

The 'Dairy Nitrogen Fertiliser Advisor'

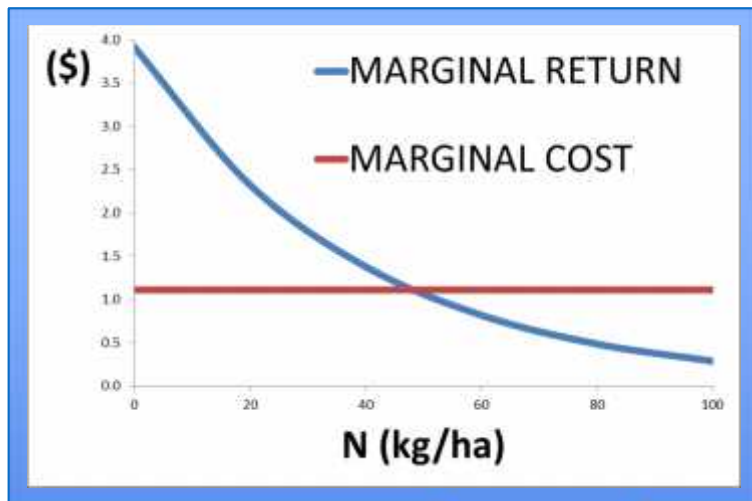
An on-line tool to improve the profitability of nitrogen
fertiliser use on dairy pastures

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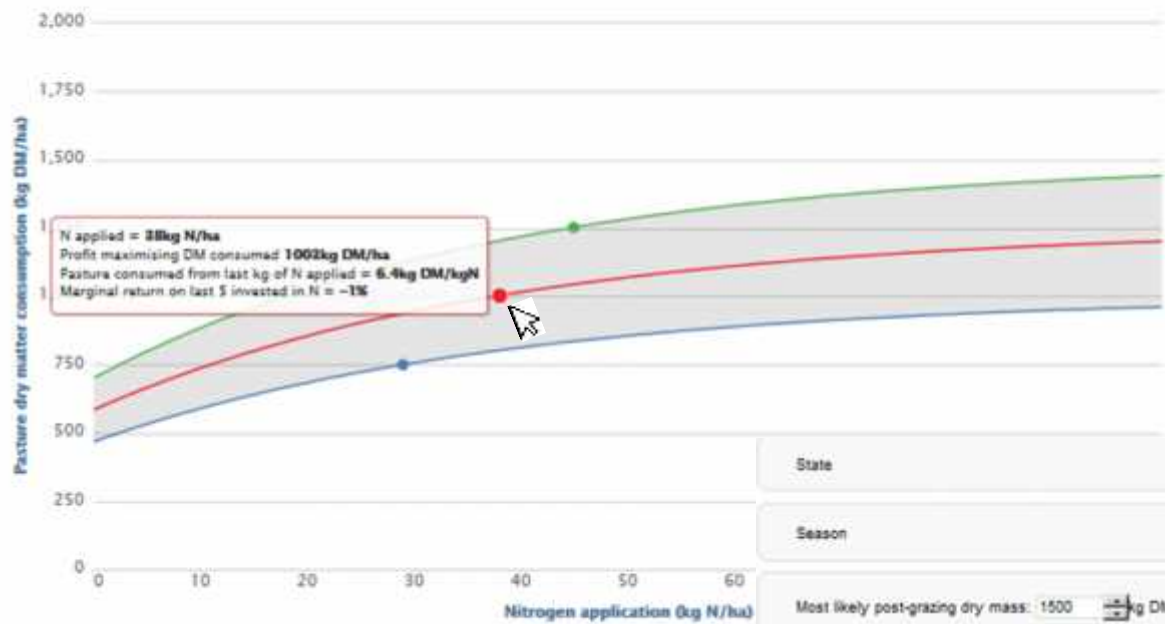


Profit-maximising principles



With their advisors dairy farmers will be able to test their intuition about how much N to apply to a particular paddock, for the particular time of the year, so that the last kilogram adds to profit.

Dairy N Fertiliser Advisor Interface.....



N applied = 38kg N/ha
 Profit maximising DM consumed 1002kg DM/ha
 Pasture consumed from last kg of N applied = 6.4kg DM/kgN
 Marginal return on last \$ invested in N = -1%

- Profit maximising N with most likely pasture consumption
- Profit maximising N with 20% better than expected pasture consumption
- Profit maximising N with 20% worse than expected pasture consumption

State: NSW SA Tas Vic WA

Season: Spring Summer Autumn Winter

Most likely post-grazing dry mass: 1500 kg DM/ha

Most likely pre-grazing dry mass: 2500 kg DM/ha

Market price for pasture consumed: \$ 210 DM

Urea cost 'as spread': \$ 630 t urea

Nitrogen cost 'as spread': \$ 1370 t N



Spare

What's in the text box?

