

# How Climate Change Affects U.S. Corn and Wheat Yields

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[https://github.com/yilongxu-  
usc/dsci510 fall2025 final project](https://github.com/yilongxu-usc/dsci510_fall2025_final_project)

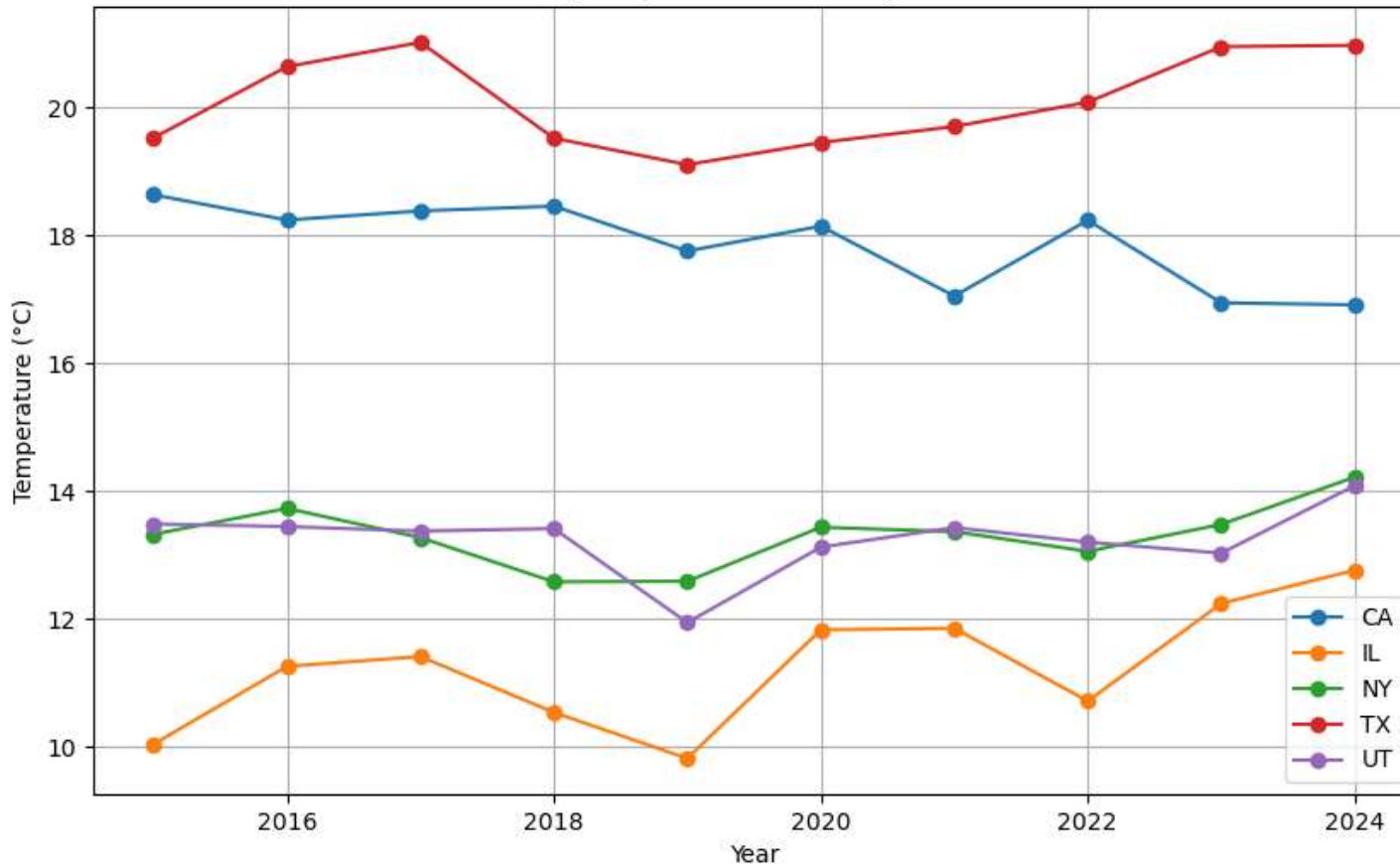
# Data Sources

Date Range: 2015/01/01- 2024-12-31

Dataset	Description	Type	Format	Data Size
Corn Yield Data, USDA NASS	<ul style="list-style-type: none"><li>Provides annual corn yield (bushels per acre) for U.S. states.</li><li>Shows how corn productivity varies geographically and how yields change over time</li></ul>	API Call	HTML response > json > CSV	2400 rows, 3 columns
Wheat Yield Data, USDA NASS	<ul style="list-style-type: none"><li>Contains annual wheat yield statistics for U.S. states</li><li>Works together with corn yield data to provide two independent agricultural indicators</li></ul>		HTML response > json > CSV	2600 rows, 3 columns
Monthly temperature and precipitaion	<ul style="list-style-type: none"><li>Provides monthly average temperature (TAVG) and total precipitation (PRCP) for multiple U.S. climate stations</li><li>Used to compute annual climate metrics (mean temperature, accumulated precipitation)</li></ul>		HTML response > json > CSV	950 rows, 7 columns

