# Organic Dairy Farming

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## Introduction

“Organic Dairy Farming” is the first of a series organic farming guides commissioned by Organic Centre Wales[1]. The information provided addresses the issues relevant to the individual sector, acknowledging the questions that are frequently directed to the Centre’s ‘Helpline’. In delivering this objective we provide a useful guide to the individual development farms but additionally a useful document for those with an interest in organic production and points the way to those who wish to look in greater depth at the issues raised.

This guide is in three interrelated parts. The first part, written principally by Richard Weller of IGER[2], deals primarily with technical issues of grassland and dairy herd management, and provides practical information for dairy farmers on key factors influencing the performance of the system and also provides options for changing to alternative strategies. It draws heavily on studies at carried out at IGER’s organic dairy farm, Ty Gwyn, which have been conducted over a number of years and funded by a number of awards. Ty Gwyn is a Farming Connect Organic Development Farm and is frequently used to demonstrate good practice.

Part 2 is a review of the financial performance of dairy farming in Wales is provided by Andrew Jackson, of the Institute of Rural Sciences, University of Wales Aberystwyth. It is based mainly on two DEFRA funded studies:

- Data for organic farms extracted from the main Farm Business Survey in Wales
- A four year project focusing specifically on organic farms, drawing on all Farm Business Survey data collected for organic farms across England and Wales as well as independently collected data

From these data, it is possible to derive whole farm income data, gross margin and cost of production data to give an overview of the economics of organic dairy farming in Wales for the latest recorded financial periods (2004/05)

The third and final part consists of 2 farmer case studies, which put many of the issues discussed in parts 1 and 2 in the context of individual farm businesses. We are grateful for the co-operation of the Fordham and Ridge families.

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[1] Organic Centre Wales (OCW) is a partnership of IGER, ADAS Wales, Soil Association, Elm Farm Research Centre and the University of Wales, Aberystwyth and provides information and support for producers, consumers, businesses

[2] IGER (The Institute of Grassland and Environmental Research) is one of eight research institutes funded by the Biotechnology and Biological Sciences Research Council.

# Part 1: The experience of IGER Ty Gwyn

# Richard Weller - IGER

## 1. Background

The Ty Gwyn organic dairy farm was established in 1992 and is currently managed to Soil Association standards. The farm is part of the IGER Trawsgoed research farm and located at 50-80 m above sea level with an annual rainfall of 1,200 mm. The Grade 3 land has soils ranging from shallow gritty loam soil with a low available water capacity to deep silty-clay loam soil with higher water retention. Before conversion to organic management the forage for both grazing and conservation had been based primarily on the production from perennial ryegrass swards grown with high inputs of fertiliser nitrogen. Crop rotations have now been established on 80% of the land with permanent pastures maintained on the other 20%. With the exception of lime which is applied when the soil pH values decline below 5.5, no organic fertilisers have been applied since 1991. In addition to the farming activities on 84 ha, wildlife habitats are provided by 12 ha of woodland and the 1,795 m of hedgerows that have been planted in recent years.

During the winter period the Holstein-Friesian dairy cows are housed in cubicle sheds and the young stock in straw-bedded yards. In recent years the cows have been inseminated with semen from bulls that have a high proportion of Friesian genetics. The aim is to breed cows that are more adapted to high-forage diets and also to increase the longevity of the cows. With the exception of hay that is fed to the young calves, silage is the main forage fed during the winter to both the dairy cows and young stock.

Since 1992 the research studies at Ty Gwyn have been primarily funded by Defra with additional funding also obtained from both EU projects and the Farming Connect scheme. In addition to the research studies that have been conducted, the farm has also been used for Open Days, technical meetings and as a teaching facility for students.

Currently two contrasting organic dairy systems are being studied at Ty Gwyn. The first is an extensive system based on self sufficiency and the growing of both the forage and concentrate feeds within the system with the objective of improving sustainability by achieving a better farm-gate nutrient balance. The second system is based on home-grown forage and purchased concentrates, with the nutritive quality of the diet meeting the cow's requirement and ensuring milk persistency is maintained during the lactation to maximise milk output per hectare. The results from the two systems and their influence on the management of the farm are discussed in the sections below.

Organic dairy farming is a complete system from the maintenance of soil fertility through to the marketing of quality milk products to meet the consumer's demands. When considering the options for changing any management practices on the farm the results from Ty Gwyn have shown the importance of evaluating the whole system rather than looking at only part of the system, as the key system drivers are inter-dependent. For example in a self-sufficient system increasing the proportion of land allocated to grain rather than forage production will increase the quantity of concentrate feeds available for the dairy herd but also have a negative affect on the availability of nutrients for crop production, particularly the quantity of N available via fixation. In a system reliant on purchased concentrate feeds any sharp increase/decrease in the quantity imported onto the farm not only affects the farm-gate nutrient budgets but also the stocking density and maintenance of milk persistency during lactation. Purchasing instead of growing concentrate feeds on the farm allows more flexibility in the management of the farm in relation to price changes in concentrate feeds and/or milk. Purchasing concentrates also provides the option of changing the feed constituents to meet the seasonal changes in the energy and/or protein content of the home-grown forage.

# 2. Nutrient budgets and soil fertility

## 2.1 Whole-farm nutrient budgets

A key objective in the Ty Gwyn systems is to efficiently utilise the available on-farm nutrients for both crop and milk production and the source of concentrates has a major influence on the whole-farm nutrient budgets. As shown in Table 1 the annual surplus of nutrients increases sharply when concentrate feeds are purchased and fed at a rate of >1.0 t/ha while growing all the feed for the dairy herd (concentrates + forage) on the farm leads to an annual deficit in both P and K. Purchasing straw also leads to a significant input of K on to the farm. In a self sufficient system the fixation of N by legumes can contribute up to 95% of the total N-input compared with only a 67.1% input when significant quantities of concentrate feeds are imported on to the farm. The efficiency of N-utilisation for milk production was higher (26 v 21%) when concentrates were fed at a higher rate (1.5 v 0.4 tonnes/cow) due to the increased milk yield per cow and a greater portion of the diet being used for milk production.

***Table 1. The annual whole-farm nutrient budgets for two contrasting organic dairy systems (not including young stock).***

| | Extensive self sufficient system | | | Higher-input system reliant on imported feed | | |
|---|---|---|---|---|---|---|
| Stocking rate (Livestock units/ha) | 1.14 | | | 1.65 | | |
| Concentrate source | Home-grown | | | Purchased | | |
| Concentrate type | Barley + triticale grain | | | Field beans, soya beans, barley & wheat | | |
| Concentrates fed/cow (t) | 0.4 | | | 1.5 | | |
| % of total nutrient input/output: | **N** | **P** | **K** | **N** | **P** | **K** |
| **1. Inputs** | | | | | | |
| N-fixation* | 95.2 | 0 | 0 | 67.1 | 0 | 0 |
| Purchased concentrate feeds | 0 | 0 | 0 | 29.2 | 96.3 | 70.3 |
| Seaweed meal | 0.4 | 15.8 | 23.5 | 0.4 | 0.6 | 7.2 |
| Purchased straw | 0.7 | 42.0 | 31.8 | 1.1 | 1.9 | 14.8 |
| Purchased sawdust | 0.3 | 21.1 | 2.4 | 0.3 | 0.7 | 0.6 |
| Rain | 3.4 | 21.1 | 42.3 | 1.9 | 0.5 | 7.1 |
| **2. Outputs** | | | | | | |
| Milk | 92.0 | 86.8 | 97.6 | 94.9 | 91.2 | 98.5 |
| Culled livestock | 8.0 | 13.2 | 2.4 | 5.1 | 8.8 | 1.5 |
| Efficiency of nutrient utilisation: | | | | | | |
| Input-Output balance (kg/ha/year) | +91 | -4 | -3 | +141 | 0 | +5 |
| Surplus N per livestock unit (kg/ha) | +80 | | | + 85 | | |
| Efficiency of N-utilisation for milk (%) | 21 | | | 26 | | |

* Calculated from published fixation rates of 40 (red clover) and 54 kg per tonne DM (white clover)

### 2.2 Maintaining soil fertility

Maintaining soil fertility is essential to ensure sufficient nutrients are available for crop production. The main source of nitrogen within the system is from N-fixation by white clover in both the 5-year leys and permanent pastures, with additional N-fixation from the red clover plants in short-term leys. The primary strategy for maintaining the soil P and K indices is to apply the bulk of the slurry to the fields that are cut for silage with slurry applied both before and after first silage cut. One application of the remaining slurry and farmyard manure is applied to the perennial ryegrass/white clover leys and permanent pastures that are continuously grazed throughout the growing season. Soil fertility remains high in the leys that are continually grazed providing the swards are not overgrazed and a good grass to clover ratio is maintained.

## 3. Field practices and cropping options

### 3.1 Establishing leys and other crops at Ty Gwyn

New leys are normally established either in the March-April period or after first cut silage has been taken in late May. Sowing spring barley as a nurse crop for establishing many of the early sown grass/clover leys leads to a reduction in the length of the non-productive period between the final harvest/grazing of the previous crop and the availability of feed from the succeeding crop. Barley is sown at a seed rate of either 150 or 200 kg/ha, with the lower rate used when the crop is undersown with a grass/clover ley and the higher rate used when the crop is grown for grain and straw production. In 15 weeks after sowing spring barley produces yields of up to 12.0 t DM of whole crop and unlike taller growing cereal crops (i.e. oats, triticale) the risk of cereal plants shading the emerging grass and clover plants is lower. No weeding of the cereal crops post-emergence has been necessary at Ty Gwyn as the number of weeds germinating each year have been low. Therefore, both the barley nurse crop and grass/legume seed mixture are sown at the same time rather than at successive sowing dates when the grass/clover seed is sown after the barley crop has germinated.

