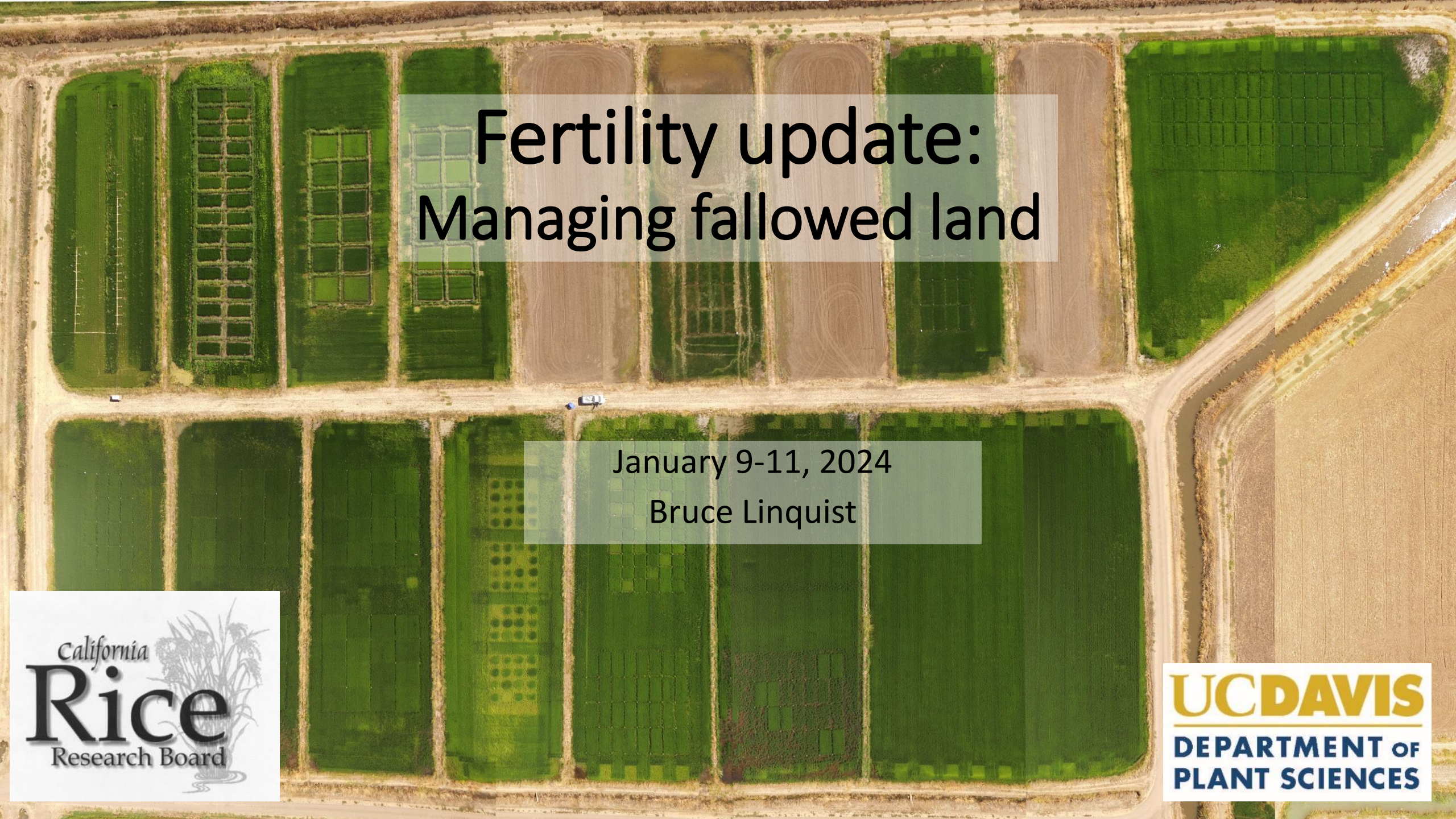


Fertility update:
Managing fallowed land

January 9-11, 2024

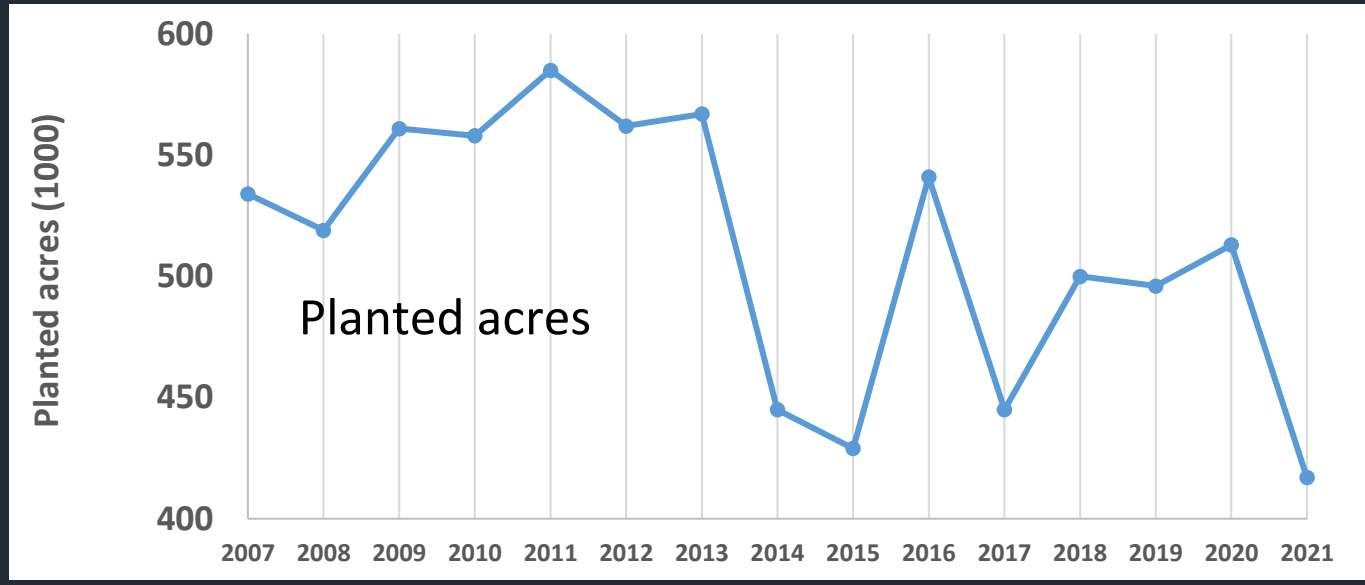
Bruce Linquist

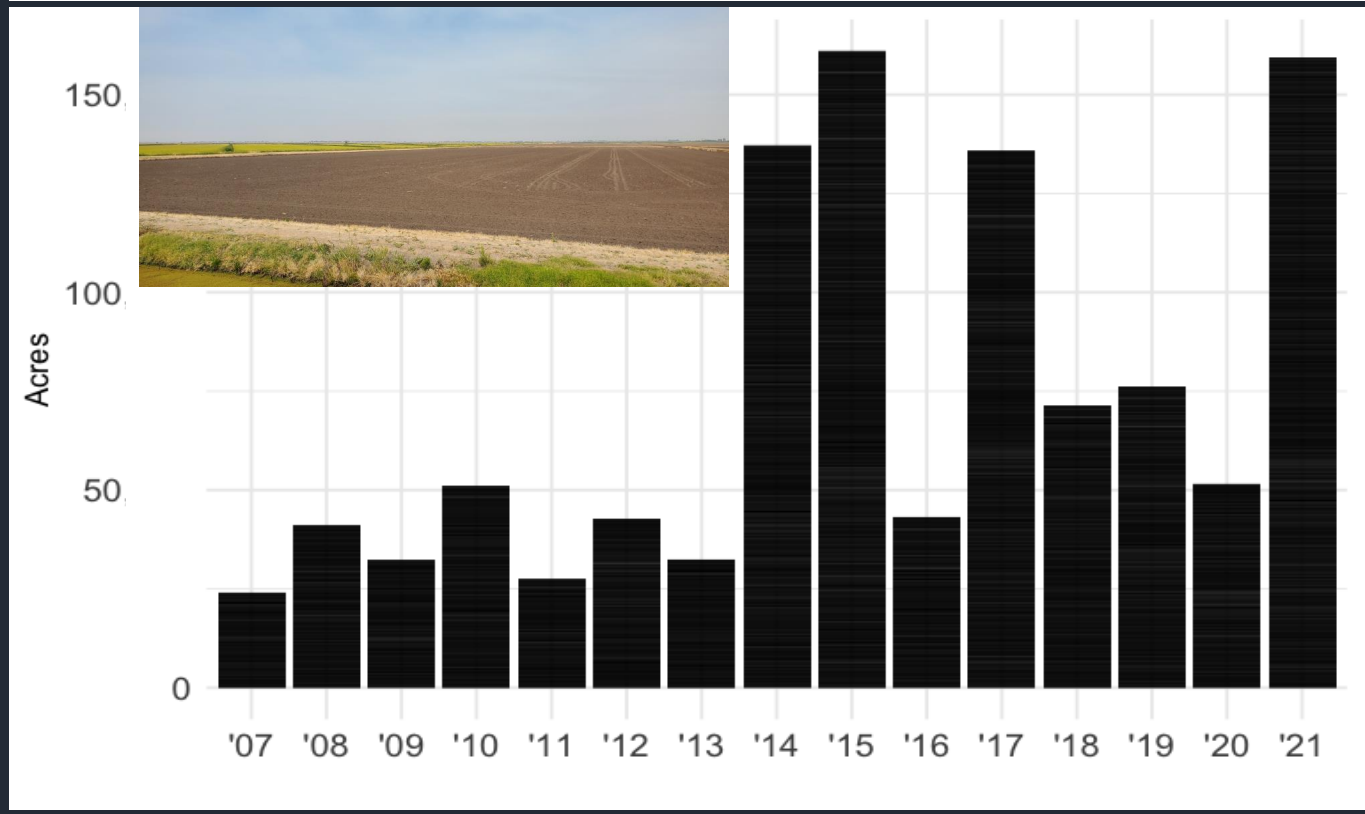
California Rice Research Board

UC DAVIS DEPARTMENT OF PLANT SCIENCES

Topics covered

- Managing a fallowed field
  - Fallowed acres increase during drought periods
  - Last decade >40,000 ac/yr fallowed
- N management
- Water-seeding into stale seedbed
  - previously fallowed and worked
- Drill seeding into stale seedbed and no-till



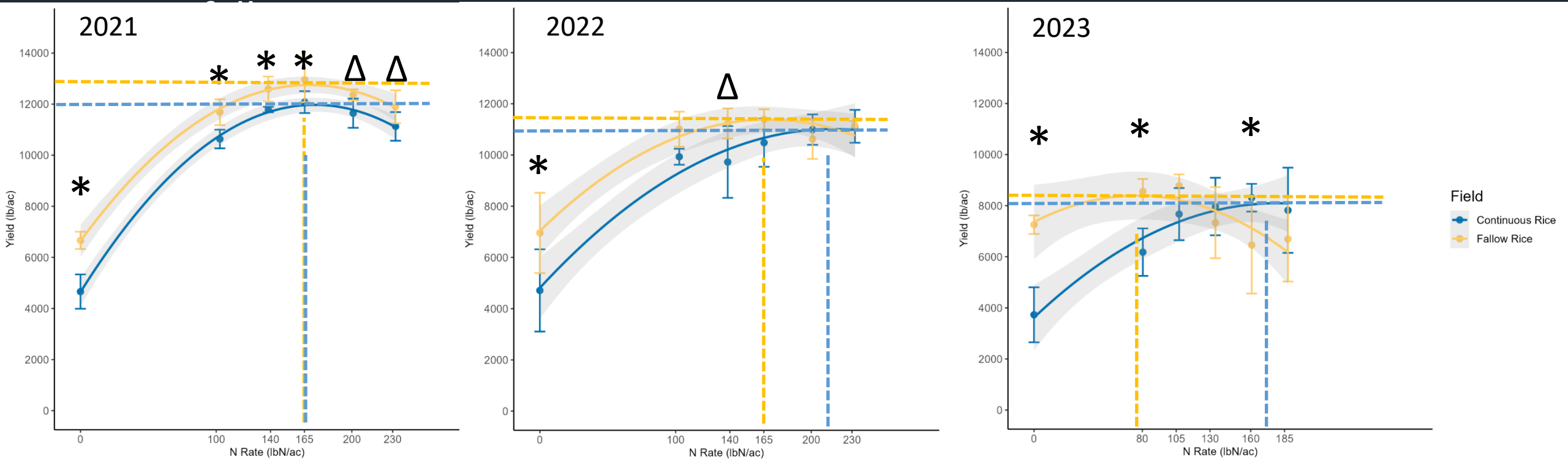


