2022 Bayer Hooded Sprayer

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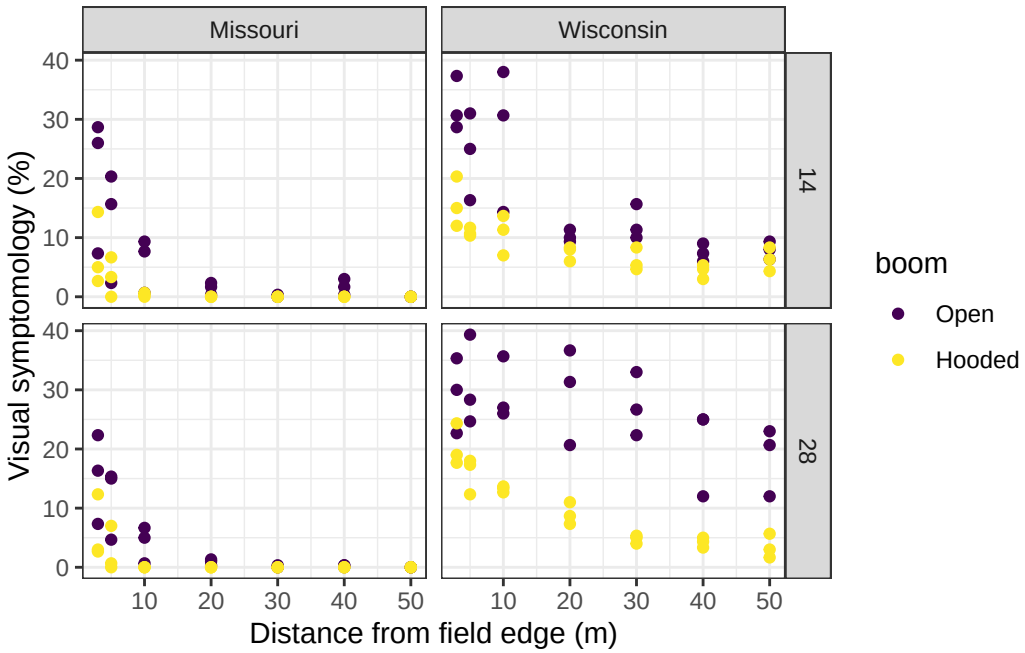
```
library(tidyverse)
library(drc)
```

```
readxl::read_excel("dataset.xlsx") %>%
  janitor::clean_names() %>%
  mutate(rating_dat = as_factor(rating_dat)) %>%
  mutate_if(is_character, as_factor) -> dat
```

```
dat %>%
#  filter(rating_dat == 14) %>%
  ggplot(aes(x = distance_m, y = rating_avg3plants, color = boom)) +
  facet_grid(rating_dat ~ location) +
  geom_point() +
  scale_color_viridis_d() +
  theme_bw() +
  labs(y = "Visual symptomology (%)",
       x = "Distance from field edge (m)")
```



