agData Maize Vignette

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```r
# devtools::install_github("derekmichaelwright/agData")
library(agData)
library(tidyverse)
```

USDA maize

The development of hybrid seed production in maize has led to major increases in crop yield in the United States.

```r
# Prep data
xx <- agData_USDA_Crops %>%
  filter(Crop == "Maize", Measurement == "Yield") %>%
  mutate(Era = ifelse(Year < 1937, "Open-Pollination",
                ifelse(Year < 1958, "Double-Cross Hybrids",
                 ifelse(Year < 1996, "Single-Cross Hybrids", "Biotech"))),
         Era = factor(Era, levels = c("Open-Pollination", "Double-Cross Hybrids",
                                      "Single-Cross Hybrids", "Biotech")))
# Prep rect data
x2 <- xx %>%
  group_by(Era) %>%
  summarise(min = min(Year), max = max(Year))
# Calculate slopes
c1 <- round(summary(
  lm(data = xx%>%filter(Era=="Open-Pollination"), Value~Year))$coefficients[2], 3)
c2 <- round(summary(
  lm(data = xx%>%filter(Era=="Double-Cross Hybrids"), Value~Year))$coefficients[2], 3)
c3 <- round(summary(
  lm(data = xx%>%filter(Era=="Single-Cross Hybrids"), Value~Year))$coefficients[2], 3)
c4 <- round(summary(
  lm(data = xx%>%filter(Era=="Biotech"), Value~Year))$coefficients[2], 3)
# Create color palette
cols <- c("darkcyan", "darkgoldenrod2", "Forest Green", "Brown")
# Plot
ggplot(x2, aes(fill = Era)) +
