Unlocking your dairy herd's hidden breeding potential

Genetics workbook

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Contents

Introduction

High-quality cattle are at the heart of profitable dairy farming. Without high-ranking genetics – however good your management – there is a ceiling to your herd's performance and profitability.

Whether this is your first-time approaching genetics, or you regularly use genetic indexes for breeding decisions, this workbook will take you through the logic and theory behind making good breeding decisions to unlock your herd's hidden breeding potential.

You will be equipped with the skills and knowledge to:

- Identify strengths and weaknesses in your herd
- Understand the genetic indexes and traits available to improve in your herd
- Monitor the genetic progress of your herd
- Compare and select your best breeding females
- Identify the best sires for your system and herd
- Make informed and safe breeding decisions

Genetic selection is now much more than just focusing on production to achieve a profitable dairy business. Health, welfare, management, and type traits all contribute to balanced breeding and provide a resilient herd suitable for future challenges.

A series of poor breeding decisions can mean the difference between profit and loss, even between a business's survival and failure. Yet the time, cost and effort needed to make a good breeding decision are much the same as those needed for a bad one.

Crossbreeding and/or block calving?

As long as you record 3 times per lactation on ICAR-accredited meters – your crossbred and/or block-calving herd is evaluated. Breeding decisions for crossbred herds follow the same logic as those used in pure-bred situations.

AHDB supply genetic evaluations that consider the beneficial heterosis of crossbreeding between two dairy breeds. Providing genetic indexes and traits that can be directly compared between different breeds (e.g. £SCI and £ACI), specifically designed for crossbreeding and/or block-calving herds.

Preparation

You will need to register for your own Herd Genetic Report for some of the exercises. Please allow three working days for the request to be processed and your herd set up.

Scan the QR code to register for your Herd Genetic Report.

ahdb.org.uk/knowledge-library/dairy-herd-genetic-reports

See the 'Your Herd Genetic Report' section on page 10 for more information.

Current breeding goals

Your current breeding goals and how you utilise them will determine the future of your herd. Ensuring they are well thought through and maintained can dramatically improve your herd's performance.

Task

Reflect on your current practices. Complete the questions below using your current knowledge and experience.

Q1. What are your current breeding goals/objectives?

What do you want your herd's performance to look like in the next 5–15 years? E.g. more profitable, better fertility, higher production?

Goal 1:

Goal 2:

Goal 3:

Q2. Why are these your current breeding goals?

E.g. to fulfil the milk contract, reduce antibiotic usage, lameness is too high?

Goal 1:

Goal 2:

Goal 3:

Q3. How do you measure success?

What data do you use to ensure that you are making progress? Are you using specific traits or measurements?

Goal 1:

Goal 2:

Goal 3:

Q4. How could you accelerate your progress?

What steps can you take to reach your breeding goals?

Answer:

Benchmarking (part one)

Knowing where your herd sits relative to the rest of the herds in the UK can allow you to identify the strengths and weaknesses of your own herd and provide a baseline to measure future improvement.

Task

Comparing your herd's progress against the rest of the UK. Using the table below, mark the percentile you think your milking herd is currently achieving genetically with a cross (X).

The example filled in with the X would represent a herd in the top 25% in the UK for milk kilograms genetics. For a quick reminder of each trait's meaning, see the trait table on page 9.

Percentile	£PLI/ £SCI/ £ACI	Milk (kg)	Fat (%)	Protein (%)	Lifespan	Fertility Index	Mastitis	Maintenance
Top 1%								
5								
10								
15								
20								
Top 25%		X						
30								
35								
40								
45								
Top 50%								
55								
60								
65								
70								
Top 75%								
80								
85								
90								
Top 95%								

Genetic indexes

Calculating and understanding the genetic merit of your herd:

- Genetic indexes are a measure of an animal's ability to pass its genes on to the next generation
- Environmental and management effects are adjusted for in the evaluation models, revealing the underlying genetic performance
- Genetic indexes are calculated from an animal's own performance and the performance of its family members
- Genetic indexes are displayed as Predicted Transmitting Abilities (PTAs)

What are they?

A genetic index measures an animal's ability to pass its genes on to the next generation. These could be genes for production, health, lifespan, conformation, or any inherited trait that can be measured. Although we are most familiar with genetic indexes for milk, fat, and protein as these production traits have been around the longest. Genetic indexes are far more than this, and their application for non-production traits is becoming increasingly important.

Why are they needed?

In measuring an animal's genetic merit and assigning it a genetic index, every effort is made to disregard the effects of its environment and to strip its performance down to the bare genetics. This means that a 12,000-litre cow from a high-input system can be compared with one in an extensive herd averaging 6,000 litres. Equally, bulls whose daughters are milking in different production systems can also be fairly compared. Before genetic indexes, there was no way of fairly making such comparisons.

Every herd has strengths they wish to maintain and weaknesses they are looking to address, and by using genetic indexes, accurate breeding decisions based on the predicted performance of a bull's daughters can be made.

How are they calculated?

In calculating a genetic index (often known as a proof), information is drawn from various sources to produce the best possible estimate of an animal's genetic worth. This includes information on the animal's own performance, where appropriate, and information on the performance of other family members. An animal's performance is a combination of genetics and environment, so allowances are made for age, lactation number, stage of lactation, herd performance and season.

How are they expressed

Most dairy genetic indexes in the UK are expressed as Predicted Transmitting Abilities (PTAs). PTAs predict the extent to which a given trait will be passed on to an animal's offspring. They do not predict the offspring's actual performance, which will vary depending on management, but instead, they predict the amount of a trait the offspring will, on average, receive from its parents, compared with 'average' parents whose PTA is zero.

