65,29
## 912	0	0	0	54,47
## 913	0	0	0	57,59
## 914	0	0	0	55,79
## 915	0	0	0	55,77
## 916	0	0	0	58,8
## 917	0	0	0	58,79
## 918	0	0	0	59,21
## 950	0	0	0	65,93
## 951	10	3	1	67,16
## 952	0	0	0	66,47
## 953	0	0	0	63,1
## 954	5	1	0	73,47
## 955	5	1	0	72,03
## 956	0	0	0	73,87
## 957	0	0	0	73,03
## 958	0	0	0	71,19
## 959	5	3	0	74,27
## 960	5	1	0	65,43
## 961	0	0	0	65,42
## 962	5	3	0	68,9
## 963	0	0	0	65,31
## 964	0	0	0	72,43
## 965	0	0	0	69,57
## 966	0	0	0	64,71
## 967	0	0	0	64,34
## 968	5	3	0	67,37
## 969	5	2	0	75,23
## 970	0	0	0	78,8
## 971	0	0	0	73,91
## 972	0	0	0	80,79
## 973	0	0	0	83,87
## 974	0	0	0	76,9
## 975	0	0	0	75,14
## 976	0	0	0	71,84
## 977	0	0	0	81,88
## 978	0	0	0	80,44
## 979	5	3	0	79,3
## 980	5	3	0	79,95
## 981	0	0	0	78,54
## 1014	90	3	1	66,01
## 1015	90	3	1	64,22
## 1016	65	3	1	64,55
## 1017	0	0	0	52,15
## 1018	10	1	1	66,88
## 1019	85	3	1	65,67
## 1020	80	3	1	59,52

```
## 1021            80                   3                 1          63,84
## 1022            70                   3                 1           59,4
## 1023            65                   3                 1          59,59
## 1024            75                   3                 1          66,61
## 1025            85                   3                 1          68,62
## 1026             0                   0                 0          68,42
## 1027            40                   2                 1          67,97
## 1028             0                   0                 0          66,38
## 1029            75                   2                 1          70,07
## 1030            80                   3                 1          68,46
## 1031            80                   3                 1           57,1
## 1032            80                   3                 1          61,13
## 1033            90                   3                 1          63,66
## 1034            95                   3                 1          66,23
## 1035             5                   1                 0          64,87
## 1036            35                   3                 1          63,92
## 1037            95                   3                 1          63,53
## 1038            80                   3                 1          64,93
## 1039            95                   3                 1          67,96
## 1040            70                   2                 1          66,55
## 1041            70                   2                 1          56,86
## 1042            90                   3                 1          61,97
## 1043            95                   3                 1          53,72
## 1044            95                   3                 1          70,23
## 1045            95                   3                 1          64,59
##      T5.Relative.Growth.Rate.RGR..cm. T9.length..cm. T9.RGR..cm.
## 30                              60,8          80.29       67.87
## 31                             59,3          80.73       67.43
## 32                            57,06          74.60       61.35
## 33                            43,74          58.28       49.64
## 34                            45,44          61.47       53.31
## 35                            54,27          68.90       59.99
## 36                            52,51          67.02       57.24
## 37                            55,19          73.75       62.03
## 39                               51          67.58       57.46
## 40                            57,24          73.70       63.96
## 41                                           38.69       38.69
## 42                            53,14          72.53       62.87
## 43                             53,9          70.99       62.26
## 44                            51,69          71.90       60.81
## 45                            48,41          72.08       59.15
## 46                               50          72.11       64.88
## 47                            49,51          72.91       62.45
## 48                            43,02          61.30       54.21
## 49                             26,4          32.80       23.35
## 50                            50,18          66.22       54.95
## 51                             14,5          24.77       15.32
## 52                            39,78          56.31       45.84
## 53                            41,95          61.16       49.85
## 54                            44,64          62.58       49.97
## 55                            47,99          64.19       51.30
## 56                            54,96          72.83       57.93
## 57                            67,38          78.68       67.69
## 58                             61,6          72.23       60.97
```

```
## 59      62,16    75.59    64.37
## 60      60,73    74.08    62.78
## 61      60,95    72.25    62.64
## 62      61,29    77.11    68.15
## 63      55,61    71.73    59.40
## 64       51,1    71.82    57.48
## 65      54,99    73.74    62.08
## 66      55,36    73.49    63.34
## 67      59,23    75.30    64.36
## 68      53,52    74.88    61.97
## 69      54,97    79.45    64.51
## 70      52,04    76.35    63.81
## 71      54,74    70.78    58.89
## 72       54,1    75.06    62.20
## 73      50,63    76.90    65.98
## 74      47,77    73.85    60.59
## 75      45,25    71.41    58.09
## 76      43,24    66.34    54.44
## 77      52,63    77.65    65.91
## 78      47,47    71.96    60.86
## 79      45,67    72.02    58.02
## 80       41,3    69.30    53.78
## 81      52,28    70.61    59.02
## 82      53,29    70.39    58.43
## 83      55,07    74.23    62.04
## 84      48,48    66.66    53.54
## 85      51,44    69.75    57.38
## 86      42,79    61.35    46.44
## 87      52,58    69.42    55.94
## 88      54,27    71.36    60.10
## 89      49,95    69.51    55.92
## 90      49,96    69.43    58.15
## 91      42,57    58.71    49.80
## 92      52,44    72.69    60.40
## 93      49,66    68.98    56.89
## 126     62,58    85.12    71.95
## 127     56,62    78.05    64.39
## 128     53,54    73.60    61.52
## 129     54,08    72.74    62.98
## 130     57,04    74.41    60.81
## 131      55,6    70.98    58.68
## 132     62,16    82.52    68.76
## 133     60,14    78.60    65.83
## 134     63,17    84.65    71.49
## 135     56,79    76.34    63.94
## 136     58,61    83.44    66.50
## 137     49,94    78.22    65.70
## 138     49,94    79.44    65.10
## 139     46,11    77.28    63.27
## 140     47,91    74.94    61.33
## 141     49,72    80.62    66.77
## 142     48,12    73.21    59.62
## 143     51,09    80.78    66.41
## 144     48,94    76.97    62.65
```

```
## 145  56,86  73.43  61.11
## 146  53,94  75.96  62.82
## 147   53,4  73.41  62.53
## 148  53,22  72.73  63.21
## 149  51,86  70.32  57.86
## 150  59,34  78.04  65.08
## 151  58,68  75.28  61.36
## 152  62,37  77.89  65.09
## 153  63,76  80.99  68.91
## 154  65,31  83.97  71.22
## 155   60,4  75.55  62.65
## 156  58,04  72.37  59.77
## 157  66,36  78.10  67.98
## 158  63,47  75.07  64.03
## 159  66,16  78.89  66.93
## 160  63,15  80.16  65.95
## 161  57,32  77.05  63.60
## 162   51,7  68.75  56.59
## 163  48,08  68.76  57.28
## 164  45,85  65.34  52.51
## 165  55,83  75.86  62.79
## 166  53,67  68.88  58.30
## 167  54,28  72.50  60.27
## 168  55,16  78.67  65.05
## 169  60,34  79.39  66.51
## 170  54,82  75.76  64.30
## 171  49,84  72.68  60.80
## 172  48,83  74.86  60.30
## 173  49,28  76.24  63.27
## 174     48  70.67  56.27
## 175  44,32  73.55  58.36
## 176  37,77  61.83  50.03
## 177  47,72  67.07  53.75
## 178  44,31  64.47  50.63
## 179  37,94  56.44  44.61
## 180   44,5  65.35  50.38
## 181  47,96  67.28  53.24
## 182  53,18  72.63  57.63
## 183  52,54  66.73  54.92
## 184  41,71  64.86  47.78
## 185  61,64  74.96  62.91
## 186  64,97  79.72  66.03
## 187  59,69  76.25  63.82
## 188  63,16  78.95  66.61
## 189  55,13  71.98  61.48
## 222  52,79  80.37  63.20
## 223  55,67  80.22  63.47
## 224  53,32  81.15  66.30
## 225  38,57  64.79  47.69
## 226  41,92  59.31  46.35
## 227   43,8  66.85  49.98
## 228  42,11  61.59  46.71
## 229  46,96  70.64  56.02
## 230  42,99  65.16  48.48
```

```
## 231   44,36   64.09   46.77
## 232   42,94   64.58   48.12
## 233   28,69   55.89   40.18
## 234   32,01   62.99   44.85
## 235   35,26   64.90   50.14
## 236   30,87   60.76   46.54
## 237   35,31   68.17   49.84
## 238   31,91   63.92   46.74
## 239    31,2   62.91   45.69
## 240   31,24   56.54   39.23
## 241   41,52   65.06   50.59
## 242   40,71   66.14   50.17
## 243   39,45   65.39   50.63
## 244   37,42   65.18   46.03
## 245   37,84   67.97   49.47
## 246   35,69   63.45   47.68
## 247   35,89   65.72   47.48
## 248   26,54   55.62   34.63
## 249   52,85   71.71   53.68
## 250    46,4   71.11   54.08
## 251   46,33   71.38   55.38
## 252   47,05   68.47   51.92
## 253      46   71.22   53.67
## 285   40,86   58.24   41.00
## 286      37   55.74   40.41
## 287   37,97   58.94   43.52
## 288   30,49   53.48   37.62
## 289   26,67   51.32   35.36
## 290    9,75   44.20   30.25
## 291   24,66   50.77   35.06
## 292   28,06   47.39   32.10
## 293   29,43   46.10   33.17
## 294   26,35   47.16   30.91
## 295   24,57   48.23   32.04
## 296   29,76   47.33   33.91
## 297   30,56   48.89   34.53
## 298   32,36   50.69   36.15
## 299   29,54   49.83   35.10
## 300   29,66   48.42   36.09
## 301   30,66   48.83   36.32
## 302   28,81   48.37   34.76
## 303   33,25   53.16   43.39
## 304   31,19   46.42   29.95
## 305    34,8   47.16   32.80
## 306    30,8   46.73   30.18
## 307   33,09   48.55   33.13
## 308   33,36   46.08   32.27
## 309   31,47   46.27   30.57
## 310    6,52   44.59   27.22
## 311   26,55   45.39   28.25
## 312   34,99   49.22   35.46
## 313   38,44   55.04   40.04
## 314   35,99   52.81   38.02
## 315   36,99   51.38   35.31
```

## 316	35,57	49.73	31.14
## 349	60,51	80.66	70.30
## 350	64,65	84.13	73.19
## 351	61,3	81.82	68.87
## 352	50,36	72.14	62.85
## 353	47,24	72.05	63.38
## 354	48,01	77.12	65.78
## 355	46,71	74.16	63.40
## 356	45,04	74.60	64.17
## 357	40,64	69.40	60.07
## 358	44,81	69.98	60.73
## 359	44,58	69.88	59.63
## 360	49,85	75.99	65.25
## 361	50,77	72.10	62.94
## 362	49,49	77.42	71.01
## 363	48,6	77.81	68.34
## 364	47,08	69.83	62.67
## 365	45,36	70.15	60.61
## 366	41,79	65.98	57.04
## 367	38,25	65.19	53.13
## 368	37,77	60.57	51.38
## 369	46,83	71.13	58.70
## 370	44,76	66.40	52.59
## 371	55,87	74.79	66.62
## 372	56,26	81.05	69.55
## 373	59,19	80.97	72.05
## 374	49,79	76.87	63.30
## 375	51,31	74.53	60.61
## 376	50,93	71.67	59.45
## 377	49,24	71.71	59.57
## 378	50,03	71.69	60.99
## 379	49,65	71.92	63.86
## 380	49,13	69.67	57.13
## 413	58,35	88.84	78.07
## 414	56,7	83.44	72.47
## 415	54,99	84.74	74.55
## 416	55,62	76.78	65.99
## 417	54,84	80.64	69.38
## 418	50,6	74.88	64.59
## 419	51,97	76.86	66.59
## 420	48,4	76.21	67.65
## 421	49,49	77.77	68.07
## 422	44,48	73.09	62.64
## 423	49,63	78.48	67.19
## 424	51,01	80.22	68.84
## 425	53,05	84.08	72.29
## 426	53,87	84.19	73.18
## 427	52,35	83.43	72.96
## 428	54,8	85.09	74.87
## 429	54,12	85.43	75.29
## 430	46,76	86.76	76.17
## 431	56	81.18	72.75
## 432	56,02	81.85	71.97
## 433	56,42	85.33	75.15

```
## 434   61,64   88.31   77.73
## 435   58,41   85.36   74.79
## 436    54,2   82.27   70.57
## 437   53,82   83.08   73.34
## 438   53,65   83.84   72.98
## 439   54,98   80.54   69.78
## 440   53,39   81.48   71.59
## 441   55,59   86.87   75.91
## 442    54,8   84.59   75.72
## 443   56,32   84.52   75.19
## 475    38,7   65.03   53.52
## 476   40,52   66.67   53.94
## 477   37,74   62.04   49.39
## 478   27,65   52.04   39.56
## 479   26,85   49.68   35.32
## 480   28,97   47.51   35.79
## 481   33,93   55.91   43.73
## 482    31,1   51.50   38.08
## 483    29,4   47.67   35.05
## 484    29,2   50.09   35.87
## 485   28,94   49.92   36.25
## 486   29,63   57.68   45.87
## 487   31,91   56.04   43.65
## 488   28,25   53.92   40.28
## 489   23,68   50.10   37.98
## 490   30,37   54.27   43.30
## 491    27,4   55.89   42.43
## 492   29,85   57.89   44.64
## 493    26,8   52.11   38.41
## 494   36,64   63.76   51.41
## 495    32,2   59.33   48.52
## 496   30,54   54.65   42.59
## 497   28,38   55.52   41.05
## 498   32,89   65.59   47.50
## 499   28,28   58.71   42.67
## 500   40,92   50.44   35.66
## 501   25,26   60.94   43.94
## 502   31,71   50.20   38.74
## 503   32,02   49.81   39.01
## 504   34,09   12.41    0.42
## 505   32,59   49.19   38.10
## 506   35,68   55.31   43.29
## 539   65,09   84.76   75.11
## 540   58,24   78.60   67.26
## 541   47,83   71.89   59.53
## 542   52,16   72.15   59.97
## 543   53,44   70.23   59.21
## 544   56,64   78.41   65.87
## 545   54,75   77.44   67.07
## 546   60,59   84.20   70.63
## 547    52,2   80.25   66.58
## 548   55,81   79.05   67.27
## 549   50,22   75.82   63.95
## 550   46,48   72.71   59.72
```

```
## 551          44,77          73.90          59.44
## 552          48,01          74.59          61.51
## 553          43,96          71.00          58.35
## 554          43,26          74.30          61.30
## 555          43,69          74.34          62.81
## 556          44,49          73.39          60.33
## 557          45,16          75.24          63.45
## 558          55,49          73.91          62.08
## 559           50,2          72.13          61.44
## 560          48,33          70.88          59.96
## 561          51,17          70.83          60.06
## 562          55,24          73.83          62.59
## 563          53,56          71.71          57.91
## 564          51,53          73.85          62.75
## 565          46,78          69.55          59.65
## 566          55,24          78.51          67.05
## 567           48,6          77.55          64.97
## 568          53,26          84.75          72.04
## 569          55,83          76.75          64.84
## 570          54,56          77.73          67.33
## 603          54,98          67.74          57.12
## 604          52,88          71.60          60.42
## 605           54,7          68.49          56.43
## 606          43,07          61.98          51.68
## 607             40          74.18          64.98
## 608          48,55          73.24          62.52
## 609          50,52          72.31          62.10
## 610          52,84          72.05          61.99
## 611          50,68          71.00          60.24
## 612             52          60.61          50.12
## 613          41,49          62.21          51.06
## 614          40,32          70.82          60.71
## 615          39,54          71.85          60.32
## 616           47,4          71.74          59.72
## 617          47,15          71.16          60.58
## 618          43,58          71.08          56.81
## 619           46,5          74.37          63.09
## 620          48,08          65.40          54.39
## 621           48,3          63.71          54.71
## 622          47,89          67.79          57.75
## 623          46,98          67.79          55.09
## 624          43,47          67.82          54.52
## 625          48,96          67.89          58.69
## 626          51,68          73.36          60.12
## 627           47,9          72.54          59.52
## 628          47,42          65.76          53.81
## 629          46,84          63.88          53.67
## 630          48,06          73.88          64.60
## 631          45,98          66.88          57.67
## 632          50,71          71.10          61.70
## 633          50,15          68.04          59.39
## 634          50,82          68.01          59.50
## 667          47,45          66.20          56.53
## 668           43,8          63.58          52.52
```

```
## 669  43,87  60.11  49.70
## 670  32,75  52.21  39.95
## 671     39  55.74  41.93
## 672  35,25  50.99  37.94
## 673  34,13  49.04  37.65
## 674  35,85  54.54  42.07
## 675   36,4  52.53  41.28
## 676  32,63  51.19  37.72
## 677  36,78  55.08  41.39
## 678  32,38  55.89  44.17
## 679  29,55  50.32  39.61
## 680  31,23  66.62  54.87
## 681  36,18  53.38  38.86
## 682  28,82  48.82  36.63
## 683  40,54  53.55  39.29
## 684   43,8  49.19  37.29
## 685  47,93  57.76  46.99
## 686  33,56  53.99  42.19
## 687  39,97  53.71  40.94
## 688  39,46  60.23  49.15
## 689  30,84  60.54  49.14
## 690  35,92  52.29  39.28
## 691  38,84  61.26  50.90
## 692  39,26  64.26  55.76
## 693  33,85  57.85  46.39
## 694  41,42  58.74  48.92
## 695   37,4  51.58  40.35
## 696  30,64  46.02  34.80
## 697  35,56  52.13  41.24
## 698  36,12  50.31  41.03
## 731  64,54  84.45  73.87
## 732  60,39  84.49  72.47
## 733  59,33  80.48  69.28
## 734  55,72  83.45  72.55
## 735  51,85  78.50  67.32
## 736   50,5  77.94  66.53
## 737  50,99  72.25  65.88
## 738  56,55  80.21  71.54
## 739  52,09  75.30  66.12
## 740  50,83  71.66  60.96
## 741   54,5  79.44  67.19
## 742  48,63  70.68  62.17
## 743  50,19  76.46  67.56
## 744  50,74  80.42  69.68
## 745  59,05  84.98  76.08
## 746  53,93  81.39  71.85
## 747  52,79  76.35  67.77
## 748  52,72  78.84  69.70
## 749  55,99  79.60  71.21
## 750  58,78  75.26  68.01
## 751  60,58  80.54  72.02
## 752     59  82.39  72.04
## 753  56,93  80.74  70.08
## 754  56,67  80.59  71.78
```

```
## 755   52,69   68.58   57.68
## 756   55,67   78.63   66.71
## 757    54,1   73.69   61.10
## 758    53,4   72.08   63.76
## 759      54   72.34   63.88
## 760   56,25   75.42   66.68
## 761    60,4   81.35   73.55
## 762   59,17   80.25   72.93
## 795   64,03   94.40   79.75
## 796   53,64   89.41   74.27
## 797   64,84   98.30   82.96
## 798   54,97   84.59   69.04
## 799   53,15   85.39   68.72
## 800   57,44   86.08   71.85
## 801    49,8   86.14   71.05
## 802   59,73   92.73   78.96
## 803   56,84   89.54   75.27
## 804   63,86   96.33   82.90
## 805   63,18   88.26   77.34
## 806   55,22   86.64   70.48
## 807   50,53   82.89   67.31
## 808   55,77   87.31   72.03
## 809   53,63   89.43   74.24
## 810   53,88   91.11   75.82
## 811   59,65   85.63   69.94
## 812    56,7   87.68   72.97
## 813   55,48   85.99   71.67
## 814   62,57   85.90   73.21
## 815   57,53   78.87   66.74
## 816    63,8   89.90   75.07
## 817   64,91   87.44   73.22
## 818   62,37   89.89   74.12
## 819   64,37   91.13   74.97
## 820   59,14   84.24   66.89
## 821   55,13   79.82   63.42
## 822   39,23   57.66   42.76
## 823    61,3   89.87   77.70
## 824   44,36   71.70   57.91
## 825   62,83   94.02   80.96
## 826   63,71   96.31   82.00
## 859   67,98   91.18   78.47
## 860   65,68   91.15   79.14
## 861   71,97   93.50   81.77
## 862   63,24   87.13   74.56
## 863   58,14   82.13   69.17
## 864   64,71   88.13   75.24
## 865   56,67   79.17   67.74
## 866   62,03   84.12   70.97
## 867   58,77   85.44   72.33
## 868   53,17   77.55   66.66
## 869   51,09   73.70   62.20
## 870    55,3   87.14   72.13
## 871   63,22   87.23   75.62
## 872   57,59   89.23   77.51
```

```
## 873  58,43  84.33  71.39
## 874  54,51  87.89  73.50
## 875  54,36  86.68  73.61
## 876  50,39  85.88  72.05
## 877  58,27  83.02  69.73
## 878  58,05  85.51  70.69
## 879  60,05  86.11  72.87
## 880  61,39  86.41  74.39
## 881  61,46  89.41  76.50
## 882  51,35  84.88  69.76
## 883  50,02  79.75  68.54
## 884  54,06  81.69  68.54
## 885  62,41  83.17  72.10
## 886  53,76  75.09  63.20
## 887  57,47  82.47  70.05
## 888  60,82  86.69  76.24
## 889  58,77  87.52  75.93
## 890  63,09  86.23  77.16
## 906  45,17  69.02  58.54
## 907  44,08  72.23  59.56
## 908  45,66  62.69  58.64
## 909  48,16  67.06  59.14
## 910  56,43  79.54  69.19
## 911  52,55  76.86  64.12
## 912  43,88  58.81  48.22
## 913  46,81  66.81  56.03
## 914  44,72  66.37  55.30
## 915  47,06  70.37  61.66
## 916  47,96  69.52  58.68
## 917  49,72  72.53  63.46
## 918  49,56  72.50  62.85
## 950   54,9  83.86  72.83
## 951  53,06  85.33  71.23
## 952  54,43  84.76  72.72
## 953  53,92  72.62  63.44
## 954  60,99  83.49  71.01
## 955  60,94  82.04  70.95
## 956  63,37  86.81  76.31
## 957  60,47  81.37  68.81
## 958  59,99  81.38  70.18
## 959  63,74  83.91  73.38
## 960  50,58  79.69  64.84
## 961  53,76  85.52  73.86
## 962  58,33  91.48  80.91
## 963  55,06  83.16  72.91
## 964  61,76  91.09  80.42
## 965  58,95  88.77  78.15
## 966  54,24  87.76  77.29
## 967  53,49  85.78  74.93
## 968  56,75  88.39  77.77
## 969  63,99  85.65  74.41
## 970   68,3  87.79  77.29
## 971  63,18  87.10  76.37
## 972  71,78  93.51  84.50
```

```
## 973                          73,61          97.37       87.11
## 974                          65,62          96.13       84.85
## 975                          64,05          94.55       83.46
## 976                          61,83          87.58       77.57
## 977                          68,88          95.00       82.00
## 978                          66,35          93.72       79.63
## 979                          66,66          92.46       79.82
## 980                          67,81          95.12       82.98
## 981                          68,76          92.66       82.88
## 1014                         54,39          78.80       67.18
## 1015                         52,27          75.43       63.48
## 1016                          50,6          75.91       61.96
## 1017                         41,69          70.74       60.28
## 1018                         53,43          72.43       58.98
## 1019                         53,99          76.53       64.85
## 1020                         50,58          73.67       64.73
## 1021                         54,41          74.49       65.06
## 1022                         47,96          70.26       58.82
## 1023                         47,43          69.59       57.43
## 1024                          53,8          75.55       62.74
## 1025                         56,09          83.21       70.68
## 1026                         55,88          83.43       70.89
## 1027                         57,31          80.70       70.04
## 1028                         54,85          82.45       70.92
## 1029                         59,71          87.34       76.98
## 1030                         56,53          85.39       73.46
## 1031                         46,48          81.39       70.77
## 1032                         48,41          78.09       65.37
## 1033                         51,52          70.26       58.12
## 1034                         55,05          72.31       61.13
## 1035                         53,15          77.80       66.08
## 1036                         53,21          73.48       62.77
## 1037                         51,35          68.86       56.68
## 1038                         53,33          74.15       62.55
## 1039                         56,49          74.06       62.59
## 1040                         53,15          73.77       60.37
## 1041                         46,97          67.80       57.91
## 1042                         52,04          71.97       62.04
## 1043                         44,67          63.21       54.16
## 1044                         59,84          79.92       69.53
## 1045                         53,09          71.14       59.64
##                    sensitivity
## 30              Very sensitive
## 31              Very sensitive
## 32              Very sensitive
## 33              Very sensitive
## 34              Very sensitive
## 35              Very sensitive
## 36              Very sensitive
## 37              Very sensitive
## 39              Very sensitive
## 40              Very sensitive
## 41              Very sensitive
## 42              Very sensitive
```

```
## 43                Very sensitive
## 44                Very sensitive
## 45                Very sensitive
## 46                Very sensitive
## 47                Very sensitive
## 48                Very sensitive
## 49                Very sensitive
## 50                Very sensitive
## 51                Very sensitive
## 52                Very sensitive
## 53                Very sensitive
## 54                Very sensitive
## 55                Very sensitive
## 56                Very sensitive
## 57                Very sensitive
## 58                Very sensitive
## 59                Very sensitive
## 60                Very sensitive
## 61                Very sensitive
## 62                Very sensitive
## 63                Very sensitive
## 64                Very sensitive
## 65                Very sensitive
## 66                Very sensitive
## 67                Very sensitive
## 68                Very sensitive
## 69                Very sensitive
## 70                Very sensitive
## 71                Very sensitive
## 72                Very sensitive
## 73                Very sensitive
## 74                Very sensitive
## 75                Very sensitive
## 76                Very sensitive
## 77                Very sensitive
## 78                Very sensitive
## 79                Very sensitive
## 80                Very sensitive
## 81                Very sensitive
## 82                Very sensitive
## 83                Very sensitive
## 84                Very sensitive
## 85                Very sensitive
## 86                Very sensitive
## 87                Very sensitive
## 88                Very sensitive
## 89                Very sensitive
## 90                Very sensitive
## 91                Very sensitive
## 92                Very sensitive
## 93                Very sensitive
## 126               Very sensitive
## 127               Very sensitive
## 128               Very sensitive
```

```
## 129              Very sensitive
## 130              Very sensitive
## 131              Very sensitive
## 132              Very sensitive
## 133              Very sensitive
## 134              Very sensitive
## 135              Very sensitive
## 136              Very sensitive
## 137              Very sensitive
## 138              Very sensitive
## 139              Very sensitive
## 140              Very sensitive
## 141              Very sensitive
## 142              Very sensitive
## 143              Very sensitive
## 144              Very sensitive
## 145              Very sensitive
## 146              Very sensitive
## 147              Very sensitive
## 148              Very sensitive
## 149              Very sensitive
## 150              Very sensitive
## 151              Very sensitive
## 152              Very sensitive
## 153              Very sensitive
## 154              Very sensitive
## 155              Very sensitive
## 156              Very sensitive
## 157              Very sensitive
## 158              Very sensitive
## 159              Very sensitive
## 160              Very sensitive
## 161              Very sensitive
## 162              Very sensitive
## 163              Very sensitive
## 164              Very sensitive
## 165              Very sensitive
## 166              Very sensitive
## 167              Very sensitive
## 168              Very sensitive
## 169              Very sensitive
## 170              Very sensitive
## 171              Very sensitive
## 172              Very sensitive
## 173              Very sensitive
## 174              Very sensitive
## 175              Very sensitive
## 176              Very sensitive
## 177              Very sensitive
## 178              Very sensitive
## 179              Very sensitive
## 180              Very sensitive
## 181              Very sensitive
## 182              Very sensitive
```

```
## 183              Very sensitive
## 184              Very sensitive
## 185              Very sensitive
## 186              Very sensitive
## 187              Very sensitive
## 188              Very sensitive
## 189              Very sensitive
## 222                   Sensitive
## 223                   Sensitive
## 224                   Sensitive
## 225                   Sensitive
## 226                   Sensitive
## 227                   Sensitive
## 228                   Sensitive
## 229                   Sensitive
## 230                   Sensitive
## 231                   Sensitive
## 232                   Sensitive
## 233                   Sensitive
## 234                   Sensitive
## 235                   Sensitive
## 236                   Sensitive
## 237                   Sensitive
## 238                   Sensitive
## 239                   Sensitive
## 240                   Sensitive
## 241                   Sensitive
## 242                   Sensitive
## 243                   Sensitive
## 244                   Sensitive
## 245                   Sensitive
## 246                   Sensitive
## 247                   Sensitive
## 248                   Sensitive
## 249                   Sensitive
## 250                   Sensitive
## 251                   Sensitive
## 252                   Sensitive
## 253                   Sensitive
## 285                   Sensitive
## 286                   Sensitive
## 287                   Sensitive
## 288                   Sensitive
## 289                   Sensitive
## 290                   Sensitive
## 291                   Sensitive
## 292                   Sensitive
## 293                   Sensitive
## 294                   Sensitive
## 295                   Sensitive
## 296                   Sensitive
## 297                   Sensitive
## 298                   Sensitive
## 299                   Sensitive
```

```
## 300                     Sensitive
## 301                     Sensitive
## 302                     Sensitive
## 303                     Sensitive
## 304                     Sensitive
## 305                     Sensitive
## 306                     Sensitive
## 307                     Sensitive
## 308                     Sensitive
## 309                     Sensitive
## 310                     Sensitive
## 311                     Sensitive
## 312                     Sensitive
## 313                     Sensitive
## 314                     Sensitive
## 315                     Sensitive
## 316                     Sensitive
## 349           Reasonably sensitive
## 350           Reasonably sensitive
## 351           Reasonably sensitive
## 352           Reasonably sensitive
## 353           Reasonably sensitive
## 354           Reasonably sensitive
## 355           Reasonably sensitive
## 356           Reasonably sensitive
## 357           Reasonably sensitive
## 358           Reasonably sensitive
## 359           Reasonably sensitive
## 360           Reasonably sensitive
## 361           Reasonably sensitive
## 362           Reasonably sensitive
## 363           Reasonably sensitive
## 364           Reasonably sensitive
## 365           Reasonably sensitive
## 366           Reasonably sensitive
## 367           Reasonably sensitive
## 368           Reasonably sensitive
## 369           Reasonably sensitive
## 370           Reasonably sensitive
## 371           Reasonably sensitive
## 372           Reasonably sensitive
## 373           Reasonably sensitive
## 374           Reasonably sensitive
## 375           Reasonably sensitive
## 376           Reasonably sensitive
## 377           Reasonably sensitive
## 378           Reasonably sensitive
## 379           Reasonably sensitive
## 380           Reasonably sensitive
## 413  intermediate with some damage
## 414  intermediate with some damage
## 415  intermediate with some damage
## 416  intermediate with some damage
## 417  intermediate with some damage
```

```
## 418  intermediate with some damage
## 419  intermediate with some damage
## 420  intermediate with some damage
## 421  intermediate with some damage
## 422  intermediate with some damage
## 423  intermediate with some damage
## 424  intermediate with some damage
## 425  intermediate with some damage
## 426  intermediate with some damage
## 427  intermediate with some damage
## 428  intermediate with some damage
## 429  intermediate with some damage
## 430  intermediate with some damage
## 431  intermediate with some damage
## 432  intermediate with some damage
## 433  intermediate with some damage
## 434  intermediate with some damage
## 435  intermediate with some damage
## 436  intermediate with some damage
## 437  intermediate with some damage
## 438  intermediate with some damage
## 439  intermediate with some damage
## 440  intermediate with some damage
## 441  intermediate with some damage
## 442  intermediate with some damage
## 443  intermediate with some damage
## 475                Very sensitive
## 476                Very sensitive
## 477                Very sensitive
## 478                Very sensitive
## 479                Very sensitive
## 480                Very sensitive
## 481                Very sensitive
## 482                Very sensitive
## 483                Very sensitive
## 484                Very sensitive
## 485                Very sensitive
## 486                Very sensitive
## 487                Very sensitive
## 488                Very sensitive
## 489                Very sensitive
## 490                Very sensitive
## 491                Very sensitive
## 492                Very sensitive
## 493                Very sensitive
## 494                Very sensitive
## 495                Very sensitive
## 496                Very sensitive
## 497                Very sensitive
## 498                Very sensitive
## 499                Very sensitive
## 500                Very sensitive
## 501                Very sensitive
## 502                Very sensitive
```

```
## 503                Very sensitive
## 504                Very sensitive
## 505                Very sensitive
## 506                Very sensitive
## 539           Reasonably sensitive
## 540           Reasonably sensitive
## 541           Reasonably sensitive
## 542           Reasonably sensitive
## 543           Reasonably sensitive
## 544           Reasonably sensitive
## 545           Reasonably sensitive
## 546           Reasonably sensitive
## 547           Reasonably sensitive
## 548           Reasonably sensitive
## 549           Reasonably sensitive
## 550           Reasonably sensitive
## 551           Reasonably sensitive
## 552           Reasonably sensitive
## 553           Reasonably sensitive
## 554           Reasonably sensitive
## 555           Reasonably sensitive
## 556           Reasonably sensitive
## 557           Reasonably sensitive
## 558           Reasonably sensitive
## 559           Reasonably sensitive
## 560           Reasonably sensitive
## 561           Reasonably sensitive
## 562           Reasonably sensitive
## 563           Reasonably sensitive
## 564           Reasonably sensitive
## 565           Reasonably sensitive
## 566           Reasonably sensitive
## 567           Reasonably sensitive
## 568           Reasonably sensitive
## 569           Reasonably sensitive
## 570           Reasonably sensitive
## 603            Relatively tolerant
## 604            Relatively tolerant
## 605            Relatively tolerant
## 606            Relatively tolerant
## 607            Relatively tolerant
## 608            Relatively tolerant
## 609            Relatively tolerant
## 610            Relatively tolerant
## 611            Relatively tolerant
## 612            Relatively tolerant
## 613            Relatively tolerant
## 614            Relatively tolerant
## 615            Relatively tolerant
## 616            Relatively tolerant
## 617            Relatively tolerant
## 618            Relatively tolerant
## 619            Relatively tolerant
## 620            Relatively tolerant
```

```
## 621            Relatively tolerant
## 622            Relatively tolerant
## 623            Relatively tolerant
## 624            Relatively tolerant
## 625            Relatively tolerant
## 626            Relatively tolerant
## 627            Relatively tolerant
## 628            Relatively tolerant
## 629            Relatively tolerant
## 630            Relatively tolerant
## 631            Relatively tolerant
## 632            Relatively tolerant
## 633            Relatively tolerant
## 634            Relatively tolerant
## 667                      Sensitive
## 668                      Sensitive
## 669                      Sensitive
## 670                      Sensitive
## 671                      Sensitive
## 672                      Sensitive
## 673                      Sensitive
## 674                      Sensitive
## 675                      Sensitive
## 676                      Sensitive
## 677                      Sensitive
## 678                      Sensitive
## 679                      Sensitive
## 680                      Sensitive
## 681                      Sensitive
## 682                      Sensitive
## 683                      Sensitive
## 684                      Sensitive
## 685                      Sensitive
## 686                      Sensitive
## 687                      Sensitive
## 688                      Sensitive
## 689                      Sensitive
## 690                      Sensitive
## 691                      Sensitive
## 692                      Sensitive
## 693                      Sensitive
## 694                      Sensitive
## 695                      Sensitive
## 696                      Sensitive
## 697                      Sensitive
## 698                      Sensitive
## 731                      Resistant
## 732                      Resistant
## 733                      Resistant
## 734                      Resistant
## 735                      Resistant
## 736                      Resistant
## 737                      Resistant
## 738                      Resistant
```

```
## 739                    Resistant
## 740                    Resistant
## 741                    Resistant
## 742                    Resistant
## 743                    Resistant
## 744                    Resistant
## 745                    Resistant
## 746                    Resistant
## 747                    Resistant
## 748                    Resistant
## 749                    Resistant
## 750                    Resistant
## 751                    Resistant
## 752                    Resistant
## 753                    Resistant
## 754                    Resistant
## 755                    Resistant
## 756                    Resistant
## 757                    Resistant
## 758                    Resistant
## 759                    Resistant
## 760                    Resistant
## 761                    Resistant
## 762                    Resistant
## 795                    Sensitive
## 796                    Sensitive
## 797                    Sensitive
## 798                    Sensitive
## 799                    Sensitive
## 800                    Sensitive
## 801                    Sensitive
## 802                    Sensitive
## 803                    Sensitive
## 804                    Sensitive
## 805                    Sensitive
## 806                    Sensitive
## 807                    Sensitive
## 808                    Sensitive
## 809                    Sensitive
## 810                    Sensitive
## 811                    Sensitive
## 812                    Sensitive
## 813                    Sensitive
## 814                    Sensitive
## 815                    Sensitive
## 816                    Sensitive
## 817                    Sensitive
## 818                    Sensitive
## 819                    Sensitive
## 820                    Sensitive
## 821                    Sensitive
## 822                    Sensitive
## 823                    Sensitive
## 824                    Sensitive
```

```
## 825                     Sensitive
## 826                     Sensitive
## 859                      tolerant
## 860                      tolerant
## 861                      tolerant
## 862                      tolerant
## 863                      tolerant
## 864                      tolerant
## 865                      tolerant
## 866                      tolerant
## 867                      tolerant
## 868                      tolerant
## 869                      tolerant
## 870                      tolerant
## 871                      tolerant
## 872                      tolerant
## 873                      tolerant
## 874                      tolerant
## 875                      tolerant
## 876                      tolerant
## 877                      tolerant
## 878                      tolerant
## 879                      tolerant
## 880                      tolerant
## 881                      tolerant
## 882                      tolerant
## 883                      tolerant
## 884                      tolerant
## 885                      tolerant
## 886                      tolerant
## 887                      tolerant
## 888                      tolerant
## 889                      tolerant
## 890                      tolerant
## 906                highly tolerant
## 907                highly tolerant
## 908                highly tolerant
## 909                highly tolerant
## 910                highly tolerant
## 911                highly tolerant
## 912                highly tolerant
## 913                highly tolerant
## 914                highly tolerant
## 915                highly tolerant
## 916                highly tolerant
## 917                highly tolerant
## 918                highly tolerant
## 950  intermediate with some damage
## 951  intermediate with some damage
## 952  intermediate with some damage
## 953  intermediate with some damage
## 954  intermediate with some damage
## 955  intermediate with some damage
## 956  intermediate with some damage
```

```
## 957  intermediate with some damage
## 958  intermediate with some damage
## 959  intermediate with some damage
## 960  intermediate with some damage
## 961  intermediate with some damage
## 962  intermediate with some damage
## 963  intermediate with some damage
## 964  intermediate with some damage
## 965  intermediate with some damage
## 966  intermediate with some damage
## 967  intermediate with some damage
## 968  intermediate with some damage
## 969  intermediate with some damage
## 970  intermediate with some damage
## 971  intermediate with some damage
## 972  intermediate with some damage
## 973  intermediate with some damage
## 974  intermediate with some damage
## 975  intermediate with some damage
## 976  intermediate with some damage
## 977  intermediate with some damage
## 978  intermediate with some damage
## 979  intermediate with some damage
## 980  intermediate with some damage
## 981  intermediate with some damage
## 1014                Very sensitive
## 1015                Very sensitive
## 1016                Very sensitive
## 1017                Very sensitive
## 1018                Very sensitive
## 1019                Very sensitive
## 1020                Very sensitive
## 1021                Very sensitive
## 1022                Very sensitive
## 1023                Very sensitive
## 1024                Very sensitive
## 1025                Very sensitive
## 1026                Very sensitive
## 1027                Very sensitive
## 1028                Very sensitive
## 1029                Very sensitive
## 1030                Very sensitive
## 1031                Very sensitive
## 1032                Very sensitive
## 1033                Very sensitive
## 1034                Very sensitive
## 1035                Very sensitive
## 1036                Very sensitive
## 1037                Very sensitive
## 1038                Very sensitive
## 1039                Very sensitive
## 1040                Very sensitive
## 1041                Very sensitive
## 1042                Very sensitive
```

```
## 1043                Very sensitive
## 1044                Very sensitive
## 1045                Very sensitive
```

```
disease_score_clean$Treatment <- disease_score_clean$Treatment..1.34.
disease_score_clean$Block <- disease_score_clean$Block.nr.
disease_score_clean$Plant_nr <- disease_score_clean$Plant.nr.
disease_score_clean$T3 <- disease_score_clean$T3.disease..0.1.
disease_score_clean$T4 <- disease_score_clean$T4.disease....leaves.
disease_score_clean$T5_per <- disease_score_clean$T5.disease....
disease_score_clean$T5 <- disease_score_clean$T5.affected..0.1.
disease_score_clean$T6_per <- disease_score_clean$T6.disease....
disease_score_clean$T6 <- disease_score_clean$T6.affected..0.1.
disease_score_clean$T7_per <- disease_score_clean$T7.disease....
disease_score_clean$T7 <- disease_score_clean$T7.affected..0.1.
disease_score_clean$T8_per <- disease_score_clean$T8.disease....
disease_score_clean$T8 <- disease_score_clean$T8.affected..0.1.
disease_score_clean$T8_con <- disease_score_clean$T8.mate.disease..0.3.
disease_score_clean$T9_per <- disease_score_clean$T9.disease....
disease_score_clean$T9 <- disease_score_clean$T9.affected..0.1.
disease_score_clean$T9_con <- disease_score_clean$T9.mate.disease..0.3.
disease_score_clean$T5_length <- disease_score_clean$T5.length..cm.
disease_score_clean$T5_RGR <- disease_score_clean$T5.Relative.Growth.Rate.RGR..cm.
disease_score_clean$T9_length <- disease_score_clean$T9.length..cm.
disease_score_clean$T9_RGR <- disease_score_clean$T9.RGR..cm.
disease_score_clean$sensitivity_f <- disease_score_clean$sensitivity

disease_score_clean$time_to_first <- apply(disease_score_clean[,c("T3", "T5", "T6", "T7", "T8","T9")], 
    affected_week <- which(x == 1)
    if (length(affected_week) == 0) {
        return(70)
    } else {
        return(affected_week[1])
    }
})

new_dataframe <- data.frame()

new_dataframe <- disease_score_clean %>%
  select(sensitivity_f, Treatment, Soiltype, Cultivar, Pathogen, Plant_nr, Block, T3, T4, T5, T5_per, T

new_dataframe$sensitivity_f <- factor(new_dataframe$sensitivity_f, ordered = TRUE,
                                      levels = c("Very sensitive", "Sensitive", "Reasonably sensitive",
                                                 "intermediate with some damage", "Relatively tolerant", 
                                                 "highly tolerant", "Resistant"))

new_dataframe$T3 <- ifelse(new_dataframe$T3 == 0, 0, 1)
new_dataframe$T5 <- ifelse(new_dataframe$T5 == 0, 0, 1)
new_dataframe$T6 <- ifelse(new_dataframe$T6 == 0, 0, 1)
new_dataframe$T7 <- ifelse(new_dataframe$T7 == 0, 0, 1)
new_dataframe$T8 <- ifelse(new_dataframe$T8 == 0, 0, 1)
new_dataframe$T9 <- ifelse(new_dataframe$T9 == 0, 0, 1)

new_dataframe$Pathogen <- factor(disease_score_clean$Pathogen)
```

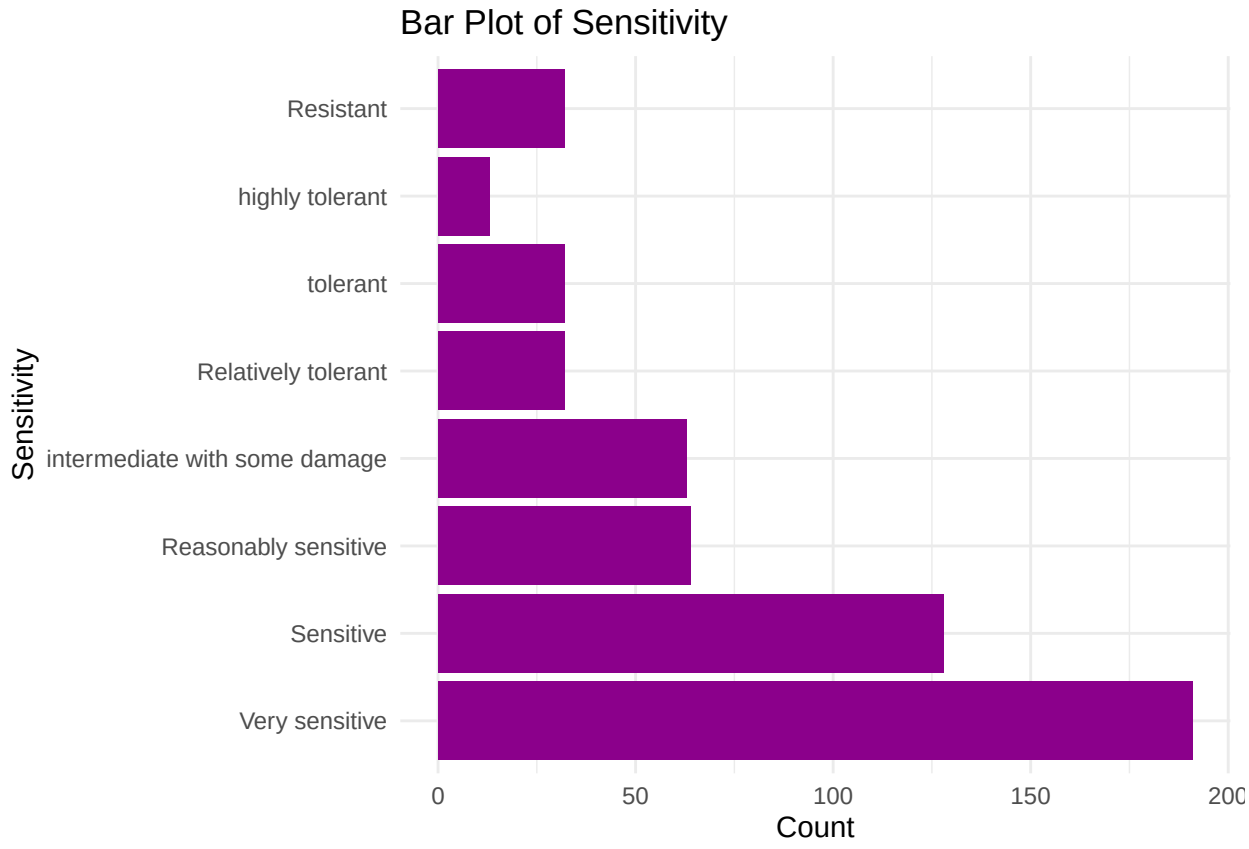
```r
new_dataframe$Soiltype <- factor(disease_score_clean$Soiltype)
new_dataframe$Cultivar <- factor(disease_score_clean$Cultivar)
new_dataframe$Treatment <- factor(disease_score_clean$Treatment)

new_dataframe$T8_con <- factor(new_dataframe$T8_con, levels = 0:3)
new_dataframe$T9_con <- factor(new_dataframe$T9_con, levels = 0:3)
new_dataframe$T5_length <- as.numeric(sub(",", ".", new_dataframe$T5_length, fixed = TRUE))
new_dataframe$T9_length <- as.numeric(sub(",", ".", new_dataframe$T9_length, fixed = TRUE))
new_dataframe$T5_RGR <- as.numeric(sub(",", ".", new_dataframe$T5_RGR, fixed = TRUE))
new_dataframe$T9_RGR <- as.numeric(sub(",", ".", new_dataframe$T9_RGR, fixed = TRUE))
```

```r
summary(new_dataframe)
```

```
##                        sensitivity_f   Treatment           Soiltype
##  Very sensitive               :191   3      : 32   Potting Soil:492
##  Sensitive                    :128   5      : 32   Soil        : 63
##  Reasonably sensitive         : 64   6      : 32
##  intermediate with some damage: 63   8      : 32
##  Relatively tolerant          : 32   10     : 32
##  tolerant                     : 32   12     : 32
##  (Other)                      : 45   (Other):363
##          Cultivar             Pathogen      Plant_nr          Block
##  Kennedy     :127   Conidia       :492   Min.   :  33.0   Min.   :1.000
##  130.857.000 : 32   Microsclerotia: 63   1st Qu.: 236.5   1st Qu.:2.000
##  91.023.000  : 32                        Median : 504.0   Median :3.000
##  Abbey Purple: 32                        Mean   : 518.5   Mean   :2.526
##  Alamos      : 32                        3rd Qu.: 802.5   3rd Qu.:4.000
##  Antonov     : 32                        Max.   :1056.0   Max.   :4.000
##  (Other)     :268
##        T3                T4                T5            T5_per
##  Min.   :0.00000   Min.   : 0.0000   Min.   :0.000   Min.   :  0.00
##  1st Qu.:0.00000   1st Qu.: 0.0000   1st Qu.:0.000   1st Qu.:  0.00
##  Median :0.00000   Median : 0.0000   Median :0.000   Median :  5.00
##  Mean   :0.01622   Mean   : 0.8883   Mean   :0.436   Mean   : 19.41
##  3rd Qu.:0.00000   3rd Qu.: 0.0000   3rd Qu.:1.000   3rd Qu.: 30.00
##  Max.   :1.00000   Max.   :17.0000   Max.   :1.000   Max.   :100.00
##
##        T6              T6_per             T7             T7_per
##  Min.   :0.0000   Min.   :  0.00   Min.   :0.0000   Min.   :  0.00
##  1st Qu.:0.0000   1st Qu.:  0.00   1st Qu.:0.0000   1st Qu.:  5.00
##  Median :1.0000   Median : 10.00   Median :1.0000   Median : 30.00
##  Mean   :0.5459   Mean   : 24.09   Mean   :0.7027   Mean   : 35.13
##  3rd Qu.:1.0000   3rd Qu.: 45.00   3rd Qu.:1.0000   3rd Qu.: 60.00
##  Max.   :1.0000   Max.   :100.00   Max.   :1.0000   Max.   :100.00
##
##        T8             T8_per             T9             T9_per
##  Min.   :0.000   Min.   :  0.00   Min.   :0.0000   Min.   :  0.00
##  1st Qu.:1.000   1st Qu.: 10.00   1st Qu.:1.0000   1st Qu.: 10.00
##  Median :1.000   Median : 50.00   Median :1.0000   Median : 60.00
##  Mean   :0.764   Mean   : 42.97   Mean   :0.8036   Mean   : 50.04
##  3rd Qu.:1.000   3rd Qu.: 70.00   3rd Qu.:1.0000   3rd Qu.: 80.00
##  Max.   :1.000   Max.   :100.00   Max.   :1.0000   Max.   :100.00
##
```

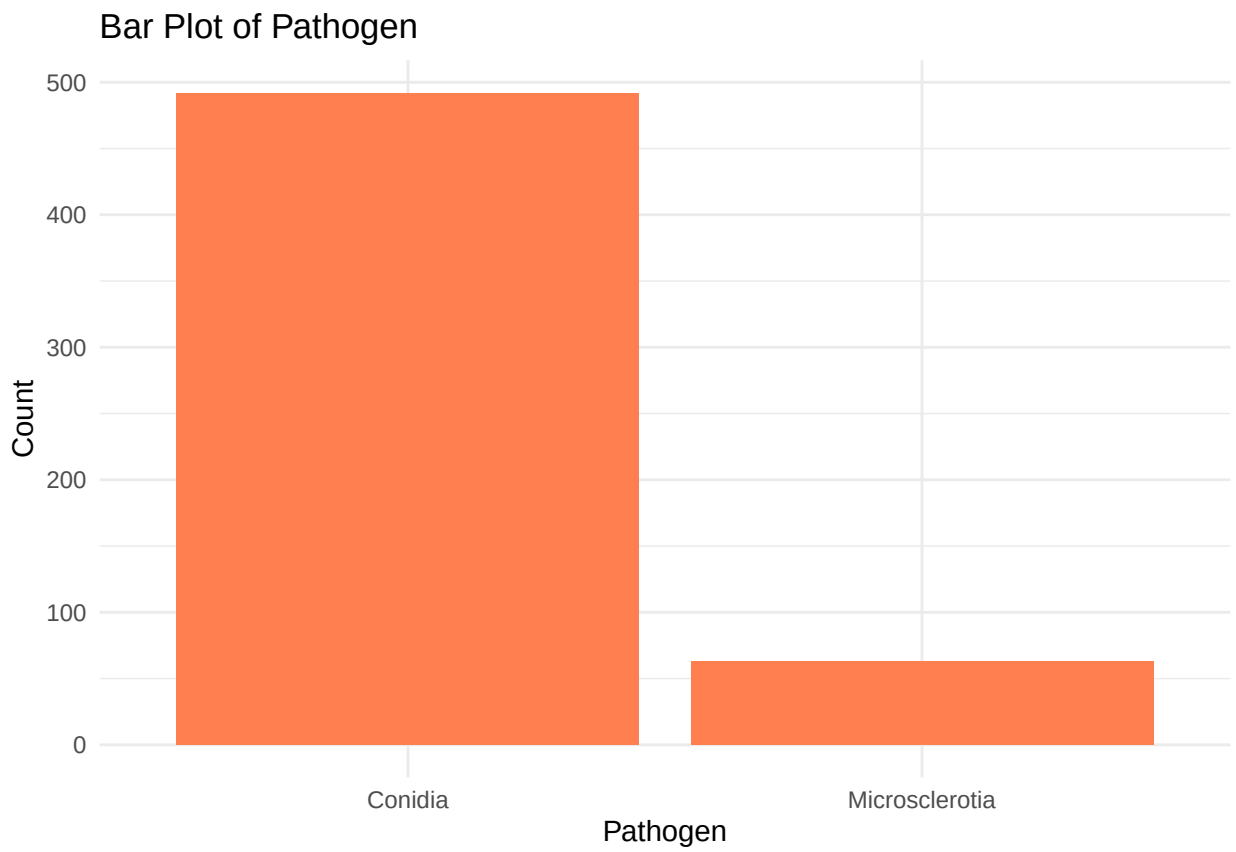
```
##  time_to_first     T5_length       T9_length         T5_RGR
##  Min.   : 1.00   Min.   :23.70   Min.   :12.41   Min.   : 6.52
##  1st Qu.: 2.00   1st Qu.:55.68   1st Qu.:65.39   1st Qu.:43.70
##  Median : 3.00   Median :62.79   Median :73.21   Median :51.05
##  Mean   :15.85   Mean   :61.39   Mean   :72.00   Mean   :49.19
##  3rd Qu.: 5.00   3rd Qu.:68.16   3rd Qu.:80.63   3rd Qu.:55.96
##  Max.   :70.00   Max.   :83.87   Max.   :98.30   Max.   :73.61
##                  NA's   :1                       NA's   :1
##      T9_RGR      T8_con  T9_con
##  Min.   : 0.42   0: 78   0: 71
##  1st Qu.:53.19   1:154   1:110
##  Median :62.04   2: 96   2: 98
##  Mean   :59.83   3:227   3:276
##  3rd Qu.:68.97
##  Max.   :87.11
##
```

```
# Bar plot for Sensitivity_f
ggplot(new_dataframe) + aes(x = sensitivity_f) +
  geom_bar(fill = "darkmagenta") + coord_flip() +
  theme_minimal() +
  labs(title = "Bar Plot of Sensitivity", x = "Sensitivity", y = "Count")
```

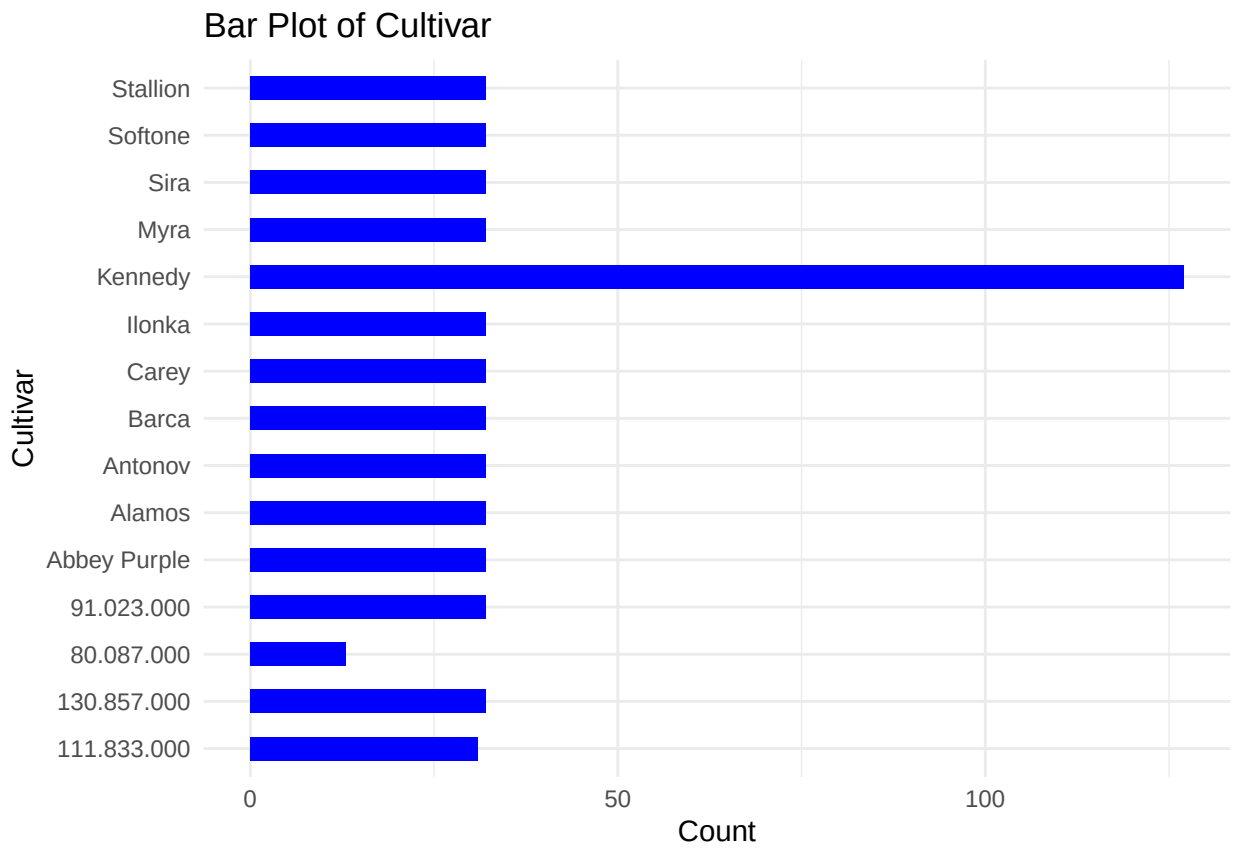



```
# Bar plot for Pathogen
ggplot(new_dataframe, aes(x = Pathogen)) +
```

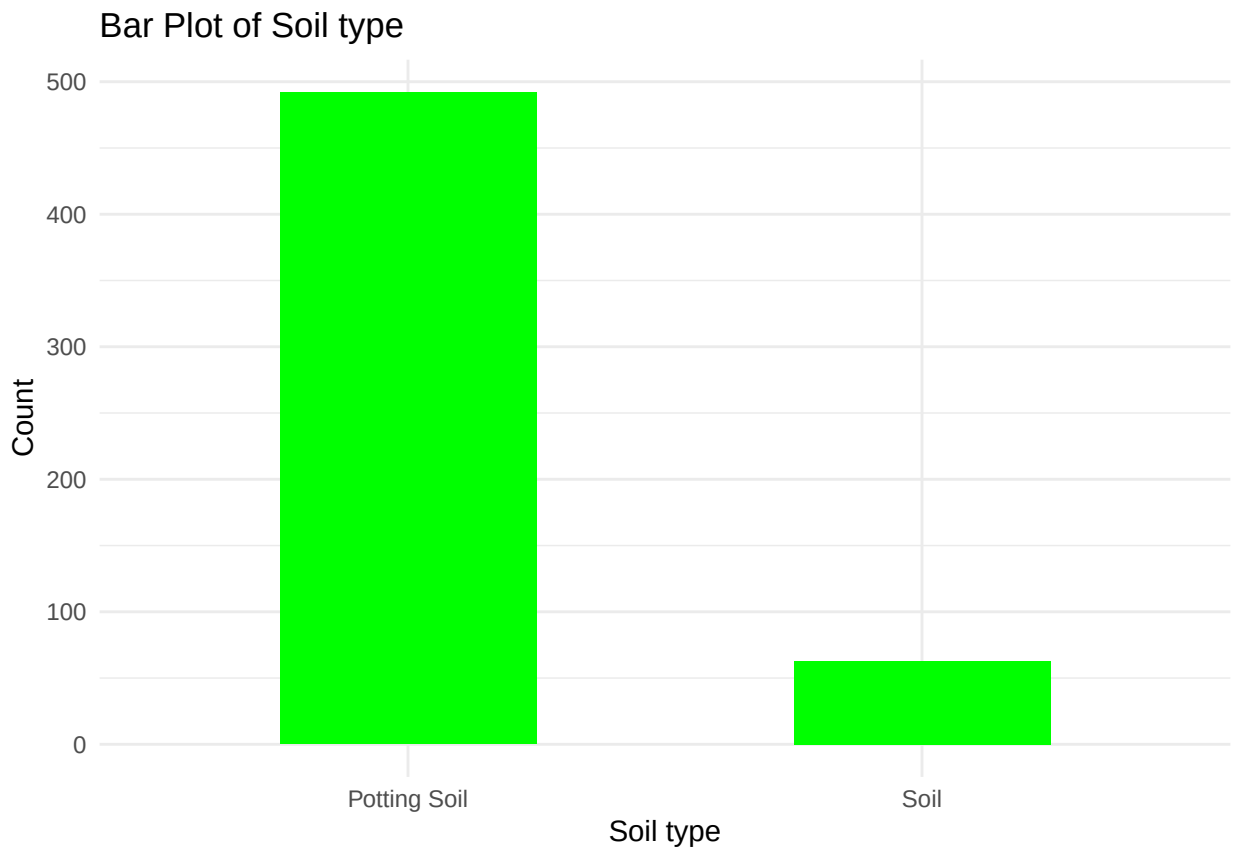
```
  geom_bar(fill = "coral") +
  theme_minimal() +
  labs(title = "Bar Plot of Pathogen", x = "Pathogen", y = "Count")
```



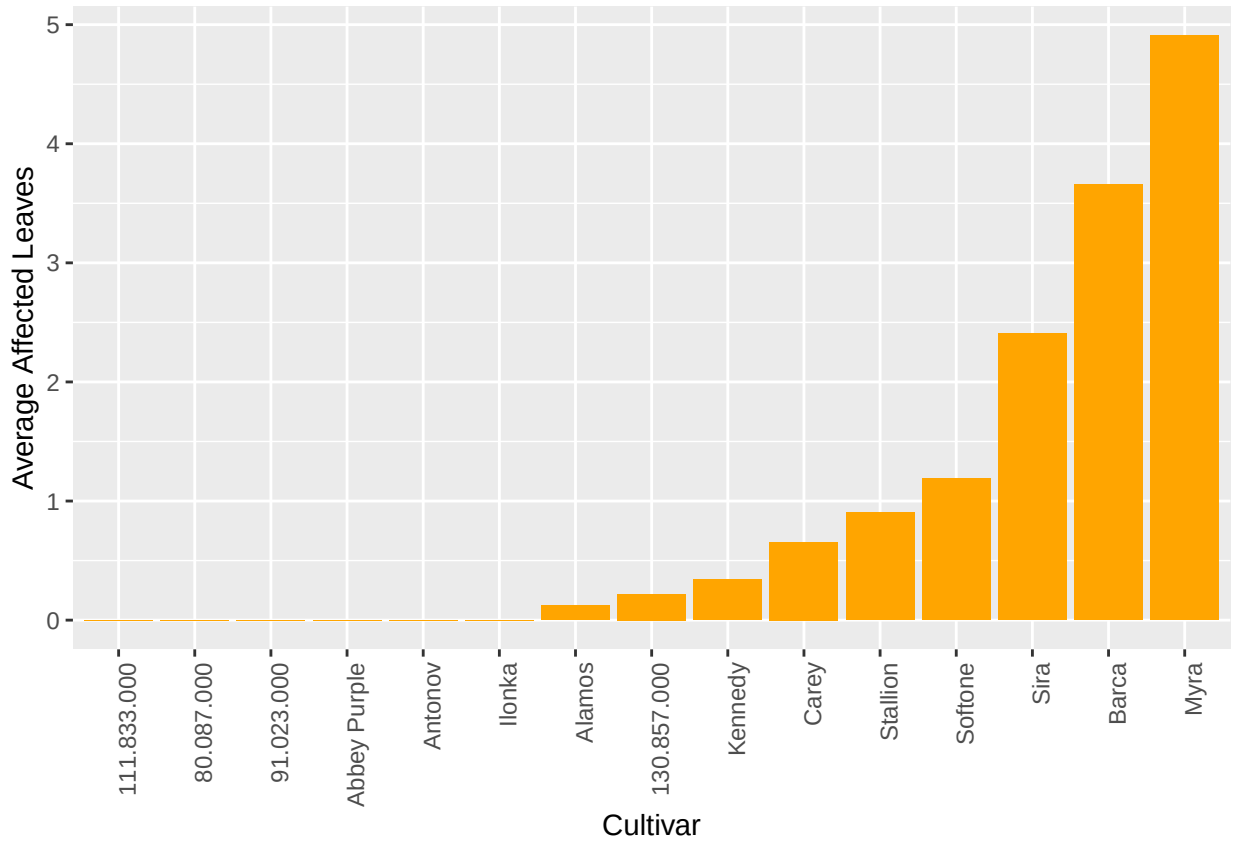

```
# Bar plot for Cultivar
ggplot(new_dataframe, aes(x = Cultivar)) +
  geom_bar(fill = "blue", width = 0.5) + coord_flip() +
  theme_minimal() +
  labs(title = "Bar Plot of Cultivar", x = "Cultivar", y = "Count")
```




```r
# Bar plot for Soil type
ggplot(new_dataframe, aes(x = Soiltype)) +
  geom_bar(fill = "green", width = 0.5) +
  theme_minimal() +
  labs(title = "Bar Plot of Soil type", x = "Soil type", y = "Count")
```




```
average_affected_leaves <- aggregate(T4 ~ Cultivar, data = new_dataframe, mean)
average_affected_leaves_sorted <- average_affected_leaves %>%
  arrange(desc(T4))
ggplot(average_affected_leaves_sorted, aes(x = reorder(Cultivar, T4), y = T4)) +
  geom_bar(stat = "identity", fill = "orange") +
  theme(axis.text.x = element_text(angle = 90, hjust = 1)) +
  labs(x = "Cultivar", y = "Average Affected Leaves")
```




```
by_cultivar <- split(new_dataframe, new_dataframe$Cultivar )
```

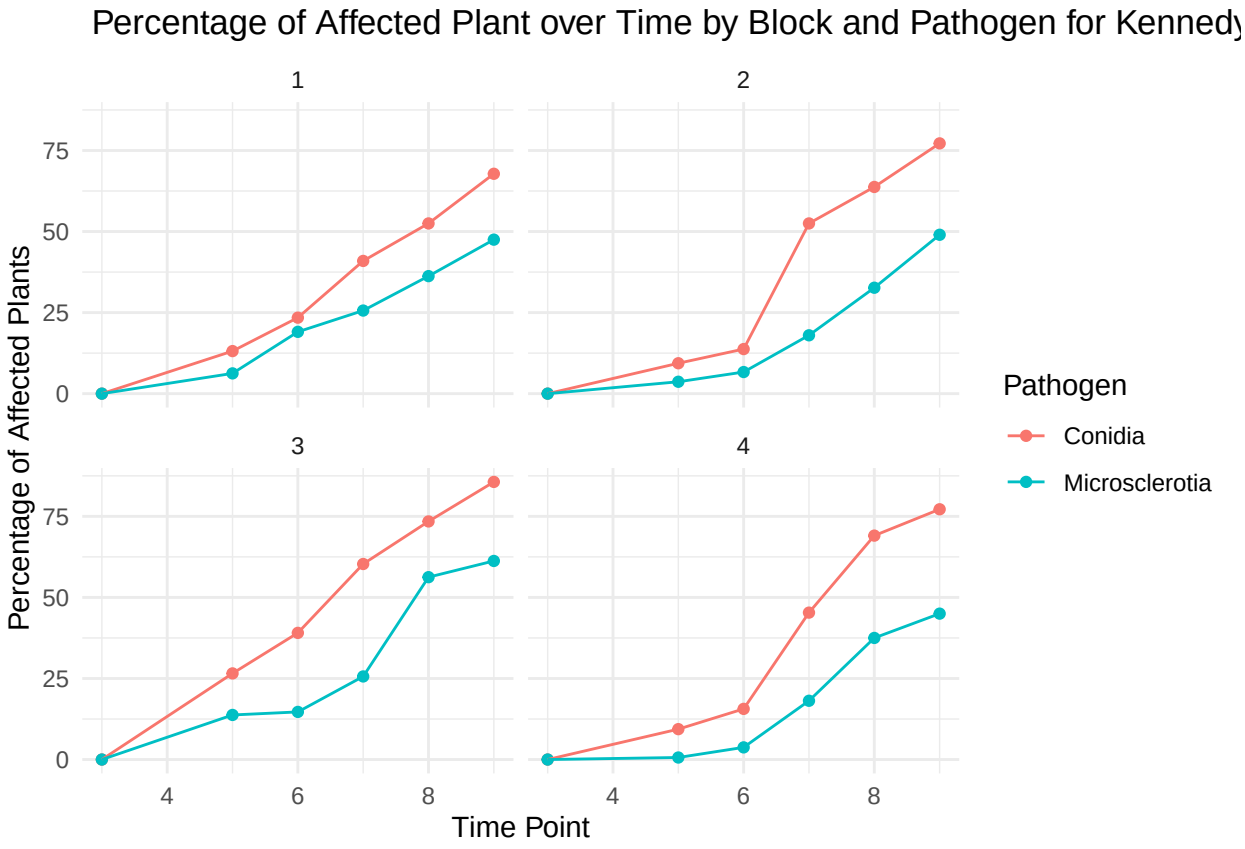
```
# plant's frequency
analysis_by_cultivar_freq <- function(cultivar, with_regression = FALSE) {
  cultivar_data <- by_cultivar[[cultivar]]

  combined_data <- list()

  for (block in unique(cultivar_data$Block)) {
    block_data <- cultivar_data[cultivar_data$Block == block, ]
    block_ag <- block_data %>%
      group_by(Pathogen) %>%
      summarise(
        f3 = mean(T3),
        f5 = mean(T5),
        f6 = mean(T6),
        f7 = mean(T7),
        f8 = mean(T8),
        f9 = mean(T9),
      ) %>%
      pivot_longer(cols = starts_with("f"), names_to = "TimePoint", values_to = "Freq")

    # Add block information
    block_ag$Block <- block
    combined_data[[block]] <- block_ag
  }
```

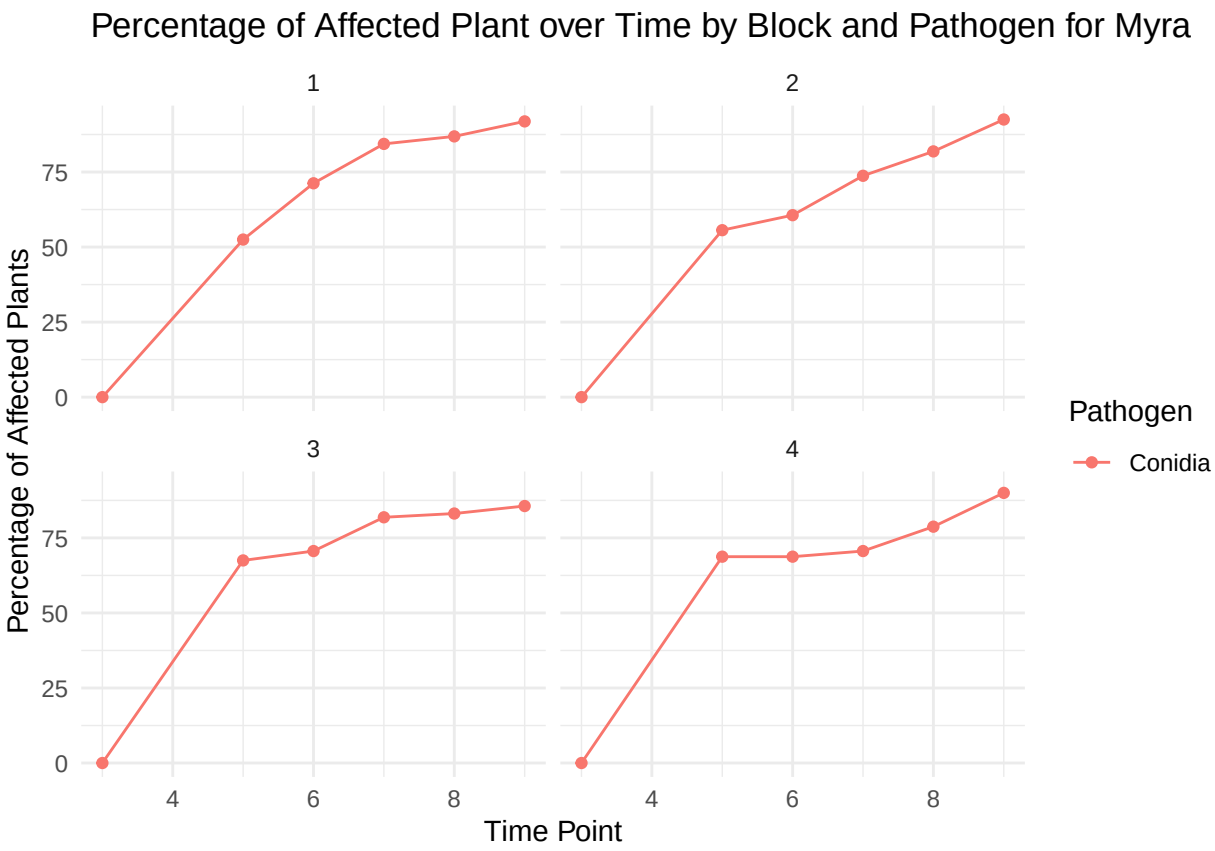
```
  long_data <- bind_rows(combined_data)

  long_data$TimePoint <- as.numeric(gsub("f", "", long_data$TimePoint))

  r <- ggplot(long_data, aes(x = TimePoint, y = Freq, group = interaction(Block, Pathogen), color = Pat
    geom_line() +
    geom_point() +
    facet_wrap(~Block) +
    theme_minimal() +
    labs(title = paste("Affected Plant Frequency over Time by Block and Pathogen for", cultivar),
         x = "Time Point",
         y = "Frequency of Affected Plants",
         color = "Pathogen")
}
```

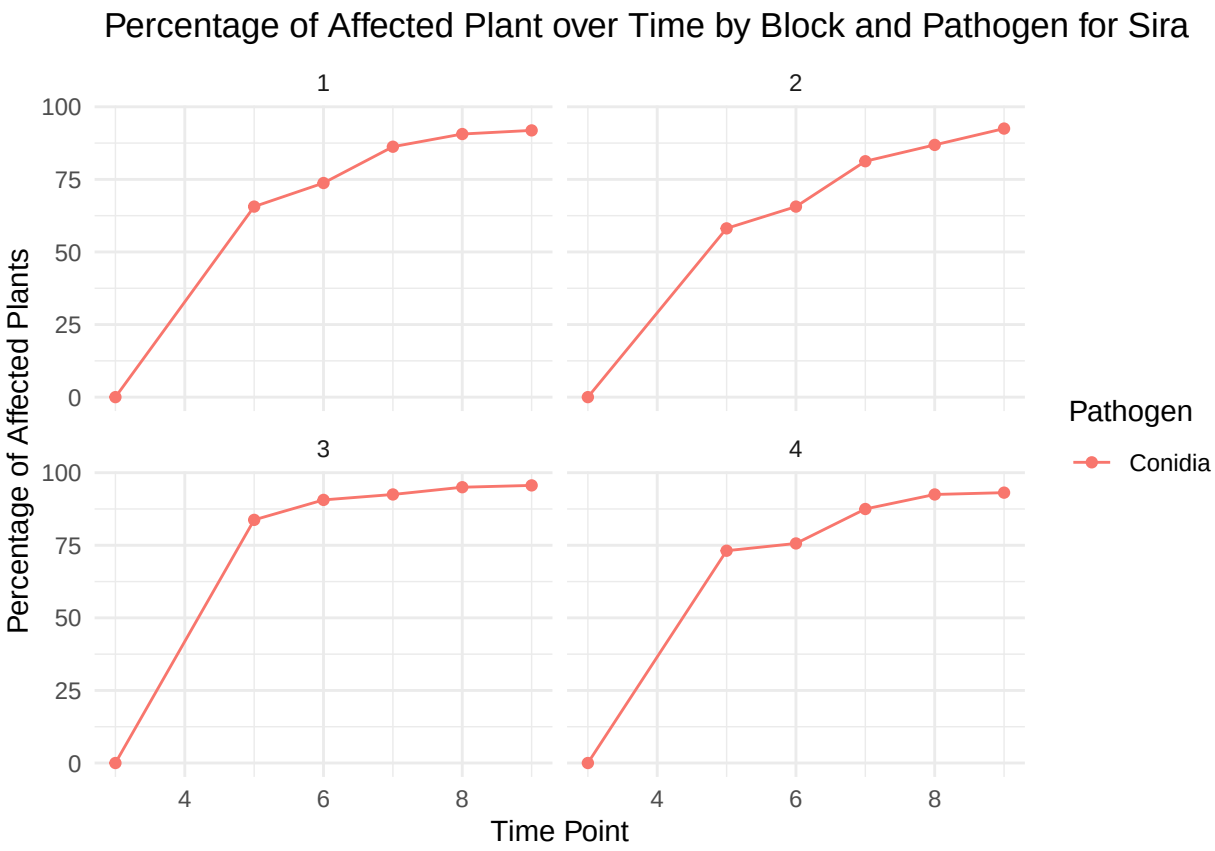
```
# affected plants rate
analysis_by_cultivar_percentage <- function(cultivar, with_regression = TRUE) {

  cultivar_data <- by_cultivar[[cultivar]]

  combined_data <- list()

  for (block in unique(cultivar_data$Block)) {
    block_data <- cultivar_data[cultivar_data$Block == block, ]
    block_ag <- block_data %>%
      group_by(Pathogen) %>%
      summarise(
        t3 = 0,
        t5 = mean(T5_per),
        t6 = mean(T6_per),
        t7 = mean(T7_per),
        t8 = mean(T8_per),
        t9 = mean(T9_per),
      ) %>%
      pivot_longer(cols = starts_with("t"), names_to = "TimePoint", values_to = "Percent")

    # Add block information
    block_ag$Block <- block
    combined_data[[block]] <- block_ag
  }

  long_data <- bind_rows(combined_data)

  long_data$TimePoint <- as.numeric(gsub("t", "", long_data$TimePoint))

  r <- ggplot(long_data, aes(x = TimePoint, y = Percent, group = interaction(Block, Pathogen), color = P
    geom_point() +
    geom_line() +
    facet_wrap(~Block) +
    theme_minimal() +
    labs(title = paste(" Percentage of Affected Plant over Time by Block and Pathogen for", cultivar),
         x = "Time Point",
         y = "Percentage of Affected Plants",
```

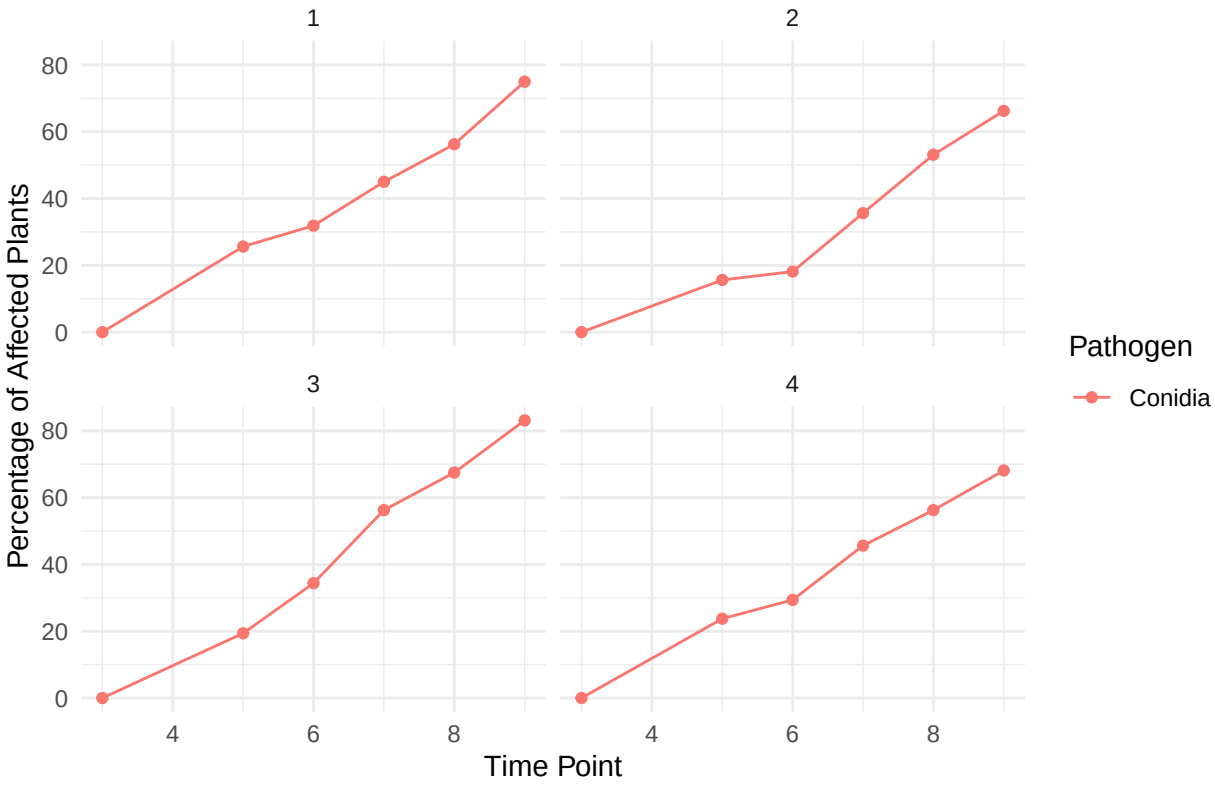
```
        color = "Pathogen")
}
```

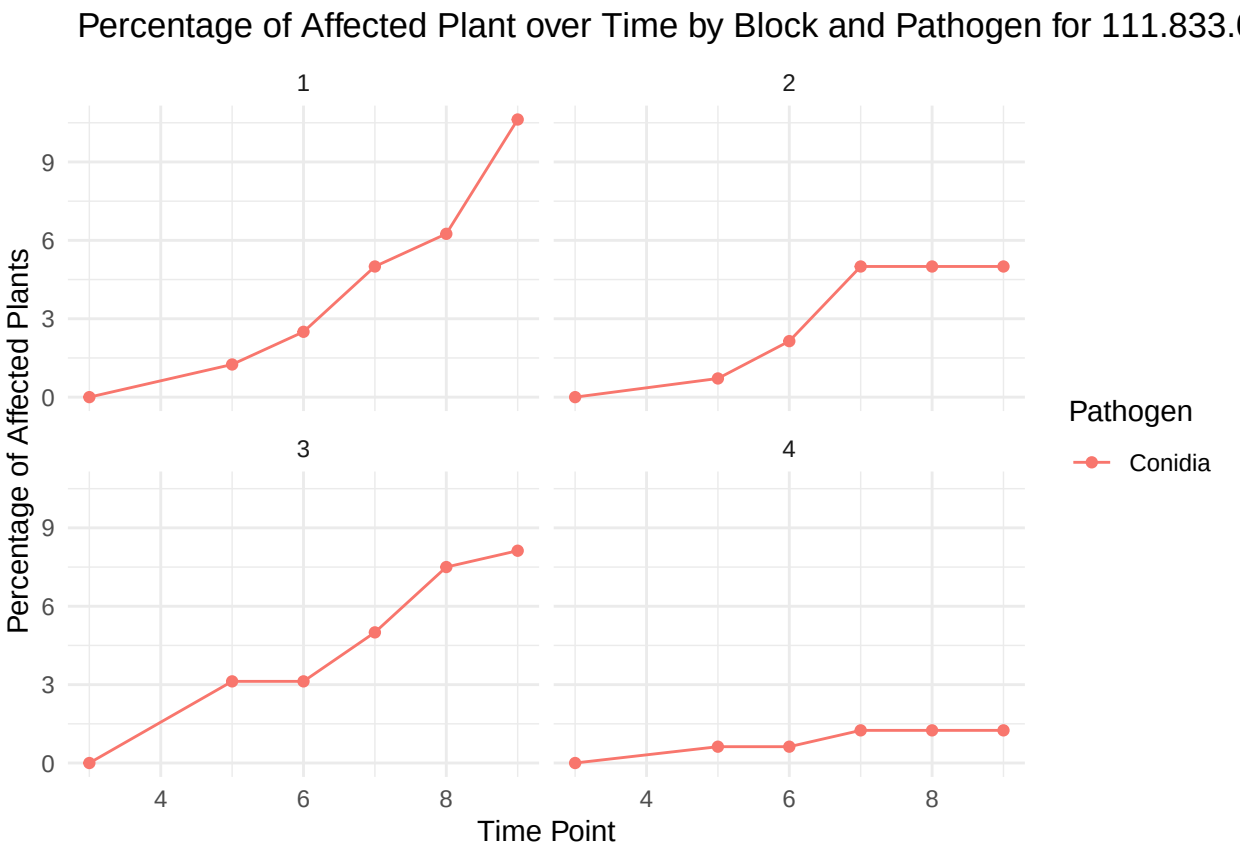
```
for (cultivar in unique(new_dataframe$Cultivar)) {
    print(analysis_by_cultivar_percentage(cultivar, TRUE))
}
```

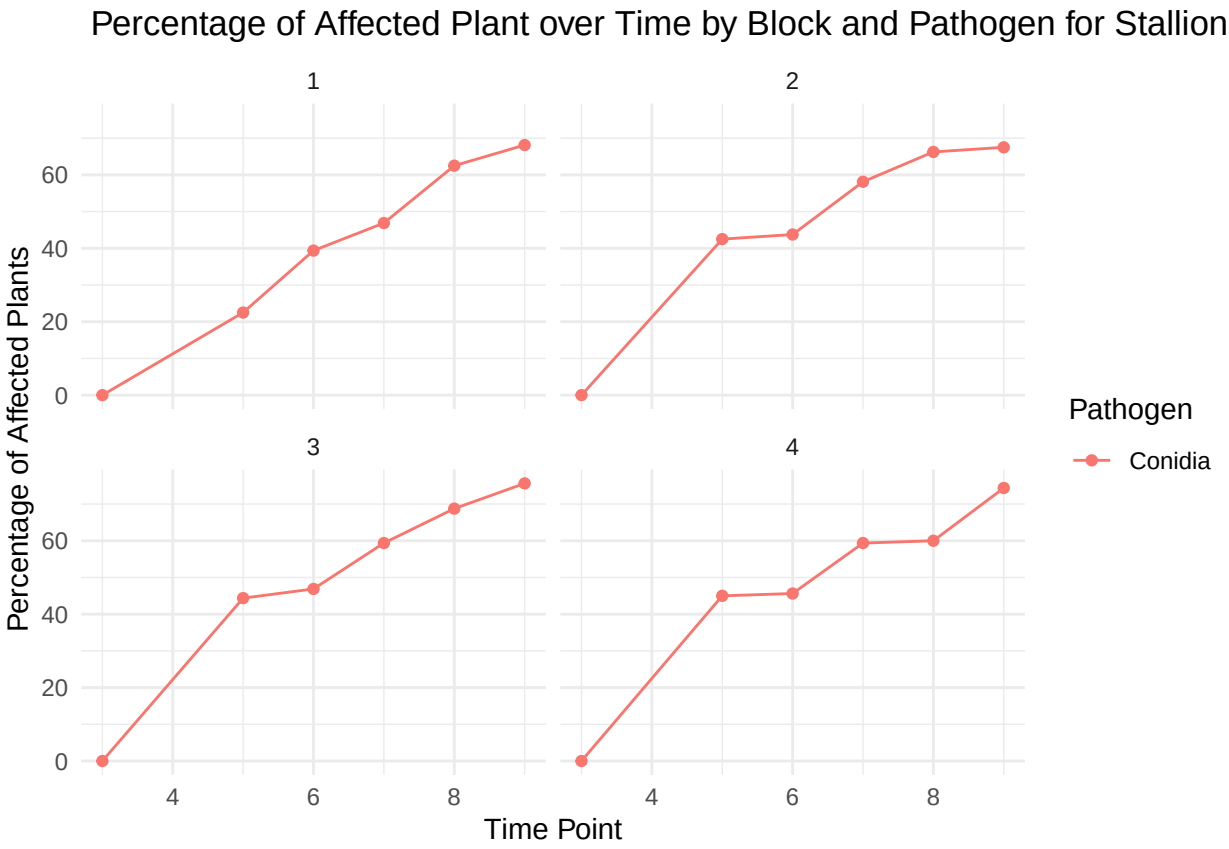


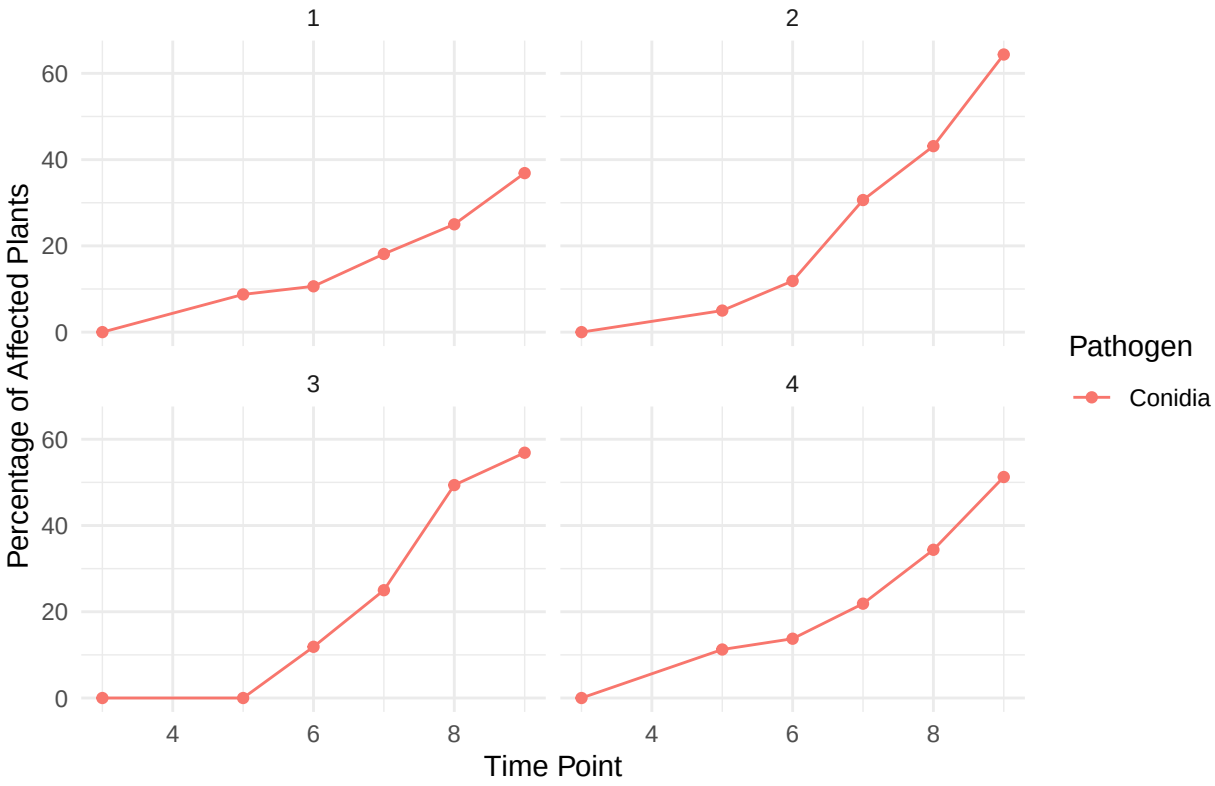

Percentage of Affected Plant over Time by Block and Pathogen for Myra
1
2
3
4
Percentage of Affected Plants
0
25
50
75
4
6
8
Time Point
Pathogen
Conidia

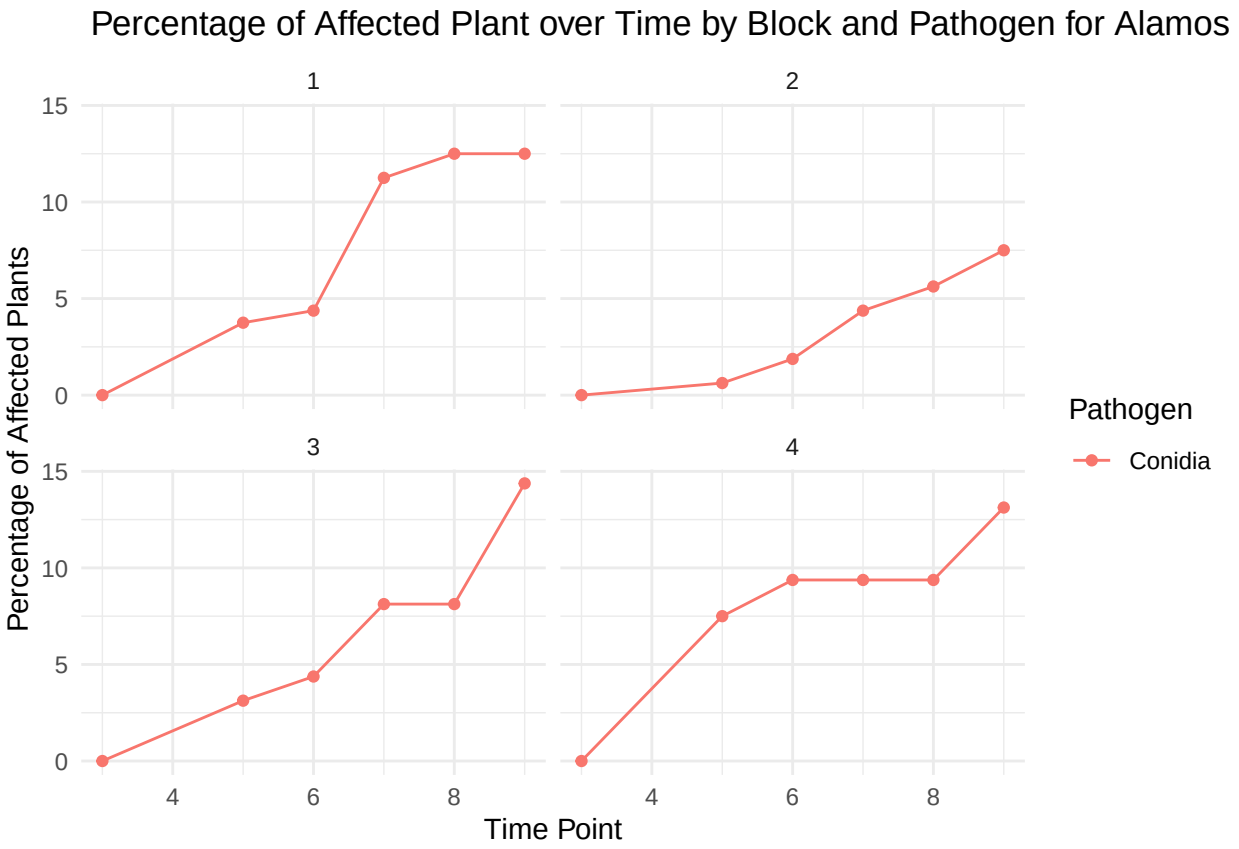

Percentage of Affected Plant over Time by Block and Pathogen for Sira
1
2
3
4
100
75
50
25
0
4
6
8
Percentage of Affected Plants
Time Point
Pathogen
Conidia

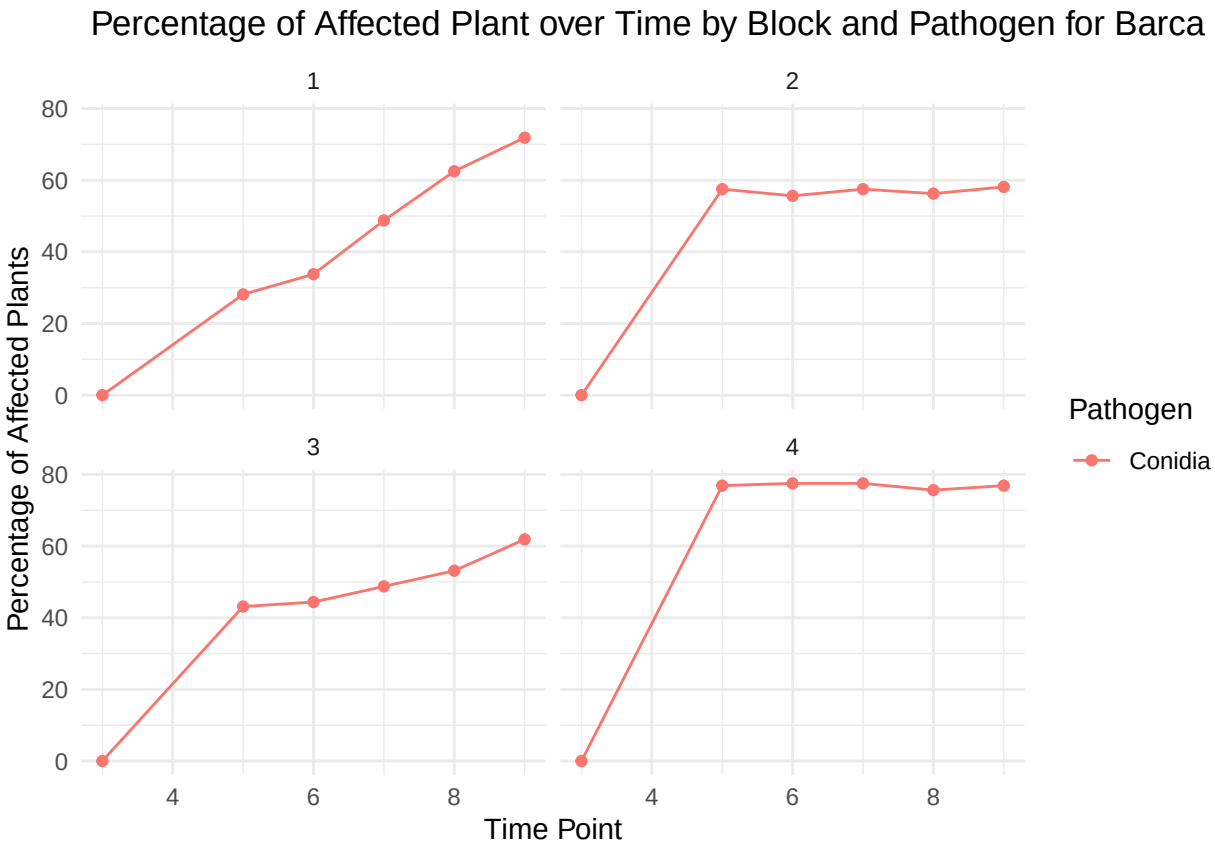

Percentage of Affected Plant over Time by Block and Pathogen for Softone
1
2
3
4
Percentage of Affected Plants
0
20
40
60
80
4
6
8
Time Point
Pathogen
Conidia

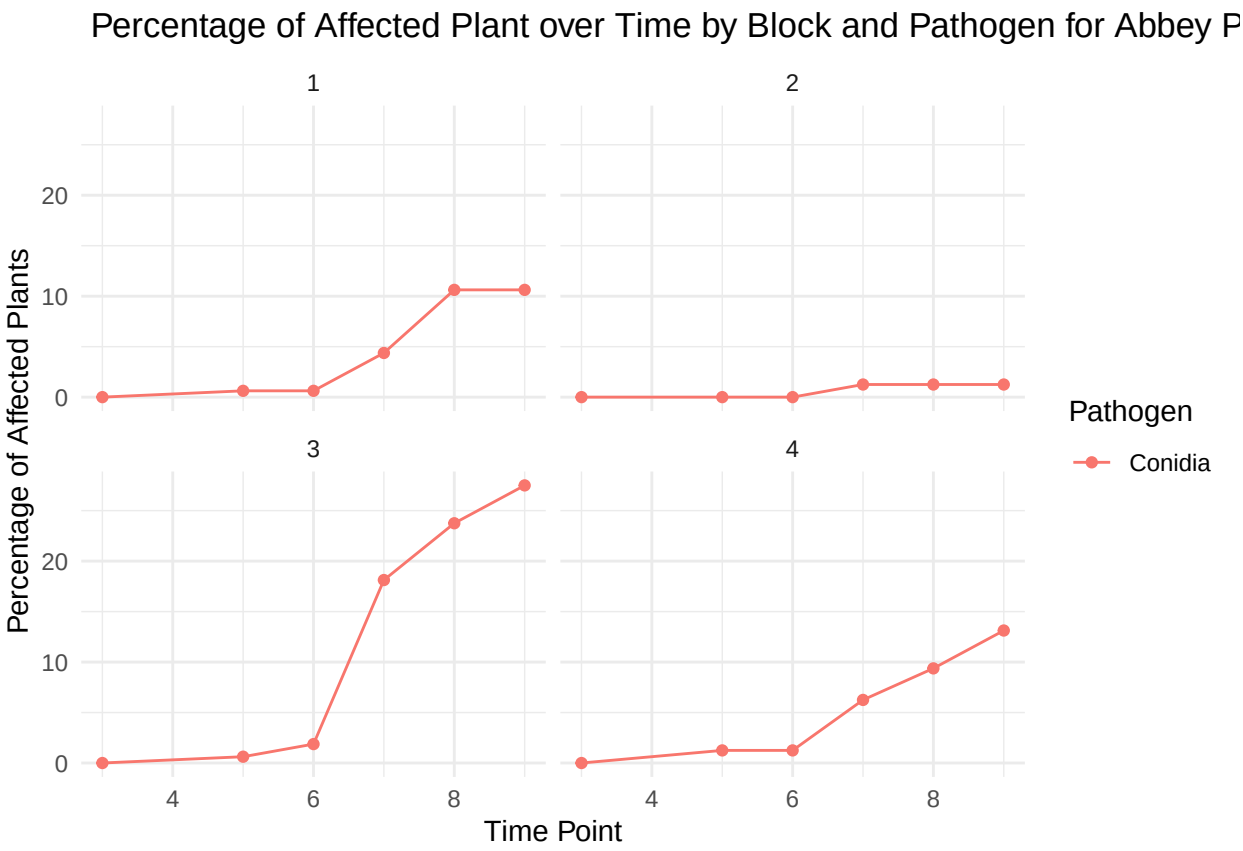

Percentage of Affected Plant over Time by Block and Pathogen for 111.833.(
1
2
3
4
Percentage of Affected Plants
0
3
6
9
4
6
8
Time Point
Pathogen
Conidia

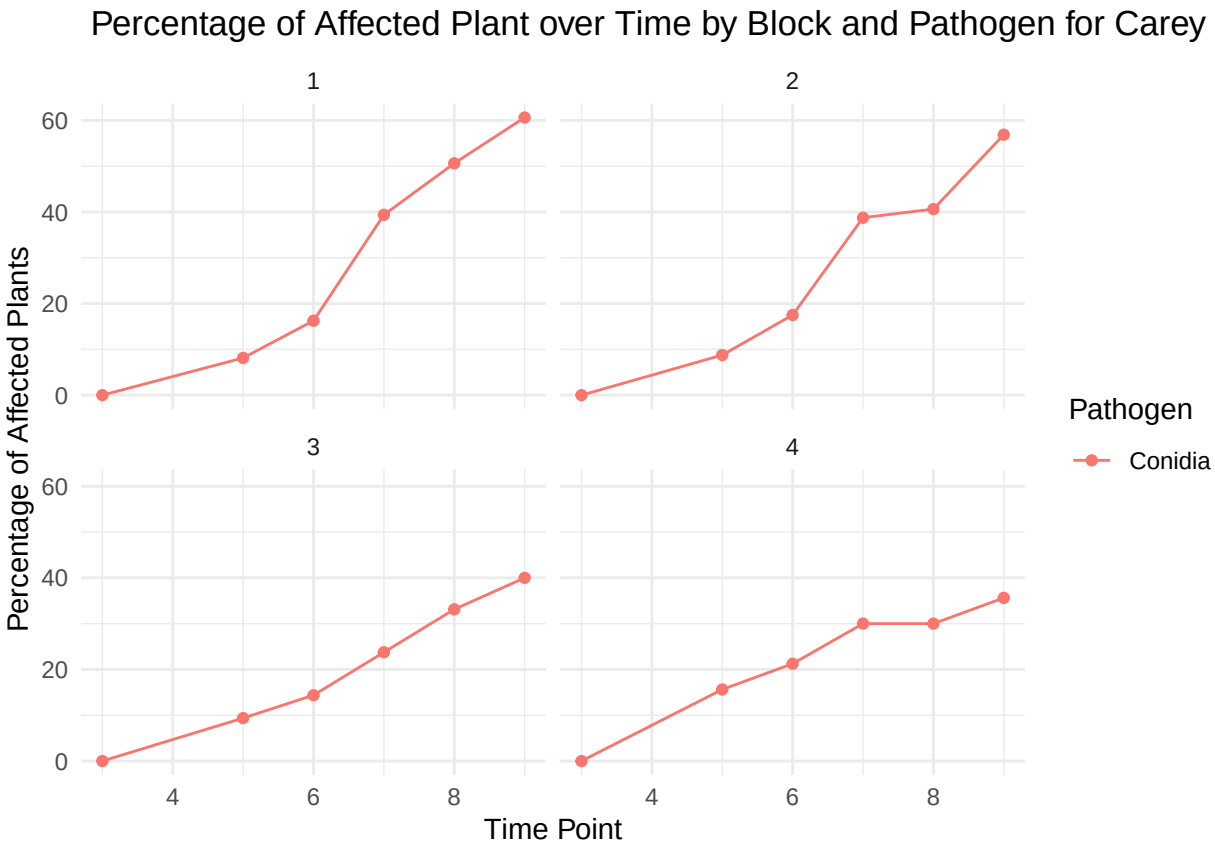

Percentage of Affected Plant over Time by Block and Pathogen for Stallion
1
2
3
4
Percentage of Affected Plants
0
20
40
60
4
6
8
Time Point
Pathogen
Conidia

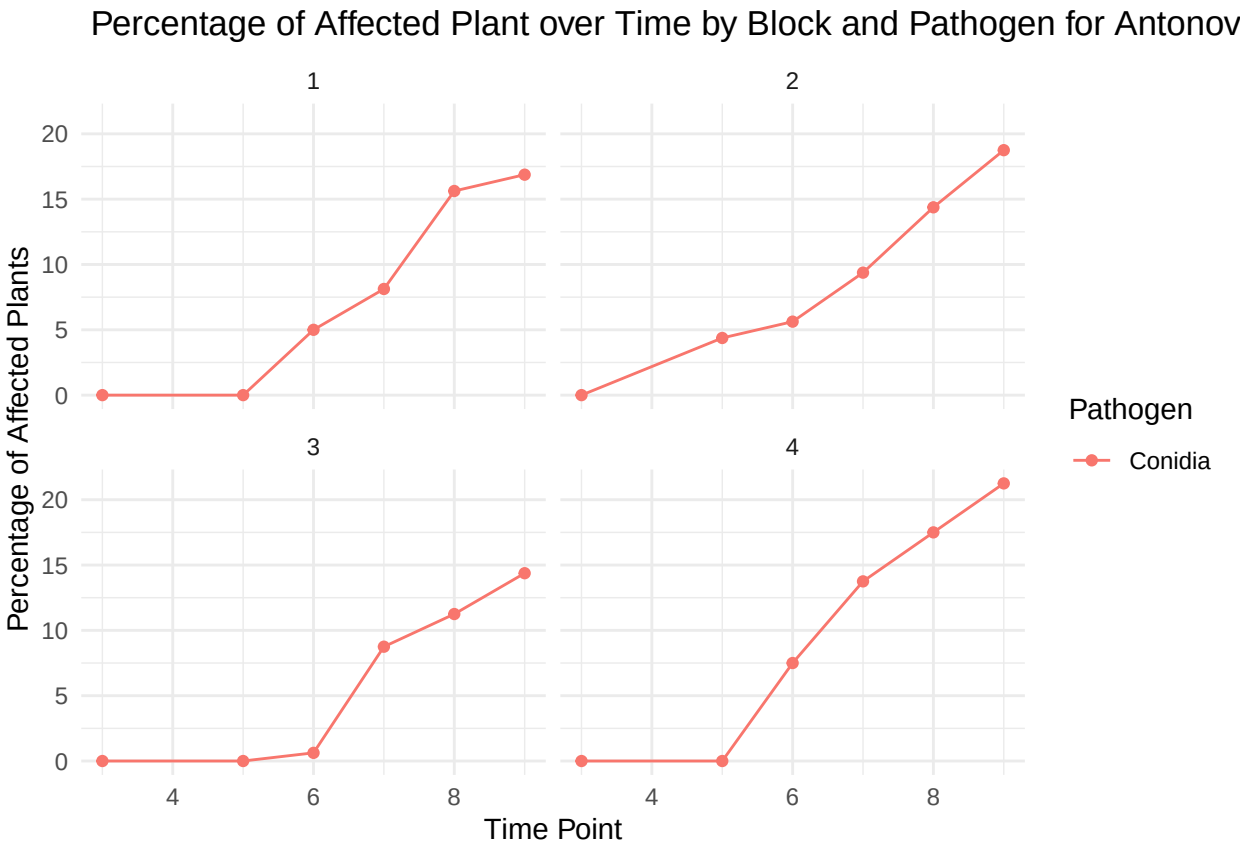

Percentage of Affected Plant over Time by Block and Pathogen for Ilonka
1
2
3
4
Percentage of Affected Plants
0
20
40
60
4
6
8
Time Point
Pathogen
Conidia

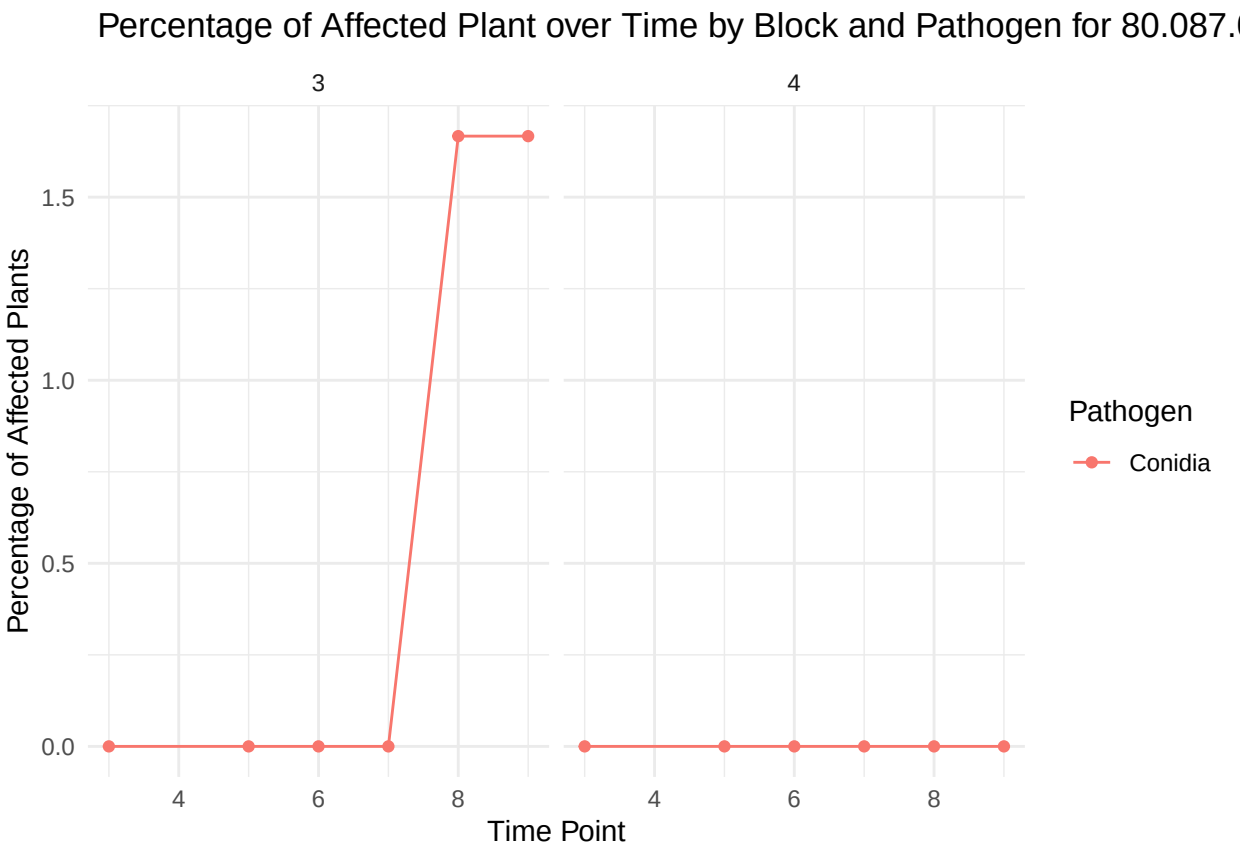

Percentage of Affected Plant over Time by Block and Pathogen for Alamos
1
2
3
4
15
10
5
0
4
6
8
Percentage of Affected Plants
Time Point
Pathogen
Conidia

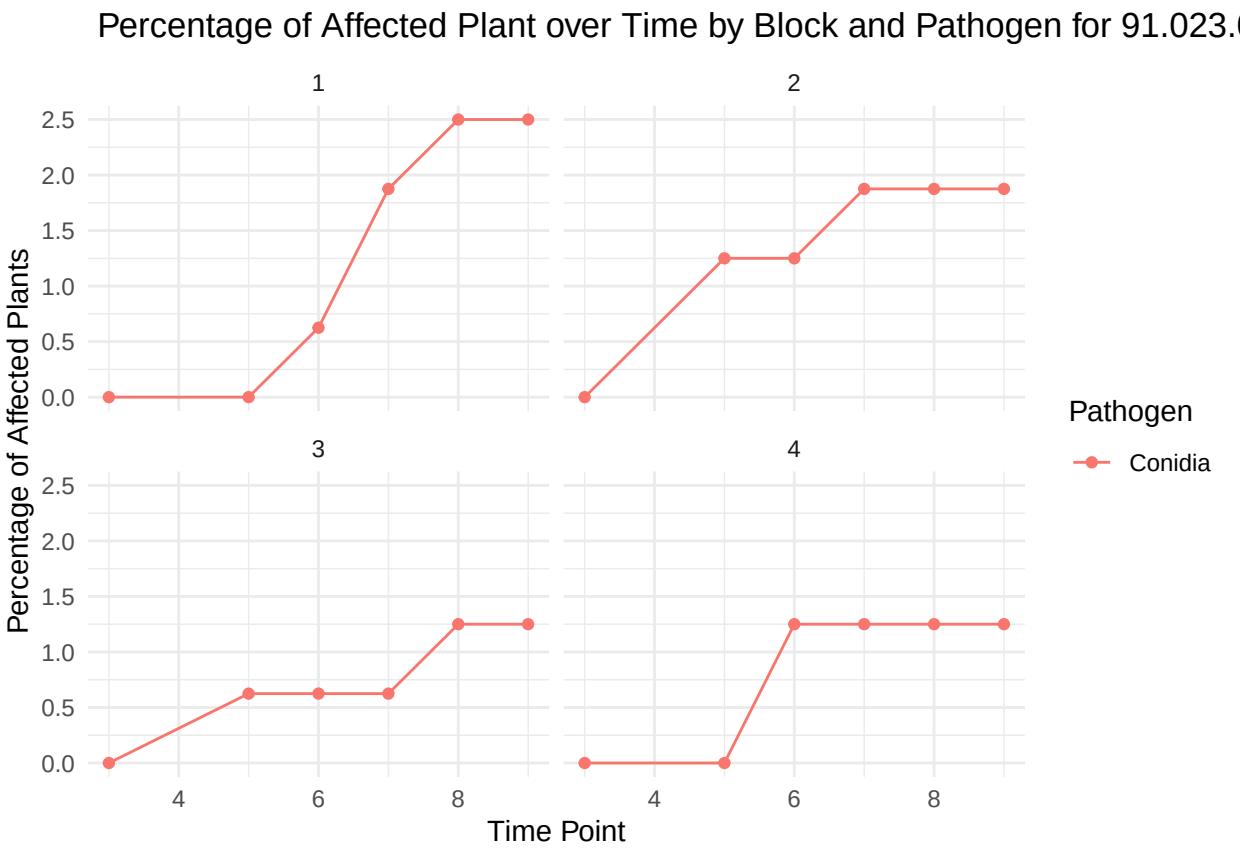

Percentage of Affected Plant over Time by Block and Pathogen for Barca
1
2
3
4
Percentage of Affected Plants
0
20
40
60
80
4
6
8
Time Point
Pathogen
Conidia

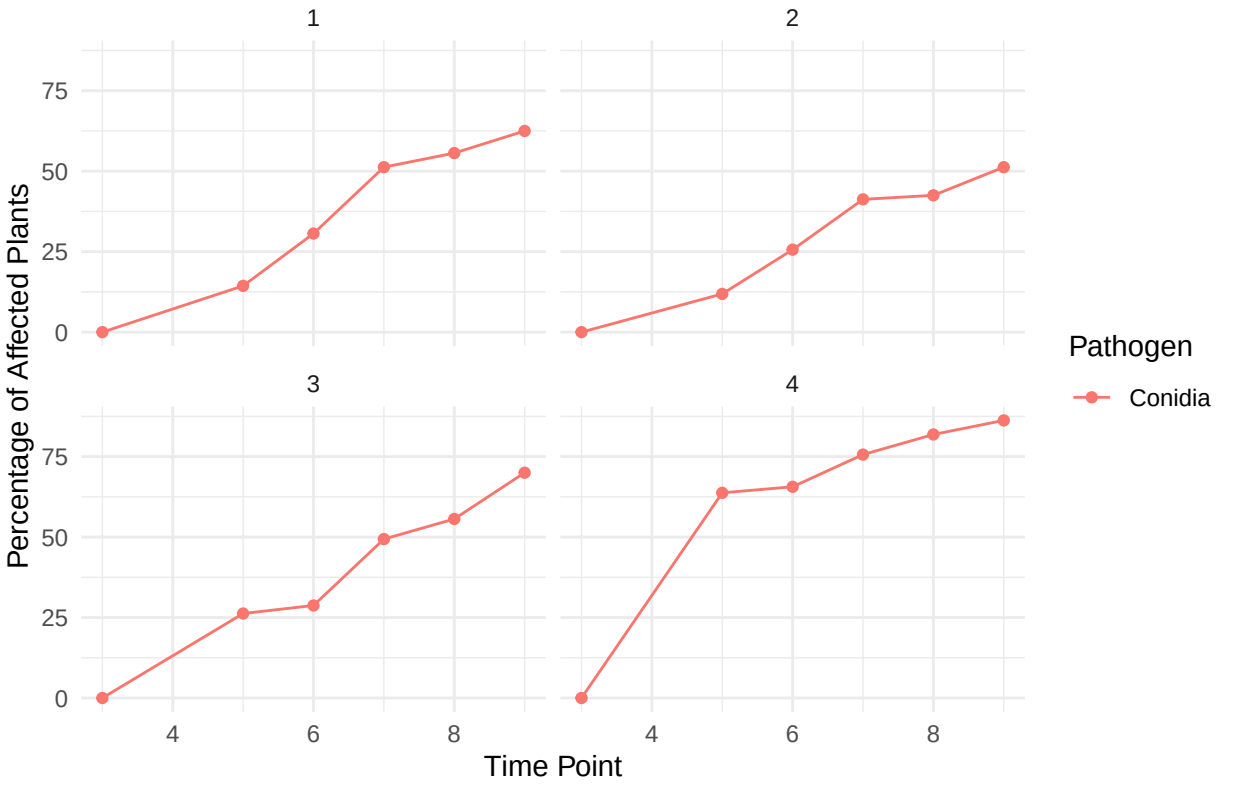

Percentage of Affected Plant over Time by Block and Pathogen for Abbey P
1
2
3
4
Percentage of Affected Plants
0
10
20
4
6
8
Time Point
Pathogen
Conidia


Percentage of Affected Plant over Time by Block and Pathogen for Carey
1
2
3
4
Percentage of Affected Plants
0
20
40
60
4
6
8
Time Point
Pathogen
Conidia


Percentage of Affected Plant over Time by Block and Pathogen for Antonov
1
2
3
4
Percentage of Affected Plants
0
5
10
15
20
4
6
8
Time Point
Pathogen
Conidia


Percentage of Affected Plant over Time by Block and Pathogen for 80.087.(
3
4
1.5
1.0
0.5
0.0
Percentage of Affected Plants
4
6
8
Time Point
Pathogen
Conidia


Percentage of Affected Plant over Time by Block and Pathogen for 91.023.(
1
2
3
4
Percentage of Affected Plants
0.0
0.5
1.0
1.5
2.0
2.5
4
6
8
Time Point
Pathogen
Conidia




```r
# AUC
analysis_by_cultivar_percentage <- function(cultivar, filtered=FALSE) {
  cultivar_data <- by_cultivar[[cultivar]]

  combined_data <- list()
  auc_data <- data.frame(Block = integer(), Pathogen = character(), Soiltype = character(), AUC = numer

  if (filtered) {
    cultivar_data <- cultivar_data %>% filter(Pathogen != "Microsclerotia", Soiltype != "Soil")
  }

  for (block in unique(cultivar_data$Block)) {
    block_data <- cultivar_data[cultivar_data$Block == block, ]
    block_ag <- block_data %>%
      group_by(Pathogen, Soiltype) %>%
      summarise(
        t3 = 0,
        t5 = mean(T5_per),
        t6 = mean(T6_per),
        t7 = mean(T7_per),
        t8 = mean(T8_per),
        t9 = mean(T9_per),
        .groups = "drop"
      ) %>%
      pivot_longer(cols = starts_with("t"), names_to = "TimePoint", values_to = "Percent")
```

```
    block_ag$Block <- block
    combined_data[[block]] <- block_ag

# Calculate AUC for each pathogen and soil type within the block
    for (combo in unique(paste(block_ag$Pathogen, block_ag$Soiltype, sep = "_"))) {
      combo_data <- block_ag[block_ag$Pathogen == strsplit(combo, "_")[[1]][1] & block_ag$Soiltype == st
      time_points <- as.numeric(gsub("t", "", combo_data$TimePoint))
      percent_values <- combo_data$Percent
      auc_value <- trapz(time_points, percent_values)
      auc_data <- rbind(auc_data, data.frame(Block = block, Pathogen = strsplit(combo, "_")[[1]][1], So
    }
  }

  return(auc_data)
}
```

```
auc_results <- list()
for (cultivar in unique(new_dataframe$Cultivar)) {
  auc_results[[cultivar]] <- analysis_by_cultivar_percentage(cultivar)
}

print(auc_results[["Kennedy"]])
```

```
##    Block       Pathogen     Soiltype      AUC Cultivar
## 1      1        Conidia Potting Soil 229.6875  Kennedy
## 2      1        Conidia         Soil 111.2500  Kennedy
## 3      1 Microsclerotia Potting Soil 182.8125  Kennedy
## 4      1 Microsclerotia         Soil  45.3125  Kennedy
## 5      2        Conidia Potting Soil 183.1250  Kennedy
## 6      2        Conidia         Soil 182.1875  Kennedy
## 7      2 Microsclerotia Potting Soil 135.3125  Kennedy
## 8      2 Microsclerotia         Soil  32.5000  Kennedy
## 9      3        Conidia Potting Soil 335.3125  Kennedy
## 10     3        Conidia         Soil 175.6250  Kennedy
## 11     3 Microsclerotia Potting Soil 104.6875  Kennedy
## 12     3 Microsclerotia         Soil 190.9375  Kennedy
## 13     4        Conidia Potting Soil 198.4375  Kennedy
## 14     4        Conidia         Soil 166.8750  Kennedy
## 15     4 Microsclerotia Potting Soil  82.5000  Kennedy
## 16     4 Microsclerotia         Soil  83.1250  Kennedy
```

```
print(auc_results[["Myra"]])
```

```
##   Block Pathogen     Soiltype      AUC Cultivar
## 1     1  Conidia Potting Soil 367.1875     Myra
## 2     2  Conidia Potting Soil 345.9375     Myra
## 3     3  Conidia Potting Soil 379.6875     Myra
## 4     4  Conidia Potting Soil 366.2500     Myra
```

Cleaning up

Removing Soiltype="Soil" and Pathogen="Microsclerotia"

```r
auc_results <- list()
for (cultivar in unique(new_dataframe$Cultivar)) {
  auc_results[[cultivar]] <- analysis_by_cultivar_percentage(cultivar, TRUE)
}

print(auc_results[["Kennedy"]])
```

```
##   Block Pathogen     Soiltype      AUC Cultivar
## 1     1  Conidia Potting Soil 229.6875  Kennedy
## 2     2  Conidia Potting Soil 183.1250  Kennedy
## 3     3  Conidia Potting Soil 335.3125  Kennedy
## 4     4  Conidia Potting Soil 198.4375  Kennedy
```

```r
print(auc_results[["Myra"]])
```

```
##   Block Pathogen     Soiltype      AUC Cultivar
## 1     1  Conidia Potting Soil 367.1875     Myra
## 2     2  Conidia Potting Soil 345.9375     Myra
## 3     3  Conidia Potting Soil 379.6875     Myra
## 4     4  Conidia Potting Soil 366.2500     Myra
```

```r
print(auc_results[["Barca"]])
```

```
##   Block Pathogen     Soiltype      AUC Cultivar
## 1     1  Conidia Potting Soil 223.1250    Barca
## 2     2  Conidia Potting Soil 284.6875    Barca
## 3     3  Conidia Potting Soil 241.8750    Barca
## 4     4  Conidia Potting Soil 384.3750    Barca
```

```r
print(auc_results[["Sira"]])
```

```
##   Block Pathogen     Soiltype      AUC Cultivar
## 1     1  Conidia Potting Soil 395.0000     Sira
## 2     2  Conidia Potting Soil 367.1875     Sira
## 3     3  Conidia Potting Soil 451.5625     Sira
## 4     4  Conidia Potting Soil 411.8750     Sira
```

```r
print(auc_results[["Softone"]])
```

```
##   Block Pathogen     Soiltype      AUC Cultivar
## 1     1  Conidia Potting Soil 209.0625  Softone
## 2     2  Conidia Potting Soil 163.4375  Softone
## 3     3  Conidia Potting Soil 228.7500  Softone
## 4     4  Conidia Potting Soil 200.9375  Softone
```

```r
print(auc_results[["Stallion"]])
```

```
##   Block Pathogen     Soiltype      AUC Cultivar
## 1     1  Conidia Potting Soil 216.5625 Stallion
## 2     2  Conidia Potting Soil 265.6250 Stallion
## 3     3  Conidia Potting Soil 279.3750 Stallion
## 4     4  Conidia Potting Soil 269.6875 Stallion
```

```
print(auc_results[["Carey"]])
```

```
##   Block Pathogen     Soiltype      AUC Cultivar
## 1     1  Conidia Potting Soil 148.7500    Carey
## 2     2  Conidia Potting Soil 138.4375    Carey
## 3     3  Conidia Potting Soil 105.3125    Carey
## 4     4  Conidia Potting Soil 122.5000    Carey
```

```
print(auc_results[["130.857.000"]])
```

```
##   Block Pathogen     Soiltype      AUC    Cultivar
## 1     1  Conidia Potting Soil 190.3125 130.857.000
## 2     2  Conidia Potting Soil 152.8125 130.857.000
## 3     3  Conidia Potting Soil 208.1250 130.857.000
## 4     4  Conidia Potting Soil 361.8750 130.857.000
```

```
print(auc_results[["Alamos"]])
```

```
##   Block Pathogen     Soiltype     AUC Cultivar
## 1     1  Conidia Potting Soil 40.0000   Alamos
## 2     2  Conidia Potting Soil 16.5625   Alamos
## 3     3  Conidia Potting Soil 32.5000   Alamos
## 4     4  Conidia Potting Soil 45.9375   Alamos
```

```
print(auc_results[["Ilonka"]])
```

```
##   Block Pathogen     Soiltype      AUC Cultivar
## 1     1  Conidia Potting Soil  85.3125   Ilonka
## 2     2  Conidia Potting Soil 125.3125   Ilonka
## 3     3  Conidia Potting Soil 114.6875   Ilonka
## 4     4  Conidia Potting Soil 112.5000   Ilonka
```

```
print(auc_results[["Antonov"]])
```

```
##   Block Pathogen     Soiltype     AUC Cultivar
## 1     1  Conidia Potting Soil 37.1875  Antonov
## 2     2  Conidia Potting Soil 45.3125  Antonov
## 3     3  Conidia Potting Soil 27.8125  Antonov
## 4     4  Conidia Potting Soil 49.3750  Antonov
```

```
print(auc_results[["Abbey Purple"]])
```

```
##   Block Pathogen     Soiltype     AUC     Cultivar
## 1     1  Conidia Potting Soil 21.8750 Abbey Purple
## 2     2  Conidia Potting Soil  3.1250 Abbey Purple
## 3     3  Conidia Potting Soil 58.4375 Abbey Purple
## 4     4  Conidia Potting Soil 25.3125 Abbey Purple
```

```r
print(auc_results[["91.023.000"]])
```

```
##   Block Pathogen     Soiltype    AUC   Cultivar
## 1     1  Conidia Potting Soil 6.2500 91.023.000
## 2     2  Conidia Potting Soil 7.8125 91.023.000
## 3     3  Conidia Potting Soil 4.0625 91.023.000
## 4     4  Conidia Potting Soil 4.3750 91.023.000
```

```r
print(auc_results[["80.087.000"]])
```

```
##   Block Pathogen     Soiltype AUC   Cultivar
## 1     3  Conidia Potting Soil 2.5 80.087.000
## 2     4  Conidia Potting Soil 0.0 80.087.000
```

```r
print(auc_results[["111.833.000"]])
```

```
##   Block Pathogen     Soiltype      AUC    Cultivar
## 1     1  Conidia Potting Soil 20.93750 111.833.000
## 2     2  Conidia Potting Soil 15.71429 111.833.000
## 3     3  Conidia Potting Soil 24.37500 111.833.000
## 4     4  Conidia Potting Soil  4.68750 111.833.000
```

```r
df_anova <- bind_rows(auc_results)
df_anova$Block <- as.factor(df_anova$Block)

# ANOVA test
anova_result <- aov(AUC ~ Cultivar + Block, data = df_anova)
summary(anova_result)
```

```
##             Df Sum Sq Mean Sq F value Pr(>F)
## Cultivar    14 992782   70913  48.651 <2e-16 ***
## Block        3  10218    3406   2.337 0.0882 .
## Residuals   40  58303    1458
## ---
## Signif. codes:  0 ’***’ 0.001 ’**’ 0.01 ’*’ 0.05 ’.’ 0.1 ’ ’ 1
```

```r
# estimated marginal means
emmeans_result <- emmeans(anova_result, specs = ~ Cultivar)

# cumulative link model
lsd_result <- cld(emmeans_result, adjust = "sidak")

# contrast function
pairwise_comparisons <- contrast(emmeans_result, method = "pairwise", ref = "Kennedy")
summary(pairwise_comparisons)
```

```
##  contrast                   estimate   SE df t.ratio p.value
##  111.833.000 - 130.857.000  -211.85 27.0 40  -7.848  <.0001
##  111.833.000 - 80.087.000     28.46 33.5 40   0.851  0.9999
##  111.833.000 - 91.023.000     10.80 27.0 40   0.400  1.0000
```

```
##  111.833.000 - Abbey Purple   -10.76 27.0 40  -0.399  1.0000
##  111.833.000 - Alamos         -17.32 27.0 40  -0.642  1.0000
##  111.833.000 - Antonov        -23.49 27.0 40  -0.870  0.9999
##  111.833.000 - Barca         -267.09 27.0 40  -9.894  <.0001
##  111.833.000 - Carey         -112.32 27.0 40  -4.161  0.0116
##  111.833.000 - Ilonka         -93.02 27.0 40  -3.446  0.0745
##  111.833.000 - Kennedy       -220.21 27.0 40  -8.157  <.0001
##  111.833.000 - Myra          -348.34 27.0 40 -12.903  <.0001
##  111.833.000 - Sira          -389.98 27.0 40 -14.446  <.0001
##  111.833.000 - Softone       -184.12 27.0 40  -6.820  <.0001
##  111.833.000 - Stallion      -241.38 27.0 40  -8.941  <.0001
##  130.857.000 - 80.087.000     240.31 33.5 40   7.183  <.0001
##  130.857.000 - 91.023.000     222.66 27.0 40   8.248  <.0001
##  130.857.000 - Abbey Purple   201.09 27.0 40   7.449  <.0001
##  130.857.000 - Alamos         194.53 27.0 40   7.206  <.0001
##  130.857.000 - Antonov        188.36 27.0 40   6.977  <.0001
##  130.857.000 - Barca          -55.23 27.0 40  -2.046  0.7599
##  130.857.000 - Carey           99.53 27.0 40   3.687  0.0412
##  130.857.000 - Ilonka         118.83 27.0 40   4.402  0.0059
##  130.857.000 - Kennedy         -8.36 27.0 40  -0.310  1.0000
##  130.857.000 - Myra          -136.48 27.0 40  -5.056  0.0008
##  130.857.000 - Sira          -178.12 27.0 40  -6.598  <.0001
##  130.857.000 - Softone         27.73 27.0 40   1.027  0.9992
##  130.857.000 - Stallion       -29.53 27.0 40  -1.094  0.9984
##  80.087.000 - 91.023.000      -17.65 33.5 40  -0.528  1.0000
##  80.087.000 - Abbey Purple    -39.22 33.5 40  -1.172  0.9967
##  80.087.000 - Alamos          -45.78 33.5 40  -1.368  0.9857
##  80.087.000 - Antonov         -51.95 33.5 40  -1.553  0.9592
##  80.087.000 - Barca          -295.55 33.5 40  -8.834  <.0001
##  80.087.000 - Carey          -140.78 33.5 40  -4.208  0.0102
##  80.087.000 - Ilonka         -121.48 33.5 40  -3.631  0.0474
##  80.087.000 - Kennedy        -248.67 33.5 40  -7.433  <.0001
##  80.087.000 - Myra           -376.80 33.5 40 -11.263  <.0001
##  80.087.000 - Sira           -418.44 33.5 40 -12.508  <.0001
##  80.087.000 - Softone        -212.58 33.5 40  -6.354  <.0001
##  80.087.000 - Stallion       -269.84 33.5 40  -8.066  <.0001
##  91.023.000 - Abbey Purple    -21.56 27.0 40  -0.799  1.0000
##  91.023.000 - Alamos          -28.12 27.0 40  -1.042  0.9990
##  91.023.000 - Antonov         -34.30 27.0 40  -1.270  0.9928
##  91.023.000 - Barca          -277.89 27.0 40 -10.294  <.0001
##  91.023.000 - Carey          -123.12 27.0 40  -4.561  0.0037
##  91.023.000 - Ilonka         -103.83 27.0 40  -3.846  0.0273
##  91.023.000 - Kennedy        -231.02 27.0 40  -8.557  <.0001
##  91.023.000 - Myra           -359.14 27.0 40 -13.303  <.0001
##  91.023.000 - Sira           -400.78 27.0 40 -14.846  <.0001
##  91.023.000 - Softone        -194.92 27.0 40  -7.220  <.0001
##  91.023.000 - Stallion       -252.19 27.0 40  -9.342  <.0001
##  Abbey Purple - Alamos         -6.56 27.0 40  -0.243  1.0000
##  Abbey Purple - Antonov       -12.73 27.0 40  -0.472  1.0000
##  Abbey Purple - Barca        -256.33 27.0 40  -9.495  <.0001
##  Abbey Purple - Carey        -101.56 27.0 40  -3.762  0.0340
##  Abbey Purple - Ilonka        -82.27 27.0 40  -3.047  0.1796
##  Abbey Purple - Kennedy      -209.45 27.0 40  -7.759  <.0001
##  Abbey Purple - Myra         -337.58 27.0 40 -12.505  <.0001
```

```
##  Abbey Purple - Sira         -379.22 27.0 40 -14.047  <.0001
##  Abbey Purple - Softone      -173.36 27.0 40  -6.422  <.0001
##  Abbey Purple - Stallion     -230.62 27.0 40  -8.543  <.0001
##  Alamos - Antonov              -6.17 27.0 40  -0.229  1.0000
##  Alamos - Barca              -249.77 27.0 40  -9.252  <.0001
##  Alamos - Carey               -95.00 27.0 40  -3.519  0.0625
##  Alamos - Ilonka              -75.70 27.0 40  -2.804  0.2853
##  Alamos - Kennedy            -202.89 27.0 40  -7.516  <.0001
##  Alamos - Myra               -331.02 27.0 40 -12.262  <.0001
##  Alamos - Sira               -372.66 27.0 40 -13.804  <.0001
##  Alamos - Softone            -166.80 27.0 40  -6.179  <.0001
##  Alamos - Stallion           -224.06 27.0 40  -8.300  <.0001
##  Antonov - Barca             -243.59 27.0 40  -9.023  <.0001
##  Antonov - Carey              -88.83 27.0 40  -3.290  0.1068
##  Antonov - Ilonka             -69.53 27.0 40  -2.576  0.4148
##  Antonov - Kennedy           -196.72 27.0 40  -7.287  <.0001
##  Antonov - Myra              -324.84 27.0 40 -12.033  <.0001
##  Antonov - Sira              -366.48 27.0 40 -13.575  <.0001
##  Antonov - Softone           -160.62 27.0 40  -5.950  0.0001
##  Antonov - Stallion          -217.89 27.0 40  -8.071  <.0001
##  Barca - Carey                154.77 27.0 40   5.733  0.0001
##  Barca - Ilonka               174.06 27.0 40   6.448  <.0001
##  Barca - Kennedy               46.88 27.0 40   1.736  0.9086
##  Barca - Myra                 -81.25 27.0 40  -3.010  0.1937
##  Barca - Sira                -122.89 27.0 40  -4.552  0.0038
##  Barca - Softone               82.97 27.0 40   3.073  0.1703
##  Barca - Stallion              25.70 27.0 40   0.952  0.9996
##  Carey - Ilonka                19.30 27.0 40   0.715  1.0000
##  Carey - Kennedy             -107.89 27.0 40  -3.997  0.0183
##  Carey - Myra                -236.02 27.0 40  -8.743  <.0001
##  Carey - Sira                -277.66 27.0 40 -10.285  <.0001
##  Carey - Softone              -71.80 27.0 40  -2.660  0.3642
##  Carey - Stallion            -129.06 27.0 40  -4.781  0.0019
##  Ilonka - Kennedy            -127.19 27.0 40  -4.711  0.0024
##  Ilonka - Myra               -255.31 27.0 40  -9.457  <.0001
##  Ilonka - Sira               -296.95 27.0 40 -11.000  <.0001
##  Ilonka - Softone             -91.09 27.0 40  -3.374  0.0881
##  Ilonka - Stallion           -148.36 27.0 40  -5.496  0.0002
##  Kennedy - Myra              -128.12 27.0 40  -4.746  0.0021
##  Kennedy - Sira              -169.77 27.0 40  -6.289  <.0001
##  Kennedy - Softone             36.09 27.0 40   1.337  0.9884
##  Kennedy - Stallion           -21.17 27.0 40  -0.784  1.0000
##  Myra - Sira                  -41.64 27.0 40  -1.542  0.9613
##  Myra - Softone               164.22 27.0 40   6.083  <.0001
##  Myra - Stallion              106.95 27.0 40   3.962  0.0201
##  Sira - Softone               205.86 27.0 40   7.626  <.0001
##  Sira - Stallion              148.59 27.0 40   5.504  0.0002
##  Softone - Stallion           -57.27 27.0 40  -2.121  0.7138
##
## Results are averaged over the levels of: Block
## P value adjustment: tukey method for comparing a family of 15 estimates
```

Pairwise T-test

```
pairwise.t.test(df_anova$AUC, df_anova$Cultivar, p.adjust.method = "bonferroni")
```

```
##
##  Pairwise comparisons using t tests with pooled SD
##
## data:  df_anova$AUC and df_anova$Cultivar
##
##              111.833.000 130.857.000 80.087.000 91.023.000 Abbey Purple Alamos
## 130.857.000  2.5e-07     -           -          -          -            -
## 80.087.000   1.00000     5.7e-06     -          -          -            -
## 91.023.000   1.00000     7.2e-08     1.00000    -          -            -
## Abbey Purple 1.00000     8.9e-07     1.00000    1.00000    -            -
## Alamos       1.00000     1.9e-06     1.00000    1.00000    1.00000      -
## Antonov      1.00000     4.0e-06     1.00000    1.00000    1.00000      1.00000
## Barca        4.7e-10     1.00000     2.9e-08    1.5e-10    1.6e-09      3.2e-09
## Carey        0.02743     0.10671     0.06616    0.00832    0.08639      0.16977
## Ilonka       0.20722     0.01343     0.32956    0.06811    0.59180      1.00000
## Kennedy      9.5e-08     1.00000     2.6e-06    2.7e-08    3.3e-07      7.2e-07
## Myra         1.1e-13     0.00182     1.9e-11    3.8e-14    3.0e-13      5.8e-13
## Sira         2.1e-15     1.4e-05     5.9e-13    8.2e-16    5.7e-15      1.1e-14
## Softone      6.7e-06     1.00000     8.4e-05    1.9e-06    2.4e-05      5.2e-05
## Stallion     8.4e-09     1.00000     3.3e-07    2.5e-09    2.9e-08      6.1e-08
##              Antonov Barca   Carey   Ilonka  Kennedy Myra    Sira    Softone
## 130.857.000  -       -       -       -       -       -       -       -
## 80.087.000   -       -       -       -       -       -       -       -
## 91.023.000   -       -       -       -       -       -       -       -
## Abbey Purple -       -       -       -       -       -       -       -
## Alamos       -       -       -       -       -       -       -       -
## Antonov      -       -       -       -       -       -       -       -
## Barca        6.5e-09 -       -       -       -       -       -       -
## Carey        0.31438 0.00022 -       -       -       -       -       -
## Ilonka       1.00000 2.2e-05 1.00000 -       -       -       -       -
## Kennedy      1.5e-06 1.00000 0.04424 0.00526 -       -       -       -
## Myra         1.1e-12 0.65121 1.5e-08 1.7e-09 0.00473 -       -       -
## Sira         1.9e-14 0.00854 1.5e-10 1.9e-11 3.7e-05 1.00000 -       -
## Softone      0.00011 0.55367 1.00000 0.25132 1.00000 7.1e-05 5.1e-07 -
## Stallion     1.2e-07 1.00000 0.00425 0.00046 1.00000 0.04890 0.00045 1.00000
##
## P value adjustment method: bonferroni
```

```
# Simulate different number of blocks

redistribute_blocks <- function(df, num_new_blocks) {
  if (num_new_blocks <= 0) {
    stop("Number of blocks must be a positive integer.")
  }

  set.seed(123)
  shuffled_df <- df[sample(nrow(df)), ]
```

```
  # Assign new block numbers
  shuffled_df$Block <- as.factor(rep(1:num_new_blocks, length.out = nrow(shuffled_df)))

  return(shuffled_df)
}
```

```
# Anova test with new number of blocks
ddf_anova <- redistribute_blocks(df_anova, 11)

anova_result <- aov(AUC ~ Cultivar + Block, data = ddf_anova)
summary(anova_result)
```

```
##             Df Sum Sq Mean Sq F value Pr(>F)
## Cultivar    14 992782   70913  54.966 <2e-16 ***
## Block       10  25948    2595   2.011 0.0644 .
## Residuals   33  42574    1290
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

```
# estimated marginal means
emmeans_result <- emmeans(anova_result, specs = ~ Cultivar)

# cumulative link model
lsd_result <- cld(emmeans_result, adjust = "sidak")

# contrast function
pairwise_comparisons <- contrast(emmeans_result, method = "pairwise", ref = "Kennedy")
summary(pairwise_comparisons)
```

```
##  contrast                   estimate   SE df t.ratio p.value
##  111.833.000 - 130.857.000   -237.63 32.3 33  -7.363  <.0001
##  111.833.000 - 80.087.000     -11.52 37.1 33  -0.311  1.0000
##  111.833.000 - 91.023.000      13.47 31.4 33   0.429  1.0000
##  111.833.000 - Abbey Purple   -28.48 31.2 33  -0.912  0.9997
##  111.833.000 - Alamos          -6.61 31.4 33  -0.210  1.0000
##  111.833.000 - Antonov        -49.28 29.7 33  -1.658  0.9313
##  111.833.000 - Barca         -287.85 27.3 33 -10.542  <.0001
##  111.833.000 - Carey         -130.46 27.8 33  -4.692  0.0034
##  111.833.000 - Ilonka         -76.46 28.3 33  -2.706  0.3442
##  111.833.000 - Kennedy       -227.07 29.0 33  -7.830  <.0001
##  111.833.000 - Myra          -375.27 30.3 33 -12.372  <.0001
##  111.833.000 - Sira          -402.19 29.4 33 -13.691  <.0001
##  111.833.000 - Softone       -177.35 26.1 33  -6.783  <.0001
##  111.833.000 - Stallion      -261.58 30.3 33  -8.624  <.0001
##  130.857.000 - 80.087.000     226.10 37.2 33   6.075  0.0001
##  130.857.000 - 91.023.000     251.09 28.8 33   8.728  <.0001
##  130.857.000 - Abbey Purple   209.14 26.2 33   7.983  <.0001
##  130.857.000 - Alamos         231.02 30.5 33   7.575  <.0001
##  130.857.000 - Antonov        188.35 27.1 33   6.944  <.0001
##  130.857.000 - Barca          -50.23 29.6 33  -1.696  0.9198
##  130.857.000 - Carey          107.17 30.4 33   3.522  0.0686
##  130.857.000 - Ilonka         161.17 29.9 33   5.398  0.0005
```

```
##  130.857.000 - Kennedy        10.55 30.8 33   0.343  1.0000
##  130.857.000 - Myra         -137.65 28.7 33  -4.795  0.0026
##  130.857.000 - Sira         -164.57 29.1 33  -5.658  0.0002
##  130.857.000 - Softone        60.27 32.2 33   1.869  0.8515
##  130.857.000 - Stallion      -23.96 31.6 33  -0.758  1.0000
##  80.087.000 - 91.023.000      24.99 34.9 33   0.715  1.0000
##  80.087.000 - Abbey Purple   -16.96 36.6 33  -0.464  1.0000
##  80.087.000 - Alamos           4.91 34.8 33   0.141  1.0000
##  80.087.000 - Antonov        -37.76 36.4 33  -1.038  0.9990
##  80.087.000 - Barca         -276.33 34.5 33  -8.012  <.0001
##  80.087.000 - Carey         -118.94 36.0 33  -3.308  0.1103
##  80.087.000 - Ilonka         -64.93 35.8 33  -1.814  0.8757
##  80.087.000 - Kennedy       -215.55 34.2 33  -6.302  <.0001
##  80.087.000 - Myra          -363.75 32.7 33 -11.139  <.0001
##  80.087.000 - Sira          -390.67 36.1 33 -10.813  <.0001
##  80.087.000 - Softone       -165.83 37.0 33  -4.483  0.0061
##  80.087.000 - Stallion      -250.06 31.8 33  -7.860  <.0001
##  91.023.000 - Abbey Purple   -41.95 27.2 33  -1.543  0.9595
##  91.023.000 - Alamos         -20.07 28.6 33  -0.701  1.0000
##  91.023.000 - Antonov        -62.75 28.6 33  -2.198  0.6643
##  91.023.000 - Barca         -301.32 29.5 33 -10.208  <.0001
##  91.023.000 - Carey         -143.93 28.9 33  -4.977  0.0016
##  91.023.000 - Ilonka         -89.92 28.2 33  -3.192  0.1408
##  91.023.000 - Kennedy       -240.54 28.8 33  -8.354  <.0001
##  91.023.000 - Myra          -388.74 28.5 33 -13.645  <.0001
##  91.023.000 - Sira          -415.66 28.5 33 -14.582  <.0001
##  91.023.000 - Softone       -190.82 31.3 33  -6.101  0.0001
##  91.023.000 - Stallion      -275.05 29.0 33  -9.474  <.0001
##  Abbey Purple - Alamos        21.87 29.6 33   0.740  1.0000
##  Abbey Purple - Antonov      -20.80 26.3 33  -0.792  1.0000
##  Abbey Purple - Barca       -259.37 28.7 33  -9.049  <.0001
##  Abbey Purple - Carey       -101.98 28.7 33  -3.551  0.0641
##  Abbey Purple - Ilonka       -47.98 28.9 33  -1.663  0.9299
##  Abbey Purple - Kennedy     -198.59 29.7 33  -6.683  <.0001
##  Abbey Purple - Myra        -346.79 28.6 33 -12.134  <.0001
##  Abbey Purple - Sira        -373.71 27.4 33 -13.650  <.0001
##  Abbey Purple - Softone     -148.87 31.3 33  -4.761  0.0028
##  Abbey Purple - Stallion    -233.10 30.7 33  -7.581  <.0001
##  Alamos - Antonov            -42.67 30.3 33  -1.408  0.9806
##  Alamos - Barca             -281.24 29.0 33  -9.698  <.0001
##  Alamos - Carey             -123.85 30.0 33  -4.131  0.0154
##  Alamos - Ilonka             -69.85 27.3 33  -2.562  0.4283
##  Alamos - Kennedy           -220.47 27.8 33  -7.927  <.0001
##  Alamos - Myra              -368.66 28.8 33 -12.801  <.0001
##  Alamos - Sira              -395.59 28.1 33 -14.060  <.0001
##  Alamos - Softone           -170.74 31.3 33  -5.448  0.0004
##  Alamos - Stallion          -254.97 29.8 33  -8.569  <.0001
##  Antonov - Barca            -238.57 28.2 33  -8.474  <.0001
##  Antonov - Carey             -81.18 27.5 33  -2.954  0.2245
##  Antonov - Ilonka            -27.18 29.2 33  -0.931  0.9997
##  Antonov - Kennedy          -177.79 29.4 33  -6.048  0.0001
##  Antonov - Myra             -325.99 28.4 33 -11.487  <.0001
##  Antonov - Sira             -352.92 27.3 33 -12.939  <.0001
##  Antonov - Softone          -128.07 29.8 33  -4.297  0.0100
```

```
##  Antonov - Stallion          -212.30 29.7 33  -7.140  <.0001
##  Barca - Carey                157.39 27.7 33   5.690  0.0002
##  Barca - Ilonka               211.40 27.8 33   7.592  <.0001
##  Barca - Kennedy               60.78 27.8 33   2.190  0.6692
##  Barca - Myra                 -87.42 28.0 33  -3.122  0.1624
##  Barca - Sira                -114.34 27.2 33  -4.206  0.0127
##  Barca - Softone              110.50 28.1 33   3.938  0.0252
##  Barca - Stallion              26.27 28.8 33   0.911  0.9997
##  Carey - Ilonka                54.00 27.8 33   1.940  0.8165
##  Carey - Kennedy              -96.61 27.2 33  -3.556  0.0634
##  Carey - Myra                -244.81 28.3 33  -8.656  <.0001
##  Carey - Sira                -271.74 27.2 33  -9.985  <.0001
##  Carey - Softone              -46.89 27.8 33  -1.684  0.9236
##  Carey - Stallion            -131.12 29.1 33  -4.504  0.0057
##  Ilonka - Kennedy            -150.62 26.9 33  -5.593  0.0003
##  Ilonka - Myra               -298.82 28.2 33 -10.607  <.0001
##  Ilonka - Sira               -325.74 27.9 33 -11.670  <.0001
##  Ilonka - Softone            -100.90 27.5 33  -3.667  0.0489
##  Ilonka - Stallion           -185.12 29.8 33  -6.213  <.0001
##  Kennedy - Myra              -148.20 27.3 33  -5.433  0.0004
##  Kennedy - Sira              -175.12 27.4 33  -6.401  <.0001
##  Kennedy - Softone             49.72 28.9 33   1.718  0.9122
##  Kennedy - Stallion           -34.51 28.1 33  -1.229  0.9943
##  Myra - Sira                  -26.92 29.0 33  -0.927  0.9997
##  Myra - Softone               197.92 29.6 33   6.691  <.0001
##  Myra - Stallion              113.69 27.0 33   4.208  0.0126
##  Sira - Softone               224.84 30.1 33   7.461  <.0001
##  Sira - Stallion              140.61 30.2 33   4.657  0.0038
##  Softone - Stallion           -84.23 30.2 33  -2.789  0.3005
##
## Results are averaged over the levels of: Block
## P value adjustment: tukey method for comparing a family of 15 estimates
```

```r
set.seed(42)

# Get means of each variable per each block
adjusted_dataframe <- new_dataframe %>%
  group_by(Cultivar, Block) %>%
  summarise(
    T9_per_mean = mean(T9_per, na.rm = TRUE),
    T5_per_mean = mean(T5_per, na.rm = TRUE),
    T6_per_mean = mean(T6_per, na.rm = TRUE),
    T7_per_mean = mean(T7_per, na.rm = TRUE),
    T8_per_mean = mean(T8_per, na.rm = TRUE),
    T5_length_mean = mean(T5_length, na.rm = TRUE),
    T5_RGR_mean = mean(T5_RGR, na.rm = TRUE),
  ) %>%
  ungroup()
```

```
## `summarise()` has grouped output by 'Cultivar'. You can override using the
## `.groups` argument.
```

```r
data_size <- nrow(adjusted_dataframe)

train_indices <- sample(1:data_size, size = round(0.8 * data_size))

train_set <- adjusted_dataframe[train_indices, ]
test_set <- adjusted_dataframe[-train_indices, ]

#First model with all variables
model.1 <- lm(T9_per_mean ~ T5_per_mean + T6_per_mean + T7_per_mean + T8_per_mean + T5_length_mean + T5
summary(model.1)
```

```
##
## Call:
## lm(formula = T9_per_mean ~ T5_per_mean + T6_per_mean + T7_per_mean +
##     T8_per_mean + T5_length_mean + T5_RGR_mean, data = train_set)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -8.0442 -3.0921 -0.6718  2.5502  9.5765
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)    -2.71763    7.71387  -0.352   0.7265
## T5_per_mean     0.08781    0.17225   0.510   0.6131
## T6_per_mean    -0.58342    0.24941  -2.339   0.0245 *
## T7_per_mean     0.34074    0.23407   1.456   0.1535
## T8_per_mean     1.16301    0.13718   8.478 2.21e-10 ***
## T5_length_mean -0.04025    0.47199  -0.085   0.9325
## T5_RGR_mean     0.12543    0.49259   0.255   0.8003
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 4.627 on 39 degrees of freedom
## Multiple R-squared:  0.9829, Adjusted R-squared:  0.9802
## F-statistic: 372.9 on 6 and 39 DF,  p-value: < 2.2e-16
```

```r
# Second model with earlier time points
model.2 <- lm(T9_per_mean ~ T5_per_mean + T6_per_mean + T5_length_mean + T5_RGR_mean, data = train_set)
summary(model.2)
```

```
##
## Call:
## lm(formula = T9_per_mean ~ T5_per_mean + T6_per_mean + T5_length_mean +
##     T5_RGR_mean, data = train_set)
##
## Residuals:
##     Min      1Q  Median      3Q     Max
## -26.585 -12.202  -3.284   9.483  30.152
##
## Coefficients:
##                Estimate Std. Error t value Pr(>|t|)
## (Intercept)     10.9604    24.4169   0.449 0.655878
```

```
## T5_per_mean     -1.6973     0.4705  -3.607 0.000833 ***
## T6_per_mean      2.6597     0.4560   5.832 7.49e-07 ***
## T5_length_mean   0.5463     1.5000   0.364 0.717571
## T5_RGR_mean     -0.5772     1.5699  -0.368 0.714996
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
##
## Residual standard error: 14.9 on 41 degrees of freedom
## Multiple R-squared:  0.8133, Adjusted R-squared:  0.7951
## F-statistic: 44.65 on 4 and 41 DF,  p-value: 2.023e-14
```

```
predictions <- predict(model.1, newdata = test_set)

mse <- mean((test_set$T9_per_mean - predictions)^2)

rmse <- sqrt(mse)

print(paste("MSE:", mse))
```

```
## [1] "MSE: 10.0795876264494"
```

```
print(paste("RMSE:", rmse))
```

```
## [1] "RMSE: 3.1748366298834"
```

```
# Model with only week 5 data
model_w5 <- lm(T9_per_mean ~ T5_per_mean + T5_length_mean + T5_RGR_mean, data = train_set)
predictions_w5 <- predict(model_w5, newdata = test_set)
mse_w5 <- mean((test_set$T9_per_mean - predictions_w5)^2)
rmse_w5 <- sqrt(mse_w5)

# Model with only week 6 data
model_w6 <- lm(T9_per_mean ~ T6_per_mean + T5_length_mean + T5_RGR_mean, data = train_set)
predictions_w6 <- predict(model_w6, newdata = test_set)
mse_w6 <- mean((test_set$T9_per_mean - predictions_w6)^2)
rmse_w6 <- sqrt(mse_w6)

print(paste("Week 5 MSE:", mse_w5, "RMSE:", rmse_w5))
```

```
## [1] "Week 5 MSE: 294.548003979153 RMSE: 17.1624008803883"
```

```
print(paste("Week 6 MSE:", mse_w6, "RMSE:", rmse_w6))
```

```
## [1] "Week 6 MSE: 267.717854523651 RMSE: 16.3620858854747"
```

Splitting cultivars into two sets (Susceptible, Resistnat) based on Mean AUC (affected leaves rate)

```r
# Assuming auc_results is a list of dataframes, each representing a cultivar
# Function to calculate the mean AUC for each cultivar
mean_auc_per_cultivar <- function(df) {
  mean_auc <- mean(df$AUC, na.rm = TRUE)
  data.frame(Cultivar = unique(df$Cultivar), Mean_AUC = mean_auc)
}

# Apply the function to each element in the list and combine the results
combined_auc_means <- do.call(rbind, lapply(auc_results, mean_auc_per_cultivar))

sorted_auc_means <- combined_auc_means[order(combined_auc_means$Mean_AUC, decreasing = TRUE), ]
split_index <- ceiling(nrow(sorted_auc_means) / 2)

# Splitting into two sets
susceptible_cultivars <- sorted_auc_means[1:split_index, ]
resistant_cultivars <- sorted_auc_means[(split_index + 1):nrow(sorted_auc_means), ]
```

```r
# Splitting the adjusted_dataframe
resistant_data <- adjusted_dataframe[adjusted_dataframe$Cultivar %in% resistant_cultivars$Cultivar, ]
susceptible_data <- adjusted_dataframe[adjusted_dataframe$Cultivar %in% susceptible_cultivars$Cultivar,

# Adding the "Sensitivity" column
resistant_data <- resistant_data %>% mutate(Sensitivity = "Resistant")
susceptible_data <- susceptible_data %>% mutate(Sensitivity = "Susceptible")

T5_t_test_result <- t.test(T5_per_mean ~ Sensitivity, data = rbind(resistant_data, susceptible_data))
T6_t_test_result <- t.test(T6_per_mean ~ Sensitivity, data = rbind(resistant_data, susceptible_data))

print(T5_t_test_result)
```

```
##
##  Welch Two Sample t-test
##
## data:  T5_per_mean by Sensitivity
## t = -7.871, df = 32.166, p-value = 5.373e-09
## alternative hypothesis: true difference in means between group Resistant and group Susceptible is no
## 95 percent confidence interval:
##  -43.34479 -25.52544
## sample estimates:
##   mean in group Resistant mean in group Susceptible
##                   2.09478                  36.52990
```

```r
print(T6_t_test_result)
```

```
##
##  Welch Two Sample t-test
##
## data:  T6_per_mean by Sensitivity
## t = -9.2931, df = 33.563, p-value = 8.345e-11
## alternative hypothesis: true difference in means between group Resistant and group Susceptible is no
## 95 percent confidence interval:
##  -47.19571 -30.25126
```

```
## sample estimates:
##   mean in group Resistant mean in group Susceptible
##                   3.95261                  42.67610
```