615 EDA

Quarto

Quarto enables you to weave together content and executable code into a finished document. To learn more about Quarto see https://quarto.org.

```r
library(ggplot2)
library(dplyr)
```

```
   'dplyr'


The following objects are masked from 'package:stats':

    filter, lag


The following objects are masked from 'package:base':

    intersect, setdiff, setequal, union
```

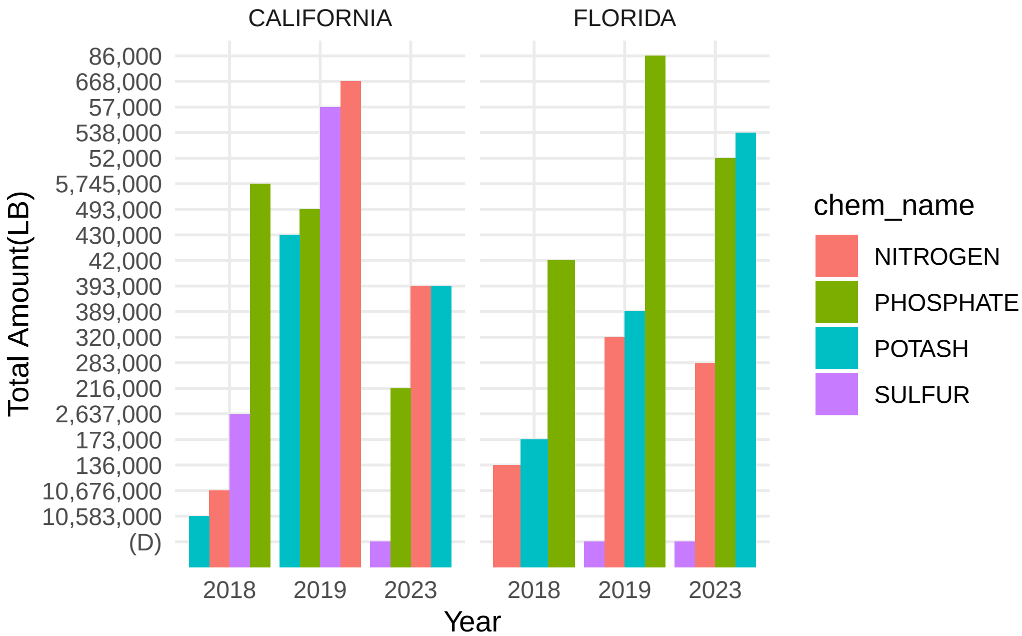
```r
data <- read.csv("C:/Users/Owner/Downloads/new.csv")
head(data)
```

```
  Year      State          mk2                 measure other chem_name   Value
1 2023 CALIFORNIA APPLICATIONS                      LB  <NA>  NITROGEN 393,000
2 2023 CALIFORNIA APPLICATIONS                      LB  <NA> PHOSPHATE 216,000
3 2023 CALIFORNIA APPLICATIONS                      LB  <NA>    POTASH 393,000
4 2023 CALIFORNIA APPLICATIONS                      LB  <NA>    SULFUR     (D)
5 2023 CALIFORNIA APPLICATIONS LB / ACRE / APPLICATION   AVG  NITROGEN      13
6 2023 CALIFORNIA APPLICATIONS LB / ACRE / APPLICATION   AVG PHOSPHATE      10
```

2. Distribution of Chemicals

```
data_chem<- data %>%
  filter(Year %in% c("2018", "2019", "2023") & State %in% c("CALIFORNIA", "FLORIDA")& chem_na

ggplot(data_chem, aes(x = factor(Year), y = Value, fill = chem_name))+
  geom_bar(stat = "identity", position = "dodge")+
  facet_wrap(~ State)+
  labs(
       x = "Year",
       y = "Total Amount(LB)")+
  theme_minimal()
```



