

# Improving ewe breeding for Better Returns



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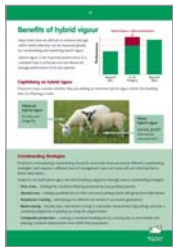
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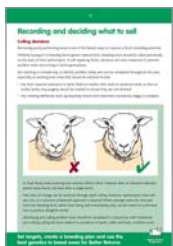
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The breeding ewe is key to any sheep system. However, selecting ewes for your own replacements or to sell to others is no simple task.

Potential breeding stock needs to be selected to suit the specific system and the intended markets for its progeny.

Thankfully, the challenge of selection is made easier by the availability of a range of Estimated Breeding Values (EBVs) which will assist the breeder to select ewes that will complement the long-term aims of the flock.

This manual, the ninth produced by EBLEX Ltd's Sheeps BRP, aims to help you understand the issues that could improve your breeding ewes, and the overall financial performance of your sheep system. From deciding between buying-in or breeding your own replacements, through to the key traits that will affect the marketability of resulting lambs, you are sure to find some useful tips and advice.

I hope you find this publication useful. Be sure to try out the strategic pointers which will help you devise the targets that will underpin the profitability of your sheep enterprise and deliver Better Returns.



*D Raine*

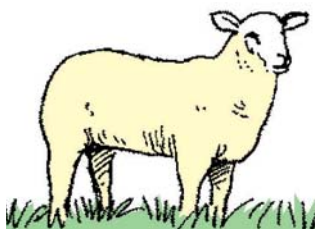
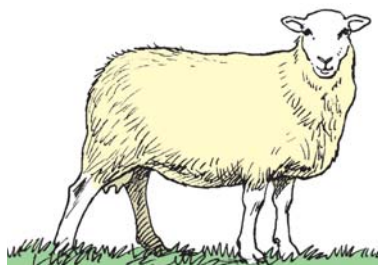
David Raine  
Board Member  
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# Profitable sheep production

A flock's physical performance significantly affects profitability, either through reduced input costs or increased output. Both breeding potential and flock management affect performance.

Maternal breeding strategies are complex. A breeding ewe's ideal genetic makeup will depend on far more traits than are required in a slaughter lamb.

**Diagram 1. Genetic traits that may influence a flock breeding plan**



## Traits expressed in the ewe

### Productivity

Early maturity  
 Out of season breeding  
 Fertility – including pregnancy rate  
 Number of lambs born \*  
 Lambing ease  
 Maternal behaviour (lamb survival)  
 Maternal ability (miliness) \*  
 Mature size (ewe efficiency) \*  
 Longevity

### Health and ease of management

Temperament  
 Local adaptivity (hardiness)  
 Disease resistance e.g.
 

- Worm resistance \*
- Worm resilience
- Footrot resistance
- Mastitis susceptibility
- Scrapie genotype

 Polling  
 Wool shedding  
 Freedom from dag

## Traits expressed in the lamb

### Lamb survival

Birth weight  
 Lamb vigour  
 Lamb survival

### Lamb sale value

Growth rate (weight & feed efficiency) \*  
 Carcase conformation \*  
 Fat class/level of finish \*

\* EBVs can be used to influence these traits

## Remember

Selective breeding can improve all these traits by exploiting:

- Within-breed differences (using EBVs)
- Hybrid vigour
- Genetic differences between breeds.



# Planning a breeding strategy for the flock

A number of issues require careful consideration when determining an appropriate breeding strategy for your flock.

## 1). Review current performance of your flock

- Recognise strengths and weaknesses of current system
- Compare performance to national benchmarks.

## 2). What will you be producing in the future?

- Define what you plan to market, eg sell 1.85x19kg R3L lambs from each ewe
- Consider factors shaping your enterprise, eg climate, available labour, housing, and feed resources.

## 3). What do you want to change in the current flock?

Establish a set of breeding goals by listing the traits you wish to change in:

- Breeding flock
- Slaughter generation.

