

Winegrape Vineyard Nitrogen Management Survey Report

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Helaine Berris - UCCE Water & Soil Advisor for Sonoma, Napa, Mendocino, and Marin

Reviewed by Chris Chen - UCCE Integrated Vineyard Systems Advisor for Sonoma, Menocino, and Lake

Background

The California State Water Resources Control Board convened a Statewide Agricultural Expert Panel in 2025 to develop science-based recommendations on whether and how statewide nitrogen (N) application limits and reporting requirements should be developed under the Irrigated Lands Regulatory Program. N poses a risk to environmental and human health when present above a certain threshold in surface and groundwater. The Panel was tasked with reviewing past N recommendations, identifying key data gaps, and evaluating the practicality and appropriateness of N limits across crops and regions.

These recommendations may impact future vineyard fertilization, monitoring, and reporting requirements. The North Coast winegrape growing regions of Sonoma, Napa, Mendocino, Marin, and Lake counties are lacking in N management data, highlighting the need to better understand and document typical practices in the region to inform policy decisions. The region also exhibits substantial variability in microclimates, topography, elevation, and soils which further contributes to the complexity of nitrogen management and risks to water quality. Results from the *Winegrape Vineyard Nitrogen Management Survey* were submitted to the panel and document the diversity and complexity of current N management practices in North Coast winegrape systems.

Methods

The “Winegrape Vineyard Nitrogen Management Survey,” was disseminated through Google Forms from Dec 15, 2025 - Feb 24, 2026. The survey was sent to winegrape growers predominantly in North Coast growing regions, however some outreach included growers statewide. This report will only include data from participants with vineyards in North Coast growing regions. See Appendix A for the full list of 22 survey questions. All survey responses were exported and analyzed in R 4.4.2 Programming. Outreach avenues included listservs and newsletters from UCCE and 10 partner organizations who operate in the region.

Results

Groundwater Quality

Groundwater quality exceeding the EPA maximum contaminant level (MCL) of 10 mg/L for nitrate+nitrite is rare in the surveyed regions. The Groundwater Ambient Monitoring and Assessment (GAMA) is a state wide program that monitors groundwater quality through a network of public and private wells. GAMA data (accessed 4/21/2026) show that 10 of 639 wells (1.56%) tested for nitrogen over the past 10 years exceeded the MCL in Sonoma, Napa, Mendocino, and Lake counties.

Local groundwater sustainability agencies (GSA) located within the surveyed regions are also implementing initiatives to monitor and track groundwater quality through monitoring wells located in SGMA basins. GSA annual reports from the most recent years show that 2 out of 180 wells (1.11%) exceed the MCL (Table 1).

Table 1. Groundwater data from GSA annual reports showing nitrate + nitrite exceedances of the EPA 10 mg/L MCL.

GSA	County	Year	Number of Monitored Wells	Wells Exceeding nitrate+nitrite MCL
Petaluma Valley	Sonoma	2024	19	0
Santa Rosa Plain	Sonoma	2024	61	0
Sonoma Valley	Sonoma	2024	28	0
Napa Valley	Napa	2025	53	0
Ukiah Valley	Mendocino	2024	19	2

Survey Participant Demographics

50 growers and vineyard managers from the North Coast winegrape growing regions participated in the survey. 86% of participants manage or work on vineyards in either Sonoma or Napa counties and some had vineyards in multiple counties (Table 2).

Table 2. Vineyard locations by county.

County	Count	Percent
Napa	22	44
Sonoma	21	42
Mendocino	8	16
Lake	5	10

Surveyed participants predominantly operate small vineyards, with 70% managing 100 acres or less and 48% managing 50 acres or less. A majority of growers (74%) are enrolled in at least one certification program that requires some form of nutrient monitoring, reporting, budgeting, or implementation of practices to manage nutrient cycling and protect water quality (Table 3). Many growers participate in multiple certifications programs while 26% did not report a certification.

Table 3. Number and percent of surveyed winegrape growers that participate in a certification program.