N management in rice following a fallow or rice

- Rice Experiment Station
- Treatments
  - Fallow vs continuous rice
    - Fallowed treatments were fallowed in previous yr
  - 6 N rates
    - 0, 80, 107, 134, 160, 187 lb N/ac
    - All as aqua
- 2021-2023

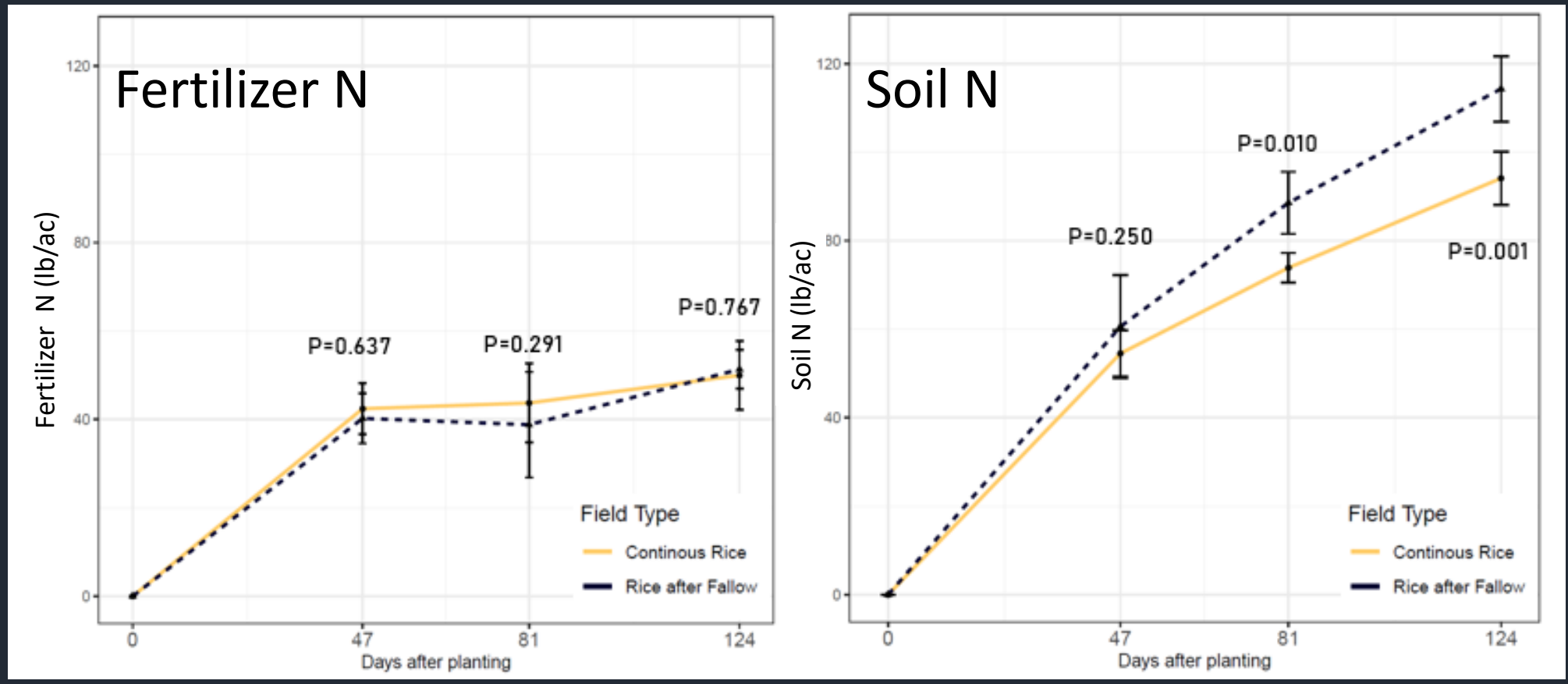
Rice Yields

- Yield potential higher or similar for rice after fallow
- Rice after fallow rice yielded higher than continuous rice at low N rates
  - Lower N rate required to achieve maximum yields in rice after



Where is nitrogen coming from: fertilizer or soil?

