Teagasc
Agriculture and Food Development Authority

National BEEF CONFERENCE 2024

Tuesday,
19 November

Carrick-on-Shannon,
Co. Leitrim

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Sustainable Cattle Production

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Teagasc National Beef Conference 2024

"Sustainable Beef Farming: Pathways to a greener future"

Agriculture and Food Development Authority

Tuesday 19th November
The Landmark Hotel, Carrick-on-Shannon, Co. Leitrim

Edited by:
Mark McGee, Teagasc Grange

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Speaker Biographies

Session 1:
'Innovating for Efficiency: Smart farming in the Irish beef sector'

Dr. Peter Doyle – *Teagasc, Grange Research Centre*

Peter is a Research Officer based in Teagasc Grange. One of Peter's main research roles is focused on improving the efficiency of suckler calf-to-beef systems, through the use of clover and animal genetics. His research also includes meat quality, enteric methane production, nitrogen use efficiency, cattle grazing behaviour and intake at pasture, herbage growth and quality, and modelling the cost of feedstuffs for livestock systems. He received a Ph.D. from University College Dublin for research on forage-only beef systems, and was awarded Teagasc Walsh Scholar of the Year in 2021. Peter is from a suckler beef and tillage farm in Co. Wexford.

Dr. Patrick Forrestal – *Teagasc, Johnstown Castle Research Centre*

Patrick Forrestal is a Senior Research Scientist in the Soils, Environment and Land Use Department of Teagasc. Patrick grew up on a mixed livestock and arable farm. His research programme and team focuses on the development and extension of practical and economic soil, nutrient management and agronomic solutions to support Irish agricultural production systems while addressing water quality, greenhouse gas and ammonia challenges. With his team he has published more than 50 scientific papers providing, for example, the scientific evidence for new loss reduction solutions under Irish conditions and the basis for agriculture to receive emission inventory credit for solutions implemented by farmers.

Dr. John Donlon – *Teagasc, Grange Research Centre*

John graduated with a degree in veterinary medicine from University College Dublin in 2018. He went into farm animal practice in south west Wales for a year after which he returned to UCD to pursue a PhD and specialisation in bovine herd health. His research focused primarily on respiratory disease in dairy calves. During this time he continued to work part-time in a suckler cattle focused veterinary practice in east Clare. In 2023, John joined Teagasc as a beef herd health research officer. He has varied research interests that encompass respiratory disease, calving difficulty and summer scour syndrome.

Speaker Biographies

Session 2:
'Harnessing Innovation: Future proofing Irish beef farming'

Dr. Eoin Ryan - *Department of Agriculture, Food and the Marine*

Eoin qualified as a vet from University College Dublin in 2002. He worked in mixed practice and then completed a PhD in foot-and-mouth disease in the Pirbright Institute, UK. He has worked for the UN Food and Agriculture Organisation and in various roles in the Department of Agriculture, Food and the Marine. He is currently head of the National Disease Control Centre within the Department.

Martina Harrington - *Teagasc, Programme Manager, Future Beef Programme*

Martina is a Teagasc Cattle Specialist with over 20 years of experience, focusing on the south east of Ireland. She holds a B.Agr.Sc. from University College Dublin and a Master's in Rural Environmental Conservation Management. Martina worked as a Business and Technology (B&T) drystock advisor, where she played a key role in facilitating beef discussion groups, offering one-on-one consultations, and helping farmers implement best practices in their operations. She brought 16 years experience working in REPS and with local discussion groups and farmers in Wexford into her role as a specialist. Martina works closely with beef advisors and farmers, leading initiatives to improve farm efficiencies, profitability and sustainability. Currently, her work includes managing the Teagasc Future Beef Programme. This entails collaboration with farmers in the programme to improve profitability through increased output per livestock unit, while also reducing inputs and costs. The Future Beef Programme also aims to reduce greenhouse gas (GHG) emissions and improve water quality.

Shane Pearson - *Design Your Life Coaching*

Shane hails from a beef farming background, where he worked full-time on his family farm before following his passion for helping others achieve greater levels of health and wellbeing. With over 15 years of experience in facilitating positive change, Shane has spent the past decade focused on Health & Wellness coaching. An ICF Certified Coach, nutritional therapist and master practitioner of NLP, he specializes in stress management and resilience, integrating expertise in mindset, health, and wellness to create lasting transformations. Shane has provided his expertise to top-tier companies throughout Ireland on wellbeing programs, and provides one-on-one coaching for individuals seeking personal and professional growth. As a multi-award-winning coach and accredited Thought Leader in Behavioural Change, he is dedicated to empowering clients to thrive through life's challenges.

Foreword

Welcome to the 2024 Teagasc National Beef Conference. The Irish beef sector is a vital pillar of our economy, supporting over 70,000 farms and contributing €2.7 billion in exports annually. As one of the world's largest net exporters of beef, approximately 90% of the beef produced in Ireland is supplied to over 70 markets globally, including the UK, EU, and emerging markets in Asia and the Middle East. Beef farming in Ireland goes beyond economics; it is deeply woven into our culture, rural heritage, and traditions. However, the industry faces significant challenges, such as low farm level profitability, an uncertain price environment, increasing environmental regulations, and the need to reduce greenhouse gas emissions. The theme of this year's conference, "Sustainable Beef Farming: Pathways to a Greener Future," focuses on the innovations that beef farmers can adopt to enhance profitability, while meeting agriculture's goals for reducing greenhouse gas emissions and improving water quality.

Ireland's beef systems rely heavily on incorporating a high proportion of grazed grass and forage in the cattle's diet throughout their lifetime. Two papers presented at today's conference showcase the latest technologies our researchers are exploring to make these grassland systems more sustainable. Research from Teagasc Grange indicates that incorporating white clover in pastures can boost liveweight gain and reduce nitrogen fertiliser use on beef farms. Initial findings show a significant increase in carcass weights for cattle grazed on these legumes. Meanwhile, research at Teagasc Johnstown Castle highlights several proven methods to reduce nitrate-based fertiliser usage, lowering greenhouse gas emissions from beef farms without compromising production.

Healthy animals are essential for profitable and high-welfare beef farming. Two papers presented today address different aspects of the challenges in maintaining beef cattle health. The persistent challenge of controlling pneumonia in suckler weanlings requires a multifaceted approach, with research showing the potential of both traditional and innovative solutions to mitigate its impact. Bluetongue, a disease that poses a major threat to Irish livestock, presents serious risks; preventing its introduction is crucial to protect animal health, welfare, and trade in live animals and genetic materials—factors vital to farmers' livelihoods.

Many of the innovations presented today are currently being deployed and tested on the 22 suckler farms in our Future Beef suckler demonstration programme. These farmers are gaining first-hand experience of what works and the best ways to apply it on their own farms. Teagasc is grateful to these farmers for allowing us to share both their successes and challenges, providing valuable insights for the wider farming community. Finally, we are addressing an issue relevant to everyone here. Farmers often face poor mental health, high rates of burnout, and physical health issues due to stress. Our closing paper offers practical advice on how small changes can significantly boost resilience for farmers and their families.

I want to extend my thanks to our chairpersons and speakers, whose time and expertise have shaped this conference. A special thanks goes to my colleagues at Teagasc involved in putting together and organising a conference that tackles the key challenges and exciting opportunities facing the Irish beef industry. My hope is that each of you takes away valuable insights from the presentations and discussions—ideas that will empower you to make your farms, not only more profitable, but also more sustainable for the future. Let's continue learning, innovating, and working together to shape a stronger, greener industry.

Professor Frank O'Mara, Director, Teagasc

The impact of red and white clover on animal performance in suckler calf-to-beef production systems

Peter Doyle[1], Peter Bennett[1], Michael O'Donovan[2], Nicky Byrne[1], Alan Kelly[3], Paul Crosson[1] and Mark McGee[1]

[1] *Teagasc, Grange Animal & Grassland Research and Innovation Centre, Dunsany, Co. Meath*

[2] *Teagasc, Moorepark Animal & Grassland research and Innovation Centre, Fermoy, Co. Cork*

[3] *School of Agriculture and Food Science, University College Dublin, Belfield, Dublin 4*

Summary

- Suckler yearling steers and heifers grazing grass-white clover pastures had a greater live weight gain (+ 0.1 kg/day), and were 23 kg heavier at the end of the grazing season resulting in a 14 kg heavier carcass, compared to animals grazing grass-only pastures.
- Suckler progeny reared on a grass-clover based production system (i.e. grass-white clover grazed pasture and grass-red clover silage) from birth-to-finishing were 27 kg heavier at finishing resulting in an 18 kg heavier carcass, compared to animals reared on a grass-only (i.e. grazed grass and grass silage) system.
- Incorporating clover reduced the requirement for chemical nitrogen fertiliser.

Introduction

Irish beef farming has faced a number of challenges around controlling costs and maximising farm profit. In recent years, there has been an unprecedented rise in the cost of fertiliser, feed and fuel, which has significantly increased the cost of feed production on beef farms (Doyle et al., 2022). Feed provision accounts for over 70 % of total direct costs on Irish beef farms (National Farm Survey, 2023). In the Derrypatrick suckler herd at Teagasc Grange, the three largest variable costs are silage-making, concentrate feed and chemical fertiliser, respectively. In order to reduce feed costs, improving cattle live weight gain on our cheapest feed source, grazed pasture, is vital for the financial resilience of suckler-beef farms (Doyle et al., 2024). The agricultural industry is also facing additional challenges around climate change, as it is required to reduce its greenhouse gas (GHG) emissions by 25 % between 2018 and 2030. Reducing nitrogen (N) fertiliser inputs and finishing age of beef cattle are two of the main strategies identified to reduce GHG emissions. In light of the above challenges, climate and cost mitigation strategies need to be evaluated within beef systems.

Compared to grass-only pasture, clover-based pasture offers farmers the opportunity to further reduce feed costs through lower N fertiliser inputs (Doyle et al., 2024), and to reduce environmental footprint (Herron et al., 2021). However, there is relatively little information available on the live weight gain response of beef cattle consuming clover-based pasture compared to grass-only pasture, and this requires research.

The Derrypatrick herd

The Derrypatrick herd is a suckler calf-to-beef research herd at Teagasc Grange. The current research project entails "developing more sustainable suckler beef systems in the context of grass-clover pastures and animal genetics". The overall objectives of this project, using an 80 cow spring-calving herd stocked at 2.2 livestock units/hectare (ha) (equivalent to 170 kg organic N/ha), are to increase farm profitability and decrease environmental footprint through reducing:

1. Animal finishing age (and consequently winter feed costs)
2. Concentrate input
3. Nitrogen fertiliser input

The research project will validate and quantify the role of legumes (red and white clover) in helping to achieve these objectives. This paper will outline the results, to date, from two experiments evaluating the role of clover on suckler beef cattle performance over 'one grazing season' (Experiment 1) and from 'birth-to-finish' (Experiment 2).

Experiment 1: Live-weight gain of suckler-bred cattle grazing grass-only or grass-white clover pastures over one grazing season

The objective of the experiment was to quantify the carcass gain of suckler-bred yearling cattle grazing grass-only pasture compared to grass-white clover pasture over a single grazing season (2023) within the context of a suckler calf-to-beef system. Following a common indoor winter period where they were offered grass silage *ad libitum* plus 1.5 kg concentrate per head daily, early-maturing (Aberdeen Angus-sired) and late-maturing (Charolais-, Simmental-, Limousin-sired) yearling heifers (average initial weight, 346 kg) and steers (average weight, 442 kg) were assigned to either, 1) perennial ryegrass-only or 2) perennial ryegrass-white clover pasture for the entire 'second' grazing season. Chemical N fertiliser application levels on the whole farm were 134 and 67 kg N/ha (equivalent to 108 units N/acre and 54 units N/acre) for the grass-only and grass-white clover systems, respectively.

Heifers were initially turned out to pasture on 30 January, but had to be re-housed between 9 March and 6 April, due to poor weather conditions. Steers were turned out on 5 April. Cattle grazed their assigned pastures in a rotationally stocked system and at the end of the grazing season (11 October for heifers and 1 November for steers), they were transported to a commercial abattoir and carcass traits were determined.

Mean pre-grazing herbage mass and post-grazing sward height of the two pasture types are presented in Table 1. The mean clover dry matter (DM) content in the grass-clover pasture over the grazing season was 10%.

Table 1. Pre-grazing herbage mass and post-grazing sward height of the two pasture types grazed by the heifers and steers in Experiment 1.

	Heifers	Heifers	Steers	Steers
Pasture type	**Grass-only**	**Grass-clover**	**Grass-only**	**Grass-clover**
Pre-grazing herbage mass (kg DM/ha)	1817	1613	1783	1653
Post-grazing sward height (cm)	5.3	5.1	5.4	5.2

Cattle grazing the grass-white clover pasture had a greater live weight gain (+ 0.1 kg/day), and were 23 kg heavier at the end of the grazing season resulting in a 14 kg heavier carcass, than those grazing the grass-only pasture (Table 2). Herbage nutritive value and animal intake at pasture was also measured, but this analyses is on-going.

The increased live weight gain for cattle on grass-clover pastures is consistent with research carried out at Teagasc, Johnstown Castle (Fitzpatrick et al., 2024) and internationally (Yarrow and Penning, 2001) with dairy-beef cattle. It should be noted, that excessively high levels of clover (> 50 %) can reduce animal performance due to the onset of bloat (Wolfe and Lazenby, 1972). There were no incidences of bloat during this experiment; however, it must be considered that the cattle on the grass-white clover treatment were always grazing grass-white clover and not switching between pasture types, where the risk of bloat increases. It is important to remain vigilant and, where required, take the necessary precautions for bloat prevention.