Certification	Count	Percent
Fish Friendly Farming	20	40
Certified CA Sustainable Vineyard	18	36
Certified Organic	13	26
not reported	13	26
Regenerative Organic Certified (ROC)	2	4
Napa Green	1	2
Sustainability in Practice (SIP) Certified	1	2

Target yields are low due to growers valuing winegrape quality over quantity. 78% of growers stated their average target yield over the past 5 years to be between 2-6 tons/acre with only 2% targeting 18-20 tons/acre (Figure 1). Grape quality was the leading production goal, cited by 92% of growers as a primary driver of fertilization practices (Table 4).

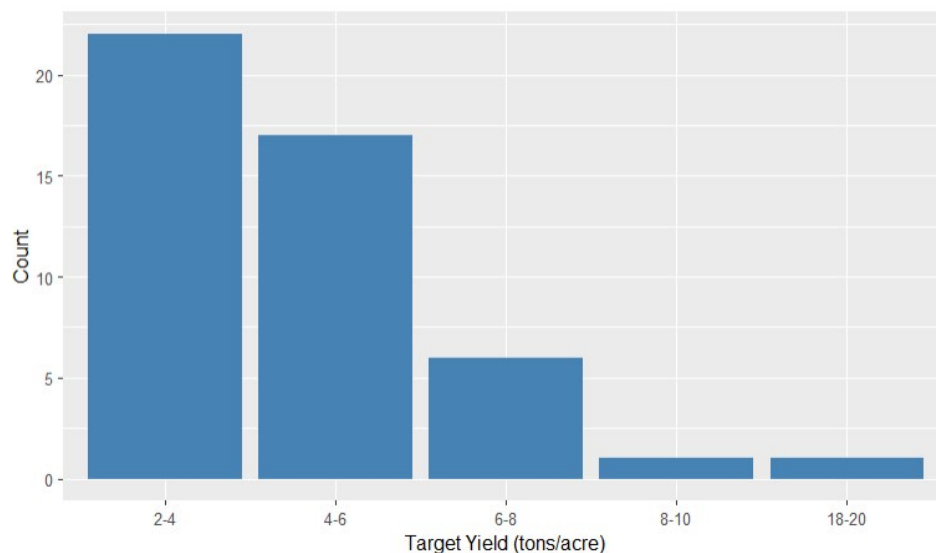


Figure 1. Target yield (tons/acre) for winegrape growers.

Table 4. Winegrape production goals driving fertilization management.

Goal	Count	Percent
Grape quality	46	92
Soil health	30	60
Grape yield	19	38
Water efficiency	15	30
plant health	5	10
Vine health	1	2

Nitrogen Management

Winegrape growers apply a wide variety of amendments and fertilizers to address vineyard nitrogen requirements. Compost is the most commonly applied (72%) with synthetic fertilizers being the second most commonly applied (54%) (Figure 2). Growers apply amendments and fertilizers using fertigation (74%), soil banding or broadcasting (58%), and foliar sprays (42%).

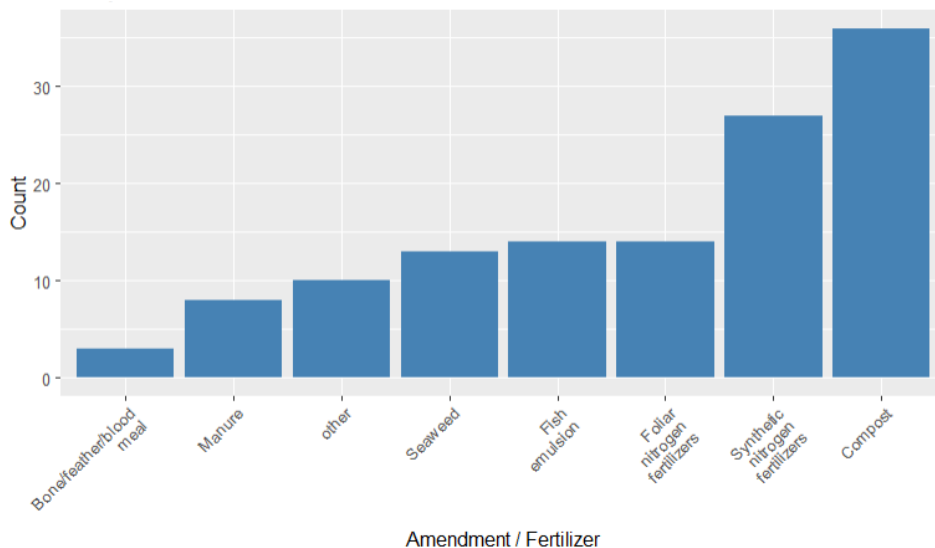


Figure 2. Reported amendments and fertilizers used to address nitrogen in winegrape vineyards).

