



POSTGRADUATE SEMINAR 2016

AFBI Hillsborough
Thursday 9th June

This event was organised by
a committee of postgraduate students:

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Abstracts edited by
Anna Lavery and Rory Lunny

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the Postgraduate Centre, Queen's University Belfast
and the Agri-Food and Biosciences Institute.

The Committee appreciates the support and
presentation given by Mr Simon Doherty of UKTI and
Blackwater Consulting

Schedule for the AFBI Postgraduate Conference 2016

THURSDAY, 9th JUNE 2016

09:00 – 09:25 Registration

PLENARY SESSION

09:25 – 09:30

Welcome address – Dr. Sinclair Mayne

Director of Sustainable Agri-Food Sciences Division, AFBI

09:30 – 10:00

Keynote Speaker – Simon Doherty

Specialist (Animal Sciences) UK Trade & Investment (UKTI)
Director, Blackwater Consulting
Trustee, Send a Cow

SESSION I – Grassland, soil and tree intercropping studies.

10:00 – 10:20

Defoliation timing on yield and tiller dynamics in perennial ryegrass clones

Gerard Hoppé

10:20 – 10:40

The interactions of a willow biomass intercrop with a cherry tree crop in an Alley Coppice System.

Rory Lunny

10:40 – 11:00

The effect of soil pH on phosphorus fertiliser efficiency as measured by soil test P, herbage growth and herbage P concentration at contrasting grassland sites.

Ian Fox

11:00 – 11:20

COFFEE

SESSION II – Livestock performance, immune function & methane emission output studies.

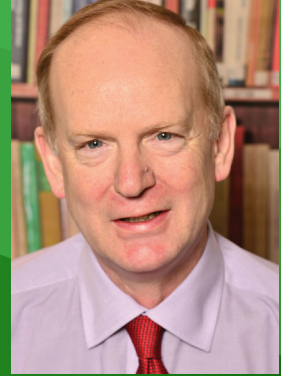
11:20 - 11:40	Performance of dairy cows offered silages produced from grass swards or red clover/grass swards. David Johnston
11:40 – 12:00	Concentrate supplementation during the close-up dry period: dairy cow production and immune function. Mark Little
12:00 – 12:20	The effect of age at which once-a-day feeding of milk replacer commences on the behaviour, welfare and performance of individually housed dairy calves. Gillian Scoley
12:20 – 12.40	Performance of individual piglets when reared on sows divergent in output potential. Aimee-Louise Craig
12:40 – 13:00	Prediction of methane emissions and nitrogen excretion in sheep offered fresh perennial ryegrass (<i>Lolium perenne</i>). Yiguang Zhao
13.00 – 14:00	LUNCH & POSTER SESSION

SESSION III – Science & industry, environmental and economic studies.

14:00 – 14:20	Bridging the gap between science and industry – towards a more sustainable future. Conor Dolan
14:20 – 14:40	How to tackle the elusive diffuse agricultural water pollution? Annabel Sharma
14:40 – 15:00	Economic and Environmental Implications of European Union Milk Quota Abolition for the Agri-Food Sector in the Island of Ireland. Adewale Adenuga
AFBI Services available	
15:20 – 15:30	AFBI Stats Services
	AFBI Library Services
	CONFERENCE CLOSE

Foreword by Dr Sinclair Mayne

Director,
Sustainable Agri-Food Sciences Division
Agri-Food and Biosciences Institute



Post graduate scholars are the life blood of any research organisation, providing an enthusiasm and drive for scientific discovery that has a major positive impact on the output of AFBI and in turn on innovation within the local agri-food industry and wider economy. Within AFBI, we have a very diverse post graduate community of over 60 scholars involved in a wide range of scientific disciplines. I am confident that many of today's post graduate scholars will play a major role in helping society meet the global challenge of sustainable intensification of food production, in their future careers.

