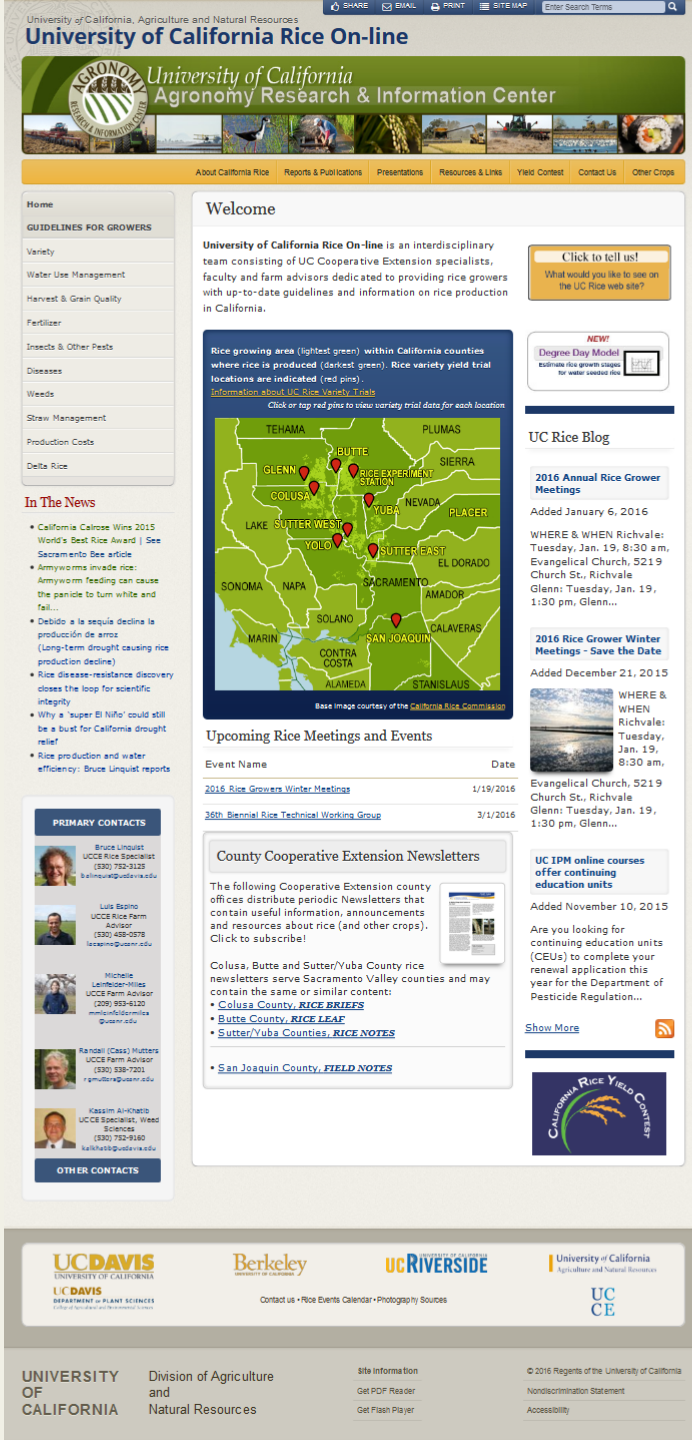
Nutrient management in California rice systems

Bruce Linquist

January 19 and 20, 2016

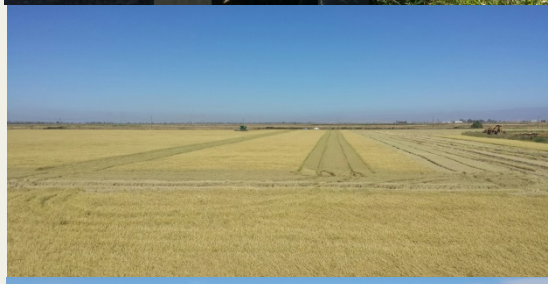


Outline

- Rice Yield Contest and winners
- Website
- Salinity
- Topdress N

Yield Contest

- 2015 Pilot study – Butte County
- 5 field entries
- Yields ranged from 108 to 127 cwt/ac
  - Minimum of 3 ac from a 10 ac plot
  - 14% moisture plus dockage
- 2-3 hours (without recheck)



2015 Rice Yield Contest winners

- Joe Richter (Richter Ag, Inc)
  - 126.9 cwt/ac
  - M205

- Rodney Jenkins
  - 113.0 cwt/ac
  - M206

2015 Rice Yield Contest: what did we learn?

- The varieties available have very good yield potential
- Yield and quality
  - Head/total
    - 1st 66/73 (M205)
    - 2nd 65/69 (M206)
- High yields were achieved with solid management practices
  - Total N applied across fields ranged from 162-180
- Learned enough to try again

Rice Yield Contest

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In The News

- California Calrose Wins 2015 World's Best Rice Award | See Sacramento Bee article
- Armyworms invade rice: Armyworm feeding can cause the panicle to turn white and fail...
- Debido a la sequía declina la producción de arroz (Long-term drought causing rice production decline)
- Rice disease-resistance discovery closes the loop for scientific integrity
- Why a 'super El Niño' could still be a bust for California drought relief

UCCE Rice Yield Contest

Purpose

The purpose of the California Rice Yield Contest is to provide an opportunity for rice producers and UC scientists to share information about intensive rice production in California and to recognize individuals who have achieved the highest yields in the state. Please read the rules carefully.

Organization

The California Rice Yield Contest is run and operated by the University of California Cooperative Extension. If you have any questions please call Bruce Linquist (530 752-3125), Randal Mutters (530 538-7201) or Luis Espino (530 458-0578). Entry form, Rules and Harvest forms can all be viewed and downloaded here.

Rice Yield Contest 2015

- Rice Yield Contest Rules 2015
- Yield Contest Entry form 2015
- Yield Contest Harvest form 2015

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Production

Welcome

University of California Rice On-line is an inte... team consisting of UC Cooperative Exte... specialists, faculty and farm advisors dedicate... ing rice growers with up-to-date guidelines an... ion on rice production in California.

Click to tell us!
What would you like to see on the UC Rice web site?

Rice ... (lightest green) within California counties ... produced (darkest green). Rice variety yield trial ... are indicated (red pins).
...formation about UC Rice Variety Trials
Click or tap red pins to view variety trial data for each location

Base image courtesy of the California Rice Commission

NEW!
Degree Day Model
estimate rice growth stages for water seeded rice

In The News

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- Why a 'super El Niño' could still be a bust for California drought relief
- Rice production and water efficiency: Bruce Linquist reports

UC Rice Blog

2016 Annual Rice Grower Meetings
Added January 6, 2016
WHERE & WHEN Richvale: Tuesday, Jan. 19, 8:30 am, Evangelical Church, 5219 Church St., Richvale Glenn: Tuesday, Jan. 19, 1:30 pm, Glenn...

2016 Rice Grower Winter Meetings - Save the Date
Added December 21, 2015

WHERE & WHEN Richvale: Tuesday, Jan. 19, 8:30 am, Evangelical Church, 5219 Church St., Richvale Glenn: Tuesday, Jan. 19, 1:30 pm, Glenn...

UC IPM online courses offer continuing education units
Added November 10, 2015
Are you looking for continuing education units (CEUs) to complete your renewal application this year for the Department of Pesticide Regulation...

Show More

Upcoming Rice Meetings and Events

Event Name	Date
2016 Rice Growers Winter Meetings	1/19/2016
36th Biennial Rice Technical Working Group	3/1/2016

County Cooperative Extension Newsletters

The following Cooperative Extension county offices distribute periodic Newsletters that contain useful information, announcements and resources about rice (and other crops). Click to subscribe!

Colusa, Butte and Sutter/Yuba County rice newsletters serve Sacramento Valley counties and may contain the same or similar content:

- Colusa County, ***RICE BRIEFS***
- ... County, ***RICE LEAF***
- ... Counties, ***RICE NOTES***
- San Joaquin County...

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OTHER CONTACTS

UC DAVIS · Berkeley · UC RIVERSIDE · University of California Agriculture and Natural Resources

Contact us • Rice Events Calendar • Photography Sources

UC CE

UNIVERSITY OF CALIFORNIA Division of Agriculture and Natural Resources

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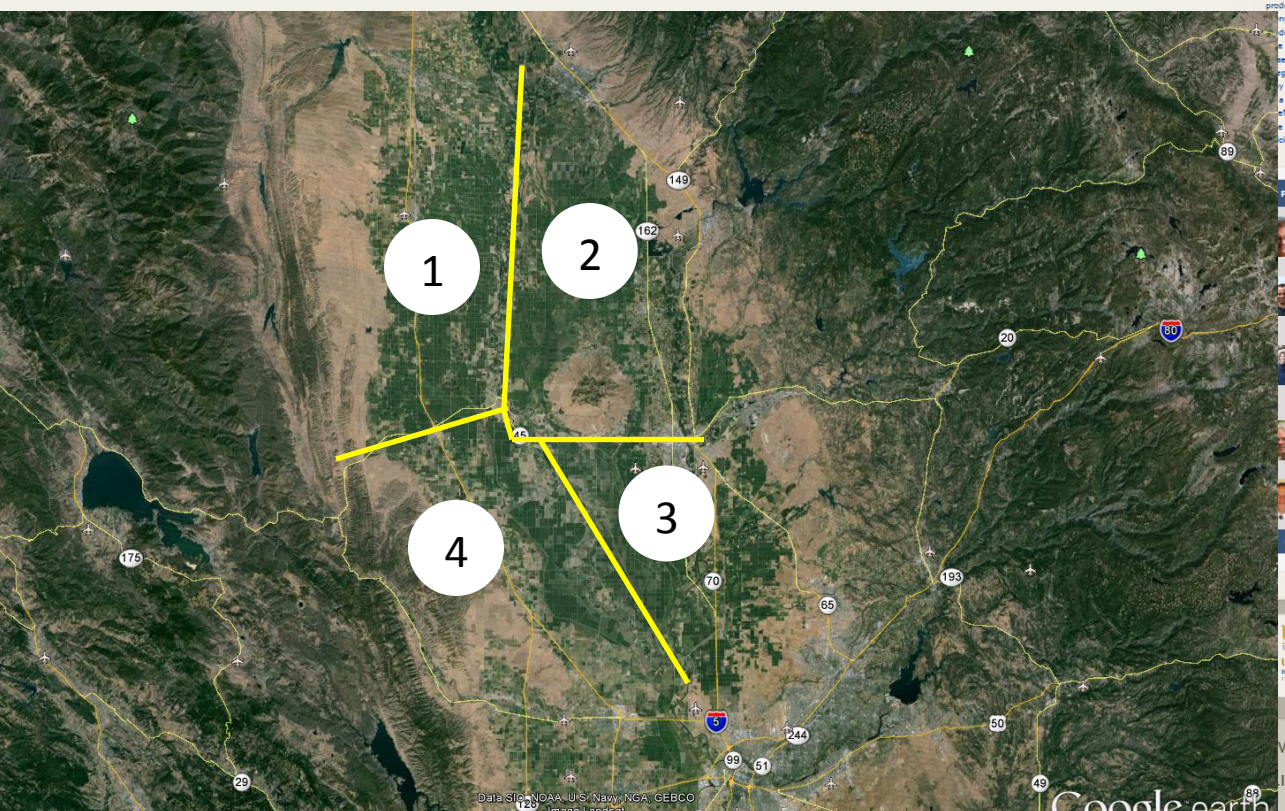
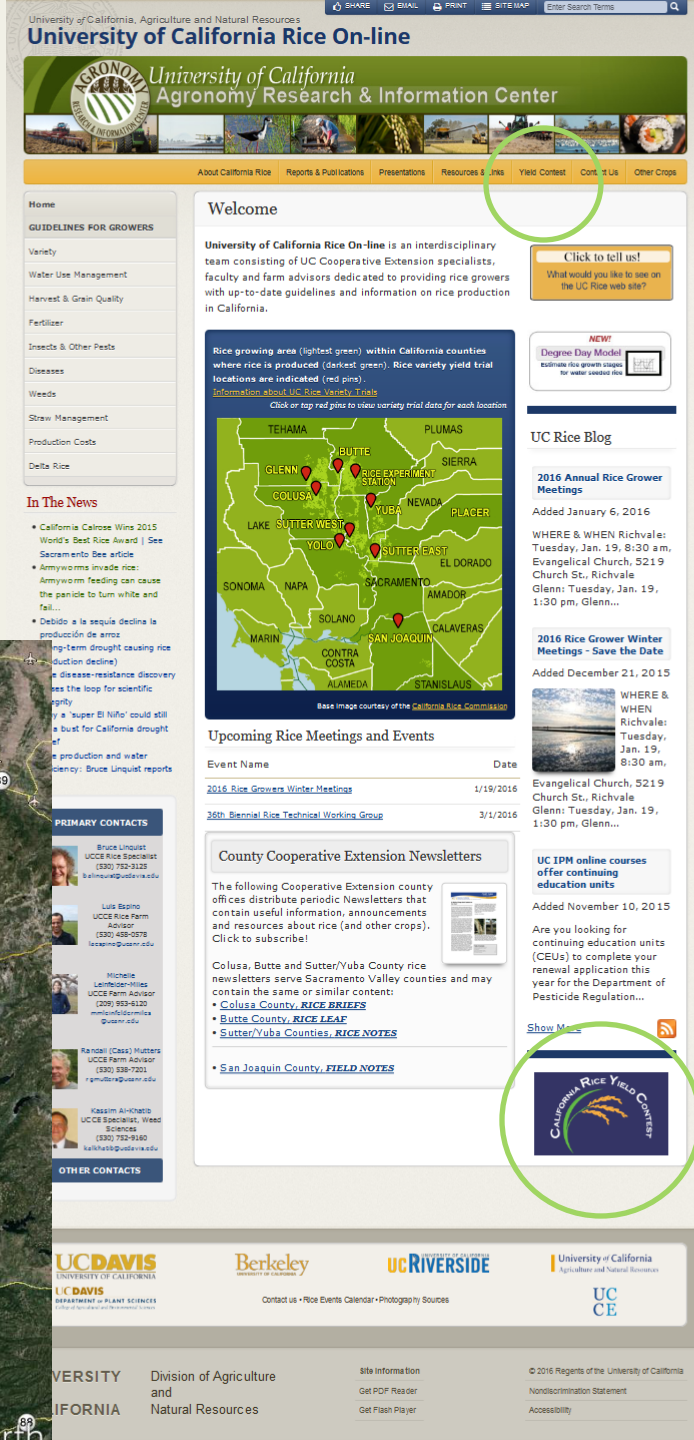
2016 Rice Yield Contest