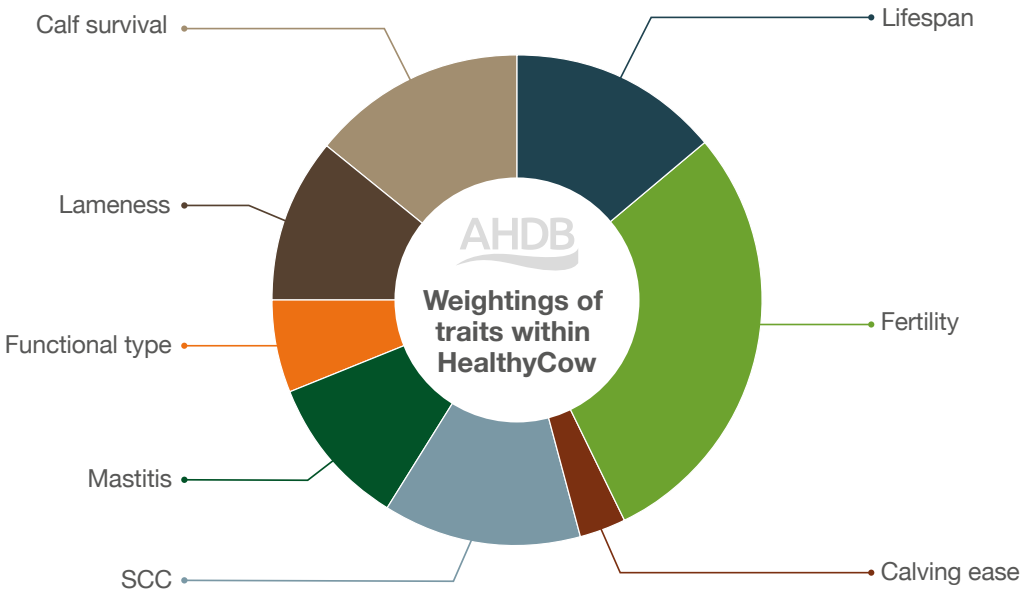
Multi-trait selection

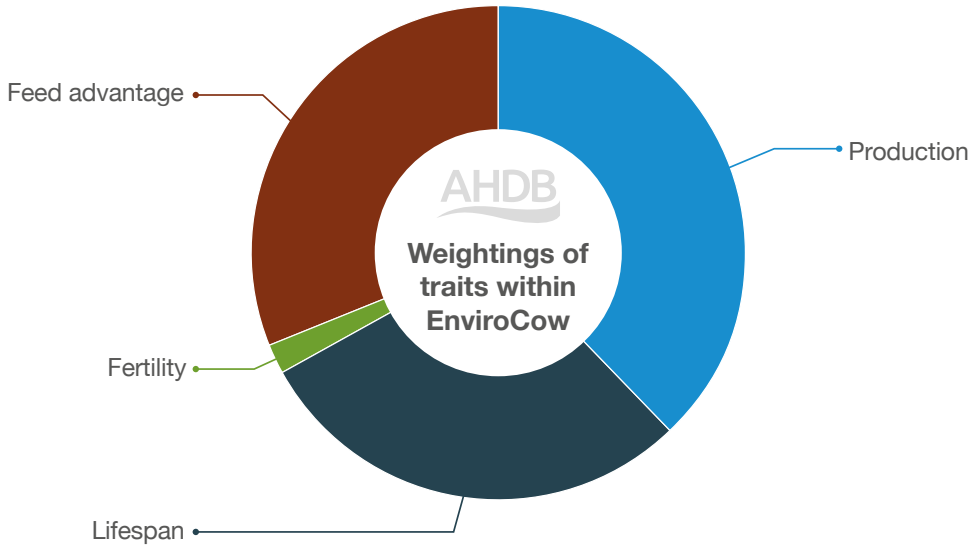
Breeding choices can often be daunting, given the vast amount of information available on each animal nowadays. We have therefore developed multi-trait selection indexes to simplify the process. Selecting multiple traits within your breeding objective will give a well-rounded, balanced animal that can thrive in any given situation. Focusing on single traits for selection risks improving one area at the detriment of another. However, it can be time-consuming and often not practical to select animals by studying all their individual trait PTAs to find the animals to breed the next generation for your herd.

Combined indexes can simplify the multi-trait selection process by combining several traits into a single index. Breeding decisions that incorporate a combined index will automatically select a broad range of beneficial characteristics while also, importantly, not introducing weaknesses for traits that might otherwise be overlooked.

Some examples of multi-trait selection indexes are:

- **Profit indexes (£PLI, £SCI, and £ACI)** – combine production, survival, fertility, health, functional type, and efficiency traits into a single profit number. These traits are combined, using system-specific economic weighting based on the cost of production to provide a well-rounded single profitability value for the animal (more detail provided on page 8)
- **HealthyCow index** – a sub-index of £PLI combining survival, fertility, health, and functional type to be used as a secondary filter to ensure daughters are more profitable due to improved genetics for health. This breeds even more fertile, healthier cows that stay in the herd for longer
- **EnviroCow index** – combines production, longevity, and feed advantage (a measure of efficient feed conversion) and will improve overall efficiency by reducing feed costs and maximising the lifetime yield of the cow. Having a desired EnviroCow index will breed cows which are predicted to create the least GHG emissions in their lifetimes for each kilogram of solids-corrected milk they produce





Adding multi-trait indexes such as HealthyCow and EnviroCow to your selection criteria will ensure you also improve your herd's overall health and environmental credentials.

Profit indexes (£PLI, £SCI, and £ACI)

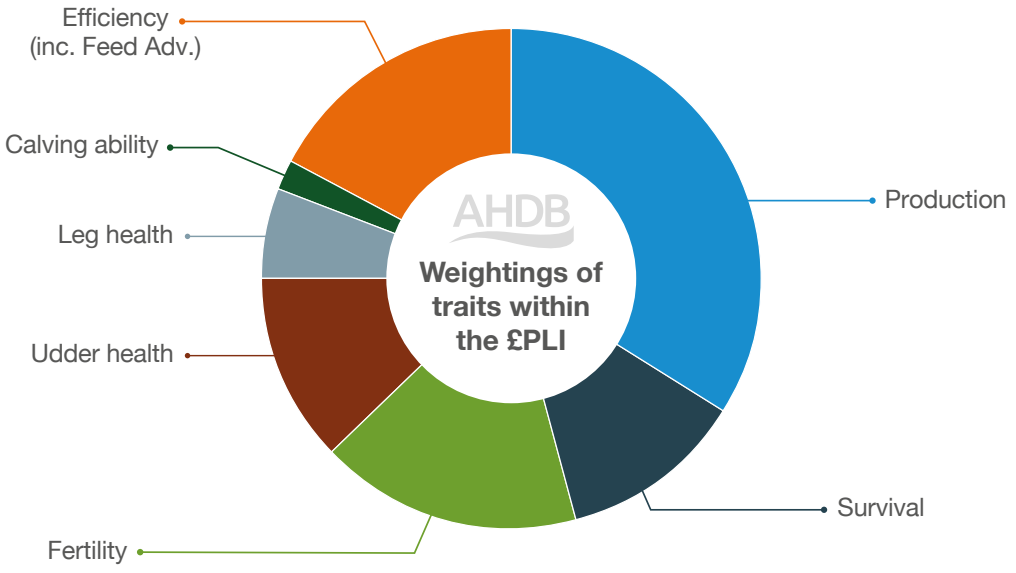
Profit indexes combine several key traits into a single figure that is then weighted based on the UK's economic environment. They represent the additional monetary profit that a parent is expected to transmit to its progeny compared to an index value of 0.