I congratulate all involved in organising today's 2016 Post Graduate Conference. The Organising Committee has developed an extremely interesting programme of plenary and poster sessions, and a very important interactive event with supervisors, statisticians and our librarian.

On behalf of AFBI's Executive Management Team, I would like to thank all the funding organisations and university and AFBI supervisors of our post graduate scholars. Particular thanks also to our special guest speaker, Mr Simon Doherty, Consultant (Animal Health and Animal Science) AgriTech Organisation, UK Trade and Investment.

I am pleased to welcome everyone to what I hope will be a highly stimulating day of scientific presentations and discussion.

Dr Sinclair Mayne

Defoliation timing on yield and tiller dynamics in perennial ryegrass clones

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Abstract

Perennial ryegrass is the most abundant species found in intensive grassland swards in the UK and Ireland. Ryegrass is an out-crossing species; therefore commercial varieties are a population of individual genotypes. Previous experiments (with varieties grown under silage management) have found high levels of variability in yield and quality responses when varieties with differing maturity are harvested at different dates during the spring. These effects have consequences for the regrowth and silage cuts 2 and 3 but are not well understood.

Accurate identification of the growth stages of plants within a sward are critical to many forage management decisions. The study objective was to examine and quantify the yield differences in light of the phenological development of the clonal sward at the time of harvest and its effects on regrowth. This study utilized a split-plot design with three diploid clonal types with contrasting maturity (early and late flowering) and five harvest dates (on-farm silage cut date and 4 treatments either 1 and 2 weeks earlier or later). Results reveal that DM yield responses to harvest date are influenced mainly through the distribution of tiller types within the clonal swards. Primary growth (cuts 1-5) shows contrasts in yield and tiller development between clonal sward types and the knock-on effects for regrowth and silage cut 2 (cuts 6-10). By Silage cut 3 (cuts 11-15) the effects of delayed cutting are not evident.

The interactions of a willow biomass intercrop with a cherry tree crop in an Alley Coppice System.

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Abstract

Agroforestry (AF) is an economically, environmentally and socially proven climate smart, land use system that can deliver a range of ecosystem services. Short rotation coppice (SRC), a fast growing source of woody biomass, can also deliver environmental and social benefits. Interactions between the tree crop and intercrop were investigated in an innovative study combining both AF & SRC in a novel Alley Coppice (AC) system.

Trial layout was a randomised block design in 3 blocks with a split-split-split plot treatment structure. A buffer zone treatment (2m, 1m) was applied to 2 main plots within each block; each main plot was split to form 6 sub plots to which the 6 Cherry (*Prunus avium* L.) clones (Saturn, Pluto, Concordia, Neso, Hermes & Control) were allocated. Each subplot was further split to form 5 sub-sub plots to which the 5 Willow (*Salix* spp.) varieties (Resolution, Olaf, Beagle, Endeavour & Terra Nova) were allocated. Thus there were 180 sub-sub plots in total and 60 treatment combinations. Data was analysed by analysis of variance appropriate to this randomised block with split-split-split plot treatment design.

The trial was established in May 2013 and during the 2014 & 2015 growing season monthly measurements of willow variables root collar diameter (rcd), total height (th) and environmental variables soil volumetric moisture (%) and photosynthetic active radiation (PAR) were made. Total willow yield and dry matter % were also assessed. In July 2015 when mean cherry heights were compared within different levels of buffer zone treatment, there were very significant differences ($P < 0.05$) noted.

The effect of soil pH on phosphorus fertiliser efficiency as measured by soil test P, herbage growth and herbage P concentration at contrasting grassland sites.

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Abstract

Phosphorus (P), a macro nutrient, is required in relatively large quantities by high productivity grassland. Phosphorus levels in Irish soils are naturally low and its bioavailability is also strongly related to soil pH status. A recent survey of grassland soils used for agriculture show 63% of samples had sub-optimum pH(1), highlighting a key factor potentially leading to underperformance in agricultural production and increased potential for low fertiliser P use efficiencies. The adoption of grazed grassland production systems by farmers has been promoted as conferring advantages in terms of profitability and environmental sustainability however, the accrual of these benefits are dependent on high quantities of grass production over a long growing season. The aims of this experiment were to investigate the interaction of lime with chemical P applications and their effects on soil P, herbage growth and herbage P concentration.

