Response to Potassium & Implications for Grass Silage Production

Mark Plunkett, Teagasc, Johnstown Castle, Wexford
Land Use Areas and Main Crop Types

- Grass: 2177.3 ('000 ha)
- Grass Silage: 1206.4 ('000 ha)
- Hay: 211.8 ('000 ha)
- Crops: 345.1 ('000 ha)

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Annual Grass Silage Requirement?

10 million Ton Dry Matter
Potassium – Key Soil & Plant Nutrient

- Irish soils tend to have good reserves
- Soil K levels change relatively fast
- Water & Nutrient movement in the plant
- No legislative limits on K
- K Deficiency “The Hidden Hunger”
- N Uptake & Efficiency in the plant
Grass K Requirements

K Requirements of Grazing & Grass Silage Crops

<table>
<thead>
<tr>
<th>Farm System</th>
<th>kg/ha</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drystock</td>
<td>10</td>
</tr>
<tr>
<td>Dairy</td>
<td>30</td>
</tr>
<tr>
<td>Grass Silage</td>
<td>140</td>
</tr>
</tbody>
</table>
Fertiliser K Sales 1990 to 2017

No Limits on K Fertilisers !!

The Irish Agriculture and Food Development Authority
Fertiliser K Use on Grassland Farms

Potassium (K) (kg/ha)

Year

Dillon et al. 2018. NFS fertiliser use survey

Dairy
Cattle

K advice for Dairy at 2LU/ha

K advice for Drystock at 2LU/ha

K advice for 1st cut silage 5t/ha DM
Soil Fertility K Trends over last 10 years

Percentage of Grassland Soil Samples on Dairy & Drystock Farms at Soil K Index 1 & 2

60% of Soils Deficient in K

Source:- Teagasc Data Base
$1 \text{ kg } K \text{ fertiliser} = 6 \text{ kg grass}$
K fertiliser response in mixed grassland swards

Mean Grass yield 2005-2009 (kg/ha DM)

1 kg K fertiliser = 9 kg grass

K offtake
375 kg/ha K

Plunkett, M & Wall, D.P. 2018
Importance of K when using high N fertiliser rates

Average Grass DM yield (kg/ha)

K fertiliser rate (kg/ha)

Low N: 200 kg/ha
High N: 400 kg/ha

K required to drive N fertiliser efficiency

Plunkett, M & Wall, D.P. 2018
### Recommended rates of K for 1st, 2nd & 3rd cut grass silage

<table>
<thead>
<tr>
<th>Soil Index</th>
<th>1st Cut 5 t/ha DM</th>
<th>2nd Cut 3 t/ha DM</th>
<th>3rd Cut 2 t/ha DM</th>
<th>Total K kg/ha (units/ac)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>185</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>155</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>125</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td></td>
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</table>

*On Index 4 soils omit K for one year and revert back to Index 3 advice until next soil test.*

*Adjust K advice by +/- 25kg K/ha per tonne of grass DM.*
**Fertiliser Advice for Grass Silage Crops**

<table>
<thead>
<tr>
<th>Soil Index</th>
<th>1&lt;sup&gt;st&lt;/sup&gt; Cut (5 t/ha DM)</th>
<th>2&lt;sup&gt;nd&lt;/sup&gt; Cut (3 t/ha DM)</th>
<th>3&lt;sup&gt;rd&lt;/sup&gt; Cut (2 t/ha DM)</th>
<th>Total K (kg/ha)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>185</td>
<td>75</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>155</td>
<td>75</td>
<td>50</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>125</td>
<td>75</td>
<td>50</td>
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<tr>
<td>1</td>
<td>185</td>
<td>75</td>
<td>50</td>
<td>310 (248)</td>
</tr>
<tr>
<td>2</td>
<td>155</td>
<td>75</td>
<td>50</td>
<td>280 (224)</td>
</tr>
<tr>
<td>3</td>
<td>125</td>
<td>75</td>
<td>50</td>
<td>250 (200)</td>
</tr>
<tr>
<td>4</td>
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On Index 4 soils omit K for one year and revert back to Index 3 advice until next soil test. Adjust K advice by +/- 25kg K/ha per tonne of grass DM.
K Sources for Grass Silage Crops

Cattle Slurry

- Recycle cattle slurry on silage fields
- Replenish soil K levels
- Correct P : K Ratio
- DM % large effect on P & K values

P & K supplied in 33m³/ha of cattle slurry and impact of slurry DM%

- Test slurry & check nutrient values
- Adjust applications based on DM
**Fertilisers**

- 24-2.5-10 (3 bags/ac)
- 18-6-12 (4 bags/ac)
Fertilisers with a Low DM Slurry (4%)

P & K supplied in 33m³/ha of cattle slurry and Crop Requirements

### Maintenance

<table>
<thead>
<tr>
<th>Fertiliser Programme - Index 3</th>
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<tr>
<td>2 bags/ac 15-3-20</td>
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Kg of Applied

- P
- K

P & K in Slurry

- 3.50%
- P & K Req.
Fertilisers with a Low DM Slurry (4%)

