EFFLUENT MANAGEMENT ON A DAIRY SHEEP FARM

RESEARCH AIM 1.4: ENVIRONMENTAL FOOTPRINT

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AgResearch
OUTLINE

• Overview of Research Aim – Environmental Footprint
• Effluent characteristics
  • Effluent volumes
  • Effluent concentrations
  • Comparison with other dairying systems
• Effluent delivery systems
• Rules and Regulations
OVERVIEW OF ENVIRONMENTAL FOOTPRINT RESEARCH AIM

Objective 1: Understanding the dairy sheep farm system
   » Literature Review
   » Case study farm nutrient flows

Objective 2: Characterising dairy sheep effluent
   » Characterise nutrient and bacteria contents
   » Understand volumes and flows
   » Develop best management practices

Objective 3: Understand the modelling framework
   » Information required to incorporate dairy sheep into OVERSEER® nutrient budget model

Objective 4: Design a low N footprint dairy sheep farm system
   » $ profit per unit N leached

Objective 5: Dairy sheep farming as a low N emitter to water
   » Field validation research trials
OBJECTIVE 2: CHARACTERISING DAIRY SHEEP EFFLUENT

Aim:
• Characterising the nutrient contents on our case study farms
• Quantifying the volumes and flows of effluent

Outcome:
• Report on dairy sheep effluent based on case study farm data
• Factsheet on dairy sheep effluent good management practices
UNDERSTANDING DAIRY SHEEP EFFLUENT

Information collected:

1. Estimates of dairy shed wash down volumes

2. Effluent sampling for laboratory analysis of nutrient composition

3. Effluent measurements from delivery systems to calculate hydraulic and nutrient loadings to land
EFFLUENT VOLUMES

Effluent comprises:
- Stock excreta at dairy shed
- Dairy shed and holding yard wash down
- Milk vat cleaning (not necessarily daily)
- Once vs twice a day milking

Rainfall:
- Holding yard
• Effluent generated from dairy sheds
  = 5-10 L/ewe/day
  (50-70 L/cow/day)

• If sheep are housed in barns - effluent volumes increase considerably
  = 15-20 L/ewe/day
## DAIRY SHEEP SUMP EFFLUENT COMPOSITION

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Mean</th>
<th>Median</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solids (% DM)</td>
<td>0.36</td>
<td>0.24</td>
<td>0.11 – 1.42</td>
</tr>
<tr>
<td>Nitrogen (kg/m³)</td>
<td>0.170</td>
<td>0.144</td>
<td>0.045 – 0.465</td>
</tr>
<tr>
<td>Phosphorus (kg/m³)</td>
<td>0.031</td>
<td>0.030</td>
<td>0.010 – 0.056</td>
</tr>
<tr>
<td>Potassium (kg/m³)</td>
<td>0.145</td>
<td>0.135</td>
<td>0.065 – 0.270</td>
</tr>
<tr>
<td>Sulphur (kg/m³)</td>
<td>0.019</td>
<td>0.017</td>
<td>0.007 – 0.057</td>
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</tbody>
</table>
# COMPARISON OF DAIRY EFFLUENTS

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Sheep</th>
<th>Goat</th>
<th>Cow</th>
</tr>
</thead>
<tbody>
<tr>
<td>Solids (% DM)</td>
<td>0.4</td>
<td>1.4</td>
<td>0.9</td>
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<tr>
<td>Nitrogen (kg/m³)</td>
<td>0.17</td>
<td>0.21</td>
<td>0.45</td>
</tr>
<tr>
<td>Phosphorus (kg/m³)</td>
<td>0.03</td>
<td>0.06</td>
<td>0.07</td>
</tr>
<tr>
<td>Potassium (kg/m³)</td>
<td>0.15</td>
<td>0.15</td>
<td>0.37</td>
</tr>
<tr>
<td>Sulphur (kg/m³)</td>
<td>0.02</td>
<td>0.14</td>
<td>0.06</td>
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<tr>
<td>Nutrient value ($/m³)</td>
<td>5.00</td>
<td>7.00</td>
<td>12.60</td>
</tr>
</tbody>
</table>
RELATIONSHIP BETWEEN NITROGEN AND SOLIDS CONTENT OF EFFLUENTS

$R^2 = 0.55839$
EFFLUENT MANAGEMENT SYSTEMS

Storage

Sump

Stone trap

Stormwater

Images sourced from DairyNZ
EFFLUENT DELIVERY SYSTEMS

- Travelling irrigator
- Stationary rain gun
- Travelling rain gun
- Low application system
EFFLUENT SPREADING DISTRIBUTION

Average application depth

15 mm

5 mm

Monaghan et al, 2009
## NUTRIENT LOADING – TRAVELLING IRRIGATORS

example from dairy cow industry

<table>
<thead>
<tr>
<th>Speed Setting</th>
<th>Speed (m/hr)</th>
<th>Depth (mm)</th>
<th>N (kg/ha)</th>
<th>K (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fast</td>
<td>60</td>
<td>12</td>
<td>36</td>
<td>42</td>
</tr>
<tr>
<td>Medium</td>
<td>36</td>
<td>18</td>
<td>63</td>
<td>69</td>
</tr>
<tr>
<td>Slow</td>
<td>24</td>
<td>24</td>
<td>124</td>
<td>86</td>
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</table>

Longhurst et al, FLRC, 2014
RULES AND REGULATIONS

• 12 Regional Councils & 3 Unitary Regions (Tasman, Marlborough & Gisborne) control effluent land application
• Applications come under resource consent or covered by permitted activity rules
• However, district councils (67) may also have additional rules
• Nutrient loading (kg N/ha/yr): 150 - pasture; 200 – crop
• Hydraulic loading – application depth < 25 mm
• Not allow effluent to enter a waterway – i.e. good management practice around effluent placement & timing
TAKE HOME MESSAGES ON MANAGING DAIRY SHEEP EFFLUENT

• Understand local rules and regulations
• Understand your soil types
• Install appropriate effluent delivery systems
• Monitor spreading distribution to understand depth of application
• Sufficient storage
• Solids management
• Ensure system handles wool fibres
ACKNOWLEDGEMENTS

MBIE
Waituhi Kuratau Trust
Kingsmeade Artisan Cheese
Spring Sheep Dairy
Maui Milk
Antara Ag

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   and David Houlbrooke