Rainfall & Tractor Project

Tanya Sinha

Github Repository: https://github.com/tanyasinha2625/carnot25/

Task 1: Track how farming activity evolves day-to-day across MH.
Daily:

Task 1: Engine Hours and Rainfall per Day (Apr–Jun 2024)
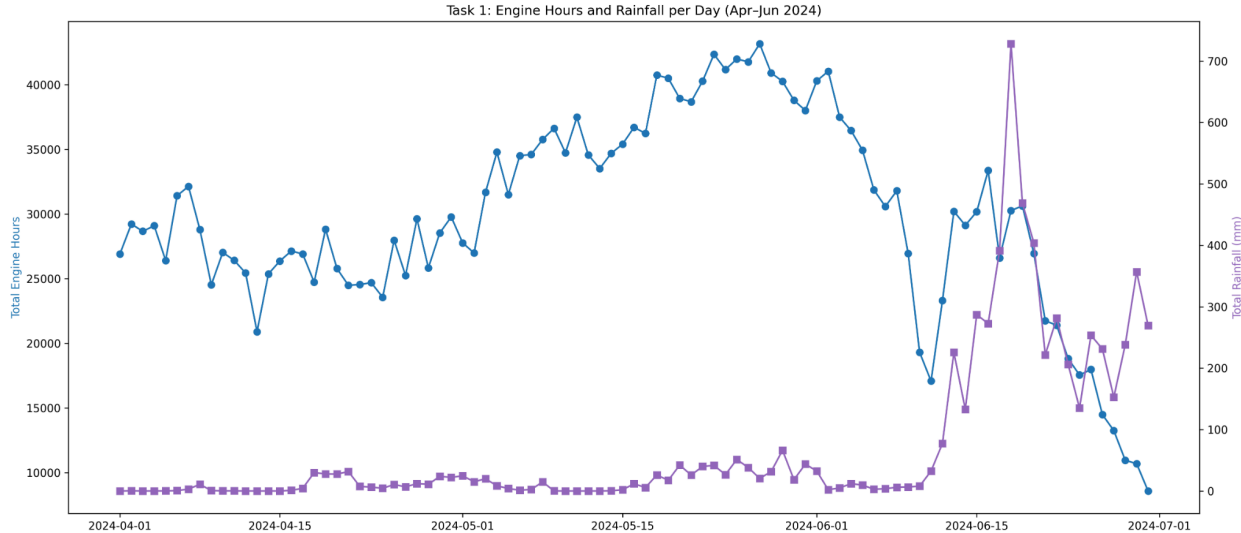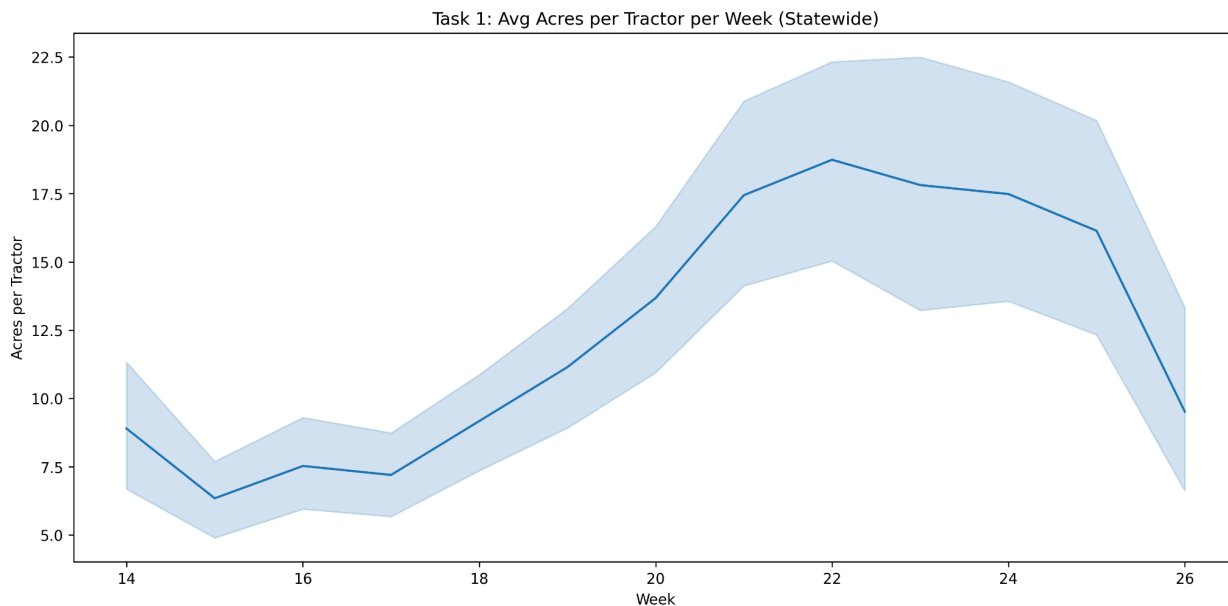
Observations:
- Strong dip in engine hours when monsoon/first significant rainfall is expected.
- Immediate increase in engine hours as rain picks up
- Directly proportional falls in both statistics for approx 3 weeks in high heat weather.
- Engine hours continue falling with no clear relational trend with rainfall levels.

