Focus Site Project Review

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1.0 Summary

1.1 Farm details

- Shordley Hall (Aintree Holsteins) is a 275 cow dairy herd based in Hope near Wrexham. The herd is well renowned in the dairy industry for its excellent quality stock and high genetic makeup.
- The herd is fed a Total Mixed Ration (TMR) twice a day made up of grass and maize silage, with additional feeds such a soya, rape, caustic wheat, Nutritionally Improved Straw (NIS), and minerals also being part of the diet.
- Cows are milked three times a day with milk sold per cow amounting to 10,900 litres per cow at 3.8% butterfat per annum.
- High attention to detail is given on breeding for health and efficiency.
- High quality forages are grown each year to ensure the foundations of the herds ration is of high quality to provide maximum yields and optimum rumen health.

Business Objectives:

- Continue to improve the herd genetics
- Continue to breed for health and fertility
- Maximise herd health and breeding knowledge levels through genomic testing

1.2 Project key objectives

- Investigate the effects and impacts of various haplotypes (HH1, HH2, HH3, HH4, HH5) that have been discovered in the DNA of the black and white breed.
- Investigate the influence of the Haplotype Cholesterol Deficiency (HCD) gene on calf mortality. This new haplotype was identified by German researchers and first reported in July 2015.
- Investigate historic cases of reduced fertility and poor calf survival in some families as a result of Clarifide Genomic testing of youngstock.
- Use information to adjust mating decisions if necessary.

1.3 Project achievements

The project has been a great success for the business resulting in awareness of additional animal genetic status allowing better breeding decisions to be made and targeted differently to methods prior to Clarifide testing. Press articles have appeared in the Wales Farmer and online, whilst further commentary has appeared in the Holstein Journal (UK). Further articles were also posted on the Farming Connect website.

https://businesswales.gov.wales/farmingconnect/shordley-hall

1.4 Project details

As a result of the commercialisation of the breeding industry and subsequent adoption of new genetic screening technology, this has enabled previously unknown genetic recessive disorders to be identified present in the black and white breed.

Haplotype refers to a group of single-nucleotide polymorphism (SNP) markers that are located at nearby positions on the chromosome which are then usually inherited together. Haplotyes are passed on to progeny by both parents, and whether they cause harm to the offspring depends upon how these Haplotypes are arranged. As thousands of haplotypes can now be identified through genetic testing, it is important to utilise this technology to understand what Haplotypes could cause a negative effect on health and fertility to ensure that these negative effects are not then passed onto future generations.

Haplotypes have been discovered that impact on cow fertility resulting in failed conceptions and early embryonic death.

5 Holstein fertility haplotypes have been found since 2011 (and also 1 Jersey, 1 Ayrshire, 2 Brown Swiss) with a mating of a carrier sire X carrier dam giving a reduction in fertility performance

Although the biological reasons for non-viable embryo or foetus not yet known it causes losses at different stages of pregnancy which could result as:

1. Not holding in calf (pre-day 16) EED
2. Late return/abnormal cycling (Embryo lost after day 16-25)
3. Abortion
4. Stillbirth (Brown Swiss BW2)
5. Poorer than expected Embryo Transfer results

Three Haplotypes have been identified to cause negative impacts on fertility which are HH1, HH2 and HH3, with animals able to be carriers (C) or tested non-carriers (T). It is still not understood how these carriers impact on fertility levels, but it is thought that the inheritance of the Haplotype from both parent results in failed conception or early embryonic death

If both parents are carriers of an undesirable haplotype (HH1C), there is a 25% chance that there will be an affected offspring that would not survive to birth. Of the live offspring, one-third will be unaffected non-carriers whilst the other two-thirds will be carriers.

For example: HH1C Sire (carrier = Rr) x HH1C Dam (carrier = Rr)

R = Normal haplotype r = HH1 Haplotype (containing the causative mutation)

X	R (Sire)	r (Sire)
R (Dam)	RR (Free)	Rr (Carrier)
r (Dam)	Rr (Carrier)	rr (Death)

Embryonic loss – failed conception

If the cow and the bull were carriers of different haplotypes, e.g. if the cow was HH1C and the bull was HH2C, the following resulting offspring could be expected:

1. 25% non-carriers of both (HH1T and HH2T)
2. 25% carriers of one (HH1C)
3. 25% carriers of the other (HH2C)
4. 25% carriers of both (HH1C and HH2C)

(Source:NBDC)