Table 2. Effect of pasture type (grass-only or grass-white clover) on suckler-bred heifer and steer performance during the 'second' grazing season (Experiment 1).

	Heifers	Heifers		Steers	Steers		
Pasture type	**Grass-only**	**Grass-clover**	**Sig.** [1]	**Grass-only**	**Grass-clover**	**Sig.** [1]	*Mean difference*
Turnout weight (kg)	347	346	NS	443	442	NS	*None*
Daily live weight gain at pasture (kg)	0.70	0.80	***	0.66	0.75	*	*0.10 kg/day*
Live weight gain at pasture (kg)	178	204	***	137	158	*	*23 kg*
Final live weight (kg)	525	550	*	580	600	0.08	*23 kg*
Kill-out proportion (g/kg)	540	540	NS	550	550	NS	*None*
Carcass weight (kg)	282	298	*	317	329	*	*14 kg*
Conformation score (1-15)	7.96	8.19	NS	7.37	7.52	NS	*None*
Fat score (1-15)	6.07	7.86	***	5.85	5.24	NS	*None*
Finish age (months)	19.4	19.3	NS	20.1	20.1	NS	*None*

[1]Sig. = statistical significance, where NS = not significant, and * = P < 0.05

Based on the results of this experiment, the profitability and GHG emissions of grass-only (134 kg N fertiliser/ha) vs. grass-white clover (67 kg N fertiliser/ha) grazing pastures in a suckler calf-to-beef system where progeny are finished from pasture at 20 months of age was assessed. The analysis incorporated all the inputs and outputs from the experiment described above. Key price assumptions included, protected urea @ €550/tonne, beef carcass price @ €5.00/kg and concentrate ration @ €350/tonne. The cost of over-sowing 25% of the farm each year for the grass-clover system was also included. Results indicated that stocking rate was slightly lower for the clover system due to greater estimated animal intake. Overall, incorporating white clover into grazing pasture increased net margin by 16 % (€581 to €688/ha), and reduced GHG emissions per kg carcass weight and per cow unit by 3% and 6%, respectively. Therefore, beef farms that incorporate white clover into pastures can obtain the combined benefits of superior animal growth, reduced N fertiliser input, and improved economic and environmental sustainability.

Figure 1. Late-maturing breed cattle grazing grass-white clover pastures (Experiment 1).

Experiment 2: Performance of suckler cattle on a grass-only compared to a grass-clover based production system from birth-to-finishing

Building on the results of Experiment 1, where performance of yearling cattle grazing grass-only or grass-white clover pastures was compared over a single grazing season, the current Derrypatrick herd experiment is evaluating lifetime performance (birth-to-finishing). In this experiment, Aberdeen Angus- or Charolais-sired suckler cattle are produced on a grass-only (150 kg N/ha or 120 units N/acre) or a grass-clover (75 kg N/ha or 60 units N/acre) based production system as summarised in Figure 2. In the grass-clover system, both white clover (grazing) and red clover (silage) were used.

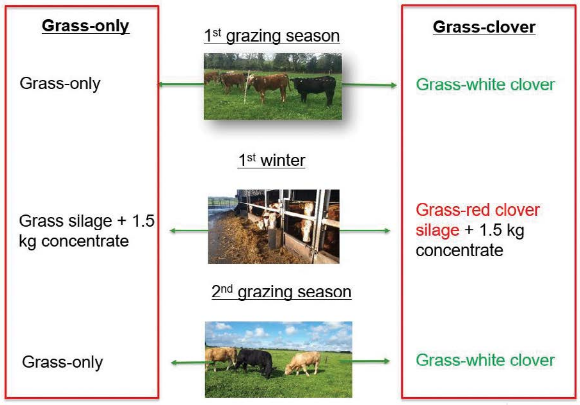

Figure 2. Pasture system (grass-only vs. grass-clover) treatments in the Derrypatrick suckler herd.

The aim of this experiment is to finish progeny from pasture at the end of the second grazing season at 19 to 20 months of age, and therefore avoid an expensive 'second' indoor winter period.

Animal genetics

Challenges with this pasture-finishing system include achieving sufficient carcass weight and achieving an adequate carcass fat score (≥2+) at 19 to 20 months of age. In this regard, specific sires were chosen with a focus on 'weight-for-age' and 'improved' fat cover at young ages. The Aberdeen Angus and Charolais sires were chosen for use on mature cows using the following selection criteria:

- Calving difficulty < 8 % (*easy-calving*)
- Carcass weight PTA: 5-star (*high carcass weight*)
- Age to slaughter PTA: 4- and 5-star within or across breed (*early slaughter age*)
- Carcass fat PTA: 1- and 2-star within or across breed (*improved 'fleshing' ability*)
- Reliability of key traits: >70 % (*proven bulls*)

An example of some of the sires used to date include:

Aberdeen Angus:	BJG, AA4089, AA4323, AA4638, AA4640, AA8559
Charolais:	CH2216, CH4251, CH4562, CH6271, CH6298, CH6310

Production system management

This systems experiment will run over three production cycles. Only one production cycle is completed to date - the first set of calves, born in spring 2023, were finished in autumn 2024. Only growth performance-related results from these animals are presented here, with the caveat that this is only the first of three years data.

In spring 2023, Aberdeen Angus and Charolais sired calves from Limousin × Holstein-Friesian dams were assigned to a grass-only (150 kg chemical fertiliser N/ha) or a grass-clover (75 kg chemical fertiliser N/ha) production system (as illustrated in Figure 2) at approximately 3 weeks of age. The calves were balanced across treatments based on sex, breed, sire, date of birth (mean, 25 Feb 2023) and live weight. Each pasture system had its own individual farmlet of 32.5 ha. All treatments were stocked at 2.2 LU/ha equivalent to 170 kg organic N/ha (i.e. just under Nitrates Derogation limit). Nitrogen fertilizer application rates on the grass-only and grass-clover production systems were 134 and 67 kg N fertiliser/ha, respectively, in 2023. Corresponding values for 2024 were 156 and 83 kg N/ha. The online tool "PastureBase Ireland" was used as an aid for grazing management.

During the first grazing season, the calves rotationally grazed with their dam and were gradually weaned from 9 October 2023 (~7.5 months of age), following which they spent a further five weeks at pasture. Calves received 1.0 kg concentrate/head daily pre- and post-weaning. On 13 November, the weanlings were housed and offered a mixture of first and second cut of their assigned silages *ad libitum,* along with 1.45 kg concentrate/head daily. Following 150 days on their assigned silage treatments, cattle were turned out to pasture on 12 April 2024, where they grazed their assigned pasture types for 181 days. All steers and heifers were drafted for slaughter on 10 October 2024, regardless of fat cover. No concentrates were fed at finishing; however, cattle did receive 58 kg concentrate/head during part of the second grazing season in order to measure their enteric methane production - a small amount of concentrate 'bait' feed is used to entice animals to enter the 'Greenfeed' system. In total, each animal received 265 kg concentrate from weaning until the end of the first indoor winter period, as well as the additional 58 kg concentrate during the methane measurement phase during the second grazing season. Steers and heifers were treated the same (e.g. concentrate quantity fed, days at grass etc.).

Herbage characterization and production

The average clover content was 11 % for the cows and calves during the first grazing season (2023), and 22 % for both steers and heifers, during the second grazing season (2024). Mean pre-grazing herbage mass and post-grazing sward height of the two pasture types grazed by the heifers and steers are presented in Table 3.

Table 3. Pre-grazing herbage mass and post-grazing sward height of the two pasture types grazed by the heifers and steers in Experiment 2.

	Heifers	**Heifers**	**Steers**	**Steers**
Pasture system	**Grass-only**	**Grass-clover**	**Grass-only**	**Grass-clover**
Pre-grazing herbage mass (kg DM/ha)	2067	1844	1785	1647
Post-grazing sward height (cm)	5.32	5.47	5.31	5.25

Three cuts of silage for the grass-only and the grass-red clover systems were harvested in 2023 (i.e. May, July and September). Clover DM percentage was 14, 69 and 88 %, for the first, second, and third cut, respectively. Due to its seasonal growth the red clover content for first-cut silage will always be relatively low. Across the three cuts in 2023, the grass silage pasture received 234 kg chemical N fertiliser/ha, whereas the grass-red clover pastures received no chemical N fertiliser. A total of 50 kg organic N/ha (slurry) was applied across both silage systems. In 2023, the total yield for the 3-cut silage (excluding grazing) was 14.0 t DM/ha and 16.1 t DM/ha for the grass-only and grass-red clover silage systems, respectively. In 2024, the 3-cut yields were 15.4 (273 kg inorganic N/ha) and 15.0 t DM/ha (0 kg inorganic N/ha) for the grass-only and grass-red clover silage systems, respectively.

Animal performance

Cows grazing the grass-white clover pastures had a greater live weight gain during the grazing season (calving to weaning) compared to their grass-only counterparts, but there was no difference in body condition score (Table 4).

Table 4. The impact of pasture system (grass-only or grass-clover) on cow live weight and body condition score (BCS, scale 0-5) during the 2023 and 2024 grazing seasons.

Pasture system	Grass-only	Grass-clover	Sig.[1]	*Mean difference*
2023				
Live weight at weaning (kg)	553	570	NS	*None*
BCS at weaning (0-5)	2.93	2.92	NS	*None*
Live weight change from calving to weaning (kg)	-9.9	12.0	**	*22 kg*
BCS change from calving to weaning (0-5)	0.02	0.01	NS	*None*
2024				
Live weight at weaning (kg)	585	599	NS	*None*
BCS at weaning (0-5)	2.60	2.63	NS	*None*
Live weight change from calving to weaning (kg)	8.6	23.8	*	*15 kg*
BCS change from calving to weaning (0-5)	0.01	0.01	NS	*None*

[1]Sig. = statistical significance, where NS = not significant, * = $P < 0.05$ and ** = $P < 0.01$.

In 2023, calves grazing grass-white clover pastures had a 10 kg heavier 200-day weight (+0.06 kg/day) than their grass-only counterparts (for the 2024-born calves, this differential was 14 kg – not presented), and this difference had increased to 13 kg by the end of the first grazing season (Table 5, overleaf). During the 'first' indoor winter, weanlings offered grass-red clover silage gained an additional 13 kg live weight (+0.08 kg/day) compared to their counterparts offered grass-only silage. Consequently, at turnout to pasture for the 'second' grazing season (13.5 months of age), the live weight difference between two pasture systems had increased to 27 kg, in favour of the grass-clover cattle. During the second grazing season, however, there was no difference in daily live weight gain between the grass-only and grass-white clover pastures. This meant that the cattle on the grass-clover system were still 27 kg heavier at the end of the grazing season, which resulted in an 18 kg heavier carcass weight at the same age. Carcass fat score did not differ between pasture systems, but the grass-clover cattle had a greater carcass conformation score than the grass-only cattle.

In contrast to Experiment 1, there was no difference in animal live weight gain during the second grazing season between the two pasture types in Experiment 2. A likely reason for this inconsistency is that, unlike Experiment 1 where all animals were offered the same diet resulting in similar winter growth performance, in Experiment 2, the cattle on the grass-clover system had a superior live weight gain during the first winter (0.62 vs. 0.54) compared to those on the grass-only system. Consequently, cattle on the grass-only system were likely to have had comparatively more compensatory growth potential during the second grazing season (McGee et al., 2014), thus negating the benefits of the grass-white clover over the grass-only pasture.

Similarly, research at Teagasc, Grange with dairy-beef weanling steers showed that animals offered second-cut grass-red clover silage (87 % red clover content) achieved 0.12 kg greater daily live weight gain (0.68 vs. 0.56 kg) over the first winter compared to those offered grass-only silage (Byrne et al., 2024). However, in that study, the 9 kg difference in live weight at the end of the indoor winter period in favour of the grass-red clover treatment had 'disappeared' by the end of the second grazing season. In this case, animals grazed a similar pasture type (grass-only) and the steers offered grass-only silage the previous winter achieved a compensatory growth index of 1.0.

The results from Byrne et al. (2024) and Experiment 2 indicate that grass-red clover silage could be used to reduce the amount of concentrates fed over the first winter, rather than increase animal performance beyond the recommended growth target of 0.5 kg/day for suckler-bred cattle (McGee et al., 2014). Alternatively, grass-red clover silage could be targeted towards priority animal groups with limited opportunity for subsequent compensatory growth (e.g. finishing cattle). In this scenario, the ability to capitalise on the increased intake characteristics and animal growth potential of red clover may be realised. Further research is required in this area.

Table 5. Effect of grass-only or grass-clover production system on growth and carcass traits of heifers and steers during the 2023/24 production cycle.

