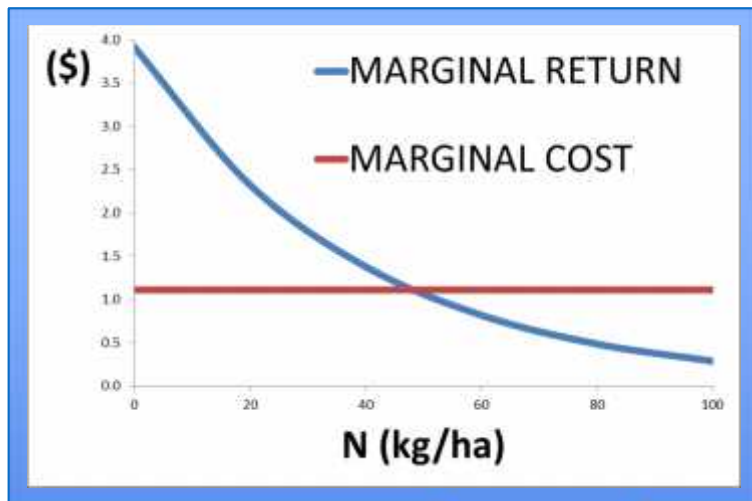# The 'Dairy Nitrogen Fertiliser Advisor'

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

K Stott, M Cox, M Hannah,
C Gourley, B Malcolm

AGRICULTURE VICTORIA

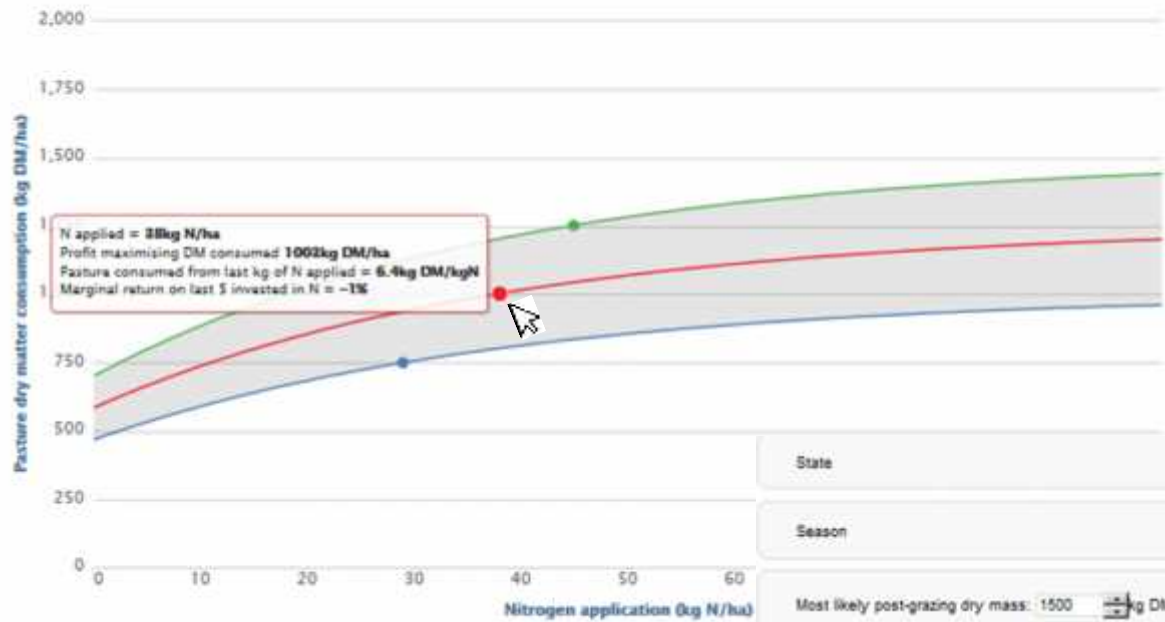# Profit-maximising principles

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.

AGRICULTURE VICTORIA

Dairy N Fertiliser Advisor Interface...............

