Final USDA NASS Data Cleaning first time update

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```
# Load necessary libraries
library(tidyverse)
```

```
── Attaching core tidyverse packages ──────────────────────── tidyverse 2.0.0 ──
✔ dplyr     1.1.4     ✔ readr     2.1.5
✔ forcats   1.0.0     ✔ stringr   1.5.1
✔ ggplot2   3.5.1     ✔ tibble    3.2.1
✔ lubridate 1.9.3     ✔ tidyr     1.3.1
✔ purrr     1.0.2
── Conflicts ────────────────────────────────────────── tidyverse_conflicts() ──
✖ dplyr::filter() masks stats::filter()
✖ dplyr::lag()    masks stats::lag()
ℹ Use the conflicted package (<http://conflicted.r-lib.org/>) to force all conflicts to
become errors
```

```
# Load the datasets
census <- read.csv("census_clean_output.csv")
survey <- read.csv("survey_clean_output.csv")

# Explore dataset structures
print("Census Dataset Structure:")
```

```
[1] "Census Dataset Structure:"
```

```
str(census)
```

```
'data.frame':   953 obs. of  13 variables:
 $ Program        : chr  "CENSUS" "CENSUS" "CENSUS" "CENSUS" ...
 $ Year           : int  2022 2022 2022 2022 2022 2022 2022 2022 2022 2022 ...
 $ Period         : chr  "YEAR" "YEAR" "YEAR" "YEAR" ...
 $ Geo.Level      : chr  "NATIONAL" "NATIONAL" "NATIONAL" "NATIONAL" ...
 $ State          : chr  "US TOTAL" "US TOTAL" "US TOTAL" "US TOTAL" ...
 $ State.ANSI     : int  -1 -1 -1 -1 -1 -1 -1 -1 -1 -1 ...
 $ Sub_Type       : chr  "OTHER" "OTHER" "OTHER" "OTHER" ...
 $ Operation_Type : chr  "ACRES BEARING" "ACRES NON-BEARING" "ACRES NON-BEARING" "ACRES
NON-BEARING" ...
 $ Domain         : chr  "AREA GROWN" "AREA GROWN" "AREA GROWN" "AREA GROWN" ...
 $ Category_Class : chr  "AREA GROWN" "AREA GROWN" "AREA GROWN" "AREA GROWN" ...
 $ Additional_Info: chr  "0.1 TO 0.9 ACRES" "0.1 TO 0.9 ACRES" "1.0 TO 4.9 ACRES" "100 OR
MORE ACRES" ...
 $ Value          : int  963 236 535 666 244 210 547 315 161 146 ...
 $ CV....         : chr  "5.6" "13.2" "5.1" "4.2" ...
```

