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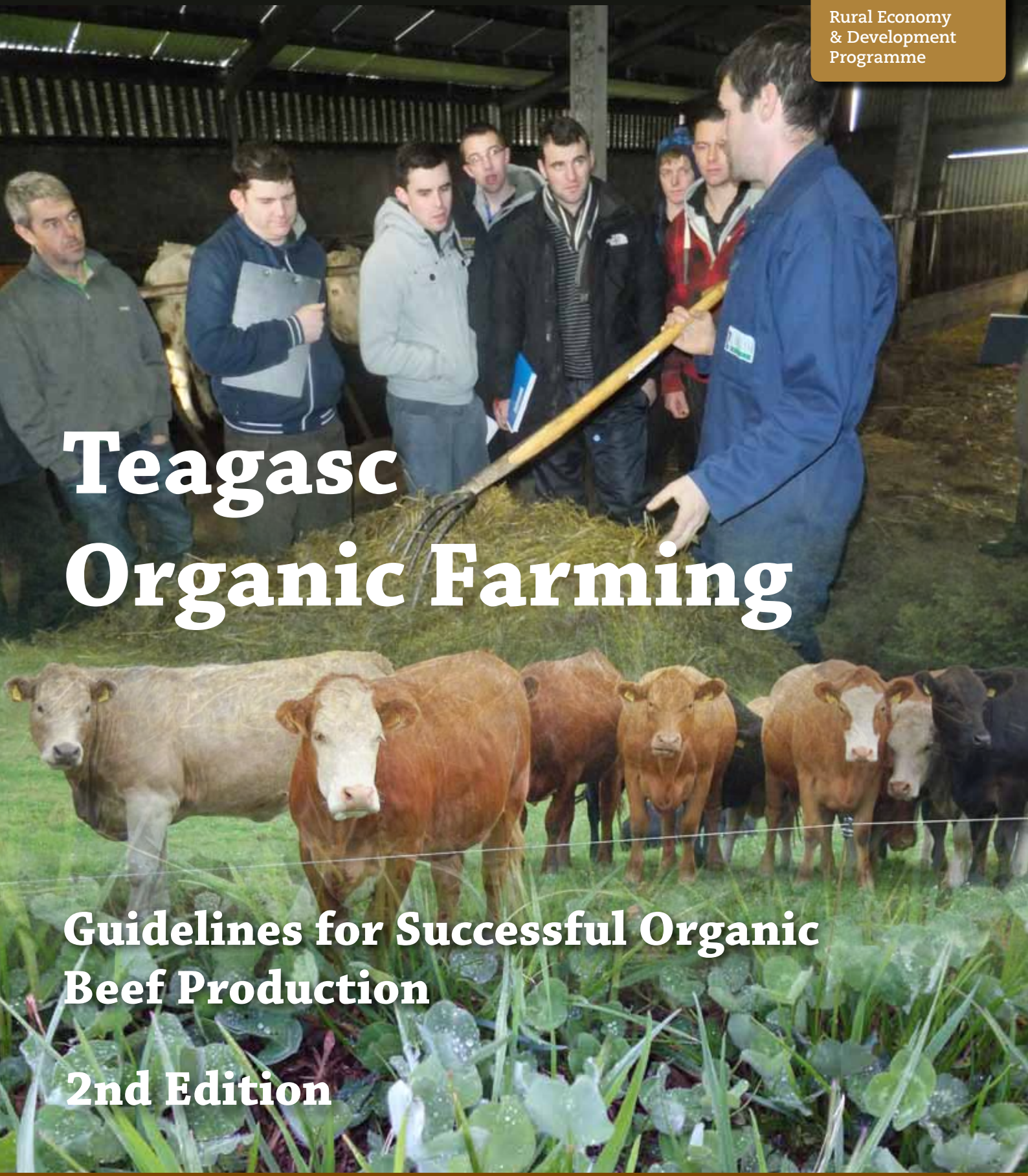

Teagasc Organic Farming

Guidelines for Successful Organic Beef Production

2nd Edition

Agriculture and Food Development Authority

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Guidelines for Successful Organic Beef Production

Edited by

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Teagasc Rural Economy & Development Programme

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Agriculture and Food Development Authority

Foreword

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Organic cattle production is the most important sector in the organic industry with approximately 70% of organic farmers involved in the sector. Making the most of the land while farming to EU organic standards can be a challenge as there are few quick fix solutions in organic farming but with the right attitude, skills and knowledge it is possible to be productive and increase profitability. The aim of this guidelines book is to bring into focus some of the key on-farm management practises which are part of a successful organic beef production system.

Whether you are an existing organic farmer or a conventional farmer taking a serious look at converting, this booklet contains relevant information for you. This 2nd edition includes timely updates regarding industry and technical information as well as comprehensive updates to both the forage production and the nutrient management chapters. We would like to thank each of the contributors both within and outside of Teagasc for their time and help in bringing this publication to fruition.

We wish every success with your farming enterprise.

Fintan Phelan,
Head, Teagasc Farm
Management and Rural
Development Programme

There has been a large increase in the number of organic farmers in recent years. While the Organic Farming Scheme has been important in facilitating this growth, enhancing the underlining profitability of the system will be vital if this is to be maintained. Teagasc has a role in promoting organic farming but this only makes sense if it is profitable for farmers.

Like all beef farmers, organic farmers are dependent on the market to deliver a return. Markets are required for our products and current signals are good regarding export markets however as in other beef enterprises there is always risk. It is however open to every farmer to control what they can within the farm gate through the use of up to date technology and best practice outlined in this booklet.

I would encourage you to read the booklet and select individual areas that you can focus on to improve the efficiency of your farm. You can develop your knowledge further by networking with other organic farmers, joining an Organic Discussion Group and attending Teagasc/DAFM Organic Demo Farm Walks.

Organic beef production in Ireland: structure and steps towards successful conversion

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Introduction

Organic production is defined as "an overall system of farm management and food production that combines best environmental practices, a high level of biodiversity, the preservation of natural resources, the application of high animal welfare standards and a production method in line with the preference of certain consumers for products produced using natural substances and processes".

Consumers purchase organic food for a number of reasons including:
• concerns about the build-up of chemicals in the body,
• taste,
• a return to traditional food values,
• animal welfare and
• impact on the environment.

After recession related decline, the organic market in Ireland and the UK has stabilized and has returned to growth. Irish organic food enjoys an excellent reputation both at home and especially across Europe. Latest figures show the organic retail food market in Ireland is now worth over €136 million annually (source:Bord Bia, 2016) which represents approximately 1% of all food sales. In the European Union, the market for organic food is worth €24 billion (2014) a doubling in size over the last 10 years. The largest markets exist in Germany (€7.6 billion euro), France (€4.8 billion), the UK (€2.3 billion) and Italy (€2.1 billion). This growth represents an opportunity for Irish farmers to supply more organic food, especially organic beef.

At farm level in Ireland, the organic sector has experienced a large influx of new farmers in recent years with 1,800 farmers now farming organically including approximately 600 who entered conversion in 2015. About 70% of organic farmers are cattle farmers. Organically managed land now occupies approximately 2% of the total utilizable agricultural area (UAA) in the country, which is over a doubling in area compared to the previous decade. This compares with an average of 6.2% of UAA across the European Union.

Organic beef farming in Ireland

According to DAFM, in February 2017 there were approximately 1,400 organic cattle farms in Ireland, most of whom were suckler farms. In total there were over 59,000 cattle, including 18,500 suckler cows, farmed organically. This represents an increase of 65% in cattle farms and an increase of 100% in cattle numbers since 2008. Figure 1 shows the location of all organic farmers and location of cattle per county in Ireland. Figure 2 shows the number of organic cattle disposals in 2012 per month through factories, abattoirs and exported live. In 2012, there were over 9,000 organically farmed cattle slaughtered in Ireland by approximately 500 farmers.

With the relatively large influx of new organic farmers entering conversion in 2015, it is expected that these cattle disposal figures will rise by about 40% by 2018.

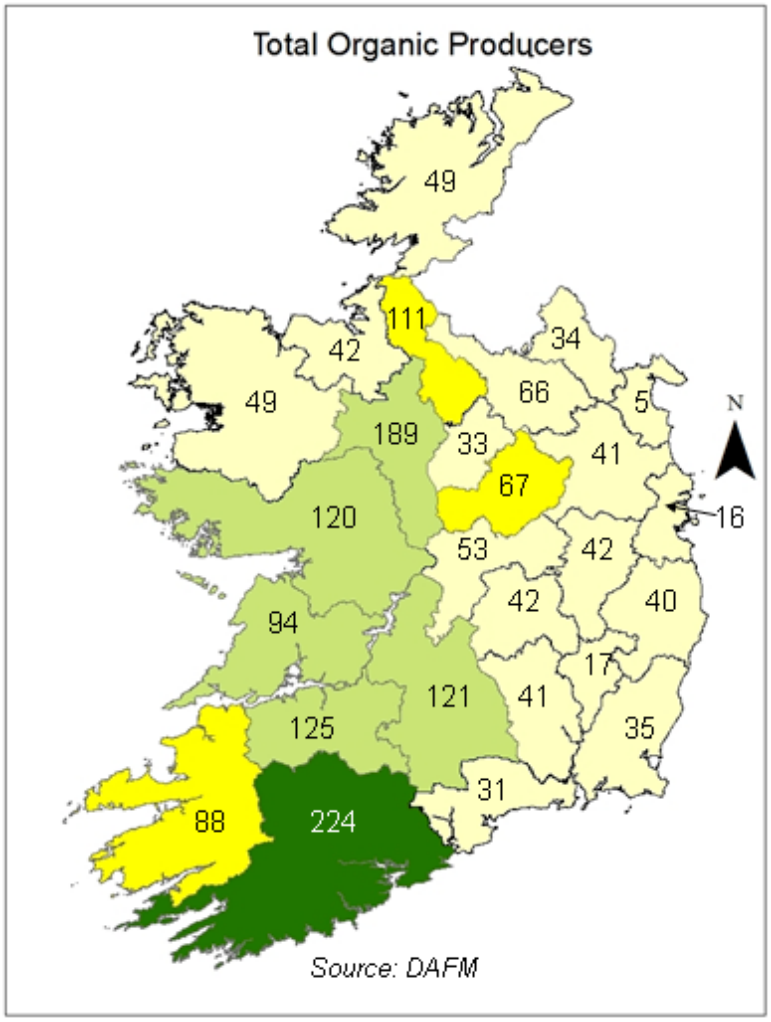
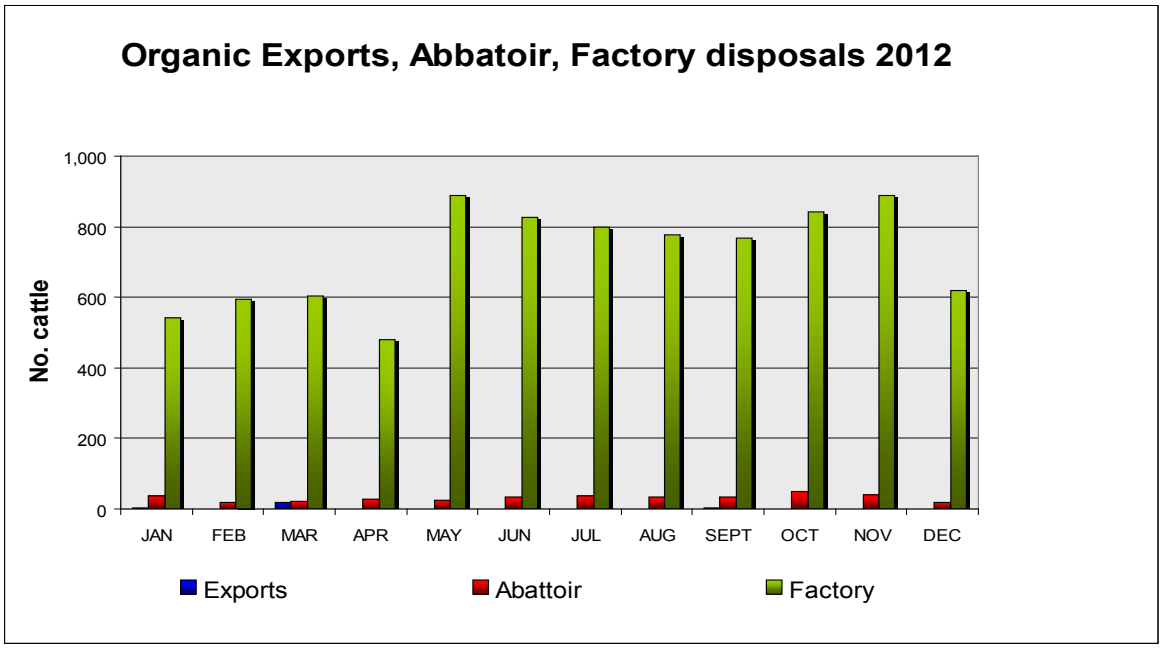


Figure 1: Location of all organic producers in Ireland - February 2017



Two-thirds of disposals May-Nov

Source: DAFM

Figure 2: Organic cattle disposals through factories, local abattoirs and exported live per month in 2012. Annual total = 9,000.

Is organic beef farming profitable?

There is a perception that organic farming is difficult, contains a lot of 'red tape', is demanding on labour and returns low levels of productivity. The reality is quite different. The best organic farmers, using good husbandry and management skills, can achieve stocking rates up to 170 kg N/ha. In terms of paperwork, detailed records must be kept but farmers in the Bord Bia Quality Assurance scheme and GLAS are already familiar with this type of record keeping.

Steps to Successful Organic Beef Production

1. **Get the information**

   It is important that you get as much information as possible before making the switch to organic farming. Prospective organic farmers should first consult with their agricultural consultant or advisor to determine suitability. This should be followed by attending some of the Teagasc/DAFM Organic Demonstration Farm Walks to see organic production systems at first hand and to meet with other organic farmers, staff from the Organic Certification Bodies, the organic unit of the DAFM and Teagasc advisors/specialists. There is a wide variety of publications, advisory guidelines, research updates, videos, event/course details along with links to relevant organic bodies and organisations available on www.teagsc.ie/organics.