Pasture System	**Heifers Grass-only**	**Heifers Grass-clover**	**Steers Grass-only**	**Steers Grass-clover**	**Sig.**[1]	*Mean difference*
Date of birth	24/02	23/02	26/02	28/02	.	
Live weight (kg)						
Birth	41.4	41.5	46.6	45.7	NS	*None*
200-days	277	283	293	307	0.07	*10 kg*
Housing	312	315	322	344	0.06	*13 kg*
Turnout to pasture	393	411	406	442	**	*27 kg*
Final	571	592	598	630	**	*27 kg*
Live weight gain (kg)						
200-day	1.18	1.21	1.23	1.30	*	*0.06 kg/day*
First winter	0.54	0.61	0.55	0.63	*	*0.08 kg/day*
Second grazing season	0.99	1.01	1.07	1.04	NS	*None*
Carcass traits						
Carcass weight (kg)	299	308	313	340	***	*18 kg*
Conformation score (1-15)	7.76 (R=)	8.14 (R=)	6.81 (R-)	7.61 (R=)	**	*0.59*
Fat score (1-15)	8.35 (3=)	8.48 (3=)	6.27 (2+)	6.80 (3-)	NS	*None*
Carcass value @ €5.00/kg base price	1605	1669	1647	1809	***	*€113*
Finishing age (months)	19.4	19.4	19.5	19.5	.	.

[1]Sig. = statistical significance, where NS = not significant, * = $P < 0.05$, ** = $P < 0.01$, and *** = $P < 0.001$.


Figure 3. Aberdeen Angus- and Charolais- sired calves grazing grass-clover pastures

Overall, good animal performance was achieved during the 2023/24 production cycle, with cattle on the grass-clover system averaging 1.26 kg live weight/day at 200-days of age, 0.62 kg live weight/day over the first winter, and 1.02 kg live weight/day during the second grazing season, resulting in a final carcass weight of 308 kg and 340 kg for heifers and steers, respectively, at 19.5 months of age. Across the pasture systems and breed types, 100 % of the heifers and 84 % of the steers were finished (i.e. carcass fat score ≥ 2+) from pasture with no concentrate supplementation during the finishing period. The performance difference between the two sire breeds will be presented when the three production cycles are completed.

Current and future research

The preliminary findings presented above (Experiment 2) are part of a much-larger on-going study. Future results will outline the impact of pasture system (grass-only or grass-clover) and sire breed (Aberdeen Angus or Charolais) on:

- Animal intake (grazing and indoors)
- Enteric methane emissions
- Calf immunity
- Herbage production
- Herbage nutritive value
- Silage preservation
- Long-term white and red clover persistency
- Soil N-fixation
- Soil nitrate leaching
- Farm systems financial and environmental sustainability

Figure 4. Heifers (left) and steers (right) grazing grass-clover at 19 months of age

Establishing white and red clover

Incorporating white clover in a full reseed is the most reliable method of clover establishment; however, it will take too long to establish clover throughout the whole farm if this is the sole method used. It is likely that over-sowing will be the most common clover establishment method on drystock farms. Over-sowing is a simple and low-cost method of introducing white clover into swards and is very applicable for drystock farms. For both processes, it is better to reseed/over-sow in April and May rather than late summer/autumn. In the Derrypatrick herd, over-sowing was carried out on a large number of paddocks, and was very successful when done correctly. However, there were a small number of paddocks that were unsuitable for over-sowing. Success rate on paddocks that had a very dense sward base (similar fields grazed by sheep) was poor. This is likely due to the lack of light reaching the newly established clover plant. Consequently, these fields were prioritised for reseeding rather than over-sowing. It was also difficult to successfully over-sow silage fields post-cutting in June, as moisture/rainfall was limiting in recent years. These experiences are consistent with the recommendations that over-sowing should be completed in April (preferably) and May. The main steps to over-sowing revolve around the simple principles of having moisture, light and nutrients available to the over-sown plant, with post-sowing management having the biggest impact on light availability. Key tips to follow when over-sowing are outlined in more detail by O'Donovan et al. (2024).

Red clover is typically established via reseeding, as it can be difficult to over-sow in silage pastures due to the tendency of silage swards to shade out small seedlings. Reseeding red clover follows similar principles to a conventional reseed. However, a red clover safe herbicide must be used. The importance of using the correct red clover variety cannot be overstated. The UK recommended list can be used to pick a suitable variety. On-going research at Teagasc sites has shown that varieties not on this recommended list have very poor persistence (Kearney and Doyle, 2024). The persistence of red clover can be low (ca. 4 years). Key management factors that need to be considered in order to improve red clover persistence include:

- Soil fertility: huge impact on plant survival (Phosphorus (P) and potassium (K) ≥ soil index 3 and pH ≥ 6.5).
- Reseeding: aim for spring.
- Avoid wet fields and compaction (machinery and poaching).
- Variety: only use varieties on the recommended list.
- Three- to four-cut silage system.
- Grazing: limit the number of times it is grazed, but be sure to remove herbage before the winter.
- Avoid having excessive pasture cover (>700 kg DM/ha) over the winter.
- Bloat (grazing): be mindful of bloat when clover content is high.

These factors are outlined in more detail by Byrne et al. (2022).

Figure 5. Red clover varieties side-by-side under similar management

Conclusions

Incorporation of red and white clover into pasture reduces the requirement for N fertiliser inputs and increases animal live weight gain in a suckler calf-to-beef system. Successfully incorporating clover onto the farm will increase farm profitability, while also helping meet sectorial climate targets. Successful establishment of clover onto farms requires vigilant management procedures to be adhered to.

Acknowledgements

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Practical nutrient management solutions that beef farmers can implement on their farms to increase efficiency, reduce costs and address environmental pressures facing the sector

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Summary

- Liming mineral soils to achieve a pH in the range 6.2-6.7 will release plant available phosphorus (P) from the soil P pool. This release can often give a one-unit increase in the soil test P index, thus saving money on P fertiliser.
- Prior to clover sward establishment, aim to achieve a soil pH of at least 6.3 for best success, and to reduce nitrogen (N) fertiliser cost and reliance.
- The use of low/no nitrate fertilisers including urea protected with the urease inhibitors NBPT, NBPT+NPPT or 2-NPT in place of nitrate-based fertilisers (e.g. calcium ammonium nitrate, CAN) will maintain grassland production, while reducing greenhouse gas (GHG) emissions on beef farms.
- Including sulphur with N fertilisation increases the grass yield response to applied N, gives potential to reduce N fertiliser application rates, while also reducing nitrate leaching loss to water, particularly in free-draining soils.
- Ribwort plantain inclusion in grass-clover swards reduces nitrate leaching losses across a range of soils, while maintaining sward production.

Introduction

Beef farmers face challenges to reduce greenhouse gas (GHG) and ammonia emissions along with reducing nutrient losses to water, while maintaining viable farm enterprises. Research in Irish soils and under Irish conditions is providing pathways and tools for Irish farmers to meet these challenges. This paper outlines some of the recent and new practical nutrient management solutions that Irish Beef farmers can consider implementing on their own farms to increase their efficiency, reduce costs and address environmental pressures facing the sector.

Liming to release soil phosphorus, reduce nitrous oxide emission and increase success with clover

Liming has many benefits in soils managed for production including favouring the retention of more productive grasses and clover. Phosphorus (P) is the most expensive of the macronutrients purchased by farmers; however, under acidic conditions, particularly below pH 6, this purchased phosphorus is readily locked up in non-plant available forms. Liming represents a good investment in these soils with increases in pH freeing up P from the bank of soil P. Liming alone without P application can increase the soil pool of plant available P (Figure 1a), often resulting in an increase in soil P index. In addition, trials at Teagasc, Johnstown Castle have shown that increasing the soil pH prior to seeding clover plays a critical role in the success of clover in that new sward (Figure 1b). Recent work in mineral nitrogen (N) fertilised Irish soil by Žurovec et al. (2021) has also shown that emissions of the GHG nitrous oxide declined linearly with increasing soil pH.

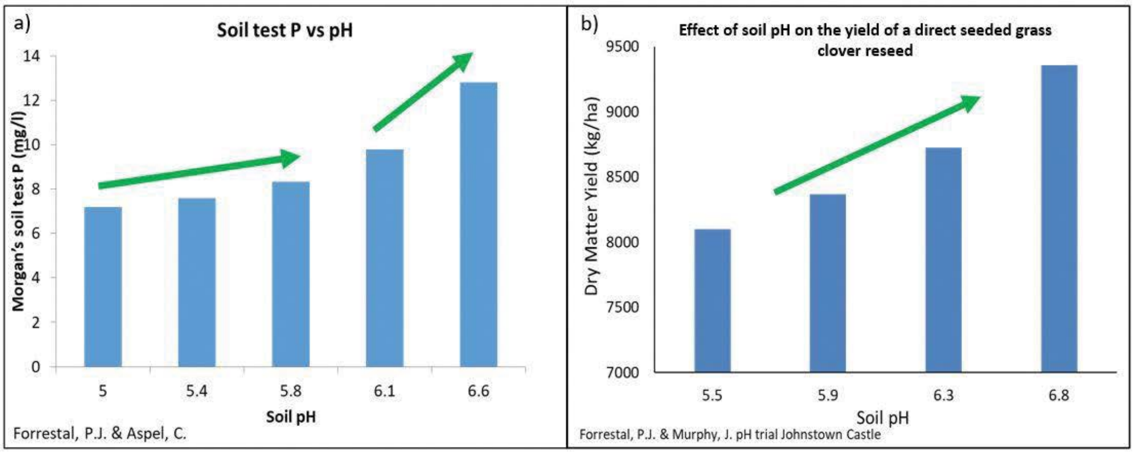

Figure 1a. Morgan's soil test Phosphorus levels increase as soil pH increases. **b.** Yield and success with a new grass clover sward increases as soil pH increases.

Urea protected with NBPT, NBPT+NPPT or 2-NPT maintain grassland production while reducing emissions of the greenhouse gas nitrous oxide in Irish soils compared to calcium ammonium nitrate (CAN)

In a multi-site experiment conducted over 2 years in Ireland, Forrestal et al. (2017) reported that urea protected with NBPT and calcium ammonium nitrate (CAN) fertilised grass consistently produced the same dry matter (DM) yield, and had the same level of N recovery as urea+NBPT.

Research carried out at Teagasc, Johnstown Castle during the relatively poor grass growing conditions of 2024, compared CAN with urea and urea protected by NBPT, NBPT+NPPT and 2-NPT, and found no statistically significant difference in grass DM production between the different N fertilisers (Figure 2). Although grass DM yield is similar between fertiliser N types in Irish grassland, important differences in emissions of the GHG nitrous oxide have been reported between N fertilisers. Emission factor reductions of approximately 70% with urea-based N compared to CAN (Harty et al., 2016), and of 66% for ammonium only compared to nitrate only fertiliser (Rahman and Forrestal, 2021) (Figure 3a and b, respectively).

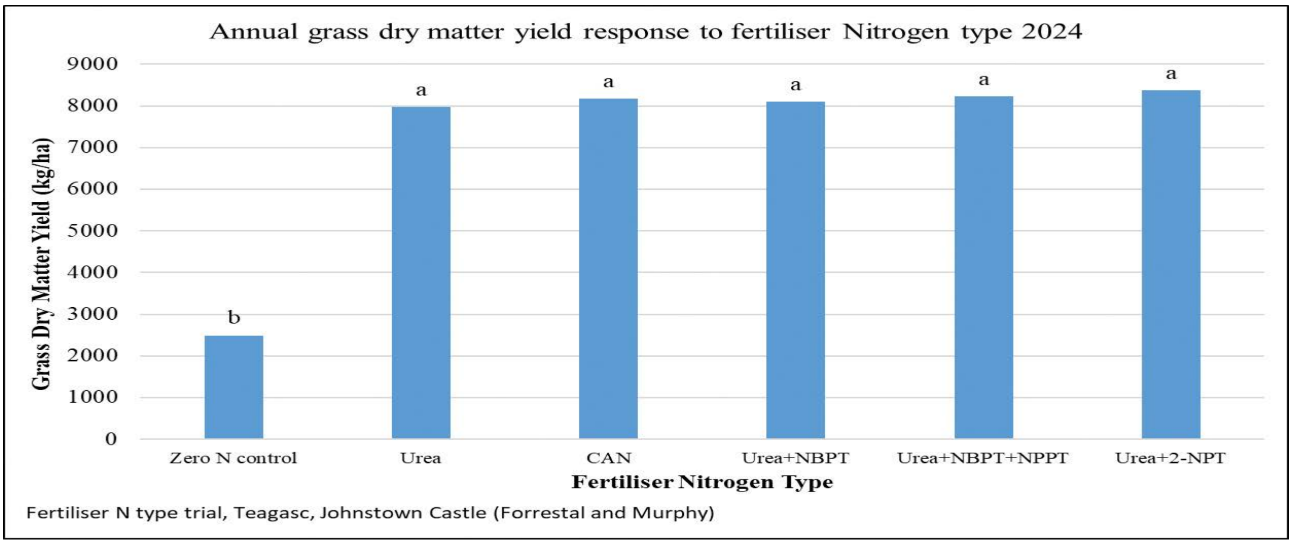

Figure 2. Effect of fertiliser nitrogen source on grass dry matter yield in 2024. Treatments with differing lettering are significantly different ($P \leq 0.05$).

