Soil nutrients – the contribution made by purchased feeds

Findings from the "Sustainable dairy farm systems for profit" project

M5 Project Information Series - Studies on Mutdapilly Research Station and subtropical dairy farms 2001 to 2005

Rob CHATAWAY ***edited by Anne CHAMBERLAIN***

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Overview

MANY dairy farms are now importing a substantial amount of concentrates and forages. This feed contains important soil nutrients such as nitrogen (N), phosphorus (P) and potassium (K). These nutrients need to be accounted for - they can either make an important contribution to plant growth when returned to the farm in animal manure, or pose a potential risk of environmental pollution. Good management of animal wastes can lead to savings in purchased fertiliser, and reduce environmental risk.

Industry background

IN the last 20 years, dairy farmers have more than doubled the amount of concentrates (such as grain, molasses) that they feed their cows, and have increased their use of purchased silage and cottonseed.

This has enabled farms to increase their stocking rate and/or milk production per cow. One impact of extra cows and extra purchased feed has been an increase in manure production (dung and urine) on farms.

Most dairy farms are now in what could be considered a 'net positive' nutrient balance, with more nutrients coming onto the farm than leaving it.

This increase in farm nutrient inputs demands greater attention to the management of manure, to prevent it becoming an environmental hazard. Looked at positively, there is potential to significantly reduce the need for bagged fertilisers.

Lessons from the M5 farming systems project

THE aim of the *Sustainable dairy farm systems for profit* project was to research the possibilities and implications of intensifying the common dairy farming systems in the subtropical region and to examine feedlot dairying. The project's M5 farmlets at the Mutdapilly Research Station provided four years of data, through both good and bad farming seasons. Economic goals for all farmlets were set at 10% return on assets and 600,000 L of milk/labour unit.

NB. The 20-cow farmlets were managed under research station conditions and in the low-rainfall Mutdapilly environment, so results cannot be directly extrapolated to commercial farms across Queensland and northern NSW. However, the farmlets project does indicate potential ways forward for similar farming systems in the region.

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Cows in all five farming systems were heavily supplemented with purchased grain, molasses and protein meals (around 10 kg/cow/day). Some systems also relied on the purchase of roughage to overcome feed gaps.

By conducting a *farm gate nutrient balance* for these farming systems – nutrients coming in (via fertilisers, grain, hay) less nutrients going out (via milk, meat) – we were better able to appreciate both the sources of nutrients, and the net balance of nutrients, entering and leaving through the farm gate.

Table 1 describes the farming system in each of the M5 farmlets. *Table 2* shows the productivity of the five farming systems in terms of per cow and unit area production *Table 3* summarises the average amount of purchased concentrate and forage brought on to each farmlet. *Table 4* shows the balance of nutrients coming in and out of the five farming systems via the farm gate; and *Table 5* shows the proportion of total nutrients entering the farm in supplementary feeds.

TABLE 1. THE five farming system farmlets at Mutdapilly (2001-2005).

Farmlet	Description
M1	Raingrown tropical pasture some oats
M2	Limited irrigation pastures
M3	Limited irrigation forage crops and ryegrass
M4	High irrigation pastures and forage crops
M5 feedlot	Feedlot home grown irrigated silage and hay

TABLE 2. MILK production during the 4-years of the project.

Farmlet	Milk production		
	L/cow/yr	L/ha/yr	L/ha from HG forage
M1	6,400	12,500	6,000
M2	6,500	17,800	8,000
M3	6,800	9,000	5,000
M4	7,400	21,000	11,500
M5 feedlot	9,600	41,000	25,500

HG = Home grown

TABLE 3. AVERAGE quantities of purchased feed (per cow per year) used on Mutdapilly farmlets.

Farmlet	Purchased concentrate	Purchased forage
M1	3.0 t	1.4 t hay
M2	3.3 t	0.6 t hay
M3	3.4 t	0.4t hay
M4	3.2 t	0.2 t hay
M5 feedlot	3.2 t	2.9 t silage

All tonnages are “as fed”. For convenience purchased forage is expressed as hay at 85% DM or silage at 38% DM.

TABLE 4. FARMGATE input: output ratios (N, P and K) for Mutdapilly farmlets (2001-2005).

Farmlet	N	P	K
M1	6:1	2:1	4:1
M2	5:1	2:1	4:1
M3	4:1	2:1	2:1
M4	3:1	1.5:1	1.5:1
M5 feedlot	2.5:1	1.5:1	1:1

TABLE 5. THE contribution purchased supplementary feeds (%) made to total farm gate nutrient inputs.

Farmlet	N	P	K
M1	45	65	85
M2	45	70	90
M3	55	55	85
M4	55	60	85
M5 feedlot	80	90	85

Comments

- Farmlets M2, M4 and in particular M5 feedlot, were highly productive in terms of milk production per hectare (*Table 2*).
- With respect to a farmgate nutrient balance, all farmlets were in an overall positive net balance for the three major plant nutrients.
- N inputs, in proportion to outputs, were higher on Farmlets M1 and M2 where there was a stronger emphasis on perennial grass pastures rather than annual crops/grasses and legumes.
- Phosphorus inputs were generally double that of outputs for all farmlets (*Table 4*), and,
- Potassium inputs vs. outputs were generally higher for Farmlets M1 and M2, due to the higher reliance of these two farmlets on molasses and purchased fodder.

- For each of the farmlets, a substantial amount of nutrients came in the form of supplementary feed, ranging from 45 to 80% for N, 55 to 90% for P and 85 to 90% for K (*Table 5*). This heavy reliance on supplementary feeds as a nutrient input source increases the importance of ensuring that manure deposited in loafing and feedout areas is returned to areas of forage production. This will minimize the risk of point source pollution and reduce the requirement for bagged fertilizer. The contribution of purchased supplements to the farmgate N, P, K balance was particularly high for the M5 feedlot farmlet.

Conclusions

- A simple farm gate nutrient balance can be used to quickly identify gross distortions in the whole farm nutrient balance. When used over a period, it will identify trends in the changes in nutrients entering and leaving the farm.
- If a high proportion of nutrients are entering the farm in supplementary feed, this should reduce the demand for bagged fertiliser. However, this will be dependent on how well the manure can be distributed over the farm.
- When complemented by soil tests at the paddock scale, this information can assist in the development of fertiliser programs.

Contacts

Rob Chataway, Mutdapilly Research Station
Environmental issues and cropping systems
Ph (07) 5464 8745
Email: rob.chataway@dpi.qld.gov.au

The *Sustainable Dairy Farm Systems for Profit* project at Mutdapilly Research Station and on associated commercial farms investigated the potential impact of intensification of five subtropical dairy farming systems on business productivity, on the social well being of farming families and on the farm environment.