

University of California

Nitrogen Management Training

for Certified Crop Advisers

MODULE 1

California's Nutrient Management Regulations – Frequently Asked Questions

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Introduction

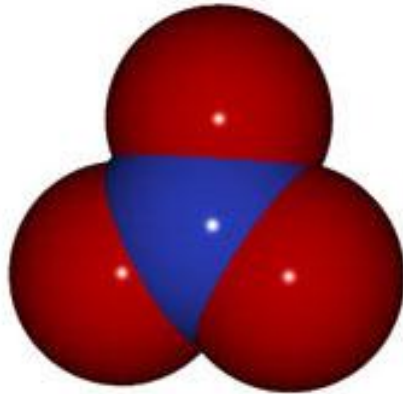


- CCA's have been chosen, following training and certification, to sign off on nitrogen management plans for California growers.
- This presentation addresses some of the questions CCA's may have regarding their role in the future of nitrogen management plans.

What is the Problem?

- Nitrate in Drinking Water
 - Concentrations in drinking water from certain California aquifers exceed the Federal/California EPA Maximum Contaminant Level (MCL) of 45 mg NO₃ /L which is equal to 10 mg NO₃-N /L).
 - CA State Water Resources Control Board noted as of June 2010, 1,077 drinking water wells out of 13,153 (8%) exceed the nitrate threshold.

A review of how to measure nitrate concentration?



Nitrate (NO₃) is 23% Nitrogen
77% Oxygen

10 mg NO₃-N/L (measure **N** only)

45 mg NO₃/L (measure **N + O**)



Similar to converting gallons to liters (know the conversion factor of 3.78)

What Impact does Nitrate-Polluted Water Have on Health?

Some references for further reading:

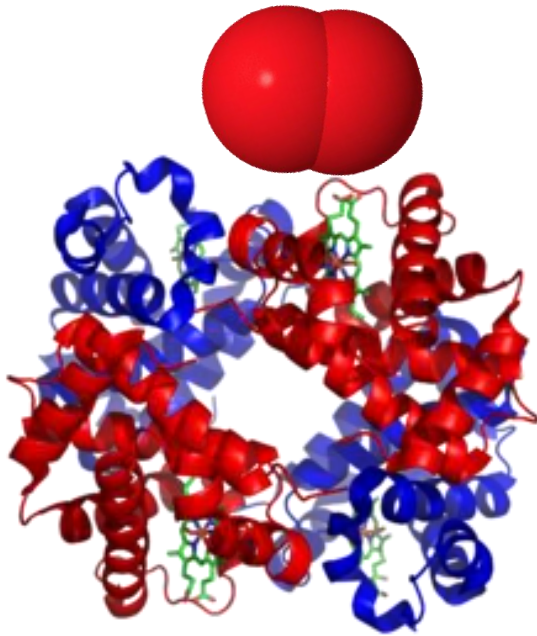
- <http://www.epa.gov/>
 - [Nitrates and Nitrites TEACH Chemical Summary](#)
- <http://www.epa.gov/region09/ag/workshop/nitrogen/index.html>

USEPA's View of Nitrate (and Nitrite) Toxicity

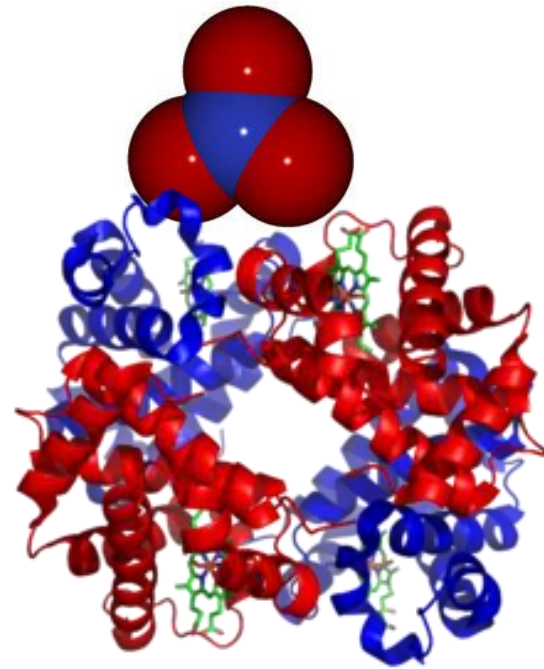
Nitrate (NO_3) and nitrite (NO_2) effects are related:

