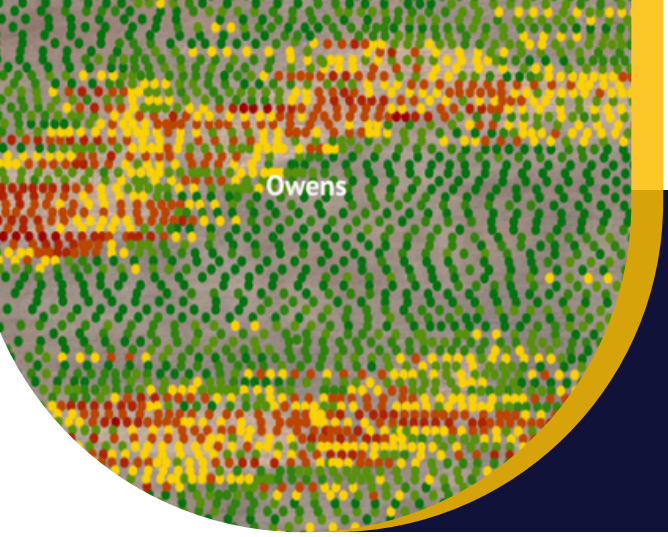



CropScanAg

# CASE STUDY – 44

Independent Research and Commercial Validation

CropScan
On Combine Grain Analyser

# IMPROVING NITROGEN DECISIONS WITH HARVEST PROTEIN MAPPING

Every tonne of nitrogen fertiliser represents a significant investment. Yet many nitrogen decisions are still based on a limited number of soil tests and blanket fertiliser applications across highly variable paddocks.

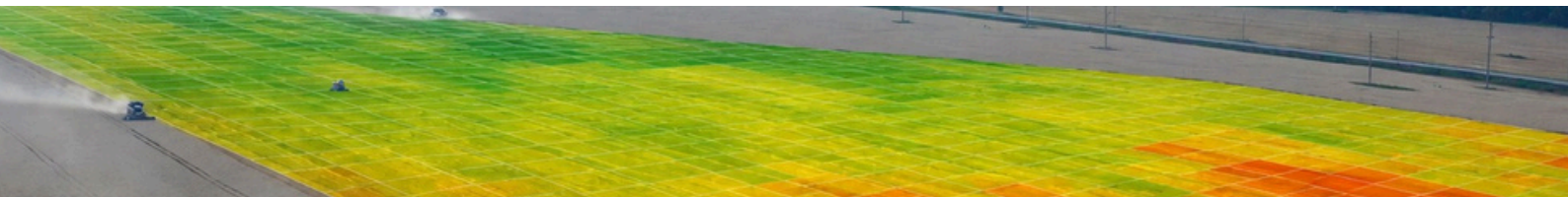
Research and commercial grower demonstrations have shown that grain protein maps provide valuable insight into how crops responded to nitrogen across a paddock. By identifying areas where nitrogen was sufficient and areas where it became a limiting factor, growers can make more informed fertiliser decisions and improve the return on their nitrogen investment.

CropScan Protein Mapping allows growers to visualise nitrogen variability at harvest. When combined with targeted Deep N testing, protein maps help identify nitrogen opportunity zones, improve fertiliser allocation, reduce unnecessary applications and support the development of more effective variable-rate nitrogen strategies.

Importantly, this approach has proven effective across a wide range of Australian farming environments, from sandy soils through to heavy clay soils, and from low rainfall to high rainfall production zones. While every season and field is different, the protein map consistently tells the story of how nitrogen availability varied across the landscape relative to available moisture.

Rather than treating every hectare the same, growers can focus nitrogen investment where it is most likely to generate a return.

**Key Message**
Protein maps do not replace Deep N testing.
Deep N testing tells us how much nitrogen is available in the soil.
Protein mapping shows us where nitrogen was sufficient and where it was a limiting factor in production during the season.
Together they provide a smarter framework for nitrogen management.



