Planning for Profit

Planning for change

The shift to a flat rate area payment system in 2015 will challenge many farm businesses.

If you are a 'loser' in this change, how can you fill the gap?

All businesses face new challenges and opportunities in our globalised volatile markets. How can we set ourselves up for success in this new world?

The **Planning for Profit** project receives support through the Scotland Rural Development Programme, which is jointly funded by the Scottish Government and the European Union

FOREWORD

The objectives of the **Planning for Profit** initiative are simple and clear – it is aimed at ensuring your farm businesses are competitive and well-placed to benefit from the exciting opportunities ahead for our industry.

The long-term future looks bright for our industry but it is vital farmers optimise the profitability and competitiveness of livestock and mixed livestock/arable farms, particularly in the face of the possibility of reduced support payments following the CAP restructure.

Planning for Profit is, however, not just a response to CAP reform. It is also a great opportunity for farmers to think about the future and how they grow their businesses to play a key role in the delivery of the produce which will be required to meet Scotland Food & Drink's ambitious growth targets of £16.5bn by 2017.

There's a real need to improve our farm productivity to increase our competitiveness and a key objective will be to provide a structured approach for farm business planning – to confidently re-tune your businesses for the future.

The results of a huge amount of excellent research are readily available to producers and I very much hope your participation in this project will prove the catalyst leading to the implementation of changes, which have proved successful for others, to allow your business to grow through increased productivity and efficiency.

This initiative, supported by the Scottish Government's Skills Development Scheme, Quality Meat Scotland (QMS) and NFU Scotland, is also an example of the value of collaboration within our industry, and the collective input which has resulted in an excellent 18-months programme of activity.

The **Planning for Profit** programme includes farm visits and workshops and our thanks for the hard work in developing and delivering the project go to SAOS, SAC Consulting (part of Scotland's Rural College) and agricultural consultant, Peter Cook.

I would encourage you to take the time to carefully consider the many ideas that you will find within the pages of this new Reference Guide. The Guide is packed with examples of best practice, innovation, applied research and includes practical case studies of farmers throughout Scotland who are already adapting their farm systems.

We have fantastic brands like Scotch Beef and Scotch Lamb with huge potential for growth in the home and overseas markets but we need to ensure we have an efficient, productive and competitive industry poised to benefit from that demand.

Jim McLaren, Chairman QMS

think.
plan.
do...

INTRODUCTION

Planning for Profit – think. **plan. do...** is about facing the challenge of CAP reform which may reduce SFP payments to many of our more intensive beef and sheep farms. It's also about all types of farming business facing up to the risks and uncertainties of operating in a volatile world market.

At the very least how do we fill the profit gap created by any reduction in SFP and maintain output to our processing and food sectors? On the positive side, change always creates opportunities – where can we improve our businesses to cash in on these?

This Reference Guide provides lots of ideas on how you might improve your business. Its aim is to get you thinking. Some are step changes, while others are small improvements. All require us to take a proactive approach to the management of our businesses. The well established Monitor Farm programmes have taught us that improvement depends on measuring what is really going on in the business, identifying the problems, selecting solutions, measuring the result and then moving on to the next improvement. More than anything the discipline of continual improvement is what will deliver a profitable future for our industry.

There are three components to the Planning for Profit programme

- **This Reference Guide** to give you lots of ideas for change
- **Big Idea Roadshows** where selected farmers will describe what they are doing to tackle the SFP challenge and build a profitable business
- **Farmer Workshops** where smaller groups of farmers can identify their individual challenges and cost out improvements

Your first step - what are my objectives?

You need to decide on your objectives.

Most of us carry on from day to day trying to make the best of our situation. However, stand back for a moment. What is really important to you and what would you like to achieve?

- What are your lifestyle aims?
- Do you do nothing but work?
- Can you organise the business differently?
- What do you really like/dislike?
- What are you good at?
- What does the whole family want?
- What's your income target?
- What do you need to bring up and educate a family and/or to meet your lifestyle goals?
- Do you have successors who are keen to farm?
- What will need to change if they are to come in to the business?
- Is your aim expansion?
- How are you going to do it when land prices are so high?
- How much profit do you need to allow you to set aside cash for investment?
- Are there other ways to grow?
- What are your retirement aims?
- What does this mean for the income you need to generate and the investments you make?

Everyone has a unique situation. The important thing is to carry out an honest appraisal of what you want from your farming life. Then you've got a basis for planning your business.

Planning for Profit - principles

Consider the following principles for the design of your farming business

1 RETURN ON CAPITAL

Where in your business can you get the best return on additional investment? How can you use your assets better?

2 IMPROVE LABOUR PRODUCTIVITY

It's one of our biggest costs and our most important asset. How can we do jobs faster and better? How can we reduce the time spent on low value tasks and apply labour where it generates most return.

3 IMPROVE TECHNICAL EFFICIENCY

Scrutinise and benchmark your physical performance and tackle your weaknesses.

4 MAXIMISE RETURN FROM INPUTS

All inputs – fertiliser, fuel – have increased in price. How can you buy well and apply these inputs most efficiently?

5 ADD VALUE TO PRODUCTION

Get the maximum amount of product within the specification required by your markets, and look for profitable ways to add more value.

6 SUPPLY CHAIN COLLABORATION

Can you reduce costs and secure better prices by working with input suppliers and processors? There is simply great value in sharing information, pooling resources and working together to reduce waste.

7 JOINT VENTURE AND COOPERATION

Sharing capital, marketing infrastructure, input buying and labour/machinery work helps achieve benefits of scale and releases assets and time for other areas of the business. It also shares ideas and allows innovation.

8 GROW YOUR PERSONAL CAPABILITIES

The people working in the business are the biggest determinant of success so you need to grow their capabilities too! This applies to both you and staff /other family members.

Planning for Profit - building blocks

Here are some steps to help you implement improvements.

1 SET ASIDE MANAGEMENT TIME

You need time to think about your objectives, do some numbers and set a strategy. Everyone is too busy but are you doing the right things?

2 UNDERSTAND YOUR BUSINESS

Do the analysis, compare yourself to the best, identify where most improvement is needed. Carry out a full resource audit and assessment of the business.

3 MEASURE

Not everything, but the most important indicators for your business e.g. calving %, weaning weight, purchased feed cost per head, barren cow reasons, profit before subsidy. Track these over time. Remember the old adage; if you don't measure it how well can you manage it and how do you know if you are improving it?

4 SET TARGETS

Set targets to help achieve your objectives. If you've got something clear to aim for it's much easier to set priorities and focus your effort. Write it down!

5 LOOK AROUND

Get out there and look for examples of the best, systems that work well, new ideas, innovations, how things are done in other places or other industries. What can you adapt from all this for your own farm, to help you meet your targets?

6 MONITOR

Monitor performance to see if your changes are having a positive impact, and use this information to continue to fine tune your enterprises or business. Adopt an evidence based approach to change.

Planning for Profit

The following sections contain some of the latest thinking on best practice for beef, sheep, grassland and arable enterprises, backed up by farm case studies that should inform and inspire in equal measure. We all have different limitations on our businesses be this quality of land, weather, labour availability, limited capital, or barriers to expansion and the important point is to make the most of what you've got. Our case study farmers have looked at their resources and designed a farming system that suits them and their farms. Some case study farmers have made step changes while others have continually worked away at small gradual changes that have made their enterprises more efficient. The common theme is attention to detail – most have observed, measured and monitored performance and used this as the basis of good decision making.

Several of the features describe how farmers have adopted new technology, such as EID tags as a source of management information or use of EBVs to assist in the selection of better performing and more easily managed animals. Simplicity is also a common theme with many of the farmers striving to make their farming system as focussed as possible. Some features illustrate new ideas while others have been around for a long time, but have yet to be taken up by the industry – techniques that get more production from grass being a classic example. Linking the supply chain is also a key topic – see the feature on improving efficiency across the lamb supply chain.

We hope you find the Guide useful in helping you improve the efficiency and profitability of your business. These are just some examples – we should all keep looking for more.

CATTLE OPTIONS SECTION 1

1. Cow efficiency – Right breed, right feed, right place

In order to maintain the profitability and viability of Scottish suckler herds, we need to efficiently produce quality fast growing calves, whilst reducing the cost of keeping our suckler cows, particularly over winter. The reducing Scottish beef herd should be a cause for concern for farmers and processors and retailers. Consider the following facts:

- The Scottish beef suckler herd has reduced by 37,000 cows or 7.5% of the 2002 figure over the past 10 years (2002 to 2012).
- This has occurred at a time when beef prices have substantially increased and we continue to have some of the highest beef prices in the world.

Average cow weight has increased from around 475kg in 1975 to 650kg at present, but have calf weaning weights increased sufficiently to cover the extra cost of keeping these larger cows? There have been gains in weaning weights through use of better bull genetics but the value of these gains does not come anywhere close to covering the cost of feeding a cow that is now almost 200kg heavier.

We therefore need to consider good fertility, efficiency, cow depreciation costs, weaning weights and prices when reviewing our suckler beef systems.

The evidence

QMS commissioned SAC Consulting to assess cow efficiency on two farms in the NE and SW of Scotland in 2007. Both farms produced similar results that appeared to demonstrate that smaller cows were more efficient than the larger cows in each herd when assessed for cow efficiency as calculated below.

Cow efficiency can be measured as kg of calf weaned (adjusted to 200days), per 100kg of cow weight. Therefore a 650kg cow rearing a 280kg calf has a cow efficiency score of 43 (280 divided by 6.5).

The North East farms results are shown in the table below. These results are very much a case of "one farm in one year", however, on the basis of this evidence it can be concluded that calf weaning weight does not increase in proportion to increasing cow weight. This is a well managed herd rearing 150 calves from Simmental cross, Limousin cross and British Blue cross cows. Average adjusted weaning weights were 333kg for bulls and 289kg for heifers. Average weaning weights at 220 days were 333kg for bulls and 289kg for heifers. A higher score suggests better cow efficiency.

	Bull Calves		Heifer Calves	
Cow Weights (kg)	**Number**	**Efficiency factor**	**Number**	**Efficiency factor**
501 - 550	3	52.1	2	49.2
551 - 600	15	53.9	8	45.3
601 - 650	11	51.6	17	43.4
651 - 700	17	46.1	15	39.5
701 - 750	17	42.0	7	36.1
751 above	4	39.4	4	37.2

There are many farmers doing a fine job who are happy with their cows as they are, but faced with reducing support payments and increasing costs, is it time for a re-think on cow size and cow efficiency?

think. plan. do...

1. Cow efficiency – Right breed, right feed, right place *continued...*

The following two case studies feature herds that achieving excellent fertility as well as rearing well grown calves from reasonably sized cows. In both cases the cows happen to be hardy types with excellent foraging and fleshing ability. Cow efficiency is very much a case of using a breed that makes best use of your farms resources and reduces your labour requirements. The calf growth potential comes from mating the cows with terminal sires that have suitable scale and excellent growth EBVs. The third factor is good management - both farmers pay a lot of attention to detail and have continually refined their systems over the years.

CASE STUDY 1

Willie and James Porter East Scryne, Carnoustie

Blue Grey cows have for many years been an "unfashionable" choice, at a time when many farmers have favoured larger continental crosses. A recent report commissioned by the Blue Grey Society has proved the breed is perhaps surprisingly efficient and profitable, on the basis of costings for the spring 2011 and autumn 2010 calving herds taken through to weaning, relative to other Scottish hill, upland and lowground suckler herds. These findings may equally apply to other hardy, maternal breeds. They also apply to well run units using continental cross cows. The key is having the right breeds on the right system for you and your farms resources. This case study is a classic example of the right cow in the right system. Easy management, tight calving and fast growing calves are key components.

Background

Messrs Porter farm 890 acres of mainly arable land near Carnoustie augmented by 7500 acres of rough hill in Glen Lyon. Willie and his son James have persisted with the Blue Grey as their preferred cow breed and have continually fine tuned their farming system to make this enterprise as efficient and profitable as possible.

Arable cropping – cereals, soft fruit, and potatoes - take priority on the 890 acre mainly arable units at West Scryne and Carnegie, Carnoustie, and management of the suckler herd has to fit in with arable work and field availability. Spring calving cows remain on the arable unit all year round grazing temporary grass and permanent pasture from turnout to weaning in September. They then forage across potato and brassica crops before outwintering on grass, straw and minimal concentrates up to calving from February onwards. Autumn calving takes place in a tight 10 week calving period from mid September onwards, with cows then outwintered on strip grazed kale plus ad lib straw and restricted concentrates to mid March, then silage plus straw before weaning in mid April and summering on the hill at Glen Lyon. All male calves are left entire and get a limited amount of creep feed before moving on to ad lib cereal finishing diets. Results are impressive with Charolais bull calves finishing at mainly U grade at 14.2 months of age, averaging 355kg dwt. Heifer calves are finished on silage and concentrate diets or grass averaging 270kgDW at around 16 months of age.

Replacement bulling heifers are purchased through auction sales at Newcastleton in the Borders, typically at 18-24 months old, and are mated to Limousin bulls at around 400kg. Cows are mated to Charolais bulls and the target is for each bull to produce 200 calves through both longevity and use on the spring and autumn herd.

	Porter	Porter	Hill Herds	Upland Herds
	Spring 2011	Autumn 2011	QMS Average	QMS Average
	£ per cow	£ per cow	£ per cow	£ per cow
Gross output	£526	£607	£634	£521
Variable costs	£186	£237	£354	£262
Gross margin	£341	£370	£279	£258
Fixed costs	£227	£240	£374	£343
Net margin	£114	£130	-£95	-£84

Why the Porters favour Blue Grey cows

- **Profitability** – the Porters suckler herds left net margins (after deducting fixed costs) of £114/cow and £129/cow for spring 2011 and autumn 2010 calving to weaning respectively. This compares favourably with QMS cattle enterprise profitability costings that show large negative net margins for "average" farms and breakeven for top third.
- **Simplicity** – working with one cow breed simplifies management. Don't need to vary management for different groups, other than for heifers.
- **Labour** – easily managed outwintering system, easy calving, few problems with cows and calves.
- **Foraging ability** – spring calving cows are always in fit condition by weaning, and have sufficient body reserves to 'rough it' from mid November to calving in early February. Allowing spring calvers to drop to a leaner condition score by calving saves substantial feed cost. Autumn calving cows do well on hill ground over summer. Calves grow well on milk and grass alone.
- **Ease of calving** – despite their small size, Blue Grey cows have a wide pelvic area and calve easily – the Porters select Charolais bulls with good frame and growth EBVs, and don't worry too much about calving ease figures because they bring cows down to lean condition by calving.
- **Longevity –** the average cow in the herd produces 9 calves.
- **Calf mortaility** – calf mortaility is extremely low with very few instances of calf deaths.
- **Cow efficiency** – typically cows averaging 525kg mature weight rear calves averaging 332kg for bulls and 280kg for heifers, weaning at seven months of age. Taking an average weaning weight of 306kg, gives us a Cow Efficiency Factor of 58 – well above all of the values in the table on page 11.
- **Arable system** – cow grazing improves soil fertility and has increased crop yield on lighter land. Cattle also forage and dispose of groundkeepers on potato land and tidy up brassica stems.

1. Cow efficiency – Right breed, right feed, right place *continued...*

CASE STUDY 2

Iain, Sarah and Angus Malcolm, Cromlix, near Dunblane

MACGREGOR PHOTOGRAHY – COURTESY THE BRITISH SHORTHORN SOCIETY

Simplicity, is the word that best describes the Malcolms beef enterprise at Cromlix near Dunblane. For Iain Malcolm simplicity means sticking with a tried and trusted breed whose foraging ability allows them to be wintered on hill grazing, without any silage, supplemented only by minimal concentrates from mid to late winter. Because spring born calves are sold store there is no need for silage. No silage and no cattle housing means the Malcolm's carry little in the way of machinery save for one 80HP tractor, three quad bikes, a grass topper, lime spreader, direct drill and a post chapper. This is truly a low cost beef enterprise that delivers excellent results.

"I haven't made any silage for 18 years" said Iain Malcolm at a recent farm open day at Cromlix, much to the surprise of the audience. How many farms carrying 170 cows and 1000 ewes make no silage? There are two key factors that make this a reality: attention to detail in stock and grass management and 2700 acres of tenanted hill and upland ground that is relatively lightly stocked.

Iain farms Cromlix and Coilechat with wife Sarah and son Angus. They run 170 Beef Shorthorn x Highland cows. According to Iain "The Beef Shorthorn x Highland cross has proved it's place on the farm for over 50 years. We have bought heifer replacements from Highland cows since I was a boy. The cross disappeared from the market when the Highlander export trade grew in the 1980's but I was keen to re-introduce it when I had the opportunity in 1998, with the entire herd converted by the early 2000's because we find the Shorthorns maternal traits, coupled with the Highlands hardiness, ideally suits our system. The herds all year round foraging ability has made massive savings to our fixed costs, and overall make a significant contribution to maximising margins on the less favoured grazing. Many farmers now breed their own replacement but I like to keep the system simple and buy Shorthorn x Highland heifers from the west coast".

"We are currently crossing 50:50 to Charolais and Simmental bulls and have sold 40-50 breeding cross Simmental heifers and in calf cows most years, but again for reasons of simplicity we aim to put more to the Charolais in future and sell all of our calves as stores in October".

"Choosing high performance Charolais bulls is also essential to our returns. Charolais bulls are selected for calving ease EBVs first and foremost, coupled with the visuals of length, height and a rangey frame to produce shapely calves that are fast growing with unbeatable weight for age."

Livestock detail and key points

- **2700 acre hill and upland unit**
- **170 Beef Shorthorn x Highland cows calving outdoors from mid March**
- **1000 Blackface ewes**
- **Cows overwintered on standing grass from late October to early March – standing grass. Hill not grazed by sheep in summer.**
- **No wintering accommodation, no conserved forage or forage crops..**
- **Supplemented by 490kg/head purchased concentrate from January onwards – average 2.5 kg per day fed through snacker**
- **Use body condition gained in summer months to reduce winter feed requirements**
- **50% of herd mated to high EBV Charolais bulls rest mated to Simmental**
- **Only 3% barren cows in last year**
- **Bulls only in with cows for 9 weeks**
- **61% calved within first 3 weeks of calving, 100% calved within 8 weeks.**
- **91% calves reared**
- **1.2kg/day liveweight gain from birth to weaning at 22 weeks (mid September) off milk and grass**
- **Creep offered two weeks prior to weaning and in run up to sale at end October**
- **Sale averages steers 275kg and heifers 265kg in October.**
- **Herd tested for BVD and no cases of Johnes**
- **Good cow longevity**

2. Reducing cow wintering costs

Our northerly latitude and relatively short grazing season sets Scottish farmers at a disadvantage when compared to producers in other countries. Typical housing periods vary between 150 and 240 days depending on location. A study undertaken in 2007 showed that it costs three times as much to finish cattle in winter when compared to summer.

Housing costs include labour, machinery, feed, veterinary bills and all of the costs associated with straw - hauling, storing, bedding and spreading FYM, or slurry storage and handling. Additional costs need to be allocated for maintenance and capital costs of buildings and fixed equipment.

Some strategies to reduce wintering costs include:

- **Delayed housing**
- **Early turnout**
- **Outwintering systems**

It is unrealistic to assume that we can outwinter finishing cattle, but there are options for reducing wintering costs for suckler cows, particularly spring calvers, and store cattle. The issue here is not the ability of cattle to survive outdoors, indeed recent studies have shown that they have fewer problems when outwintered, but the damage to fields (and feed wastage) due to a combination of high rainfall and imperfectly drained soils.

Examples of alternative low cost cow wintering systems include:

- **Outwintering cows on forage brassicas and straw**
- **Outwintering cows on deferred grazing – strip grazed grass**
- **Outwintering cows on deferred grazing on a dry hill**
- **Outwintering weaned calves on forage brassicas and straw**

Outwintering suckler cows

The vast majority of UK beef production systems revolve around the use of grass for grazing in summer and silage in winter. Considerable investment has been put into buildings and equipment designed to make silage feeding easy and efficient. So why should we consider outwintering systems which take cows back outside for part of or all of the winter? Why, because our current systems are expensive in terms of the building, machinery fuel and labour costs and are mostly uneconomic without subsidy.

Future profitability of beef will depend on increasing returns and reducing costs. On the cost side, bedding and machinery costs would appear the easiest targets to tackle.

Most farmers can easily value the cost of straw, but can you also put a cost on driving in and stacking bales, bedding courts, mucking out and spreading the dung? Strip grazed outwintering systems miss out the straw costs and encourage cattle to efficiently spread the dung across the field themselves! This is not a new idea and a few farmers had worked outwintering systems that suited their soils and systems, before SAC, co-funded by QMS, set up demonstrations that encouraged uptake of outwintering systems.

Further information on outwintering systems can be found in the QMS/SAC publication *Cattle Outwintering Systems* published in 2007.

Advantages

- Save on costs associated with straw bedding and machinery
- Reduce wintering costs by keeping cattle out for part or all of the winter
- Potential to increase numbers of cows kept with some inwintered and outwintered
- Outwintering dry cows provides extra capacity to retain store cattle that would normally be sold
- Store cattle can be successfully outwintered on forage crops plus straw, thus reducing their wintering costs and reducing pneumonia risk
- Evidence that spring calving cows have fewer calving problems if 'exercised' on outwintering systems

Key requirements for outwintering

Shelter and a dry lie

Welfare will be compromised if the cattle cannot find shelter from the prevailing wind or if they cannot find a dry lie – either on a runback area, or as has been commonly observed, on the strip that they have grazed that day. Only farms that have well drained soils and reasonable rainfall will prove suitable for outwintering.

Eliminating damage to soils and run off

Most soil damage and run off is caused by either deep ruts from tractor tracks, or animals congregating round ring feeders in one location over a period of time. These systems eliminate the need for heavy machinery in the field after the cattle start feeding, by setting

2. Reducing cow wintering costs *continued...*

up rows of bales beforehand that can be fed as the feed face moves forward. The system allows water to settle in hoof marks rather than run off in deep ruts.

Minimising poaching

Moving the feed face forward every day using an electric fence gives the cattle a fresh bite and slowly moves the cattle across the field. This movement of the feed are prevents animals from congregating in one part of the field for any length of time, which is the main cause of poaching.

Breed and condition score

We recommend that only the fitter cows at around Condition Score 3 off grass, are outwintered on forage brassicas. Cows are likely to lose some condition on the system, therefore some need to be excluded. In the SAC case, those excluded were lean cows, first and second calvers and any cows over 9 years of age. In terms of breed "maternal" types that hold condition well are more suitable than cows bred from "terminal sire" bulls.

Restricted access

Cattle are offered a fresh bite of a calculated amount of strip grazed forage that is usually supplemented by big bales of either straw or silage. This means that each animal gets the correct requirement of forage brassica and tops up with roughage. This needs to be calculated using test weighing the crop and ration calculation. It also ensures effective utilisation of both leaves and stem.

Minerals

Free access minerals need to be fed to balance any deficiencies in the diet. Cattle on forage brassicas should receive increased levels of copper, selenium and iodine.

The favoured systems

Swedes

Swede crops offer the highest potential yield of the forage crops. This system is best suited to free draining soils because the high yield means a longer grazing period on each strip and increased risk of poaching and damage to soil structure.
Stocking rate: good yield – 22 cows/ha (9 cows/acre) for 100 days.

Stubble turnips

Stubble turnips are best sown in early to mid August, which makes them a suitable crop to after wholecrop cereal, winter barley or early harvested spring barley. Establishment can be hit or miss in drier season and soil moisture or rain within 10 days of establishment are essential. However this is an excellent opportunity to grow feed that helps delay the costs of housing on farms with arable crops. Modern varieties are reasonably frost hardy and have been grazed well after the turn of the year in recent seasons. Best results when disc fields, sow and Cambridge roll.
Stocking rate: good establishment approx. 5 cows/ha (2 cows/acre) for 100 days.