Weekly:


Task 1: Avg Acres per Tractor per Week (Statewide)

Observations:
- Similar trend over 26 week period over all the districts, indicating similar agricultural demands regardless of the difference in rainfall.
- Maximum variation in a particular week is approx 10 acres (week 23).

Task 2: Compare activity levels across subdistricts and districts
Daily:

Task 2: Top 10 Districts by Total Acres Tilled
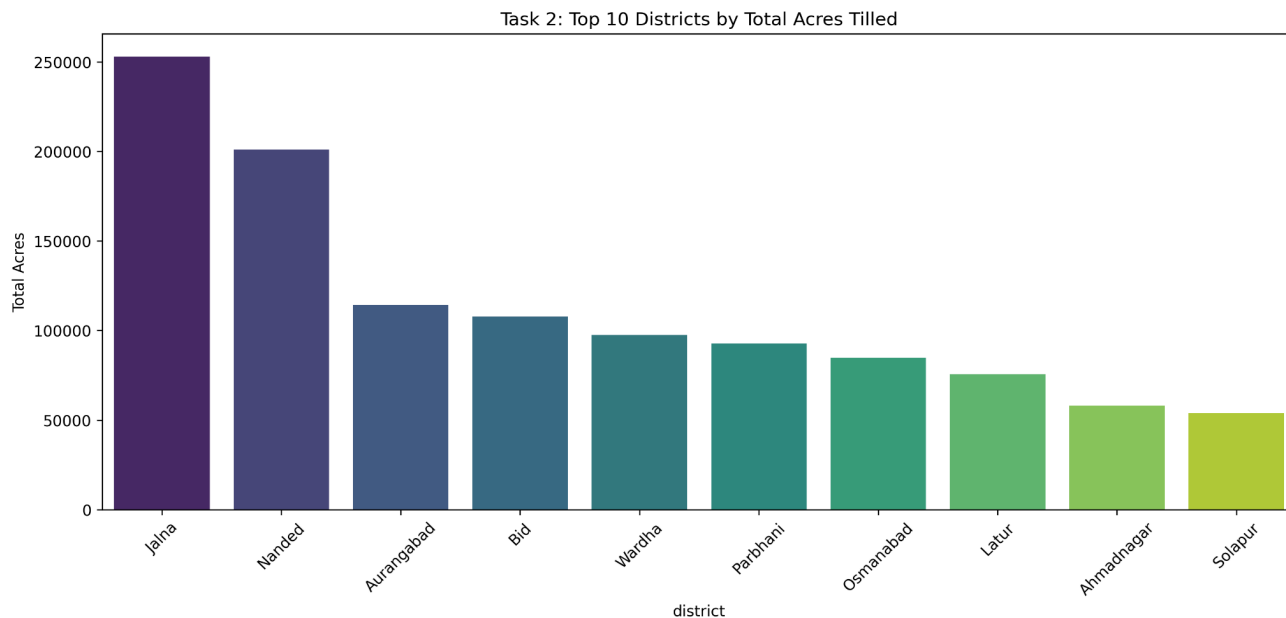
Observations:
- Jalna has the highest acres tilled, despite being 18th in rankings of districts by size.
- Steep drop in acres tilled after first couple districts.
- This trend is only indicative of sales in the area, rather than farmer tendency or agricultural land size.