## 4). How will you enhance flock performance through breeding?

- Are the traits you wish to change easier to enhance through within-breed selection (using EBVs) or crossbreeding (exploiting hybrid vigour).

## 5). Will you achieve changes by purchasing new breeding stock?

- Are EBVs available to support selection decisions?

## 6). Will you achieve changes by selecting superior home-bred replacements?

- Do you need a recording system to identify the best home-bred sheep?
- Will the system identify sheep that perform well or those to be culled?
- How will animals be identified?
- Which traits will you record and when will they be collected?
- How will records be analysed?
- How will you make selection decisions?
- How will you select superior rams to enhance maternal traits?

## 7). How will you monitor your success over time?



# Setting breeding objectives

Establish breeding objectives by identifying which traits could be most easily improved to boost flock profitability.

Comparing flock performance with national benchmarks can help.

Once flock strengths and weaknesses are identified, simple calculations can help determine which traits have the greatest financial impact.

Where strategic changes are planned, eg out-of-season breeding, mating ewe lambs or moving to a low labour system, greater changes in the genetic merit of the ewe may be needed.



## Benchmarks of physical performance

	Typical English Lowland Flock	Current	Target
Average flock size	460 ewes		
Stocking density (LSU/ha)	1.72		
Number of lambs born alive	156 per 100 ewes mated		
Lamb mortality	16 per 100 ewes mated		
Lambs sold/retained for breeding	140 per 100 ewes mated		
Average lamb carcass weight	19.2kg		
Lamb sold/kg ewe	28.0kg		
Carcasses hitting premium conformation class (EUR)	85%		
Carcasses hitting premium fat grade (2, 3L)	78%		
Days to slaughter	150 days		
Ewe longevity	3.5 years		
Ewe mortality	3%		

## Determine the most profitable breeding strategy

Example: Farm A – a flock lambing at 150%, selling 18.5kg carcasses averaging £2.30/kg deadweight, with 70%+ carcasses meeting target specifications.

### Four scenarios

### Potential value £ per ewe

- Increase lamb numbers sold by 10% = £4.26
- Increase average carcass weight by 0.5kg = £1.73
- Reduce 4L carcasses by 20% (25p/kg penalty) = £1.39
- Increase U grade carcasses by 10% (21p/kg premium) = £0.58

Here the biggest financial driver is increased prolificacy – providing lambs are successfully reared

Identify key factors to improve your flock

# Breed your own or buy-in female replacements?

Deciding whether to retain home-bred female replacements, or buy them in, depends on several factors that influence the flock's financial performance.

	Buy-in replacements	Home-bred replacements
Impact on replacement costs	Depends on relative market price for lambs and breeding ewes	
Control over breeding potential of ewe	Very little	High with EBV-based selection
Extra resources needed, eg land and labour	No	Yes
Threat to flock health status	Significant risk – where females are brought in	Greatly reduced – closed flock may be run

Keeping replacement females should not be a knee-jerk reaction to either high breeding stock prices, or low ewe lamb values. Instead aim for a planned approach to enhance flock performance by keeping females of known breeding potential and health status.

Producers considering breeding their own replacements must develop a plan which:

- Assesses financial implications of keeping home-bred females
- Establishes performance-based breeding goals
- Considers selection of stock rams based on Estimated Breeding Values (EBVs) to improve economically important traits
- Capitalises on hybrid vigour
- Establishes simple recording systems to identify animals to keep or cull.



## Remember

- Plan a breeding strategy carefully to produce more productive females.
- Don't practise 'negative selection' – keeping poor performing, less saleable females for breeding.

A simple costings exercise can compare the relative benefits of buying vs. breeding female replacements. These two examples show different approaches will suit different farms.