  geom_rect(aes(xmin = min-0.5, xmax = max+0.5, ymin = -Inf, ymax = Inf), alpha = 0.2) +
  geom_line(data = xx, size = 1.5, aes(x = Year, y = Value, color = Era)) +
  geom_point(data = xx, size = 3, aes(x = Year, y = Value, color = Era)) +
  geom_smooth(data = xx, method = "lm", se = F, colour = "Black",
              aes(x = Year, y = Value)) +
  scale_color_manual(name = "Era:", values = cols, guide = F) +
  scale_fill_manual(name = "Era:", values = cols) +
  scale_x_continuous(breaks       = seq(1865, 2015, by = 10),
                     minor_breaks = seq(1865, 2015, by = 10)) +
  coord_cartesian(xlim = c(1865, 2018), ylim = c(0, 11.5), expand = c(0, 0)) +
  annotate("text", x = 1900, y = 0.75, size = 5, label = paste("m =", c1)) +
  annotate("text", x = 1947.5, y = 1.25, size = 5, label = paste("m =", c2)) +
  annotate("text", x = 1980, y = 4, size = 5, label = paste("m =", c3)) +
```
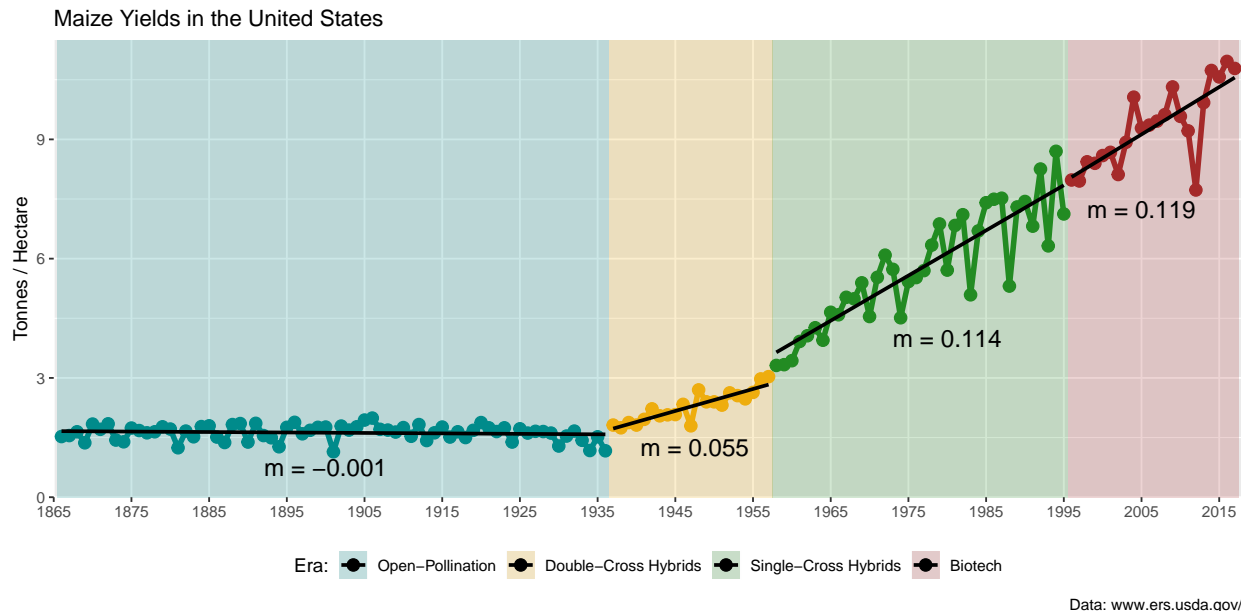
```r
  annotate("text", x = 2005, y = 7.25, size = 5, label = paste("m =", c4)) +
  theme(legend.position = "bottom") +
  labs(title   = "Maize Yields in the United States",
       caption = "Data: www.ers.usda.gov/",
       y       = "Tonnes / Hectare",
       x       = NULL)
```

Maize Yields in the United States

Data: www.ers.usda.gov/

USDA Maize vs Wheat yields

Maize yeilds have increased on a much faster pace than wheat, in part due to the adoption of hybrid seed in Maize.