Weekly:

Task 2: Avg Acres per Tractor per Week by District
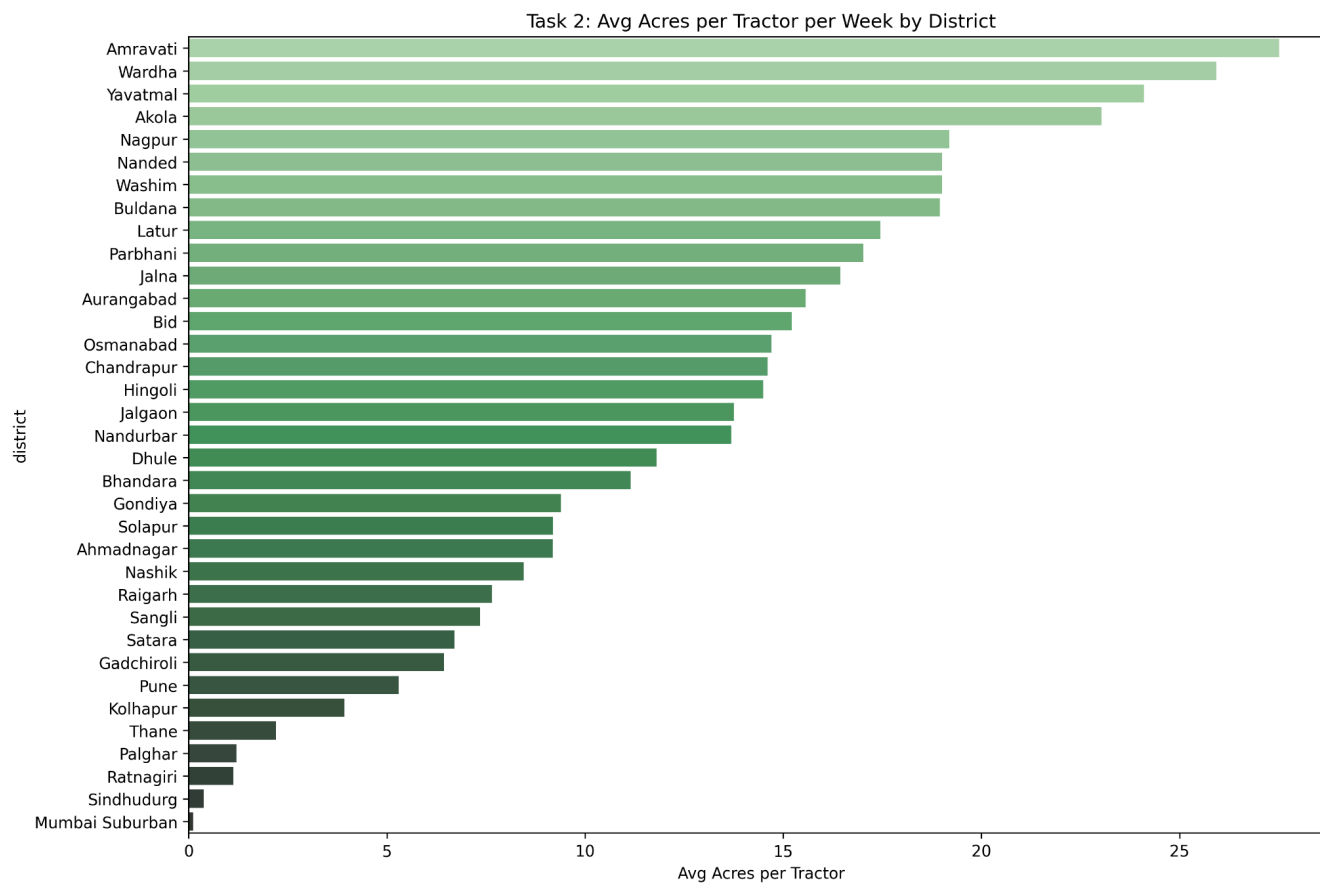
Observations:
- Amravati has the highest average acres per tractor, at about 28 acres per week.
- Amravati, Wardha, Yavatmal, and Akola (Vidarbha Region) by far have the highest productivity, accounting for agricultural land size and sales in the areas.
- Lowest average acres are highly residential/low agricultural areas, like Mumbai Suburban