An important consideration when new medium-term perennial ryegrass/white clover leys are established is to ensure an adequate seed rate of up to 35 kg/ha is sown. The establishment of dense swards prevents dock populations increasing from being a minor problem in the fields to one that affects both the growth and yield of the grass and legume plants. In many of the seed mixtures intermediate perennial ryegrass varieties with good ground cover rating (AberGold) and high-sugar content (AberDart) are now being included.

In the Ty Gwyn self sufficient system the following crop rotation has been established:

- Year 1-3 Short-term ley of either (a) Italian ryegrass/hybrid ryegrass/red clover or (b) pure red clover
- Year 4 Winter triticale for grain and straw production
- Year 5 Winter barley for grain and straw production
- Years 6-10 Perennial ryegrass/white clover/herbs

In the system where the concentrate feeds are purchased a crop rotation for producing only forage has been found to be expensive in relation to forage production costs, fossil energy inputs and the loss of production while crops are being established. Therefore, the crop rotation is now being replaced by the establishment of different multi-species long-term leys. The management strategy for the leys is based on three silage cuts per annum in Years 1-2 followed by primarily grazing the leys in Years 3-10. While perennial ryegrass and white clover provide the basic constituents in the seed mixture other species have been included with hybrid ryegrass and red clover increasing the yields during the early years. In addition other grasses (including meadow fescue, timothy and cocksfoot) have been included as they have the potential in low-N input systems to produce similar yields to perennial ryegrass and are more suited to either heavy soils that have higher water retention (e.g. timothy, meadow fescue) or shallow soils with low water retention (e.g. cocksfoot). Alsike and birdsfoot trefoil are also been evaluated as potential legumes for organic mixtures.

### 3.2 Forage production

The standards for organic production require at least 60% forage in the total diet. Forage production for the dairy herd needs to achieve high yields for both grazing and conservation while aiming for good quality to meet the cow's nutrient requirement, especially during the critical early lactation period. The production costs of different forages also need to be determined to ensure milk production costs are minimised.

Therefore, when different forage crops and mixtures are evaluated at Ty Gwyn the total yield, cost of production and the nutritive value per tonne DM are determined. Additional factors to be considered are the impact of a new crop or mixture on the nutrient availability within the whole system and the potential requirement for additional labour or specialist machinery for sowing, harvesting and storing the crop (e.g. fodder beet production).

Table 2 shows the comparative cost and nutritive value of different forage crops and mixtures grown at Ty Gwyn. Included in the calculations are the costs for rent, seed, cultivations, slurry applications, liming and harvesting. The nutritive value (£/t DM) for each forage has been calculated using the equivalent unit cost of feed energy (MJ of ME/kg DM) and protein (kg protein/t DM) of purchased organic feeds. The cheapest forage is produced from grass/clover leys, with the increased cultivations costs but higher yield of the 3-year ley leading to similar costs per tonne of DM to those of both the lower yielding re-seeded white clover/perennial ryegrass ley and permanent pasture.

Fodder beet is a high energy forage and an ideal feed for organic dairy herds, with the potential to increase the energy density of the total diet. However, the high cost of seed, requirement for a number of inter-row cultivations and the low yield led to high production costs when the crop was grown at Ty Gwyn. The annual fertility building ley is expensive to grow but produces high yields within a shorter time span than many other forage crops and has the flexibility to either provide forage or be ploughed in to improve soil fertility for the succeeding crop.

***Table 2. Costs of forage production at Ty Gwyn and the nutritive value per tonne of DM.***

| | Energy value | Protein value | Yield (t DM/ha) | Cost of Production (£/t DM) | Nutritive Value (£/t DM) |
|---|---|---|---|---|---|
| Whole-crop cereals: | | | | | |
| Spring barley | M | L | 10.3 | 50.2 | 102 |
| Spring triticale + Vetch | M | M | 11.8 | 49.4 | 107 |
| Fodder beet | H | L | 8.5 | 99.1 | 101 |
| Permanent pasture | M | H | 8.5 | 44.3 | 130 |
| Re-seeded leys: | | | | | |
| 1-yr fertility building | M | H | 10.2 | 56.3 | 130 |
| 3-yr Red clover + Italian ryegrass | M | H | 10.4 | 43.0 | 130 |
| 5-yr White clover + Perennial ryegrass | M | H | 9.7 | 44.1 | 130 |

**L, M & H = Low, moderate and high**

### 3.3 Grazing strategy

Grazed herbage is the cheapest feed for the dairy cow and a key aim for many organic farmers is to maximise milk production during the grazing season. To ensure sufficient herbage is continually available at Ty Gwyn the total area of grass/clover leys and permanent pastures is allocated for grazing and conservation in a ratio of 1:2 (spring), 1:1 (early summer) and 2:1 (late summer). In the autumn all the fields are grazed by the dairy cows and followers, with sheep lightly grazing the fields only during the November-December period as grazing after this time reduces the quantity of herbage available for grazing in the following spring. In drier years when herbage growth is slow in mid-summer big-bale silage is fed as a buffer feed. The grazing period is normally from April to the end of October but is influenced by both the grass growth and quantity of rainfall in the early spring and autumn periods.

During the grazing season some concentrate feeds are fed to the higher yielding cows at Ty Gwyn. Other studies have shown there is an increase in milk yield when grazed herbage is supplemented with concentrates for cows producing >25 kg/day. Stocking density is an important factor during the grazing season with an increase in density leading to a higher milk output/ha but lower milk yield/cow. During periods of frequent rainfall there is better resistance to the potential damage from poaching when dense rather than more open swards are grazed, irrespective of whether the swards are permanent pastures or well established re-seeded leys of perennial ryegrass and white clover.

A balanced grazing sward has an average of 25-35% white clover in the total herbage yield. However the average clover content often varies between seasons due for example to different weather patterns, changes in the stocking density or the effects of the previous season when a high clover content will increase the availability of N and stimulate grass growth in the following growing season. Table 3 shows both the average and range of clover % in the permanent pastures and re-seeded leys at Ty Gwyn during a 9-year period.

***Table 3. The clover content of the permanent pastures and leys at Ty Gwyn (9-year period).***

| Sward type: | Permanent pasture | Re-seeded perennial ryegrass/white clover 5-year ley | Re-seeded Italian ryegrass/red clover 3-year ley |
|---|---|---|---|
| Clover type: | **White** | **White** | **Red** |
| Average of all fields (%) | **26.0** | **29.9** | **33.3** |
| Range during 9 years (%) | **20.5 – 30.0** | **22.8 – 37.6** | **25.2 – 46.4** |

The dock populations in the field at Ty Gwyn have not increased since the farm was converted. In the more open short-term leys taking three cuts of silage prevents any viable seed production by the dock plants, with the grazing swards topped after each grazing rotation has been completed.

To avoid the risk of problems from gastrointestinal parasites in the growing cattle a clean grazing policy is practiced with all young stock grazed on separate fields from the adult cattle. As the heifers calve at 2-years of age quality herbage is essential for these animals during the grazing season to ensure satisfactory growth rates are recorded. When herbage growth is slow (i.e. during dry periods) or quality low (e.g. lush autumn growth) the feeding of a concentrate supplement is essential to ensure satisfactory growth rates are maintained.

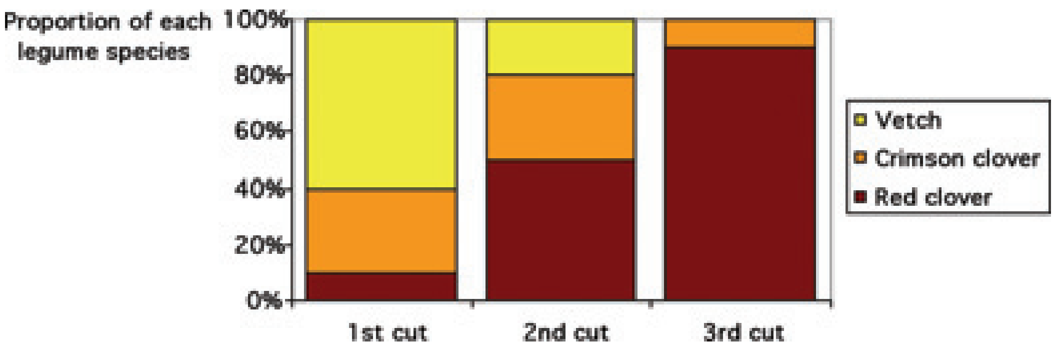
### 3.4 Silage

The primary objective at Ty Gwyn is to conserve enough silage in the clamps for the 180-day winter period and depending on the quantity of concentrates to be fed a total of 2.5-3.25 tonnes of silage DM is normally required per cow. In addition some big-bale silage is made for feeding in the winter period and to provide a buffer feed when required during the grazing period. Feeding silage during the grazing season to compensate for inadequate herbage growth ensures milk persistency is maintained, leading to better total lactation yields.

Herbage from the leys is conserved as silage in May, July and September. An 8-week re-growth period is essential to allow the leys to recover and produce adequate yields at each cut. The evaluation of different cutting heights has shown that the highest re-growth yields are recorded when the cutting height is at least 10 cm above ground level as this allows the plants to maintain a reserve of carbohydrates that can be used during the re-growth period. Cutting lower than 10 cm can reduce yields by up to 22%. An inoculant is applied to all the herbage prior to ensiling to ensure good fermentation is achieved, with adequate rolling and sealing of the clamps important to minimise waste. At the end of most winters there is normally a reserve stock of clamp silage left to provide an insurance against a poorer growing season that leads to less total silage for feeding in the following winter.

