

# WHOLE FARM NPK BALANCES ON MARITIME DAIRY FARMS

Interim Research Report E2010-59

## BACKGROUND

The overall objective of this project is to estimate whole-farm nutrient budgets for representative farm operations in New Brunswick and PEI for which a nutrient management plan has been performed. Nitrogen, phosphorus and potassium (NPK) will be considered. The results of this research will be used to evaluate current nutrient management planning practices. The information also will indicate the likely trends in soil P content, and levels of excess N contributing to gaseous and water-borne emissions.

In 2009 and 2010, the project is collecting data on twelve farms in New Brunswick and PEI, including some organic and conventionally managed farms.

Information relevant to the flows indicated in Figure 1 is being collected. On most farms, internal flows (horizontal arrows) will be roughly estimated based on manure volume and tests, and approximate crop yield, average nutrient tests and inventory changes. These flows and N fixation are being quantified in greater detail on two of the farms. For most farms, N fixation estimates will be based on total N in forage, multiplied by estimated percent legume in forage, and multiplied by 0.4 for forage cuts following manure application or 0.6 for forage cuts not preceded by manure application. For the two farms studied in detail, quadrat samples of forage are being collected and the <sup>15</sup>N natural abundance technique is being used to estimate N fixation.

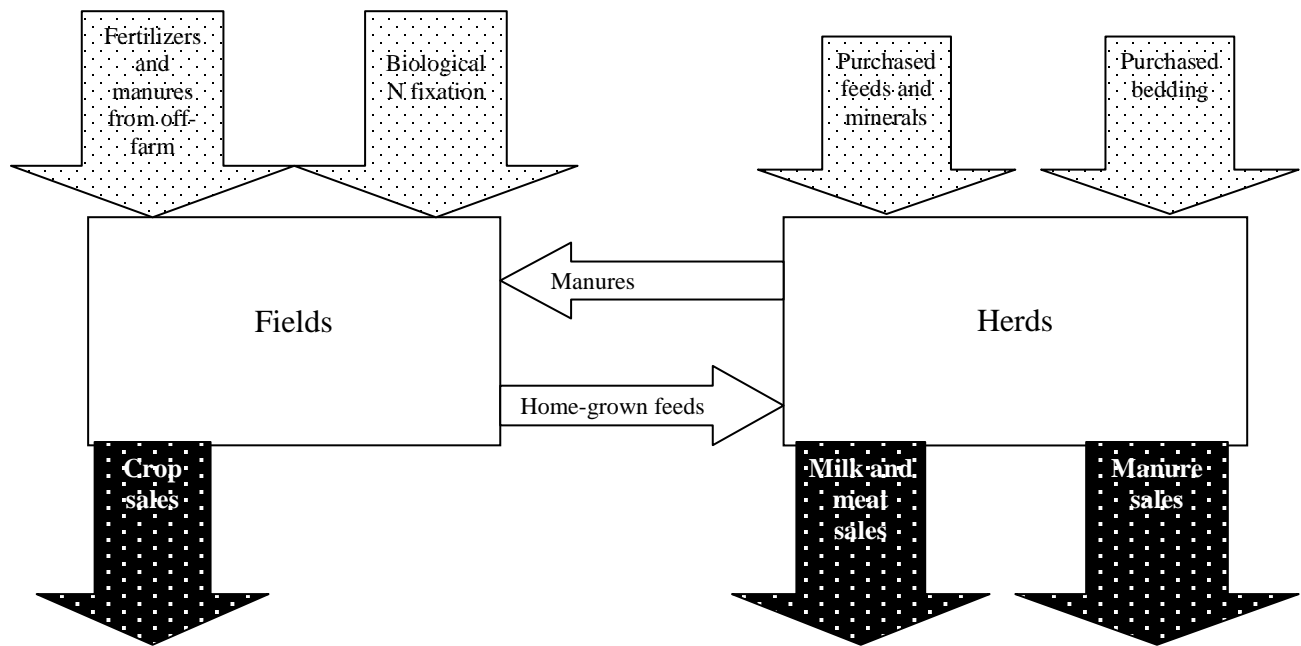


Figure 1. Conceptual NPK balance model. The flows indicated by dotted fill are being monitored in detail.

## INTERIM RESULTS

Data collection is ongoing. Based on interim data, an example nutrient balance has been calculated for one farm. This is shown in Table 1. The final line of Table 1 indicates the net balance on a per hectare basis. The level of nutrient excess (65 kg N ha<sup>-1</sup> and 10.7 kg P ha<sup>-1</sup>) is fairly typical of other studies where most concentrates are purchased. It is notable that the majority of farm nutrient input is in purchased feed, and these numbers are much larger than nutrients exported in milk. Unutilized N is typically emitted at various stages in the cycle, as (in order of magnitude) ammonia, nitrate, nitrogen gas and nitrous oxide, in addition to some portion accumulating in organic matter.

The interim results from the farms studied in greater detail reveal a similar trend to the example N balance presented in Table 1. Examining the flow of nutrients between the fields and herds allows for more specific assessment of farm nutrient utilization. For example, by accounting for the nutrients exported and imported to the field component of a farm, a mean N balance of +76.9 kg N ha<sup>-1</sup> has been observed. Within a farm, there was a large variation from field to field for N balance, encompassing a range of 17-140 kg N ha<sup>-1</sup>. The mean N use efficiency (export/import) for field components was 63.7%.

The whole farm P balance indicates a significant positive P balance that may be expected to lead to a trend of increasing soil P levels over time. Ten kg P ha<sup>-1</sup> y<sup>-1</sup> excess translates to 23 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> y<sup>-1</sup>. These levels of excess are fairly typical of past studies of conventional farms. The project team will continue data collection through 2010, and will participate in review and revision of nutrient management guidelines in New Brunswick.

## CREDITS

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Table 1. Draft whole-farm nutrient balance table for an example farm (using book values for some nutrient analyses)

	N	P
	kg farm <sup>-1</sup> year <sup>-1</sup>	
<b>Inflows:</b>		
Purchased concentrates	5998	1290
Purchased forage	789	108
Purchased livestock	0	0
Purchased fertilizers & composts	0	0
N fixation	1526	0
<b>Total Inflows</b>	<b>8314</b>	<b>1398</b>

<b>Outflows:</b>		
Milk sales	2489	423
Livestock sales	135	43
Feed sales	0	0
Manure/compost sales	0	0
<b>Total Outflows</b>	<b>2624</b>	<b>467</b>

Utilization: Export/Import (%)	31.6%	33.4%
Net Import - Export (kg)	5690	931
Hectares	87	87
<b>(Import - Export)/Hectares (kg ha<sup>-1</sup>)</b>	<b>65</b>	<b>10.7</b>

## THE BOTTOM LINE...

Nutrient balance on dairy farms can often be traced back to purchased feed concentrates. These excess nutrients are passed on to the fields where they may be lost or accumulate in the soil.

## FUNDING

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