Haplotyope Cholestorol Deficiency (HCD) is a genetic abnormality that is caused by calves born with a genetic defect that causes a lack of cholesterol in their cells and the inability to convert energy into fat. The calf often dies within one to six months. It is thought that 8% of the UK herd are carriers of the HCD gene with some of the UK's top proven bulls have also been tested as carriers. Similar to the Fertility Haplotypes, the mating of carriers should be avoided as seen in the example table below:-

HCD1 Sire (Carrier) x HCD1 Dam (Carrier)

X	R (Sire)	r (Sire)
R (Dam)	RR (Free)	Rr (Carrier)
r (Dam)	Rr (Carrier)	rr (Death)

Early calf mortality

The offspring expected from the above mating would result as:-

- 25% Chance of Non carrier calf (HCD0)
- 50% Chance of Carrier calf (HCD1)
- 25% Chance of double recessive and early calf mortality

(Source:NBDC)

Industry understanding of both Haplotypes is limited, and as change in the Welsh dairy herd continues as herds get larger and the turnover of sires used quickens, it is important that these 'lethal genes' are tracked within carrier cows to avoid infertility and early calf mortality and subsequent negative business impacts.

However it should be remembered that many carrier animals have other extremely positive health and functionality traits that should not be lost from the wider gene pool by overacting to individual animal status.

It is critical however that farmers and breeders understand the issue and then use genetic management software or tools to assist with any matings to reduce the risk of any negative breeding impacts.

Process of identifying carriers

Animal hair samples were taken and then analysed by the Clarifide process (Zoetis). These samples are then analysed against the database to determine their status as carrier or non-carrier.

1.5 Farmer commentary

We plan to continue genotyping every female heifer calf for recessive disorders because it will help further improve the herd. We can now manage our breeding around this. There is nothing wrong with an animal with a negative haplotype but by knowing they have got one of these, it gives us the full picture. We can manage any animal with a negative haplotype to avoid future grief. At around £33 per animal, the test isn't cheap but when balanced against the cost of sexed semen and selecting which animals to breed heifers from according to haplotype, it is a sound investment. The outlay will also be reduced by preventing calf mortalities due to HCD. It costs a lot to rear a heifer replacement. To lose an otherwise healthy animal at three months old when you have put all that cost in is very frustrating, and hopefully the new management practices implemented as part of the project will stop this happening in the future.

2 Business Review

2.1 Herd baseline review

No benchmarking was carried out as part of the project

2.2 Potential impact of the project on business

200 animals from all ages were tested for genotype disorders with the results showing:

- 25% of females tested carried at least one genetic recessive
- 2% of the females carried more than one recessive
- 8% of females tested were carriers of HCD

One of the highest genetic merit heifers tasted (Calf 3973) was a carrier of one of the fertility haplotypes as well as a carrier of HCD. This animal itself highlights the importance of knowing the herd status to enable correct mating. For this animal, it would be critical to avoid mating to a carrying bull. In the top ten available proven bulls for Profitable Lifetime Index (PLI) there are two carriers of HCD (shown as HCD1 in the below table from Holstein UK: http://holstein-uk.org/animaldata)

(UK & Int) Top PLI Daughter Proven Bulls

This list is defaulted to rank by PLI, please note that you can re-rank on any of the column headings within the table.

50 of 622 results

Name	PLI £	PLI RIb %	TM	TM RIb	TOrig	Mam	L&F	Loc.	LS	SCC %	CS	FI	GBAI	NIA
MOCON HCD0	689	77	0.89	72	ITB	0.96	0.35	0.11	0.7	-23	-0.11	6	BUL	
GEN-I-BEQ LAVAMAN ET HCD1	684	97	0.64	96	ITB	0.79	0.98	1.38	0.3	-4	-0.93	15.7	SMX	SM
S-S-I SHAMROCK MYSTIC ET HCD0	654	80	0.85	74	ITB	0.56	-0.04	0.13	0.6	-20	-0.04	19.8	WWS	WW
DE-SU 11236 BALISTO ET HCD0	652	95	1.41	95	ITB	1.01	0.92	1.09	0.5	-21	-0.36	1.4	GEN	GEN
VIEW-HOME LITTLEROCK ET RDF HCD1	646	76	0.65	71	ITB	0.95	0.81	0.96	0.5	-18	-0.58	8.7	SMX	SM
TEEMAR SHAMROCK ALPHABET ET HCD0	636	82	-0.08	75	ITB	-0.3	0.65	0.78	0.8	-3	0.29	18.5	GEN	GEN
CO-OP ROBUST CABRIOLET ET POF CDF HCD0	628	91	1.86	87	ITB	1.11	1.26	1.39	0.4	-8	-0.08	3.8		AIS
APINA NORMAN HCD0	622	84	2.15	82	ITB	2.06	0.75	0.75	0.6	-10	-0.39	12		AIS
EDG RUBICON ET HCD0	616	82	3.08	80	ITB	1.79	2.62	2.85	0.3	-14	0.56	5.3	CBL	CBI
DE-SU ROOKIE 11057 ET RDF HCD0	606	79	1.42	75	ITB	1.62	0.66	0.81	0.6	-27	-0.56	4.2	WWS	WW
DELTA G-FORCE CDF	603	88	1.08	77	ITB	0.96	1.55	1.37	0.4	-17	-0.7	6.3		AIS
DELABERGE PEPPER ET VG85 HCD0	600	87	3.33	87	ITB	2.35	2.7	3.04	0.5	-15	0.85	8.6	WWS	
LADYS-MANOR L-BRN AMRYN ET HCD1	599	71	1.36	65	ITB	0.6	0.87	1.23	0.6	-27	-0.2	8.1	GEN	GEN

