BASF: Miticide Use Porath, Ethan Portscheller, Saatvik Sharma, Ethan Wang, Saumya Muthukumar

California produces 80% of the world's almonds and all the United States commercial supply. Among other challenges, almonds growers have to navigate around serious damage to their orchard from spider mites. Fortunately, there are several tools to manage spider mites, miticides being the most commo BASF, a leading chemical company, produces Nealta a premium miticide with the active ingredient (AI) Cyflumetofen. Nealta is specifically designed to target spider mites without affecting beneficial mites. However, some farmers prefer general miticide (Abamectin) which are cheaper but kill all mites. The repercussion of killing all the mites can cause mites to reappear forcing farmers to have to reapply during the growing season. The objective of our year-long project was to demonstrate that Nealta can save money in the long run due to its reduced need for reapplication compared to competitor miticides.

In our project, we analyzed growers' miticide use reports in almonds over the last 10 years This analysis helped us understand the usage patterns of these Als throughout the growing season and assess the impact of early-season miticide applications on the need for subsequent treatments. In addition, we aimed to understand how California's geography influences miticide usage by identifying the regions with the highest miticide usage and most commonly used Als.

Research Methodology

Last Semester/Al Stats:

Introduction

Background

Motivation

Data Cleaning

- · Deleted unnecessary columns and rows with missing data, in Python
- · Separated data based on AI & application month

Probability Analysis

· Calculated probability of needing a summer reapplication given a certain AI was used for the primary spring application

Cost Analysis

· Used these probabilities to estimate the expected overall (spring & summer) cost of using a given AI in the spring

Visualization

· Created graphs & charts to visualize the above findings Used matplotlib library

Geospatial:

County Segmentation

- · Divided California by county, in Python
- · Discovered miticide usage was concentrated around San Jose

Regional Analysis

- · Split data into north, south, & central subregions
- · Performed analysis on most-used AI in all 3 subregions, using pandas library

Visualization

- Created a graphical display to visualize correlations between county & ALuse
- · Used matplotlib library
- Fig 1. Map of San Jose region senarated into North (green), Central (red) and Southerr (blue) sections

Conclusions

Active Ingredient Statistics:

We found the probabilities of needing a second application (summer treatment) depending on what was applied in the Spring.

Probability of needing a summer treatment when a spring treatment is applied (by acres)		
Spring Window	Summer Window	
	Cyflumetofen	6.96%
Cyflumetofen	Abamectin	9.99%
Abamectin	Cyflumetofen	8.51%
	Abamectin	17.49%

- A 10-year analysis of using Cyflumetofen (Nealta) during the May application shows that the probability of needing a reapplication in July-August is nearly 200% higher when using Abamectin compared to Cyflumetofen
- · Cyflumetofen has a higher initial upfront cost but applying during the May application can save almost \$4000 per season due to fewer reapplications

Price Breakdown (Active Ingredient and Labor) Cyflumetofen \$5103.78 Cyflumetofen & Abamectin \$6934.08 Abamectin & Abamectin \$9624 54

Geospatial

- Cvflumetofen is used significantly more in the Southern counties
- Different areas of California need different marketing strategies
- Component about application windows (code not yet completed)



Cyflumetofen or Abamectin Total Treated Acres by year & season

Al Distribution over CA regions from 2014-2024



Southern Counties: 2332741 Total treated Acres

References

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- https://coststudyfiles.ucdavis.edu/2024/09/30/2024%20AlmondsSPFinalDraft%202.pdf
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We create chemistry

Recommendations

- Apply Nealta during May to prevent the need of a second application later in the Summer
- product cost is greater.

To BASF:

Target advertising of Nealta to regions where Abamectin is currently used most, emphasizing Nealta's long-term cost savings and reduced need for reapplication.

Future Goals

- Expand the range of the project by analyzing the effectiveness of miticides on other nut crops and evaluating applications in other areas.
- Continue to work with BASF to identify other factors that affect seasonal growth and miticides application
- Build a predictive model off the data we've collected that can predict the reapplication percentages and help BASF develop a marketing model using the results.

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