Identification of resistant clones of Eurasian (Myriophyllum spicatum) and hybrid (M. spicatum X M. sibricum) watermilfoil to an operational rate of fluridone - Data Analysis

Authors: Gregory M. Chorak and Ryan A. Thum

10/16/2020

1. Loading the data into R.

```
library(readr)
Fluridone_data <- read_csv("~/Desktop/Fluridone/IPSM Submit/Fluridone_Full.csv")
```

```
## Parsed with column specification:
## cols(
##   ID = col_character(),
##   Accession_Genotype = col_character(),
##   Treat = col_character(),
##   Tank = col_character(),
##   Rep = col_character(),
##   DryWt = col_double(),
##   Trial = col_double()
## )
```

```
print.data.frame(Fluridone_data)
```

```
##          ID Accession_Genotype Treat   Tank     Rep DryWt Trial
## 1     Ind.1           1_MG-237     C Tank.1 ATank.1  1.47     1
## 2     Ind.2           1_MG-237     C Tank.1 BTank.1  1.50     1
## 3     Ind.3           1_MG-237     C Tank.1 CTank.1  1.77     1
## 4     Ind.4           1_MG-237     C Tank.2 ATank.2  0.94     1
## 5     Ind.5           1_MG-237     C Tank.2 BTank.2  1.10     1
## 6     Ind.6           1_MG-237     C Tank.2 CTank.2  1.07     1
## 7     Ind.7           1_MG-237     C Tank.5 ATank.5  1.20     1
## 8     Ind.8           1_MG-237     C Tank.5 BTank.5  1.30     1
## 9     Ind.9           1_MG-237     C Tank.5 CTank.5  1.26     1
## 10   Ind.10           1_MG-237     T Tank.3 ATank.3  1.08     1
## 11   Ind.11           1_MG-237     T Tank.3 BTank.3  1.29     1
## 12   Ind.12           1_MG-237     T Tank.3 CTank.3  0.89     1
## 13   Ind.13           1_MG-237     T Tank.4 ATank.4  1.14     1
## 14   Ind.14           1_MG-237     T Tank.4 BTank.4  0.69     1
## 15   Ind.15           1_MG-237     T Tank.4 CTank.4  1.43     1
## 16   Ind.16           1_MG-237     T Tank.6 ATank.6  1.11     1
## 17   Ind.17           1_MG-237     T Tank.6 BTank.6  0.71     1
## 18   Ind.18           1_MG-237     T Tank.6 CTank.6  1.62     1
## 19   Ind.19           1_MG-237     C Tank.1 ATank.1  1.03     2
```

```
## 20   Ind.20          1_MG-237     C Tank.1 BTank.1  1.41     2
## 21   Ind.21          1_MG-237     C Tank.1 CTank.1  1.11     2
## 22   Ind.22          1_MG-237     C Tank.4 ATank.4  0.70     2
## 23   Ind.23          1_MG-237     C Tank.4 BTank.4  0.84     2
## 24   Ind.24          1_MG-237     C Tank.4 CTank.4  1.87     2
## 25   Ind.25          1_MG-237     C Tank.6 ATank.6  0.99     2
## 26   Ind.26          1_MG-237     C Tank.6 BTank.6  2.15     2
## 27   Ind.27          1_MG-237     C Tank.6 CTank.6  0.66     2
## 28   Ind.28          1_MG-237     T Tank.2 ATank.2  0.71     2
## 29   Ind.29          1_MG-237     T Tank.2 BTank.2  0.76     2
## 30   Ind.30          1_MG-237     T Tank.2 CTank.2  1.84     2
## 31   Ind.31          1_MG-237     T Tank.3 ATank.3  0.56     2
## 32   Ind.32          1_MG-237     T Tank.3 BTank.3  2.09     2
## 33   Ind.33          1_MG-237     T Tank.3 CTank.3  0.81     2
## 34   Ind.34          1_MG-237     T Tank.5 ATank.5  1.24     2
## 35   Ind.35          1_MG-237     T Tank.5 BTank.5  0.79     2
## 36   Ind.36          1_MG-237     T Tank.5 CTank.5  2.15     2
## 37   Ind.37          2_MG-237     C Tank.1 ATank.1  1.85     1
## 38   Ind.38          2_MG-237     C Tank.1 BTank.1  1.52     1
## 39   Ind.39          2_MG-237     C Tank.1 CTank.1  1.68     1
## 40   Ind.40          2_MG-237     C Tank.2 ATank.2  1.43     1
## 41   Ind.41          2_MG-237     C Tank.2 BTank.2  1.14     1
## 42   Ind.42          2_MG-237     C Tank.2 CTank.2  1.28     1
## 43   Ind.43          2_MG-237     C Tank.5 ATank.5  0.97     1
## 44   Ind.44          2_MG-237     C Tank.5 BTank.5  1.53     1
## 45   Ind.45          2_MG-237     C Tank.5 CTank.5  1.20     1
## 46   Ind.46          2_MG-237     T Tank.3 ATank.3  1.34     1
## 47   Ind.47          2_MG-237     T Tank.3 BTank.3  0.62     1
## 48   Ind.48          2_MG-237     T Tank.3 CTank.3  1.42     1
## 49   Ind.49          2_MG-237     T Tank.4 ATank.4  0.84     1
## 50   Ind.50          2_MG-237     T Tank.4 BTank.4  0.76     1
## 51   Ind.51          2_MG-237     T Tank.4 CTank.4  0.78     1
## 52   Ind.52          2_MG-237     T Tank.6 ATank.6  1.50     1
## 53   Ind.53          2_MG-237     T Tank.6 BTank.6  1.72     1
## 54   Ind.54          2_MG-237     T Tank.6 CTank.6  1.51     1
## 55   Ind.55          2_MG-237     C Tank.1 ATank.1  1.50     2
## 56   Ind.56          2_MG-237     C Tank.1 BTank.1  1.13     2
## 57   Ind.57          2_MG-237     C Tank.1 CTank.1  1.03     2
## 58   Ind.58          2_MG-237     C Tank.4 ATank.4  1.88     2
## 59   Ind.59          2_MG-237     C Tank.4 BTank.4  1.00     2
## 60   Ind.60          2_MG-237     C Tank.4 CTank.4  0.61     2
## 61   Ind.61          2_MG-237     C Tank.6 ATank.6  0.52     2
## 62   Ind.62          2_MG-237     C Tank.6 BTank.6  1.09     2
## 63   Ind.63          2_MG-237     C Tank.6 CTank.6  1.64     2
## 64   Ind.64          2_MG-237     T Tank.2 ATank.2  0.97     2
## 65   Ind.65          2_MG-237     T Tank.2 BTank.2  1.26     2
## 66   Ind.66          2_MG-237     T Tank.2 CTank.2  0.80     2
## 67   Ind.67          2_MG-237     T Tank.3 ATank.3  1.24     2
## 68   Ind.68          2_MG-237     T Tank.3 BTank.3  0.87     2
## 69   Ind.69          2_MG-237     T Tank.3 CTank.3  0.73     2
## 70   Ind.70          2_MG-237     T Tank.5 ATank.5  1.30     2
## 71   Ind.71          2_MG-237     T Tank.5 BTank.5  0.88     2
## 72   Ind.72          2_MG-237     T Tank.5 CTank.5  1.88     2
## 73   Ind.73          3_MG-237     C Tank.1 ATank.1  1.39     1
```