Vineyard nitrogen application rates are lower compared to other parts of CA. 42% of growers reported applying 0-10 lbs N per acre annually (Figure 3). 30% of farmers apply more than 10 lbs N per acre and 16% were unsure how much N they apply annually. The most recent UCCE cost studies from the past 5 years reported an average of 4 lbs N per acre as the standard application rate for vineyards in Napa County (Kurtural et al., 2020). These application rates are much lower than the average rates reported in the North San Joaquin (13 lbs N per acre) and South San Joaquin vineyard UCCE cost studies (25-45+ lbs N per acre) (Zhuang et al., 2019; Murdock et

al., 2020).

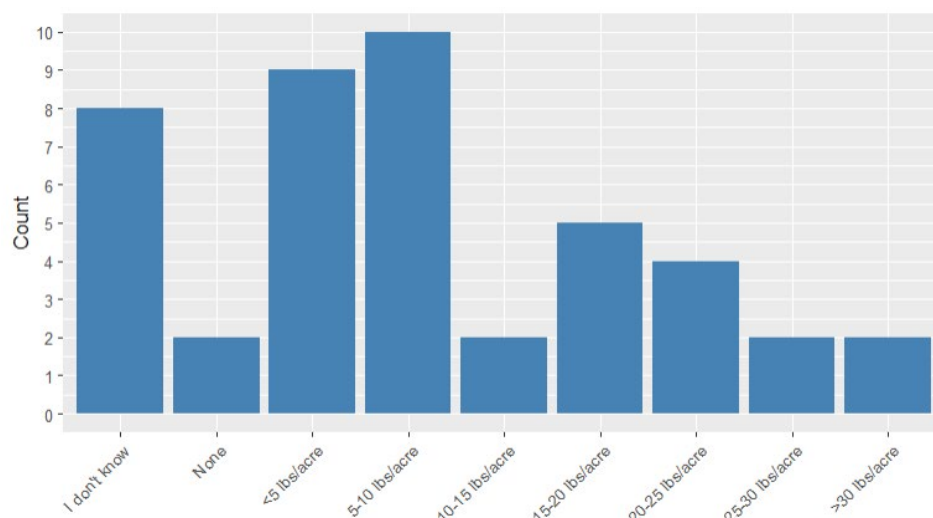


Figure 3. Vineyard nitrogen application rates reported by surveyed growers.

40% of growers report predominantly applying nitrogen in April, May, and June with another small spike in applications after harvest in October and November. 80% of growers do not apply the same amount of nitrogen every year, but say it depends heavily on plant tissue tests (78%), visual cues (76%), and other indicators (Table 5). Additionally, 100% of growers surveyed plant cover crops or let native vegetation grow between vine rows, practices which contribute to the reduction of nitrate leaching and runoff from fields. A majority of growers (90%) believe they are applying nitrogen at an appropriate level to limit nitrogen leaching and/or runoff from their fields.

Table 5. Indicators used to inform nitrogen management reported by winegrape growers.

Indicator	Count	Percent
Plant tissue (petiole) testing	39	78
Visual plant cues and intuition	38	76
Vine growth stage (e.g. bud break, veraison, etc)	27	54
Soil type and testing	18	36
Historical fertilization management and schedules	13	26
Crop removal rates	1	2

Growers reported multiple challenges and need resources to better inform nitrogen management on their vineyards. The biggest challenges growers face are cost of implementing nitrogen management practices, nitrogen application timing, and determining application rates

(Figure 4). The most needed resources reported were decision support tools, education and training, and financial resources (Table 6).