Wisconsin

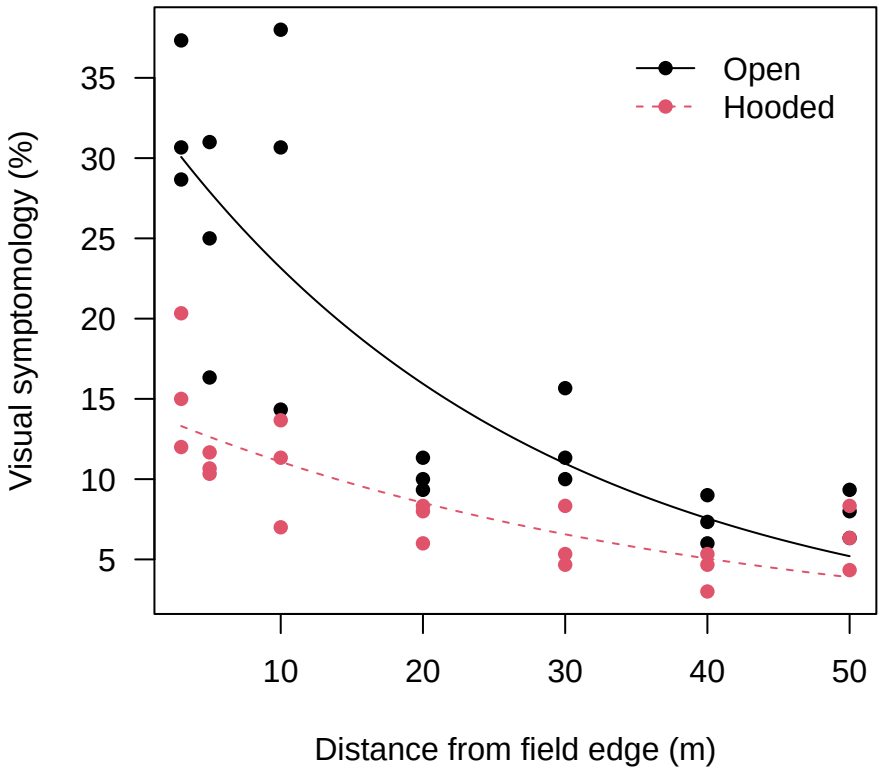
14 days after application

```
wisc14 <- dat %>%
  filter(rating_dat == "14" & location == "Wisconsin")
```

```
model_14_wi <- drm(rating_avg3plants ~ distance_m, boom,
                   fct = EXD.2(),
                   data = wisc14)
```

```
plot(model_14_wi, type = "all",
     col = c(1,2),
     pch = 16, log = "",
```

```
      ylab = "Visual symptomology (%)",
      xlab = "Distance from field edge (m)")
```




```
summary(model_14_wi)
```

```
Model fitted: Exponential decay with lower limit at 0 (2 parms)

Parameter estimates:
```

```
          Estimate Std. Error t-value   p-value
d:Open     33.6379     2.5369 13.2594 8.364e-16 ***
d:Hooded   14.3956     2.3099  6.2322 2.735e-07 ***
e:Open     26.7826     4.2638  6.2814 2.342e-07 ***
e:Hooded   38.1935    14.8301  2.5754   0.01403 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error:

 4.725031 (38 degrees of freedom)
```

```r
ED(model_14_wi, c(5, 10, 50, 90))
```

```
Estimated effective doses

             Estimate Std. Error
e:Hooded:5    1.95907    0.76068
e:Hooded:10   4.02409    1.56250
e:Hooded:50  26.47375   10.27941
e:Hooded:90  87.94388   34.14745
e:Open:5      1.37377    0.21870
e:Open:10     2.82182    0.44923
e:Open:50    18.56426    2.95541
```