- Oral ingestion can lead to methemoglobinemia “blue baby syndrome” in infants
 - First described in 1945
 - Reference Dose established 1991
 - Basis of nitrate and nitrite Maximum Concentration Levels (MCLs)
- Not a human carcinogen (2002)

What happens with Methemoglobinemia?



Hemoglobin binds with
oxygen in blood



Hemoglobin binds with
nitrate in blood
(blocks oxygen)

What is Methemoglobinemia?

- AKA “Blue Baby Syndrome”
- Inhibition of blood’s ability to carry oxygen
 - Lips and skin can turn bluish (cyanosis)
- Can be caused by several agents including nitrate
- Normal hemoglobin is converted to methemoglobin, which cannot carry oxygen
 - 0-20% methemoglobin yields bluish skin
 - 25-40% yields hypotension, rapid pulse and breathing
 - > 50% can be fatal



Methemoglobinemia in California

- Agency for Toxic Substances and Disease Registry did an assessment at the request of CA DHS (now DPH) in 2000
- 42 total methemoglobinemia cases over 13 years studied
 - *None specifically associated with nitrate*
 - Four were located in areas where wells are used
- National figures similar - rare to find a clear, unique association with drinking water nitrate

Is Nitrate a Human Carcinogen?

- USEPA does not currently believe so, based on lack of supporting data and substantial negative data
 - Theory is that nitrate --> nitrite --> nitrosamines
- Animal toxicity studies show nitrosamines cause cancer, but not nitrate or nitrite alone
- Human epidemiology studies are not clear
- Bottom line: no smoking gun

Where Does Nitrate Pollution Occur?