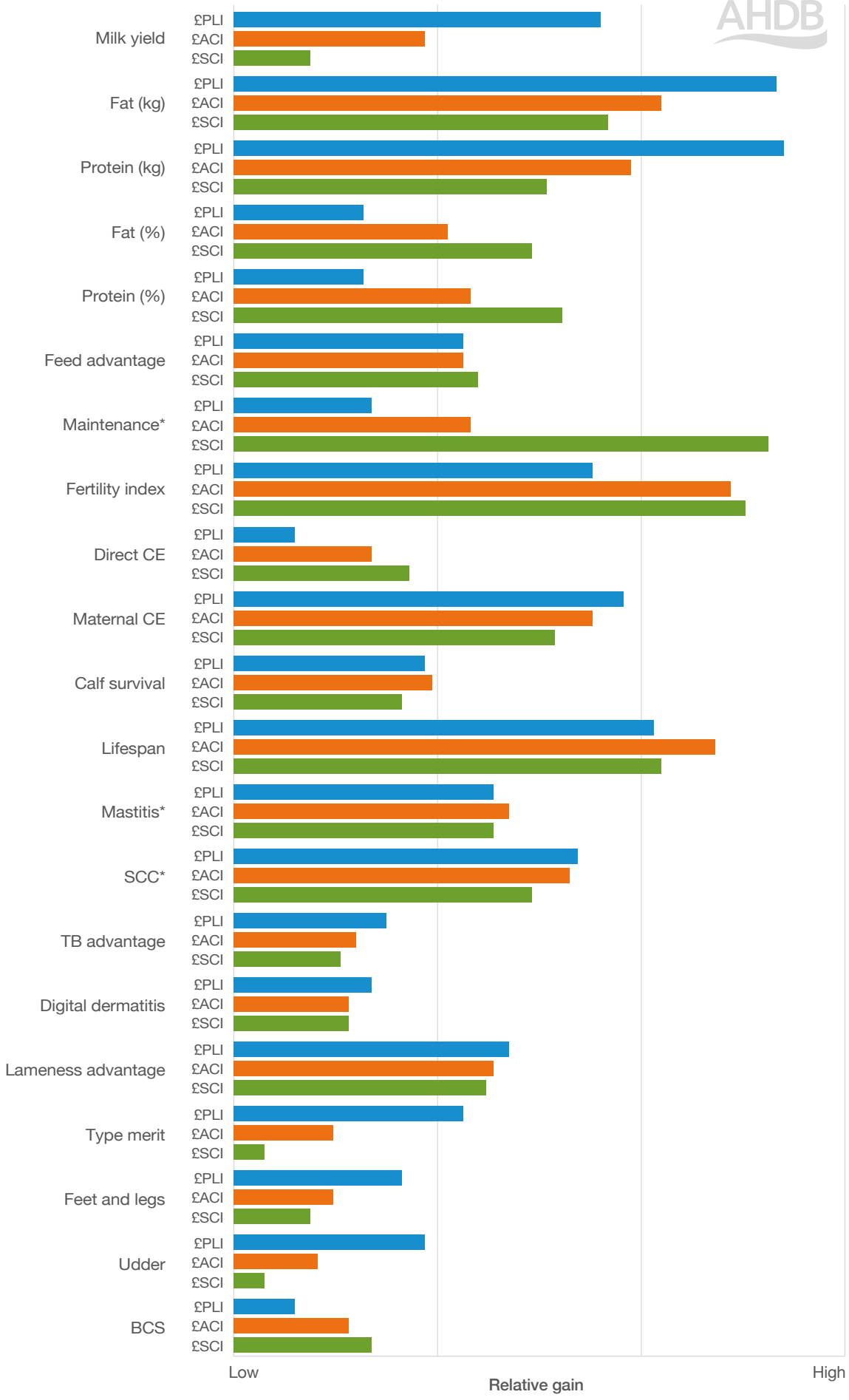
- **£PLI (Profitable Lifetime Index)** is designed for all-year-round calving herds, being a within-breed genetic ranking index
- **£ACI (Autumn Calving Index)** and **£SCI (Spring Calving Index)** are across-breed genetic indexes for the respective block-calving herds

By having three indexes, each is fine-tuned to represent each UK dairy system. Each trait is weighted differently in each profit index to reflect the needs of that system. For example, fertility is more favoured in £ACI and £SCI to achieve tight block calving compared to higher kg of milk being favoured for all year-round calving, £PLI herds.

Profit indexes capture an important range of traits precisely weighted under UK economic conditions. Using either £PLI, £SCI, or £ACI as a primary selection tool in your breeding decisions is highly recommended to maintain a profitable, balanced herd.

Each point in £PLI has previously been shown to be worth £1.58 in additional margin per cow per year (Promar, 2021).





Relative weighting of traits within £PLI, £ACI, and £SCI. Asterisks (*) denote traits that are reversed for presentation purposes.