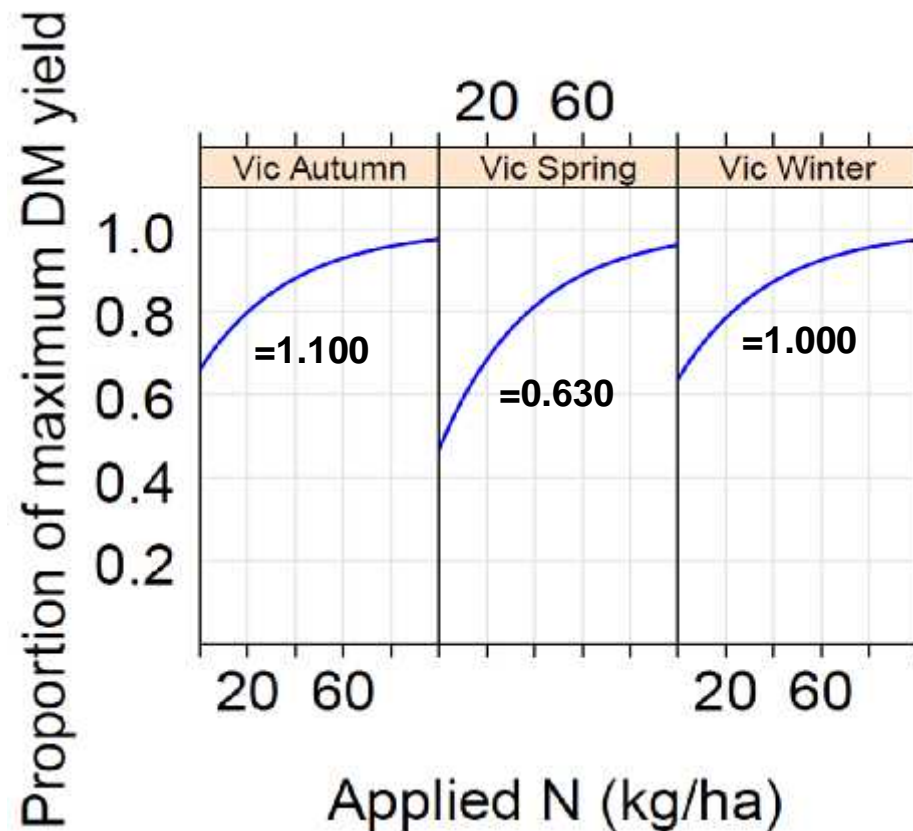
N applied	Pasture consumption	Additional consumption compared with no N	Average pasture consumption per kg N applied	Pasture consumption from last kg of N applied	Value of pasture consumed from last kg of N applied	Cost of last kg of N applied	Return from last kg of N applied	Rate of return on last \$ invested in N
(kg N/ha)	(kg DM/ha)	(kg DM/ha)	(kg DM/kg N)	(kg DM/kg N)	(\$/kg N)	(\$/kg N)	(\$/kgN)	(%)
0	546	-	-	-	-	-	-	-
10	689	143	14.3	12.5	3.07	1.40	1.67	119%
20	799	253	12.7	9.6	2.36	1.40	0.96	69%
30	884	338	11.3	7.4	1.82	1.40	0.42	30%
40	950	403	10.1	5.7	1.40	1.40	0.00	0%
50	1,000	454	9.1	4.4	1.08	1.40	-0.32	-23%
60	1,039	492	8.2	3.4	0.83	1.40	-0.57	-41%
70	1,069	522	7.5	2.6	0.64	1.40	-0.76	-54%
80	1,092	545	6.8	2.0	0.49	1.40	-0.90	-65%
90	1,109	563	6.3	1.6	0.38	1.40	-1.02	-73%
100	1,123	577	5.8	1.2	0.29	1.40	-1.11	-79%

Model of N fertiliser responses

- $Y = \text{max} \cdot (1 - \exp(-k \cdot N))$

3 parameters.....