2. **Assess the market**

   For organic farming to be profitable a premium price must be achieved for produce sold. While the majority of beef supplied to the market is from steers and heifers, recent markets have emerged for calves (organic veal) and cull cows. Beef farmers interested in organic conversion should speak with other organic farmers, processors and wholesalers about potential markets. Major factory outlets for organic beef are Goodherdsmen, Slaney Meats, ABP and Jennings. Premium prices of 15 to 20% have generally been achievable for organic beef in recent years. According to processors the demand for Irish organic beef will continue to rise, especially in mainland Europe.

3. **Maximise payments from the Organic Farming Scheme and other supports**

   Consult with your agricultural consultant or advisor, or the DAFM website (www.agriculture.gov.ie) about scheme and grant support available for organic farming. An organic farming scheme (OFS) which is an area-based payment and both an on-farm (OCIS) and an off-farm capital investment scheme is funded under the new Rural Development Programme (2015-2020) and opens up at various stages throughout the programme.

4. **Complete an organic course**

   A 25-hour 'Introduction to Organic Production' course has to be completed before acceptance into the DAFM Organic Farming Scheme (OFS).

5. **Choose an organic certification body (OCB)**

   In Ireland, there are three certification bodies (Demeter, IOFGA or Organic Trust) which certify organic operators involved in land-based farming under the auspices of the DAFM. The farmer initially applies to one of the three certification bodies with the application form, conversion plan and fee payable. Once the application is accepted, a conversion date is granted and a conversion period (normally 2 years) commences. The Organic Certification Body carries out an annual inspection to check compliance with the standards and to ensure that organic records are in order. Spot inspections may also be carried out to check for compliance with organic regulations.

6. **Complete an organic conversion plan**

   This involves a detailed description of management practices on the farm, the changes required on the farm, soil analysis, faecal analysis, livestock housing plan, animal health plan (in consultation with your veterinary surgeon) and land/crop rotation plan. The plan can be drawn up by the farmer alone or in consultation with the farm advisor. Attending a FETAC accredited "Introduction to organic farming course" is an excellent way of learning how to complete the conversion plan.

7. Provision of quality forage

To maintain farm productivity, stocking rate must be maintained as high as possible. In the absence of artificial nitrogen, white clover may be introduced into pastures to maintain grass production levels. White clover is the 'engine' that drives productivity on organic farms and can fix in excess of 100 kg N/ha annually. Red clover can fix in the region of 200 kg N/ha annually and can be a high yielding, high protein feed for wintering animals. Organic concentrates are more expensive than conventional concentrates. Prices for organic rations for ruminants are generally around €500/tonne. Maximising use of grass, using home-grown grain, purchasing grain from other organic producers and having the correct breed and system which matches land type and market specification required can reduce feed costs significantly. Organic straights can be purchased from a variety of organic farmers for between €300 and €350 per tonne with combi-crop mixes of peas and a cereal available for between approximately €380 and €400/tonne.

Regular topping is necessary to maintain grass quality and control weeds particularly in mid-season. High quality silages can also be produced using red clover-grass swards and enough silage should be produced on farm to meet winter feed requirements as it is not permitted to source silage from conventional farmers.

8. Animal health

Ensuring high animal health and welfare standards is a fundamental ethos of organic principles. The farmer must be aware that the level of stocksmanship required with animals is very high on organic farms. Routine treatment of animals with anthelmintics is prohibited, and a rotational grazing system should be in place to minimise worm burden. If a problem occurs faecal analysis is recommended and the vet must sign off the appropriate treatment on the organic farmer's record book. Early detection of animal health problems is essential. Remember good animal husbandry is paramount. If an animal is suffering it must be treated and the necessary permission must be sought from the vet. The animal health plan, produced as part of the conversion plan, will deal with mineral deficiencies and vaccination issues.

9. Animal housing

Many farmers find that the greatest alterations that need to be made at farm level are changes to winter housing. More generous space allowances are required – for cattle the rule of thumb is that 1.0 m^2 is required for every 100 kg live weight. All stock must have access to a dry bedded lying area. Up to 50% of this area can be slatted but the rest must be solid floor and not slatted. Conventional straw may be used for bedding.

10. Nutrient recycling

Maintenance of soil fertility levels depends on the creation of a sustainable system which balances inputs and outputs without relying on external inputs. Good clover swards, crop rotation and targeted use of farmyard manure and slurry mean that coping without artificial fertiliser can be managed effectively. Farmyard manure needs to be put back onto grassland areas designated for grass silage production, which is rotated around the farm, and slurries needs to be applied at the most appropriate time using methods that ensure maximum recovery of the nutrients. Certain slow-releasing natural mineral sources of fertilisers are also permitted. Ground limestone is permitted as are certain commercial 'bagged' lime products provided they are approved by an organic certification body.

11. A helping hand

Whether you are thinking about converting, a recent organic convert or an experienced organic farmer there is no end to the learning involved in organic production methods. It is important that you get as much information as possible about best practices that suit your own farm situation. There is a wide variety of publications, advisory guidelines, research updates, videos, event/course details along with links to other relevant organic bodies and organisations available on **www.teagasc.ie/organics**

Optimising animal health on organic cattle farms

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Introduction

Organic livestock production is a food production system that is governed by EU Legislation with production protocols delivering a high status of animal welfare, care for the environment, restricted use of medicines and the production of a healthy product without residues.

The organic certification system as it is currently implemented under the EU Council Regulations is based on assuring standards which mainly describe resources, such as stocking densities, provision of quality forage and restricted use of conventional products. The organic system is designed to and aspires to guarantee various outcomes such as:

- More effective immunity,
- Improved animal welfare,
- Minimisation of residues in milk and meat and
- Reduced damage to flora and fauna

The certification system does not take any legal responsibility over these outcomes. However these outcomes are an integral part of organic farming objectives and a major reason for continued consumer interest in organic products.

The standards for organic livestock production emphasise preventative strategies based on the principles that an animal is allowed to exhibit natural behaviour, is not subject to stress and is fed high quality feed to meet its nutritional requirements so that the animal has optimal natural resistance to combat disease.

Animal welfare

The principles of organic animal welfare are largely based on Professor Roger Brambell's 5 principles of animal welfare which are under human control:

- ***Freedom from hunger or thirst*** by ready access to fresh water and a diet to maintain full health and vigour
- ***Freedom from discomfort*** by providing an appropriate environment including shelter and a comfortable resting area
- ***Freedom from pain, injury or disease*** by prevention or rapid diagnosis and treatment
- ***Freedom to express normal behaviour*** by providing sufficient space, proper facilities and company of the animal's own kind
- ***Freedom from fear and distress*** by ensuring conditions and treatment which avoid mental suffering

Maintenance of a very high standard of animal health and welfare is key in organic farming

Prevention of disease

Disease prevention on organic farms is based on:

- High levels of biosecurity on the holding.
- Selection of appropriate breeds and strains of animals.
- Use of animal husbandry practises appropriate to the requirements of each species, encouraging strong resistance to disease and the prevention of infections.
- Provision of high quality feed together with regular access to grazing areas encouraging the natural immunological defence of the animal.
- Appropriate stocking densities both during the housed period and at grass reducing stress on animals.

In organic systems, animal health is seen not simply as the absence of disease; it is seen as a positive characteristic which is to be achieved through the application of biological and animal husbandry principles rather than the routine use of conventional veterinary medicines. Where medicines are required, the use of complementary methods both for the prevention and treatment of disease is encouraged.

The development and management of organic livestock production systems requires special care in nurturing positive health and vitality, ensuring the proper control of the disease and the encouragement of positive animal welfare i.e. the satisfaction of the animal's needs, including behavioural needs and not merely the avoidance of cruelty.

In essence the aspirations of organic farmers should be:

1. To have healthy and productive livestock
2. To develop organic systems which deliver positive health and welfare.
3. To continually improve the health and welfare of livestock.
4. To progressively reduce dependence on medicines

Adjustments to organic housing standards may require the provision of extra space and dry bedding

Herd health plan

When a farmer undergoes conversion to organic status an Animal Health Plan is recommended to be drawn up by the vet, which specifies the current animal health issues on the farm and how the farmer will tackle these issues into the future while conforming to the requirements of organic certification standards.

The Herd Health Plan ultimately needs to address issues such as:

1. What diseases are currently issues on the farm.
2. How can these be controlled or prevented.
3. What modifications can be made at farm level to reduce the risk of disease.

Faeces testing for your present livestock can help to identify the level and type of internal parasites which you have to plan to reduce. Keeping the herd health plan up to date is an on-going process. Whenever an animal needs treating you must treat it, but do think about what could be done to avoid having to treat again in the future.

The taking of faecal dung sample helps to identify the type and level of internal parasites in the herd

Steps to developing an animal herd health plan:

1. It is recommended that the animal herd health plan is drawn up by the vet.
2. Identify the disease organism or health problem
3. Learn about the organism's life cycle and/or health problem.
4. Identify the current veterinary or other treatments used.
5. Think about management/husbandry practices that could be used to break the organism's lifecycle or improve the animal's health whilst reducing reliance on veterinary treatments.
6. Identify management husbandry practices or alternative therapies that could be used to minimise or reduce the problem.
7. Identify in advance the alternative veterinary medicines that can be used should the management practices not be successful
8. Identify the specified withdrawal periods for the treatments and calculate the longer withdrawal periods required for organic management.

Complying with organic certification requirements

In all cases, permission must be sought from your relevant Organic Certification Body (OCB) in advanced of carrying out animal mutilation procedures. ***In all cases, adequate anaesthesia and/or analgesia must be used.*** Procedures for which permission (derogation) must be sought include dehorning, disbudding, castration and tail docking/use of rubber rings for lambs.

Under organic livestock management, preventative husbandry and management practices must be introduced to avoid and minimise pest and disease problems and reliance on chemical treatments. However, the standards do permit the use of synthetic chemical medicines in order to avoid suffering and distress, and where homeopathic and herbal preparations would not be effective.

Detection of problems needs to be early, and timely veterinary advice is invaluable - when an animal is ill the organic farmer reacts in the same manner as their conventional neighbour and veterinary assistance is sought immediately. Failure to treat sick animals may result in the withdrawal of organic status for the entire farm (ie. treatment must be administered even if the result would mean an animal losing it's organic status).

In the case of the clean grazing system, if it breaks down and individual animals become infected (showing clinical symptoms) then it is permitted to use certain wormers to treat individual animals. Permission may be granted base on veterinary advice to use avermectin products if evidence of need is demonstrated - for

example resistance to other wormers. Consult with your vet to select the right wormer for the job.

If a significant number of animals require treatment, the use of wormers on a whole-herd basis may be allowed. You will be required to get veterinary advice and/or evidence to support the treatment, such as faecal egg counts.

Withdrawal periods

The withdrawal periods for allopathic medicines are longer for organic animals than for conventional animals. Use products with shorter withdrawal periods where possible, paying special attention as to when the animal will enter the organic market. Treated animals which are sold to other organic farms and which have existing withdrawal periods yet to elapse must complete the withdrawal period on the buyers farm.

The following withdrawal periods must be adhered to for the production of organic beef production.

- No withdrawal period indicated - withdrawal period of seven days.
- For legal withdrawal period of between 1 to 18 days - 3 times the legal withdrawal period eg. a legal withdrawal period of 6 days would then result in an organic withdrawal period of 18 days.
- For legal withdrawal periods of between 19 - 28 days - organic withdrawal period of 56 days.
- For legal withdrawal periods of 29+ days - twice the legal withdrawal period applies.

Products with the active ingredients listed below must not be used in the production of organic beef if supplying beef to Good Herdsmen Ltd: Updated 2016

Product Name	Active Ingredient
Tetracycline	Tetracycline (This may have to be used - if used inform the processor)
Benastermycin	Bebethamin-Penicillin
Fatroximin	Rifaximin
Buscopan	Buthylscopolamin
Cydectin	Moxidectin
Trodax	Nitroxtmil
Alamycin	Oxytetracyclin-Hydrochloride
Engemycin	Oxytetracyclin
Oxipra	Oxytetracyclin
Receptal	Buserelin
Source: Good Herdsmen Ltd., March 2016.	

Note: Organic beef producers must keep up to date with their relevant Organic Certified Body or organic beef processor regarding any changes to prohibited veterinary products.

Number of antibiotic treatments permitted

The use of antibiotics in clinical cases only is a restricted practice where no other remedy would be effective or after a major trauma as a result of surgery or accident. In other words they should be used only where necessary. The organic standards set out the number of antibiotic treatments permitted per animal:

- Animals for meat consumption: One course of antibiotics is allowed within a 12 month period.
- Animals for breeding: Two courses of antibiotics are allowed within a 12 month period.
- Dairy Mastitis: Two courses of antibiotics are allowed within a 12 month period.

A course of treatment means all necessary measures taken to restore the animal to health following a particular disease episode. If the number of treatments permitted are exceeded, the animal should then be sold conventionally or undergo a further fifteen month conversion period.

Use of vaccines
Vaccination is permitted only in cases where there is a known disease risk (confirmed in writing by the vet) on a farm or neighbouring land which cannot be controlled by any other means.

Single vaccines (monovalent) are preferred, unless a multiple problem exists. A vaccination programme should be developed as part of the animal health plan, following advice from your vet.

Use of alternative therapies
Organic management encourages the use of alternative therapies, such as homeopathy that improve the animal's ability to resist disease rather than treating the disease specifically. It is important to remember that there is a danger of misuse of alternative therapies as much as with conventional (allopathic) medicines.

Mineral supplementation
The inclusion of forage legumes in the diet of cattle improves the nutritive value of the diet and improves individual performance. Animals which are fed a high quality forage are less likely to succumb to disease pressures.

Features of organic farming such as improved soil biological activity, more balanced crop rotations, less production pressure on livestock enterprises, more diverse swards and a prohibition of artificial fertilizers are expected to reduce problems of micro-nutrient deficiency relative to conventional systems.

There is a need to be aware of nutritional deficiencies when solely home-grown feed is used, particularly in areas where inherent soil deficiencies are known to be prevalent. The need for supplementation is based on a veterinary recommendation following interpretation of a blood or herbage sample. Treatment may be in the form of organic seaweed based minerals or conventional licks, bolus or injection.

Animal housing
- Adjustments to meet organic standards may be necessary – depends on farm situation.
- Housing is not compulsory.
- Livestock housing must have a smooth but non-slippery floor and must be provided with a comfortable, clean and dry lying area. At least 50% of the total floor areas must be solid, that is, not of slatted or grid construction.
- Straw, rushes or untreated wood shavings are acceptable bedding materials and these need not be organic.
- All animal housing is subject to inspection and approval by the Organic Certification Body (OCB).