P & K supplied in 33m³/ha of cattle slurry and Crop Requirements

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<td>Fertiliser Programme - Index 3</td>
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<td>2 bags/ac 15-3-20</td>
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<tr>
<td>+ Build Up</td>
</tr>
<tr>
<td>Fertiliser Programme - Index 2</td>
</tr>
<tr>
<td>1 bags/ac 0-10-20</td>
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P & K in Slurry

Kg of Applied

- 3.50%
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P & K supplied in 33m³/ha of cattle slurry and Crop Requirements

P & K in Slurry

Kg of Applied

- 3.50%
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Fertilisers with a Low DM Slurry (4%)

**Maintenance**

- **Fertiliser Programme - Index 3**
  - 2 bags/ac 15-3-20
  - + Build Up

- **Fertiliser Programme - Index 2**
  - 1 bags/ac 0-10-20
  - + Build Up

- **Fertiliser Programme - Index 1**
  - 2 bags/ac 0-10-20

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P & K supplied in 33m³/ha of cattle slurry and Crop Requirements

<table>
<thead>
<tr>
<th>P &amp; K in Slurry</th>
<th>P &amp; K Req.</th>
</tr>
</thead>
<tbody>
<tr>
<td>3.50%</td>
<td>P</td>
</tr>
<tr>
<td></td>
<td>K</td>
</tr>
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</table>

**Kg of Applied**

- P
- K

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The Irish Agriculture and Food Development Authority
Fertilisers with a High DM Slurry (8%)

P & K supplied in 33m³/ha of cattle slurry and Crop Requirements

Maintenance

Fertiliser Programme - Index 3

Straight N or 27's / 24's

P & K in Slurry

The Irish Agriculture and Food Development Authority
Fertilisers with a High DM Slurry (8%)

P & K supplied in 33m³/ha of cattle slurry and Crop Requirements

Maintenance

Fertiliser Programme - Index 3
Straight N or 27’s / 24’s
+ Build Up
Fertiliser Programme - Index 2
1 bags/ac 0-10-20

The Irish Agriculture and Food Development Authority
Fertilisers with a High DM Slurry (8%)

P & K supplied in 33m³/ha of cattle slurry and Crop Requirements

- **Maintenance**
  - Fertiliser Programme - Index 3
    - Straight N or 27’s / 24’s
    - + Build Up
    - Fertiliser Programme - Index 2
    - 1 bags/ac 0-10-20
    - + Build Up
    - Fertiliser Programme - Index 1
    - 2 bags/ac 0-10-20

The Irish Agriculture and Food Development Authority
Fertiliser Requirements without Slurry

<table>
<thead>
<tr>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>K Index 3</td>
</tr>
<tr>
<td>2.5 bags/ac 0-7-30</td>
</tr>
</tbody>
</table>

The Irish Agriculture and Food Development Authority
Fertiliser Requirements without Slurry

<table>
<thead>
<tr>
<th>Maintenance</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>K Index 3</strong></td>
<td>2.5 bags/ac 0-7-30</td>
</tr>
<tr>
<td><strong>+ Build Up</strong></td>
<td></td>
</tr>
<tr>
<td><strong>K Index 2</strong></td>
<td>1.0 bags/ac 0-7-30</td>
</tr>
</tbody>
</table>

The Irish Agriculture and Food Development Authority
### Fertiliser Requirements without Slurry

#### Maintenance

<table>
<thead>
<tr>
<th>K Index</th>
<th>Requirement</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2.5 bags/ac 0-7-30 + Build Up</td>
</tr>
<tr>
<td>2</td>
<td>1.0 bags/ac 0-7-30 + Build Up</td>
</tr>
<tr>
<td>1</td>
<td>2.0 bags/ac 0-7-30</td>
</tr>
</tbody>
</table>

1 bag/ac of 50% K Req. every 2 years to balance K off-takes

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The Irish Agriculture and Food Development Authority
## Timings of Fertiliser K

<table>
<thead>
<tr>
<th>Maintenance</th>
<th>Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>K Index 3</strong></td>
<td>Early Spring Application</td>
</tr>
<tr>
<td>2.5 bags/ac 0-7-30</td>
<td></td>
</tr>
<tr>
<td>+ Build Up</td>
<td></td>
</tr>
<tr>
<td><strong>K Index 2</strong></td>
<td>After 1&lt;sup&gt;st&lt;/sup&gt; Cut Silage</td>
</tr>
<tr>
<td>1.0 bags/ac 0-7-30</td>
<td></td>
</tr>
<tr>
<td>+ Build Up</td>
<td></td>
</tr>
<tr>
<td><strong>K Index 1</strong></td>
<td>After 1&lt;sup&gt;st&lt;/sup&gt; Cut Silage</td>
</tr>
<tr>
<td>2.0 bags/ac 0-7-30</td>
<td></td>
</tr>
</tbody>
</table>

Max. K In Spring 90kg/ha
In Summary

• Grass silage crops have a high K demand
• Plan K applications to fulfil crop K requirements
• Recycle *all* cattle slurry on silage area
• Test Slurry & adjust app. rates appropriately
• Select a suitable fertiliser blend (*High P / K* rather than *High N fertiliser compounds!!!*)