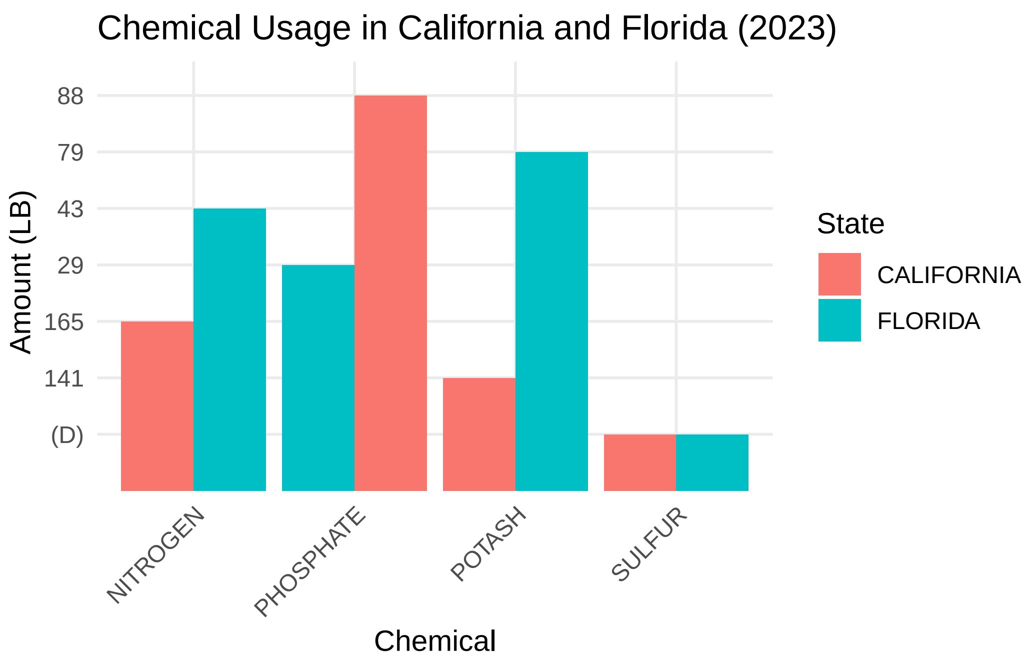
Chemical yealy usage per Acre in California and Florida (2023) - Measured in LB/ACRE/YEAR

```
# Load necessary libraries
library(ggplot2)
library(dplyr)

# Define the years you want to visualize
data_2023 <- data %>%
```

```
  filter(Year == 2023 & State %in% c('CALIFORNIA', 'FLORIDA') &
         chem_name %in% c('NITROGEN', 'PHOSPHATE', 'POTASH', 'SULFUR')&measure == "LB / ACRE

# Plot chemical usage for California and Florida in 2023
ggplot(data_2023, aes(x = chem_name, y = Value, fill = State)) +
  geom_bar(stat = "identity", position = "dodge") +
  labs(title = "Chemical Usage in California and Florida (2023)",
       x = "Chemical", y = " Amount (LB)") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```

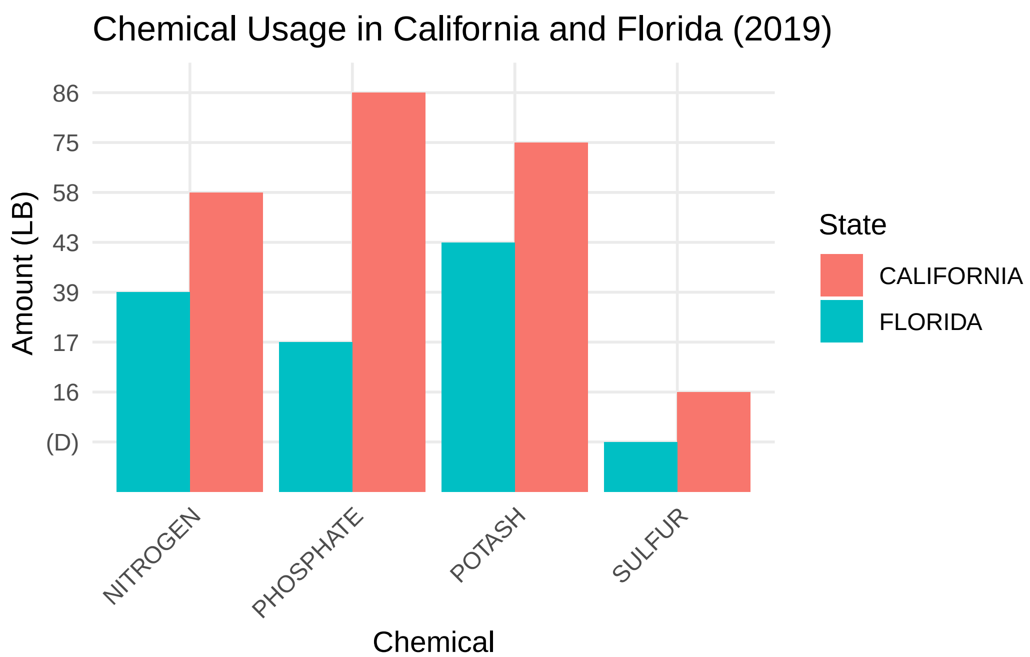


Chemical yearly usage per Acre in California and Florida (2019) - Measured in LB/ACRE/YEAR