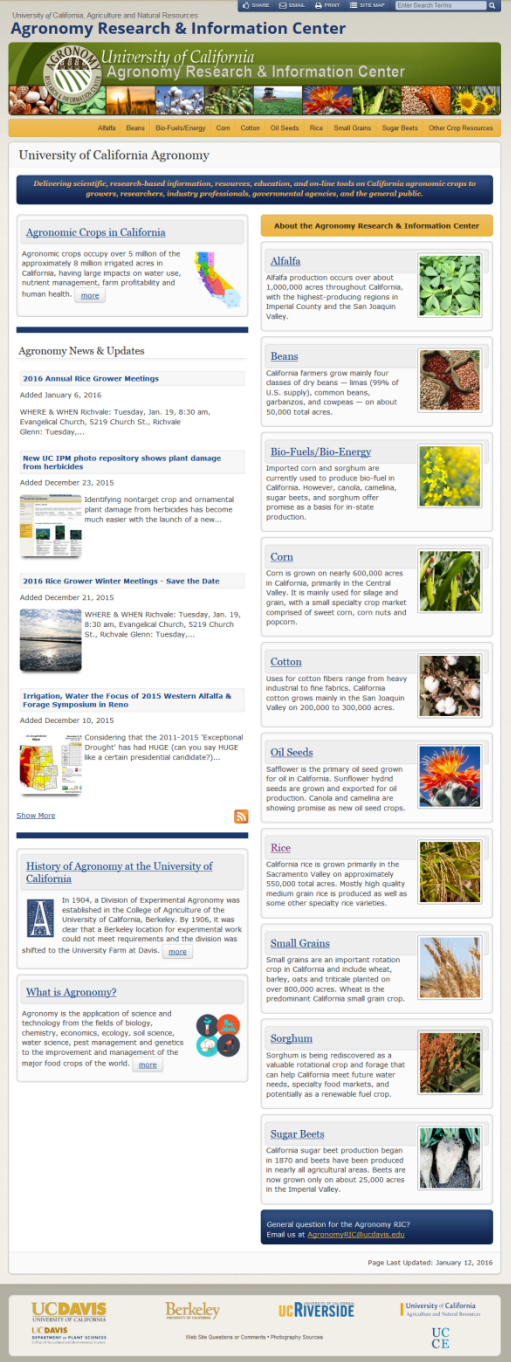
- Go to web site to find rules
  - Rules will be updated for 2016
- **Entries will be due by Aug 1**
- Open to all participants this year
- Competition will be between growers in 4 regions
  - E/W of Sacramento River
  - N/S of Hwy 20





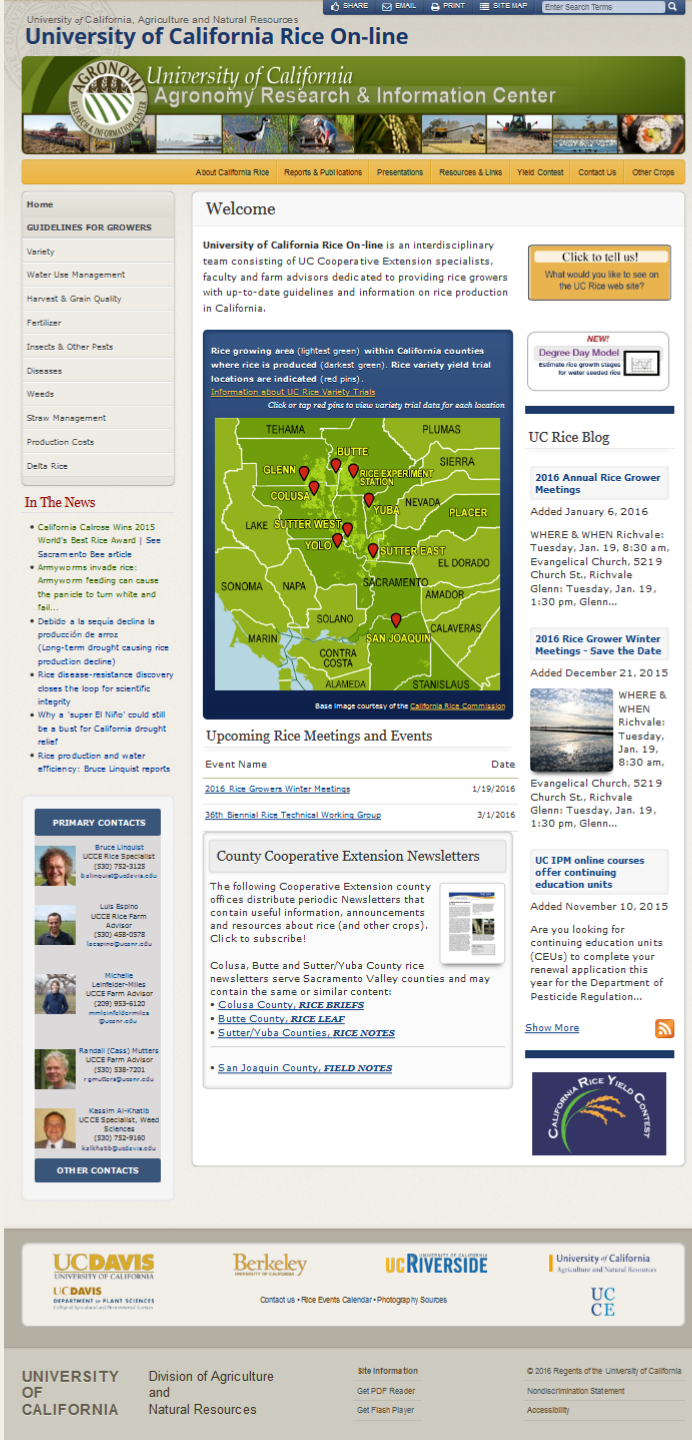
Agronomy Research and Information Center (RIC)

http://agric.ucdavis.edu/



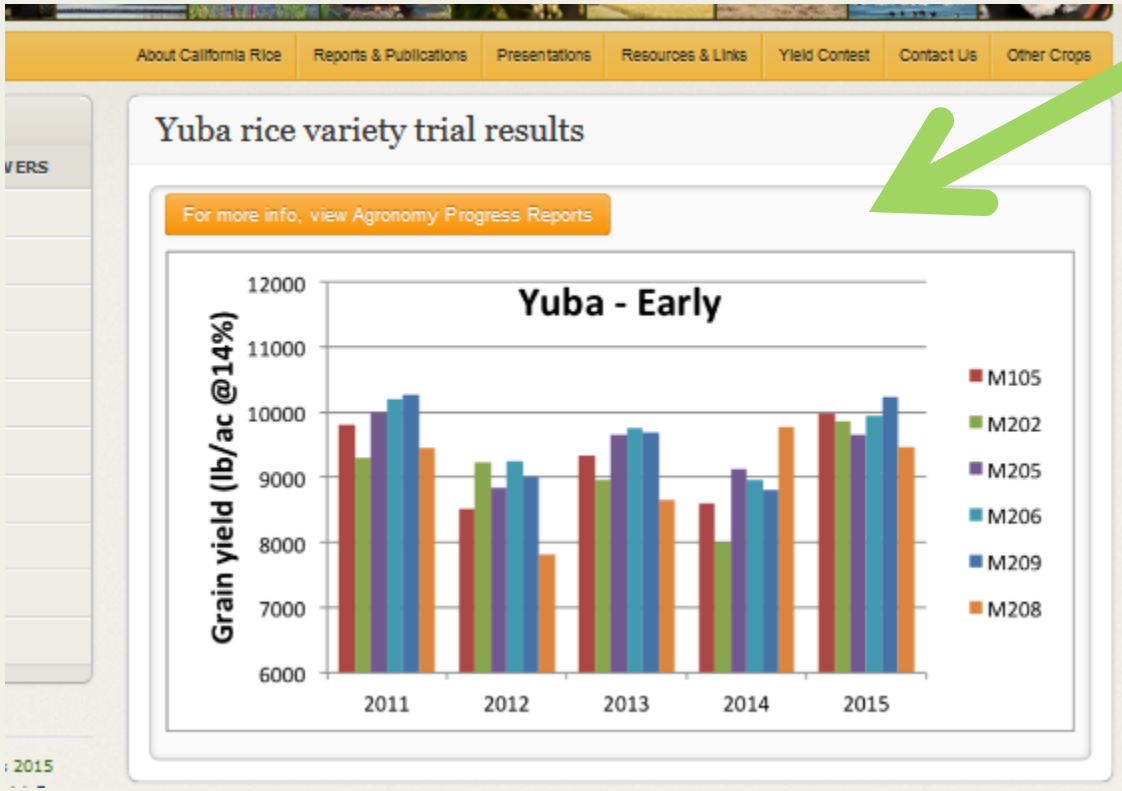
http://rice.ucanr.edu/

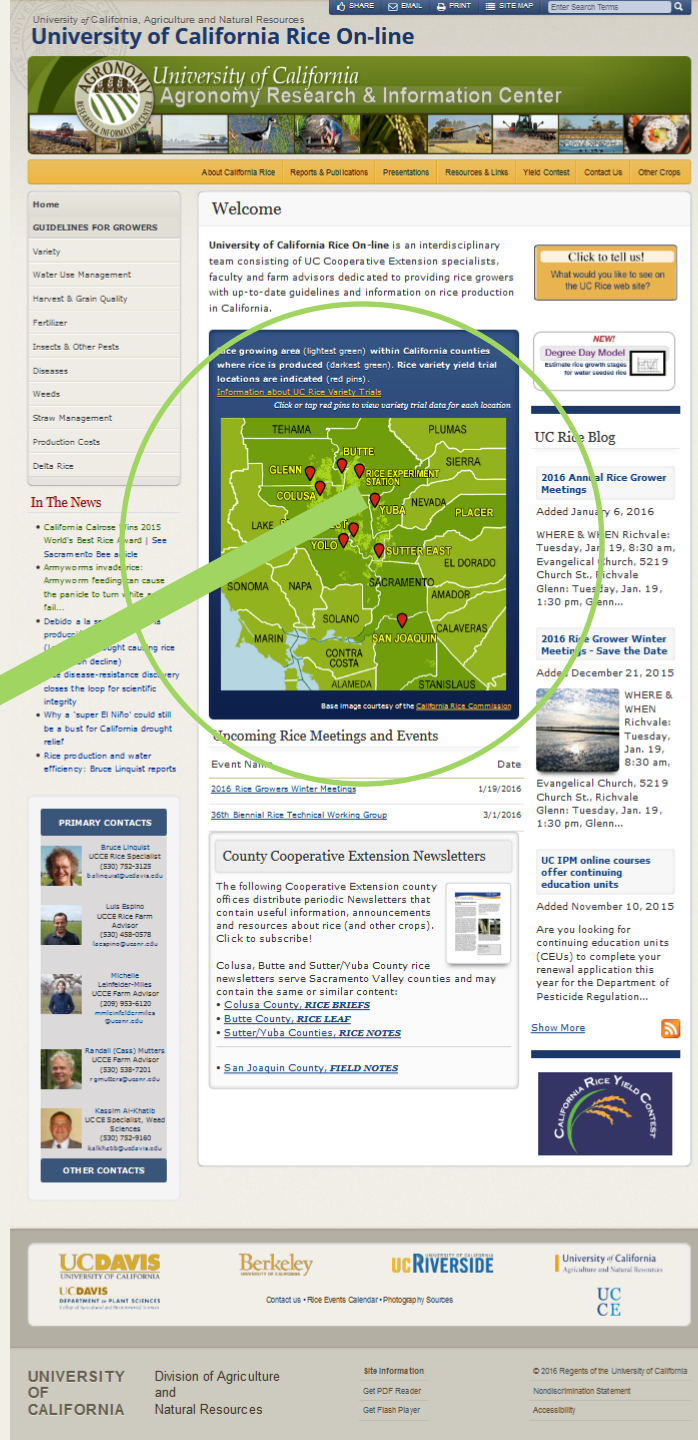
- Website overview
  - Meetings, news, newsletters, blogs, presentations, reports, contacts, yield contest
  - Place for comments
  - Guidelines,