The production of 9-15 t DM/ha from short-term 2-3 year leys based on Italian ryegrass, hybrid ryegrass and red clover make a valuable contribution to both the total forage requirements for the year and the building up of soil fertility for the succeeding crop. The red clover plants also contribute nitrogen to the swards via fixation and provide extra protein feed. In short-term leys the low protein content in first cut silage can be increased by sowing Italian ryegrass with three legumes (vetch, crimson clover and red clover) rather than red clover as the sole legume species. As shown in Figure 1 vetch is the primary legume in May with crimson clover also making a valuable contribution to the total yield of legumes. By the third cut red clover is the primary legume. This type of ley produces 5 t DM in 13 weeks after sowing and is a valuable forage source when a long winter leads to a depletion of the reserve silage stock. While this type of ley is normally grown as a one year crop and leads to relatively high forage production costs, the results at Ty Gwyn have shown good yields can be achieved in the second year from the remaining red clover and Italian ryegrass plants.

***Figure 1. The temporal change in the contribution of legumes to a short-term ley based on Italian ryegrass.***




Red clover is also grown as a monoculture in the self sufficient system at Ty Gwyn and the 16-20% protein content of the red clover increases the protein content of the winter diets and balances the low protein (10-11%) of the barley and triticale grain. Whether red clover is sown in a mixture or as a monoculture, the leys are primarily grown for conservation and only grazed in the autumn period. A break of seven years between red clover leys ensures the potential problem of stem eelworm is avoided. Alsike clover has the potential to tolerate more acidic and lower fertility conditions than red clover and is also more resistant to stem eelworm. Although alsike has been successfully established in some of the mixtures at Ty Gwyn, the yield from a pure stand of alsike is markedly lower when compared with the yield recorded from red clover.

Silage is also made from whole-crop cereals, with spring barley sown to provide a higher DM silage (35+%) for feeding in the winter period with the barley crop cut when the grain reaches the hard-dough stage of ripening. Whole-crop cereal crops (barley, oats, triticale or wheat) can be readily grown on many farms and as shown in Table 4 the digestibility of the whole-crop cereals can be improved by raising the cutting height from 10 to 20 or 30 cm above the ground. While this reduces the total yield of the crop, in years when ample quantities of grass/clover silage are available the increase in the cutting height of the cereal crop provides high quality forage for feeding in the winter period, particularly if the DM and quality of the grass/clover silage is low. The aerobic stability of whole-crop cereal silage is often lower than grass silage, therefore the crop should preferably be ensiled in a long, narrow clamp and once open fed out at a fairly rapid rate. An alternative option is to ensile the whole crop as a layer in a clamp of grass/clover silage.

***Table 4. The effect of increasing the cutting height on both the yield and quality of whole-crop cereals.***

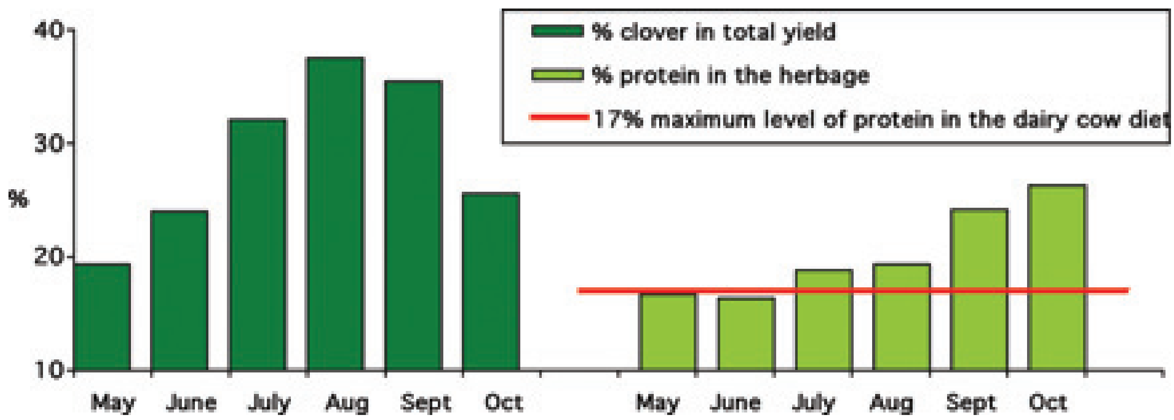
| Cutting height | Digestibility % | | | Loss of DM yield (%) | | | Crop |
|---|---|---|---|---|---|---|---|
| above ground level (cm): | 10 | 20 | 30 | 10 | 20 | 30 | DM% |
| Spring barley (Year 1) | 71.9 | 73.2 | 75.0 | 100 | 92.3 | 83.6 | 36.3 |
| Spring barley (Year 2) | 69.8 | 73.5 | 77.5 | 100 | 91.4 | 81.5 | 41.4 |
| Spring oats | 55.0 | 57.1 | 59.1 | 100 | 90.4 | 80.4 | 37.2 |

When the crop is not undersown the quality of the whole-crop forage is improved by sowing a cereal/legume mixture as the protein content of legumes (18+%) is markedly higher than the protein content found in cereal plants. As protein is the expensive part of the dairy cow ration the addition of legumes is beneficial in reducing the quantity of protein that is required from the concentrates in the ration. Successful spring-sown cereal/legume mixtures have been grown at Ty Gwyn from barley/vetch and oat/vetch mixtures. Triticale/vetch mixtures have also provided high yields but the later growth of spring triticale, compared with the taller vetch plants, increases the risk of the crop being more prone to lodging if heavy rain occurs prior to harvesting.

### 3.5 Forage quality

A range of grass/clover mixtures are grown at Ty Gwyn, from short-term leys based on Italian ryegrass/red clover to medium-term perennial ryegrass/white clover leys and permanent pastures. Analysis of samples from these different mixtures has shown that difference in quality between the different swards are mainly attributable to the stage of growth of both the grass and clover plants and also the ratio of grass to legume in the total yield. Increasing plant maturity leads to a fall in both energy and protein content.

***Figure 2. Changes during the growing season in the proportion of clover in the sward and the protein content of the mixed herbage of grass + white clover.***



In both re-seeded leys and permanent pastures the major change during the growing season is the changing protein content of the sward as the growing season progresses. As shown in Figure 2 the average white clover content in a sward increases from spring until mid summer and then decline. The increasing clover in the sward leads to progressively higher protein contents in both the grass and white clover plants. From late June onwards the increasing protein leads to excess nitrogen in the diet of the dairy cow and poor efficiency of nitrogen utilisation by the dairy cow unless the diet is supplemented with a high energy/low protein feed (e.g. cereal grain). In some individual swards the clover content can increase to over 65% by mid summer.

In Table 5 the mineral concentrations of the herbage from two organic fields at Ty Gwyn have been compared with published mineral ranges for grass and white clover herbage grown on conventional farms (Whitehead, 2000). All the mineral concentrations from the Ty Gwyn field are within the ranges published for conventional herbage, with a number of minerals having concentrations at the lower end of the range values.

***Table 5. A comparison of the mineral composition of organic fields with published conventional values.***

| System: | Organic | Organic | Conventional | Conventional |
|---|---|---|---|---|
| Pasture type: | Re-seeded perennial ryegrass/white clover ley (25% clover) | Permanent pasture (21% clover) | Perennial ryegrass | White clover |
| %: Nitrogen | 2.87 | 2.30 | 2.0 – 3.5 | 3.5 – 5.2 |
| mg/kg: | | | | |
| Phosphorus | 2,676 | 2,931 | 2,000 – 6,000 | 2,000 – 6,000 |
| Potassium | 24,824 | 13,259 | 15,000 – 35,000 | 15,000 – 35,000 |
| Calcium | 8,010 | 6,734 | 4,000 – 8,000 | 10,000 – 20,000 |
| Magnesium | 2,041 | 2,702 | 1,000 – 3,000 | 1,500 – 4,000 |
| Sodium | 2,972 | 3,240 | 500 – 4,000 | 500 – 4,000 |
| Sulphur | 2,937 | 2,095 | 2,000 – 5,000 | 2,000 – 5,000 |
| Manganese | 88 | 160 | 30 – 300 | 30 – 200 |
| Copper | 7 | 7 | 3 – 15 | 5 – 12 |
| Zinc | 55 | 45 | 15 – 60 | 20 – 40 |
| Molybdenum | 0.56 | 0.95 | 0.10 – 0.40 | 0.10 – 10.50 |
| Cobalt | 0.22 | 0.18 | 0.03 – 0.20 | 0.06 – 0.40 |
| Selenium | 0.04 | 0.05 | 0.02 - 0.40 | 0.02 – 1.2 |
| Iodine | 0.25 | 0.15 | 0.10 – 0.50 | 0.10 – 0.50 |

The difference between the mineral concentration in red clover crops grown on adjacent conventional and organic dairy farms is shown in Table 6. The red clover was from the first silage cut taken in early June. As shown by the high potassium value the conventional red clover sward was grown on an intensive dairy farm with a high stocking rate and the crop received significantly higher applications of slurry pre-cutting than the organic red clover sward. The calcium, magnesium and zinc concentrations were also higher but sodium markedly lower in the conventionally grown red clover. The composition of the slurry from the two farms was different as the conventional farm purchased all the concentrate feeds (1.8 t/cow) and fed a mineral supplement to the cows compared with home-grown concentrates (0.4 t/cow) and seaweed meal on the Ty Gwyn organic self sufficient system