```r
print("Survey Dataset Structure:")
```

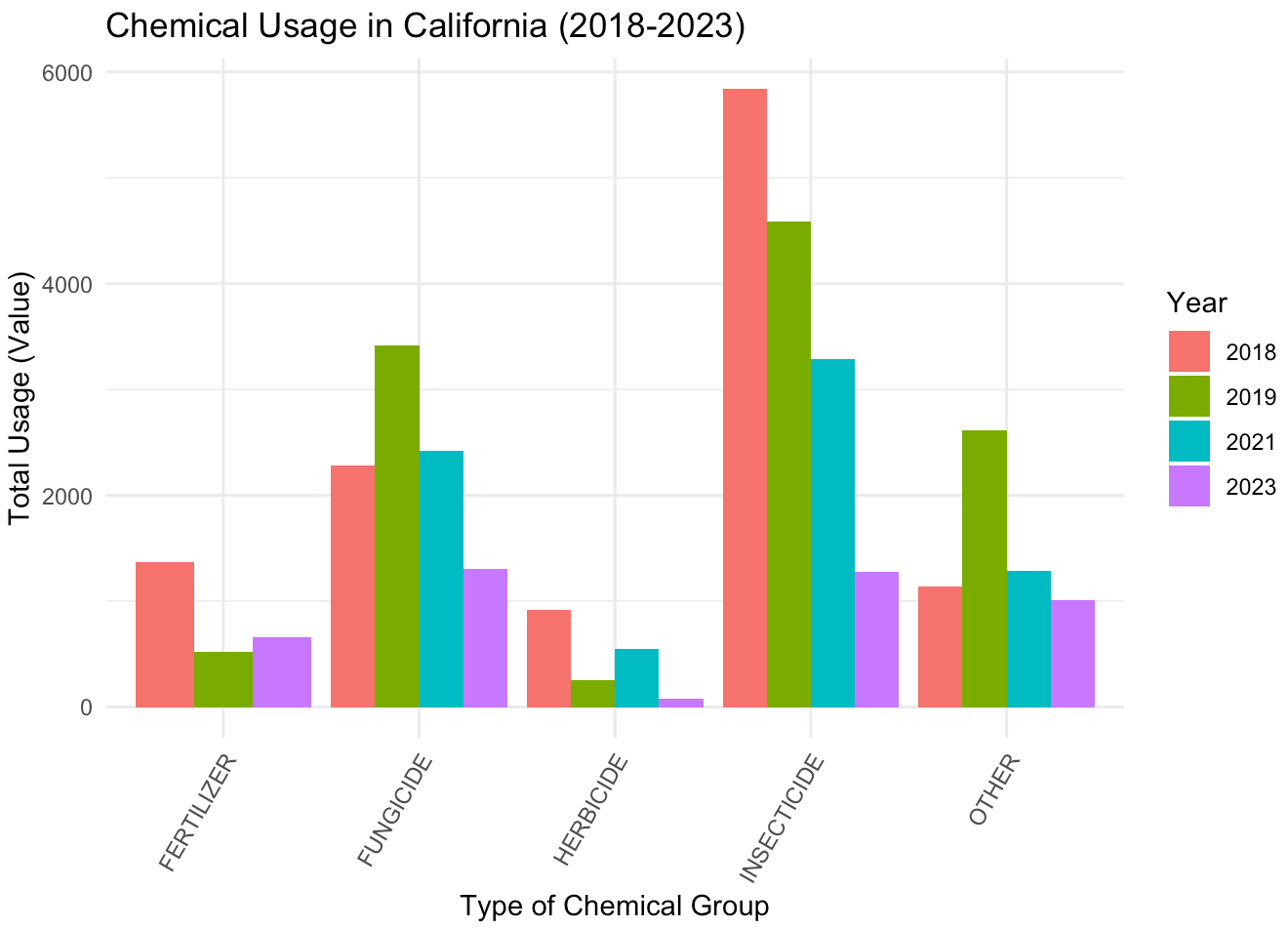
```
[1] "Survey Dataset Structure:"
```

