

Agronomic Overview of Nitrogen Management Planning Results from the Irrigated Lands Regulatory Program

Background and Objectives

Irrigated Lands Regulatory Program (ILRP) orders require Central Valley irrigators to complete Nitrogen Management Plans (NMPs) for each crop. For acreage designated highly vulnerable, certain NMP data are reported to growers' water quality coalitions, who in turn summarize them for the Water Board. The South San Joaquin Valley Management Practices Evaluation Program (SSJV MPEP) analyzed 2016 NMP data from an agronomic perspective to examine the yield growers realize across a range of N application rates. The data also illustrate commonly, occasionally, and rarely reported ranges of N application rates. For most crops, the N balance (N applied minus N removed in the crop, and thus the N subject to storage and loss) grows steadily as N application increases. This is a snapshot of what growers reported for one row, one permanent, and one forage crop in 2016. Preliminary implications about how best to balance profitability and environmental risk associated with N fertilization are suggested.

Methods

2016 NMP Dataset

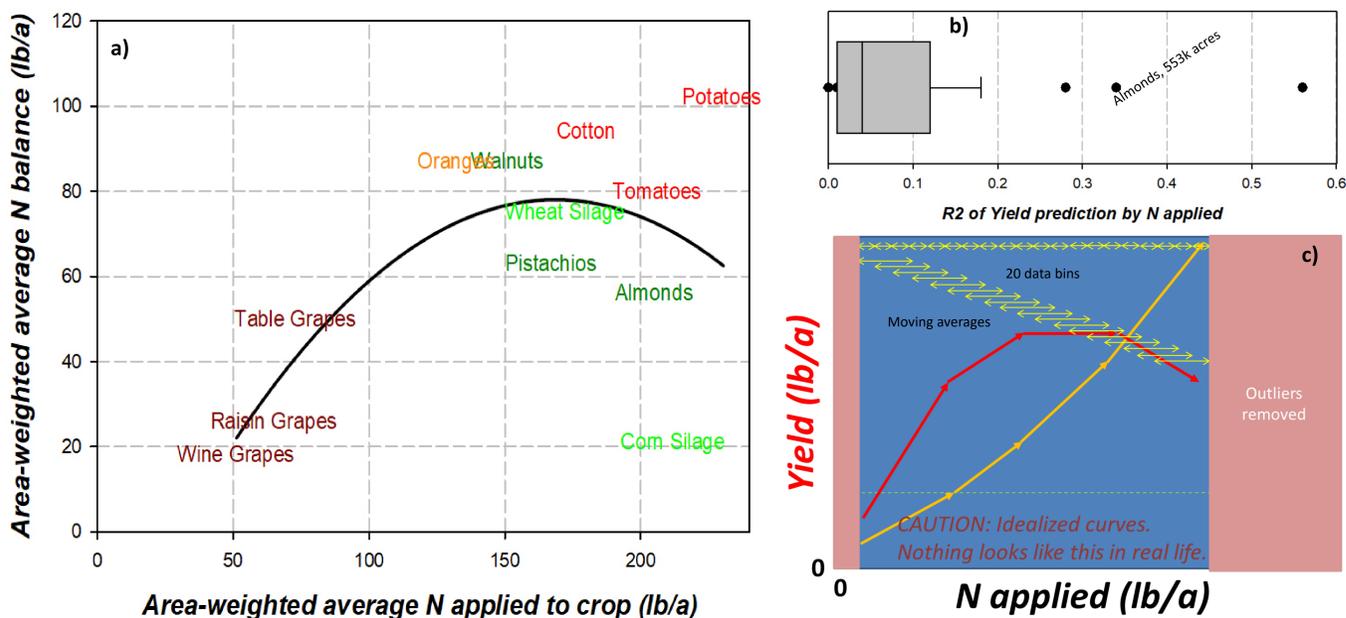
- Source: anonymized NMP data from 12 water quality coalitions.
- Total acreage of NMP data: over 1.8 million acres.
- NMP data reported: crop type, acreage, total N applied, and crop yield.
- Crop classes reported by different coalitions varied and are grouped here to the extent feasible.

Analysis Methods (see Figure 1c)

- Removed N applied and yield outliers with the interquartile technique.
- Binned data into 20 groups by equally dividing N application.
- Calculated N removed based on N concentrations from Geisseler (2016) multiplied by reported crop yield.
- Calculated area-weighted averages (AWA) of yield, N applied, N removed, and N balance for each bin.
- Identified the upper limit of N application for the majority of acreage as an N application threshold.
- Flagged bins that contained less than 1% of total reported acreage.

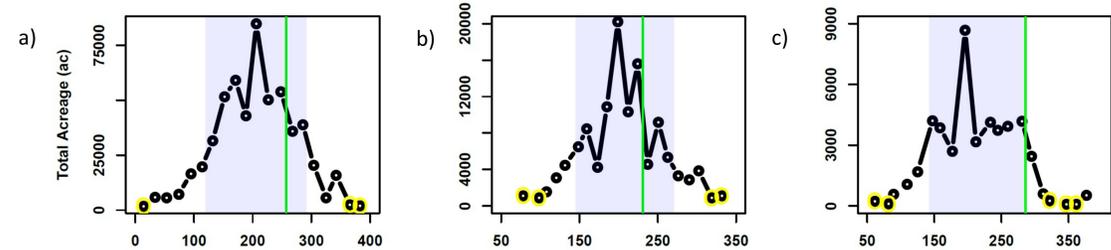
Results

Figure 1. a) N balance relative to N applied for 12 major crops on 1.8M acres; b) R² for yield response to applied N, same crops; c) illustration of data smoothing approach used to plot yield and N balance (Figures 3 and 4).