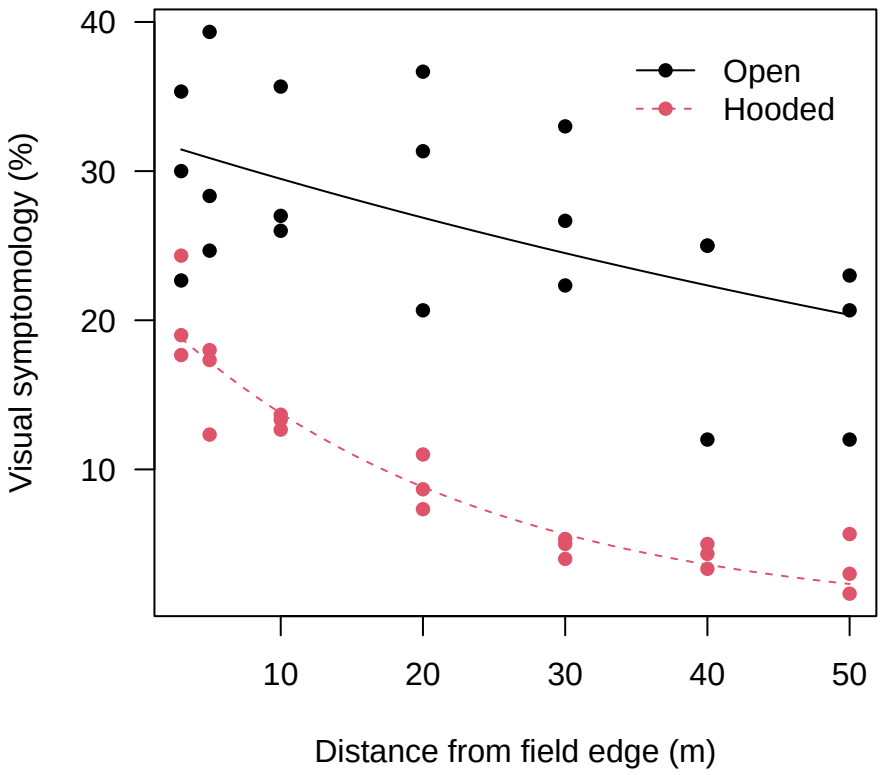
```
e:Open:90   61.66913    9.81768
```

28 days after application

```
wisc28 <- dat %>%
  filter(rating_dat == "28" & location == "Wisconsin")
```

```
model_28_wi <- drm(rating_avg3plants ~ distance_m, boom, fct = EXD.2(), data = wisc28)
```

```
plot(model_28_wi, type = "all",
     col = c(1,2),
     pch = 16, log = "",
     ylab = "Visual symptomology (%)",
     xlab = "Distance from field edge (m)")
```




```
summary(model_28_wi)
```

```
Model fitted: Exponential decay with lower limit at 0 (2 parms)

Parameter estimates:

         Estimate Std. Error t-value   p-value
d:Open    32.3366     1.7967 17.9979 < 2.2e-16 ***
```

```
d:Hooded  21.4973     2.6228  8.1962 6.308e-10 ***
e:Open   108.1046    27.3537  3.9521 0.0003254 ***
e:Hooded  22.4464     5.5530  4.0422 0.0002491 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error:

 4.541804 (38 degrees of freedom)
```

```r
ED(model_28_wi, c(5, 10, 50, 90))
```

```
Estimated effective doses

             Estimate Std. Error
e:Hooded:5    1.15135    0.28483
e:Hooded:10   2.36496    0.58507
e:Hooded:50  15.55863    3.84907
e:Hooded:90  51.68466   12.78634
e:Open:5      5.54504    1.40306
e:Open:10    11.38996    2.88200
e:Open:50    74.93241   18.96012
e:Open:90   248.92009   62.98416
```

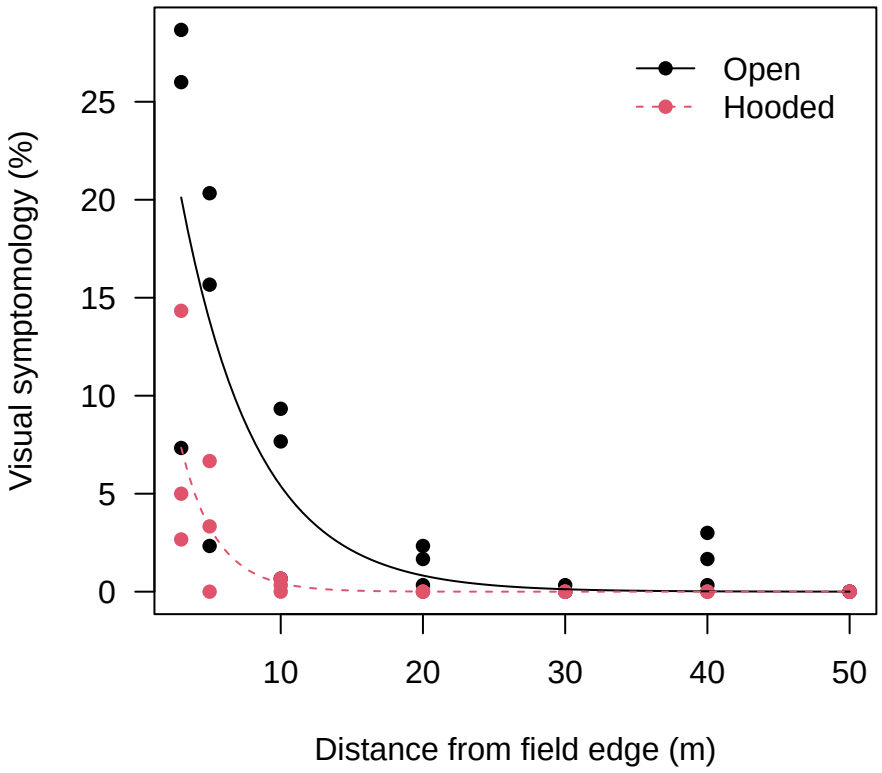
Missouri

14 days after application

```
miss14 <- dat %>%
  filter(rating_dat == "14" & location == "Missouri") %>%
  mutate(rating_avg3plants = case_when(
    rating_avg3plants == 0.000000 ~ 0.000001,
    TRUE ~ rating_avg3plants
  ))
```

```
model_14_mo <- drm(rating_avg3plants ~ distance_m, boom,
                   fct = EXD.2(),
                   data = miss14)
```

```
plot(model_14_mo, type = "all",
     col = c(1,2),
     pch = 16, log = "",
     ylab = "Visual symptomology (%)",
     xlab = "Distance from field edge (m)")
```




```
summary(model_14_mo)
```

```
Model fitted: Exponential decay with lower limit at 0 (2 parms)

Parameter estimates:

         Estimate Std. Error t-value   p-value
d:Open    35.3675     8.7849  4.0259 0.0002615 ***
```

```
d:Hooded  24.5941    28.8420  0.8527 0.3991577
e:Open     5.3172     1.6489  3.2247 0.0025928 **
e:Hooded   2.4835     2.0922  1.1870 0.2425937
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error:

 3.992089 (38 degrees of freedom)
```

```r
ED(model_14_mo, c(5, 10, 50, 90))
```

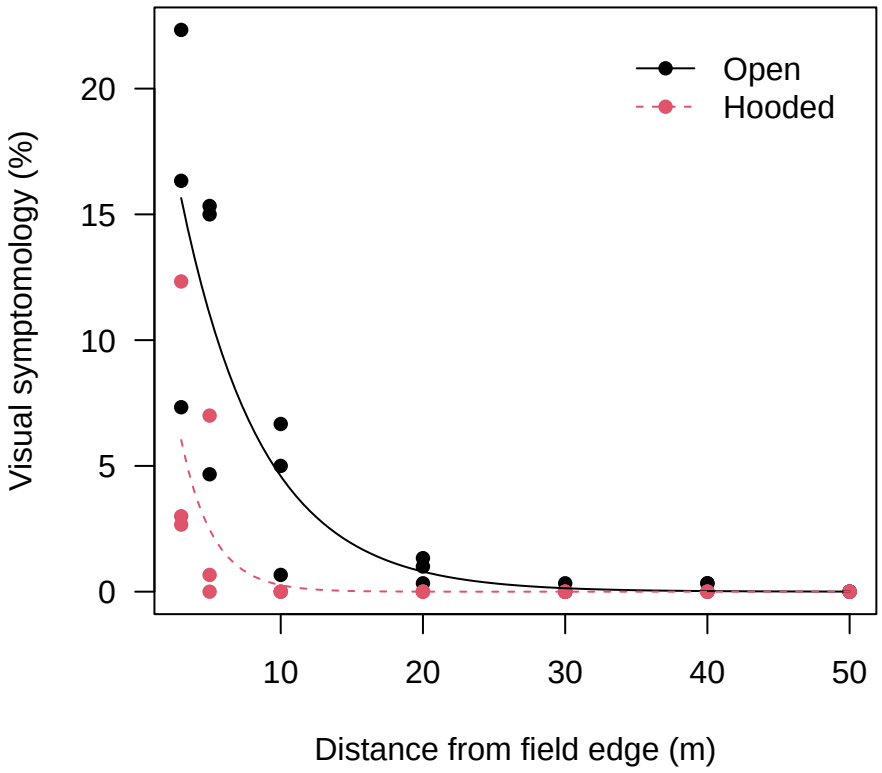
```
Estimated effective doses

             Estimate Std. Error
e:Hooded:5   0.127386   0.107317
e:Hooded:10  0.261661   0.220438
e:Hooded:50  1.721418   1.450221
e:Hooded:90  5.718427   4.817530
e:Open:5     0.272737   0.084578
e:Open:10    0.560224   0.173730
e:Open:50    3.685611   1.142934
e:Open:90   12.243335   3.796746
```

28 days after application

```
miss28 <- dat %>%
  filter(rating_dat == "28" & location == "Missouri") %>%
  mutate(rating_avg3plants = case_when(
    rating_avg3plants == 0.000000 ~ 0.000001,
    TRUE ~ rating_avg3plants
  ))
```

```
model_28_mo <- drm(rating_avg3plants ~ distance_m, boom,
                   fct = EXD.2(),
                   data = miss28)
```

```
plot(model_28_mo, type = "all",
     col = c(1,2),
     pch = 16, log = "",
     ylab = "Visual symptomology (%)",
     xlab = "Distance from field edge (m)")
```




```
summary(model_28_mo)
```

```
Model fitted: Exponential decay with lower limit at 0 (2 parms)

Parameter estimates:

         Estimate Std. Error t-value   p-value
d:Open    26.4652     5.1850  5.1042 9.584e-06 ***
```

```
d:Hooded  23.1460    24.8630  0.9309 0.3577615
e:Open     5.7097     1.4360  3.9760 0.0003032 ***
e:Hooded   2.2299     1.5764  1.4146 0.1653400
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error:

 2.810194 (38 degrees of freedom)
```

```r
summary(model_28_mo)
```

```
Model fitted: Exponential decay with lower limit at 0 (2 parms)

Parameter estimates:

         Estimate Std. Error t-value   p-value
d:Open    26.4652     5.1850  5.1042 9.584e-06 ***
d:Hooded  23.1460    24.8630  0.9309 0.3577615
e:Open     5.7097     1.4360  3.9760 0.0003032 ***
e:Hooded   2.2299     1.5764  1.4146 0.1653400
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1

Residual standard error:
```

```
 2.810194 (38 degrees of freedom)
```

```r
ED(model_28_mo, c(5, 10, 50, 90))
```

```
Estimated effective doses

              Estimate Std. Error
e:Hooded:5    0.114378   0.080858
e:Hooded:10   0.234942   0.166088
e:Hooded:50   1.545637   1.092663
e:Hooded:90   5.134493   3.629749
e:Open:5      0.292871   0.073659
e:Open:10     0.601581   0.151302
e:Open:50     3.957690   0.995389
e:Open:90    13.147163   3.306611
```