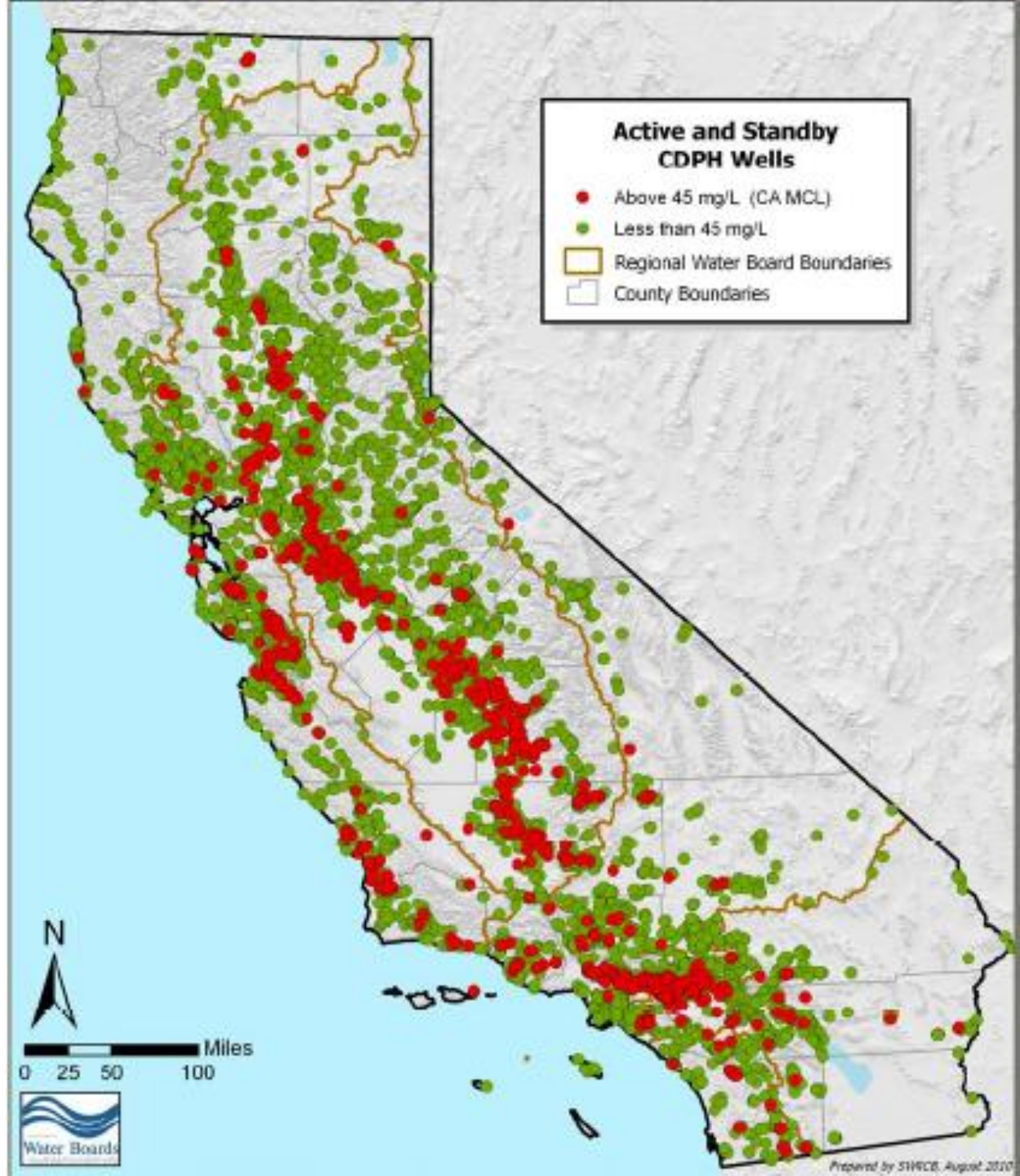
- Nitrate is the most common drinking water pollutant in the world.
- USEPA estimates 52% of US community water wells and 57% domestic wells have levels in excess of 2 mg NO₃ /L (considered background levels).
- USGS estimates up to 15% wells exceed MCL
- Problem Areas in California:
 - San Joaquin Valley, Santa Ana Valley and Salinas

Where is Nitrate a Problem in CA?

- Los Angeles, San Bernardino and Tulare are counties with the most nitrate drinking water violations.
- Nitrate polluted wells occur throughout California but mainly where there is shallow depth to groundwater.
- Some rivers, especially along the coast, have elevated nitrate concentrations.

Areas with shallow groundwater and intensive agriculture are vulnerable to nitrate contamination