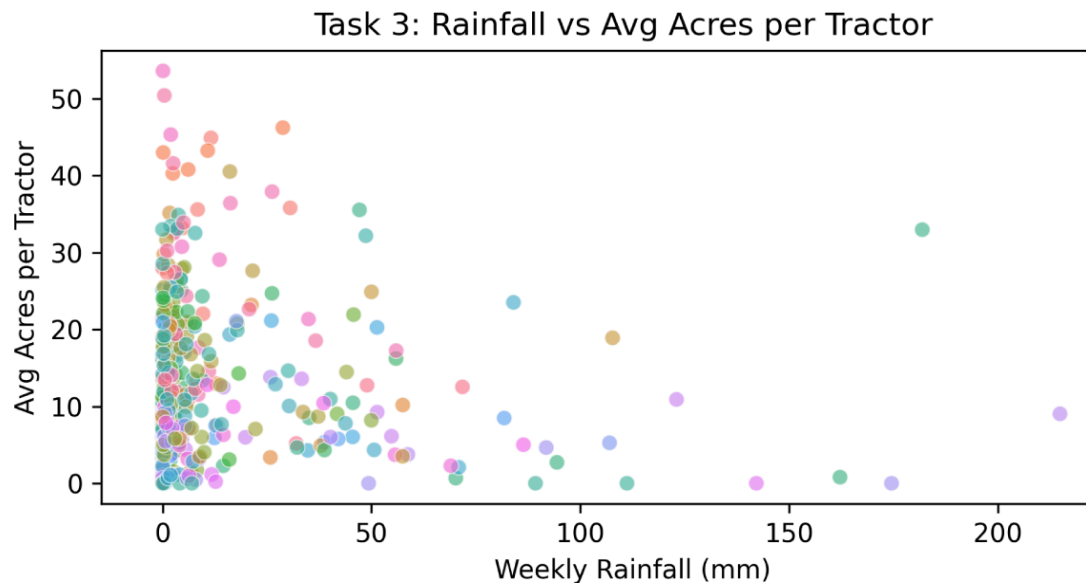
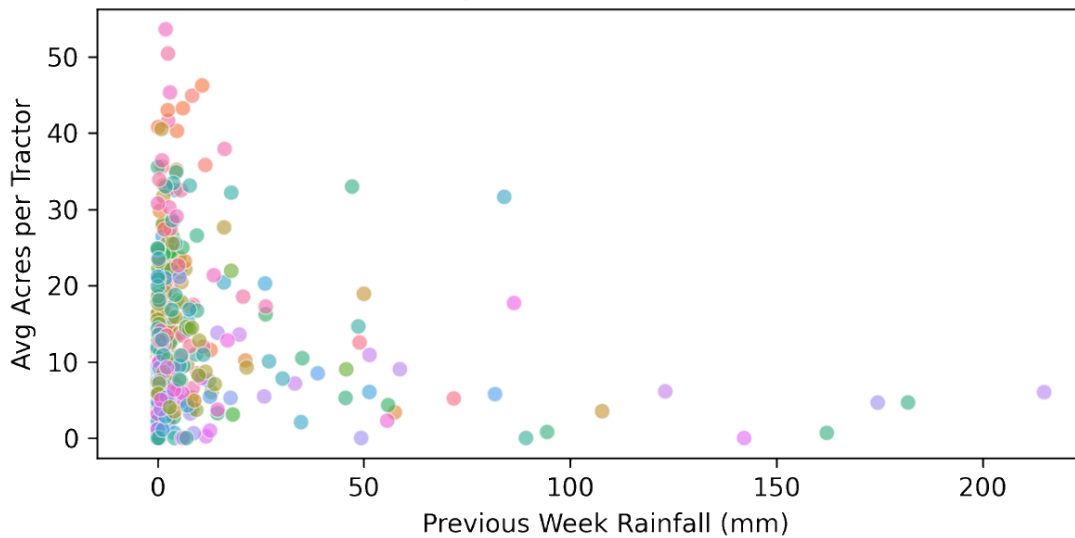Task 3: Rainfall vs Tractor Activity
Daily:
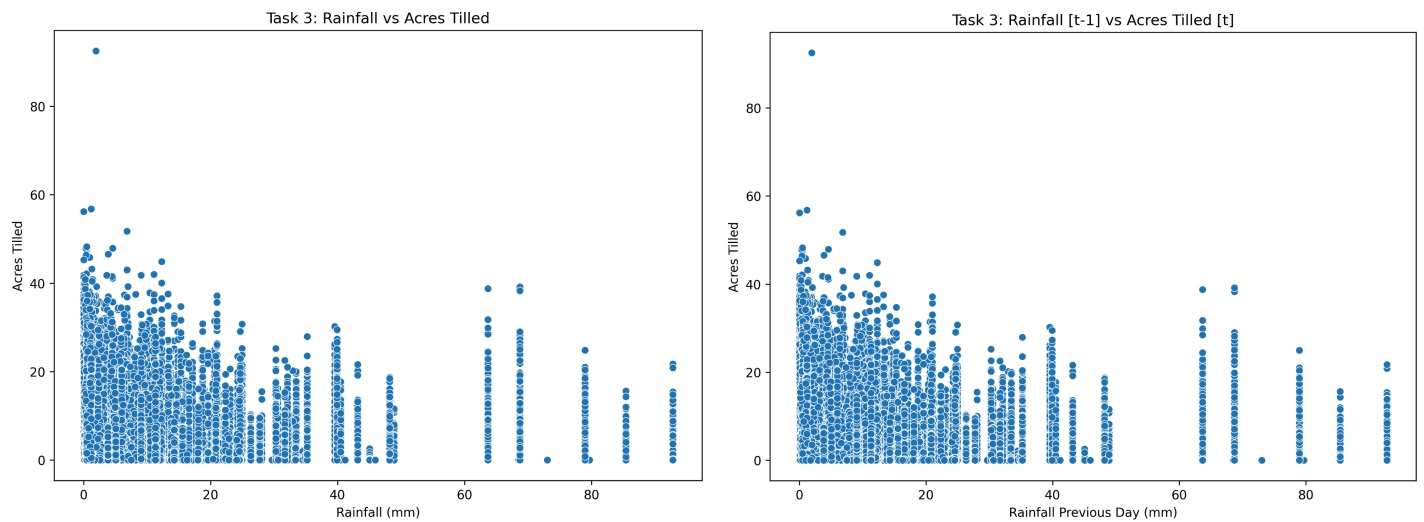
Observations:
- No significant correlation between rainfall (both day of & previous day) and acres tilled.
- General trend of inverse proportionality followed until ~50mm of rainfall, but activity appears agnostic of precipitation.