***Table 6. A comparison between the mineral concentration of red clover plants grown on conventional and organic farms.***

| Red clover from: | Conventional farm | Organic farm | | Conventional farm | Organic farm |
|---|---|---|---|---|---|
| %: Nitrogen | **4.2** | **2.0** | **mg/kg:** | | |
| mg/kg: | | | **Manganese** | **48.3** | **40.0** |
| Phosphorus | **2,940** | **2,204** | **Copper** | **9.5** | **5.6** |
| Potassium | **35,704** | **18,988** | **Zinc** | **38.9** | **17.1** |
| Calcium | **15,194** | **11,057** | **Molybdenum** | **0.6** | **1.1** |
| Magnesium | **3,611** | **2,057** | **Cobalt** | **0.1** | **0.1** |
| Sodium | **307** | **1,144** | **Selenium** | **0.1** | **0.01** |
| Sulphur | **1,658** | **1,381** | **Iodine** | **0.5** | **0.3** |

**3.6 Cereal crops for the production of grain and straw at Ty Gwyn**

Both barley and triticale have been grown as grain crops at a seed rate of 200 kg/ha with soil fertility primarily provided from the previous grass/clover leys. Following an application of slurry or farmyard manure before ploughing, winter triticale is grown in the first year followed by a crop of winter barley in the second year. Growing two cereal crops in succession is only viable if the soil fertility of the fields has been improved by the preceding crop. The barley ripens in August and allows a grass/clover ley to be sown and become well established before the winter period. A typical range in the grain yields from the cereal crops are 2.33-3.07 (spring barley), 3.78-4.45 (winter barley) and 4.27-5.49 t/ha (winter triticale). Analysis of the triticale grain has shown the average digestibility, starch and protein concentrations to be higher than those found in the barley grain: 91.3 v 87.5, 64.8 v 58.9 and 11.9 v 11.1%.

Although oats have been successfully included in the dairy cow diets problems have occurred in the growing of the crop as Ty Gwyn is located in a grassland area with few other cereal crops grown in the locality. Large numbers of rooks have caused extensive damage to the crop at sowing and also when the crop reaches the grain ripening stage. Barley crops are less attractive to rooks than oats but damage still occurs in the 3-4 week period before combining when the cereal is grown during drier seasons and the rooks are desperate for food. Minimal damage has occurred with triticale crops.

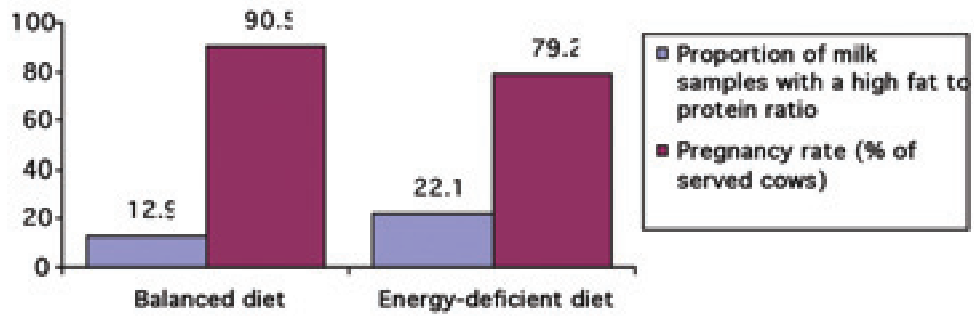
Crimped grain is an alternative option for some farms and at Ty Gwyn crimping provided a quality feed that was palatable to the cows. Cereal crops for crimping are cut 3-4 weeks earlier than for normal dry grain and the earlier harvest is beneficial for winter cereals as there is still time to establish another crop before the start of the winter period.

# 4. The management and performance of the organic dairy cow

### 4.1 Feeding the dairy cow

A negative energy balance occurs with many dairy cows during the first few weeks of lactation as milk production increases at a faster rate than feed intake. Organic diets are based on feeding a minimum of 60% forage in the total diet and the results from trials at Ty Gwyn have shown that the biggest challenge is to provide sufficient energy for the cows during the early and mid-lactation periods.

***Figure 3. The importance of energy in the diet to maintain good milk quality and efficient reproductive performance.***




Work in Austria and Denmark also supports the view that energy is the main limiting factor in herd performance. Therefore, it is important to produce high-quality forage that will minimise the energy deficit during this period. As shown in Figure 3 a balanced diet leads to fewer monthly milk samples having both low protein values and a high fat to protein ratio, with reproductive performance is also significantly improved. Sub-clinical ketosis has been identified as a problem in herds where the energy diet is low and the milk fat to protein ratio high.

Feed protein supply in dairy cow diets can also be erratic during the year. In May 60% of the annual silage requirements for Ty Gwyn is made from first cut, providing high quantities of silage but with protein contents <15% due to the later spring growth of legumes compared with grasses. The option of delaying taking first-cut silage can improve the protein content of the silage but also increases the risk of poor herbage re-growth and low silage stocks in dry seasons. Higher proteins at second and third cuts (16-20%) and the growing of pure red clover swards both increase the protein content of the total silage stocks and compensate for the lower protein content in the May-cut silage.

Total annual feed intake for the dairy cow is 6-6.5 tonnes DM and in the self sufficient system at Ty Gwyn the between-season variations in climatic conditions have a marked influence on the sustainability of the system. With 17% of the total land area allocated to growing grain crops to produce 0.4-0.7 t of grain/cow, there is a requirement to reduce the stocking density to below 1.2 cows/ha to ensure sufficient forage (i.e. 5.3-6.1 t DM/cow) is available annually for grazing and conserving as silage. Silage intake in the winter period can vary and is not always correlated to silage quality as the type of feeding system has an effect on the quantity of feed consumed by the cow. Table 7 includes the correction factors published by Chamberlain & Wilkinson (1998) and others showing the influence different winter feeding systems can have on the feed intake of the dairy cow.

*Table 7. The potential effect of the winter feeding system on feed intake.*

| System: | Correction factor | Comments |
|---|---|---|
| TMR/Complete diet | **1.2 -1.3** | **Increases in intake depend on the quality of the diet. Diet needs 35+% forage, DM% of 40-50%** |
| Mixed forages | **1.0 -1.05** | **Depends on the how complementary the different forages** |
| Self-feed silage | **0.8 - 0.95** | **Depends on width of silo face** |
| Poor quality silage | **0.7 - 0.9** | **Influenced by the forage: concentrate ratio** |
| Out-of-parlour feeders | **1.05 -1.11** | **Influenced by the quality and availability of the available forage** |

The mineral content of a ration is important for the dairy cow and seaweed meal is added to the silage-based diets at Ty Gwyn during the winter period. To increase the quantity of minerals in the diet chicory, plantain, salad burnet and yarrow have been included in many of the 5-year leys based on perennial ryegrass and white clover. Compared with grass and white clover plants both the chicory and plantain plants have higher mineral concentrations, however, their contribution to the diet is limited by their failure to persist when grown in a mixture with the grass and clover. The alternative option of establishing herb strips reduces the competition from the grass and clover plants but also increases the risk of dock populations causing problems as the swards are more open and the herb species less able to compete against the more aggressive dock plants.

When diets for the dairy cow are formulated energy, protein and minerals are often the primary factors to be balanced. However, the quantity of fibre on the diet is also important. The dairy cow requires a minimum of 35-40% fibre in the diet. In a grazing sward grass plants have an adequate fibre content of 40-45%, but the fibre content of white clover is <25%.  When cows graze clover-rich but low fibre swards the fat content of the milk can decline to 3.6% unless long-fibre forage is also offered to the cows.

### 4.2 Changes in the organic feed standards

The removal of the non-organic feed allowance will increase the cost of milk production for many Welsh farmers. For farms able to grow combinable crops (e.g. crimped grain) the option of producing home-grown concentrates may be financially viable. However, for those farming under less favourable climatic conditions and dependent on purchased concentrate feeds (e.g. high-protein feeds, sugar beet) the options are limited. For these farms some of the cropping options outlined above may increase the energy and protein quality of the forage component of the diets and reduce the quantity of concentrates required to balance the diets.

Feeding 100% forage diets is an option being considered on some farms to avoid any increase in feed costs but removing concentrate feeds completely from the diet raises four key points:

- The variability in quality is greater in forages than concentrate feeds
- Will an all-forage diet of high quality provide sufficient energy and protein for the cow in early lactation ?
- Will the cow consume enough forage (e.g. on winter silage-based diets) ?
- Yield per cow is likely to be lower and overhead costs per kg of milk higher

### 4.3 Calving season options

The month of calving can have a marked effect on both the performance of the herd and milk production costs. To meet the cow’s nutrient requirements from high-forage diets requires the block calving of a herd 4-5 weeks before the cows are turned out in the spring. The strategy of calving before rather than at turn-out allows the cows to maximise feed intake when peak milk production occurs and also maintain better milk persistency throughout the lactation. Producing milk primarily from high-quality herbage also reduces production costs per litre. However, the benefits of block-calving a herd in the spring need to be balanced against any seasonality/dual pricing scheme that is implemented by the milk buyer as there may be a substantial reduction in the price of milk being produced in the spring/early summer period.

Block calving when 90% of cows calve within a short period (e.g. 8 weeks) requires the feeding of high-energy diets in early lactation, good oestrus detection and high conception rates in early lactation. Table 8 shows the effects on a spring block-calving herd when conception is delayed by 42 and 84 days (i.e. 2 and 4 oestrus cycles), with a failure to conceive within the target period leading to a longer calving interval and critically for some producers a different milk production profile. Over a 2-year period the accumulated effect of delayed conception significantly changes the calving pattern from the pre-turnout period to late summer when peak yield will not be reached until the August/September period. Delayed conception also reduces the herd average yield/cow/day and potentially increases feed cost for those cows calving in the late summer period when the availability of grazed herbage is lower.