Variety yield comparison

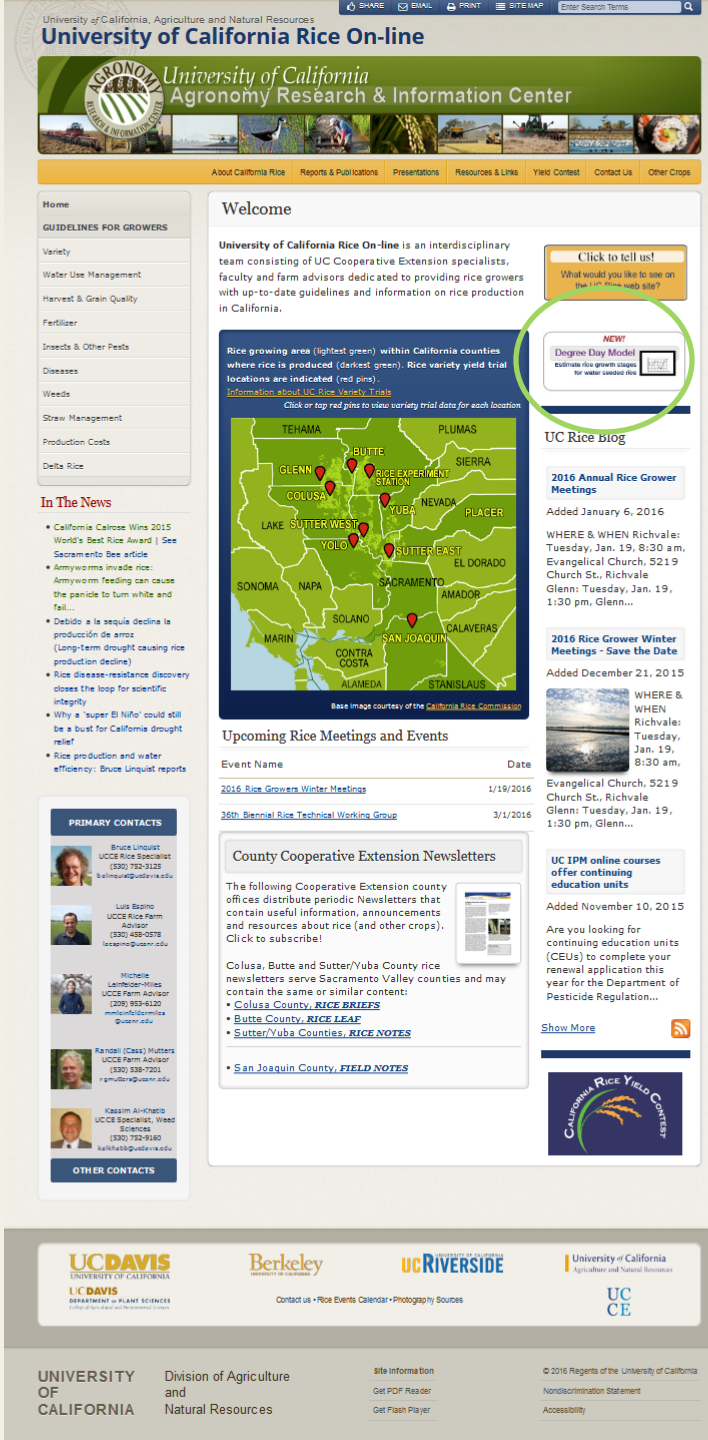
- Click on a dot to get yields of main varieties over past 5 years
  - Data from UCCE variety trials funded by RRB



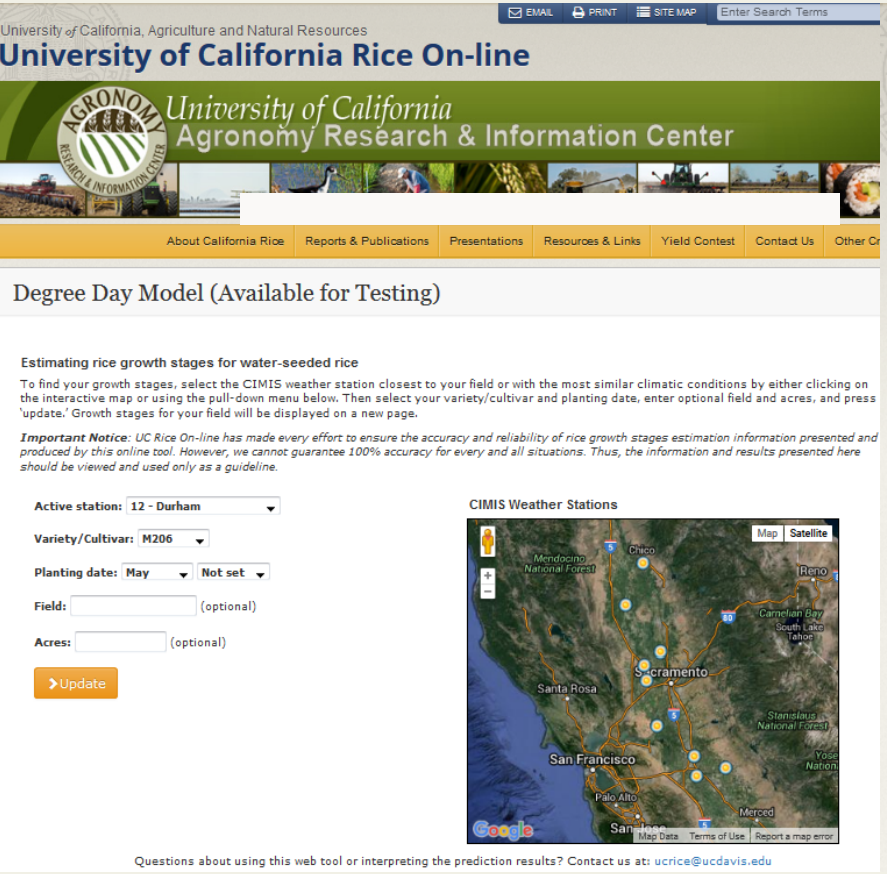


Degree day calculator

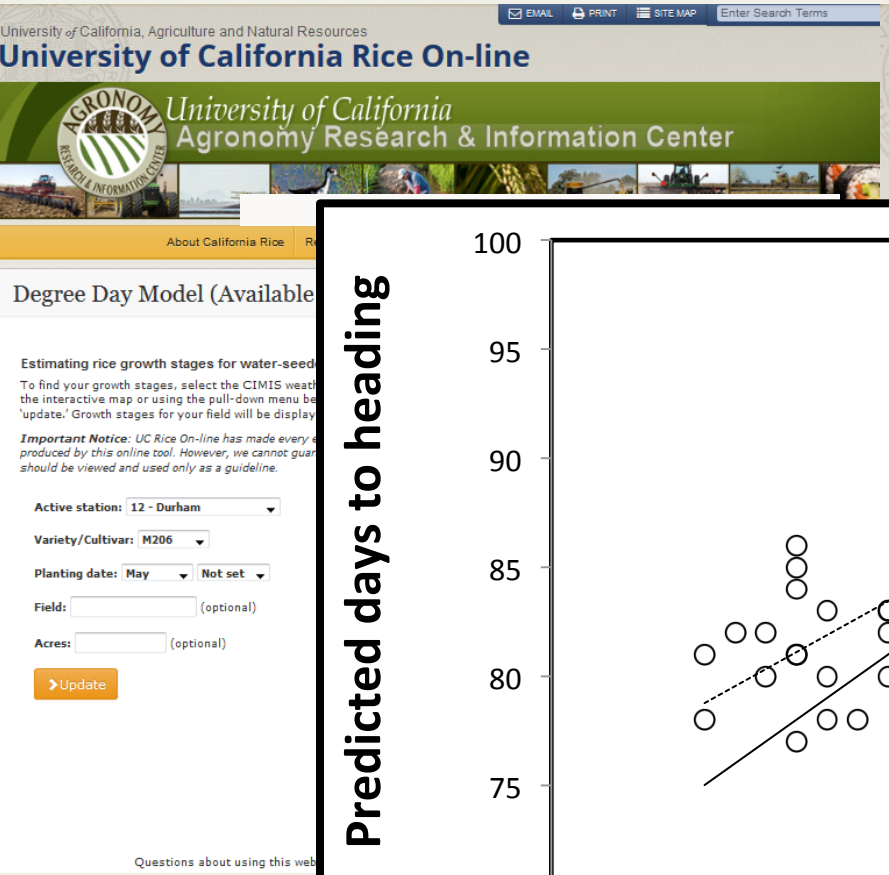
- Estimates date of
  - PI
  - Heading
  - R7 (roughly 3 weeks after heading and when draining the field should be considered.
- Estimates these times using a DD model
  - Planting to current date based on current year data
  - Forward projection based on average weather data from current date onwards
- Info required
  - A weather station
  - Variety
  - Planting date

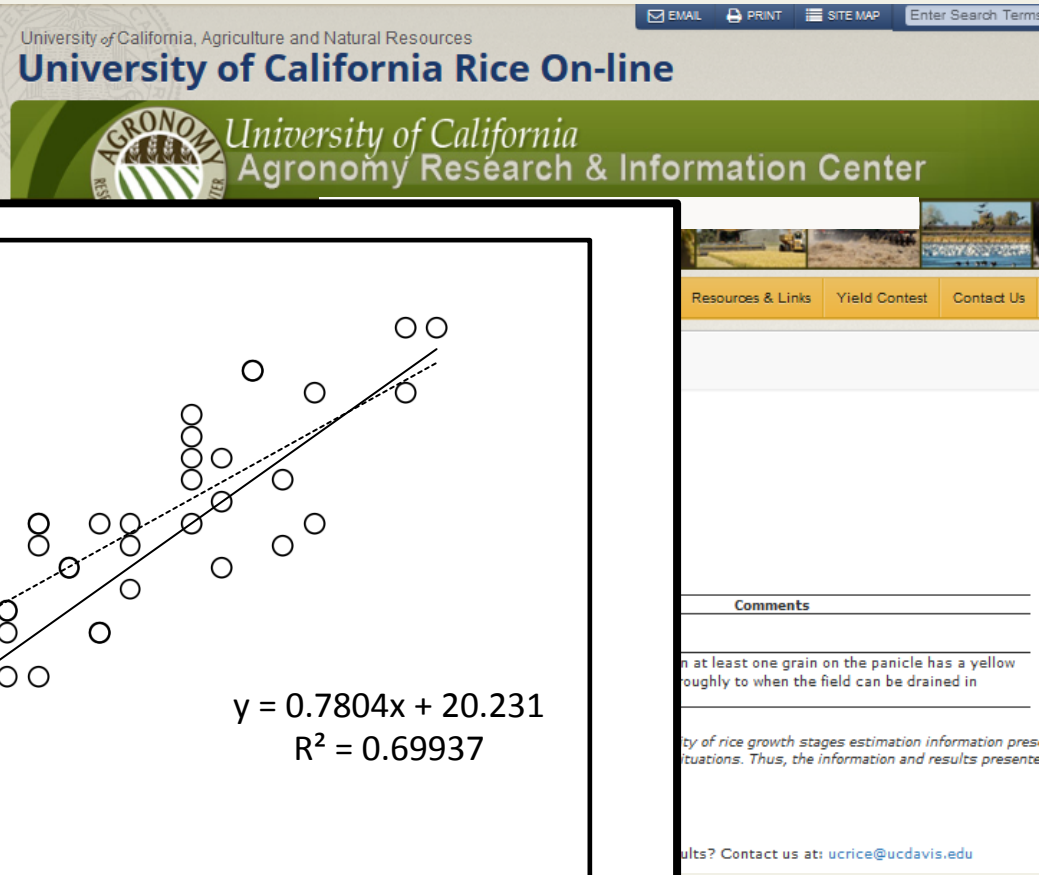


Degree Day model to predict key growth stages



Degree Day model to predict key growth stages





Phosphorus management

- Deciding the correct rate
- How to apply

Phosphorus management: rate

- Should you apply?
- Frequency of P deficiencies
  - Less than 10% of CA rice soils respond significantly to added P fertilizer.
- Determining the P status of your soil.
  - Soil test
  - Plant tissue test
  - Input-output P budget
- How much do should you apply?