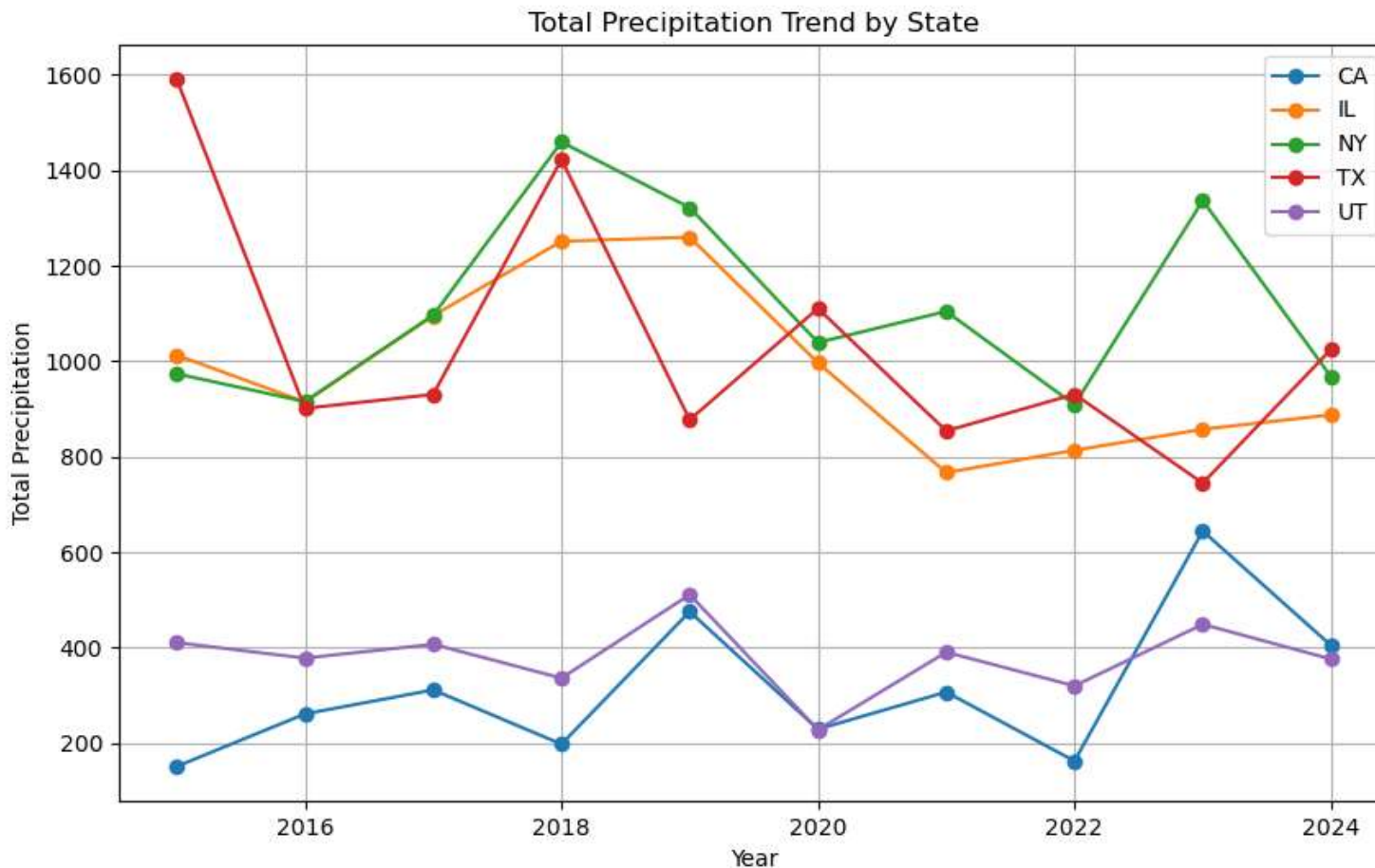
# Temperature Trends Across States (2015–2024)