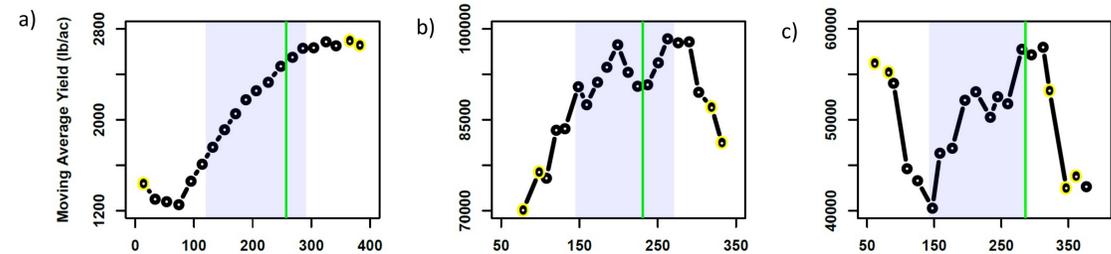
Results (cont.)

Figure 2. Distribution of N application by acreage for a) almonds, b) tomatoes, and c) corn silage



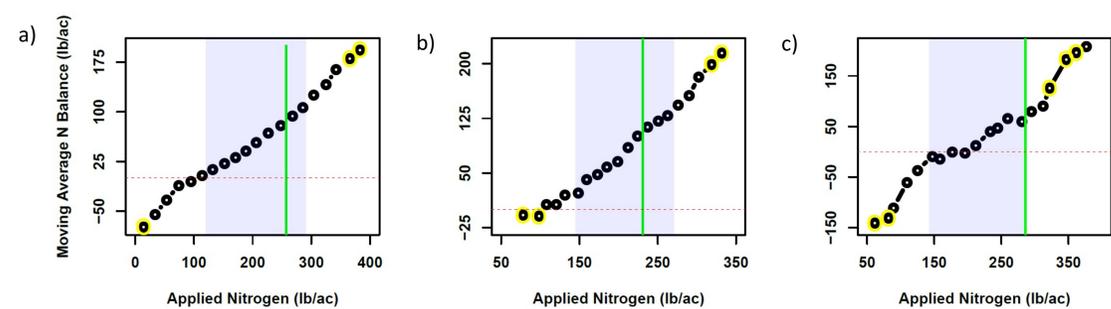
N application ranges were large for all crops, but these 3 illustrate a concentration of acreage in the middle of that range.

Figure 3. Yield response to N application for a) almonds, b) tomatoes, and c) corn silage



For most acreage, yield usually increases with N application, noting that unshaded areas represent less than 20% of the acres, and that bins containing less than 1% of the total crop acreage are highlighted yellow.

Figure 4. N balance compared to N applied for a) almonds, b) tomatoes, and c) corn silage



The N balance increases as N applied increases for each crop. This demonstrates a relatively constant rate of N use efficiency within each crop. The dotted red line denotes an N balance of zero.

Notes: 1) Green lines indicate the upper limit of N application for the majority of fields. 2) Moving averages are based on three data bins. 3) Shaded areas represent 80% of reported NMP data. 4) Yellow markers represent bins that contain less than 1% of the total reported acreage.

Preliminary Implications

- ❖ Base realistic/accurate yield goals on available information, like crop history.
- ❖ Use tools to dial in N rate and to maximize recovery of applied N:
 - Manage uncertainty with tools like tissue testing.
 - Analyze soil samples and consider N in irrigation water to understand what is already there.
 - Split applications into smaller, more frequent applications.
 - Reconsider fall applications where not shown to be effective (e.g., recent findings for almonds).
 - Consider most recent information about crop needs (e.g., walnut, which appears to require less N than previously thought).
- ❖ Each additional 10 pounds of N increases the N at risk of leaching for any crop. Reconsider applications in the high range unless they result in commensurate production benefits. Data suggest a major opportunity to dial back.
- ❖ When N recovery efficiency increases, either or both of the following should ensue:
 - Higher yields if fields have additional yield potential
 - Lower N application rates, since less is needed for the same level of production

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References

CVRWQCB (Central Valley Regional Water Quality Control Board). Nitrogen Management Plan Worksheet. Template for the Nitrogen Management Plan Summary of Regulatory Requirements. For Compliance with the General Orders for the Irrigated Lands Regulatory Program, Approved December 23.
 Geisseler, Daniel. 2016. Nitrogen Concentrations in Harvested Plant Parts – A Literature Overview. December 2.
 MPEP Team. 2018. The South San Joaquin Valley Management Practices Evaluation Program – New Tools & Outlook for CCAs & Growers. CAPCA Ed Tulare CE Seminar. August 9.



Buena Vista Coalition
 Cawelo Water District Coalition
 Kaweah Basin Water Quality Association
 Kern River Watershed Coalition Authority
 Kings River Watershed Coalition Authority
 Tule Basin Water Quality Coalition
 Westside Water Quality Coalition

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