Kale

Strip grazed kale is the best option for farmers considering outwintering in wetter areas. Direct drilling the kale seed into a grass sward that has been desiccated using glyphosate leaves a root mat and some regrowth that helps bind the soil and reduce poaching. Best sown around early June.
Stocking rate: approx. 10 cows/ha (4 cows/acre) for 100 days

Deferred grazing

Deferred grazing systems generally involve setting aside and resting areas of grass for grazing in autumn and winter. SAC Trials in 2007 involved shutting off and fertilising a field in July. The long grass was grazed off behind an electric fence, moved every day. Cows were grazed solely on this grass, without any other supplementation, from mid November to early January. Previous experience showed that grass quality deteriorates by New Year and cows should ideally be taken off deferred grazing at this point, or supplementary feeding started. At SAC 19 cows grazed 2.7ha for 56 days, but grazing will vary depending on farm, sward and altitude. Subsequent spring grazing can be delayed and more seed may need to be broadcast in areas where cattle have sheltered. Again deferred grass can help delay housing by around 2 months.

Other farmers have avoided grazing stock on hill areas from midsummer and grazed the "standing hay" from October to March with supplementary concentrates from January onwards.

2. Reducing cow wintering costs *continued...*

CASE STUDY

Jim Riddell, Nether Coullie, Kemnay, Aberdeenshire

Jim Riddell has been outwintering cows at Nether Coullie, Kemnay, Aberdeenshire every year for the past 26 years through a variety of mild, frosty, snowy or wet winter conditions. This has resulted in a significant savings in shed costs, feed cost, mucking out costs and feeding time.

This is not a system that would suit every farm and has only been possible through use of free draining sandy loam soils that don't suffer structurally, recover quickly, and go on to grow good crops of feed barley the next summer. Another key factor is the cow type – the herd is predominantly Aberdeen Angus of "medium" size – which tend to hold condition well. Average cow weight at weaning was found to be 586kg when the farm was used as an outwintering demonstration farm

It is feasible to outwinter cows from late October right through calving to early April in a good year with the number of cows carried dictated by the size of the swede crop which can vary considerably from year to year. All of the spring calving cows are outwintered with the exception of in calf heifers, first calvers and any cows in poorer body condition score which are housed on silage based diets. Some cows are taken off the swedes and housed in harder winters if there is a risk of body condition decreasing too far. The farm carries approx. 120 spring calving cows and heifers and around 80 cows can be outwintered on 12 acres of swedes plus straw bales in a decent year. This is good swede growing land and a typical yield is 115 tonnes/ha (46 t/acre) with exceptional crops up at 148 tonnes/ha (60 t/acre).

Swedes are rationed by moving a temporary electric fence each day to provide fresh roots and shaws. Experience and judgement of condition score is used to decide how many rows to allow each day. The whole operation takes 15 minutes and provides an excellent opportunity to see each animal individually while they are lined up on the fresh break. A further 15 minutes is required to provide roughage in the form of three straw bales fed from ring feeders near the access road. Swedes are drilled on the flat and very little is wasted using this strip grazing system.

Whilst some shelter is advisable in the worst winter weather the outwintered cows longevity, fertility and productivity has proved to be as good as for housed cows provided that condition score is monitored.

Advantages

- **Quick and easy feeding with minimal machinery and labour input**
- **Opportunity to check all cows whilst lined up to feed**
- **Shed space vacated by cows is used to finish cattle thus boosting net margin per hectare.**
- **No need to make, store and feed silage to cows – most of the silage can be fed to weaned calves and finishing cattle again boosting output and margin per hectare.**
- **The amount of straw fed is roughly equal to the amount of bedding cows would have used if housed. The real saving lies in substituting low cost swedes for higher cost silage and also by saving mucking out costs.**
- **Outwintered cows are healthier and well exercised – the latter helps reduce the risk of difficult calvings.**

Care must be taken to:

- **Select a free draining field which will not poach too badly.**
- **Select a field with some shelter against the worst winter weather.**
- **Monitor cow condition and be prepared to pull out lean cows for extra feeding elsewhere**
- **Adopt a flexible approach in years when swede crops are below average – there always needs to be a Plan B.**

3. Feed planning, rationing and reducing cost of purchased feeds

A Managing purchased feed costs

Before any feed is purchased it is important to work out what feed is most suitable and how much you are likely to need. Analysing forage is an essential tool to help decide which concentrates are needed to balance up rations. Once the forage has been analysed having a ration worked out to meet your stocks' requirements will allow a decision to be made on to what to purchase. Keep in touch with local suppliers to see what the best buys are that suit your system.

Consider group buying; this can get reduced prices through a bigger tonnage, also giving manufacturers notice of how much is needed allows them to plan ahead too and offer the best prices. A wider range of feeds, including distillery co-products and food and arable industry by-products, could be available through merchants that is not available to farmers directly.

Taking feed in bulk rather than in 25kg bags will save around £25/t and taking in tonne bags instead of 25kg bags will save £18/t. This is only a saving if the feed is not then to be bagged on farm (labour cost). Buy feeds that meet the needs of your stock, cheaper lower quality feeds are a false economy and are likely to cost you more in the long run.

B Accurate rationing is crucial

A significant number of farmers don't bother to analyse their forages or get rations calculated to ensure that:

a) the ration is going to deliver the intended target liveweight gain or body condition and
b) that performance is on track at the lowest possible cost.

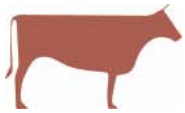
Feed is the largest cost in any cattle finishing system, so why leave rationing to chance?

The following table shows three rations for 500kg steers fed a silage and barley diet to gain 1kg/day – for cattle fed on silages that are good, average and poor for energy (ME).

Silage quality	Silage required	Barley required	Cost/kg gain barley @ £145/t silage @ £25/t
Poor	22kg	5kg	£1.30
Average	24kg	3.8kg	£1.18
Good	25kg	2.5kg	£0.95

If the farmer assumes that his poor silage is of average quality his finishing cattle will grow at a slower liveweight gain and take longer to finish thus increasing costs and upsetting marketing plans.
If the farmer assumes that his good silage is average then he will lose out on 23p/day of feed cost savings he could have gained, had he analysed the silage and got rations calculated. 23p/day saving is £41/steer over 180 days and £4100 for a hundred finishing cattle.
And thirdly, the cost differences show the value of setting out to make good silage for finishing cattle. For 100 cattle over a 180 day winter the saving between good and average silage is £4140 and between the good and poor silage is £5760.

think.
plan.
do...



3. Feed planning, rationing and reducing cost of purchased feeds *continued...*

C Feed budgeting and planning winter feeding chart

The following chart shows the steps required to make decisions based on the quantity and quality of silage that you have in your pit.

Measure forage stocks

This should be done to assess how many tonnes of dry matter the farm has to feed. Is is important to measure stocks in the dry matter as silages vary year on year. Density is dependant on the DM of the silage: this can be calculated as follows:
PIT SILAGE (t) = length x width x height x density. Total tonnes x DM%/100 = tonnes dry matter
Note: Length, width and height of the pit are measured in metres. Assume the ramp is half the pit height and add this on.
BALE Silage No of bales x weight of bale x dry matter/100 = tonnes DM. Weigh a representative bale (probably between 500-750kg per bale depending on the dry matter).

Do you have enough stock for the feeding peroiod?
If you know the dry matter (DM) of forages you have available you can estimate how much you require. See guide box 1.

NO → **Look at your options early...**
Could you sell some stock? Buy in forage? Sow some crops? Better to plan early than later in the season when it's too late

YES

Allocate the correct forage to each class of stock
For example, your best silage would go to ewes, autumn calvers (lactating) and growing cattle; lower quality silage is better suited, for example, to dry spring calving cows in the earlier part of the winter.

Ration planning
Get a ration plan in place to ensure you are not over or under feeding. For example, getting cows and ewes into the correct condition for calving or lambing, and ensuring that store cattle liveweight gains are on target. A nutritionist will make up rations using your forage and what concentrates are available. Knowing what and how much you are feeding will give you control of how the stock will perform.

Group animals
For example group cows into thin, fat and OK and feed them accordingly. The same anount of feed will be used but in a more targetted approach.
Seek ration advice for availability and prices of concentrates and what is best suited to the forages you have.

Are rations working?
Assess condition of cows and ewes regularly and weigh youngstock to ensure rations are working and condition/ growth targets are being met.

Guide Box 1 Forage requirements calculation
DM intakes of animals will vary depending on breed and the quality of the forages being fed.
A Count the number of cows that need feeding over winter.
B Estimate the cow's daily dry matter intake of silage (DDM)
C Multiply the number of cows (A) x DDM (B) = Daily DDM
D Multiply the Daily DDM (C) x estimated feeding period (days) = Kg DDM required to feed cows over winter.
E Repeat for each class of livestock
F Add together all livestock grass silage DDM requirements and add a safety margin in case of a longer winter and wastage (eg 20%) = total silage dry matter requirement over winter feeding period. If you want carryover stocks add them here.

The table below can be used as a guide. ***It is based on a generic grass silage ration*** and is highly dependent on silage quality. If you have more detailed formulated rations available substitute typical figures with your own. The table also shows target quality by appropriate class of stock.

	Daily Dry Matter intake (DMI) silage	Target ME/kgDM
Rearing cattle	4.0kg	10.5
Finishing cattle	7.0kg	10.5
Spring suckler cows	7.0 (+ straw)	9.5 -1 0
Ewes	1.0kg	11.0
Lambs	0.5kg	11.0

Calculate the surplus of shortfall in grass silage requirements on your farm using the total silage DM grown less estimated total silage DM required. Convert any tonnage shortfall in grass silage from dry matter back to fresh weight (eg 100t DM shortfall divided by 25% ie .25 = 400t fresh weight required).

4. Improving Suckler Herd Fertility

Managing and improving your herd's fertility is one of the easiest ways to increase your beef enterprise margin without making any major structural changes to your business. Much of this can be simply achieved through good management that minimises the chance of things going wrong be this infertility, calving problems or calf losses. Two main ways to improve suckler margins are:

- **Increase the number of calves reared for every cow and heifer put to the bull**
- **Achieve a compact calving of around 9-10 weeks with a target of 65% calves born in the first 3 weeks of calving.**

Scottish suckler herd performance

QMS Enterprise costing figures show that the average Scottish suckler herd rears only 87 calves for every 100 cows and heifers put to the bull, when the top third are achieving 90% and the best herds can manage over 95%. Consider the extra value you could add to your income if you could consistently achieve a target of 94%.

	Calves reared per 100 cows/heifers to bull		
	Bottom third	**Average**	**Top third**
Cows reared per 100 cows and heifers to bull	83	87	90
Extra calves compared to bottom third	-	4	7
Extra calves if reach 94% target	11	7	4

* **Source** *Cattle and Sheep Enterprise Profitability in Scotland – 2009, 2010 and 2011. Aggregated data for Non LFA, LFA selling weaned calves and LFA selling yearling calves.*

Compact calving

Herd fertility involves more than just getting cows in calf. The true measure of fertility is getting cows in calf in a tighter calving period. Our target is a 9 week bulling period for cows that results in a calving period of 9-10 weeks. While more calves may be reared by extending the mating period in any one year, this leads to the retention of poorer cows, poorer fertility and a lot of cows that have not calved by the time mating starts. Herds with a compact calving are easier to manage and suffer from fewer problems.

The financial benefits of better fertility

What is the combined financial benefit from raising the numbers of calves reared and achieving a compact calving? The table below shows the impact of firstly raising the percentage of calves reared per cow and heifer to the bull from 87% to 94% with a moderate or "average" calving pattern which improves margin by £44/cow, then factoring in a tight calving pattern with 65% of calves born within the first three weeks of calving, which further improves the margin by another £54/cow, for a combined gain of £98/cow or £9816 per 100 cows in the herd.

	Rear 87% calves Moderate calving pattern	Rear 94% calves Moderate calving pattern	Rear 94% calves Compact calving pattern
Calves reared %	87	94	94
Av weight per calf weaned (kg)	274	274	299
Av calf wt weaned per cow/heifer (kg)	238	258	281
Average price (p/kg)	2.30	2.30	2.30
Output per cow (£)	548	592	646
Change in output (£)		44	98
Change for 100 cow herd (£)		4411	9816

* *Moderate and Compact calving patterns taken from SAC Consulting Fertbench programme results.*

The benefits of a tight calving pattern

- **Calves –** calves born earlier in the calving period are heavier at weaning, which makes a significant difference to weaning weights.
- **Labour –** working with larger batches of more evenly sized cattle, easier management of suckler herd, less time involved checking on cows calving.
- **Selecting heifer replacements –** more calves born early in the calving period means a bigger pool of well grown heifers to select from for bulling (target mating weight is 65% of mature cow size).
- **Calf health –** larger batches of similarly aged calves reduce risk of disease spread e.g. scours from older to younger calves.
- **Cows –** easier to manage condition score, less risk of late calving cows becoming overfat resulting in difficult calvings, particularly in autumn calving herds.
- **Marketing –** more even batches of calves at sale.

4. Improving Suckler Herd Fertility *continued...*

Key areas to tackle to improve suckler herd fertility

- **Management of replacement heifers** – bulling weights, tight mating, preferential treatment as bulling heifers and first calvers – this is the key factor.
- **Managing cow condition** – year round, but particularly condition score at calving.
- **Checking bull fertility** – soundness, fertility testing, checking records.
- **Avoiding difficult calvings** – cow condition and bull EBVs.
- **Health planning and avoidance of disease problems –** discussing your farm situation with your vet, buy replacements from Checks accredited herds.
- **Monitoring your herds performance –** use a monitoring tool such as the SAC Consulting Fertbench programme.

Targets for improved fertility

- **Calvings per cow and heifer put to the bull – 95%.**
- **Barren cows – 5% or less.**
- **Cows calving in first 3 weeks – 65%.**
- **Bulling periods – 9 weeks for cows and 6 weeks for heifers.**
- **Calf mortality birth to weaning – less than 3%.**
- **Calves reared – 94% (calves reared to cows and heifers bulled)**
- **Replacement rate - less than 15%**

To find out more...
Contact QMS to obtain a copy of the booklet *A Guide to Improving Suckler Herd Fertility* or download a copy from the QMS website www.qmscotland.co.uk.

CASE STUDY Alex King, Wolfstar, Ormiston, East Lothian

Alex and Ross King run 160 late spring calving suckler cows and 20 pedigree Simmentals on areas of permanent pasture within their mainly arable unit at Wolfstar in East Lothian. The beef herd is managed to fit in with other arable work with a tight 9 week bulling period leading to an equally compact calving in late April/May/June. Cows are currently crosses of Simmental, South Devon and Aberdeen Angus with Simmental and Aberdeen Angus bulls criss crossed to provide replacements and a number of breeding females for sale. Calves are finished as steers or heifers on an ad lib concentrate diet.

2011 calving figures are impressive with 97% calves reared per cow and heifer to the bull, 66% calving in the first three weeks of the calving period, and all of the calving finished within 9 weeks. These figures were at the top end of Fertbench results for 2011 and have been consistently achieved for several years.

What are the secrets of their success?

- **Use of breeds with good maternal characteristics**
- **Selection of bulls for maternal traits as well as growth rate and muscle.**
- **Selecting heaviest heifers for breeding at turnout with a 10 month target weight of 380kg, target gain of 0.9kg/day in first winter.**
- **Hybrid vigour – Alex comments that fertility improved when he moved away from 7/8 or 15/16 Simmental to cross cows.**
- **Management of cow condition – grouping according to condition or age, and control of diets from weaning to calving to avoid overfit cows.**
- **Preferential treatment of first calvers – housed along with leaner cows to provide an opportunity to grow and maintain condition.**
- **Bull MOTs – bulls examined and semen tested each year – reduces the risk of a subfertile bull wrecking the calving pattern.**
- **Culling for problems – no second chances for barren cows.**
- **Herd health monitoring through a Herd Health Scheme and buying in stock based on their health records.**
- **Outdoor calving in May and June (when weather permits) – physically fitter cows calve easier and less risk of disease spread from calf to calf. Only heifers calved indoors.**

This is a classic example of good heifer selection and management leading to a tight heifer calving and close management of cow and bulls maintaining that pattern year-on-year.

5. Using EBVs to improve beef margins

Bull selection

Many producers buy a bull on looks alone. While this does provide useful information on it's scale, length, correctness, soundness and condition, judging by eye cannot provide other critical information on how his calves will perform, such as:

- **How easily will his calves be born?**
- **How fast will they grow?**
- **What will be the carcase yield & eye muscle area of his progeny?**
- **How milky will his daughters be?**
- **How fertile his daughters will be?**

The above characteristics are determined by the bull's genetics and the tools to measure this have been available for some time in the form of Estimated Breeding Values (EBVs).

Using a combination of EBVs and your EYE, will give the best chance of buying the correct bull for your needs.

Which EBVs are most important?

The most important EBVs will depend on whether the bull is being selected as a terminal sire, a dual purpose/maternal bull where some of his heifers will be kept for breeding, or a bull bought to use on heifers. The priority in all cases is **a live calf**.

	Terminal sire	Breeding Heifer replacements	Use on Heifers
Ease of Calving Direct	✔	✔	✔
Ease of Calving Daughters		✔	
Gestation length			✔
200 Day Milk		✔	
400 Day Weight	✔	✔	
Also consider	Beef Value/ Retail Meat Yield	Scrotal size Link with fertility	

For more detailed information refer to the QMS booklet *Bull Selection Made Simple- A Guide For The Commercial Buyer*
Download a copy from www.qmscotland.co.uk or you can obtain a hard copy by contacting QMS on 0131 472 4040.

CASE STUDY 1

The pedigree bull breeder. David Walter, Balthayock, Perth

David Walter has no doubt about the impact that 35 years of performance recording has had on the progress made by his pedigree Charolais enterprise. His bulls are in demand from buyers and many of his young stock feature in the British Charolais societies most promising bulls list. He has developed a reputation for selling bulls that last, are sold in 'fit not fat' condition with excellent EBVs for growth rate and easy calving.

"It gives us a lot of pleasure when customers say how well a bull has done. This to me is far more valuable than a red, white and blue rosette gathering dust in the farm office" says David.

The breed has featured at Balthayock since a Charolais bull was purchased from the first breed sale at the Royal Show in 1969. At present the farm is stocked with 70 pedigree Charolais cows and just over 150 commercial suckler cows. Home bred Charolais bulls are used on the commercial cows and all stock is finished on farm. About 25 Charolais bulls are sold annually at the Societies national sales and others are sold privately.

"Breedplan is a mine of information where you can find out everything you want to know about all animals in the country. It helps inform my breeding and purchasing decisions and my belief that the science behind the system has not only worked but excelled in practice. The figures show that we have been making the right decisions, and we can see this on screen and on paper".

"Breedplan is not perfect and it does not measure some very

5. Using EBVs to improve beef margins *continued...*

important qualities such as good feet, locomotion, conformation and docility in bulls and udder shape in females, but if used intelligently with all the information put into the system 100% correct, it is a wonderful tool for breed improvement. I use it to select the best heifers for herd replacements so I have a compelling reason to ensure that all my figures are correct. I pay particular attention to the balance between easy calving direct and in their daughters, the 200 and 400 day weights, the latter confirmed independently when the animal is scanned to measure its eye muscle area, and the EBV for milk, all of which are vital in making the right choice. By recording every calf born whether good, bad or indifferent and only keeping the best, it is not long before massive improvements in herd performance are achieved."

According to David the most important issue is to get the genetics in the cow herd right. If you can breed a cow herd of consistently high genetic merit you can then afford to bring in bulls that improve on different attributes without compromising performance. David also finds the mating predictor, which provides estimates on the EBVs of the progeny of each cow/bull combination very useful.

This scheme has enabled the Balthayock herd to achieve impressive breed improvement with particular emphasis on easy calving, growth rate, milk yield, eye muscle area, scrotal circumference and retail yield EBVs.

Balthayock Adonis

David considers this to be the best bull he has ever bred, one that ticks all of the boxes. Its attributes are also reflected in it's progeny with 133 animals listed on the British Charolais website, including renowned bulls Balthayock Eagle and Blelack Digger. There is much evidence to show that Adonis and his sons are breeding consistently across a number of herds.

The standout features for the bull are it's exceptional growth rate and eye muscle area combined with easy calving both direct and for daughters. It shows postive EBVs for eye muscle area and scrotal circumference – traits which normally have a negative correlation. The eye muscle is where the quality and the highest value lies in the carcase and this should be recognised in future when value based grading is introduced. This bull has high accuracy percentage figures due to the large number of relatives and progeny in the pedigree Charolais population.

Balthayock Adonis EBVs

September 2013 BRITISH CHAROLAIS BREEDPLAN ANALYSIS															
	Calving Ease Direct (%)	Calving Ease Daughters (%)	Gestation length (days)	Birth Wt (kg)	200 Day Wt (kg)	400 Day Wt (kg)	600 Day Wt (kg)	Mat. cow Wt (kg)	200 day milk (kg)	Scrotal size (cm)	Carcass wt (kg)	Eye muscle area (cm²)	Fat depth (mm)	Retail beef yield (%)	IMF (%)
EBV	7.8	2.6	0.5	2.6	40	68	85	-	10	0.3	72	7.9	-1.7	4.1	-0.8
Acc	76	63	81	91	89	88	83	-	62	81	76	63	72	69	58
Breed Avg. EBVs for 2011 born calves															
EBV	-1.2	-0.6	1.3	2.7	25	42	48	48	5	-0.2	38	3.0	-0.4	1.0	-0.1

think. plan. do...

5. Using EBVs to improve beef margins *continued...*

CASE STUDY 2

The commercial breeder/finisher. Graeme Mather, Shandford, Forfar

Beef breeder and finisher Graeme Mather has evidence to prove that finished cattle sired by bulls with higher value EBVs are showing better performance and returns when compared to bulls with poorer figures. He reviews the performance of his finishing cattle using data from EID records, the SAC Livestock Record Programme and abattoir returns. As a pedigree Charolais breeder in his own right, who now breeds most of the bulls used on his commercial herd, he needs to know whether his bulls are improving growth rates and margin over feed costs in the finishing herd.

The table below shows the results from a study of Charolais cross heifers born in 2009 undertaken by the Mathers, ABP and the British Charolais Society. Charolais cross heifers sired by Bull A, within the top 35% for 400 day growth, finished at an average 360kg deadweight within 648 days (just over 21 months) and achieved a margin over total feed costs of twice that of heifers by bull D, whose 400 day growth EBV was in the breeds bottom 10%. Progeny of Bulls A and B have clearly outperformed C and D in terms of slaughter weight, daily liveweight gain and margin over feed costs. Carcase value and margin over feed differentials would be more pronounced if calculations were to be adjusted for current costs. Figures for daily liveweight gain and slaughter weight for 2011 born heifer and bull calves have also been analysed and these results confirm the general correlation between high 400 day growth and high daily liveweight gain. However the differentials in performance are becoming smaller as Graeme has culled the poorer performing stock bulls and replaced them with others of higher genetic merit.

Sire	400 day growth EBV	Slaughter weight (kg)	Days to slaughter	Average daily LW gain (kg/day)	Carcass weight (kg)	Carcass value (£)	Margin over total feed costs (£)	Difference in margin from Bull A
A	45	654	648	0.94	360	1187	539	-
B	40	606	650	0.87	333	1100	450	-89
C	28	496	618	0.74	273	900	282	-257
D	27	467	602	0.73	263	868	266	-273

"These differences may appear unreal for producers yet to get to grips with performance recoding data and understanding the relevance of EBVs" says Graeme, "but we know from experience that it is worth taking seriously."

Graeme, in partnership with his grandmother Mary, father Graeme, uncles David and William, and cousins Scott and Grant, farm 560 ha (1600 acres) of arable and grass at Shandford Farm, Fern, near Brechin. Livestock consists of 1400 breeding ewes and 360 spring (February to April) and summer (May to July) calving cows. Most cattle are finished on the farm with spring born male calves left entire to be finished at 12-15 months and heifers finished on grass/forage diets in their second winter. Steer calves are sold store.

All calves are given EID tags which allow weights and gains to be easily recorded at regular intervals. This allows Graeme to assess how animals are performing according to target and crucially when finishing cattle hit peak growth rate.