```r
str(survey)
```

```
'data.frame':   1432 obs. of  15 variables:
 $ Program        : chr  "SURVEY" "SURVEY" "SURVEY" "SURVEY" ...
 $ Year           : int  2024 2024 2023 2023 2023 2023 2023 2023 2023 2023 ...
 $ Period         : chr  "YEAR" "YEAR" "MARKETING YEAR" "MARKETING YEAR" ...
 $ Geo.Level      : chr  "NATIONAL" "NATIONAL" "NATIONAL" "NATIONAL" ...
 $ State          : chr  "US TOTAL" "US TOTAL" "US TOTAL" "US TOTAL" ...
 $ State.ANSI     : int  -1 -1 -1 -1 -1 6 12 -1 -1 -1 ...
 $ Market_Category: chr  "FRESH MARKET" "PROCESSING" "OTHER" "FRESH MARKET" ...
 $ Measure_Type   : chr  "PRICE RECEIVED, ADJUSTED BASE" "PRICE RECEIVED, ADJUSTED BASE"
"PRICE RECEIVED" "PRICE RECEIVED" ...
 $ Unit_Type      : chr  "$ / CWT" "$ / TON" "$ / CWT" "$ / CWT" ...
 $ Domain         : chr  "TOTAL" "TOTAL" "TOTAL" "TOTAL" ...
 $ Chemical_Group : chr  "NOT SPECIFIED" "NOT SPECIFIED" "NOT SPECIFIED" "NOT SPECIFIED"
...
 $ Chemical_Name  : chr  "NOT SPECIFIED" "NOT SPECIFIED" "NOT SPECIFIED" "NOT SPECIFIED"
...
 $ Chemical_Code  : int  NA NA NA NA NA NA NA NA NA NA ...
 $ Value          : num  10.9 4.04 123 142 43.8 121 147 142 43.8 485 ...
 $ CV....         : logi  NA NA NA NA NA NA ...
```

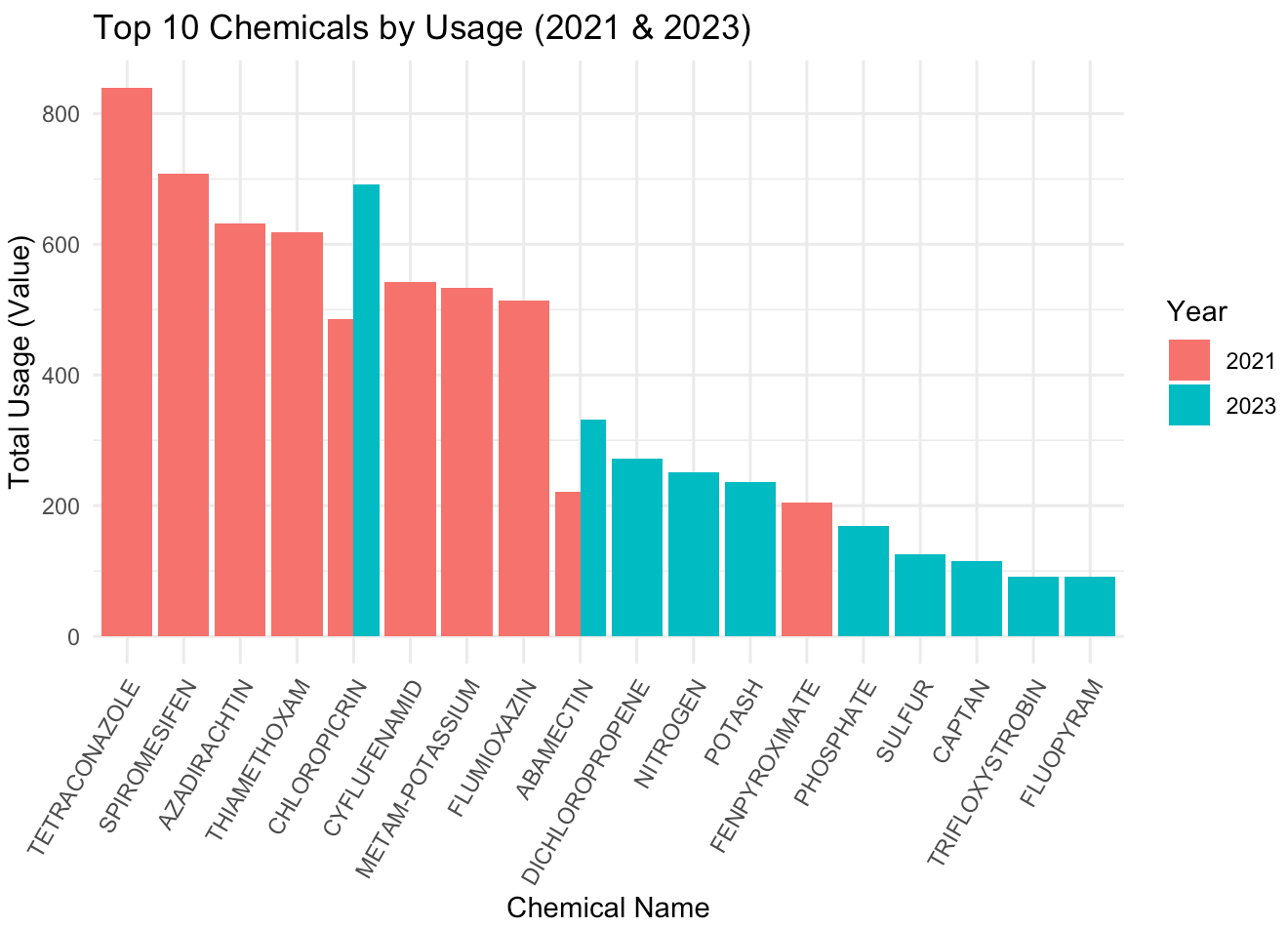
```r
# Filter survey data for California-specific information
california_data <- subset(survey, toupper(State) == "CALIFORNIA")

# Exclude unspecified or total values in `Chemical_Name`
cleaned_data <- subset(california_data,
                       !(Chemical_Name %in% c("NOT SPECIFIED", "TOTAL")))

# Focus on data from the past five years (2018-2023)
recent_data <- cleaned_data[cleaned_data$Year >= 2018, ]

# Check if recent_data is empty
if (nrow(recent_data) == 0) {
  stop("No data available after applying the filters.")
}

# Summary and visualization of survey data

# Summarize chemical usage by group and year
usage_summary <- recent_data %>%
  group_by(Chemical_Group, Year) %>%
  summarise(Total_Usage = sum(Value, na.rm = TRUE), .groups = 'drop')