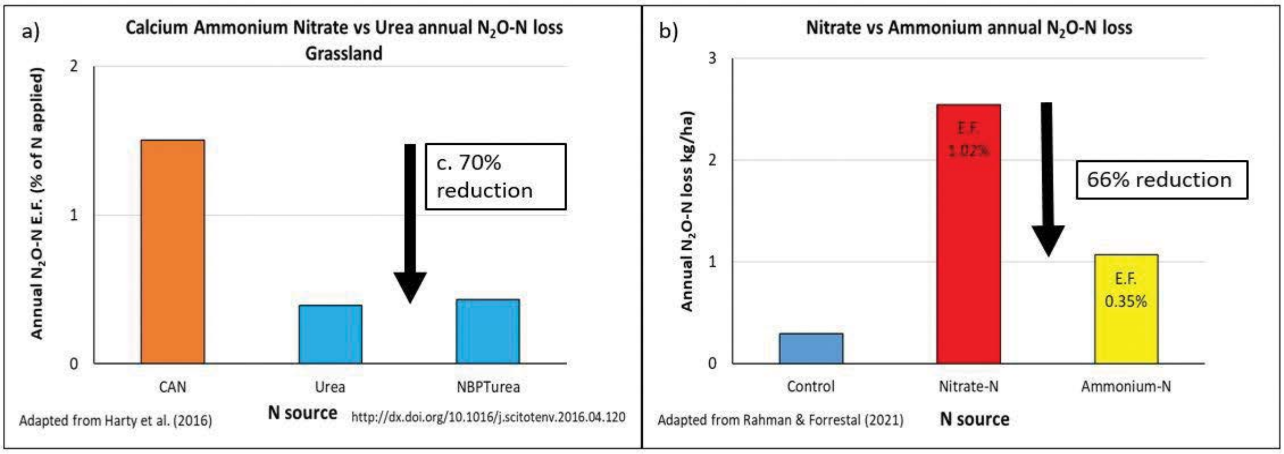

Figure 3a. The effect of calcium ammonium nitrate (CAN) compared to urea and urea protected with NBPT on the nitrous oxide (N_2O) emission factor in Irish soils. **b.** the effect of zero N, nitrate only and ammonium only fertiliser N on N_2O emissions and emission factors.

Optimising sulphur applications has potential to increase grass yield, nitrogen use efficiency and reduce nitrate leaching losses

Suboptimal plant sulphur (S) availability can reduce plant N efficiency and yield thereby increasing N loss potential. An experiment was conducted at Teagasc, Johnstown Castle using a free-draining sandy loam soil to determine if alleviating S deficiency in a grass sward affects nitrate leaching. The study also examined a number of strategies for applying N and S, including the use of cattle slurry (Aspel et al., 2022).

Application of mineral S fertiliser increased grass yields by up to 2,907 kg DM/ha and increased apparent fertiliser N recovery from 39% to 47–49%. Addressing the grass S deficiency on the tested soil by the addition of mineral S to N decreased nitrate leaching losses by 46% compared to N only. The maximum allowable nitrate-N level for drinking water was not breached for treatments that included S (6.6–11 mg nitrate-N per L), whereas this limit was breached for treatments without S (23–40 mg nitrate-N per L) (Figure 4). The S applied in the slurry treatment (9 kg S/ha) was not adequate to meet plant S requirements in this soil.

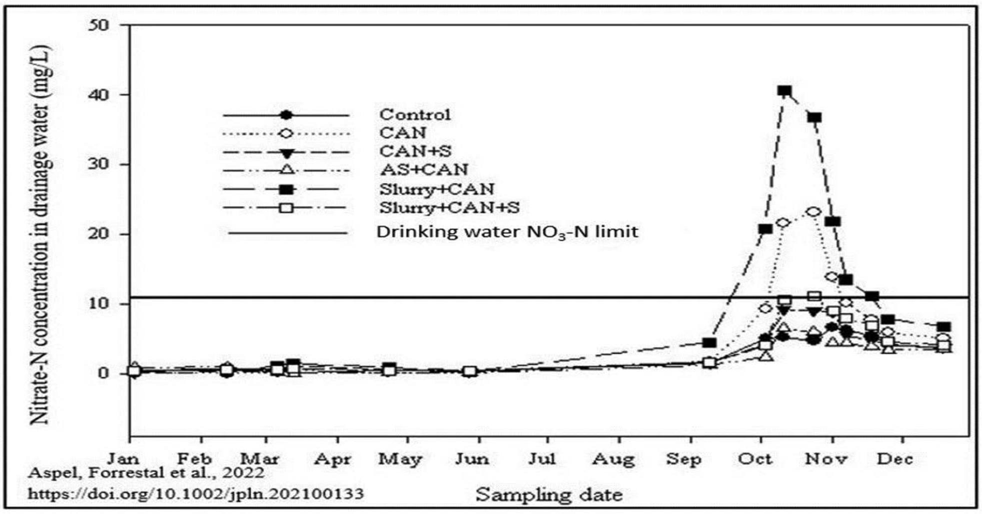

Figure 4. Inclusion of sulphur (S) with nitrogen fertilisation reduces nitrate-N concentrations in leachate in a free-draining soil. The horizontal straight line indicates the maximum allowable concentration of nitrate-N in drinking water.

This study provides evidence that optimization of S nutrition has the potential to deliver both grass yield benefits and environmental impact reduction to Beef and other farm as a nitrate leaching migration strategy on S-deficient soils.

Ribwort plantain inclusion in grass-clover swards maintains yield, while reducing nitrate leaching losses to water

A two-year study was conducted at Teagasc Johnstown Castle to evaluate the potential of ribwort plantain (*Plantago lanceolate L.*) inclusion in grass-clover (*Lolium perenne L.* and *Trifolium repens L.*) swards across five contrasting soils (Egan et al. *In review*).

At a target inclusion of 30% plantain, nitrate-N leaching losses were reduced by 32-74% (mean 56%) in year one, and by 93-99% (mean 96%) in year two. In poorly-drained soils the loss reduction was 3-10% (mean 6%) in year one and 97-98% (mean 97%) in year two. Increasing the plantain target inclusion to 50% further reduced N losses; however, much of the benefit of plantain was achieved at the 30% inclusion level (Figure 5).

Exceedances of the maximum allowable nitrate-N level for drinking water in leachate samples were reduced from 28 in the grass-clover treatment to seven in the 30% plantain inclusion treatment, and to four in the 50% plantain inclusion treatment. Overall, across a broad range of soils, the inclusion of plantain in grass-clover swards was shown to be an effective tool for reducing nitrate-leaching losses in pasture systems.

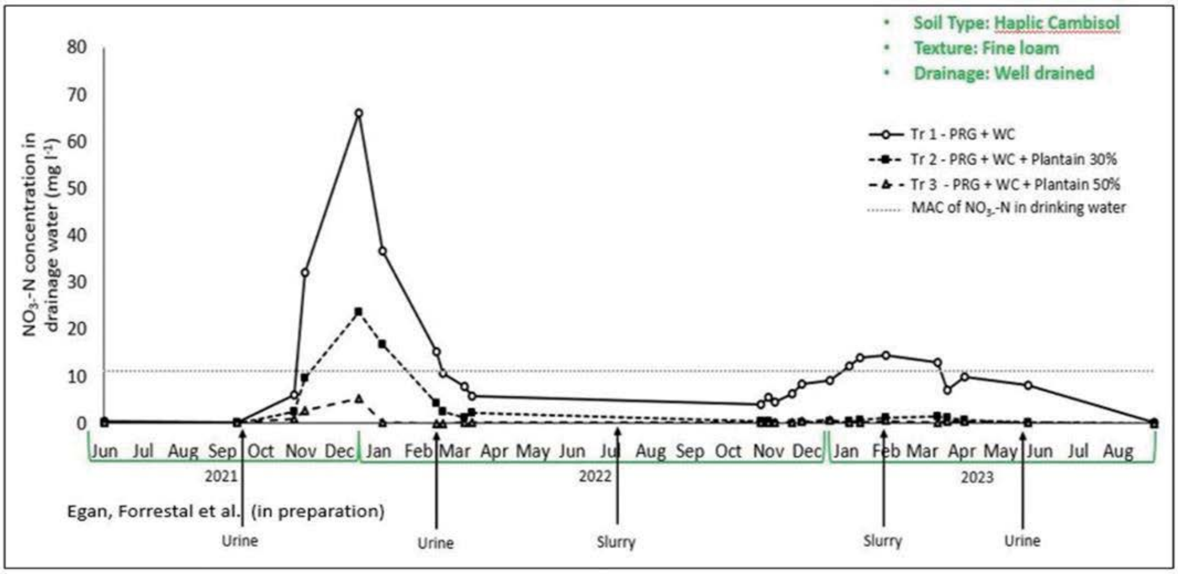

Figure 5. The inclusion of ribwort plantain in perennial ryegrass - white clover (PRG+WC) swards reduces nitrate-N concentrations in leachate over two years on a well-drained fine loamy soil. The horizontal straight line indicates the maximum allowable concentration of nitrate-N in drinking water

Summary

The use of liming, low/no nitrate fertilisers such as urea protected with NBPT, NBPT+NPPT or 2-NPT, the use of sulphur and the integration of ribwort plantain into grass clover swards all represent practical and cost effective options that farmers can implement on their farms to increase efficiency of herbage production, reduce costs and address environmental pressures facing the sector.

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Controlling pneumonia in suckler weanlings

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Summary

- Pneumonia or bovine respiratory disease (BRD) is the most significant infectious disease challenge in suckler weanlings.
- Controlling pneumonia involves reducing stress, improving immunity and avoiding concurrent disease.
- Stress can be reduced in weanlings at weaning time through provision of concentrates and a gradual weaning process.
- Vaccination against specific pathogens can reduce the risk of pneumonia but needs to be integrated into an overall herd health plan.
- Regular monitoring of weanlings for clinical signs of pneumonia is vital to early treatment and reducing its detrimental impact.

Introduction

Bovine respiratory disease (BRD) or pneumonia is a multifactorial disease affecting cattle of all ages. Internationally, and in Ireland, it represents the most significant cause of bovine morbidity and mortality. Pneumonia in weanlings was identified as one of the most significant infectious herd health problems faced by suckler farmers in Ireland (O'Shaughnessy et al., 2013; Murray et al., 2017). In the most recent all-island animal disease surveillance report pneumonia was diagnosed in 47.6% of suckler weanlings submitted for post-mortem. Outbreaks of BRD can have numerous detrimental consequences for a suckler farm. It can result in reduced profitability through animal mortality, reduced live weight gain (e.g. 0.09 kg/day in weanlings with lung consolidation, Cuevas-Gómez et al., 2020), and increased treatment and prevention cost. Bovine respiratory disease outbreaks also result in increased workload and animal handling, which can put pressure on many suckler enterprises where part-time farming is common (Dillon et al., 2023).

The predominant suckler beef enterprises in Ireland are spring-calving herds with approximately 75% of cows calving between January and June. In most cases these systems are calf-to-weanling systems where calves are sold post-weaning (typically October/November). Both the process of weaning and movement (+/- mart) to another farm are stressful events, which can be further compounded by weather changes (dropping temperatures, increased rainfall) associated with autumn. These stresses can, in turn, have a negative effect on the immune system of weanlings, making them more susceptible to disease in particular BRD.

In this paper, we will discuss how various interventions can be used to reduce the risk of BRD in weanlings, and new developments in diagnostics to help more accurately diagnose it.

Pathogens

Bovine respiratory disease can be caused by a host of viruses and bacteria. It is often the case that multiple infectious agents can be identified in weanlings with pneumonia (Murray et al., 2017). In weanlings, the most common pathogen type to be identified was bacteria (DAFM, 2023). Bacterial pathogens most commonly identified in weanlings in descending order of frequency are: *Mannheimia haemolytica, Pasteurella multocida,* *Mycoplasma bovis* and *Histophilus somni*. Certain bacteria such as *P. multocida* can be found in healthy lungs of cattle (Murray et al., 2017). These bacteria may only become harmful to cattle after an initial stress event or infection with a respiratory virus.

The most commonly identified viral pathogens in weanlings are: Bovine herpes virus 1 (BoHV1) (Infectious bovine rhinotracheitis (IBR) virus), bovine respiratory syncytial virus (BRSV) and bovine parainfluenza 3 virus (BPIV3). Although the aforementioned viruses are the most commonly identified in weanlings with BRD at post mortem, it is essential to recognize that there are other viruses that can cause BRD too. A recent study of purchased suckler beef weanlings to Teagasc, Grange Beef Research Centre, found that the viruses detected in nasal swabs (using Illumina sequencing) obtained on the day of arrival were, bovine coronavirus (BCoV, 78.3%), followed by bovine rhinitis A virus (BRAV) at 36.7% and bovine rhinitis B virus (BRBV) at 31.7% (Ní Dhufaigh et al., 2024). These findings are consistent with other such BRD studies. Although viruses including BoHV1, BRSV, bovine viral diarrhoea virus (BVDV), and BPIV3 are well documented as BRD opportunistic pathogens, BoHV-1 was only found in four calves, BRSV was only identified from one healthy, asymptomatic calf, and BVDV and BPIV3 were not detected at all upon arrival. Calves that later became diagnosed with BRD were more positive at arrival for BCoV (83.3%), BRAV (53.3%) and BRBV (40%) than calves that remained clinically healthy (73.3%, 20%, 23.3%, respectively) throughout the study. Using quantitative PCR, O'Neill et al. (2014) conducted a retrospective study on the common viral agents found in calf swabs from Ireland during 2008 to 2012. BCoV and BRSV were the most common viruses found, followed by BPIV3, BoHV-1, and BVDV which, interestingly, was present all year round. Another significant finding from the O'Neill et al. (2014) study was that 34.6% of calves were infected with one or more viruses. In the Teagasc Grange study, 78% of calves were virus positive, suggesting that viruses are commonly found in the nasal tract of weanlings.