- Fertilizer N: Same
- Soil N: More from fallow. Especially later in season
  - Due to phenols which bind N and build up when fields are flooded a lot



20 lb N/ac

What is a stale seedbed?

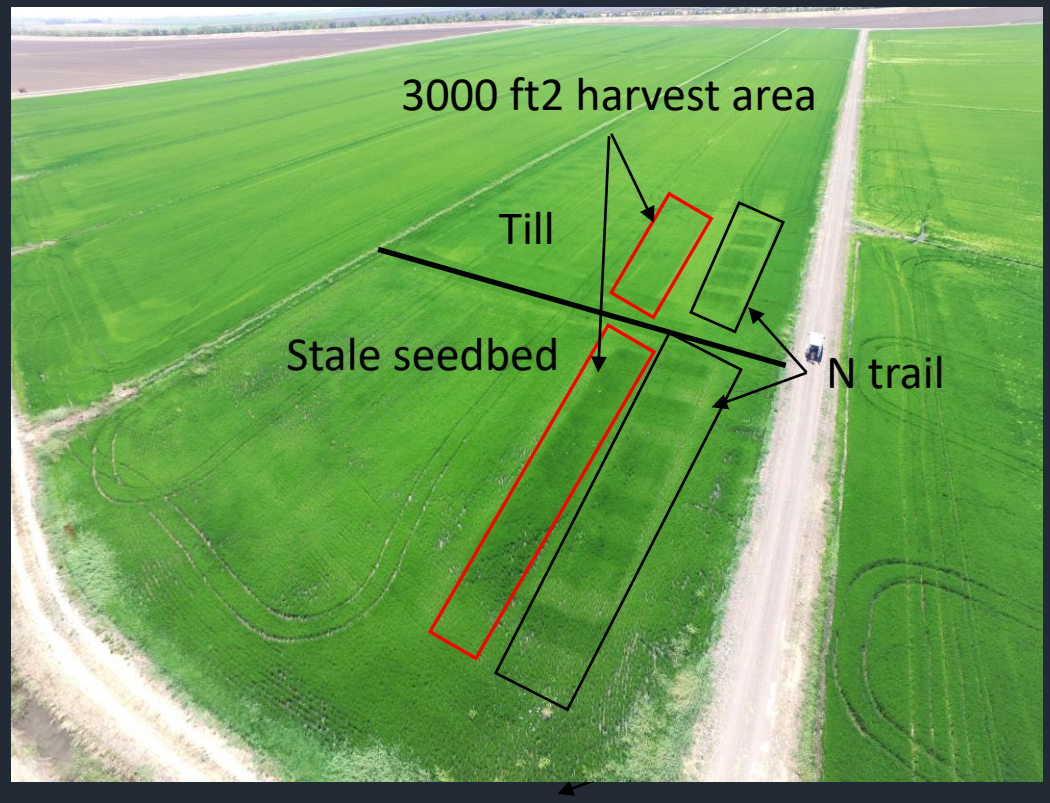
- Ground that has been previously worked into a seedbed.
  - Spring stale seedbed: During the same season
    - What we discussed earlier for herbicide resistant weeds
  - Summer stale seedbed: Previous season
    - Ground fallow due drought, rains or something else - but worked.

Can we water-seed into a stale seedbed?

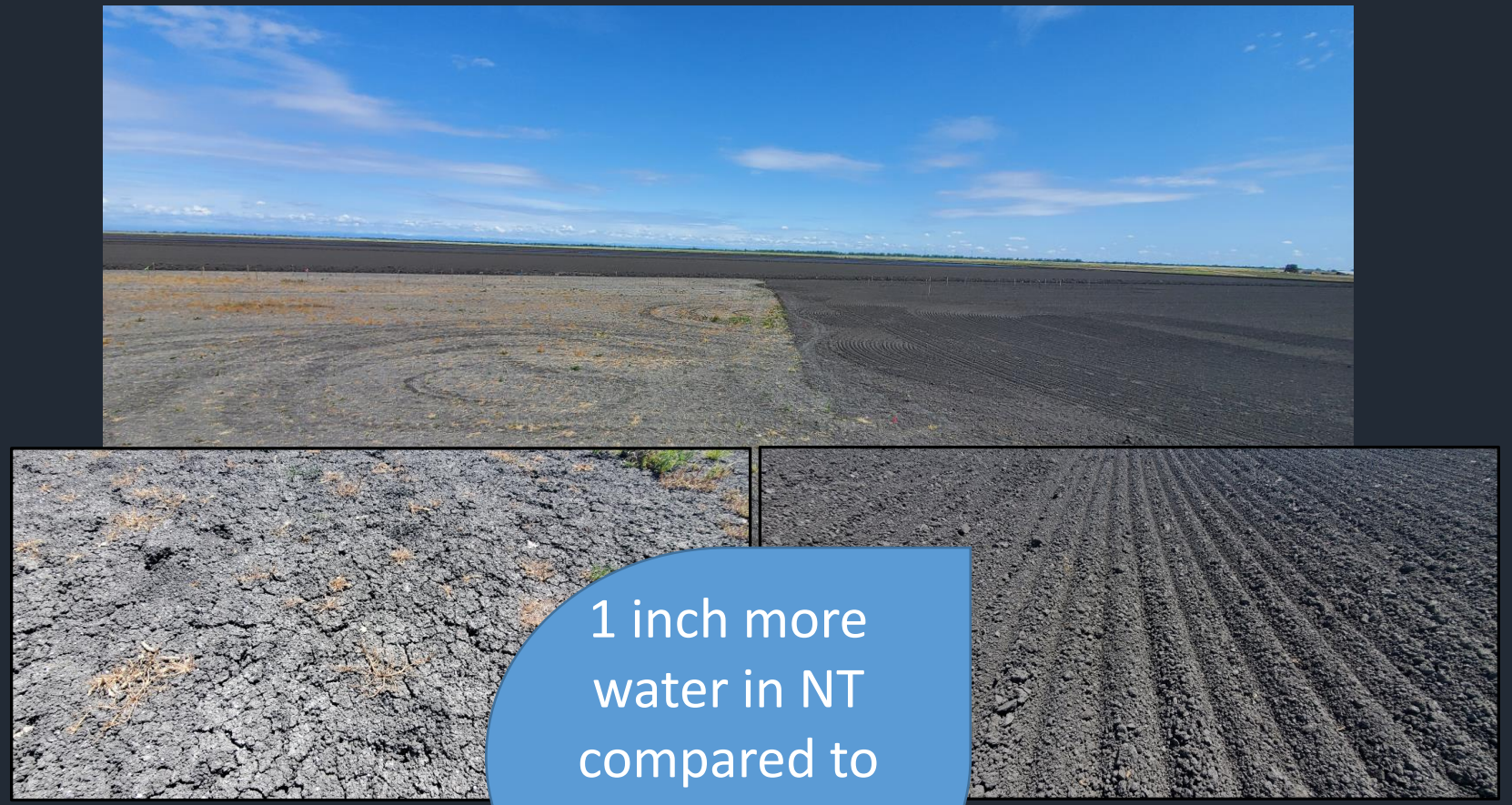
- Evaluate feasibility of planting directly (no-tillage) onto a field that was previously fallowed and had the ground worked during the fallow period.

Design

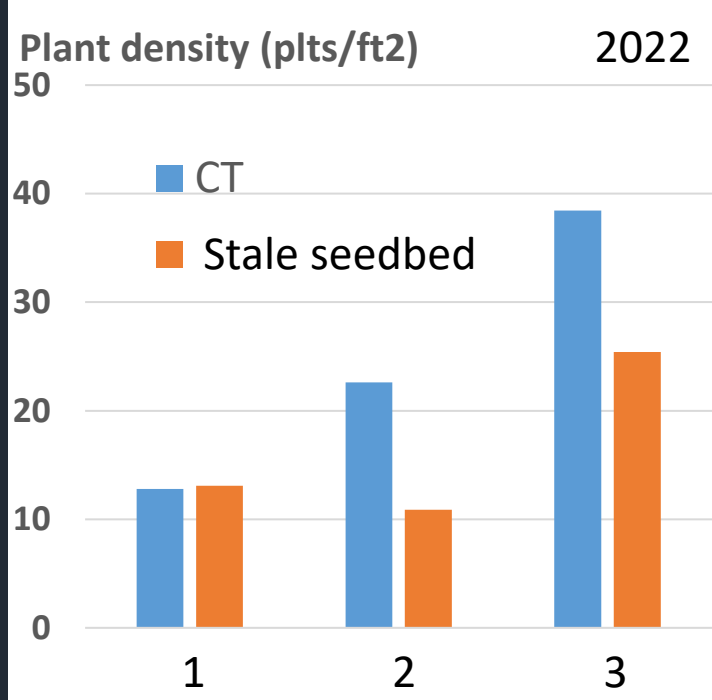
- RES 2023
- 3 on-farm locations
  - In 2022 & 2023
- N rate trial
- Evaluated weeds and pests
- Large area to examine variability and yields