Spares

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

- $Y = \alpha*(1-\exp(-\beta-\gamma*N))$

3 parameters….

- Maximum attainable yield when N applied is large and has had sufficient time to express itself (α =1)
- Implicit measure of existing soil nitrogen (β, varies with season and State)
- Measure of curvature (γ, constant)
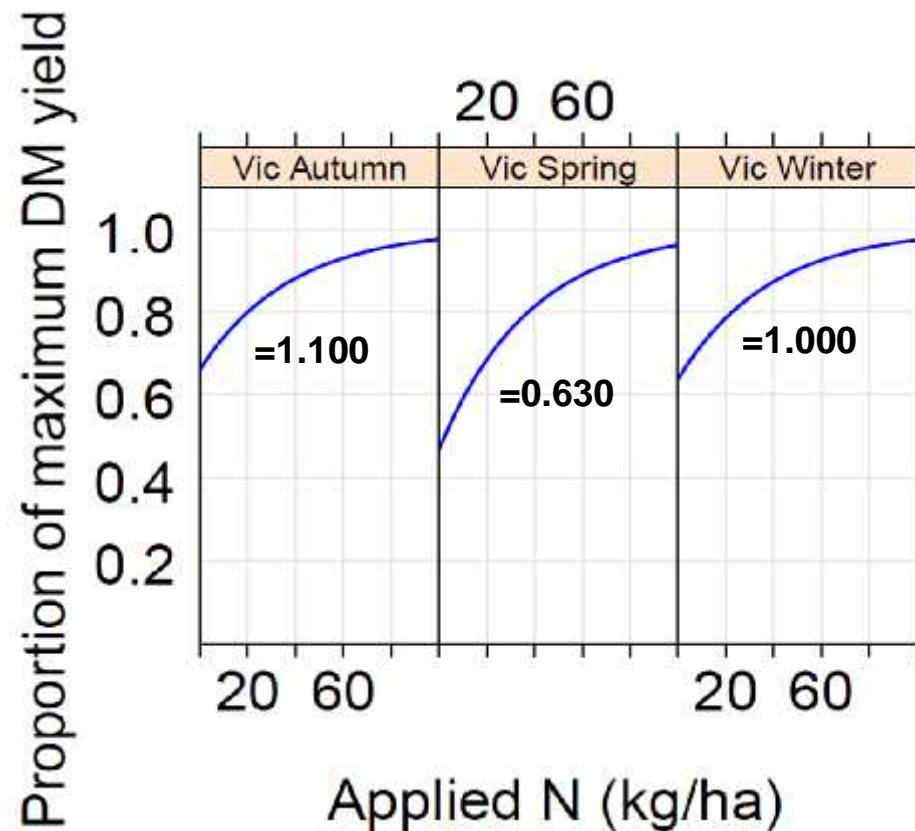
Profit maximising N rate (N*)

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}).
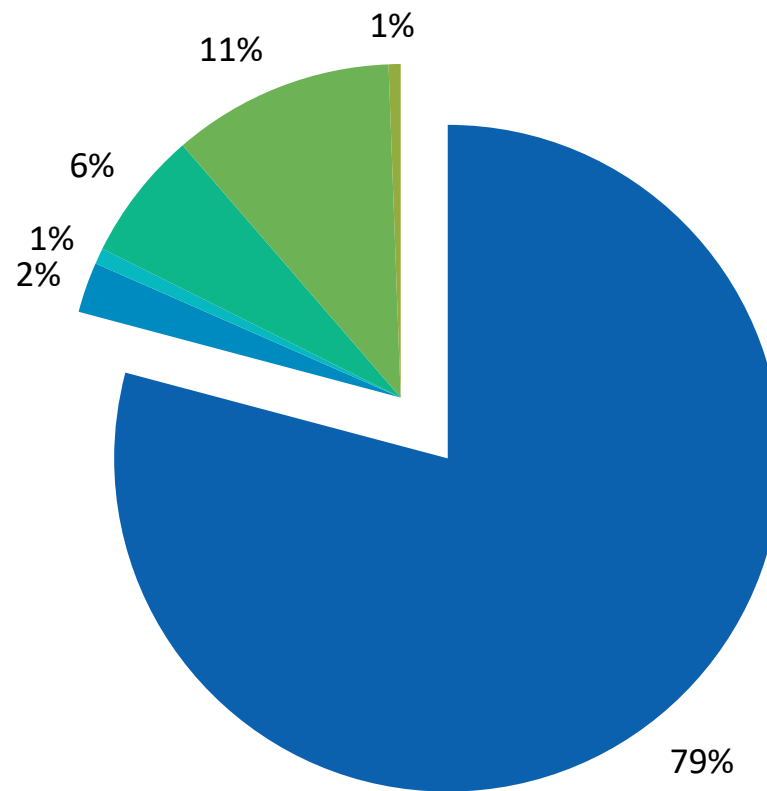
$$* \ *\exp(- \ - \ *N) = P_n/P_{dm}$$