# FARMLINK RESEARCH

## VALIDATES PROTEIN MAPPING AS A NITROGEN MANAGEMENT TOOL

FarmLink
change adapt prosper

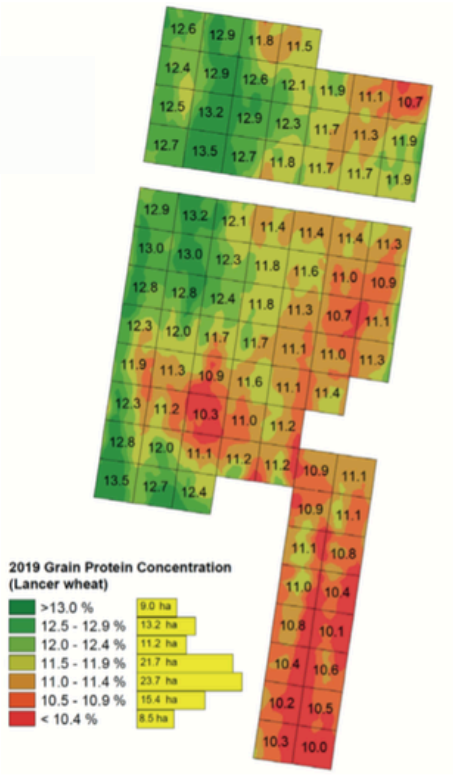
Led by Eva Moffitt
EM Ag Consulting

In 2020, FarmLink Research, led by Eva Moffitt of EM Ag Consulting, investigated whether harvest protein maps could be used to better understand and manage within-paddock nitrogen variability across Southern NSW.

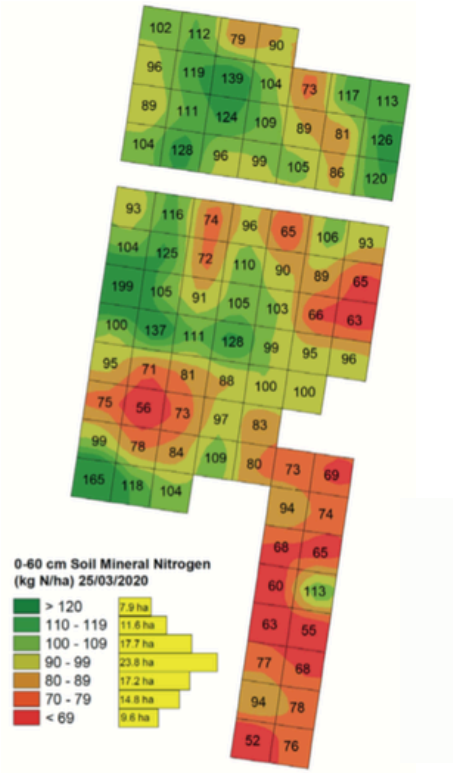
Using the CropScan On-Combine grain analysers, researchers collected high-resolution grain protein maps from the 2019 harvest and compared them with detailed Deep N soil testing undertaken before sowing in 2020.

### THE OBJECTIVE

Can harvest protein maps help identify where nitrogen is available, where it is limiting, and where future nitrogen investment is most likely to generate a return?




**STRONG RELATIONSHIP**




### KEY FINDINGS

- Moderate to high levels of nitrogen variability were identified across all trial sites.
- At four of the five fields, grain protein maps showed a significant relationship with pre-sowing Soil Mineral Nitrogen (SMN) levels.
- **Grain protein correlated more strongly with soil nitrogen supply than grain yield** or most other variables measured.
- Low grain protein areas generally coincided with low soil nitrogen areas.
- High grain protein areas generally contained higher levels of plant available nitrogen.
- Historical protein maps successfully identified nitrogen opportunity zones within fields.

**EXPLORE THE RESEARCH**

SCAN ME

# RESEARCH CONFIRMS THE RELATIONSHIP BETWEEN GRAIN PROTEIN AND NITROGEN SUPPLY

Independent research conducted by Trengove Consulting has confirmed the strong relationship between grain protein and soil nitrogen availability.

**Key Findings**

- Grain protein is a better indicator of soil nitrogen supply than grain yield.
- Areas with higher grain protein generally contained higher levels of plant-available nitrogen.
- Areas with lower grain protein were more responsive to additional nitrogen fertiliser.
- Historical protein maps can be used to develop targeted variable-rate nitrogen prescriptions.

**Research Results**

- For every 1% increase in grain protein, soil nitrogen increased by approximately 8.5 kg N/ha.
- For every 1% increase in grain protein, optimum fertiliser requirement reduced by approximately 15–16 kg N/ha.