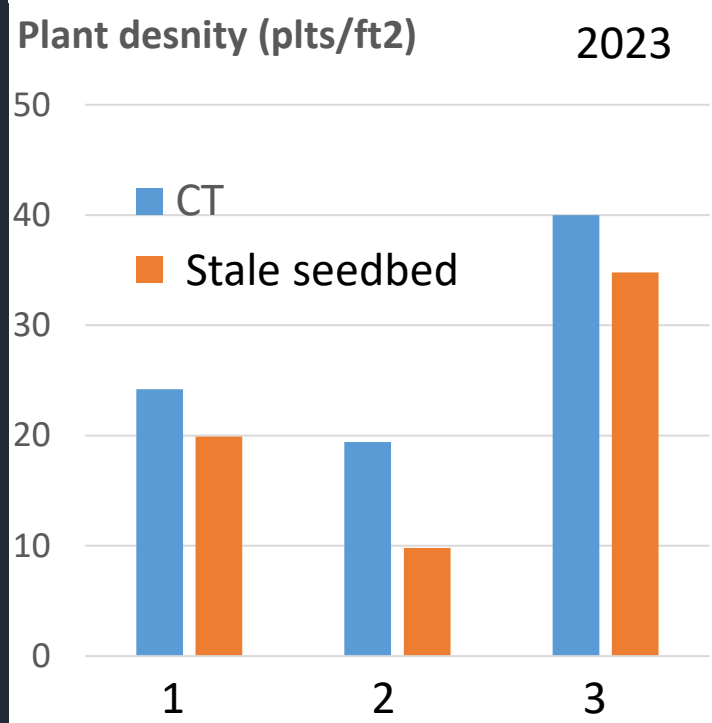


Preflood soil conditions/planting density



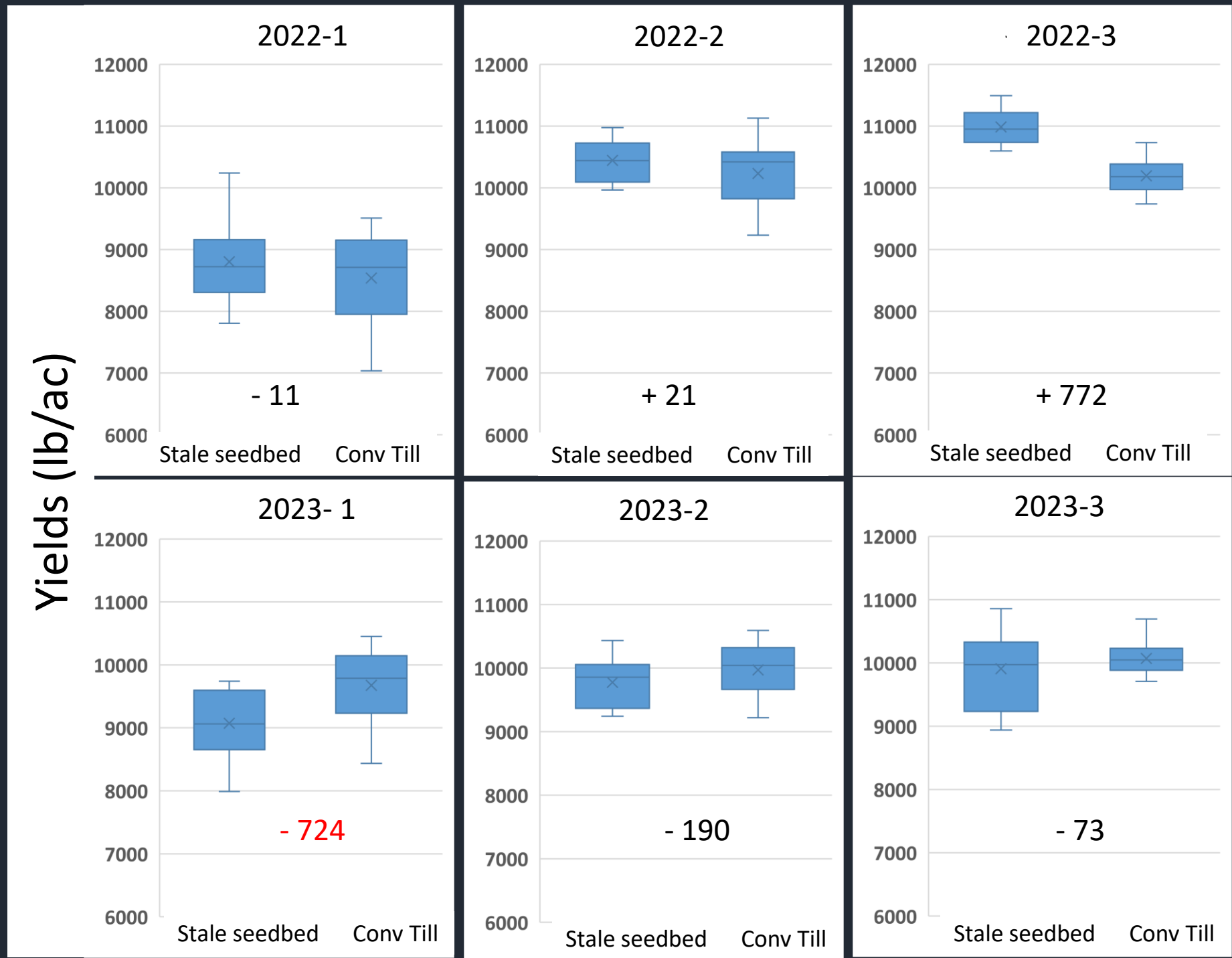
1 inch more water in NT compared to CT (both years)