```
## 74   Ind.74          3_MG-237     C Tank.1 BTank.1  1.31     1
## 75   Ind.75          3_MG-237     C Tank.1 CTank.1  1.57     1
## 76   Ind.76          3_MG-237     C Tank.2 ATank.2  1.70     1
## 77   Ind.77          3_MG-237     C Tank.2 BTank.2  1.34     1
## 78   Ind.78          3_MG-237     C Tank.2 CTank.2  1.22     1
## 79   Ind.79          3_MG-237     C Tank.5 ATank.5  1.03     1
## 80   Ind.80          3_MG-237     C Tank.5 BTank.5  0.89     1
## 81   Ind.81          3_MG-237     C Tank.5 CTank.5  0.99     1
## 82   Ind.82          3_MG-237     T Tank.3 ATank.3  1.32     1
## 83   Ind.83          3_MG-237     T Tank.3 BTank.3  1.20     1
## 84   Ind.84          3_MG-237     T Tank.3 CTank.3  1.22     1
## 85   Ind.85          3_MG-237     T Tank.4 ATank.4  0.60     1
## 86   Ind.86          3_MG-237     T Tank.4 BTank.4  0.34     1
## 87   Ind.87          3_MG-237     T Tank.4 CTank.4  0.88     1
## 88   Ind.88          3_MG-237     T Tank.6 ATank.6  0.99     1
## 89   Ind.89          3_MG-237     T Tank.6 BTank.6  1.24     1
## 90   Ind.90          3_MG-237     T Tank.6 CTank.6  0.89     1
## 91   Ind.91          3_MG-237     C Tank.1 ATank.1  1.48     2
## 92   Ind.92          3_MG-237     C Tank.1 BTank.1  0.16     2
## 93   Ind.93          3_MG-237     C Tank.1 CTank.1  0.48     2
## 94   Ind.94          3_MG-237     C Tank.4 ATank.4  1.36     2
## 95   Ind.95          3_MG-237     C Tank.4 BTank.4  0.83     2
## 96   Ind.96          3_MG-237     C Tank.4 CTank.4  1.45     2
## 97   Ind.97          3_MG-237     C Tank.6 ATank.6  1.44     2
## 98   Ind.98          3_MG-237     C Tank.6 BTank.6  0.93     2
## 99   Ind.99          3_MG-237     C Tank.6 CTank.6  2.27     2
## 100 Ind.100          3_MG-237     T Tank.2 ATank.2  1.00     2
## 101 Ind.101          3_MG-237     T Tank.2 BTank.2  0.94     2
## 102 Ind.102          3_MG-237     T Tank.2 CTank.2  0.89     2
## 103 Ind.103          3_MG-237     T Tank.3 ATank.3  1.48     2
## 104 Ind.104          3_MG-237     T Tank.3 BTank.3  0.91     2
## 105 Ind.105          3_MG-237     T Tank.3 CTank.3  1.63     2
## 106 Ind.106          3_MG-237     T Tank.5 ATank.5  0.23     2
## 107 Ind.107          3_MG-237     T Tank.5 BTank.5  1.74     2
## 108 Ind.108          3_MG-237     T Tank.5 CTank.5  0.33     2
## 109 Ind.109          4_MG-237     C Tank.1 ATank.1  1.40     1
## 110 Ind.110          4_MG-237     C Tank.1 BTank.1  1.21     1
## 111 Ind.111          4_MG-237     C Tank.1 CTank.1  1.84     1
## 112 Ind.112          4_MG-237     C Tank.2 ATank.2  1.43     1
## 113 Ind.113          4_MG-237     C Tank.2 BTank.2  1.20     1
## 114 Ind.114          4_MG-237     C Tank.2 CTank.2  1.17     1
## 115 Ind.115          4_MG-237     C Tank.5 ATank.5  1.35     1
## 116 Ind.116          4_MG-237     C Tank.5 BTank.5  1.47     1
## 117 Ind.117          4_MG-237     C Tank.5 CTank.5  1.09     1
## 118 Ind.118          4_MG-237     T Tank.3 ATank.3  0.80     1
## 119 Ind.119          4_MG-237     T Tank.3 BTank.3  0.94     1
## 120 Ind.120          4_MG-237     T Tank.3 CTank.3  0.43     1
## 121 Ind.121          4_MG-237     T Tank.4 ATank.4  0.73     1
## 122 Ind.122          4_MG-237     T Tank.4 BTank.4  0.71     1
## 123 Ind.123          4_MG-237     T Tank.4 CTank.4  0.65     1
## 124 Ind.124          4_MG-237     T Tank.6 ATank.6  0.66     1
## 125 Ind.125          4_MG-237     T Tank.6 BTank.6  0.84     1
## 126 Ind.126          4_MG-237     T Tank.6 CTank.6  1.08     1
## 127 Ind.127          4_MG-237     C Tank.1 ATank.1  0.51     2
```

```
## 128 Ind.128          4_MG-237     C Tank.1 BTank.1  1.49     2
## 129 Ind.129          4_MG-237     C Tank.1 CTank.1  1.28     2
## 130 Ind.130          4_MG-237     C Tank.4 ATank.4  1.28     2
## 131 Ind.131          4_MG-237     C Tank.4 BTank.4  1.94     2
## 132 Ind.132          4_MG-237     C Tank.4 CTank.4  2.34     2
## 133 Ind.133          4_MG-237     C Tank.6 ATank.6  0.76     2
## 134 Ind.134          4_MG-237     C Tank.6 BTank.6  1.38     2
## 135 Ind.135          4_MG-237     C Tank.6 CTank.6  1.83     2
## 136 Ind.136          4_MG-237     T Tank.2 ATank.2  0.93     2
## 137 Ind.137          4_MG-237     T Tank.2 BTank.2  1.81     2
## 138 Ind.138          4_MG-237     T Tank.2 CTank.2  0.76     2
## 139 Ind.139          4_MG-237     T Tank.3 ATank.3  1.38     2
## 140 Ind.140          4_MG-237     T Tank.3 BTank.3  1.79     2
## 141 Ind.141          