Canolfan Organig Cymru
Organic Centre Wales

100% Organic Livestock Feeds – preparing for 2005

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1. Project Brief

A project entitled "100% Organic Livestock Feeds – Preparing for 2005" looking at the implications for organic farmers of the removal of the current derogation to use a percentage of non-organic livestock feeds.

1) Researching the required volume of feed stuff, in particular protein crops, and potential for feed production within Wales.

2) Researching the suitability of alternative protein sources, and evaluating livestock systems regarding the potential for a reduction in energy and protein levels.

3) Proposing strategies for the development and stimulation of the industry.

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David McNaughton – Soya UK
Mike Tame – Abacus Consultants
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2. Background

Since the introduction of the EU Livestock Regulation in August 2000, the derogation to use a percentage of non-organic feeds in organic livestock diets has been set to expire on 24th August 2005.

The derogation was put in place primarily because of the difficulty of providing adequate quantities of organic protein for dairy, pig and poultry stock from an under-developed organic arable market at that time, which was an obstacle to the conversion of organic livestock farmers. The regulations have always stated that farmers should aim feed to 100% organic and since August 2000[1] they have stated that non-organic components should only be used "where farmers are unable to obtain feed exclusively from organic production" (UKROFS). In practice, most organic farmers are utilising this non-organic allowance to some extent, or to the maximum, even where organic feed is obtainable, and certification bodies have not prevented this.

The derogation made it possible for livestock producers who relied on brought-in feeds to embark on organic conversion and in this objective it has certainly been very successful. However, its existence has created an industry whose economics are largely dependent upon this small but significant concession. Although there is now good availability of organic cereals, pulses and soya as well as other important constituents, cost has become a major issue, particularly in the face of falling or non-existent margins in some organic livestock sectors.

In Wales, there is a dominance of livestock production – in particular beef, sheep and dairy production, with a growing poultry sector.

The removal of the non-organic allowance is considered important by policy makers because this is a key area where organic farming falls short of delivering its objectives to be a closed system that does not rely on synthetic fertilisers and pesticides to sustain itself. Apart from not delivering the fully "organic" product, which is clearly desirable, this is an area that draws criticism of organic food and farming that should therefore be eliminated if possible.

The farmer survey carried out in this report suggests that this view is shared by roughly half of organic farmers, who in principle feel that the derogation should be removed. However this leaves the other half who do not feel the removal of the non-organic allowance is important. The majority of these felt it was either completely unnecessary, or at least that it would cause more harm than good, through farmers being forced out of organic production due to economics or technical obstacles.

[1] The EU livestock regulation was introduced on the 24th August 2000. Before then there had been no EU wide definition of organic farming for livestock; however UKROFS had introduced its own livestock standards before then, which were being applied in the UK.

3. Methodology

3.1 Feed consumption predictions

The following references have been used to make projections regarding livestock feed use in Wales:

- Improving market intelligence for the red meat sector in Wales – Anna Bassett, Soil Association, 2003
- Improving market intelligence for the dairy sector in Wales – Jake Hancock and Rob Haward, Soil Association, 2003
- Organic pig production in the UK – Anna Bassett, Soil Association, 2002

3.2 Feed industry consultation

All the licensed UK feed mills were surveyed to try and quantify the volume of organic and non-organic ingredients used in licensed compound feeds, and the status of various ingredients and their availability organically. In addition to this, feed compounders were invited to make comments if they wished. The Soil Association benefits from regular contact and a good working relationship with individuals in most of the major feed companies, and therefore the response from feed mills was very positive. Most were more than happy to make detailed comments and give information. All respondents were able to quantify total organic and approved non-organic feeds used, which enabled us to quantify the totals for these. Some struggled with the detail of the survey; however, the contribution of those that did complete surveys has enabled us to get a good overview of the current situation.

In addition to this, a focus group meeting was carried out for feed compounders at the Soil Association offices in Bristol on the 19th February 2003, giving some of the findings of the project at that stage and inviting discussion and feed back. ABN, BOCM, Vitrition, Mole Valley Farmers & Thomas's attended the feed compounders' meeting.

Current and projected compound feed use

Responses were received from 12 of the major licensed feed companies. It is estimated that these companies account for at least 80% of the total market for feed being used on organic farms.

It is important to remember that the results of this survey account for the volume of concentrate feed being used from commercially compounded sources. It does not account for straight cereals, pulses and other crops that may have been traded and fed on organic farms, which may or may not be organic. This project has not directly quantified this trade although it is thought to be significant particularly for beef and sheep producers. In addition, the compounders were unable to break this down in to what was sold in Wales as opposed to the rest of the UK; however, this is not considered too important since the feed trade is not limited by, or defined along, regional boundaries.

3.3 Farmer consultation

A survey was produced to canvass the opinions and options being considered by all licensed Welsh farmers. A response was received from 87 farmers, which was considered a significant sample. Many farmers made significant additional comments on their survey which are in this report.

In addition, a farmers' focus group was held in Aberystwyth on the 24th February 2003. 12 farmers and representatives from OCW and IGER attended the farmers' focus group meeting from OCW and IGER.

The format of the meeting was to present the issues and the findings of the project at that stage and to invite discussion, to identify problems and suggestions to feed into a strategy.

3.4 Expert contributions

This report also uses, includes, or refers to the following papers produced specifically for it:

- Alternative forages – Richard Wellar – IGER (chapter 6)
- Availability of ingredients and cost projections – Mike Thompson – BOCM Pauls (App. 1)
- Implications of the changes in feed standards – Mike Tame – Abacus Consultants (App. 2)
- Soya and Lupins for the UK organic sector – David McNaughton – Soya UK (App. 3)

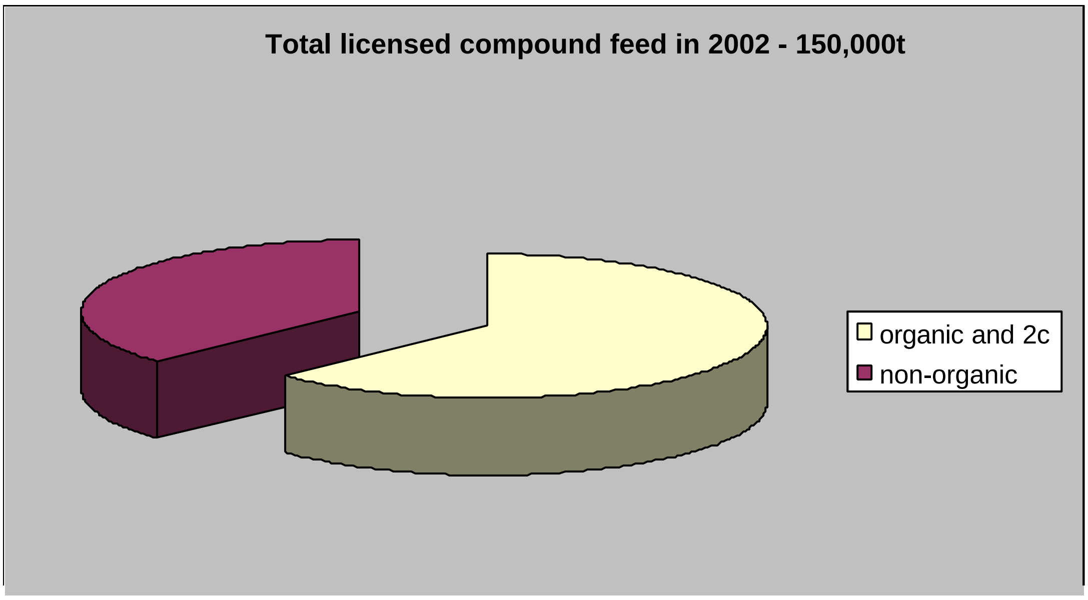
4. Results

4.1 Current compound feed situation (feed mill survey results)

Quantity

From the survey results, 123,000 tonnes of licensed feeds were handled by mills last year (2002). This includes organic, partial and approved non-organic feeds for all classes of stock. Since it is felt that this represents 80% of the total, it is assumed that approximately 150,000 tonnes of compound feeds were used to feed organically managed stock across the UK.

Figure 1: Current status of compound feeds



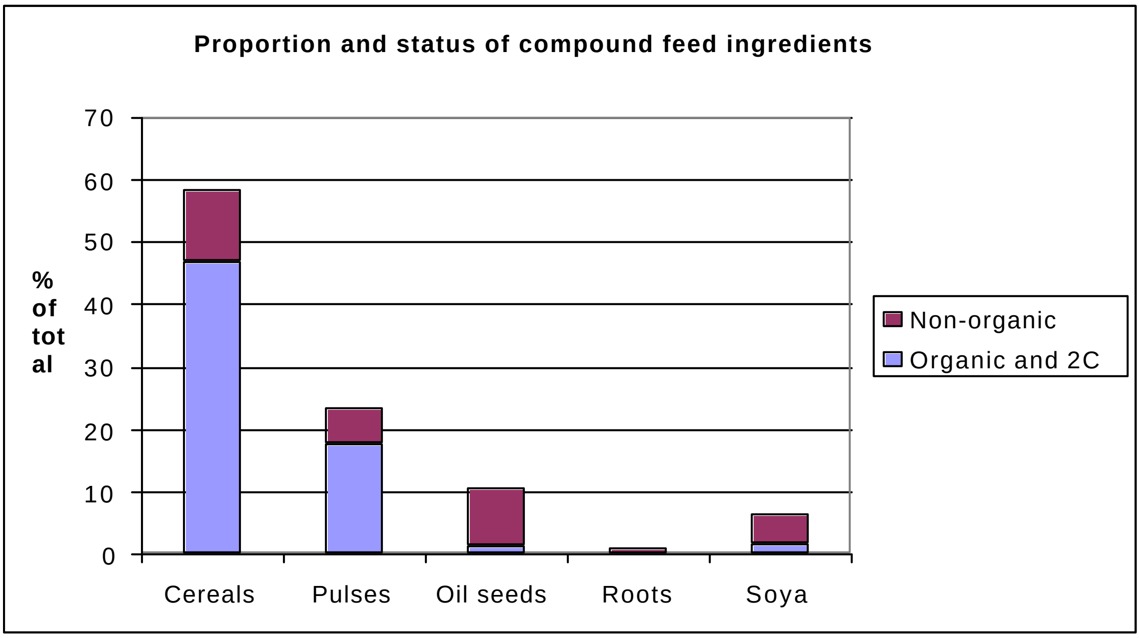
Source: feed mills survey, January 2003

Approved non-organic

The total non-organic component, which includes approved non-organic feeds and the non-organic component of partially organic feeds was 44,800 tonnes. Since it is estimated that this represents 80% of the total we assume that the total is in the region of 55,000 tonnes of non-organic compound feeds being used to feed organically managed stock. This means that 37% of compound feed used on organic farms is currently non-organic. Broadly speaking, this will be predominantly in the form of 100% non-organic beef and sheep feeds (when compound use fits within the 25% daily and 10% annual non-organic allowances), the non-organic component of partial organic dairy feeds (often 50:50) and the 20% non-organic component of pig and poultry feeds.

Compound feed ingredients

Figure 2: Breakdown of compound feed ingredients



Source: consultation feed mills, January 2003

Figure 2 shows the breakdown of type and status of ingredients used in compound feeds and is taken from the feed mill survey. Not all compounders completed this section of the survey, but those that did enabled us to build a good picture of the situation.

Cereals

Overall, 58% of compound feeds are cereals; the graph clearly shows that about 80% of those cereals are already coming from organic / conversion sources. This indicates that there should not be a severe problem with the availability of organic cereals in 2005. It is likely that if broken down further, there would be a large component of organic wheat being used in pig and poultry diets, as well as a significant proportion of conversion cereals being used in dairy rations.

Pulses

These are predominantly beans and peas. We can see that 75% of them are already organic or conversion, indicating once again that there should not be an insurmountable problem with availability in 2005. Beans and peas are an important component in all types of stock feed.

Oil seeds

These are predominantly rape meal, linseed, and sunflower expeller. Although used in lesser quantities, oil seeds provide important concentrated energy and protein in many rations. Currently, only 12% of oil seeds are coming from organic sources. At present, there is minimal organic production of oil seeds in UK and also in Europe. There is little to prevent growing sunflowers organically, and there should be some demand for organic rape and sunflower vegetable oil so their may be potential to increase the production of these. Linseed expeller is a by-product of the paint industry so without a real demand for organic linseed, an increase in production may be slow.

It is therefore felt that there may well be issues with the availability of organic oil seeds when the derogation expires unless the production of these develops.

Roots

Currently less than 1% of organic rations are roots, which may on the face of it seem insignificant. Of these roots all are non-organic. There is a significant production of organic root crops and it may seem a minor task to adapt it, but it is important to understand the form and use of roots in compound rations. Two possible parts of the roots' components may be potato protein and betaine (a sugar-beet extract). Both of these are considered very important concentrated sources of lysine and methionine for pig and poultry rations, which now have to be made without the use of synthetic amino acids. The problem is that potato protein is the expensive by-product of the wallpaper paste industry, and therefore is not currently available in an organic form. Currently there is no organic betaine either. Although there is now a significant organic sugar-beet industry in the UK providing some potential for the production of organic betaine, the likelihood of availability is not known.

Soya

Soya is heavily relied on in dairy and mono-gastric rations (more so for mono-gastrics since the removal of synthetic amino acids) to provide the high levels of protein needed. Roughly 30% of the soya currently used is organic, which indicates that availability may be an issue.

Origin of feeds

Roughly 20-25% of the cereals and pulses currently used in compound feeds are from the UK, the rest being from southern and eastern Europe. Although there is significant potential to increase the UK production of organic cereals, the current trend is that cheaper imports from Europe are undermining the price for organic cereals. Left to market forces this may prevent more organic cereals being produced in the UK.

About half the total quantity of oil seeds is coming from Europe, with the other half coming from outside Europe. There is potential for more production of oil seeds in the UK, although it does not seem likely to become significant in the near future.

About one third of the soya used is coming from Europe, with two thirds imported from further afield (e.g.the Americas).

4.2 Current straight feed trade

From the farmer survey, we can see that at least one third of farms are buying straights already, and a further third is considering it if they are not doing it already. It is difficult to quantify the volume of this trade from the data collected so far, but it suggests a significant volume that cannot be accounted for through the feed compounders. One of the major concerns here is that it may be far more difficult to obtain the same range and quantity of straights organically as it is non-organically, particularly in Wales where a reasonable volume of grain would be needed to justify the haulage.

4.3 Projections for livestock feed use in Wales

Beef

From predictions regarding finished stock sales (Soil Association, Improving market intelligence for the red meat sector in Wales, 2003), we can make some outline projections for the quantity of concentrate feed required in Wales. This assumes an average concentrate use, per finished animal, of 450kg (including suckler cow feed). Although there will be a significant number of stock finished on grass or with less concentrate than this, there will be good numbers finished with more, and some suckler cows may be given some extra hard feed so this should be sufficient to give outline figures.

Table 1: Predicted volumes of concentrates for beef production in Wales

YEAR	HEAD OF BEEF PRODUCED	TOTAL VOLUME OF CONCENTRATE
2002	2,200	990 tonnes
2003	2,800	1260 tonnes
2004	3,200	1440 tonnes
2005	3,700	1665 tonnes
2006	4,300	1935 tonnes

Lambs

Volume of concentrate used for lambs has been worked out using the assumptions of a lambing percentage of 120% and a concentrate use of 35kg per ewe (including lamb creep). A recent Soil Association study in the South West of England found 16% of farmers were finishing lambs off roots, 13% off concentrate and the remaining 71% off grass. These calculations are not intended to give precise figures, but rather an idea of the scale of the issue.

Table 2: Predicted volumes of concentrates for lamb production in Wales

YEAR	LAMBS PRODUCED	TOTAL VOLUME OF CONCENTRATE
2002	68,800	2006 tonnes
2003	87,300	2546 tonnes
2004	100,500	2931 tonnes
2005	116,400	3395 tonnes
2006	135,000	3938 tonnes

Dairy

33.8 million litres of milk were produced in Wales during 2002 (Soil Association, Improving market intelligence for the organic dairy sector in Wales, 2003). At a current estimate of 5000 litres per cow this suggests that there are 6760 organic dairy cows in Wales, which roughly matches the current 140+ herds at an average 50 cows / herd in Wales.

6760 cows receiving 5kg DM of concentrate / day average over lactation = 33.8 tonnes of dairy cake / day. Over a 9 month lactation this equates to 9,300 tonnes DM of dairy cake per year which is being used to feed the Welsh organic dairy herd.

It is difficult to make projections regarding the dairy market at the current time because of milk price and possible drop out by large numbers of farmers. However, given an upturn in price, it is likely that milk production, and therefore feed consumption, could increase rapidly by up to 30%, which would be 12,000 tonnes of dairy cake / year.

Pigs

Generally there are not a lot of organic pigs produced in Wales. OF&G and SA Cert have 20 pig producers in Wales between them; most of them producers with less than 10-15 sows. The report "Organic Pig Production in the UK" (Soil Association, 2002) predicts that the UK market will stay roughly static over the next couple of years, although smaller producers with successful direct market may see growth in sales. Assuming, therefore, that there are no more than 150 organic sows in Wales and assuming that one sow will use 1.6 tonnes of feed / year and on average her 18 progeny will eat a further 4.3 tonnes, Wales would therefore need a maximum of 900 tonnes of organic pig feed / year.

Egg producers

There are approximately 35,000 organic laying hens currently in production in Wales (Source: SA & Deans Foods) which at 120g feed / bird / day equates to a total layer feed consumption of 1,500 tonnes year, 80 per cent or 1,200 tonnes of this is already organic.

Table birds

There are a handful of poultry meat producers in Wales mostly selling small numbers directly to consumers, however one producer is killing 8-10,000 / week for the multiple retailer market.
This equates to 520,000 birds / year or 1300 tonnes of chicken. A feed conversion of 2.6 would mean that 3400 tonnes of grower feed would be used. Given projections from the large producer this figure could rise to 6000 tonnes in the next 2 years.

Total

Therefore the estimated total tonnage of concentrate feed being used in Wales is 17,900 tonnes (DM) or 23,000 tonnes fresh weight. This is 15.4% of the 150,000 tonnes estimated for the UK as a whole (from feed-mill data).

4.4 Anticipated implications of the removal of the derogation

This section expands on points raised by feed compounders at their focus group meeting

Cost

All feed compounders pointed out that cost would be a major obstacle for producers in most sectors, and that it was possible that a strict tightening of the regulations at a time when margins are down may make it difficult for many farms to remain viable. Currently, the dairy and pig sector in particular have both had to deal with large cuts in farm gate prices, and their viability is already in question.

In the beef and sheep sector, although there is still a premium to be found, it is not what it was two years ago. As one feed company representative pointed out "it would be a great tragedy if a large part of the organic movement was destroyed as a result of regulation change at this stage".

Organic grain price dynamics

Exchange rate pressure and increased rates of conversion in Eastern Europe have had a significant bearing on the market. As a result UK cereal prices have dropped significantly over the last few years e.g. in 1999 the price of Organic feed wheat was £200/t in 2002 this price had fallen to £170/t and are currently at £130/tonne. These kinds of price changes have been felt across the board putting increasing pressure on organic farmers. Besides exchange rate pressure and increased conversion rates in Eastern Europe there is also the issue of certification equivalence surrounding imports, with shorter conversion periods allowed in some circumstances which have not helped the UK price.

For more UK grain to be used greater support is needed from the multiple retailers to extend beyond providing the UK livestock product on the shelf to the feed stuff of the animals during rearing. Consumers are not aware that when they buy British meat it could have been fed imported grain, which is potentially produced to a lower standard than they expect. Coupled with greater support from the multiples other major grain buyers such as feed mills should be encouraged to source UK grain.

One of the other main factors besides price encouraging feed mills etc. to source imports is to do with the ease of purchase. When sourcing UK grain there are no central collection points, which buyers can get large quantities of consistent specification grain from. This means they would have to buy lots of smaller quantities from different regions to get the amount of grain they require. This compromises the quality of the grain and increases paperwork. The flip side of the coin is that it is far easier to pick up the phone and order a boatload of grain from abroad. There is less paperwork and the quality of the grain is consistent.

The balance in supply of feed materials is also of concern with shortages in supply of high price feeds. This is particularly marked for proteins and oil seeds, such as soya and oil seed rape. With both of these crops there are GM contamination issue surrounding imports and their incompatibility to growing in much of the UK. However the lifting of the derogation in 2005 should provide an incentive for producers to address this imbalance. Extensions to the derogation would undermine the confidence of those considering investment, as has been experienced with organic seed.

Problems with processing and binding aids

Vegetable oils

Expelled vegetable oils are used as processing aids to lubricate feeds as they go through the milling machinery, as well as for their nutritional value. Although these are available in an organic form this is currently only as human food grade, so they are expensive.

Molasses

Molasses is used to bind feeds. It would seem that there is potential to obtain these in an organic form but again this affects the cost of producing feeds, because it would require a separate molasses tank on the processing line.

Ruminant sector

With home-grown forages being the major feed component for ruminant stock, these producers have more opportunity to reduce the impact of the removal of the non-organic allowance. However, producers in Wales may be more limited in the range of crops they can grow than producers in other parts of the UK and for many cereals and pulses will not be an option. For the dairy sector, the availability of soya is again likely to be the major problem and there could be a heavy impact on this industry, particularly in Wales, if the option to use non-organic soya is completely removed in 2005.

Mono-gastric sector[2]

Cost aside there are serious technical obstacles to producing "required specification" rations with only organic ingredients, for monogastrics. This is due to their very high amino acid requirement and a current complete lack of some critical ingredients in an organic form. Until recently, organic producers have been able to rely on synthetic amino acids. This is no longer an option. The critical ingredients are: fishmeal, potato protein, prairie meal (maize meal), and betaine (sugar-beet extract – it is not known how significant this component is at this stage). Although it is possible that some of these ingredients could be produced organically, developments have not begun thus far, and the cost is not known. It is likely to be relatively high for relatively small quantities of product. Fish-meal is possibly the most important of these ingredients and it is highly unlikely that this would be available organically and certainly not in any quantity.

It is unclear from the UKROFS regulations whether fishmeal will be affected by the 2005 deadline. This is because the relevant standard (UKROFS 4.8) does not specify whether "conventional feeding stuffs" relates to ingredients of plant origin (chapter 2c - 1) or all non-organic ingredients (UKROFS 2c - 12&3). This would include mineral and animal origin (it is assumed that the mineral ingredients at least will remain). A later standard (UKROFS 4.13) specifically relates to the ingredients of plant origin, but is it safe to assume this also applies to 4.8? This is an area that requires clarification from UKROFS. It is clear that if there is any flexibility to be negotiated on the removal of the non-organic allowance, this is a key area.

Organic soya bean expeller will be very important in the mono-gastric sector to provide the right levels of protein and amino acids. Although there is currently some availability of organic soya, the majority is from non-organic sources. Therefore, there needs to be a significant improvement in the availability of organic soya. It could be argued that the current lack of availability of organic soya and its associated high price is precisely because of the current non-organic allowance which does not encourage its production, because soya is probably the first choice constituent to come from non-organic sources given its cost. Rations for most classes of stock can be made without needing more than 10% total soya; it therefore fits neatly into the non-organic allowance.

DEFRA fishmeal regulations

There is currently a ban on using fishmeal in mills that produce feed for ruminants (these are industry wide rather than organic regulations). This means that organic feed compounders with only one mill (who cannot now use synthetic amino acids), producing ruminant and mono-gastric rations, can no

[2] There is little doubt that part of the problem on the poultry side at least is the modern types of poultry used; unlike with other livestock and crops the currently expected "normal" output of poultry across organic and conventional sectors is similar. Certainly organic producers currently expect the same egg numbers as conventional producers (300+/bird/year). Although the chicken producers do not look for the same growth rates as conventional broiler flocks (70-80 days minimum killing age rather than 44), these "slower growing strains" are still growing quickly by any standards and their amino acid requirement is very high. It seems that organic poultry producers cannot continue to expect such high output and it is likely that we will see significant change in this sector in coming years, not least because organic breeding will soon also become a requirement.

longer use fishmeal at all. This means that those mills in particular will struggle to produce a mono-gastric ration that is anything near adequate. From an organic perspective, therefore, this change in the DEFRA regulations has been extremely damaging.

Minimum 65% cereals in poultry rations

This EU/UKROFS requirement is descended from traditional free range and French Label Rouge requirements with the aim of limiting protein concentrations in rations to slow growth rates / egg production and therefore improve taste and deliver environmental and welfare improvements. Given the removal of synthetic amino acids from organic diets (which would be allowed for Label rouge / traditional free range) it is felt that there is a good case for being less restrictive on the types of ingredients that make up organic poultry rations. There would seem to be an argument that the requirement should be removed or at the very least pulses should be allowed to count towards the 65%.

4.5 Recommendations and predictions from the feed industry

The feed compounders made the following predictions if all non-organic feeds are removed:

Use of alternative crops

- Although producers may be considering alternative crops, they may require additional cost such as new machinery or contractors, expertise and skills, and they may not be suitable to climate and soil type, so actual achievements may not match considered potential.

- Soya will take many years to make a significant UK contribution. Experience so far with lupins has produced very variable results in terms of yield and protein content, although this could improve.

- Peas are a more reliable crop and more flexible for stock feeds.

- If farmers are producing arable crops for sale to feed compounders they must be ACCS farm assured. They should also grow what is needed rather than what they can grow easily – wheat, peas and beans are preferred to barley and triticale.

Consequences for production

- Beef and sheep producers would buy in minimal amounts or no feed and use home produced crops – those that couldn't would drop out.

- Dairy would move to low input/low output and spring calving – many will already have been driven out due to poor milk price.

- Organic pigs and poultry would become small-scale farming and local markets only (unless fishmeal and other key ingredients are retained).

- Growth rates, carcase quality and egg production would become much more variable.

<u>Removal of the derogation</u>

The main recommendations from the feed mills if the allowance must be removed are:

- That it is done in stages rather than going straight from 10 or 20 percent to zero – i.e. 5% for ruminants and 15 or 10 % for pigs and poultry.

- That the current margins are considered by legislators if they do not wish to lose organic farmers and organically managed land.

- That certain non-organic products are definitely not removed in order that pig and poultry production is not made completely unviable – specifically, sustainably harvested fish-meal, potato protein, prairie meal. This is particularly important since synthetic amino acids have been banned in organic agriculture.

- That molasses and vegetable oils from non-organic sources continue to be allowed.

- That in 2008 mills should not be not obliged to have separate lines.

4.6 Projected feed costs

<u>Ruminant sector</u>

The approximate cost of switching various ruminant feeds to 100% organic/in-conversion (agricultural ingredients) is shown in Table 3:

Table 3: Additional cost for ruminant rations

Feed type	Additional cost/tonne of 100% organic
Approved 50% organic:50% non-org	+£55*
Approved non-organic	+£100*

Dairy herds

The average dairy farmer making full use of his non-organic allowance and feeding 1.5 tonnes of compound feed annually will be using a feed containing approximately 50% approved non-organic ingredients. The cost of changing a 50:50 product to one containing 100% organic/in-conversion is approximately £55/tonne. Therefore a herd using 1.5 tonnes concentrate per cow will increase farm production costs by £82.50 per cow or by 1.4 pence per litre assuming a 6000 litre average herd yield. This will place additional unwelcome pressure on dairy herd profitability.

Beef

The extra costs of beef production will vary dramatically depending on breed, system and quality of forage, as well as the market for which beasts are destined (supermarket or specialist butchers). Some examples are given below based on Organic Farm Management Handbook figures and current concentrate prices.

Approved non-organic feed = £170 / tonne (Source –Mole Valley Farmers)
50% organic = £215 / tonne (Source – MVF)
100% organic = £250 / tonne

Suckler cow, single suckled and calf to 9 months:

Currently (using n/o conc.)	– 200kg concentrates @ £170 / tonne	= £34 / head
With 100% organic	– 200kg concentrate @ £250 / tonne	= £50 / head

Extra cost £16 / head

Beef finishing (transfer at 9 months)

Example 1– Beef finishing – spring born calves finishing at 18 months on grass

Currently (using n/o feed)	– 250kg concentrates @ £170 / tonne	= £42 / head
With 100% organic	– 250kg concentrates @ £250 / tonne	= £63 / head

Extra cost £21 / head

Example 2 – Beef finishing – spring born calves at 24 months of silage

Currently (using n/o conc.)	– 350 kg @ £170 / tonne = £60 / head
With 100% organic	– 350 kg @ £250 / tonne = £88 / head

Extra cost = £28 / head

Using these examples demonstrates that the total extra cost will be up to £43 / head. There are organic systems that use much less concentrate and several 100% forage farms. In appendix 1 there are costings by Mike Thompson based on higher concentrate use.

Lowland spring lamb production

The cost of moving to 100% organic/in-conversion is approximately £2.80 per ewe.

Pre-lambing feeding	25kg approved non-organic cake
Lamb creep	10kg 50:50 lamb pellets

Monogastric sector

The combination of lower specification diets due to a lack of organic specialist ingredients and an increase in ration costs (approximately £30 per tonne) is almost certainly going to reduce enterprise profitability. A conservative estimate looks like increasing feed cost by approximately 10 pence per dozen eggs. For pigs, this increase in annual feed cost may be £50 / sow and £17 / finishing pig.

5. Results - farmer consultation

These results – are primarily from the farmer survey. Additional comments from the focus group have been added where necessary.

Already feeding 100% organic

20% of the people who responded to the questionnaire were already feeding completely organic feeds, which was considered a significant and surprisingly high proportion. It is most likely that these are producers who are either low stocked with more traditional breeds and finishing off grass, or producers with the ability to grow alternative forages, cereals and pulses and therefore able to feed completely home grown feeds, although there may have been exceptions.

Simply swapping to organic compound feeds

"Simply" is probably the wrong word considering the cost implications of doing this. What was meant by the question was to see if simply buying organic compounds rather than non-organic ones was part of the strategy. 56% of the producers felt that this would be an option they would use. Obviously if cost makes it prohibitive, these producers will either adopt another strategy or opt out of certain enterprises or organic farming.

Buying straights

1. About a third of all responses said 'No and not considering it'. However, at least half of those are already growing cereal and pulses of their own.
2. About a third of the responses said that they are already buying in non-organic straights of some kind. The most commonly used straights were barley, oats, peas, beans, wheat and sugar-beet; soya beans are also used by some dairy farmers.
3. A final third said that they are considering or intending buying in straights as part of their strategy in the future.

Many of the respondents that were already buying in straights, or considering it, felt that there was currently, and would continue to be, a significant problem with the availability of organic straight grains. This is likely to be a significant issue in many areas of the country. Unless farmers are in the vicinity of grain dealers they are likely to be reliant on their local agricultural / feed merchant. Many of these will have limited scope to supply farmers with relatively small quantities of organic straight grains; one comment was that it is unlikely that any organic sugar-beet pellets get as far as Wales.

One alternative would be for farmers to buy cereals from other farms in their area and this may be an option for many, although it appears as though there may be issues in doing this with some of the farm assurance schemes.

Linked to the issue of using straights is that of on-farm milling and mixing, and 67% of farmers were considering this as an option or doing it already.

Alternative forages

45% of the responses favoured the use of alternative forages such as whole-crop cereals and pulses, red clover, lupins, undersown cereals, sheep grazing of winter cereals and stubble turnips. Several producers emphasised the importance of some of these to reduce the need for brought-in protein. It is clear that many hill farmers can not grow either forages or cereals and some were upset at being asked the question; however, it is also clear that forage and cereal options are very relevant for other producers in Wales and will be widely used.

The situation of hill farmers without these options needs to be given careful consideration by the those implementing the Organic Action Plan in Wales and throughout the UK. Both at a regulatory level and when devising environmental payment schemes, it is important to ensure that farmers in less favoured areas are not penalised in the organic system if they are delivering tangible benefits.

Cereal production

43% of producers said that they were producing, or would consider producing grain on farm and potential options being chosen include oats, triticale, barley, wheat, peas and lupins. One issue that is likely to be a significant issue in Wales is the handling of damp grain where there are no drying facilities. Currently, proprionic acid is only allowed for the crimping of grain. This being the case, there may be an argument for allowing proprionic acid to preserve grain, crimped or not and this may assist farmers in production of their own stock feed and becoming more self sufficient. The advantages of enabling more home production of feed from an organic perspective have to be weighed against the desirability or otherwise of using organic acids in organic production. This is an issue that could be given consideration by OCW, sector bodies and UKROFS.

Farming system / breed change

Only 32% of respondents planned significant system changes for their farms, 24% planned breed change, and 17% planned to give up an enterprise or give up organic farming when the derogation expires.

The system changes that were suggested included:

- less concentrate (low input/low output),
- summer finishing of grass,
- arable production of stock feed,
- growing expensive crops and buying cheap ones,
- arable silage replacing some or all concentrate,
- NZ system more off grass,
- spring calving,
- reducing stock numbers, selling stores rather than finish.

Breed changes that were detailed included:

- moving to Herefords,
- suckler herd in favour of dairy,
- MRI and Ayrshire rather than Holstein and cheviots in favour of mules.

There are already a large proportion of organic farmers using better “forage” breeds such as Welsh Black cattle, speckle faced and Welsh mountain ewes so further breed change would not be envisaged for many.

Another suggestion was made that hill farms should explore the options to develop links with lowland farms with a view to developing a trading relationship for exchange of forage, grain and store stock. Farmers should recognise that certification bodies, OCW and producer services are well placed to help put farmers in touch.

At the focus group, options were suggested for setting up co-operative producer groups with a view to buying feeds and other resources, and the sharing of machinery and contractors’ services. These options should be explored and developed where producers can benefit.

17% of the responses predicted that they would probably give up either one enterprise or organic farming altogether if they had no option to use non-organic feeds. These figures are confusing compared to the 68% that said these changes may make their enterprises unviable. This may be partly because farmers may have a wish to stay farming beyond when, as businessmen, they would determine their situation as unviable.

Do farmers feel it is important to remove the non-organic allowance?

This question was of particular interest and the response can be broken down into 4 primary groups:

1) 25% of farmers claimed that it was important to remove the non-organic allowance and that it did not affect the viability of their farms.
2) 23% of farmers claimed that it was important but that it would affect the viability of their enterprise(s).
3) 7% of farmers felt that it was not important to remove the non-organic allowance; however, it did not affect their viability.
4) 45% of farmers that responded felt it was not important and that it would affect the viability of their enterprise / farm, and 17% of those specifically mentioned giving up an enterprise or organic farming altogether.

Of those that felt that it is important to remove the non-organic allowance, the following reasons were given:

- It is vital from both an organic perspective and from a consumer point of view to remove the non-organic allowance – many organic consumers are unhappy when they find out about it.
- It is important for organic agriculture not to be dependent on or supporting conventional agriculture – the non-organic allowance is a major argument from critics of organic agriculture.
- Generally, hill land is not sprayed so a major benefit of these farms going organic is to have a wider impact on intensive arable land through feed. The comment was made: "why should we subsidise such minimal changes"?
- The integrity of organic status is essential in the long term – ignoring or accepting a major derogation for the sake of economics is unsustainable for organic farmers and will lead to the rapid devaluation of the organic status and market.
- At the same time, several of these producers felt it was important to take economics into account and consider the timing or a staged reduction.

Of the farmers that felt it was important to keep the non-organic allowance, the following reasons were given:

- It is of no benefit, will not increase sales, will make organic farming unviable and send many farmers and farms back to conventional methods.
- Premium is currently due to carcase quality benefits of Limousin bulls and Texel rams – will not be possible with no allowance.

- Sad for both the farmers that have to drop out and the policy makers that want to encourage organic farming, because feed cost will drive them out.
- Upland farms penalised through inability to grow quality forages and concentrates.
- This will encourage spring calving dairy herds – winter imports of milk from EU.
- Unavailability of organic straights, soya and protein sources.
- Chickens cannot be produced without synthetic amino acids.

6. Production of protein and energy crops in Wales

by Richard Weller and Heather McCalman

There are a number of crops across the world that are grown to provide protein and energy for livestock. Throughout history, new crop varieties and livestock species have been bred, and so different feeds have come in and out of favour with farmers to meet the ever changing demands of livestock and the growing conditions of individual regions. This is of particular importance for organic farmers who are more reliant than their non-organic counterparts on the use of proteins. At the moment, organic farmers are allowed to use a percentage of non-organic feed when feeding their livestock, but this amount is reducing annually and by the end of August 2005 farmers are likely to have to feed ruminants and monogastrics on 100% organic feed.

There is a limitation on the range of crops that are suited to the Welsh climate. Richard Weller and Heather McCalman of IGER report on some of the possibilities for growing alternative forage crops in Wales.

6.1 White clover

<u>Introduction</u>

White clover is the most important legume grown in organic systems and influences the quantity of forage that is produced for grazing and conservation, stocking density and output of marketable products (e.g. milk, meat) from the farm. The plant is adapted to a wide range of soil types and climatic conditions and is grown on both lowland and upland farms. White clover is an essential plant on organic farms where cropping systems are based on permanent pasture, a crop rotation or a mixture of both. Unlike many other legumes, white clover produces stolons and can spread laterally across the field. The persistency of clover within a sward is dependent on the development and continuous replacement of stolons.

The primary use of white clover is in either re-seeded or permanent pastures for grazing and first-cut silage, with the clover providing nitrogen via N-fixation for the companion grass species. When grass/white clover mixtures are grown in a rotation, the N-supply from the clover helps to improve the fertility of the soil by providing nitrogen for the succeeding crop. Hopkins (1997) and Newton (1993) reported that N-fixation by white clover varied considerably and ranged from 100-250 and 86-392 kg DM/ha, respectively, depending on the proportion of white clover in the sward. A general guide would be a fixation rate of 50 kg of N/ha per tonne of clover DM.

Considerable work has been undertaken to breed new, improved varieties of white clover. There is a range of modern varieties that have been bred for specific use. These include small-leaved varieties that persist under intensive grazing by sheep on both lowland and upland farms, medium-leaved varieties for grazing by sheep and cattle, and also the large-leaved varieties. The latter are suitable for inclusion in both cutting leys and grazing swards, but some varieties are less persistent under intense defoliation and are more suitable for a rotational grazing system. Modern varieties tend to be more vigorous and competitive than earlier ones and a good balance of grass to clover can be maintained in swards when the clover is grown with either erect or prostrate varieties of perennial ryegrass.

Establishing and maintaining clover in the sward

While clover will grow at pH levels of 5.0, a minimum of 5.5 or above is recommended for optimal growth. A soil index of 2 or above for both P and K is required by white clover (Hopkins *et al*, 1994).

When grass/clover mixtures are sown at a seed rate of 30-35 kg/ha, 4-5 kg of white clover seed would be included in the mixture. White clover seed, whether sown alone or in a mixture with grass, should be sown in the spring or late summer, but not later in the year as the plants need time to establish before the onset of cold weather.

Over grazing of grass/clover swards will affect the growth of the stolons and reduce both the clover content and total yield in the following year. An optimum clover content in a sward is an average of 30-35% during the growing season, ranging from under 20% in the early spring to over 50% in mid summer. The clover content of a sward will vary between seasons. Optimum production from grass/clover swards will be achieved when the sward height is maintained at 4-6 cm for sheep and 6-8 cm for cattle (Hopkins, 1997). A rotational grazing system allows the clover to recover after grazing. In set-stocking systems, swards are normally grazed continuously during the growing season. However, in swards where the clover content has declined, taking a silage cut during part of the season will allow clover to increase. The clover content of a sward can be increased by over sowing into an existing sward at a rate of c.5 kg of seed/ha or by slot-seeding clover into the sward. Results from both methods can be variable and influenced by weather conditions (e.g. moisture), sward density and damage by slugs to the emerging plants. The surface sowing of seed should not be carried out in either very dense or ungrazed swards. A further method that has been practised on some farms is to broadcast the clover seed and then let sheep tread the seed into the soil. Conversely, where the clover content is too high and grass growth poor, perennial ryegrass can be successfully slot-seeded into the sward. If the white clover plants are allowed to flower, the soil seed bank will be increased with the seeds germinating and providing a nitrogen-fixing under storey when the field is ploughed and a forage crop such as cereals or forage maize established (Hopkins, 1997).

Although white clover via N-fixation is the main source of nitrogen for crop production in grass/clover systems, the productivity from clover and persistency of the plant can be severely affected by damage from slugs, weevils (e.g. sitona) and leatherjackets. Damage to clover leaves can increase leaf senescence and leaf mortality.

Yield and conservation

Pure stands of white clover grown organically on lowland farms yield from 5-8 t DM/ha (Newton, 1993; Halling *et al*, 2001). However, growing white clover alone is not a practical option for organic farmers for a number of reasons. These include the relatively low yields compared with other forages (35-37% lower than red clover and lucerne), high risks of bloat to the grazing animal, and an increase in the dock population, as white clover is not a good competitor against weeds. In practice, white clover is established in mixed swards with grass species (mainly perennial ryegrass), as the N-fixing clover is complementary to the high yielding but N-demanding grass crop. Organically grown grass/white clover swards yield between 5-12 t DM/ha (Hopkins, 1997; Weller *et al*, 2002), with the yield influence by not only soil type and climatic conditions but also management practices and whether the farm is in the lowlands or uplands.

A disadvantage of white clover is its late growth development in the spring, as it requires a higher temperature than grass before growth commences. This can result in the crude protein content of first-cut silage being significantly lower than the values recorded at later cuts, due to the low quantity of clover in the sward. Delayed growth also affects the companion grass, and the turnout date is often later for herds on organic farms compared with conventional herds grazing fertilised ryegrass swards.

Care needs to be taken when grass/white clover swards are cut for conservation as either silage or hay. Over wilting the crop to high dry matter contents increases the risk of leaf shatter and a reduction in quality. White clover, similar to other legumes, has a low buffering capacity. The use of a suitable additive is therefore advisable for crops with a high clover content or those ensiled at low DM contents.

Quality and feeding value

White clover is a high-quality legume for feeding to ruminants and has a higher soluble cell content, digestibility and protein content, and lower cell wall content than grass. Therefore, as shown in a number of trials, including white clover in the diet can significantly increase feed intake by 20-30%, leading to improved animal performance (Hopkins et al, 1994). However, care needs to be taken when grazing grass/white clover swards, as bloat can occur and the fibre content of the herbage is lower than that required by the ruminant animal. It is essential to minimise the risk of bloat problems by ensuring that animals have a consistent daily supply of herbage for grazing. White clover also maintains its quality for a longer period than grass, with the digestibilty declining by 0.15 units per day compared with 0.5 units in the grass (Bax & Browne, 1995) – an advantage when bad weather delays the cutting date for silage making.

Table 4: Typical analysis of white clover compared with perennial ryegrass herbage (Thomson *et al*, 1985).

% in the total DM	White clover	Perennial ryegrass
Crude protein	27.5	17.5
Cell wall content	21.6	42.7
Cellulose	17.3	24.0
Hemicellulose	0.8	16.1
Lignin	3.8	2.7
Pectin	4.0	0.8

Table 5: Analysis of grass/clover silage from five commercial farms (Bax & Browne, 1995).

	Range of values
Dry matter %	21.8-29.2
Crude protein %	10.7-13.6
‘pH	3.7-3.9
ME (MJ/kg of DM)	10.8-12.2

During the growing season, the protein content of both the grass and white clover in the sward increases (Weller & Cooper, 2001). This results in the grazed herbage having excess protein from early July onwards, leading to poor utilisation of the protein by the animal unless a high energy/low protein supplement is fed to balance the diets. Not only is the protein poorly utilised, but the animal also requires more energy to excrete the surplus protein.

6.2 Red clover

Introduction

Red clover is an important legume for many organic systems, producing high yields and having the potential to be effective when grown in mixed swards with grass species, or as a pure stand to provide a high-protein forage that can be fed during the winter period of housing. Unlike white clover, red clover is a short-lived plant that is normally grown as a 2-3 year ley and is, therefore, mainly grown in organic systems that are based on a rotation (rather than permanent pasture), including those growing both forage and concentrate feeds on the farm. The primary role of red clover is to provide forage for conservation as silage and Rhodes (2001) suggested that the plant could be grown on both lowland and upland farms for feeding to dairy, beef or sheep.

Red clover can be widely grown on a range of soils, and native species have been reported growing in every county of the UK, although not at high altitudes (Spedding *et al*, 1972). The highest yields will be obtained when the crop is grown on fertile soils. On poorer soils, other legumes, including alsike clover and sainfoin, can produce equivalent yields. Not only is red clover a high-yielding crop, it also provides

N via fixation for the benefit of companion and succeeding crops, with c.40 kg of N/ha fixed per tonne DM of red clover. N-fixation rates by red clover of 103-249 kg/ha reported by Newton (1993) in a review of the results from different studies.

An additional role for red clover is as a component species in fertility-building leys that are established for one growing season only. These mixtures are becoming more popular in organic systems, producing a high-yielding crop that is cut for silage and is then ploughed in. Companion species in these mixtures can include, for example, the short-lived Westerwolds ryegrass, Italian ryegrass and vetches.

Many people tend to advise growing either red or white clover in a mixture with each clover type included in different types of leys. However, concerns about the potentially high price of organic seed are leading IGER to evaluate the potential benefits of longer-term leys. These leys would include red and white clover, perennial ryegrass, hybrid ryegrass and other grass species including timothy. The objective of these leys is to reduce forage production costs and provide suitable cutting leys for years 1 and 2 (with red clover and hybrid ryegrass the main contributors) and then in the following years to primarily graze the leys with white clover taking over the role of the main N-provider from fixation.

Establishing red clover leys

Red clover is an erect plant with a stout tap root and the stems growing from the crown of the plant. Unlike white clover, red clover does not produce stolons and is, therefore, unable to spread laterally. The tap root has been reported to grow to 60-90 cm (Spedding *et al*, 1972) and the plant is more tolerant of drier climatic conditions and periods of low rainfall than is white clover. However, red clover is less tolerant of dry conditions than either lucerne or sainfoin, which are both deeper rooting. Similarly to white clover, adequate soil P and K indices (2 or above) are required for red clover, and lime should be applied prior to sowing if the pH is below 6.0. When growing red clover as a forage crop for cutting, it is essential that the P and K removed at the silage cuts is replaced by applications of either/both slurry and FYM. Low soil P and K indices will lead to reduced crop yields and a lower contribution to soil fertility for the succeeding crop. At IGER Trawsgoed, the practice is to give each red clover/grass ley two slurry applications each year, the first before and the second after first cut silage has been taken. Red clover crowns are vulnerable to damage, and so care must be taken to apply slurry or FYM when ground conditions are good and damage to the plants from machinery wheels minimal.

The seed rates that are used for red clover will depend on whether the crop is being sown alone or in a mixture, including the type of grass. Rates of c.15 kg/ha have been suggested for establishing a pure red clover ley. In mixtures with grass species, the inclusion of red clover in a mixture sown at 30-35 kg/ha to establish a short-term ley will be c.7.5-10.0 kg. In most short-term leys, red clover is grown with Italian ryegrass, hybrid ryegrass or perennial ryegrass, or in a combination of two of the grasses. Tetraploid rather than diploid varieties of ryegrass are often selected as the companion grass, due to their higher sugar content (beneficial for good fermentation during ensiling) and their compatible erect growth habit. Timothy is a grass that is suited to high rainfall areas and is also included in some mixtures.

In Wales, successful establishment of both pure red clover and red clover/Italian ryegrass mixtures have been achieved when the crops are undersown in the spring under a cereal crop, with spring barley providing a consistent cover crop on Welsh organic farms. The most successful cover crops are likely to be cereals grown for conservation as silage, with the adverse effects of shading more apparent when the cereals are taken through to the fully mature grain stage.

Although newer varieties of red clover have increased resistance to the fungal disease Sclerotina (clover rot) and the nematode pest, stem eelworm, the plant should not be continuously grown on the same site, as soil-borne diseases can survive in the soil for many years. According to the NIAB list of recommended red clover varieties (NIAB, 2001), there are also large variations between modern varieties in their resistance to disease problems. Generally, red clover plants survive longer on upland compared with lowland sites as the incidence of disease is lower (Rhodes, 2001). Slugs have been identified as a major pest (Young, 2002); however, no problems have been experienced with the red clover crops (both pure and in mixtures with grasses) at IGER Trawsgoed, despite the fact the farm is located in a wet area (1,200 mm of rain per year).

Yield and conservation

NIAB (2001) reported that a pure stand of red clover could produce 15.25 t DM/ha during the first full year of production. However, these yields were recorded from experimental plots and published results show that a potential yield on the organic farm of 7-13 t DM/ha is more realistic. When sown with a high-yielding grass (e.g. Italian ryegrass or hybrid ryegrass) then the yields will generally be higher than in pure stands and results from IGER Trawsgoed have shown that red clover/Italian ryegrass leys produce 9-15 t DM/ha, with the highest yields recorded in the first full year of production. Timothy has also been successfully grown as a companion grass with red clover, although the grass is lower yielding than either Italian or hybrid ryegrass. One of the advantages of growing red clover with a companion grass is that a denser sward is established, which helps to minimise the problem of docks.

Depending on the farm location, either 2-3 cuts will be taken per year, with most lowland farms able to grow 3 cuts with a 7-8 week re-growth period between each cut. In organic systems, the proportion of red clover in a grass/clover sward will be lower at first cut than at the subsequent cuts, as red clover is slower growing in the spring than grass, requiring a higher temperature for growth to commence. Care needs to be taken when red clover leys are cut for conservation, including avoiding cutting the crop too low as this will damage the crown of the plant and reduce future yields. Over wilting and the conservation of high DM crops will increase the risk of leaf shatter and a reduction in silage quality. When conserving red clover crops (either pure or a grass/clover mixture), both wilting prior to ensiling and the use of an additive may be beneficial as the plant has a low buffering capacity.

Red clover is less suitable for conserving as hay rather than silage. The plant has thick, fleshy stems and during the drying of the crop the stems may not reach a satisfactory DM content before the leaves become dry, brittle and then shatter (Sheldrick *et al*, 1987).

Grazing

Although red clover is normally grown for conservation, many crops (both pure and mixed swards) are often lightly grazed by cattle or sheep during the autumn and after the crop has been cut 2-3 times for silage during the earlier part of the growing season. However, the risks of bloat can be high if the crop re-growth is grazed when the herbage is lush and highly digestible. Over grazing will damage the growing crown and reduce both the plant populations and yield in the following season. Although pure red clover crops grown conventionally have been rotationally grazed throughout the growing season, on organic farms this practice is likely to lead to an increase in the dock populations as red clover has an erect growth habit.

A concern for the farmer, particularly when red clover is grazed, is the high level of oestrogenic compounds in some varieties of red clover which can lead to a reduction in the fertility of ewes at mating time and a reduced lambing percentage, even when red clover swards have only been grazed for a short period (Austin *et al*, 1982; Rhodes, 2001). Jones (2001) suggested that ewes should not be grazed on red clover swards for six weeks before and six weeks after tupping. However, a positive aspect of red clover is that a high content of oestrogenic compounds may improve lamb growth rates, and Austin *et al* (1982) showed a positive effect from red clover, as the pregnancy rate of heifers increased when they were fed red clover silage rather than grass silage.

Quality and feeding value

Frame (2000) reported that compared to grass species, red clover has better nutritional qualities and intake characteristics due to the low ratio of structural carbohydrate to soluble plant cell content. As with some other legumes, these benefits can have a significant effect on improving live-weight gain or milk yield.

On some organic lowland farms, three cuts from red clover/grass leys have the potential to provide over 60% of the winter silage requirements. However, when to cut the crops is a key decision, and inevitably there is a compromise between the different stages of growth of the red clover and grass plants within the ley, and also whether high yield or high quality is the priority. The growth stage at which the red clover plant is cut will influence the quality of the crop for feeding, with a delay in the cutting date from May 12 to June 11 increasing DM yield but reducing the digestibility from 67% to 59%, and the crude protein content from 25.0% to 17.5% (Green, unpublished data). Red clover/grass leys cut at a mature stage of growth have a digestibility of 60-69%, with the protein content increasing from under 12% at first cut to up to 20% by the third cut (Weller *et al*, 2002). Other published analyses for red clover cut at the early flowering stage and a DM content of 19-21%, show values of 65% digestibility, 10.2-11.0 MJ/kg DM of metabolisable energy and a crude protein content of 18-21%.

The effect of growth stage and harvesting techniques (including leaf loss) on the quality of red clover leys are shown clearly in the following table.

Table 6: Analyses of different red clover hays (MAFF, 1975)

Red clover hay type	**Digestibility (%)**	**Metabolisable energy (MJ/kg DM)**	**Crude protein (%)**
High quality	61	9.6	18.4
Good quality	57	8.9	16.1
Poor quality	50	7.8	13.1
Very poor quality	46	6.9	14.1

Compared with grass silage, the feeding of red clover silage has been found to lead to significant improvements in animal performance, including increases of 10% in the milk yield of dairy cows and 17% in the live-weight gain of steers (Frame, 1976; Randby, 1992).

6.3 Galega

Introduction

There is limited information on Galega (*Galega orientalis* or goats rue) in Northern Europe. It not used widely in agriculure but has been developed and improved in Estonia where it is highly productive and persistent (Nommsalu, 1994). In a recent study across several European countries, galega was rather variable but, once established, did show good persistence particularly at the third year in Sweden and Finland. (Halling, Hopkins, Nissinen, Paul, Tuori and Soelter, 2001)

Establishing and maintaining the sward

Galega is slow to establish and prefers lighter soils with a pH of between 6.0-7.5. For successful establishment, inoculation is needed. In keeping with its preference for light soils, galega is drought tolerant and is persistent under these conditions. Seed rates sown in trials by IGER have been c.20-30 kg/ha when grown pure and c.12-18 when grown with 8-12 kg of grass. Much of the work on this crop has been done in Eastern European countries where, similarly, it seems to thrive on well-drained mineral soils. Seed rate significantly affects establishment, and when grown in pure stands, 83-100% plant survival was seen in the first year (Lavrov, Bolatbekova and Baklanov, 1998), with rates of 80-88% and 62-77% when undersown with either peas or oats as the nurse crop. The authors favoured barley as nurse crops but galega seed rates of 28 kg/ha were recommended. Yields increased with P and K up to 120kg/ha but no N was needed. In a separate study in Lithuania, mixtures of 25% timothy and 25%

perennial ryegrass gave the best ground cover and soil microbial activity when compared with pure mixtures (Balezentiene, 2001).

Yield and conservation

Adamovich (2001) found that inclusion of galega in mixtures with a range of grass species (including *Festuca* spp., cocksfoot, timothy) provided continuous green cover over the whole summer season. Yield and energy from the swards ranged from 7.5-11.2 t DM/ha and 8.3-13.4 MJ of ME/kg DM and the study found the swards that received no nitrogen to be more productive and of higher quality than those that received nitrogen fertiliser (using up to 90kgN/ha).

Table 7: Example of quality of fresh herbage of galega and grass species (Lattemae and Kiisk, 2002)

	Galega	**Galega and timothy**	**Galega and meadow fescue**	**Galega and cocksfoot**	**Galega and ryegrass**
DM g/kg	197	238	232	208	224
CP g/kg	221	165	159	163	172
Sugars g/kg	56	102	131	109	160

In Canada, herbage productivity of galega was compared across latitudes from 45°-56° and longitudes 52°W to 120°W with a range of forage legumes, and was found to be comparable to *Medicago sativa* (Apica and Beaver lucerne) and Altaswede red clover, but better than alsike clover and lotus corniculatus. It ranked third over the seven species over all the nine sites (Fairey, Lefkovitch, Coulman, Fairey, Kunelius, McKenzie, Michaud & Thomas, 2000).

Due to its high buffering capacity and low water-soluble carbohydrates, galega, in common, with many legumes, has low ensilability. Additives, bacterial and chemical, were shown to improve the ensilability of pure galega mixed with a range of different grasses with improved fermentation, compared with untreated galega silage (Lattemae and Kiisk, 2002). Inclusion of the different grass species did not reduce clostridial fermentation and there were negative effects of ensiling with cocksfoot. The chemical (based on sodium benzoate) gave the better result but would not be permitted under an organic system.

As one of the three most important legumes in Estonia, galega was compared with red clover and lucerne. Under a two cut harvest system, by the seventh productive year the yield of galega was highest but alfalfa and red clover were more productive in the second and third years. However, as cutting intensity increased, the alfalfa and galega both gave reduced production and became increasingly sensitive to final cutting date and weather conditions (Lillak & Laidna, 2000).

Quality and feeding value

In Sweden (Halling *et al*, 2001), the quality of galega was similar when compared with lucerne, but lower than white clover in crude protein (205 g/kgDM), ME (9.7 MJ of ME/kg DM) and water-soluble carbohydrate (47 g/kg). Fresh herbage analyses of galega/grass mixtures showed galega/ryegrass had the highest crude protein at 172g/kg while the lowest was in galega/meadow fescue. In galega grown pure the crude protein levels were 221 g/kg (Lattemae and Kiisk, 2002).

It seems that galega may have potential for organic farmers in Wales, but as concluded by Doyle and Topp (2002), major problems of establishment, uncertainty of yield consistency and possible increased N leaching risks all need to be overcome. The potential benefits and disadvantages of growing galega in Wales have not been fully investigated, and further research is required before reliable recommendations can be made for growing galega commercially.

6.4 Cereals for whole-crop silage

Introduction

Cereal crops that are grown for conservation as whole-crop silage have an important place in many organic systems. Within Wales, they can be grown as a useful forage source and also to provide a nurse crop for the establishment of grass/clover leys. They can also provide more reliable annual yields of forage than those crops with a growth pattern that is more strongly influenced by variations in seasonal climatic conditions. Their use is either as a moderate energy but low protein crop within a rotation that includes both N-fixing (e.g. legumes) and N-demanding crops (e.g. grasses, cereals, fodder crops), or as a cover crop for the establishment of grass/clover leys on all-grassland farms. When included in a rotation on farms with a longer growing season, cereal crops offer the flexibility of being suitable for either forage or grain production, depending on the annual feed requirements of the farm. Cereal crops are grown mainly on farms with an altitude of <300 metres. When conserved in big bales whole-crop cereal silage with a DM content >35% can be used as a buffer feed for feeding either when spring or autumn herbage is very lush and intakes low, or as a supplementary feed during periods of dry weather and poor herbage growth.

Cereals conserved as whole-crop silage

Within the UK, most of the studies on cereal crops grown for forage rather than grain production have been with wheat and barley, with little work carried out with either oats or triticale. However, in Wales, barley and oats are likely to be the main cereal crops, with wheat less suitable in wetter areas. Triticale (wheat x rye) is already being successfully grown by farmers in Wales as a grain crop and may also have an important role as a forage crop. On poorer land, rye may also be worth considering.

Establishment

Unlike many forage crops, cereals provide the option of sowing either winter or spring varieties, depending on their position within a crop rotation. Winter varieties are normally sown in the September to mid-October period, spring varieties of oats by mid-April and spring barley varieties by the end of April (Toosey, 1982). Cereal crops require good drainage if good yields are to be produced, and barley needs a soil pH above 6.0 while oats can tolerate some degree of acidity (Toosey, 1982). Altitude has a strong influence on the growing season, shortening its length by 14 days for every 100 metres increase in height above sea level (Wibberley, 1989). The seed weight will vary for the individual varieties of cereals within each species, and the average sowing rate on organic farms will be in the range of c.150-200 kg of seed/ha. However, for crops to be undersown with a grass/clover mixture the seed rate should be decreased to avoid problems of the cereal nurse crop adversely affecting the establishment and growth of the undersown crop.

A possible option would be to grow more than one species of cereals together for whole-crop production. If the two cereals mature at different times there is the potential to increase the harvesting window as the period of optimal quality and suitability for ensiling are increased.

Cereal crops are useful cover or nurse crops in organic systems where grass/clover mixtures are being established. This practice provides extra forage during the year when the grass/clover leys are being established, with either the grass/clover seed sown after the cereals have germinated or at the same time. On some farms, winter-sown cereal crops have been grazed at the leafy stage of growth by sheep to encourage the cereal plants to tiller and to provide extra forage before optimal grass/clover growth is achieved.

Over the last ten years, weed problems in cereal crops grown at IGER Trawsgoed have been minimal. However, on some farms, when cereal crops are grown within a rotation, the crop will need to be grown in a number of fields with different soil types. Farmers' experience in Wales has shown that some weeds, including redshank, can be a problem in higher rainfall areas and on heavier soils. The weed problem can reduce yields, and if crops are taken through to grain, rather than being conserved as silage, some areas of the field may not be combinable. Disease problems (mildew, rust etc) occur when cereals are grown as a forage crops in Wales but no reports have been made on their effect on either yield or quality. Wales has a predominantly grassland system, and growing cereal crops when the surrounding farms have only grassland can lead to problems of reduced yields from rook damage if crops are taken to the crimped or fully mature stage of growth. However, for cereal crops to be conserved as whole crop silage, this problem should not occur as the crops are harvested at an earlier stage of maturity.

Yield and conservation

Younie (2002) suggested that on organic farms, yields of 6-11 t DM/ha could be expected from spring barley crops. The field yields from different barley whole-crops (undersown with grass/clover ley) grown at IGER Trawsgoed have ranged from 7.16 to 10.10 t DM/ha, with an average of 8.52 t DM/ha (IGER, 1999). Better establishment of grass clover crops was achieved when barley rather than oats were used as the nurse crop. Yields will usually be higher when cereal crops are not undersown. Plot yields of 12.1 t DM/ha were recorded at IGER Trawsgoed (Weller, unpublished data) when spring barley was sown at a rate of 200 kg of seed/ha but not undersown with a grass/clover ley.

Whole-crop cereals are usually conserved at DM contents of 35-45%, when the grain is at the soft-dough stage. Although harvesting the crop at a more mature stage of growth would increase the proportion of grain and therefore the quality of the feed, major problems can occur, including poor fermentation and the difficulty of achieving satisfactory consolidation of the crop within the clamp. Aerobic spoilage also can occur with high DM silages when the clamp is open – the problem is minimised if the silage is made in a narrow clamp and fed out at a rapid rate. Also, in higher DM crops the grain is harder and there is a higher risk of grains passing through the animal undigested.

On many organic farms whole-crop cereals are likely to be conserved as big bale rather than clamp silage. Care needs to be taken in the storage of big bales, as rats can be a major problem and cause considerable wastage. One practical solution that is used on a number of farms is to store the bales on a layer of sand.

Quality and feeding value

Critical factors in the quality of whole crop cereals are the stage of maturity when the crop is cut, and the leaf and grain to stem ratio, which can be low in tall crops of oats and triticale that have a high proportion of straw in the total weight. It should be noted that unlike forage maize varieties, the varieties of the different cereal species have been screened for their potential as grain rather than forage crops. Large variations in quality can occur between varieties within one species. For example Adegosan *et al*, (1998) compared the quality of whole crop from two different wheat varieties. They found large differences between the varieties with large differences in sugar, fibre and digestibility values (8.2, 7.8 and 11.5 units of digestibility).

Table 7: Published values for whole-crop silage (Young, 2002)

	Cut at (%DM)	Crude protein (%)	ME (MJ/kg DM)	Starch (%)
Barley	39	9.0	9.1	19
Oats	41	7.8	10.1	19
Triticale	40	9.0	9.7	19
Wheat cut	41	10.0	10.0	21

The quality of whole crop can be increased by raising the cutting height and reducing the proportion of the less digestible stem. Work in Wales during 2002 (Weller, unpublished data) showed that the digestibility of whole-crop barley cut at 30 rather than 10 cm above ground level was over 70%, compared with the digestibility of the plants between 10-30 cm being <60%. Although raising the cutting height reduced the yield from 12.0 to10.1 t DM/ha, the gain in extra quality increased the digestibility and value and energy density of the feed.

Whole-crop cereal silage should be regarded as a moderate energy feed (9.5-10.0 MJ of ME/kg DM) with a low protein content (<10%). The energy content will be lower than that of high-energy forages such as maize silage and fodder beet. Therefore, the forage is suitable for feeding as part of the forage portion of the winter diet to either non-lactating stock or those in the later stages of lactation. For animals in early lactation, or growing stock with the target of a high growth rate, other higher energy feeds are required in the ration to meet the animal's nutrient requirements. Studies with dairy cattle have shown that including whole-crop silage in the diets of dairy cows can lead to an increase in intake. However, increased intake has generally not led to improvements in either the yield or quality of the milk produced, with whole-crop silage viewed as a useful complementary forage to maintain but not improve animal performance.

It is possible that there may be larger differences in quality between varieties within a cereal species than between species, as screening of varieties has been based on grain yield as the main criterion. Therefore, a further study on the forage potential of the currently available cereal species and varieties could lead to farmers being able to select and grow crops that can be classified as high energy feeds rather than moderate energy sources.

6.5 Cereal crops grown for grain and straw production

For organic farms in Wales that are suitable for growing cereal crops for grain and straw production, this option produces grain that is a high energy/low protein feed suitable for including in concentrate mixes and to different livestock groups. It is important to note that if cereal crops are to be undersown with a grass/clover mixture then a lower seed rate should be sown, leading to a lower yield of grain compared with cereal grain crops that are not undersown. Potential grain yields (Lampkin & Measures, 2001) for the grain yields (t grain/ha) from cereal crops not undersown are:

Table 8: Potential yields from cereal crops (Lampkin & Measures, 2001)

Crop	Potential yields (t/ha)
Winter barley	3.7
Spring barley	3.2
Winter oats	4.0
Spring oats	3.5
Rye	3.8
Triticale	4.5
Winter wheat	4.0
Spring wheat	3.2

Grain can be taken to full maturity and then dried to a moisture content of <14% when the grain is to be stored for a relatively long period. Cereal grains have a reliable nutritive quality and, with the exception of fodder beet, will always have a higher energy value than forage crops. Organically produced grain has a high quality and, for example, organic oat grain has been found to have a significantly higher oil content than conventionally grown oats (see table below). A comparison of the average quality of organic grain from different home-grown or purchased cereal grains at IGER Trawsgoed with published values for conventionally grown grain (Weller *et al*, 2002) are shown in the following table:

Table 9: Average quality of organic grain from different home-grown or purchased cereal grains

	Digestibility %	Crude protein %	Oil %	Starch %
Average organic grain quality at IGER				
Barley	87.5	11.1	2.8	58.9
Oats	72.3	8.3	8.0	48.9
Triticale	91.3	11.9	2.3	64.8
Wheat	91.5	11.3	2.4	68.7
Average conventional grain quality				
Barley	86.0	11.7	1.3	53.0
Oats	65.0	11.0	4.3	47.0
Triticale	92.1	13.5	1.9	54.0
Wheat	93.5	12.0	1.8	66.0

The alternative that is being successfully practised on some farms in Wales is to combine the cereal crops, then crimp the grain and apply organic acids at a rate of 3-5 litres per tonne of grain. Crimped grain is harvested 3 weeks earlier than normal grain harvest, and this is an advantage on farms where there is not a guarantee that fully mature grain crops can reliably be produced due to seasonal differences in the growing season. Earlier harvesting also increases the time period available before the end of the growing season for establishing the next crop. The crimped grain will have a lower DM content than grain combined at full maturity and needs to be ensiled (i.e. stored under anaerobic conditions). The acid lowers the pH rapidly, reduces aerobic deterioration and prevents yeast and moulds developing. Crimped grain is a palatable feed that is suitable for feeding to ruminants instead of fully-mature grain. The analysis of the crimped grain (a mixture of barley and triticale) that was harvested at IGER Trawsgoed in 2002 was equivalent to the quality of fully mature grain:

Table 10: Analysis of crimped grain harvested at IGER Trawsgoed in 2002

Analysis	%
DM	50.5
crude protein	10.9
Digestibility	88.7
neutral detergent fibre	14.0

Crops grown for grain production also produce straw that can be used for bedding. Alternatively, when silage stocks are limited, the straw can be included in the ration of ruminants, but only as a small proportion of the total forage fed. For Welsh livestock farmers, buying straw can be expensive due to the high costs of transport incurred by bringing straw from the eastern areas of the UK. Therefore, home-grown straw is a more valuable commodity for organic farmers in Wales than in some other parts of the UK.

6.6 Soyabeans

Soyabeans are a high quality feed. Soya is palatable and a very useful ingredient for inclusion in concentrates mixes. The average analysis of beans will be >40% crude protein and a high ME value of 15+ MJ/kg DM (Broddle, 1997). Including soyabeans in the rations for organic livestock would be beneficial, particularly as a protein balancer to cereal grains and conserved forage crops, and especially as the latter often have lower protein contents than those required by the ruminant animal. The predicted increase in temperatures due to global warming will increase the interest in growing soyabeans, particularly in southern parts of the UK. However, with the exception of a few farms with a warm climate and long growing season, soyabeans would not be currently suitable for the majority of Welsh organic farms as the crop needs soil temperatures in the spring to reach 10-12^{0}C before germination occurs. Therefore the crop has a slightly higher temperature and daylight hour requirement than forage maize which is considered a marginal crop within Wales. Soyabeans, unlike maize crops, would not be a viable forage crop. This is because they have the disadvantage of needing a longer growing period for the beans to mature, and also because the requirement for adequate space between the individual plants leads to relatively low total yields.

6.7 Lupins

Lupins are a high protein leguminous crop and there are three main UK agricultural species: narrow leaved (*L.angustifolius*), white (*L.albus)* and yellow (*L.luteus*). Within the species there is great variation.

It is the narrow-leaved varieties that have been the focus of most research and breeding has mainly been carried out in Western Australia.

Establishment, yield and conservation

Lupins are generally more tolerant of acid conditions than other legumes, but do not thrive in waterlogged or compacted soils. Research has been conducted under conventional farming conditions using routine herbicide and fungicide treatments to achieve yields of around 8 t/ha of whole-crop ensiled lupins. However, anecdotal evidence shows that in commercial practice, organic farmers have suffered strong weed competition and would tend to favour the bushy denser branching varieties with better canopy cover to suppress weed growth.

Table 11. Forage yield at harvest (t $DMha^{-1}$)

Variety	**Weeks of growth at harvest**			
	12.5	14.5	16.5	18.5
Arthur	4.62	5.28	6.08	5.32
Nelly	5.05	6.54	8.03	6.71

Table 12. Forage yield at harvest (Fychan, 2001)

Variety	Whole crop	Crimped *	Dry *
	t $DMha^{-1}$	t ha^{-1}	t ha^{-1}
Borweta	6.62	4.21	2.83
Bordako	8.45	1.96	1.43

* Adjusted to 14% moisture

Further research under organic systems is required, in particularl to evaluate agronomic aspects of the crop, including weed control and resistance to disease.

Quality and feed value

Table 13: Nutritional composition of *Lupin* species in comparison with other grain legumes (adapted from Heath, 1987)

Grain legume	Crude Protein %	Lipid %	Crude fibre %
Lupins			
Lupinus angustifolius	28-38	5-7	13-17
Lupins albus	34-45	10-15	3-10
Lupinus luteus	36-48	4-7	15-18
Soyabean	39.6	25.3	12.8
Faba beans			
Winter	26.5	1.5	9.0
Spring	31.4	1.5	8.0
Peas	24.9	1.5	19.5

6.8 Field beans and peas

Field beans

Spring and winter varieties of field beans have an erect growth habit and are members of the legume family. Bean crops can be grown as a forage crop (Young, 2002) but are more generally taken to maturity and harvested as grain legumes. In a rotation beans can follow cereals as a break crop and are sown at a seed rate of 25 seeds/m^2 (winter) or 45 seeds/m^2 (spring). Beans are often grown on heavier land that is unsuitable for peas. Lampkin & Measures (2001) suggested average grain yields of 3.0 t and 3.5 t from spring and winter varieties of beans grown organically. Lampkin & Measures (2001) suggested undersowing bean crops with ryegrass to increase weed suppression and to ensure better utilisation post-harvest of the nitrogen fixed by the bean crop. The main disease problems are chocolate spot in winter beans and brown rust in spring beans, with spring beans also being more susceptible to aphid problems. The main weeds – bindweed and cleavers –can both cause lodging of the bean crop. Young (2002) suggested that rooks might be a problem when the crop is being established.

Table 14: Typical analysis of whole-crop beans grown to maturity for grain production (Lonsdale, 1989)

DM	13.3-13.6 MJ of ME/kg
Crude protein	28.0-34.0%
Digestibility	79.0-81.0%
Starch	36.0-40.0%

Table 15: Typical analysis of whole-crop beans grown for conservation as silage (Young, 2002)

DM	21.0%
Crude protein	18.0
Digestibility	9.4 MJ/kg DM
Starch	6.4%
Starch sugars	9.7%

Peas

Similar to field beans, peas are a high-protein legume that can be grown for both forage and grain production. However, Lampkin & Measures (2001) suggested that peas were more difficult to grow as a grain crop than beans due to weed problems, therefore, their role on organic farms in Wales is more likely to be as a forage crop, either grown alone or in a pea/cereal mixture. When grown with spring cereals, peas provide nitrogen via N-fixation for the cereal crop and also increase the protein quality of the whole-crop silage, reducing the protein that is required from other feeds to balance ruminant rations. Peas are normally sown in the March-July period, into a soil with a pH of 6.0 and with pure crops established at c.125 kg of seed/ha. Peas establish quickly, and in Wales they have been found to produce a useful forage crop of 5-6 t DM/ha in a period of 12-14 weeks (Fraser *et al*, 2001), with Sheldrick *et al* (1987) suggesting that DM yields of up to 10.0 t/ha were achievable from the crop. Lodging of pea crops can be a problem when traditional varieties are grown but the problem can be reduced by sowing semi-leafless varieties that have tendrils. Young (2002) suggested that in a short rotation peas would fix c.75 kg of N/ha for the following crop. Young (2002) reported that the major pests were pigeons, rooks, pea and bean weevil and pea aphid, and the major diseases: downy mildew, wilt and leaf and pod spot. A four-year rotation is required to avoid problems of sclerotina, pea cysts and downy mildew. As a rapidly growing crop, weed problems should be minimal.

Peas are a low DM crop and therefore require 48 hours wilting prior to ensiling at a DM >25%. As a low sugar/high-buffering crop an additive (e.g. inoculant) is essential when pure crops of peas are ensiled. Pure stands of peas can also be vulnerable to lodging. Therefore, to reduce these problems, it will be more attractive for organic farmers to ensile a mixture of cereals (e.g. spring barley) and peas, rather than peas alone. This provides the option of either growing the cereals and peas together in a mixture or growing them separately prior to ensiling the combined crops.

Table 16: Typical value of pea silage (Young, 2002)

DM	30.0%
Crude protein	16.0
ME	9.5 MJ/kg DM
Starch	7.5%
Sugars	12.0%

Table 17: Typical feeding value of peas taken to maturity and combined as grain have a feeding value Lonsdale (1989) and Ewing (1997)

DM	26.0%
Crude protein	16.0
ME	9.5 MJ/kg DM
Starch	7.5%
Sugars	12.0%

6.9 Lotus species (Birdsfoot trefoil or *Lotus corniculatus*)

Wilkins *et al* (2001) reported that birdsfoot trefoil was a good legume for low fertility soils and under drier growing conditions. The plant will grow on both lowland and upland farms but is slow to establish, and is susceptible to poor over-wintering survival. The plant is more drought tolerant than some other legume species. In a series of trials in four different countries (including the UK), Halling *et al* (2001) reported yields of 4.3-8.4 t DM/ha when the crop was grown on a range of soils, with the lowest and highest yields from crops grown on sandy and loam soils, respectively. However, it should be noted that the yields were significantly lower than the average yield for red clover (7.1-11.0) and lucerne (4.8-10.5 t DM/ha), but slightly higher than white clover (3.2-7.7 t DM/ha). Unlike white clover, the yield of the birdsfoot trefoil declined after three cuts, showing poor persistency. Higher intakes and digestibility values have been recorded at IGER with birdsfoot trefoil silage when compared with other legume silages (Fraser *et al*, 2000).

These results show that birdsfoot trefoil is a lower yielding legume that may have a limited role on organic farms when included in seed mixtures and grown on low fertility soils in the drier areas of Wales. However, on more productive soils, either white or red clover will be the main legume. The slow establishment of the plant is also a disadvantage as this allows other, more aggressive species to establish and dominate.

It should be noted that common birdsfoot trefoil should not be confused with another separate species of Lotus (Marsh birdsfoot trefoil or *Lotus corniculatus*) which grows under wetter conditions and will be found growing naturally on many farms.

Of particular interest to organic farmers is the use of Lotus species to increase sheep production without the use of anthelmintics (Restrope, Barry, Villaloboos, Kemp, Pomroy, McNabb, Harvey and Shabolt, 2002). In New Zealand, they found that the condensed tannin-containing Lotus can be used to stimulate wool and body growth and decrease faecal egg count, dag formation and the need for drenching. Min, Fernandez, Barry, Mcnabb and Kemp (2001), found that compared with grass and white clover pastures, those containing *L. corniculatus* gave higher dry matter intake, wool production and staple length, and increased reproductive efficiency, although liveweight gain was lower. In a review of advances in legume technology, Frame (2001) noted the beneficial role in animal nutrition of the condensed tannins in *L. corniculatus* (among other species) in prevention of bloat, improved N utilisation through more ammonia N reaching the small intestine and alleviating the effects of intestinal nematodes in sheep.

Closer to home, work in Wales and Northern England by Marley, Barret, Lampkin, Cook and Keatinge (2002) found that lambs grazing *L.corniculatus* had lower faecal egg counts by day seven on trial and fewer adult helminths than lambs grazing chicory or ryegrass white clover swards. However, by day 35 there was some evidence of lower faceal egg counts in the chicory than the other forages.

7. EU wide initiatives and potential for collaboration

The end of the feed derogation on 24th August 2005 will also apply to all other EU countries. The IFOAM EU-group, which will meet again at the end of March 2003, is set to discuss this issue. As an interim measure and to get an idea of how the rest of Europe is preparing for the lifting of the derogation, a short questionnaire was sent to all the representatives of the IFOAM EU-group. Three of the members responded and the concerns expressed over the removal of the derogation are similar to those stated by farmers in Wales. A summary of the concerns voiced by IFOAM representatives of Belgium, Germany and Holland follow.

7.1 Actions that other countries have taken

<u>Netherlands</u>

Joost Gist, Platform Biologica (NL): 'None yet, much attention given to synthetic amino acids, hoping/waiting for European Commission approval of use.'

<u>Germany</u>

Dr. Klaus-Peter Wilbois, FiBL (DE): 'No special initiatives in Germany. We've got the federal program on organic agriculture supporting some studies on that issue but not explicitly on 100% organic feed. Private organic organisations do a lot right now to get in this direction. For instance Bioland the biggest organic organisation has released new standards taking steps to bring this issue forward.'
Please note: Bioland, the largest German certification body, will request 100% organic feed for ruminants from October 2003. 100% is also requested for the mono-gastric sector. Derogations will be available for use of potato protein source for lactating sows and weaners. For poultry, derogations will be available for 4 conventional protein sources. To satisfy the increasing demand for organic protein, Bioland will promote growing peas and beans for example. Only feed from dedicated organic feed mills must be used on Bioland farms.

<u>Belgium</u>

Johan Meeus, Molens Dedobbeleer (BE): 'The best solution for us (Molens Dedobbeleer - in name of the union of organic feed mills) to authorise the use of synthetic amino acids, organic acids and some others additives to make it possible without to many nutritional disorders to ban the use of conventional feedstuffs by 2005. There has to be an agreement on the use of phytotheraputic additives and vaccinations in livestock (using only curative treatments is not the best solution for animal welfare and to prevent the build up of residues more use of allopathic medicine is needed). These questions have been transferred to Probila/Bioforum. There is a need for scientific studies to help us establish new standards on animal needs, selection of more appropriate species,...etc.'

7.2 Major obstacles and implications facing other countries

Netherlands

Joost Gist, Platform Biologica (NL): 'Particular problems with chicks due to lack of organic feed with correct amino acids. Also relevant for piglets. Health problems already occur, will exacerbate with 100% organic requirement.'

Germany

Dr. Klaus-Peter Wilbois, FiBL (DE): 'Protein supply for non-ruminants, poultry, pigs for instance. Need to develop better protein feed, need to establish this via change in organic plant production. The protein supply should not collide with the issue of mainly farm produced feed.'

Belgium

Johan Meeus, Molens Dedobbeleer (BE): 'It is certain that the new regulation will have an important implication on the price of organic meat and animal production. We need to import more feed-ingredients from third countries especially to assure the needs for protein. The actual situation gives us the possibility to make corrections with high quality vegetable protein like potato protein and maize gluten 60%. We have no good organic alternative for this high quality protein. The only alternative if to use more local cereals in feed for pork and chicken is to authorise the use of synthetic amino-acids. If this is not possible I can see no solution to achieve normal animal performance.

The obligation of 100% organic feed will have even a greater impact on the price of organic beef and milk. The market is used to giving only a slightly higher price for organic milk and beef.

Supplementation is mostly for protein and energy (starch and vegetable oil). We work actually on a concept of the introduction of polyunsaturated fatty acids in milk and meat by the way of the use of linseed (functional foods). Protein and vegetable oil are not sufficiently available in organic.'

Conclusion

It is clear from the responses above that the main concerns over the lifting of the derogation in 2005 are the potential negative health effects on pigs and poultry. Bioland has released new standards in Germany to help deal with the forthcoming situation, but it seems as though little else has been done to address the situation in the other two countries which responded to the questionnaire. The IFOAM EU group may come up with some recommendations after their meeting at the end of March and minutes from this meeting should be consulted when doing further research work.

8. Conclusions

Although it is important to seek efficiencies in production, these are limited in organic farming due to the organic standards and the EU regulation. Any additional costs associated with 100% organic livestock diets should be recognised in the market place. Supermarkets agree that the integrity of organic farming is crucial to its future success, and, in terms of livestock production, the capacity to feed non organic feed-stuffs presents the risk of jeopardising integrity. As the organic sector responds to the removal of the non organic feed derogation it is crucial that additional costs are recognised.

8.1 Beef

Overall, it is doubtful that substantial reductions in feeding concentrate type feed to beef cattle can be achieved when total average amounts used are 360kgs/hd. It must also be remembered that one of the most frequent criticisms of organic stock (which is becoming resolved) is that of under-finished stock. However, there are opportunities for farmers to review feeding strategies in order to minimise the effects of the non organic derogation removal in August 2005 including;

1. Changing breed types to more traditional native breeds. Any such change would need the support of processors and retailers, but could result in the availability to finish more cattle on forage alone or limited concentrate use.

2. Upland farmers to concentrate on store stock production allowing stock to be finished on farms with higher quality grassland, or on farms where cereal production is an option. This option would need commitment to pay fair and ongoing prices for store stock.

3. Improving the quality of forage, grazed and conserved, produced on farm, and increasing the range of protein and energy crops within cropping rotations where possible

However, it must be recognised that in order to provide market continuity, stock will need to be finished at periods when grass or forage quality needs supplementation.

The OTMS is forcing farmers to finish stock within set time scales. The removal of the 30month limit could enable some farmers particularly with traditional breeds to reduce concentrate usage.

The move towards 100% organic feeds may present additional hurdles to dairy beef animals entering the organic food chain. There are already problems with dairy type beef animals being a viable option for organic rearing and finishing – increasing the costs of rearing an animal that consumes significantly more concentrate feed than single suckled stock is likely to favour emphasis on suckler beef.

8.2 Lamb

As with beef there appear initially to be few savings that could be made in terms of concentrate usage. However, there are again system changes that could be made providing certain factors come into play. Improved store lamb producer/ finisher relationships would lead to lambs being finished on better quality pastures on lowland farms, but as with beef cattle, store producers need assurances of viable prices.

Early lamb production needs concentrate feed in order to finish lambs before grass quality or climatic conditions are good enough to finish lambs. There is currently no premium over organic for early-season lambs and consequently, producers are likely to question the economics of increased feeding costs associated with 100% organic diets when additional premiums are unavailable.

Breed changes on some farms could lead to lambs being able to be finished on forage/roots alone late in the season, while some breeds currently being used need concentrate/cereal feeding for 6-8 weeks prior to slaughter.

Scanning ewes could lead to feed savings, with feed being targeted to twin and triplet bearing ewes. This may become more critical with the advent of 100% organic feeds.

Farmers following the principles of the standards and keeping ewe breeds that are appropriate for land types could lead to reduced concentrate usage, although this will be balanced with higher potential income from higher prolificacy ewes, and higher income from heavier lambs. Any changes in breed types need to recognise market demands and the avoidance of over-fat carcasses.

Shifts to later lambing can result in reduced concentrate usage, particularly where stocking levels are not too high. Spring grass growth in line with increased nutritional demands of pregnant ewes can negate the need for concentrate feed in some cases.

As with beef farms, where opportunities exist for farms to add cereal or protein crops, these should be explored.

8.3 Dairy

While dairy farms often have the opportunity to grow some non-forage feed stuffs on farm, most rely on, and seem set to continue to rely on, compounded dairy-cake for at least a proportion of their requirements. The move to 100% organic rations will impact on the costs of organic milk production at a time when there is severe pressure on dairy margins. Estimates are that fully organic rations could add between 1.5 and 2p per litre of milk produced. These increased costs give even more importance to finding solutions for dairy farmers who have no access to an organic premium at all, yet have to manage and feed all stock on organic farms to full organic standards. Farms operating in this way are already unviable and significant numbers of organic dairy farmers may be lost as farms come to the end of their 5 year OFS agreements.

The future of the Holstein Fresian within organic farming may be questioned even more than at present, due to the high requirement of diets to match the genetic capability of the cow. Cow breeds that can milk from grass are likely to find increasing favour amongst farmers trying to reduce costs.

Spring calving herds may become more popular, but again, continuity of supply is crucial in developing the retail market based on UK production, and seasonality payments may be required to even out annual supply.

Producers should aim to maximise the quality of their forages, and the contribution of high quality and alternative forages to protein in rations must not be overlooked since they can play a significant role in reducing the concentrate protein requirement. The higher protein of second cut silage and the introduction of two or more types of forage in the daily ration will be important areas for farmers to develop.

8.4 Pigs and poultry

The organic pig and poultry industry suffers in most cases from being wholly reliant on brought-in feeds, and certainly the high protein requirement would be very difficult to provide from the holding for most farms with any reasonable scale of production. This issue will certainly come to a head in 2011, if not before, because at this point pig and poultry farms will be required to provide 50% of their feed requirements from the holding or linked holdings. Farmers should be thinking ahead now:

- Farmers should begin exploring options to produce elements of their pig and poultry feeds on their farm or on local farms that have that capacity – there may already be significant opportunities to reduce feed costs here, providing rations can be balanced.

- For pig producers, one option would be the development of the forage element of their feed and the use of roots, which may be particularly valuable for dry sow nutrition.

- For all mono-gastrics, if cereals and pulses can be produced on the holding or from linked units these may provide a valuable contribution in the future. However, it is likely that many producers with high-output systems will wish to ensure diet of the optimum specification at all times, and there may be concerns in doing this.

- Although performance may be lower on home-produced feeds, under current arable payments the subsidised cost of producing feeds can compensate for this by minimising feed costs i.e. the same number of eggs could be produced per pound spent on feed, even if a hen lays only 200 eggs / year.

With the imminent removal of derogations for synthetic amino acids, the immediate concern for 2005 would be the loss of the remaining natural high protein ingredients currently not available in an organic form – specifically, fishmeal, potato protein and maize (prairie) meal.

For both the dairy and the mono-gastric sector, the availability of organic soya will be a primary issue for stability in these sectors during 2005 and beyond.

9. Recommendations

9.1 Farmers

Although it is possible that some feed derogations may be extended beyond 2005, farmers need to be assessing their options to be able to feed 100% organic feeds now, and should be considering the following options where appropriate:

Developing high quality and alternative forages. There is extensive information regarding this in this project and Welsh farmers can capitalise on free consultancy, details available through the OCW help-line (01970 622100).

- Developing the production of arable crops for energy and protein on farm or on linked units that are able to produce arable crops.

- Farmers will need to be able to know and monitor the nutritional value of their home produced forages and cereals and will need to ensure they have access to a professional analysis service.

- Developing co-operative links as widely as possible such as: links between upland store and breeding stock producers and lowland finishing farms to capitalise on the resources of each, cooperation between farmers to reduce the costs of buying feeds and machinery and to reduce costs of contractors such as mill and mixers etc.

- Links between farmer groups and compounders / feed merchants could result in better feed availability and security. A valuable role for compounders is to ensure consistency of ration analysis, and the production of pellets, nuts and rolls to ease feeding practicalities and reduce dusts and feed losses. Feed compounders could be used to help balance home-produced rations for protein.

- Changes to systems such as: breed, moving to store and breeding stock production (organisations such as OCW, producer services and producer groups can help develop links with finishing farms), lambing / calving and finishing times, exploring different / new feed options and feeding programs.

- With an increase in the use of home-produced feeds farmers need to be developing options for on-farm milling, mixing and crimping of grains.

9.2 Feed compounders

Feed companies will play a pivotal role in developing the availability of ingredients, ensuring that farmers have feeds available to them and provision of important nutritional information not only for farmers but for those at the Soil Association, UKROFS and Brussels who are producing and administering standards. Their roles can be developed in several ways:

- Compounders have a central role in creating demand and therefore availability of ingredients that are required. There is a need to improve availability of all organic ingredients, but particular areas of concern would be soya and oil seeds.

- They should also aim to develop future options for obtaining organic maize meal, potato protein, vegetable oils and molasses in order to prepare for a possible loss of these ingredients. It is also likely that they will be at the forefront of developing new ingredients to provide better rations in the absence of synthetic amino acids and other restricted ingredients such as vitamins and minerals.

- Compounders and merchants will need to ensure that they can offer services that are likely to be required such as:
    - A possibility of changing from complete to balancing rations.
    - They may be needed for forage analyses and nutritional advice.
    - There is likely to be a demand for merchants to be able to provide organic straights such as sugar-beet pellets / shreds, barley and peas etc. They will need to develop their ability to provide these.

- Mill and mixing companies may see an increase in demand from organic clients and need to ensure that they are aware of organic standards and procedures.

- Feed compounders provide, and no doubt will continue to provide, essential input on technical and cost issues in the decision making process at every level of certification and legislating. This can be co-ordinated through groups such as the Soil Association feed working groups, which could be expanded to provide a focus and channel of communication for all concerned.

9.3 Certification bodies, UKROFS, policy makers and strategists

These bodies need to manage the removal of the derogation very carefully if their own aims and objectives are to be achieved in the short and long term. Most people in these organisations recognise the reasons behind the removal of the non-organic allowance and would want to see organic farmers reduce their reliance on conventional agriculture wherever possible. However, as identified by one of the farmers, it would be a great shame for both them and the farmers if in the way and timing that this is done it made it genuinely impossible for farmers to continue in organic farming. The current major obstacles are technical, through the simple non-availability of key ingredients, and cost, given current poor margins in many areas of organic stock farming.

The following recommendations should be considered:

- Although cost cannot be considered an issue when defining basic organic principles, it is critical that it is taken into account over the next few years when deciding how quickly farmers should move towards those principles. Failure to take current poor margins into account could, in a short space of time, seriously undermine many of the achievements of recent years if farmers revert to conventional farming methods.

- It will be important to look at strategies such as a step-down decrease in non-organic allowance, and the timing of such decreases should be carefully considered in the context of availability, cost and margin. It is felt that reducing the scope of ingredients that can be used non-organically would also be a strategy that should be given proper consideration and is clearly moving in the right direction whilst stimulating availability.

- Certain ingredients are prime candidates for special treatment – namely, fishmeal, potato protein, linseed expeller and maize meal, which are currently not available organically (fishmeal may never be) and would have a catastrophic impact on the organic pig and poultry sector if lost.

- There are other processing aids used in relatively small proportions that are either unavailable or have large implications if they have to be organic, such as molasses and vegetable oils.

- Soya will be a critical ingredient for the dairy, pig and poultry sector, and is a primary candidate for a carefully controlled step-down derogation approach.

- Consideration should be given to relaxing requirements that hinder the home grown or localised production of stock feeds such as allowing the use of proprionic acids on uncrimped grain where drying of grain is difficult.

- The removal of the requirement for poultry feeds to be based on 65% cereals hinders poultry ration formulation in the absence of synthetic amino acids and there is a strong case for removing this requirement or allowing pulses to count towards the 65%.

- Work needs to continue to improve the premiums achievable for organic produce through positive promotion and consumer education. It is important to develop farmers' ability and options to sell their produce and work can be done at many levels. One option may be to encourage supermarkets to develop a market / brand for traditional breed / grass finished products that do not look like the bright red fat-free products that many customers currently expect, but that may exceed them on taste. This would enable producers to have more options for selling stock finished without high levels of concentrate. The potential for encouraging the use of UK cereals to feed British meat stock should be investigated, possibly driven by supermarkets promotion or branding.

- The removal of the 'Over Thirty Months Scheme' should be seriously considered by DEFRA, in particular for organic animals since as yet there has not been a case of BSE in organically managed cattle.

If the aims of these organisations are to be successfully achieved then every effort needs to be made to support farmers in adapting to any new requirements, by providing technical information and advice, and encouraging the development of new ways forward, alongside carefully planned and co-ordinated phasing out of derogations. Sector bodies and organisations such as the Soil Association and OCW can facilitate many of these suggestions.

10. References

Basset, Anna 2003 - Improving market intelligence for the red meat sector in Wales - Soil Association

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Lampkin, Measures & Padel 2002 – 2002/03 Organic Farm Management Handbook - University of Wales

11. Glossary of terms

- **DEFRA:** Department of Environment, Farming and Rural Affairs – Government ministry that replaced MAFF in England
- **OCW:** The Organic Centre Wales
- **OF&G:** Organic Farmers and Growers
- **OFS**: Organic Farming Scheme – A five year payment scheme offered by DEFRA and the National Assembly for Wales for farmer who undertake organic conversion. The scheme ties producers in to remain registered to organic standards for 5 years.
- **SA Cert:** Soil Association Certification Ltd – the certification business set up and owned by the Soil Association charity which certifies to SA standards.
- **t**: tonnes
- **UKROFS:** United Kingdom Register of Organic Food Standards – the DEFRA department that is responsible for the implementation of the EU organic standards in the UK and overseas the certification bodies such as the SA Cert.
- **WDA:** Welsh Development Agency

12. APPENDICES

Appendix 1: Mike Thompson – BOCM Pauls

Availability of ingredients and cost projections

Background

The current derogation permitting the use of Approved Non-organic feeds ends on 24th August 2005. This presents the industry with a number of interesting questions namely:

Are there adequate organic and in-conversion raw materials available globally to meet the additional demand created by the end of the derogation?

What are the cost implications of the change?

What are the barriers to increasing the use of home produced farm feeds and home-mixed concentrates?

What are the likely implications for the nations feed compounders who currently supply Approved feeds to organic producers?

The raw material supply situation

Raw materials used by the feed compounding industry are currently home produced or imported. There are a number of additional raw materials which could potentially be imported in 2005 to meet increased demand. See Table 1.

Table 1.

	Origin of Organic Materials	
Domestic produced	**Current import**	**Potential import**
Wheat	Wheat	Rapeseed exp
Barley	Barley	Linseed
Oats	Oats	Lupins
Peas	Peas	Palm expeller
Beans	Beans	Millet
Lucerne	Lucerne	Potato protein
Maize	Maize	Safflower
Rye	Sunflower	Molasses
Triticale	Toasted soya	Soya expeller
Lupins		

Source: Gleadells

For the last two years there have been no problems in obtaining adequate organic raw materials for inclusion in animal feeds as the supply chain has developed. This year (2003/2004) the UK is expected to import 60% of its organic feed raw material requirements. See Table 2.

Table 2.

Estimated UK Supply and Demand 2003/2004

	Supply	Demand
Feed Wheat	23000	95000
Milling Wheat	5000	25000
Barley (Feed & Malt)	16000	13500
Oats	4000	8000
Peas	1500	8000
Beans	2000	8000
Triticale	2500	1500
Lucerne	850	7000
Maize	500	1000
Rye	500	500
Others	500	1000
Inconversion materials	23500	32000
Total	79850	200500

Source: Gleadells

With organic farming continuing to develop in the UK's arable sector (a number of large estates are converting to supply the increased expected industry demand) and one assumes globally also then the best estimate I can gather from our main raw material suppliers is that there will be adequate raw materials available in 2005/2006. Table 3 below shows a forecast of world supply and demand for 2003/2004.

Table 3.

Estimated World Supply and Demand 2004/2005

	Supply	Demand
France	76043	281361
Germany	190109	266153
Italy	152087	53230
UK	91252	226131
Holland	76043	45626
Ukraine	152087	3802
Eastern Europe	76043	1901
USA	152087	76043
Canada	152087	76043
Australia	152087	76043
Denmark	38021	152087
Belgium	30418	53231
Others	76043	152087
Total	1414407	1463738

Source: Gleadells

The Ruminant sector

Cost implications for various livestock categories in the ruminant sector
The approximate cost of switching various ruminant feeds to 100% organic/in-conversion (agricultural ingredients) is shown below:

Feed type	Additional cost/tonne of 100% organic
Approved 50% organic:50% non-org	+£65*
Approved non-organic	+£100*

*These costs only reflect additional ingredient costs and don't include any cost incurred by feed mills by having to produce 100% organic feeds. E.g. separate molasses tanks, spray lines and spraying equipment, additional raw material bins.

Dairy herds
The average dairy farmer making full use of his non-organic allowance and feeding 1.5 tonnes of compound feed annually will be using a feed containing approximately 50% approved non-organic ingredients. The cost of changing a 50:50 product to one containing 100% organic/in-conversion is approximately £65/tonne. Therefore a herd using 1.5 tonnes concentrates per cow will increase farm production costs by £97.50 per cow or by 1.63pence per litre assuming a 6000 litre average herd yield. This will place additional unwelcome pressure on dairy herd profitability.

Before and after comparison:

	Compound feed (tonnes/cow)	Cost/tonne (£)	Cost/cow (£)	Cost/litre (p/litre)
Current	1.5	200	300	5
b) 100% organic	1.5	265	397.50	6.63

18-22 month beef enterprise
The table below shows the effect on enterprise costs of moving to 100% organic ingredients:

	Concentrate use (kg/animal)	**Extra cost** (£/tonne)	**Extra cost** (£/animal)
Year 1	375*	£65	£24
Year 2	455**	£90	£41
Total extra cost /animal			**£65**

*assumes currently using a diet containing 50% non-organic ingredients
** assumes currently using a diet containing 90% non-organic ingredients

This additional production cost of £65/head is equivalent to a reduction of 13pence/kg LW (500 kg animal).

Before and after comparison:

	Compound feed (tonnes)	Average cost/tonne (£)	(p)	Concentrate cost/kg LW (500 kg animal)
current	0.375*	200	15	
	0.455**	140	12.74	
		Total concentrate cost/kg LW		**27.74**
b) 100% organic	0.375	265		19.9
	0.455	230		20.9
		Total concentrate cost/kg LW		**40.8**

*assumes currently using a diet containing 50% non-organic ingredients
** assumes currently using a diet containing 90% non-organic ingredients

This additional production cost of £65/head is equivalent to a reduction of 13pence/kg LW (500 kg animal).

Lowland spring lamb production
Typical feed use would currently be:
Pre-lambing feeding 25kg approved non-organic cake
Lamb creep 15kg lamb pellets (50% organic:50% non organic)

The cost of moving to 100% organic/in-conversion is approximately £4.21 per ewe.

Before and after comparison:

	Compound feed (kg/head)	Average cost/tonne (£)	Concentrate cost/kg/ewe (£)
current	25 kg/ewe	140	3.50
	15 kg/lamb	200	4.50 (1.5 lambs)
		Total concentrate cost per ewe	**8.00**
100% organic	25 kg/ewe	250	6.25
	15 kg/lamb	265	5.96 (1.5 lambs)
		Total concentrate cost per ewe	**12.21**

Home grown feeds
The additional costs associated with moving to 100% organic rations may stimulate some producers to look at producing more feeds from their own resources. In the ruminant sector these additional feeds could be either forages or concentrated feeds such as pulses or cereals.

Forages:
The advantages of feeding mixed forages are well documented with improvements in drymatter intake leading to improved performance.
One of the most costly elements of ruminant organic diets is the protein fraction. Therefore higher protein forages should be considered. Examples being:
Clover based swards
Whole crop silage containing legumes
Lupin silage
Pea silage
Lucerne

Other lower protein forages which could be grown for winter feeding are:
Maize silage
whole crop cereal silage
Fodder beet

If additional forages are planned, due consideration needs to be given to crop rotations, the agronomy of the crop, harvesting, storage and feed out. Capital expenditure may be necessary to ensure management is kept simple and any change is successfully implemented.

Home grown concentrates:
There is a choice of grain crops which can be considered.
Examples of these are:

	Energy (ME/kg DM)	Protein (%)
Wheat	13.8	13
Barley	13.1	12
Oats	12.2	11.8
Triticale	13.5	14
Beans	14	29
Peas	13.6	26
Lupins (white)	14.5	32

Growing grain crops to be harvested and fed as concentrates needs to be planned carefully.
Consideration should be given to the following:
Organic crop rotations
Crop agronomy
Harvesting, cleaning and drying
Other processing options such as crimping
Storage facilities including working within DEFRA codes of practice
Nutrition/dietary balance for different classes of stock
Processing prior to feeding e.g. rolling and mixing
Handling and feeding
Risks associated with On-farm mixing. These include aspects such as contamination by vermin, mycotoxin contamination, non-uniform mixing, inadequate feed ingredient quality, levels of testing (e.g. for nutrient content and salmonella)
Compliance with feed stuffs legislation (The Feeding Stuffs Regulations) and assurance scheme requirements (e.g. NDFAS, FABBL)
The cost of implementing and operating a change in feeding system

The Monogastric sector
Currently 80% of the agricultural ingredients must be Organic or In-conversion, so the scale of change is less than in the ruminant sector. However the withdrawal of synthetic amino acids in June 2003 is likely to affect animal performance particularly in Growing Pigs and Laying Hens where egg numbers and size will suffer.
The end of the Non-organic derogation will further affect performance in the Monogastric sector as natural ingredients rich in amino acids will be hard to source and consequently costs will be high. Two of the main ingredients fitting into this category are:
Fishmeal. Conventional caught fish can't be regarded as organic (Article 4 of (EC) No 1804/1999 section 11 states that "products of hunting and fishing of wild animals shall not be considered as organic production") Therefore only fishmeal from organically produced farmed fish could be used. This is likely to be in very short supply.
Organic Potato protein. There appears to be little or no supplies of this material available.

Laying Hens

	Feed Intake (g/day)	Egg Production	Feed Cost	Feed cost /doz. eggs
a) Current	120g	280	£235/tonne	44 pence
b) no a.a's	120g	280	£285/tonne	53.4 pence
c) no aa's 100% org	123g	272	£275/tonne	54.3 pence

shows the current situation using the available synthetic amino acids
shows the amino acid requirements are obtained by using a combination of fishmeal, potato protein and praire meal
shows the likely position with amino acids removed and diets at 100% organic. The reason cost per tonne is lower for the no amino acid / 100%Org diet is due to the fact that we will have to "cut diet nutrient specification" in order for it to run and hence production will be lower.

It may also be worth pointing out that the figures and scenarios are likely to change quite dramatically as RM availability and prices change.

The combination of lower specification diets due to a lack of organic specialist ingredients and an increase in ration costs (~£ /40tonne) is almost certainly going to reduce enterprise profitability.
A conservative estimate looks like increasing feed cost per dozen eggs by approx. 10 pence. Are the retailers willing to pay this additional price to the producer and is the consumer willing to pay an additional price, considering the fact that she believes that she is buying "Organic" already !!!

Summary
Forecasts suggest there will be adequate Organic/In-conversion raw material cover available for the end of the derogation in 2005, although there will be a problem with sourcing amino-acid rich ingredients to supply the amino acid needs of some monogastric animals.
If global feed raw material supply exceeds demand and there is a large increase in UK organic arable output then there could be a reduction in feed raw material costs, which would counter the effect of increasing the organic content of feeds to 100%.

Assuming there is no reduction in feed raw material prices, all livestock sectors will be faced with an increase in production costs as ration prices rise with the inclusion of additional organic raw materials. This may influence a number of producers to revert to conventional farming which may in turn bring supply and demand into better balance. In the dairy sector this could result in a higher price for milk as a greater proportion of the milk still being produced actually ends up being sold as organic. For producers remaining this could help offset the increase in feed costs.

Farmers may react by attempting to grow and use more of their own home-grown forages and concentrates although for many this may require the development of new skills, capital investment in equipment, storage and on-farm mixing equipment and compliance with additional legislated and farm assurance standards.

All farmers should be encouraged to review the way they do things currently, although change may not necessarily be the correct course of action.

The end of the non-organic derogation will probably increase costs associated with animal feed manufacture. This may deter some feed compounders from being involved in the organic sector.

Appendix 2: Mike Tame – Abacus

Implications of the changes in feed standards

Making the most of your silage

As of 24th August 2005 all feeds for livestock must be to full organic standards. Can we cope with this change and if so how?

What are going to be the main problems?

For those buying in compound feeds and straights they are two-fold; availability and cost. Protein is likely to be more of a problem as there is likely to be less of it available and it will certainly be more expensive. Indeed, bought in feed in general will be much more expensive. So can this costbe offset and if so how?

The cost cost can be offset to some extent by reducing the requirement both for bought in protein and for bought in concentrates but it will probably mean making some changes to your system. If you do need to make changes they will almost certainly make your system more robust.

Ssome research done by Richard Weller and his colleagues at Trawscoed, Aberystwyth. shows what happens to grass/white clover swards through the season and quantified the changes. As expected, the clover content of the sward increases as the season progresses but what are the implications of this. Richard's work showed that, in each of 2 seasons in 1995 and 1996 the clover content increased from making up around 20% of the swards in May to a peak of between 30 and 40% in August and September. His work also showed that the protein content of the sward as a whole increased through the season starting from a low of around 13.5% in May and rising to a peak of 20% in September of the same year. The following year the figures were from a low of nearly 17% to a high of just over 26% in October. The figures seem to vary considerable from year to year but the point is that protein levels are low in early season and high in late season. However, it has to be remembered that these figures were for fresh grass. The corresponding for figures for silage made from these swards would be much lower as there is a degree of protein breakdown in the clamp. My experience is that the crude protein levels in first cut silages tend, in most years, to be between 10 and 12%, though there are exceptions. The implication of the low protein levels in first cut silage is that we need to supplement diets for dairy cows with additional protein. There may also be a problem for some beef animals with very low protein silages though the problem is much less serious.

So how can buying in very expensive proteins be avoided? The obvious answer is not to be reliant on first cut. Always be sure to make some second cut as this should have a higher protein content, between 2 and 5% higher. This may well require a change for those relying on making all their silage in one cut. The second change will be the way the clamp is filled. The second cut should not be put in front of the first but on top of it so that both silages are accessible at the same time.

Introducing a second forage.
A further step in to helping to reduce the increased cost would be to introduce a second forage. Whenever a second forage is introduced into the diet there is almost always a small increase in forage dry matter intake of between 1 and 2 kg dry matter per head per day for dairy and beef animals which reduces the requirement for bought in concentrates, particularly where several cuts of grass/clover silage are made. The most suitable forages in this situation would be whole crop cereal silage that can take a variety of forms. In some situations this could simply be whole crop wheat or barley (wheat is likely to have a higher starch level). If you are unable to make a second or third cuts of grass/clover silage you will need to add peas or vetches to the cereal to increase the protein content. Some work done a few years ago by Bola Adesogan at WIRS, Aberystwyth showed that it is possible to achieve protein levels of 14 – 18% with barley/pea mixes harvested at 14 – 15 weeks. Vetches are usually grown with oats but could be grown with other cereals, particularly long strawed varieties. Other alternatives would be peas or lupin silage though we do need to learn a bit more about lupin silages. For some fodder beet may be a possibility. Adding fodder beet to a ration will have two main effects. The first is that it will significantly increase dry matter intake from forage (fodder beet is classed as a forage as far as the standards are concerned) with intakes of grass/clover silage, whole crop and fodder beet being up to 15 – 17 kg per cow per day. In addition, experience suggests that it will help reduce the protein requirement.

It is difficult to give accurate figures about the size of the cost reductions that can be achieved as they will depend on a variety of different factors on different farms, but, in very broad terms, introducing a second forage should result in an increase in forage dry matter intake of between 1 and 2 kg per head per day giving a saving of somewhere between 15 and 30p per animal per day for dairy cows but probably less for beef animals. Each farm will need to do their own calculations.

Home grown cereals, beans and lupins.
For some of you it may be possible to grow cereals and either beans or lupins for grain. All of these would make a valuable contribution towards reducing the need for expensive bought in feeds. Again, we do not yet have enough experience of growing lupins in the UK but the newer varieties look very promising.

It is certainly possible to support reasonable yields in dairy cows and good growth rates in beef animals with a combination of forages and home grown cereal and legume grains. For example with a protein content of around 10% in the forages a dairy diet supporting 30 litres would require both beans and lupins alongside some cereal and if available in sufficient quantity could replace all the bought in compound. If the protein content of the forages can be increased to 14% or more it may well be possible to achieve 30 litres with only beans and cereals, again giving a cost saving. So you can see how important it is to pay attention to increasing the protein content of the forages.

Summary.
In summary, post-2005 the protein requirement can be reduced by:

- Making more than one cut of grass/clover silage
- Filling the clamp(s) so that all cuts are accessible at the same time
- Using high protein forages such as whole crop with peas, oats with vetches, peas for forage.

The concentrate requirement can be reduced by:

- Using more than one forage
- Introducing some form of whole crop based forage

Mike Tame B.Sc.
Ph.D.
Principal Associate.

Appendix 3: David McNaughton – Soya UK

Soya and Lupins for the UK organic sector

Introduction "The Protein Problem"

The protein problem is a problem, which currently faces the whole of the UK stock farming industry. It is a problem which has its roots as far back as the late 80's, with the onset of BSE, and has become particularly acute in the last 3 years, as international and domestic events have taken place.

1988	Meat & Bone Meal ban in UK.
1992	Removal of the pea & bean processing subsidy.
2000	BSE in Europe- EU Ban on all "processed animal proteins", including fish meal and meat & bone meal in Europe.
2001	Implementation of the fish meal ban in the UK.

For the organic sector, the question of how to source acceptable forms of protein is a particular problem. The organic sector cannot rely upon imported soya meal, as the conventional sector does, because nearly all "world market" soya meal is either made from Genetically Modified (G.M.) soya or is, at least, contaminated with G.M. material.

Soya meal, which is sold, as Identity Preserved (I.P.) is a useful source of Non-G.M. protein, however, soya planting patterns in both North and South America are moving rapidly in favour of G.M. varieties, thus ensuring that I.P. material is scarcer, and more expensive.

North American Planting of G.M.soya.

1999	34%
2000	54%
2001	68%
2002	75%
2003	Over 80%

Source USDA

There also remains the question of whether I.P. soya will remain acceptable to the organic sector. The current definition of "G.M. free" in North America allows up to 1% contamination with any soya. There are currently plans to raise this to 2% and it seems likely that by 2005, not even I.P. soya will be regarded as a truly G.M. free option.

Impact on the Protein Sector.

In the marketing year 1999/2000 total feed use in EU15 was around 394 million tonnes. Just above half of this feed was tradeable feed. The rest of total feed use is roughage, mainly grass and cereal (maize) silage. The protein content of the total feed

(measured as crude protein) totalled 64 million tonnes, of which 59% comes from tradeable sources, and 41% is originating from roughage. Roughage is the primary protein source in the EU, however roughage is nearly entirely consumed by cattle (and sheep).

The breakdown of the EU 64 million tonnes of Crude Protein is as follows:-

Roughage 41%

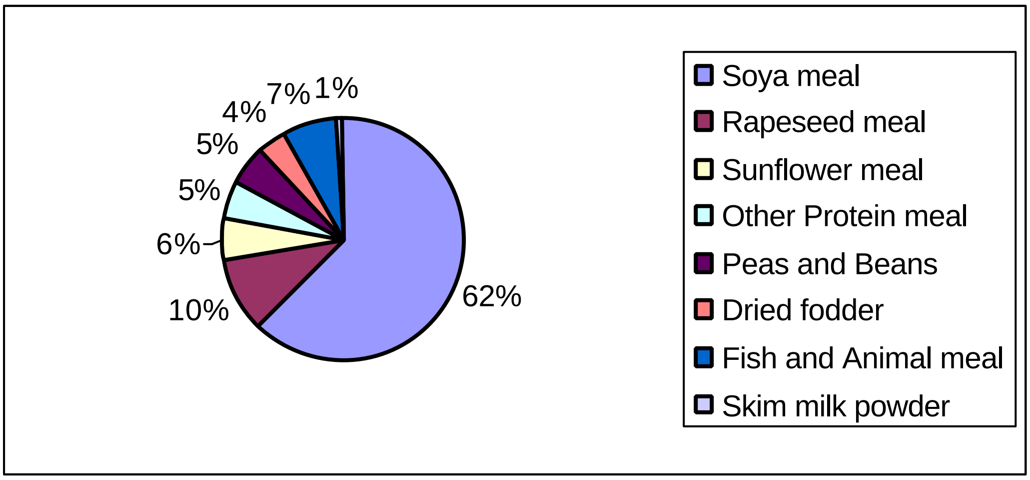
Cereals 18%

Energy Rich % (eg beet pulp, molasses, brans, vegetables, food by-products)

Protein-rich meal 33%

Breakdown of the protein-rich sources which are 33% of the EU's consumption of 64million tonnes of crude protein. (Soya meal accounts for 13 million of the total 64 million tonnes)
Source; EU post-BSE protein report

Nearly all of this soya meal is imported from outside the E.U., from countries which are embracing G.M.



technology. The potential implications of this heavy reliance on world market soya meal have already yielded up one very good example (though not a widely publicised one).

In January 2001, two of the UK's leading supermarkets announced that, from that point on, all white meat sold in their supermarkets would be from animals fed on an entirely non-G.M. diet. As of today, in early 2003, if we buy conventional (not organic) white meats from these supermarkets, they are still fed with conventional feedstuffs (i.e. feedstuffs formulated using world market soya meal). Industry commentators believe that this "quiet climb-down" is because supermarkets did not fully appreciate the difficulty in imposing such criteria at the time of this initial announcement. Foot and Mouth disease was discovered just 3 weeks later and the supermarkets' non-G.M. feedstuffs announcement was never heard of again.

In short, the E.U. livestock industry cannot do without imported soya meal, since no viable alternative exists, whether G.M, or G.M. contaminated, it remains "Hobson's Choice" for the non-organic livestock industry, and since the UK is a major player in the E.U. livestock industry, this issue is particularly relevant.

<u>Growing protein crops to avoid and replace imported soya meal</u>

Growing protein at home to avoid importing it is not a new idea. For some time U.K. stock farmers have sought to reduce their costs of "bought in" feeds by using home-grown, and in many cases, to great effect. Until now however, the primary motivation for this production has been to reduce energy costs rather than protein costs. When wheat was worth £130 per tonne, this provided a benchmark for the cost of alternative feedstuffs and, to buy in concentrates, the energy component was expensive. Protein alternatives, such as soya meal or fish meal would not represent a proportionally expensive part of the ration, and were commonly bought in to be fed, along with homegrown wheat or cereals. With conventionally grown wheat now worth £60, the cost of energy is relatively low for the livestock producer, so home mixing remains popular, however the protein component has become increasingly expensive and problematic.

Peas and Beans

The UK's traditional protein crops of peas and Faba beans are a firm favourite on many farms. Although very familiar to UK farmers, there are 3 main complications, which mean that peas and beans can only ever be part of a solution.

Firstly, both peas and beans can be difficult to produce organically. Both crops can suffer from a range of pests and diseases, which conventionally are sprayed against, and organically can reduce yields significantly. Peas commonly suffer from Pea and Bean Weevil, Nematode attack, Aphid attack, Pea moth, Ascochyta, Damping Off, Downy Mildew, Botrytis and Foot rots. Beans typically suffer from Pea and Bean Weevil, Slugs, Bulb Nematode, Black Bean Aphid, Bruchid Beetle, Ascochyta, Sclerotinia, Mildew, Chocolate Spot and Bean Rust.

Many of these pea and bean diseases are associated with crop rotation, and any intensification in the growing of peas and beans would intensify the problems, which would eventually become self-defeating, especially in organic scenarios.

The second complication with peas and beans is that they are not suitable for all land types and all areas. The UK's main livestock areas, in the North and West, are traditionally areas where peas and beans have not been grown. This is mainly because pest, disease, and harvesting problems are accentuated by wetter weather, and partly because these crops simply do not perform as well in these areas. These crops also require more intensive management, and the level of specialised arable expertise and equipment is not necessarily found on livestock units.

The third, and perhaps most fundamental, reason is the protein content of peas and beans. On a dry matter basis, peas and beans have a crude protein content of around 25%. This protein content, though very useful, is not in a particularly concentrated form, say in comparison to soya meal at 46%, or fish meal (now banned) at 70%. Protein density is in practice, the most significant limiting factor for combinable protein crops, and this is certainly the case for peas and beans.

The significance of protein density

Protein density is one of the most pivotal problems that should be understood in addressing this problem. If I wish to formulate a diet for "low production" stock, such as suckler cows, where simply feeding the cow for maintenance over winter is considered good enough, then a dietary protein level of 12% would be more than sufficient. Formulating a diet of 12% using silage at 10% and some peas or beans, would be no problem. Moving up the scale, breeding sheep, with twin lambs at foot, need a dietary protein of at least 14 %, or this body–condition and performance can be rapidly depleted. Fortunately, a ration of hay, barley and peas or beans, would probably deliver this, without too many problems.

Moving up the productivity scale again, we begin to understand why protein density becomes an issue. A high-production Holstein dairy cow, as is standard on most UK dairy farms has a dietary protein requirement equivalent to 18% of her total diet when she is in early lactation, moving to 16% in mid-lactation. Although this does not sound too bad, we should remember that the forage that forms the basis of her ration might only be 12% protein (good silage is around 14% protein). In order to balance this ration, the dairy farmer would traditionally have fed an 18% dairy cake in order to stimulate the rumen activity and maintain forage digestion, and at the same time, raise the total amount of digestible protein being fed to the animal. Any protein shortfall would be compensated for by a loss in body condition during early lactation. The problem is that, in order to make an 18% C.P. dairy cake, you must use a dense protein source. Peas and beans at 25% would need to be included at over 70% of the formulation, in order to make an 18% cake, and then the attributes of the cake would not be much different to simply feeding peas and beans as they are. Unfortunately, feeding large proportions of peas and beans begins to have a detrimental effect on rumen performance, and the cow begins to metabolise body reserves, in order to maintain production.

High production stock in intensive beef systems, top yielding dairy cows on lactations above, say, 8,000 kg, pigs of all classes, and poultry of all classes, would all struggle to meet levels of production, if the most dense source of protein available were peas and beans at 25% C.P./kg D.M.

The lessons from this are as follows:-

1. Where the dry matter intake is maximised, the higher the production level, the higher the protein density that needs to be fed in order to avoid a protein deficit.

2. Simply feeding "what you have" is not an option, as it does not simply result in lower production, but can result in serious animal welfare implications.

3. The protein content of the forage, which makes up the majority of ruminant feed intake, is absolutely crucial in delivering as much of the total protein requirement as possible.

4. A typical UK dairy cow in early lactation, on typical grass silage, would be at the absolute limit of the potential for peas and beans. Higher production cows, or cows in a situation where silage quality is poor, would have a problem if only peas and beans were available.

The Solution

It is worth noting, that the protein problem can only be solved through two distinct strands of production.

1. On the UK's livestock farms where, as already said, geographic climatic and economic limitations apply, however there is potential to develop not only high protein combinable crops, bit also high protein forage crops such as clovers.

2. On the UK's arable farms where high protein forage crops do not feature, but new high protein combinable crops could represent new, much needed, cropping options. This sector would also be critical in producing the combinable crops necessary for supply into the organic feed compounding industry, for the higher protein formulations needed for the high production stock.

If by 2005, UK organic livestock farmers are to meet current levels of production from organically grown produce, we must find protein crops, which meet the following criteria:-

- Protein density. Greater than peas and peas and beans.

- Palatability and absence of anti-nutritional factors. No point in growing it if the animal will not eat it.

- Ease of production – many crops exists which may hold out significant potential, but can they be grown in the UK? Are they suitable for our livestock areas in the North and West? Will the livestock farmers in these areas have the skills and equipment to produce these crops?

- Tradeable commodity - not just forage crops, but also combinable crops for the arable sector.

- Economic competitiveness – ultimately, these new crops must make economic sense, or UK organic production will suffer in the market place. Competition, both from the conventional sector, where G.M. soya-meal is set to remain acceptable, and from the organic sector in other countries, where the economics of production may be very different.

U.K. Lupins and Soya Beans

Soya

The UK experience with soya so far has been a mixed bag. The crop is expanding slowly with the organic sector taking its share. The crop has the potential to become a very useful new cash crop in the arable regions of England, with new varieties, and strong market demand now coming into place. It is unlikely that UK soya will ever replace the enormous volumes of imported soya, currently coming into the UK, however it certainly will be a useful and profitable crop for those who grow it. There are a number of reasons why UK grown soya is limited in its use as regards the "protein problem":-

Oil crop, not protein (20% oil 36% protein).

- Cannot be fed on farm, but requires processing, so suitable as a cash crop only and not for home feeding.
- Arable expertise required to grow.
- Weed competition- problematic for organic growers.
- Not suitable for all areas. East of the M5 and South of the Humber.
- Can be foraged but not particularly productive and, as an oil crop, not a great forage.
- Only when the oil is crushed out, and the meal is heat-treated, does soya meal become a major protein source.

The crop does have a number of positive aspects:-

- New varieties giving better yields and agronomy.
- Arable crop.
- New varieties becoming available, and potentially significant crop for conventional sector.
- 100% non-G.M.
- Very good nitrogen fixer (up to 175kg/Ha).
- Has huge potential for the future.
- A good arable break crop option for growers in the right area, not looking to feed stock, but grow for cash.
- Could potentially contribute to the solution for post-2005, but not a full answer by any means.

Lupins – A very useful part of a solution

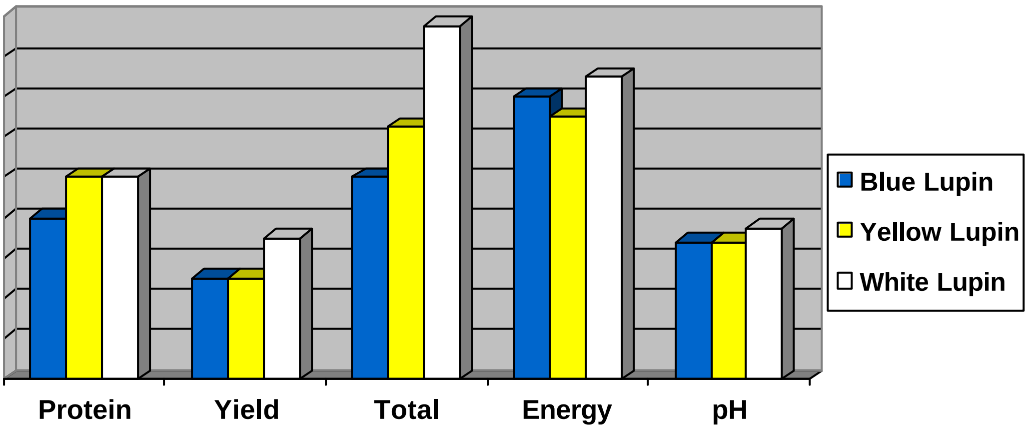
- Suitable for all land types.
- Suitable for all areas.
- Suitable for all farmers, easy to grow, handle and harvest.
- No pest/disease.
- Can be fed at home – no processing.
- Protein density :- (Up to 40%)
  Allows 100% substitution in dairy cattle below 9,000 litres.
  Allows 75% substitution in dairy cattle above 9,000 litres at peak lactation.
  Allows 50% substitution of dietary protein in pig diets.
  Allows 30% substitution of dietary protein in broiler diets.
  Allows 100% substitution in beef and sheep.
- Can be foraged.
- Can be combined.
- Readily traded commodity, and acceptable to the compounding industry.
- Can be crimped/propcorned.
- Forage - 20% C.P., 11.5 M.E. palatable.
- Grain - 38% C.P., 15.0 M.E. palatable.
- Very good nitrogen fixer. (up to 200kg/Ha).
- Good agronomy, competitive crop, so particularly suitable for organic.
- Economic – high yielding crop.
- G.M. Free.
- Traceable.
- A.A.P.S. Protein Payment.
- Highly palatable.

Negative Future pests and disease?
No pH above 7.5 (7.7 at a push)

Need responsible development of the crop.

Lupin Varieties

Three different species of agricultural lupin exist. White lupin (*lupinus albus*), yellow (*lupinus luteus*), and blue (*lupinus angustifolius*). All three are available in the spring-sown form, with albus types available as winter-sown in other countries.



Spring Lupins

All three types are available as Spring-sown options in the UK. The table below summarises the main varieties with Dieta, Bora, Prima, and Wodjil accounting for the vast majority of UK area.

	Variety	pH Tolerance	Protein %	Main Use	Growth Habit
White	Dieta Tuman Verity	7.5	38 – 40 %	Forage in all areas. Combining in Southern half of England.	Semi Semi Semi
Blue	Bora Borweta Prima Bordako Bolivio Sonet	6.8	31 – 35 %	Combining in Northern areas.	Semi Determinate Determinate Semi Semi Determinate
Yellow	Wodjil Amber	6.8	32 – 42 %	Combining in Southern half of England.	Semi Semi

Growth Habits
Semi determinate = Branching = Better competitiveness.
Determinate = Early, but poorer competitor.

For competitiveness with weeds, organic growers are likely to favour semi-determinate types. They would also have greater yield.

Winter Lupins

Winter lupins are unlikely to prosper in the UK until a range of agronomic challenges can be overcome. Unlike the Spring-sown versions, Winter lupins (like most winter crops) tend to be more prone to weed competition, diseases, and pest attack from pigeon, slugs, rabbits, and aphids. Winter kill due to frost, exposure, and water-logging are also big factors. Plant breeders continue to develop hardy types, however, significant development will be necessary before UK winter lupin growing is viable enough to become widespread.

Nutritional Value of Lupins

Feeding trials from a variety of sources in Australia, USA and UK, have concluded that lupins can be used as a direct replacement for soya meal.

Response of dairy cows fed sweet white lupins (day 22 to 140 post-partum).

		Milk yield (kg/day)		Fat yield		Protein yield		
Treatment[z]	No. cows	uncorrected	3.5% fat corrected	(%)	(kg/day)	(%)	(kg/day)	Dry matter intake (kg/day)
SSSS	11	27.3	27.5b[y]	3.7	0.97	3.0	0.82	19.9
SSSL	11	28.9	29.1ab	3.7	1.03	3.0	0.86	20.8
SSLL	10	28.4	28.6ab	3.6	1.01	2.9	0.81	20.6
SLLL	12	30.0	30.3a	3.7	1.08	2.9	0.86	21.0
LLLL	10	28.3	28.8ab	3.8	1.02	2.9	0.82	20.4
SE		0.84	0.68	0.1	0.03	0.1	0.02	0.49

All means are covariantly adjusted.
SSSS = 100% of supplemental protein as soybean meal. Each 'L' represents 25% of this protein being replaced by lupin protein.
Treatment means with different subscripts are significantly different (P < .06).

Source Putnam 1997

Comparison to Peas and Soya Meal

Nutrient	Peas	Blue Lupin	White Lupin	Soya meal
Crude Protein	230	322	387	440
Total Lysine	15.6	15.0	18.6	28
Available lysine, pigs	14.3	10.4	14.0	24.9
Available lysine, poultry	14.2	13.5	17.3	25.5
Crude oil	11	58	105	28
DE, pigs (MJ)	14.5	14.6	15.4	14.5
ME, cattle (MJ)	11.7	12.8	14.8	13.7
ME, sheep (MJ)	12.0	12.9	15.4	13.7
Total Calcium	0.9	2.2	2.1	4.0
Total Phosphorus	3.9	3.0	3.6	6.0
Crude Fibre	58	150	78	66
ADF	85	197	166	110
NDF	128	227	218	130

13. Nutritional values of feedstuffs – ruminants

Food	Dry Matter (g/kg)	ME (MJ/kg DM)	CP (g/kg DM)
Rapeseed meal	880	12.0	400
Barley	860	13.0	125
Hay (average)	850	8.6	85
Hay (good)	860	9.2	100
Silage (average)	240	10.8	140
Silage (good)	240	11.5	160
Barley Straw	860	6.5	40
Oats	850	12.0	105
Wheat	860	13.6	126
Maize	860	13.8	100
Wheat dark grains	900	13.5	340
Malt distiller dark grains	900	12.4	270
Maize gluten (20%)	880	12.9	220
Soya bean meal (full fat)	900	13.3	520
White fish meal	900	14.2	700
Sugar beet pulp (molassed)	860	12.5	120
Peas	860	12.7	260
Beans	860	12.5	260
Blue Lupin	860	12.9	340
Yellow Lupin	860	13.5	400
White Lupin	860	14.8	400

Sources: ***SAC, Western Australian Department of Agriculture***

To achieve a white lupin equivalent of 38% using a protein mix of soya meal and wheat, a 76% soya / 24% wheat mix would be required. The mix would have an energy content of 13.4 MJ/Kg DM as compound, compared to 15.0 in the white lupin.

To achieve a blue lupin equivalent of 32%, using a protein mix of soya meal and wheat, a 58% soya / 42% wheat mix would be required. The mix would have an energy content of 13.4 MJ/Kg DM as compound, compared to 12.9 in the blue lupin.

Australia are the world's number one grower/exporter of lupins, and the Australians have developed lupins as a crop, as opposed to soya. The Australian model therefore, holds out an excellent example of where the UK can aim to be.

It is worthy of note, that the Australian dairy industry uses four times the tonnage of Lupins, than the tonnage of Soya meal.

Total Feed Use By The Australian Dairy Industry (Kilotonnes)

Feed	**1993 / 1994**	**1999 / 2000**
Barley	325	646
Wheat	159	317
Sorghum	98	195
Other course grains	227	451
Lupins	138	215
Field & other peas	18	23
Total pulses	155	238
Soybean meal	0	56

Source, WA Dept of Agriculture

Economic Impact

If growers are in the position to replace bought-in concentrates with home-grown lupins, the economic benefits could be enormous.

14. Comparison as a protein crop for farm feeding – per hectare basis

	Peas	**White Lupins**
Yield (t/ha)	3.7	4.5
% Protein	26	38
Protein Yield/Hectare	0.96	1.71
Area Aid (£/ha) (English Rate)	260.00	260.00
Total Income (£/ha) + protein	*260.00 + 0.96 tonne protein*	*260.00 + 1.71 tonne protein*
Seed Cost (£/ha)	70.00	136.00
Fertiliser Cost (£/ha)	25.00	25.00
Spray Cost (£/ha)	89.00	55.00
Total Cost (£/ha)	*184.00*	*216.00*

Gross Margin (£/ha)	76.00 **+ 0.96 tonne protein**	44.00 **+ 1.71 tonnes protein**

The table below, shows the current profitability of the average English dairy farm (conventional and organic together). Apart from making very depressing reading, with a net farm income of just £9/Hectare, it reveals the biggest single cost to be concentrates, at £357/Hectare. In organic scenarios, this figure is potentially much higher, and addressing this figure holds out more scope for improving dairy profitability than any other avenue. Replacement of 75% of this concentrate with home-grown lupin would save £148/Hectare, taking net farm income from £9/Hectare to £157/Hectare (assuming a value to the farmer of £120/tonne for his home-grown lupins, a concentrate value of £140/tonne, and an opportunity cost of the land at £9/Ha).

ENGLAND – DAIRY FARMS

	1999-00 ACUTAL £/ha	**2001-2002 Estimates £/ha**
Output		
Milk	1225	1112
Cattle	175	145
Crops	105	82
All other output	96	112
	1601	1451
15. Variable Costs		
Concentrates	348	357
Sundry livestock expenses (incl. haulage)	177	192
Seed (incl. home-grown)	19	18
Fertiliser and lime	64	57
Crop sprays and sundry crop expenses	31	29
Contract, casual labour	88	64
	727	717
Gross Margin	**874**	**734**
Fixed Costs		
Labour (excl. farmer & spouse manual work)	204	189
Machinery: repairs etc	95	97
depreciation	115	102
Rent or rental value and leasing	196	190
Miscellaneous	152	147
	762	725
16. Net Farm Income	**112**	**9**
Less farmer and spouse manual work	190	225
Management and Investment Income	-78	-216
Tenancy Capital	1880	1214
(M&II as % of Tenancy Capital)	(0%)	(0%)

Sources:- SAC Deloitte & Touche

17. Conclusion

Solving the protein problem will require a good, co-ordinated approach and a realistic appreciation of the nutritional requirements of modern stock. The modern dairy cow giving a lactation of 9000 litres is the biological equivalent of the jet engine. She is designed to run on a certain grade of fuel, and putting two star petrol in her and crossing our fingers, is simply not good enough. Either we find a way of making this fuel, or we relax our view of genetically modified fuel, or we go back thirty years to lower production, less efficient breeds, which at least can run on lower grade fuel. Since options two and three are unpalatable and unfeasible to the organic sector, option one remains the only feasible option, i.e. grow new high-protein crops here in the UK.

The crops which will contribute to this are high grade forages with high protein contents, such as clover mixtures or lupin and lucerne silages, and high grade combining crops such as lupins, soya, peas, and beans.

Within this, lupins are the best new option to appear on the horizon in a long time, and fulfil every single criteria we are currently looking for in a protein replacement crop.

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