Using 16S rRNA gene sequencing of the nasal microbiome, the common bacterial genera associated with BRD were also identified (namely, Mannheimia, Pasteurella and Mycoplasma) with significant differences in the genus Filobacterium between healthy and BRD-infected suckler beef weanlings (Ní Dhufaigh et al., 2024). Furthermore, longitudinal changes in relative Mycoplasma abundance was found with greater increase of abundance occurring on the day of BRD detection. It is likely that many cases of BRD start as viral infections and develop into bacterial infections.

Prevention

In the past, prophylactic treatment (treating a healthy animal before they got sick) with antimicrobials could be used to reduce the impact of pneumonia in high-risk weanlings. Since the implementation of EU regulation 2019/6 this practice has been banned. Therefore, detailed planning of the weaning period is crucial to controlling BRD. There are several key components to reducing the impact of BRD:

1. Managing weaning stress,
2. Vaccination,
3. Control of concurrent parasite burden

Managing weaning stress

Research at Teagasc, Grange has shown that the process of weaning is stressful for the beef calf and that imposing additional stressors (housing, castration, dehorning) around weaning time heightens the distress (Lynch et al., 2019). Housing has been reported to alter the immune response of weaned calves, along with the acute phase response (Lynch et al., 2010), with a more pronounced stress response occurring in calves weaned at housing compared with those housed with their dams (Lynch et al., 2010; 2011). Reducing the cumulative effect of multiple stressors around weaning time results in a less marked stress response in the calf. Stress has an adverse effect on the immune system making calves more susceptible to disease (Earley et al., 2023). These alterations in calf immunity following weaning stress are of great importance as they are considered to be associated with increased incidence and severity of BRD.

Calves should be castrated/dehorned at least four weeks prior to weaning date, or at least two weeks after the calf has been weaned, as these are stressful procedures. When managing the weaning of suckler calves avoid abrupt weaning of all animals at the one time. Instead calves should be gradually weaned. Calves should be weaned in at least two separate groups with each cow group being removed at a minimum interval of five days.

Research at Teagasc, Grange has shown that single-suckled beef calves supplemented with concentrates prior to weaning were less immune-compromised, started consuming meal faster when housed indoors and spent more time lying down (rather than standing and walking) post-weaning compared with non-supplemented calves. If calves are at pasture, introduce concentrates one month prior to weaning and gradually increase the allowance with the intention of having the calf consuming 1 kg/day at weaning time. Continue to feed the concentrates for at least two weeks after weaning. There may also be advantages in delaying housing of recently-weaned calves. If calves are indoors, allow the calves access to cows in an adjacent pen and offer the calves forage *ad libitum*, while simultaneously increasing the concentrate allowance gradually over a two-week period to one kg/day. After this period, calves' access to cows can be ended.

Ensure that weanling housing has adequate inlets and outlets to allow for proper ventilation and is not overstocked. In newly-purchased weanlings mixing of groups from different farms should be avoided as there is a risk of bullying behaviour and potential for cattle to be exposed to new pathogens.

Vaccination

Uptake of vaccination for BRD on suckler farms is variable. Previous work conducted by Teagasc indicated that 44% of suckler farms were vaccinating against BRD (O'Shaughnessy et al., 2013). Vaccination is an important part of BRD control in weanlings; however, it cannot be relied on as a crutch for poor weaning management. Vaccines are available for the most common BRD pathogens. As previously highlighted, however, there are still numerous other viruses and bacteria that can cause pneumonia. Therefore, we must ensure that calves are not put in situations where their immune systems are compromised. Table 1 (injectable vaccines) and Table 2 (intranasal vaccines) list the currently licenced vaccines against BRD pathogens available in Ireland (excluding IBR vaccines). In examining these tables, one will note that no single vaccine contains protection for all of the major causes of BRD in Irish cattle. Testing of samples, such as nasopharyngeal swabs, from weanlings that are diagnosed with BRD can be useful in determining which pathogens are present on a given farm; however, the pathogens on a farm may vary especially if the herd is not closed.

Key to vaccination of suckler weanlings is planning ahead of time. As indicated in Table 1, all of the injectable vaccines provide long-lasting immunity but require two doses separated by several weeks. With most of the vaccines in Table 1, immunity takes several weeks after the second vaccine to develop. Therefore, the vaccination schedule for weanlings in a herd health plan needs to take that interval into account (e.g. vaccination may need to be completed in September). In cases where there is insufficient time prior to weaning, intranasal vaccines (Table 2) can be given as they only require one dose, and provide immunity more rapidly than injectable vaccines. However, because administration of this vaccine requires restraining the head of the animal, good handling facilities are required to conduct the vaccination process safely.

Infectious bovine rhinotracheitis (IBR) is different to many of the other pathogens that cause BRD in weanlings because once a calf is infected it will remain a carrier for its entire life. For that reason, we have chosen to address its control/prevention separately from the general recommendations above. As part of the 2024 national beef welfare scheme, farmers were required to blood sample 20 randomly selected cattle over 9 months of age for IBR. The results of these blood tests were then used to determine if a particular herd was infected with IBR, and to what degree. The preliminary results of this work suggested that 50% of herds were negative for IBR with 88% of animals testing negative (Donlon and Guelbenzu, 2024). Animal Health Ireland (AHI) have developed guidelines for interpretation of these results. In herds that only had one animal test positive, it is likely that there is a low level of infection. In these herds a blood screen would allow for identification and culling of infected animals. In herds with two or more positive bloods, vaccination is recommended as culling isn't likely to be feasible. In herds that are trying to reduce the prevalence of IBR vaccination, using live vaccines in young cattle will allow for early protection with a booster vaccination being given prior to the weaning stress period. Closed herds with good biosecurity may be able to eradicate IBR however to maintain this status good biosecurity will be key.

Table 1. Summary of the key characteristics of injectable BRD vaccines licenced in Ireland

Trade name	Pathogen	Vaccine type	Route of administration	Number of doses (Interval between doses)	Minimum age for vaccination	Onset of immunity	Duration of immunity
Bovalto Respi 3	BRSV BPIV3 *M. haemolytica*	Inactivated	Under skin	2 (3 weeks)	2 weeks	3 weeks	6 months
Bovalto Respi 4	BRSV BPIV3 *M. haemolytica* BVDV	Inactivated	Under skin	2 (3 weeks)	2 weeks	3 weeks	6 months
Bovilis Bovipast Rsp	BRSV BPIV3 *M. haemolytica*	Inactivated	Under skin	2 (4 weeks)	2 weeks	2 weeks	Not established
Hiprabovis Somni	*M. haemolytica* *H. somni*	Inactivated	Under skin	2 (3 weeks)	2 months	3 weeks	Not established
Hiprabovis-4	*BoHV1* BPIV3 BVDV	Inactivated	In muscle	2 (3 weeks)	2 months	3 weeks	1 year
Hiprabovis-4	BRSV	Live	In muscle	2 (3 weeks)	2 months	3 weeks	1 year
Pneumovac Plus	BRSV BPIV3 *M. haemolytica* BVDV	Inactivated	Under skin	2 (3 weeks)	2 weeks	3 weeks	6 months
Protivity	*M. bovis*	Live	Under skin	2 (3 weeks)	1 week	12 days	Not established
Rispoval 2	BRSV BPIV3	Live	In muscle	2 (3 weeks) (1 dose @ 12 weeks if RS+BPIV3 IntraNasal is used)	12 weeks	3 weeks	6 months
Rispoval 3	BPIV3 BRSV	Live	In muscle	2 (3 weeks)	12 weeks	3 weeks	6 months
Rispoval 3	BVDV	Inactivated	In muscle	2 (3 weeks)	12 weeks	3 weeks	6 months
Rispoval Rs	BRSV	Live	In muscle	< 4 months old: 2 doses (3 weeks apart with a third dose @ 4 months of age) > 4 months: 2 doses (3 weeks)	1 week	Not established	4 months

Table 2. Summary of the key characteristics of intranasal BRD vaccines licenced in Ireland

Trade name	Pathogen	Minimum age	Onset of immunity	Duration of immunity
Bovalto Respi Intranasal	BRSV BPIV3	10 days	10 days	12 weeks
Bovilis Intranasal RSP Live	BRSV BPIV3	Day of birth	BRSV: 6 days (for calves vaccinated from the day of birth onwards); 5 days (for calves vaccinated from the age of 1 week onwards) 1 week	12 weeks
Rispoval RS+BPIV3 Intranasal	BRSV BPIV3	9 days	BRSV: 5 days BPIV3: 10 days	12 weeks
Bovilis Nasalgen-C	Bovine coronavirus	Day of birth	5 days	12 weeks

Control of concurrent parasite burden

Parasites can have a negative effect on the competence of a calf's immune system, and this factor should be avoided around the time of weaning. Lungworm is of particular concern with regard to weanling pneumonia; it was found in 30.7% of post-mortems where pneumonia was diagnosed (DAFM, 2023). Lungworm infestations can damage the lungs of weanlings which, in turn, can increase the severity of a BRD outbreak. Coughing calves at grass should not be overlooked. Rapid treatment is required in these calves as heavy lungworm infestations can quickly develop. It is essential that a herd health plan is in place prior to weaning that includes a plan for worming. If calves are showing signs of a lungworm infection, weaning may need to be delayed until they have recovered, and are not showing signs of infection (i.e. coughing, high temperature).

Diagnosis

Rapid identification and treatment of weanling with BRD is key to mitigating the detrimental effects where prevention measures have not worked. Weanlings should be observed two to three times daily for signs of BRD. Currently, most vets and farmers rely on clinical signs to detect BRD. These signs include nasal discharge, ocular discharge, coughing and rapid breathing. In many cases, farmers may also use rectal temperatures to detect weanlings with fever. Any temperature greater than 39.2°C should be considered high. Recent research from Teagasc, Grange has highlighted that 9.2% of suckler weanlings may have lung damage without showing clinical signs (Cuevas-Gómez et al., 2020). This lung damage can be identified through a technique called thoracic ultrasound. Figure 1 and Figure 2 are examples of ultrasound images taken from BRD research studies conducted in Teagasc Grange (Cuevas-Gómez et al., 2020). This is a method of pneumonia diagnosis that will hopefully become more commonly available through veterinary practice.

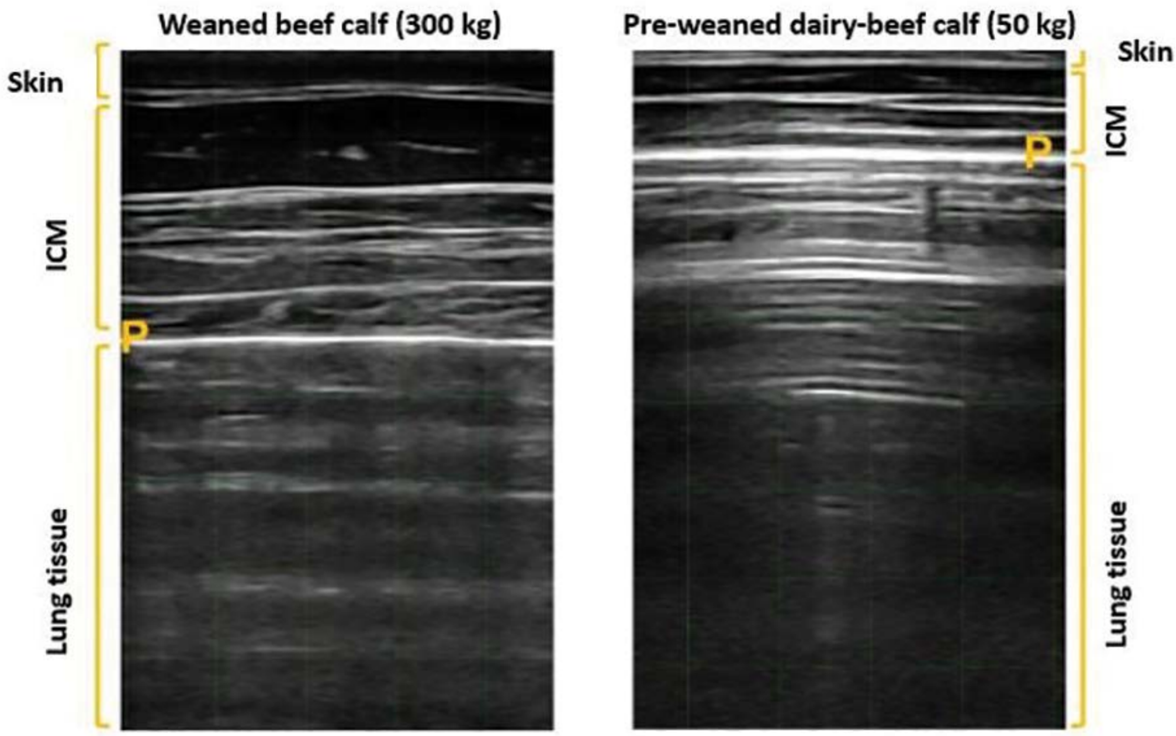

Figure 1. Ultrasound image of a normal aeriated lung in weaned and pre-weaned calves. IMC, intercostal muscles; P, pleura

