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Evaluation of The Withdrawal of Chlorpyrifos for Six Major California Commodities: A Retrospective Analysis

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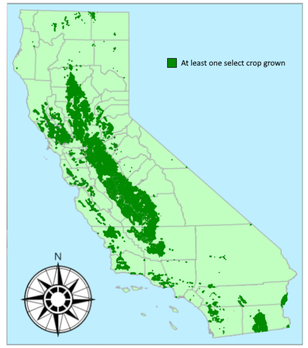
Background

- Chlorpyrifos was listed as a toxic air contaminant by the California Department of Pesticide Regulation (DPR) in 2019 due to evidence identified in its risk assessment that exposure to chlorpyrifos causes developmental neurotoxicity in children and sensitive populations.
- As a result, DPR determined that use of chlorpyrifos is a detriment to public health and sent notices to cancel chlorpyrifos product registrations to registrants on August 14, 2019 (CDPR, 2019).
- In 2019, the Goodhue Lab produced a report regarding the role of chlorpyrifos in pest management, as well as an estimate of economic impacts of the withdrawal of chlorpyrifos in six crops.
- These six crops (alfalfa, almond, citrus, cotton, grape, and walnut) accounted for 86% of chlorpyrifos use and 48% of the value of California's field, fruit, nut, vegetable and melon production in 2017 (CDFA, 2018).
- For the six crops considered, annual pest management costs were estimated to increase by $10.9 million to $12.5 million, depending on the base year used.

Figure 1. Select Crop Production Areas



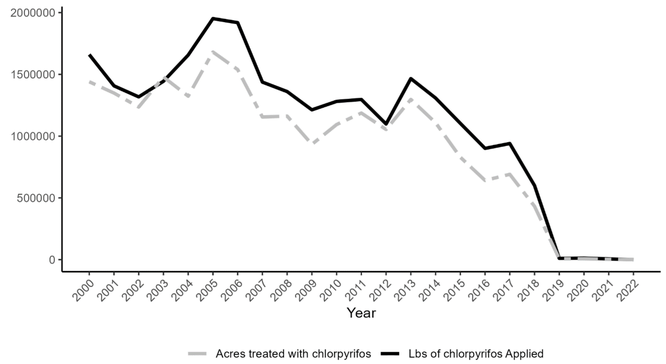
Objectives

- Evaluate accuracy of predictions of alternate AI use and increases in management costs based on historical (2015-2017) crop acreage and prices.
- Calculate the actual costs of changes in insecticide use accounting for modern crop acreage and product prices using new prices and acreages.
- Identify regional, grower, commodity and product-related factors that influence the use of alternate active ingredients (AIs).

Data

- The 2019 report used pounds of pesticides applied and acres treated by AI data from the Pesticide Use Reporting (PUR) Database maintained by DPR to examine the pesticide use trends of six crops. Almond, alfalfa, citrus, cotton, grape (table and wine grapes separately), and walnut were chosen based on their high chlorpyrifos use and economic importance.
- Following the methods from the 2019 report, we recreate the analysis using PUR data from 2020-2022. Specifically, we use pre- and post-ban PUR data to evaluate the accuracy of the Office of Pesticide Consultation and Analysis' (OPCA's) predictions of insecticide use patterns and the resulting cost change estimates in response to the withdrawal of chlorpyrifos.

Figure 2. Statewide Chlorpyrifos Use: 2000-2022



Methods

- Based on consultations with UC Cooperative Extension personnel, key pests targeted by chlorpyrifos and the alternative AIs available to control them were established for each crop.
- First, the total acreage treated with chlorpyrifos and its alternatives over 2015-2017 was calculated. Then, to predict expected changes in AI use after the withdrawal of chlorpyrifos, the proportion share of each alternative AI was recalculated with chlorpyrifos removed. The accuracy of these predicted values is the subject of this analysis.
- Following the exact methods in the 2019 report, we recreate the analysis using PUR data from 2020-2022. To evaluate the accuracy of our cost estimates, given the information available at the time, we re-run our cost analysis using actual acreage shares of alternative AIs with the prices used in the 2019 report.
- We calculate the 2020-2022 costs of the withdrawal using 2020-2022 treated acreage, acreage shares for AIs, and current prices in the same manner as we calculated the 2019 projected costs.

Example Results

- We disaggregate the difference between the realized costs and those in the 2019 report to show the impact of changes in total treated acreage, pesticide use decisions, and prices.

Table 1. Descriptive Comparison of Scenarios

	Scenario 1	Scenario 2	Scenario 3	Scenario 4
Post-ban predicted chlorpyrifos treated acreage				X
Post-ban pesticide price			X	X
Post-ban use shares of alternative AIs		X	X	X

- The following table shows the results for alfalfa, broken down by scenario. A common trend among all crops is that the estimated change in cost (column 7) is increasing from Scenario 1 to Scenario 3, with varying trends for Scenario 4. Meaning that, if we account for 2020-2022 AI shares and prices, the average predicted change will be larger than predicted by the 2019 report.
- In alfalfa, the decline in acreage post-ban results in lower expected costs in Scenario 4 than in Scenario 3, though this is not uniform across all crops.

Table 2. Alfalfa Results

Year	Chlor. Acreage	2015-17 Cost	Alt Cost	Chlor. available ($)	Chlor. withdrawn ($)	Change in cost	Change in cost (%)
Scenario 1							
2015	223,051	4.28	13.14	954,687	2,931,949	1,977,262	207.1
2016	137,455	4.28	13.14	588,324	1,806,808	1,218,484	207.1
2017	153,607	4.28	13.14	657458	2,019,127	1,361,669	207.1
Scenario 2							
2015	223,051	4.28	15.85	954,687	3,554,821	2,600,134	270.3
2016	137,455	4.28	15.85	588,324	2,178,327	1,590,003	270.3
2017	153,607	4.28	15.85	657,458	2,434,303	1,776,845	270.3
Scenario 3							
2015	223,051	4.28	16.72	954,687	3,730,048	2,775,361	290.7
2016	137,455	4.28	16.72	588,324	2,298,635	1,710,311	290.7
2017	153,607	4.28	16.72	657,458	2,568,749	1,911,291	290.7
Scenario 4							
2020	161,472	4.28	14.26	691,099	2,301,781	1,610,682	233.1
2021	135,528	4.28	14.26	580,059	1,931,952	1,351,893	233.1
2022	120,110	4.28	14.26	514,072	1,712,172	1,198,100	233.1

Discussion

- This retrospective analysis provides a better estimate of the economic reality of chlorpyrifos-related pest management in the post-withdrawal period and allows us to compare how similar our 2019 predictions were to the actual costs of control.
- Retrospective analyses represent an important reflection on predictive research. As agricultural policies continue to shift and mutate, looking back on the accuracy of past published reports is vital for the continual improvement of predictive economics.

References

CDFA. 2018. California Agricultural Statistics Review 2017-2018. https://www.cdfa.ca.gov/statistics/PDFs/2017-18AgReport.pdf

CDPR. 2019. Alternatives to Chlorpyrifos Work Group Announced. https://www.cdpr.ca.gov/docs/pressrls/2019/081419.htm.