Minimum housing area per head and by weight

Animal	**Minimum Indoor Areas** *(net area available to each animal)*	
	Live-weight Minimum (kg)	**m^2/head**
Calves	Up to 100kg	1.5
Beef Cattle	Up to 200kg	2.5
	Up to 350kg	4.0
	Up to 500kg	5.0
	Over 500kg	Min. 1m^2/100kg
Dairy Cows	Up to 600kg	6.0 min.
Suckler Cows	Over 600kg	1m^2/100kg
Breeding Bulls		10m^2

Source: Organic Standards

Forage production in organic farming

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Introduction

The general principle of livestock feeding in organic systems is that the animals have to be fed a species specific diet in a way 'suited to their physiology'. Nutrient supply must be based on the animal's requirements to avoid 'metabolic disturbances' and to maintain fertility and overall health. The Organic Food and Farming Standards in Ireland (Council Regulation EC 834/2007 as amended) to which all Irish organic producers farm, permits a maximum daily allowance of 40% of DM (dry matter) intake in a ruminants diet post weaning to contain grain. Therefore the objective of feeding organic beef cattle should be the provision of predominantly forage based diets supplied by the farm itself. This will normally be based on grass/clover grazing and quality conserved forages such as red clover/grass leys. Most organic beef producers feed grain during the finishing stage of the animal. This will increase the weight gain of the animals; it also gives the meat the fat content required by the market. The level of feed supplement offered, and for what length of time, varies from farm to farm depending on the type and age of animal, and the required market weight. Forage quality contributes significantly to the efficiency of the system from both a cost and a performance perspective, and the lower the quality of the forage then the greater the requirement for supplementation with grain. Overall the aims of organic beef production systems are based on providing an overall balanced diet of energy, protein and vitamins, primarily from grazed and conserved forages, with the management option of incorporating grain as an additional source of energy.


Organically sourced seaweed minerals and cereals

At farm level two key components of achieving this are:

- Forage Management
- Forage Quality

Forage Management

Grazing perennial ryegrass and white clover swards

The management of grazing swards is divided into three distinct periods according to studies carried out by Teagasc, which are:

1. Autumn / Winter
2. Spring
3. Main Grazing Season

1. Autumn / Winter Management

The main aims are to maximise grass-clover intake and prepare the sward for Spring grazing.
For organic farmers in particular, it is important to keep grazed covers low over the Winter as the carrying of high covers over the Winter may have a detrimental effect on white clover the following Spring

- From August onwards rotation length should be increased from 30 (August) to 40 (Sept.) to 50 (October) days.
- The last rotation should start around 1st October, with the first fields closed identified for grazing first in early Spring.

- Swards should be grazed down to a 4.0 cm stubble height to enable light to reach the clover stolons. This encourages budding and future growth the following Spring
- It is essential to avoid poaching at all costs as this has a detrimental effects. On swards and especially clover persistency.

Bloat:
White clover may contribute over 40% of the DM (dry matter) in the sward from August onwards. While bloat is not normally a problem on organic farms (for cattle are accustomed to grazing clover pastures), be cautious about the risk of bloat especially later in the grazing season and use preventative measures to minimise bloat risk. Cattle most at risk are those which are not accustomed to clover in their diet. Some preventative measures are as follows:

- For animals not accustomed to clover, feed them to fill with hay/straw immediately before putting them onto a clover-rich pasture.
- Move 'at-risk' cattle to a high clover pasture when the herbage is dry rather than wet.
- Adding pluronic agents to drinking water may be allowed. Consult with your relevant Organic Certification Body.

2. Spring Management

The aim of this period is to get animals to commence grazing as early as feasible to minimise the cost of production and maximise animal performance from grass.

- The main aim during this period is to maximise intake and prepare the sward for Summer grazing/silage.
- Commence grazing as early as feasible as late turnout to a high grass cover can lead to poor grass utilisation and quality later in the season. Start grazing early (target mid-Feb., ground permitting). Use on/off grazing, strip-grazing, back-fencing, multiple entrances to paddocks, etc., as needed.
- Rotation 1 will be about 50-60 days duration. Fields intended for first-cut silage can make up 30-40% of the grazing area for the first rotation. The aim should be to finish this rotation by the middle of April.
- Graze to a 4.5cm stubble height. At most 10-15 % clover will be present at this stage of the year. It will be important to prevent it being swamped by grass
- Slurry is an imortant sourse of nitrogen (N) for spring growth:
  - aim in mid/late January to spread slurry on final paddocks closed pre-Winter.
  - after grazing in the first rotation, spread slurry on the paddocks being closed for first-cut silage.

3. Main Grazing Season Management

The aim during this period is to maximise animal performance from a complete forage diet. This is achieved by providing a consistent supply to the animals on a daily basis. With good grassland management it is possible to have a long grazing season

- Rotation length should be maintained at 28 to 30 days to allow swards to re-grow.
- Heavily stocked farm targets: pre-grazing sward height of 8 - 10 cm. Avoid grazing higher covers as this will affect animal performance.
- The quality of the pasture should be maintained by topping pastures to a 4cm stubble height. Topping should take place from mid-May rather than waiting until later in the season.
- Walk the grazing area weekly to identify surpluses/deficits and take remedial action e.g. remove surplus grass as bales.

Grass-white clover silage swards

As conserved forage contributes approximately 40% of the animal's annual diet and organic farmers can only source it from fellow in-conversion or organic farmers (if required), it is especially important for organic farmers to produce adequate quantities of conserved silage/hay of the required quality. The following are some of the management techniques required to achieve this:

- Avoid a carryover of dead vegetation at the base of the sward during the Winter as this will decrease the energy value of the silage sward. High grass covers over the Winter also detrimentally affect clover development.
- In Spring, graze the paddocks intended for first-cut silage to an even stubble height of 4cm if ground conditions allow. This will help increase the quality of the silage sward and further encourage clover growth during the season.
- Ensure the P, K and pH status of the soil is adequate by providing required input of P, K and lime, based on soil analyses taken within the last five years.
- Apply slurry as early in the season as possible.
- Avoid compacting soil during organic manure spreading and silage making.
- Measure the grass yield prior to cutting. One of the benefits of this is that poorly performing fields can be identified and necessary action can be taken to correct this.
- Make an inventory of silage stocks to calculate that you have enough feed for your animals over the Winter period.

Forage Quality

Grazing Swards

Due to the considerably lower cost of grazed grass as a feedstuff compared to silage or grain, one of the objectives of organic beef producers should be to optimally exploit this by providing a highly digestible leafy sward over an extended grazing season.
On organic farms, the incorporation of white clover in grass swards is widely recognised as the driver of grassland production in the system and with good grassland management it is possible to have a long grazing season of high quality feed. To ensure that the grazing swards are of good quality, the following practises should be considered:

- Use a rotational grazing system to help maintain grass-clover quality throughout the year.
- Walk the farm on a weekly basis, measuring grass growth and assess the supply of grass
- Spread slurry in Spring when both crop demand and the N availability of slurry is highest. Early application provides nitrogen for grass growth before clover starts to fixate atmospheric nitrogen.

Silage swards

There is a wide range in silage quality on Irish farms. The level of dry matter digestibility (DMD) achieved has a major effect on the cost of the silage and the performance of the animals being fed. The DMD is most frequently used as an index of the feed value of silages. Highly digestible silages must be fed when high rates of performance are required from housed animals. This would be the case for an organic beef farmer finishing animals for slaughter over the winter housing period. Highly digestible silages are produced from swards that have a high content of leaf, relatively little stem or seed heads and a low content of dead herbage, docks and other less digestible plants.

Ensuring that the silage is well preserved is also essential if the nutritive value of the silage is to be fully realised. Preservation is a process that takes place under air free conditions. Good preservation will result in the cattle eating more and therefore performing better. Preservation can be judged by the general appearance and smell of the silage, while laboratory analysis can determine it's pH and ammonia-N values.

The potential of white and red clover silages can be clearly seen from an experiment at Teagasc Grange where a comparison was made between silages made from swards of grass, lucerne (aka alfalfa), red clover and grass/white clover (Table 1). Both red clover and particularly lucerne were more difficult to preserve satisfactorily, however the mean liveweight gains were higher for silages containing clover or lucerne.

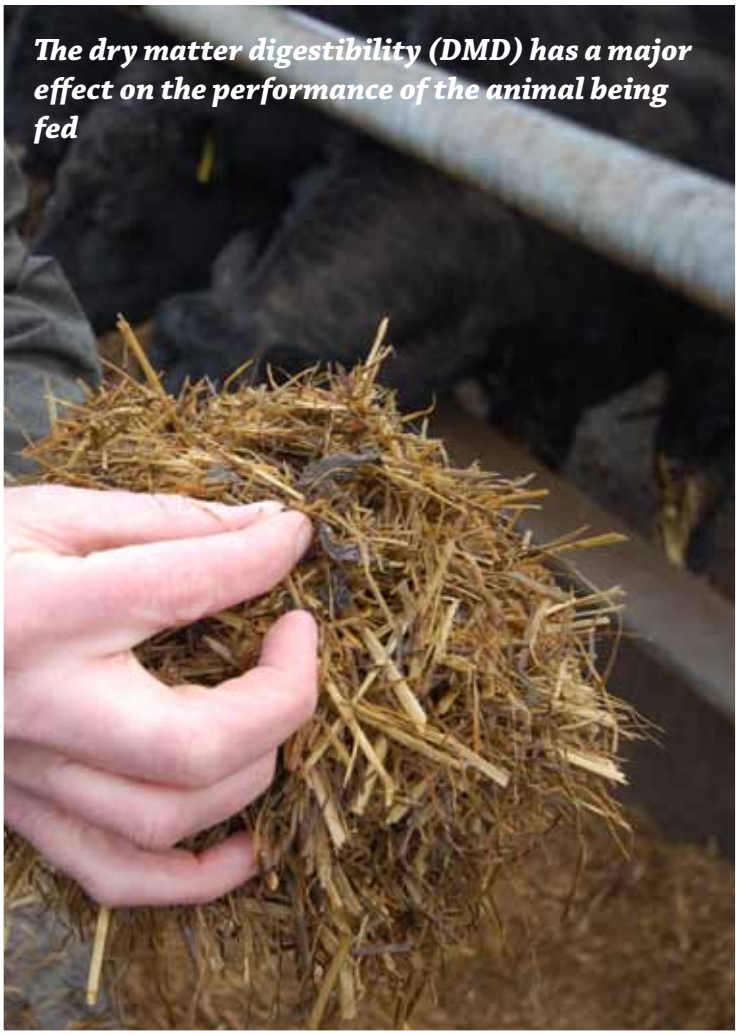
Table 1: Comparison of average daily live-weight gains between 4 different silage diets

Silage crop	Average daily liveweight gain (LWG) kg
Grass silage	0.59
Lucerne	0.72
Red clover	1.04
Grass/white clover	0.83

Source: Teagasc Grange Beef Research Centre

Key Points

- A low cost home-produced forage-based diet is the foundation stone of organic beef production.
- A requirement of organic beef systems is the production of quality grazing and silage swards.
- To provide a balanced diet in organic beef production systems, dynamic and timely use of modern grassland management techniques are necessary.
- With appropriate grassland management in place, good quality grazing and silage swards will be produced and maintained within the system.
- Grass-clover silage offers the potential to produce a very high quality forage for the Winter diet.



The dry matter digestibility (DMD) has a major effect on the performance of the animal being fed

Nutrient management on organic cattle farms

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Summary
The aim of organic farming is to maintain good soil fertility primarily by maintaining soil pH in the optimum range (grassland soils pH 6.3 to 6.5) to ensure the availability of major soil nutrients (N, P, K, Ca, Mg & S). This will be the first step to ensuring efficient recycling and utilisation of applied nutrients such as farmyard manure, slurry and or compost. The efficient storage and spreading of farmyard manure, slurry or compost is vital to the success of organic farming. Management of organic farms should ensure regular inputs of manures and a level of microbial and earthworm activity sufficient to breakdown organic matter and ensure the continuous and efficient recycling of nutrients. Shortfalls in nutrients as evidenced in soil sample analysis should be addressed by the application of external sources of certain permitted organic and mineral fertilisers.

Lime

Maintaining soils in the optimal soil pH range facilitates organic matter breakdown and nutrient recycling which is essential for successful organic farming. Many Irish soils are naturally acidic due to our high annual rainfall. Implementing a farm liming programme is the best way of keeping soils at a pH 6.3 to 6.5 based on recent soil analysis.

Soil samples should be taken once every 3 to 5 years to check soil pH levels and plan lime applications based on soil test results and crop requirements. Only apply lime as recommended on the soil test report.

The benefits of correcting a lime deficiency include the following:

- Grassland soils release up to 80kg N/ha once restored to soil pH 6.3.
- Maintaining the correct soil pH is critical for nutrient availability of both soil and applied nutrients.
- Increased survival and productivity of rye grasses & clover.
- Research shows where soil pH was lifted from pH 5.5 to 6.3, grass produced increased by at least an extra 1.0 tonne DM/ha annually.

Recent research from Johnstown Castle clearly shows the importance of lime in relation to the availability of soil P. Figure 1 shows the benefits of liming in unlocking soil P (Lime only bar). This trial shows that by correcting soil pH from 5.2 to 6.4 through the application of 5t/ha of ground limestone, this increased soil P by ~ 5mg/L. The application of lime for pH correction is the first step to consider when building / improving soil P levels. To maximise the response from applied P during the growing season, maintain soil pH in the optimum range for example grassland pH 6.3 to 6.5 and tillage crops pH 6.5 to 6.8.