- Maximum attainable yield when N applied is large and has had sufficient time to express itself ($k = 1$)
- Implicit measure of existing soil nitrogen (max , varies with season and State)
- Measure of curvature (k , constant)



Profit maximising N rate (N*)

N* was obtained by equating the slope of the production function to the ratio of the cost of the input (P_n) to the value of the output (P_{dm}).

$$- \alpha N^{\alpha-1} \exp(-\beta N) = P_n / P_{dm}$$

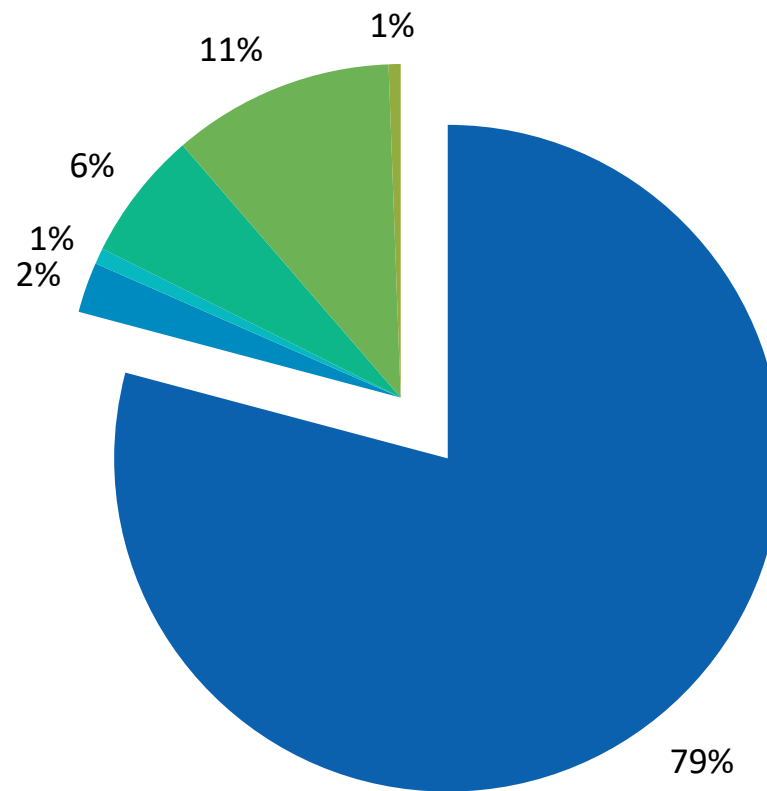
$$\Rightarrow N^* = \left(\frac{1}{\alpha} \right) * \left(\frac{\ln((P_n / P_{dm}) / (-\beta))}{\alpha} \right) + \beta$$

Pre-and post grazing dry-mass:

Picture showing post-grazing residual of 4-6 cm, equivalent to 1,500-1,600 kg dry matter (DM) per ha. Source: <http://www.dairyaustralia.com.au/~media/Documents/Animal%20management/Feed%20and%20nutrition/thirtythirty/3030%20-%20PRG%20I%20-%20Max%20growth%20and%20nutritive%20value%201.pdf>