# Plot chemical usage by category
```

```r
ggplot(usage_summary, aes(x = Chemical_Group, y = Total_Usage, fill = as.factor(Year))) +
  geom_bar(stat = "identity", position = "dodge") +
  labs(title = "Chemical Usage in California (2018-2023)",
       x = "Type of Chemical Group",
       y = "Total Usage (Value)",
       fill = "Year") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 60, hjust = 1))
```



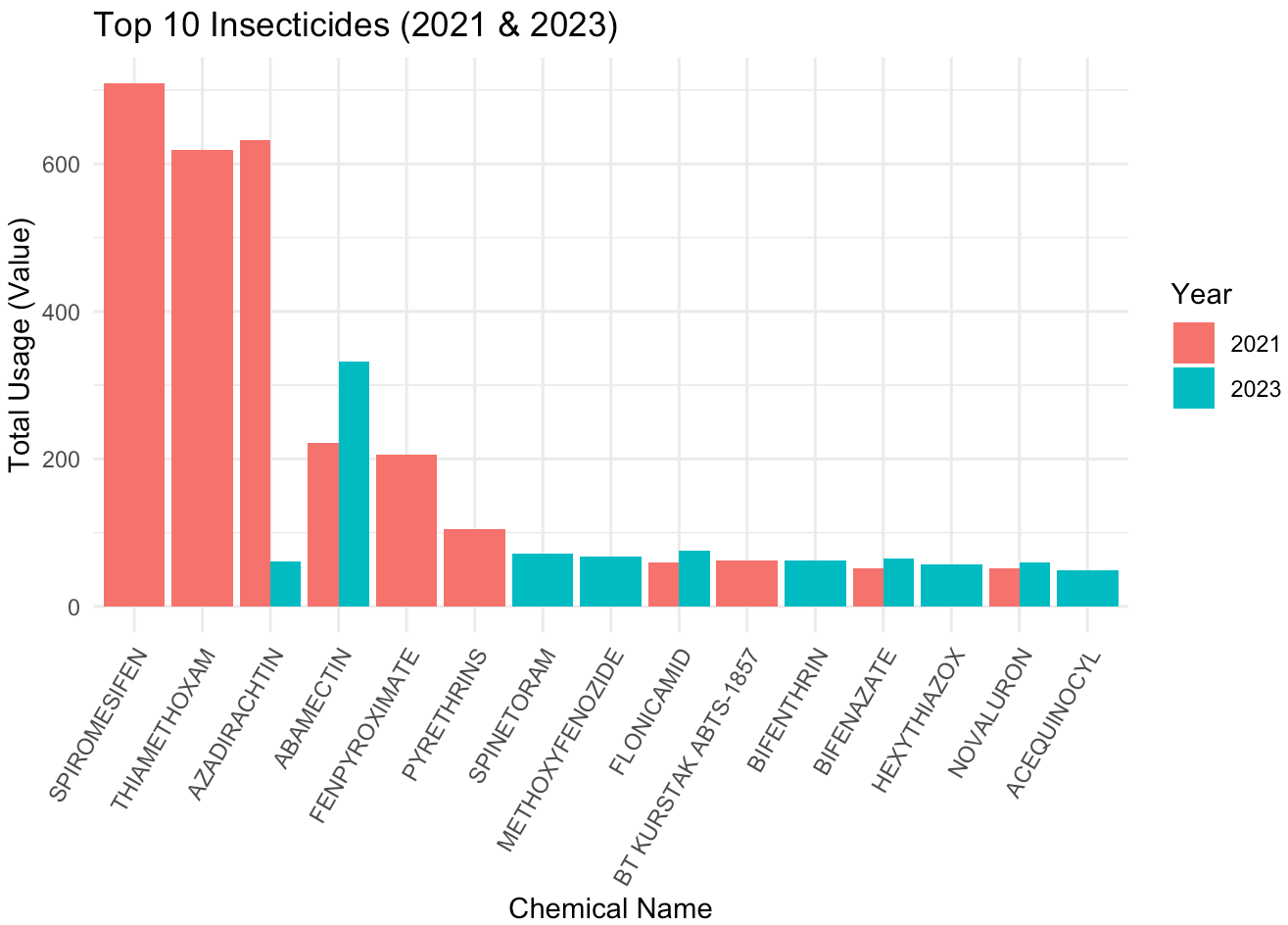

```r
# Analyze top chemicals for specific years
chemicals_by_year <- recent_data %>%
  group_by(Chemical_Name, Year) %>%
  summarise(Total_Usage = sum(Value, na.rm = TRUE), .groups = 'drop')

top_chemicals <- function(year, n = 10) {
  chemicals_by_year %>%
    filter(Year == year) %>%
    arrange(desc(Total_Usage)) %>%
    head(n)
}

top_2023 <- top_chemicals(2023)
top_2021 <- top_chemicals(2021)
```

```r
# Combine data for comparison
comparison_data <- bind_rows(top_2023, top_2021)