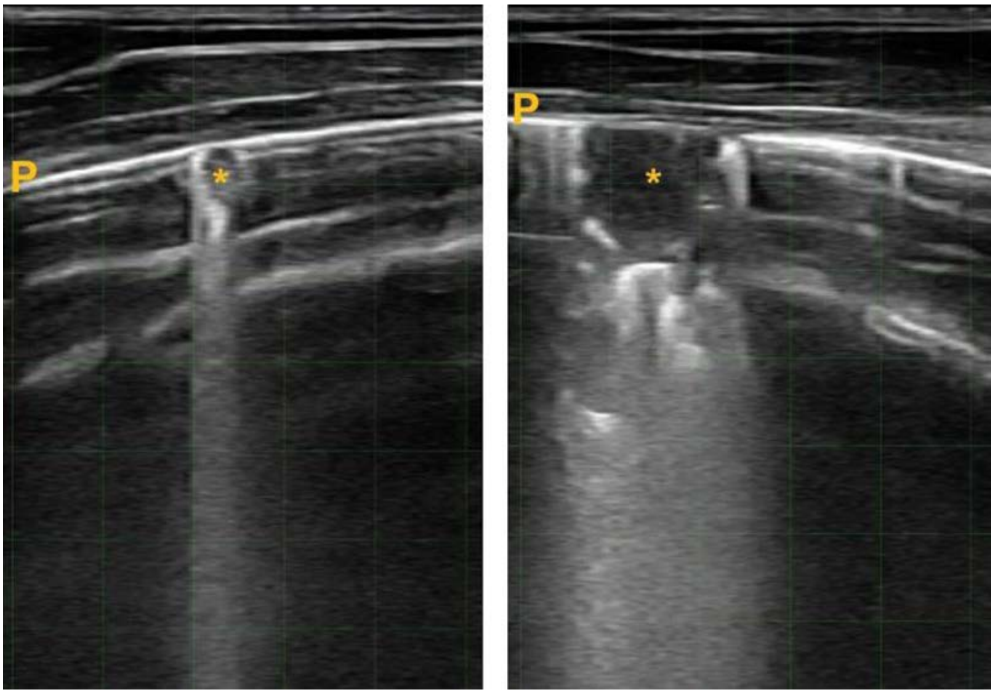

Figure 2. Ultrasonograms with different sizes of consolidation (lobular pneumonia). Lung consolidation (star); P, pleura.

Teagasc, Grange suckler herd

Preventing any incidences of BRD is a key priority in the Grange spring-calving suckler herd. Key prevention strategies include a good vaccination program and reducing stress on animals. Table 3 outlines the vaccination protocol used in Teagasc Grange to prevent/minimise respiratory infections, commencing post-birth. The following tips are taking pre-weaning to reduce stress on calves:

- Castration is completed in August (8 weeks prior to weaning).
- A creep wire is introduced prior to weaning to encourage calves to creep-graze ahead of the cows and help break the bond.
- Concentrate supplementation is introduced 4 weeks pre-weaning and continues thereafter.
- At weaning, cows are removed from calves at pasture in four separate stages/batches over a 3 to 4 week period, and dried-off.
- Housing of calves post-weaning is delayed, if weather conditions allow.
- Calves are housed, where possible, on a dry, windy day, and in a well-ventilated shed.

Table 3. Vaccination protocol used in Teagasc, Grange to prevent/minimise respiratory infections in suckler-bred calves

Time-point	**Vaccine**
February (post-birth ca. 7 days of age)	Intranasal live vaccine (BRSV + BPIV3)
March	Intranasal live IBR vaccine
May (~12 weeks of age)	Subcutaneous (BRSV + BPIV3 + *M. haemolytica*)
June	Subcutaneous booster (BRSV + BPIV3 + *M. haemolytica*) Intramuscular Live IBR booster
September (4 weeks pre-weaning)	Subcutaneous booster (BRSV + BPIV3 + *M. haemolytica*) Intramuscular Live IBR booster

Conclusion

Controlling BRD in suckler weanlings is challenging and requires a multifaceted approach. Developing a herd health plan that addresses each area is vital to reducing the impact of BRD. Reducing stress through good weaning procedures is key to maintaining a robust immune system. Vaccination can help to develop immunity to the most common pathogens that cause pneumonia but cannot be solely relied upon. As the prevalence of lungworm appears to be increasing, managing it will become a more important part of weaning calves. Improvement in these areas should yield a more profitable calf with higher welfare and no requirement for antimicrobials, which will further reinforce the image of Irish suckler beef as a high-value product.

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Bluetongue: What are the risks for Irish cattle farmers and what can we do about it?

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Summary

- Bluetongue is a serious disease of cattle, sheep, goats and camelids.
- It is caused by a virus which is transmitted between animals by biting midges (Culicoides species).
- There are many strains of the virus; during 2024, the strain bluetongue virus 3 (BTV3) spread widely across northwestern Europe, including to eastern and central England. While no cases have been detected in Ireland at the time of writing, Irish cattle and sheep remain at high risk from this disease.
- Temperature plays a key role in bluetongue transmission and gives rise to the seasonality associated with the disease. The midges which spread the virus, which are present in Ireland, are less active now that temperatures have dropped, but midge activity will resume around April as the summer approaches. At that stage, the risk of spread across the Irish Sea will correspondingly increase.
- The risk of introducing infection via imported livestock, semen or embryos remains, despite the considerable controls put in place.
- Bluetongue virus entry into Ireland would have a significant impact on animal health and welfare and trade implications for live animals and germinal products (ova, semen, embryos), and thus for the livelihoods of farmers.
- There are three things Irish cattle farmers can do to reduce the risk to their herds:

1. Do not import cattle into Ireland. If you choose to do so despite this advice, take every precaution and fully comply with the strict rules in place to address this risk.
2. Do not import semen or embryos into Ireland. If you choose to do so despite this advice, take every precaution and fully comply with the strict rules in place to address this risk.
3. Report any suspect cases of bluetongue to your Regional Veterinary Office promptly, so that (if the suspect case is confirmed) onward spread to other farms across Ireland can be halted before it is too late.

- There are no public health risks associated with bluetongue. Bluetongue does not affect human health or food safety.

Introduction

Bluetongue is a notifiable exotic disease, caused by bluetongue virus (BTV), that infects ruminant animals (such as sheep, cattle, goats and deer) and camelids (such as llama and alpaca).

Although Ireland is currently bluetongue free, the virus could spread to Ireland through import of infected animals, infected foetuses, germinal products (ova, semen, embryos) or wind dispersal of infected midges from infected areas. Several different serotypes (variations) of bluetongue virus are currently circulating in Europe.

As bluetongue is a notifiable disease, any suspect case of bluetongue must be reported to the Department of Agriculture, Food and the Marine (DAFM) without delay. Farmers, veterinary practitioners and other relevant stakeholders should remain vigilant for bluetongue. It is important that bluetongue is considered as a possible differential diagnosis if suggestive clinical signs are present, as quick detection is key for successful management and control. The quicker we detect the first case, the better our chances of stopping it spreading widely. This could mean a huge difference to cattle and sheep farmers across Ireland.

There are no public health risks associated with bluetongue. Bluetongue does not affect human health or food safety. However, it does have a huge impact on farmers whose animals become infected, due to the financial and emotional stresses involved.

What do infected animals look like? The clinical signs of bluetongue

Cattle or sheep infected with bluetongue can develop a range of clinical signs. These may include some or all of the following: fever, inappetence (loss or lack of appetite), drop in milk yield, reddening of the mucus membranes, sores on the nose, gum and dental pads, swelling of the face, lips and tongue (i.e. "blue tongue"), breathing difficulties if the tongue swells, drooling, discharge from the eyes and/or nose, lameness due to coronitis (inflammation and swelling at the top of the hoof) and abortion or deformities in offspring/ foetuses. In severe cases, death can result.

Sheep are more likely to show obvious and more severe clinical signs of bluetongue than cattle if they become infected, and mortality rates can reach 30 to 70%. Some animals may not show any clinical signs; however, and these animals can pose a risk for spreading the disease to new areas or countries.

The clinical signs of bluetongue can resemble other conditions commonly seen in sheep and cattle such as infectious bovine rhinotracheitis (IBR), photosensitization, malignant catarrhal fever (MCF), or anaphylaxis. Cases of bluetongue serotype-3 in the Netherlands in autumn 2023 and into 2024 resulted in huge production losses, significant welfare issues and high mortality (up to 60%) in some outbreaks.

Due to the similarities between the deformities caused by Schmallenberg virus and bluetongue virus in offspring/ aborted foetuses, foetal carcasses submitted for post-mortem to Regional Veterinary Laboratories are routinely tested for bluetongue and Schmallenberg viruses. Similarly, because bluetongue is only one of a number of conditions which can cause severe milk drop in dairy cattle, samples from such disease investigations are routinely tested for bluetongue as part of the overall diagnostic testing.

How do midges spread bluetongue?

Bluetongue is a vector borne disease; it is carried and spread by infected biting midges (*Culicoides* species). These midges are present in Ireland and are generally most active between April and November. Bluetongue is non-contagious; this means it does not transfer directly from an infected animal to another animal, which might be in the same pen via direct contact. Infection is spread when a biting midge bites an infected animals and subsequently transmits the virus by biting another susceptible ruminant host. A single bite from a bluetongue infected midge can cause a new bluetongue infection.

Temperature plays a key role in bluetongue transmission and gives rise to the seasonality associated with the virus. Warmer temperatures throughout the summer and into the autumn months, increase the risk of bluetongue transmission during this time. Warmer temperatures are needed for both bluetongue virus replication within the midge (referred to as the 'extrinsic incubation period' or EIP) and for an increase in midge activity. In the late summer-to-autumn period, midge numbers are at their highest and temperatures are still high enough for the virus to replicate in infected midges. Bluetongue virus replication within a midge can take between 4 to 20 days, and requires an average temperature above 12°C. The speed of replication increases as temperatures increase, which shortens the bluetongue replication cycle. This means that, when temperatures are higher, the virus replicates faster within infected midges, shortening the time required for the infection cycle and thus aiding the rapid spread of the disease. Although midges will remain active above temperatures of 4°C, during colder winter temperatures, midges are unable to spread the virus during these colder periods, and so the transmission risks reduce.

Once bluetongue virus enters the midge population, eradication becomes very difficult requiring high vaccination uptake levels maintained over a period of several years. If a vaccine is not available for a given serotype, eradication is not usually feasible.

How could bluetongue come to Ireland?

There are several potential ways in which bluetongue virus could be introduction into Ireland.

During the warmer months when midges are more active and the virus can replicate in them (roughly April to November), infected midges could be blown on the wind from Britain or France across the sea and onto counties along the southeast and eastern coast. Once there, these infected midges could bite susceptible animals, establishing infection. If the outbreak is not reported and tackled promptly, or if animals are moved to other areas before the disease becomes obvious, bluetongue could spread across the area and more widely in Ireland.

The virus could spread to Ireland through the import of infected animals. Imports from Great Britain have been suspended since November 2023. For the movement of cattle and sheep to Ireland from other EU Member States, there are complex certification requirements in place to prevent infected livestock entering Ireland. Despite these controls, the risk is still present as they cannot eliminate all risk. For this reason, the Department strongly recommends against importing any susceptible livestock into Ireland at all.

Bluetongue can also be spread by germinal products (ova, semen, embryos) collected from infected animals. This can happen in cases where the animal is not showing obvious clinical signs at the time of collection. For this reason, the import of germinal products poses a danger of importing bluetongue virus, as appropriately certified germinal products from bluetongue affected countries are not without risk of introducing bluetongue into Ireland. This is why the Department strongly recommends against importing bovine or ovine germinal products into Ireland at all currently.

Pregnant cattle which become infected can pass the infection to their unborn calf. When these calves are then born weeks or months later, they are infectious. Midges which feed on them can then spread a new wave of infection in that area.

The epidemiological situation in Europe has changed rapidly during 2024, with disease spreading quickly into new, previously unaffected, regions and countries. This is why it is risky to import livestock; although the area may be thought to be free of bluetongue at the time the stock are purchased, by the time they are to be shipped to Ireland, the virus may have spread locally and not yet have been detected.

A summary of the current restrictions on the movements of live animals and germinal products into Ireland

Great Britain (GB) to Ireland (IE):

- The import of live ruminants from Great Britain (GB) to the island of Ireland (IE & NI) remains suspended.
- Germinal products (semen, ova, embryos) may be imported from GB into Ireland once the relevant animal health requirements for bluetongue virus can be certified.

Other EU Member States to Ireland (IE):

- → The introduction of livestock or germinal products from other EU member states is permitted only where detailed certification requirements to safeguard against bluetongue can be satisfied.
- → The Department will not pay compensation for animals infected by imported germinal products, nor for imported animals which subsequently test positive for bluetongue in the post-entry sampling.
- → There is currently a chance that animals in certain EU Member States may not meet certification requirements for entry into Ireland, if there are bluetongue outbreaks in the area.

Vaccination against bluetongue virus

Vaccination against bluetongue virus is a key control measures and is necessary for disease eradication.

Licensed bluetongue vaccines are commercially available for bluetongue serotypes 1, 4 and 8 which can help to facilitate intra-EU movement. Animals from certain countries require vaccination against bluetongue to meet certification requirements, prior to movement. Proof of vaccination status for the BTV strains recently circulating in those countries or regions should be obtained.