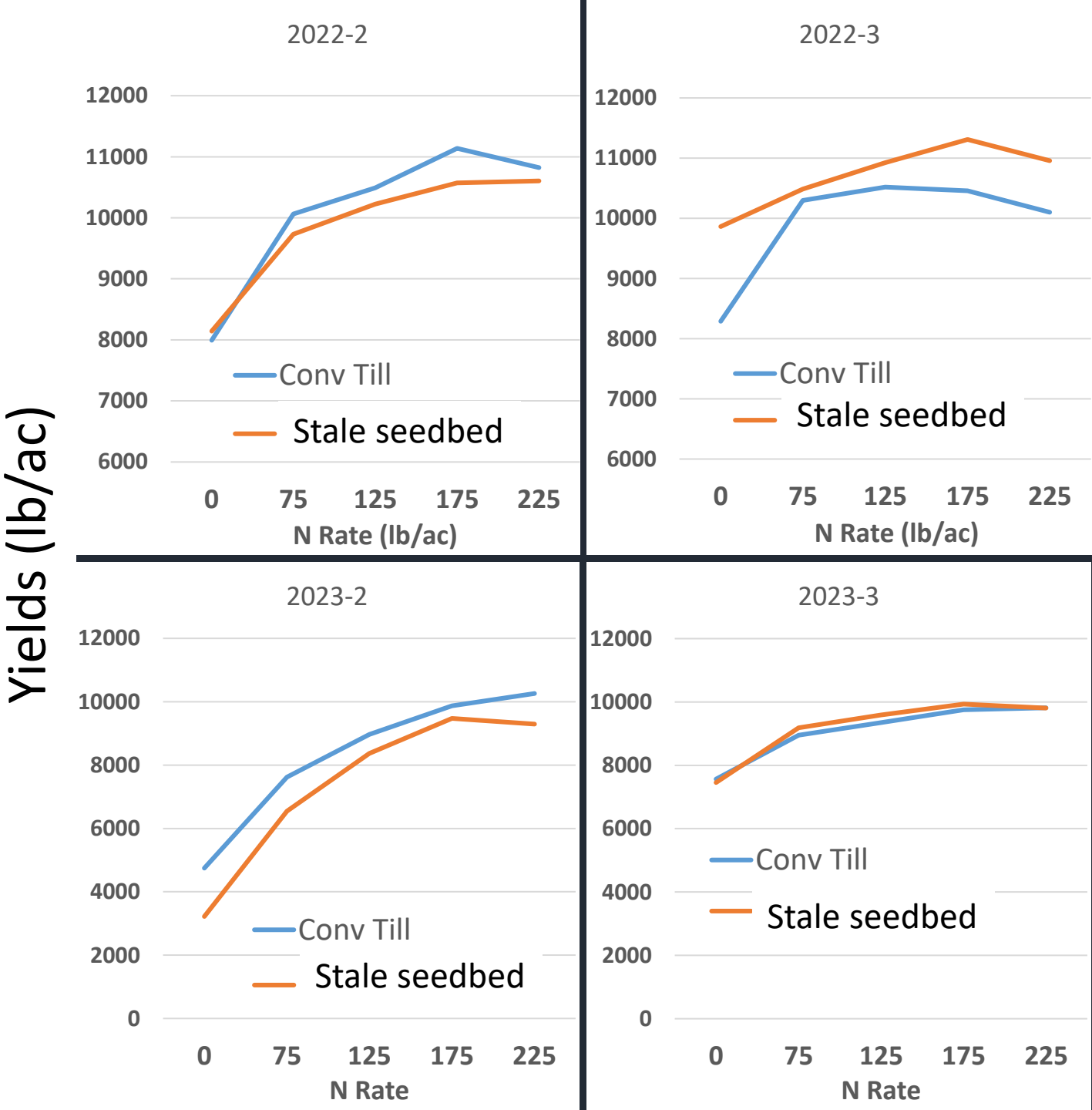
Large plot yields and variability

- Similar or lower yields in NT
  - Except 2022-3



Yield vs N rate

- Maximum CT yields similar to or higher in NT.
  - Except 2022-3
- Similar response to N
- Similar results at the RES

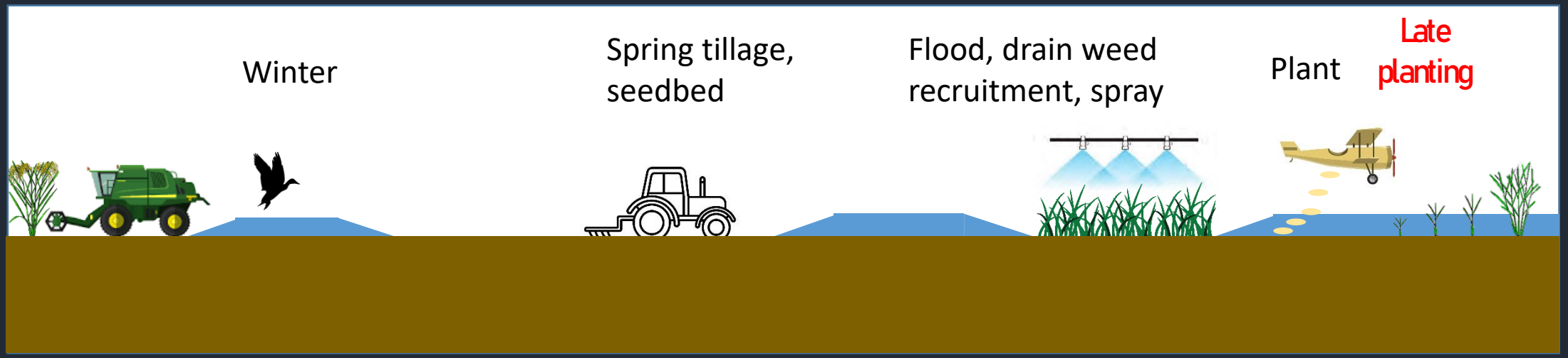


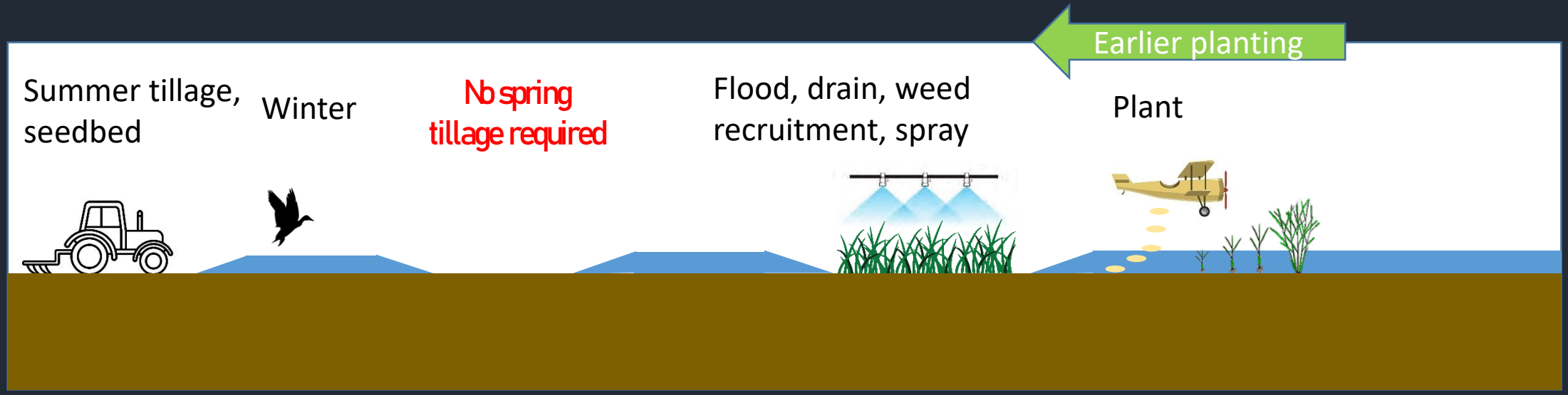
Lessons

- Yield potential appears to be similar
  - These results confirm previous findings
- Wind can cause reduced stand.
  - During fallow year, end with a roller
  - Use a Leather's drain to improve establishment
- Potential to get in early
- Savings on tillage costs
- Small water savings (1")
  - More if planting earlier
- Need to use urea as opposed to aqua-NH_3
- Use as a stale-seedbed for herbicide resistant weed control?

Stale seedbed options:

Spring and Summer





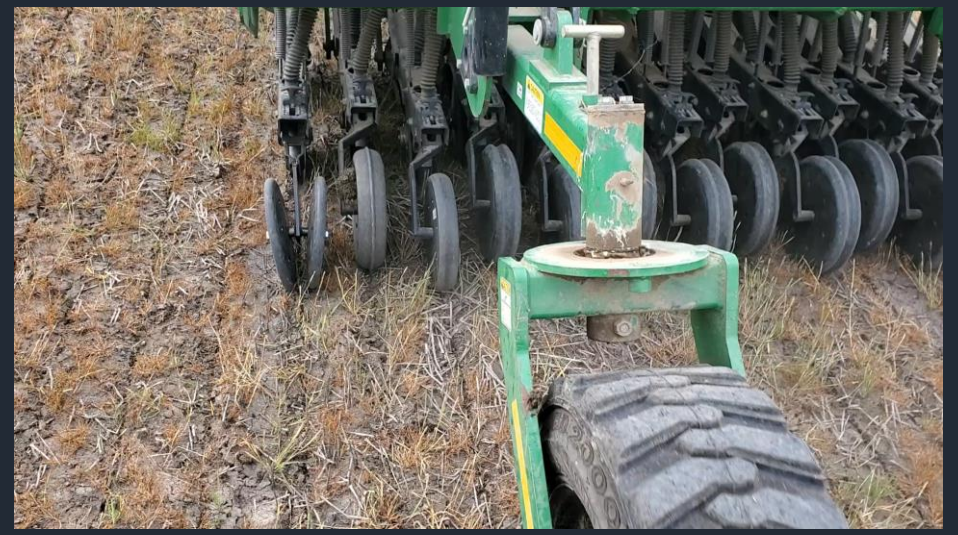
No-till drill seeding (Pilot study)

Justification

- The availability of irrigation water is threat to the sustainability of CA rice systems
- Some practices can reduce water consumption by small amounts (1”)
  - Short duration varieties
  - Planting late
- Are there practices that can reduce water by more?
  - Yes, no-till drill-seeding could save up to 6” of water
    - 17% of ET/consumptive water use
    - Conserve water that is normally evaporated during tillage and early crop growth