***Table 8. The effect of delayed conception on both the calving period during the year and calving interval.***

| Herd target calving period - 01 Feb – 31 March | Actual calving period | Post-calving days to conception | Calving Index | Next calving date |
|---|---|---|---|---|
| A: Regular breeding cows | **01 Feb – 31 Mar** | **80** | **365** | **01 Feb – 31 Mar** |
| B: Cows with 40-day delayed conception | | | | |
| - Year 1 | **01 Feb – 31 Mar** | **122** | **407** | **12 Mar – 12 May** |
| - Year 2 | **10 Mar – 10 May** | **122** | **407** | **13 Apr – 13 June** |
| C: Cows with 80-day delayed conception | | | | |
| - Year 1 | **01 Feb – 31 Mar** | **164** | **449** | **26 Apr – 25 June** |
| - Year 2 | **12 Apr – 11 June** | **164** | **449** | **4 July – 3 Sept** |

Suitable calving season options when milk buyers require a level monthly production of milk are year-round calving or two block calving periods in the spring and autumn, however, the latter option may complicate the management of the farm. Both these options also provide a more consistent milk quality profile throughout the year. Year-round calving leads to a more even workload during the year but cows calving from mid-summer until the end of the grazing season may produce low yields unless the declining availability and quality of the grazed herbage is supplemented with extra feed (e.g. concentrates, high-quality forage).

### 4.4 Herd performance and breed selection

Table 9 shows the results from the two Ty Gwyn systems with the Holstein-Friesian cows efficiently converting forage into milk when very high forage diets are fed. Increasing the level of concentrate inputs from 0.08 to 0.26 kg/litre of milk led to a significant increase in yield but sharply reduced the quantity of milk being produced from forage.

*Table 9. The performance of cows fed different levels of concentrate feeds during lactation.*

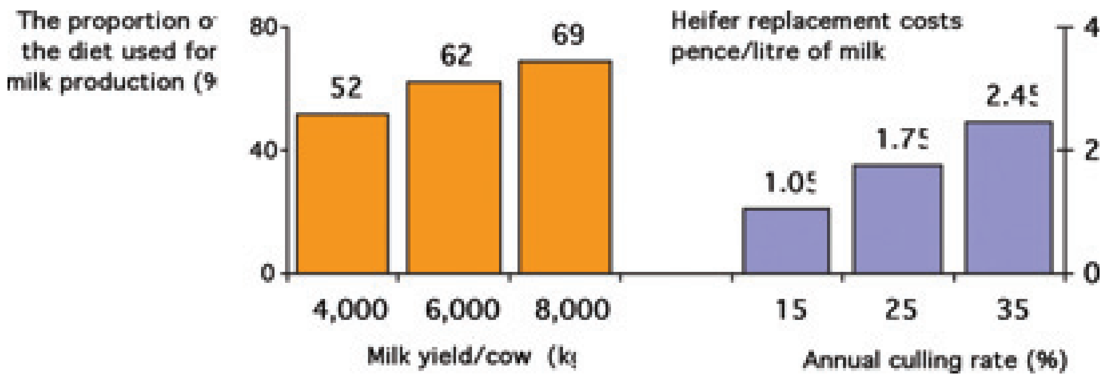
| | Extensive self sufficient system | Higher-input system reliant on imported feed |
|---|---|---|
| Concentrates fed/litre of milk (kg) | **0.08** | **0.26** |
| 305-day milk yield/cow (kg) | **5,867** | **6,967** |
| Yield of milk fat + protein (kg) | **396** | **458** |
| % of milk produced from forage | **83.1** | **46.5** |
| Efficiency of feed conversion into milk (MJ of milk per MJ of feed) | **0.37** | **0.41** |

Irrespective of the quantity of concentrates fed the average productive life of cows in both the Ty Gwyn systems is low compared with the Friesian cows that were in the original herd. The main reasons for cows being culled are infertility and lameness, with some cows also culled due to persistently high cell counts.  To extend the longevity of the two herds the cows are now inseminated with semen from bulls with a high proportion of Friesian genetics. Alternative options under consideration are crossing the cows with another breed (e.g. Jersey) to gain the advantages of heterosis or changing to an alternative native breed.

As the milk yield from cows of a similar bodyweight declines a higher proportion of the total feed intake is used for maintenance rather than milk production (Figure 4) and these lower-yielding cows are less efficient converters of feed into milk. However, a comparison between large-framed Holstein cows and Jersey cows with a smaller feed requirement for maintenance has shown both breeds to have similar feed-into-milk conversion rates. In addition the reduced feed conversion efficiency of lower yielding cows is often balanced by a reduction in health and fertility problems and also increased longevity, which reduces both the culling rate and herd replacement costs. Compared with high genetic merit Holstein cows, other lower yielding breeds and cross breeds have the potential when fed high-forage diets to produce quality milk, breed regularly and maintain the appropriate body condition during lactation without the requirement for significant quantities of concentrates in the diet.

The cost per litre increases sharply as culling rates increase and the number of replacements required annually for the herd increases. Milk income is also likely to be lower when a heifer replaces a mature cow in the herd. In addition to producing milk and becoming pregnant, a heifer calving at 2-years old will also grow during the lactation period. At Ty Gwyn the total lactation yield of first-lactation heifers has been between 75-79% of the yield produced by the mature cows in the herd, leading to a potential loss of milk income of £236-337/cow.

***Figure 4. The relationship between milk yield per cow and the efficiency of feed conversion (Haiger, 2000) and also the cost implications of different culling rates.***



### 4.5 Herd health

The incidence of different health events varies markedly between herds and is influenced primarily by differences between farms in standards of livestock husbandry, environmental conditions (e.g. length of the winter housing period; straw yards or cubicle housing) and the suitability of the type of cow for an individual system. The maintenance of a closed herd also minimises the risk of disease problems in the herd.

Compared with many conventional herds the number of cases of both lameness and clinical mastitis has been found to be lower at Ty Gwyn. The lower incidence of lameness recorded at Ty Gwyn and in other organic herds is attributed to the feeding of diets that are higher in forage content and lower in protein content.

As long-acting antibiotics are not used at the end of the lactation a key challenge for some herds is to ensure the level of somatic cell counts in the milk remain low, especially if clinical mastitis from ***Staphylococcus aureus*** occurs in the herd. Good parlour hygiene, the grouping and milking of high-cell count cows last and the culling of cows with persistent high cell counts all contribute to reducing the average cell count in the herd.

The level of cell counts in the milk is important as high cell counts lead to:
- Lower milk production per cow
- Reduced shelf life of liquid milk
- Reduced milk casein and fat content
- Longer clotting times, reduced curd firmness and up to 10% lower yields during cheese making
- Poorer fermentation during yoghurt making

A number of alternative therapies have been tried at Ty Gwyn with some success in temporarily lowering cell count levels but no longer-term benefits have been recorded.  The winter housing of cows in straw yards rather than cubicles can lead to an increased incidence of mastitis but depends on the management strategy of the straw yards, including the frequency of adding fresh straw, time period between the removal of manure from the yard, bedding area per cow and type and cleanliness of the cubicles.

Mineral supplementation from seaweed meal and rock salt in the winter silage-based diets and the mineral contribution from different plant species during the grazing season ensure mineral supply is normally adequate for the cows at Ty Gwyn. No cases of hypomagnesaemia have been recorded at Ty Gwyn and with the exception of both selenium and iodine shortage during two grazing seasons, the incidence of health problems related to mineral deficiency (retained placenta, metritis, milk fever) has been low.

# 5. Acknowledgements

Since the conversion of the farm Peter Bowling has been responsible for undertaking both the sampling routines and the collection and collation of data from the farm. The input of all the farm staff involved in the different tasks at Ty Gwyn, including the field operations and the feeding of the dairy cattle, is acknowledged with special thanks to Huw Morris and Alun Lloyd for managing the Ty Gwyn herd.

# 6. References

Chamberlain A T & Wilkinson J.M (1996). ***Feeding the dairy cow***. Published by Chalcombe Publications, Lincoln, UK. 241 pages

Haiger A (2000) Lifetime dairy performance as breeding aim. ***Proceedings of the 13th IFOAM Scientific Conference*** 'The world grows organic'. Eds – Alfoldi T., Lockeretz W. & Niggli U. pp.316-319.Basel, Switzerland.

Whitehead D C (2000) ***Nutrient elements in grassland: Soil-Plant-Animal relationships***. Published by CABI Publishing, Wallingford. 384 pages.

# 7. Suggested further reading:

British Grassland Society (2004) Organic farming: Science and practice for profitable livestock and cropping. BGS Occasional Symposium No.37. Joint BGS/AB/COR 2004 Conference.

Nicholas P K, Padel S, Cuttle S P, Fowler S M, Hovi M, Lampkin N H & Weller R F (2004) Organic dairy production: A review. ***Biological Agriculture and Horticulture*** 22: 217-249.

Underwood E J & Suttle N F (1999) ***The mineral nutrition of livestock***. Published by CABI Publishing, Wallingford. 614 pages.

Weller R F & Cooper A (2001) Seasonal changes in crude protein concentration of white clover/perennial ryegrass swards grown without fertiliser N in an organic farming system. ***Grass and Forage Science***. 56:92-95.

Weller R F & Bowling P J (2004) The performance and nutrient use efficiency of two contrasting systems of organic milk production, ***Biological Agriculture and Horticulture***. 22: 261-270.

