```
library(tidyverse)
library(cmdstanr)
source("scripts/functions.R")
df <- read.csv("data/main.csv")
set.seed(12042014)
```

The Bayesian Bootstrap
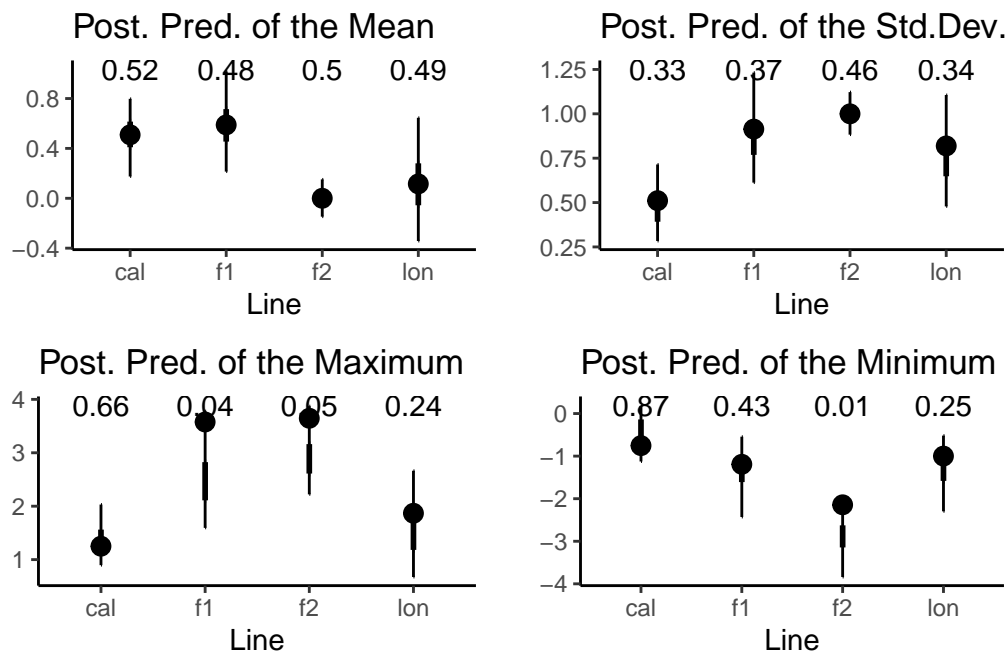
$$w \sim Dirichlet(\alpha)$$