Most of the stock bulls used on the commercial herd are now bred through the 20 cow pedigree herd and Graeme is looking to get top 10% performance in the British Charolais breed for calving ease and 400 day growth. Difficult calvings are avoided through good management of cow condition – "fit not fat" - and selecting bulls with positive direct calving ease figures. Again Graeme has noticed a correlation between calving ease direct EBVs and calf birthweights which are measured using a birthweight tape, which measures the circumference of the coronary band at the top of the calves hoof and converts this into an estimated weight. "My aim is to keep birthweights under 40kg to practically eliminate difficult calvings at the same time as seeing calf growth rates edge towards 2.0kg/day for bulls and 1.0kg/day for heifers" says Graeme. He works closely with ABP in Perth and Sainsburys and is keen to get feedback from the abattoir that will help further improve performance.

6. Improving Calf Survival

A Colostrum – essential for calf survival

Suckler herd profitability is largely influenced by numbers of calves reared. After delivering good cow conception rates and a relatively trouble free calving, ensuring that all of your calves survive their first few days is key to rearing target numbers and maximising calf growth rates.

Obtaining adequate colostrum in the first hours of life is crucial to ensuring calf survival. Colostrum is both a rich source of nutrition that also provides protection through antibodies against the infections that calves are likely to encounter in the weeks ahead. Calves that receive insufficient colostrum are three times more likely to die than those that received adequate colostrum.

Calves require 10% of their own bodyweight of colostrum in their first 12 hours of life e.g. 4kg of colostrum for a 40kg calf. The timing is important because after 12 hours their ability to absorb colostrum rapidly falls. If you are going to provide supplementary colostrum it should ideally be provided in the first 6 hours after birth and within 12 hours at latest.

The antibodies that your calves receive from colostrum can help protect against infectious disease for up to six months. However it is in the first month when this protection is most required. Calves at that time are susceptible to the infections that cause calf scour, navel ill, joint ill and meningitis. Most of the calves that die from these conditions can be shown to have poor levels of antibody from colostrum. The specific protection against calf scour or clostridial disease gained from the colostrum can be increased by vaccinating your cows with the appropriate vaccine and boosted one month before calving is due. This approach can be recommended if either of these groups of disease cause problems in your calves.

Main points

- **Calves require 10% of their bodyweight of colostrum ideally within the first 6 hours and certainly within the first 12 hours.**
- **Cows calving without difficulty and in target condition score should have adequate colostrum.**
- **Cows calving below target condition score 2.0 may produce poor quality colostrum. Calves born to these cows will also absorb colostrum antibodies less efficiently.**
- **It is critical that calves born after a prolonged or difficult calving get adequate colostrum.**
- **An estimate of calf weight can be made using an ankle tape.**
- **Collect colostrum from milky, docile cows within the first 6 hours of calving because antibody concentration reduces rapidly – this can be frozen for later use. Beware that Johnes can be spread through colustrum.**
- **If a calf has not fed sufficiently well give it a top up of 2 litres colostrum at around 6 hours of age.**
- **Artificial colostrum supplements are inferior to the real thing. It is difficult to advise on their use as the antibody content is not declared, because of this you should not use them as anything other than a top-up.**

B Avoiding difficult calvings

Difficult or prolonged calvings often result in either dead calves, or weak calves that are slow to get up and suck. Weak calves have less drive to consume sufficient colostrum within the critical time limits. Ensuring that these weak calves get sufficient colostrum, ties up a large amount of labour that could be diverted to other tasks if the problem could be dealt with at source – by minimising the prospect of difficult calvings.

Minimising difficult calvings

- **Over fat cows are slow to calve and have more difficult calvings than cows calving in the target condition score. Fitter cows will have more fat around the birth canal, increasing calving difficulty.**
- **Use EBVs to select bulls with low calf birthweight, short gestation length and good calving ease direct traits. Long gestation normally leads to increased birth weight, which increases the risk of difficult calvings. Avoid bulls with extreme minus calving ease figures.**
- **Check calving ease figures for bulls used to breed replacements as EBVs are now provided which tell us how easily a bulls' daughters will calve as cows.**

6. Improving Calf Survival *continued...*

Calves require colostrum ideally within the first 6 hours and certainly within the first 12 hours of life

CASE STUDY John Paterson, Hartbush, Dumfries

Hartbush, the Dumfries Monitor Farm (Beef Finishing) is a 245 ha (604 ac) mixed beef, sheep and arable unit on the outskirts of Dumfries, run by John Paterson. John runs 260 mostly SimmentalX and LimousinX suckler cows put to Simmental, Limousin and Charolais bulls. All young stock are finished on farm with young bulls are sold prime at 13 to 14 months and heifers finished from 18 to 20 months of age.

Calf survival was identified as a priority objective early in the Dumfries Monitor Farm programme, particularly in relation to losses through infections in early life. The farms vet, Peter Hastings, of Nithsdale Vets, thought that survival rates could be improved through ensuring adequate colostrum intake shortly after birth.

Accordingly, in spring 2013 the Hartbush team set about ensuring that every calf had 3 litres of colostrum within their first 4 to 6 hours of life. Calves were checked within 3 hours of birth to ensure they had suckled and checks continued until they were 12 hours old. John and Amanda found it much easier to get calves to suckle at 3 hours than later in their first day. "It was noticeable how they still had a real urge to actively suckle if you were trying to help them in their first 2 or 3 hours. If you were later in doing this they seemed to have lost that urge and were a lot more difficult to handle."

To monitor the success of the strategy Peter Hastings then visited the farm once a week during calving to blood test all calves up to a week old. These blood samples were analysed to ascertain the levels of immuno-globulins in each calf's blood stream. Peter's analysis showed that 50% of calves had adequate levels of immuno-globulins in their blood. The other 50%, despite all the efforts of the team to ensure they had the 3 litres of colostrum within 4 to 6 hours of birth, had lower than desired levels of immuno-globulins. Further analysis failed to identify any common factor - heifers, cows of all ages, those with the more difficult calvings all had 50% of calves with low levels of immuno-globulins.

Unfortunately, given the weather and resultant dietary challenges of spring 2013 losses at Hartbush were up on last year. However John said "The calves definitely suffered from less scours, which I take to be evidence of the vaccination immunity being passed successfully from cow to calf through the improved colostrum intake. Unfortunately crypto is not influenced by colostrum intake and our results were affected by that this year. I do believe the changes were worth while and heaven knows what might have happened this year if we hadn't done what we did."

Given the 50% of calves with lower immuno-globulin levels this is considered to be a work in progress and we now plan to alter the cows' diet as they approach calving next year to see if levels of calf immunity can be further improved.

7. Simplified feeding systems

A KEEPING IT SIMPLE

Alternate feeding of silage and straw for dry cows
A Lanarkshire farmer has recently altered his feeding regime giving him considerable time savings each week.

His Dry Spring Calving Cows are on slats with a base ration of 25kg Silage with 4kg Straw. He was feeding 60 cows in 2 pens of 30. Using a silage round bale feeder it was calculated that he needed 1.5 Round Bales per pen of 30 each day so he used 3 bales in total per day for the 60 cows. At night he then rolled out 1 bale of Straw for all of them.

He then decided that he should calculate what total requirement they required per week rather than per day, as it amounted to the same intake. For all the 60 cows it was 18 Bales Silage and 8 Bales Straw needed per week. He now feeds 6 bales of silage on a Monday, Wednesday and Friday morning. On a Tuesday and Thursday morning they receive only 2 Bales of Straw and sometime at the weekend 4 Bales of Straw are given.

These changes have freed up time - previously he lost time in the afternoons having to return to the steading just to feed out straw to the cattle. Now he has the rest of the day to concentrate on other work.

He also had far less time at the weekend for his family as he was the only labour on the farm. Now on a Saturday when no feed is put out he only needs to carry out a quick visual inspection of the cattle. On a Sunday he quickly rolls out 4 bales of straw. Time saving benefit was estimated to be 2.5 hours per week. It is the small changes that matter.

B KEEPING IT SIMPLE

Using bunkers and hoppers for less frequent feeding
A Borders farmer reduced feeding time and increased his ability to feed different diets to different classes of stock through the construction of multi purpose bunkers outside his cattle shed. Making holes in the outer wall to access locally constructed bunkers transformed feeding time from daily rationing of feed via a central pass to less frequent topping up of outside hoppers.

This system offers great flexibility with bunkers filled with either bale silage, straw, ad lib concentrates or a complete mixed diet, very easily from the outside of the building. Each pen holds 25 suckler cows which are fed silage on Mondays, Wednesdays and Fridays with straw bales fed on the other days. Intensively finished cattle have been fed an ad lib cereal diet with hoppers topped up twice per week.

think.
plan.
do...

8. Improved handling systems

Safe Cattle Handling Systems

SRUC research has found that those finishing cattle which show the wildest behaviour in the crush grow 20% more slowly than the calmest. Whilst cattle temperament is inherited from one generation to the next just as strongly as traits such as growth rate, 70% of poor temperament results from other causes.

Reduced stress during handling can therefore have a significant welfare, time and economic impact on the business, also encouraging greater performance recording of livestock. Good handling systems work by making use of the animals' own behavioural tendencies. This idea is not new in the USA, Canada and Australia and some of the general principles that have been shown to work in these countries have been implemented successfully in the UK at a smaller scale.

Key features of efficient, safe handling facilities

- **Provide a single exit that is obvious at all times by sheeting the sides of races and pens**
- **Eliminate apparent dead ends**
- **Make use of animals tendency to circle a handler**
- **Hide the crush and handlers from view**
- **Avoid distractions from other animals and objects by having solid sides**
- **Keep the system calm, quiet and uniformly lit**
- **Return the animals back in the direction from which they came**

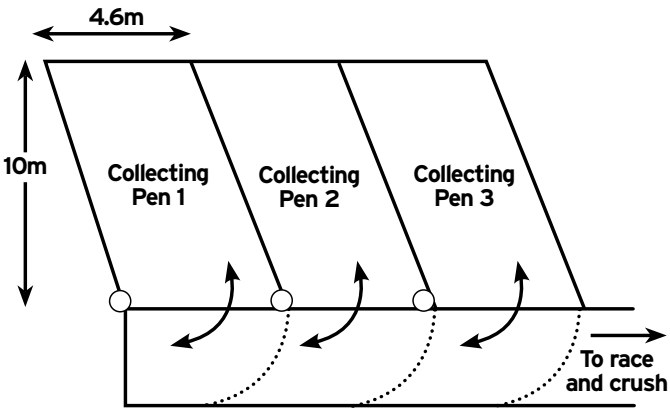
Several other principles become intuitive if a handler walks through a system and sees it from the animal's perspective. Wide collecting pens tend to allow cattle to escape to left or right of the handler and create corners into which cattle can bury their head when the exit gate is opened. In contrast, long narrow collecting pens of one gate width make it easier for a single handler to move animals towards a forcing pen and eliminate corners when the gate is opened.

The diagram on the right shows the configuration of collecting pens at the SRUC Beef Research Centre. A long straight race leading to a crush discourages forward movement. The use of a gently curving race with only a short straight section before the crush will encourage the animals to move forward as the only obvious escape route.

Whilst changes such as these have a cost implication, some low-cost changes can also be made to existing systems which will greatly improve the ease of movement. Examples include removing objects which, when seen from inside the race, appear to block the exit of the crush, removing distracting objects (e.g. string) from the line of vision, reducing the noise of a crush by use of rubber strips and improving the grip of a crush floor. If the opportunity to fit sheeting onto gates is limited, the forcing gate is a priority as one of open design will encourage animals to face the direction from which they came and away from the race entrance.

Why invest in an efficient handling system?

- **Improved operator safety, design the system to encourage the cattle to move themselves**
- **Reduces frustration and liklihood of accidents for man and beast**
- **Faster operation encourages farmers to handle cattle more often, reduces waiting time and costs for vet work**
- **Meat Quality – well designed systems reduce animal stress. Stressed animals have a higher meat pH that leads to tougher dark cutting meat.**



The collecting pens are orientated at a gentle angle to make the exit lane appear less like a dead end. The pens are long and narrow to prevent cattle escaping past the handler when the pens are being emptied

Two SRUC technical notes have been produced which give other suggestions on ways of modifying existing systems to improve movement (TN564) and suggestions for new builds (TN 565).

8. Improved handling systems *continued...*

CASE STUDY

Cattle Handling Systems – Andrew Baillie, Carstairs Mains, Lanarkshire. Clyde Monitor Farmer

Andrew Baillie moved to Carstairs Mains with his family in 2011. Since then he has been building up livestock numbers and adapting facilities to make operations as simple as possible. With the assistance of the Scottish Rural Development Programme – Rural Priorities (SRDP-RP), the installation of a purpose built fixed cattle handling system has greatly improved operator safety and livestock welfare. The time spent handling stock has reduced as has livestock stress and injury, whilst the incorporation of EID has improved business performance.

Andrew reflects that "we used to have to tie up 15 hurdles just to get cattle to the crush. We now simply close three gates". He continues "80 bulls from three different lots can now be weighed and drafted safely by one man in less than 30 minutes"

The system is quiet to operate aided by all of the gates and rails being stock boarded rather than using noisy metal sheeting. The bugle shape handling system exploits the cattle's natural behaviour to return to where they entered from and they calmly follow each other round the system. The forcing pen also doubles up as a loading pen for cattle. This allows the safe loading of cows, store cattle and bulls.

Added Benefits

Having a fixed facility at Carstairs Mains has allowed more regular handling of stock meaning treatments are administered to cattle more timeously. Andrew has experienced improved performance in his herd and problems previously experienced such as feet issues sometimes associated with intensive bull beef have been

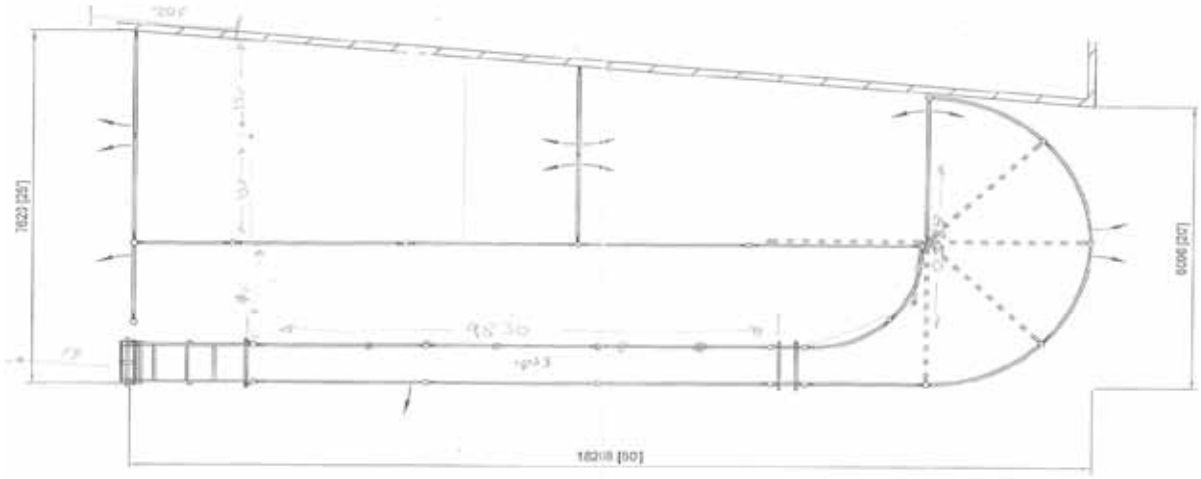
reduced through ease of treatment. Individual treatments are no longer held off until the main handling event.

As well as reducing the time spent handling stock and improving operator health and safety and improving cattle welfare, additional benefits have been gained through the use of EID. Incorporating EID into the system allows Andrew to regularly monitor the cattle weights and calculate the Daily Live Weight Gains of his cattle. Stock can be marketed as soon as they reach the target weights. Equally those not meeting targeted DLWG are highlighted more quickly for further investigation.

Information collected in the handling system is downloaded to the farm laptop. Commenting on the ease of use of the EID system Andrew said "once you get your head round it, it's easy. A bit like learning to use a new mobile phone"

Next Steps

Having embraced the benefits of EID Andrew is now moving towards automatically recording all health treatments as cattle pass the EID reader locate in the crush.



9. Cattle Health

Managing Johne's Disease

Management of paratuberculosis in cattle (Johne's disease) can be notoriously frustrating for farmers, not least because of the very long incubation time of the disease and because infected animals sometimes prove difficult to detect. The three year Paraban project brought together farmers, vets, health scheme providers, laboratories, researchers and industry members to try to increase understanding of the disease and demonstrate how incidence of Johne's could be reduced on farm. The project was led by Scotland's Rural College (SRUC) in partnership with the University of Glasgow, The University of Edinburgh, and the James Hutton Institute, funded by the Scottish Funding Council in conjunction with Scottish Government and with support from Quality Meat Scotland (QMS) and other industry stakeholders.

The project followed nine Champion Farmers and their vets over the course of three years. The farms followed were not chosen because they necessarily had a severe problem with Johne's, as each farm had a different level of infection, but rather because they were run by farmers who were ready to stand up and take the lead through demonstrating how this endemic disease could be tackled across a range of disease levels and types of farm. Results from live animal testing, abattoir testing and environmental testing were discussed at each meeting to help build a comprehensive picture of the issues on each farm.

Testing and control strategies

Early detection and removal of infected animals, before they spread the disease, is key to control. However this is not without its challenges because of a number of factors including a long incubation time, a lengthy delay (years) in antibody production in response to infection (where the antibody does not afford any protection from the disease), intermittent faecal shedding of the causative bacteria Mycobacterium avium ssp. Paratuberculosis (MAP) and consequently, low sensitivity of blood and faecal tests. Samples were also taken of gut and lymph node tissue samples from abattoirs. Environmental sampling of areas categorised as high or low risk was also carried out on each farm - the causative bacteria (MAP) survives best in cool, moist conditions and acidic soils with a high availability of iron.

Results to date

The majority of farms in the Paraban study opted for twice yearly whole herd screening of all breeding animals over one year of age, with isolation and prompt cull of infected animals. A fall in seroprevalence has been observed across these farms during the course of the programme, with an average reduction in positive blood tests (seropositives) of 65%. A combination of test and cull, and management strategies has been effective with farms implementing the most aggressive test and cull strategies making the most headway.

For further information, please contact Selene Huntley or Jo Baughan, Epidemiology Research Unit, SRUC Research, Inverness. selene.huntley@sruc.ac.uk or jo.baughan@sruc.ac.uk

CASE STUDY Tackling Johne's on a Monitor Farm

Johnny MacKenzie, Westfield, Thurso

Johnny Mackenzie, has farmed at Westfield near Thurso for 25 years. The farm is a typical Caithness farm, with beef and sheep enterprises and was chosen as the Caithness and Sutherland Monitor Farm for a three year period from February 2010 to 2013. Livestock consist of 300 mainly Saler cross spring calving suckler cows and 800 North Country Cheviot hill ewes. Achieving better health status was one of the primary aims at the first Monitor Farm meeting and steps were taken to tackle Johne's when the farm became a demonstration unit for the Paraban project. Johnes was a real problem with an average of 2-3 cows per year dying as well as others culled, which were suspected of carrying the disease.

The Westfield bloods test results show a trend of reduction in positive blood tests following the introduction of the test and cull policy. According to Johnny "The twice yearly testing although a lot of work has clearly paid off as numbers of positive animals are reducing. This can be attributed to the separate management groups of positive and negative cattle which in turn is reducing further infection".

Results

Westfield blood test results

Date	No. tested	No. postive	No. inconclusive or suspicious
Jan 2011	Herd (291)	15	27
Dec 2011	Herd (291)	12	2
May 2012	Herd (291)	9	7

Dec 2011 6 of the 12 blood positives were positive on faecal test
Dec 2011 2 inconclusive on blood were negative on faecal test

Tackling the Problem

- **Testing commenced through the PARABAN project which involved twice yearly testing of all adult cattle over 1 years of age. The test comprised taking blood samples and also faecal samples as a back up. This was done at housing and again before turnout.**
- **Due to the fact that cows with clinical Johne's are very infectious, post testing management was also extremely important. Animals testing positive were managed in a separate group and culled immediately if not suckling a calf or culled as soon as the calf was weaned.**

10. Reducing fixed costs through away wintering

CASE STUDY Alastair Robb, Townhead Farm, Stirling

An upland beef and sheep producer near Stirling has successfully boosted his suckler cow net margin by £2,000 following a decision to away-winter his cattle. Alastair Robb runs the 65 cow and suckled calf producing upland unit of Townhead farm in partnership with his wife, Elizabeth. They took the decision to collaborate with a lowland Fife farmer after investigating options as a Quality Meat Scotland (QMS) Stirling Business Improvement Group (BIG) member.

"Alastair was encouraged to trial the concept of collaborating with a lowland farmer to off-winter cattle after visiting a farm in North Yorkshire on the Stirling BIG trip" said Stephen Whiteford, SAC Consulting Stirling BIG group facilitator.

During the visit the group were hosted by two farmers who had entered into a collaborative partnership. One of the farmers was a large scale arable producer with a suckler herd and the other was an upland beef and sheep producer. Due to his high input costs for wintering cows, the upland farmer was incurring considerable losses. Faced with the possibility of having to disperse his herd, he challenged himself to find an arable farmer who would be willing to winter his cattle. In return, the arable farmer would increase his supply of dung and would be able to summer graze his own cattle on the upland farm.

Stephen continues "The mutually beneficial agreement allows the upland farmer to maintain a profitable suckler cow enterprise whilst the lowland farmer benefits from improved efficiency of his arable and suckler cow enterprises."

After witnessing the success of this simple partnership, the Robbs underwent a full financial and technical appraisal of the suckler enterprise. Subsequent to this process the Robbs trialled the off-farm wintering of cattle during 2012/13, sending in-calf cows away at the beginning of November before returning four months later pre-calving at the beginning of March. An agreement with a farmer in West Fife who had available shed space was put in place, whereby the arable farmer would supply silage and the required labour at a cost of £10/head per week. The Robbs supplied straw for bedding and any supplementary feeding.
Alastair noted that "transport costs were quite high but for biosecurity reasons we felt it was a worthwhile investment to ship the cattle to a farm which does not have stock, to avoid any disease transfer risk."

Key points

- **Importance of attending meetings to see others ideas - decision made to away wintering after getting idea from Stirling BIG (Business Improvement Group) trip to Yorkshire.**
- **Upland farmer reduces cow wintering costs, lowground farmer increases supply of dung for arable land**
- **Important that both parties sign up to a written agreement covering all eventualities.**
- **Biosecurity a key issue - move stock to farm that does not keep cattle.**

The result was an over-wintering cost saving of more than £2,000. One key area where savings were made was on the reduced amount of concentrates required because the cattle were in-wintered. Alastair also said "this would have been a larger saving were it not for the fact that we had to buy in more silage than expected when they came home due to the exceptionally slow spring"

The Robbs are planning to repeat the off-wintering of their cattle again this winter and confident further savings can be made, perhaps by reducing straw costs by renting a slatted or cubicle shed for the 2013/14 winter.
A further major benefit of the off-wintering was it allowed the Robbs to have more time to focus on the overall management of the farm during the winter as a result of not having to feed and check the cattle each day.

think.
plan.
do...

SHEEP OPTIONS SECTION 2

1. Developments in lower input sheep systems

A desire to reduce costs and difficulty finding suitably skilled labour has prompted an upsurge of interest in lower input lambing systems in recent years. Rises in input costs have not been matched by the increased value of lambs making lower labour input systems attractive. Farmers often take up the system when sourcing labour is a problem or when downsizing a flock after the shepherd retires.

Lambing is the pinch point for labour with typically one man per 150 ewes indoors. The key to reducing labour input in larger flocks has found to be lambing later outside on grass which eliminates ewe feeding, separate penning and trafficking back to the field with ewes and lambs. The number of ewes assisted in low labour flocks is now typically less than 10 ewes per thousand, achieved through selection for easy lambing and reducing condition score to 2-2.5 at lambing. This allows one man to manage 600 ewes at lambing for meat and wool breeds and one per 2000 ewes if ewes are wool shedding and less likely to get backed. Such improvement does not occur overnight and much planning needs to go into breed selection, culling policy and management.