Traits

Genetic indexes in the form of PTAs are published by AHDB and describe the genetic difference for the below range of traits:

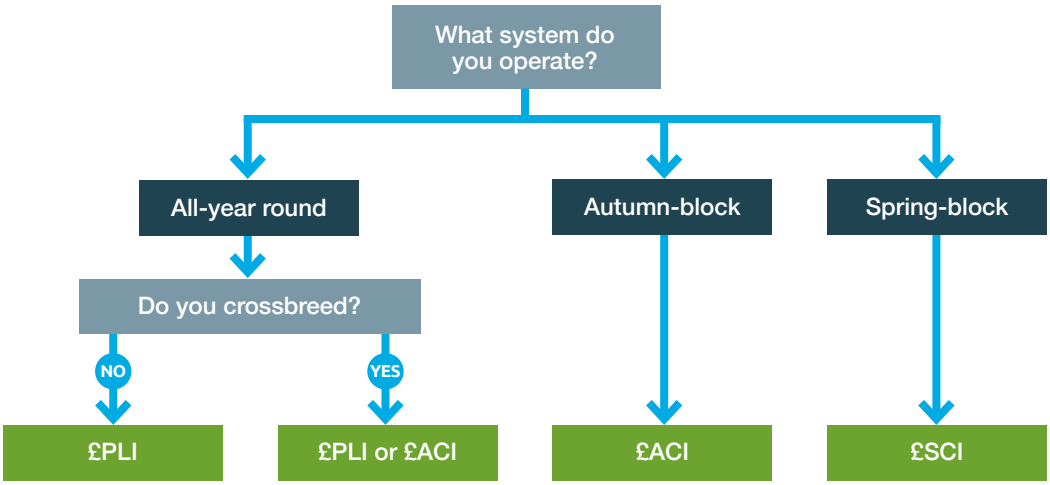
		Definition	Range of values	
			Bad	Good
Production	Milk (kg)	Total kilograms of milk produced during a 305-day lactation.		
	Fat (kg)	Quantity of butter fat produced during a 305-day lactation.		
	Protein (kg	Quantity of protein produced during a 305-day lactation.		
	Fat (%)	The percentage of butter fat in milk.		
	Protein (%)	The percentage of protein in milk.		
Health, welfare, and fitness	Somatic cell count (%)	The percentage increase or decrease of somatic cell count (SCC) in a daughter.	40	-40
	Mastitis (%)	Calculated from actual cases of mastitis recorded by on-farm records via milk recording organisations, it gives the genetic resistance to reduce the incidence of mastitis in the herd.	5	-5
	Fertility Index	Provides a prediction of female fertility based mainly on a combination of calving interval and non-return rates.	-20	20
	Lifespan (days)	Ability of the daughter to survive, either calculated by actual daughter survival data or proxy traits such as foot and leg, udders and SCC, which predicts the likelihood for involuntary culling cases.	-250	250
	Calf survival (%)	Shows that calves of some sires are more likely to survive between tagging and 10 months of age than others. This trait uses data from BCMS.	-5	5
	Lameness advantage (%)	Lameness incidence from on-farm data is combined with feet and legs, locomotion, and digital dermatitis traits to predict the chance of daughters becoming lame.	-5	5
	Digital dermatitis (%)	This data has been collected as part of the Dairy Breed Society classification process. It gives a better indication of sires that transmit resistance to digital dermatitis to their daughters.	-2	2
	TB advantage (%)	Degree of resistance to bovine tuberculosis that an animal is predicted to pass to his offspring.	-4	4
Management	Maintenance (kg)	The feed cost of maintaining a cow is relative to its weight. Smaller cows require less input and can produce equal output. Cows' weight is predicted from stature, chest width, body depth and angularity.	60	-60
	Feed advantage (kg)	Identifies animals with better feed conversion genetics that is represented as kilograms of dry matter intake saved during each lactation.	-250	250
	Calving ease (%)	Expressed as per cent of easy calvings; direct calving ease predicts the ease a calf by that sire will be born; maternal calving ease predicts the ease a daughter of that sire will give birth.		
	Gestation length (days)	Identifies bulls whose progeny have shorter gestation length in days.	7	-7
	Dairy carcase index	Developed to aid producers sending dairy youngstock to the beef supply chain, based on weight, age and carcase information from most major abattoirs in the UK.	-5	5
Type	Type merit (standardised)	Measures overall genetic conformation scores by incorporating the following type traits: udder, feet and legs and linear body traits using data collected by classifiers.	0 represents the average. -3 and +3 are extreme type.	
	Mammary (standardised)	Overall udder conformation score.		
	Feet and legs (standardised)	Overall feet and leg conformation score.		

For more detailed information on the traits that are evaluated, scan the QR code to visit the AHDB website – Breeding Indexes and Traits.

ahdb.org.uk/knowledge-library/breeding-indexes-and-traits

Task

Using the flowchart below, identify which profit index you should use when considering your herd or bulls.



Answer:

If you are an all-year-round calving crossbreeding herd and have answered '£PLI or £ACI', use £PLI when comparing within a breed and use £ACI when comparing across breeds.

Your Herd Genetic Report

AHDB process your data using levy money – your Herd Genetic Report (HGR) is available to you for free. HGRs are available to any UK dairy farmer who fully milk records. They allow you to see the genetic potential of milking cows and youngstock to allow you to make breeding decisions.

Search for 'AHDB HGR' or use the links below.

Register for your Herd Genetic Report by scanning the QR code.

ahdb.org.uk/knowledge-library/dairy-herd-genetic-reports

Sign in to your Herd Genetic Report by scanning the QR code.

breedingdairy.ahdb.org.uk/hg_reports.asp

Benchmarking (part two)

In Benchmarking (part one), on page 4, you estimated how your herd is performing compared to the rest of the UK, but by using your HGR, you can base it on the actual genetic merit of your herd.

1. Log into your Herd Genetic Report.
2. Select your herd number (if you have only one herd on your account, this step is automatic).
3. If your profit index was £PLI, select your breed. Otherwise, select £ACI or £SCI.
4. Scroll down to your Breed/£SCI/£ACI herd standards table.
5. Note that there is a drop down that allows you to select between milking herd, youngstock, first lactation, second lactation, and third lactation+.

If you need any further guidance on the steps above, use the links on the previous page for more information.