$$\mu = \sum_{i=1}^{n} w_i x_i$$

$$\sigma = \sqrt{\sum_{i=1}^{n} w_i (x_i - \sum_{i=1}^{n} w_i x_i)^2}$$

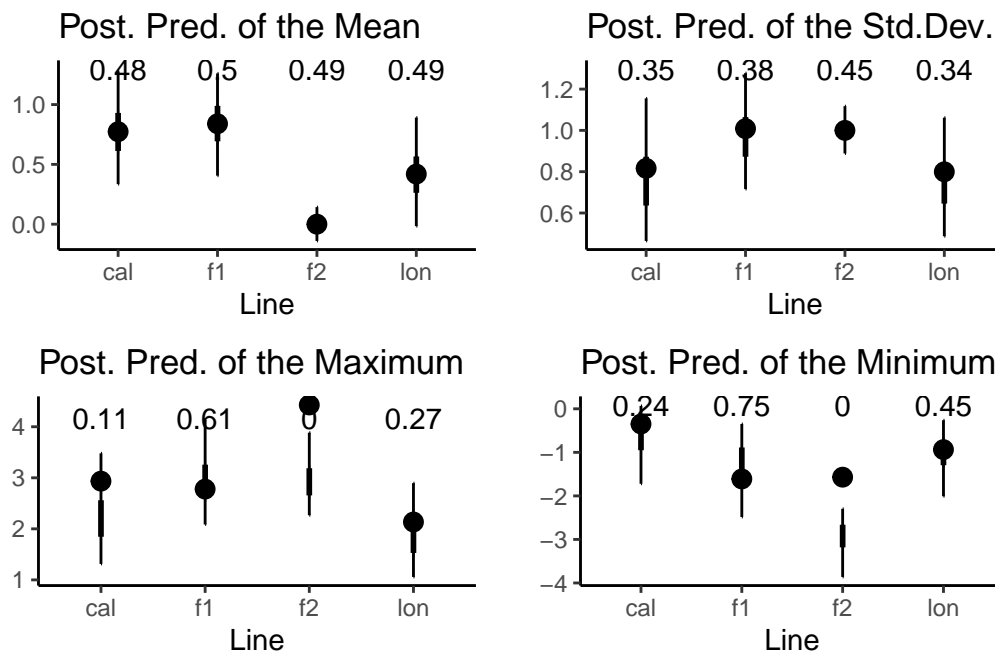**Posterior Predictive Checks**

1DAG

```
post_pred_check(df, "day_4", lik = "normal")
```

```
# post_pred_check(df, "day_4", lik = "gamma")
# post_pred_check(df, "day_4", lik = "log-normal")
```
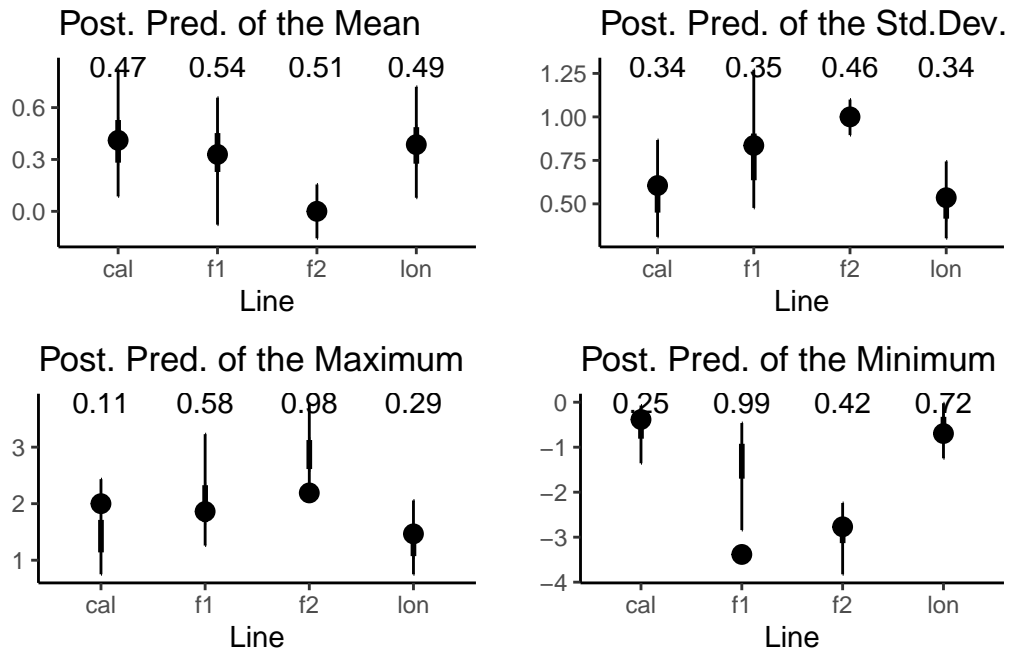
14DAG

```
post_pred_check(df, "day_17", "normal")
```

Post. Pred. of the Mean

0.48 0.5 0.49 0.49

Post. Pred. of the Std.Dev.

0.35 0.38 0.45 0.34

Post. Pred. of the Maximum

0.11 0.61 0 0.27

Post. Pred. of the Minimum

0.24 0.75 0 0.45

```
# post_pred_check(df, "day_17", "gamma")
# post_pred_check(df, "day_17", "log-normal")
```

RGR

```
post_pred_check(df, "rgr", "normal")
```

Post. Pred. of the Mean

Post. Pred. of the Std.Dev.