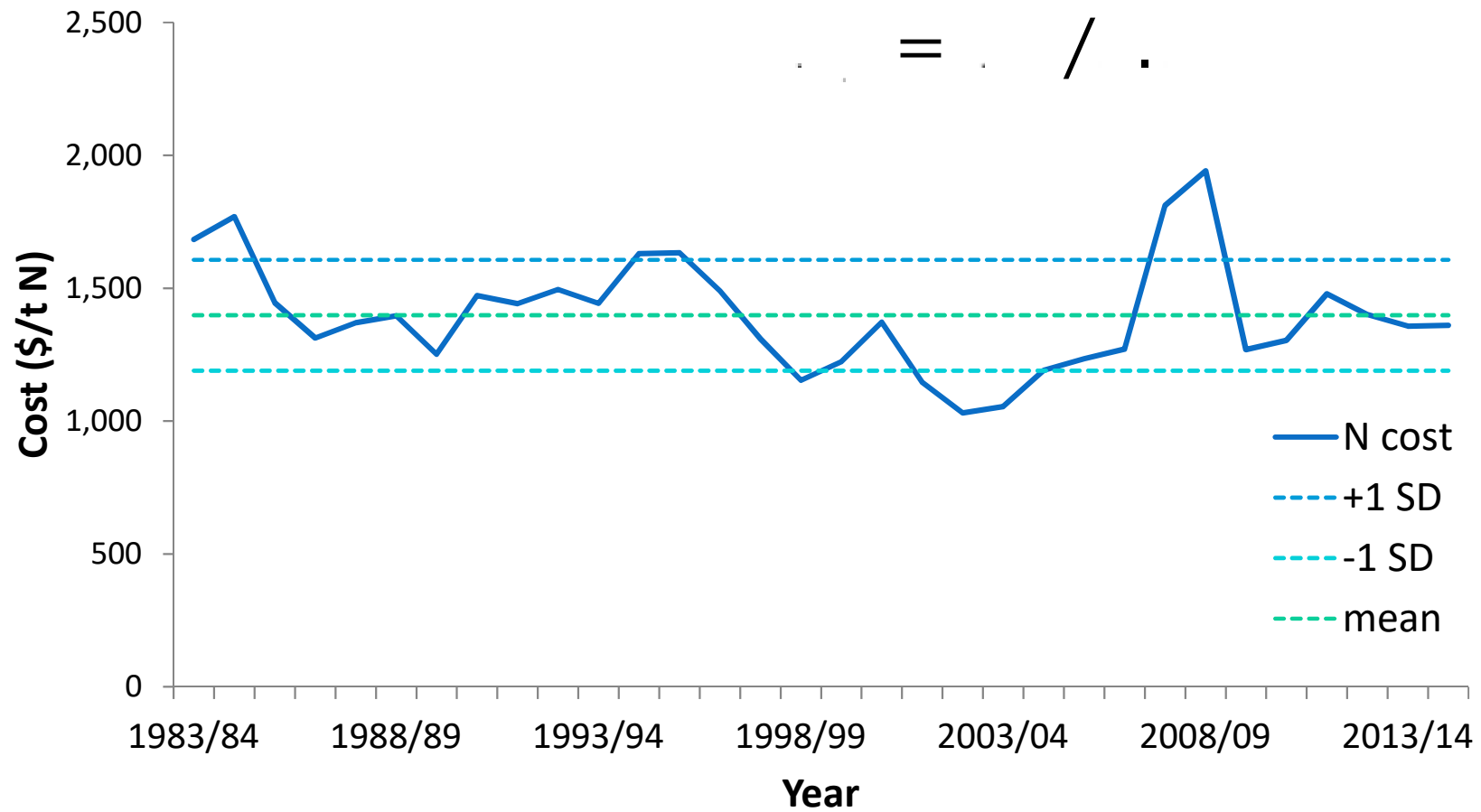


Major N-type fertilisers used in the dairy industry

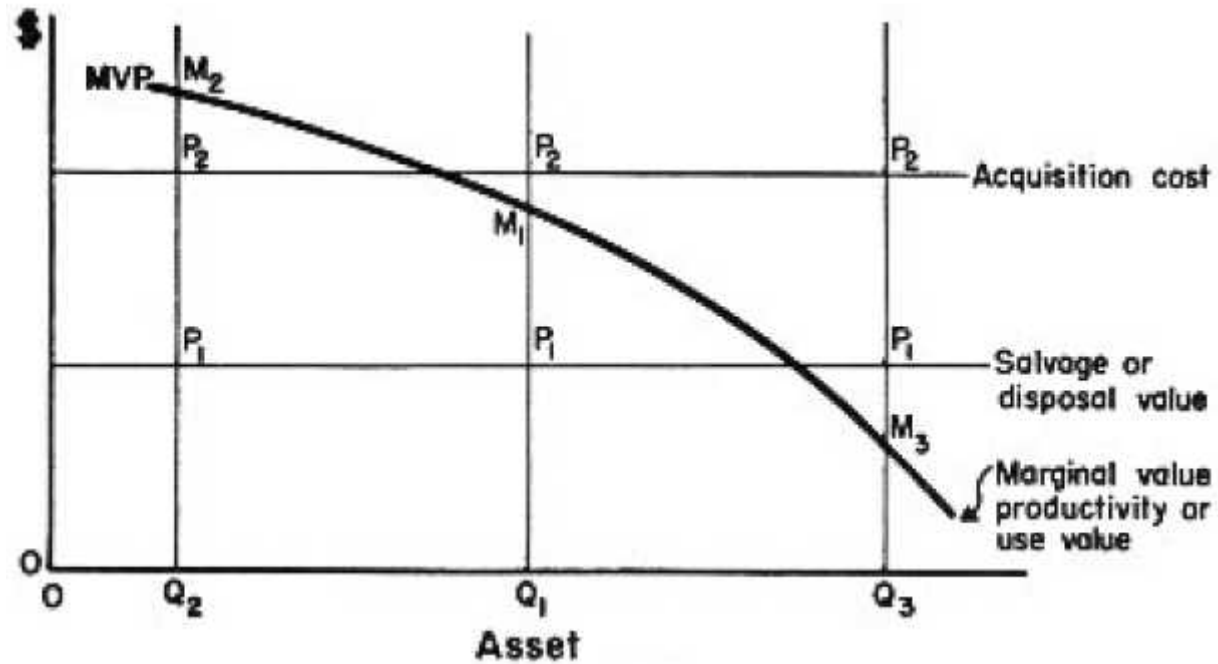


- Urea
- Ammonium sulphate