## Example 1. Bob, Home Farm, Chesterwich

	Buying in shearling ewes	Retaining home-bred replacements
Potential value of purchased shearling ewe/home-bred ewe lamb	Cost of shearling ewe @ £70 + £3 haulage + £2 vet costs on arrival = £75	Value of top third of lambs @ £43, + 2% mortality over 12 months = £43.86
Plus costs associated with management for extra 12 months to mating	None – because ewes are bought in	Grazing costs £10, Additional feed £2.40, Vet costs £2.50, Labour £12 = £24.90
True cost of shearling ewe	£75	£70.76
Difference in cost of a shearling ewe		Benefit = £4.24
Potential benefit from improved health over working lifetime		Running a closed flock is planned to reduce losses and labour costs associated with enzootic abortion and lameness: £2.00 x 3.5 years = £7.00
Potential benefit from improved breeding over working lifetime		Breeding strategy designed to increase number of lambs sold by 3% per annum: £1.50 x 3.5 years = £5.25
Improvement in flock performance		Benefit = £12.25
By retaining home-bred replacements this farm has a total benefit worth (£4.24 + £12.25) £16.49 or £4.71/ewe a year. Retaining home-bred ewe lambs is clearly not a cheap option, but significant improvements in flock productivity can be achieved through greater control over breeding potential and flock health status.		

## Example 2. David, Church Farm, Middledown

	Buying in shearling ewes	Retaining home-bred replacements
Potential value of purchased shearling ewe/home-bred ewe lamb	Cost of shearling ewe @ £70 + £3 haulage + £2 vet costs on arrival = £75	Value of top third of lambs @ £43, + 3% mortality over 12 months = £44.29
Plus costs associated with management for extra 12 months to mating	None – because ewes are bought in	Grazing costs £15, Additional feed £3.50, Vet costs £2.50, Labour £13 = £34
True cost of shearling ewe	£75	£78.29
Difference in cost of a shearling ewe	Benefit = £3.29	
Potential benefit from improved health over working lifetime	Ewes sired by rams selected for worm resistance £1.25 x 3.5 years = £4.38	
Potential benefit from improved breeding over working lifetime	Larger framed ewes selected to increase carcase weights: £1.10 x 3.5 years = £3.85	
Improvement over working lifetime	Benefit = £8.23	
Here the total benefit of buying in replacements is (£3.29 + £8.23) £11.52, or £3.29/ewe a year. It is relatively expensive to rear home-bred replacements and purchasing ewes from a known source provides scope to improve both worm resistance and lamb growth rates.		



## Counting your cost

Consider your enterprise and, based on your own experience, calculate the costs you incur if buying in or breeding your own replacements.

	Buying in shearing ewes	Retaining home-bred replacements
Potential value of purchased shearing ewe/home-bred ewe lamb		
Plus costs associated with management for extra 12 months to mating		
True cost of shearing ewe	£	£
Difference in cost of a shearing ewe	Benefit = £	
Potential benefit from improved health over working lifetime		
Potential benefit from improved breeding over working lifetime		
Improvement in flock performance	Benefit = £	
Total benefit (£) = difference in cost of shearing ewe (£) + improvement in flock performance (£)		

Flock replacement costs not only depend on the relative value of the breeding ewe, but also on the length of her productive life and salvage value.

### Remember

Consider retaining home-bred replacements where:

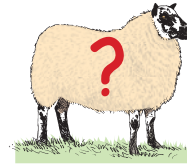
- Bought-in replacement cost is high, relative to lamb sale values
- Resources exist to run a sub-flock of female replacements
- Productivity could rise through:
  - Improving flock health by closing the flock
  - Improving ewes' breeding potential.