Typically production levels are 20% lower at around 150-160% lambs sold compared with the best indoor lambing flocks. Lambs do not attain the highest auction prices for E and U grades as later born lambs selected for easy lambing result in poorer conformation, but it is possible to produce a majority of R3Ls which is perfectly acceptable for the home lamb market. Low labour systems suit larger flocks or instances where labour is limited. Lamb losses around lambing tend to average 10-15% of lambs born due to fewer triplets. Most of the tasks associated with sheep are due to wool and where breeders have incorporated wool shedding genes by using Easycare rams production of around 3000 lambs per man/year has been attained.

Breeding

The low labour approach works best with closed flocks – closed for all but ram purchases. Breeds used include Lleyn, NZ Romney, Rissington Highlander and wool shedding Easycare. Ewes that have to be assisted to lamb, leave their lambs at birth, need help to suckle or have been handled for any reason outside of a flock gather can be subsequently crossed to terminal sires and their current lambs sold. High input labour needs are bred out of the flock. EID systems can help with culling decisions but ear notching is equally efficient.

The place for low labour systems

- **Suit larger flocks or situations where labour is limited**
- **Good option for those finishing lambs, poorer conformation may be an issue for store lamb sellers under current market conditions**
- **Works best in closed flocks**
- **Breed choice is important – works best when using breeds with low labour attributes**

A closed flock reduces the risk of buying in serious diseases such as Jaagsiekte, EAE, CLA, MV and CODD thus reducing the cost of vaccinations and sheep losses providing there is good biosecurity. Once the flock has stabilised on the desired genotype then up to 60% of ewes can be crossed to terminal sires with easy lambing traits which gives better opportunities to sell lambs as stores and improves the weight and grade of finished lambs.

Traits associated with easy lambing are light shoulders, long necks and longer legs and bodies, more likely to result in an R3L carcass. Rewards for better conformation are not reckoned to be high enough to offset the associated extra labour costs at lambing in larger flocks. There is no proven relationship between high conformation grades and increased saleable lean meat content in lamb carcasses and when sold deadweight purebred wether lambs are not penalised. However these breeds are less popular in store markets. Target production is 1kg lamb produced per kilo of ewe mated. Ewe mature weights at 65kg are lighter than many crossbreds such as Mules, increasing efficiency. Lamb carcass weights are targeted at 19kg with fewer lambs going over spec on carcass weight and being financially penalised.

Benefits

- **Labour: 1:600 at lambing outdoors versus 1:150 indoors, no time spent taking ewes from house to individual pen to field. 1 man can manage 2000 wool shedding ewes**
- **Spend time managing the flock as a whole rather than dealing with individual problems.**
- **Typically less than 5 kg of concentrates are fed per ewe which contrasts with conventional systems where concentrate use is rising and may be over 50kg at lambing.**
- **30% increase in house stocking capacity due to either wool shedding or winter shearing and not having to feed ewes inside for the last 10-14 days of pregnancy, enabling less trough space requirement.**
- **High ram to ewe ratios of 1:100 using rams that have not been brought out on concentrates and survive on average for 4 seasons saving £4 in ram cost per lamb.**

Further information can be found in the SAC Consulting publication *Managing the Change to Lower Input Systems with UK Sheep Breeds*

1. Developments in lower input sheep systems *continued...*

CASE STUDY Low labour sheep system

Charley and Andrea Walker have been among the UK pioneers of low labour systems. According to Charley "As much as I like my sheep and cattle, the more of my life that I can spend with my wife and children the better – better for me, better for my family and, I have come to realise, better for the sheep and cattle. That is the motivation behind my farming." The couple farm 800 ewes and 80 suckler cows at Barnside Abbey, St Bathans near Duns.

Their outlook on work life balance and how they manage their stock has been shaped by two travel scholarships that Charley undertook through Nuffield and ASDA Beeflink. This case study outlines the farming philosophy in Charley's own words:

"Labour comprises almost one third of the cost of sheep and beef production. On family farms this often translates into long working hours with little time for management and a poor quality of family life. Our quest for maximizing production has often led us into genetics and systems that require high levels of input, particularly labour. But high productivity does not necessarily generate high profit – success should be measured by net profit, not by ability to maximize production. And we should judge ourselves by the results of our efforts rather than priding ourselves on the effort itself. My point is this – just because we are accustomed to doing something a certain way, because we have been taught that way, because everyone else does it that way, it doesn't mean that it's the best way. There may be other ways that are easier or more effective, they're just going to feel different and be different from what we're used to. In business, as in nature, it is not the strongest that survive, nor is it the most intelligent, it is those that are most adaptable to change. I have found a better way to farm and it consists of 3 key elements: Nature, Nurture and Nudity.

Nature

"Charley mate, if you breed an animal that makes you money and doesn't cause you hassle, you'll soon get to like the look of it." So said one of my Australian hosts – and his words have really stuck with me, because they summed up the business like attitude of the breeders that I met. They did not let tradition or emotion stand in their way. They simply could not afford to. What I learnt from those breeders convinced me that the selection of breeding stock should be based on three underlying principles:

- **They must give birth and rear their progeny without assistance.**
- **They must have a strong constitution.**
- **They must perform on grass rather than grain**

Animals that require individual attention should be culled and their progeny should not be retained for breeding. Such a selection policy mimics the way that nature prevents weakness from propagating weakness – nature's great herds have managed extremely well without man's input for a very, very long time.

PICTURES COURTESY OF FARMERS WEEKLY

Nurture

"So, Charley, you said you run 800 ewes and 80 cows on your place – that'll keep you busy a couple of days a week, what do you do the rest of the time?" This was asked of me by a New Zealander, and it got me thinking because as he said it I realised he wasn't joking. I visited many large flocks that were run with limited labour and as I understood how they operated I realised that nurture is not about lavish individual care and attention – it is about the management of whole flocks and herds and their interaction with the environment. Once the right genetics are in place, management can focus on two key areas – reproductive efficiency and grazing management. Amazingly, lambing and calving, the area to which we often devote so much of our effort, is something which can be left alone as long as the supporting management is sound.

Nudity

Sheep without wool, not shorn sheep, but sheep which naturally shed their fleece in early summer and the wool is not collected. Wool shedding sheep offer significant cost savings, mainly in terms of labour. No shearing, no crutching, no tail docking, no flystrike, less shepherding and less gathering, with consequent benefits to growth rate and welfare. The loss of saleable wool is far outweighed by the cost savings achieved. Wool shedding ewes and their lambs can remain unhandled from the period prior to lambing until weaning in late summer.

Critical aspects to the sheep system

Wool shedding sheep – We have bred our own line of wool shedding sheep using a combination of breeds and the best way to describe the flock is as three quarters Easycare bred from a Romney/Cheviot base. Advantages covered in nudity (above).

Ruthless Selection - Our selection policy acts in the same way that the wolf pack does in nature by removing weaker animals from the herd or flock and preventing the continuation of problem breeding lines. Any animals requiring individual attention, whether it be for birthing assistance, foot treatment, udder problems or preferential feeding are culled once they have reared their progeny and their progeny are not retained for breeding.

Late Lambing - By timing lambing for the end of April we eliminate the need for concentrate feeding to ewes because they receive those last 4 weeks of critical pre-lambing nutrition from fresh spring grass. We are able to lamb ewes outdoors with absolutely minimal intervention – less than 2% of ewes are handled at lambing time.

Rotational grazing - is essential in maintaining pasture quality. We already have a rotational grazing system in place for cattle and intend to do likewise for sheep. The key aim will be getting more production off the acres we farm.

The result of this is that we now have a farming system that is more easily defined by the things that we don't do rather than by the things that we do. Andrea and I are running a profitable farm business with sensible working hours, plenty of time for management and an excellent quality of family life.

Things the Walkers don't do

- **We don't employ any labour**
- **We don't winter house stock**
- **We don't calve or lamb indoors**
- **We don't shear our sheep**
- **We don't feed concentrates**
- **We don't spread fertiliser**
- **And most of all, we don't tolerate animals that need individual attention.**

2. More effective ram purchase

Getting more lambs per ram purchased has to be good value but trials show that around 20% of rams need to be culled prematurely and that the accepted 1 ram : 40 ewes can be extended to 1 ram:100 ewes if they have not been overfed concentrates. For many years it has been the norm for breeding rams to be presented over-fed, which limits the number of ewes served and lifetime capability.

This is a response to strong market signals – buyers prefer the biggest rams. However it is important to consider the consequences for the animal and with compounds for rams costing £300 – £400 tonne the cost to the industry. Rams with improved serving ability, through better feeding, and improved genetics, through selection based on EBVs, have the potential to increase returns by up to £8 per lamb.

For ram breeders success comes through repeat ram purchases by happy commercial farmers which is more likely where rams last 3-4 years. But too many die or have to be culled early because of infertility or feet and leg problems. To leave a return for the commercial farmer rams must stay alive and mate successfully. They must produce vigorous lambs at birth that survive and express the improved genetics of the ram.

Over-feeding reduces the numbers of years a ram lives and the number of ewes he mates per year. It can mask genetic merit for traits such as grazing ability and parasite resistance and cause welfare issues due to joint and kidney problems. Concentrate feeding reduces grazing time and results in poor ram physical fitness with rams lying down more. This results in warmer testicles that reduce sperm viability. Over fat rams get overheated when asked to work and serve fewer ewes. In addition fat deposition in the testicle can make it too warm for sperm maturation.

Cost per 100 lambs produced with rams at £650 each

Lifetime mating seasons	Number of ewes mated per season per ram Lambing at 150%			
	40	60	80	100
1	1083	722	542	433
2	542	361	271	217
3	361	241	181	144
4	271	181	135	108

Where rams are not fed concentrates ram: ewe ratios of 1:100, well above the 1:40 average, are possible. Some ram breeders are bringing rams out on chicory/white clover swards. Rams get fit from grazing activity which increases serving ability and the chicory improves trace element and mineral supply.

More breeders are now bringing out rams under commercial conditions where the EBV's that are measured reflect how their progeny will perform given the same low cost diets. Lamb survival is likely to be better. Developments in across flock EBV calculations that take out farm effects ensure their EBVs are not reduced by this. Now farmers can buy rams at on-farm sales and auctions where the need to overfeed and compete on size is removed. But to avoid animals at these sales that are genetically small it is essential to have figures on which to base purchase decisions ie EBVs.

For further details see the latest SAC booklet *Ram management and Purchase* http://www.sruc.ac.uk/info/120109/beef_and_sheep/764/ram_management_and_purchase

Key points

- **The sheep industry has a problem with overfed rams, which limits the number of years rams live and the number of ewes they can mate each year.**
- **Removing concentrate feeding can increase the ram to ewe ratio from a 'conventional' 1:40 to 1:100 – a huge increase.**
- **A ram costing £650 mating 100 rams each year over a 4 year lifetime costs £1.08 lamb produced. A ram mating 40 ewes each year over a 3 year lifetime costs £3.61 per lamb produced.**

2. More effective ram purchase *continued...*

CASE STUDY Selection policy for a hill Blackface flock Alex Brewster, Rotmell, Ballinluig, Pitlochry

Alex Brewster has been a believer in performance recording since returning to the family farm in 2000, and was strongly influenced by many of the practices he saw when working on a large sheep station in New Zealand. His philosophy is that every ewe has to have the right tools in her tool box and "do for itself" and any ewe that causes problems is culled, with its offspring sold rather than retained. Lambing is more a case of supervision rather than direct hands on work.

The Brewsters farm 1900 ewes and 120 suckler cows on 9500 rented acres north of Dunkeld. Much of the land is rocky, rough hill, with about 800 acres of improved grassland with a small acreage of arable silage and forage rape. The 1900 ewes are now exclusively Blackface bred pure, a breed that Alex thinks is the only one suited to such a hard hill environment.

"Managing the average" is a phrase he has learnt through his 4,000 laying hen business, and what it means for sheep is managing a flock of consistent performers without having to provide special treatment for strugglers. He is looking for a level group of ewes correct in structure, scope and breed type with the right hardiness, right weight and tight skins. Alex intends to run a genuinely closed sheep flock, a decision prompted by a fear of bringing in Jaagseikte in purchased tups, that was reinforced by attendance at a sheep health meeting.

The nucleus flock consist of 150 ewes and the intention is to increase this to 250 ewes in 5 families. Ewes lamb from 20th April. This flock is performance recorded through Signet and the ewe must be robust, durability, self-sufficient with the ability to lamb and get that lamb going. By building from the nucleus flock any negative physical traits can be bred out of the commercial flock.

- **Controlling mature size – would like to keep 80% of the ewes within the 45-55kg weight band. Rams with exceptional mature size figures are not welcome, because larger ewes find it harder to perform in this hard hill environment.**
- **Holding litter size – anything above a 120% lambs reared would not fit the system.**
- **Improving muscle score – better fleshing will aid winter survival and lamb finishing.**
- **Increasing maternal score mainly based on milking ability.**

The above adds up to measures that reduce input costs more than trying to increase output and benefitting from the large numbers that can be kept on this extensive farm. Is he making progress? Yes, judging by improvements in the performance of an 800 ewe Blackface flock he contract farms at Riemore, Butterstone Estate. In the first year, 2008 the ewes scanned at 89%. This has been constantly improved by bringing in improved BF genetics and the 2013 scan was an impressive 119%. The ambition is to wean a 10% loss from scanning, and since bringing in his own tups, lamb survival has improved.

Key points

- **Breed a sheep suitable for a hard hill environment that can 'do for itself' as much as possible.**
- **Intend to manage the sheep as a flock rather than as individuals.**
- **Replacements must have hardiness, durability and good EBV figures.**
- **Early warning of lamb growth rate issues through use of EID tags and software, long before any problem is apparent to the eye.**

Using EID for management purposes

All lambs are given an EID tag at marking and liveweight gains are recorded at each handling in a Prattley crate with a Trutest head. He can accurately weigh 10 lambs per minute, and the Trutest provides instant information on growth rates, and predictions on future growth. This has proved to be an excellent early warning system for problems that are not yet apparent to the eye.

"EID is an important part of my management system allowing me to see evidence of problems, through poorer growth rates, before anything is noticeable". One field of lambs suddenly stopped gaining weight and after tests a touch of coccidiosis, cobalt/selenium deficiency brought on by dry conditions, and a worm challenge were identified as the problems and promptly treated. Secondly, Blackface lambs were gaining 220g/day while some terminal sire crosses had dropped to 165g/day average when they should have been doing better. This raised alarm bells and the problem was found to be an increased level of scald.

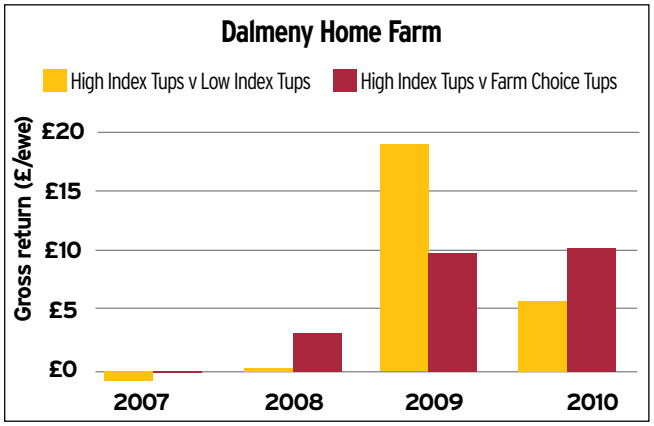
This gives Alex full control over the flock right up until they are loaded into a lorry and he is disappointed that he can't currently get individual lamb information back from the abattoir. 'I know from NZ that the faster a lamb is growing the better it will kill out and I would like to be able to prove this with abattoir feedback.' The converse is also true that poorer finishing animals kill out at lower percentages. How much more improvement would we see in the Scottish sheep flock if more farmers had access to growth rate information and feedback on individual lambs from abattoirs?

2. More effective ram purchase *continued...*

CASE STUDY More Effective Ram Purchasing. Hugh Kyle, Dalmeny Home Farm, South Queensferry

Hugh Kyle is the shepherd at Dalmeny Home Farm, Dalmeny estate. With many years experience as a shepherd, Hugh was becoming frustrated by reoccurring problems within the flock and concluded that alternative methods must be worth trying.

The result on the 500 acres available for sheep production was a change in breeding policy and increased use of Estimated Breeding Values (EBVs) to select replacement tups. They participated in an early Scottish Sheep Strategy trial where the progeny of tups with high EBVs was assessed against those of lower genetic merit and Farm Choice Tups (those selected on a visual assessment alone). As Hugh described "this process helped selection for the genetic potential, the bit you cannot see."



Hugh said that "At the outset of the trial the advantage of using a high index tup compared to the conventional farm choice tup was negligible but as the trial continued, higher index replacements started coming into the system and those gimmers crossed to a high index tup resulted in significant financial advantage for the flock." The cumulative benefit of using high index tups over the four year trial period was in excess of £23 per ewe compared with lower index and farm choice tups. The average was £6/ewe per year. And since genetics are cumulative and permanent, there will be an advantage year on year.

Having previously run 1,000 North of England Mules, the farm now carries nearly 1,300 Llyen ewes. High index Llyen tups are used on the best ewes to provide replacements. Tups are selected on maternal traits, particularly 8-week weight, from within the top 1% of the breed. The remainder of the flock are crossed with a Texel. This selection is based on high terminal sire index tups within 1% of the breed. This has all been achieved on the same land area, with no extra labour, whilst actually increasing the number of 'U'-grades and reducing days to slaughter and tail end lambs requiring concentrate feeding. With the exception of tups it is now also a closed flock, aiding flock health. Hugh notes that "the use of EBVs combined with the continual selection for ewes with good mothering ability and sound and well presented terminal sires within the top of the breed is really starting to show through"

Two Llyen tups - it is the bit you cannot see, the genetics, where additional potential has been realised

Financial Benefit of Using EBVs as Tup Selection Criteria

- **A reduction in the number of days to slaughter**
- **Improved carcase confirmation**
- **More uniform batches of lambs**
- **More efficient growth leading to a reduction in cost of production**

Hugh also described that whilst he is converted to the merits of using EBVs as part of his selection process they do not deploy a complicated recording regime themselves. "We rely on the tups to bring the potential so that we can maintain relatively simple records" - simple but effective. Replacement ewe lambs are selected using a five point score. Any problem ewes are marked and sold. This process combined with selection on maternal index helps "instil good mothering ability".

Five point plan to female selection

1. **Select ewe replacements from twin bearing ewes**
2. **Assessment of mothers milkiness**
3. **Assessment of mothers willingness to stand for the lambs to suckle**
4. **Assessment of the mothers ability to rear two lambs**
5. **Mother is free from any lameness or other imbalances**

To further aid selection the majority of Hugh's tups are purchased on farm where he feels they have not been pushed to the same degree. Grass fed tups are really showing their worth at Dalmeny Home Farm since "the number of breeding years has increased by 2 or 3 years in both the Texel and Llyen since starting to select this way. The average number of ewes per tup has also increased from around 50 to 80 ewes per season." This significantly reduces the cost of a tup. This has not been at the expense of a short lambing period. 80% of ewes are lambed within the first 20 days with lambing essentially completed within the month, all without the aid of teaser rams. Again this is a reflection of good tupping ability and the breeding criteria for replacements.

3. Reducing the risk of introducing disease – how closed flocks can help

Ewe deaths and abortions make sheep unprofitable but can be addressed by closing the flock except for the introduction of a small number of stock rams that can be quarantined for long periods. The flock has to be secure from neighbours' sheep wandering in for this to work so changes to fences and gates may be needed. The most common problems are Enzootic Abortion of Ewes (EAE) and toxoplasmosis, which count for 75% of abortions.

Toxovax vaccine reduces the barren rate, abortion rate and numbers of weak lambs caused by toxoplasmosis which infects sheep through feeds contaminated by cat faeces that carry the infection. You cannot fence out cats so farmers who feed supplements should vaccinate.

The most common cause of introducing EAE into a flock is through buying-in infected female replacements. Flocks tested under health schemes such as the Highlands & Islands Sheep Health Scheme are free from EAE, but they will need vaccinating if the farm has a previous history of infection or if there is a risk of spread at lambing from neighbours sheep, bought in pet lambs or poor biosecurity. Even if only a few ewes have aborted in previous years vaccination is much cheaper than suffering an an epidemic. If the farm is bio secure and EAE free then the cost of vaccination can be saved

It is common to have ewe deaths in the range 2-5 % per year for lowland and upland farms, which are unassociated with long term fatal diseases but above 5% may indicate long term virus problems. Thin ewes not keeping up with the flock should be tested for Jaagsiekte. Maedi Visna and Johnne's, also cause regular losses. These diseases are now increasingly found in hill flocks where they can be introduced by bringing in replacements kept under intensive conditions. Once established these diseases can make farming uneconomic so that the flock has to be culled and a new uninfected flock started again. This is hugely expensive and no easy task with hefted sheep so it is important, where the farm is bio secure to take all steps to prevent introducing the problems. Similarly with Contagious Ovine Digital Dermatitis (CODD) –it rarely kills sheep but the cost and labour of controlling this nasty cause of lameness is enough to make closing the flock worthwhile.

Replacement selection

Whether you practice your own stratified breeding system with traditional breeds or have moved to one of the new breeds used for self- contained flocks such as the Lleyn, Romney, Rissington or

Easycare the importance of selecting your own female replacements to reduce labour input is essential.

Prolificacy has low heritability and is often at satisfactory levels, therefore it is more important to concentrate on improving lamb survival and selecting replacements which come from ewes that keep lambs alive. Select lambs from ewes that reared twins from twins born, or as a second choice, ewes that reared singles from singles born. Select from ewes that have not been assisted to lamb, suckle or mother lambs and that have good udders with small teats and good teat placement. Deselect overweight and underweight ewes for breeding replacements from, the remainder going to a colour marking terminal sire.

Purchase of replacement dam line sires requires EBVs for maternal traits as these are not visible by looking at the ram. Buy from breeders with the same aims as yourself and similar culling practices in their pedigree flocks. It is essential they have the highest health status. Buy from MV accredited flocks that are CLA tested. There is no individual test for Jaagsiekte but a flock test is being developed. Avoid introducing CODD by inspecting the sheep before purchase. Sheep scab and anthelmintic resistant worms can be avoided with an endectocide and Group 4 drench or an OP dip and dual-active drench during quarantine.

Ewes that aborted or are dry can be tested by your vet in summer to decide on suitable vaccine for use four weeks before mating.

3. Reducing the risk of introducing disease – how closed flocks can help *continued...*

CASE STUDY Breeding for efficiency in a closed pedigree Lleyn flock. Neil McGowan, Incheoch, Blairgowrie

Neil and Debbie McGowan, who run 1100 ewes and 220 suckler cows at Incheoch, near Alyth, believe that "Many farms have good sheep, it is just a case of identifying the best ones and focussing on them in your breeding programme. Tools such as EBVs and new computer software have opened the door to take pedigree breeding into a new world of possibilities."

Central to the sheep enterprise is a nucleus ram breeding flock of around 350 Lleyn ewes, run alongside 70 pure Texels and commercial Lleyn ewes mated to the Texel. The Lleyn flock lamb outdoors on grass from 20th April, under commercial conditions. Tups sold as shearlings, and marketed through their "Working Genes" brand are offered the best grass in spring and no supplementary concentrates prior to sale. Signet recording is used to identify rams with genetic merit for growth, carcass and maternal traits. The McGowans have followed their strict selection criteria to increase ewe efficiency – basically the ewes ability to convert grass into kg of meat. Success can be demonstrated by the fact that the McGowans have, over the past 7 years, managed to sell the same number of lambs from 100 less ewes. The Lleyn flock are bred for upland/lowland farms with improved pasture and to suit outdoor lambing. Other key points about the system are:

- **A high lambing percentage that maximises twins when mated late in the year.**
- **Ability to lamb unaided outside on grass without supplementation.**
- **Ability to finish lambs off grass and grazed forage crops by December.**
- **Low cost of labour at lambing time – easy lambing characteristics.**
- **Disease free stock with minimal intervention for dosing, footrot, control of fly strike treatment etc.**

$$\text{Ewe efficiency (\%)} = \frac{\text{Total weight of lambs weaned at 100 days (kg)}}{\text{Total ewe weight put to the tup (kg)}}$$

Results From Selection For Efficiency at Incheoch

The table below shows that over the period 2006-2013 the Ewe Efficiency score has averaged 84% or 0.84 kg lamb produced to weaning per kg of ewe put to the tup. Removing the weather affected 2012 and 2013 seasons results alters the average to 88%.

