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Nitrogen use efficiency and farmer engagement

International Nitrogen Initiative Conference: Concurrent session 5A ‘national and community nitrogen footprints’

8 December 2016

Overview

- The challenges
- Our solution
- Why we did what we did
- Case study: producers & advisors
- How the process can influence decision making

The challenges at hand – cropping

- Reliance on recipes for N fertiliser application
- Lack of soil testing for available N
- Lack of nutrient budgeting based on removal rates
- Application of too much or too little N fertiliser

The challenges at hand – cropping

Our solution needed to be:

- Engaging producers & advisors
- Simple, using data on hand
- Relatable
- Relevant & practical
- Manageable
- Conducive to decision making
- Useful to compare paddocks, crops & farms

What we did about it

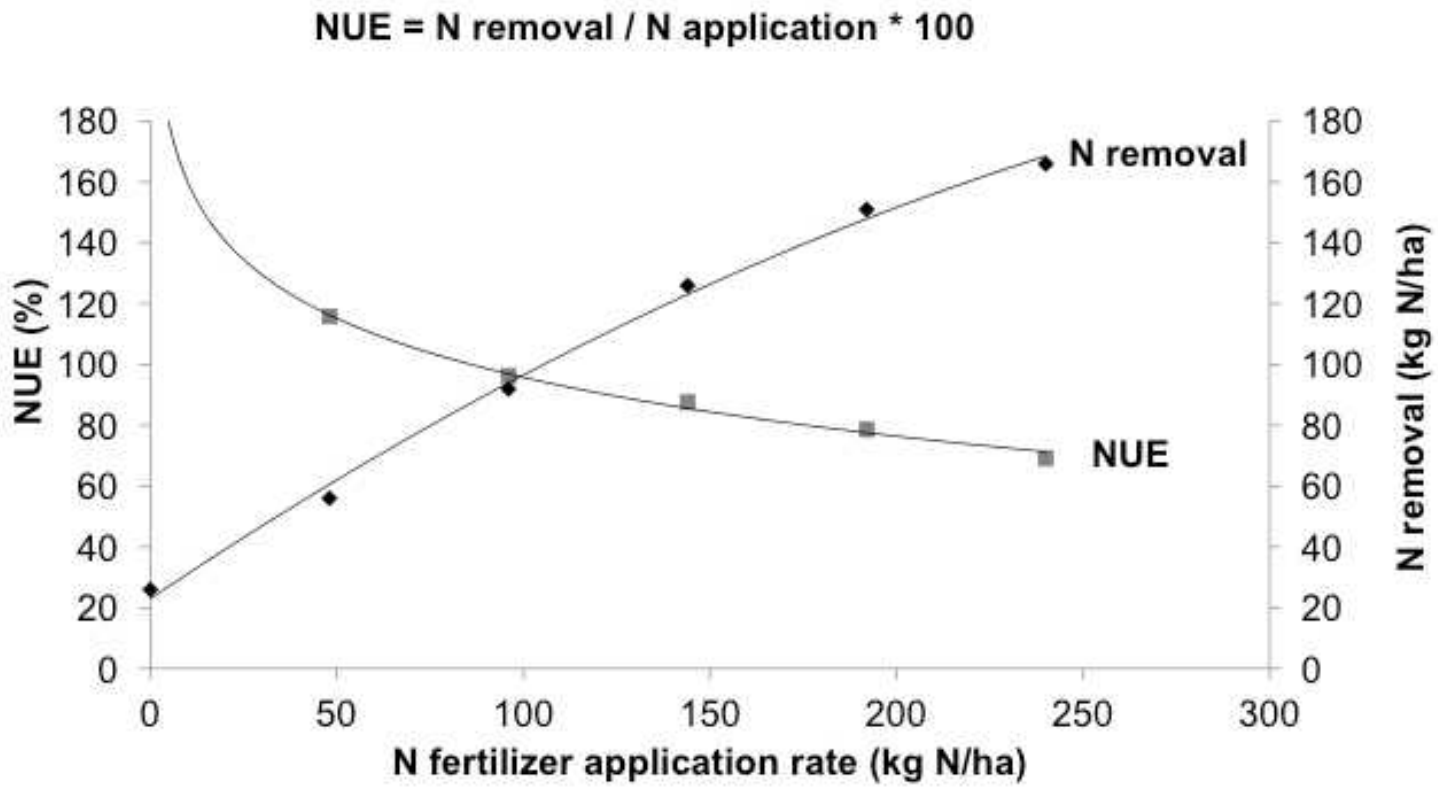
Partial nitrogen balance

NUE % = NCR/NFI X 100

N crop removal (NCR) *(= all parts of the crop that are harvested and removed e.g. grain and straw*), **divided by** mineral N fertiliser input (NFI), both in kilograms per hectare (kg/ha). The result is expressed in % NUE.

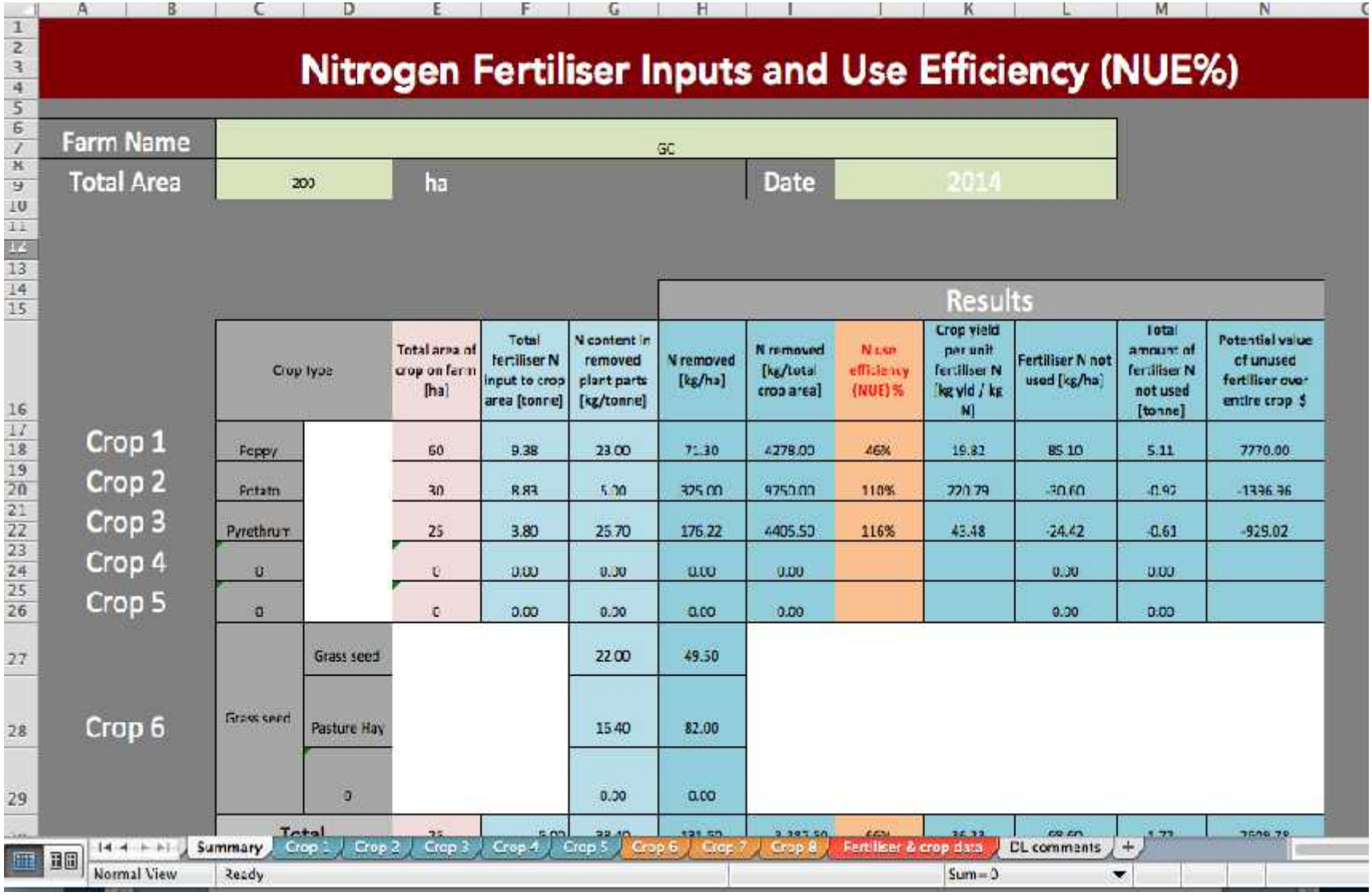
NUE% - what the science tells us

Ratio of fertiliser nitrogen to nitrogen removed via biomass removal (e.g. harvest, grazing)



Broadbalk long-term trial with winter wheat in Rothamsted, UK

What we did about it



Nitrogen Fertiliser Inputs and Use Efficiency (NUE%)

Farm Name	GC											
Total Area	300	ha					Date	2014				

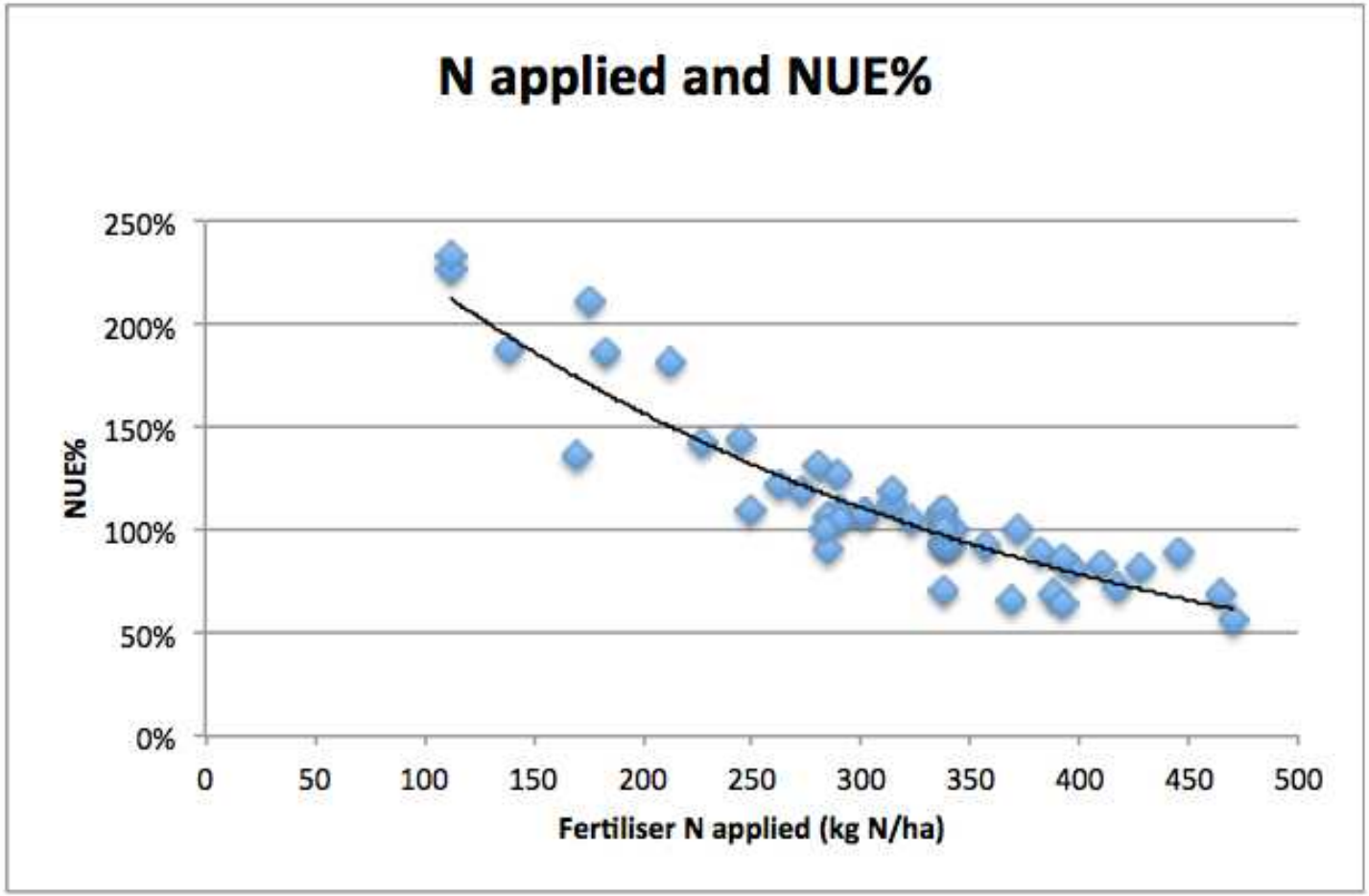
						Results						
	Crop type		Total area of crop on farm [ha]	Total fertiliser N input to crop area [tonne]	N content in removed plant parts [kg/tonne]	N removed [kg/ha]	N removed [kg/total crop area]	N use efficiency (NUE) %	Crop yield per unit fertiliser N [kg yld / kg N]	Fertiliser N not used [kg/ha]	Total amount of fertiliser N not used [tonne]	Potential value of unused fertiliser over entire crop $
Crop 1	Poppy		60	9.38	23.00	71.30	4278.00	46%	19.82	85.10	5.11	7770.00
Crop 2	Potato		30	8.83	5.30	305.00	9150.00	110%	220.79	-30.60	-0.92	-1336.36
Crop 3	Pyrethrum		25	3.80	25.70	176.22	4405.50	116%	43.48	-24.42	-0.61	-929.02
Crop 4	0		0	0.00	0.00	0.00	0.00			0.00	0.00	
Crop 5	0		0	0.00	0.00	0.00	0.00			0.00	0.00	
Crop 6	Grass seed	Grass seed			22.00	49.50						
		Pasture Hay			15.40	82.00						
		0			0.00	0.00						
	Total											

Summary | Crop 1 | Crop 2 | Crop 3 | Crop 4 | Crop 5 | Crop 6 | Crop 7 | Crop 8 | Fertiliser & crop data | CL comments

Normal View | Ready | Sum = 0

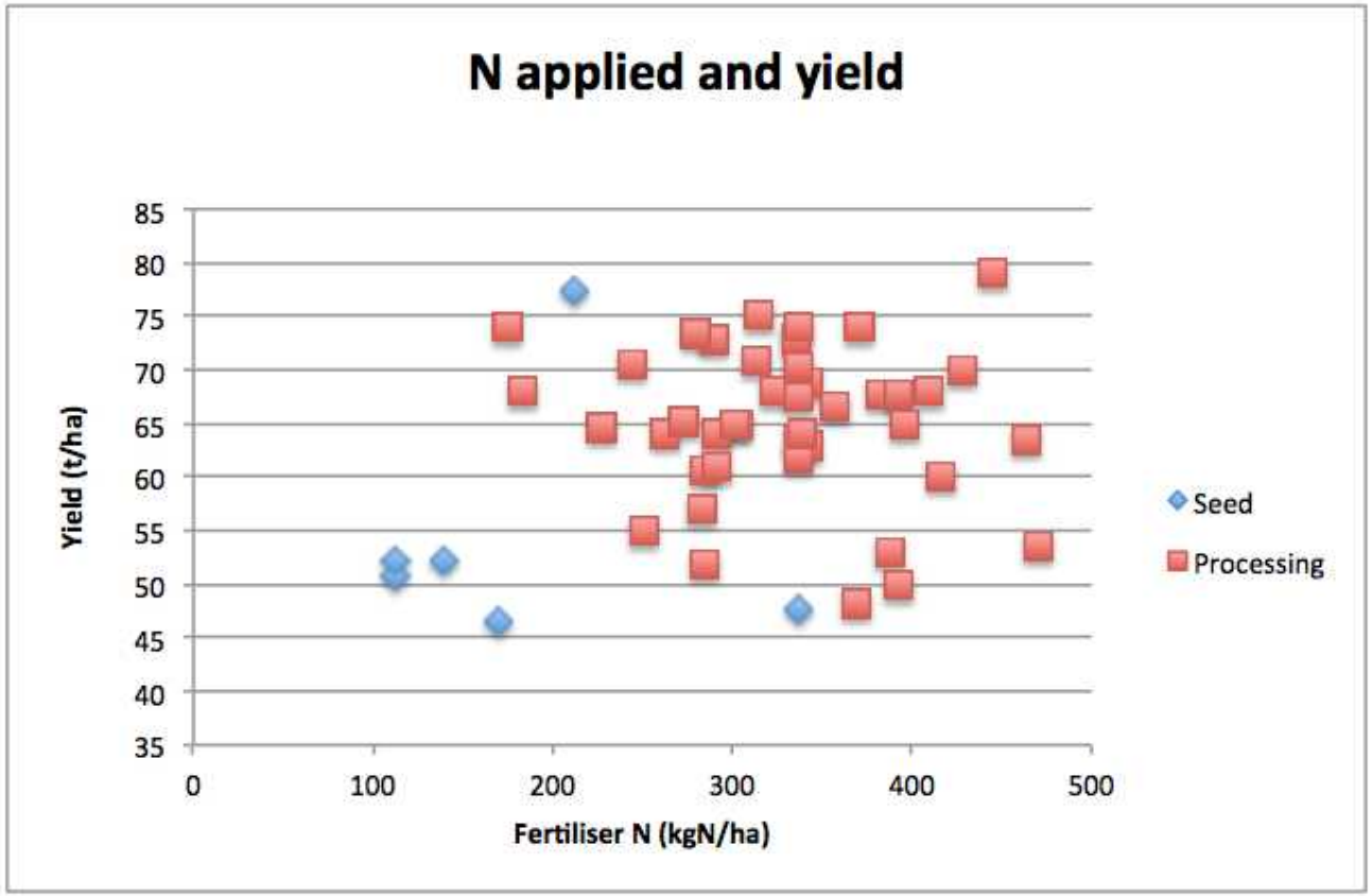
Potato crop NUE% - what the farmer's data tells us

N fertiliser input vs. NUE% (Simplot, Australia)



Potato crop NUE% - what the farmer's data tells us

N fertiliser applied vs. yield (Simplot, Australia)

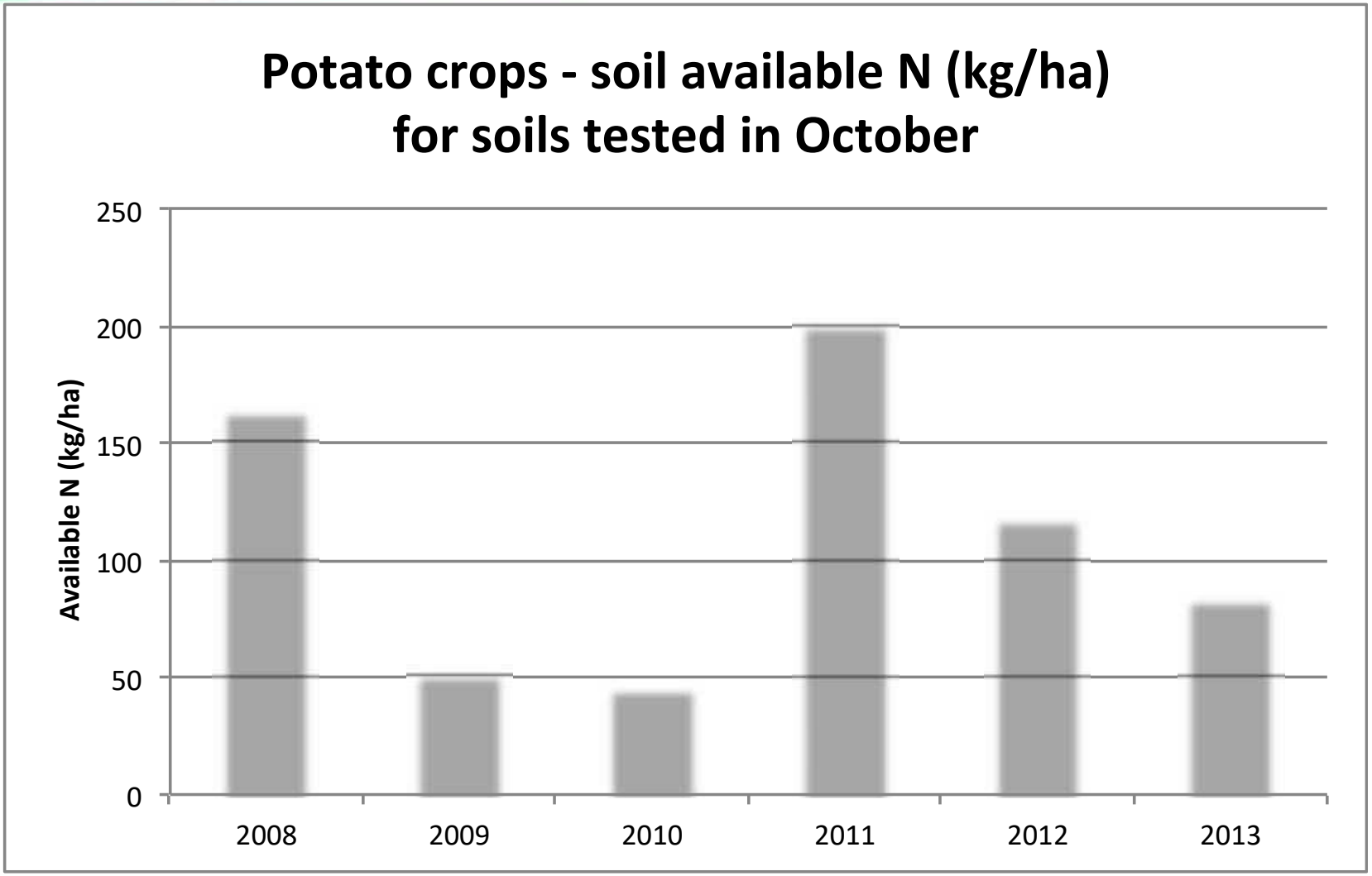


NUE% - what the farmer's data tells us

2015 data from a dairy/cropping farmer

Crop	Fertiliser N input (kg/ha)	N removed (kg/ha)	NUE%
Potatoes (overall)	465	334	72
Potatoes (lowest yielding)	465	284	61
Potatoes (highest yielding)	465	395	85
Poppies	166	57	34

Soil testing



Data: AgVita Analytical

What we found

Crop	Average NUE	Range	n
Poppies	50%	35 – 85%	8
Potatoes	109%	57 – 233%	57
Wheat	160%	93 – 271%	6

How it impacts decision making on farm

N application rate (kg N/ha)	N removal (kg N/ha)	NUE (%)	Interpretation
0	26	-	Soil mining [1]
48	56	116	
96	92	96	Risk of soil mining [2]
144	126	88	Balanced in- and outputs [3]
192	151	79	
240	166	69	Risk of high N losses [4]

(1) Soil mining = N removal exceeds N input -> declining soil fertility and yield = unsustainable

(2) Risk of soil mining = additional N requirement for roots and straw is not met by N input

(3) Balanced in- and outputs = N fertilizer input meets total crop demand (grain, straw, roots)

(4) Risk of high N losses = N fertilizer input exceeds total crop demand -> increased risk of leaching

Data from the long-term “Broadbalk Experiment”, Rothamsted/UK, winter wheat, avg. yield of 1996-2000

Monitoring


6
MONITOR NUE%
Monitor paddock and rotation NUE% over time, adjusting approach as required
1
DETERMINE CROP N REQUIREMENT
Consider removal rates. (eg. 5kgN/t of potatoes and yield expected)
5
REVIEW NUE% AT THE END OF THE SEASON
Calculate the NUE % for the crop, if the figure is low, identify why
Ensure the soil is in good condition, all nutrients are in balance, irrigation is managed well and the crop is healthy
2
CALCULATE N FERTILISER REQUIREMENTS
• Measure soil available N via soil tests (eg. N-check)
• Consider mineralisation (from soil organic matter and previous crop residues)
4
MANAGE AND MONITOR THE CROP
• Monitor available soil N
• Adjust N management and plan as required
• Use plant sap tests
3
PLAN N RATES, FERTILISER TYPES AND TIMING
Aim to match timing with crop needs using split applications.
When applying N, follow the 4 Rs,
1. Right type
2. Right amount
3. Right time
4. Right placement

Key points

- The NUE% data is useful for monitoring efficiency over time

- Starting with complex information is less effective in supporting the decision making process with farmers and advisors

Thank-you

Any questions?

Acknowledgements

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