

**Title:** Weeds no problem.

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## **Weeds no problem**

Organic production

A common misconception about organic farming is that weeds will take over because the farmer is not able to use herbicides. But results from Massey University's organic versus conventional dairy farm trial are showing very little difference in weed composition between the two farming systems.

Weeds are being monitored by setting up fixed quadrats along transects in 10 organic paddocks and 10 conventional paddocks. Every six months for eight years the same quadrats in each paddock were visited. They were one square metre in size, and there were 10 in every paddock monitored. The percentage of every weed species was estimated in each of these quadrats in May and November to see whether the number of weeds changed over time.

A huge variability in weed growth was found in the permanent pastures between visits, between paddocks and between farmlets. But generally the weeds were only ever about 5% of the pasture in total, and often less, so they were generally below a level that was economically worth doing anything about. And as a broad generalisation, in most years the weeds were no worse on the organic farmlet than the conventional part. The two main weeds were docks and buttercups, but others were present such as Californian thistle, daisy, dandelion and pennyroyal.

Part of the reason for the lack of difference is that weeds were generally never bad enough to spray on the conventional part of the farm. This meant boom-sprayed herbicides were almost never used, so pressure on weeds was similar.

Most weed control occurred on both farmlets through good grazing and pasture management. By keeping the pastures dense by applying fertilisers, not over-grazing and not pugging in winter, new weeds had trouble establishing, and good grazing pressure helped keep any weeds that were present in check. Occasional topping in late spring and summer also helped. The main weed control was chipping of Scotch thistle and pulling of ragwort on the organic farmlet, while these were spot-sprayed in conventional paddocks.

But pastures weren't exactly the same, with the main difference being that urea was applied regularly on the conventional farmlet, which isn't permitted in organic farming. Osflo (composted chicken manure) was applied to organic paddocks to try giving some nitrogen (N) input, but there was less N being applied overall, resulting in greater pasture growth on the conventional farmlets.



*Dr Kerry Harrington assessing an*

*organic pasture with good establishment of plantain and chicory.*

### **More grazing**

At times it was difficult to get sufficient supplementary feed for the organic cows as there are restrictions on what can be used, and generally a shortage of organic supplementary feed on the market. As the trial was trying to keep milk production levels similar between the farmlets, this resulted in more grazing pressure being applied on average on the organic farmlet.

The main weed species differences between the two units were that docks occurred more frequently on the conventional farmlet while buttercups were often more frequent on the organic unit. This can be explained by the differences in grazing pressure. Contrary to popular belief, cows do eat docks, but they're not a favoured food and grazing is more likely to happen when pressure is increased as was occurring on the organic farmlet.

The main buttercup species on the farmlets was hairy buttercup, though there was quite a bit of creeping buttercup too. There was no giant buttercup which perhaps meant results from the trial may have differed if this more aggressive buttercup species had been present. The creeping buttercup densities remained fairly static throughout the trial, but there were large fluctuations in hairy buttercup. Hairy buttercup is a winter annual species, meaning it germinates in autumn wherever pasture density is open enough to allow weed germination, then it grows over winter, flowers in spring and dies in summer.

It was thought there was more hairy buttercup at times on the organic farmlet due to heavier grazing in summer opening up the pasture to allow ingress of the weed, which wasn't happening as much on the conventional farmlet where urea was keeping pasture growing more vigorously.

These differences were fairly subtle. The big difference in weediness between the organic and conventional farmlets occurred when pasture renewal was attempted. In conventional paddocks, glyphosate could be used to kill off existing perennial weeds before resowing the pasture.

In organic paddocks, this weed control was attempted by using mouldboard ploughing followed by three to four weeks fallow and then further cultivation before planting turnips as a summer crop, followed by further cultivation and resowing of pasture in autumn.

Despite all this cultivation, well established perennial weeds such as docks and Californian thistle were never adequately removed from the system and popped up again in the new pasture along with all the weed seedlings that also occur in new pastures.

Apart from not being able to use glyphosate, there could also be no use of MCPB or Preside (flumetsulam) to remove young weeds from the new pastures, especially the hairy buttercup. So in the following spring, new pastures on the organic farmlet were always a sea of yellow flowers as the hairy buttercup flowered, while on the conventional farmlet, these were often sprayed out in late autumn or early winter.

But once the hairy buttercup had flowered and died in that first season new plants were unable to establish the following autumn due to pasture competition and so the weed densities settled down.

Docks were often more prevalent for the first few seasons after regrassing on the organic farmlet too. Topping of the paddocks as the buttercup flowering began helped cut down the amount of seeds going back into the soil.

