Impact of Importing Feed on the Farm Nutrient Balance

John A. Lory, Ph.D.

University of Missouri Extension
Nutrient Balance Concept

Inputs

Outputs

Your Farm
Nutrient Balance Concept

Inputs

Outputs

Your Farm
Nutrient Balance Concept

Inputs

Outputs

Your Farm

BALANCE +

Nutrient Accumulation
Nutrient Balance Concept

Inputs

Outputs

Your Farm

BALANCE - Nutrient Depletion
Farm Nutrient Balance

Inputs

What are Inputs and Outputs on Your Farm for N, P and K?

Outputs
# Farm Nutrient Balance

## Inputs

**Managed**
- Purchased feed*
  - Concentrates
  - Bought hay
  - Silage
- Fertilizer
  - N fixation by legumes
  - Purchased fertilizer
- Bought calves and cows

## Outputs

**Managed**
- Milk*
- Sold calves and cows

**Un-Managed**
- N loss from manure*
Farm Nutrient Balance

What is the Impact?

Imported Hay

Concentrate Fed in the Barn
Example Grazing Dairy -36

• 1 cow/acre
• Milk Production ~12,000 lbs/cow/yr
• Feed Profile
  – % Imported DM – 36%
  – Concentrate - 1.5 T/cow/yr
  – Bought Alfalfa - 0.84 T/cow/yr
<table>
<thead>
<tr>
<th>Nutrient Balance Concept</th>
</tr>
</thead>
</table>

**Inputs**

- N = 120
- P = 17
- K = 68

**Outputs**

- N = -123
- P = +5
- K = +50

**BALANCE: GD36**

- N = 243
- P = 12
- K = 18

Units: lb/cow
## Nutrient Balance Concept

**Inputs**

- Concentrate (1.5 T/cow/yr)
  - N = 64.4 lb/cow
  - P = 11.8 lb/cow
  - K = 25.8 lb/cow

- Alfalfa (0.8 T/cow/yr)
  - N = 56.1 lb/cow
  - P = 5.1 lb/cow
  - K = 42.3 lb/cow

**Outputs**

- **Managed**
  - Milk (12,000 lb)
    - N = 62.2 lb/cow
    - P = 12.1 lb/cow
    - K = 18.2 lb/cow

- **Un-Managed**
  - N loss from manure
    - N = 181 lb/cow

Example Dairy GD36
Example Grazing Dairy -51

• 0.75 cow/acre
• Milk Production ~12,000 lbs/cow/yr
• Feed Profile
  – % Imported DM – 51%
  – Concentrate - 1.5 T/cow/yr
  – Bought Alfalfa – 1.2 T/cow/yr
  – Bought Hay – 0.6 T/cow/yr
Example Grazing Dairy -0

- 1.4 cow/acre
- Milk Production ~9,000 lbs/cow/yr
- Feed Profile
  - % Imported DM – 0%
  - Concentrate - 0 T/cow/yr
  - Bought Alfalfa – 0 T/cow/yr
  - Bought Hay = 0 T/cow/yr
## Impact of Imported Feed on Farm Nutrient Balance

<table>
<thead>
<tr>
<th>GD0 BALANCE</th>
<th>GD36 BALANCE</th>
<th>GD51 BALANCE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>N</strong> = - 227</td>
<td><strong>N</strong> = - 123</td>
<td><strong>N</strong> = - 75</td>
</tr>
<tr>
<td><strong>P</strong> = - 9</td>
<td><strong>P</strong> = + 5</td>
<td><strong>P</strong> = + 10</td>
</tr>
<tr>
<td><strong>K</strong> = - 14</td>
<td><strong>K</strong> = + 50</td>
<td><strong>K</strong> = + 90</td>
</tr>
</tbody>
</table>

Units: lb/cow
## Impact of Imported Feed on Farm Nutrient Balance

<table>
<thead>
<tr>
<th>GD0 Balance</th>
<th>GD36 Balance</th>
<th>GD51 Balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = -227</td>
<td>N = -123</td>
<td>N = -75</td>
</tr>
<tr>
<td>P = -9</td>
<td>P = +5</td>
<td>P = +10</td>
</tr>
<tr>
<td>K = -14</td>
<td>K = +50</td>
<td>K = +90</td>
</tr>
</tbody>
</table>

Feed Fertilizer Value

- 0
- ~$85
- ~$130

**Units:** lb/cow, $/cow
Conclusions:

- Imported feed = fertilizer for your farm.
- Farms with imported feed are typically phosphorus and potassium neutral or surplus... on average.
Nutrient Balance: Within the Farm

Where do the nutrients go?
Where do the nutrients go?

- Milk Tank
- Manure Storage
- Laneways
- Paddocks
Where does the phosphorus go?

- Purchased Concentrate: 12
- Purchased Alfalfa: 5
- Grazed Forage: 19
- Fed Forage: 8
- Milk: 12

Excreted:
- While Grazing: 15
- While Eating Hay: 13
- To Storage: 2
- To Laneways: 2

Export: 27

Paddocks

+3

Returned: 30

GD36 - Units: lb P/cow/yr
Where does the phosphorus go?

- Grazed Forage: 19
- Fed Forage: 8
- Purchased Concentrate: 12
- Purchased Alfalfa: 5

**Graze Only**
- Balance: -4

**Graze, Fed Hay**
- Balance: +1

**Graze, Winter**
- Balance: +6

**Export:**
- 10
- 10
- 7

**Returned:**
- 6
- 11
- 13

**To Storage:**
- 2

**To Laneways:**
- 2

**While Grazing:**
- 15

**While Eating Hay:**
- 13

**Balance:**
- +6

**Milk:**
- 12

GD36 - Units: lb P/cow/yr
Where does the nitrogen go?