3 Project Review

3.1 SWOT analysis

STRENGTHS	• Excellent historic record levels • Innovative approach to breeding management • Can improve/hold value of "sale breeding heifers" as the genomic test will also be available for them • Analysis of the herd allows maximum health status to be achieved
WEAKNESSES	• 25% of animals tested carry one genetic recessive (but no comparison to UK herd available) • Cost of test
OPPORTUNITIES	• Test every animal going forward • Increase sale value of animals further by having herd classification status for HCD and Haplotype
THREATS	• Milk price and impact on income stream • BREXIT uncertainty • Complicated nature of industry breeding databases

3.2 Benefits for other Welsh dairy businesses

From a knowledge transfer perspective, the project has proved useful to start an industry discussion around recessive disorders, herd status and subsequent breeding decisions. The principles of this project are available to every Welsh dairy farm. Other farms could benefit using the techniques outlined in this project. Farmers often comment that at certain times, there seems to be additional issues with animal health or mortality. It could be that this is a result of unknown haplotype status and inadvertently breeding incorrectly.

3.3 Alignment with dairy sectors strategic goals

This work contributes to the Welsh Dairy Sector's strategic objectives; specifically in relation to ***Strategic aim 3 - To improve the business performance of producers and processors in response to changing market conditions, environmental requirements Climate Change and consumer demands***.

The success of the project is likely to result in further business efficiencies due to better calf rearing success, combined with better fertility results resulting in less semen usage. Not only vetinary and medicine costs should reduce, antibiotic usage should also lower due to fewer animals needed to be treated for sickness. This goes some way to meeting

consumer demands in improving animal welfare whilst also reducing overall antibiotic usage.

4 Impact on the industry

4.1 Impact on individual business

It is hard to quantify the impact of the project at this stage due to the fact that breeding decisions made take at least three years to filter through into production. However, the business deems the project a success and will continue with the process.

4.2 Impact on wider industry

It is currently unknown how many Welsh dairy businesses are carrying out genomic testing. However, considering the business has made great efforts over the last 30 years to maximise breeding impacts correctly, 25% of the females tested still carried at least one recessive, with 8% being carriers for HCD. If this is classed as “normal” it could go some way to explain high calf mortality on some farms where management level is still high.

The project has also highlighted that the industry lacks easy to interpret data for farm producers. This could then have negative impacts on breeding decisions due to the way data is presented back to farmers.

4.3 Impact on Welsh Government’s cross cutting and priority themes

Climate change

The UK government is legally required to reduce greenhouse gas emissions across agriculture by 80% of the 1990 levels, by 2050 (there is also an interim reduction target of 11% by 2020). Agriculture has to play a key role in achieving these reductions. Through better animal health, and potentially reduced mortality rates, this could have a reduction on carbon footprint as a result of the herd being more technically efficient.

Animal Health and Welfare (AHW)

Being aware of Haplotype and HCD status allows better breeding decisions to be made which in turn could result in better overall health of calves as well as reducing culling risk for fertility of the milking herd. As a result, there could be a reduction in the use of antibiotics for calves as well as a reduction in the use of hormones to breed those cows with poor fertility.

Future Generations

New techniques for managing health and fertility levels (such as this project) can make farming more attractive to younger farmers and new entrants.

The Natural Environment

The potential reduction in usage of antibiotics per animal reared is of benefit to the dairy industry.

Tackling Poverty

By farms being more profitable, typically the additional monies are then reinvested back into the business. This results in more money being spent in the locality with suppliers to the business, resulting in continuation of job retention in local communities.

Health & Safety

There is no major change to Health and Safety as a result of this project.

5 Project Team

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