Herd standards example

Compare against national averages for milking herd

Percentile	£PLI	Healthy Cow	Enviro Cow	PTA Milk (kg)	PTA Fat (%)	PTA Prot (%)	Lifespan	Fertility Index	Mastitis	Maintenance
1	285	110	1.2	446	0.15	0.10	67	9.7	-1.4	-26.1
5	229	92	1.0	332	0.11	0.07	51	6.8	-1.0	-18.0
10	199	81	0.9	270	0.09	0.05	42	5.3	-0.8	-11.8
15	177	74	0.8	228	0.07	0.05	36	4.2	-0.6	-8.3
20	160	69	0.7	191	0.06	0.04	33	3.4	-0.5	-6.0
25	144	64	0.7	159	0.05	0.03	29	2.9	-0.5	-4.6
30	130	59	0.6	130	0.05	0.03	26	2.4	-0.4	3.5
35	115	54	0.5	104	0.04	0.02	24	2.0	-0.3	-2.7
40	100	49	0.5	76	0.03	0.02	22	1.6	-0.3	-2.1
45	86	45	0.4	47	0.03	0.02	19	1.3	-0.2	-1.4
50	71	40	0.4	14	0.02	0.01	17	0.9	-0.2	-0.8
55	57	36	0.3	-18	0.02	0.01	14	0.5	-0.1	-0.2
60	39	31	0.3	-53	0.01	0.01	12	0.1	-0.1	0.3
65	22	25	0.2	-92	0.01	0.00	9	-0.3	0.0	0.9
70	4	19	0.1	-133	0.00	0.00	6	-0.6	0.1	1.6
75	-18	12	0.0	-189	0.00	-0.00	2	-1.1	0.1	2.2
80	-46	2	-0.1	-258	-0.01	-0.01	-4	-1.6	0.2	2.9
85	-87	-13	-0.3	-334	-0.02	-0.01	-14	-2.2	0.3	3.7
90	-159	-45	-0.6	-420	-0.03	-0.02	-31	-3.1	0.5	4.6
95	-259	-97	-1.0	-548	-0.04	-0.03	-60	-4.2	0.9	6.1

The highlighted boxes indicate which percentile this milking herd is in. For example, the second column shows that this herd is in the top 25% of herds in the UK for £PLI.

Task

Look at your herd standard table (for your milking herd) and answer the following questions.

Q5. What are your herd's strengths?

Which traits are higher up the table compared to your other traits or the rest of the UK herd?

Answer 1:

Answer 2:

Answer 3:

Q6. What are your herd's weaknesses?

Which traits are lower down the table compared to your other traits or the rest of the UK herd?

Answer 1:

Answer 2:

Answer 3:

Task

Go back to Benchmarking (part one) on page 4 and mark the percentile your milking herd is actually achieving with a tick (✓).

Q7. Are there any traits where you are above where you originally thought?

Answer:

Q8. Are there any traits where you are below where you originally thought?

Answer:

Q9. Are there any traits where you would like to see improvement?

Consider if these align with your current breeding goals.

Answer:

As youngstock are the next generation of milking cows and the next source of genetic progress, it's important to know where they stand. Compare your youngstock benchmarking table with your milking herd benchmarking table. Using the drop-down menu above the herd standard table, select youngstock.

Task

Now look at your herd standard table (for your youngstock herd) and answer the following questions.

Q10. Consider your breeding goals and previous answers. Are your youngstock higher or lower percentiles than your milking herd for the most important traits?

Goal 1:

Goal 2:

Goal 3:

Q11. If they are lower, why do you think this is?

Answer:

Q12. Now you know the current state of your milking herd and youngstock, will you adjust your breeding goals?

If yes, which breding goal(s) will you be:

i. **Adding or prioritising higher**

ii. **Removing or prioritising lower**

If no, explain why:

Reliabilities

Always pay attention to the reliabilities when considering individual proofs (for both males and females). This indicates the likelihood of a PTA being a true estimate of an animal's genetic value. Values fall between 10 to 99% and increase as more performance data is acquired. For bulls, this improves when their daughters begin milking and increase with each subsequent crop. For females, reliability increases when they begin their first lactation and increase further when their daughters are milking.

This rate of increase in reliability is also affected by genomics. A genomically tested heifer calf's proof can have the same reliability as a first lactation cow. Similarly, a respectable 65% reliability can be reached by a genomically evaluated bull that doesn't yet have milking daughters.

Traditional		Age of bull (years)		Genomic
Second crop daughter proof	99%	6	99%	Second crop daughter proof
Progeny milking	85%	5	90%	Progeny milking
Progeny bred	35%	4	65%	Progeny bred
Progeny born	35%	3	65%	Progeny born
Semen collected	35%	2	65%	Semen collected
	35%	1	65%	DNA analysis
	35%	Born	35%	

The lower the reliability of the index, the greater the chance the index will change as more information becomes available. It is important when considering young genomic bulls to spread the risk over a larger team of bulls to use on your herd of cows. In comparison, a smaller team can be used if they are daughter proven, as the proofs are more reliable. However, the use of elite, genomically tested young bulls is encouraged to increase the rate of genetic progress that can be achieved.

Genomic testing

Genomic evaluations are now routine for testing the genetics of young bulls for the main dairy breeds found in the UK. These give higher reliability proofs compared to traditional pedigree indexes and have helped accelerate the rate of genetic gain in the dairy industry in recent years.

However, it is becoming increasingly common to test females as another tool to give the confidence to select the animals with superior genetics (comparing maiden heifers with milking cows) to breed the next generation of replacement heifers. Genomic indexes are calculated using a young animal's own DNA or genetic material rather than being estimated from the performance of its parents and ancestors. Genomic testing can also pick up on pedigree errors, which will help manage future inbreeding and identify the best females for breeding.

Breeding replacements

With the availability of sexed semen, fewer females are needed to produce the cohort of heifer calves giving more scope to target which females you want to breed your replacements from. This can accelerate the rate of genetic gain in your herd, so taking the time to identify these females is important to the success of your breeding plan.

Over 75% of dairy semen sold in the UK in 2022 was sexed.

The Herd Genetic Report is a tool that allows you to look at the genetics of individual females and select your best milking cows and heifers to put to sexed semen for replacements, leaving the remainder to be put to beef semen to maximise profitability.

