

## Fertiliser and Slurry Management Plan Greenmount Campus Dairy Farm

To safely handle the slurry produced on a modern dairy farm in compliance with the environmental legislation, may require substantial capital investment in storage capacity. Slurry spreading also ties up either considerable farm labour resource or incurs further annual expenditure on specialist contractor fees. Given the costs and investments required, it is important to ensure that the management practices employed make the most efficient use of the nutrients available from slurry to minimise fertiliser costs.

This technical note outlines how fertiliser and slurry is managed on the Greenmount Campus dairy farm and the technologies being adopted to meet anticipated EU environmental regulations.

### Farm stock

The Greenmount Dairy Unit is stocked as outlined in Table 1 below. Replacement heifers are reared and bred to calve at 24 months of age.

**Table 1. Livestock on the Greenmount Dairy Unit**

Stock	Number	Weekly slurry production (m <sup>3</sup> )
Dairy cows	175	65
Replacement heifers 1-2 years old	65	12
Replacement heifers 0-1 years old	65	5
Ewes*	150	3
<b>Total weekly slurry production (m<sup>3</sup>)</b>		<b>85</b>

*\*Ewes housed for part of the winter period*

## Slurry production

Grass is grazed by late lactation cows well into the autumn and milking cows are turned out to grass as early as feasible in spring. This helps to minimise slurry production and storage. Total slurry production over a typical 6-month winter amounts to 2210 cubic metres (m<sup>3</sup>) of neat slurry at approximately 10% dry matter.

In addition to slurry produced by the livestock, rainwater falling onto above ground slurry stores, open lagoons and un-roofed silos amounts to a further 49 m<sup>3</sup> of dirty water per week over the winter period. Summer rainfall on the slurry stores and lagoon adds a further 702 m<sup>3</sup> of dirty water. This takes the total slurry production to store and spread to 4186 m<sup>3</sup>. The addition of the rainwater dilutes the slurry dry matter to approximately 5%. This is a relatively 'thin' slurry consistency, ensuring easy spreading but increasing the volume to be spread.

## Constructed Wetland Research Project

Parlour washings, runoff from cow walkways to and from houses and paddocks, plus runoff during the winter feeding period from five unroofed silos is directed to a constructed wetland system. The Wetland is being researched at Greenmount by the Agri-Food and BioSciences Institute (AFBI) and the Environment and Heritage Service to evaluate the systems efficiency under Northern Ireland conditions. The Constructed Wetland receives approximately 63 m<sup>3</sup> of dirty water per week from the sources listed above. If stored conventionally, this would add an additional 47% to the spread volume.

## Slurry storage capacity

Slurry storage capacity on the Greenmount Dairy Unit is shown in Table 2. The capacity available provides for 47 weeks of slurry storage, where dirty water is diverted to the constructed wetland. Without the constructed wetland, the storage capacity would only be sufficient for 32 weeks.

**Table 2. Slurry storage capacity on the Greenmount Dairy Unit**

<b>Storage structure</b>	<b>*Capacity</b>
Below ground tanks	1682
Above ground slurry stores	4484
Concrete lagoon	170
<b>Total capacity (m<sup>3</sup>)</b>	<b>6336</b>

*\*Allowing for freeboard requirements*

## Slurry separation

A rotary-screen Carrier separator is used to separate approximately 50% of the dairy cow slurry at Greenmount Campus. The separated liquid is spread on grass silage swards after each cut of silage. Separated solids are spread on fields included in the arable rotation to maintain soil organic matter.

## Farm stocking rate

The livestock outlined in Table 1, are carried on 132 hectares of grassland with a further 18 hectares cropped in a combination of winter barley, winter wheat and potatoes. The overall stocking rate works out at 2.05 cow equivalents per hectare (CE/ha) of grassland. The average stocking rate on Northern Ireland dairy farms is 1.98 CE/ha with the top 15% of farms stocked at 2.43 CE/ha.

In terms of organic nitrogen loading, the livestock carried on the Greenmount Campus Dairy farm produce 152.6 kg of manure nitrogen per hectare across the 150 hectares of combined grassland and cropping area.

## Silage area

The core grassland area harvested for first and second cut silage is 55.5 hectares. Third cut silage is harvested from 21.5 hectares. In addition 5-10 hectares of the grazing area may also be harvested as big bale or clamp silage depending on grass growing conditions. Slurry is spread prior to first cut and after each cut of silage. Table 3 outlines how the total slurry production is utilised over the silage cutting area.