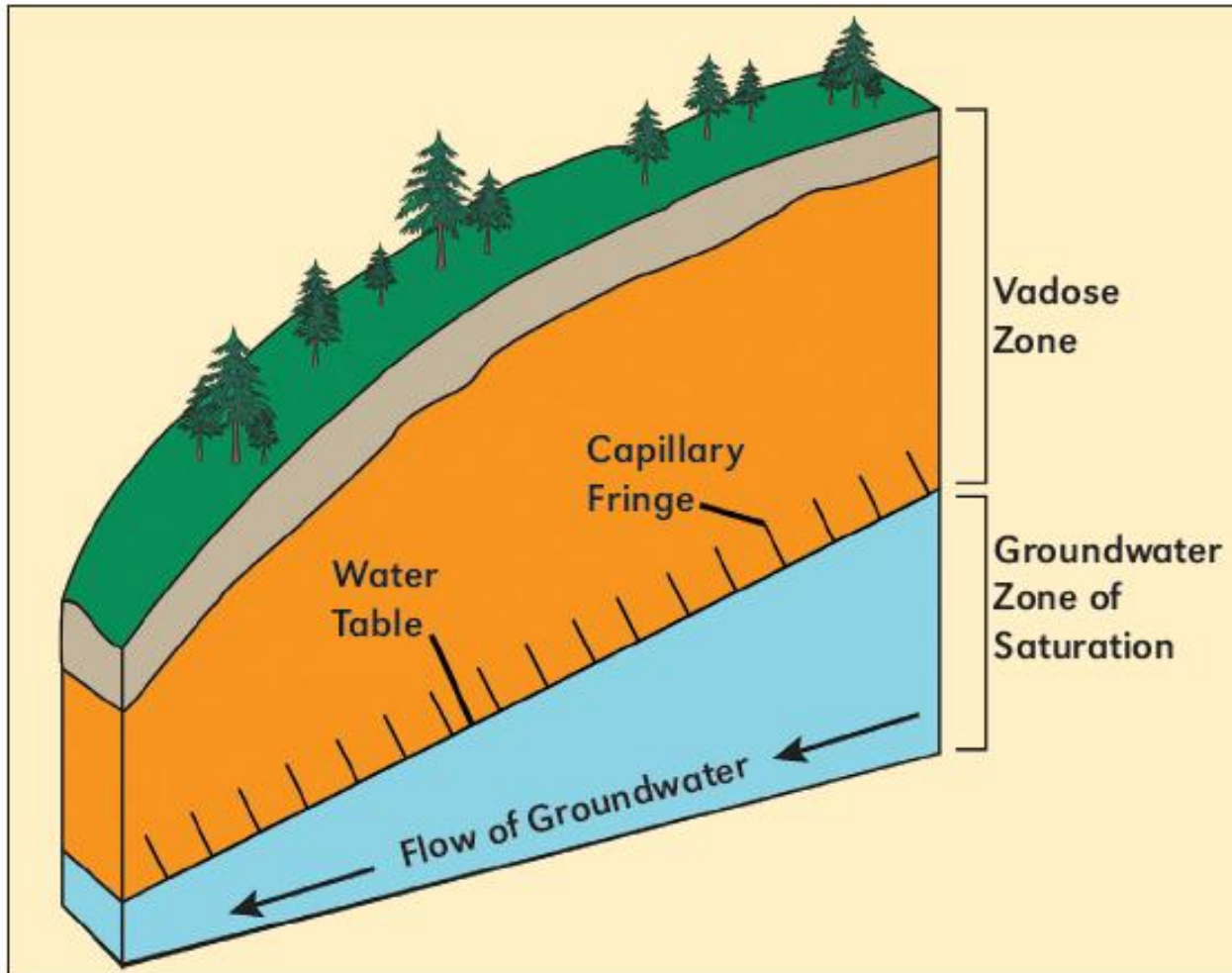
- **Above** 45 mg NO₃/L
(10 mg NO₃-N/L)
- **Below** 45 mg NO₃/L
(10 mg NO₃-N/L)



Why are Shallow Wells Most Affected?

- Nitrate is an anion and is not retained by soil. It moves with the wetting front.
- Water moving below the root zone carries nitrate with it. **WATER is the mechanism of transport!**
- Very localized, nitrates can also come from septic systems.
- After years of downward flow with water, nitrate eventually reaches the aquifer.
- The farther from the source, the longer nitrate takes to reach the groundwater.

Once nitrate moves below the rootzone, it moves with water through the “Vadose Zone” (slowly or quickly) until it reaches groundwater



How Did Nitrate Become a Problem?

- In nature, nitrogen cycles through the soil, water, and plants at low concentrations.
- California agriculture has a long history of N use, with cropped acreage, N fertilization rates, dairy production, and irrigated land increasing in last 50 years.
- Agriculture requires considerable N inputs to produce economically profitable crops.
- Inefficiency of irrigation/rainfall and N applications leads to some unavoidable nitrate leaching losses. Must be carefully managed!