$$=> N^* = \ (1/- \ )*((\ln((P_n/P_{dm})/(\ * \ )))+ \ )$$

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
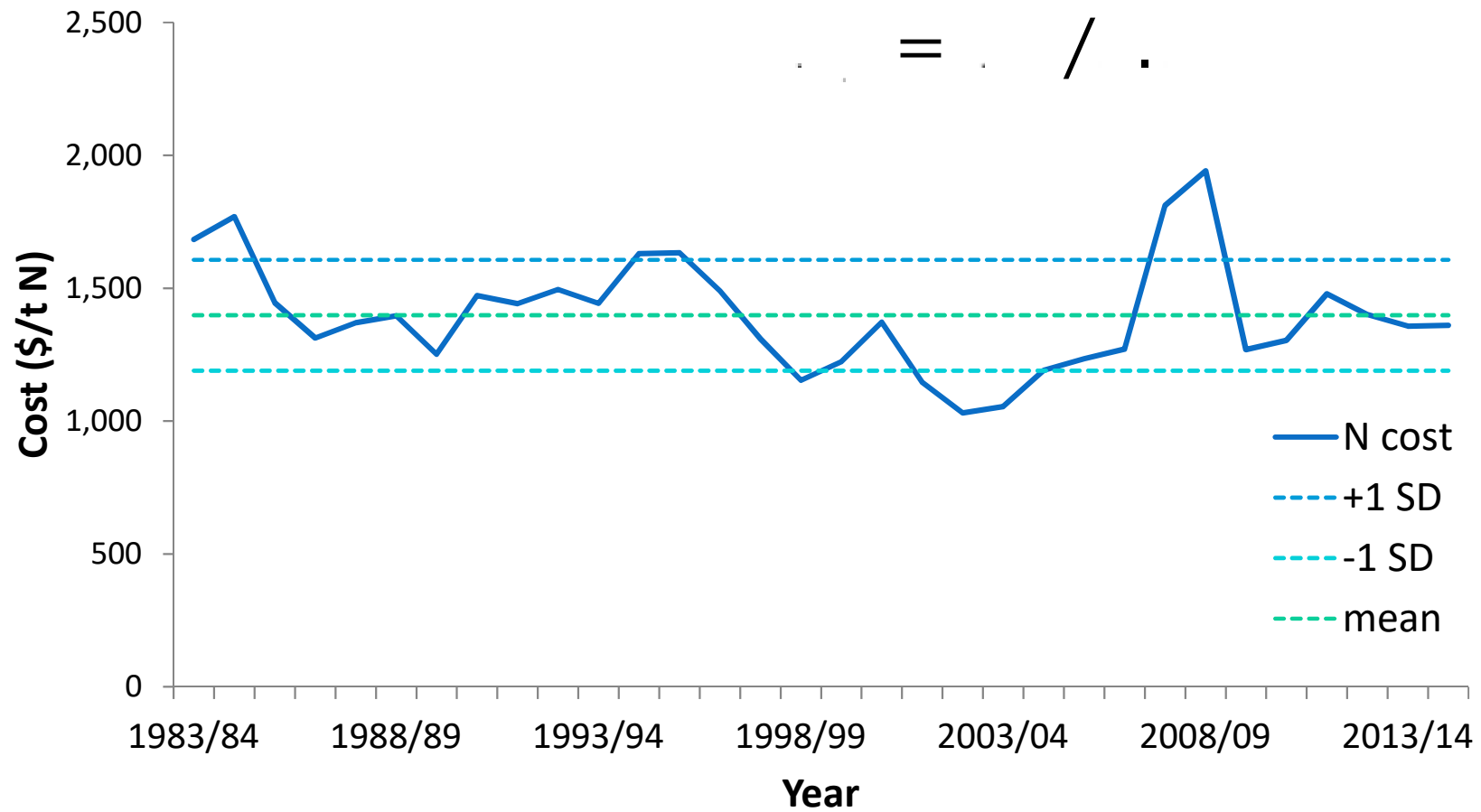
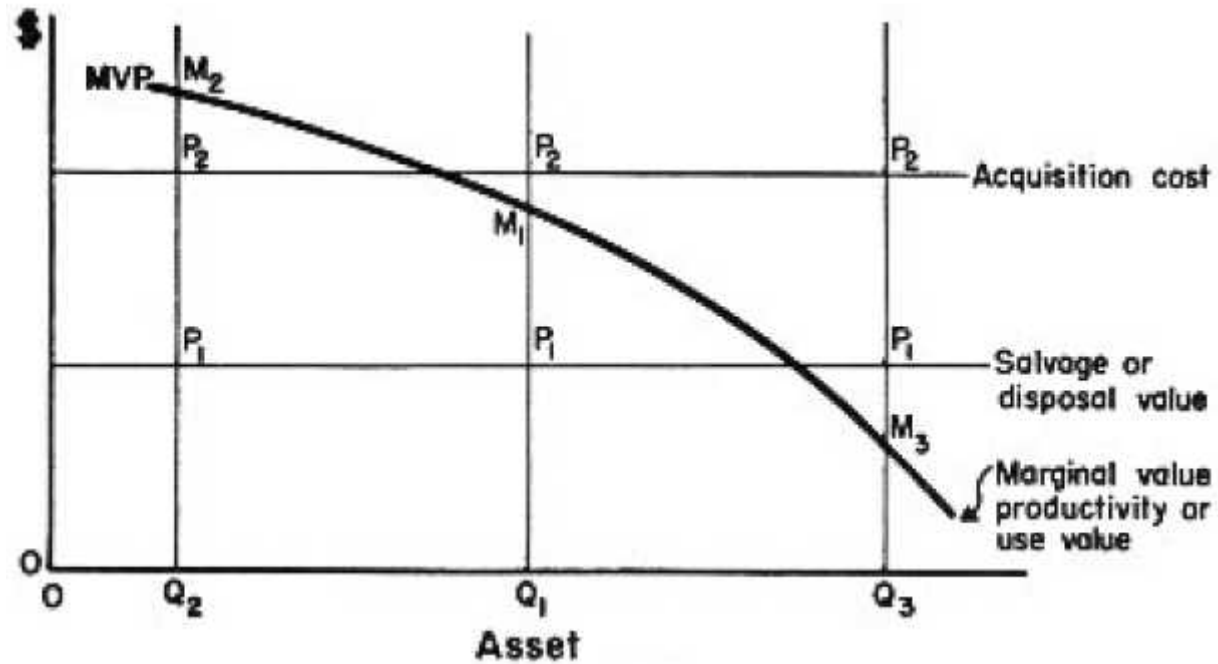# Major N-type fertilisers used in the dairy industry

