Using the Trimble® GreenSeeker® Handheld to Determine Rice Response to Midseason Nitrogen

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Introduction

Traditionally most direct-seeded, delayed-flood rice producers in Arkansas have applied nitrogen (N) fertilizer using a two-way split application with the majority of the N fertilizer applied preflood and the remaining 50 kg N ha^{-1} or 34 kg N ha^{-1} applied at midseason or boot, respectively, depending on cultivar/hybrid. Many farmers striving to increase their N management efficiency already use best management practices such as the Nitrogen Soil Test for Rice (N-STaR) to pinpoint field-specific N rates, applying NBPT-treated urea to a dry soil surface, and obtaining and maintaining a quick flood. Previous research has shown that equivalent rice yields may be obtained with a lower total N rate, when a single preflood N management plan is properly implemented. However, many producers are reluctant to move towards a single preflood N application due to the yield potential tied to this early season N application, as well as the inability to determine if the N rate was sufficient to produce maximal yields. While hybrids continue to benefit from 34 kg N ha^{-1} at boot to prevent lodging, most of Arkansas' semi-dwarf, stiff-strawed cultivars do not consistently exhibit an increased yield response to the 50 kg N ha^{-1} midseason N application as long as preflood N has been properly managed. Unexpected N losses are always a possibility and often leave producers questioning the efficacy of a salvage midseason N application. There is no question that soil testing drives fertilization decisions earlier in the season, but farmers have largely relied on visual guesswork after rice is flooded and has reached internode elongation. Thanks to new optical sensor based technology, farmers now have a real-time, non-subjective tool to evaluate the vegetative response of their crop which can help answer the question- will rice yield benefit from a midseason N application?

Materials and Methods

- Six fields seeded with pureline cultivars enrolled in the 2015 Rice Research Verification Program (RRVP)
- Two 1.5 x 1.5 meter N-rich strips established in each field
  - Used the current standard N rate for that soil texture plus an additional 252 kg N ha^{-1}
- N rates for these RRVP fields
  - Determined by N-STaR
  - Applied as a single preflood optimum N rate
- Measured Normalized Difference Vegetative Index (NDVI)
  - 10 random 15-30 m strips across the field (Fig. 1)
  - 3 weeks postflood using the Trimble® GreenSeeker® Handheld (Fig. 2)
- NDVI values from each strip were compared to the N-rich strip to determine a response index
  - Response Index = $\frac{\text{NDVI of N-rich Strip}}{\text{NDVI of Farmer Practice}}$
- Previous research shows an average response index less than 1.2 indicates relative grain yield would not benefit from additional midseason N application (Fig. 3)

Table 1. Agronomic Details, Trimble GreenSeeker Handheld Results, Response Indexes, and Midseason N Fertilizer Management Decisions of Six 2015 RRVP Fields

County	Variety	Standard N Rate (kg N ha^{-1})	N-STaR N Rate (kg N ha^{-1})	Average N-Rich Strip Value (NDVI)	Average Response Index	Response Index Range	Midseason N Applied?	Yield (kg ha^{-1})
Desha	Jupiter	168	190	0.725	1.03	0.99-1.06	No	8574
Jefferson	LaKast	168	134	0.800	1.04	1.01-1.05	No	--
Lee	LaKast	168	129	0.735	1.29	1.04-2.04	On South Half Only	6002
Lonoke	CL 151	190	103	0.795	1.10	1.05-1.22	No	8423
Monroe	Jupiter	201	154	0.715	0.99	0.95-1.02	No	9281
Phillips	LaKast	168	129	0.750	1.08	1.01-1.29	No	8071

Figure 1. Example Field Layout

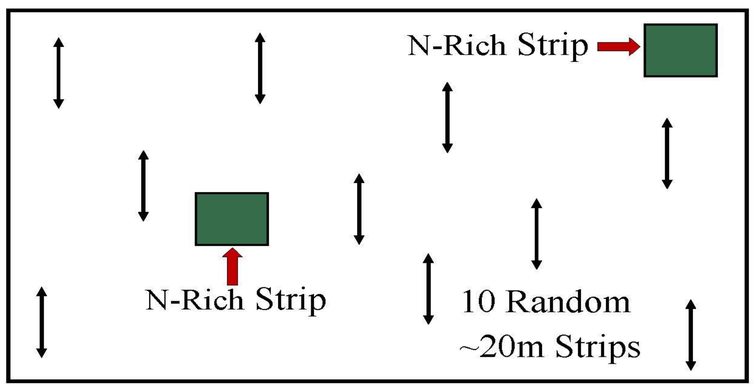
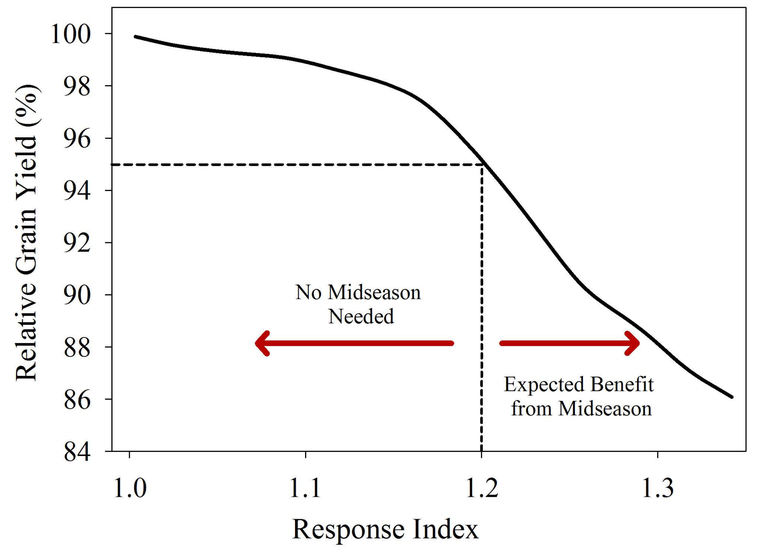


Figure 2. Trimble® GreenSeeker® Handheld

Results

Only one of the six fields evaluated, Lee County, resulted in an average response index greater than 1.2, calling for additional midseason N (Table 1). There was a clear separation in the NDVI measurements of this field. The south half of the field averaged a response index of 1.43 while the north half averaged only 1.09, therefore additional midseason N was applied to the south half of the field only, avoiding costly over fertilization on the north half. Unfortunately, heavy spring rains hit the broadcast planted, Lee County field causing low average stand counts and preflood N loss, especially on the south half of the field. The Jefferson County field was not harvested because of substantial herbicide drift damage.

Figure 3. Using Response Index vs. Relative Grain Yield for Midseason N Fertilizer Decisions



Implications

The Trimble® GreenSeeker® Handheld offers producers and consultants a very easy to use, objective, fairly inexpensive, in-season, field-specific assessment tool to aid in N management decisions. The NDVI measurements are not easily or accurately compared to other locations, year to year, or a database of measurements, but when compared to N-rich strips in the same field they do offer definitive answers regarding the need for midseason N application.

Acknowledgements

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