# Why growth matters

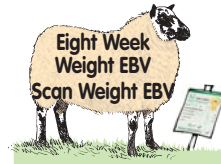
High growth rates can:

- Increase weight of lambs sold either on a live or deadweight basis
- Increase the size of store lambs
- Enhance production efficiency by reducing days to slaughter
- Enhance timing of sales to hit periods with better market returns



Weaning weight

+23kg



+27kg at weaning

## Which EBVs are important?

Eight Week Weight EBV (kg)	Scan Weight EBV (kg)
<p>An indication of breeding potential for growth to 8 weeks</p> <p><b>Example</b> A ram with an EBV of +4kg is estimated to produce lambs which are 2kg heavier at 8 weeks of age than a ram with an EBV of 0.</p>	<p>An indication of breeding potential for growth to 21 weeks</p> <p><b>Example</b> A ram with an EBV of +6kg is estimated to produce lambs which are 3kg heavier at 21 weeks of age than a ram with an EBV of 0.</p>



## Remember

The breeding potential for high growth rates:

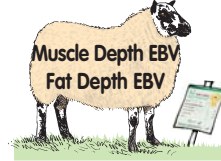
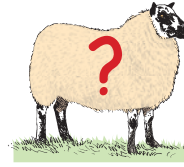
- Is only realised under good management – adequate feed and high flock health status
- Will increase carcase weights and reduce time to slaughter

However, selecting rams with EBVs for high growth rate alone can increase ewe mature size which, on some systems, will reduce flock efficiency (page 11).

## Why quality matters

Rams with superior Muscle Depth EBVs will produce more lambs that meet market specifications.

Rams with low Fat Depth EBVs will sire lambs that can be taken to greater weights, without being penalised for over fatness.



Carcase  
quality

R3H

U3L

### Which EBVs are important?

Muscle Depth EBV (mm)	Fat Depth EBV (mm)
An indication of breeding potential for muscling across the loin	An indication of breeding potential for fatness across the loin
<p><b>Example</b></p> <p>A ram with an EBV of +4mm is estimated to produce lambs with loin depths 2mm deeper at 21 weeks of age than a ram with an EBV of 0.</p>	<p><b>Example</b></p> <p>A ram with an EBV of -1mm is estimated to produce lambs with 0.5mm less fat across the loin at 21 weeks of age than a ram with an EBV of 0.</p>

### Remember

Improving carcass traits usually has a lower priority within a maternal breeding programme, where other traits can give greater economic advantage.

However, in certain circumstances producers will wish to enhance carcass traits, particularly where:

- The flock is self-contained and the breeding goal is to produce a dual purpose breed or breeding line
- Hill lambs are failing to hit market specifications and further increases in prolificacy are deemed undesirable
- Lowland flocks have already reached optimum prolificacy and milking ability, so financial gains can be achieved by improving carcass quality

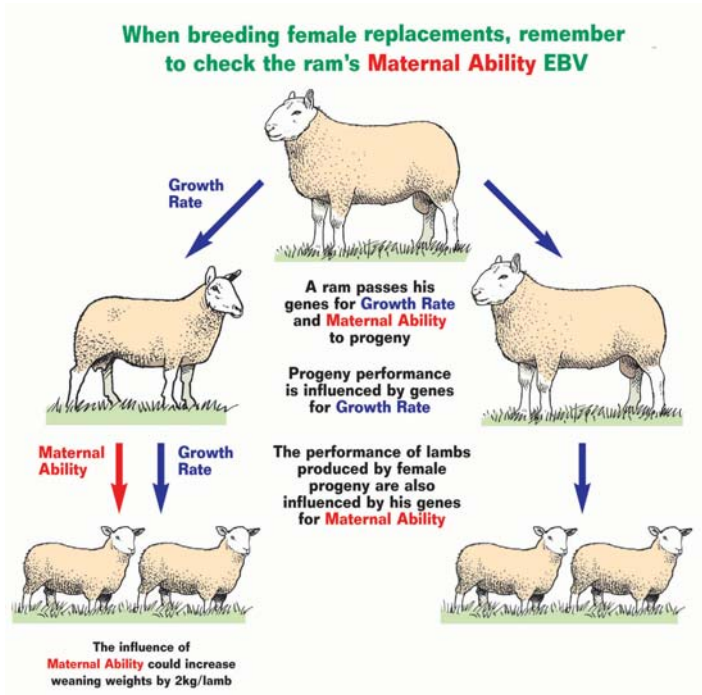
Research has shown that selecting breeding lines that will produce genetically leaner lambs will not influence ewe survivability.