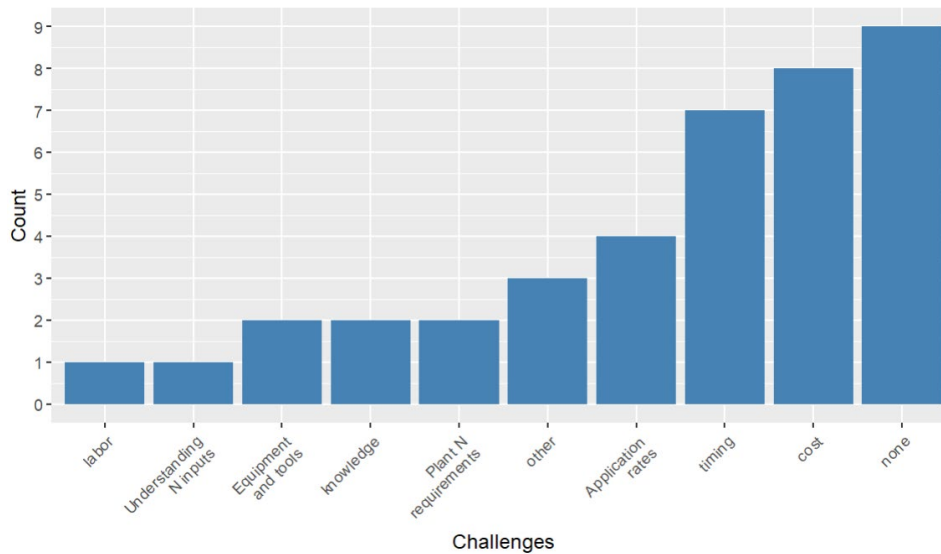


Figure 4. Challenges in vineyard nitrogen management faced by growers.

Table 6. Reported resources needed by winegrapes growers to better inform vineyard nitrogen management.

Resources	Count	Percent
Decision support tools (N calculators, vineyard & site specific data, application rate guidance))	19	38
Education and training	16	32
Financial resources (grants, funding mechanisms)	15	30
Novel or existing technology (eg. automations, apps, precision sensors)	15	30
Labor & equipment	13	26
On farm demonstrations	10	20
One on one technical assistance	7	14
Farmer to farmer learning	6	12
More region specific research	6	12

Irrigation Management

Irrigation primarily takes place from April through October, with peak activity in July and August, when 82% of growers report irrigating. A small share of growers (8%) dry farm. The majority (84%) irrigate less than 8 gallons per vine per week, while only 4% report applying more than 8

gallons per vine per week on average (Figure 5). Much like nitrogen management, irrigation applications are driven by primarily grape quality goals and other indicators (Table 7).

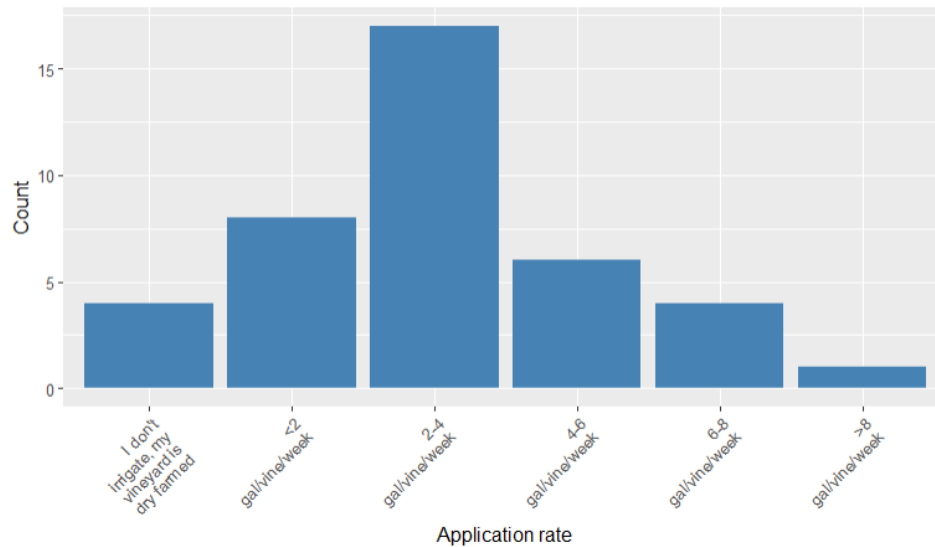


Figure 5. Average irrigation application rates for winegrape growers.

