Introduction

The Massey University comparison of a conventional and an organic dairy system started in spring 2001 and finished in autumn 2011. Many of the changes in the productivity and management of the two systems have been reported. In this article the changes in the botanical composition of the pastures in the two systems are described.

Table 1 shows that over the 10 years of the systems comparison the major changes in botanical composition were: 1) the percentage of perennial ryegrass was lower in the organic than the conventional system; 2) the percentage of white clover was higher in the organic than the conventional system; and 3) the percentage of herb species, chicory and plantain, was higher in the organic than the conventional system. There were no significant differences in the percentage of sown or other grasses, weeds or dead matter between the two systems.

The pastures were monitored by measuring the botanical composition of the same paddocks each May and November. The number of paddocks monitored in each system was normally ten but this varied by one or two paddocks in some years due to establishment of forage crops or new pasture.

Perennial ryegrass

The largest change in botanical composition was in perennial ryegrass. Typically the percentage of perennial ryegrass in the organic system was 10% lower than that in the conventional system. Figure 1 shows that after three years of organic farming the percentage of perennial ryegrass was consistently lower than in the conventional system. The lower percentage of perennial ryegrass in the organic system would have decreased pasture growth in winter and early spring.

Over the ten years of the trial the pasture production in the organic system was usually from 1-2 t DM/ha/yr less than in the conventional system. At least half this extra production in the conventional system resulted from the N applied being from 60-110 kg N/ha/yr greater than in the organic system, but some of the superior pasture production would have been due to the extra ryegrass in the conventional system.

White clover

Although the percentage of white clover was on average higher in the organic system the year to year variation was high in both systems. Figure 2 shows the variation in the percentage of white
clover over ten years of the trial. White clover naturally varies from year to year in response to the weather and grazing management but an added factor during the trial was the arrival of the clover root weevil in the Manawatu mid-trial.

Neither farming system in the trial had a sufficient percentage of white clover in its pasture to fully meet the N fixation required by the systems. The relatively poor performance of white clover in both systems reflected the difficulty in maintaining white clover in Tokomaru silt loam, which is distinguished by being heavy and wet and prone to treading damage in early spring, and by forming a hard surface in dry summers that inhibits the rooting of white clover stolons.

**Herbs**

The greater percentage of the herbs chicory and plantain in the organic system was simply a consequence of sowing these species only in the organic system. Despite the heavy and wet soil the herbs persisted in the few paddocks they were sown into.

One factor that limited the sowing of herb species was their requirement to be sown at warmer soil temperatures than perennial ryegrass. Spring sowing was difficult in the organic system due to the feed shortage at that time despite calving being later than in the conventional system. In autumn the difficulty was the extra time for seedbed preparation required in the organic system, because herbicide could not be used, that pushed the time of sowing into the colder half of autumn.

Another factor that limited the introduction of herb species was the concern that weed problems would be created that were difficult to manage if new pastures were regularly established in the organic system.

**Weeds**

In practice weeds either as a consequence of pasture establishment or in the established pastures were no greater a problem in the organic than the conventional system. Timely grazing management and the maintenance of dense pastures were the keys to weed control in both systems, although use of herbicide in the conventional system decreased the period after pasture establishment that weeds were a problem.

The most successful pasture establishments in the organic system were in autumn following a turnip crop. The turnip crop provided a relatively weed free starting point for pasture establishment and reduced the time spent on seedbed preparation.

**Discussion**

The botanical composition of the pastures in both the organic and conventional systems was remarkably resilient over the ten years of the trial. However, the percentage of white clover was higher in the organic system and the percentage of perennial ryegrass was lower. These changes in
two key pasture species were relatively small but as a consequence the organic system grew approximately one tonne per ha less perennial ryegrass per year than the conventional system which would have affected winter and spring production in particular.

The extra white clover in the organic system was approximately 200 kg/ha/yr more than grew in the conventional system. This extra white clover was insufficient to provide enough N fixation to compensate for the lower application rate of N provided in the organic fertiliser relative to the manufactured fertiliser used in the conventional system. However, it is likely that on a soil type more suited to white clover that the difference in white clover percentage between the two systems would have been greater.

In conclusion, the botanical composition of the organic pastures and the conventional pastures drifted slowly apart over ten years, but the consequences to production were small. Pasture renovation can be used in organic systems, as in conventional systems, to remedy any shortcomings in botanical composition without a permanent increase in weeds.

Table 1: The mean botanical composition of the pastures in a conventional and an organic dairy farm at Massey University from November 2001 to May 2011. Values are percentage of above ground pasture dry matter.

<table>
<thead>
<tr>
<th></th>
<th>Ryegrass</th>
<th>Sown Grass</th>
<th>Other Grass</th>
<th>White Clover</th>
<th>Weeds</th>
<th>Dead</th>
<th>Herbs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Conventional</td>
<td>52.5</td>
<td>1.4</td>
<td>19.5</td>
<td>3.9</td>
<td>4.9</td>
<td>17.7</td>
<td>0</td>
</tr>
<tr>
<td>Organic</td>
<td>43.9</td>
<td>1.0</td>
<td>22.6</td>
<td>6.0</td>
<td>6.5</td>
<td>17.5</td>
<td>2.7</td>
</tr>
<tr>
<td>SEM</td>
<td>2.15</td>
<td>0.35</td>
<td>1.64</td>
<td>0.65</td>
<td>0.66</td>
<td>1.26</td>
<td>0.54</td>
</tr>
<tr>
<td>Probability</td>
<td>0.008</td>
<td>0.503</td>
<td>0.178</td>
<td>0.026</td>
<td>0.103</td>
<td>0.916</td>
<td>0.001</td>
</tr>
<tr>
<td>Significance</td>
<td>***</td>
<td>NS</td>
<td>NS</td>
<td>*</td>
<td>NS</td>
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</table>
Figure 1: The percentage of perennial ryegrass in the pasture dry matter of an organic and a conventional dairy farm system over 10 years at Massey University. The botanical composition was measured in November each year.

Figure 2: The percentage of white clover in the pasture dry matter of an organic and a conventional dairy farm system over 10 years at Massey University. The botanical composition was measured in November each year.