Avg Temperature Trend by State



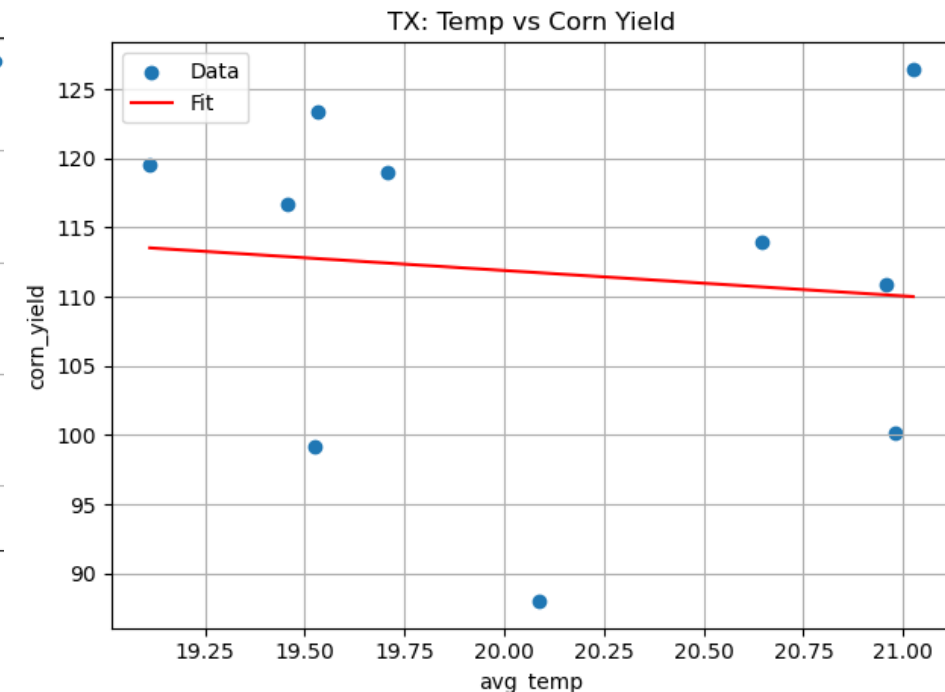
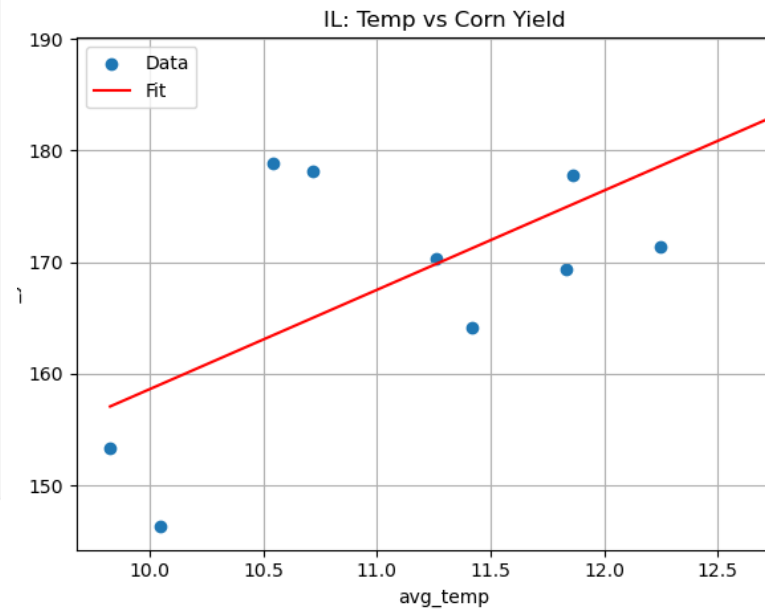
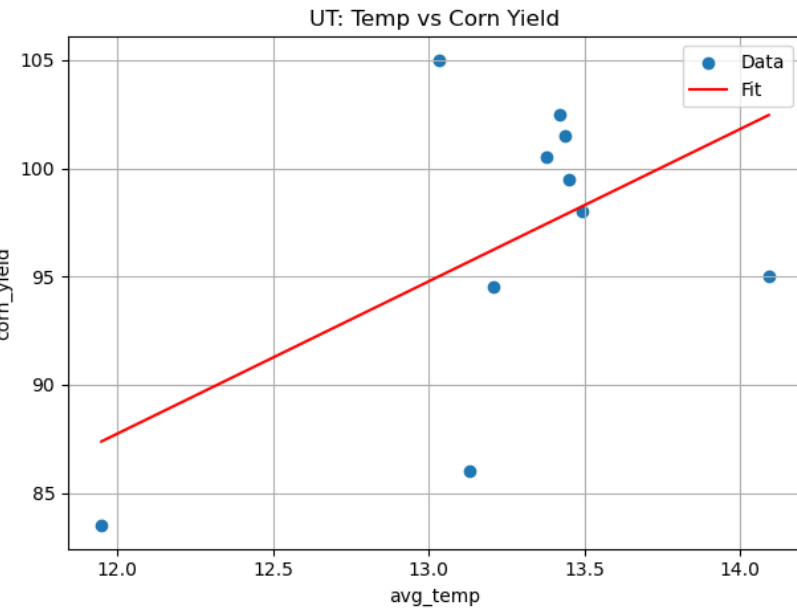
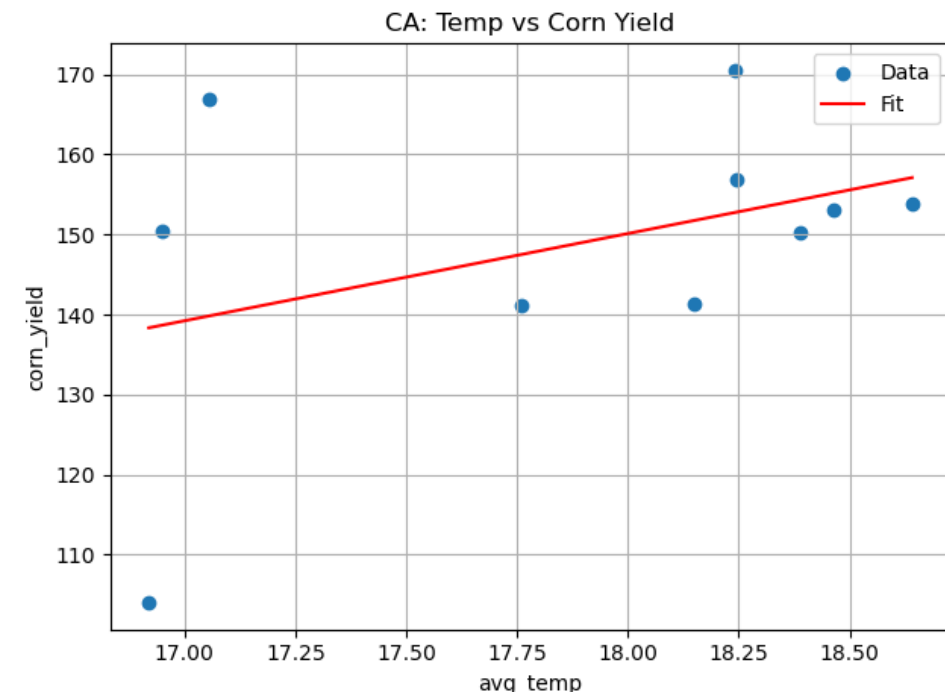
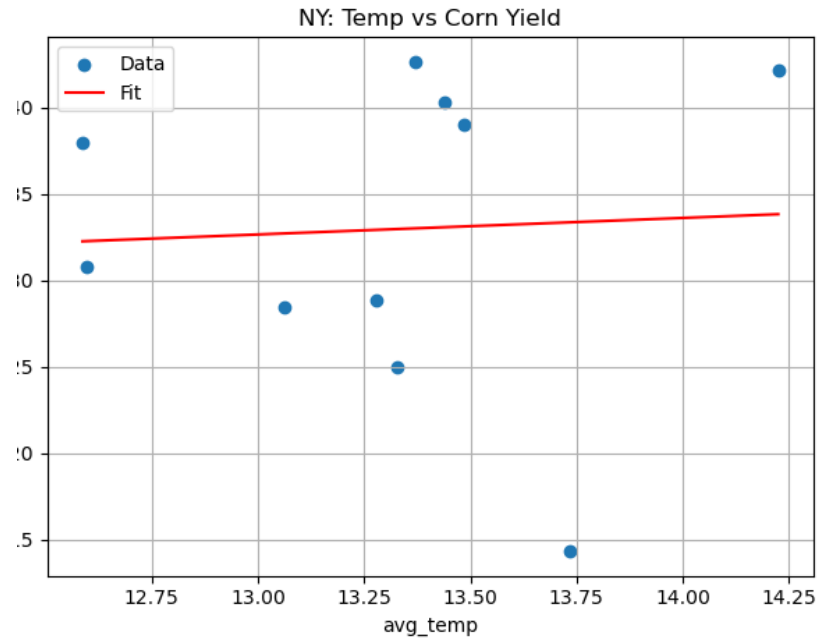
- All five states (CA, IL, NY, TX, UT) show mild warming trends, but not uniformly.
- California and Texas have the warmest average temperatures (17–20°C range)
- Illinois and New York stay cooler (9–14°C range)
- Utah shows the largest year-to-year fluctuation, indicating higher climate variability