Farmyard manure is a very important source of organic matter and nutrients on organic farms

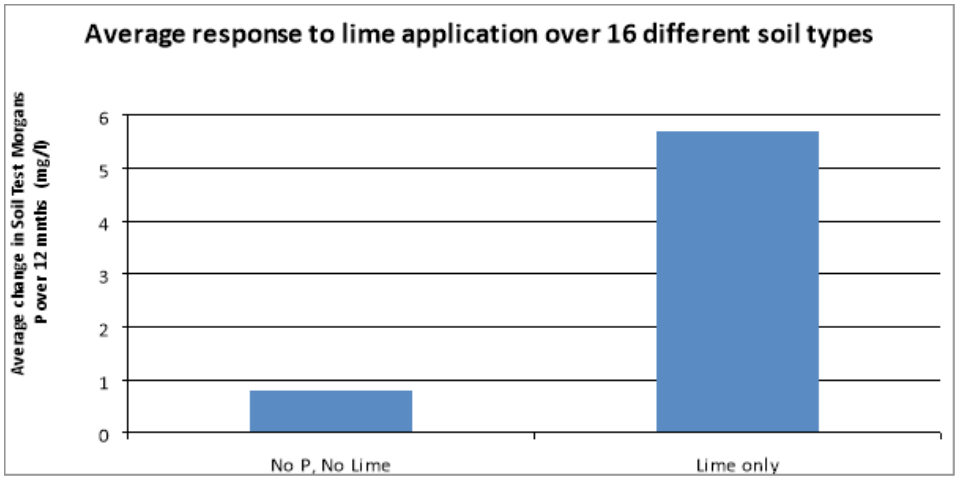

Figure 1: Average change in soil test P (Morgan's) across 16 soils (av. pH 5.5) treated with lime (5 t/ha of lime), over 12 months in controlled conditions. (Sheil, et al, 2015).

Importance of soil pH on grass production

Correcting soil pH close to the optimum pH, will increase the production of grass annually. Figure 2 shows the grass yield response to lime in grassland over a full growing season. The application of 5t/ha ground limestone (Lime Only Bar) produced ~1.0t/ha of extra grass dry matter compared to the un-limed treatment. The untreated plot had a soil pH 5.2 and the limed plot had a soil pH 6.4 after receiving the 5t/ha of ground limestone.

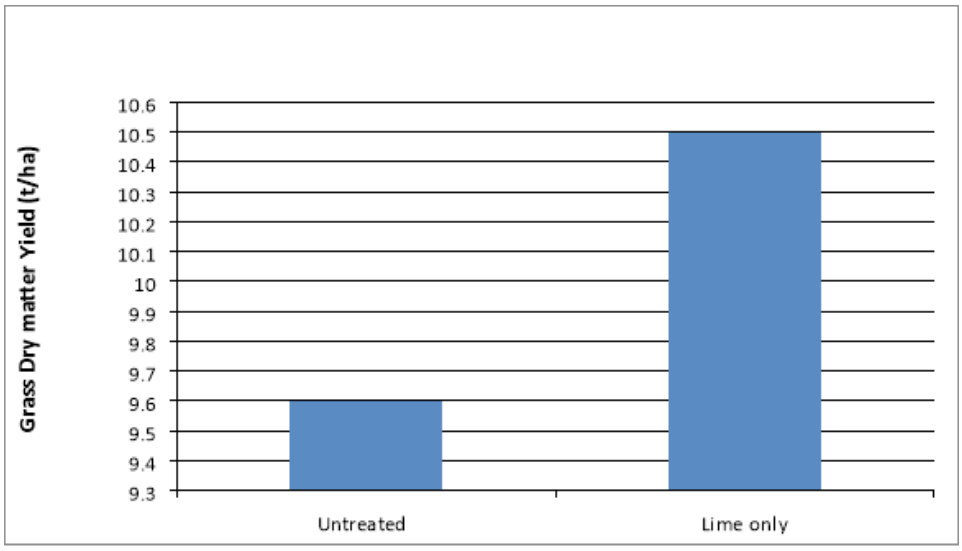

Figure 2: Relative grass DM yield response in grassland treated with Lime (5 t/ha of lime) over a full growing season (average yield reponse across two grassland sites.)

Return on Investment (ROI) from ground limestone usage

When the pH of grassland soils are maintained close to the optimum range, increased grass production by at least 1.0t DM/ha/year can be achieved. In addition to P and K release from the soil, N supply worth up to €80 euro may also be achieved, boosting spring and autumn growth in particular. If this extra grass production is utilised by the grazing livestock it has the potential to reduce farm feed bills by at least €181/ha year. One tonne of additional grass production each year over a typical 5 year liming period (5 t/ha lime applied) represents a 7:1 (grass €181/t : lime €25/t) return on investment in lime, not including the potential for reducing fertiliser costs into the future.

In other words, for every €100 investment in lime there will be a return of approximately €700 in extra grass production annually, thus representing a return of €7 for every €1 invested in lime.

Lime advice - ground limestone

- Leave at least 3 months between liming & silage harvest.
- Wait 7 days after applying slurry before applying lime.
- Leave 3 months between applying lime first and slurry application after.
- Lime can be applied at any time of the year, however, mid-summer and autumn are ideal as soils are dryer and firm. In addition, there are increased spreading opportunities post silage and grazing and there is less interference with slurry or FYM applications.
- A 3-5 year liming plan for the farm should be developed to address the fields that urgently require pH correction and those that will need maintenance lime applications in future years. As part of this liming plan, all lime applied to achieve the target soil pH should be based on the soil test report (lime requirement (t/ha)).
- On heavier and organic soils, there is often hesitance to applying lime for fear of "softening the sod" or increased poaching (due to rapid break down of soil organic matter). On these soils, it is best to apply lower application rates of lime (<5 t/ha) on a more regular basis to control soil acidity to avoid "softening the soil".
- Ground limestone (calcium limestone) is the most suitable liming material where soil pH is low and a large quantity of lime is required to increase the soil pH to the target range.
- Apply Magnesium (Mg) lime (dolomitic limestone) where soil Mg levels are low (Index 1 or 2) to replenish soil Mg reserves.
- Don't exceed 7.5t/ha in a single application. Where the lime requirement is large (>7.5 t/ha [3 t/ac]) split the lime application (i.e. apply 50% now and the balance in year 3).
- On high molybdenum (Mo) soils, maintain soil pH <6.2 to prevent negative effects on copper (Cu) uptake in ruminant animals.
- On high Mo soils, only lime a proportion of the farm each year (e.g. 20% of the farm annually) to reduce the risk of an acute copper deficiency in grazing animals arising from high Mo levels (related to high soil pH) in grass across the entire farm.
- Magnesium lime is slower to increase soil pH and therefore maybe more suitable on high Mo soils to reduce the incidence of copper deficiency.

Granulated limes

- Granulated lime is composed of fine lime (i.e. <0.10 mm sieve) and therefore is very reactive (i.e. ~ 100% will react within the year of application).
- Treat granulated liming products like a fertiliser in that they should be applied annually.
- Where soil pH is close to the target level, granulated lime could be considered as a maintenance type liming product.
- The rate of application from maintenance will depend on the level of lime loss and acid production (i.e. from manure applications) annually, e.g. lime utilization and loss will typically range from 450 to 900 kg/ha per year.
- The industry recommends to apply granulated lime at a rate of ~1:3 (compared to ground limestone). This would equate to a granulated lime application of 150 to 300kg/ha to replace lime utilization, loss and acid production referred to above.
- Consider costs over the 3-5 year period when considering granulated limes.

For further information on Lime grassland advice refer to:

https://www.teagasc.ie/media/website/publications/2016/Advice-on-Liming-Leaflet.pdf

Ground limestone

The main source of Nitrogen (N) on productive organic farms is from a grass-clover sward

Phosphorus and potassium efficiency from animal manures

The efficiency of phosphorus (P) and potassium (K) uptake from animal manure applications is largely not affected by application timing or method. However, application of P and K in quantities that are in excess of the levels that crops require represents poor utilisation of a valuable asset on the farm.

This is particularly the case where slurry or farmyard manure (FYM) is applied to fields that have no P or K requirement (i.e. land with soil P or K levels at Index 4). Historically, slurry has often been applied in fields that were more convenient to the farmyard and slurry storage tanks to minimise slurry spreading costs.

However, as fertiliser prices increase, so too does the economic value of the nutrients in slurry and FYM. The value of the N, P and K content in 1,000 gallons of cattle slurry (7% DM) or 1 tonne of FYM is approximately €20 and €9 respectively at present. If this slurry or FYM is applied to a field with no P or K requirement, then this potential saving will not be realised. To make best use of P and K in organic manures check soil test results and target manures to fields with the largest demand during the growing season. 'For example' cattle slurry is an excellent source of K and is ideal for replenishing fields with low soil K levels.

Table 1: Target P and K levels in organic grassland soils

	Phosphorus (P)	Potassium (K)
Target Index	Index 3	Index 3
Morgan's Level (mg/l)	Grassland 5.1 to 8.0 mg/L	Grassland 101-150 mg/L
	Tillage 6.1 – 10 mg/L	

Note: - Additional P and K applications will be required at soil Index 1 and 2 to build soil fertility levels to the target Index 3. Further information available at https://www.teagasc.ie/crops/soil--soil-fertility

Nitrogen efficiency from animal manures

As discussed in other parts of this booklet, the over-riding source of nitrogen (N) on productive organic farms is from leguminous (nitrogen fixing) plants such as white and red clover. However, animal manures are another significant source of N. The efficiency of N utilisation will depend to a large extent on the weather conditions at the time of application. Farmyard manure contains low levels of N in a form that is immediately available to plants. The N contained in FYM normally requires a period of time in order to break down and become available. Autumn application is often favoured for this reason so that a proportion of the N becomes available to plants in the following spring.

25 tonnes of organic chicken layer manure

Granulated lime

Unlike FYM, slurry contains a significant amount of N that is immediately available for plant uptake. However, this N can also be lost to the air. Losses of N to the air from slurry application are higher when weather conditions are warm and dry. Cool, overcast or misty conditions at the time of application will result in reduced N losses and improved N efficiency. Consequently, spring application is generally recommended rather than summer application. For example, 1,000 gallons of cattle slurry (7% DM) contains approximately 6.5 units of N when applied in spring. However, the same slurry applied in summer is only worth approximately 3 units of N.

Alternative application methods such as bandspreading, trailing shoe or shallow injection will increase the N efficiency from slurry applications. For example, the trailing shoe will increase N recovery by 3 units/1,000 gals. However, the main advantage of adopting such methods is by way of reducing the grass contamination from slurry application. This may facilitate more slurry being applied in between grazing rotations and, on silage ground during Spring when conditions permit rather than onto bare swards following silage harvesting in summer.

Importation of fertilisers

Organic fertilisers are a nutrient source and should be regarded as a supplement to, and not a replacement for nutrient recycling within the farm. They should be used only to replace the nutrients that are removed by the farming system or when soil fertility has been inadvertently compromised by harvesting silage from the same area each year.

Some common examples of imported organic manures/materials permitted according to organic standards

Farmyard manure (FYM) is a good source of nitrogen (N) and potassium (K) on organic farms

include to the following:

- Cattle slurry from both organic and non-organic farms including non-organic derogation farmers (>170 kg N/ha) with a normal grass-based outdoor system.
- Free - range and organic poultry manure.
- Dairy processing sludge from certain dairy processors (consult with an Organic Certification Body for a list of certified processors).
- Horse manure from organic or non-organic farms.
- Straw (conventional is permitted), sawdust (un-treated) and wood chips for bedding of animals or supplement to existing manures.

A number of caveats exist regarding the importation of such manures onto organic farms:

- Manures imported onto an organic holding must come from a system of extensive husbandry and manures from factory farming origin are not permitted. vis a vis imported organic manures from zero-grazing of cattle, sheep, pigs and horses, all poultry systems with the exception of organic and free range and commercial piggeries where pigs are permanently housed.
- A composting period of 3 months is generally required for organic manures that originate from non-organic sources.
- Mushroom compost made from materials which come from ineligible material including poultry manure not from a free-range or organic enterprise are not permitted.

Also, certain types of mineral fertilisers can be used (Table 2). Examples of such products include, ground rock phosphate, sulphate of potash and basic slag. The performance of some of these fertilizers is different to that of conventional fertilizers. For instance, ground rock phosphate works best in more acidic soils (pH <6.5) and may become inert above pH 7.0. Also, both ground rock phosphate and basic slag release P slower compared to conventional fertilizers eg. superphosphate. In all cases the Organic Standards should be consulted to ensure that the product is permitted for use.

Table 2: Sources of mineral fertilizers on organic farms

Phosphorus (P)	Ground Rock Phosphate (typically 11% P) works best in soils at <pH 6.5.
Potassium (K)	A. Potassium sulphate (also known as SOP or sulphate of potash) i. 41% K ii. 18% S B. Potassium sulphate with magnesium and sulphur: (e.g., Patentkali®) i. 26% K ii. 6% Mg iii. 17% S C. Potassium sulphate with sodium and sulphur (e.g., Magnesia-Kainit®) i. 9% K ii. 3% Mg iii. 20% Na iv. 4% S
Other fertilisers	A. Basic Steelworks slag (variable content, check with supplier). Contains some P, K, and other trace elements. B. Seaweed fertilisers - potassium (K) and other trace elements.

Note: In all cases the Organic Standards should be consulted to ensure that the product is permitted for use.

Maintaining white clover content and productivity in organic grazing swards

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Introduction

Grazed pasture makes up between 60 and 75% of the diet of cattle on Irish farms. This reliance on grazed pasture results in lower production costs compared with other countries in Europe. On organic cattle farms, the very high cost of concentrates create a strong incentive to maximise the proportion of grazed pasture in the diet of cattle. White clover is a key component of organic pastures because swards that contain white clover can have twice the productivity of swards that don't (Figure 1).

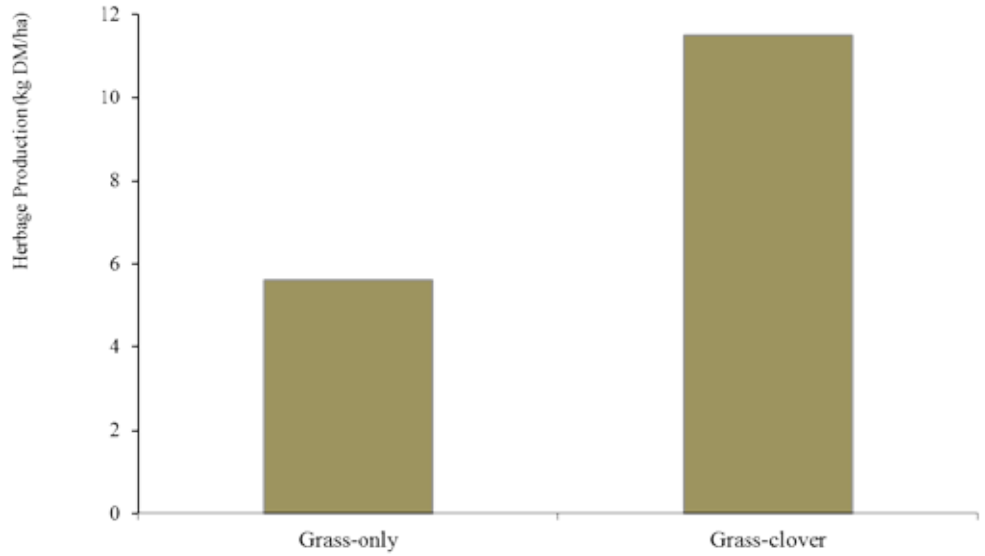

Figure 1: Herbage dry matter (DM) production of grass-only and grass-clover swards receiving no inputs of synthetic fertilizer N.