Some farms will be better off finishing lambs at lighter weights directly off grass. When grass finishing, a ram with a positive Fat Depth EBV can be considered – depending on the breed.

# Why litter size and maternal ability matter

One key economic driver influencing profitability is the number of lambs reared a ewe.

Selecting rams with high Litter Size EBVs will increase lamb numbers produced by their female offspring. Selecting for improved Maternal Ability will ensure ewes have sufficient milk to rear their lambs.



## Which EBVs are important?

Litter Size EBV (lambs)	Maternal Ability EBV (kg)
<p>An indication of breeding potential for female prolificacy</p> <p><b>Example</b> A ram with an EBV of +0.20 is estimated to produce ewes which produce 10% more lambs than a ram with an EBV of 0.</p>	<p>An indication of breeding potential for maternal care, particularly milkiness</p> <p><b>Example</b> A ram with an EBV of +1 is estimated to produce ewes whose lambs are 0.5kg heavier at 8 weeks than a ram with an EBV of 0.</p>

## Remember

- Although litter size heritability is not high, significant progress can be made by selecting rams and ewes using the Litter Size EBV.
- Using EBVs to enhance prolificacy is more reliable than simply selecting rams reared as twins or triplets.

Lamb survival is influenced by several factors, both genetic and non-genetic. Flock management should be reviewed if large increases in prolificacy are planned.

## Why ewe mature size matters

There is a relationship between lamb growth rate and ewe mature size. There is usually a benefit from increasing lamb growth rates, but breeders must consider how this may affect mature size.

### Effects of increased ewe size

#### Advantages

- ✓ Lambs with superior growth rate
- ✓ Increased milking ability and prolificacy in some breeds, subject to adequate nutrition
- ✓ Increased cull ewe value
- ✓ Potential to increase breeding stock value, where larger ewes are in demand

#### Disadvantages

- ✗ Increased feed requirements
- ✗ Poor performance in a harsh environment
- ✗ Increased capacity required for housing
- ✗ Heavier, stronger sheep to catch and handle regularly
- ✗ Lower stocking density

### Which EBVs are important?

Mature Size EBV (kg)	OR	Scan Weight EBV (kg)
<p>An indication of breeding potential for size at maturity</p> <p><b>Example</b> A ram with an EBV of +8kg is estimated to produce ewes which are 4kg heavier at maturity than a ram with an EBV of 0.</p>		<p>Where flocks are not recording mature size and the Mature Size EBV is of limited benefit, the Scan Weight EBV can be used to identify breeding lines that will be heavier at maturity.</p>

### Remember

- Optimum mature size for ewes in a flock depends on the target lamb market and available farm resources, particularly feed and housing.
- The close relationship between lamb growth rate and mature size makes it difficult to select for faster lamb growth rate and smaller mature size – however certain bloodlines are available that can do both.





While EBVs can help to select breeding stock according to specific traits they can also be combined into a breeding index. To produce an index each EBV is weighted according to its economic importance in meeting one or more specific breeding objectives.

The Signet Sheepbreeder Service produces six indexes.