Purchased Concentrate: 64
Purchased Alfalfa: 56
Grazed Forage: 201
Fed Forage: 59

Milk: 62

Excreted:
- While Grazing: 160
- While Eating Hay: 120
- To Storage: 17
- To Lanes: 22

N Losses: 184

Graze Only
Balance: -72

Graze, Fed Hay
Apply Manure
Balance: -41

Graze, Winter
Balance: -13

Returned: 26
Returned: 57
Returned: 52

Export: 98
Export: 98
Export: 65

GD36 - Units: lb P/cow/yr
Where does the phosphorus go?

- Graze Only
  - Balance: - 4
- Graze, Fed Hay
  - Apply Manure
  - Balance: + 1
- Graze, Winter
  - Balance: + 6

Purchased Concentrate: 12
Purchased Alfalfa: 5
Grazed Forage: 19
Fed Forage: 8
Milk: 12

Excreted
- While Grazing: 15
- While Eating Hay: 13
- To Storage: 2
- To Lane ways: 2

Export: 10
Returned: 6

Export: 10
Returned: 11

Export: 7
Returned: 13

GD36 - Units: lb P/cow/yr
### Loading the Laneways:

<table>
<thead>
<tr>
<th>Cows</th>
<th>Laneway</th>
<th>P/A</th>
</tr>
</thead>
<tbody>
<tr>
<td>100</td>
<td>0.5 miles</td>
<td>164 lbs</td>
</tr>
<tr>
<td>100</td>
<td>1.0 mile</td>
<td>82 lbs</td>
</tr>
</tbody>
</table>

- Assume 20-ft wide laneway
Conclusions:

• Imported feed = fertilizer for your farm.
• Your farm is a patchwork of nutrient surplus and nutrient deficit paddocks.
• Nutrient balance calculations help you understand where fertilizer is needed on your farm.
Supplemental Information
Example Grazing Dairy -51

- 0.75 cow/acre
- Milk Production ~12,000 lbs/cow/yr
- Feed Profile
  - % Imported DM – 51%
  - Concentrate - 1.5 T/cow/yr
  - Bought Alfalfa – 1.2 T/cow/yr
  - Bought Hay – 0.6 T/cow/yr
## Nutrient Balance Concept

### Inputs

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amount (lb/cow)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>164</td>
</tr>
<tr>
<td>P</td>
<td>22</td>
</tr>
<tr>
<td>K</td>
<td>108</td>
</tr>
</tbody>
</table>

### Outputs

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amount (lb/cow)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>-75</td>
</tr>
<tr>
<td>P</td>
<td>+10</td>
</tr>
<tr>
<td>K</td>
<td>+90</td>
</tr>
</tbody>
</table>

### BALANCE: GD51

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Amount (lb/cow)</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>239</td>
</tr>
<tr>
<td>P</td>
<td>12</td>
</tr>
<tr>
<td>K</td>
<td>18</td>
</tr>
</tbody>
</table>
Nutrient Balance Concept

**Inputs**

- Concentrate (1.5 T/cow/yr) Managed
  - $N = 64.4$ lb/cow
  - $P = 11.8$ lb/cow
  - $K = 25.8$ lb/cow

- Alfalfa (1.2 T/cow/yr)
  - $N = 77.0$ lb/cow
  - $P = 6.6$ lb/cow
  - $K = 57.9$ lb/cow

- Bought Hay (0.6 T/cow/A)
  - $N = 23.0$ lb/cow
  - $P = 2.9$ lb/cow
  - $K = 24.2$ lb/cow

**Outputs**

- Milk
  - $N = 62.2$ lb/cow
  - $P = 12.1$ lb/cow
  - $K = 18.2$ lb/cow

- Un-Managed
  - N loss from manure*
    - $N = 177$ lb/cow

Example Dairy GD51
Example Grazing Dairy -0

- 1.4 cow/acre
- Milk Production ~9,000 lbs/cow/yr
- Feed Profile
  - % Imported DM – 0%
  - Concentrate - 0 T/cow/yr
  - Bought Alfalfa – 0 T/cow/yr
  - Bought Hay – 0 T/cow/yr
## Nutrient Balance Concept

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>lb/cow</td>
<td>lb/cow</td>
</tr>
</tbody>
</table>

### BALANCE: GD0

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>N</td>
<td>0</td>
<td>-227</td>
</tr>
<tr>
<td>P</td>
<td>0</td>
<td>-9</td>
</tr>
<tr>
<td>K</td>
<td>0</td>
<td>-14</td>
</tr>
<tr>
<td></td>
<td>N = 227</td>
<td>P = 9</td>
</tr>
<tr>
<td></td>
<td>K = 14</td>
<td></td>
</tr>
</tbody>
</table>
Nutrient Balance Concept

**Inputs**

- **Concentrate (1.5 T/cow/yr)**
  - Managed
  - $N = 0$ lb/cow
  - $P = 0$ lb/cow
  - $K = 0$ lb/cow

- **Alfalfa (1.2 T/cow/yr)**
  - $N = 0$ lb/cow
  - $P = 0$ lb/cow
  - $K = 0$ lb/cow

- **Bought Hay (0.6 T/cow/A)**
  - $N = 0$ lb/cow
  - $P = 0$ lb/cow
  - $K = 0$ lb/cow

**Outputs**

- **Milk**
  - $N = 46.3$ lb/cow
  - $P = 9.0$ lb/cow
  - $K = 13.6$ lb/cow

**Un-Managed**

- **N loss from manure**
  - $N = 181$ lb/cow

Example Dairy GD0