# Precipitation Trends (2015-2024)

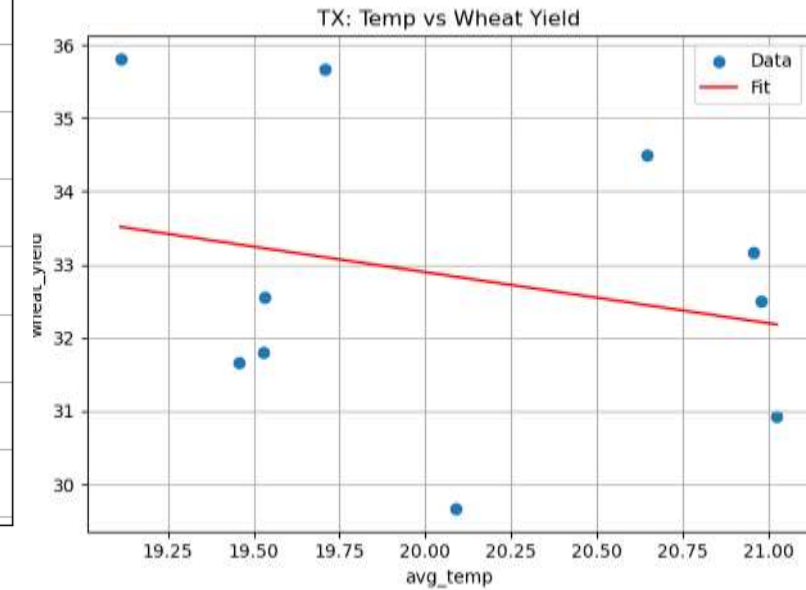
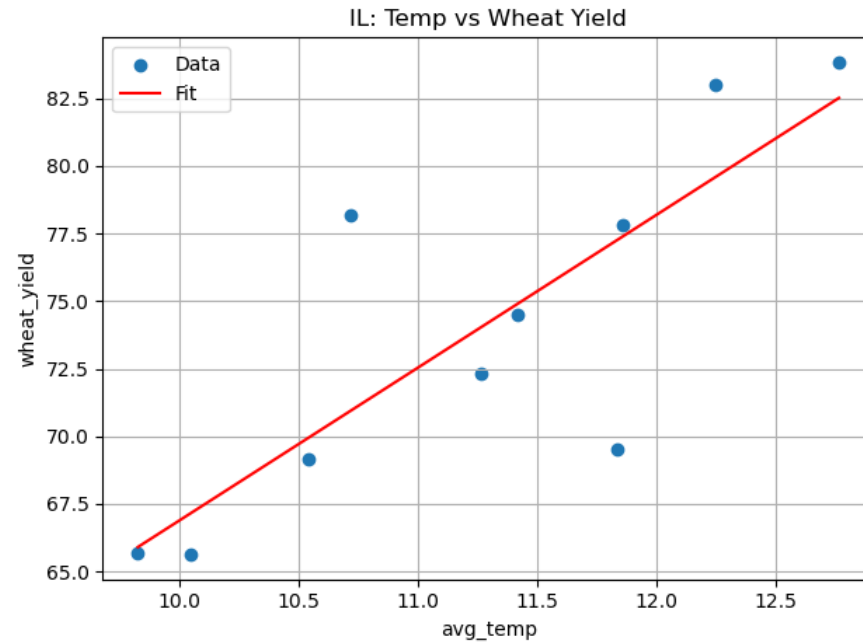
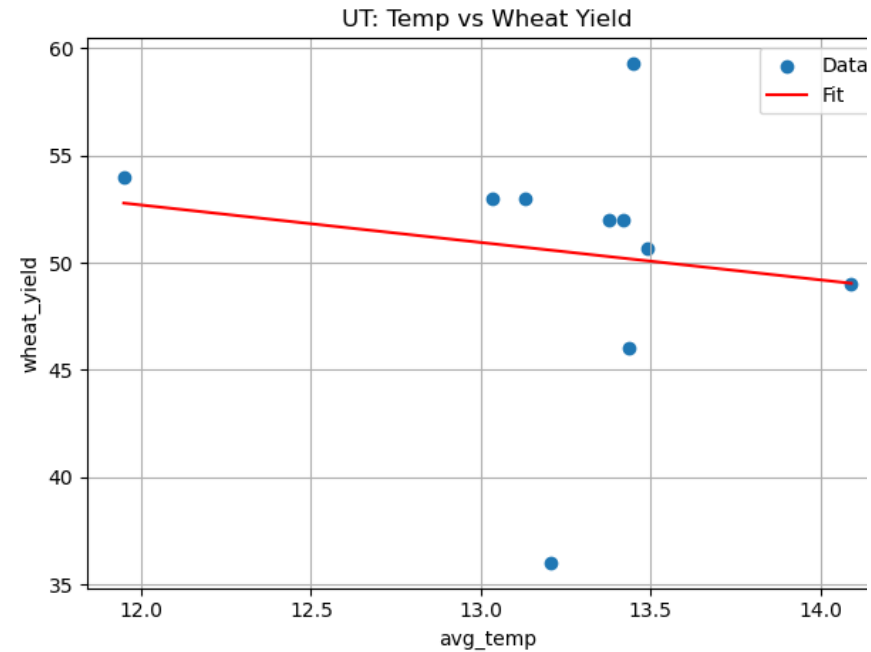
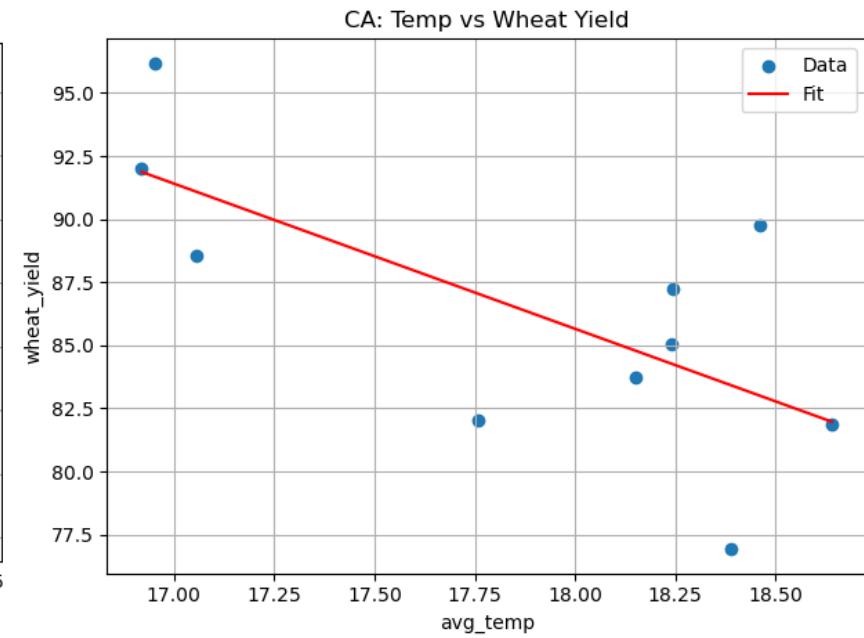
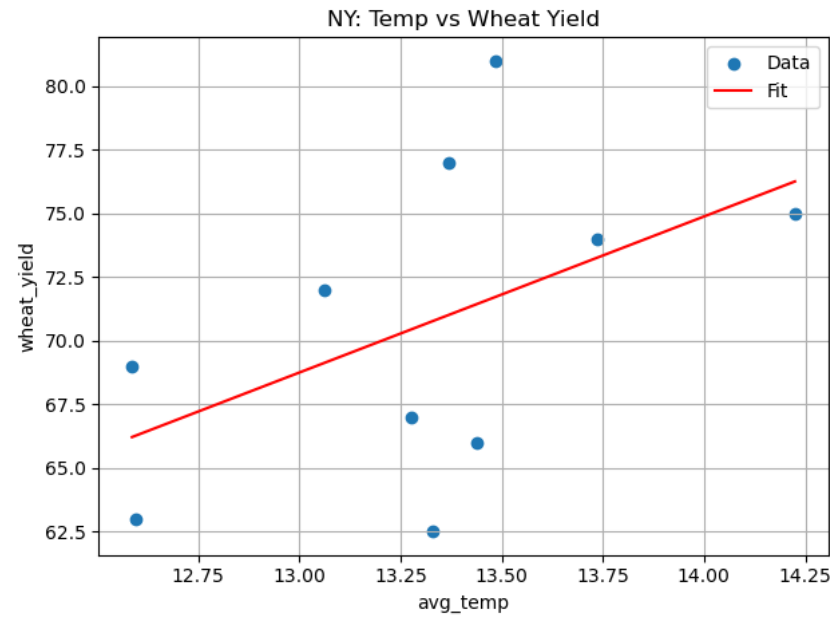