Number of ewes recorded	**300-350**
Weaning percentage	**173%**
Av ewe weight at mating	**66.5kg**
Av lamb weight at weaning (100 days)	**32.5kg**
Weight of lambs weaned per ewe	**56kg**
Ewe efficiency score	**84%**

Key selection criteria for the nucleus Lleyn flock

1. **Sheep have to look right – visual appraisal of suitability for an upland environment.**
2. **Ewes with the potential to rear two lambs every year without the need for assistance.**
3. **Rely on Signet EBVs to assess production criteria. Key figures are Maternal Index and growth rate figures. Look to avoid extreme figures for litter size, muscling and fat.**
4. **Select on basis of ewe efficiency (see previous column).**

These results come close to achieving a target of weaning one kg of lamb per kg of ewe mating weight due to relatively high prolificacy and a reasonable weaning weight of 32.5kg. The ewe weight at mating of 66.5kg is less than many other crossbreds, which typically weigh 75kg with these larger ewes requiring more feed for the same level of performance. By lambing outside and relying less on concentrates the ram breeding system of this flock meets the needs of farmers with outdoor lambing situations. It takes a number of years of selection to achieve both easy care traits and high output using Signet recording. Sale results show a relationship between EBV and price in this flock, those with this highest maternal index making the highest prices at the 2013 on farm sale.

Maternal improvement

It can be difficult to measure improvement in maternal sheep genetics, however, the McGowans decided to take a step back and analyse their progress. Working with Martin Tompkins at Border Software they compared their ewes with the best and poorest maternal indices for four years of data. The results were significant. Lambs from the top 10% maternal index ewes were on average 20% heavier than the bottom 10% at 20 weeks old. "The figures really work. We've always selected hard on maternal index in our elite flock and that selection pressure has been key to the improvement." says Neil. From 8 weeks the lambs in the high index group went on to reach an average of 45kg at 4.5 months old while the low index group averaged 35kg at the same age.

3. Reducing the risk of introducing disease – how closed flocks can help *continued...*

CASE STUDY Moving to a single breed selected for efficiency in a closed flock Brian and Janet Hill, Plan Farm, Bute

Significant improvements in performance and labour efficiency were achieved by replacing existing BF and BFL sires that had been on the farm up to 2004, with the Lleyn breed in a closed flock selecting for efficiency. A benchmark based on ewes producing 1kg lamb per kg ewe mated was set.

Signet recording was considered but it was felt more important to establish a firm foundation of females first. For this, on farm data was used making use of electronic tags and software, selecting ewes achieving target to return to the Lleyn tup to breed flock replacements and crossing those ewes not meeting target to a terminal sire.

The aim was to identify ewes that could produce two lambs unassisted outside and rear them to a combined weaned weight of 65 – 70kg (i.e. 100% efficiency with each ewe rearing lambs that match its body weight. The top performing half of ewes and their daughters on this benchmark were selected and mated to maternal Lleyn sires the following year. Poorer performing ewes were crossed to a terminal sire. Initially the Meatlinc was used but now the Hampshire Down is the terminal sire of choice, producing fast growing lambs that are up and suck quickly in an outdoor lambing situation. They also have the advantage of a brown face so are easily identifiable as being off the poorer performing ewes and therefore ewe lambs not to be retained for replacements. Any ewes committing serious crimes are culled.

PROGRESS TOWARDS TARGETS

	2004/5	2009/10	2010/11
Ewes to ram	1039	628	650
Ram:Ewe ratio	1:40	1:80	1:80
Scan % (no of lambs)	120% (1246)	160% (1022)	185% (1202)
Barren ewes	9%	5%	0.075%
Lambs sold fat	20%	65%	70%
Lambs sold store	60%	13%	8%
Flock replacement	20%	22%	22%

The results show that after 7 years the same number of lambs are now being scanned from 650 ewes than were previously scanned from 1039 ewes. By culling inefficient ewes feed resources have been freed up to enable 70% of lambs to be finished compared to 20% in 2004.

A weaning weight efficiency benchmark of 1kg/1kg has now been achieved within the top performing half of the flock. It is assumed that by 'raising the bar' each year a 'knock on' effect should see improvements filter through to the ewes crossed to the terminal sire.

Time and technology have been used to reach this point and it is estimated that over a flock of 250 nucleus (recorded) ewes, time spent tagging and recording takes between 1 – 2 hours per day. Extreme bouts of severe weather do tend to disrupt the recording routine but a little extra time spent using a simple system of identifying ewes and lambs at 'ringing' has proven to be not too onerous over the years. Labour at lambing time is not now necessarily any greater as time spent recording is saved in time spent dealing with lambing difficulties.

Future work will now be concentrated upon selecting both maternal and terminal sires using EBVs for growth and carcass, without losing the efficient maternal traits now established, with a target of reaching 1kg/1kg across the whole flock.

Following on from the work done on using on-farm records for establishing an efficient flock of females, the use of EBVs to select both maternal and terminal sires, has resulted in an average increase of 2.5kg deadweight per lamb sold.

"To me, the work I have been doing in selecting for efficiency has been an obvious part of trying to run a profitable system and the results are clear to see. However, the greatest rewards come in the form of personal achievement – it gave me a great 'buzz' to achieve a scan with just one empty ewe out of more than 600, I think they call it 'job satisfaction'!" says Janet.

Key points

- **Rear same number of lambs from 650 ewes now, than used to be achieved from 1039 ewes seven years ago.**
- **Lambs finished has increased from 20% to 70% with average lamb deadweight increasing by 2.5kg.**
- **Set targets for ewe performance and cull inefficient ewes.**
- **Produce fast growing lambs that are up and suck quickly in an outdoor lambing.**

4. Improving lamb supply chain efficiency

The adversarial trading model, whereby each part of the supply chain is interested in achieving the best outcome for itself, is now struggling with farmers, hauliers, processors and retailers finding difficulty in making a margin from lamb production and processing. A study conducted in 2012-13 by SAC Consulting, SAOS and the Scottish Manufacturing Advisory Service and fully funded by QMS on one particular lamb supply chain identified a number of areas where better communication through a more integrated and collaborative supply chain would deliver better outcomes for all concerned. A number of problems were identified that if tackled correctly could add back considerable value to the supply chain.

A summary of the main issues are as follows:

Farmers (aided by the Farm Stock Scotland procurement team) were generally doing a good job in hitting specification. This study only looked at the supply chain from the stage of drafting lambs on farm and it is clear that much could be done to improve lamb survival, boost growth rates to finish more lambs off grass and avoid growth checks. Few farms keep meaningful records of lamb performance, and if we adopt technology such as EID for management purposes a huge amount of data could become available that could help identify why some farms or lambs are doing better than others. Issues identified on farm were:

- **Handling and loading facilities – the better the facilities the more they will be used and lambs will be marketed at the correct time.**
- **Gathering lambs on time for haulage – lambs being gathered after the lorry has arrived is a major cost and source of frustration for hauliers, and vice versa late communication from hauliers is a source of frustration for farmers.**
- **Keeping fleeces dry before transit – processors cannot process lambs until fleeces are dry and waiting for fleeces to dry wastes much time at the abattoir.**
- **Avoiding dirty lambs by offering only water in the 12 hours before transport – this essentially ensures that lambs are "empty" at loading and prevents their fleeces becoming dirty in transit and the risk of these lambs contaminating others. Dirty fleeces are a major problem in the abattoir and clipping lambs costs the farmer around 90p/lamb.**

The haulier is in the ideal position to identify issues from both ends of the chain. Haulage is an expensive business and short notice, loading delays, and part loads increase the cost. Hauliers have invested large sums in lorries that meet EU legislation and these high spec large lorries often struggle to manoeuvre up narrow farm roads and in tight spaces. The potential to set up collection centres, which could reduce lamb journey times and ensure full loads, whether on shared premises or redundant farm buildings, should be investigated, although there may be legislative and financial hurdles to overcome. Driver recruitment is an issue and the job would be viewed as more attractive if pick ups were made easier, incidence of dirty lambs was reduced, and lorry washing facilities were more widely available.

Procurement through a Co-op such as Farm Stock Scotland was considered beneficial in improving the percentage of member's lambs hitting processors specification (which stood at 94% when the report was published), and also by shortening the lines of communication for processors. Issues for Farm Stock Scotland staff include a lack of standardised feedback from processors, and compatibility issues with emailed lamb grading reports and their own member's database. FSS holds data which could provide information for improving member's performance particularly if individual lambs could be identified on grading sheets. Also members failing to have lambs ready in time for pick up, farmers altering lamb numbers when loading and dirty lambs. The co-op was also concerned about the lack of lamb processing capacity in Scotland, which results in longer journey times and increases the proportion of dirty lambs that require clipping.

Processing sector - the biggest issues for the processing sector is the poorly planned lamb supply, which results from producer "push" rather than consumer "pull" and is influenced by weather factors. Solutions include better communication within the chain and a better understanding of each others needs. Forward contracts could be considered. Other major issues are wet lamb fleeces, which require drying before processing and dirty lambs, which require clipping before processing. High incidence of liver fluke resulted in an extraordinary number of condemned livers following wet seasons, which has removed considerable value form the chain. There is a clear need for regular communication between processors and farmers, to address how these major issues are tackled.

The retailer is looking for a more uniform branded product. A standardised product with less variation in fat class and conformation would reduce processing waste, better fit pack/cut sizes, and result in less waste or increased consumption at retail level. Again there is need for discussion between farmers, processors and retailers as to how these aims can be best achieved and to understand when and why there is a restricted season for sale of UK lamb. The potential for new branded products could also be explored.

A follow on project has been funded by the Scottish Government, Farm Stock Scotland and QMS to focus on the reports recommendations through a series of on farm and supply chain premises meetings. A full copy of the report may be requested from QMS – 0131 4724040.

Key points

- **Farmers, hauliers, processors and retailers struggling to make a margin from lamb – need for greater collaboration within a joined up supply chain**
- **Farmers need to ensure that where possible lambs are housed pre transit to avoid delays caused by wet lambs and dirty lambs at the abattoir**
- **Feeding back individual lamb weight and grading results will provide farmers with the information they need to improve production efficiency**
- **Good potential to save significant costs from the supply chain from a joined up approach.**

5. Sheep Enterprise Margins

CASE STUDY Messrs Patrick Dickson, Acrestrype, Fyvie, Aberdeenshire.

Keeping detailed physical and financial records of their sheep flock performance has enabled Patrick Dickson junior and senior to identify areas that need attention and draw up plans for improvement. Decisions have been taken on the basis of hard facts rather than gut feel and the tables in this feature bear out how performance has improved year on year.

Their sheep enterprise comprises approximately 250 ewes and hoggs to the tup. Originally the ewes were Shetland Cheviots with replacements bought annually, but in recent years the Dicksons have switched to a mainly Lleyn cross closed flock, only buying tups. Lambing starts 1 April and all lambs are finished.

The Dicksons farm a total of 450 tenanted acres in two blocks at North Camalynes (LFA) and half a mile away at Acrestrype/ Birkenhills (non LFA), and the unit recently featured as the Aberdeenshire Monitor Farm. Typically for lowland Aberdeenshire around 235 acres are in cereals (winter barley, oilseed rape, winter wheat, spring barley) and 215 acres in grass, a small part of which is permanent grass on steep banks. The farm also carries an 80 head spring calving suckler herd with bull calves intensively finished and heifers finished at 18 – 22 months or retained or sold for breeding.

This technical performance record has allowed the Dicksons to track key performance indicators over time and make comparisons against industry standards. Critically it helped them to set some **aims** for the enterprise;

- **The ewes need to do more of the job themselves and the system needs to be simpler, especially at the spring workload peak, if the sheep are to stay. The Patricks are running three enterprises (crops, cattle, sheep) on two units and while Patrick senior is not retiring, he deserves some free time! Also the cattle and crops are bigger enterprises, with the sheep fitting around them.**
- **Part of the simplification (and profit improvement) needs to be through increasing the proportion of lambs sold off grass/ forage. While ewe concentrate use is low, tail end lamb finishing on pellets pushes the total sheep feed bill above average.**
- **Some health issues need to be tackled**

Table 1. Sheep Technical Performance Record

	2007	2008	2009	2010	2011	2012
BREEDING						
Scan % ewes	202	194.6	198.5	215	229	223
Scan % hogg	85	145.2	165.7	159	145.5	135
Barren % ewes	0.94	0.45	2.0	1.15	0.52	
Barren % hoggs	37.5	16.67	14.3	5.5	14.5	5% ewes & hoggs
Lambing % to weaning	164	169.55	158.65	174.5 marked	185.4 @ 29.6.11	
Ewes and hoggs put to tup	252	266	237	247	247	262
Concentrate feed per ewe (kg)		11.84	3.8	5.06	3.2	5.3
Energy buckets per ewe (kg)		2.37	4.0	3.04	2.5	2.8
Average weaning weight (kg)		30.83	33.88	30.07	33.5	30.54
FINISHING						
% lambs finished by end October		30	65	36.5	65.4	77.5
Average sale weight kg DWT		19.96	21.28	19.87		20.43
% U, R and O.		10, 85, 4	16, 84, 0	25, 74, 1		25, 75, 0
Average price per head £		55.47	66.24	74.34	78.6	73.47
Lambing %, sold/ retained	161.9	168.4	158.23	168.4	180.9	177.8

Changes

1. **Closed the flock and adopted strict regime for selecting replacements.**
   - Only keep a ewe lamb if it has lambed itself and sucked itself (tag these)
   - Weight at weaning
   - Not kept if its mother has tag clipped for bad feet
   - In past, only if it is a twin or triplet. Now actively not selecting from triplets.
   - Selecting from one tup to avoid in-breeding.

2. **Tup purchasing**
   Only buy private, direct from breeder. Not over fed with concentrate = better feet, fitter and last much longer. Find can put 1 forage reared Lleyn tup to 90 ewes. Using EBVs.

3. **Lambing management**
   - Lamb in parks beside steading – separate twins, triplets, singles.
   - In past all came in at night. Now only triplets in, others only in bad weather. Less pen work – ring lambs and tag good ewe lambs outside.

5. Sheep Enterprise Margins *continued...*

- Very little concentrate feeding – twins only get high energy tubs. Triplets and thin twins get concentrate. All ewes are wintered on neighbouring grazings, so tend to come home in good condition.

4. Finishing off grass

- Big change in proportion sold off grass, but varies with year.
- Move sheep more often to maintain critical sward height and get rapid regrowth.
- First few lambs sold have been doing over 400g daily liveweight gain from birth, finishing in only 90 days.
- Also, breed changes and the selection of ewe lambs on the basis of weaning weight are having an influence.
- Tried red clover/chicory mix.

5. Health

- Underlying toxoplasmosis problem, hit ewe lambs. Tried medicated feed buckets, but now toxoplasmosis and enzootic abortion vaccines used.
- Closing flock gives control.
- Introduced FECs
- Cull persistently bad feet. Any ewe caught for foot treatment gets ear tag notched and don't keep her daughters.

Has it worked?

Margins have been tracked over time and compared with the other farm enterprises on a per acre basis, and against QMS averages as Table 2

Results

The Net Margin figures show that while the Dicksons Gross Margin is below the QMS average, the simplicity of the system and the ability of the sheep to do more of the job by themselves has kept fixed costs low, so that the Net Margin is higher than average.
Technical performance has generally improved (table 1) - scanning and sales % is well up, barren rates have fallen, especially in the hoggs, and feed use by the ewes has been kept very low. The proportion of lambs sold off grass/forage has increased greatly, even in the poor 2012 season, but the cost of concentrates to finish the last third has been high in recent years.

Key Points

- **Figures give you evidence – what's good, what's bad, whether or not improvement is being achieved. Decisions can then be based on reality, not gut feeling.**
- **Make the ewes work for you. Sheep can have a place alongside bigger cattle and crop enterprises if the hassle factor is removed.**
- **Selection works even in a medium sized flock, especially if you cull problems and breed from the ones which do the job themselves**
- **Tup selection – buy on basis of figures and looks, prefer if not concentrate fed**
- **Lambs grow quickly and cheaply on a well managed, clean, grass/clover swards.**

Table 2. Dicksons 2012 Sheep Net Margin Compared to QMS Lowground Average

£ per sheep to the tup	Dicksons	QMS lowground flocks average
OUTPUT		
Sales	123	119
Less replacements	-13	-13
Wool	3	3
GROSS OUTPUT	**113**	**109**
VARIABLE COSTS		
Homegrown concentrates		2
Purchased concentrates	19	8
Other purchased feeds		3
Vet and med	10	7
Bedding	1	2
Forage costs	18	4
Sundries	4	8
Total variable costs	**52**	**34**
GROSS MARGIN	**61**	**75**
FIXED COSTS		
Power & machinery	9	23
Property expenses	2	6
Property depreciation		7
Admin/misc	1	3
Employed labour	11	5
Total fixed costs excluding rent and interest	**23**	**44**
NET MARGIN per ewe	**38**	**31**

7. Controlling footrot – time for a different approach

Footrot has a huge effect on productivity in many flocks and traditional control measures involving running the whole flock through the pens and footbath and regular foot trimming may have done more harm than good.

National infection levels at around 10% of sheep affected shows that we are not making a good job of control on most farms. In a survey it was found that farmers who were willing to catch any lame ewe in the flock and treat them immediately had around 5% footrot, those waiting a few days until there was a group needing treatment had around 10% lame and those who did not make it a policy of catching lame sheep and were just dependant on foot bathing and trimming had around 17% infected.

We often forget that footrot is an infectious disease, which explains why bringing the ewes into the pens for a day's trimming and foot bathing then running them through the same mud they walked in from is unlikely to be effective. The regular trimming of feet is now considered unnecessary. Too often it results in weakening of support from the horn wall through over-trimming putting pressure on the thin sole of the foot and causing inflammation of the chorium, pain and lameness. Rate of foot infection depends of the number of infected feet met, which is a product of the number of infected feet in the flock and duration of exposure. We now think footrot is spread due to the dose of the disease not just the presence as some sheep will have a degree of immunity. Listing treatments in decreasing order of their effectiveness in reducing infectiousness ie the time taken for healing is shown in the table:

Product/Treatment	Estimated time to healing
Long acting antibiotic injection	2 days
Trim and antibiotic spray	9 days

By far the most effective treatment is the long last antibiotic injection.

It is clear that to control footrot you need effective treatments like an antibiotic injection that when applied in the field cures the sheep quickly and reduces spread. Alternatively if the problem is too big for this approach and you bring the whole flock in for a less costly flock treatment such as foot bathing then it is important that any infected sheep identified are kept away from the rest of the flock, and that the flock is returned to a fresh field, without getting infected on the way. This reduces the rate of spread, which is always highest in warm wet weather.

Tips to reduce footrot

- **Make it a policy to check feet in individual pens at lambing and not to turnout ewes into the main groups that have footrot.**
- **Give infected ewes a long lasting action antibiotic injection and put them into a separate hospital group close to the pens where they can be run through the footbath until problems are resolved.**
- **Antibiotic treatment of lame sheep, caught in the field can keep on top of a low incidence problem**
- **If possible pull out ewes and their lambs for treatment if handling in early summer while the numbers are still readable on the lambs, isolate ewes and if they do not respond to antibiotic injection mark then for culling at weaning.**
- **If the main mob shows signs of footrot, particularly in lambs, put them through a footbath of 3% formalin and let them stand on concrete for one hour to reduce spread. This has to be done immediately the first symptoms are seen – not a few days later as this delay can lead to the difference between success and failure.**
- **Take every opportunity to sort out infected sheep from sound sheep, eg at housing or shearing and treat infected sheep in a separate group.**
- **Cull ewes with repeated footrot treatments from the breeding flock so their genetics are not maintained.**

GRASS OPTIONS SECTION 3

Grass is our cheapest and most widely available resource, but does it get the management attention it deserves? The honest answer has to be no. How much cost could we trim from Scottish beef and lamb production if we maximised growth from grass, and how much extra production could we achieve if we maximised output per hectare?

However, things are changing and a growing number of Scottish farmers now realise that they have to become better soil and pasture managers if they are to run their beef and sheep systems profitably. These farmers acknowledge that they have to get the basics right, starting with the soil, and now talk about managing their livestock "from the soil up".

Soil is the raw material from which most food is produced and soil conditions directly influence how well grass and forage crops grow and the quality of feed they produce. At its most basic this starts with soil analysis to apply the correct level of lime or nutrient and secondly use of a spade to assess soil structure and identify how to deal with any compaction issues. Next there are decisions to be taken on seed mixtures and pasture establishment.

It may be fair to say that we have most to learn about grassland utilisation. Ironically the science behind rotational, paddock or cell grazing techniques described in our case studies was known as far back as the 1950s and 60s, but was not adopted by mainstream beef and sheep farmers, perhaps due to the cost and time involved in fencing the paddocks, before the arrival of lower cost electric fencing options. Lessons learned from trips overseas and the increased adoption of paddock grazing in our own dairy sector has prompted our case study farmers to look at the potential of rotational grazing, which can increase output per hectare by 50%.

This section features some genuinely innovative case studies plus selected grassland tips.

To find out more detail refer to the QMS publication *Better Soil and Grassland Management for Scottish Beef and Lamb Producers.*

think.
plan.
do...

1. Rotational grazing to improve pasture utilisation

CASE STUDY Paddock grazing for sheep production – Michael Blanche, Cultuechar, Forgandenny, Perthshire

"Most of us don't make a profit without subsidy. Yet right in front of our noses we have two golden keys to making lots of money from sheep – soil and grass. If we flip our viewpoint and manage stock from the soil up, not the sheep down, I reckon we can revolutionise our profits".

Michael Blanche is a relatively new entrant to farming, having built up a sheep flock on seasonal grazings from 2003, before gaining the tenancy of Cultuechar and Netherholm, near Forgandenny, in the foothills of the Ochils in 2011. Here he runs 650 ewes and their progeny on 515 acres of permanent pasture and "green" hill. In the following article Michael describes the key points of cell grazing.

I am a first generation farmer. I have no cash and only a tiny bit of capital. To get a farm I needed to offer more rent than was comfortable. I sold SFP to buy sheep so I will only get around £2,500 in SFP and LFASS combined this year. I also did a Nuffield Scholarship that put me in touch with grass managers of mind blowing ability.

I say all this to give context. My position is that I have no choice but to try something different. Being traditional - without subsidy, paying a big rent, with no financial backing - will not work! If I am to grow my business, I need to get much more from an acre, much more from every pound of capital invested whilst spending tiny amounts of cash.

What I saw from the pasture based dairy farmers in Wales and England was proof that grass can be the game changer in Scottish sheep and beef farms. I first saw the principles in New Zealand, read about them in a book by a Frenchman (Andre Voisin) and finally learned practical implementation from an Irishman.

Paddock grazing relies on certain principles:

1. **Think in kilograms of dry matter - how much grass is there, how much it is growing, what the stock need per day (the latter can triple between simple maintenance and peak lactation).**
2. **Never graze more than 3 consecutive days (in growing season). Grazing regrowth suppresses growth potential significantly. Grass grows grass. Grass leaves are like solar panels - the more leaf, the more growth.**
3. **Enter a paddock at the right point. Entry levels should be 2,500kg DM/ha for sheep and 2,800kg for cattle. In terms of height this actually differs between seasons but in Summer these would be around 7 and 9 cm (compressed height e.g. a clipboard on the sward) respectively.**
4. **Exit a paddock leaving the right residual level. Residual is extremely important for the first half of the season. As low as 1,200kgDM/ha up to 1,500kgDM/ha for sheep and 1,500kgDM/ha for cattle. Below these points you are starving your stock, above you are reducing quality for the next time. This is why the best graziers will graze to the hour i.e. If the paddock will hit its ideal residual level at 4pm, leaving it till 5pm is unacceptable. Again grass grows grass. Over-grazing and not leaving enough leaf means much slower recovery.**
5. **Keep it easy and simple. You can set up temporary "cells" as the stock move or you can have the electric fencing in place so all you need to do is open a gate every 24, 48 or 72 hours. I've done both and I know which I prefer!**
6. **Plan and think. Entry and exit grazing "covers" are fine in principle but when you consider that grass growth varies between 70 to 100kgDM/ha per day at its peak and 10 to 20kg in October and zero in January then managing the rotation length needs planning two weeks, one month and six months in advance. You need to try and fit stock demand with grass supply as closely as you can. It sounds complicated but nothing a calculator and a couple of hours every so often can't control.**

Paddock grazing system with lambs grazing ahead of ewes

The claims of what cell or paddock grazing can give you include: twice the yield of grass per hectare (more realistic is 50% increase); twice the animal production per hectare; increase in grass utilisation from 50% to 85%; an increase of almost 1MJ of ME per kg of Grass Dry Matter; increasing ryegrass populations significantly (doubling in one season); and soil improvement.