The reason for this is that clover forms a symbiotic relationship with N-fixing Rhizobium bacteria that can supply up to 200 kg N per ha per year under Irish conditions (figure 2).

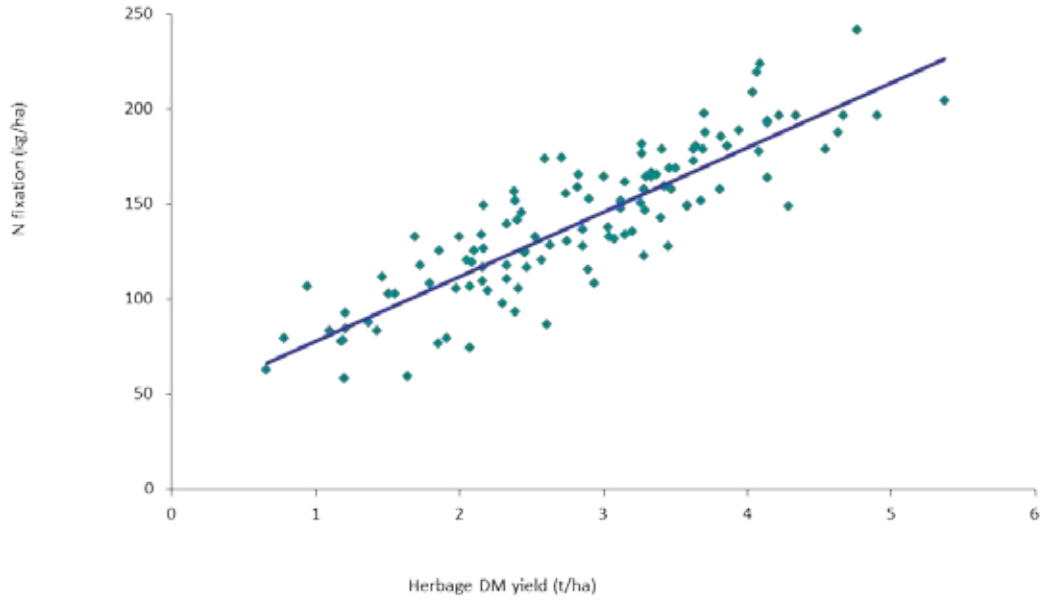

Figure 2: The relationship between white clover herbage yield and N fixation at Solohead Research Farm, Co. Tipperary.

Pasture supply during the year

Growth rates of white clover are quite low until late March and this is associated with a low clover content of swards (Figure 3). In general clover likes warm temperatures and does not begin to grow and fix N until soil temperatures reach around 9°C in April. However, the grass component of the sward will start growing from early March onwards. On organic farms, the growing season is curtailed in spring unless slurry or farmyard manure (FYM) is used to increase spring growth. In many instances the availability of slurry FYM is unlikely to be sufficient to entirely meet this requirement. Slower pasture production in spring raises the question of calving date on organic dairy and suckler farms. The clover makes a small direct contribution to pasture production in spring accounting for 5% or 15% of sward DM during February and March. Clover makes an increasing contribution to pasture production during April and May. There is usually a peak in grass production during late May followed by a sharp reduction due to the death of reproductive grass tillers during this time of year. During mid-summer, depression of grass growth clover becomes prominent in the sward because (i) high soil temperatures during this time of the year favours clover growth and (ii) the dip in grass growth rates means that it is less competitive with the clover.

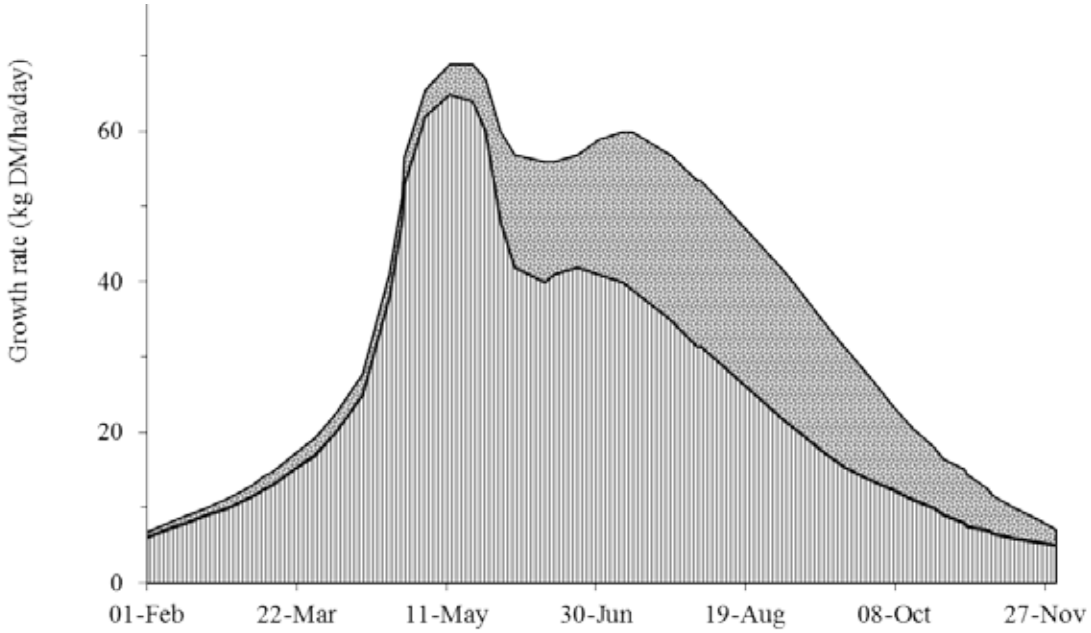

Figure 3: Changes in the grass and white clover content of swards during the year

From mid-summer onwards, approximately 50% of the sward is composed of clover and it is during this time of the year that most N fixation takes place. Some of this fixed N becomes directly available for pasture production and the remainder is tied up in the clover stolons at the base of the sward. During the summer and early autumn there can be a four-fold increase in the amount of clover stolon per ha. During the winter much of the clover stolons die back releasing N for pasture production when soil temperatures rise during the following spring and early summer. Hence, some N fixed in one year is carried over the winter and released for growth during the early part of the following year.

While the rate of pasture accumulation of grass-clover swards is relatively low in spring, high soil temperatures and a high clover content of the sward means that rates of pasture production from grass-clover swards can be very high during the summer and autumn, matching the production of perennial ryegrass swards receiving high inputs of fertilizer N. These grass-clover swards also have high nutritive value because white clover has one of the highest nutritive value of any grassland species. It also has a high crude protein content and high digestibility. Furthermore, research has shown that a grass-clover sward being grazed on a 42-day rotation had similar nutritive value to a grass-only sward on a 28-day rotation during the autumn. The clover content of the sward is at it's highest during the autumn and this contributes to maintaining sward nutritive value under long rotations. Progressively increasing rotation lengths in a planned way during the late summer and autumn facilitates extending the grazing season into the winter. Hence, while growth of organic grass-clover swards during the spring is relatively low, there is substantial potential to extend the grazing season into the winter by extending out rotation lengths from the late summer onwards. This combined with intermediate

stocking densities (1.6-2.0 LU per ha) on organic farms means that long grazing seasons can be achieved on grass-clover swards despite relatively low growth rates on spring.

Maintaining the clover content and productivity of swards

Maintaining the clover content of swards is a key component of maintaining productivity from year to year. Experience at Teagasc Solohead has shown that there are two key components in achieving this objective:

1. Tight grazing during the year and particularly during the autumn and winter;
2. Regular renovation of the clover plants in the sward

Tight grazing during the year

Clover does not compete as aggressively and can be shaded out by the grass component of the sward. Clover is most vulnerable to shading during the winter and early spring because, as pointed out above, it needs higher soil temperatures for growth than grass. At Solohead, cows graze down to a post-grazing height (PGH) of 4 cm from turnout in spring. Tight grazing during the late autumn and winter allows light down to the clover stolons at the base of the sward. The amount of light penetrating to the base of the sward directly influences the survival of stolons over the winter and the more stolon that survives the winter, the higher will be the clover content of the sward and a doubling of N fixation during the following growing season.

Regular renovation of the clover plants in the sward

White clover has a reputation for inconsistent production from year to year. Part of the reason for this is differences in weather conditions from year to year. Fixation of N is a biological process dependent on conditions such as soil temperature and moisture availability. Cold soil conditions and too little or an excess of water can impede N fixation and these are factors that vary from year to year. Nevertheless, the main reason for inconsistent production is the interaction between grass and clover. In newly established re-seeded swards receiving no fertilizer N, the clover usually has an advantage because it can fix its own independent supply of N. However, over time the N content of the soil builds up as clover stolons increase and die back from year to year. Greater availability of N in the soil favours the grass, which increasingly shades out the clover. The clover goes into decline and the rate of N fixation drops off. This is often seen happening after a period of four or five years. In the next year the productivity of the sward can be relatively high although the clover content of the sward is quite low because grass growth is fuelled by the residual N in the soil. However, in the following year pasture production can be very low because the residual N has been used up and there is little clover remaining in the sward.

Freed from competition from the grass due to declining grass growth, the clover content of the sward will again increase during the following year or two and remain productive for another couple of years before competition from the grass again drives the clover into decline and the cycle is repeated. Often it is adverse weather conditions in a particular year that can trigger the decline in the clover content of swards and this has consequences for maintaining pasture growth rates across the entire farm. Hoof damage by grazing cattle is another factor that can lead to the sudden loss of clover from a sward. Hooves penetrating down thought the soil surface can bury and break up stolons and this is detrimental to clover survival. This inconsistency of pasture production from year to year can make it difficult to operate an efficient production system with consistent output from year to year.

At Solohead methods of maintaining consistent supply of clover from year to year have been investigated. Tight grazing is important as pointed out above. Over-sowing 20% of the farm each year is also an important component. On organic farms, clover seed must be untreated (naked) and can be over-sown using a slug pellet applicator, or mixed with lime, an approved granulated liming agent or other permitted mineral fertiliser. 20% of the farm should be over-sown each year on a five-year rotation to ensure that there are swards of different ages distributed across the farm. Each sward is in a different stage of development which acts as a hedge against swards with declining clover contents. Swards with low clover contents due to competition from grass or due to hoof damage should be identified and then over-sown in the following year. Hence, these swards can be brought quickly back into production. When managing clover swards it is

necessary to accept that not all parts of the farm will be fully productive all the time; some will have declining clover contents whereas others which have been recently over-sown will take around a year to become fully productive again. On the other hand, using a planned approach to maintaining the clover content of swards avoids the boom and bust cycles usually associated with clover swards.

Although, it is recommended that 20% of the farm is over-sown each year it may not always the same paddocks that are over-sown every five years. This is because the clover content of some swards can go into decline after three years whereas it can be as long as seven years in other paddocks, with an average of five years across all paddocks. Therefore, the clover content of swards should be examined and recorded each year and paddocks with declining clover contents should be identified for over-sowing in the following year.

Grassland management calendar for a white clover-based grassland system (based on experience at Teagasc Solohead Research Centre, Co. Tipperary)	
Late January	2,500 gallons slurry per acre to 60% of farm – applied to swards with lightest covers that were grazed last in the previous autumn.
First week February	Calved cows out to grass (post grazing height = 3 to 4 cm) graze approximately 40% of farm that did not get slurry until mid-March. Graze the remaining 60% until early April.
Last week March	3,000 gallons slurry per acre applied to the silage ground that has been grazed at this stage. Slurry tanks are virtually empty.
April	End of first rotation in early April. 50% of farm closed for silage from mid-April. Stocking density on the grazing area is approximately 3.6 livestock units (LU) per ha from mid-April to mid-June. Clover content of swards is 10 to 15%. Clover starts supplying nitrogen in the soil.
May	Target post grazing height is 4 cm. Any surplus pasture harvested as bales before 10 May. First cut silage harvested last week of May.
Late May	20% of the farm area over-sown with white clover seed – 5 kg per ha broadcast onto silage stubble. Mixture of remaining slurry and dirty water applied to silage stubble. Slurry and dirty water tanks are empty.
June	Area harvested for bales in early May is back in the grazing rotation. Stocking density on the grazing area is approximately 3.3 LU per ha.
July	First cut silage area is back in the grazing rotation. Stocking density is approximately 2.0 LU per ha. Surplus pasture is harvested as bales from approximately 10% of farm before 15 July. No bales harvested after this date. Commence building covers for the autumn.
August	Stocking density is approximately 1.8 LU per ha. Length of the grazing rotation increases to 30 days. Clover content of swards is approximately 40% - very high quality herbage available for grazing. Area harvested for bales in mid-July is back in the grazing rotation by end August. Target post grazing height is 4 cm.
September	Length of the grazing rotation increases to 40 days. Highest pasture covers on the farm in late September. Long intervals between grazing allow dirty water to be applied immediately after grazing with little fear of contamination and rejection by cattle in the following grazing rotation.
October	Rotation length is approximately 50 days. Commence the final grazing rotation in mid-October. All paddocks grazed to less than 4 cm in the last rotation. Clover content of swards starts to decline (winter dormancy).
November	Cattle are housed in late November or early December.

Summary and conclusions

Relatively high levels of output are possible from organic clover-based grassland. Although clover-based swards receiving no fertilizer have relatively low growth in spring, a long grazing season can be achieved by extending the grazing season during the autumn and winter. High growth rates during the summer and autumn and stocking rates of less than 2 L.U. on organic farms facilitate this. Maintaining the clover content of swards is important to maintain productivity. Tight grazing to 4 cm throughout the year and particularly during the late autumn and winter is important. Identifying swards with declining clover contents due to competition from the grass component of the sward or due to hoof damage is also important. These swards need to be over-sown the following year with the target of over-sowing or re-seeding no less than 20% of the farm each year.