Post. Pred. of the Maximum

Post. Pred. of the Minimum

```
# post_pred_check(df, "rgr", "gamma")
# post_pred_check(df, "rgr", "log-normal")
```

Height

```
post_pred_check(df, "height_122", "normal")
```

Post. Pred. of the Mean

	0.52	0.5	0.49	0.48

Post. Pred. of the Std.Dev.

	0.33	0.38	0.46	0.34

Post. Pred. of the Maximum

	0.83	0.67	0.01	0.16

Post. Pred. of the Minimum

	0.69	0.87	0	0.23
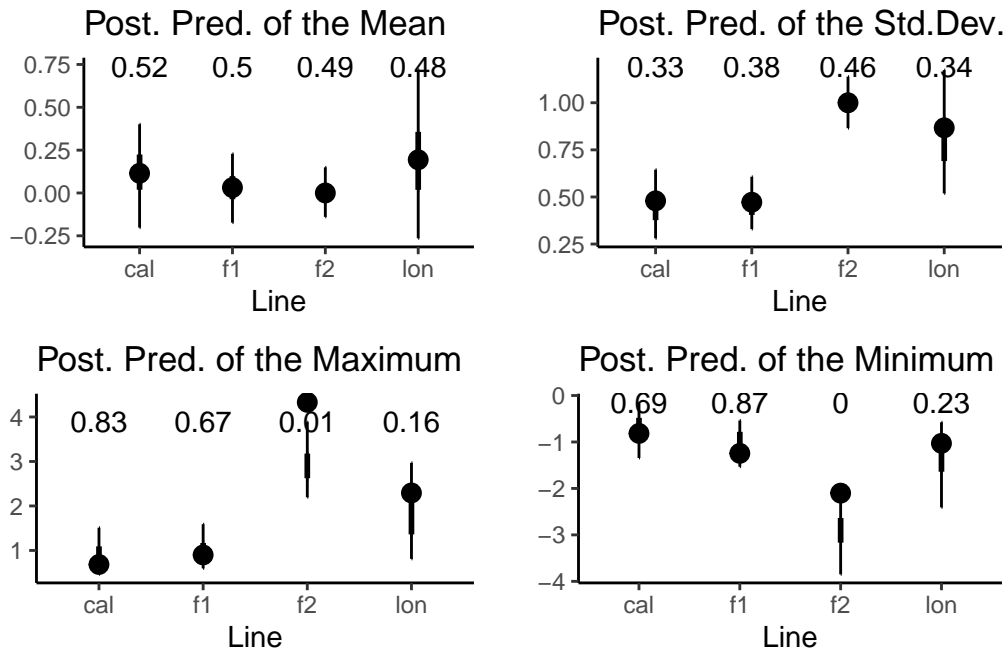

```
# post_pred_check(df, "height_122", "gamma")
# post_pred_check(df, "height_122", "log-normal")
```