```
data_2019 <- data %>%
  filter(Year == 2019 & State %in% c('CALIFORNIA', 'FLORIDA') &
         chem_name %in% c('NITROGEN', 'PHOSPHATE', 'POTASH', 'SULFUR')& measure == "LB / ACRI

# Plot chemical usage for California and Florida in 2019
ggplot(data_2019, aes(x = chem_name, y = Value, fill = State)) +
  geom_bar(stat = "identity", position = "dodge") +
  labs(title = "Chemical Usage in California and Florida (2019)",
```

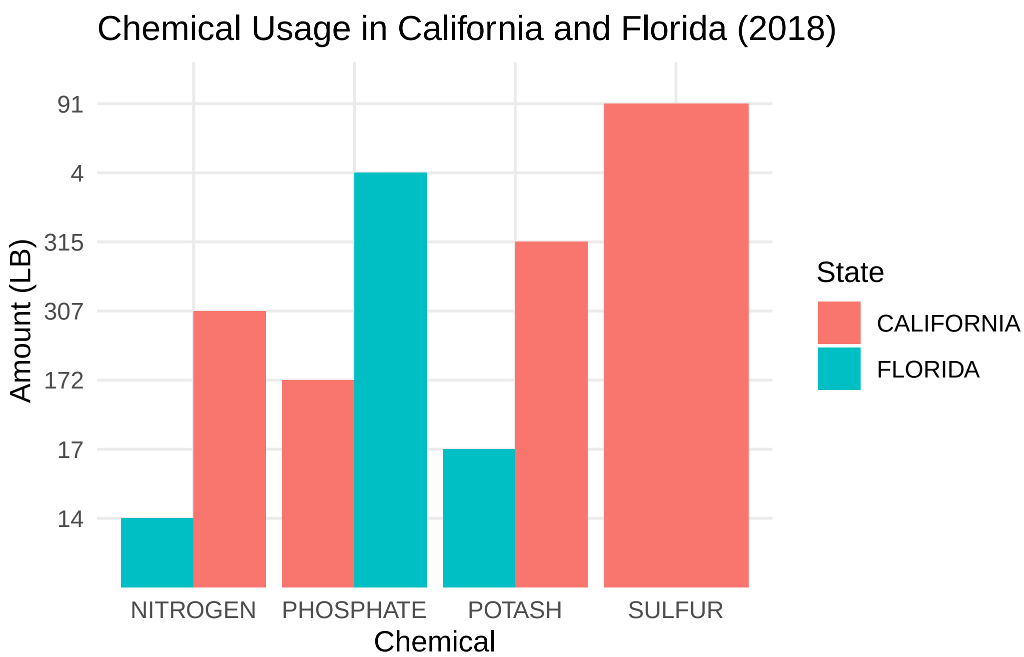
```
       x = "Chemical", y = " Amount (LB)") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 45, hjust = 1))
```



Chemical yearly usage per Acre in California and Florida (2018) - Measured in LB/ACRE/YEAR