**Table 3. Slurry utilisation on silage harvesting areas.**

<b>Silage Harvest</b>	<b>Area (ha)</b>	<b>Harvest date</b>	<b>Slurry application rate m<sup>3</sup>/ha (gallons/acre)</b>	<b>Slurry utilisation (m<sup>3</sup>)</b>	<b>Cumulative slurry use (m<sup>3</sup>)</b>	<b>Annual slurry balance 4186 (m<sup>3</sup>)</b>
1	55.5	Early May	40 (3500)	2220	2220	1966
2	55.5	Mid June	28 (2500)	1554	3774	412
3	21.5	Late July	23 (2000)	495	4269	-83

## Grazing area

In previous seasons where a pig herd was retained at Greenmount Campus, dairy cow grazing areas were spread with pig slurry. However, to optimise the use of potash and nitrogen (N) from the remaining cow slurry, all dairy cow slurry will be applied to grass silage and cropping areas as outlined above.

## Grass clover swards

The grazing area utilised by the replacement heifers and sheep on the farm are managed to maintain a high level of clover in the sward. Inorganic nitrogen fertiliser use on this land is considerably less than on the dairy cow grazing paddocks, where stocking densities are considerably higher due to the limited availability of grazing land within walking distance of the milking parlour.

## Slurry spreading systems

The majority of slurry is spread by a contractor at Greenmount Campus. To improve the nitrogen availability from slurry, the College of Agriculture, Food and Rural Enterprise (CAFRE) policy is to use spreading systems which optimise the availability of N from the slurry. A combination of band spreading, trailing shoe and shallow injection systems are being evaluated for operational efficiency. Recent research carried out at AFBI, Hillsborough shows that the use of trailing shoe application systems can reduce the use of inorganic N fertiliser by 48 kg N/ha where 44 m<sup>3</sup> (4000 gallons/acre) of slurry has been applied per hectare. This represents a financial saving of £28 per hectare (£11.50/acre).

## Nutrient management planning

Soils analysis is carried out on a 3 year cycle across the land area farmed by Greenmount Campus. Table 4 shows the trend in soil phosphate (P) analysis results over the last 12 years. Applying the principles of nutrient management planning has resulted in a 83% reduction in P fertiliser application to grassland and has reduced the proportion of fields with excessively high phosphate levels (4/5) from 26% to 0% through the use of zero-P and straight-N fertilisers. Use of these fertilisers also resulted in an annual saving of over £6000.

**Table 4. Percentage of farmland according to Soil P Index**

<b>P Index</b>	<b>1994</b>	<b>1998</b>	<b>2003</b>
4/5	26	16	0
3	37	50	55
2	16	20	38
0/1	21	14	7
<b>Average</b>	<b>39</b>	<b>35</b>	<b>27</b>

## Fertiliser use

The nutrient content of slurry and slurry application method is allowed for in calculating the inorganic (bagged) fertiliser requirements for each crop according to the principles established in the MAFF publication “ Fertiliser Recommendations for Agricultural and Horticultural Crops” (RB209). Table 5 shows the trend in fertiliser use at Greenmount Campus over the last 6 years.

**Table 5. Fertiliser use (%) on the Greenmount Campus Dairy Farm**

<b>Year</b>	<b>1998</b>	<b>2004</b>
Compound fertiliser	53	6
Straight-N	43	73
Zero-P	4	21

The inorganic N fertiliser use across the various types of grassland at Greenmount Campus is outlined in Table 6 below. Grass clover swards are maintained on the dairy heifer replacement area, as outlined above. The most intensively fertilised area of the farm is the dairy cow grazing paddocks followed by the 3-cut silage area, which also includes fertiliser applied for late Summer/Autumn grazing.

**Table 6. Inorganic N fertiliser use at Greenmount Campus (kg N/ha)**

<b>Year</b>	<b>2005</b>	<b>5-year average</b>
Dairy cow grazing paddocks	264	283
3-cut silage area	217	278
Replacement heifer grazing	103	144
All grassland area	193	228

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## Conclusions

To make best use of slurry on the Greenmount Dairy Farm, spreading takes place mainly on silage swards during the spring and summer period, to best utilise the slurry nutrients for grass growth. Alternative slurry spreading technologies including trailing-shoe and trailing-hose systems are being used to reduce nitrogen losses to the atmosphere and maximise the nutrient use by the growing crop.