# Plot top chemicals for 2021 and 2023
ggplot(comparison_data, aes(x = reorder(Chemical_Name, -Total_Usage),
                            y = Total_Usage, fill = as.factor(Year))) +
  geom_bar(stat = "identity", position = "dodge") +
  labs(title = "Top 10 Chemicals by Usage (2021 & 2023)",
       x = "Chemical Name",
       y = "Total Usage (Value)",
       fill = "Year") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 60, hjust = 1))
```




```r
# Filter for insecticides
insecticides <- recent_data %>%
  filter(Chemical_Group == "INSECTICIDE") %>%
  group_by(Chemical_Name, Year) %>%
  summarise(Total_Usage = sum(Value, na.rm = TRUE), .groups = 'drop')

top_insecticides <- function(year, n = 10) {
  insecticides %>%
```

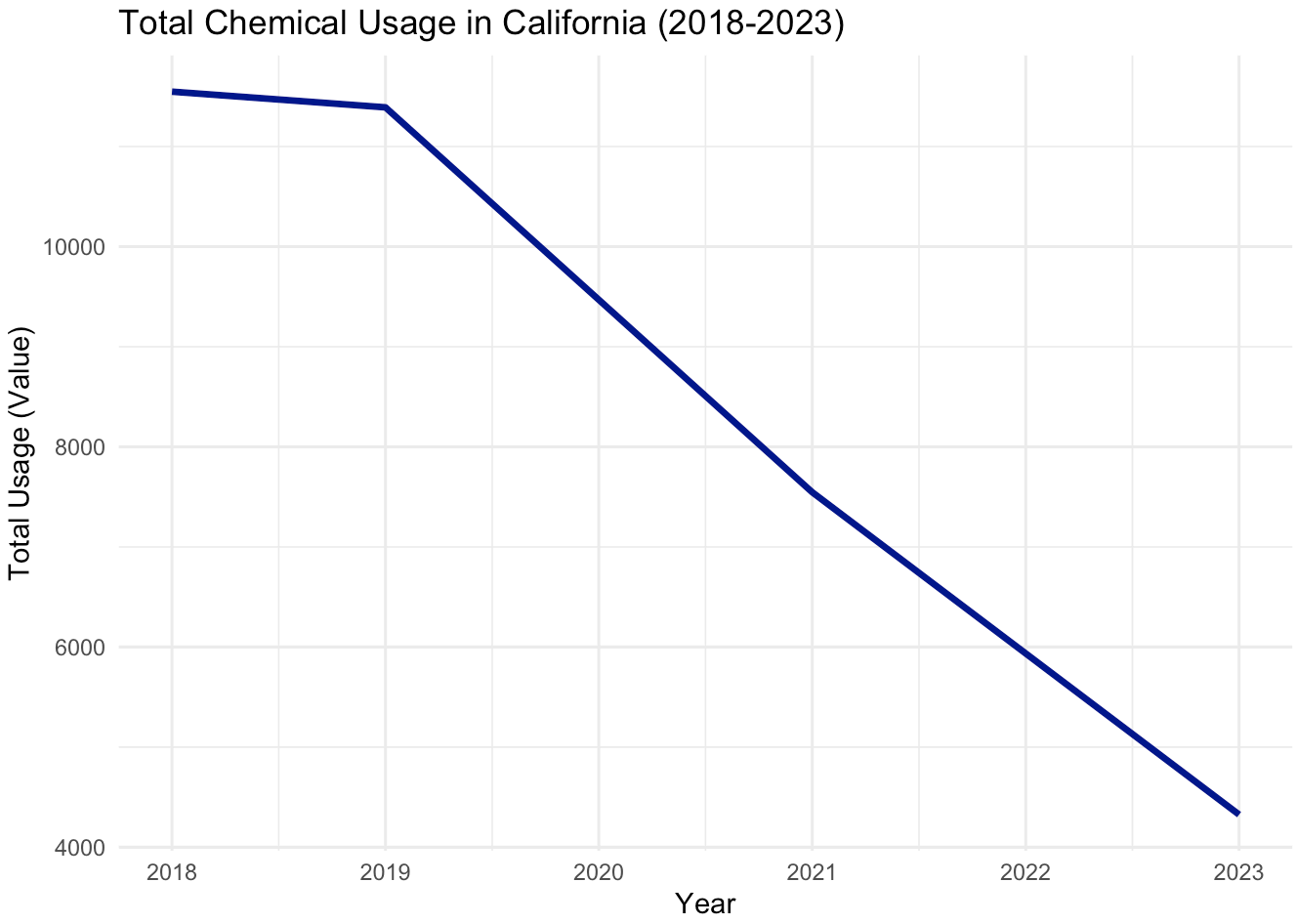
```
    filter(Year == year) %>%
    arrange(desc(Total_Usage)) %>%
    head(n)
}

insecticides_2023 <- top_insecticides(2023)
insecticides_2021 <- top_insecticides(2021)