It sounds too good to be true but I believe it. I still describe my system as "in development" because some of my attempts to put the theory into practice haven't worked. That said some of them have and that is really exciting. They say it takes three years to be a good "grazier" and there is a lot you can get wrong. It is always a balance between managing the grass and managing the animals. The better you can walk that line the more you will transform your production.

I have sub-divided a 60Ha block. The aim is to work on 2ha paddocks. Based on 48 hours shifts I can have one 60 day rotation (20kg DM/ha/day growth) up to three 20 day rotations (65kg DM/ha/day growth).

Sub division is a tool. It has cost me about £25/acre with probably another £5 needing spent to make water more easily managed. I don't use nitrogen but I can grow grass.

I think we can get sucked into thinking in terms of production and margins per ewe or cow when actually its more important to think of production and margins per hectare. There is also a huge craving for more land in farming when actually there is so much potential with the area we have already.

Many of Scotlands dairy farmers have already adopted these grazing systems so why can't they work for sheep?

1. Rotational grazing to improve pasture utilisation *continued...*

CASE STUDY Rotational grazing for beef cattle – Doug Greenshields, South Mains, Sanquhar, Dumfriesshire

Doug Greenshields has successfully introduced a rotational grazing system for store cattle at South Mains, which featured as a QMS Grass Demonstration Farm from 2009-11. Up until 2008 Stabiliser store bullocks were sold in spring at 10-11 months of age. A change in farm policy in 2008 saw sheep numbers reduced along with farm labour. Some of the grassland released from the reduction in sheep was made available to graze store cattle for another season for sale as forward stores in September.

The system has proved to be successful and robust in a variety of different grass growing seasons. Bullocks have grown on average 1.05kg/hd/day on this system which is an excellent result compared to expected gains of 0.6 to 0.8 on beef farms operating set stocked systems. Heifer growth rates have been lower, as expected although still very acceptable. It must be remembered that the "best" heifers are the ones retained as replacements and were not on this system.

A good testament to the success of the system is Doug Greenshields himself. He says "We have tried a lot of different things at South Mains over the years. However while most of these have come and gone I am certain that rotational grazing is something we will still be doing in 20 years time".

Setting up a rotational grazing system

A simple rotational grazing system was set up in time for the 2009 grazing season. This was achieved by erecting permanent electric wire along the top of stone dykes on a block of land of 49 hectares and purchasing temporary electric fencing. This block had 11 fields ranging in size from 1.2 ha to 7.15 ha and included some fields that had been re-seeded and some permanent pasture. Eight of the fields can be cut for silage (each year 16 hectares has been cut either as part of a planned silage cut or as a flexible cut taken when the grass was surplus to requirements. Four central fields are able to be grazed by different groups adding to management flexibility.

It is preferable to only graze part of the field for 3-4 days so in practice larger fields would be split into 2 or 3 sections using temporary electric fencing. As the season progresses and grass reaches peak growth (up to 100kgDM/ha) this is when fields can be taken out of the rotation for silage or re-seeding. Then as grass growth declines in mid summer and silage has been made these areas come back into the grazing rotation as the cattle are heavier and need more grass.

Above: Temporary electric fencing
Below: Bullocks grazing a high clover pasture

Summary of 3 years results for bullocks

	Housing wt kg	Turnout wt kg	Winter lwg kg	Sale wt kg	Grass lwg kg
2009		383		545	1.08
2010	242	335	0.55	488	1.10
2011	255	357	0.63	498	0.97

Doug Greenshields with rising plate meter

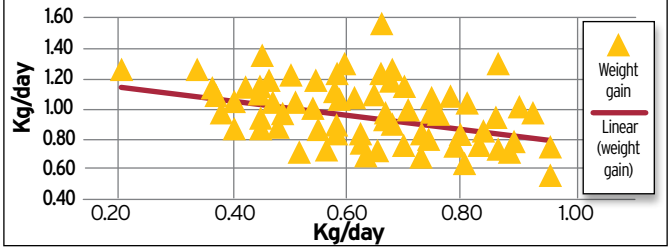
Winter feeding strategy at South Mains

At South Mains the calves are housed with their mothers in late October with creep being built up to around 3 kg/hd/day as soon as possible. After weaning in early December the concentrates are then cut back in 1 kg increments through the winter so that for the final month they are only getting silage. This hi-low system of concentrate feeding initially helps with rumen development then adjusts the rumen to a forage only diet so there will be a reduced turnout check and compensatory growth can be achieved. The following graph shows the relationship between winter growth and liveweight gained at grass in 2010 (bullocks).

Key points

- **Very easy system to operate, higher grass utilisation and higher quality grass**
- **Excellent liveweight gains means that 180kg at grass is feasible leading to heavier sale weights and reduced weight gain to finish cattle required**
- **Grass finishing may become a realistic option (with some supplementary feeding at grass)**

Winter growth and liveweight gained at grass in 2010 (bullocks)



Example grass budget	
Paddock size	1ha
Pre-grazing cover	2,700 kg DM/ha (10-12 cm)
Desired residual	1,500 kg DM/ha (5-6 cm)
Number of cattle	40
Liveweight	400 kg
Daily group demand	400 kg DM (40 x 400 x 2.5%)
Available DM	1,200 kg (2700-1500 x 1 ha)
Days grazing	3 (1,200/400)

Basic principles

- **Grass growth was monitored every 7-10 days to aid with forward planning**
- **Dry matter intakes of 2.5% of liveweight was assumed**
- **Grass was grazed to a residual of around 1500kg DM/ha (5cm)**
- **When grass was plentiful either silage was taken or a field was re-seeded**
- **When grass was short then extra fertiliser was applied or some of the central silage fields such as 3, 7 and 8 were part grazed behind an electric fence**
- **The cattle were split into 3 batches of 40-46 cattle, by sex and weight. Generally there would be a group of heavy bullocks (380kg), a group of lighter bullocks (330kg) and a group of light heifers (300kg).**

2. All grass wintering for sheep

All grass wintering, a system that involves taking ewes through the winter on rotationally grazed grass, is a relatively new concept for Scottish farmers. For a full winter the reduction in feed cost compared to housing has been around £15 per head per ewe and with removal of the need for making silage, major cuts in fixed costs are also possible.

UK trials conducted by SAC Consulting started in 2011 in Cornwall using 2000 NZ Romney ewes, and subsequent trials across the UK and new work in NZ have identified that it has the potential to work in Scottish conditions.

Our more northerly latitude may support a variation on all grass wintering involving a winter grazing rotation followed by housing for lambing rather than lambing at grass. This system was trialled on a Northumberland farm with a 900 Mule ewe flock in 2012 and shows promise in areas with low winter grass growth.

The system depends on building up a wedge of grass in the autumn for grazing after tupping, on a daily shift system at up to 1000 ewes/ha.(400 ewes /acre). This runs from 25 days after ram turnout to 10 days pre lambing (100-110 days) when ewes can either be set stocked at 15/ha(6/acre) in the fields that were split into the first 65 paddocks used, or housed for lambing. Lambing outside requires winter grass growth of 10kg DM/ha per day. For lambing inside, where winter grass growth is 5kgdm/day growth at best, ewes should are supplemented with concentrates for 10 days outside before being housed.

The winter cell rotations have now been tested on a one day shift basis across a range of breeds and locations including West Wales with breeds including Mules, Easycare Texel Cross, Dartmoor and Romney Crosses. The good news is that farmers are sticking with the system and found:

- **Major savings in feed costs of £10 to £15 /ewe.**
- **Ewes have become very docile from being moved daily**
- **No major issues with fencing or gates.**
- **Snow meant ewes had to be taken off for between 5 and 10 days for supplementary feeding, but this can be planned for**

How it works ideally need to integrate with summer rotation

- **Measure grass cover in autumn- plate meter/sward stick**
- **Allocate 1 kg DM/hd pre scanning, 1.25 post scanning**
- **Work out how much area to give the mob each day, set up a weeks worth of fences in half a day, 10-15 minutes to move sheep each day therafter.**
- **Graze to residual of 800-1000 kgDM/ha pre scanning, higher post scanning**
- **Monitor ewe condition throughout- remove ewes not coping**
- **Grass gets long rest, grazed once in winter**
- **Have covers of 1700kgDM/ha in spring for lambing**

If it worked in the horrendously wet conditions experienced in 2012 it should work in any year. However farms chosen for the project had in general dry soils and were in favourable grass growing areas, so there are still only a proportion of farms where this wintering system can be used. The system rations grass to give the ewes just what they need when grass feed availability is tight and the alternatives are expensive. Without this strict rationing there is risk of over or under-estimating what grazing provides. Under-estimation represents inefficient use of feed, and can lead to over-fat ewes at lambing. If ewes have to be supplemented outside it is expensive and causes pasture damage around feeders and through tractor tracks.

Conclusions

Wintering ewes solely on grazed grass looks feasible on southerly farms for all of the winter and for part of the winter on northern farms. New work from NZ suggests 4-day shifts will work, this will appeal to farmers with flock sizes below 300 ewes where paddock size becomes an issue but this system has not yet been successfully demonstrated in the UK. There are significant cost savings.

950 NZ Romney ewes lambing at 160% and stocked on 110 ha during a 110 day rotation in Cornwall in the 2011/12 winter required only 11kg of silage/ head supplementary feed /year.

3. Grassland establishment and management – TOP TIPS

Grassland tips for sheep farmers

Grass varieties etc

- **High sugar grasses** - (generally "Aber" varieties although other plant breeders' varieties have high sugar) help to increase protein utilisation. Now breeding varieties with lower CP to obtain a better balance of energy & protein.
- **Digestibility** – look at recommended list for grazing D value - best PRG's in high 70s, average on list 74-75%. This can be compared against low 60's for weed grasses. Higher D value = higher ME = higher growth rates. Estimated to be up to 20g/ lamb per D value point)
- **For sheep grazing** use late heading PRG + small/medium leaved clover + Timothy for early season growth. Diploid varieties have good persistence and ground cover, Tetraploid varieties are vigorous and are compatible with white clover due to more erect growth habit e.g. Beechgrove mixture – SAC Consulting Technical Note 274.
- **Growth pattern** For grazing you need spring and autumn growth to reduce costs and increase production from grass. New varieties are bred with higher spring and autumn growth and trials are progressing on testing PRG varieties under low and zero nitrogen levels. Also new developments such as Festulolium (e.g. Matrix, Revolution) which have higher winter growth rates.
- **Productive grass species** have better response (3-5 times higher) to Nitrogen than weed grasses.

Clover

- **Good for soil structure and fixes Nitrogen** – extensive system with low stocking rate using <100kg N can just rely on white clover - perhaps a small dressing of N in spring to get grass going as clover needs slightly higher soil temp (8oC) to get going than ryegrass (6oC). Once well established clover fixed N should get the spring grass going.
- **High digestibility** - 75-80 D value = high ME, higher intakes, high protein = 20% higher daily liveweight gain for growing lambs.
- **Red clover** - use for silage (cattle and pregnant sheep), graze lambs on aftermaths, "rocket fuel" for lambs, best to avoid garzing breeding sheep 6 weeks pre to 6 weeks post tupping and don't graze ewe lambs on red clover either.

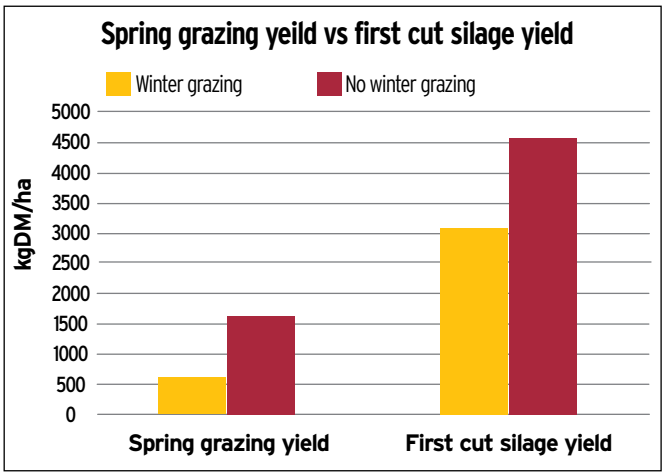
Grazing management

- Aim to prevent heading, keep swards short and productive, highly digestible grass
- **Rotational grazing - the benefits...**
  Higher yields due to rested grass
  Higher quality - D value, less stems & seed heads
  Higher utilisation of grass - less waste
  Higher flexibility as can take surplus grass out for other stock/silage etc or apply N or buffer feed if shortage predicted
  Rotationally graze when grass growth is fast to improve utilisation and flexibility
- **Set stocking - the benefits...**
  Is easier but can lead to wasted grass/poorer quality grass in good years or reduced intake in poor years leading to reduced animal performance
  Useful though at lambing or tupping when stock need to be more settled and grass growth is slower

3. Grassland establishment and management – TOP TIPS *continued...*

Management tools to even out feed supply and demand – sheep

- **Lambing date.** Either lamb to match grass growth on your farm or accept that you will have a need for a lot of concentrates to feed ewes (and lambs) until grass arrives.
- **Weaning date.** Not fixed, should be flexible depending on ewe condition and grass available. Little point in leaving lambs on ewes beyond 12 weeks, 14 weeks max (keeping each other company but no more). Ewe DM requirement is halved at weaning so earlier weaning can save DM for later. Also important to wean lambs before their growth rate starts to drop. Higher costs if growth slows down pre slaughter and affects KO%.
- **Sell stock.** Either barren sheep or culls or make a decision to sell store lambs beyond a certain date to save grass for breeding stock.
- **Body condition.** Know the pattern of body condition and use this to store feed on the ewes backs to use when feed is scarce.
- **Grow forage/catch crops.** When is there a gap in your feed profile? Grow a cheap catch crop or more expensive full season crop to fill this gap. Crop depends on when the gap is e.g. rape pre Xmas, Kale either side of Xmas, swedes later in winter.
- **Build up grass wedge.** This means allocating grass to stock so they don't waste it- (feed budgeting by kg DM) and pushing the feed available further into the winter. Essentially what happens with all grass wintering.
- **Apply Nitrogen.** Quick(ish) fix during the growing season to get more grass if shortage predicted - however feed budgeting will allow you to make this prediction 2-3 weeks before a shortage so you can avoid it. Helps to have productive grass that can respond to N, good soil pH etc and also useful if you can apply fertiliser at short notice - little and often.
- **Feed supplements.** Easy option but costly so know the relative values of different feeds, also what to feed when - eg. protein requirement of stock (breeding/lactating v growing), protein content of sward etc. apart from DUP to lactating sheep, high energy concentrate at grass is all that's required as grass has excess protein.



Winter grassland management

The table above shows the difference in spring grazing yield and first cut silage yield when pasture is grazed from January to March or rested from January to March.

- Rested fields (red) can grew an extra 1150kg DM/ha (= 1 tonne feed per hectare!) compared to fields grazed in late winter.
  Red bar -1750 kg DM/ha
  = 6 cm – no concentrates required
  Yellow bar - 600 kg DM/ha- bare,
  1-2 cm- full ration required
- Winter set stocking suits weed grasses. Productive grass regrows and gets eaten, depleted plant reserves, weed grasses come in
- Rotational grazing suits productive grasses- chance to recover
- More/earlier grass in spring, less concentrates, less costs, more money
- Can farms start rotating sheep in larger groups to fulfil DM required for maintenance, make grass last longer and ensure more grass in spring.

4. Grassland management from grassland development farms - TOP TIPS

From 2009 to 2011 SAC Consulting facilitated a QMS funded project to improve grassland management on Scottish beef and sheep farms. Two "Grassland Development Farms" were selected. South Mains, near Sanquhar in Dumfriesshire is a typical upland livestock farm while Hilltarvit Mains, near Cupar in Fife is a mixed arable and livestock farm.

The following tables set out some of the main messages of grassland issues from the project and some of the recommendations of the host farmers, Doug Greenshields at South Mains and Ian & John Whiteford at Hilltarvit Mains. These have been split into 4 main areas; soil, grassland establishment, grassland utilisation and silage making.

4a Doug Greenshields, South Mains, Sanquhar

Soil management issues	• Test soil every 4-5 years in rotation • Maintaining soil pH, P & K levels is like money in the bank, invest in the good times, save when times are harder (or fertiliser is dearer!) • If soil pH is low then applications of other nutrients will not be effective
Grass establishment issues	• Re-seed in late spring at peak grass growth so impact of taking a field out of production is not as big. • Graze a re-seed initially by light on-off sheep grazing to encourage tillering • Do not cut re-seed for silage in its first season • Well managed grass or re-seeds have the potential to grow at twice the rate of older or poorly managed swards in a late spring.
Grass utilisation issues	• Rotational grazing is a very effective way to add weight (value) to cattle at low cost • Monitoring grass growth and pasture cover is an excellent tool to improve grass utilisation • Rest fields from sheep for as long as possible to ensure an earlier turnout • Graze silage fields once to help achieve early turnout • Restricting concentrates in late winter will help to acclimatise the rumen to an all forage diet and can give compensatory growth. However to fully exploit the benefits of compensatory growth at grass there should be an early turnout to get a longer grazing season and rotational grazing to ensure a high diet quality • Tight grazing in early season helps to prevent heading and maintains grass quality well into late season • Graze grass for 3 days, rest for 3 weeks on rotational grazing system • Calving and lambing should match grass growth on your farm- too early means extra feeding required, too late means benefit of spring grass is wasted
Silage issues	• If possible don't make silage on same fields each year • Attention to detail at silage time - minimise wastage at clamp • Rotational grazing system gives flexibility to take extra silage from surplus grass • Analyse silage for quality and carry out feed budgets before and during the winter feeding period

4. Grassland management from grassland development farms - TOP TIPS *continued...*

4b Ian and John Whiteford, Hilltarvit Mains, Cupar

Many other issues were covered in great detail during the project- the full meeting reports can be accessed at - http://www.sruc.ac.uk/downloads/120386/grassland_development_farm_project

Soil management issues	• Correct soil structure issues before re-seeding • Split large fields for soil testing (these may have been several smaller fields with different soil types in the past) • Ploughing is the preferred method for establishing grass as it will improve soil structure and bury weeds. However surface fertility can also be buried
Grass/forage establishment issues	• Growing a forage crop as pioneer crop before re-seeding helps to break down the soil, split applications of lime and ensures that loss of a large area is minimised by the availability of a high DM crop • Seed rate of a forage crop can determine whether you get a stemmy crop (lower seed rate) suitable for dry cows or a leafier crop (higher seed rate)more suited to finishing lambs • Two stage re-seeding of long term grass allows broad leaved weeds to be sprayed off before introducing white clover. Clover seed must not be sown too deep and coated seed can help with establishment if P & K levels are not optimal • Short term grass leys in the arable rotation - 2-3 years, Italian + Hybrid Ryegrass +/- red clover for quality and fertility building
Grass/forage crop utilisation issues	• Set stocking works well on this farm, large fields, busy workload with large arable area • However you still need to manage grass well by adhering to sward height parameters to maintain grass quality and intake • Clean grazing system saves cost of worming sheep - drugs saved and time to gather and treat. Also lambs that are unchallenged will grow faster • Assess the material a sheep is grazing by "plucking" grass for a minute or two - look for green leaf, stems, clover and dead material. A high proportion of leaf and clover will be more digestible and result in less work for the ewe to achieve her intake • Red clover aftermaths can finish a lot of lambs very quickly after 2 silage cuts have been taken • Control moss in spring by using tine harrow and maintaining Phosphate levels
Silage issues	• Use young rotational grass for high quality silage and high yields which will reduce the cost/tonne • Aim for quality 1st cut - don't compromise quality for yield • Red clover and high quality silage reduces cost of purchased protein feed

think. plan. do...

5. Soil Management – thinking from the soil up

CASE STUDY Duncan Macalister, Glenbarr Farms, near Tarbert, Argyll

The experience of being Kintyre Monitor Farmer has changed the way Duncan Macalister runs his farm. He now recognises that the soil is the most important asset on his farming and now "thinks from the soil up".

The subject of soil structure and management has been re-invigorated over recent years, after wet summers and difficult winters, leading to extensive soil and sward damage. The critical message has been that the potential of any crop can only be realised if soil structure is correct; this being the foundation to growth. It allows a healthy root structure to establish and then uptake the required nutrients; ultimately to deliver the target foliage growth, yield and quality expected.

Exploring a concern that soil structure issues may be limiting the impact of efforts to improve production was a key issue raised by Duncan Macalister, Glenbarr Farms, Argyll. Duncan has been a QMS beef and sheep monitor farm in Kintyre since 2011. He used this platform to seek guidance from the community group and invited specialists on their experience on how best to identify and rectify particular soil based issues.

Duncan said "Soil damage was apparent in some grass fields as blocks of grass looked to be struggling and it was wetter than the rest. This was clearly compromising production and costing money – these areas received the same fertiliser as the other grazing fields"

The recommendation was firstly to dig a hole with the spade for a visual inspection of the soil and take a soil analysis before any further action. Duncan, who was previously a firm believer in the need to deep plough said "I'm now converted to the philosophy of retaining the organic material in the top layer of the soil, instead of burying and killing it by deep ploughing". It is also less expensive and the field is out of production for less time. Furthermore ploughing might not be the answer. On inspection of the soil in one field, there were signs of aerobic conditions; there was a slight odour on the top layer of a test dig hole, the soil was sticky, some orange patches and a brown tinge to the grass roots. But further investigation revealed the soil was quite dry below this.

Good soil structure benefits	Financial improvements
Warmer soils	Extended growing period
Improved crop nutrient uptake	Efficient fertiliser usage
Balanced crop mineral uptake	Improved herd health
More vigorous grass growth and fewer weed issues	Improved yields

Soil specialist James Bretherton explains that there was some soil structure issue in the top four inches most probably caused by livestock which could be remedied with the use of an aerator or similar with no need to plough. New grass seed, appropriate for stitching into an existing sward, could also be used to give the whole field a new lease of life if considered necessary.

Duncan adds "I would also like to stress how important it is to use the right machine for your soil. We have light soil with a high sand content, which requires vertical cracks that can only be produced by a more aggressive subsoiler type machine. These machines are a big investment and you need to ensure that you have the right tool for the job."

Key points

- **Soil structure problems can severely limit growth and yield of crops and grass**
- **Dig a hole with a spade or digger to identify compacted layers or impeded drainage**
- **Take advice on which machine to use and timing of sward lifting/subsoiling**
- **Start to "think from the soil up"**

Duncan, second left with grassland subsoiler

ARABLE OPTIONS SECTION 4

1. Min Till

Background

Minimum Tillage refers to non-plough based cultivation systems. As cultivation costs account for 40% of the fixed costs of arable production, min till techniques can lead to significant savings in energy, time and costs. The increasing profile and importance of reduced carbon footprint and CO_2 emissions are also factors in the adoption of min till techniques in Scotland. One of the challenges to the success of non-inversion tillage is the impact of wetter summers and autumns on soil structure. A combination of ineffective drainage and heavier machinery has led to soil slumping and consequent issues with shallow tillage establishment of crops. In recent seasons, greater success has been achieved through deeper cultivations or rotational ploughing.

Advantages

Timeliness Min till can reduce the number of cultivation passes and allow crops to be established closer to optimum timing.

Higher work rates Crop establishment is achieved more quickly with benefits for reduced labour costs and machinery costs.