Red clover – agronomy and management

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Red clover can fix 150 - 200 kgN/ha

Clover is the cornerstone of organic farming and the engine that drives productivity. White clover (Trifolium repens L.) and red clover (Trifolium pratense L.) are the main clover species used in Ireland. However, there are several significant differences between the two species particularly in morphology and physiology. In contrast to white clover, red clover has an upright growth habit and a strong deep root from which finer roots arise. The crown, located at the base of the stem, acts as a store of nutrients. Stems of red clover grow upwards from the crown. The optimum management and use of red clover is significantly different from that of white clover. The main role of red clover is for silage production.

Uses of red clover

- The main role of red clover is for silage production, although it is often grazed by cattle or sheep after the final silage cut in the autumn.
- Red clover will not persist if continuously grazed or cut more frequently than every 30 days due to a combination of excessive foliage removal and plant crown damage by hoof trampling.

Benefits of red clover

- Red clover is high yielding with yields of 12 to 16 t DM/ha achievable when grown with ryegrass.
- It converts atmospheric Nitrogen into a plant usable form. An annual Nitrogen fixation of 150-200 kg/ha is achievable from swards with a high red clover content.
- Red clover is suitable as a break crop to improve soil structure and fertility and as a supplier of organic matter. It can also be used as a green manure crop. It is particularly valuable for building soil fertility once organic conversion has begun.
- Red clover is relatively drought tolerant due to its deep tap root. It offers superior production to white clover in dry summers.
- It has a high protein content of 16 to 20%. The feeding value of red clover silage is higher than grass silage resulting in greater animal intakes and higher levels of animal performance in terms of milk and protein yields, and liveweight gain. Results from an experiment conducted at Teagasc Grange found the mean liveweight gain in beef cattle offered different types of silage were grass silage 0.59 kg/day, grass/white clover silage 0.83 kg/day and red clover silage 1.04 kg/day.

Challenges with red clover

- Red clover is a short term crop with a lifespan of typically 2 to 4 years at farm level however recent research from Teagasc Grange has shown that the crop can persist for significantly longer (6 years +).This was considered to be mainly due to the very good initial establishment, the provision of optimum levels of soil fertility, phosphorus (P) and potassium (K) and low opportunity challenge from pests and diseases.

- To maximise its persistence: (i) do not cut or graze more frequently than every 30 days, (ii) cut silage crops at 7-8 cm height above ground level, (iii) ensure optimum grazing height of aftermaths is 6 cm above ground level, (iv) ensure over wintering height is 4-6 cm above ground level, (v) avoid heavy machinery in wet weather, poaching and severe winter grazing that will damage the plant crowns directly by physical damage and indirectly through soil compaction.
- Red clover can contain up to 1% of oestrogenic compounds. Oestrogen levels can lower ewe fertility. Therefore, do not allow breeding ewes to graze red clover swards or eat red clover silage for a period of 6 weeks before and after mating to avoid any adverse effect of red clover oestrogens on lambing percentage. Store lambs can be offered red clover swards and silage at any time. Reports of red clover affecting cattle fertility are rare.
- Bloat: In terms of grazing, the risk of bloat is reportedly higher with red clover than white clover. The risk is highest in cold, wet weather and when the animals are particularly hungry. The risk can be reduced by feeding roughage, such as straw or hay, before turning out and if necessary during grazing. Red clover should be introduced slowly and once introduced it should be a consistent component of the diet. Avoid daily fluctuations in the quality and quantity of clover offered. Never allow hungry stock to gorge themselves on clover-rich pastures. Moving stock onto dry rather than wet pasture also reduces the risk. Affected animals may be treated with anti-foaming agents. In severe cases remove animals from clover swards and seek veterinary advice immediately. The risk of bloat from red clover silage is negligible.
- Red clover is susceptible to a number of pests and diseases although incidences in Ireland are rare, probably due to the relatively low amount of the crop grown. Stem eelworm is the major pest of red clover. At first, patches of red clover appear with poor growth and stunted plants. These patches die out and then progressively enlarge and merge. Clover rot (Sclerotinia) is the most serious disease affecting red clover. This fungal disease is typically seen in the winter. The clover leaves become peppered with brown spots and there is a generalised rot of the crown, leaves and stems from which the plant rarely recovers. Pests and diseases can be spread between fields by infected plant material or soil on machinery. A 5 year break between red clover crops is recommended to combat pests and diseases. This should be extended to 7 years if clover rot or stem eelworm is known to be present. Also select more resistant varieties and avoid machinery movements between old and new crops.
- Choose red clover varieties on the Northern Ireland or England/ Wales Recommended Lists www.afbini.gov.uk
- Varieties are classified by ploidy (diploid or tetraploid) and flowering date (early or late).
- Tetraploid varieties are often larger plants with larger leaves and may smother commonly used companion ryegrasses. However, tetraploid varieties tended to be more persistent and disease resistant than diploid varieties; although this may not be true of modern varieties.

Red clover has a high protein content of 16- 20%

- Early varieties flower towards the end of May and late varieties 10-14 days later. Early flowering varieties start growth earlier in the spring, giving approximately 40% of annual yield for the first cut with progressively lighter yields in subsequent cuts. Late flowering varieties tend to be more grazing tolerant and persistent than early flowering varieties since they produce more buds from the plant crown.
- Red clover can be sown in a monoculture at 12-15 kg/ha.
- Red clover sown in a mixture with a companion grass offers a number of advantages including: (i) higher total forage yield, (ii) easier to obtain satisfactory silage fermentation as higher dry matter and water soluble carbohydrate concentrations are present in the total forage, (iii) reduced impact of poaching and (iv) utilisation of fixed Nitrogen by the companion grass. The species of companion grass should be selected based on the expected duration of the sward within the crop rotation. For 2 years duration, use Italian ryegrass or hybrid ryegrass. For 3 or more years duration, use perennial ryegrass or hybrid ryegrass. Tetraploid perennial ryegrass varieties are highly suitable as they generally have a more open growth habit and are less competitive than diploid perennial ryegrass varieties. The grass heading date should be matched with the flowering date of the red clover. If the grass heads before crop harvest, silage quality will be compromised. If the grass is too immature before crop harvest, total forage yield will be compromised. White clover can also be added to the seed mix and may become dominant when the red clover becomes less persistent after 3 to 4 years. Large leaf size white clover varieties should be used in silage swards. It is recommended to use grass and white clover varieties included on the Grass and Clover Recommended List for Ireland. The Recommended List may be found at the following link /www.agriculture.gov.ie/publications
- A typical seed rate for a red clover dominant sward is 15 kg/ha of red clover and 15 kg/ha of grass. A typical seed rate for a grass dominant sward is 7.5 kg/ha of red clover and 22 kg/ha of grass. An additional 2.5 kg/ha of white clover may be added to the seed mix, if required.
- Red clover swards may be established by direct reseeding or by under-sowing in an arable silage crop.
- Red clover performs best on well drained, fertile soils.
- Conduct a soil test and target soil pH of 6.0-6.5 and Index 3 for P and K for successful establishment.
- Sow from April to July.
- Ensure a fine, firm and level seedbed, roll both before and after sowing.
- Optimum sowing depth is 0.5 to 1.0 cm, and should never exceed 1.5 cm.

Red clover management

- In the establishment year, red clover should be allowed to flower before harvesting the first silage cut. This is to help root development and the growth of the bacteria that fix Nitrogen.
- In subsequent years, harvest at intervals of 6 to 8 weeks re-growth at any time between bud development and early flowering.
- 3 - 4 cuts can be taken each year. About 80-90% of the annual yield will be obtained from silage cuts completed by late July-early August. Cut or graze off the herbage in October, if this can be achieved without poaching, soil compaction and physical damage to the plant crowns.
- The final cut should be taken no later than mid-October.
- Cut silage crops at 7-8 cm height above ground level.
- Optimum grazing height of aftermaths is 6 cm above ground level.
- Optimum over wintering height is 4-6 cm above ground level.
- P and K removed by the conserved crops will need to be replaced using slurry, farmyard manure or other fertiliser sources, weather and ground conditions permitting.
- Annual P & K replacement requirements will be 100-150 kg/ha phosphate (P_2O_5) and 250-300 kg/ha Potash (K_2O) for a 12t D.M./ha yield/year.
- Farmyard manure (FYM) contains about 1.2 kg phosphate and 6.0 kg potash per tonne.

- Cattle slurry contains about 0.5 kg phosphate and 3.5 kg potash per 1,000 L.
- Slurry and FYM can be applied throughout the year including between cuts. Avoid applying slurry or cutting silage in wet weather as damage to the plant crowns directly by wheel damage and indirectly through soil compaction will reduce red clover yield and persistency.
- In a mixed grass-red clover sward, red clover will contribute 150-200 kg of N/ha

Red clover conservation

- Red clover is characterised by low dry matter and low water soluble carbohydrate concentrations and a high buffering capacity. As a result, it is more difficult to obtain a satisfactory fermentation with red clover than with all-grass silage.
- It is advisable to wilt for 24 to 48 hours in dry conditions to achieve 25-35% dry matter concentration. This will also concentrate sugars to encourage a desirable fermentation and reduce silage effluent production. Leaf is prone to shatter and it is advised not to use a conditioner mower. Avoid overwilting and excessive handling that can result in substantial leaf shatter and loss. It can also be difficult to consolidate very dry material in the silo.
- Red clover wilted to 25% dry matter will often ensile effectively without an additive. However, where herbage is wet or where there is a very high proportion of red clover, an effective additive can be used to ensure a stable fermentation.

Red clover-grass leys are normally harvested for silage 3 to 4 times a year on organic cattle farms

Re-seeding options on organic grassland farms

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Introduction

Permanent grass clover leys are a vital component of productive organic grassland farms. In all, there are 3 main ways to re-seed- full reseeding of permanent pastures, under-sowing of a cereal crop and thirdly, over-sowing onto an existing sward. In this chapter the first 2 methods will be discussed. Over-sowing of white clover on existing pasture will be discussed in the next chapter.

The objectives of reseeding organic permanent pastures with grass clover swards are to:

1) Increase the overall productivity of the farm
    a) Increase the carrying capacity (stocking rate)
    b) Increase the quality, utilisation, palatability and mineral content of the sward
2) Create a sward that is responsive to soil nutrient inputs
3) Allow white clover to establish and be maintained

How will you gain?

Grass-clover swards are the cheapest source of feed for ruminant animals. Well established grass-clover swards can produce up to 40% more dry matter compared to old permanent pasture even with zero N application. This additional grass yield is particularly noticeable in the Spring and Autumn. If well managed, these grass-clover swards can last up to 15 years. Despite this, reseeding levels in Ireland are low. Less than 2 per-cent of our annual grassland area is reseeded annually. Nationally there is huge potential to increase output of organic beef, lamb and milk from cheap grass-clover swards.

Principles of re-seeding with grass-clover swards

The objective must be to achieve by the Spring of the first year after sowing, a full dense ground cover of grass and clover such that the sward is capable of full productivity in the first harvest year, including the Spring growing period.

In order to do this, special emphasis needs to be placed on:

1. Soil fertility - eg. FYM and slurry - “feed the soil to feed the plant”.
2. High levels of white clover in the grass-seed mix
3. Correct timing of sowing
4. Good levels of management pre and post-sowing to control weeds and create a dense sward.

Which re-seeding method to choose?

A common question asked by many farmers who decide to reseed is ‘What is the best method of reseeding to establish a good grass-clover sward?’

Farmers have a wide range of establishment methods to choose from, whether they be plough-based or minimum cultivation. The recent demonstration in Kilbeggan, Co. Westmeath examined a range of reseeding methods, using machines which were available to local farmers in the area.

Benefits of ploughing for re-seeding

Some farmers choose to plough when reseeding, as it provides an opportunity to level fields, particularly after land reclamation work. Ploughing can also help to improve land drainage. A fine firm seedbed is essential in establishing a good grass-clover re-seed, and ploughing will help achieve this, together with burying older grasses and weeds. Ploughing reduces the risk of a reseed failing to establish, due to a high level of soil to seed contact in a fine seedbed, more available moisture. In addition ploughing aids the release of natural nitrogen from the soil organic matter.

Benefits of minimum cultivation for reseeding

In circumstances where ploughing is not suitable this is where minimum cultivation methods has a role. Minimum cultivation is an ideal method where ground contains a lot of stone or where there is rock near the surface. As there is minimum ground disturbance, a return to grazing is possible within 60 days in ideal conditions. Minimum cultivation is generally cheaper than ploughing, and the most fertile soil remains at the surface where nutrients are needed. However, in the organic situation where herbicides are not permitted special care must be taken to ensure that weeds are controlled effectively through grazing management as initially weeds may not be controlled satisfactorily.

Reseeding demonstration

The following were our own observations of the pros and cons of each of the reseeding methods used for the Kilbeggan event. The site chosen for the reseeding demonstration was a field which had been cut for hay and/or silage continuously over the past number of years, with the sward containing old grasses, plantain and buttercup. The field had not been reseeded for decades. The field was soil sampled to establish the P, K and lime status. Half the site was ploughed and the remainder was left uncultivated. All plots were sown in mid-June using seven different treatments, as outlined in Table 1. Farmers visited the site on 1st August when the results of each of the reseeding methods were clearly visible. Although this trial was not carried out under organic conditions, many of the observations and lessons derived were important and relevant to organic farmers. An organic demonstration plot was also established (see more details later).

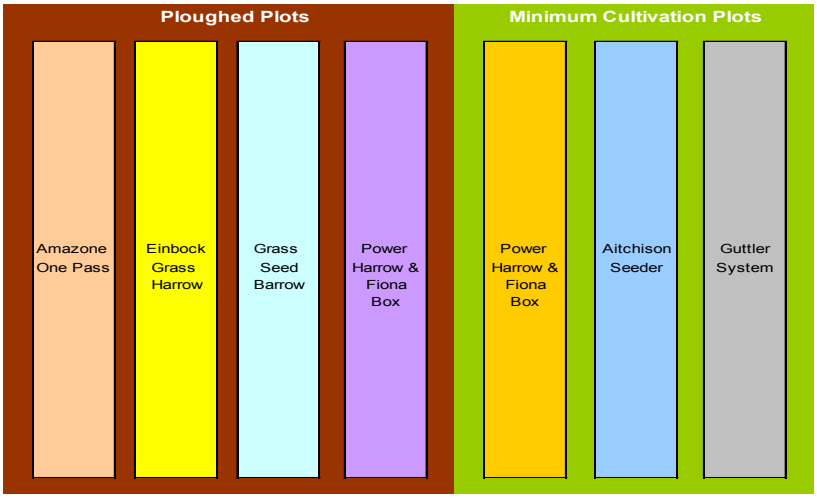

Figure 1: Site layout of the reseeding method demonstration

Ploughed plot observations

Amazone One-Pass

For: Created an excellent seedbed with one pass. Grass was sown with the tilling operation and avoided further tracking. The machine was easily and accurately calibrated.