```
data_2018 <- data %>%
  filter(Year == 2018 & State %in% c('CALIFORNIA', 'FLORIDA') &
         chem_name %in% c('NITROGEN', 'PHOSPHATE', 'POTASH', 'SULFUR')& measure %in% c('LB /

# Plot chemical usage for California and Florida in 2018
ggplot(data_2018, aes(x = chem_name, y = Value, fill = State)) +
  geom_bar(stat = "identity", position = "dodge") +
  labs(title = "Chemical Usage in California and Florida (2018)",
       x = "Chemical", y = " Amount (LB)") +
  theme_minimal()
```



Detailed EDA Based on Hazards:

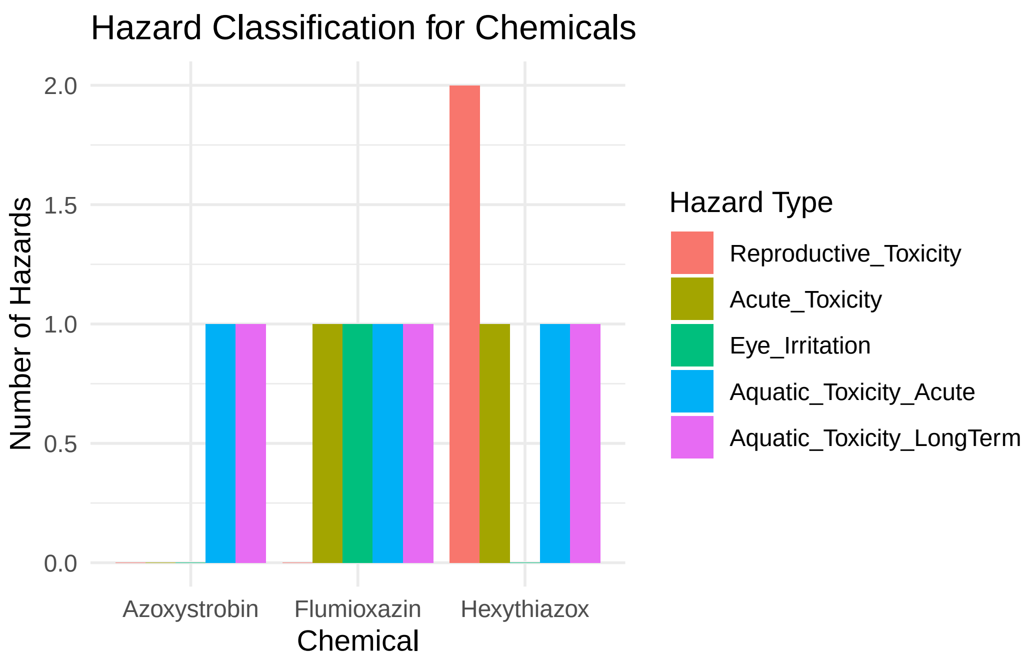
```
# Load necessary libraries
library(ggplot2)
library(dplyr)
library(reshape2)

chemical_hazards <- data.frame(
  Chemical = c("Hexythiazox", "Flumioxazin", "Azoxystrobin"),
  Reproductive_Toxicity = c(2, 0, 0),     # Example based on H360 and H361d
  Acute_Toxicity = c(1, 1, 0),            # Example based on H300 (oral toxicity)
  Eye_Irritation = c(0, 1, 0),            # Example based on H320 (eye irritation)
  Aquatic_Toxicity_Acute = c(1, 1, 1),    # Example based on H400
  Aquatic_Toxicity_LongTerm = c(1, 1, 1) # Example based on H410
)

# Reshape the data for plotting using melt() from reshape2
chemical_long <- melt(chemical_hazards, id.vars = "Chemical",
                      variable.name = "Hazard_Type", value.name = "Count")