- Precipitation levels differ widely across states. Texas (TX) and New York (NY) have the highest rainfall, while California (CA) and Utah (UT) experience consistently dry conditions
- Texas shows the strongest volatility, swinging between very wet and very dry years, indicating strong influence from extremes such as droughts and heavy storms.
- New York also fluctuates, but the changes are less dramatic compared to Texas
- Illinois has moderate and relatively stable precipitation, without extreme annual swings
- California and Utah remain low-precipitation states, with smaller overall variations, reflecting their arid climates

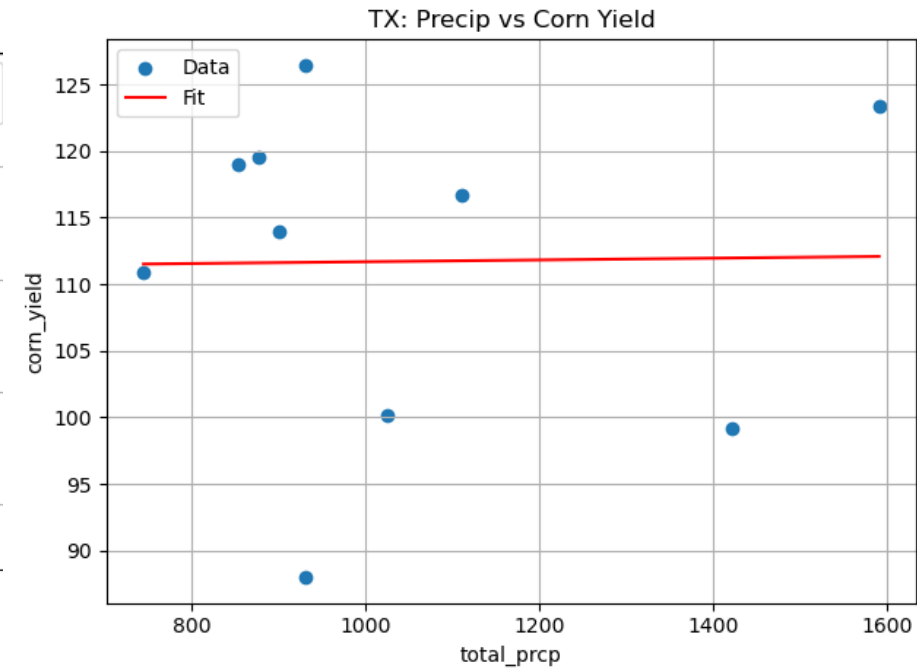
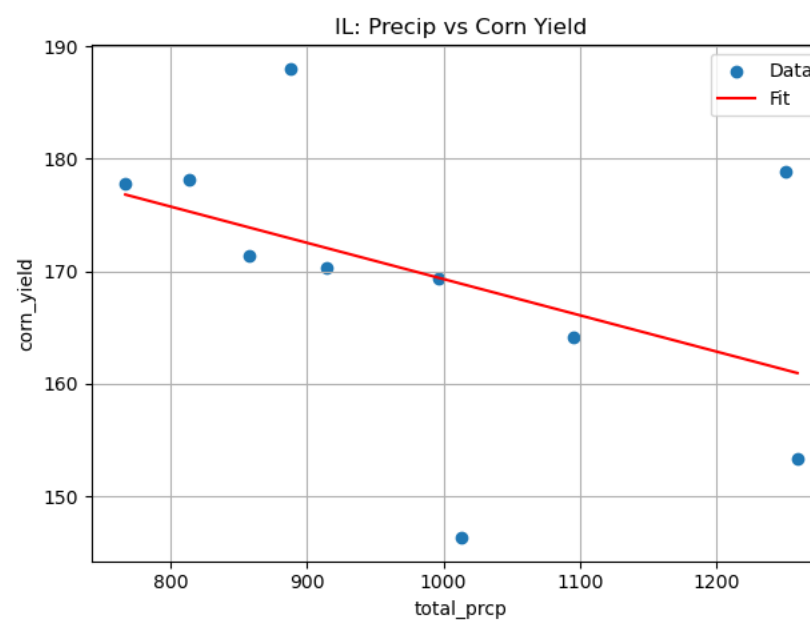
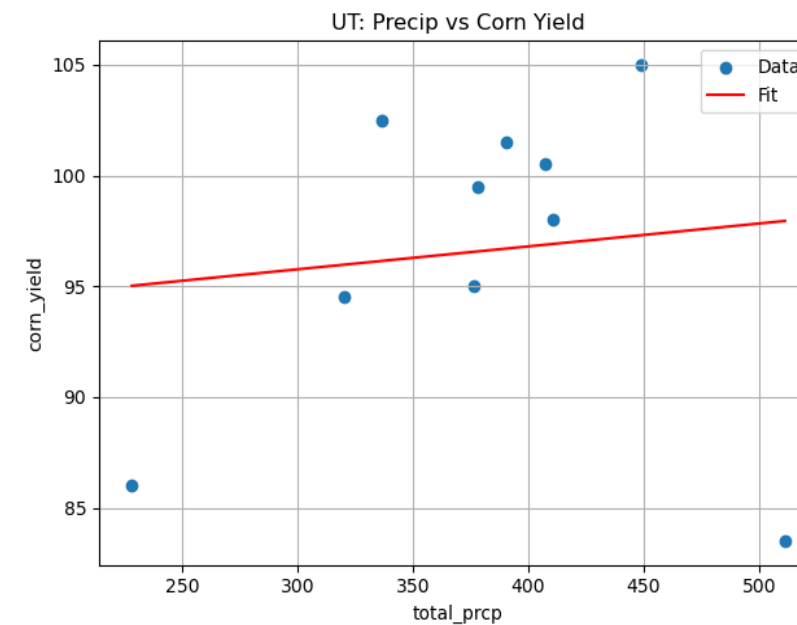
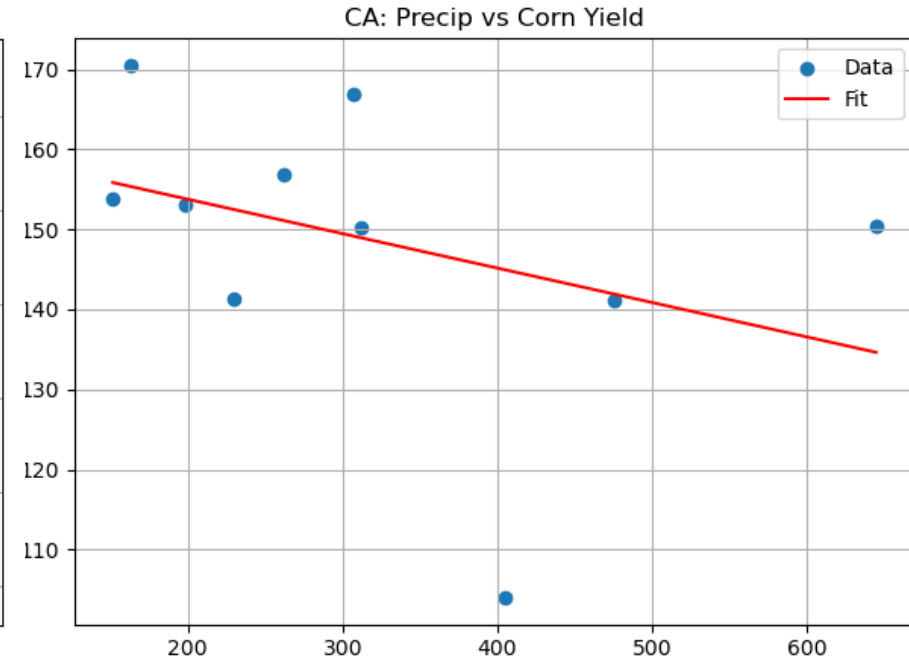
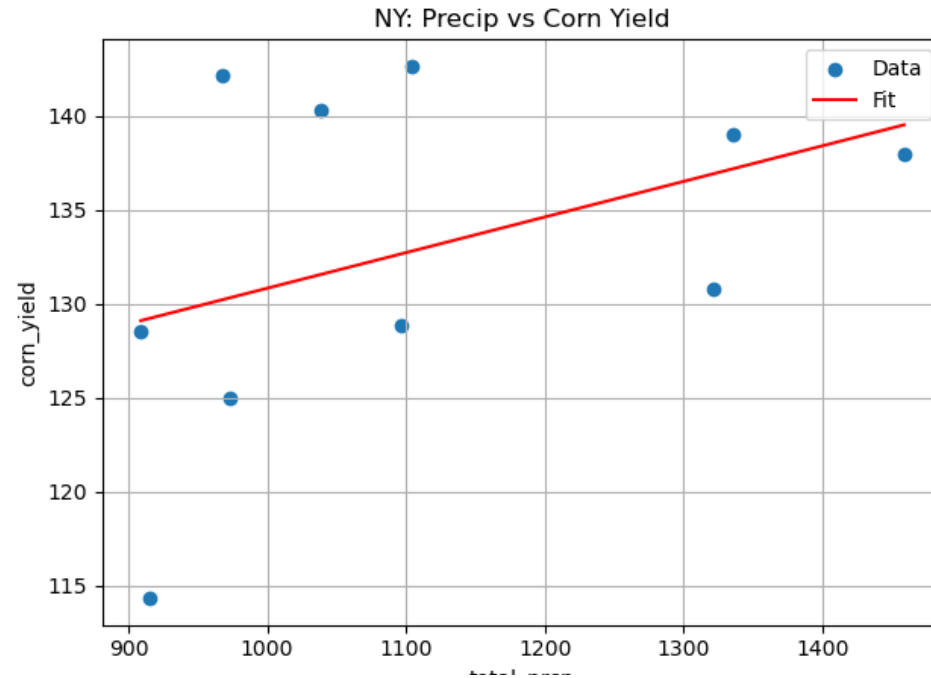
# Effect of Temperature on Corn Yields (per state)