Against: Grass established in rows, similar to a cereal crop. However this can be addressed with good post grazing management to promote tillering and improve ground cover. Care needs to be taken not to bury the seed to deep - small seed such as clover and timothy should be at or near the surface. However this can be achieved by setting the coulters on the machine to trail on or near the soil surface.

Figure 1: Amazone One-Pass

Einbock Grass Harrow

For: We observed that grass seed was very evenly and widely distributed and the tines gave seed sufficient cover to aid germination. This method is ideal for spreading small seeds such as timothy and white clover which are commonly found in organic seed mixes.

Against: The seedbed has to be fully prepared prior to using this machine. This means that there is an additional sowing cost and there is additional driving over tilled seedbed which may lead to tracking.

Figure 2: Einbock Grass Harrow

Grass Seed Barrow

For: The grass seed barrow is available free of charge to farmers from local merchants.

Against: We found it very difficult to calibrate the seed barrow for even seed distribution. We had to use a ring roller to give sufficient soil to seed contact.

Figure 3: Grass Seed Barrow

Power Harrow & Fiona Grass Seed Box - both on ploughed and unploughed plots

For: It is a specialised one-pass machine for sowing grass-clover mixes. We used this machine on both ploughed and unploughed plots. We found that the best results were seen where this machine was used on the ploughed area, but sward establishment was quite satisfactory on unploughed plots also. We found it easy to set the seeding rate and calibration was accurate.

Against: We had to use a ring roller on the ploughed area to give sufficient seed cover for better germination.

Figure 4: Power Harrow and Fiona Seed Box

Unploughed plot observations

Aitchison Grass Stitcher

For: This was the cheapest reseeding method we had on demonstration. We found it to be a very simple grass seed sowing machine with limited ground disturbance.

Against: With drilling, the seed is placed in lines, leaving bare space between the rows for possible weed invasion - potentially more of an issue for organic farmers than for non-organic farmers, who can resort to herbicides. The grass could potentially be slow to establish full ground cover. Good tight grazing after establishment is thus key to the success of this method.

Figure 5: Aitchison Grass Stitcher

Guttler Grass Seeder

For: We observed that this pneumatic seed distribution machine sowed a ley that established evenly. It was the second cheapest method of reseeding at our demo.

Against: Post sowing there was quite a lot of dry weather which did not suit this method. We conclude that this method requires plenty of moisture after sowing as there is minimum soil to seed contact for germination. Similar to the other minimum cultivation techniques, tight grazing post emergence is vital to it's success.

Figure 6: Guttler Grass Seeder

Organic demonstration

At the Kilbeggan event, a separate demonstration showed how permanent grassland-white clover swards could be re-seeded under organic conditions. Elsewhere in this booklet, there are more specific guidelines available for the establishment of red clover - ryegrass swards. There are many methods for establishing good grass clover pastures under organic conditions. Regardless of the method used, **clover seed or other small grass seeds such as timothy must not be sown deeper than 1 cm.** This is because unlike larger seeds such as ryegrass, such small seeds do not have the reserves to support the seedling while it is trying to reach the surface.

Seedbed preparation of organic re-seeds

Prior to re-seeding, the plot was mowed tightly and 10 tonnes per acre of FYM was spread (Figure 7). The plot was ploughed and cultivated using a power harrow. With very good ploughing old grasses and weeds were successfully buried. The demonstration plot received 1 ton per acre of ground limestone. The plot was then rolled prior to sowing to consolidate the seedbed and avoid burial of the clover seed. Ploughing aids in the release of natural soil Nitrogen in an old permanent sod but it should not be deeper than 15cm (Figure 8). Deeper ploughing will bury any available nutrients out of the reach of the new emerging seed.

Figure 7: 10 tonnes/acre FYM was applied prior to ploughing

Figure 8: Ploughing depth should be less than 15cm

Organic seeding method and rate

In the organic demonstration, the seed was sown using an Einboch grass harrow. The Einboch avoids burying the seed too deep yet the tines gave the seed sufficient cover to aid germination. Organically certified grass seed with 20% white clover in the mix was sourced from a local merchant. One of the key factors in achieving good levels of production on grassland organic farms is the introduction and maintenance of white clover into the new reseed. Seeding rate for new organic grassland swards should be approx. 10 kg of grass seed and 1.5 to 2kgs of white clover seed per acre. In fields where there is a known high weed seedbank, increasing the seed rate will increase the competitiveness of the sown species and may reduce weed ingress. Successful red clover-perennial ryegrass mixtures used by Teagasc include 10 kg /ha perennial ryegrass and 10 kg/ha red clover, giving very good silage yields for up to 6 years in research trials. Organic farmers must make every effort to use organically certified seed in accordance with organic standards.

Should I under-sow organic-grass mixtures?

Consider under-sowing the new re-seed to an arable silage mix (peas/oats etc) or even a cereal crop to be removed as silage especially if weed levels are high in the field or if you require extra fodder for the winter months. The arable mix is drilled in the same day as the grass grass-clover mix is broadcast or shallow drilled. The arable crop is normally cut 10-12 weeks after sowing. Normally the grass-seed mix is sown at normal rates while the cereal-pea mix is sowed at 60% of the normal weight if sown alone.

Time of sowing of organic swards

Organic swards should be sown in Spring or before late August. The main advantage of sowing in this period is that the soil is warm, and providing there is sufficient soil moisture, germination is rapid. Clover germinates and grows from seed more slowly than ryegrass and other grasses and therefore a later Autumn sowing may result in poor clover establishment. Given the importance of clover to productivity in organic systems, and the need to ensure a full establishment of clover in the sward by the following Spring, as indicated earlier, ensuring a sufficiently early sowing date is very important.

Post emergence management of organic white clover-grassland swards

Eighty percent of the success of getting grass-clover swards established is in the post–sowing management. Guidelines for the management of red clover swards are outlined in the previous chapter. Well managed white grass-white clover swards can last up to 15 years. To achieve this, emphasis needs to be placed on

1. Maintaining soil fertility
2. Good post-emergence grazing and weed management

Soil fertility

Clover requires good levels of soil fertility (pH levels 6.5 to 7.0 and Index 3 for P and K). As mentioned before, many grass and clover seeds are small, as are their seedlings and root systems. During establishment, the ability of the root to find nutrients is therefore limited. Thus it is important that soil nutrient status is satisfactory for the major nutrients lime, phosphorus (P) and potassium (K) ideally before or if not at the time reseeding takes place. According to soil test results, phosphorus (P) was Index 2 and potassium (K) was Index 2 for the demo plot. Watery slurry was spread at a rate of 2,000 gallons/acre, approximately 4 weeks after sowing. This along with the FYM spread before ploughing met the NPK requirements of the new organic re-seed in full.

Grazing and weed management of grass-white clover swards

The aim in organic grassland re-seeding is to produce a uniform, well tillered, dense sward of grass and clover. New swards should be grazed as soon as the new grass and clover plants are strong enough to withstand grazing (ie. roots stay anchored in the ground when pulled between the finger and thumb). Grazing also encourages branching of clover stolons and tillering of grass which increases ground cover, further helping to control any emerging weeds. Grazing with calves or sheep would be preferred initially as ground conditions may be fragile depending on the re-seeding method used. Frequent grazing of the re-seed in the first year post establishment will have a beneficial effect on the sward long term but it is important to avoid poaching which will increase the possibility of weeds and may effect stolon development.. New organic re-seeds ideally should not be closed for silage in their first year of production as the shading effect of heavy covers of grass will inhibit clover and tillering of the grass plant resulting in a more open sward which would be liable to weed ingress. The following grazing heights showed be used as a guideline:

1. Down to 4 cm between turnout and mid-April.
2. Down to 5 cm during the main grazing season.
3. Graze the sward to 4 cm before it is closed for the Winter.
4. Avoid heavy covers over the Winter- if you do get them grazed by early March conditions permitting.

Guidelines on the management of red clover-ryegrass swards are somewhat different and can be found elsewhere in this booklet.

Cost of organic re-seeding

In general, the overall costs of organic re-seeding are similar to that of conventional but with a focus on different input costs. In organics, there may be higher costs associated with more expensive organic seed (+30% more expensive approx.) and possible extra contractor costs for spreading and sourcing slurry and FYM but these are off-set by no costs for artificial sprays and fertilizers. Table 2 and 3 show the material and machinery costs of the organic demonstration plot in Kilbeggan. It is important to remember that extra costs may be incurred where slurry and FYM have to be sourced off-farm.

Table 2: Material costs of organic re-seed demonstration

Material Costs per acre	
FYM 10 Tonnes (sourced on farm)	0*
Organic grass seed	90
Lime - 1 tonne	25
Slurry 2,000 gallons watery - post emergence (sourced on –farm)	0*
Total Materials	**€115**

**Note: extra costs may be incurred if slurry and FYM are imported onto the farm or if commercial organically approved mineral fertilizers are used)*

Table 3: Organic re-seed machinery costs per acre

Organic re-seed machinery costs per acre	
FYM spreading	25
Ploughing	30
Rolling	7
Power Harrow x1	30
Einboch Grass Harrow	20
Rolling	7
Slurry spreading	20
Total Machinery	**€139**

Steps to a successful organic re-seed at the Teagasc Organic Unit, Athenry

Power-harrow for re-seeding

8th June - Field after 2 runs of power-harrow followed by roll using a ridge/Cambridge roller

STEP 3

Einbock air-seeder used to sow grass and white clover seed (25 kg grass seed and 5 kg white clover seed per ha). Roll again after sowing.

Athenry re-seed fully established October

Same field 24th June, started grazing 20th July

Introducing white clover into existing swards and getting variety choice right

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Full-reseeding v over-sowing

A full re-seed is considered the best means of getting clover into a sward especially for red lover leys and in in a dense pasture eg. sheep pastures or old butty pastures with little possibility of the clover seed achieving an adequate soil seed-contact to make a "hit" and germinate.

Broadcasting clover seed into existing pastures on the other hand, offers a cheaper method with a 75% success rate at farm level, but the management of the sward before and after over-sowing is the key to success.

Sowing essentials

Successful establishment of white clover in the sward by over-sowing depends on:

a) Contact between the soil and the seed to make a "hit" and allow germination
b) Moist soil conditions
c) Light penetrating down to the clover seed and seedlings; and
d) Strong well-established seedlings to survive the Winter

Methods of over-sowing

Techniques using strip or slot-seeders are not recommended because they increase costs without improving the rate of successful clover establishment. Strip or slot seeders or scratching the soil surface with a harrow can also damage the sward and open it up to weed infestation. To that end, broadcasting methods using a standard fertilizer spreader or other specialised broadcasting equipment such as an air-seeder etc. are recommended. Putting clover seed into a slatted tank and then spreading the slurry is not a reliable method of getting even application of clover seed.

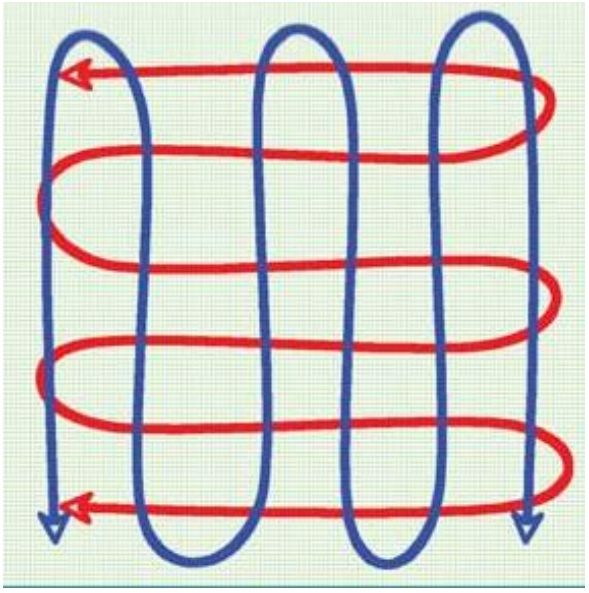
Time of over-sowing

Experience on farms and at Teagasc Solohead, Tipperary has shown that, in general, over-sowing works best after a harvest of silage during May or early June, compared to spreading on grazed swards. This is mainly because the grass recovers more quickly after grazing than after a silage cut, thus competing against the slower establishing clover seedling. Over-sowing in most years should really take place before late June. Over-sowing will be most successful in wet summers, in heavy rainfall areas in the West of the country and on heavier soils. Over-sowing is somewhat riskier on drier sandier soils in Eastern parts of the country and really should be carried out in May in these areas.

10 steps to successful clover over-sowing

1. Reseed with 5 kg of white clover seed per hectare. It is vital that organic clover (~€15/kg) or non-pelleted (naked) conventional clover (~€10/kg) is used. Pelleted clover which often contains artificial phosphorus (P) is **strictly prohibited** according to organic standards.
2. Ideally take a heavy cut of silage off the field and cut it very low to stunt the grass and make the sward as open as possible. Tight grazing over a long period is also an option before over-sowing.
3. Mix the clover seed with a mixing agent. Common mixing agents commonly used on organic farms are dry sand, granulated lime products or permitted natural granulated fertilizers (eg. sulphate of potash). Mix it in the field rather than in the yard and only mix half the amount first (each acre is spread twice – in two opposite directions). Spread about 5 to 10 acres at a time.

