SEFARI

LEADING IDEAS
FOR BETTER LIVES

Leading ideas for Livestock

SRUC

Royal Botanic Garden Edinburgh

BioSS

Moredun

The Rowett Institute

The James Hutton Institute

Scottish Government
Riaghaltas na h-Alba

Leading ideas for livestock

Introduction:

The Scottish Government's Environment, Natural Resources and Agricultural (ENRA) Strategic Research Programme (SRP) for environment land use, agriculture, food and rural communities is delivered by the Scottish Environment, Food and Agriculture Research Institutions (SEFARI).

BioSS · The James Hutton Institute · Moredun Research Institute · The Rowett Institute · Royal Botanic Garden Edinburgh · SRUC

The SRP is the mid-to-long term research component of the ENRA Portfolio, focused to environment, natural resources, agriculture, food and rural communities research. In addition to the SRP, the Portfolio also includes the underpinning of national resources at SEFARI, including supporting research farms and national data sets and, in partnership between SEFARI, Scottish Universities and Agencies, policy-facing Centres of Expertise. This work is brought together under an ethos of "Leading Ideas for better lives" by SEFARI Gateway, the Portfolio's Centre of Expertise for Knowledge Exchange and Innovation.

This Leading Ideas booklet provides insights into the programme's livestock research and its delivery of significant benefits to Scotland, UK and Global livestock health, welfare, productivity and climate impact. The research is helping policy agendas and delivering innovation and new practices contributing to Scotland's National Outcomes and the United Nations Sustainable Development Goals (SDGs).

An EPIC response to the current avian influenza outbreak

Highly pathogenic avian influenza (HPAI) virus causes severe disease and high mortality in poultry and many species of wild birds. Multiple outbreaks of HPAI are occurring across Scotland, the UK, and internationally. The impact of the disease, directly through illness and mortality, and indirectly from interventions to control the disease, has huge implications for the poultry sector, the economy and wider society.

"Highly pathogenic avian influenza has huge implications for the poultry sector, the economy and wider society"

Scientists within the Scottish Government-funded Centre of Expertise on Animal Disease Outbreaks (EPIC) have been working with government policy teams and the poultry industry to predict the spread of the disease and prioritise control strategies.

This work includes:

- Producing a risk assessment for Scottish Government to evaluate whether removing wild bird carcasses can reduce onward transmission of the virus to wildlife and captive birds. This risk assessment is available at https://shorturl.at/vzCF5
- Developing an interactive avian influenza web tool to show when and where cases have occurred, generate risk maps to predict patterns of virus transmission, and support targeted preventative and control measures
- Combining data on the genetics of the avian influenza virus and patterns of disease occurrence to track the evolution of the outbreak strain, seeking to understand changes across space and time, and estimate the speed of spread
- Developing new mathematical models to better reflect how the disease spreads in wild birds when predicting risks to poultry farms

CONTACT Katie Adam: kadam3@exseed.ed.ac.uk

Rotational grazing
- Multiple benefits from diverse swards

A range of benefits can flow from diversifying swards used by grazing livestock in combination with rotational grazing. Potential benefits include increased biodiversity, sward productivity, soil carbon, resilience to climate extremes, livestock productivity and health.

"Enhancing grassland productivity, biodiversity and livestock health to reduce GHG emissions"

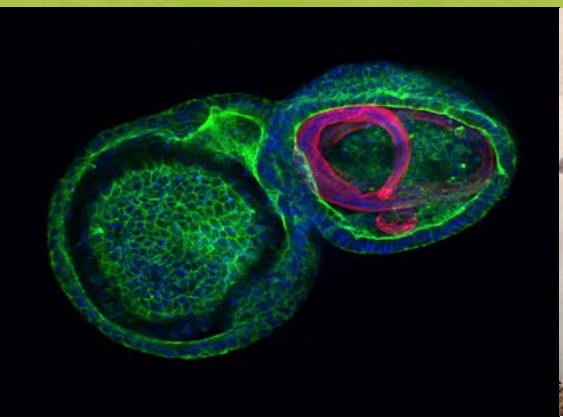
We have established two linked experiments. The first is at the James Hutton Institute's research farm at Glensaugh, where we have a replicated field experiment with a diverse species mix direct-drilled into the original rye-grass/white clover swards (avoiding the damaging impacts of ploughing) in (a) spring, (b) autumn or (c) not at all (controls). We are rotationally grazing, and also trialling a steam treatment to reduce competition for new seedlings. We are recording changes in plant and invertebrate diversity, soil carbon, lamb performance and worm burdens.

The second linked experiment is at the Moredun Research Institute's research farm at Firth Mains, two treatments are being used in combination. The first is diversifying the sward with the same species mix as at Glensaugh, compared to the traditional ryegrass/clover ley, whilst the second experiment is managing the sward, either using a set stocking approach or using rotational grazing. In the latter, the animals are moved every two to three days. Lamb weight gain and parasitic worm burdens will be the key performance indicators from an agricultural perspective.