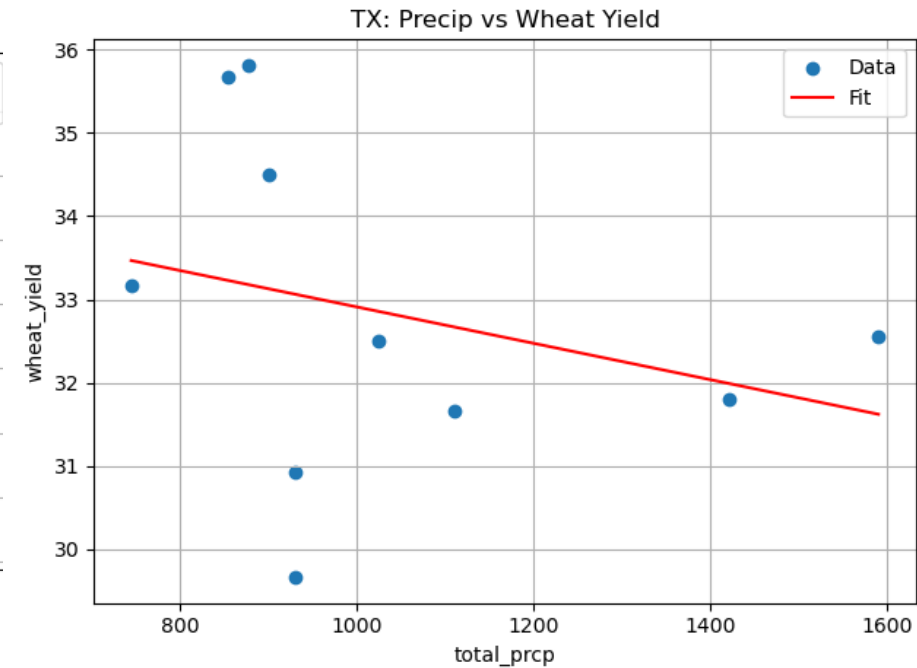
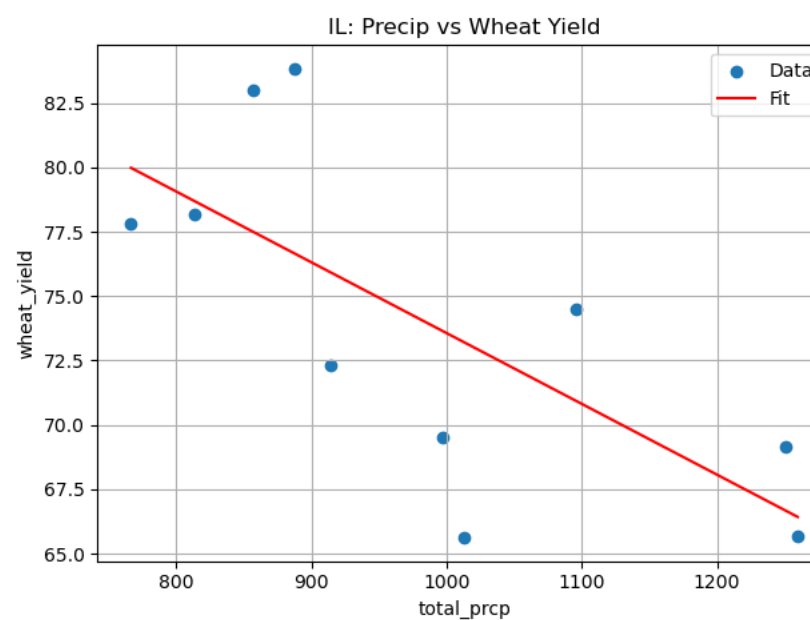
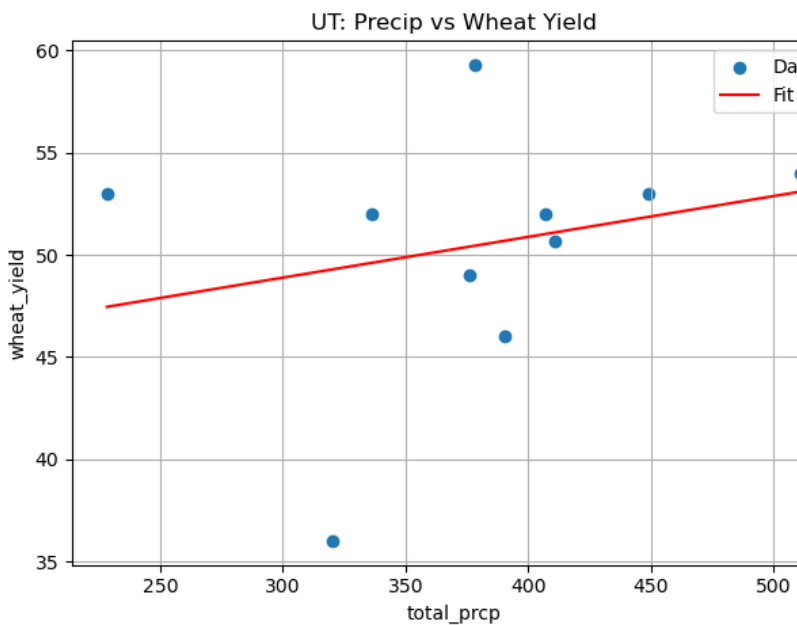
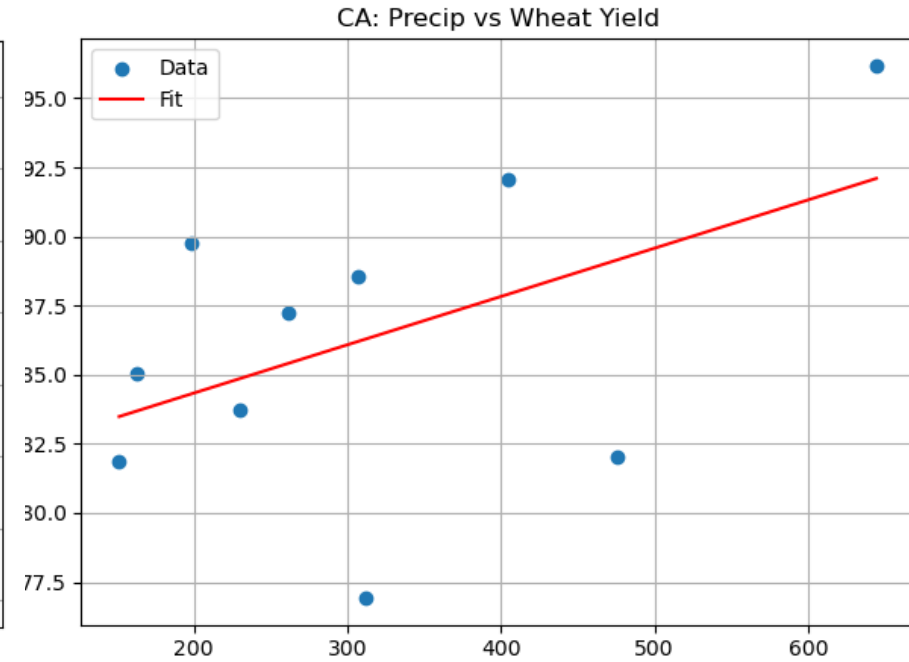
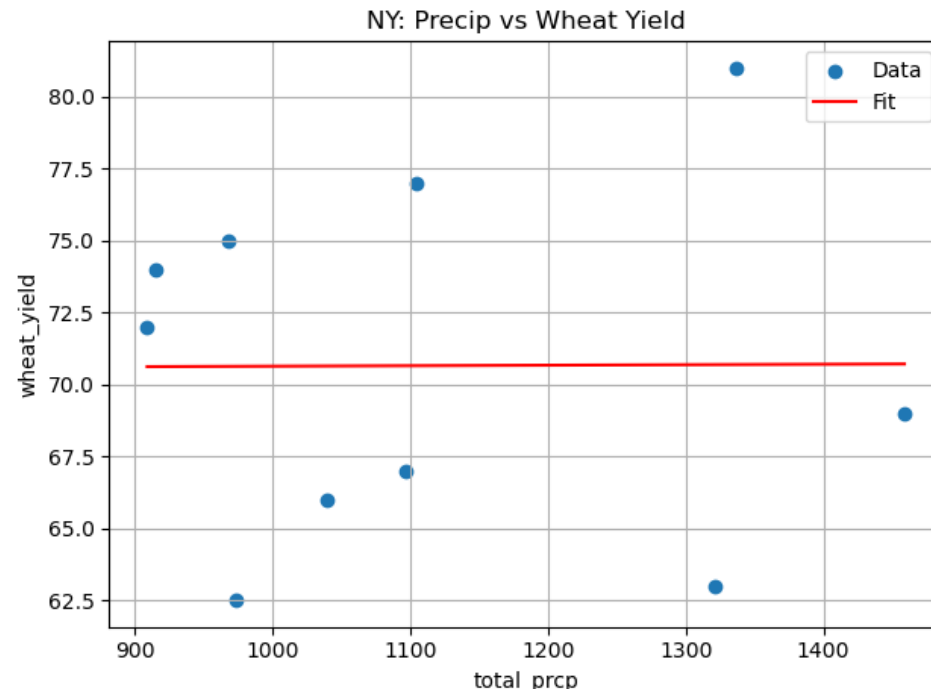
# Effect of Temperature on Wheat Yields (per state)