Determining the P status of your soil

- Soil test
  - Olsen P test (sodium-bicarbonate)
    - above 6-9 ppm
  - Bray test not good for CA rice soils
- Plant tissue test
  - Y-leaf tissue test.
    - 35 DAS
    - 0.2% P
- Input-output P budget

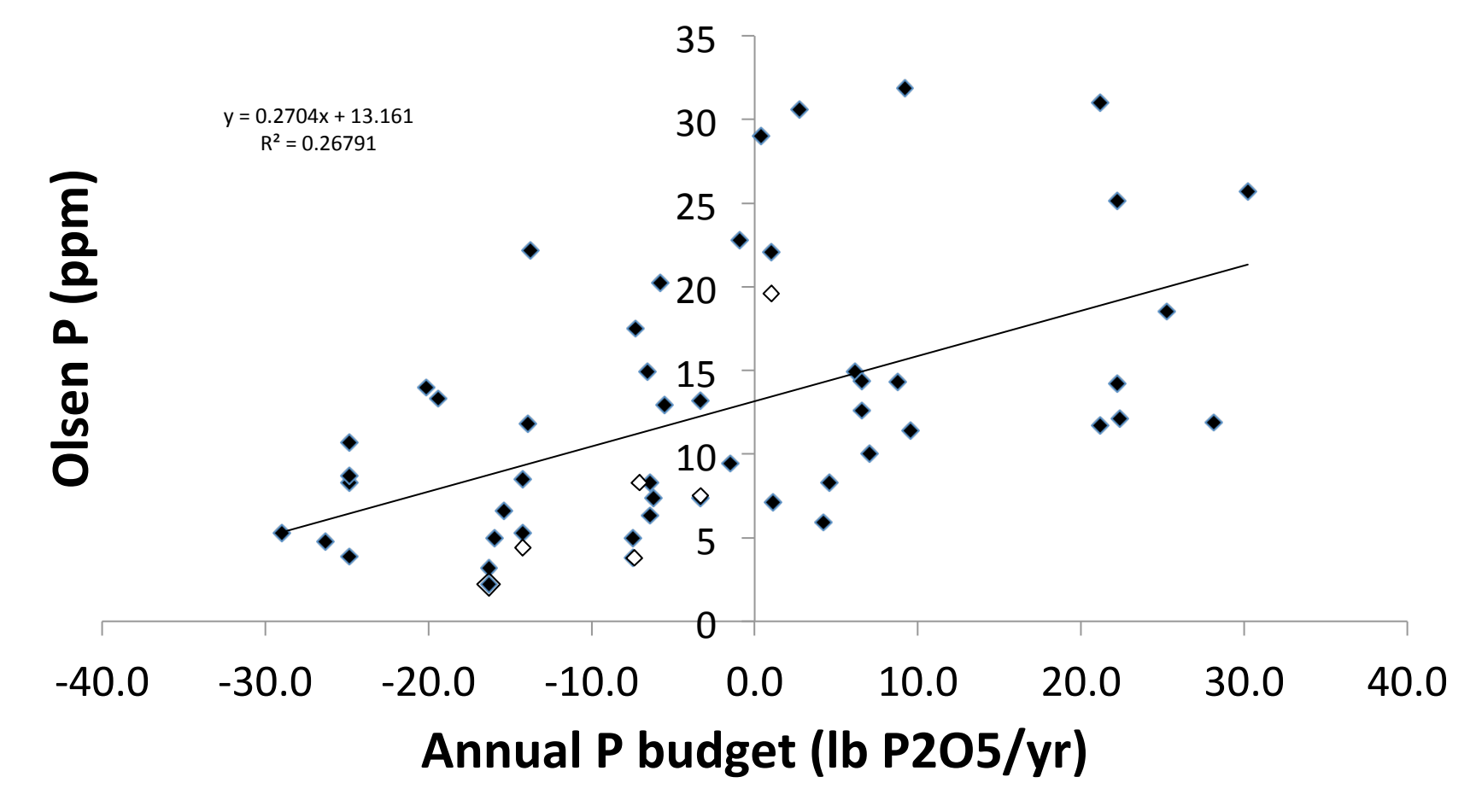
Input-output P budget: Think of soil as a phosphorus bank

- When managed correctly, P is relatively immobile in soils.
  - No gas losses
  - Little is lost through water
  - Little lost by leaching
- Inputs
  - Fertilizer
- Outputs
  - Grain removal (0.23% P / 0.52% P_2O_5)
  - Straw removal (0.08% P / 0.18% P_2O_5)

Input-output P budget

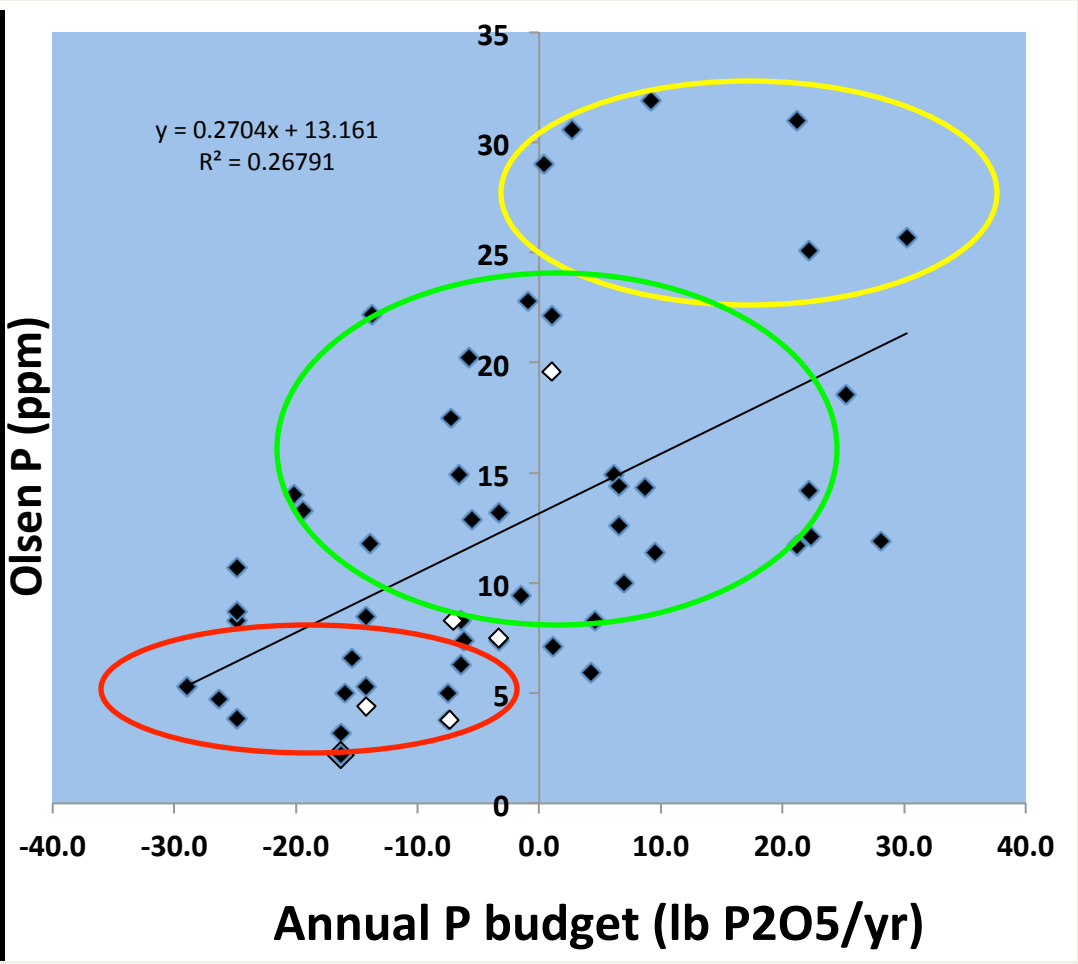
- Develop a budget
  - **Inputs** (lb/ac of P_2O_5 as fertilizer) – **Outputs** (lb/ac removed in grain and straw)
  - Develop such a budget over at least a 5 yr period – take average

P budget effects on soil P and yield response



Should you apply?

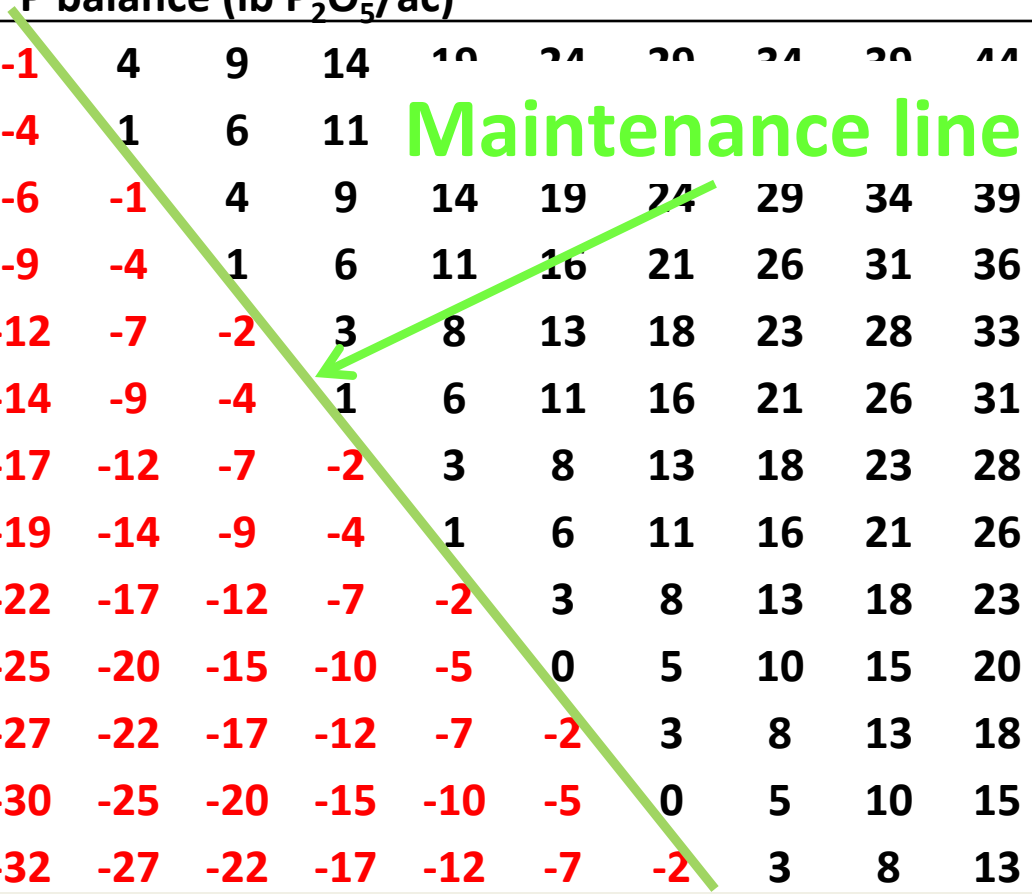
- Soils have very high P levels based on soil test (i.e. above 20 ppm) and positive P budget
  - Apply no P
- Soils have very low P (less than 6) and a negative P budget
  - Build up soil P
- In most cases where P is not limiting use a maintenance strategy
  - Apply what is removed by the crop
  - **How much is removed?**



Amount of P removed:

Only grain removed

Grain yield (cwt@14%)	P fertilizer added (lb P_2O_5/ac)														
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
	P balance (lb P_2O_5/ac)														
50	-26	-21	-16	-11	-6	-1	4	9	14	19	24	29	34	39	44
55	-29	-24	-19	-14	-9	-4	1	6	11	16	21	26	31	36	41
60	-31	-26	-21	-16	-11	-6	-1	4	9	14	19	24	29	34	39
65	-34	-29	-24	-19	-14	-9	-4	1	6	11	16	21	26	31	36
70	-37	-32	-27	-22	-17	-12	-7	-2	3	8	13	18	23	28	33
75	-39	-34	-29	-24	-19	-14	-9	-4	1	6	11	16	21	26	31
80	-42	-37	-32	-27	-22	-17	-12	-7	-2	3	8	13	18	23	28
85	-44	-39	-34	-29	-24	-19	-14	-9	-4	1	6	11	16	21	26
90	-47	-42	-37	-32	-27	-22	-17	-12	-7	-2	3	8	13	18	23
95	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15	20
100	-52	-47	-42	-37	-32	-27	-22	-17	-12	-7	-2	3	8	13	18
105	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5	0	5	10	15
110	-57	-52	-47	-42	-37	-32	-27	-22	-17	-12	-7	-2	3	8	13