Weekly:

Task 3: Lag Plot – Rain[t-1] vs Acres[t]

Legend:

|				
Ahmadnagar	Chandrapur	Kolhapur	Osmanabad	Satara
Akola	Dhule	Latur	Palghar	Sindhudurg
Amravati	Gadchiroli	Mumbai Suburban	Parbhani	Solapur
Aurangabad	Gondiya	Nagpur	Pune	Thane
Bhandara	Hingoli	Nanded	Raigarh	Wardha
Bid	Jalgaon	Nandurbar	Ratnagiri	Washim
Buldana	Jalna	Nashik	Sangli	Yavatmal

Observations:
- There is a stronger reactivity to rainfall in weekly trends, especially when mapping previous week's rainfall to the current week's activity, with acres tilled dropping dramatically when the previous week had heavier precipitation.
- Heavy rainfall weeks have low activity, indicating only non-negotiable tasks are being carried out by the tractors.

Task 4: Regional Rainfall Sensitivity
Total Activity:
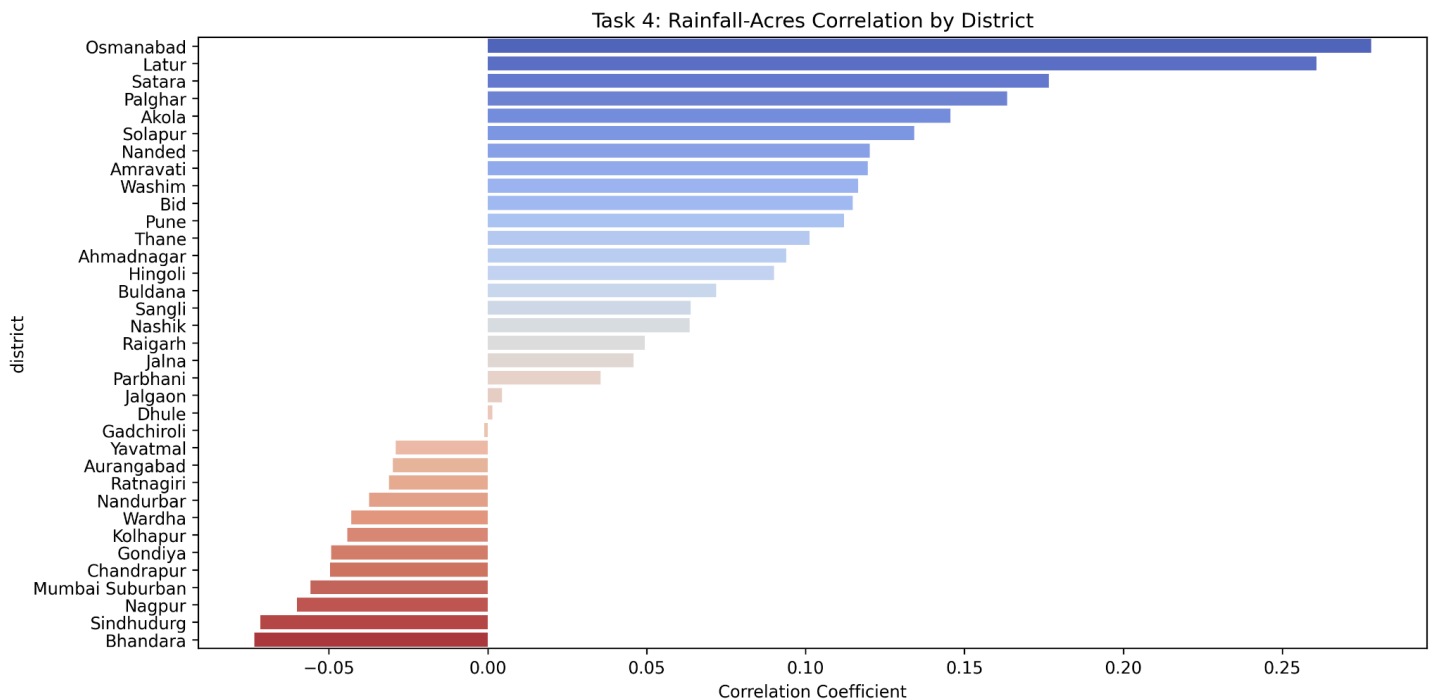
Observations:
- Wide range of correlation, from 0.28 to -0.08, indicating a myriad of agricultural tendencies, from crop patterns and rainfall management techniques.
- Areas like Osmanabad and Latur respond very well to rainfall, likely due to crops that require rainfall aligned sowing, and good drainage systems
- Areas like Jalgaon and Dhule have almost zero correlation and localised activity is almost completely independent of the weather conditions. This appears to be due to inconsistencies in rainfall and robust irrigation systems.
- Areas like Nagpur, Sindhudurg, Bhandara) show a negative correlation, indicating untimely rainfall or waterlogging tendencies.

Average Activity:

Task 4: Rainfall Sensitivity (Corr) of Avg Acres per Tractor
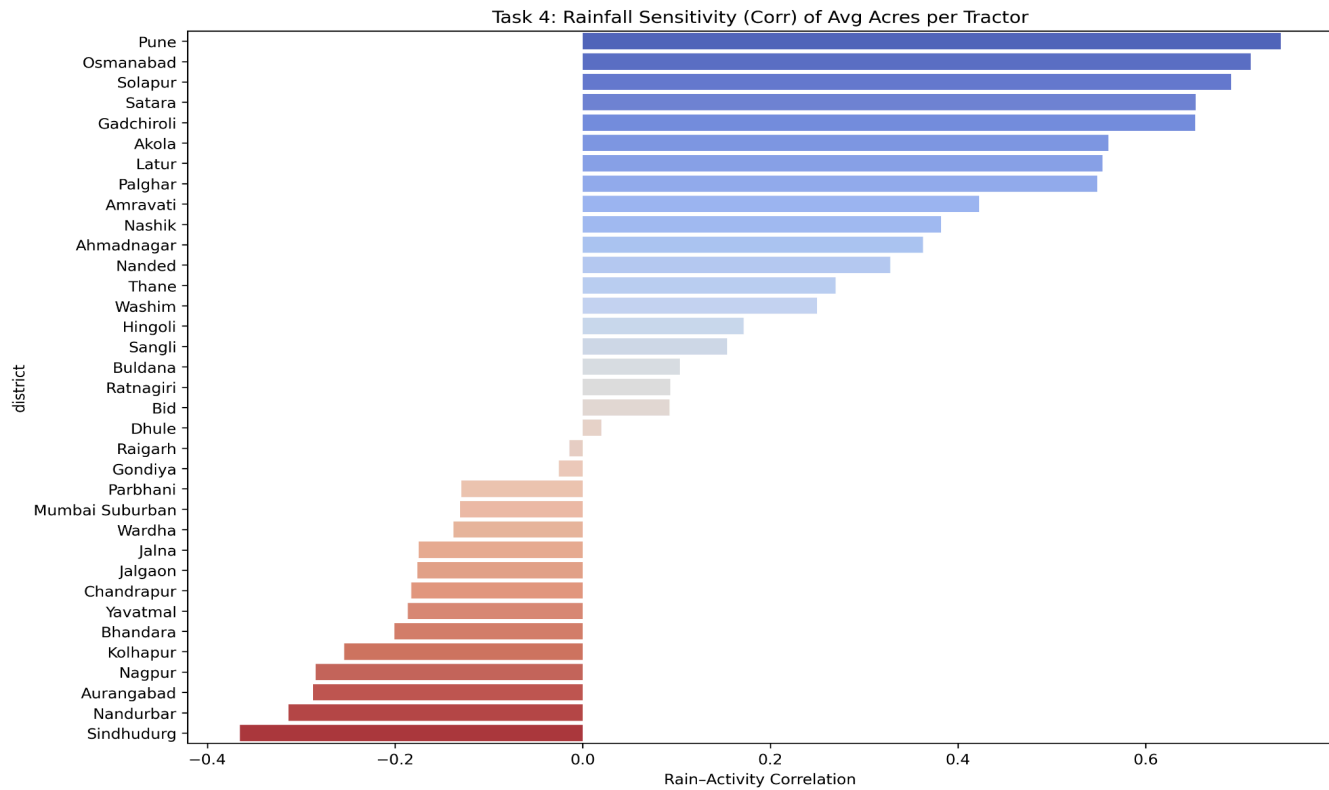
Observations:
- Wider range of correlation factor, from -0.375 to 0.75.
- Pune rises to the top at about 0.75 correlation. The indications of different correlations appear to be the same as that of total activity, but show a different level of responsiveness that accounts for the variation in district sizes and the number of tractors in each region.

Task 5: Untimely Rain Event Impact