Running matched experimental treatments at different locations gives a more robust experimental assessment of how innovative grassland management with new technological developments can reduce greenhouse gas (GHG) emissions and produce whole system multiple benefits for livestock, biodiversity and climate resilience.

CONTACTS: alison.hester@hutton.ac.uk, fiona.kenyon@moredun.ac.uk

The use of organoids in the development of anti-parasite vaccines



Parasitism by gastrointestinal nematodes (parasitic worms, which live in the gut) has a major impact on animal production worldwide. As well as health and welfare impacts for infected animals, this inefficiency in production also impacts our ability to reach Net Zero targets.

"parasites are now developing widespread resistance to wormers"

Traditionally, parasitic worms in sheep have been controlled using chemical drenches ("wormers") but the parasites are now developing widespread resistance to these wormers, so a more sustainable alternative means of control needs to be found.

Prototype vaccines against parasitic nematodes have variable effectiveness and need to be improved to become commercially acceptable. The best way to do that is to understand, at a detailed level, how the parasites interact with the host, but it's not easy to do that in a living system. We have developed a solution and can now use organoids ("mini guts"), grown in the lab from sheep stem cells, to examine, at a microscopic level, the interactions between parasites, their excretory and secretory ("E/S") products, and the host.

This research greatly advances our understanding of how parasites interact with their hosts and allows us to develop novel ways of controlling those parasites, including understanding the host and parasite responses to vaccination.

CONTACT: alasdair.nisbet@moredun.ac.uk

Leveraging trading behaviour to assist livestock disease control in Scotland

Control of livestock disease is a complex problem. For example, trade in livestock is a risk for transmission of disease but is essential for farm businesses. Any attempts to severely restrict trade, such as movement bans, are likely to come up against strong imperatives to continue trade, and can only ever be temporary. However, their use to control disease in extreme circumstances illustrates the importance of trade in livestock disease transmission.

"'Small changes to trade can amplify the effectiveness of traditional disease controls"

Biomathematics Statistics Scotland (BioSS) and Scotland's Rural College (SRUC) are developing a trade model that captures trading behaviour of individual cattle farms. To understand the potential for subtle modification of trade to transform attempts to reduce both endemic and exotic disease risks to the Scottish livestock sector.

Key results from this model include:

- Low disruption trade control intended to reduce trade frequency while maintaining animal flows (farm trade needs) nevertheless prompts farms to adapt their trading patterns
- As predicted, these adaptations counteract control, with modelled reductions in percentage of infected herds smaller than in the absence of adaptation
- However, when combined with more conventional post-movement batch testing, this trade-based control significantly enhances the effectiveness of batch testing, resulting in much larger reductions in prevalence of endemic disease than otherwise expected

These results motivate further exploration of novel control strategies that better account for the dynamics of the Scottish cattle trading system. We are currently using models to explore the impact of targeting controls on larger suppliers, the potential benefits of risk-based trading and how such schemes could be implemented.

CONTACT: martin.knight@bioss.ac.uk

Feed supplements for reducing enteric methane production

In 2021, enteric methane contributed 52% of agricultural greenhouse gas emissions in Scotland. Reducing these emissions is important for the long-term sustainability of the beef, dairy and sheep sectors. A wide range of feed supplements have been tested for their ability to reduce enteric methane. These feed supplements are either plant-based (e.g. essential oils), or synthetic (e.g. nitrate).

"Methane reducing feed supplements show promise but more R&D is required"

Meta-analyses of studies for on- or near-to-market methane-reducing supplements have shown average reductions in methane yield (grams methane per kilogram of feed dry matter consumed) of 12 to 37%. Actual reductions in methane depend on the supplement and are specific to individual farming systems (e.g. species and diet type) and can range from 0 to >90% emissions reductions.

Recent research from SRUC has highlighted gaps in our knowledge:

- Studies have primarily focused on housed cattle. This means there is less certainty about other production systems
- Supplementing grazing animals is difficult, due either to high dosage levels, or an inability to ensure all animals consume enough to be effective
- There is a lack of evidence on the net impact of feed additives. Emissions from manufacture, transport, and downstream effects, e.g. emissions from manures during storage and after application to soils, are not known and may offset reductions in enteric methane emissions

CONTACT: gemma.miller@sruc.ac.uk

SEFARI

LEADING IDEAS
FOR BETTER LIVES

Charles Bestwick
Director
SEFARI Gateway

Philip Skuce
Knowledge Broker
for Livestock

Contact us

www.sefari.scot

info@sefari.scot

@SEFARIscot
#LeadingIdeas

PB Jan24