# Combine and plot insecticide data
insecticide_comparison <- bind_rows(insecticides_2023, insecticides_2021)

ggplot(insecticide_comparison, aes(x = reorder(Chemical_Name, -Total_Usage),
                                   y = Total_Usage, fill = as.factor(Year))) +
  geom_bar(stat = "identity", position = "dodge") +
  labs(title = "Top 10 Insecticides (2021 & 2023)",
       x = "Chemical Name",
       y = "Total Usage (Value)",
       fill = "Year") +
  theme_minimal() +
  theme(axis.text.x = element_text(angle = 60, hjust = 1))
```




```
# Total usage trend over years
total_usage <- recent_data %>%
```

```
  group_by(Year) %>%
  summarise(Annual_Usage = sum(Value, na.rm = TRUE), .groups = 'drop')

ggplot(total_usage, aes(x = Year, y = Annual_Usage)) +
  geom_line(color = "darkblue", size = 1.2) +
  labs(title = "Total Chemical Usage in California (2018-2023)",
       x = "Year",
       y = "Total Usage (Value)") +
  theme_minimal()
```

```
Warning: Using `size` aesthetic for lines was deprecated in ggplot2 3.4.0.
ℹ Please use `linewidth` instead.
```




```
# Census Data Analysis

# Quick summary of census data
census_summary <- census %>%
  summarise(across(where(is.numeric), list(mean = mean, sd = sd, median = median), na.rm
```

```
Warning: There was 1 warning in `summarise()`.
ℹ In argument: `across(...)`.
Caused by warning:
! The `...` argument of `across()` is deprecated as of dplyr 1.1.0.
```

```
Supply arguments directly to `.fns` through an anonymous function instead.

  # Previously
  across(a:b, mean, na.rm = TRUE)

  # Now
  across(a:b, \(x) mean(x, na.rm = TRUE))
```

```
print("Census Data Summary:")
```

```
[1] "Census Data Summary:"
```

```
print(census_summary)
```

```
  Year_mean  Year_sd Year_median State.ANSI_mean State.ANSI_sd
1  2021.127 1.213387        2022        29.69675      16.01592
  State.ANSI_median Value_mean Value_sd Value_median
1                31   111.4008 169.1082           36
```

```
# Check unique values in census for specific fields
unique_census_fields <- lapply(census, unique)
print("Unique Census Fields:")
```

```
[1] "Unique Census Fields:"
```

```
print(unique_census_fields)
```

```
$Program
[1] "CENSUS"

$Year
[1] 2022 2021 2019

$Period
[1] "YEAR"

$Geo.Level
[1] "NATIONAL" "STATE"

$State
 [1] "US TOTAL"       "ALABAMA"        "ALASKA"         "ARIZONA"
 [5] "ARKANSAS"       "CALIFORNIA"     "COLORADO"       "CONNECTICUT"
 [9] "DELAWARE"       "FLORIDA"        "GEORGIA"        "HAWAII"
[13] "IDAHO"          "ILLINOIS"       "INDIANA"        "IOWA"
[17] "KANSAS"         "KENTUCKY"       "LOUISIANA"      "MAINE"
[21] "MARYLAND"       "MASSACHUSETTS"  "MICHIGAN"       "MINNESOTA"
[25] "MISSISSIPPI"    "MISSOURI"       "MONTANA"        "NEBRASKA"
[29] "NEVADA"         "NEW HAMPSHIRE"  "NEW JERSEY"     "NEW MEXICO"
```

```
[33] "NEW YORK"       "NORTH CAROLINA" "NORTH DAKOTA"   "OHIO"
[37] "OKLAHOMA"       "OREGON"         "PENNSYLVANIA"   "RHODE ISLAND"
[41] "SOUTH CAROLINA" "SOUTH DAKOTA"   "TENNESSEE"      "TEXAS"
[45] "UTAH"           "VERMONT"        "VIRGINIA"       "WASHINGTON"
[49] "WEST VIRGINIA"  "WISCONSIN"      "WYOMING"

$State.ANSI
 [1] -1  1  2  4  5  6  8  9 10 12 13 15 16 17 18 19 20 21 22 23 24 25 26 27 28
[26] 29 30 31 32 33 34 35 36 37 38 39 40 41 42 44 45 46 47 48 49 50 51 53 54 55
[51] 56