How much to apply:

Remove grain and ½ of straw

Grain yield (cwt@14%)	P fertilizer added (lb P_2O_5/ac)														
	0	5	10	15	20	25	30	35	40	45	50	55	60	65	70
	P balance (lb P_2O_5/ac)														
50	-31	-26	-21	-16	-11	-6	-1	4	9	14	19	24	29	34	39
55	-34	-29	-24	-19	-14	-9	-4	1	6						
60	-37	-32	-27	-22	-17	-12	-7	-2	3						
65	-40	-35	-30	-25	-20	-15	-10	-5		5	10	15	20	25	30
70	-43	-38	-33	-28	-23	-18	-13	-8	-3	2		12	17	22	27
75	-46	-41	-36	-31	-26	-21	-16	-11	-6		4	9	14	19	24
80	-49	-44	-39	-34	-29	-24	-19	-14	-9	-4	1	6	11	16	21
85	-52	-47	-42	-37	-32	-27	-22	-17	-12	-7	-2	3	8	13	18
90	-55	-50	-45	-40	-35	-30	-25	-20	-15	-10	-5		5	10	15
95	-58	-53	-48	-43	-38	-33	-28	-23	-18	-13	-8	-3	2	7	12
100	-61	-56	-51	-46	-41	-36	-31	-26	-21	-16	-11	-6		4	9
105	-64	-59	-54	-49	-44	-39	-34	-29	-24	-19	-14	-9	-4	1	6
110	-67	-62	-57	-52	-47	-42	-37	-32	-27	-22	-17	-12	-7	-2	3

Maintenance line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(Fertility & Crop Nutrition section)
Fertilizer Research & Education Program
General Water-Seeded Rice Fertilizer Guidelines
FREP
Phosphorus Fertilizer Budget &
Application calculator
New!


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Phosphorus Fertilizer Budget and Application online calculator
Introduction
To determine if a P application is necessary we estimate a field P balance and use a soil P test (Olsen P) if available.
P balance: The P balance is calculated as the difference between what you apply and what is removed by the crop. Most P is removed in the grain but if you remove straw then you are also removing some P. Below we ask you to estimate straw removal, grain yields and fertilizer P additions. We suggest taking the average of the past 5 years.
Using this P balance we assume that the only P added to the field comes from fertilizer and that the only P removed is that which is removed when harvesting the crop (i.e. the P in the grain and the straw-if straw is removed). Burning straw does not remove significant amounts of P from the field. Also little P is added or removed in irrigation water. Finally P is not readily leached in these high clay soils.
Soil test: For the soil P test it is important that you have the Olsen P test. Sometimes this is called the bicarbonate P test.
Important Notice: UC Rice On-line has made every effort to ensure the accuracy and reliability of phosphorus fertilizer application information presented and produced by this online tool. However, we cannot guarantee 100% accuracy for every and all situations. Thus, the information and results presented here should be viewed and used only as a guideline.
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How much P should I apply?
When should I apply P?
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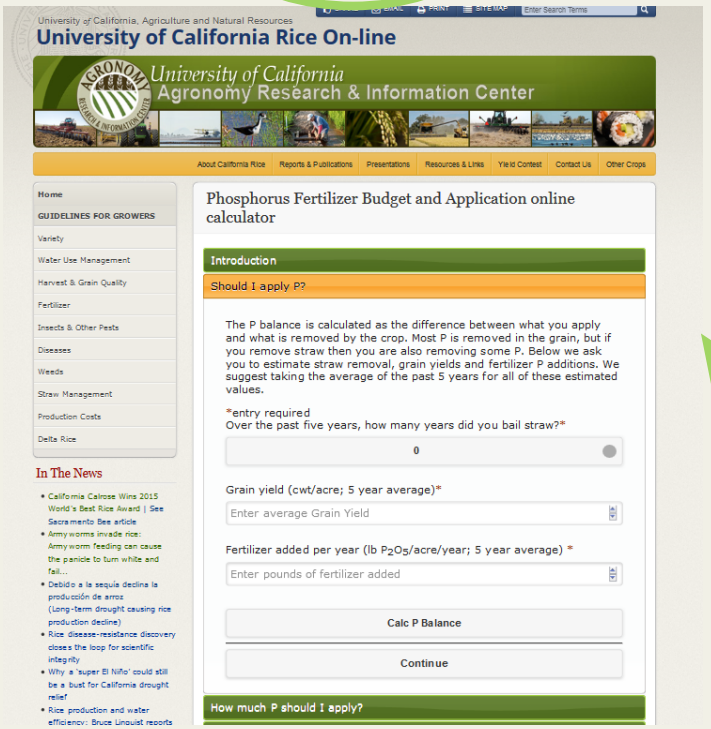
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*entry required
Over the past five years, how many years did you bail straw?*
0
Grain yield (cwt/acre; 5 year average)*
Enter average Grain Yield
Fertilizer added per year (lb P_2O_5/acre/year; 5 year average) *
Enter pounds of fertilizer added
Calc P Balance
Continue
How much P should I apply?
In The News

Phosphorus Fertilizer Budget and Application online calculator

Introduction

Should I apply P?

The P balance is calculated as the difference between what you apply and what is removed by the crop. Most P is removed in the grain, but if you remove straw then you are also removing some P. Below we ask you to estimate straw removal, grain yields and fertilizer P additions. We suggest taking the average of the past 5 years for all of these estimated values.

*entry required
Over the past five years, how many years did you bail straw?*

0

Grain yield (cwt/acre; 5 year average)*

93

Fertilizer added per year (lb P_2O_5/acre/year; 5 year average) *

40

Calc P Balance

Yield: 93 (cwt@14%)
 # Years straw was bailed: 0
P Fertilizer added: 40 (lb P_2O_5/ac/year)
P balance: -8 (lb P_2O_5/ac/year)
Because P balance is negative, P should be applied.

- If your P balance is positive and your Olsen P soil test is above 15 you probably do not need to apply P.
- You should consider adding P if your P balance is negative and/or your Olsen P is below 15 ppm.
- We recommend getting a soil test done. If you do not have a soil P test result, we recommend applying P at least at maintenance levels (see next section)

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Phosphorus Fertilizer Budget and Application online calculator

Introduction

Should I apply P?

How much P should I apply?

Please complete the fields below to estimate a maintenance phosphorus fertilizer application.

*entry required
Over a five year period, how many years did you bail straw?*

0

Grain yield (cwt/acre/year; 5 year average)*

93

How Much P fertilizer for maintenance application?

Yield: 93 (cwt@14%)
 # Years straw was bailed: 0
P Fertilizer to add: 48 (lb P_2O_5/ac/year)

This is the amount of P to add to maintain soil P levels at their current levels. If Olsen soil P levels are below 6 ppm, then consider adding more to build up soil P.

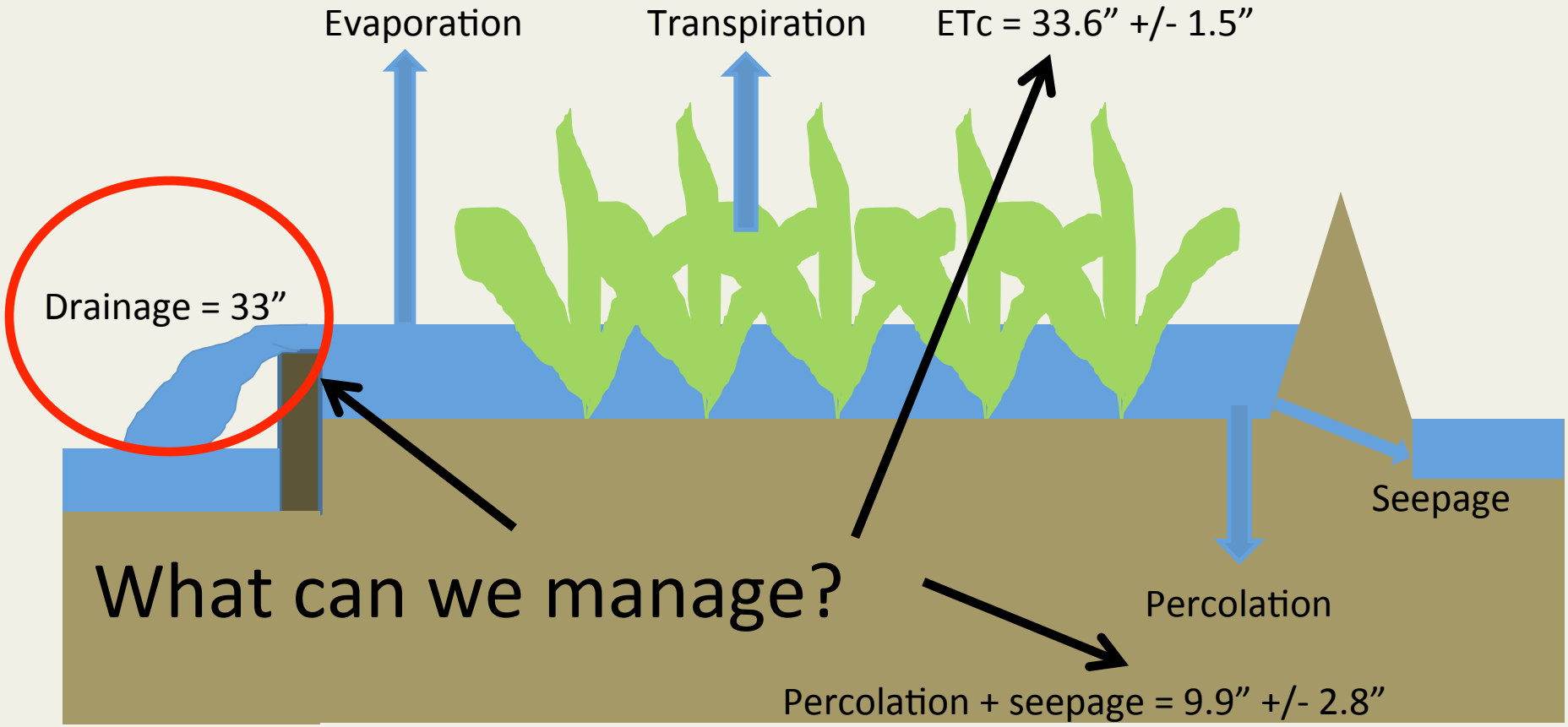
If you do not have a soil P test result and your soil P balance is positive or slightly negative (i.e. -5 lb P_2O_5/yr), then we recommend applying the maintenance P level. If the soil P balance was less than that (ie. A more negative value), then we suggest a buildup P application.

Continue

When should I apply P?

Salinity and water management

Seasonal rice field water losses



Total water input = 77”

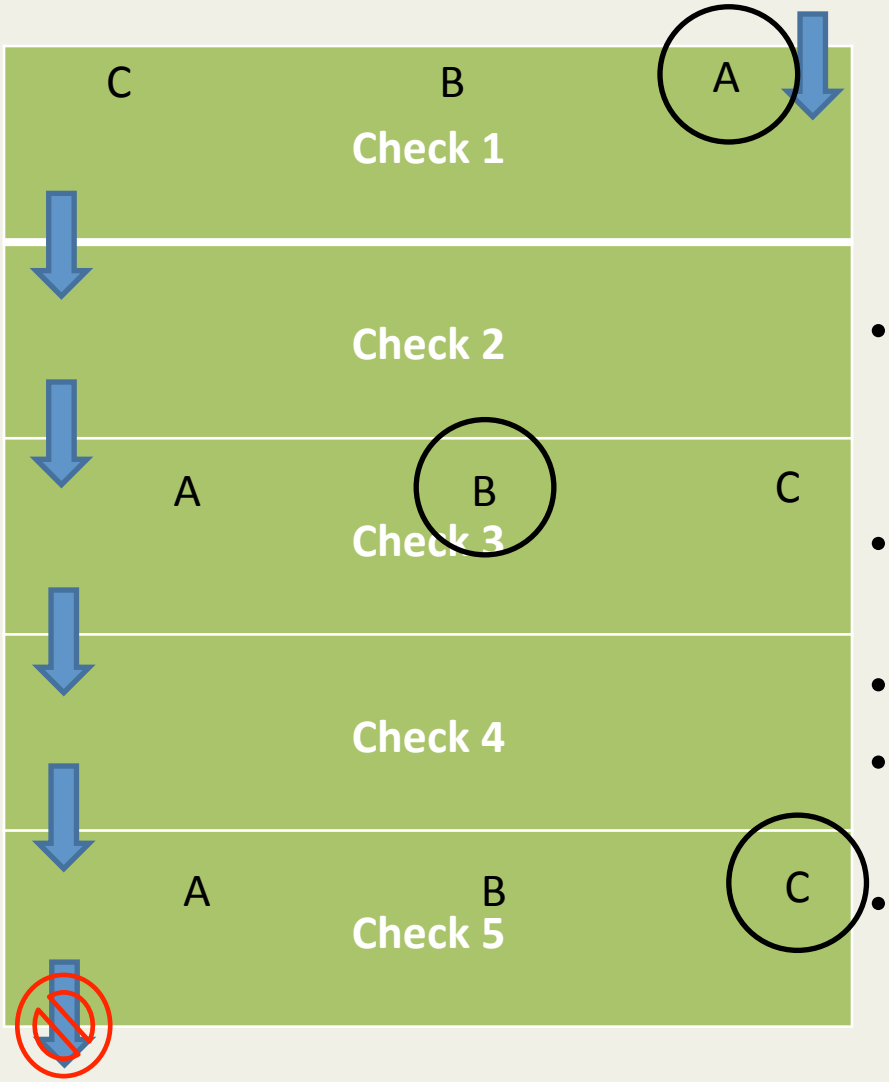
No-spill water management

- Maintenance flow management
  - **Minimize salinity**
  - Maintain water levels
- No-spill
  - Does salinity increase due to evapo-concentration?
    - If so, enough to reduce crop yield?