Index	Breeds using the Index	Important EBVs
Terminal Sire Index	Charollais, Hampshire Down, Ile de France, Meatlinc, Bleu du Maine, Rouge de l'Ouest, Poll Dorset, Suffolk, Texel, Beltex and Vendéen	Scan Weight, Muscle Depth, Fat Depth and Gigot Muscularity
Maternal Index	Some Lleyn and Poll Dorset flocks	Eight Week Weight and Maternal Ability
Longwool Index	Bluefaced Leicester	Muscle Depth, Maternal Ability Scan Weight and Mature Size
Welsh Index	Welsh hill breeds, eg Beulah and Welsh Hardy Speckles	Maternal Ability, Scan Weight Muscle Depth and Fat Depth
Carcase+ Index	Shropshires and some Lleyn flocks	Maternal Ability, Scan Weight, Muscle Depth and Fat Depth
Hill 2 Index	Scottish Blackface and North Country Cheviot	Scan Weight, Litter Size, Maternal Ability, Mature Size
Maternal+ Index	Wiltshire Horn	Maternal Ability, Litter Size, Scan Weight, Muscle Depth and Fat Depth

**Terminal Sire Index** – designed to increase lean meat yield in the carcass, whilst limiting any associated rise in fatness.

**Maternal Index** – enhances pre-weaning growth rates and lamb survival, by improving maternal ability.

**Longwool Index** – enhances the carcass quality of longwool rams and their progeny. Increases in lamb growth rates are important, but these increases are controlled so that ewe mature size does not become excessive. The index will maintain prolificacy at current levels.

**Welsh Index and Carcass+ Index** – identifies sheep with superior breeding potential for maternal ability, lamb growth and carcass quality.

**Hill-2 Index** – enhances the ewe's overall productivity by improving several traits simultaneously. The index will increase ewe mature weights, maternal ability, longevity and number of lambs reared to weaning. Lamb growth rates will increase resulting in heavier carcass weights at a constant age.

Many other commercially important traits can be enhanced through selective breeding, capitalising on differences both within and between breeds.

These include:

- **Early puberty** – Important for breeders wanting to breed from ewe lambs at an early age
- **Ability to breed out of season** – Lowland breeds have a longer breeding season than hill breeds. Poll Dorset and Dorset Horn sheep will readily breed out of season.
- **Temperament** – Differences exist between breeds, which have an impact on both shepherding and other production traits, eg lamb survival
- **Fleece characteristics** – Fleece weight and structure tend to be highly heritable. Rapid change can be made by selecting specific fleece characteristics.
- **Wool shedding** – The Wiltshire Horn breed and its crosses express the tendency to shed all or part of the fleece. This has been exploited in the “Easycare” strains of sheep
- **Health traits** – Many health traits have a low heritability and so opportunities to enhance them are more limited, but traits such as resistance to worms are now being evaluated.
- **Ewe survival and longevity** – within-breed differences tend to have a lower heritability, however major improvements can be made through crossbreeding.



Producers considering breeding their own female replacements need to consider whether these are to be purebred or crossbred.

### Advantages of breeding purebred females

- Simple system, where only one breed is required
- Potential marketing advantages from purebred sales
- Greater uniformity amongst breeding stock

### Advantages of breeding crossbred females

- Exploitation of hybrid vigour
- Wide access to different genetics
- Faster rates of genetic change



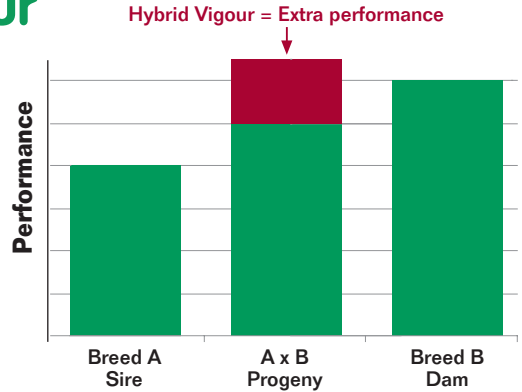
While hybrid vigour will influence growth and carcase traits, it has far more impact on traits influencing reproductive performance and longevity. In most production systems breeders capitalising on maternal hybrid vigour can enhance the number of lambs reared per ewe.