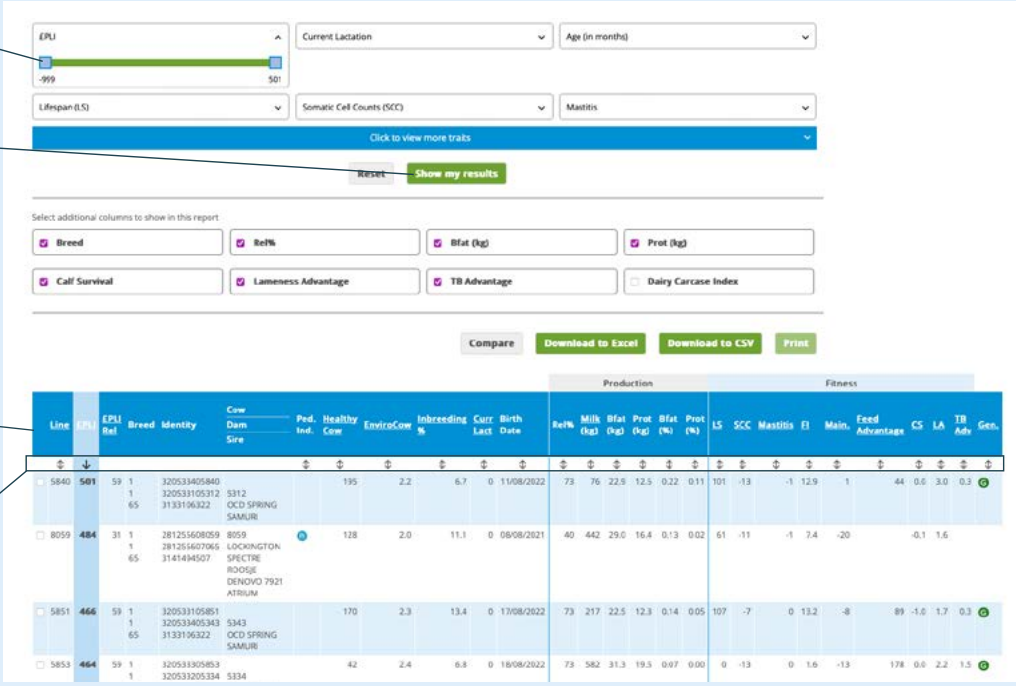
Similarly to identifying strengths and weaknesses across the whole herd with benchmarking, the full herd report allows you to identify strengths and weaknesses on an individual level – for example, if one particular heifer has much lower fertility than the rest of your herd, it may be best to breed her to beef semen or select a high ranking (£PLI/£SCI/£ACI) dairy bull that also has a high fertility index.

Even in block-calving systems where replacements are typically bred from the females that bull the earliest, having a shortlist of your genetically superior females will prevent cows from being used that may be great for fertility but have a weakness in other important traits, e.g. component percentage or health traits.

Accessing individual reports

1. Log into your Herd Genetic Report.
2. Select your herd number (if you have only one herd on your account, this step is automatic).
3. If your profit index was £PLI, select your breed. Otherwise, select £ACI or £SCI.
4. Select ‘view full herd report’.

1. Filter on traits using the sliders
2. Update filtering results
3. View individual female results
4. Sort by any specific trait



Take-home task

Filter your herd by £PLI, £SCI, or £ACI. Adjust the lower slider and update results by clicking 'show my results'. Repeat and slowly narrow your selection until you are left with the number of animals to breed the required number of replacements.

Take-home task

Try additional filters and column sorting. These tools will help you narrow down your herd for the best breeding females.

The profit index should be the first filter you apply, as by filtering for £PLI, £SCI, or £ACI, you already begin to consider multiple traits in your selection, which can be further fine-tuned by secondary filters on specific traits or herd weaknesses.

Selecting bulls

Choosing which bulls to breed from and buying semen is one of the most important decisions on farm, as it shapes your herd for years to come. Remind yourself of your breeding requirements, review which bulls are available, and be prepared before you make the next semen-purchasing decision.

Ensure the bulls you select are focused on your breeding goals, targeting weaknesses you need to address and strengths you want to maintain. A good starting point is only selecting bulls in the top 25% of sires currently marketed by breeding companies (available bulls). With a bit of refinement, this ensures you will make decisions that will improve your herd while still allowing a diversity of choice.

In collaboration with Holstein UK, we publish the available bull lists for all bulls currently marketed in the UK. Access the official available bull reports below.

Profitable Lifetime Index (£PLI:
Scan the QR code to go to the website.
Select a breed, select an available bull report.

ahdb.org.uk/knowledge-library/profitable-lifetime-index-pli

Spring Calving Index (£SCI):
Scan the QR code to go to the website.
Select an available bull report.

ahdb.org.uk/£SCI-bull-reports

Autumn Calving Index (£ACI):
Scan the QR code to go to the website.
Select an available bull report.

ahdb.org.uk/£ACI-bull-reports

Task

Below is an example herd. Consider that this herd is a Holstein, all-year-round calving herd on a contract that rewards milk volume (fat and protein components are not rewarded).

Percentile	£PLI	Healthy Cow	Enviro Cow	PTA Milk (kg)	PTA Fat (%)	PTA Prot (%)	Lifespan	Fertility Index	Mastitis	Maintenance
1	285	110	1.2	446	0.15	0.10	67	9.7	-1.4	-26.1
5	229	92	1.0	332	0.11	0.07	51	6.8	-1.0	-18.0
10	199	81	0.9	270	0.09	0.05	42	5.3	-0.8	-11.8
15	177	74	0.8	228	0.07	0.05	36	4.2	-0.6	-8.3
20	160	69	0.7	191	0.06	0.04	33	3.4	-0.5	-6.0
25	144	64	0.7	159	0.05	0.03	29	2.9	-0.5	-4.6
30	130	59	0.6	130	0.05	0.03	26	2.4	-0.4	3.5
35	115	54	0.5	104	0.04	0.02	24	2.0	-0.3	-2.7
40	100	49	0.5	76	0.03	0.02	22	1.6	-0.3	-2.1
45	86	45	0.4	47	0.03	0.02	19	1.3	-0.2	-1.4
50	71	40	0.4	14	0.02	0.01	17	0.9	-0.2	-0.8
55	57	36	0.3	-18	0.02	0.01	14	0.5	-0.1	-0.2
60	39	31	0.3	-53	0.01	0.01	12	0.1	-0.1	0.3
65	22	25	0.2	-92	0.01	0.00	9	-0.3	0.0	0.9
70	4	19	0.1	-133	0.00	0.00	6	-0.6	0.1	1.6
75	-18	12	0.0	-189	0.00	-0.00	2	-1.1	0.1	2.2
80	-46	2	-0.1	-258	-0.01	-0.01	-4	-1.6	0.2	2.9
85	-87	-13	-0.3	-334	-0.02	-0.01	-14	-2.2	0.3	3.7
90	-159	-45	-0.6	-420	-0.03	-0.02	-31	-3.1	0.5	4.6
95	-259	-97	-1.0	-548	-0.04	-0.03	-60	-4.2	0.9	6.1

Given the benchmarking report and the milk contract requirements, complete the question below.