$Sub_Type
[1] "OTHER"                 "ORGANIC"               "ORGANIC, FRESH MARKET"
[4] "ORGANIC, PROCESSING"

$Operation_Type
 [1] "ACRES BEARING"                    "ACRES NON-BEARING"
 [3] "OPERATIONS WITH AREA BEARING"     "OPERATIONS WITH AREA GROWN"
 [5] "OPERATIONS WITH AREA NON-BEARING" "ACRES GROWN"
 [7] "OPERATIONS WITH AREA HARVESTED"   "OPERATIONS WITH SALES"
 [9] "ACRES HARVESTED"                  "PRODUCTION, MEASURED IN CWT"
[11] "SALES, MEASURED IN CWT"

$Domain
[1] "AREA GROWN"     "TOTAL"          "ORGANIC STATUS"

$Category_Class
[1] "AREA GROWN"     "NOT SPECIFIED"  "ORGANIC STATUS"

$Additional_Info
[1] "0.1 TO 0.9 ACRES"   "1.0 TO 4.9 ACRES"   "100 OR MORE ACRES"
[4] "15.0 TO 24.9 ACRES" "25.0 TO 49.9 ACRES" "5.0 TO 14.9 ACRES"
[7] "50.0 TO 99.9 ACRES" "NOT SPECIFIED"      "NOP USDA CERTIFIED"

$Value
  [1] 963 236 535 666 244 210 547 315 161 146 131 510 147 514 562  17  43  22
 [19] 200  16 162 171   9 107 119  18  11  14   3  45  50   8   4   1  24 116
 [37] 128  12  71  80 138 370  46 165 676 409  27 438  38  40 169 720 189  74
 [55] 114  36  47  52 626 212  76 651  32  10  85  30  20  39  64 156  37  97
 [73]  44   5 180 469 249  54  82  19 280   2 269  21 121 150  41  72  78 175
 [91] 208  33 154 184 220 262 223 248 144  25 126 145  42  49 152 218 182 293
[109] 371 193  94 135  15 129 142  26 258 303 233  70 164  88 324 714  59 195
[127]  92 115 415 875  31  91 266  93 420 305  96 462  55 136 308 401  51  35
[145]   7  48 112 134  81 102 257 137 267 140 263 751 306 328 913  66 241 439
[163] 277 475   6 221 234 385 118 174  13  61 322 340  60 445 511 361 393  87
[181] 106 468 122 681 494 188 294 206  57 313 663 329 163 756 411 628 444 187
[199] 664  89 153 707 713 192 155 166 225  86 117 168 111 125 205 227 203 231
[217]  67 149 856 160 287 239 307  28  65 529 726 197 261  75 139 546 540 141
[235] 183 704  53  62 504 127 251 564 749 659  90 132 734 360 522 426 580 568
[253] 170 181 177 680 100 288 158 485 435  73  34 300 880 341 332 219  23
```