Hybrid vigour in the crossbred lamb		Hybrid vigour in the crossbred ewe	
Trait	Hybrid Vigour (%)	Trait	Hybrid Vigour (%)
Weaning weight	5.0	Fertility	8.7
Yearling weight	5.2	Prolificacy	3.2
Lamb survival	9.8	Lamb survival	2.7
Lambs reared/ewe	15.2	Lambs reared/ewe	14.7
Weight of lamb weaned/ewe	17.8	Weight of lamb weaned/ewe	18.0

## Benefits of hybrid vigour

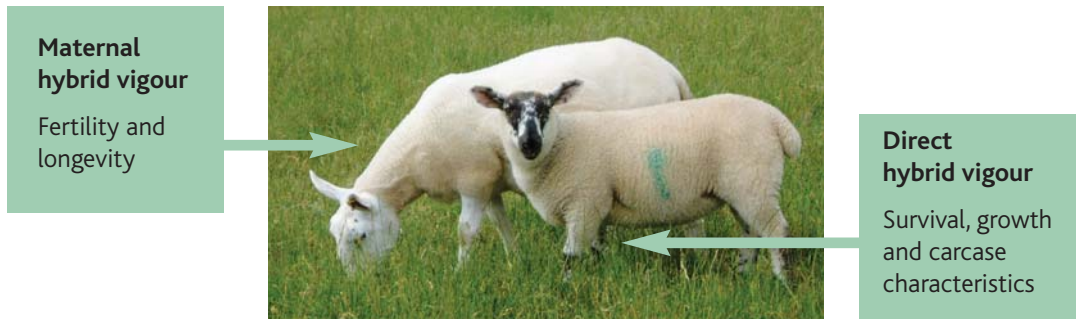
Many traits that are difficult to enhance through within-breed selection can be improved greatly by crossbreeding and exploiting hybrid vigour.

Hybrid vigour is the improved performance of a crossbred that is achieved over and above the average performance of its two parents.



### Capitalising on hybrid vigour

Producers must consider whether they are seeking to maximise hybrid vigour within the breeding ewe, its offspring or both.



### Crossbreeding Strategies

Producers contemplating crossbreeding should be aware that there are several different crossbreeding strategies. Each requires a different level of management input and some will suit individual farms better than others.

Producers can build hybrid vigour into their breeding programme through various crossbreeding strategies:

- **First cross** – utilising the crossbred offspring produced by two purebred parents
- **Second cross** – mating a purebred ram to a first cross ewe creating a lamb with genes from three breeds
- **Rotational crossing** – alternating two different sire breeds in successive generations
- **Backcrossing** – introducing a new breed to bring in a desirable characteristic (eg polling) and then a sustained programme of grading up using the original breed
- **Composite production** – creating a crossbred breeding line by crossing two or more breeds and keeping crossbred replacements from within that population.

# Recording and deciding what to keep for breeding

Record keeping need not be a chore. A simple system can quickly identify stock to keep as replacements and those that should be culled. In any flock, aim to identify sheep that will be productive, long-lived and easy-to-manage.

## Identifying potential replacements

Selecting home-bred replacements for future breeding has two phases.

- **At birth**, mark – with ear tag or notch – lambs that are born easily, sucked without assistance and whose mothers demonstrate high levels of maternal care. In many lowland flocks only multiples will be marked
- **At weaning**, or as first lambs approach slaughter weight, select from the group those that are well-grown, free from dag and structurally sound. Retain lambs passing this second inspection for breeding.

These tables enable producers to calculate the number of flock ewes that need to be mated to maternal rams to breed sufficient female replacements for their flock.