# Plot the data using ggplot2
```

```r
ggplot(chemical_long, aes(x = Chemical, y = Count, fill = Hazard_Type)) +
  geom_bar(stat = "identity", position = "dodge") +
  labs(title = "Hazard Classification for Chemicals",
       x = "Chemical",
       y = "Number of Hazards",
       fill = "Hazard Type") +
  theme_minimal()
```



1. **Human Health Hazards:**

   - **Reproductive Toxicity** (H360, H361d):

     - **Hexythiazox** poses a serious risk to reproductive health, classified under "Danger" and "Warning" categories. This makes it essential to implement strict safety protocols when using this chemical, especially around pregnant workers or in areas close to residential communities.

     - **Recommendation**: Ensure proper labeling and restrict the use of Hexythiazox in sensitive areas, as well as monitoring exposure levels among workers.

   - **Acute Toxicity (Oral) and Eye Irritation** (H300, H320):

  - Both **Flumioxazin** and **Hexythiazox** have acute toxicity if ingested. Flumioxazin also causes eye irritation.
  - **Recommendation**: Provide protective equipment to workers (gloves, goggles, masks) and establish clear safety measures to minimize ingestion risks and eye exposure.

2. **Environmental Hazards:**

- **Acute and Long-Term Toxicity to Aquatic Life** (H400, H410):
  - All three chemicals (Hexythiazox, Flumioxazin, and Azoxystrobin) show severe toxicity to aquatic life, both in the short and long term. This indicates a potential risk to water bodies, especially if these chemicals are used near rivers, lakes, or wetlands.
  - **Recommendation**: Implement strict runoff management practices, such as buffer zones around water bodies and controlled application during the rainy season to minimize leaching and runoff risks.

Comparative Analysis:

1. **Hexythiazox** stands out with more severe human health hazards (reproductive toxicity), indicating that it poses a higher risk to workers' health than Flumioxazin or Azoxystrobin. Special precautions should be taken for its usage, handling, and storage.
2. **All three chemicals share common environmental risks**, particularly in terms of their toxicity to aquatic life. This makes it critical to apply these chemicals carefully in agricultural settings near water bodies to avoid detrimental ecological impacts.

Summary and Insights:

- **Phosphate**: California consistently uses more phosphate than Florida over the years, indicating a possible reliance on phosphate for the type of crops grown or specific soil conditions. The steady need for phosphate may suggest that California's soil naturally lacks phosphorus or that it is critical for yield optimization in the crops they focus on.
- **Nitrogen**: Florida's nitrogen use has increased steadily from 2018 to 2023, while California's nitrogen usage has fluctuated slightly, suggesting that different agricultural demands or policies may have driven this change.
- **Potash**: Potash remains stable between the two states, indicating similar agricultural demands for potassium. Potash might be essential for crops common to both regions.

- **Sulfur**: Sulfur usage was significantly higher in California in 2018, possibly for addressing a particular agricultural issue (like pest control or soil management), but it has dropped in subsequent years.

Hypotheses and Future Considerations:

1. **Soil Fertility**: The consistently higher phosphate usage in California may point to lower natural soil phosphorus levels, whereas Florida's soil could be more phosphorus-rich, requiring fewer amendments.
2. **Crop Rotation**: The increase in nitrogen usage in Florida from 2018 to 2023 could indicate a change in crop rotation practices, with nitrogen-demanding crops being introduced in later years.
3. **Policy or Climate-Driven Changes**: The fluctuation in sulfur usage in California may reflect responses to climate or pest outbreaks that required sulfur-based solutions in 2018 but were less necessary in later years.
4. **Environmental Regulations**: Varying usage patterns may also be linked to environmental regulations or shifts in best practices for sustainable farming, particularly in states with strong agricultural sectors like California and Florida.

Conclusion:

The comparison of chemical usage across California and Florida from 2018 to 2023 reveals differences in nutrient needs and application trends between the two states. California consistently relies on phosphate and potash, while Florida shows increasing nitrogen demand over time. The fluctuations in sulfur usage suggest temporary agricultural challenges that were addressed in 2018. Understanding these trends can help inform sustainable agricultural practices and optimize chemical usage based on soil conditions and crop needs.