However, some of the highest weed densities measured during the trial actually occurred after regrassing on the conventional farmlet. Because there's more flexibility in timing of regrassing when using glyphosate and MCPB, often more emphasis went into getting the timing of operations correct for regrassing on the organic farmlet, and occasionally there was less effort with the conventional regrassing. As a result, some regrassing occurred a bit late in autumn when grass establishment was slower, and occasionally selective herbicides were not applied either, resulting in very high densities of hairy buttercup.

### **Regrassing timing**

Plantain and chicory were used in the regrassing programme on the conventional farmlet to help increase biodiversity within the swards. Perennial ryegrass sowing rates were dropped to about 14kg/ha so that the plantain, chicory and clover would have a better chance to establish. But this also allowed the weeds a better chance to establish too. It was a fine balance between ensuring the chicory and plantain established well yet not letting the weeds have too much of a chance to get going, and ryegrass sowing rates tended to creep up in later years.

One year, one of the farm managers decided to keep the perennial ryegrass sowing rate up fairly high and sowed just clover with it, thinking that the plantain and chicory could be oversown later. Although this resulted in

less weed establishment, the oversowing of the chicory and plantain at a later date did not succeed very well, as might be expected because the seedlings were trying to get established within a dense perennial ryegrass sward.

The plantain generally only registered at about 1% cover in following years and the chicory was only ever seen as occasional isolated plants. Completely regrassing the paddocks was required to get reasonable amounts of plantain and chicory established.

Plantain and chicory were once considered weeds and now are sought after components of the pasture because of their high mineral content and good feed value. The results of the plant analysis on weed and pasture species showed the mineral and protein content of many of the weeds compared favourably with the sown pasture species (see Table 1).

Obviously if the weed is also full of toxins or doesn't get eaten by cows, then this isn't very relevant. But flat-weeds such as dandelion are readily eaten, docks do get chewed off quite often, and even thistles get eaten if the paddock is mown prior to the cows going into the paddock.

So with established pastures, weeds didn't become any worse in organic systems compared with conventional ones. When planting new pastures weeds were more likely to be a problem in organic pastures due to not being able to use glyphosate or selective herbicides. But this usually settled down after the first year and weeds which were present generally had good mineral and protein levels.

For further information visit <http://www.massey.ac.nz.ezproxy.massey.ac.nz/?df4370822t>

**Table 1: Differences in crude protein levels, g/kg dry matter (DM), phosphorus, sulphur, magnesium (all % DM), copper and zinc (mg/kg) between species in organic dairy pastures. Figures in red are significantly ( $p < 0.05$ ) higher than in either perennial ryegrass or white clover.**

	Protein	P	S	Mg	Cu	Zn
Perennial ryegrass	232	0.370	0.347	0.173	7.9	22.0
White clover	270	0.347	0.213	0.237	8.6	22.0
Chicory	307	0.663	0.627	0.393	18.6	57.7
Narrow-leaved plantain	283	0.480	0.530	0.253	15.1	37.7
Broad-leaved dock	305	0.430	0.287	0.520	7.6	30.7
Californian thistle	292	0.357	0.570	0.307	17.0	41.7
Dandelion	287	0.570	0.393	0.353	14.2	37.0
Hairy buttercup	278	0.457	0.323	0.250	18.4	41.7
Yorkshire fog	295	0.400	0.260	0.173	5.7	19.3

TABLE: Table 1: Differences in crude protein levels, g/kg dry matter (DM), phosphorus, sulphur, magnesium (all % DM), copper and zinc (mg/kg) between species in organic dairy pastures. Figures in red are significantly ( $p < 0.05$ ) higher than in either perennial ryegrass or white clover.

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### Understanding through comparison

In 2001, Massey University set up its Dairy Cattle Research Unit (DCRU) as a whole system comparison between organic and conventional pastoral dairy farming. On August 1, at conversion, the unit was split into two similar farms, one conventionally managed and the other organically managed with the aim of having two units of similar size, soil composition, fertility and herd composition. Two years later the organic farm achieved its full AgriQuality organic certification.

Both farms have been managed individually according to "best practice" so no attempt has been made to do the same thing on both farms.

The long-term aim of the research was to better understand organic dairy farming systems by investigating component interactions in these systems, and by determining how impacts and interactions change over time as organic systems mature. Extensive monitoring was carried out on both farms and an inter-disciplinary approach, co-ordinated by project leader Professor Nicola Shadbolt, has enabled the spectrum of soils, water, pastures and forage, animal production and health, and economics to be recorded and analysed.

As well as detailed annual reports provided to the funding body, DairyNZ, there has been a range of academic and industry publications on such topics as mastitis management, weeds, animal production, genetics and environmental impact.

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By Kerry Harrington, Dr

Dr Kerry Harrington is a senior lecturer in weed science at Massey University. This is the first in a series of four articles on organic versus conventional trials being undertaken at Massey University.

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