Environmental benefits The reduction in soil movement reduces carbon and nitrate release from the soil and can lead to improvements in soil structure and reduced risk of soil erosion. Organic matter levels tend to be maintained or increased, particularly where straw is chopped and incorporated.

Disadvantages

Grass weed burden Populations of grass weeds tend to increase in non-inversion systems. This is particularly problematic in the case of brome grasses, which are very competitive and expensive to control. The use of stale seedbed techniques, typically used in England to reduce grass weed burden, is more difficult in Scotland due to the reduced turn-around time between crops.

Slug damage Some min till systems can result in greater threat from slug attack - particularly where seed is sown in bands. The inherent variability in sowing depth and lack of effective consolidation with banding means more opportunities for slugs to cause hollowing and shredding. This is particularly the case in wetter autumns and where the previous straw crop is chopped and surface incorporated.

Compaction Shallow cultivation systems may not be successful if underlying soil compaction is not dealt with. Where additional deeper cultivation is required, this may outweigh many of the cost and timeliness benefits of min till.

Scale Min till machinery tends to be wider, heavier and more expensive than plough / power harrow / drill systems. This may mean it is inappropriate and too costly for smaller farm enterprises and smaller field sizes.

1. Min Till *continued...*

Establishment of Oilseed Rape using subsoiler systems

Recently there has been a surge in use of subsoiler based seeders to establish oilseed rape. Seed is distributed into disturbed soil behind widely-spaced subsoiler tines. This system can work well in dry soil conditions, where there is surface capping or shallow compaction. However, in wet soils tines can make water-logging and root penetration worse. This technique can provide the opportunity to make the most of the tight sowing window for Scottish oilseed rape crops, sowing directly into stubbles, where plough-based systems require at least two operations. The subsoiler units have the ability to apply banded nitrogen from mounted hoppers, potentially saving a further pass. Some units also have a separate hopper which can distribute slug pellets into the seeding zone. This system can achieve the same yield potential as plough based systems, but plant establishment tends to be more uneven and losses greater when drilling into wet seedbeds. Many arable farms in Scotland have adopted a hybrid cultivation system, incorporating some elements of min till, but also using rotational ploughing. This has the advantage of reducing the grass weed burden and helping to aerate soils where surface cultivations in wet conditions would lead to water-logging. By utilising machinery rings and an increase in machinery sharing arrangements, the prohibitive costs of investing in min till machinery which may not be flexible enough to cope with variability of Scottish soils and weather may be avoided.

Cultivation cost comparison	
Cultivation type	**£/ha**
Subsoiler / seeder (OSR)	£60
Plough + combi-drilling	£105
Plough + disc drill	£84
Disc + drill	£65
Direct Drill (Claydon, Mzuri, etc.)	£50

think. plan. do...

To maximise benefit of Min Till

- **Less flexible than plough based systems, management skill is required to decide when soil conditions are appropriate for working. Tillage when soil is too wet tends to lead to increased compaction. Also more important to minimise compaction from other operations such as combining, baling, etc. Simple measures such as ensuring tyre pressures are checked regularly can reduce compaction significantly.**
- **Effective grass weed and volunteer control is more difficult/ expensive. Use of stale seedbed techniques can be helpful, but difficult because of tighter turnaround between harvest and sowing. Increased surface debris from previous crop can impact on efficacy of residual herbicides. Sequential herbicide programme is required to maximise brome control.**
- **Crop establishment in wetter conditions will increase slug threat. It is important to identify risk at early stage (pre-emergence) and take appropriate control measures without delay. Banding of seed is inherently more susceptible to slug attack than an efficient disc coulter system. Straw removal will result in less likelihood of slug damage.**

2. Precision farming

Background

The term 'precision farming' has been used to encompass a range of technologies and techniques that vary greatly in their function, complexity and cost of implementation. The guiding principal of precision farming is 'doing only what is needed and only where it needs to be done'. The technologies can assist growers in managing at a sub field level and making inputs in a more cost effective manner. The range of technologies on offer and the different functions that they serve means that new users must be very clear on their goals and how the outcome will be measured before embarking on a programme of investment in 'precision farming'.

Machinery Guidance

Bout matching is an obvious example of how technology can assist in providing measurable improvements in efficiency. Guidance systems are all based on location signals sourced from satellites but to achieve medium to high accuracies correction signals are required. The two systems most commonly employed for arable farming are DGPS (pass to pass accuracy potentially +/- 10cm) and RTK corrected (pass to pass accuracy potentially +/-2cm). RTK correction signals can be created by establishing on farm base stations or through subscription to a third party service providing access to local stations via a SIM card connected to the internet through a modem. Generally, the higher level of accuracy is required for auto-steering systems used for drilling or ridging for root crops. For applications such as primary cultivation or rolling the accuracy of a paid for DGPS signal combined with assisted-steering is generally adequate.

Assuming a 25cm overlap on a 4m cultivator then the area worked per pass can be increased by 4-6% through machinery guidance with

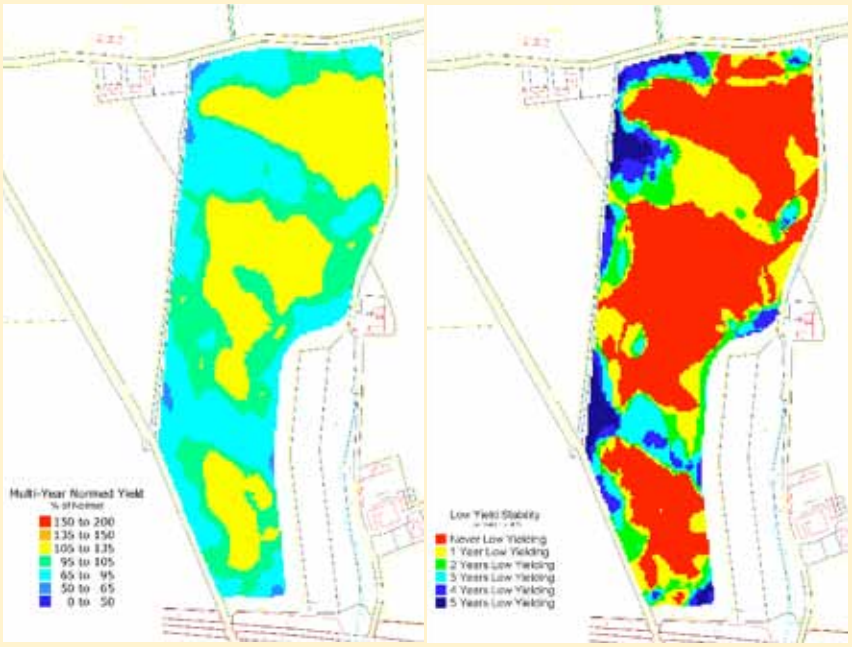
a corresponding saving in time, fuel and machinery wear. The benefits are magnified in irregular shaped fields where the systems can devise a path to reduce overlaps and short work. Accurately matching bout widths when deep ridging for potatoes eases the operators workload and can lead to improvements in the quality of work achieved. Using the higher accuracy auto-steer systems creates the possibility of moving to multi-bed planting and harvesting systems.

When used for sowing, additional savings can be achieved through reduced use of seed and more accurate placement of tramlines. It is not unusual to find tramlines 0.5 - 1m narrower than intended. Spraying with a 24m sprayer on a tramline with an average width of 23m results in an over application to 4% of the boom width. For a typical Winter

Yield Mapping

With most combine manufacturers offering yield mapping as well as a number of aftermarket options the availability of the technology is high. In recent years it has also become available for potato harvesting equipment. It is, however, only of value where the information gathered is used to inform management decisions. In essence, yield mapping can be used to identify low yielding areas to inspect for issues such as pH, soil nutrients, drainage, soil structure or pests such as potato cyst nematodes.

Yield maps can also be used in the creation of treatments zones for targeting maintenance dressings of P & K based on annual crop off take. Ongoing use of yield maps over a number of seasons can assist in identifying if the decisions taken to problems are resulting in appreciable improvement in yield and reduction of variability.



2. Precision farming *continued...*

Wheat crop this could cost an additional £6/ha on herbicides, fungicides and PGR. Combined with auto boom section shut off further savings can be made - particularly in awkward shaped fields.

The cost/benefit of machinery guidance can only be calculated with the specific knowledge of the tasks that it will be employed for, the area worked and the ability of existing equipment to integrate effectively with updated technology. For example, many current tractors are already equipped with the necessary valves for auto-steer necessitating an upgrade in electronic components only. Using a model 750ha combinable farm a recent HGCA review found a benefit of £21/ha from employing RTK based auto steering on the machinery fleet. The cost of implementing the system was placed at £12/ha resulting in a net benefit of £9/ha from auto steering. An additional £0.75/ha net benefit was calculated from adding auto boom section shut off on the sprayer to the guidance system.

Variable Rate Application

LIME Soil pH is one of the key drivers in determining the availability of macro (N,P,K +S) and micro nutrients. Barley is particularly prone yield reductions from sub optimal pH. For combinable cropping in Scottish mineral soils the optimal pH is typically 6.0 to 6.2 in all parts of the field. Soil pH can vary significantly over short distances as the chemistry involved is influenced by factors such as the clay and organic matter content as well as the movement of water through the soil profile. These soil characteristics also affect the response to liming materials. Therefore, Liming recommendations based on a single, whole field, sample tend to have a higher target pH than the optimum.

Adopting a GPS guided grid sampling system (typically comprising of multiple samples within four 50m grid sections per hectare) allows quantification of this variability and the generation of more targeted lime application maps. It also allows a target pH closer to the optimum to be adopted as field variability has already been accounted for. The technology may not necessarily alter the total amount of lime used within a field but by targeting applications to the appropriate areas it is used more effectively.

The value is derived from improved crop nutrition through better access to nutrients in the soil profile. The net benefit depends on the variability encountered in the field. This technique is generally carried out by contractors on an area basis allowing a limited initial investment on a selected area.

P&K A recent HGCA funded review of soil sampling for nutrient status found that for most fields under long term management for arable production sampling on a W pattern every four years was sufficient to maintain both soil P & K status within the target range for combinable crop production. The benefits are limited by the uncertainty in predicting the amount of applied nutrients that the crop will access from the soil. This effectively limits the ability to react to variability across the field with inputs that will result in an appreciable benefit to crop output.

The exception to this is in targeted sampling to investigate previously identified areas of poor performance (see yield mapping) where maintenance dressings may be insufficient. The creation of application zones is more likely to offer a cost effective solution for P & K than the grid sampling methods adopted for pH.

N For most Scottish soils the Soil Mineral Nitrogen (SMN) is too low to generate the variability needed to make variable rate applications based on soil sampling a practical, cost effective technique. Alternatives have been developed based on sensors that can measure vegetative growth as a vehicle passes through the crop. The influence of factors other than N supply on crop uptake and utilisation complicates the development of effective variable rate application plans for N. Targeting other sources of variation such as pH, drainage, pests and soil structure is likely to have a greater initial effect.

3. Nutrient Management

A well-planned crop rotation helps reduce input requirements, pollution and soil erosion. It boosts profit and enhances landscape and biodiversity.

Planning lies at the heart of integrated cropping. This means planning a rotation over several years. The approach can bring benefits, including more efficient use of land, labour, machinery and other resources. Integrated cropping can also improve weed, pest and disease control with reduced risk of resistance and result in cost savings. In terms of outputs, a well-planned rotation allows more high-yielding first wheat crops following break crops and affords opportunities to enhance quality. Economics have a major influence on crop choice.

Phosphate, potash, magnesium and other nutrient needs depend on soil reserves and crop off-takes. Fertility can be maintained at acceptable levels by applications to receptive crops. Nitrogen is applied crop-by-crop, according to crop needs, previous crop residues, soil organic matter reserves. Good rotational management utilises the fertility in crop residues. Farmyard manure can replace inorganic fertiliser and benefit soil fertility.

Efficient fertiliser management requires information about the soil-nutrient status and the potential to supply nutrient to the crop within each management area or field prior to fertiliser additions. The P, K and Mg soil-nutrient status can be estimated by bulking a number of soil cores from different sites within a field. A bulked sample every four years of 10-15 soil cores is sufficient to maintain both soil P and K stocks within a target range. Including more than 10 cores in the bulked sample is warranted when fields are larger than 20 Ha. The benefit from using the optimized spatial sampling instead of a standard 'W' is small. This is because the errors associated with a 'W' design with the appropriate number of cores are small enough that other uncertainties in the estimation of nutrient uptake by the crop limited the quality of the fertiliser management recommendations. Target levels are likely to be moderate for P and K in combinable rotations and high for P where potatoes or vegetables are grown. Winter cereals and OSR are not very responsive to fresh applications of P & K fertilisers unless soil reserves of available P and K are low. There are fundamental differences in the behaviour of P and K in the soil and in the amounts available in solution for crop uptake. For example soils with moderate status contain 5,700 kg/ha P2O5 and 18,000 kg/Ha K2O. Spring barley, however, is likely to be more responsive to available phosphate than most other cereal crops. Spring barley grown on cold wet soils or grown on high exposed fields are likely to benefit from fresh phosphate applications annually.

If the decision is taken to chopping straw, this will add organic matter to the soil. It is the "active" fraction of Soil Organic Matter (SOM) comprising 1-10% of total SOM that influences aggregate stability by its binding effect. These 'active' fractions consist mainly of recent additions of crop residues and organic manures with a relatively large content of polysaccharides, gums, root and/or microbial exudates, roots and fungal hyphae together with incompletely decomposed plant tissue such as lignin which change in composition both with time and source. Several studies point to the short-term nature of their effects with no more than a year in most cases, and often much less. Under arable cropping, annual returns of crop residues to the soil are the major source of these active substances, whereas under grass they are produced almost continuously.

Table 1

Typical off-take values for average yielding arable crops

		Kg per tonne of fresh material	
		P_2O_5	K_2O
Cereals	Grain only	7.8	7.8
	Grain and straw		
	Winter wheat/barley	8.6*	11.8*
	Spring wheat/barley	8.8*	13.7*
	Winter/spring oats	8.8*	17.3*
Oilseed rape	Grain only	14.0	11.0
	Grain and straw	15.1*	17.5*
Peas	Dried	8.8	10.0
	Vining	1.7	3.2
Field beans		11.0	12.0
Potatoes		1.0	5.8
Grass	Fresh @ 15-20% DM	1.4	4.8
	Silage @ 30% DM	2.1	7.2

***** *Off-take value is per tonne of grain or seed but includes nutrients in the straw*

3. Nutrient Management *continued...*

Table 2 **Assessing the nutrient content of cereal straw**

	Median removal kg/tonne straw		
	P_2O_5	K_2O	MgO
Winter wheat/barley straw	1.2	9.5	1.3
Spring wheat/barley straw	1.5	12.5	1.2
Oat straw	1.6	16.7	2.2
OSR straw	2.2	13.0	nd
Pea straw/haulm	3.9	20.0	1.7
Bean straw/haulm	2.5	16.0	1.8

On soils of adequate Mg status, transient deficiency symptoms may often occur, coincident with periods of rapid growth as Mg is transported from older leaves to younger, expanding leaves, or may be induced by drought. Under such conditions, crop response to Mg fertilisation via foliar sprays is unlikely. Soil compaction, drainage impedance and surface water-logging, surface capping, also root damage due to pest attack e.g. cereal cyst eelworm or disease infection e.g. take-all, may all induce symptoms of Mg deficiency.

Micronutrients or trace elements are those nutrients required in small amounts for essential growth processes in plants and animals. These include Copper (Cu), Manganese (Mn) and Boron (B). Cu and Mn are likely to be the most limiting in cereals and Boron can be important in Oilseed rape. The 'availability' of most of micronutrients is primarily determined by the ease of weathering of the primary minerals of which they are a part but are subsequently modified by a number of soil and crop factors such as root growth, soil structural conditions, crop susceptibility, soil pH, organic matter, surface absorption, drainage and leaching, microbial activity, crop rooting density, nutrient uptake and release of organic substances from plant roots. In general, micronutrient deficiencies are more common on the 'sandy and light,' and 'peaty' soil types than on medium or heavy soils. Visual symptoms of a deficiency of a specific micronutrient can be confused with those produced by other growth problems. Consequently, visual diagnosis of a micronutrient deficiency should, where possible, be confirmed by plant and/or soil analysis.

4. Optimising inputs

Optimising inputs involves looking at every aspect of agronomy and tweaking and fine-tuning to create the most efficient blueprint to grow crops. The key elements to consider are:

- **Variety choice**
- **Sowing date**
- **Seed rates**
- **Agrochemical programme**

Variety choice

All varieties have strengths and weaknesses. Some varieties are more suited to early sowing, other perform better sown later. Varieties differ in their susceptibility to disease, whether it is oilseed rape or cereals, and can vary significantly in their responsiveness to fungicides and growth regulators. The levy funded national Recommended List trials programme provides a huge database of information on varieties, and is the key independent source of variety performance data for UK growers. (www.hgca.co.uk).

Seed costs

Growers have a choice of either certified seed or using farm saved seed produced from their own farm. Savings can be made using farm saved seed, but there are risks associated with this if appropriate seed health checks are not carried out before seed is sown. The safest route is to test seed for germination and seed borne diseases at the Official Seed Testing Station (SASA), and then dependant on the results, growers can make an informed choice on suitable seed treatment (if any) and seed rates. In comparison, using certified seed provides the grower with confidence that he is sowing seed that has met certain statutory levels of germination and admixture, and which comes with a treatment applied to protect against seed borne diseases. A typical example of the comparable costs is given below.

Certified wheat seed	Farm saved wheat seed
£475/tonne (single purpose seed treatment)	£170/tonne
Sown at 175kg/ha = **£83/ha**	Cost of cleaning and dressing £85/tonne
	BSPB royalty £41.17/tonne
	Grower handling costs £10/tonne
	Sown at 175 kg/ha = **£53.58/ha**

Additional savings can be made if the seed is free from seed borne disease, and if the grower can clean their own seed to take out screenings and weed seed. There is little risk in sowing clean untreated seed, that has good germination (95% +).

Seed rates should be worked out using thousand seed weights (TSW). There are still instances where growers sow at a set weight of seed per hectare without checking TSW's. This can be disastrous if TSW's are low – a typical range of TSW's in wheat is 40 g to 65 g. If the grower sows at 250 kg/ha (2 cwt/ac – not untypical for later sowings), he would sow 385 seeds/m2 at the high TSW, but a massive 625 seeds/m2 at the low TSW. This would significantly increase the risk of early lodging, poor yield and grain quality. It pays to confirm TSW's in either certified or home saved seed. Optimising seed rates should take into account sowing date, seedbed quality and tillering capacity of the variety. Generally seed rates for autumn cereals should be kept

4. Optimising inputs *continued...*

at the low end of the spectrum if sowing in early September. The plants will produce more viable tillers and consequently more ears per plant. The ability of plants to produce multiple strong tillers decreases with later sowings, with a significant reduction in growth rates, and therefore more plants are required to maintain optimum ear numbers. Although trials have proven that seed rates as low as 100 seeds/m2 can produce fairly impressive yields, the reality is that any additional saving may well be small compared to the risk of being too close to the 'cliff-edge'. Any pest damage at ultra low seed rates is more likely to result in an unviable crop.

Agrochemical Inputs

Modern arable production would be uneconomic without the use of agrochemicals (herbicides, fungicides, pesticides and plant growth regulators). The UK has the highest average cereal and oilseed rape yields in the world, and this is achieved partly because of a favourable climate, but also because of the use of an effective and structured plant protection programme. Optimising these inputs is key to minimising cost of production.

The average response of crop varieties to fungicide use is around 20 per cent yield improvement. Thus without fungicide use UK cereal growers would suffer an economic loss of between £380 to £465 million each year. Some varieties are more prone to disease than others, and having an understanding of this is important in the selection of a crop protection programme that will help to optimise inputs.

Sowing date effects - Cereals	
Early sowing	**Late sowing**
Increased disease risk	Increased risk of frost heave
Prone to snow rot/mould	Greater slug risk
Increased risk of pest problems (BYDV)	Higher seed cost
Increases sterility risk	Lower yield potential
Potential increased lodging	

Sowing date effects - Oilseed rape	
Early sowing	**Late sowing**
Increased disease risk (Light leafspot, Phoma)	Increased risk of winter kill
Increased risk of pest problems (Turnip Yellows virus)	Greater slug / pigeon risk
Early flowering risk of poor pollination	Higher seed cost
Potential increased lodging	Lower yield potential
Greater risk from club root infection	

5. Arable joint venture

This system aims to get efficiency and economies of scale from operating a large business. One of the major obstacles, for any business trying to expand, is how to acquire additional land. The traditional routes of purchasing or renting results in farmers competing for a limited resource, forcing the cost beyond the economic value and benefit. This is undesirable for both the individual businesses and for the industry as a whole. The solution is for farmers to pool their arable land and resources into the creation of a new separate arable business which removes the need for competition and allows economies of scale in machinery and management.

The business created combines the arable land and resources (machinery, labour, buildings and management) the partners (say 3 or 4 farmers) into one larger trading business. Land and property ownership is however retained by the individuals with the arable company perhaps paying a rent to the owners. Partners then manage the whole business with the profits distributed on a pro-rata basis depending on the share contributed. The major advantage is that resources are better utilised and unit costs of production can be lowered leading to improved returns. In theory, there should be benefits too in the 'pooling' of management ability leading to better decisions and management. Ideally, the farmer(s) with the best arable skills would take a leading role while other farmers would concentrate on other areas.

As with any proposal, there are 'pros' and 'cons' associated with this system. This section attempts to summarise the main advantages and disadvantages for the proposed 'Large-scale Arable Business'.

Advantages

- **Removes competition (between the members of the group) and gives greater ability to take on extra land.**
- **Leads to the efficient use of resources (less machinery investment per ha).**
- **Gains economies of scale to drive costs down (bulk buying, contract deals, less machinery and labour).**
- **Allows people to concentrate on their key strengths.**
- **Improved problem solving (many heads).**
- **Allows better integration of activities.**

Disadvantages

- **Individuals lose independence.**
- **Decision making process slower (more people involved).**
- **There are costs associated with setting up and running separate business.**
- **Tax implications (may be an advantage).**
- **There are risks: disagreements between partners ; system does not yield benefits.**
- **Potential problems when a partner wishes to exit.**

Key factors for success

It can be clearly seen there are disadvantages and potential problems with the system. However, in principal, these are outweighed by the major advantages to be gained. The new 'pooled' business is in a very strong position to succeed in the competitive business environment facing farmers now and in the future. It is a system equipped to improve profitability and provide growth. To be successful the following factors need to be present:

- **The partners need to have a good relationship with each other based on trust, openness and respect. There also needs to be a willingness to make the system work.**
- **Ideally the farms need to be in the same geographic area.**
- **The following issues must be clarified: the legal structure, roles and responsibilities, how the business should be dissolved, how decisions are made, distribution of profit. Generally all the detail that cover any eventuality needs to be thoroughly discussed, agreed and record.**
- **A fundamental change in philosophy from looking after own land first to treating all the land equally is required. An underlying principal would be that the value of the land would be maintained and enhanced by good husbandry.**

Problems associated with the system

1 How do you get farmers to adopt the system? This is a major challenge. Clearly it is not applicable for everyone but it is a system with merits and would be of interest. Adaptations of the system have already occurred with neighbours sharing machinery, etc. and this would simply be a progression. Market forces will force farmers to consider the system when returns are so low and businesses look for new solutions. There is ample expertise within SAOS, SAC, Land Agencies and non farming organisations on how to operate joint venture companies. The promotion of the system with the provision of full information would create awareness and generate interest.

2 The legal structure of the new business needs careful consideration and expert advice. Likely alternatives include: Partnerships, Limited Companies, Contract Farming Agreements. Whatever business form is chosen a mechanism to cope when a partner needs to exit must be planned.

Of the three alternative business forms the Contract Farming Agreement has been the most popular. It does not fall within the Agricultural Holdings Act, thus avoiding the creation of a tenancy. It is also not a Partnership but a joint venture between two partners, the 'Farmer' (landlord) and the 'Contractor'. The 'Farmer' is engaging the services of the 'Contractor', thus the trading position is preserved as far as tax, and VAT are concerned. The 'Farmer' is considered to be actively farming so is able to enjoy all the capital taxation benefits that brings.