2014/15 salinity studies

- Evaluate flood water and soil salinity across fields and season.
  - Quantify changes in time and location in field
- Quantify the effect of soil salinity on rice yields

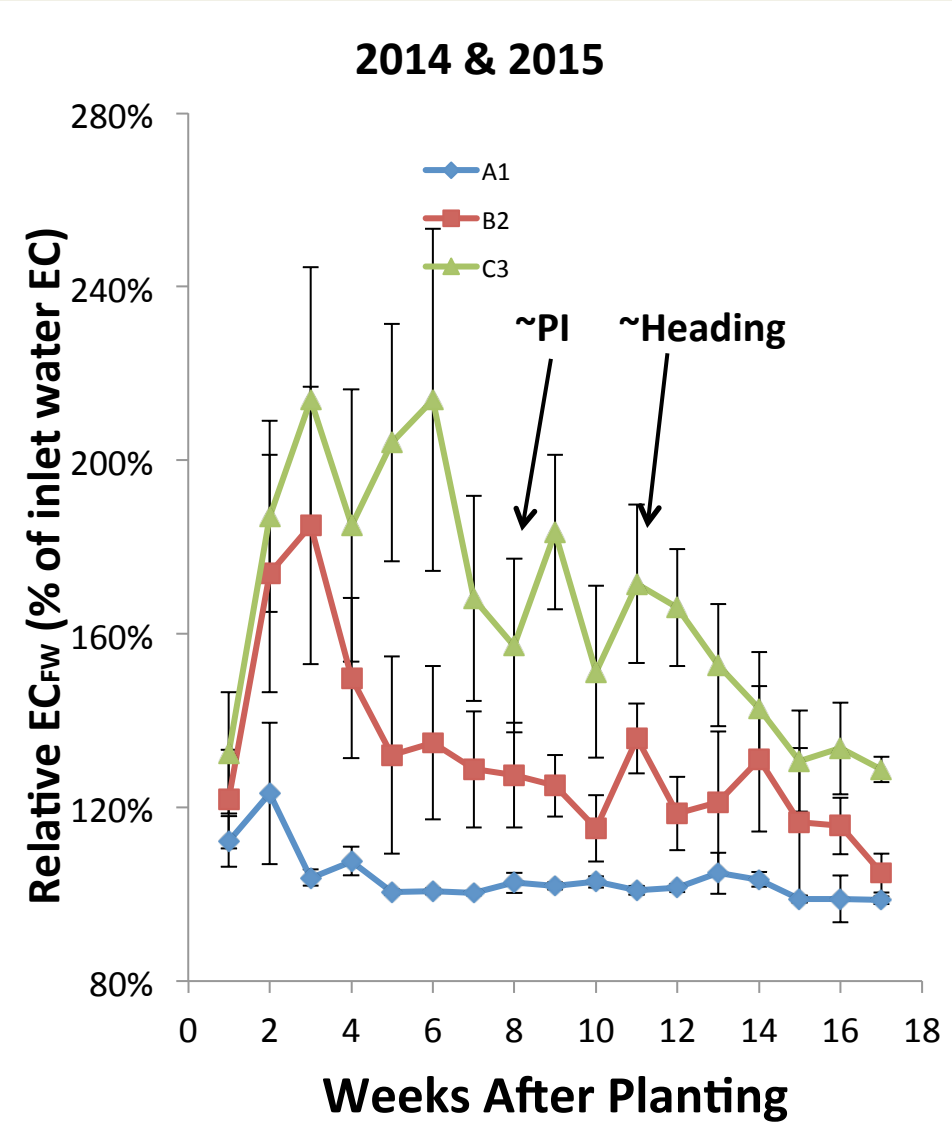
Methods: quantifying in-field salinity dynamics



- Fields
  - 6 fields in 2014
  - 5 fields in 2015
- 9 plots in each field. 3 in top, middle and bottom checks.
- 9 Fields were no-spill, 2 fields had flow.
- Weekly water salinity measurements were made in all plots in all fields.
- Soil solution was extracted from 3 points in each field: A1, B2,C3.

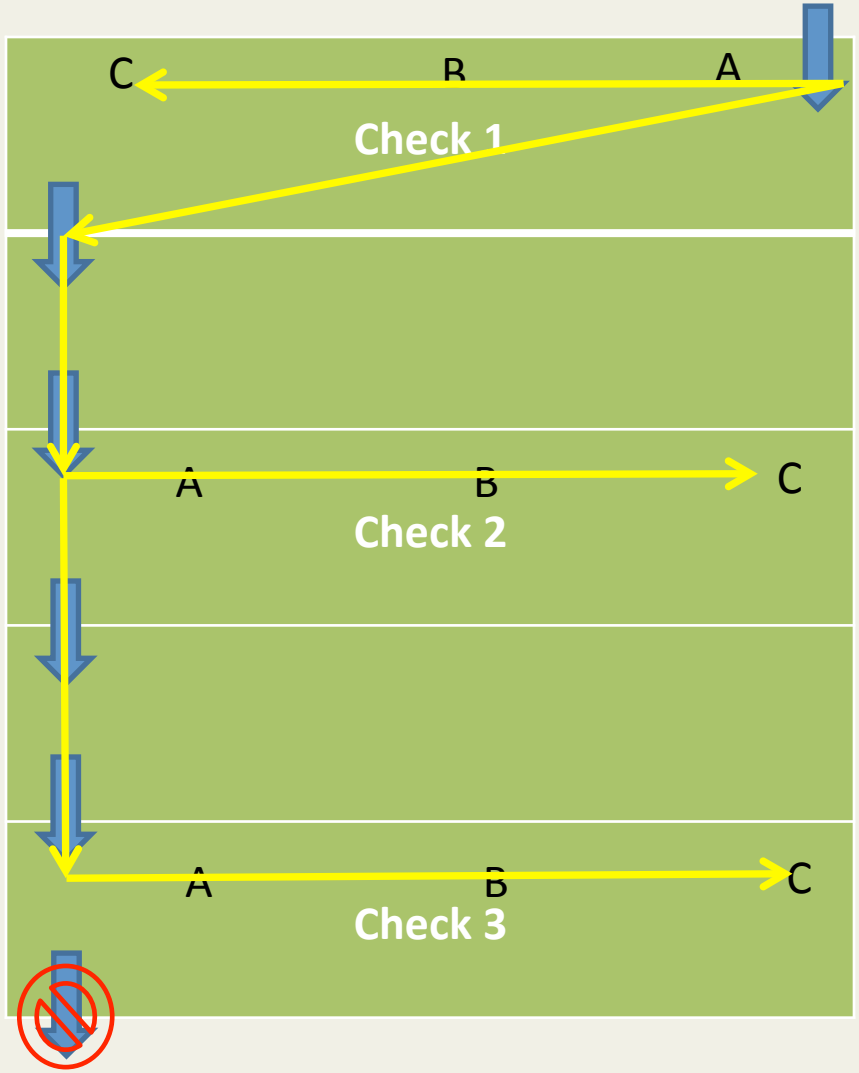
Flood water salinity through the growing season: averaged across fields and years

- Flood water salinity highest in bottom check
- Flood water salinity peaks between 2 and 6 weeks after planting
  - Water holds
  - High evaporation
- Flood water salinity declines after 6 weeks
  - Cool water/low evaporation