**What This Means On Farm**

- Better targeting of Deep N testing locations.
- Greater confidence in variable-rate nitrogen decisions.
- Improved allocation of fertiliser dollars.
- Reduced nitrogen waste.
- Increased nitrogen use efficiency.

**EXPLORE THE RESEARCH**

SCAN ME

**Harvest Protein is the Crop's Report Card**

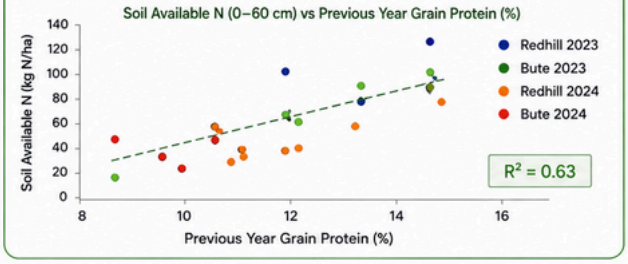
Deep N testing measures how much nitrogen is available in the soil. Protein mapping measures how much nitrogen the crop actually experienced throughout the season.
Together they provide a more complete understanding of nitrogen supply and crop response.

## RESEARCH RESULTS

Independent research by FarmLink Research and Trengove Consulting has quantified the relationship between grain protein, soil nitrogen and fertiliser requirement.

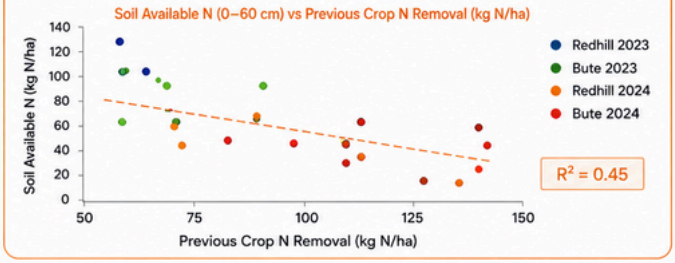
### SOIL NITROGEN INCREASES
with higher grain protein

For every **1%** increase in grain protein, soil nitrogen increased by approximately **8.5 kg N/ha** soil nitrogen increased




### FERTILISER REQUIREMENT DECREASES
with higher grain protein

For every **1%** increase in grain protein, optimum fertiliser requirement reduced by approximately **15–16 kg N/ha** fertiliser requirement reduced




**KEY TAKEAWAY**

**Every 1% increase in grain protein was associated with approximately 8.5 kg N/ha more soil nitrogen and a 15–16 kg N/ha reduction in fertiliser required.**

# BENDER FARM VALIDATION

CropScan Protein Mapping identified significant nitrogen variability across the Bender Farm paddocks before any soil samples were collected.

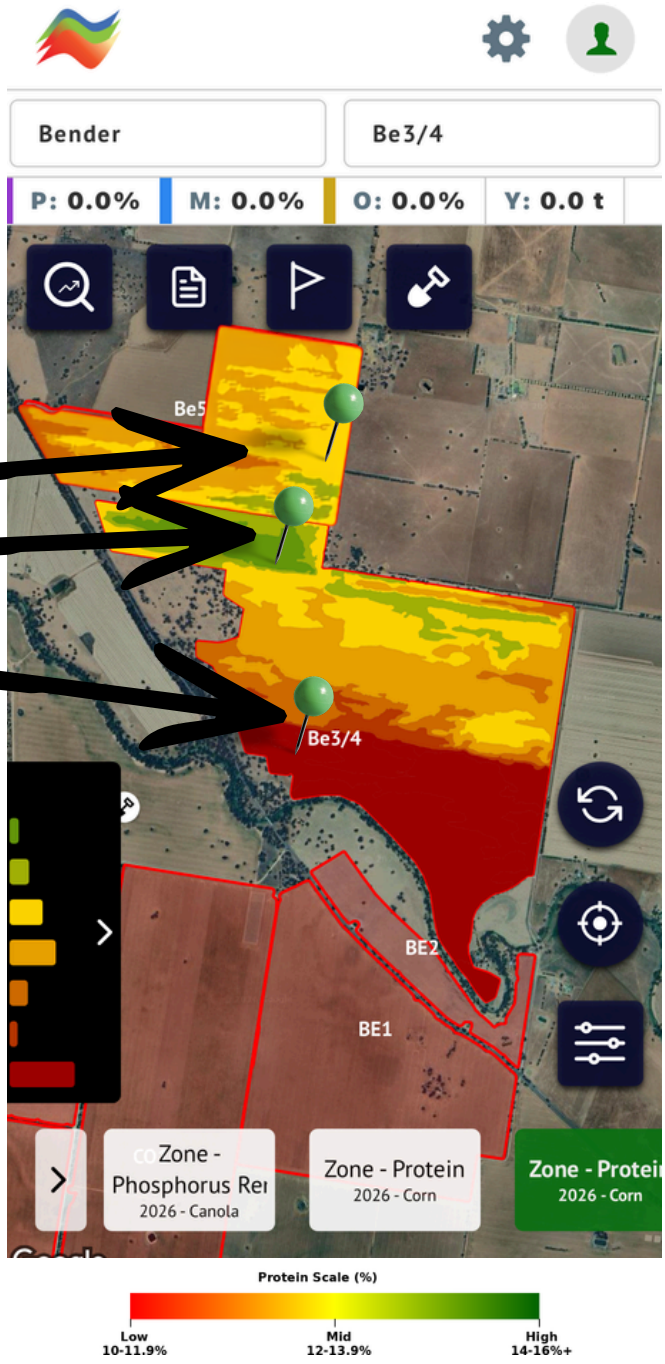
Targeted Deep N testing was then conducted across the different protein zones.