Boxplot:

Task 5: Farming Activity on Untimely vs Normal Rain Days
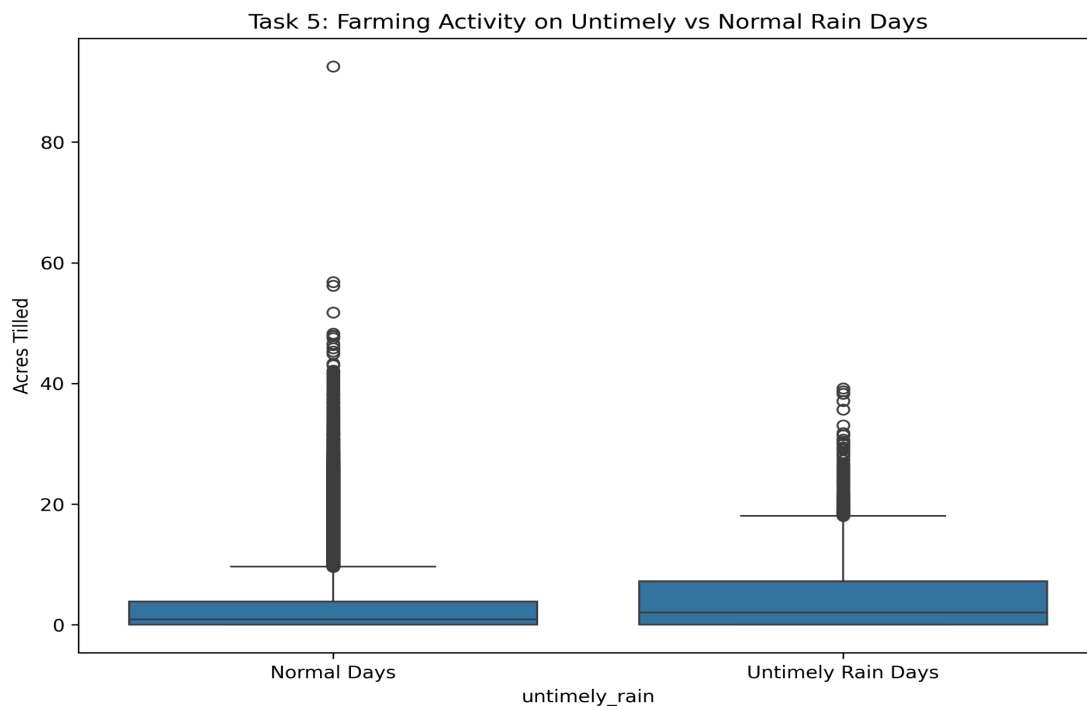
Observations:
- Significantly lower overall activity on untimely days.
- Median is lower for untimely days, indicating drop in acres tilled during untimely rain days
- Box width (IQR) is narrower for untimely days, indicating less variability. Normal days (both rainy and dry) have more extreme values, with some tractors covering up to ~90 acres in a day