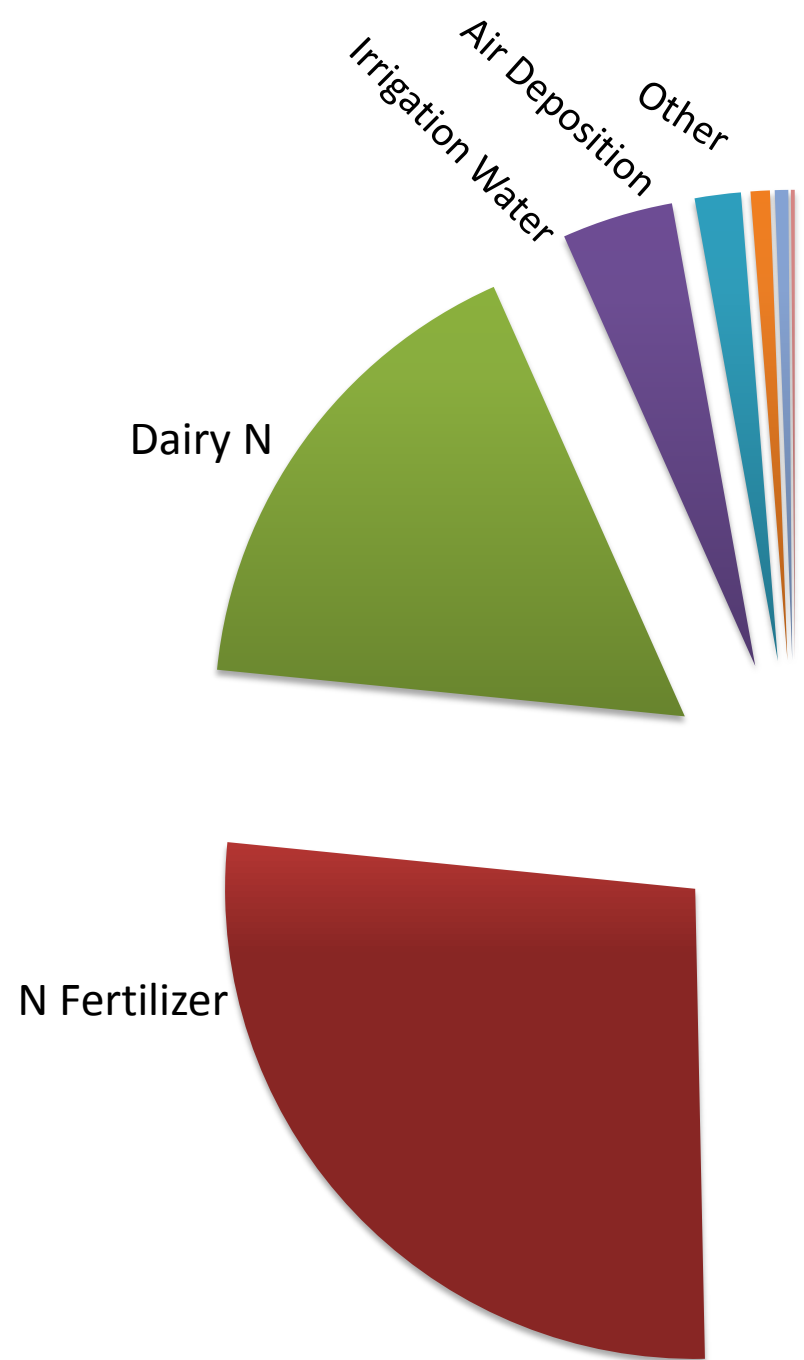
Where is the Nitrate Coming From in CA?

The two major N inputs on cropland are:

Synthetic fertilizer **53%**

Dairy Manure **33%**

Data from Salinas Valley and Tulare Lake Basin



Where is the Nitrate Going in CA?

- **34%** removed in harvest
- **10%** gaseous loss
- **5%** runoff
- **51%** available to leach to groundwater

Harvested N

Leachable N



Data from Salinas Valley and Tulare Lake Basin

What are the Impacts of Nitrate Pollution?

- Nitrate in drinking water poses two problems:
 - Public health
 - In study area (Tulare Lake Basin and Salinas Valley), 254,000 people at risk for drinking nitrate contaminated water.
 - 220,000 people drink from public water systems
 - 34,000 drink from domestic wells.
 - Financial
 - Expense of treating contaminated water or providing an alternate source of clean water.