Table 7. Indicators used to inform irrigation management for winegrape vineyards.

Indicators	Count	Percent
Visual plant cues and intuition	44	88
Winegrape quality goals	31	62
Crop evapotranspiration	20	40
Water supply and availability for irrigation	20	40
Soil moisture sensors	19	38
Historical irrigation management schedules	13	26
other tools	7	14
Leaf Water Potential	2	4

Conclusion

This survey of North Coast winegrape growers highlights the region's relatively low-input, quality-focused approach to nitrogen and irrigation management. Surveyed growers prioritize grape quality over yield, use diverse nitrogen sources and application methods, and adjust practices annually based on tissue tests, visual cues, and environmental conditions. Growers also employ cover crops and other practices to minimize nitrogen losses, demonstrating strong

stewardship of water resources which is reflected in low groundwater nitrate exceedances. Nitrogen application rates are lower than in other California wine growing regions, reflecting production goals and regional practices. Management is highly adaptive, with most growers adjusting rates and timing annually based on tissue tests, visual cues, and site-specific factors, and concentrating applications in spring with some post-harvest use. Key challenges include determining appropriate application rates and timing, as well as managing associated costs. Growers identified a need for decision support tools, education, and innovative technologies to further optimize vineyard nitrogen management. This survey collected information from a small subset of growers in a short period of time. More data is needed to understand the impacts regional agriculture has on nitrogen dynamics and water quality. The existing data gap and the qualitative findings presented in this report provided valuable context for the Statewide Agricultural Expert Panel as it considered practical, region-specific recommendations for nitrogen limits and reporting in California vineyards.

References

1. Kurtural, S. K., Stewart, D., & Sumner, D. A. (2020). *Sample costs to establish a vineyard and produce winegrapes — North Coast Region, Napa County (Crush District 4)*. University of California Agriculture and Natural Resources, Agricultural Issues Center, UC Davis. https://coststudyfiles.ucdavis.edu/uploads/cs_public/fe/24/fe24e27a-5c29-4cc3-a83c-63a31cd0c767/2020napawinegrape.pdf
2. Murdock, J., Goodrich, & et al. (2021). *Sample costs to establish a vineyard and produce winegrapes — Northern San Joaquin Valley (Crush District 11)*. University of California Agriculture and Natural Resources, Agricultural Issues Center, UC Davis. https://coststudyfiles.ucdavis.edu/uploads/pub/2022/02/28/2021_grapewinelodi_22522.pdf
3. Zhuang, S., Fidelibus, M., Kurtural, S. K., Lund, K., Torres, G., Stewart, D., & Sumner, D. A. (2019). *Sample costs to establish a vineyard and produce Cabernet Sauvignon winegrapes—Southern San Joaquin Valley*. University of California Agriculture and Natural Resources; Agricultural Issues Center, University of California, Davis. https://coststudyfiles.ucdavis.edu/uploads/cs_public/2d/10/2d10450b-f265-45db-85d6-5b15a0fde6c0/19winegrapesjvsouthcabernet.pdf

Appendix A - Winegrape Vineyard Nitrogen Management Survey Questions

1. Where is your vineyard located (county)?
 - a. Sonoma
 - b. Napa
 - c. Lake
 - d. Mendocino
 - e. Marin
 - f. I own/work on vineyards in multiple counties listed above
 - g. Other_____