The recent emergency use of BTV3 vaccines in EU Member States and in Great Britain have been authorised under emergency circumstances as a disease control measure, where BTV3 is circulating. These BTV3 vaccines do not guarantee that animals will not become infected; however, they do reduce the severity of the disease and the amount of the virus in the blood of infected animals, and so they are of great benefit to livestock farmers in reducing the impact of an outbreak of bluetongue. BTV3 vaccines have not yet obtained European Marketing Authorisation, nor have they determined an immunity period guaranteed in the specifications of the vaccine. It is important to note that, for this reason, animals vaccinated using these BTV3 vaccines do not meet the certification requirements for intra-community trade. This means that livestock vaccinated using BTV3 vaccines cannot enter Ireland.

In autumn 2024, an outbreak of serotype 12 (BTV12) was detected in the Netherlands. BTV12 had not previously ever been detected in Europe. No vaccine is available at all for this new strain. This means that if it spreads widely in spring 2025, control will be very challenging. This poses an additional risk for Ireland, in addition to the existing risk of BTV3.

Challenges regarding bluetongue control

Bluetongue is a challenging disease to manage, as several characteristics of bluetongue virus and the disease progression make control difficult. Bluetongue infected animals present with potentially severe clinical signs (in sheep) alongside a potentially high percentage of subclinical or undetected infections (adult cattle). Several bluetongue serotypes exist which may have differences in their clinical presentations.

Bluetongue infected animals have a persistent viraemia (i.e. a period during which virus remains present in the blood), during which the virus could be passed onto a biting midge, resulting in onward transmission. Bluetongue vaccinations do not provide cross protection between bluetongue serotypes. Challenges with vector control, including the potentially huge quantities of vectors in the environment, make this avenue of disease control difficult. Traditional disease control and eradication methods including movement controls, stamping out and vector controls have not always been successful in bluetongue control.

Bluetongue virus entry into Ireland would have significant implications for trade and would likely result in considerable losses at farm level through cattle and sheep becoming sick and in some cases dying. In other European countries, concerning levels of mortality have been seen, and sick animals have taken a long time to recover.

What can Irish cattle farmers do to reduce the risk of bluetongue?

Ireland is the last country in our region of Europe which is not infected with bluetongue. Although the risk is considerable, we do have a chance of remaining BTV-free and of successfully tackling any incursion if we identify it quickly and respond in time, before it spreads.

There are three things Irish cattle farmers can do to reduce the risk to their herds:

- Do not import cattle into Ireland. If you choose to do so despite this advice, take every precaution and fully comply with the strict rules in place to address this risk.
- Do not import semen or embryos into Ireland. If you choose to do so despite this advice, take every precaution and fully comply with the strict rules in place to address this risk.
- Report any suspect cases of bluetongue to your Regional Veterinary Office promptly, so that (if the suspect case is confirmed) onward spread to other farms across Ireland can be halted before it is too late.

There are no public health risks associated with bluetongue. Bluetongue does not affect human health or food safety. However, it does have a huge impact on farmers whose animals become infected, due to the financial and emotional stresses involved.

Further information on bluetongue

Please consult the following resources for further information on bluetongue virus:

Department of Agriculture Food and the Marine website https://www.gov.ie/en/publication/cd6c0-bluetongue-virus/

European Commission webpage on Bluetongue https://food.ec.europa.eu/animals/animal-diseases/surveillance-eradication-programmes-and-disease-free-status/bluetongue_en

Bluetongue - WOAH - World Organisation for Animal https://www.woah.org/en/disease/bluetongue/Health

Driving Sustainability: Innovations on Future Beef Suckler Farms

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Summary

- The Future Beef programme, launched by Teagasc in 2021, aims to help Irish beef farmers achieve economic and environmental sustainability by improving practices relating to animal breeding, grassland management, and nutrient efficiency.
- Breeding innovations for efficiency: The program emphasizes the use of targeted animal genetics, using artificial insemination (AI) and oestrous synchronisation to increase productivity, lower costs and reduce carbon footprint.
- Enhanced grassland management: Grassland management is crucial to profitability and sustainability, with strategies such as paddock infrastructure, solar-powered fencing and grass measuring apps enabling more efficient grazing, reduced fertiliser input and optimized production.
- Adoption of red clover: Integrating red clover into silage systems has proven cost-effective, by reducing nitrogen fertiliser requirements and feed costs, enhancing soil health, and improving animal growth performance.
- Soil fertility and cost reduction: Enhancing soil fertility through lime application and nitrogen management practices have increased grass yields and lowered reliance on chemical fertiliser inputs, resulting in reduced input costs and further improvements in farm profitability.
- Biodiversity and water quality can be improved by choosing actions, such as the use of riparian zones and strips, planting hedges and trees in overland flow areas and reducing fertiliser application to fields beside waterways. The trees, hedges and riparian zones improve biodiversity, while also breaking the pathway for pollutants to enter watercourses.

Introduction

Irish beef farmers are increasingly faced with the challenge of balancing economic sustainability and environmental sustainability. Farmers face rising input costs, volatile market prices, and increasing environmental pressures. To navigate these challenges, profitability must remain a key focus, alongside meeting sustainability goals. The Teagasc Future Beef Programme, launched in 2021, provides a pathway to achieving these dual objectives by integrating sustainable practices that reduce greenhouse gas (GHG) emissions, enhance biodiversity and improve water quality, while simultaneously increasing farm profitability. The programme involves 22 demonstration suckler farms across Ireland. Some of the farms have sheep and/or tillage, some are part-time, some are full-time, and all have a real passion for suckler beef production. Each farm is representative of the farm size, soil type and production systems in its region, and is acting as a model for sustainable innovation. This paper highlights how innovations in animal breeding, grassland management, labour-saving technologies, incorporation of red clover, nutrient use efficiency and improvements in water quality are driving economic, environmental and social sustainability on suckler beef farms.

Profitability: The Key to Sustainable Farming

Profitability is the cornerstone of the Future Beef programme. Sustainable practices can only succeed when they are financially viable for farmers, thus ensuring long-term adoption. The programme demonstrates that by improving efficiencies in animal breeding, grassland management, soil fertility and nutrient use, farmers can increase their profitability while also reducing their environmental footprint.

Gross margins per hectare increased by 2.5% across Future Beef farms from 2022 to 2023, despite challenges such as a prolonged winter and higher feed costs. This improvement was largely due to the adoption of innovations that reduce costs and enhance animal output per hectare. These include the use protected urea and low emission slurry spreading (LESS), incorporation of red clover into silage swards, improved animal breeding practices and the use of labour-saving technologies such as oestrous synchronisation, and automated heat detection technologies. These innovations not only reduce input costs but also increase productivity, making farms more resilient to market price and more environmentally robust.

Breeding innovations: Improving efficiency and reducing costs

The Future Beef programme places a strong emphasis on developing a herd of 'balanced' cows – with good maternal and terminal traits. The target is to have cows that are not too big, have enough milk to produce a heavy weanling and will calve down every 365 days.

Each farmer has analysed the genetics of their herd to identify the traits that cows are strong or weak in. The key traits are carcass weight, kg of milk and calving interval. Bulls are then picked to complement the herd or individual animals, as required. If a herd is low in milk, a bull with better milk figures is picked, but carcass weight and fertility are not ignored.

Breeding efficiency is also a key focus. By focusing on key performance indicators such as calving interval, calves per cow per year, and calving heifers at 24 months of age, more kg of beef per livestock unit can be produced. This improves farm output without increasing costs or stock numbers. The 'win-win' here is to increase profit margins, while reducing the carbon footprint of each kg of beef produced.

Technologies like artificial insemination (AI), synchronisation, sexed semen, sensors to identify cows in heat and vasectomised bulls are used on Future Beef farms to improve breeding efficiency and reduce labour. For example, Future Beef farmers from Co. Mayo, Michael and Niall Biggins, have successfully increased the Replacement Index of their cow herd from €85 to €111 over the last five years. This improvement has been supported by the use of sexed semen and synchronisation programs, allowing them to breed more replacement heifers on-farm, which reduces the need for buying-in animals. Over the years, they have also invested in simple, low-cost handling facilities. For example, a small yard with a cattle crush to hold three cows on each block of land makes using AI more feasible, and reduces the labour involved in handling and moving cows.

Over the last three years, there was a marked improvement in breeding efficiency figures across farms in the Future Beef programme. For example, the percentage of heifers calved at 24 months increased from 57% to 75% between 2022 and 2023, and the number of calves per cow per year increased from 0.90 to 0.96. These improvements translate into higher production without significantly increasing costs, which results in better financial margins.

In addition to improving herd genetics, the programme encourages farmers to focus on animal health as a critical component of breeding success. Vaccination programs and improved calving facilities have reduced calf mortality and morbidity, improved overall herd health, and reduced veterinary costs. Healthier, more productive animals lead to higher profitability and lower environmental impacts, as fewer resources are required to produce the same amount of beef.

Grassland management: Profit and sustainability hand in hand

Grass is the cheapest and most sustainable feed available to Irish suckler farmers, and optimizing its utilization is central to the Future Beef programme. Farmers in the programme have improved their grassland infrastructure by:

- installing more permanent paddocks,
- investing in temporary fencing resources (reels and pigtails),
- better positioning of water troughs in paddocks,
- using creep gates to improve grazing efficiency, and
- installing solar-powered fences on out-blocks of land.

These practices ensure that cattle graze for shorter periods in each paddock, allowing for faster herbage recovery and more consistent grass growth.

Grass measuring is also a key component of the Future Beef programme. The introduction of the new PastureBase app has reduced the time taken to measure grass. The key finding is that by 'measuring' you are better able to make grazing management decisions such as postponing the necessity to spread fertiliser, taking out surplus paddocks from the grazing rotation or closing additional paddocks for silage. You can also identify the worst-performing paddocks. This allows you to determine if they require lime, extra phosphorus (P) or potassium (K) or simply need to be reseeded (if extra grass is required on farm). In 2023, the average quantity of grass grown on Future Beef farms was 8.56 tons of grass dry matter (DM) per hectare, which was up slightly from 8.26 tons grown in 2022.

Red clover: A potential game changer for sustainable profitability

A key innovation within the Future Beef programme is the widespread adoption of red clover in grassland systems. Red clover offers several advantages for both sustainability and profitability, primarily due to its nitrogen-fixing ability, which significantly reduces the need for chemical nitrogen fertilisers. This not only lowers input costs but also helps farms reduce their nitrogen-related GHG emissions.

On Future Beef farms, red clover is primarily sown in silage swards as a mixture with perennial ryegrass, where it provides a high-protein feed that supports improved animal performance. The integration of red clover has proven to be a cost-effective way to produce high-quality silage, reducing the need for expensive protein supplements. On farms where red clover is well established, fertiliser costs have been reduced by as much as 21%. The deep-rooting system of red clover enhances soil structure and provides more resilience to drought, which is increasingly important in some regions given the changing weather patterns experienced in recent years.

Additionally, research at Teagasc, Grange is showing that animals offered red clover silage have a higher intake, and consequently have a higher daily live weight gain, which ultimately can translate into reduced finishing age.

Optimizing soil fertility: A long-term investment in profitability

Having fertile soil is one of the crucial components to maximize grass production and minimise input costs. The Future Beef programme places a strong emphasis on improving soil fertility through the targeted use of lime and fertilisers, combined with the integration of nitrogen-fixing crops such as red clover. By improving soil fertility, farmers can increase their grass yields, reduce their reliance on chemical inputs, and improve the overall sustainability of their farms.

Lime application has been one of the most impactful practices adopted by the Future Beef farmers. By correcting soil pH, lime unlocks P and K that may otherwise be unavailable to plants, reducing the need for synthetic fertilisers. For example, Future Beef farmers from Co. Waterford, Eamon and Donnchadh McCarthy, spread 134 tonnes of lime on their farm in 2022. This resulted in a notable improvement in their soil pH, with the percentage area having a pH >6.2 increasing from 32% to 95%. Grass yield on the McCarthy's farm increased by 2.6 tonne DM/hectare from 2022 to 2023. Growing the extra grass has helped to increase silage stocks on the farm. The additional grass growth in late summer has also meant no buffer feeding of silage at grass. Overall, this resulted in improved profitability and a lower environmental footprint through increased animal performance, reduced age at finish and a decreased requirement for concentrate feed to finish animals. On average, the soil pH levels across the Future Beef farms improved significantly between 2021 and 2023, with 61% of soils now above the critical threshold of pH 6.2.

The focus on improved nutrient management has also included the adoption of low-emission slurry spreading (LESS) and the use of protected urea, which reduces nitrogen losses to the environment. In 2023, 83% of the slurry on Future Beef farms was applied using LESS, which was a significant increase from 37% in 2021. The use of protected urea on Future Beef farms has also increased, with 45% of total chemical nitrogen applied in 2023 coming from this source.

Reducing input costs: The path to higher margins

The ability to reduce input costs while maintaining or increasing output is central to improving profitability. Many of the innovations promoted by the Future Beef programme - such as the use of red clover, improving grassland management, improving soil fertility, better nutrient management practices, using protected urea, calving heifers at 24 months of age, improving herd genetics and efficient breeding practices - are specifically designed to reduce variable costs, particularly those associated with fertilisers, feed and veterinary care.

From 2022 to 2023, the average fertiliser cost on Future Beef farms dropped by 21%, largely due to the adoption of red clover and better nutrient management practices. In addition to fertiliser savings, improved grassland management has led to a reduction in the need for concentrates at certain times of the year, which are often a significant cost for finishing cattle. By producing more high-quality grass and silage, farmers can rely more on home-grown feed and less on purchased inputs.