What are the Financial Consequences?

- Large municipalities can afford to find unpolluted water sources or treat drinking water to remove contaminants.
- Small agricultural communities cannot afford to “fix” their contaminated water nor afford to buy purified drinking water.
- No inexpensive method to remove nitrate from drinking water
- If N fertilizer is used inefficiently, grower’s finances are hurt

Other Consequence: Regulations....

- Irrigated Lands Regulatory Program (ILRP)
 - Managed by Regional Water Quality Control Boards
 - e.g. Central Valley, Central Coast, etc.
 - Applies to all growers who irrigate (except dairies)
 - The WDR specifies all the requirements that growers and third parties (coalitions) must implement to protect both ground and surface water from irrigated agricultural activities.

What is included in the Waste Discharge Requirements?

- Growers with irrigated lands must either join their regional coalition or prepare to meet WDR requirements individually (not a good idea!).
- **Tasks that will be handled by Coalitions**, at least in Central Valley, include:
 - Groundwater quality assessments and plans
 - Monitoring long term ground water quality trends
 - Assess which BMPs protect ground water quality
 - Surface water quality monitoring
 - Compilation of data submitted by growers (CV only) and Reports to regional Water Board

What is included in the Waste Discharge Requirements?

- Growers are responsible for:
 - Annual Farm Management Plans
 - Review whole operation for possible impacts on both ground and surface water
 - Annual Nitrogen Management Plans
 - Which generally will require CCA sign off if in vulnerable zone
 - Where needed, Sediment and Erosion Management Plans
 - Submitting data to Coalition or Water Board
 - Fees to pay for Coalition activities as well as Water Board staff time
- Implementation timing depends on location
 - Center Coast growers are in the process of implementing
 - East San Joaquin Coalition first... now delayed
 - San Joaquin Valley Coalition etc. at the latest by 2015
 - In Central Valley, Nitrogen Management Plans signed off by CCAs will be required as of early 2015

What Do CCA's need to do?

- Take this training course!
- The rest of this program will give you the background necessary to understand nitrogen management plans and how to complete them.
- Your signature on the NMP verifies the grower is aware of the Management Practices to reduce the potential of nitrate loss.

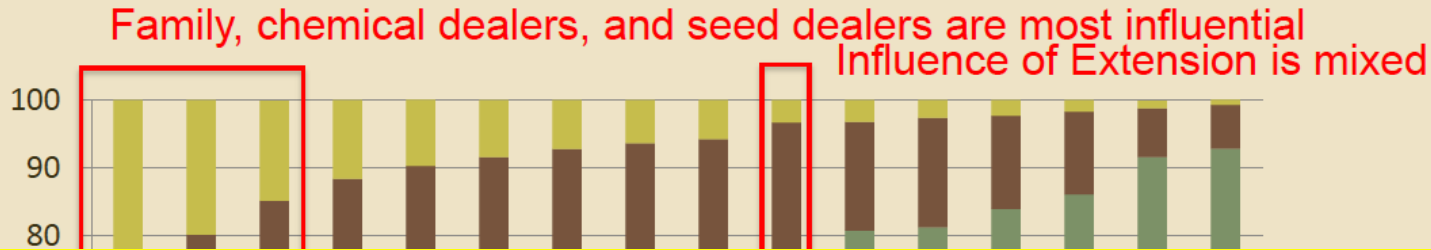
The power of CCA's



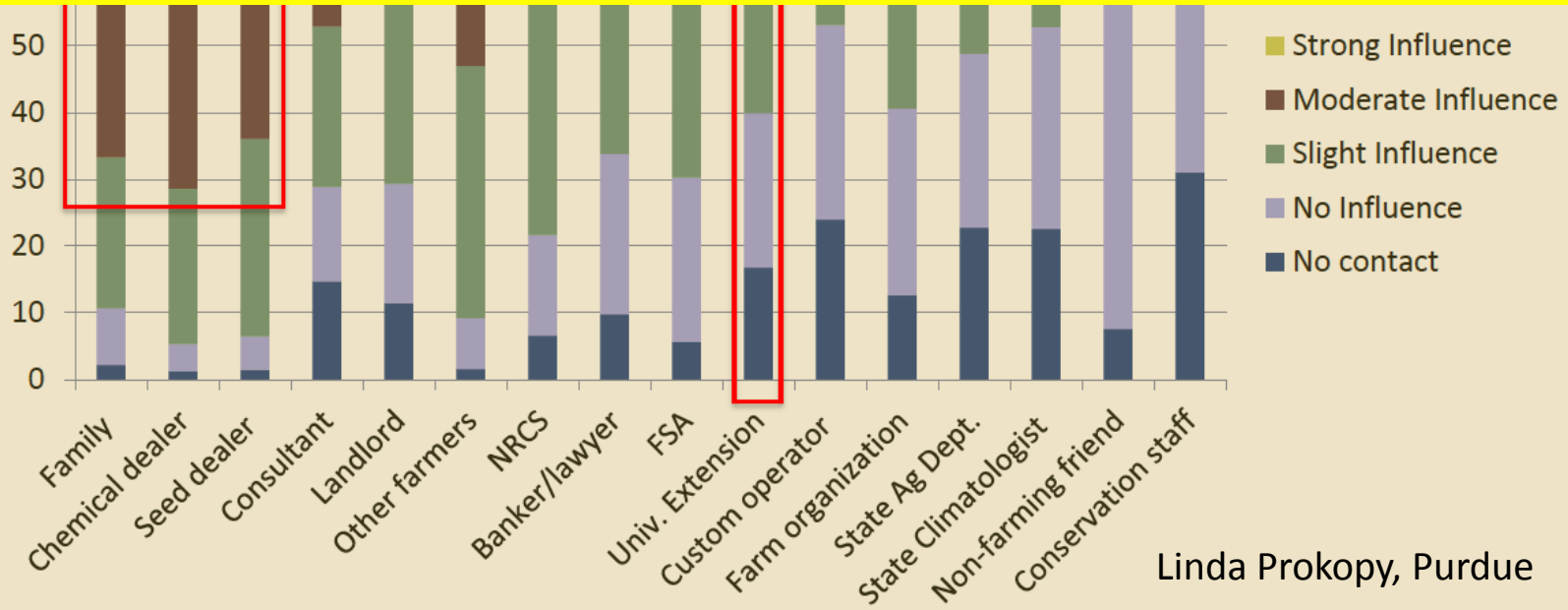
Where do farmers get their information?



Please indicate how influential the following groups and individuals are when you make decisions about agricultural practices and strategies. (16 options)



Study from Indiana indicates that “dealers and consultants” are by far the most influential group in helping farmers make decisions about agricultural practices



Linda Prokopy, Purdue

Minnesota Survey:

...the survey asked farmers about the primary decision influencer for the decision maker.

Overwhelmingly, this was the "fertilizer dealer" (Mike Schmitt, Univ Minn)