```
$CV....
  [1] "5.6"  "13.2" "5.1"  "4.2"  "34.1" "37.3" "9.9"  "(H)"  "25.4" "17.2"
 [11] "11.9" "7.3"  "44.0" "18.3" "6.4"  "27.9" "19.0" "40.9" "8.2"  "72.6"
 [21] "16.9" "17.5" "80.0" "19.7" "26.9" "(L)"  "29.4" "33.8" "93.3" "25.8"
 [31] "15.8" "38.0" "33.4" "33.0" "42.1" "36.0" "35.7" "34.2" "31.6" "45.6"
 [41] "91.9" "42.5" "31.8" "23.5" "83.7" "52.1" "50.2" "39.6" "98.6" "34.3"
 [51] "43.5" "27.1" "63.8" "42.6" "93.5" "27.8" "92.0" "39.5" "47.4" "68.3"
 [61] "77.8" "58.8" "73.5" "47.0" "59.7" "18.2" "18.8" "26.5" "22.7" "18.6"
 [71] "8.6"  "15.9" "19.4" "5.3"  "46.0" "40.2" "37.9" "76.1" "22.2" "20.1"
 [81] "59.9" "13.4" "23.3" "33.2" "21.1" "59.0" "22.5" "18.7" "41.1" "12.6"
 [91] "82.2" "68.4" "13.0" "12.7" "31.0" "16.0" "2.9"  "29.0" "27.3" "33.5"
[101] "22.8" "29.2" "15.4" "14.4" "13.7" "11.7" "5.4"  "14.1" "7.1"  "10.2"
[111] "12.1" "10.7" "17.7" "16.8" "19.5" "24.0" "21.8" "39.3" "28.1" "28.0"
[121] "32.9" "42.3" "45.4" "42.7" "33.9" "63.2" "35.3" "31.3" "18.9" "12.5"
[131] "14.2" "4.8"  "4.1"  "11.4" "11.3" "19.6" "13.5" "29.6" "9.6"  "20.0"
[141] "10.4" "67.2" "10.1" "8.7"  "61.9" "11.6" "25.3" "19.3" "44.4" "11.8"
[151] "15.7" "12.0" "71.2" "11.2" "17.0" "12.2" "37.1" "11.5" "10.8" "20.3"
[161] "14.8" "30.2" "11.0" "24.4" "89.2" "65.3" "74.1" "8.0"  "10.0" "49.6"
[171] "43.0" "26.8" "21.3" "38.3" "25.7" "78.2" "16.3" "23.6" "25.1" "24.7"
[181] "24.6" "23.4" "21.7" "7.2"  "6.3"  "6.8"  "38.1" "47.7" "40.1" "59.5"
[191] "14.3" "11.1" "31.2" "6.0"  "51.1" "5.8"  "27.4" "6.1"  "56.5" "26.7"
[201] "32.2" "34.4" "36.6" "94.7" "51.5" "31.4" "52.5" "32.7" "54.3" "60.4"
[211] "49.2" "14.9" "16.6" "14.0" "13.9" "6.2"  "10.5" "36.2" "15.2" "18.1"
[221] "64.1" "23.0" "39.2" "26.4" "60.7" "40.5" "44.7" "58.4" "40.0" "24.3"
[231] "77.5" "39.4" "6.7"  "12.9" "23.2" "84.2" "50.7" "75.0" "22.4" "30.7"
[241] "16.4" "14.5" "38.9" "35.2" "13.6" "34.7" "17.8" "24.9" "17.1" "39.1"
[251] "8.8"  "37.5" "9.3"  "6.9"  "30.6" "23.7" "42.2" "22.1" "27.0" "12.8"
[261] "12.3" "28.5" "34.5" "37.8" "69.5" "42.0" "72.3" "54.4" "48.5" "31.9"
[271] "21.2" "16.1" "25.2" "21.0" "20.9" "43.7" "25.0" "38.5" "22.9" "64.7"
[281] "17.4" "57.2" "88.3" "13.3" "71.8" "85.5" "39.7" "95.9" "97.2" "50.6"
[291] "69.4" "13.8" "53.2" "42.4" "44.1" "49.1" "25.5" "8.4"  "53.3" "9.4"
[301] "82.0" "56.0" "5.7"  "48.3" "6.5"  "5.5"  "41.8" "67.1" "89.4" "74.2"
[311] "19.2" "20.4" "60.0" "74.4" "99.8" "57.3" "92.4" "80.4" "78.0" "87.5"
[321] "71.4" "95.4" "94.9" "97.5" "96.4" "76.0" "69.1" "72.0" "62.4" "38.4"
[331] "31.1" "35.4" "89.6" "79.2" "76.5" "47.2" "32.5" "43.9" "45.8" "54.0"
[341] "43.6" "62.9" "71.5" "58.7" "76.7" "67.5" "72.1" "70.4" "54.2" "45.7"
[351] "48.1" "49.0" "43.3" "38.8" "73.0" "82.3" "73.6" "82.8" "2.7"  "2.8"
[361] "34.8" "30.4" "36.7" "33.3" "79.0" "39.8" "61.3" "56.2" "59.2" "69.8"
[371] "94.6" "94.1" "47.9" "28.7" "95.0" "66.3" "56.9" "95.2" "43.1" "76.3"
[381] "32.0" "58.3" "80.9" "56.3" "23.8" "55.9"
```

```r
# Correlation analysis (if applicable)
if (sum(sapply(census, is.numeric)) > 1) {
  numeric_census <- census %>% select(where(is.numeric))
  census_corr <- cor(numeric_census, use = "complete.obs")
  print("Census Correlation Matrix:")
  print(census_corr)
}
```

```
[1] "Census Correlation Matrix:"
                Year  State.ANSI       Value
Year       1.00000000  0.02387442  0.08525713
State.ANSI 0.02387442  1.00000000 -0.04325990
Value      0.08525713 -0.04325990  1.00000000
```

```r
# Visualization for census data (e.g., population trends, economic trends)
# Adjust field names based on actual data
if ("Year" %in% colnames(census) & "Population" %in% colnames(census)) {
  ggplot(census, aes(x = Year, y = Population)) +
    geom_line(color = "darkgreen") +
    labs(title = "Population Trends Over Years",
         x = "Year",
         y = "Population") +
    theme_minimal()
}
```