Rainfall spikes vs Farming Activity:

Task 5: Rainfall Spikes vs Farming Activity
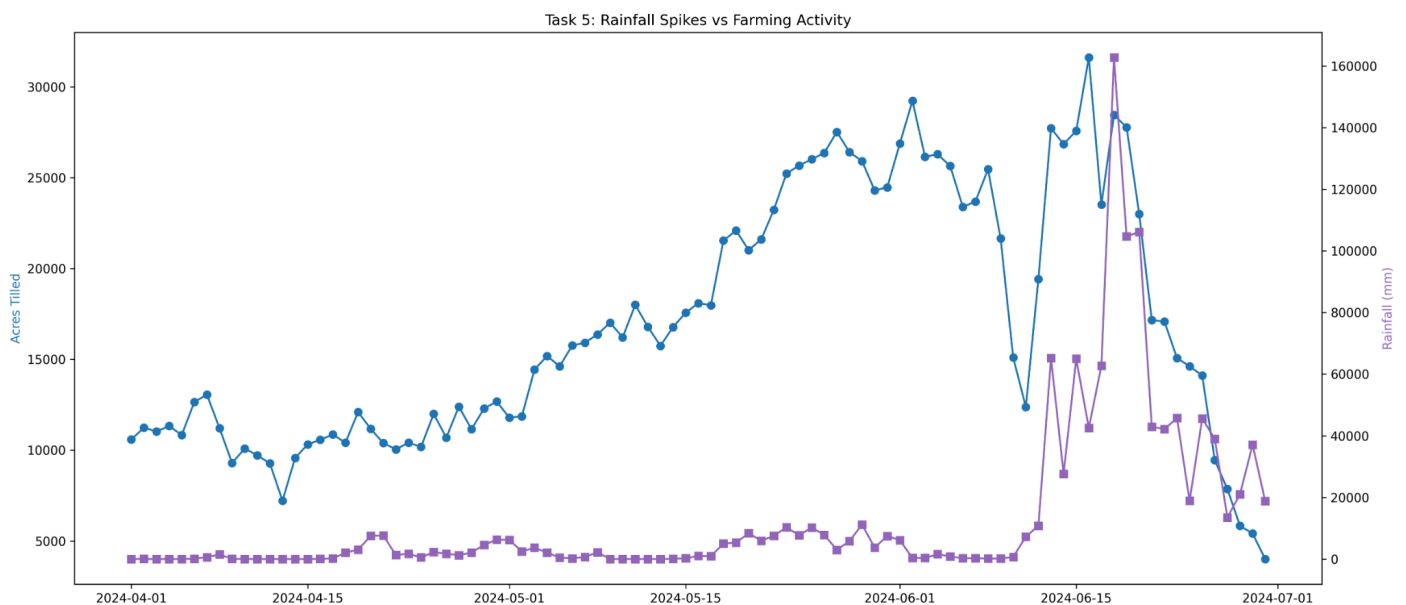
Observations:
- Pre-monsoon (April–mid June): Rainfall is low and steady during April-May, and tractor activity rises gradually, peaking in June, suggesting field prep & sowing activity rising in anticipation of monsoon.
- Rainfall spike (mid-late June): Sharp surge in rainfall begins mid-June, which corresponds to a sudden drop in acres tilled, which is consistent with disruption due to heavy or untimely rain.
- Post-spike period (late June–early July): Rainfall stays high but fluctuating, while tractor activity continues to drop steeply, nearing zero by July.