2. How many planted acres is your vineyard?
 - a. _____
3. Is your vineyard certified?
 - a. Certified Organic
 - b. Certified CA Sustainable Vineyard
 - c. Fish Friendly Farming
 - d. Demeter Biodynamic Certified
 - e. Regenerative Organic Certified (ROC)
 - f. Sustainability in Practice (SIP) Certified
 - g. Other _____
4. What has been your average target yield in tons/acre over the past 5 years?
 - a. _____
5. What goals drive your vineyard fertilization and irrigation management?
 - a. Grape yield
 - b. Grape quality
 - c. Soil health
 - d. Water efficiency
 - e. Other _____
6. What sources of nitrogen do you apply to your vineyard?
 - a. Synthetic nitrogen fertilizers
 - b. Foliar nitrogen fertilizers
 - c. Compost
 - d. Manure
 - e. Fish emulsion
 - f. Seaweed
 - g. Bone/feather/blood meal
 - h. Other _____
7. How do you apply nitrogen to the vineyard?
 - a. Soil banding / Soil broadcast
 - b. Fertigation / Nutrient irrigation injection
 - c. Foliar spray applications
 - d. Other _____
8. How much total nitrogen do you apply to your vineyard annually (1 growing season) on average (include nitrogen applications for vines and cover crop if applicable, estimate is ok)?
 - a. None

- b. <5 lbs/acre
 - c. 5-10 lbs/acre
 - d. 10-15 lbs/acre
 - e. 15-20 lbs/acre
 - f. 20-25 lbs/acre
 - g. 25-30 lbs/acre
 - h. >30 lbs/acre
 - i. I don't know
9. When do you apply nitrogen to your vineyard?
- a. Jan
 - b. Feb
 - c. March
 - d. April
 - e. May
 - f. June
 - g. July
 - h. August
 - i. Sept
 - j. Oct
 - k. Nov
 - l. Dec
10. Do you apply the same amount of nitrogen every year?
- a. Yes
 - b. No
 - c. Please provide a short explanation _____
11. What informs your nitrogen fertilization and management decision making?
- a. Plant tissue (petiole) testing
 - b. Soil type and testing
 - c. Vine growth stage (e.g. bud break, veraison, etc)
 - d. Visual plant cues and intuition
 - e. Historical fertilization management and schedules
 - f. Other _____
12. How often do you conduct plant tissue (petiole) testing?
- a. Multiple times a year
 - b. One time per year
 - c. As needed
 - d. I don't use petiole testing
 - e. Other _____
13. Do you feel like you are applying nitrogen in your vineyard at an appropriate level to limit N leaching and/or runoff from your target application area?

- a. Yes
- b. No
- c. Not sure

14. What methods and/or tools do you employ to ensure nitrogen applied to the vineyard is accessible to grapevine roots and/or leaves?

- a. Please provide a short answer here:

15. Do you plant cover crops or allow volunteer/native vegetation to grow between vine rows?

- a. Yes
- b. No

16. Do you apply any forms of nitrogen to your cover crop (including compost, manure, emulsions, etc)?

- a. Yes
- b. No
- c. Not applicable, I don't plant cover crops

17. When do you irrigate?

- a. Jan
- b. Feb
- c. March
- d. April
- e. May
- f. June
- g. July
- h. August
- i. Sept
- j. Oct
- k. Nov
- l. Dec

18. On average, how much do you irrigate your vineyard?

- a. <2 gal/vine/week
- b. 2-4 gal/vine/week
- c. 4-6 gal/vine/week
- d. 6-8 gal/vine/week
- e. >8 gal/vine/week
- f. I don't irrigate, my vineyard is dry farmed

19. What informs your irrigation management decision making?

- a. Crop evapotranspiration
- b. Soil moisture sensors

- c. Winegrape quality goals
 - d. Visual plant cues and intuition
 - e. Historical irrigation management schedules
 - f. Water supply and availability for irrigation
 - g. Other _____
20. What would help you better manage nitrogen on your vineyard?
- a. Financial resources (grants, funding mechanisms)
 - b. Labor & equipment
 - c. Novel or existing technology (eg. automations, apps, precision sensors)
 - d. Decision support tools (N calculators, vineyard specific information)
 - e. Clearer regulatory guidance (reporting requirements and expectations)
 - f. Education and training
 - g. One on one technical assistance
 - h. More region specific research
 - i. Farmer to farmer learning
 - j. On farm demonstrations
 - k. Other _____
21. What's your biggest challenge in vineyard nitrogen management?
- a. Please provide a short answer here: _____
22. Do you have any additional comments/thoughts on nitrogen management?
- a. Please provide a short answer here: