Fertility update

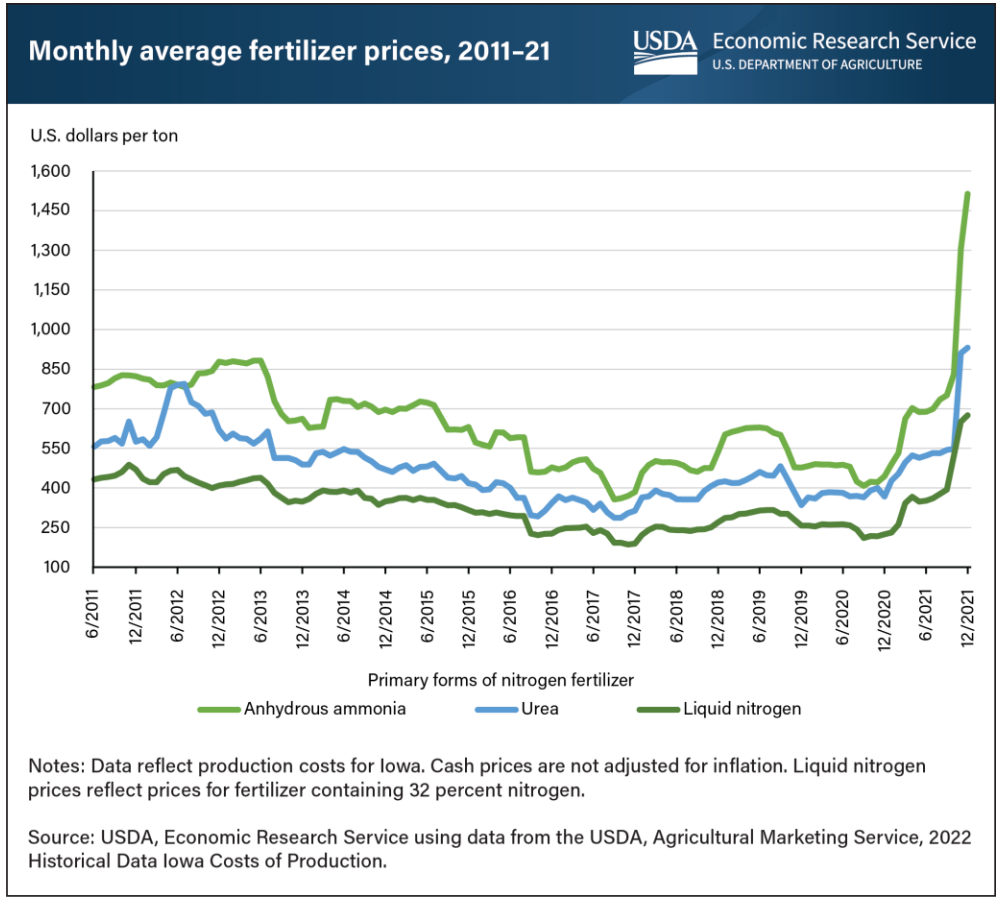
March 14, to 17, 2022

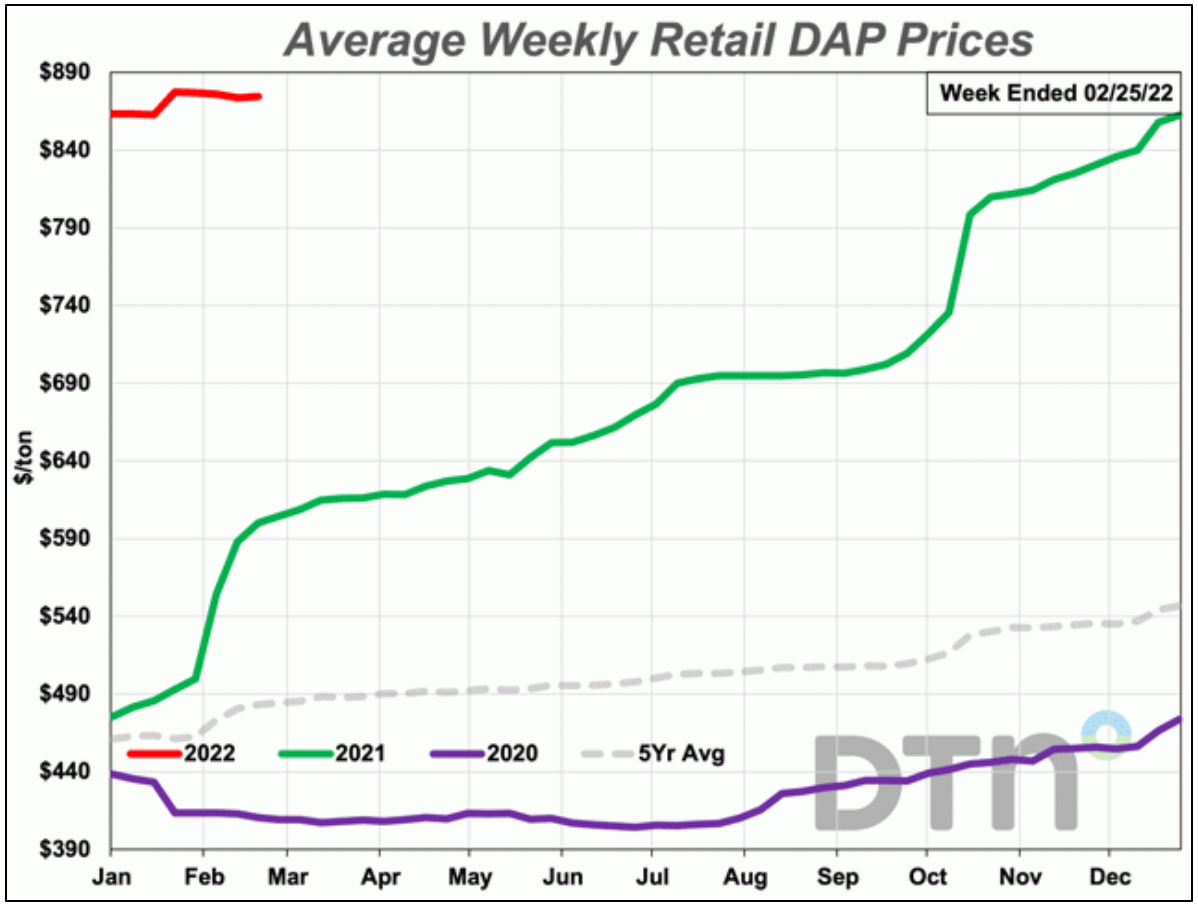
Bruce Linquist

California Rice Research Board

UC DAVIS DEPARTMENT OF PLANT SCIENCES

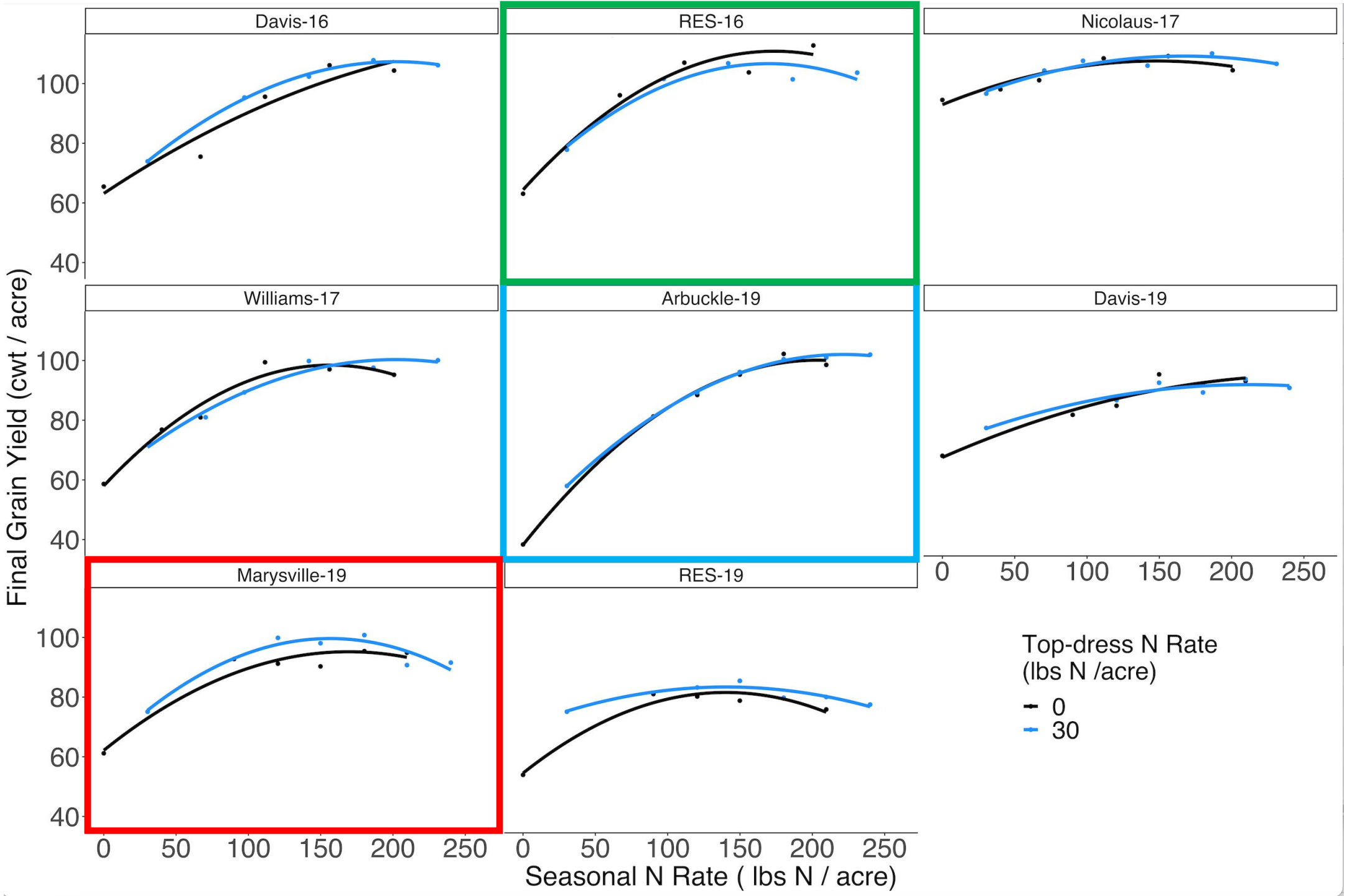
Fertilizer prices are going up





Put all of you N fertilizer up front

- Do not plan to top-dress N
- Apply your seasonal N rate at the start of the season
  - aqua and with starter blend
  - Starter up to 30 days after planting
- Check at PI if more N is necessary
  - Leaf Color Chart, GreenSeeker
  - Apply if needed


Davis-16
RES-16
Nicolaus-17
Williams-17
Arbuckle-19
Davis-19
Marysville-19
RES-19
Final Grain Yield (cwt / acre)
40
60
80
100
0
50
100
150
200
250
Seasonal N Rate (lbs N / acre)
Top-dress N Rate
(lbs N /acre)
0
30

Nutrient Survey

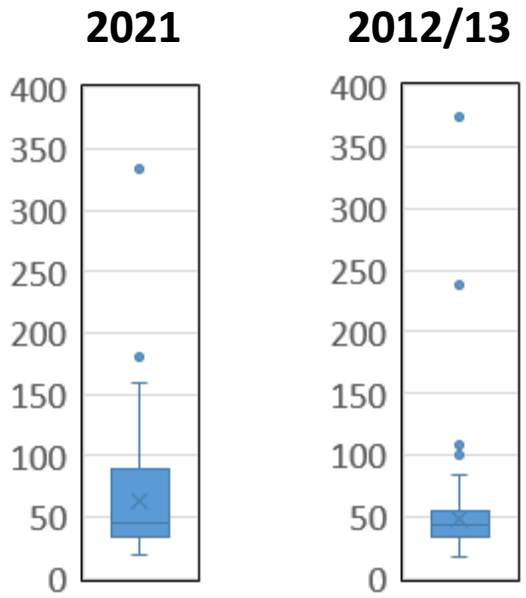
- 2021
  - 28 fields and 84 samples
  - Soils (pre fert) and Y-leaf (35 to 40 DAP)
  - Three samples per field (plow layer)
  - Nutrient/straw/ management history gathered for all fields
- 2012/2013
  - 55 fields and 160 samples
  - Soils
  - Three samples per field (plow layer)
- Soil and plant samples sent to lab for analysis

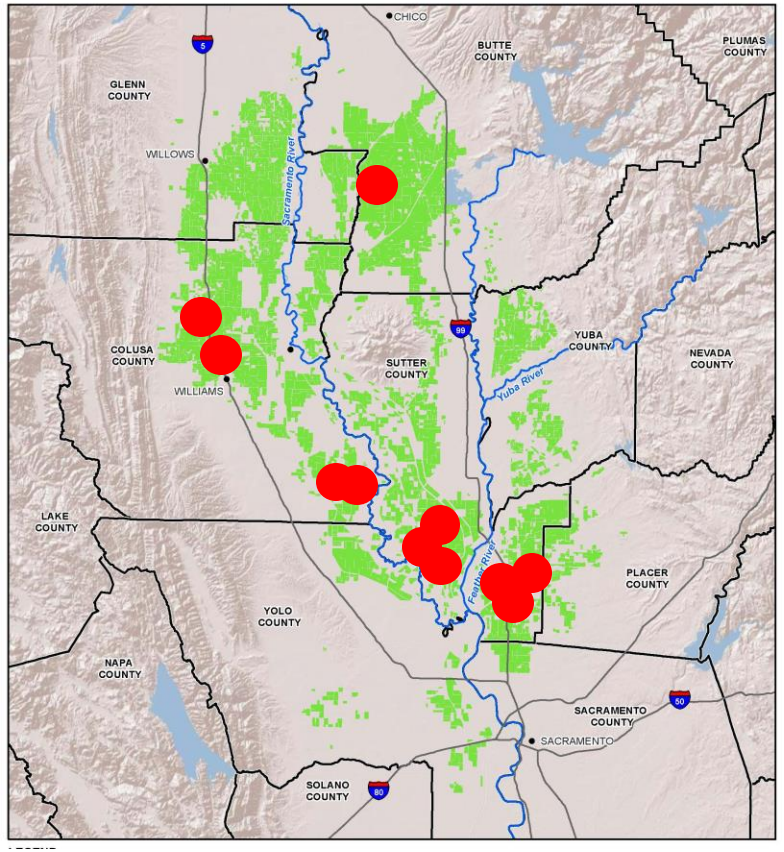
Results

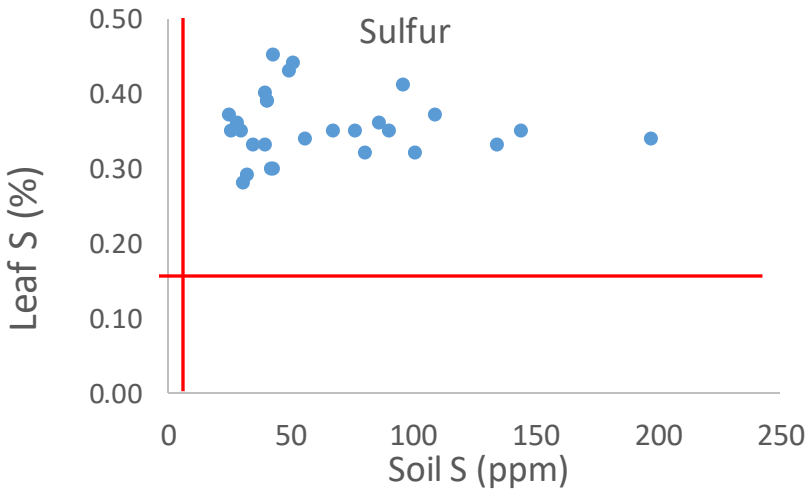
- **Nutrient deficiencies**
  - No soil or plant deficiencies: Mg, S, Zn, Mn, Fe, Cu
  - Soil deficient but not plant: B
- **Little more on S, Zn and B**

Sulfur

- Soil critical level
  - 9 ppm S: ($Ca(H_2PO_4)_2$ extraction)
  - Mean 48-60 (lowest 24 ppm)
- Plant Critical level (Y-leaf)
  - 0.16%
  - Lowest 0.28%





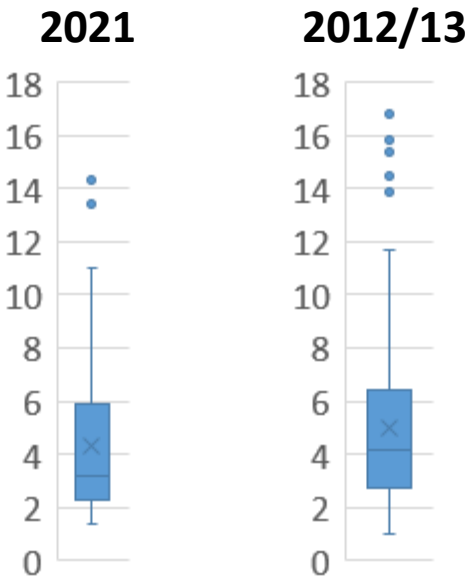


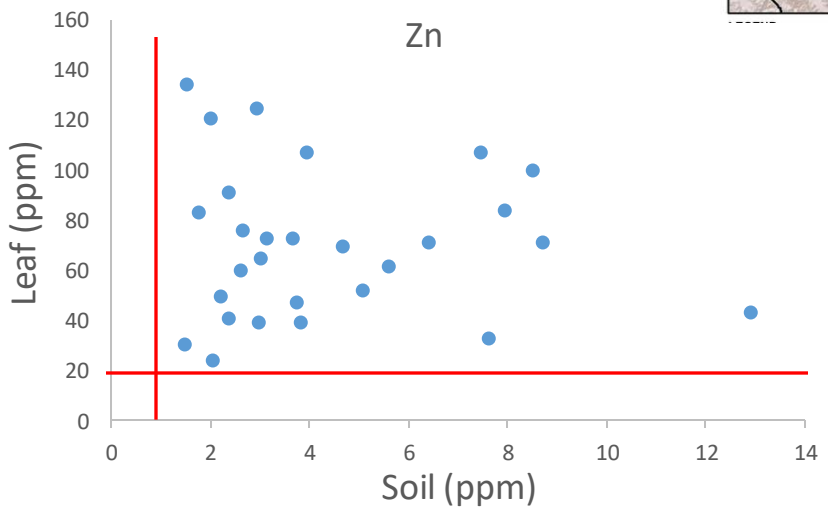
Bottom line

- S deficiency not a problem in soil or plant
- No relation between soil and plant S (S was applied in some locations)
- Lowest soil S is in the southern part of valley

Zinc

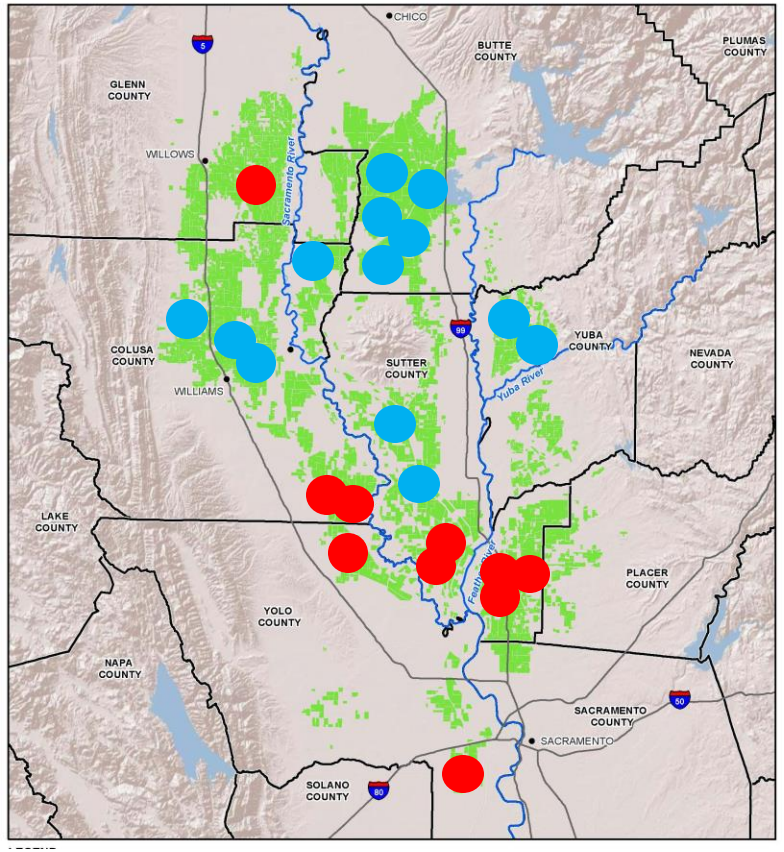
- Soil critical level
  - 0.8 ppm Zn: DTPA
  - Mean 4-5 ppm
  - Low 1.0-1.4 ppm
- Plant Critical level (Y-leaf)
  - 20 ppm (def)/ 500 ppm (tox)





Low <2

High >8



Bottom line

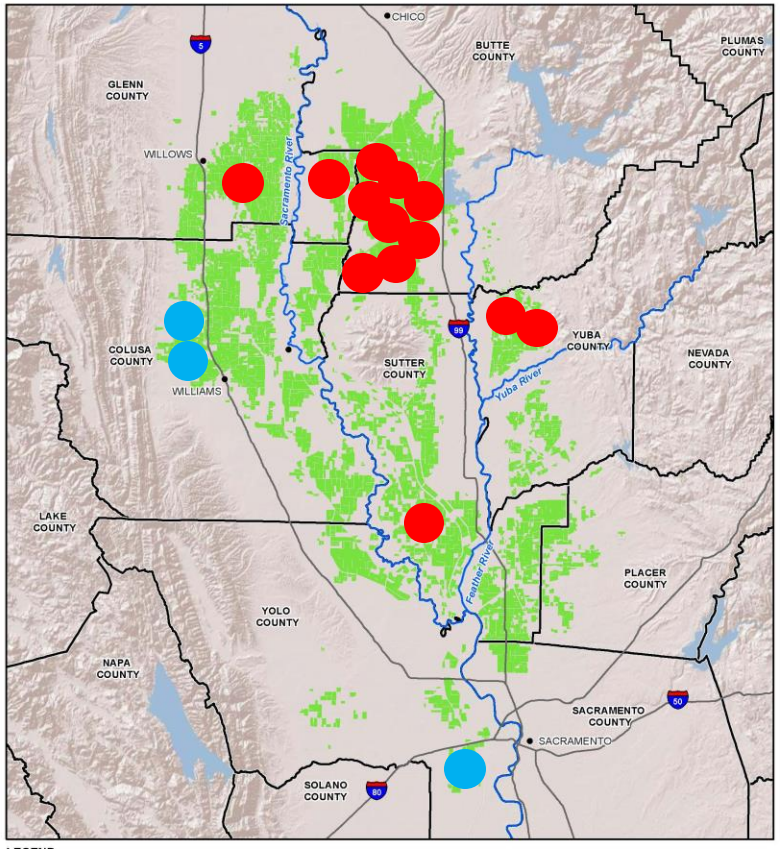
- Soil Zn all above critical level
- No plant samples showed low Zn levels.
- Soil and plant Zn not correlated (Zn was applied in some locations).
- Low Zn in South; high in North

Boron

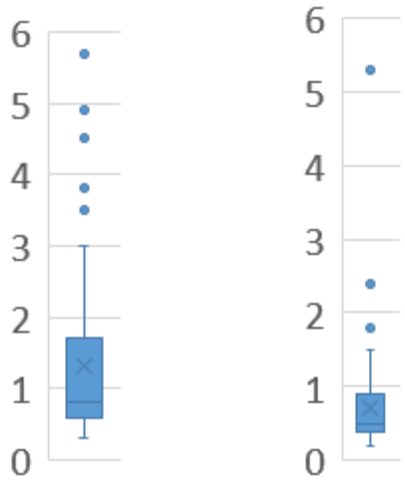
- Soil critical level
  - 0.1-0.7 ppm B: Hot water extraction
  - Mean Sorbitol-DTPA 0.7-1.3 ppm
  - Low 0.2 ppm
  - Toxicity: >5 ppm
- Plant Critical level (Y-leaf)
  - 5 ppm (def)/ 100 ppm (tox)

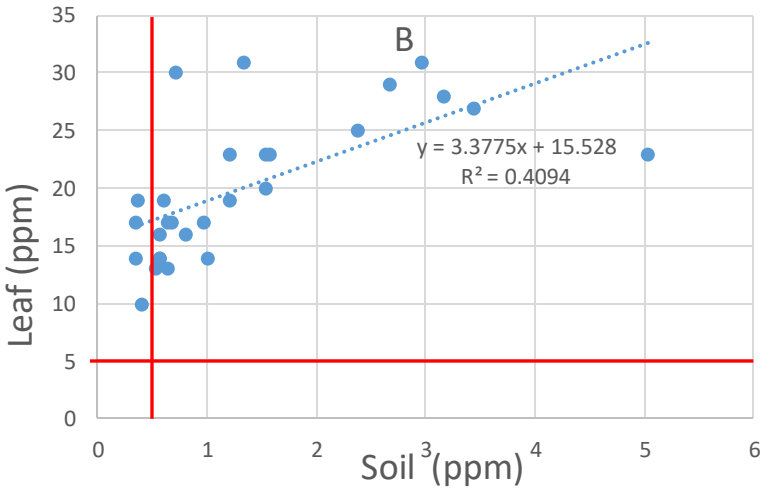
Low <0.3

High >3



2021 **2012/13**





Bottom line

- Some soils low and high in B
- Some plant samples showed low B levels but not high.
- Soil and plant B correlated.
- Lowest B levels were in NE part of Valley

Fields with straw baling

- Soil K values almost identical between fields.
  - Growers are aware of possible K deficiencies
  - Applying more K fertilizer
- Soil P values were lower in baled fields.
  - Additional P is not being applied to account for removal of P in rice straw.
  - All growers in this survey that baled, applied 40 lb P_2O_5/ac.
    - Not enough
  - More in a bit

Good year to soil test and apply if needed

- Phosphorous
  - Use **Olsen-P/Bicarbonate P** – not Bray
  - **12 ppm** or more: unlikely P fertilizer is needed
  - **6 ppm** or less: definitely need
- Potassium
  - **120 ppm** or above: unlikely K is needed
  - **60 ppm** or less: definitely need

Maintaining soil P

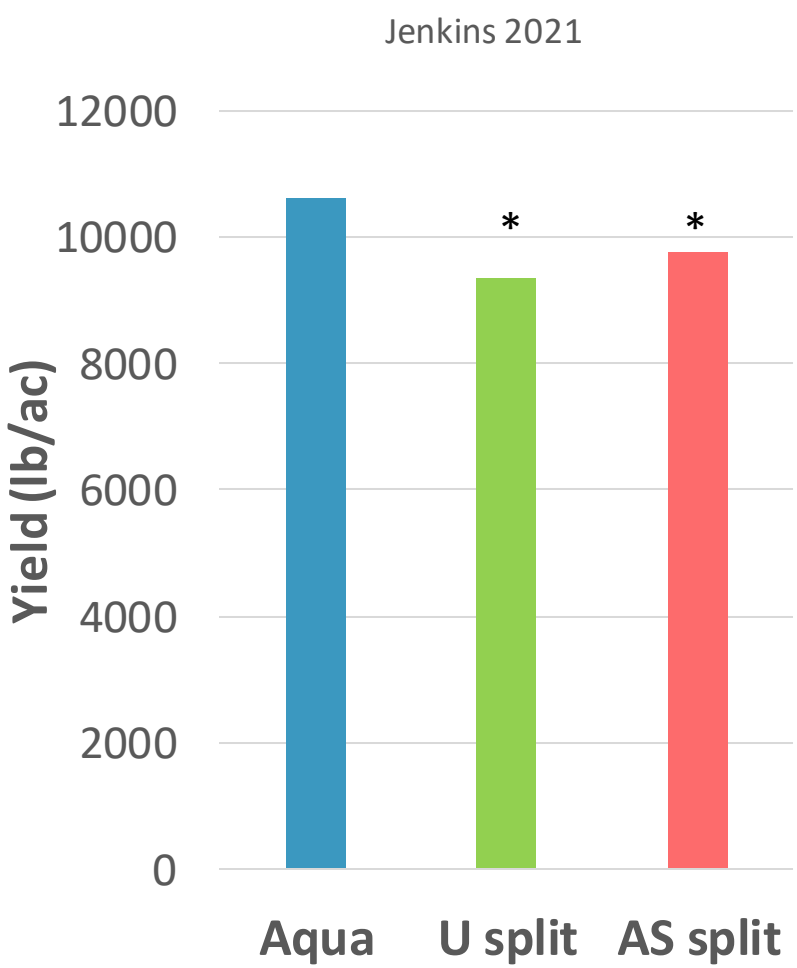
Grain yield	Straw retained	Straw removed (1/2)
	Maintenance P fertilizer requirement	
cwt/ac	lb P_2O_5/ac	
70	36	44
80	42	50
90	47	56
100	52	63
110	57	69

P deficiency symptoms

- Early on, narrow dark green leaves
- Reduced tillering
- Delayed heading

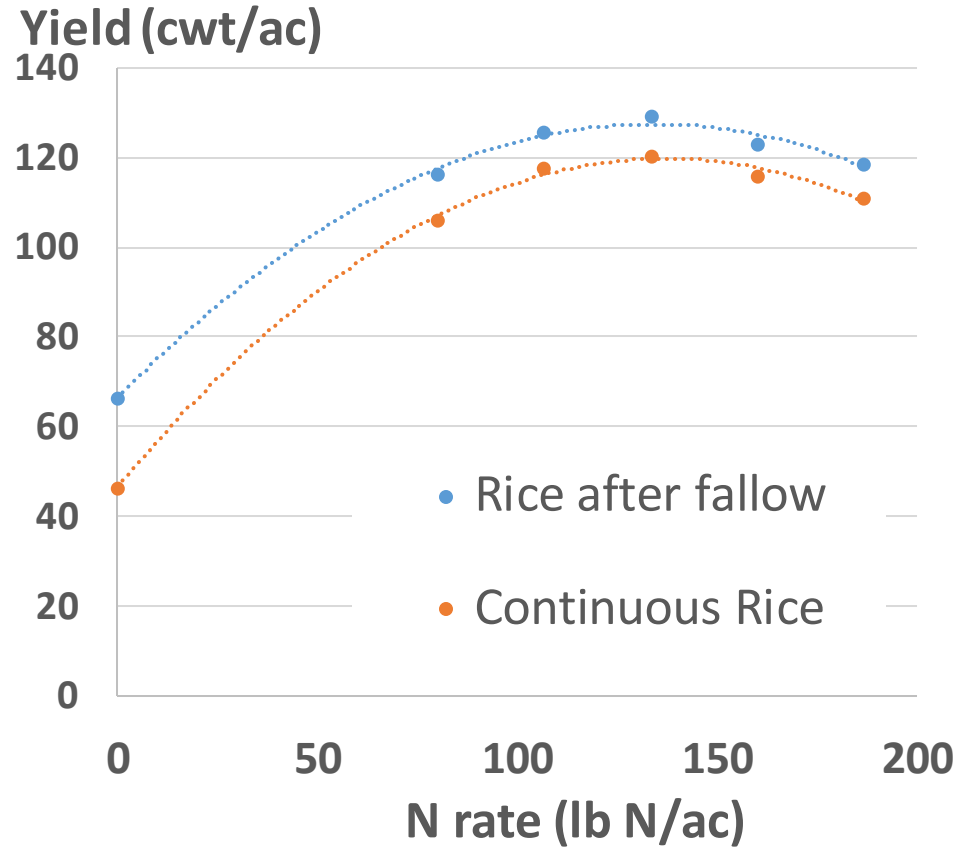
What if I can not apply aqua-NH_3?

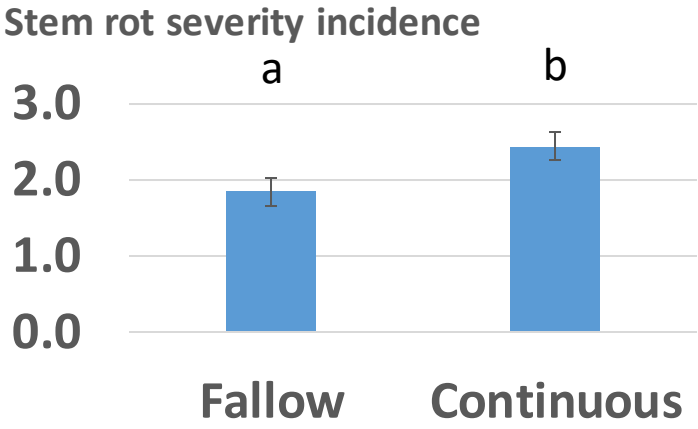
- If possible, apply urea before flooding to a dry soil
  - Aqua=urea if applied before flooding
    - incorporate prilled urea
    - apply as liquid – injected like aqua
  - Always flood as soon and as quickly as possible
- If soil is wet before preplant - applying N after flooding
  - N splits is best option
    - 3,4,5,6 weeks after planting
    - 20,30,30,20% of N rate
    - Will need to increase N rate
  - Ammonium sulfate = urea
  - Enhanced efficiency fertilizers do not work well



N management in fallowed vs continuous rice fields

- Maximum yields were similar/higher in fallowed fields
- Higher yields at the lower N rates
  - Max yields achieved at similar N rates
- Continuous rice : higher stem rot severity.
  - difference could result in a 3% yield loss.





Dry-seeding N management

- Dry seeding offers opportunity to change herbicide programs
  - Good strategy to manage some herbicide resistant weeds
- Yield potential is similar to water seeding
- Two options for N management
  - Apply N (urea+starter) just before permanent flood to a dry soil
    - Increase N rate by 40-50 lb N/ac
      - increased N losses associated with surface applied fertilizer
    - **If soil surface is wet, split applications may be necessary**
  - Apply aqua-NH_3 before planting.
    - Apply 25-50 lb N/ac more N
      - Increased N losses due to denitrification losses (from flooding and drying early in the season)

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Welcome

University of California Rice On-line is an interdisciplinary team consisting of UC Cooperative Extension specialists, faculty and farm advisors dedicated to providing rice growers with up-to-date guidelines and information on rice production in California.

FACT SHEETS

Rice growing area (lightest green) **within California counties where rice is produced** (darkest green). **Rice variety yield trial locations are indicated** (red pins).

Information about UC Rice Variety Trials

Click or tap red pins to view variety trial data for each location

Weedy Rice Information

2020 Rice Yield Contest Winners

Armyworm Monitoring Information

Looking for Wild Rice?

8:41 AM
2/2/2021

Fact Sheets

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Agronomy Fact Sheet — Fact Sheet #1

Nutrients in Rice Grain and Straw at Harvest

Background

Knowing the amount of nutr
harvest time is important for

1. It provides an idea of
needs. Some of these n
routinely in fertilizer appli
are readily available from
water.

2. It helps us understand h
soil nutrient balances. Grai
it) are removed from the
straw may or may not be re

3. The nutrient compos
implications for how it can

Nutrient Concentration

Table 1 provides the nutri
grain and straw at harvest, th

*Table 1. Nutrient concentratio
amount of nutrient in a ton o
Fairhurst, 2000).*

Nutrient	Concentra
	%
Nitrogen	1.1
Phosphorus*	0.2
Potassium*	0.29
Calcium	0.05
Magnesium	0.15
Sulfur	0.1
Silicon	2
Zinc	0.002
Iron	0.025
Manganese	0.005
Copper	0.001
Boron	0.005

* To convert P to P_2O_5 multiply

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Agronomy Fact Sheet — Fact Sheet #9

Optimal and Critical Nutrient Concentrations in Rice Tissue

Background

Nutrient deficiencies or toxicities can b
determine visually. Knowing the
concentration in the plant can greatly

*Table 1. Optimal, critical and excessive or
initiation - PI). Data source (Dobermann and*

Element	Growth stage	Plant par
Nitrogen*	Tillering-PI	Y-leaf
	Flowering	Flag-leaf
	Maturity	Straw
Phosphorus	Tillering-PI	Y-leaf
	Flowering	Flag-leaf
	Maturity	Straw
Potassium	Tillering-PI	Y-leaf
	Flowering	Flag-leaf
	Maturity	Straw
Zinc	Tillering-PI	Y-leaf
	Tillering	Shoot
Sulfur	Tillering	Y-leaf
	Tillering	Shoot
	Flowering	Flag-leaf
	Flowering	Shoot
	Maturity	Straw
Silica	Tillering	Y-leaf
	Maturity	Straw
Magnesium	Tillering-PI	Y-leaf
	Tillering-PI	Shoot
	Maturity	Straw
Calcium	Tillering	Y-leaf
	Tillering-PI	Shoot
	Maturity	Straw
Iron	Tillering	Y-leaf
	Tillering	Shoot
Manganese	Tillering	Y-leaf
	Tillering	Shoot
Copper	Tillering	Y-leaf
	Maturity	Straw
Boron	Tillering	Y-leaf
	Maturity	Straw
Aluminum	Tillering	Shoot

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Agronomy Fact Sheet — Fact Sheet #2

Managing Potassium in Rice Fields

Why Is It Important?

Potassium (K) is an essential nutrient for rice. It is important to have good K fertility not only for optimizing yields, but also K helps reduce the severity of some common plant diseases that we see (e.g. aggregate sheath spot and stem rot).

Deficiency Symptoms

K deficiency symptoms include (1) yellow/brown leaf margins, (2) dark brown spots on leaf surface, and (3) leaf bronzing (Figure 1).

Figure 1. Potassium deficiency symptoms. Yellow leaf margins and bronzing (top); brown spots (bottom). Source: top - IRRI (Rice Knowledge Bank), bottom - AgFax.

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Agronomy Fact Sheet — Fact Sheet #7

Managing Phosphorus in California Rice Fields

Why is it Important?

Phosphorus (P) is the second most commonly applied fertilizer to rice (nitrogen is the first). Plants use P for membrane integrity, energy storage and phloem transport. Phosphorus deficiencies are not common in California as many farmers apply P fertilizer (on average, 40-45 lb P_2O_5/ac). However, in a recent study, we found 10% of fields tested to be deficient. With farmers achieving higher yields, deficiencies may become more common unless P fertilizer rates are increased.

Deficiency Symptoms & Critical Levels

Deficiency symptoms often diminish with time but include: Stunted dark green plants, narrow leaves, reduced tillering, and delayed flowering.

Figure 1. Phosphorus deficiency symptoms showing narrow dark green leaves.

The Olsen-P soil test (sodium-bicarbonate) is the best test for identifying P-deficient rice soils in California. The Bray test does not work as well. An Olsen P value above 6-9 ppm is indicative of a soil that is not P deficient.

For plant tissue, if the Y-leaf P concentration at 35

Soil Phosphorus Budgets

A P budget accounting for all of the P fertilizer added and removed in grain or straw over the past five years also provides a good indicator of soil P status. If more P has been removed from the soil than has been applied, it is likely the soil P status is low (Table 1). Importantly, at harvest, about 70% of the P in the plant is in the grain; therefore, P removal in grain is the major pathway that P is removed from the system. Very little P is lost via leaching or in the tailwater drain. Given that these losses are low, it is possible to build up P in the soil.

The Four Rs of P Fertilizer Management

Right rate: First ask, should you apply? If your soil test levels are high (>15 ppm Olsen P), you probably do not need to apply any P fertilizer. If soil P levels are between 6 and 15 ppm Olsen P, apply the maintenance application rate. If Olsen P levels are below 6 ppm consider build-up application rates (rates higher than maintenance). To calculate the maintenance application rate you can go to "rice.ucanr.edu/P_Budget_calculator/". However, Table 1 provides general guidelines that will give you a rough estimate based on your expected yields and straw management.

Right time: Phosphorus fertilizer can be applied anytime from before flooding to about 30 DAS for optimal yield response. Applying P before planting can lead to algae (scum) build up in the water and lead to poor stand establishment (Fig

Thank you

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