4. Spread and then spread the same area again in the opposite direction. See Figure 1.
5. Once the clover is spread, apply around 2,000 - 3,000 gallons per acre (33 m3/ha) of fairly watery cattle slurry to the silage stubble. This helps to wash in the seed which aids germination and seedling establishment as well as supplying nutrients for plant growth.
6. Be back grazing that field within 24 days – this is very important.
7. Thereafter graze very tight each time (to 4 or 5 cm – to prevent tall grass shading out clover) and graze every 24 days. This is why lowly stocked farms may have difficulty getting clover established. Clover stolons will spread much greater distances once they have light reaching them.
8. If the ground becomes too dry do not over-sow.
9. Another option is to graze out a field with light cattle (to 4 cm or less). Spread the clover seed and then within a short period put more cattle on the field to re-graze it out again. The cattle will then walk the seed in.
10. Tight grazing is essential -
    - Down to 4 cm between turnout and mid-April
    - Down to 5 cm during the main grazing season
    - Graze the sward to 4 cm before it is closed for the winter
    - Do not have very heavy covers over the winter – if you do, get them grazed by early March



- Example – 8 acres
- Mix in the field with mixing agent eg. granulated lime product . Use 16kg of clover and 8 bags of granulated lime in total.
- As each bag of lime is filled into the spreader, the clover seed is poured in simultaneously and mixed around at regular intervals by hand.
- 4 bags of mixing agent plus 8kg seed is applied in the first run and the remaining 4 bags plus remaining seed is applied in the second run.
- First run is in Blue
- Second run is in opposite directions at right angles to the first in red.

Figure 1: Broadcasting clover into existing pasture

Experience of over-sowing white clover at Teagasc

Over-sowing has been used at Teagasc Solohead and Athenry research farms for years both to increase and maintain the white clover content of the swards. It has mostly worked well. Poor results have occurred when dry weather and soil conditions follow over-sowing. Over-sowing at Solohead has generally been between 70 and 80% successful over the years. Poor results have also been due to allowing grass get too strong after over-sowing. This is the single biggest factor for failure that lies within the farmer's control. The importance of tight grazing after over-sowing cannot be overstated. The single most important recommendation, which can greatly improve the success of over-sowing, is tight grazing for the remainder of the year.

Recommended white clover varieties

Each year DAFM produces a list of recommended grass and white clover varieties. These varieties have been trialled and evaluated over a minimum of two separate sowings in Kildare, Galway, Cork, Donegal and Kilkenny. The DAFM recommended list for 2016 is presented in Table 1 below. The Northern Ireland recommended list is more comprehensive and is also of relevance.

White clover varieties are classified by leaf size

Smaller leaf varieties are generally lower yielding but more persistent than large leaf varieties and so are recommended for sheep farms. Small-leaf clovers survive the selective grazing of sheep because their stolons

are small and close to the ground. Medium leaf varieties are intermediate in terms of yield and persistency, making them suitable primarily for grazing but also for silage.
Cattle and dairy cows are less selective grazers and graze less close to the ground than sheep. Therefore small-leaf cultivars are more at risk of being shaded out of a sward grazed. Large-leaf cultivars grow more aggressively and are better able to compete in swards grazed by cattle.

Table 1: DAFM Recommended White Clover Varieties 2017

Variety Name	Total Yield	Leaf Size*	Clover %	Year 1st Listed	Breeder	Origin
Control Mean: (t DM/ha)	*9.8*					
Barblanca	105	Large (0.76)	50	2009	Barenbrug	NL
Alice	99	Large (0.73)	50	1995	IBERS	UK
Chieftain	98	Medium (0.68)	47	2005	Teagasc	IRL
Buddy	100	Medium (0.58)	45	2015	Teagasc	IRL
Avoca	103	Medium (0.58)	47	1995	Teagasc	IRL
Iona	94	Medium (0.56)	44	2014	Teagasc	IRL
Crusader	95	Medium (0.56)	42	2009	Barenbrug	NL
Aberherald	98	Medium (0.55)	45	2003	IBERS	UK
Coolfin	104	Small (0.51)	47	2017	Teagasc	IRL
Galway	95	Small (0.36)	38	2017	Teagasc	IRL
Aberace	99	Small (0.26)	33	2016	IBERS	UK

*In the table above varieties are listed in order of decreasing leaf size. *Values in brackets indicate leaf size compared to the variety Aran (i.e. Aran = 1.00), based on data from UK D.U.S. tests.*

The main features of each variety are highlighted below. These features should be used as the basis for choosing the varieties of clover suitable to your enterprise.

Barblanca:	A large leaved variety. Very good annual yield. Considered suitable for silage production and unsuitable for hard grazing.
Alice:	A large leaved variety. Good annual yield. Considered suitable for silage production and unsuitable for hard grazing.
Chieftain:	A medium leaved variety with good yield. It is the largest of the medium-leaved category. Considered suitable for grazing.
Buddy:	A medium leaved variety with good yield. Considered suitable for grazing.
Avoca:	A medium leaved variety with very good yield. It competes well with the accompanying grass. Considered suitable for grazing.
Iona:	A medium leaved variety. It competes well with the accompanying grass. Considered suitable for grazing.
Crusader:	A medium leaved variety. Considered suitable for grazing
Aberherald:	A medium leaved variety. Considered suitable for grazing.
Coolfin:	A small leaved variety. First year on the Recommended List. Very good annual yield. It competes well with the accompanying grass. Considered suitable for grazing.
Galway	A small leaved variety. First year on the Recommended List. Considered suitable for grazing
Aberace:	A small leaved variety and is currently the smallest on the Recommended List. Considered suitable for grazing.

Clover blends depend on enterprise

In general 2 varieties of clover are used in a mix. A combination, one from large, medium or smaller leaved varieties can lead to more successful establishment of clovers and can also allow for more flexibility of management. Some factors to consider when choosing a clover mix include yield, persistency and optimum growing season.

For sheep a suitable mixture of clover cultivars could contain Avoca and Aberherald. The emphasis of this blend of clover cultivars is more on persistence than yield.

For beef and dairy swards, a suitable mixture could contain Chieftain and Buddy. This blend is targeted more towards yield rather than persistency.
If the ley is to be used for the dual purposes of grazing and hay/silage, then a mixture of Chieftain and Barblanca could be used.

Finally, for silage-only leys the larger leaved clovers are most suitable, but could be mixed with a 3rd variety eg. Buddy or Avoca to ensure good growth and cover throughout the season.

Some management pointers

As white clover needs light to survive the winter, keeping swards well grazed in late autumn and spring makes a big difference to clover survival and productivity during the following growing season.
The Rhizobia bacteria associated with clover perform best in soils with good levels of phosphorus (P) and potassium (K) and high lime status and therefore white clover does not grow very well in acid and, in particular, peat soils.

White clover can be expected to perform best and make the greatest contribution to pasture productivity on free-draining loamy soils. These soils are light and therefore warm up relatively quickly.
Under normal circumstances the clover content declines slowly and virtually disappears from the sward over time. However, there is a large residual impact of clover on soil fertility. Even as the clover content of the sward declines to low levels, sward productivity can subsequently remain very high for a year or two. This is due to the residual (slow-release) impact of the clover on soil N supply

Conclusion

Organic farmers face challenges in terms of increasing output and maximising their returns. Grazed grass is the cheapest feed available to increase live-weight gain for grassland farmers. In grassland based organic farming systems, re-seeding with grass-clover swards plays a vital role in achieving higher margins. There are many methods available to establish successful grass clover pastures under organic conditions. Every field and farm situation is different, so there is no 'one size fits all' in terms of methods of reseeding. All methods have their advantages and disadvantages, as outlined but the key is choosing the right method for your own farm situation. Regardless of the method chosen, good management (slurry and FYM for NPK, regular grazing of grazed grass-white clover swards and avoiding poaching) is especially important to produce a long lasting successful organic re-seed.

White clover stolon, roots (with nodules) and leaves. Clover stolons will spread much greater distances once they have light reaching them.

An open sward and moist soil conditions provide ideal conditions for introducing clover seedlings by low-cost over-sowing method. Clover seedlings become established in open patches in the sward. It is important that the sward is kept well grazed out after over-sowing.

Unpelleted (naked) clover and a mixing agent are mixed in the field instead of the yard to avoid the tiny clover seed from falling to the bottom of the spreader.

Profitable organic beef production

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Introduction

In order for any farm enterprise to be profitable, the returns from the enterprise must be greater than the costs of production. Organic beef farming systems are no different to any other farm enterprise. This paper will show the key components that lead to profitable organic beef production.

There are two elements to profitable production:

1. High output
2. Efficient systems of production

This is a very simplistic view of making a profit; many farmers do not know their costs of production and may not know what a high output is. The Teagasc Drystock E Profit Monitor is a farm efficiency measurement tool. It is used to measure your efficiency and help increase farm profitability.

High output

Achieving high output (maximising sales income) in an organic beef system is about selling a decent carcase size for a premium price and producing a high number of finished cattle per ha. The key components of this are:

- Market returns
- Carcase weight
- Stocking rate
- Sward management

Market returns

The key to getting the maximum returns form the market is to produce a product that the market demands. Organic beef is in demand at present. The organic beef market has always returned a premium price to the farmer. Typically this has been 15 and 25% above conventional prices. Ireland is relatively self-sufficient in organic beef at present; the export market for Irish organic beef has been growing for the last few years and this is expected to continue. The sector is small and because of this it is important to be in constant contact with processors to ensure that your animals can be slaughtered when they are fit, without any delays.

Carcase weight

In organic beef production, achieving decent carcase weights will be a problem if you are not working with the right type of stock. With the high cost of organic concentrates, the aim is to finish cattle on as little concentrates as possible. The traditional breeds of Hereford and Aberdeen Angus are early maturing breeds and will finish easily however carcase weights can be low. In general, a continental type cow is recommended using a traditional breed of bull. The higher the weight of the carcase produced, the greater the output of beef leading to a potentially greater profit. It is imperative that carcase weights are maximised and a target dead weight of 350kg should be achievable with good management.

DAFM may offer organic farmers grant support for the purchase of new machinery and DAFM spec. animal housing

Stocking rate
Stocking rate is one of the key drivers of farm profit. The area of land that an individual farms is generally limited, so stocking rate is seen as another way of increasing output. At higher stocking rates there is a greater throughput of animals. If each animal is leaving a profit, then there should be a greater profit. Another element to stocking rate is getting animals finished off the farm as young as possible; this also increases the throughput of animals. The average stocking rate in Ireland is less than 1 LU per ha. With excellent grassland management on good land it is possible to achieve up to 2 LU per ha on organic farms. Clover swards are key to achieving this target.

Support payments
Like all farming systems, scheme support payments are an integral part of farming in the EU. Organics has been well supported in the past with it's own support payment. The most recent five year scheme delivered €220 per ha up to 60ha in conversion for 2 years which reverts to €170 for the remaining three years. The average organic farm in Ireland is approximately 37ha. Support payment for such a sized farm amount to a total of €35,150 over the five years. This is a decent payment and when combined with a Basic Payment and GLAS, is a very attractive option for Irish beef farmers. In addition DAFM administer an organic capital investment scheme (OCIS) which offers grant aid on certain buildings and machinery relevant to organic farming.

Efficient systems of production
In an organic system of production, the main costs of production are different. The use of conventional fertilisers are not permitted, but it is imperative that soil fertility is managed to both maintain and increase production of herbage. Straw and concentrates costs may be higher in this system; their use needs to be correctly managed for efficient production. Good animal husbandry techniques are essential to minimise the need for veterinary treatments.

Good grassland management is essential to minimise the requirement for additional purchased concentrate/ cereal feed. Forward planning and budgeting is a key to managing this cost. Many organic farmers (beef finishers and dairy) have started growing their own cereals and pulses, this may not suit all farms due to land type, skills and machinery required.

Making the best use of pastures involves growing as much grass as possible from a hectare of land, and extending the grazing season using grass budgeting and other decision support tools. Performance is achieved by keeping the quality of the grass high and minimising the levels of parasites in the animals.

Grazing clean pastures with young animals, leader follower systems and grazing silage aftermaths are some methods of reducing costs on organic farms.

The inclusion of clover in all organic grassland sward increases the productivity of grassland and animals, and the management of this is a key to efficient production.

Summary
Organic beef production can be a very profitable enterprise with some of the most profitable beef farmers in the country farming organically. The key components to achieving this are a decent level of production, premium price coupled with an efficient system of production which includes good grassland management, herd health and soil fertility plans. The use of the Teagasc E Profit Monitor financial tool is important component to plan for the future, control costs, increase output and should be part of profitable organic beef production.

Appendix

Organic Certification in Ireland

A major factor that distinguishes organic farming from other approaches to sustainable farming is the existence of internationally acknowledged standards and certification procedures. The standards for organic production within the European Union are defined and enshrined in law by Council Regulation EC 834/2007 as amended.

In Ireland, the Department of Agriculture, Food and the Marine is the competent authority (i.e. - the Department's Organic Unit is based at Johnstown Castle Estate Wexford) for regulating the organic sector and ensuring that the obligations and requirements of Council Regulation (EC) No. 834/2007 as amended are adhered to.

The Organic Unit of the Department of Agriculture, Food and the Marine have designated Official Certification Bodies (OCB) whose role is to certify organic producers, farmers and processors through and inspection process of each individual's unit or farm. Further information can be sourced from these organic certification bodies:

IOFGA (Irish Organic Farmers and Growers Association)
13 InishCarraig, Golden Island, Athlone, Co. Westmeath, N37 N1WR
Tel: 090 6433680
www.iofga.org

Organic Trust
2 Vernon Avenue, Clontarf, Dublin 3, D03 P6D0
Tel: 01 8530271
www.organictrust.ie

BDA Certification - Organic and Demeter
The Painswick Inn Project, Gloucester, Gloucestershire, GLS 1QS, United Kingdom.
Phone: 0044 1453 766 296 Fax: 00441453 75950

Grant Aid and Scheme Support

Under the E.U. Rural Development Programme (2015 - 2020) the Department of Agriculture, Food and the Marine offer support to organic farmers through both an Organic Farming Scheme (OFS) and an Organic Capital Investments Scheme (OCIS). Please consult with Department Agriculture Food and the Marine (DAFM) www.agriculture.gov.ie regarding opening periods for these schemes.

Department of Agriculture, Food and Marine

Department of Agriculture, Food and Marine
Dept of Agriculture Food & Marine, Organic Unit, Johnstown Castle Est, Wexford
Tel: 053-9163400
Email: organicunit@agriculture.gov.ie; www.agriculture.gov.ie

National Organic Training and Skillnet

The Enterprise Centre,
Hill Road,
Drumshambo,
Co. Leitrim,
Tel: 071-9640688
Email: info@nots.ie

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