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

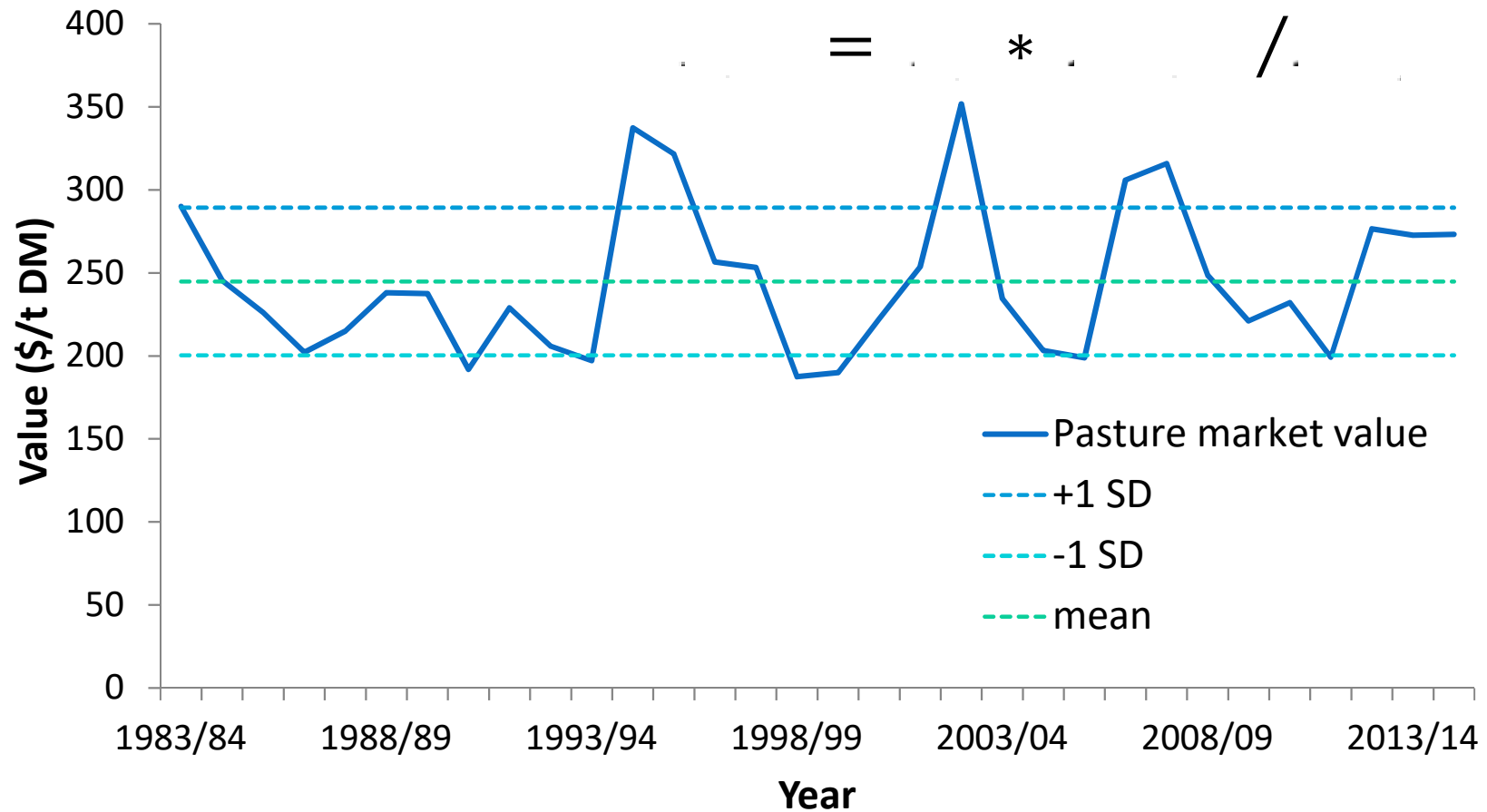Values shown: 79%, 11%, 6%, 2%, 1%, 1%
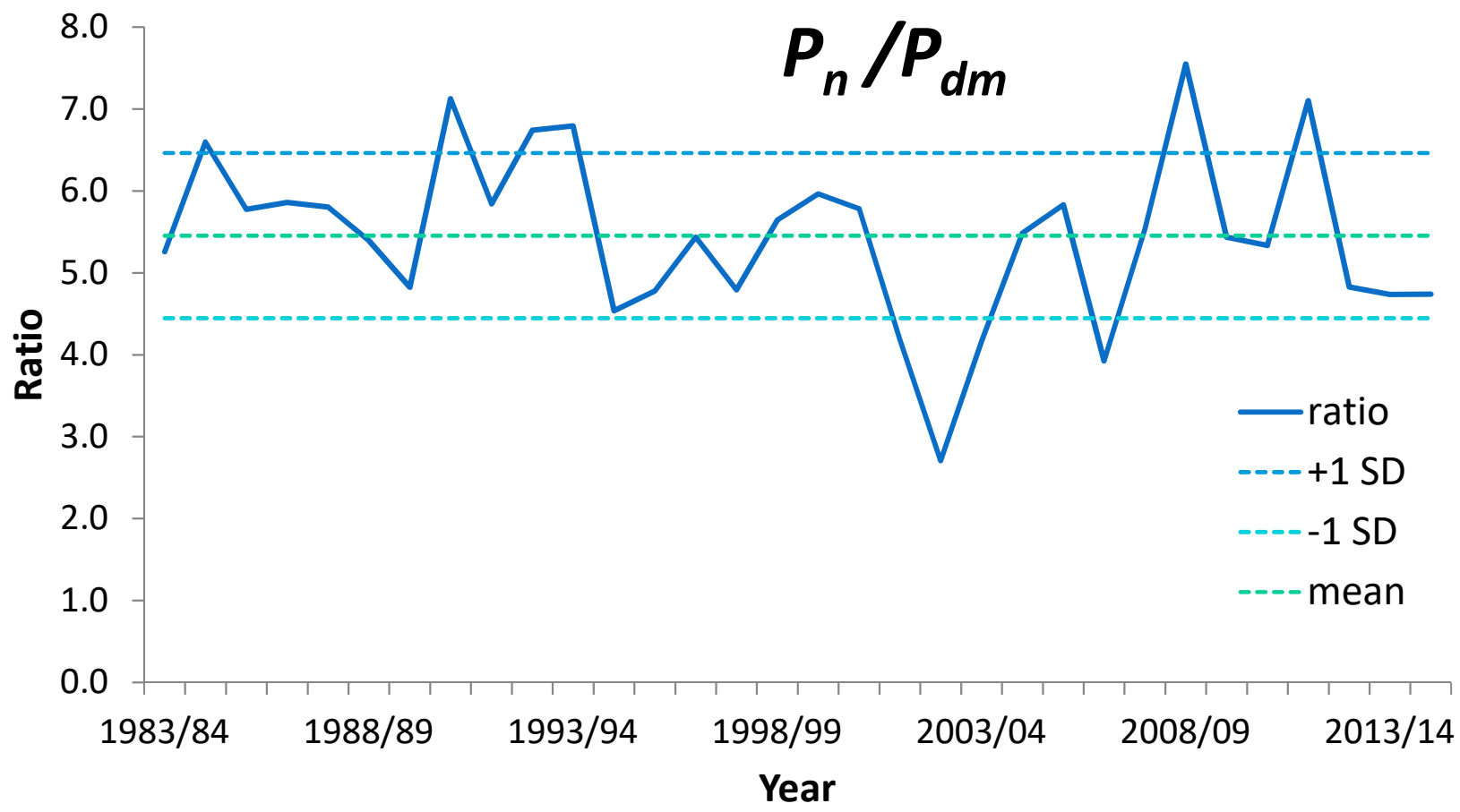
N cost 'as spread' (real)

Market value of pasture forage

Equivalent market value of pasture 'delivered' (real)

Ratio of N cost to pasture value

$$P_n / P_{dm}$$

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

AGRICULTURE VICTORIA