4_MG-237     T Tank.3 CTank.3  0.36     2
## 142 Ind.142          4_MG-237     T Tank.5 ATank.5  2.02     2
## 143 Ind.143          4_MG-237     T Tank.5 BTank.5  1.13     2
## 144 Ind.144          4_MG-237     T Tank.5 CTank.5  2.03     2
## 145 Ind.145          6_MG-237     C Tank.1 ATank.1  1.91     1
## 146 Ind.146          6_MG-237     C Tank.1 BTank.1  0.89     1
## 147 Ind.147          6_MG-237     C Tank.1 CTank.1  1.23     1
## 148 Ind.148          6_MG-237     C Tank.2 ATank.2  0.89     1
## 149 Ind.149          6_MG-237     C Tank.2 BTank.2  1.04     1
## 150 Ind.150          6_MG-237     C Tank.2 CTank.2  1.03     1
## 151 Ind.151          6_MG-237     C Tank.5 ATank.5  1.12     1
## 152 Ind.152          6_MG-237     C Tank.5 BTank.5  1.17     1
## 153 Ind.153          6_MG-237     C Tank.5 CTank.5  0.72     1
## 154 Ind.154          6_MG-237     T Tank.3 ATank.3  1.33     1
## 155 Ind.155          6_MG-237     T Tank.3 BTank.3  0.72     1
## 156 Ind.156          6_MG-237     T Tank.3 CTank.3  1.55     1
## 157 Ind.157          6_MG-237     T Tank.4 ATank.4  1.18     1
## 158 Ind.158          6_MG-237     T Tank.4 BTank.4  1.25     1
## 159 Ind.159          6_MG-237     T Tank.4 CTank.4  1.53     1
## 160 Ind.160          6_MG-237     T Tank.6 ATank.6  1.46     1
## 161 Ind.161          6_MG-237     T Tank.6 BTank.6  1.38     1
## 162 Ind.162          6_MG-237     T Tank.6 CTank.6  1.74     1
## 163 Ind.163          6_MG-237     C Tank.1 ATank.1  0.55     2
## 164 Ind.164          6_MG-237     C Tank.1 BTank.1  0.58     2
## 165 Ind.165          6_MG-237     C Tank.1 CTank.1  0.43     2
## 166 Ind.166          6_MG-237     C Tank.4 ATank.4  1.42     2
## 167 Ind.167          6_MG-237     C Tank.4 BTank.4  0.92     2
## 168 Ind.168          6_MG-237     C Tank.4 CTank.4  1.29     2
## 169 Ind.169          6_MG-237     C Tank.6 ATank.6  0.73     2
## 170 Ind.170          6_MG-237     C Tank.6 BTank.6  0.90     2
## 171 Ind.171          6_MG-237     C Tank.6 CTank.6  1.02     2
## 172 Ind.172          6_MG-237     T Tank.2 ATank.2  1.56     2
## 173 Ind.173          6_MG-237     T Tank.2 BTank.2  1.28     2
## 174 Ind.174          6_MG-237     T Tank.2 CTank.2  2.84     2
## 175 Ind.175          6_MG-237     T Tank.3 ATank.3  3.05     2
## 176 Ind.176          6_MG-237     T Tank.3 BTank.3  2.33     2
## 177 Ind.177          6_MG-237     T Tank.3 CTank.3  2.83     2
## 178 Ind.178          6_MG-237     T Tank.5 ATank.5  1.88     2
## 179 Ind.179          6_MG-237     T Tank.5 BTank.5  1.99     2
## 180 Ind.180          6_MG-237     T Tank.5 CTank.5  3.88     2
## 181 Ind.181          5_MG-237     C Tank.1 ATank.1  1.22     1
```

```
## 182 Ind.182          5_MG-237     C Tank.1 BTank.1  1.29     1
## 183 Ind.183          5_MG-237     C Tank.2 ATank.2  0.83     1
## 184 Ind.184          5_MG-237     C Tank.2 BTank.2  0.81     1
## 185 Ind.185          5_MG-237     C Tank.2 CTank.2  1.67     1
## 186 Ind.186          5_MG-237     C Tank.5 ATank.5  0.60     1
## 187 Ind.187          5_MG-237     C Tank.5 BTank.5  0.59     1
## 188 Ind.188          5_MG-237     C Tank.5 CTank.5  0.81     1
## 189 Ind.189          5_MG-237     T Tank.3 ATank.3  0.89     1
## 190 Ind.190          5_MG-237     T Tank.3 BTank.3  1.10     1
## 191 Ind.191          5_MG-237     T Tank.3 CTank.3  0.95     1
## 192 Ind.192          5_MG-237     T Tank.4 ATank.4  0.98     1
## 193 Ind.193          5_MG-237     T Tank.4 BTank.4  0.71     1
## 194 Ind.194          5_MG-237     T Tank.4 CTank.4  0.59     1
## 195 Ind.195          5_MG-237     T Tank.6 ATank.6  1.24     1
## 196 Ind.196          5_MG-237     T Tank.6 BTank.6  1.23     1
## 197 Ind.197          5_MG-237     T Tank.6 CTank.6  0.90     1
## 198 Ind.198          5_MG-237     C Tank.4 ATank.4  0.45     2
## 199 Ind.199          5_MG-237     C Tank.5 ATank.5  0.79     2
## 200 Ind.200          5_MG-237     C Tank.6 ATank.6  0.43     2
## 201 Ind.201          5_MG-237     T Tank.1 ATank.1  1.45     2
## 202 Ind.202          5_MG-237     T Tank.2 ATank.2  1.11     2
## 203 Ind.203          5_MG-237     T Tank.3 ATank.3  0.95     2
## 204 Ind.204          7_MG-377     C Tank.1 ATank.1  1.42     1
## 205 Ind.205          7_MG-377     C Tank.1 BTank.1  1.25     1
## 206 Ind.206          7_MG-377     C Tank.1 CTank.1  1.00     1
## 207 Ind.207          7_MG-377     C Tank.2 ATank.2  1.63     1
## 208 Ind.208          7_MG-377     C Tank.2 BTank.2  1.73     1
## 209 Ind.209          7_MG-377     C Tank.2 CTank.2  1.37     1
## 210 Ind.210          7_MG-377     C Tank.5 ATank.5  1.18     1
## 211 Ind.211          7_MG-377     C Tank.5 BTank.5  1.32     1
## 212 Ind.212          7_MG-377     C Tank.5 CTank.5  1.07     1
## 213 Ind.213          7_MG-377     T Tank.3 ATank.3  1.57     1
## 214 Ind.214          7_MG-377     T Tank.3 BTank.3  1.45     1
## 215 Ind.215          7_MG-377     T Tank.3 CTank.3  2.12     1
## 216 Ind.216          7_MG-377     T Tank.4 ATank.4  1.08     1
## 217 Ind.217          7_MG-377     T Tank.4 BTank.4  1.31     1
## 218 Ind.218          7_MG-377     T Tank.4 CTank.4  0.84     1
## 219 Ind.219          7_MG-377     T Tank.6 ATank.6  1.88     1
## 220 Ind.220          7_MG-377     T Tank.6 BTank.6  1.32     1
## 221 Ind.221          7_MG-377     T Tank.6 CTank.6  2.07     1
## 222 Ind.222          7_MG-377     C Tank.1 ATank.1  2.45     2
## 223 Ind.223          7_MG-377     C Tank.1 BTank.1  0.90     2
## 224 Ind.224          7_MG-377     C Tank.1 CTank.1  1.21     2
## 225 Ind.225          7_MG-377     C Tank.4 ATank.4  2.70     2
## 226 Ind.226          7_MG-377     C Tank.4 BTank.4  2.01     2
## 227 Ind.227          7_MG-377     C Tank.4 CTank.4  1.81     2
## 228 Ind.228          7_MG-377     C Tank.6 ATank.6  1.94     2
## 229 Ind.229          7_MG-377     C Tank.6 BTank.6  1.51     2
## 230 Ind.230          7_MG-377     C Tank.6 CTank.6  0.70     2
## 231 Ind.231          7_MG-377     T Tank.2 ATank.2  3.19     2
## 232 Ind.232          7_MG-377     T Tank.2 BTank.2  1.09     2
## 233 Ind.233          7_MG-377     T Tank.2 CTank.2  1.42     2
## 234 Ind.234          7_MG-377     T Tank.3 ATank.3  2.04     2
## 235 Ind.235          7_MG-377     T Tank.3 BTank.3  4.96     2
```

```
## 236 Ind.236          7_MG-377     T Tank.3 CTank.3  2.09     2
## 237 Ind.237          7_MG-377     T Tank.5 ATank.5  3.27     2
## 238 Ind.238          7_MG-377     T Tank.5 BTank.5  2.75     2
## 239 Ind.239          7_MG-377     T Tank.5 CTank.5  2.17     2
## 240 Ind.240          8_MG-429     C Tank.1 ATank.1  1.80     1
## 241 Ind.241          8_MG-429     C Tank.1 BTank.1  1.02     1
## 242 Ind.242          8_MG-429     C Tank.1 CTank.1  1.86     1
## 243 Ind.243          8_MG-429     C Tank.2 ATank.2  0.96     1
## 244 Ind.244          8_MG-429     C Tank.2 BTank.2  0.52     1
## 245 Ind.245          8_MG-429     C Tank.2 CTank.2  1.05     1
## 246 Ind.246          8_MG-429     C Tank.5 ATank.5  1.14     1
## 247 Ind.247          8_MG-429     C Tank.5 BTank.5  0.96     1
## 248 Ind.248          8_MG-429     C Tank.5 CTank.5  1.41     1
## 249 Ind.249          8_MG-429     T Tank.3 ATank.3  0.68     1
## 250 Ind.250          8_MG-429     T Tank.3 BTank.3  0.71     1
## 251 Ind.251          8_MG-429     T Tank.3 CTank.3  0.65     1
## 252 Ind.252          8_MG-429     T Tank.4 ATank.4  0.34     1
## 253 Ind.253          8_MG-429     T Tank.4 BTank.4  0.24     1
## 254 Ind.254          8_MG-429     T Tank.4 CTank.4  0.38     1
## 255 Ind.255          8_MG-429     T Tank.6 ATank.6  0.74     1
## 256 Ind.256          8_MG-429     T Tank.6 BTank.6  0.62     1
## 257 Ind.257          8_MG-429     T Tank.6 CTank.6  0.85     1
## 258 Ind.258          8_MG-429     C Tank.4 ATank.4  1.66     2
## 259 Ind.259          8_MG-429     C Tank.5 ATank.5  0.69     2
## 260 Ind.260          8_MG-429     C Tank.6 ATank.6  1.84     2
## 261 Ind.261          8_MG-429     T Tank.1 ATank.1  0.20     2
## 262 Ind.262          8_MG-429     T Tank.2 ATank.2  0.79     2
## 263 Ind.263          8_MG-429     T Tank.3 ATank.3  0.34     2
## 264 Ind.264          9_MG-268     C Tank.1 ATank.1  0.90     1
## 265 Ind.265          9_MG-268     C Tank.1 BTank.1  0.80     1
## 266 Ind.266          9_MG-268     C Tank.1 CTank.1  1.09     1
## 267 Ind.267          9_MG-268     C Tank.2 ATank.2  0.71     1
## 268 Ind.268          9_MG-268     C Tank.2 BTank.2  0.60     1
## 269 Ind.269          9_MG-268     C Tank.2 CTank.2  1.75     1
## 270 Ind.270          9_MG-268     C Tank.5 ATank.5  0.97     1
## 271 Ind.271          9_MG-268     C Tank.5 BTank.5  1.09     1
## 272 Ind.272          9_MG-268     C Tank.5 CTank.5  1.25     1
## 273 Ind.273          9_MG-268     T Tank.3 ATank.3  1.00     1
## 274 Ind.274          9_MG-268     T Tank.3 BTank.3  0.39     1
## 275 Ind.275          9_MG-268     T Tank.3 CTank.3  0.83     1
## 276 Ind.276          9_MG-268     T Tank.4 ATank.4  0.47     1
## 277 Ind.277          9_MG-268     T Tank.4 BTank.4  0.37     1
## 278 Ind.278          9_MG-268     T Tank.4 CTank.4  0.45     1
## 279 Ind.279          9_MG-268     T Tank.6 ATank.6  0.77     1
## 280 Ind.280          9_MG-268     T Tank.6 BTank.6  0.87     1
## 281 Ind.281          9_MG-268     T Tank.6 CTank.6  1.09     1
## 282 Ind.282          9_MG-268     C Tank.1 ATank.1  0.75     2
## 283 Ind.283          9_MG-268     C Tank.1 BTank.1  1.43     2
## 284 Ind.284          9_MG-268     C Tank.1 CTank.1  1.05     2
## 285 Ind.285          9_MG-268     C Tank.4 ATank.4  2.32     2
## 286 Ind.286          9_MG-268     C Tank.4 BTank.4  1.39     2
## 287 Ind.287          9_MG-268     C Tank.4 CTank.4  1.93     2
## 288 Ind.288          9_MG-268     C Tank.6 ATank.6  1.53     2
## 289 Ind.289          9_MG-268     C Tank.6 BTank.6  3.67     2
```

```
## 290 Ind.290          9_MG-268     C Tank.6 CTank.6  0.79     2
## 291 Ind.291          9_MG-268     T Tank.2 ATank.2  1.00     2
## 292 Ind.292          9_MG-268     T Tank.2 BTank.2  0.57     2
## 293 Ind.293          9_MG-268     T Tank.2 CTank.2  1.80     2
## 294 Ind.294          9_MG-268     T Tank.3 ATank.3  0.61     2
## 295 Ind.295          9_MG-268     T Tank.3 BTank.3  1.23     2
## 296 Ind.296          9_MG-268     T Tank.3 CTank.3  1.28     2
## 297 Ind.297          9_MG-268     T Tank.5 ATank.5  0.31     2
## 298 Ind.298          9_MG-268     T Tank.5 BTank.5  0.78     2
## 299 Ind.299          9_MG-268     T Tank.5 CTank.5  1.01     2
## 300 Ind.300         10_MG-457     C Tank.1 ATank.1  2.06     1
## 301 Ind.301         10_MG-457     C Tank.1 BTank.1  2.22     1
## 302 Ind.302         10_MG-457     C Tank.1 CTank.1  2.04     1
## 303 Ind.303         10_MG-457     C Tank.2 ATank.2  1.35     1
## 304 Ind.304         10_MG-457     C Tank.2 BTank.2  1.41     1
## 305 Ind.305         10_MG-457     C Tank.2 CTank.2  1.91     1
## 306 Ind.306         10_MG-457     C Tank.5 ATank.5  2.14     1
## 307 Ind.307         10_MG-457     C Tank.5 BTank.5  1.95     1
## 308 Ind.308         10_MG-457     C Tank.5 CTank.5  2.26     1
## 309 Ind.309         10_MG-457     T Tank.3 ATank.3  0.78     1
## 310 Ind.310         10_MG-457     T Tank.3 BTank.3  0.79     1
## 311 Ind.311         10_MG-457     T Tank.3 CTank.3  0.80     1
## 312 Ind.312         10_MG-457     T Tank.4 ATank.4  0.55     1
## 313 Ind.313         10_MG-457     T Tank.4 BTank.4  0.16     1
## 314 Ind.314         10_MG-457     T Tank.4 CTank.4  0.43     1
## 315 Ind.315         10_MG-457     T Tank.6 ATank.6  0.61     1
## 316 Ind.316         10_MG-457     T Tank.6 BTank.6  0.58     1
## 317 Ind.317         10_MG-457     T Tank.6 CTank.6  0.43     1
## 318 Ind.318         10_MG-457     C Tank.1 ATank.1  2.28     2
## 319 Ind.319         10_MG-457     C Tank.1 BTank.1  1.25     2
## 320 Ind.320         10_MG-457     C Tank.1 CTank.1  1.90     2
## 321 Ind.321         10_MG-457     C Tank.4 ATank.4  2.33     2
## 322 Ind.322         10_MG-457     C Tank.4 BTank.4  1.34     2
## 323 Ind.323         10_MG-457     C Tank.4 CTank.4  2.05     2
## 324 Ind.324         10_MG-457     C Tank.6 ATank.6  1.61     2
## 325 Ind.325         10_MG-457     C Tank.6 BTank.6  1.20     2
## 326 Ind.326         10_MG-457     C Tank.6 CTank.6  0.67     2
## 327 Ind.327         10_MG-457     T Tank.2 ATank.2  0.72     2
## 328 Ind.328         10_MG-457     T Tank.2 BTank.2  1.93     2
## 329 Ind.329         10_MG-457     T Tank.2 CTank.2  0.21     2
## 330 Ind.330         10_MG-457     T Tank.3 ATank.3  1.11     2
## 331 Ind.331         10_MG-457     T Tank.3 BTank.3  1.67     2
## 332 Ind.332         10_MG-457     T Tank.3 CTank.3  0.62     2
## 333 Ind.333         10_MG-457     T Tank.5 ATank.5  0.20     2
## 334 Ind.334         10_MG-457     T Tank.5 BTank.5  1.04     2
## 335 Ind.335         10_MG-457     T Tank.5 CTank.5  0.29     2
## 336 Ind.336        11_MG-5650     C Tank.1 ATank.1  1.49     1
## 337 Ind.337        11_MG-5650     C Tank.1 BTank.1  2.38     1
## 338 Ind.338        11_MG-5650     C Tank.1 CTank.1  0.97     1
## 339 Ind.339        11_MG-5650     C Tank.2 ATank.2  1.49     1
## 340 Ind.340        11_MG-5650     C Tank.2 BTank.2  1.17     1
## 341 Ind.341        11_MG-5650     C Tank.2 CTank.2  1.20     1
## 342 Ind.342        11_MG-5650     C Tank.5 ATank.5  1.35     1
## 343 Ind.343        11_MG-5650     C Tank.5 BTank.5  1.16     1
```

```
## 344 Ind.344         11_MG-5650     C Tank.5 CTank.5  1.05     1
## 345 Ind.345         11_MG-5650     T Tank.3 ATank.3  0.24     1
## 346 Ind.346         11_MG-5650     T Tank.3 BTank.3  0.32     1
## 347 Ind.347         11_MG-5650     T Tank.3 CTank.3  0.62     1
## 348 Ind.348         11_MG-5650     T Tank.4 ATank.4  0.37     1
## 349 Ind.349         11_MG-5650     T Tank.4 BTank.4  0.58     1
## 350 Ind.350         11_MG-5650     T Tank.4 CTank.4  0.33     1
## 351 Ind.351         11_MG-5650     T Tank.6 ATank.6  0.33     1
## 352 Ind.352         11_MG-5650     T Tank.6 BTank.6  0.66     1
## 353 Ind.353         11_MG-5650     T Tank.6 CTank.6  0.54     1
## 354 Ind.354         11_MG-5650     C Tank.1 ATank.1  2.38     2
## 355 Ind.355         11_MG-5650     C Tank.1 BTank.1  5.03     2
## 356 Ind.356         11_MG-5650     C Tank.1 CTank.1  2.86     2
## 357 Ind.357         11_MG-5650     C Tank.4 ATank.4  2.73     2
## 358 Ind.358         11_MG-5650     C Tank.4 BTank.4  1.97     2
## 359 Ind.359         11_MG-5650     C Tank.4 CTank.4  1.88     2
## 360 Ind.360         11_MG-5650     C Tank.6 ATank.6  1.18     2
## 361 Ind.361         11_MG-5650     C Tank.6 BTank.6  2.82     2
## 362 Ind.362         11_MG-5650     C Tank.6 CTank.6  4.03     2
## 363 Ind.363         11_MG-5650     T Tank.2 ATank.2  0.98     2
## 364 Ind.364         11_MG-5650     T Tank.2 BTank.2  0.09     2
## 365 Ind.365         11_MG-5650     T Tank.2 CTank.2  0.78     2
## 366 Ind.366         11_MG-5650     T Tank.3 ATank.3  0.51     2
## 367 Ind.367         11_MG-5650     T Tank.3 BTank.3  0.27     2
## 368 Ind.368         11_MG-5650     T Tank.3 CTank.3  0.88     2
## 369 Ind.369         11_MG-5650     T Tank.5 ATank.5  0.22     2
## 370 Ind.370         11_MG-5650     T Tank.5 BTank.5  1.35     2
## 371 Ind.371         11_MG-5650     T Tank.5 CTank.5  0.69     2
## 372 Ind.372         12_MG-1282     C Tank.1 ATank.1  1.39     1
## 373 Ind.373         12_MG-1282     C Tank.1 BTank.1  1.83     1
## 374 Ind.374         12_MG-1282     C Tank.1 CTank.1  1.11     1
## 375 Ind.375         12_MG-1282     C Tank.2 ATank.2  1.15     1
## 376 Ind.376         12_MG-1282     C Tank.2 BTank.2  1.06     1
## 377 Ind.377         12_MG-1282     C Tank.2 CTank.2  1.21     1
## 378 Ind.378         12_MG-1282     C Tank.5 ATank.5  1.57     1
## 379 Ind.379         12_MG-1282     C Tank.5 BTank.5  1.73     1
## 380 Ind.380         12_MG-1282     C Tank.5 CTank.5  1.54     1
## 381 Ind.381         12_MG-1282     T Tank.3 ATank.3  0.80     1
## 382 Ind.382         12_MG-1282     T Tank.3 BTank.3  0.84     1
## 383 Ind.383         12_MG-1282     T Tank.3 CTank.3  1.07     1
## 384 Ind.384         12_MG-1282     T Tank.4 ATank.4  0.20     1
## 385 Ind.385         12_MG-1282     T Tank.4 BTank.4  0.24     1
## 386 Ind.386         12_MG-1282     T Tank.4 CTank.4  0.35     1
## 387 Ind.387         12_MG-1282     T Tank.6 ATank.6  0.86     1
## 388 Ind.388         12_MG-1282     T Tank.6 BTank.6  1.35     1
## 389 Ind.389         12_MG-1282     T Tank.6 CTank.6  0.87     1
## 390 Ind.390         12_MG-1282     C Tank.1 ATank.1  0.79     2
## 391 Ind.391         12_MG-1282     C Tank.1 BTank.1  1.75     2
## 392 Ind.392         12_MG-1282     C Tank.1 CTank.1  1.57     2
## 393 Ind.393         12_MG-1282     C Tank.4 ATank.4  1.23     2
## 394 Ind.394         12_MG-1282     C Tank.4 BTank.4  1.91     2
## 395 Ind.395         12_MG-1282     C Tank.4 CTank.4  1.10     2
## 396 Ind.396         12_MG-1282     C Tank.6 ATank.6  1.25     2
## 397 Ind.397         12_MG-1282     C Tank.6 BTank.6  1.25     2
```

```
## 398 Ind.398         12_MG-1282     C Tank.6 CTank.6  1.69     2
## 399 Ind.399         12_MG-1282     T Tank.2 ATank.2  0.93     2
## 400 Ind.400         12_MG-1282     T Tank.2 BTank.2  1.00     2
## 401 Ind.401         12_MG-1282     T Tank.2 CTank.2  0.44     2
## 402 Ind.402         12_MG-1282     T Tank.3 ATank.3  0.99     2
## 403 Ind.403         12_MG-1282     T Tank.3 BTank.3  1.17     2
## 404 Ind.404         12_MG-1282     T Tank.3 CTank.3  0.96     2
## 405 Ind.405         12_MG-1282     T Tank.5 ATank.5  0.58     2
## 406 Ind.406         12_MG-1282     T Tank.5 BTank.5  0.75     2
## 407 Ind.407         12_MG-1282     T Tank.5 CTank.5  0.70     2
## 408 Ind.408          13_MG-231     C Tank.1 ATank.1  2.01     1
## 409 Ind.409          13_MG-231     C Tank.1 BTank.1  0.89     1
## 410 Ind.410          13_MG-231     C Tank.1 CTank.1  1.67     1
## 411 Ind.411          13_MG-231     C Tank.2 ATank.2  1.87     1
## 412 Ind.412          13_MG-231     C Tank.2 BTank.2  0.80     1
## 413 Ind.413          13_MG-231     C Tank.2 CTank.2  1.13     1
## 414 Ind.414          13_MG-231     C Tank.5 ATank.5  1.36     1
## 415 Ind.415          13_MG-231     C Tank.5 BTank.5  1.88     1
## 416 Ind.416          13_MG-231     C Tank.5 CTank.5  1.71     1
## 417 Ind.417          13_MG-231     T Tank.3 ATank.3  0.56     1
## 418 Ind.418          13_MG-231     T Tank.3 BTank.3  0.88     1
## 419 Ind.419          13_MG-231     T Tank.3 CTank.3  1.07     1
## 420 Ind.420          13_MG-231     T Tank.4 ATank.4  0.75     1
## 421 Ind.421          13_MG-231     T Tank.4 BTank.4  0.31     1
## 422 Ind.422          13_MG-231     T Tank.4 CTank.4  0.28     1
## 423 Ind.423          13_MG-231     T Tank.6 ATank.6  0.88     1
## 424 Ind.424          13_MG-231     T Tank.6 BTank.6  1.10     1
## 425 Ind.425          13_MG-231     T Tank.6 CTank.6  0.99     1
## 426 Ind.426          13_MG-231     C Tank.1 ATank.1  0.96     2
## 427 Ind.427          13_MG-231     C Tank.1 BTank.1  2.09     2
## 428 Ind.428          13_MG-231     C Tank.1 CTank.1  0.79     2
## 429 Ind.429          13_MG-231     C Tank.4 ATank.4  0.61     2
## 430 Ind.430          13_MG-231     C Tank.4 BTank.4  2.03     2
## 431 Ind.431          13_MG-231     C Tank.4 CTank.4  1.27     2
## 432 Ind.432          13_MG-231     C Tank.6 ATank.6  1.33     2
## 433 Ind.433          13_MG-231     C Tank.6 BTank.6  1.73     2
## 434 Ind.434          13_MG-231     C Tank.6 CTank.6  0.81     2
## 435 Ind.435          13_MG-231     T Tank.2 ATank.2  0.65     2
## 436 Ind.436          13_MG-231     T Tank.2 BTank.2  0.84     2
## 437 Ind.437          13_MG-231     T Tank.2 CTank.2  0.66     2
## 438 Ind.438          13_MG-231     T Tank.3 ATank.3  0.60     2
## 439 Ind.439          13_MG-231     T Tank.3 BTank.3  0.37     2
## 440 Ind.440          13_MG-231     T Tank.3 CTank.3  0.72     2
## 441 Ind.441          13_MG-231     T Tank.5 ATank.5  0.61     2
## 442 Ind.442          13_MG-231     T Tank.5 BTank.5  1.46     2
## 443 Ind.443          13_MG-231     T Tank.5 CTank.5  0.83     2
```

2. Initial linear model of data to check for significant factors.

```
Fl.lm <- lm(DryWt ~ Treat + Accession_Genotype + Trial + Tank + Rep, data = Fluridone_data)
anova(Fl.lm)
```

```
## Analysis of Variance Table
##
## Response: DryWt
##                      Df  Sum Sq Mean Sq F value    Pr(>F)
## Treat                 1  12.232 12.2322 33.2644 1.583e-08 ***
## Accession_Genotype   12  19.843  1.6536  4.4967 8.213e-07 ***
## Trial                 1   4.404  4.4039 11.9760 0.0005953 ***
## Tank                  5   1.991  0.3982  1.0829 0.3691676
## Rep                  12   2.734  0.2278  0.6195 0.8259906
## Residuals           411 151.135  0.3677
## ---
## Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

3. Determining the best fit linear mixed effects model.

```
library(lme4)
```

```
## Loading required package: Matrix
```

```
Fl.lmer <- lmer(DryWt ~ Treat * Accession_Genotype + (1 | Trial:Tank:Rep) +
                  (1 | Tank:Rep) + (1 | Rep), data = Fluridone_data)
```

```
## boundary (singular) fit: see ?isSingular
```

```
Fl.lmer2 <- lmer(DryWt ~ Treat * Accession_Genotype + (1 | Trial:Tank) +
                   (1 | Tank), data = Fluridone_data)
```

```
## boundary (singular) fit: see ?isSingular
```

```
anova(Fl.lmer, Fl.lmer2)
```

```
## refitting model(s) with ML (instead of REML)
```

```
## Data: Fluridone_data
## Models:
## Fl.lmer2: DryWt ~ Treat * Accession_Genotype + (1 | Trial:Tank) + (1 |
## Fl.lmer2:     Tank)
## Fl.lmer: DryWt ~ Treat * Accession_Genotype + (1 | Trial:Tank:Rep) + (1 |
## Fl.lmer:     Tank:Rep) + (1 | Rep)
##          npar    AIC    BIC  logLik deviance Chisq Df Pr(>Chisq)
## Fl.lmer2   29 711.81 830.53 -326.91   653.81
## Fl.lmer    30 722.89 845.70 -331.45   662.89     0  1          1
```