Q13. Which traits align with this herd's breeding goals?

Remember that you need balanced selection goals that are not just production focused. Select 3-4 traits or index of importance.

Answer:

Task

Below are four shortened examples of bulls you might see on the available lists or in breeding catalogues. Think about the differences between these bulls and use them for the next questions.

Bull A

£PLI 677 | £SCI 371 | £ACI 517

Reliability 67%	**Milk** 779
Fat (%) 0.07	**Protein (%)** 0.00

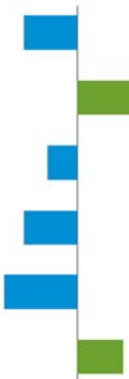
HealthyCow	223
EnviroCow	2.9
Lifespan	113
Fertility Index	7.7
Mastitis	-1
Maintenance	13

Bull B

£PLI 697 | £SCI 444 | £ACI 528

Reliability 88%	**Milk** 642
Fat (%) 0.40	**Protein (%)** 0.14

HealthyCow	-90
EnviroCow	4.1
Lifespan	-27
Fertility Index	-6.8
Mastitis	2
Maintenance	-10



Bull C

£PLI 800 | £SCI 514 | £ACI 671

Reliability 66%	**Milk** 854
Fat (%) 0.04	**Protein (%)** 0.04

HealthyCow	243
EnviroCow	4.1
Lifespan	159
Fertility Index	9.2
Mastitis	-2
Maintenance	-15

Bull D

£PLI 657 | £SCI 552 | £ACI 645

Reliability 88%	**Milk** 280
Fat (%) 0.22	**Protein (%)** 0.08

HealthyCow	246
EnviroCow	2.9
Lifespan	92
Fertility Index	12
Mastitis	-2
Maintenance	-27

Q14. Consider the example herd benchmark table given on page 17. Rank the bulls on the previous page from best to worst for this herd example.

Best: _____

_____

_____

Worst: _____

What's your main reasoning behind these choices?

Q15. Of these four bulls, how would you rank them for your herd, and why?

Best: _____

_____

_____

Worst: _____

What's your main reasoning behind these choices?

Q16. Let's assume all four bulls were going to be used in the herd. If you were ordering semen from these four bulls, roughly what proportion would you order of each, and why?

Bull A: _____%

Bull B: _____%

Bull C: _____%

Bull D: _____%

What's your main reasoning behind these choices?

Workflow summary

- Review your Herd Genetic Report (HGR). Use benchmark trait averages to find the strengths and weaknesses of your milking herd and youngstock

- Base your breeding goals on weaknesses you need to address and strengths you want to bolster
- Remember to consider multiple traits, including a profit index (£PLI, £SCI, or £ACI) for overall balanced improvement

- Filter the full herd report in the HGR to identify breeding females with the strongest genetic merit. These will produce your next generation of heifers and should be bred to elite dairy-sexed semen

- Using AHDB's available bull lists, select a shortlist of sires that match your breeding goals. Use bulls in the top 25%
- Ensure sires exceed your herd's averages on traits you are focusing on improving

- Where possible, individually select which bull should be put on each breeding female to maximise gains and address any shortcomings in particular lines
- Use the inbreeding checker to confirm that the pairing is safe

Conclusion

We hope this workbook has equipped you with the skills you need for the important and rewarding process of good breeding decisions. We recommend that you revisit this workbook for the information and to follow the general workflow and thought process before making breeding decisions on farm.

Remember that a series of poor breeding decisions can mean the difference between profit and loss or even between a business' survival and failure. Yet the time, cost and effort needed for a good breeding decision to be made are much the same as those needed for a bad one.

The skills and knowledge acquired through this process should be discussed with colleagues, consultants, vets, advisors, and semen reps when selecting heifers, cows, and bulls to breed from. Ensure that you are in a position to know how you want to progress your herd to take back control of your breeding decisions and unlock the hidden potential within your herd.

To finalise your breeding decisions, we also recommend following the inbreeding checker guide on pages 22-23.