Treatments and management

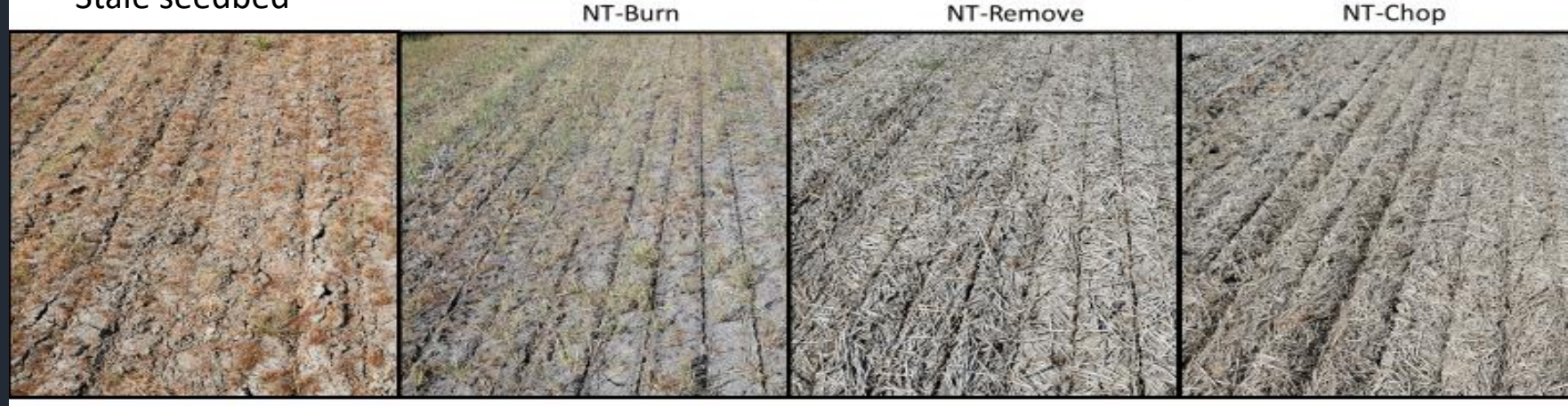
- 4 no-till treatments into:
  - Fallow (stale seedbed)
  - Straw burned
  - Straw removed
  - Straw chopped
- Seeded May 2, flushed May 4, permanent flood June 2
  - No flushes in between
  - Had to use same planting date
- Weed mgmt.
  - Just before permanent flood applied Prowl, Clincher and Propanil
- N trial
- Herbicide trial



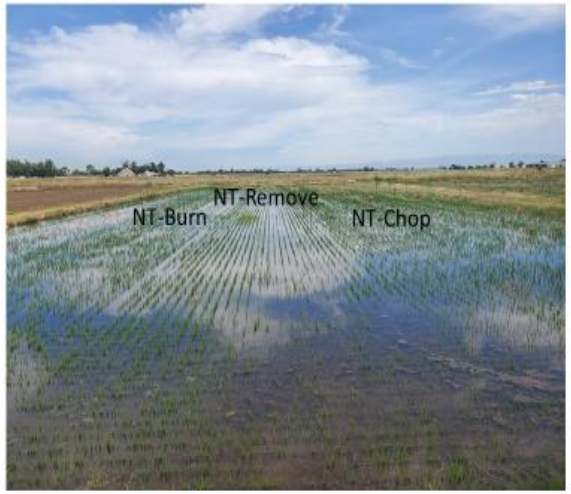
At planting

- Varying soil moisture
  - Had to wait on planting for the straw chopped treatment
- Seed treated with GA to promote stand establishment
- Winter weeds
  - Unsightly
  - Will use water
  - Did not seem to affect yields

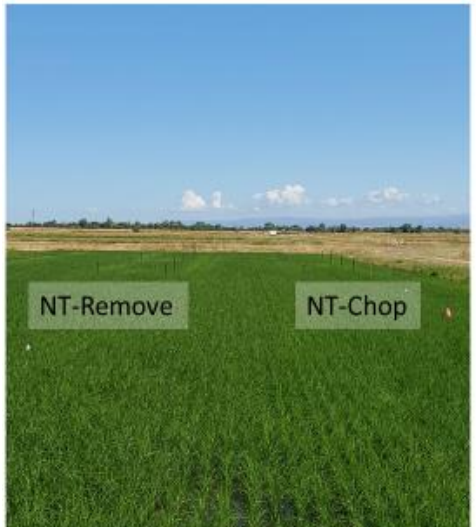
Treatments after planting (May 2)



Treatments after permanent flood (June 6)