# Effect of Precipitation on Corn Yields (per state)

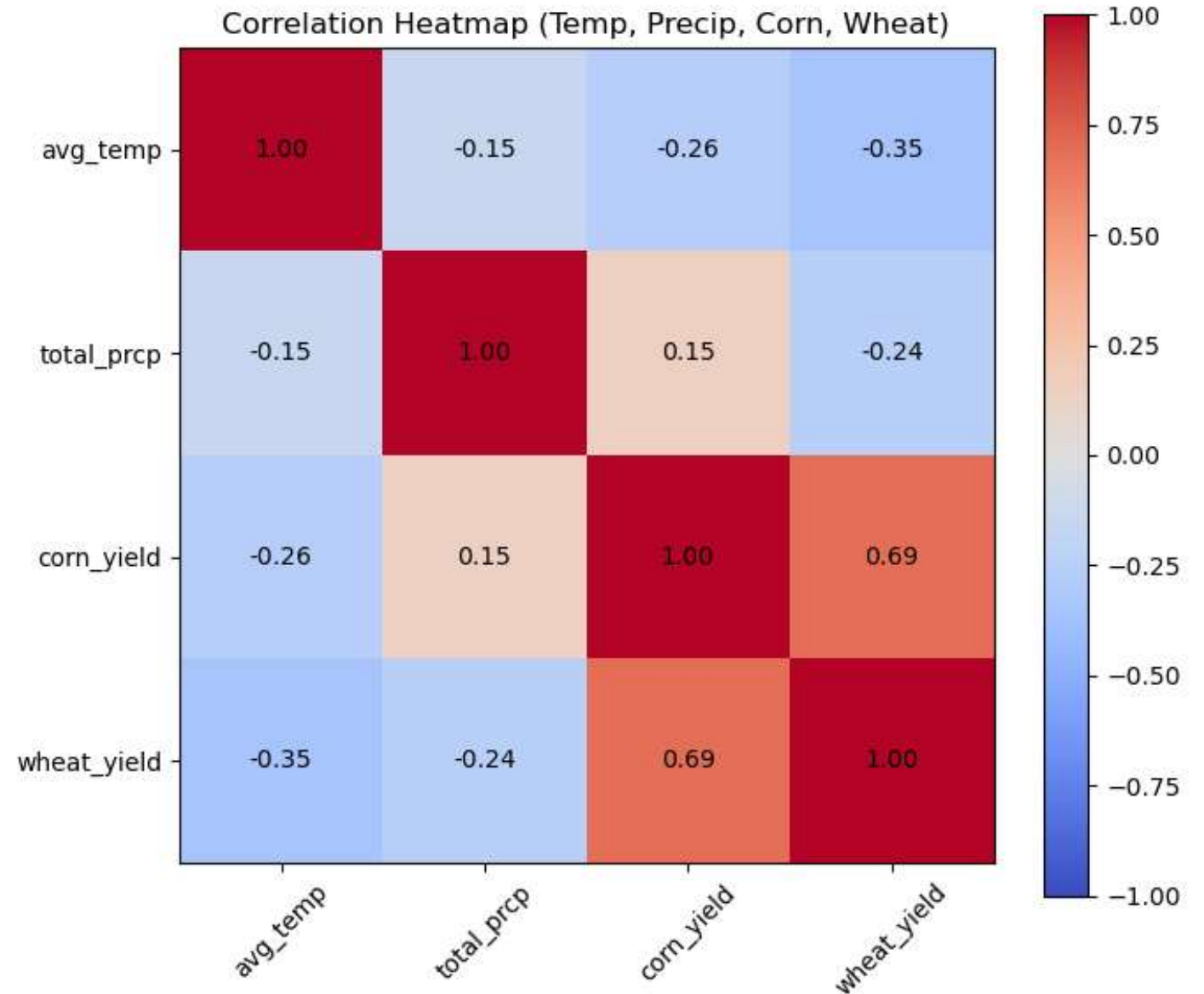


# Effect of Precipitation on Wheat Yields (per state)



# Heatmap

- Higher temperatures tend to be associated with slightly lower crop yields across states. This is consistent with heat-stress effects on both crops, especially wheat.
- Precipitation does not show a strong or consistent relationship with yields.
- States with good conditions for one crop tend to have good conditions for the other.
- Warmer years are slightly drier, but the relationship is weak and varies across states
- Temperature is a more influential factor than precipitation for both crops, but neither variable alone is a strong predictor of yield – indicating complex interactions behind crop performance



# Challenges

- Getting reliable climate data from the NOAA API
- Frequent 400 (Bad Request) Errors
- NOAA API Limitations Not Documented Clearly
- Instead of trying to download all climate data at once, I rewrote the function, so it requests each station individually, catching failures without stopping the whole program

```
Traceback (most recent call last):
  File "c:\Users\yilon\dsci510_fall2025_final_project\src\main.py", line 7, in <module>
    temp_df = get_noaa_climate_data()
  File "c:\Users\yilon\dsci510_fall2025_final_project\src\data_retrieval.py", line 72, in get_noaa_climate_data
    response.raise_for_status()
    ~~~~~^~~~~~
  File "c:\Users\yilon\anaconda3\envs\SSCI586_Fall2025_v3137\Lib\site-packages\requests\models.py", line 1026, in raise_for_status
    raise HTTPError(http_error_msg, response=self)
requests.exceptions.HTTPError: 400 Client Error: for url: https://www.ncdc.noaa.gov/cdo-web/api/v2/data?datasetid=GHCND&datatypeid=1023174&startdate=2010-01-01&enddate=2024-12-31&units=metric&limit=1000&offset=1
```

```
for name, (label, station_id) in stations.items():
    print(f" Fetching station {station_id} ({name})...")

    params = {
        "datasetid": dataset,
        "datatypeid": datatype,
        "stationid": station_id,
        "startdate": start,
        "enddate": end,
        "limit": 1000
    }
```

**Thank you &  
Questions**