Labour-saving innovations also contribute to reduced costs. As farmers adopt technologies and practices that reduce the time and effort required for routine tasks, such as handling cattle for breeding or health checks, they can focus on higher-value activities or simply reduce their overall labour input, leading to lower operational costs.

Improving biodiversity and water quality can go hand in hand

From the beginning of the programme, all the participants had a keen interest in how to protect wildlife and water quality, while farming productively. The programme advisors looked at what practices could be implemented on farm to achieve both objectives at the same time. All farms were visited by an Agricultural Sustainability Support and Advisory programme (ASSAP) advisor. The advisor looked at the PIP maps and over land flow maps for their farm and explained the best methods and options for protecting water quality. For example, in areas where phosphorus is a problem, breaking the pathway of water flowing overland and directly into drains and watercourses is essential. To break the pathway and improve biodiversity the use of riparian areas or planting hedgerows were chosen. To date 5,114 metres of hedgerow and 13,751 metres of riparian zone and strips have been established.

Conclusion

The Future Beef Programme shows that profitability and sustainability are not opposing forces but can work in harmony. By adopting innovations in animal breeding, grassland management, soil fertility and labour-saving technologies, Irish beef farmers can improve their financial margins, while simultaneously reducing their environmental impact.

Staying resilient on the farm through stressful times of the year

Shane Pearson
Design Your Life Coaching

Summary

- Beef farming in Ireland brings unique and often seasonal stressors that impact both physical and mental health, making resilience an essential skill for navigating challenging periods.
- This paper explores these challenges and offers a practical, resilience-based approach tailored specifically for beef farmers.
- Farmers frequently face heightened stress during calving season, market preparations, and inspections - times when intense physical and financial pressures peak.
- Drawing on recent research, it's evident that health and mental well-being are crucial yet challenging to maintain in farming.
- Studies show that many farmers experience poor mental health, high rates of burnout, and physical health issues related to stress, yet adequate resources to address these challenges can be scarce.
- This paper introduces a "5 Ps of Resilience" framework - Presence, Purpose, Power, People, and Preparation - that provides actionable steps tailored to the realities of farm life, supporting farmers in managing stress and maintaining well-being.

Introduction to mental health and wellbeing in beef farming

Health and wellbeing challenges in beef farming

Beef farming in Ireland is high-risk, requiring long hours, physical stamina, and the ability to manage economic unpredictability. Studies reveal that farmers face elevated rates of work-related health issues, particularly cardiovascular disease and chronic stress, with growing concerns around mental health (Hammersley et al., 2021; Agriland.ie, 2024b). The pressure to produce, while managing variables like market fluctuations and regulatory demands, adds considerable strain, impacting both physical and mental resilience (Hammersley et al., 2021).

Key statistics and findings on mental health

Recent studies highlight the scope of these mental health challenges:

- Around 27% of Irish farmers report their well-being as "poor" or "below average," identifying workload, financial pressures, and adverse weather as primary stressors (FarmSafely.ie, 2024).
- Over 25% of farmers experience burnout, with sleep issues commonly linked to prolonged stress and physical demands (O'Connor et al., 2024; Dublin City University, 2024).

- Many farmers delay seeking mental health support due to social stigma and cultural norms that discourage help-seeking, often leading to critical stress levels before intervention (Firnhaber et al., 2023; Agriland.ie, 2024b; Teagasc, 2024a).

Seasonal and specific stressors in beef farming

Beef farmers face specific stressors that fluctuate with the farming calendar. Calving season, regulatory inspections, and market uncertainties are high-stakes periods requiring both physical endurance and strategic planning. These demands often result in isolation, chronic fatigue, and heightened stress, reinforcing the need for resilience and effective stress management practices (Hammersley et al., 2021; FarmSafely.ie, 2024).

Current resources and supports

Initiatives like Teagasc's *"Sowing the Seeds of Support"* leaflet and resilience programs offer practical guidance on recognizing and managing stress (Teagasc, 2024b; Agriland.ie, 2024a). These resources provide essential tools for beef farmers to navigate high-stress times, emphasizing resilience and mental health within the farming environment. Additionally, the Irish Farmers' Association (IFA) offers free health check services at marts across the country, giving farmers easy access to basic health screenings and support in a familiar setting (Irish Farmers' Association, 2024).

In summary, beef farmers face both ongoing and seasonal pressures that demand a solid foundation in resilience and mental health management. The following sections introduce the "**5 Ps of Resilience**" as a practical framework, providing specific strategies to help farmers prepare for and navigate high-stress times with composure and adaptability.

Identifying major stress points in beef farming

Throughout the year, farmers encounter predictable and unpredictable high-stress periods. These stress points can place unique pressures on health, productivity, and resilience.

Calving season

Calving season demands close attention to each cow, often at the expense of sleep, diet, socializing, and other farm tasks. Even with easy-calving genetics, a smooth season is never guaranteed. Unpredictable challenges during calving require patience, resilience, and a steady presence as the work demands long hours and focused attention, all while balancing other life responsibilities and farm duties that can't be postponed.

Regulatory inspections and compliance

Inspections can be a significant stressor for farmers, requiring meticulous record-keeping and strict compliance with standards (Agriland.ie, 2023). For beef farmers, farm payments often hinge on passing these inspections, and a failed inspection can threaten financial stability. Many farmers remember the early days of inspections, which introduced a "new way of farming" focused on documentation and compliance. Even today, inspections add mental and emotional stress, as the risk of missed payments looms (Hammersley et al., 2021; FarmSafely.ie, 2024).

Market pressures and financial strain

Market volatility adds ongoing stress for beef farmers, as prices are often dictated by processing plants and beyond farmers' control. This lack of control over selling prices makes financial planning challenging and adds pressure, as input costs remain steady while market prices fluctuate. The resulting uncertainty reinforces the reality that "Risk & Uncertainty = Stress," making resilience essential for handling these financial challenges.

Other stressful factors and events

Additional challenges compound stress for farmers:

- *Climatic conditions*: Weather impacts livestock and crop health, requiring flexibility and adaptation (FarmSafely.ie, 2024).

- *Time pressures and long hours*: Long days during peak times contribute to exhaustion and the risk of burnout (FarmSafely.ie, 2024).
- *Animal health and disease management*: Disease outbreaks require constant vigilance and can lead to added stress and financial strain (FarmSafely.ie, 2024).

Together, these stressors highlight the need for resilience and proactive stress management. The following section introduces the "**5 Ps of Resilience"** as a practical framework to help farmers manage these pressures.

The Resilience Roadmap: Practical applications for stress management

In farming, stress is unavoidable. Each season brings its own challenges, deadlines, and unpredictable hurdles. Just as a farm vehicle needs shock absorbers to handle rough ground and unexpected potholes, farmers need resilience to absorb and manage the pressures they face. Building resilience enables farmers to tackle challenges with composure, strength, and perspective. The "**5 Ps of Resilience" -** Presence, Purpose, Power, People, and Preparation -offer practical tools for developing resilience.

Figure 1. The 5 Ps of Resilience

Presence

Presence is about staying focused on the task in front of you, rather than feeling overwhelmed by everything waiting to be done. When stress builds, the mind often jumps ahead to the next tasks, increasing tension and pulling attention away from the present moment. Staying grounded in what's happening right now keeps the mind calmer and helps prevent mistakes that could add to stress later. As a rule of thumb, the moment you recognize you've lost "presence" is your cue to return to the present moment.

Practical tips for building presence

- *Take deep breaths*: A few deep breaths with long, slow exhales at any time helps both calm and energize the mind and bring focus to the present.
- "*Come to your senses*": Take a moment to watch the cattle grazing or enjoy taking in the landscape. Really feel the rain on your skin or the sun on your face. Listen curiously to the sounds around you. Engaging your senses grounds you in the present moment, helping the mind and body relax quickly.
- *Tackle one task at a time*: Break tasks into smaller steps and focus on each one individually to reduce overwhelm and stay centred.

Purpose

A clear sense of purpose acts as an anchor, helping farmers see each task as part of a larger goal. Whether providing for family, preserving the land, or honouring a legacy, connecting daily work to a deeper purpose makes challenges more manageable. Purpose offers direction and reframes stress as a meaningful part of the journey.

Practical tips to reconnect with purpose

- *Reflect on your "why"*: Take a moment each day to remind yourself why you farm and what you're working toward. Viewing unpleasant tasks as part of a bigger picture can make them feel more meaningful.
- *Use visual reminders*: Keep family photos or mementos around the farm as daily reminders of your purpose and motivation.
- *Celebrate small wins*: Recognize accomplishments as steps toward a larger goal. Find healthy ways to reward yourself after completing a stressful task or period, reinforcing your progress and commitment.

Power

Resilience requires energy, which comes from quality sleep, nutrition, and hydration. When running on low fuel, the mind and body are more vulnerable to stress. Just as a machine needs fuel to function, the body needs proper rest and nourishment to build resilience. Staying 'powered up' is important at any time of the year but becomes especially important during busy times on the farm.

Practical tips to stay powered up

- *Prioritize quality sleep*: Aim for a consistent bedtime and improve sleep hygiene by keeping your room cool, dark, and free from screens an hour before bed. During busy times, short naps can help recharge when a full night's rest isn't possible.
- *Eat balanced, regular meals*: Ensure sustained energy by adding more vegetables to your plate and reducing portion sizes of meat and heavy carbs like potatoes, pasta, and bread. Don't skip meals—prepare quick snacks like soup and a sandwich to avoid energy dips during busy periods.
- *Mind your minerals*: Just as you ensure your cattle get essential minerals with a mineral lick, make sure you're getting yours too. Consider swapping plain table salt for sea salt or Himalayan salt for added minerals like magnesium and potassium.

People

Support is essential for resilience. Farmers are typically skilled all-rounders, capable of handling a wide range of tasks - from fencing to fixing machinery and managing livestock. However, trying to "do it all yourself" can lead to burnout. During stressful times, adopting a different mindset is crucial: Think, "Who can I get to help me with this?" Seek assistance with routine tasks so you can focus on high-priority work.

Isolation is a common challenge for farmers, which can add to stress and mental fatigue. Joining discussion groups or farmer networks can help combat isolation, offering a space to share experiences, gain insights, and find emotional support from peers who understand the unique pressures of farming. Beyond practical help, connecting with others builds resilience, and sharing stress can be a powerful emotional release.

Practical tips for leveraging support

- *Find help and delegate routine tasks*: Look for jobs or tasks you can outsource during busy times. Consider options like farm relief services & contractors or finding help like casual labour to assist with daily operations.

- *Build a support network*: Share your challenges with someone you trust, whether it's a family member, friend, or fellow farmer. Think of it like a slurry tanker left on suction mode - if the pressure keeps building without a release valve, something will eventually give. Talking things out helps prevent that buildup, acting as a release to avoid emotional overload.
- *Consider professional support*: Research shows that many farmers avoid professional help, but it can be invaluable. A counsellor, wellness coach, therapist, or support group can provide new tools to handle stress effectively.

Preparation

Effective preparation can be the difference between a smooth operation and a stressful scramble. Planning ahead allows you to anticipate challenges and set up systems that will keep things running smoothly during high-stress times. Once you're in the thick of a high-stress period, it's often too late to address small inefficiencies or lingering issues that can quickly escalate into major setbacks or delays. As the saying goes, "a stitch in time saves nine," so adopting a proactive approach means addressing minor but persistent challenges -like a badly hung gate, a leaking tap, a flat battery, missing tools, or untidy workspaces -before they escalate during busy times.

Good preparation isn't about avoiding stress; it's about managing it well in advance. Tackling these smaller issues early ensures that high-stakes periods, like calving or inspections, go as smoothly as possible, allowing you to stay focused on essential tasks rather than being distracted by preventable setbacks.

Practical tips for effective preparation

- *Plan key tasks ahead*: Map out significant events like calving, inspections, and market days on a seasonal calendar to allocate time and resources effectively.
- *Tidy up and fix small issues*: Address small annoyances, like poorly hung gates or a disorganized workshop, during quieter times and before they become big distractions.
- *Set up backup support*: Arrange for extra help during peak times, and have contingency plans for potential disruptions, such as machinery breakdowns or adverse weather conditions.

By applying the "**5 Ps of Resilience"** - Presence, Purpose, Power, People, and Preparation - farmers can build a solid foundation to handle stress, keep operations running smoothly, and sustain mental and physical well-being through each season. Resilience isn't about eliminating stress; it's about having the right "shock absorbers" to take each challenge in stride, allowing farmers to manage their unique demands with greater ease and balance.

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Notes:

FarmRes Project

The FARMRes Project aims to raise awareness about mental health issues among farmers, farm families and agricultural workers though a free interactive web app with practical support tools to enhance and strengthen personal mental health.

Open the camera on your phone & scan the QR code to use!

HELPFUL SUPPORT OPTIONS

Your Mental Health (HSE)
24/7 Information Line
Freephone 1800-111888

Samaritans
(24/7) A free, non-judgmental listening support available 24/7. Freephone 116123 or email: jo@samaritans.org

Pieta
Offers free therapeutic support to people in suicidal distress and those who engage in self-harm. Freephone 1800-247247 or visit www.pieta.ie

Text About It (24/7) Text free 50808

St Patrick's University Hospital, Dublin
provides a Support and Information Service staffed by experienced mental health nurses 9am-5pm Monday to Friday on 01-2493333.

Mental Health Ireland
Visit www.mentalhealthireland.ie

Scan the code to view the presentations & papers

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