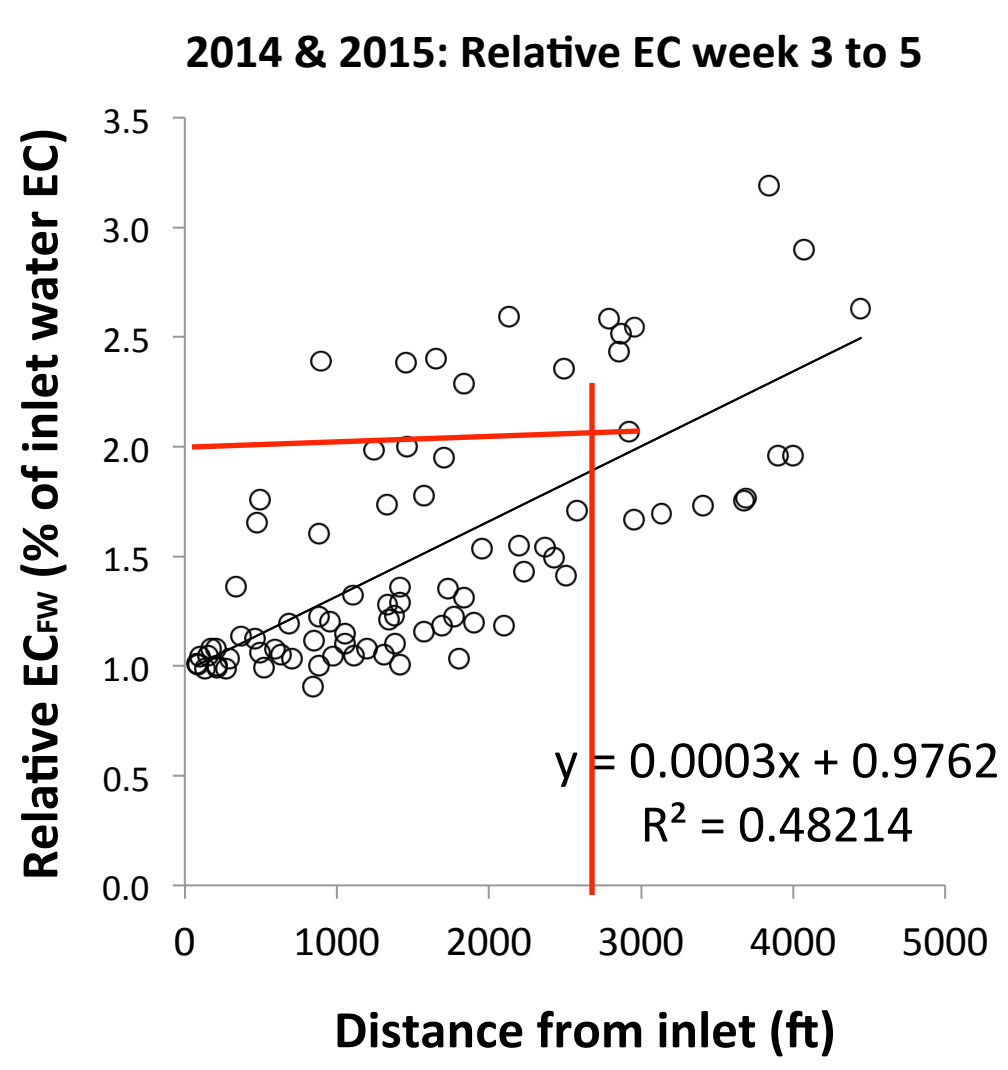
Quantifying salinity

Flood water salinity versus the distance from the inlet

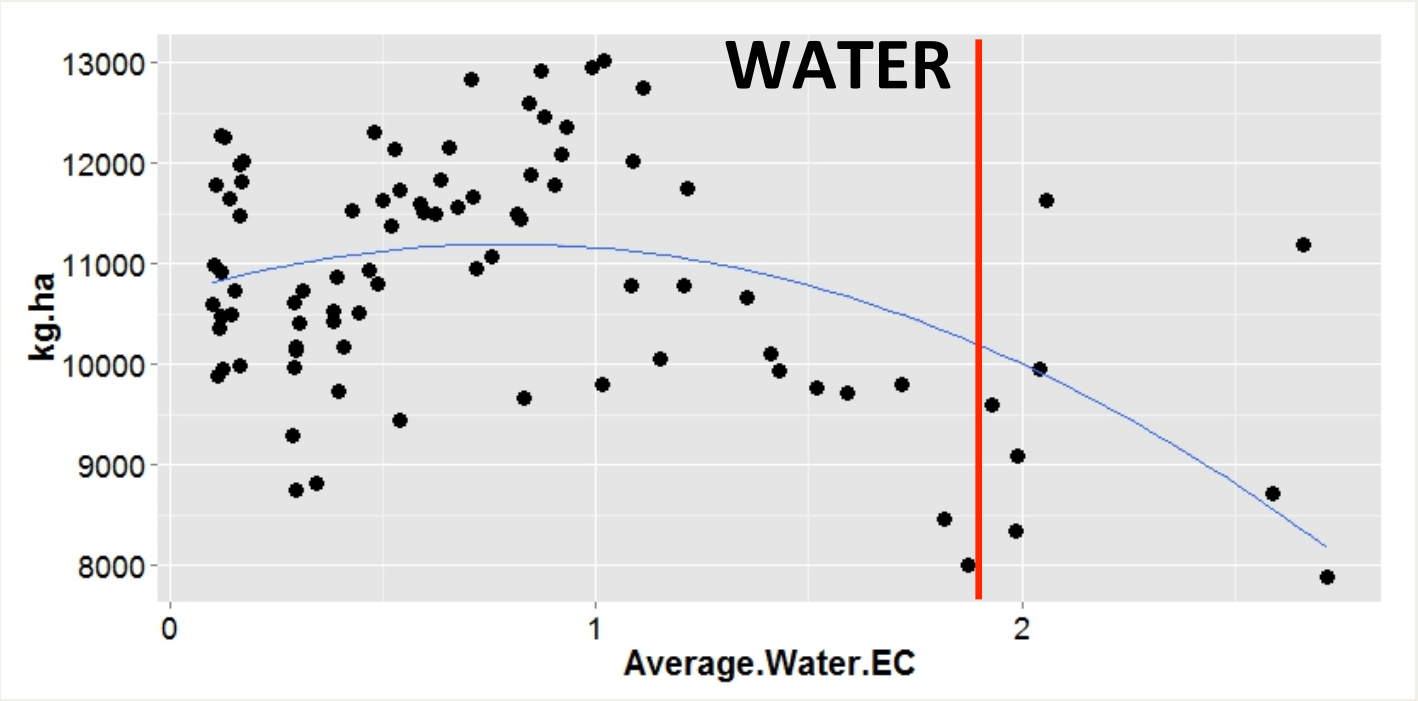


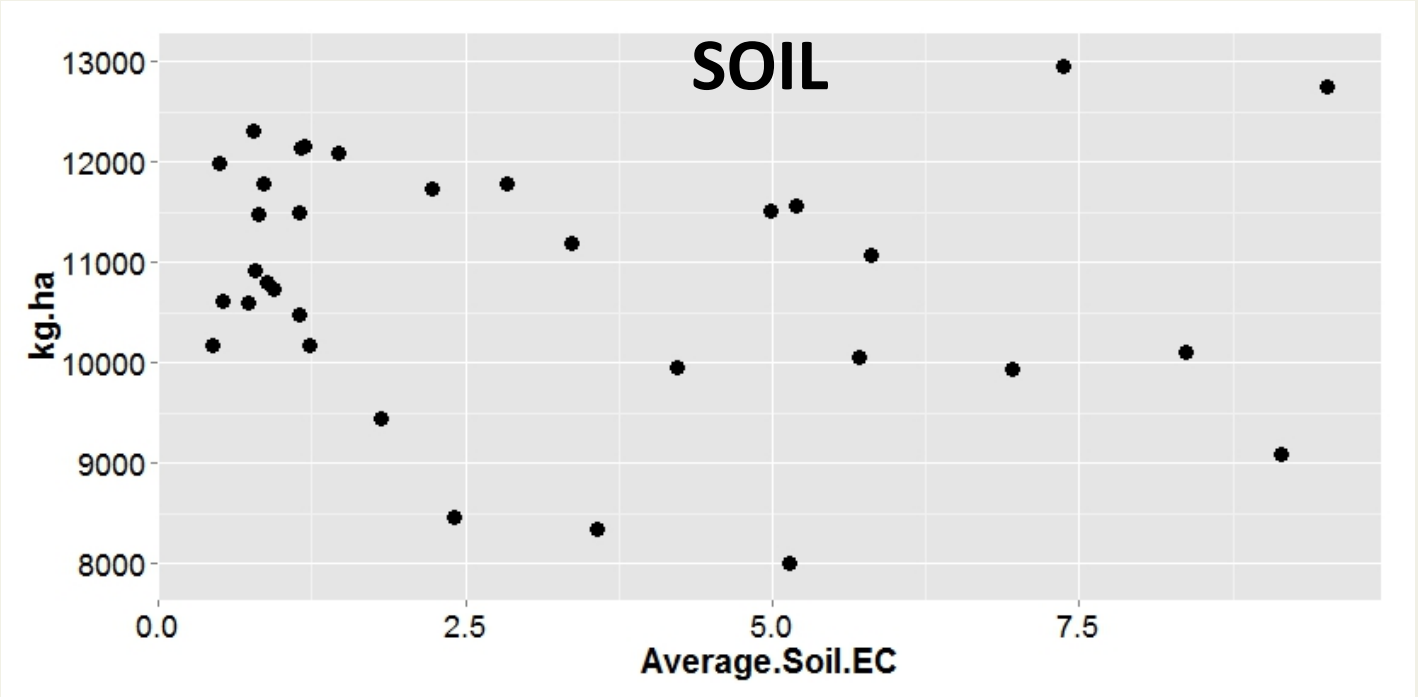
Water EC is related to distance from the inlet

- Salinity increases with distance from inlet
- Water salinity doubles with a 3000 ft run



Yield vs. water or soil salinity (dS/m2)





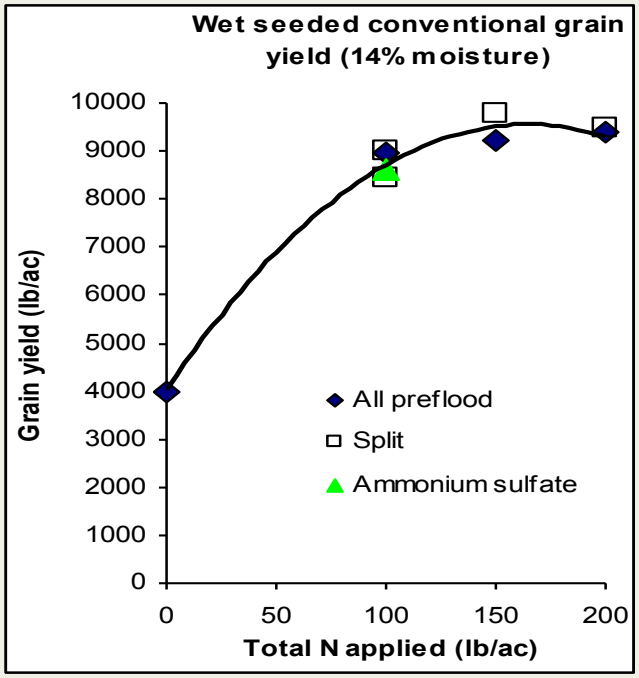
Sterility symptoms seen in high salinity treatments

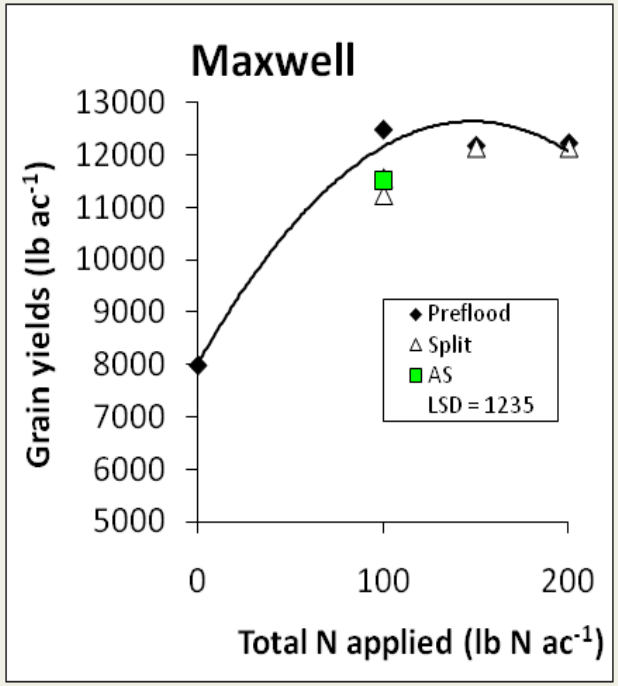
Summary

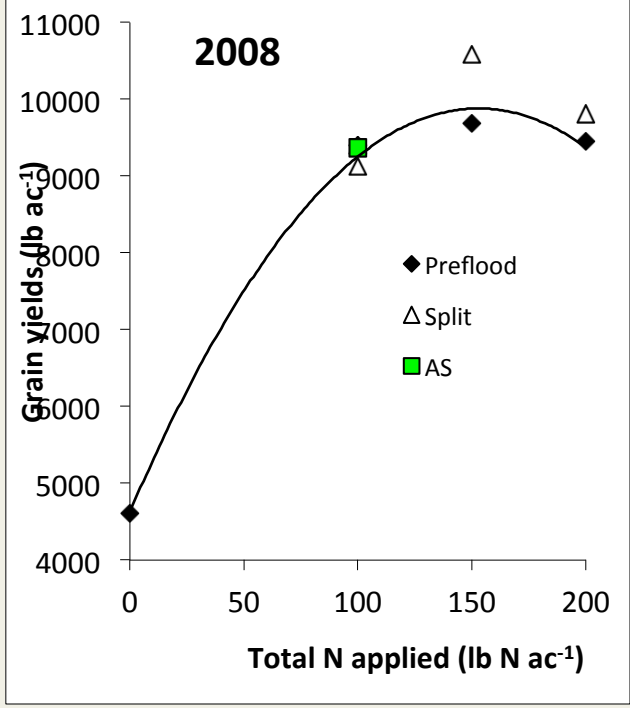
- In most fields, salinity is not a problem
  - Salinity builds up during the first month and then declines
  - Need to be mindful of the amount of salinity but also the duration of high salinity
    - Season long salinity is not a problem in most fields
  - Flood water salinity seems more important than soil salinity
    - At least once crop has established
  - Observation: If salinity is a problem, may not want to drain too early for harvest

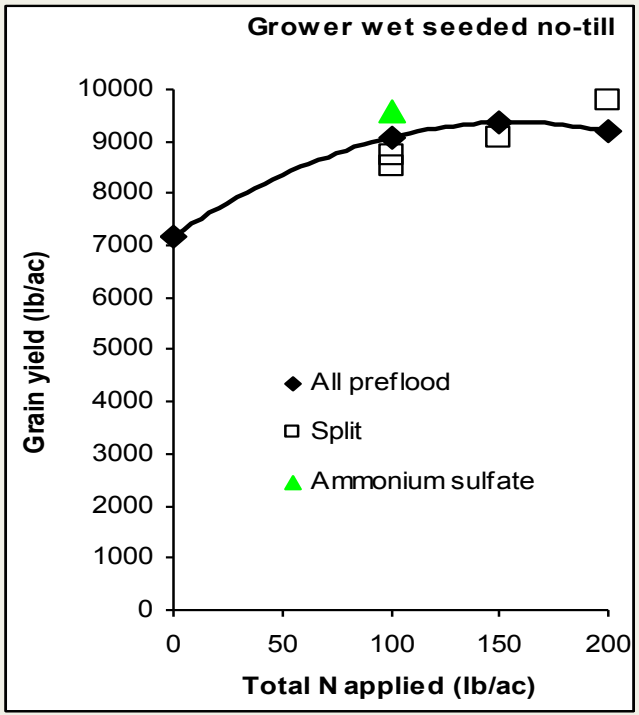
Top-dress N applications: guidelines

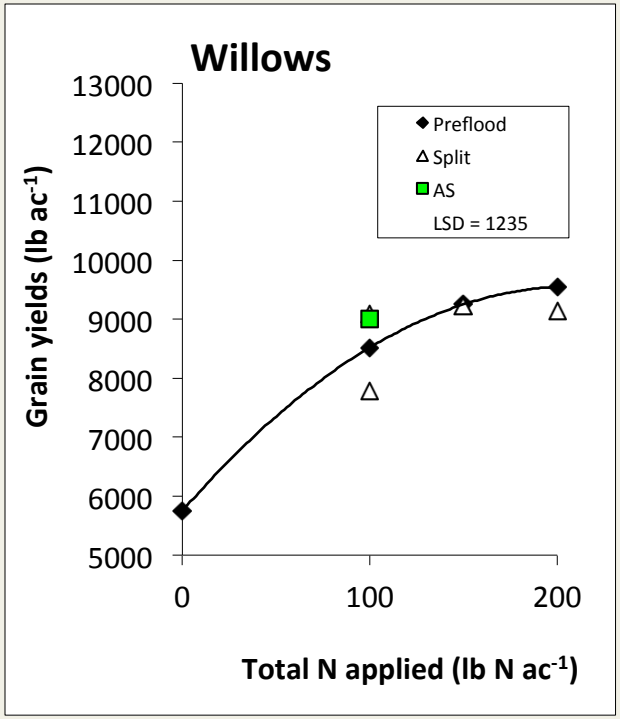
- Do not plan for a top-dress N application
- At equal amounts of N, there is no benefit of splitting the N between a preplant and top-dress.
- Apply enough preplant N (aqua and starter) for an average year
- A top-dress may be necessary
  - N losses (i.e. due to early season drain)
  - High yield potential year