# Part 2: The financial performance of organic dairy farms

## 1. Background

The organic milk market has been changeable over the past five years. Poor conventional prices in 1999/2000 saw many producers convert to organic production to realise higher premiums for organic milk. However, the demand for organic milk was lower than the increasing supply as a large number of farmers achieved organic status in 2001/02 leading to a fall in price. Subsequent price reductions occurred as organic milk was sold onto the conventional liquid market, which in turn, was faced with falling producer prices. Nevertheless, the organic milk market has strengthened and improved significantly since autumn 2004 with some producers receiving up to 26 ppl for their organic milk. The more buoyant market situation for organic dairy farmers is much needed, especially as the previous years have seen tougher times for those organic producers that converted to organic production in search of better farm incomes.

To understand further the financial performance of organic dairy farming, there are two key sources of financial performance data available for organic dairy farms in Wales, one from organic farms extracted from the main Farm Business Survey in Wales and the other from a DEFRA funded four year project that specifically surveys the financial performance of organic farms and is an amalgamation of all Farm Business Survey data collected for organic farms across England and Wales as well as independently collected data, again using farm business survey methodology. From these data, it is possible to derive whole farm income data, gross margin and cost of production data to give an overview of the economics of organic dairy farming in Wales for the latest recorded financial periods.

## 2. Whole farm incomes

### 2.1 Welsh Farm Business Survey data

Data from two samples of organic dairy farms were extracted from the main Farm Business Survey data in Wales for the financial periods 2003/04 to 2004/05 (Table 1). The results for all farms (mainly conventional) in the survey are shown alongside the organic farm data to provide a comparison. For both financial years, the conventional farms performed better on a wholefarm and net farm income basis overall compared to the organic farms.

The results show that the organic farms performed similarly from 2003/04 to 2004/05 achieving net farm incomes of £215/ha and £212/ha, respectively. As the farms are not based on identical samples, it is not possible to make comparisons between these datasets. However, it should be noted that in 2003/04, the conventional farms stocked at 2.2 LSU/ha and carried 143 dairy cows compared to a stocking rate of 1.7 LSU/ha and 99 dairy cows for the organic farms. Conversely in 2004/05, the organic farms were stocked at 2.0 LSU/ha and carried 156 cows on average compared to the main survey farms, which were stocked at 2.1 LSU/ha with 132 dairy cows milked on farm.

A key reason for poor organic farm performance shown by these two datasets is due to the low premium received for organic milk in comparison to the conventional milk price at less than a penny per litre for both financial periods. As cows managed within organic systems tend to produce less milk per cow, at a lower stocking rate, and are fed more expensive organic concentrates, poorer farm performance is to be expected without a premium for organic milk that matches the extra costs associated with organic farming systems. Previous studies have indicated that a premium of ca. 5 ppl is needed for organic farmers to achieve similar results to conventional – in these samples, an additional 4 ppl would have added £214 and £286 to net farm income in 2003/4 and 2004/5 respectively, resulting in higher incomes than the conventional group.

*Table 1. Average net farm income for organic and conventional alldairy farms (FBS 2003, 2004)*

| | 2003/04 | | 2004/05 | |
|---|---|---|---|---|
| | Org | Conv | Org | Conv |
| Number in survey | 9 | 46 | 9 | 58 |
| Milk yield (l/cow) | 5233 | 6445 | 5326 | 6190 |
| Milk price (ppl) | 19.55 | 18.22 | 19.14 | 18.24 |
| No. of dairy cows | 99 | 143 | 156 | 132 |
| Size (ha) | 93 | 102 | 114 | 94 |
| ***Values (£/ha)*** | | | | |
| Dairy output | 1098 | 1674 | 1400 | 1609 |
| Other output | 339 | 448 | 383 | 450 |
| ***Total outputs*** | 1436 | 2122 | 1783 | 2059 |
| Feeds | 305 | 478 | 381 | 441 |
| Other livestock costs | 111 | 182 | 170 | 193 |
| Crop costs | 31 | 138 | 61 | 123 |
| **Whole farm margin** | **990** | **1324** | **1171** | **1301** |
| Labour | 259 | 328 | 328 | 320 |
| Machinery | 164 | 213 | 199 | 211 |
| Other fixed costs | 352 | 450 | 431 | 474 |
| ***Total inputs*** | 1222 | 1788 | 1571 | 1763 |
| **Net Farm Income** | **215** | **334** | **212** | **295** |

### 2.2 Organic Dairy Farm Incomes in England and Wales 2003/04 – 2004/05

Identical samples of organic dairy farms were monitored during the financial periods 2003/04 to 2004/05[3]. This financial data was recorded using Farm Business Survey methodology. In total, a sample of 14 lowland and five LFA organic dairy farms in England and Wales were derived from this dataset.

#### *2.21 Lowland dairy farms (identical farm samples)*

For this farm type, the identical sample of organic farms were based in England and Wales where one farm was located in Northern England, six in the South West region and two from Central and Eastern England and five in Wales. From this sample of organic farms, net farm incomes decreased from £357/ha in 2003/04 to £262/ha in 2004/05. Milk prices decreased marginally during this period. A key aim of this research is to match conventional farm data from the main Farm Business Survey data to derive comparable conventional farm data for each organic farm. In 2004/05, the organic farms performed better with net farm income 13% higher for organic farms in 2004/05 compared to £232/ha for conventional farms. Nevertheless, it should be noted that during this financial period, the organic farms managed 25% more cows on a greater area in comparison to the comparable conventional farms. Moreover, the organic farms increased their herd size by 10% from 2003/04 to 2004/05 and incorporated more area into their total farm area overall. In contrast, the comparable farm size and herd size remained similar between these financial periods. As a result, stocking rates increased slightly for organic farms from 1.4 to 1.5 LSU/ha in contrast to the comparable farms which decreased slightly from 1.7 to 1.6 LSU/ha.

[3] Jackson, A.J., and Lampkin, N.H. (2005) Organic Farm Incomes in England and Wales 2003/04. Report for DEFRA contract ref. OF0189. Institute of Rural Sciences, Aberystwyth.

The identical dataset for the lowland organic dairy farms indicates that costs increased for all cost categories in 2004/05 with the exception of feed costs on a per hectare basis. However, homegrown concentrate useage did increase on a £ per farm basis, which effectively offset some of the reduction in purchased feed costs.

In terms of business stability, the organic farms maintained a positive return on both tenants and all associated farming capital of 8.4% and 4.5%, respectively. However despite a positive return, the external liability status for the identical farm sample increased slightly overall with the average overdraft facility increasing from £34,451 to £43,830 from 2003/04 to 2004/05 indicating that there were insufficient returns at the current milk price level to reduce liabilities whilst enabling capital investment into the business.

***Table 2. Average net farm income for organic and conventional lowland dairy farms (UWA, 2006)***

| | 2003/04 | | 2004/05 | |
|---|---|---|---|---|
| | Org | Conv* | Org | Conv* |
| Number in survey | 14 | | 14 | |
| Milk yield (l/cow) | 5892 | 6074 | 5901 | 6087 |
| Milk price (ppl) | 20.3 | 17.8 | 20.5 | 17.9 |
| No. of dairy cows | 126 | 113 | 139 | 111 |
| Size (ha) | 124 | 113 | 130 | 116 |
| | | | | |
| ***Values (£/ha)*** | | | | |
| Dairy output | 1187 | 1111 | 1204 | 1095 |
| Other output | 518 | 676 | 439 | 653 |
| ***Total outputs*** | 1705 | 1786 | 1643 | 1749 |
| Feeds | 281 | 342 | 252 | 308 |
| Other livestock costs | 152 | 159 | 174 | 167 |
| Crop costs | 50 | 173 | 52 | 140 |
| **Whole farm margin** | **1221** | **1111** | **1164** | **1134** |
| Labour | 205 | 235 | 218 | 227 |
| Machinery | 267 | 279 | 279 | 277 |
| Other fixed costs | 392 | 387 | 406 | 399 |
| ***Total inputs*** | 1347 | 1575 | 1381 | 1517 |
| **Net Farm Income** | **357** | **211** | **262** | **232** |

* Comparable conventional farms selected on the basis of similar resource endowments to individual organic farms

### *2.22 LFA dairy farms (identical farm samples)*

For this farm type, it was possible to derive financial data for an identical sample of five organic dairy farms, where one farm was located in Northern England with the remaining four located in Wales (Table 3.). Here, net farm incomes increased slightly from 2003/04 to 2004/05 to £178/ha from £173/ha. Milk prices decreased marginally during this period. In 2004/05, the conventional farms performed better on a net farm income basis than the organic farms by 24% at £220/ha with 40% more cows on a smaller farm area in comparison to the organic farms by 12%. Stocking rates increased slightly for organic farms from 1.5 to 1.6 LSU/ha and remained at 1.7 LSU/ha for the comparable farms during these financial periods.

In general, costs increased for all cost categories in 2004/05 for the organic farms with the exception of other livestock costs which decreased slightly on a per hectare basis. Outputs increased slightly for both dairy and other output categories. Similarly, costs increased for the comparable conventional farms.

A key difference between the lowland and LFA organic dairy farm datasets is the difference in milk price received. It would appear that more lowland farms were able to sell a greater proportion of their milk to the organic market to achieve an average milk price of 20.5 ppl in 2004/05 compared with 18.7 ppl for the LFA identical organic farm sample. As a result, the effect on business stability for the LFA organic dairy farms is negative in terms of achieving zero or negative returns on capital associated with the farm business, whilst the comparable farms for this farm type were able to derive a positive return on both tenants and all associated farming capital, albeit at a low rate of 2.4% and 1.3%, respectively. With a poor return on capital invested, the external liability status for the identical organic farm sample remained unchanged for this financial period.