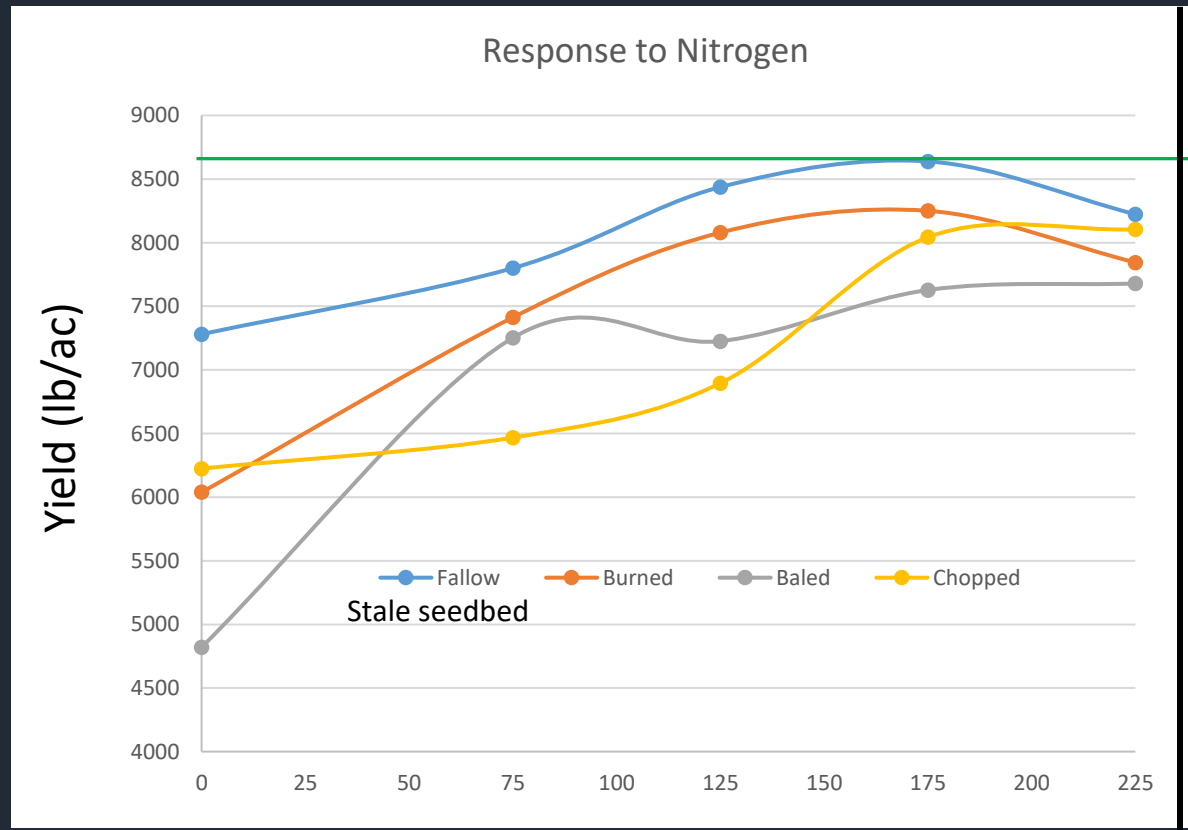


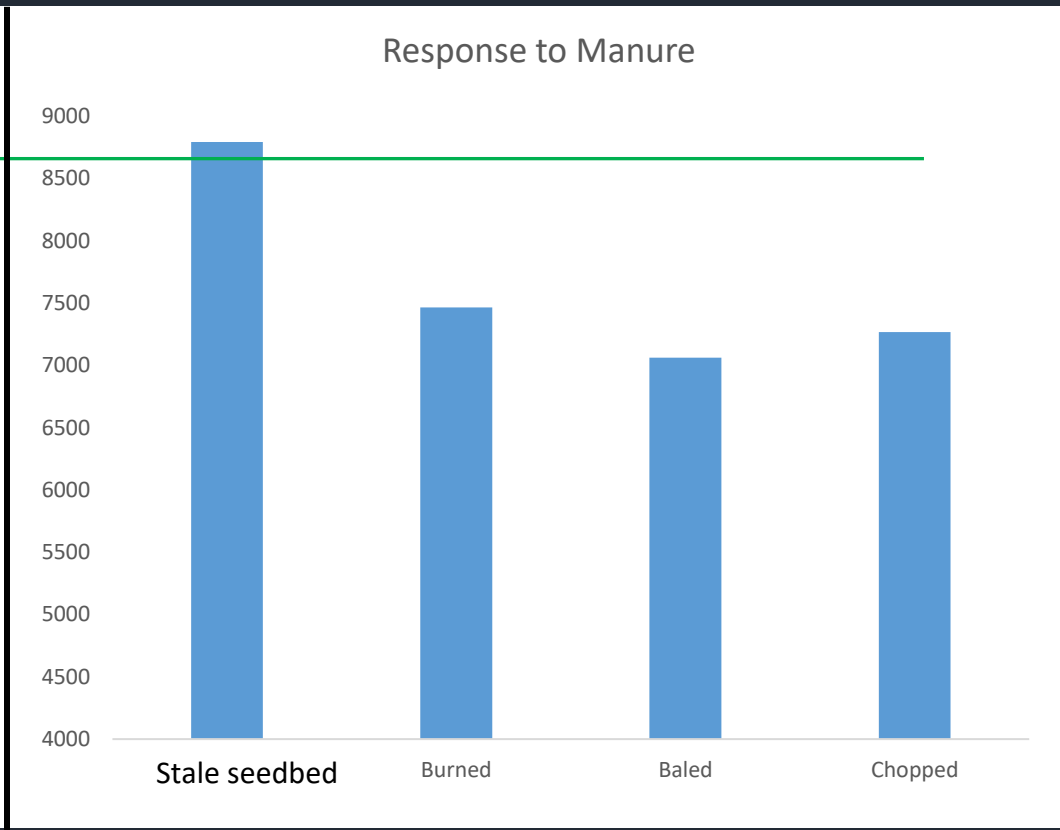
June 20



Response to N fertilizer: urea/manure at PF

- Highest yields in fallow
  - Max yields: same as those achieved in the water-seeded studies at RES in 2023
  - Optimal N rate was 175 lb N/ac
  - Manure in the Fallow had same max yield
    - Manure in other trts resulted in lower yields





Opportunities and challenges

Opportunities

- Early planting
- Save water
- Rainfall during April and May is a benefit
- No tillage costs (true no-till)
- Likely less weed pressure

Challenges

- Expensive equipment
- Heavy clay soils may not close around seed (need to have moisture right; flush)
- Won’t work if fields were rutted up during previous years harvest

2024: Weed & N management, optimal plant dates, quantify water savings

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Thank you

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Next Steps

- Finish up analysis of Fallow vs Continuous rice N research
- Expand no-till drill seeded research
  - Plant when suitable
  - Weed management
  - Fertility
  - Water use

Managing M-211

Weeds/Pests/Disease

- Seed midge
  - NT => CT
- Tadpole shrimp
  - NT = CT
  - Data is limited
- Stem Rot
  - NT =< CT
- Aggregate Sheath Spot
  - NT = CT
- Weeds
  - NT = CT
  - Maybe some species shifts

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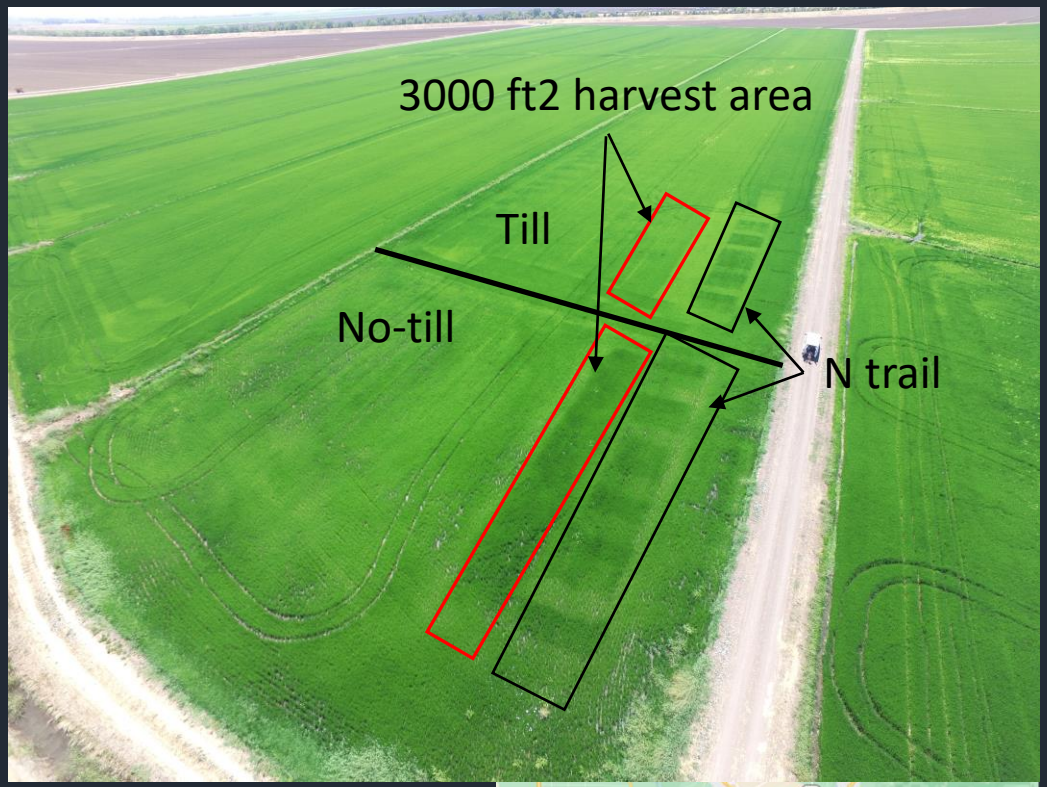
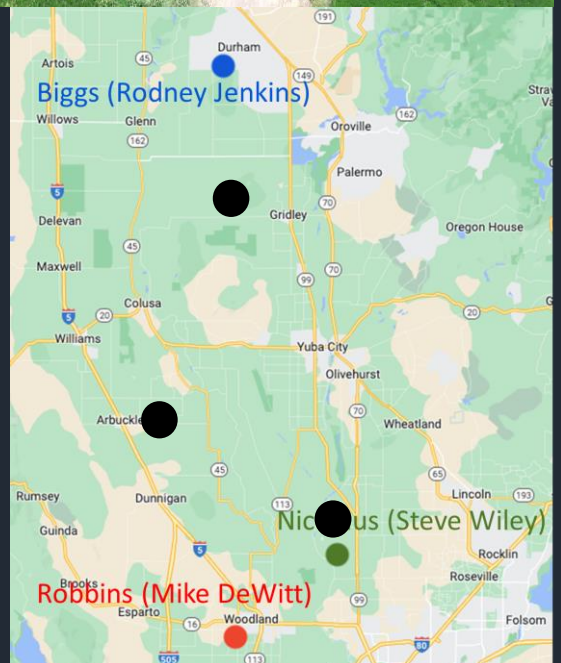




How much water could be saved?

