Winter Management of Maize Paddocks

Key Points

- Winter management options differ for maize grain and maize silage paddocks.
- Late harvest and high residue levels make establishing winter crops difficult in grain paddocks.
- Grazing fallow grain paddocks can increase pugging and N leaching risk.
- Incorporating residue will enhance break down and possibly reduce N leaching risk.
- There is more potential for winter crops in maize silage paddocks.
- Direct drilling winter crops reduces the risk of soil compaction by grazing stock.
- Not grazing winter crops will reduce soil compaction and nitrate leaching and improve structural stability, but may not improve yields of summer crops.

Introduction

Winter management of maize paddocks is influenced by harvest time of the maize crop, and whether the crop is harvested for grain or silage.

- Maize grain paddocks are often harvested too late for successful establishment of many winter crops. Residue levels also make winter crop establishment difficult.
- Maize silage paddocks are often sown with annual ryegrass and grazed over winter. As the entire plant is harvested, there is little residue to contend with.

Clearly these two production systems will require different management approaches.

Maize Grain

The amount of residue left after grain harvest is approximately the same as the amount of grain removed. So if you have a 12 t/ha grain crop, you will have approximately 12 t/ha of residue left. In each tonne of residue, there is approximately

- 7 kg Nitrogen
- 2 kg Phosphorus
- 9 kg Potassium
- 440 kg Carbon

Residue is made up of stem, leaf, husk leaves and rakis (the core of the cob). The proportions of these in residue and their carbon and nitrogen contents are given below.

<table>
<thead>
<tr>
<th>% of residue</th>
<th>Carbon %</th>
<th>Nitrogen %</th>
<th>C:N ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stem</td>
<td>41</td>
<td>44.6</td>
<td>0.70</td>
</tr>
<tr>
<td>Leaf</td>
<td>24</td>
<td>41.2</td>
<td>0.68</td>
</tr>
<tr>
<td>Husk</td>
<td>14</td>
<td>45.5</td>
<td>0.91</td>
</tr>
<tr>
<td>Rakis</td>
<td>21</td>
<td>46.7</td>
<td>0.46</td>
</tr>
<tr>
<td>All residue</td>
<td>100</td>
<td>44.4</td>
<td>0.67</td>
</tr>
</tbody>
</table>

The higher the carbon to nitrogen ratio, the longer it takes for the residue to break down. When soil microbes break down residue, they need nitrogen as an essential nutrient. If there is not enough nitrogen in the residue (C:N ratio more than 25) they will take it out of the soil, a process called immobilisation.

All components of maize residue have a C:N ratio greater than 25. While this suggests the addition of N fertiliser (to decrease the C:N ratio) may increase residue breakdown, two experiments on this subject showed adding N fertiliser did not in fact increase residue decomposition (see Maize Arable Update 15).

Grazing

There is little nutritional value in the residue for grazing animals. In addition, animals will contribute to N leaching via urine patches, especially as there is no living vegetation to take up nitrogen or water. Fallow ground is also more susceptible to pugging damage.

Leave standing

The harvester will often break the stems around 40cms from the ground, so some of the stalk will remain standing. If the residue is left standing over winter, a substantial amount will not be in contact with the soil micro-organisms which break down crop residue.

Mulching

Mulching the residue will increase the amount of residue in contact with the soil, and therefore enhance residue breakdown. Mulching will cut the residue up into smaller segments which will also be easier to break down. Crop residues mulched and left on the soil surface can reduce evaporation and conserve soil moisture.

Incorporation

Incorporating residues after harvest is the best way to increase residue break down. In a study when residues were incorporated in June, there was only 31% remaining by October compared with 74% when residue was mulched and left on the surface (Figure 1 - see also Maize Arable Update 15).
Discing in residue is preferable to ploughing as the residues are distributed more evenly through the topsoil. Ploughing can leave a concentrated residue layer at plough depth. As well as increased residue breakdown, the resulting immobilisation can also reduce the amount of N available for leaching.

Maize Silage

Maize silage paddocks are harvested much earlier than grain paddocks, so there is more opportunity to sow a winter crop. Paddocks used for maize silage production every year are often sown with an annual ryegrass and grazed over winter.

FAR and Crop & Food Research have conducted a number of trials relevant for maize silage. These include:
1. Type of winter crop
2. Method of establishment
3. Effect of grazing

Winter crop type

Six types of winter crops were compared with fallow (no crop) over two winters in both Otorohanga and Hastings (see Maize Arable Update 34). However this experiment was run in a maize grain rotation, so the winter crops were sown late (June) and yields were lower than expected.

At harvest (mid October year 1, early November year 2), the highest yielding winter crop was double-take triticale, at 9800 kg DM/ha and 6000 kg DM/ha at Otorohanga and Hastings respectively. Sown earlier in a maize silage rotation, we would expect these crops to perform much better. The winter crops were effective at improving soil stability and decreasing N leaching.

Method of establishment

How winter cover crops are established and the soil moisture when they are grazed has a large impact on soil bulk density (a measure of soil compaction) and crop yields.

A study at Lincoln showed that a winter crop (triticale cv Doubletake) sown using no tillage could be grazed at any soil moisture content (including saturated) without causing soil compaction or affecting crop regrowth (Figures 2 and 3).

However where winter crops were sown using intensive tillage, the soil was badly compacted when grazed at a soil moisture of field capacity or wetter, and crop regrowth was severely affected (Figures 2 and 3).

Effect of grazing

Withholding grazing during winter was studied in a long term summer cropped paddock in Hawke’s Bay. Annual ryegrass was sown in April and by September, the ungrazed plots had 2550 kg DM/ha more pasture. This equates to around 64 kg N/ha, 10 kg P/ha and 74 kg K/ha more nutrients that were incorporated into the soil as pasture at the end of winter.

A number of soil quality parameters were improved by not grazing over winter.
- Ungrazed plots had less soil compaction in the top 5 cm and top 15 cm.
- Soil aggregate stability was greater in the ungrazed plots.
- Grazed plots had nearly three times more nitrate in soil leachate (measured at 30 cm) than the ungrazed plots.

Yield increases in subsequent crops were not observed in this study, but the profitability of a non grazed system could be improved by harvesting the pasture for silage. A similar study in Southland showed cereal crops following winter grazing by dairy cows were around 70% of those following non grazed winter crops.

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