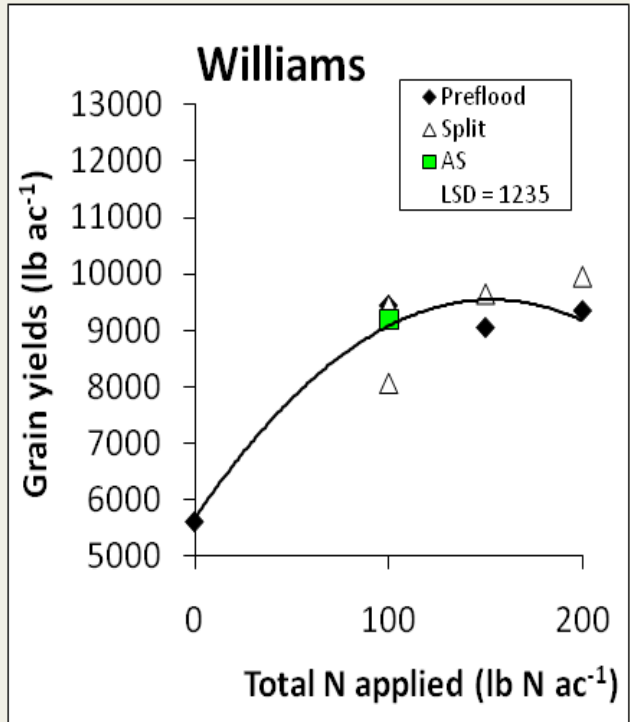

Wet seeded conventional grain yield (14% moisture)
Grain yield (lb/ac)
Total N applied (lb/ac)
All preflood
Split
Ammonium sulfate


Maxwell
Grain yields (lb ac-1)
Total N applied (lb N ac-1)
Preflood
Split
AS
LSD = 1235


2008
Grain yields (lb ac-1)
Total N applied (lb N ac-1)
Preflood
Split
AS

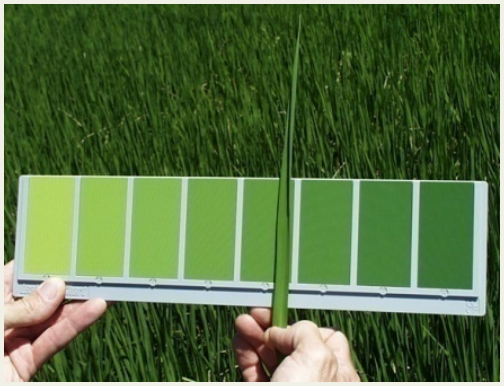

Grower wet seeded no-till
Grain yield (lb/ac)
Total N applied (lb/ac)
All preflood
Split
Ammonium sulfate


Willows
Grain yields (lb ac-1)
Total N applied (lb N ac-1)
Preflood
Split
AS
LSD = 1235


Williams
Grain yields (lb ac-1)
Total N applied (lb N ac-1)
Preflood
Split
AS
LSD = 1235

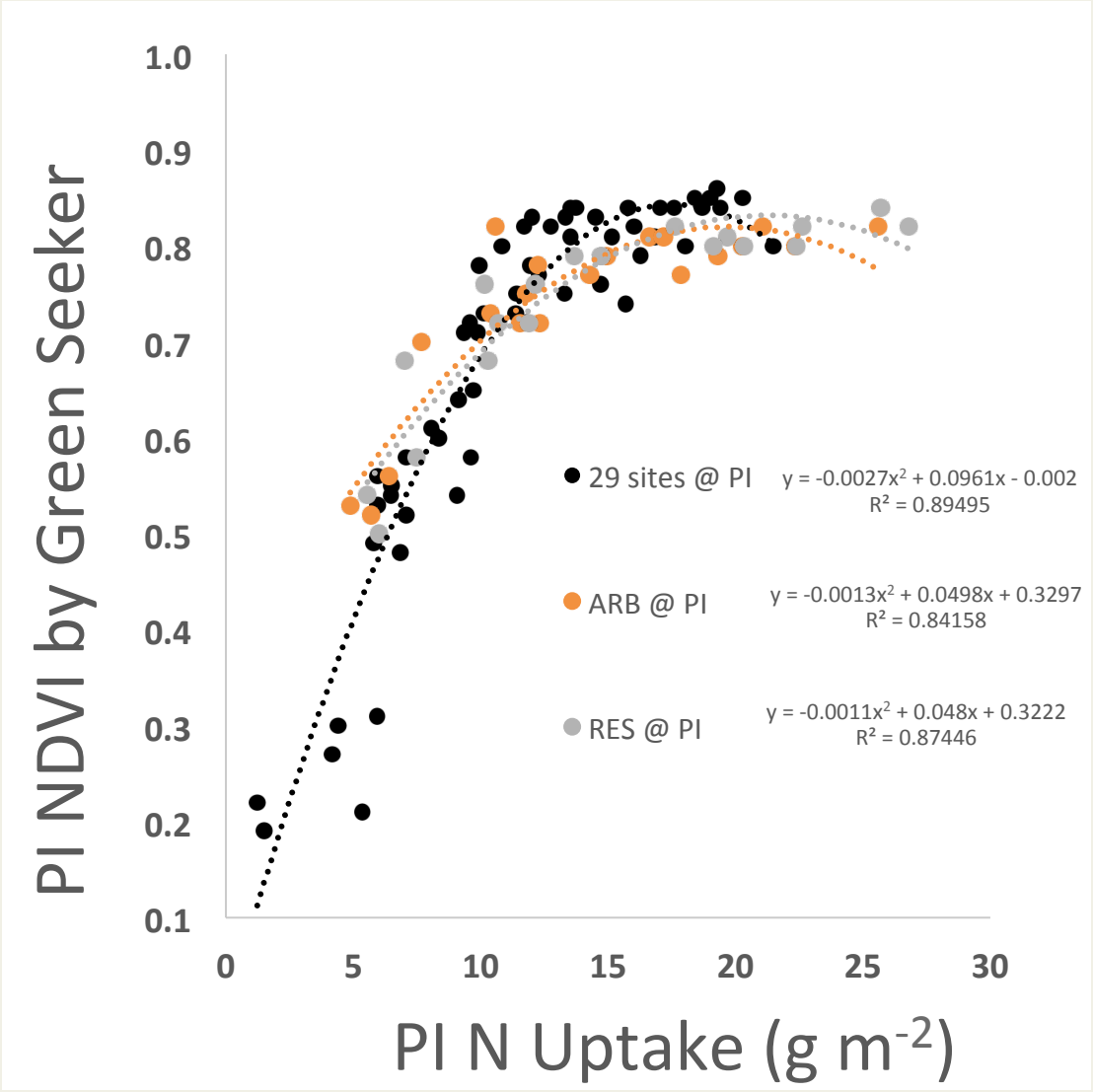
Top-dress N applications: Is it necessary?

- Leaf-color chart
- SPAD meter
- We are evaluating the potential for using aerial imagery
  - NDVI is not a great indicator of
    - N concentration
    - Biomass
  - NDVI may be promising for estimating total N (N conc X biomass)



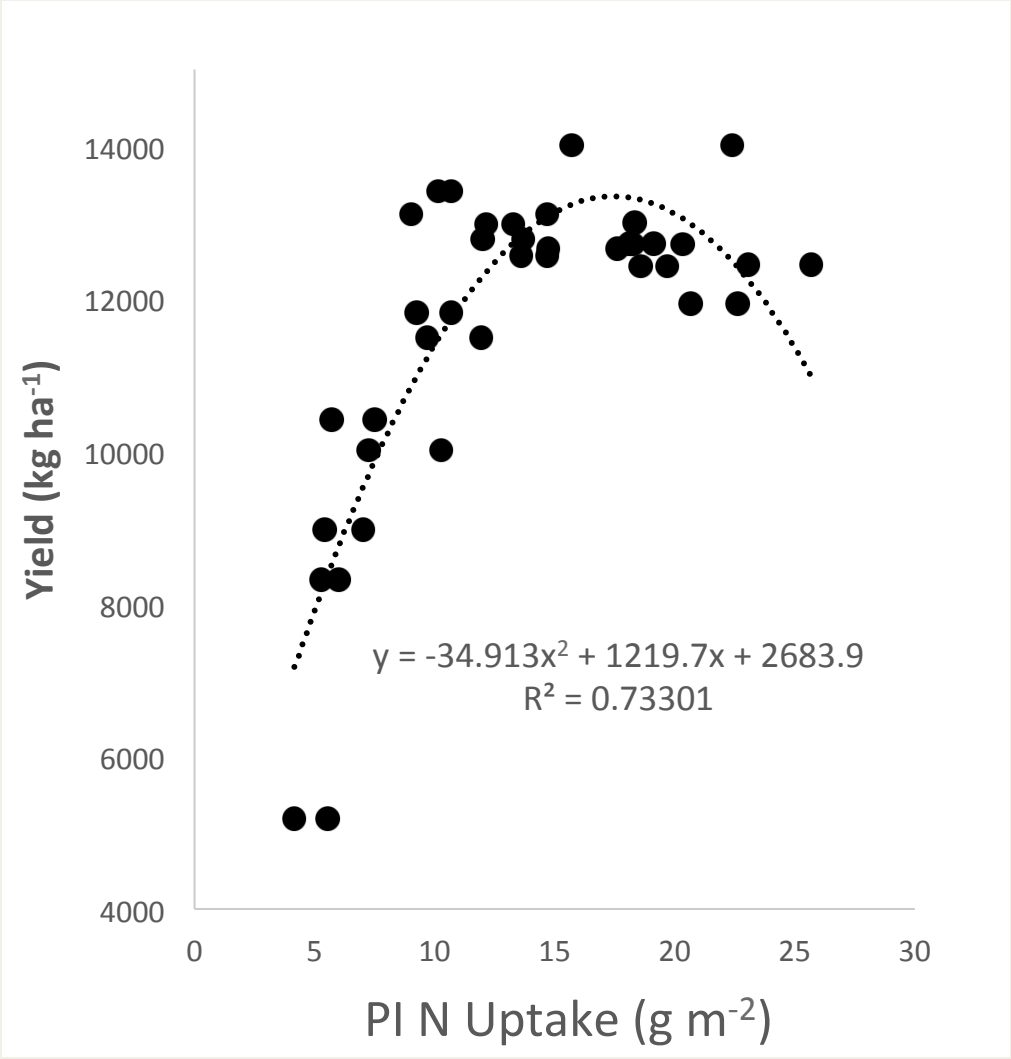
Preliminary results: NDVI at PI

- Not good at estimating biomass and N concentration
- Good correlation with N uptake



N uptake at PI versus yield

- SINCE
  - NDVI is a good predictor of PI N uptake AND
  - PI N uptake is good at predicting final yield
- THEN
  - We see potential in using the NDVI index to inform on midseason N management decisions.



Top-dress N applications: 2016 research

- Continue with 2015 research
  - Can we use aerial imagery to accurately access crop N status?
  - Experimental plots
    - Effects across N rates and when is a top-dress nessesary
  - Large field trials

Top-dress N applications: Field trials

- 3 treatments (one per check)
  - standard preplant N rate with no top-dress
  - standard preplant N rate with top-dress
  - increased preplant N rate with no top-dress

Preplant (aqua +starter)	Top-dress
150	0
150	30
180	0

Top-dress N applications: Field trials

- 3 treatments (one per check)
  - standard preplant N rate with no top-dress
  - standard preplant N rate with top-dress
  - increased preplant N rate with no top-dress
- Run by growers
  - Application of rates
  - Yields from combines with yield monitors
- At time of top-dress
  - Measurements: biomass, NDVI from all treatment plots
- ***Sign up in back if you may be interested***

Thank you