```r
# Prep data
xx <- agData_USDA_Crops %>%
  filter(Crop %in% c("Maize", "Wheat"),
         Measurement == "Yield") %>%
  mutate(Era = ifelse(Year <= 1940, "Pre-1940", "Post-1940"))
#
x2 <- xx %>%
  group_by(Era) %>%
  summarise(min = min(Year), max = max(Year))
#
c1 <- round(summary(
  lm(data = xx%>%filter(Crop=="Maize",Era=="Post-1940"), Value~Year))$coefficients[2], 2)
c2 <- round(summary(
  lm(data = xx%>%filter(Crop=="Wheat",Era=="Post-1940"), Value~Year))$coefficients[2], 2)
# Plot
ggplot(xx) +
  geom_line(aes(x = Year, y = Value, color = Crop)) +
  geom_point(aes(x = Year, y = Value, color = Crop, shape = Era)) +
  geom_smooth(data = xx %>% filter(Crop == "Wheat"), method = "lm",
              se = F, colour = "Black", aes(x = Year, y = Value, group = Era)) +
  geom_smooth(data = xx %>% filter(Crop == "Maize"), method = "lm",
              se = F, colour = "Black", aes(x = Year, y = Value, group = Era)) +
```

```
  geom_rect(data = x2, alpha = 0.1,
            aes(xmin = min-0.5, xmax = max+0.5, ymin = -Inf, ymax = Inf, fill = Era)) +
  annotate("text", x = 1985, y = 4.5, size = 5, label = paste("m =", c1)) +
  annotate("text", x = 1985, y = 1, size = 5, label = paste("m =", c2)) +
  scale_x_continuous(breaks       = seq(1865, 2015, by = 10),
                     minor_breaks = seq(1865, 2015, by = 10),
                     expand = c(0,0)) +
  scale_color_manual(values = c("darkgreen", "darkgoldenrod2")) +
  scale_fill_manual(values = c("darkgreen", "darkgoldenrod2")) +
  theme(legend.position = "bottom") +
  labs(title = "Maize and Wheat Yield in the USA",
       y = "tonnes/ha", x = NULL)
```


Maize and Wheat Yield in the USA
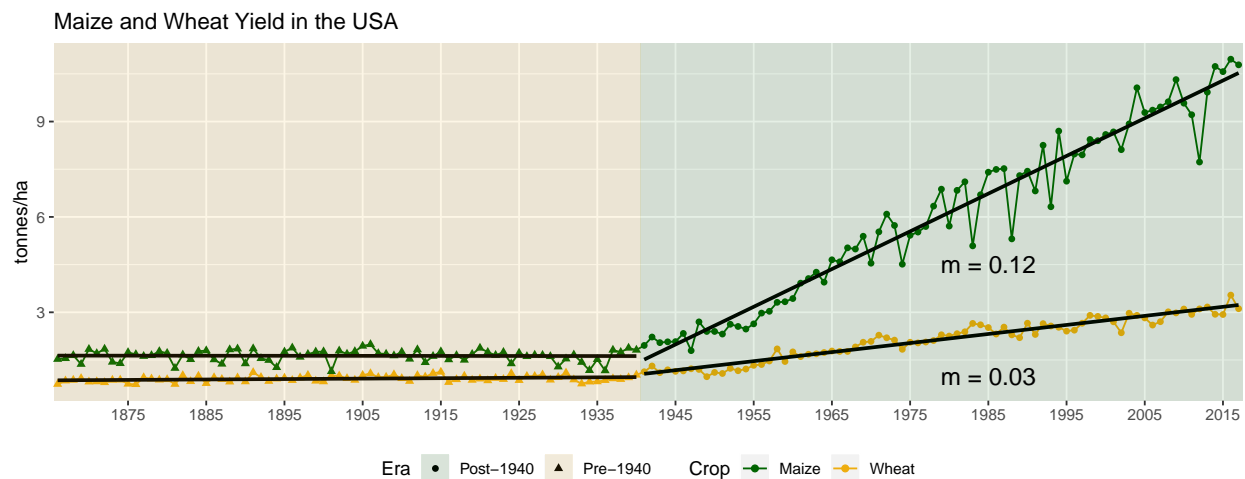
Maize yields in the developed vs developing world

Maize yields in developing countries have lagged behind those in developed countries. This is due to a conbination of factors, including lack of access to crop inputs, machinery, and improved crop varieties.

```
# Get some Colors
cols <- c("Dark Blue", "darkgoldenrod2", "Dark Red", "Dark Green")
# Prep data
x1 <- agData_USDA_Crops %>%
  filter(Crop    == "Maize",
         Measurement == "Yield",
         Year != 2017)
x2 <- agData_FAO_Crops %>%
  filter(Crop    == "Maize",
         Measurement == "Yield",
         Area %in% c("Germany", "Mexico", "Africa"))
xx <- bind_rows(x1, x2) %>%
  mutate(Area = factor(Area, levels = c("USA", "Germany", "Mexico", "Africa")))
xE <- xx %>% top_n(1, Year) %>% pull(Value)
# Plot
ggplot(xx, aes(x = Year, y = Value, color = Area)) +
  geom_line(size = 1.5) +
  theme(legend.position = "bottom") +
  scale_color_manual(values = cols) +
  scale_x_continuous(breaks       = seq(1865, 2015, by = 10),
```

```
                minor_breaks = seq(1865, 2015, by = 10),
                expand = c(0, 0)) +
scale_y_continuous(sec.axis = sec_axis(~ ., breaks = xE)) +
labs(title   = "Maize Yields – Developed vs Developing World",
     caption = "Data: www.ers.usda.gov/",
     y       = "Tonnes / Hectare",
     x       = NULL)
```

Maize Yields – Developed vs Developing World

Data: www.ers.usda.gov/

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