5. Arable joint venture *continued...*

Advantages for the farmer

- **Avoids creation of a tenancy**
- **Retains occupation of the farmhouse and land**
- **Income can be more stable**
- **Frees up time to pursue other activities or semi-retire**
- **Frees up working capital**
- **Benefits from Contractors skill and scale.**
- **Retains capital taxation reliefs**
- **Suits new investors in farming –gain the tax advantages but don't need the faming experience**

Advantages to the contractor

- **Allows opportunity to expand business and gain economies of scale**
- **Better utilisation of spare capacity; machinery, labour, capital, etc.**
- **Broadens the farming base**

Financial analysis of the system

A group of 10 farmers in a Turriff discussion group were asked 'what would be the machinery and labour requirement to farm 3,500 acres of crops?' After their considered response, the current total machinery and labour resource was calculated for their 10 businesses (on which the crop area also totalled 3,500 acres). See results:

Ideal versus actual machinery and labour complement to farm 3,500 acres of crops

	Ideal	Actual	Capital Released (£,000)
Labour	3+ Casual/Ring	11	136
Tractors	4 + 2 hired	37	495
Combine	3	9	180
Ploughs	1 + Contractors	10	13
Drills	2	8	12
Sprayers	1	9	8
Grain Driers	1	10	18
			£862,000

The potential benefits are clear to see, with a saving in capital (if moving from the actual to the ideal situation) of £862,000. Even allowing for the need to purchase larger, high output machines the benefit should exceed £500,000.

In addition, the unit costs should be lower with improved efficiency (ie lower fuel, repairs and labour costs per ha). This would make the cost to produce a tonne of grain lower and the business more competitive. There are good examples of arable joint ventures. The mechanisms required to operate these groups are becoming well established.

6. Effective Grain Marketing

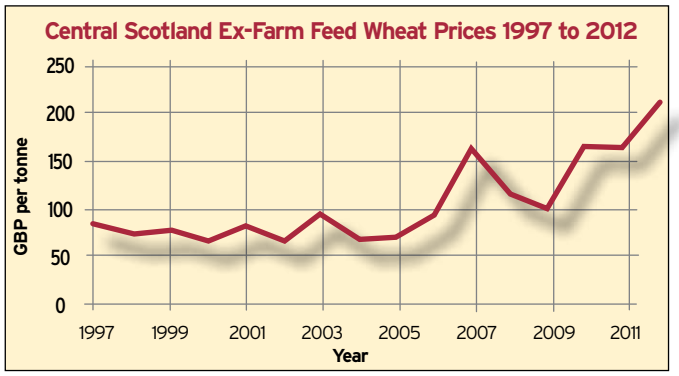
In a volatile market, it is essential to take steps to manage the price risks inherent in world commodity markets.

The price which each and every producer receives for their cereal and oilseed is directly impacted by the global trade in these commodities. Exposure to world prices means exposure to volatility for Scottish prices and therefore farm incomes. It is no longer acceptable to plant the crop and wait until harvest to sell, as the price which encouraged you to plant may no longer be achievable when harvest comes.

Managing that risk plays an integral part in the profitability of the overall farm business. To do this effectively requires an understanding of production costs, and therefore carrying out a farm budget to compare break-even production cost to the market price. If the comparison is good enough to plant, then it should be good enough to sell a proportion forward.

Effective marketing revolves around using risk management techniques to reduce your business exposure to increased global price volatility.

There has been a significant shift in the market dynamics, from a relatively stable market to what is now a highly volatile market as illustrated in the graph below. For example the average price for the period 1997 to 2006 was £77/tonne with a 22% variation over the period, whereas from 2007 to 2012 the average price was £152/tonne with a 39%variation over the period.



What is price risk management?

The one area of increasing risk important to virtually every producer is price/income risk. This has led to most grain exchanges expanding their products, such as "futures" and "options", to manage price risk for producers. Used correctly they can successfully manage price risk, however used incorrectly they are merely speculation with potentially severe financial implications. The key is to thoroughly understand what they are, how they work, and how they can benefit your business.

There are several steps which are worth following to help initiate effective price risk management:

1. Know your cost of production

You need to know what costs your selling price has to cover, and calculating the cost of production will help in establishing a minimum target price.
However market prices are not directly influenced by your cost of production and it may be the case where the market is not going to cover these costs. In this instance, a marketing strategy becomes more crucial, to ensure any gap is minimised. In this case you need to question your costs and benchmarking with other producers can be both useful and enlightening.

2. Set a target price

Decide on the minimum price level at which you would be prepared to start making decisions. This should be based on your Cost of Production and will become your "trigger" price in the market place.

3. Understand and monitor the market

Once you have established your trigger point, then monitor the market prices to ensure that you capitalise on any market movements in your favour. This can be done well in advance with futures trading open for a 32 month period. Before beginning to monitor markets, make sure you are familiar with market terminology and reliable sources of independent advice eg www.hgca.com/markets

4. Know your basis

This is when it starts to become more complicated. "Futures" price is effectively the price paid in to store. Your "basis" is the difference between your ex-farm price and a specific futures contract, and will account for costs incurred such as storage, transport, quality etc.
Your basis will vary depending on factors such as distance from port, and can rise or fall independent of price movements.
Your basis can be calculated by comparing the relevant futures price to ex-farm merchant quotes for the same time period.

5. Understand the tools available to you

Ensure you have an understanding of the various tools such as "futures" and "options", and find a risk management partner to act on your behalf. If you don't understand it don't do it.
Grain merchants and co-ops should give you access to these tools as part of a physical forward grain contract, although you can access them independently of your physical grain.

6. Develop a strategy

Your strategy will be based on your trigger price, as well as cash flow, storage and any other business considerations. The strategy will determine whether you trade futures, options, spot markets or a combination, and in what relation to your physical grain production. It should also fit with your attitude to risk, risk profile, target market and market view.

- **Risk profile relates to the proportion of your crop that is either un-priced, fixed price or minimum priced. If 100% is un-priced then your risk profile is high.**
- **Market view is your own and is based on the market information available to you, and your view should influence your strategy. The less information you have available, the less accurate your view will be, and the lower risk profile your strategy should be.**
- **Your attitude to risk describes how much of a risk taker you are, but this should reflect the ability of your business to absorb that risk.**

7. Trading futures

Trading futures requires an initial cash deposit, and may require additional payments to cover margin calls if the market moves against your position, to keep your position liquid.
It is important to monitor your trading positions regularly so that you can get out of the market if you need to.

8. Buying options

Options are effectively price insurance and should be included in your budget for calculating cost of production. The cost is related to the sale price of the grain.

- **Call Options are used to capture price rises on previous sales – if the market moves up you can use the option to get out of the original price and sell at the new price.**
- **Put Options are used to protect the value of unsold grain.**

9. Speculation

Speculation is not risk management – don't trade more futures or options than your physical grain. They only function as a risk management tool when balanced against your physical exposure to the market, so be realistic about yields and quality when deciding on your amounts.

10. Monitoring

Risk management is an on-going process and your strategy is specific to your business circumstances. You cannot take a generic plan and apply it to your business in any format other than as a guide. Monitor the market daily to decide how to act on your existing positions and strategy.

If you cannot, or are unable, to follow these steps, then use a partner who can.

7. Soil Management

The basic things that the plant requires from the soil are:

- **Nutrients**
- **Water**
- **Oxygen**
- **Support and anchorage**
- **Open structure for roots to penetrate (lack of compaction)**
- **No adverse materials such as toxins/pollutants**

Texture versus structure

Soil is often described by two properties:

- **Soil texture** – the relative amounts of the primary particles sand, silt clay and organic matter
- **Structure** – the arrangement and packing of particles resulting in their grouping into aggregates

Soil texture is fixed, while soil structure is changed by many agricultural activities including cultivation and machinery traffic.

Functions of organic matter

Organic matter is an essential component of soils because it:

- **Stabilises the soil by holding soil particles together, thus reducing the hazard of erosion.**
- **Improves soil structure by making the soil more friable, less sticky, and easier to work.**
- **Helps maintains open un-compacted structure that facilitates penetration by plant roots.**
- **Increases porosity for air and water infiltration, reduces runoff**
- **Stores and supplies nutrients such as nitrogen, phosphorus, and sulphur, and acts as a holding reservoir for P, K and Mg.**
- **Retains carbon from the atmosphere and other sources.**
- **Provides a food source for soil microbes.**

Structure

Soil structure is the architecture of the soil. Structure describes the size, shape and stability of units in which the individual particles of the soil are held together, commonly called aggregates with associated spaces or pores between and within these aggregates. The relevance of structure to good soil husbandry lies in the key role played by the pores. It is here that drainage, aeration and growth of the roots takes place and also where countless organisms live, ranging from beneficial bacteria and fungi to worms and beetles.

The strength of a soil (resistance deformation) depends on texture and on its water content. Soil strength decreases with increasing wetness and the greatest risk of structural damage occurs when soils are at, or near, field capacity. As water content of the soil increases the soil becomes softer and more easily deformed and will reach a phase called "plastic". The plastic limit or plasticity describes the soils ability to be shaped when stress is applied and to retain the new shape after the removal of the force. Above the plastic limit, a soil that is compressed will retain the compressed form. Typically, these alterations are in response to externally applied forces such as mechanical cultivations or internally from strains that occur as a result of changes in soil water content by drying, wetting, freezing and thawing.

The only real oportunity a grower has to modify a soils structure is in the period between crops. The extent and nature of every cultivation operation should be adjusted according to the soils current state, as soils when wet at operational working depth are more easily damaged and to a much greater extent.

A wide range of practices are possible to preserve and improve soil structure. For example increasing organic matter content by incorporating straw, reducing or eliminating tillage and cultivation, avoiding soil disturbance during periods of excessive dry or wet when soils may tend to shatter or smear and ensuring sufficient ground cover to protect the soil from raindrop impact.

Soil Water Movement and Pore Space Relationships

The most important functions of soil are to store and make available moisture and nutrients. Water in the soil is held in the pores between soil particles. The amount of water that a soil can hold after drainage has stopped depends on soil texture and to a lesser degree on soil structure and compaction.

Hydraulic conductivity is a property of soil that describes the ease with which water can move through the soil. It depends on the permebility of the soil (pores size, fissures and compaction) and the moisture content of the soil. The infiltration rate can only be maintained if the system of coarse pores is maintained.

Infiltration is the process by which water on the ground surface enters the soil. The water enters the soil through the pores by the forces of gravity and capillary action. The largest cracks and macropores offer the greatest conduit for the initial flush of water. This allows a rapid infiltration. The smaller pores take longer to fill and rely on capillary forces as well as gravity. The smaller pores have a slower infiltration rate as the soil becomes more saturated.

Drainage rates are a combination of hydraulic conductivity and infiltration, hence do not relate well to texture. In most soils, the subsoil drainage rate will control the whole profile.

8. Agronomy Groups

Working with other farmers to share experiences in crop production, and utilising the skills of independent agronomists can result in substantial improvements in efficiency and margins.

CASE STUDY

Scottish Agronomy (Independent cooperative)

Scottish Agronomy (SA) has 200 members covering more than 50,000ha of combinable crops and potatoes. Working with 18 groups of farmers from Easter Ross to the Borders, SA generates topical and novel information from its national trials programme. The trials encompass all elements of agronomy, and this combined with the knowledge generated from working with farmers in different parts of the country over a wide range of soil and climatic conditions, creates a unique pool of practical information that can be distributed to members in a very efficient manner. Member services include:

- **Regular bulletins describing crop development, input requirements, seasonal problems and updates on trials.**
- **Open days on trial sites to update members on trials progress and answer queries.**
- **Annual regional results meetings impart the conclusions of the season's trials.**
- **An annual conference with speakers on a diversity of topics – EU policy, core research, supply chain, etc.**

The group service operates on a monthly basis, meeting on a different farm in the group by rotation. A Scottish Agronomy advisor leads the morning discussion on detailed crop input and management issues as well as topical marketing and legislative issues. Group participation and feedback is key to enhancing the value of the service to each member. Informal (and some formal) machinery and labour sharing activities take place to at least some degree within each group. As well as the group service, a one-to-one agronomy service is provided, with bespoke advice given on a more detailed field by field basis. Members subscribing to this service are also welcome to attend their local monthly group meetings. An information package is also available to those interested in accessing the data generated by the trials programme. This service is enhanced by regular bulletins as well as telephone and email contact with the advisory staff.

Current topical areas of research within the trials programme include

- **Comparison of the performance of ammonium nitrate vs urea in winter wheat, winter barley and spring barley. Urea is currently very competitively priced against ammonium nitrate, but growers may be wary because of perceived spreadability and volatilisation issues. This trials series will help to provide answers.**
- **Seed treatments. Using heavily infected seed to separate the men from the boys. These trials have identified highly significant plant establishment and ultimate yield differences between the best and worst seed treatments used to control microdochium nivale – the most common seed borne cereal disease.**
- **Fast tracking high yielding varieties. Large scale variety trials are identifying varieties at an early stage of development that show outstanding yield and disease resistance. Detailed agronomic input trials are carried out on these varieties to provide a 'best practice' blueprint for growers, optimising fertiliser, fungicide and growth regulator programmes.**

Until recently spring malting barley yields had remained largely static since Optic was first introduced in 1995. Recently introduced varieties have demonstrated the greatest potential to advance yields of quality barleys since then. Scottish Agronomy trials have demonstrated average yield increases of 0.6 t/ha from these new varieties. In addition they are also significantly less prone to disease, with resultant savings possible in fungicide spend. A significant investment has been made in the last two seasons to fine-tune the agronomy of this exciting new wave of barley varieties.

9. Information technology

A number of specialist arable software packages are available. At their heart all of these systems are about recording information and then presenting it in a format that serves a function for the business. Electronic systems allow common data such as field names, areas, products and practices to be stored and allocated in a simpler more repeatable manner than longhand recording. With the correct training it is possible to develop a basic on farm system using standard software; however, it is likely to require a great deal of time. A typical crop management software package starts at around £900. Most software developers offer a range of modules that can be added to produce a package suitable to the needs of an individual business.
Software developers are utilising the increasing ruggedness and adaptability of mobile devices such as smart phones and tablet computers to allow data to be viewed and recorded in the field. Wireless data transfer through 'cloud computing' systems increases the reliability of data gathered on such devices.

Application Planning

Software systems are available to perform a number of planning functions. These include;

- **Creating plans for fertiliser applications within a Nitrate Vulnerable Zone.**
- **Assisted checking of product label restrictions on timing, sequencing, tank mixing etc of planned pesticide applications.**
- **Automatic publication of standardised application sheets for operators and contractors to minimise the potential for communication errors.**

Stock Control

Adequate recording of stocks of inputs such as pesticides and fertiliser may offer a reduction in excess inputs being held on farm. This has financial and practical benefits. By comparing planned applications with the recorded stocks downtime of machines and operators can be minimised. Adequate stock records of inputs such as nitrogen fertiliser and pesticides are a statutory requirement and necessary for a number of marketing schemes.

Field Records

Adequate recording of field applications is a basic requirement to satisfy a range of legislative and market requirements. In most systems the application plan can be converted to a completed field record without the need for multiple entry of the same information. It can then be retrieved to inform inspectors and to review management decisions.

Enterprise Analysis

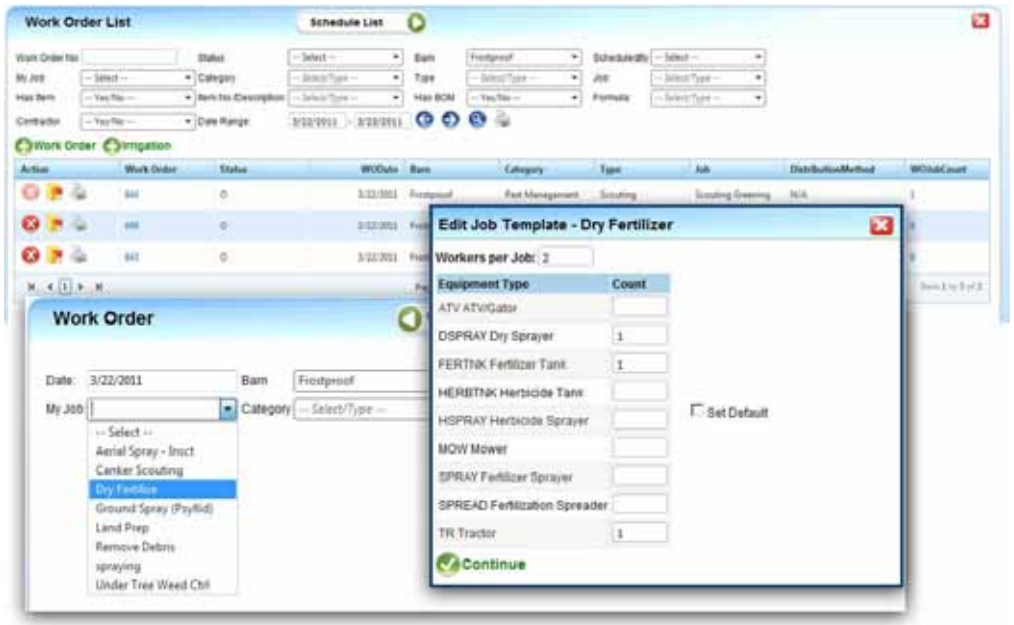
The information stored within dedicated crop recording software can be used to analyse financial performance at the field, crop or whole farm level. Entering pricing information for an individual input or output allow it to be applied across the whole business. This creates the opportunity to evaluate the financial implications of the management decisions made in response to field or crop conditions.

Mapping Software

- **Mapping modules can be used to fulfil a range of functions.**
- **Issuing clear instructions to staff or contractors.**
- **Recording areas with restrictions on applications – eg waterside buffer zones for spraying or fertiliser.**
- **Viewing and manipulating data from precision farming systems – eg viewing yield maps or producing application zones for P&K fertiliser.**

Sources of Information

http://farmplan.co.uk/software/crop-management.aspx
http://en.muddyboots.com/cropwalker
http://www.farmworks.com/



10. Machinery rings

Machinery Rings are an integral part of Scottish agricultural allowing farmers to make more efficient use of machinery, access labour and source inputs. There are currently 8 Machinery Rings which cover the majority of Scotland. Their combined turnover is nearly £75million with a total membership of circa 6,500 and growing. The following case study is a good example of how a Machinery Ring can help its members.

HBS Ring Ltd was formed in 1989 in Munlochy under the guise of Highland Machinery Ring. The Machinery Ring business has changed in form several times since it's inception and now runs as two businesses – HBS Ring Ltd and it's wholly owned subsidiary company HALS Ltd. HBS Ring Ltd is based at Glaikmore, Tore in wholly owned purpose built offices at North Kessock near Inverness. The accommodation houses a small team of employees who are on hand to meet the needs of the HBS Ring Ltd members. The HBS Machinery Ring membership has grown to around 1,150 at present. The business was further expanded when HBS incorporated the Argyll Ring into the existing business in 2007 and the Skye Machinery Ring in 2010. The growth in business is highlighted by an increase in throughput from £1.2m in 2001 to £6.5m (2013) over the last 10 years.

For 12 years, the HBS business has been run by Managing Director Alan McLean who has seen the needs of the membership change:

"Machinery rings now are much more than a means to arranging your contracting. As farming has changed over the years then so too has HBS. We are now able to offer a full suite of services to meet almost any rural business request. To meet this demand the requirement of skills in the office have also had to change. HBS employs specialist staff to deal with demand for training and labour as well as the ability to recognise the best deals available over a wide range of inputs"

The range of services offered by HBS has evolved to meet the needs of it's members over the years. The initial offering of machinery contracting and machinery sharing has been joined by a comprehensive range of other services. This is facilitated by a well-established and robust database which holds the member details and the offers of supply from each of them as individuals.

The main activities of the ring can be split into five areas...

- **Machinery hire and Contracting** Allowing members to share machinery giving smaller businesses access to equipment without the cost and commitment of ownership for the demander while providing a return on investment to the supplier.
- **Labour** Filling short and long term requirements on farms. This ensures good quality staff are available at key times whilst removing the extra work and hassle and expense involved in employing staff.
- **Training** Providing a large range of vocational training courses which is crucial to businesses keeping abreast of Health and Safety legislation and to maintaining an efficient qualified workforce
- **Farm Supplies** The Ring through it's service company HALS Ltd provides a brokerage service for members on a full range of farm inputs which includes Fuels and tanks, Fertilisers, Limes, Seeds, Feeds, Forages right through to Phones and Electricity. One phone call to the Ring office can result in Ring staff contacting a range of local suppliers to find the best price available on a host of commodities and services.
- **Renewables** HBS through HALS Ltd has become a focal point for members looking for information and competitive options for the installation of renewables. As an "honest broker" – Ring members trust the Ring to help them find the best solution for their needs.

10. Machinery rings *continued...*

**HBS Staff Members;
Back row left to right
Rod McKenzie, Isla Christie,
Alan McLean, Richard Jones,
Mary McLean, Donald Douglas
Front row left to right
Louise Dodd, Sandra Rea,
Carol McKay, Beth Davren
and Jean Gray**

This means that when a member contacts the Ring to request a service, a search of the members who have that service available can be carried out on a geographical basis. Once the work has been carried out and an invoice raised HBS will collect the money by Direct Debit from the Demander's bank account and then pay the relevant sum directly into the Supplier's account. For this, HBS charge a small commission which is usually 2% of the total job cost. Machinery Rings continue to be genuine cooperatives who charge an annual membership fee from each member, no matter what size of Agricultural holding or business they may have. Each member owns an equal shareholding in HBS to all other members. A Board of Directors is then elected from the membership to direct the business.

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Machinery Ring contacts...

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11. Co-operative advantages

CASE STUDY East of Scotland Farmers

Benefits to Members

East of Scotland Farmers Ltd is a co-operative, established in 1959, with a purpose to service its members in all aspects of growing and marketing of grain, particularly malting barley, and dedicated to working in their interests. The co-operative handles 65,000 tonnes of grains with 165 members dedicated to the grain pools. What differentiates EOSF is that it provides a one-stop-shop with its full range of services in support of producing grain. The benefit to members is that it reduces their risks, increases the value of grain and reduces overall costs of growing, harvesting and marketing.

In 2013, the co-op invested over £3.5m in upgrading and expanding its grain handling and drying facilities, ensuring members and customers get improved service and value for money. As chairman, George McLaren, commented: "This investment takes East of Scotland Farmers forward and ensures that we can continue to meet the needs of our farmer members and our grain customers for decades to come."

Farmers by working together through EoSF provide themselves with the following:

Grain Marketing

- Professional staff marketing grain on farmers' behalf on a pooled basis
- Direct markets, market security from reputation with customers
- 80% of price paid at harvest, but full season's trading opportunities
- Information provision re: varieties for markets, etc

Grain storage and drying

- Farmers do not have to invest in storage or drying assets on farm
- Farmers deliver grain in to store on an ad-hoc basis 7 days/week
- Local service – easy to get samples tested, short trip home for rejected loads
- Grain segmentation by quality, and season long storage
- EOSF accepts Malting Barley & Feed Barley at the same intake – no redirection fee for rejections

Inputs

- Fertiliser pool to secure partnership and competitive prices from manufacturers
- Stock of seed, feed, chemicals and range of farm and domestic products
- Seed dressing plant for members to dress home-saved seed
- Business credit accounts

Advice

- Agronomy service – geared to producing crops for defined markets

Agricultural contracting

- Access to range of general and specialist equipment
- High quality service
- Stubble to stubble management service

Benefits of grain pool membership

- Pool prices (not top prices, but safe, above average prices)
- Market security, spread risk and peace of mind
- Cash flow, early initial payments
- Quick movement off-farm, long opening hours, reliable transport
- No redirection fees if loads do not meet specification
- Able to question analysis results, and talk to those conducting the tests
- Ability to commit grain from a stated area (most pools require a defined tonnage, leaving you to market the balance, or risk being bought against on any shortfall).
- Local facilities, access to local decision makers
- Transparency of finances
- Being part of a farmer co-operative working in your interests

think.
plan.
do...