## DEEP N RESULTS (0–60 CM)

**BE4** 148 kg N/ha

**BE5** 101 kg N/ha

**BE3** 73 kg N/ha




### WHAT WE FOUND

Protein mapping successfully identified areas with significantly different nitrogen availability.
The lowest nitrogen zone (BE3) contained approximately 50% less plant-available nitrogen than the highest nitrogen zone (BE4).
This variation would not have been visible using a single paddock average.
The Deep N results closely aligned with the protein map, providing confidence that harvest protein data can be used to identify meaningful nitrogen opportunity zones.

### AGRONOMIC INTERPRETATION

Low-protein zones indicate areas where nitrogen likely became inadequate during grain fill.

These zones represent the greatest opportunity for future nitrogen investment and are the areas most likely to respond to additional nitrogen fertiliser.
High-protein zones indicate areas where nitrogen supply was sufficient and fertiliser response may be lower.

By identifying these zones, growers can move beyond blanket nitrogen strategies and begin targeting fertiliser investment where it is most likely to generate a return.

# 4.6X DIFFERENCE IN NITROGEN SUPPLY

To validate the relationship between harvest protein and soil nitrogen availability under commercial farming conditions, Deep N testing was conducted within both low-protein and high-protein zones identified by CropScan Protein Mapping.

### DEEP N RESULTS (0–60 CM)

Low Protein Zone: **20.3** kg N/ha

Vs

High Protein Zone: **93.6** kg N/ha

The high-protein zone contained approximately 4.6 times more plant-available nitrogen than the low-protein zone.

**What This Means**
If both zones receive the same fertiliser rate, nitrogen is likely to be under-applied in one area and over-applied in another.

The low-protein zone had significantly less available nitrogen and represents a nitrogen opportunity zone where additional fertiliser is more likely to generate a positive response.
The high-protein zone already contained substantially higher nitrogen levels, suggesting lower responsiveness to additional nitrogen applications.

This result demonstrates how protein mapping can be used to identify areas of differing nitrogen requirement before fertiliser decisions are made.
By combining harvest protein maps with targeted Deep N testing, growers can direct fertiliser investment towards the areas most likely to deliver an economic return.

## RESULTS

Deep nitrogen (0—60 cm) results from low-protein and high-protein zones across the three validation fields:

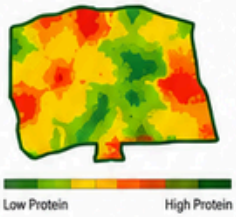
| Field | Low protein zone (kg N/ha) | High protein zone (kg N/ha) | Difference (kg N/ha) | Difference (Urea Equivalent – kg/ha) | High vs low |
|---|---|---|---|---|---|
| Kennys | 20.28 | 93.60 | 73.32 | 160 kg | 4.6x |
| Big Pig | 53.82 | 85.80 | 31.98 | 70 kg | 1.6x |
| Holidays | 21.06 | 54.60 | 33.54 | 73 kg | 2.6x |
| AVERAGE ACROSS FIELDS | 31.7 | 78.0 | 46.3 | 101 kg | 2.5x |

**KEY TAKEAWAY**
**Protein mapping identified a 73 kg N/ha difference in soil nitrogen supply across the same paddock. This level of variability cannot be effectively managed using a blanket nitrogen strategy.**

# FROM PROTEIN MAP TO NITROGEN STRATEGY

Harvest protein maps provide more than just grain quality information. They create a practical framework for improving future nitrogen decisions.

