

## N-Rich Reference Zone Case Study: Sacramento County 2019-20

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Nitrogen (N) rich reference zones were implemented on a 55 acre wheat field in the Sacramento County Delta where the 2019-20 seasonal average grain yield and protein on the ranch were approximately 6500 lb/ac and 10.5%. Historically, this ranch averages about 5500 lb/ac and 10% protein. The grower attributed the better-than-average season to the dry conditions where soils were not waterlogged and applied nitrogen stayed in the root zone.

### N-rich reference zone creation:

The field had two different soil types: Gazwell mucky clay and Rindge mucky silt loam. The Gazwell series is characterized as having approximately 11% organic matter in the top foot of soil, and the Rindge series has approximately 18%. The grower's pre-plant aqua ammonia application provided approximately 60 lb/ac N. The wheat was planted on 11/15/19. Soil samples for nitrate-N in the top 1 ft of soil on 11/18/19 indicated that there was approximately 40 lb/ac N fertilizer equivalent in the Gazwell soil and 27 lb/ac N fertilizer equivalent in the Rindge soil. Three N-rich reference zones were created on 11/25/19— two in the Gazwell soil and one in the Rindge soil (each zone was 90ft x180ft). To create the N-rich zones, urea was broadcast at a rate of approximately 60 lb/ac N. The application was timed ahead of a storm that resulted in 0.5 in. of rainfall.

### Early season conditions:

Overall, the 2019-20 season was a dry season. Between planting and the in-season assessments made on 2/19/20, the crop received approximately 4.3 in. of rain, which was 4.2 in. less than historical average. No rain fell in the month of February. Environmental losses of N may have been reduced as a result of the dry conditions. At of the 2/19/20 assessments, the crop was at the mid-tillering stage of growth, and approximately 21% of the total seasonal N uptake had occurred at this point. March and early-April rainfall provided another 4.1 in.

### Plant and soil measurements:

At tillering, soil was sampled for nitrate-N from the top foot and canopy reflectance measurements were taken on 14-day intervals. On 2/19/20, the N-rich reference zones had a fertilizer N equivalent of 25-37 lb/ac N. The surrounding field had a fertilizer N equivalent of 13-21 lb/ac N. The GreenSeeker canopy reflectance readings were similar between the N-rich reference zones and the surrounding field, indicating

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## SITE INFORMATION

**Location:** Sacramento County

**Soil type:** Gazwell mucky clay & Rindge mucky silt loam

**Previous crop:** Corn

**Variety:** WestBred 9229

**Seeding method:** Grain drill, 2" planting depth

**Seeding rate:** 150 lbs/ac

**Planting date:** 11/15/19

**Bedded:** No

**Weed Management:** Osprey (4.75 oz product/ac) and MCPA (0.5 pint product/ac)

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## PRE-PLANT N MANAGEMENT

**Field rate:** 60 lb/ac

**N-rich zones:** 120 lb/ac

**N Form:** Aqua ammonia + urea in N-rich reference zones

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N sufficiency in the field. These measurements were expressed as a Sufficiency Index (SI). A SI is the ratio of the measurements taken from the broader field to the measurements taken in the N-rich zones. This field had a SI of 0.98 around all three N-rich zones. SI values less than 0.97 indicates possible crop N deficiency, and values less than 0.93 indicate likely crop N deficiency. There were also no fertility differences indicated by drone imagery (Figure 1).

#### Fertilizer recommendations and in-season management actions:

Since there was no rain on the horizon by late-February, the grower decided not to apply additional N. The crop was unlikely to respond to additional N fertilizer based on the plant and soil measurements. Monitoring continued, but there was never a SI below 0.97. By mid-March, work restrictions due to the COVID-19 pandemic limited the ability to address whether an N application ahead of a March storm would have had a yield effect.

#### End of season results:

Hand harvested samples from the N-rich reference zones and the surrounding field indicate that there was no differences between the yield of the N-rich reference zones and the surrounding field ( $p = 0.68$ ). Yield in the N-rich reference zones was approximately 8600 lb/ac, and yield in the field was 8400 lb/ac. The hand-harvest yields likely overestimated the field yield. Since no in-season N deficiency was detected with the canopy measurements and the field yield was comparable to that in the N-rich zones, the crop was unlikely to have responded to an in-season N fertilizer application.

#### OUTCOMES:

- In-season N fertilizer application recommended? No
- In-season N fertilizer applied? No
- Yield
  - 6500 lb/ac (ranch average)
  - 1000 lb/ac higher than historical average
- Protein
  - 10.5% (ranch average)
  - 0.5% higher than historical average
- Crop N removal
  - 148 lb/ac
- Total N fertilizer applied
  - Pre-season: 60 lb/ac
  - In-season: 0 lb/ac

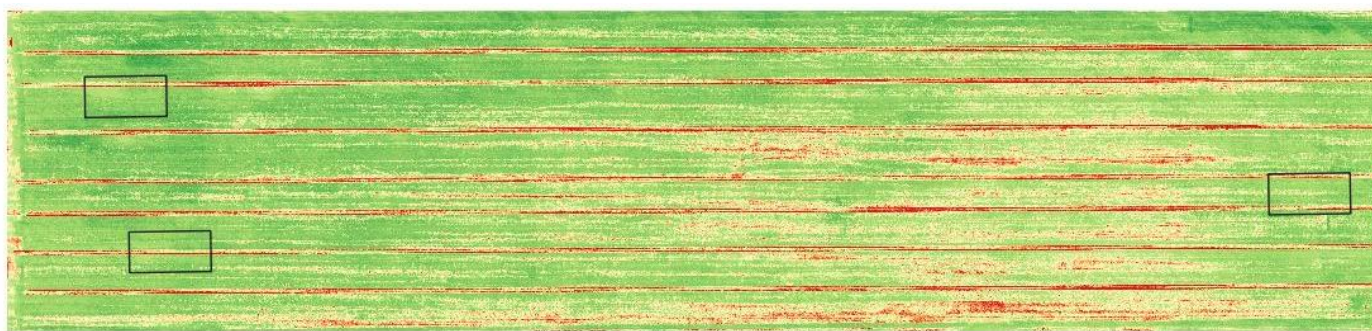


Figure 1. Drone imagery representing canopy reflectance (NDRE) measured on 2/19/20. N-rich reference zones are illustrated by rectangular shapes, but a lack of color differentiation indicates no differences in nitrogen uptake between plants in the field and those in the N-rich zones.

We thank Dennis Lewallen for his cooperation and insights.

*"It was a warm February with no rain. I haven't seen that since 1991. We could have lost the crop, but the rains in March saved it."* Dennis