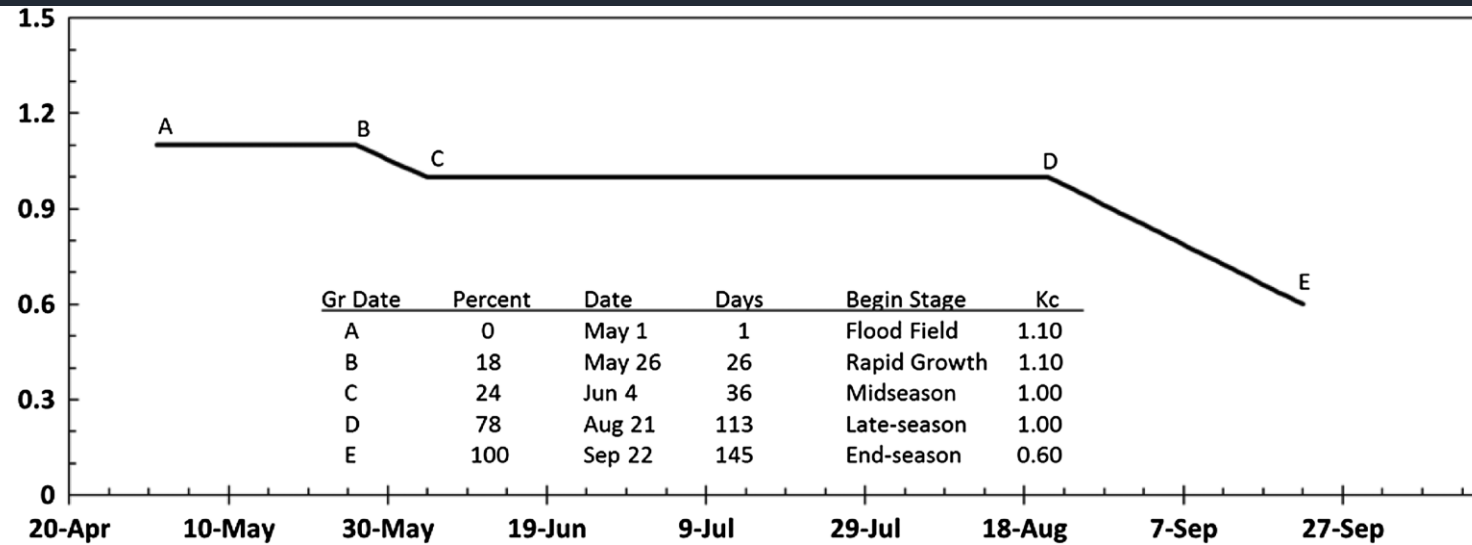
- Evapotranspiration (ET) = ETo X Kc (reference ET X crop coefficient)
  - ETo during April and May is 5 mm/day
  - Kc is 1.1 in a water seeded flooded rice fields
  - 5.5 mm/day (0.22 inches/day) of irrigation water being used.
    - During the first month of growing season most of this is lost as “E”.
  - Get rice to the 4 leaf stage (about 1 mo in water seeded system)
    - Save 30 d X 0.22 in = 6.6 in water

Table 1 Monthly mean solar radiation (R_s), maximum (T_{max}) and minimum (T_{min}) temperature, wind speed (Wind), dew point temperature (T_{dew}), precipitation (Pcp), and reference evapotranspiration (ET_o) from the Colusa CIMIS station #32 within the rice-growing region

Mon	R_s (MJ m^{-2} day^{-1})	T_{max} (°C)	T_{min} (°C)	Wind (m s^{-1})	T_{dew} (°C)	Pcp (mm)	ET_o (mm)
Jan	7.1	13.6	3.0	2.2	4.8	128.6	1.2
Feb	10.6	16.1	4.1	2.4	5.6	113.7	1.8
Mar	15.8	19.4	5.8	2.5	7.0	87.2	2.7
Apr	20.9	22.8	7.1	2.4	7.2	34.1	4.3
May	25.1	27.1	10.8	2.4	9.7	29.8	5.4
June	28.1	31.2	13.9	2.4	12.4	10.6	6.4
July	28.3	34.1	15.4	2.2	14.4	0.3	6.8
Aug	25.3	33.8	14.3	2.1	13.0	1.6	6.1
Sept	20.2	31.6	11.8	1.9	11.3	9.2	4.8
Oct	14.3	26.3	8.3	1.9	8.1	25.2	3.2
Nov	8.9	18.4	4.7	1.9	6.0	63.2	1.7
Dec	6.4	13.0	2.3	2.2	3.9	104.8	1.1

Means and totals were calculated over the period January 1, 1986 through December 31, 2014

Mean daily values for the ratio of total global irradiance to estimated clear sky solar irradiance (Allen et al. 2005) were 0.81, 0.85, 0.89, 0.93, 0.94 and 0.89 for the months April through September, respectively, during 2007–2010 at the Colusa CIMIS station



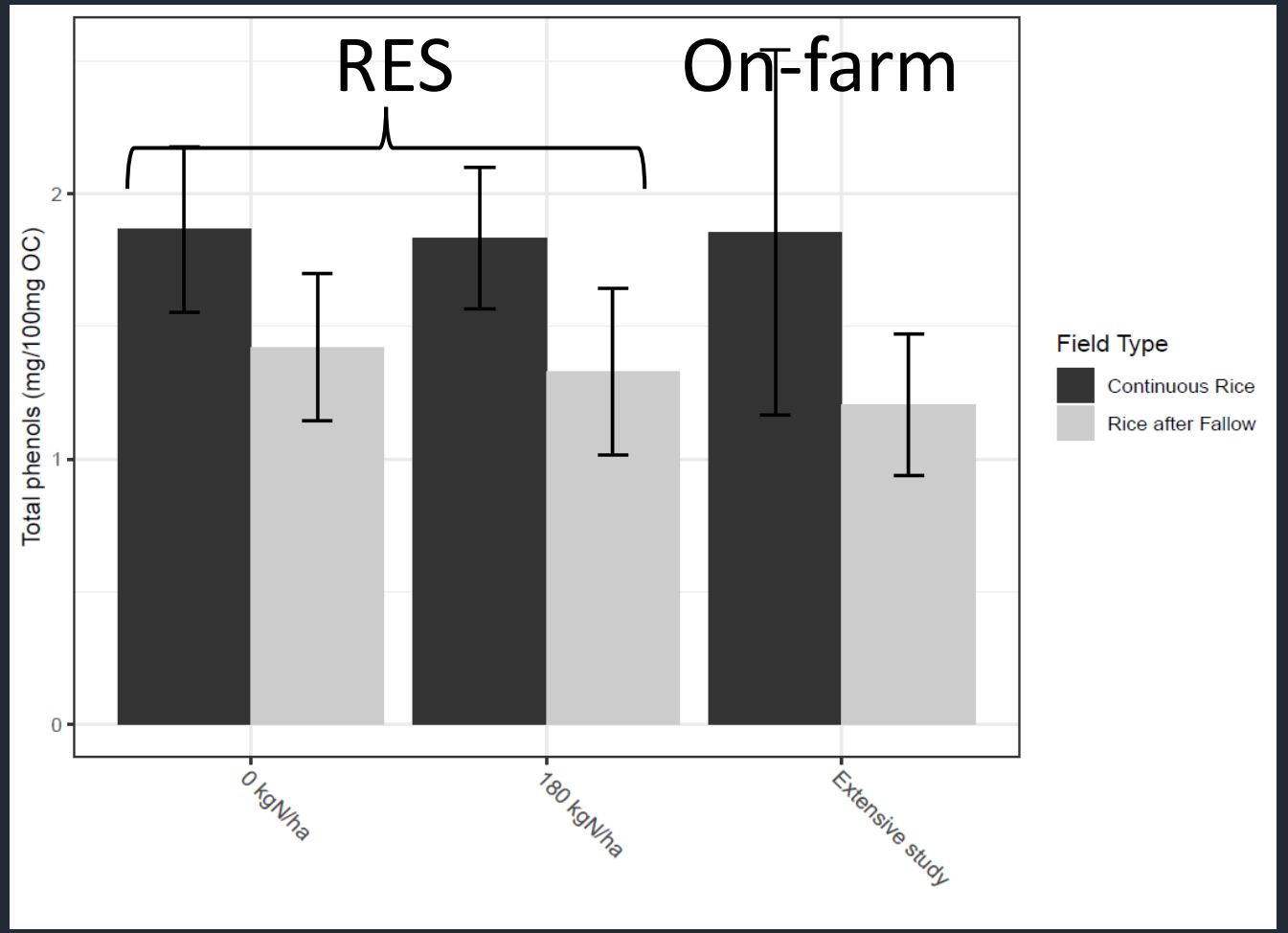
Gr Date	Percent	Date	Days	Begin Stage	Kc
A	0	May 1	1	Flood Field	1.10
B	18	May 26	26	Rapid Growth	1.10
C	24	Jun 4	36	Midseason	1.00
D	78	Aug 21	113	Late-season	1.00
E	100	Sep 22	145	End-season	0.60

Differences in pest dynamics

- Seed midge and TPS wont be a problem
- Aggregate sheath spot
  - No differences: overall incidence was low (0.13)
- Weeds
  - Weed pressure in untreated control
    - Fallow = Burned = Baled > Chopped
    - Chopped only had sprangle top
  - Prowl at planting
    - Provided good control across treatments
  - Prowl, Clincher and Propanil at PF
    - Provided control similar to Prowl at planting

Why less soil N?

- Higher soil phenols seen in continuous rice at both RES and on-farm sites (4 pairs)
- Continuous rice systems are flooded for long periods (winter and growing season)
- Decomposition of rice straw under flooded conditions lead to build up of phenols
- Phenols bind nitrogen.



Why is the yield potential higher in rice after fallow?

- Maximum yields were always higher in rice after fallow
  - only significant in 2021.
- Stem Rot was higher in continuous rice
  - Quadris was applied in all seasons