- Potassium nitrate
- Ammonium Phosphate
- Other specialised blends
- Urea ammonium nitrate

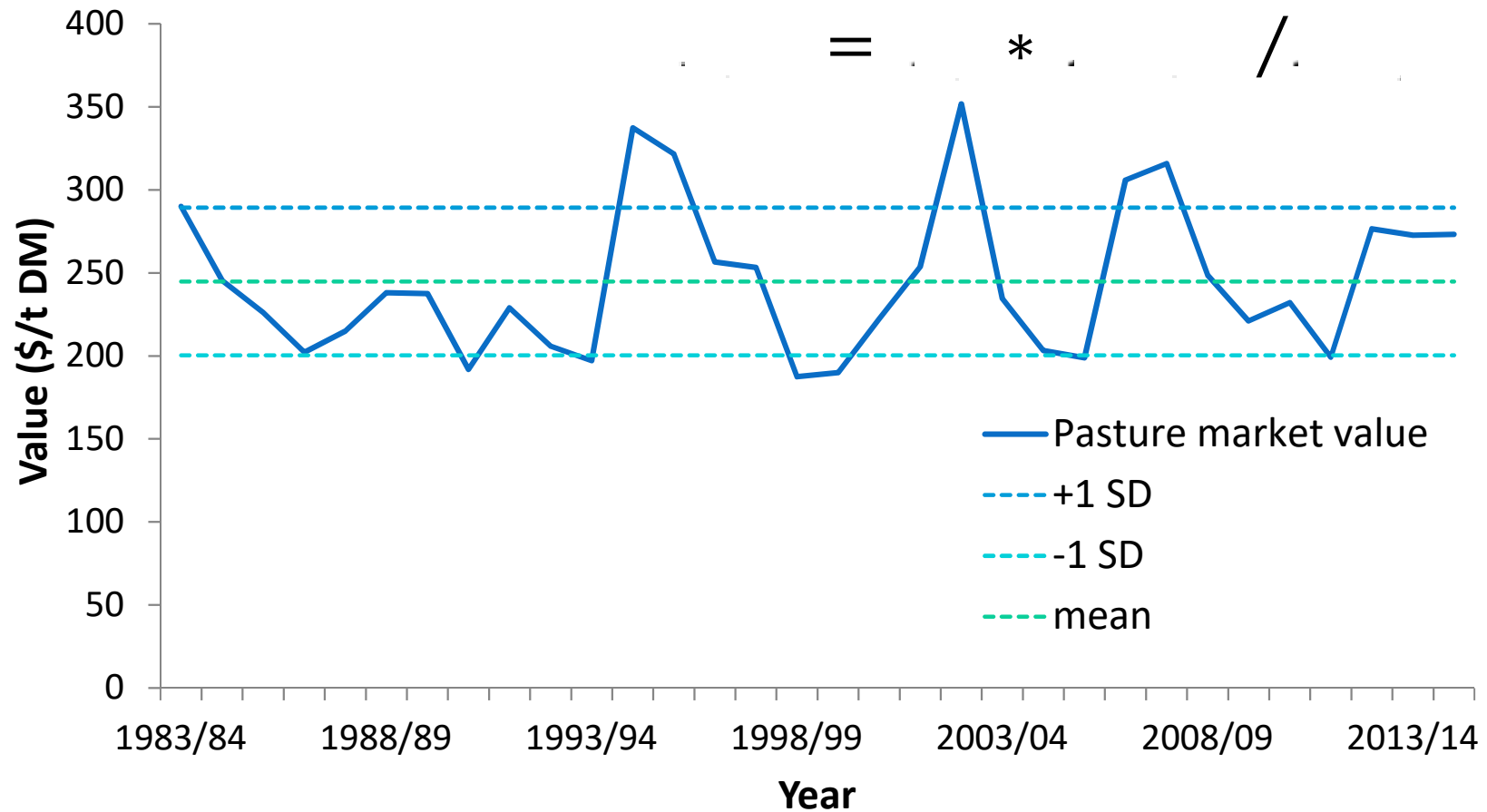
N cost 'as spread' (real)