Meet the team

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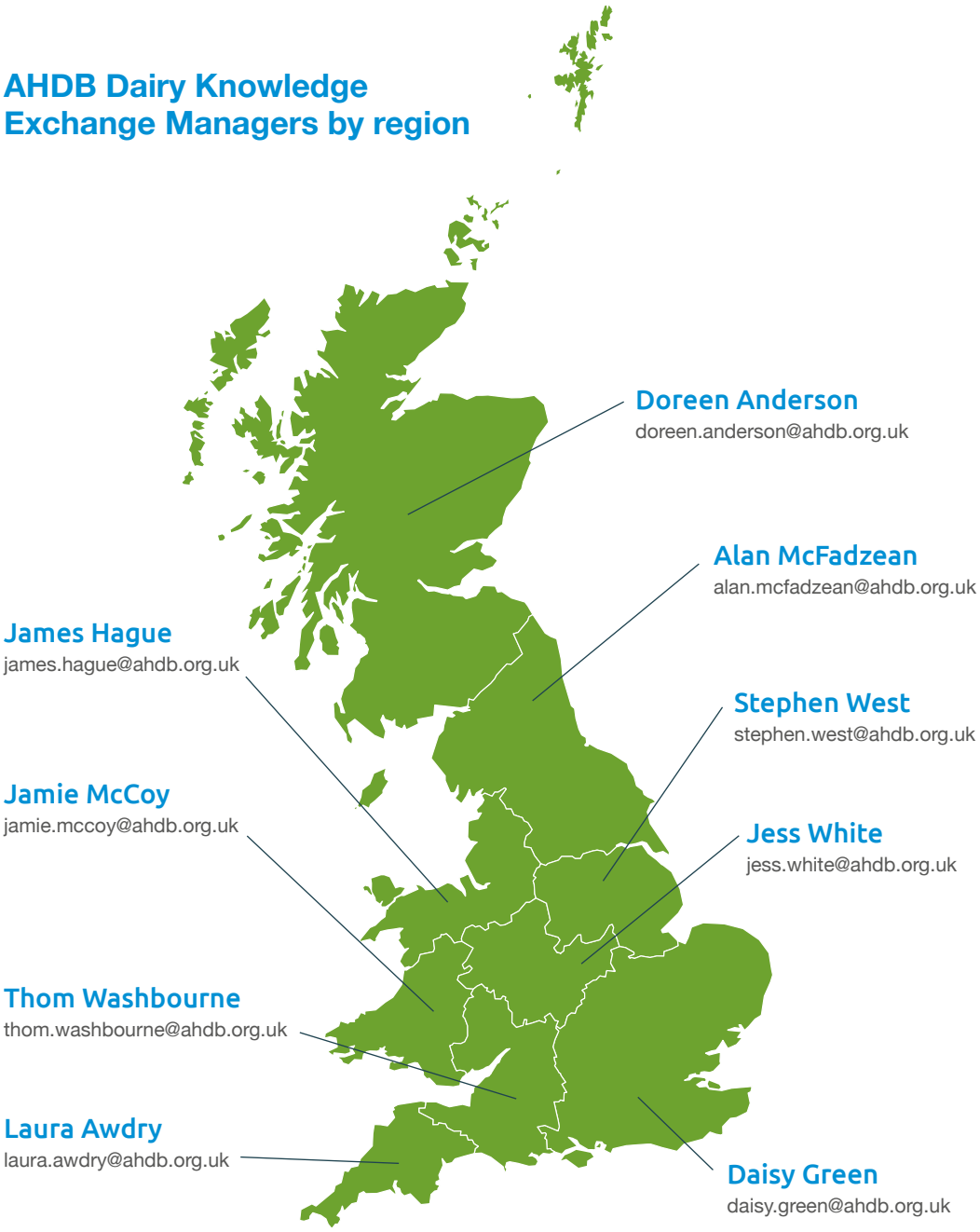

Inbreeding checker

Inbreeding refers to the mating of related individuals (where the sire and the dam share a recent common ancestor). It is important to monitor inbreeding and the potential negative effects that can accumulate. This can be achieved through management decisions such as genotyping for specific disease-causing recessive mutations, using PTAs and indexes to counteract negative traits (such as fertility and mastitis), or more broadly by checking inbreeding coefficients (preferably genomic inbreeding coefficients).

The inbreeding checker allows you to calculate the inbreeding coefficients of potential matings between your current herd and a shortlist of sires. This can be used to help finalise breeding decisions to avoid pairings of closely related individuals.

Accessing the inbreeding checker

1. Log into your Herd Genetic Report.
2. Select your herd number (if you have only one herd on your account, this step is automatic).
3. If your profit index was £PLI, select your breed. Otherwise, select £ACI or £SCI.
4. Select ‘inbreeding checker’.

Inbreeding checker steps

1. Dam group selection
   a. Select as a starting point ‘milking herd’, ‘youngstock’, or ‘whole herd’. You will get the opportunity to refine dams in the next step.
2. Dam edits
   a. Filtering and sorting works in the same way as the full herd report to help refine the list by a dam’s proof.
   b. Using the checkboxes in the first column of the dam table, tick which females you want to pair in the inbreeding checker.
   c. When the list is finalised, click ‘save and continue’ to move on.
3. Sire group selection
   a. Select the base list with the bulls you want to use.
4. Sire edits
   a. Filtering and sorting work in the same way as the available bull reports to help refine the list by a sire’s proof.
   b. Using the checkboxes in the first column of the sire table, tick which bulls you want to pair in the inbreeding checker.
   c. The ‘average expected inbreeding’ column gives the average expected inbreeding level of the progeny for each bull when mated to the group of cows selected in step 2.
   d. The ‘number of safe matings’ column indicates the number of dams which can be safely mated to the bull.
   e. The ‘bull search’ can be used to add additional bulls by name or herdbook number that do not appear in the selected list.
   f. When the list is finalised, click ‘save and continue’ to move on.

5. Results

   a. A table of inbreeding results is presented with dams down the rows and sires across the columns.

   b. The view can be switched between:

      i. Progeny inbreeding level – the inbreeding level of the progeny of each mating in the table expressed as a percentage.

      ii. Inbreeding change – the increase or decrease in inbreeding from dam to progeny, known as the rate of change in inbreeding.

      iii. PA adjusted for inbreeding impact – the Parent Average for the profit index of choice (£PLI, £SCI, or £ACI), applying a reduction based on the level of inbreeding in the progeny.

   c. Certain flags may appear alongside values in the results table:

      High level of inbreeding from this mating.
      Icon: Red exclamation mark **(!)**

      Limited pedigree available for this calculation, unreliable results.
      Icon: Yellow triangle (⚠)

      Genomic indicator – calculated when both the sire and dam are genomically tested.

      Icon: Letter G in a green circle (Ⓖ)

While it is important to ensure that resultant inbreeding levels from matings are low, the bull giving the lowest level of inbreeding may not be the best choice for your herd. Remember to check that the bulls of interest also meet your herd's genetic breeding goals and result in a safe level of inbreeding.

Genomic inbreeding

Using genomic testing to generate inbreeding results gives far superior estimates to traditional pedigree records. It has also improved our understanding of the effects of inbreeding and how to balance the global increase in dairy cattle inbreeding with genetic progress. See the link below for a detailed breakdown of genomic inbreeding, including the advantages over traditional methods.

For more information on genomic inbreeding', scan the QR code to visit the AHDB website.

ahdb.org.uk/knowledge-library/genomic-inbreeding

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