***Table 3. Average net farm income for organic and conventional LFA dairy farms (UWA, 2006)***

| | 2003/04 | | 2004/05 | |
|---|---|---|---|---|
| | Org | Conv* | Org | Conv* |
| Number in survey | 5 | | 5 | |
| Milk yield (l/cow) | 5040 | 5361 | 4929 | 5543 |
| Milk price (ppl) | 18.8 | 16.6 | 18.7 | 16.4 |
| No. of dairy cows | 70 | 113 | 79 | 111 |
| Size (ha) | 91 | 83 | 92 | 82 |
| ***Values (£/ha)*** | | | | |
| Dairy output | 777 | 753 | 831 | 784 |
| Other output | 440 | 537 | 508 | 567 |
| ***Total outputs*** | 1217 | 1290 | 1338 | 1350 |
| Feeds | 223 | 269 | 257 | 253 |
| Other livestock costs | 84 | 113 | 77 | 128 |
| Crop costs | 19 | 85 | 26 | 85 |
| **Whole farm margin** | **892** | **823** | **977** | **885** |
| Labour | 132 | 107 | 147 | 111 |
| Machinery | 243 | 202 | 284 | 230 |
| Other fixed costs | 344 | 291 | 368 | 324 |
| ***Total inputs*** | 1045 | 1068 | 1160 | 1130 |
| **Net Farm Income** | **173** | **222** | **178** | **220** |

* Comparable conventional farms selected on the basis of similar resource endowments to individual organic farms

## 3. Dairy gross margins

The gross margin performance for dairy herds is improved under conventional management than for those herds managed organically at present according to the latest 2004/05 Farm Business Survey data derived from farms located in Wales only. In 2003/04, gross margins were similar under both organic and conventional production as organic farms were able to command a better premium on organic milk at 19.55 ppl compared to 19.14 ppl in 2004/05. As a result, the erosion of the price premium for this sample of organic farms in comparison to dairy gross margins from the main survey farms has resulted in lower gross margins achieved on organic farms. If the organic milk has to be sold at the conventional milk price then the gross margin is worse still, mainly due to the high cost of organic feed. Assuming a stocking rate of 1.6 LSU/ha on the organic farms and 2.2 LSU/ha for the main survey farms, the calculated gross margin per hectare on organic farms is substantially lower again for the organic farms at £1,005/ha compared to £1,520/ha for the main survey farms.

This trend is replicated in the latest Organic Farm Income report covering the 2003/04 and 2004/05 financial periods[4]. Here, gross margin data including forage costs for organic farms was £810/cow in 2003/04 with milk yields averaging 5,699 litres per cow with the average organic milk price recorded at 21.05 ppl whereas in 2004/05, the gross margin (including forage costs) value fell to £738/cow with milk yields averaging at 5,240 litres per cow and milk price falling to 19.35 ppl on average. These datasets are not based on identical samples. This equates to slightly better gross margin performance in comparison to the conventional FBS gross margins shown below.

A simple sensitivity analysis to determine the effect of an increase in organic milk price to 26 ppl was carried out using the Welsh Farm Business survey organic dairy gross margin data. At this level of price premium, the gross margin excluding forage is significantly higher than the current gross margin level. For instance in 2004/05, the organic dairy gross margin could be expected to be in the region of £1068/cow, which is 52% higher than at the current level of gross margin per cow achieved on farm.

***Table 3. Organic and conventional dairy gross margins (Source: Farm Business Survey, UWA)***

| | **2003/04** | | **2004/05** | |
|---|---|---|---|---|
| | Organic | Conv | Organic | Conv |
| Sample No. | 9 | 81 | 9 | 65 |
| Milk yield (litres/cow) | 5,233 | 6,431 | 5,326 | 6,188 |
| Milk price (ppl) | 19.55 | 18.06 | 19.14 | 18.15 |
| | | | | |
| ***Values (£/cow)*** | | | | |
| Financial output | 1,028 | 1,160 | 1,058 | 1,165 |
| Purchased feed | 207 | 241 | 200 | 231 |
| Other costs | 95 | 122 | 155 | 155 |
| Total variable costs | 302 | 363 | 354 | 386 |
| **Gross margin** | **726** | **797** | **703** | **780** |
| at conventional prices | 648 | - | 650 | - |
| with organic premium (26 ppl) | 1064 | - | 1068 | - |
| Forage costs | 68 | 96 | 75 | 88.86 |
| **GM inc forage (£/cow)** | **659** | **700** | **628** | **691** |
| | | | | |
| Assumed stocking rate* | 1.6 | 2.2 | 1.6 | 2.2 |
| GM inc forage (£/ha) | 1054 | 1541 | 1005 | 1520 |
| with organic premium (26ppl) | | | | |
| GM inc forage (£/ha) | 1702 | - | 1707 | - |

[4] Jackson, A.J., and Lampkin, N.H. (2006) Organic Farm Incomes in England and Wales 2004/05. Report for DEFRA contract ref. OF0189. Institute of Rural Sciences, Aberystwyth.

## 4. Costs of production

The cost of producing a litre of organic milk is an important consideration for the financial performance of organic dairy farms. The Welsh Farm Business Survey has recorded the cost of production for organic milk at 14.64 ppl, with the top 5 (low cost group) producing milk at 13.67 ppl in 2003/04 (Table 4). It is important to note that these costs exclude imputed costs such as family labour, imputed rent (rental equivalent) and interest on tenant's capital. In addition, fixed costs are split on a livestock unit basis. For calculating milk costs, the livestock proportion relates to the dairy cows alone and excludes youngstock or heifers in rear. As a result, fixed costs of production associated with the dairy enterprise can be diluted. Using the same methodology for calculating costs of milk production, but with the inclusion of imputed costs, these being: family labour, imputed rent (applicable for owner-occupied land) and interest on tenants capital (notional interest value excluding actual interest paid); the results from the DEFRA organic farm income survey indicate that the total cost of production for milk in 2003/04 was 20.92 ppl and 19.69 ppl for the top 5 group. For the whole group, the price received for milk was marginally below the cost of production.

***Table 4. Organic and Conventional dairy gross margins (Source: Farm Business Survey, UWA)***

| **Milk production costs** - pence per litre | **Welsh FBS Organic farms** 2003/04 All farms | Top 5 | **DEFRA organic survey (E&W)** 2003/04 All farms | Top 5 |
|---|---|---|---|---|
| **Number of farms** | **9** | **5** | **10** | **5** |
| Feed | 3.95 | 3.88 | 3.91 | 3.36 |
| Veterinary and medicines | 0.41 | 0.45 | 0.45 | 0.34 |
| Other livestock costs | 1.41 | 1.59 | 1.65 | 1.42 |
| Forage | 1.17 | 1.12 | 0.92 | 1.01 |
| **Total variable costs** | **6.94** | **7.04** | **6.94** | **6.13** |
| **Herd replacement** | **0.88** | **0.57** | **0.62** | **0.78** |
| Labour | 1.83 | 1.27 | 1.36 | 0.70 |
| Power and machinery | 1.92 | 1.88 | 2.35 | 1.97 |
| Buildings | 0.77 | 0.67 | 0.50 | 0.90 |
| General farm costs | 1.59 | 1.46 | 2.12 | 1.91 |
| Rent | 0.50 | 0.64 | 0.92 | 1.06 |
| Finance | 0.21 | 0.14 | 0.65 | 0.45 |
| **Total overhead costs** | **6.82** | **6.06** | **7.90** | **7.00** |
| **Total costs** | **14.64** | **13.67** | **15.46** | **13.90** |
| **Margin** | **4.34** | **6.41** | **6.73** | **8.44** |
| Margin over concentrates ppl | 15.68 | 15.74 | 16.92 | 17.81 |
| Milk price received (p/litre) | 19.55 | 19.62 | 20.84 | 21.17 |
| Unpaid labour | | | 2.55 | 2.32 |
| Imputed rent | | | 1.34 | 1.85 |
| Interest on tenants capital | | | 1.57 | 1.62 |
| **Total imputed costs** | | | **5.46** | **5.79** |
| **Total costs including imputed costs** | | | **20.92** | **19.69** |

# 5. Conclusions

There is now significantly more data available to determine the financial performance of organic dairy farming in Wales. The latest data based on the financial periods from 2003/04 to 2004/05 indicates that the profitability of organic dairy farming at that time was marginal in comparison to conventional milk production. The Welsh Farm Business Survey data indicates that conventional dairy farming was more profitable than organic dairy farming; however, the organic milk price premium received was negligible for this sample. The identical organic farm sample based on farms located across England and Wales indicates slightly better net farm incomes compared to conventional farms, but this was based on managing more cows on a greater area and receiving a greater milk price premium of 2.6 ppl above conventional price. Organic dairy farming in less favoured areas (LFA's) appeared economically unsustainable at the then organic milk price of 18.7 ppl for this farm sample. With the recent strong increases in demand and prices for organic milk, this situation is likely to be transformed in 2005/6 for those producers with access to organic outlets.

The dairy gross margins derived from the Welsh Farm Business Survey indicate that conventional farmers were able to achieve better gross margins than organic farmers in 2004/05 at £691 per cow compared to £628 per organically managed cow. This is potentially a serious concern for organic farmers as they stock less than conventional farmers due to operating without the use of artificial fertilisers. Consequently, organic farmers could expect to derive less income per hectare based on achieving lower gross margins per cow in comparison to conventional farming. The dairy gross margin data derived from the DEFRA organic study indicates that the organic gross margins per cow were better in comparison to the conventional FBS data. A sensitivity analysis to observe the effect of increasing milk price in the changing organic milk market indicates much improved gross margins.