## Number of female replacements required

	Future flock size		Annual ewe culls		Annual ewe deaths		Initial flock size		Number of female replacements required
Example	500		100	+	20	-	500	=	120
Your flock		+		+		-		=	

## Number of flock ewes to be mated to breed replacements

	Number of replacements required		Lambing rate Number of lambs reared per ewe mated		Proportion of females born Assume 50% of lambs are female		Retention rate of ewe lambs Proportion of ewe lambs selected for breeding		Number of ewes to be mated to maternal ram
Example	120		Currently 1.35 lambs sold per ewe mated $120 \div 1.35 = 89$	÷	$89 \div 0.50 = 178$	÷	70% of ewe lambs retained $178 \div 0.7 = 255$	÷	255 ewes should be mated to breed female replacements... and the rest can be mated to a terminal sire
Your flock		÷		÷		÷		=	



# Recording and deciding what to sell

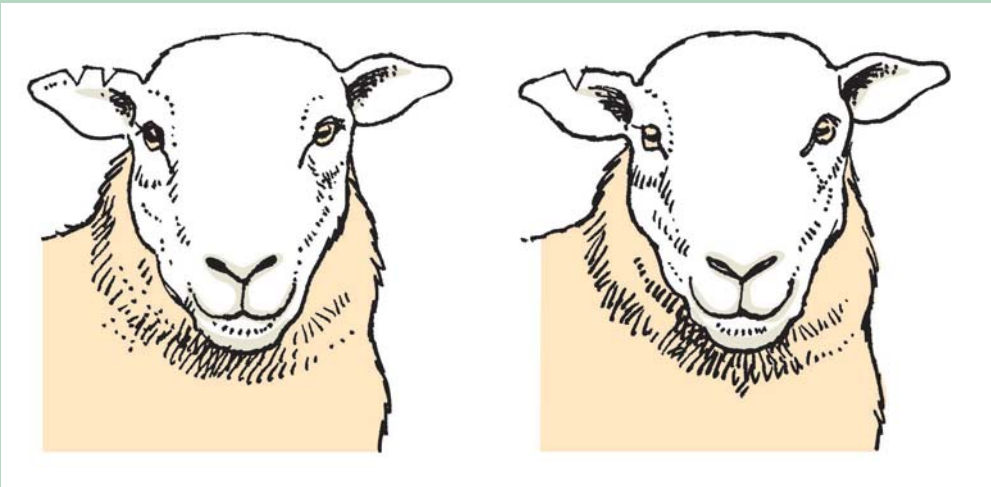
## Culling decisions

Removing poorly performing ewes is one of the fastest ways to improve a flock's breeding potential.

Whether buying-in or breeding home-grown replacements, breeding stock should be culled periodically on the basis of their performance. In self-replacing flocks, decisions are more important to prevent problem traits reoccurring in future generations.

Ear notching is a simple way to identify problem sheep and can be completed throughout the year, especially at lambing time. Ewes that should be notched include:

- Any that: required assistance to lamb, failed to mother their lamb or produced weak, or slow to suckle, lambs. Any progeny should be marked to ensure they are not retained.
- Any creating additional work, eg requiring routine foot treatment, excessively daggy or prolapse.



In most flocks ewes receiving two notches will be culled. However after an intensive selection period some flocks cull ewes after a single notch.

Fast rates of change can be achieved through rapid culling. However, replacement costs will also rise, so in practice a balanced approach is required. Where younger ewes are removed from the breeding flock, rather than being sold immediately they can be mated to a terminal sire to produce slaughter lambs.

Identifying and culling problem ewes should be completed in conjunction with traditional pre-mating culling decisions related to soundness of teeth, udder and body condition score.

**Set targets, create a breeding plan and use the best genetics to breed ewes for Better Returns**



This is one of a number of booklets produced under the Better Returns Programme. Other titles in the series include:

1. Target Lamb Selection for Better Returns
2. Target Ram Selection for Better Returns
3. Target Lamb Management for Better Returns
4. Target Ewe Management for Better Returns
5. Target Store Lambs for Better Returns
6. Target Easier Management for Better Returns
7. Target Lameness for Better Returns
8. Target Worm Control for Better Returns

All contain useful pointers to where you can achieve savings in time and money as well as increase the value achieved from your sheep enterprise.

Copies are available FREE from EBLEX Ltd, call 0870 241 8829 or email [brp@eblex.org.uk](mailto:brp@eblex.org.uk)

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