Posterior Predictive Distributions of Delta

```
dag1 <- post_pred(df, "day_4", "normal")$delta_pp
dag14 <- post_pred(df, "day_17", "normal")$delta_pp
rgr <- post_pred(df, "rgr", "normal")$delta_pp
height <- post_pred(df, "height_122", "normal")$delta_pp

data.frame(DAG1 = dag1, DAG14= dag14,
           RGR = rgr, Height = height) %>%
  pivot_longer(1:4, names_to = "trait", values_to = "delta") %>%
  mutate(trait = factor(trait, levels = c("Height", "DAG14","DAG1", "RGR"))) %>%
  group_by(trait) %>%
  summarise(upr = quantile(delta, .975),
            lwr = quantile(delta, .025),
            upr.5 = quantile(delta, .75),
            lwr.5 = quantile(delta, .25)) %>%
  ggplot() +
  geom_vline(xintercept = 0, color = "grey", linewidth = 1) +
```

```
    geom_errorbarh(aes(y = trait, xmin = lwr, xmax = upr), height = 0,
                   linewidth = 1) +
    geom_errorbarh(aes(y = trait, xmin = lwr.5, xmax = upr.5), height = 0,
                   linewidth = 2) +
    theme_minimal() +
    labs(y = "Trait",
         x = "O(F2) - E(F2)")
```
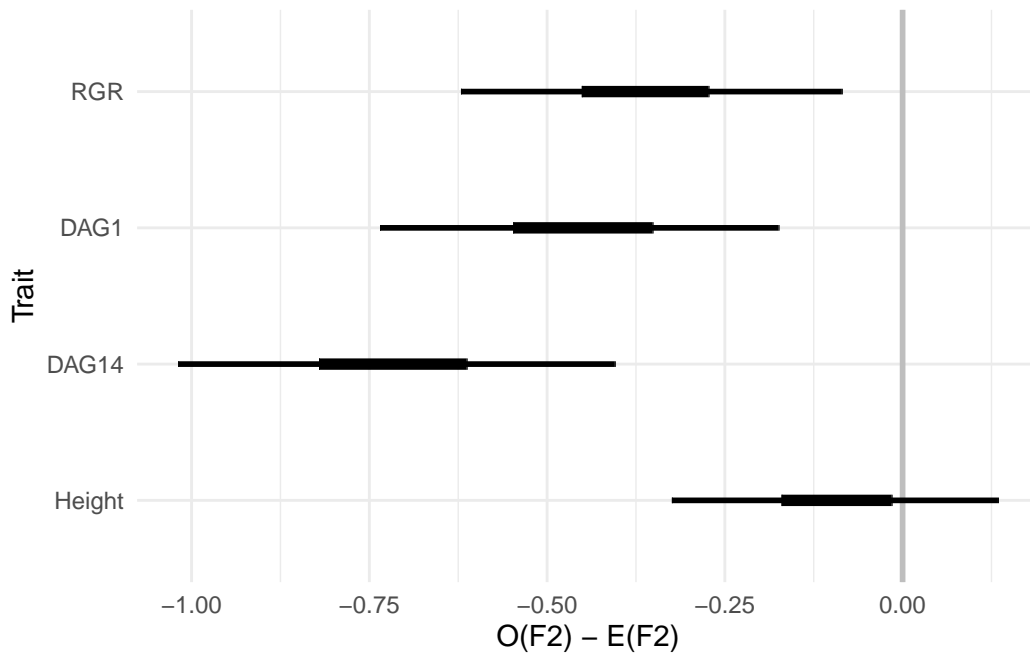


```
dag1 <- post_pred(df, "day_4", "normal")$boots
dag1 <- dag1 %>%
  pivot_longer(1:5, names_to = "line", values_to = "trait") %>%
  group_by(line) %>%
  summarise(mu = round(mean(trait),2),
            upr = round(quantile(trait, .975),2),
            lwr = round(quantile(trait, .025),2),
            upr.5 = round(quantile(trait, .75),2),
            lwr.5 = round(quantile(trait, .25),2)) %>%
  mutate(trait = "1DAG")
```

```r
dag14 <- post_pred(df, "day_17", "normal")$boots
dag14 <- dag14 %>%
  pivot_longer(1:5, names_to = "line", values_to = "trait") %>%
  group_by(line) %>%
  summarise(mu = round(mean(trait),2),
            upr = round(quantile(trait, .975),2),
            lwr = round(quantile(trait, .025),2),
            upr.5 = round(quantile(trait, .75),2),
            lwr.5 = round(quantile(trait, .25),2)) %>%
  mutate(trait = "14DAG")

rgr <- post_pred(df, "rgr", "normal")$boots
rgr <- rgr %>%
  pivot_longer(1:5, names_to = "line", values_to = "trait") %>%
  group_by(line) %>%
  summarise(mu = round(mean(trait),2),
            upr = round(quantile(trait, .975),2),
            lwr = round(quantile(trait, .025),2),
            upr.5 = round(quantile(trait, .75),2),
            lwr.5 = round(quantile(trait, .25),2)) %>%
  mutate(trait = "RGR")

height <- post_pred(df, "height_122", "normal")$boots
height <- height %>%
  pivot_longer(1:5, names_to = "line", values_to = "trait") %>%
  group_by(line) %>%
  summarise(mu = round(mean(trait),2),
            upr = round(quantile(trait, .975),2),
            lwr = round(quantile(trait, .025),2),
            upr.5 = round(quantile(trait, .75),2),
            lwr.5 = round(quantile(trait, .25),2)) %>%
  mutate(trait = "Height")

library(knitr)
library(kableExtra)
```