The cost of production data highlights the key issue associated with poorer performance of organic dairy farming in comparison to conventional farming. Although the Welsh Farm Business Survey data indicated that costs of production of 14.64 ppl were below the average milk price received at 19.55 ppl, the organic farm income survey data (funded by DEFRA) indicates that the costs of production for organic milk production were in the region of 20.92ppl compared to an average milk price received of 20.84 ppl.

In summary, the organic data derived from the Farm Business Survey and the Organic Farm Income report funded by DEFRA indicates mixed results in determining the performance of organic dairy farming. As to be expected, the profitability of organic dairy farming can be rewarding in a more buoyant organic milk market, which has been reported since autumn 2004. However, the effect on profitability compared to conventional dairy farming in an oversupplied market as observed between 2001/02 to 2004/05 can be fairly marginal as the associated costs of producing organic milk can barely be met within the confines of the conventional milk price. Therefore, it is reasonable to suggest that in the absence of a strong market for organic milk, conversion to organic farming is not a solution to the financial problems faced by conventional producers.

# 6. Abbreviations

LSU/ha – livestock units per hectare
ppl – pence per litre
FBS – Farm Business Survey

The full Organic Farm Income reports are published on the DEFRA and Organic Centre Wales websites. Farm Business Survey data is available via the Institute of Rural Sciences website.

Organic Centre Wales has developed a benchmarking programme to calculate gross margin and cost of production information for farm business' in Wales. If you would like to benchmark your farm business and receive results that are compatible with the data shown here, then please contact Organic Centre Wales at organic@aber.ac.uk or tel 01970 622100.

# Part 3: Case Studies

## 1. Nick & Matthew Fordham

### 1.1 Farm profile

**Location:** Dolgoch Farm, Brongest, Carmarthenshire.
**Size of farm:** 100ha
**Herd:** 100 dairy cows with the average cow having 75% Friesan + 25% Holstein genetics. The future breeding policy is to move to smaller British Friesian cows

The farm was converted in 1998 and is in a lower rainfall area of Wales (33.35" or 850 mm). The soil type is medium loam on 90% of the farm, with light clay on the other 10%. The farm is registered with the Soil Association and in the Tir Gofal scheme. Since the farm was converted to organic management there has been an increase in both the number of plant species and butterflies that have been identified on the farm. The farm is regularly visited by parties of school pupils.

### 1.2 Cropping strategy

The pastures and crops grown on the farm include perennial ryegrass + white clover medium-term leys (>55% of the land area), permanent pastures, oats + peas for whole-crop silage and oats for combining. Growing a mixture of oats and peas produces higher quality whole-crop silage compared with growing oats alone, particularly extra feed protein. Growing oats for combining within the crop rotation provides valuable feed for the dairy herd and also efficiently utilises the fertility from the previous grass and clover ley.

During the period of silage making a contractor cuts and rows-up the swathes, with Nick and Matthew carting and ensiling the crops. Good fermentation is achieved when the different crops are ensiled and quality silage regularly made on the farm without the need to apply additives prior to ensiling. Weeds are not a major problem on the farm with a Lazy Dog used to remove any thistles and any small areas of docks are cleared after ploughing by harrowing and removing the dock roots from the field.

### 1.3 Herd performance

The herd calves all-the-year-round with an average calving interval of 370-384 days, providing a relatively level milk profile during the year. A rotational grazing system with 30-day paddocks is used for the herd during the 8-month grazing season that lasts from mid-March to mid-November. There is an emphasis on checking the fields are grazed efficiently while at the same time ensuring the cows have adequate herbage to achieve both optimal intakes and reduce competition and stress between the cows. The stocking density on the farm averages 1.1 cows /ha and each cow is fed 0.85 tonnes of concentrates per year. The concentrate is a mixture of home-grown oat grains and a purchased concentrate pellet. The herd is currently averaging 5,900 litres per cow with 3,738 litres produced from forage and National Milk Records regularly monitor the herd's performance in relation to the milk yield and quality of the individual cows, including somatic cell counts.

### 1.4 Herd health and fertility

A sound health status is maintained and can be attributed to good husbandry that includes attention to detail to ensure any problems are identified at an early stage. No antibiotics have been used to treat cases of clinical mastitis since the farm was converted to organic management and homeopathy is used to treat any ailments that occur. No veterinary treatment is required for cases of metritis which are now treated successfully with Hydrastis 30. The lack of health problems is reflected by the low culling rate, with one 14-year old cow currently in the herd having produced 11 calves. During the winter period the lactating cows are housed in cubicles bedded with an adequate allocation of straw to ensure optimal comfort, with the dry cows loose-housed in a straw-bedded yard.

Good pregnancy rates are recorded in the herd, with all cows naturally served with either a British Friesian or Limousin bull. Heifers enter the dairy herd at just over 2-years of age. Nick comments that since conversion to organic management "the veterinary bills have fallen, the number of cases of milk fever are lower and pregnancy rates higher".

### 1.5 Nutrient budgets

The nutrient inputs and outputs from the farm have been measured and the annual farm-gate nutrient budgets for N, P & K calculated. The figures show a surplus of 130 kg of nitrogen/ha, with the quantity of phosphorus and potassium sold from the farm in both milk and cull animals similar to the quantity imported in the purchased feeds and straw.

### 1.6 Future plans

Nick and Matthew plan to erect a new building for the young stock and also increase the herd size from 100 to 110 cows. Nick hopes that in the future the area of organic land in Wales will increase.

# 2. Bill & Sarah Ridge

### 2.1 Farm Profile

**Location:** Vaynor Farm, Bethesda, Pembrokeshire.
**Size of farm:** 303 ha including some land currently in conversion.
**Herd:** 420 cows, mainly Friesian-type Holsteins with a few cows of other breeds and also Holstein x Jersey heifers entering the herd

The farm was converted in 2001 and has two soil types, silty loam over gravel (2/3) and clay loam (1/3). The annual rainfall is 56-60” (1,422-1,524 mm). The farm is certified by the Soil Association and is in the Tir Gofal scheme.

### 2.2 Cropping strategy

To maintain a simpler system to manage the cropping on the farm is based on an all-forage rotation rather than a mixture of both forage and combinable crops. Forage production for both grazing and silage is primarily from medium-term perennial ryegrass leys and also barley + peas whole-crop. Extra forage is available from permanent pastures and also stubble turnips that are established after whole-crop cereals are harvested. If forage stocks are low towards the end of the winter some extra forage or crimped grain is purchased.

A key aim on the farm is to maximise the output of milk from forage, particularly from grazed herbage from the well-managed grass/clover leys. Herbage growth is checked regularly during the season to ensure the leys are efficiently grazed. The leys are rotationally grazed during the 10-11 month grazing season which starts in the mid-January to mid-February period and ends in mid-December. The leys are topped after grazing to minimise any potential weed problems and an aerator also used to improve the soil structure. Management of the large herd during the grazing season has been improved by the decision to build stone cow tracks, installing adequate water trough capacity and erecting high tensile electric fences that are both flexible and cheap and also allow the entrance to each paddock to be easily moved which minimises the risk of poaching in the gateways.

A contractor is used to carry out the silage-making tasks with two main cuts taken annually. Good fermentation after ensiling is achieved without the use of additives.

### 2.3 Herd performance

The calving pattern of the herd is based on two 8-week periods in the year, with 2/3 of the herd (including all the heifers) calving in the spring and 1/3 in the autumn. Having two separate calving periods during the year leads to a relatively level annual milk production profile. A calving index of 360-365 days ensures the 8-week block-calving periods in the spring and autumn are maintained. Grazed herbage and silage are the main component of the annual diet with 1.0 tonnes of concentrates per cow fed during the year. In addition to cereal grains, crimped grain and wheat distillers, either beans or peas are included as the main protein source. Minerals are fed to the cows during the dry period.

The current stocking density is 1.6 cows/ha and the herd is currently producing 5,100 litres per cow with over 3,000 litres produced from forage. The aim is to increase yields to 5,500 litres.

### 2.4 Herd health and fertility

Despite the long-grazing season, including during the wetter months of the year, few lameness problems are recorded in the herd. The incidence of milk fever and other post-calving problems is low, with a magnesium supplement fed to the cows to minimise the risk of hypomagnesaemia. Orbseal will be used in future to prevent the problem of a few cows in the herd calving down with mastitis. During the winter the majority of cows are kept in cubicle sheds bedded with sand with 80 cows out-wintered completely.

Good husbandry and attention to detail has resulted in pregnancy rates of over 90% being recorded. All the heifers are bred to a Jersey bull to ensure the potential problem of large calves at calving is avoided. While the majority of cows are bred to a Holstein bull a Hereford bull is also used as a sweeper bull on the remainder of the herd. Calves are reared on yogurtised milk with the system leading to healthy calves and few digestive problems.

### 2.5 Nutrient budgets

The annual farm-gate nutrient budgets for N, P & K show a surplus of 108 kg of nitrogen/ha with 27% of the total nitrogen converted into milk. While the P and K exported from the farm (i.e. in the milk and cull animals sold) leads to a small deficit, these nutrients are replenished by the P and K in the purchased concentrates and straw brought onto the farm and also by the application of a small quantity of organic fertilisers.

### 2.6 Key challenges

Bill and Sarah suggest the key challenges for anyone changing to organic dairy production is to establish a viable infrastructure, ensure sufficient land is available to sustain the system, maintain an adequate clover content in the swards and give a high priority to good record keeping. A key aim for the farm business is to maintain a simple system that is not only viable but also avoids unnecessary complications that would not benefit the business. For anyone changing to an organic system Bill and Sarah felt the key factors were good husbandry, including the regular handling of stock and early detection of any health problems and less reliance on conventional medicines.