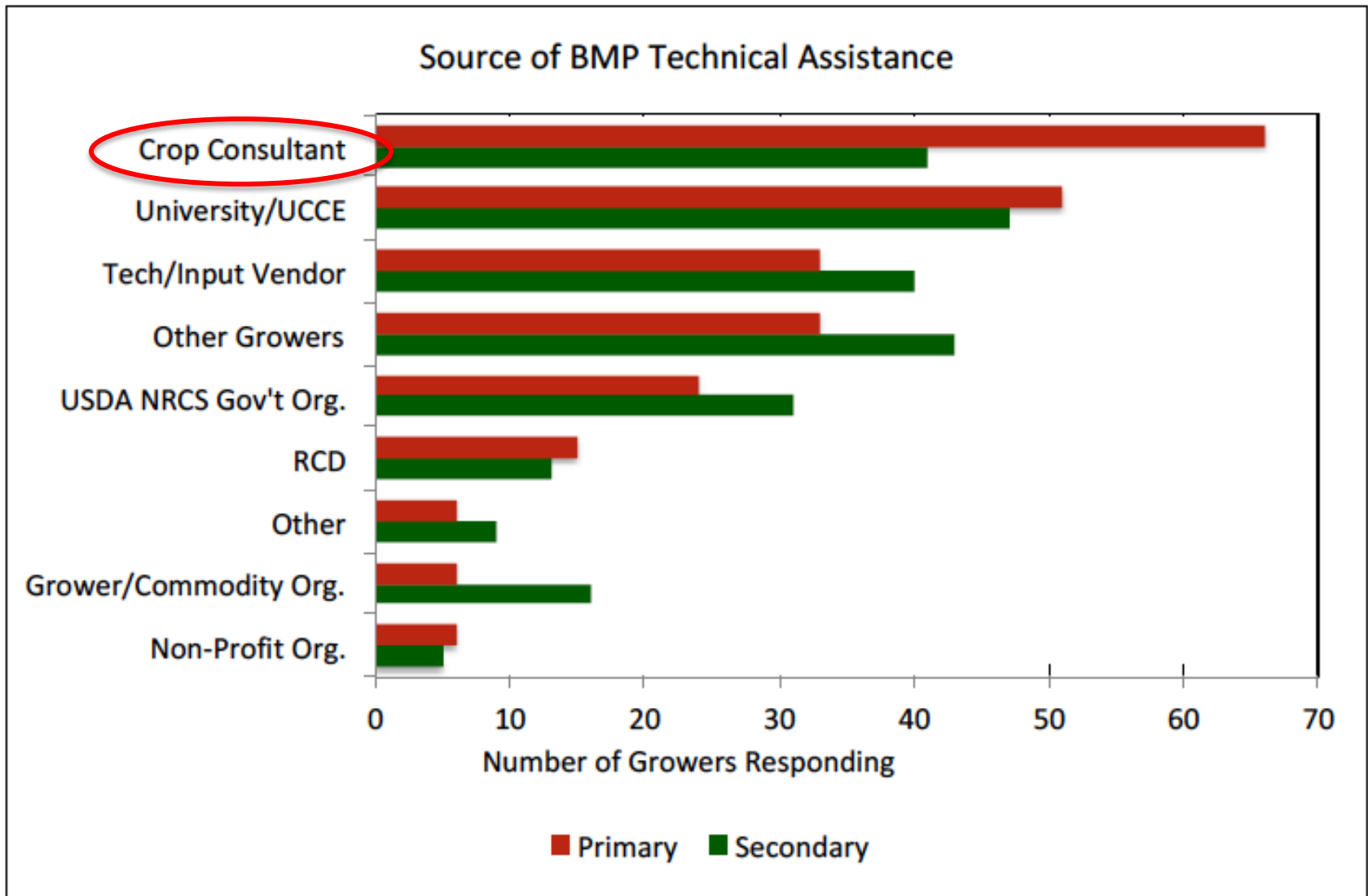


American Farmland Trust polled California specialty crop growers, asking them what would make it more likely for them to try practices such as micro-drip, alternate furrow irrigation, and timed application and precise placement of nitrogen fertilizers.

The results are contained in a American Farmland Trust report:

***Encouraging California Specialty Crops
Growers to Adopt Environmentally Beneficial
Management Practices for Efficient Irrigation
and Nutrient Management***

Crop Advisors are the most consulted source of technical assistance in helping farmers change nutrient management and irrigation practices



Certified Crop Advisors **CAN** Facilitate Change

CCA's have the relationship with farmers to help them improve their practices ... everyone can improve:

- The poor managers get good at using water and nitrogen
- The good managers get better at using water and nitrogen
- The better managers get great at using water and nitrogen

CCA's have been empowered by the Water Board to take the lead in changing nutrient management practices:

- Get Educated
- Get Busy



University of California

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Course materials available at:

ciwr.ucanr.edu/NitrogenManagement

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