```
Fl.lmer2
```

```
## Linear mixed model fit by REML ['lmerMod']
## Formula: DryWt ~ Treat * Accession_Genotype + (1 | Trial:Tank) + (1 |
##     Tank)
##    Data: Fluridone_data
## REML criterion at convergence: 712.2855
## Random effects:
##  Groups     Name        Std.Dev.
##  Trial:Tank (Intercept) 0.1557
##  Tank       (Intercept) 0.0000
##  Residual               0.5113
## Number of obs: 443, groups:  Trial:Tank, 12; Tank, 6
```

```
## Fixed Effects:
##                            (Intercept)                                 TreatT
##                               1.229810                              -0.055175
##          Accession_Genotype10_MG-457          Accession_Genotype11_MG-5650
##                               0.533333                               0.820556
##         Accession_Genotype12_MG-1282           Accession_Genotype13_MG-231
##                               0.153333                               0.142778
##           Accession_Genotype2_MG-237            Accession_Genotype3_MG-237
##                               0.035000                              -0.029444
##           Accession_Genotype4_MG-237            Accession_Genotype5_MG-237
##                               0.144444                              -0.364571
##           Accession_Genotype6_MG-237            Accession_Genotype7_MG-377
##                              -0.251667                               0.268333
##           Accession_Genotype8_MG-429            Accession_Genotype9_MG-268
##                               0.007307                               0.091667
##  TreatT:Accession_Genotype10_MG-457  TreatT:Accession_Genotype11_MG-5650
##                              -0.977222                              -1.440000
## TreatT:Accession_Genotype12_MG-1282   TreatT:Accession_Genotype13_MG-231
##                              -0.531667                              -0.551111
##   TreatT:Accession_Genotype2_MG-237    TreatT:Accession_Genotype3_MG-237
##                              -0.062222                              -0.141667
##   TreatT:Accession_Genotype4_MG-237    TreatT:Accession_Genotype5_MG-237
##                              -0.247778                               0.281449
##   TreatT:Accession_Genotype6_MG-237    TreatT:Accession_Genotype7_MG-377
##                               0.966667                               0.604444
##   TreatT:Accession_Genotype8_MG-429    TreatT:Accession_Genotype9_MG-268
##                              -0.553763                              -0.429444
## convergence code 0; 0 optimizer warnings; 1 lme4 warnings
```

4. ANOVA of the best fit linear mixed effects model. P-values do not show up in R-markdown document. See Table 2 in manuscript for P-values associated with factors here.

```
require(lmerTest)
```

```
## Loading required package: lmerTest
```

```
##
## Attaching package: 'lmerTest'
```

```
## The following object is masked from 'package:lme4':
##
##     lmer
```

```
## The following object is masked from 'package:stats':
##
##     step
```

```
anova(Fl.lmer2, type = 2)
```

```
## Warning in anova.merMod(Fl.lmer2, type = 2): additional arguments ignored:
## 'type'
```

```
## Analysis of Variance Table
```

```
##                           npar Sum Sq Mean Sq F value
## Treat                        1  2.431  2.4306  9.2973
## Accession_Genotype          12 18.719  1.5599  5.9670
## Treat:Accession_Genotype    12 42.366  3.5305 13.5047
```

5. Calculating pairwise least-squares means and contrasts between control and 6ppb fluridone treatment means.

```
library(emmeans)
Fl.emm <- emmeans(Fl.lmer2, ~ Treat | Accession_Genotype)
pairs(Fl.emm)
```

```
## Accession_Genotype = 1_MG-237:
##  contrast estimate    SE  df t.ratio p.value
##  C - T      0.0552 0.200 136  0.276  0.7831
##
## Accession_Genotype = 10_MG-457:
##  contrast estimate    SE  df t.ratio p.value
##  C - T      1.0324 0.200 136  5.160  <.0001
##
## Accession_Genotype = 11_MG-5650:
##  contrast estimate    SE  df t.ratio p.value
##  C - T      1.4952 0.200 136  7.473  <.0001
##
## Accession_Genotype = 12_MG-1282:
##  contrast estimate    SE  df t.ratio p.value
##  C - T      0.5868 0.200 136  2.933  0.0039
##
## Accession_Genotype = 13_MG-231:
##  contrast estimate    SE  df t.ratio p.value
##  C - T      0.6063 0.200 136  3.030  0.0029
##
## Accession_Genotype = 2_MG-237:
##  contrast estimate    SE  df t.ratio p.value
##  C - T      0.1174 0.200 136  0.587  0.5583
##
## Accession_Genotype = 3_MG-237:
##  contrast estimate    SE  df t.ratio p.value
##  C - T      0.1968 0.200 136  0.984  0.3269
##
## Accession_Genotype = 4_MG-237:
##  contrast estimate    SE  df t.ratio p.value
##  C - T      0.3030 0.200 136  1.514  0.1323
##
## Accession_Genotype = 5_MG-237:
##  contrast estimate    SE  df t.ratio p.value
##  C - T     -0.2263 0.234 283 -0.969  0.3335
##
## Accession_Genotype = 6_MG-237:
##  contrast estimate    SE  df t.ratio p.value
##  C - T     -0.9115 0.200 136 -4.556  <.0001
##
```

```
## Accession_Genotype = 7_MG-377:
##  contrast estimate    SE  df t.ratio p.value
##  C - T     -0.5493 0.200 136 -2.745  0.0069
##
## Accession_Genotype = 8_MG-429:
##  contrast estimate    SE  df t.ratio p.value
##  C - T      0.6089 0.230 273  2.652  0.0085
##
## Accession_Genotype = 9_MG-268:
##  contrast estimate    SE  df t.ratio p.value
##  C - T      0.4846 0.200 136  2.422  0.0167
##
## Degrees-of-freedom method: kenward-roger
```