Attaching package: 'kableExtra'

The following object is masked from 'package:dplyr':

```
    group_rows
```

```
tab_dat <- bind_rows(dag1, dag14, rgr, height)

tab_dat %>%
  select(Line = line, Mean = mu, "2.5%" = lwr, "25%" = lwr.5,
         "75%" = upr.5, "97.5%" = upr) %>%
  mutate(Line = case_when(Line == "cal" ~ "Calycinus",
                          Line == "f1" ~ "F1",
                          Line == "f2" ~ "F2",
                          Line == "lon" ~ "Longiflorus",
                          Line == "e_f2" ~ "Expected F2")) %>%
  kbl() %>%
  kable_classic_2() %>%
  add_header_above(c(" " = 1, "Posterior Distribution of Line Mean" = 5)) %>%
  pack_rows("1DAG",1,5) %>%
  pack_rows("14DAG",6,10) %>%
  pack_rows("RGR", 11,15) %>%
  pack_rows("Height",16,20)
```

```
(p1 <- dag1 %>%
  mutate(plon = c(0, .51, .49, .5, 1),
         group = c("a", letters[2:4], "a")) %>%
  ggplot(aes(x = plon, y = mu, group = group, color = line)) +
  geom_line() +
  geom_errorbar(aes(x = plon, ymax = upr, ymin = lwr), width = 0,
                linewidth = 1) +
  geom_errorbar(aes(x = plon, ymax = upr.5, ymin = lwr.5), width = 0,
                linewidth = 2) +
  scale_color_manual(values = c("black", "red", "black", "blue", "black")) +
  theme_minimal() +
  labs(x = "Proportion Longiflorus"))
```

	Posterior Distribution of Line Mean				
Line	Mean	2.5%	25%	75%	97.5%
1DAG					
Calycinus	0.51	0.28	0.44	0.58	0.72
Expected F2	0.45	0.28	0.39	0.51	0.63
F1	0.59	0.33	0.49	0.68	0.88
F2	0.00	-0.10	-0.04	0.04	0.11
Longiflorus	0.12	-0.21	-0.01	0.23	0.48
14DAG					
Calycinus	0.77	0.47	0.65	0.88	1.13
Expected F2	0.72	0.53	0.65	0.78	0.91
F1	0.84	0.53	0.74	0.95	1.13
F2	0.00	-0.10	-0.03	0.03	0.10
Longiflorus	0.42	0.11	0.31	0.52	0.75
RGR					
Calycinus	0.41	0.19	0.32	0.49	0.70
Expected F2	0.36	0.20	0.31	0.42	0.51
F1	0.33	0.04	0.26	0.42	0.55
F2	0.00	-0.11	-0.04	0.04	0.11
Longiflorus	0.38	0.16	0.30	0.46	0.62
Height					
Calycinus	0.11	-0.11	0.04	0.19	0.32
Expected F2	0.09	-0.03	0.05	0.13	0.22
F1	0.03	-0.11	-0.02	0.08	0.17
F2	0.00	-0.10	-0.04	0.03	0.11
Longiflorus	0.19	-0.13	0.07	0.31	0.57