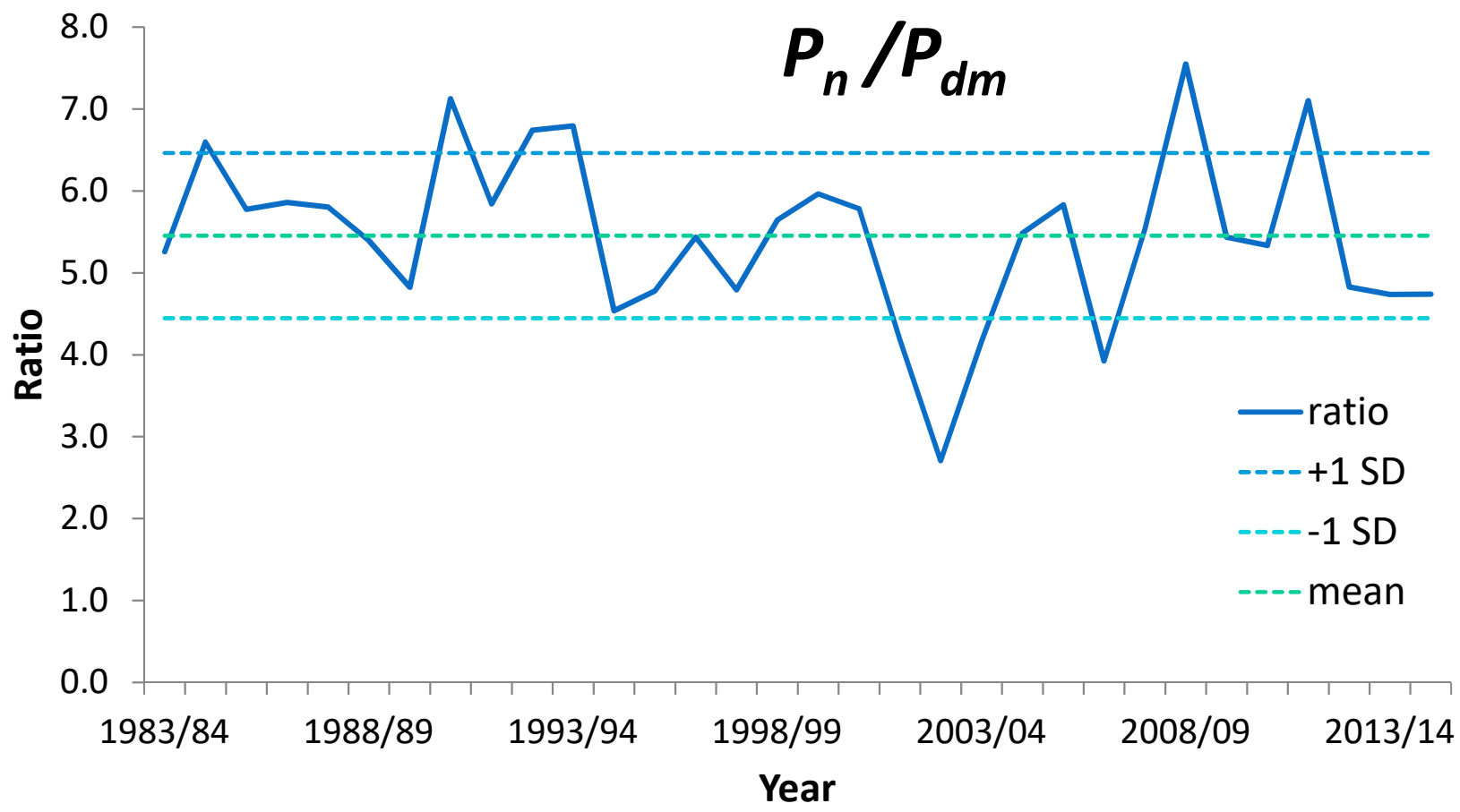
Market value of pasture forage



Equivalent market value of pasture 'delivered' (real)



Ratio of N cost to pasture value



Conclusions

The N-advisor provides production and profitability information that has the rigour and relevance to add value to farmer decision-making about their application of N.

- 40 years of experimental data on N fertiliser responses.
- profit maximising principles
- what-if analysis on risky variables