### 1 PROTEIN MAP




CropScan Protein Mapping captures protein and yield data on combine and identifies nitrogen opportunity zones.

### 2 DEEP N TEST

Deep N testing confirms the amount of plant-available nitrogen in each zone.

### 3 UNDERSTAND

Compare protein maps with Deep N results to understand where nitrogen was limiting or sufficient.

### 4 VARIABLE RATE

Develop variable-rate nitrogen prescriptions to better match fertiliser rates to crop requirements.

### 5 BETTER RETURNS

Target nitrogen investment where it will respond, improving efficiency and return on investment.

## RESEARCH & COMMERCIAL VALIDATION – KEY FINDINGS

**73**
**kg N/ha**
Largest nitrogen difference identified (Kenny's Field)

**2.5**
**X**
Average high protein zone (All validation sites)

**4.6**
**X**
Kenny's Field (Hi vs Low P% Zone)

**15-16**
**kg N/ha**
Reduce fertiliser requirment (Farm Research)

## WHY THIS WORKS

**Protein Maps Identify Opportunity Zones**
Shows where nitrogen became limiting and where additional nitrogen is most likely to generate a response.

**Deep N Testing Validates Supply**
Confirms how much plant-available nitrogen exists within each management zone.

**Variable Rate Application Targets Investment**
Matches fertiliser rates to crop requirements rather than applying the same rate across the entire paddock.

**KEY TAKEAWAY**

Harvest protein maps provide the missing link between harvest results and future nitrogen decisions.

Research and commercial validation demonstrate that protein mapping can identify meaningful nitrogen variability, improve the targeting of Deep N testing and support more effective variable-rate nitrogen strategies.

# CONCLUSION

**Smarter Nitrogen Decisions**
**Better Efficiency stronger returns**

Independent research conducted by FarmLink Research and Trengove Consulting has demonstrated a consistent relationship between grain protein, soil nitrogen availability and crop response to nitrogen fertiliser.

Across multiple sites and seasons, grain protein proved to be a stronger indicator of nitrogen supply than grain yield. Areas with lower grain protein were generally more responsive to additional nitrogen fertiliser, while higher protein zones often contained greater levels of plant-available nitrogen and required less fertiliser to achieve optimum economic returns.

## 1 KEY RESEARCH FINDINGS

- Grain Protein was a better indicator of soil nitrogen than grain yield
- For every 1% increase in Protein, soil increase by aprox. 8kg N/ha
- Areas with lower grain protein were constantly more responcive to additional N fertilizer

## 2 COMMERCIAL VALIDATION

- Bender Farm: 73–148 kg N/ha
- Kenny's Field: 73 kg N/ha difference
- Equivalent to 160 kg/ha of Urea
- Approximately $160/ha of Nitrogen Value
- Validation sites averaged 2.5x more available nitrogen

## 3 WHY IT MATTERS

- Target nitrogen where it is most likely to respond
- Reduce over-application in high nitrogen zones
- Improve fertiliser efficiency
- Improve return on fertiliser investment
- Turn harvest protein data into next season's nitrogen plan

Importantly, these findings are not limited to a single region or farming system. Independent research and commercial validation have demonstrated that harvest protein mapping provides valuable insight into nitrogen variability across sandy soils through to heavy clay soils, and across both low and high rainfall production zones. While management decisions will always vary depending on soil type, seasonal conditions and farming objectives, the protein map consistently identifies where nitrogen was sufficient and where it became limiting, providing growers with greater confidence when planning future nitrogen strategies.

**KEY TAKEAWAY**

- Deep N testing tells us how much nitrogen is available.
- Protein mapping shows us where nitrogen was insufficient.
- Research and commercial validation demonstrate that when these tools are used together, growers can better identify nitrogen opportunity zones, improve fertiliser efficiency and maximise the return from every fertiliser dollar invested.
- **$160/ha difference in nitrogen value identified within the same field.**

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