This experiment was established in 2014 on two pre-existing grassland trial sites, where a unique range of pH and soil P levels existed. For this experiment four annual P application treatments (0, 20, 40 and 60kg_{ha}⁻¹) were applied while lime was applied at the start of the experiment to half of the trial plots (5t _{ha}⁻¹) with the other half receiving no lime. Phosphorus was applied as triple super phosphate (16%P) and lime was applied as ground lime stone. Nitrogen was applied at 300kg_{ha}⁻¹ annually across all treatment plots and harvesting was conducted on a monthly basis to a height of 4cm to simulate grazing.

The addition of lime significantly increased soil pH, STP and crop P (P<0.0001) across all treatment combinations. The addition of fertiliser P significantly increased soil P levels regardless of soil pH status. Fertiliser P rate also had a significant effect on herbage yield up to 20kg_{ha}⁻¹ P applied. These results will be discussed in more detail in the presentation.

Performance of dairy cows offered silages produced from grass swards or red clover/grass swards.

Johnston, D. J.^{1,2*}, Dale, A.J.¹ and Ferris, C. P.¹

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²Queens University Belfast, Belfast

*Presenting author

Abstract

Due to price volatility and instability in supply, the UK livestock sector is seeking to reduce its reliance on imported protein feedstuffs. The use of locally-grown forage legume crops, including red clover (*Trifolium Pratense*), may help achieve this objective.

This 13 week study (involving 28 dairy cows), examined the performance of cows offered silages produced from three successive harvests of either a pure grass sward (GS) or red clover/grass sward (RCS). Swards were harvested on 12 June, 7 August and 2 October (H1, H2 and H3, respectively) following wilting periods of 48, 72 and 72 hours, respectively. The GS sward received a total of 248 kg N/ha over the season, while no N was applied to the RCS sward. Silages from H1, H2 and H3 were offered for 5, 5 and 3 weeks, respectively, while all cows were offered 8.0 kg concentrate per day throughout the experiment. Data were analysed by ANOVA. Total herbage DM yields (t DM/ha) across H1-3 were 10.4 and 9.9 for grass and red clover/grass swards, respectively. Silage DM intakes for the GS and RCS treatments were 8.8 and 11.7 (P<0.001: H1), 9.2 and 10.4 (P<0.006: H2) and 12.3 and 11.5 (P=0.224: H3) kg/day, respectively, with mean values across H1-H3 being 9.6 and 11.1 kg/day (P<0.001), respectively. Milk yield for the GS and RCS treatments were 24.9 and 25.5 (P=0.221: H1), 22.1 and 23.1 (P=0.093: H2) and 21.8 and 24.7 kg/day (P<0.05: H3) respectively, with mean values across H1-3 being 23.2 and 24.4 kg/day (P<0.05), respectively. Mean milk fat across H1-3 was 46.6 and 45.7 g/kg (P=0.439) for the GS and RCS treatments, respectively, while the respective values for milk protein were 32.3 and 31.5 g/kg (P=0.201). Fat plus protein yield for the GS and RCS treatments were 2.60 and 2.55 kg/day (P=0.648: H1-3) respectively.

In conclusion, intakes were higher with the RCS, but milk solids yield/cow was unaffected. There was a saving in fertiliser costs with the RCS treatment, but milk solids output/ha (assuming 15% in-silo losses with both treatments) was numerically lower with RCS (2396 and 1940 kg for GS and RCS, respectively).

Concentrate supplementation during the close-up dry period: dairy cow production and immune function.

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Abstract

The transition period (three weeks peripartum) is the period of greatest disease risk during the dairy cow's production cycle, with negative energy balance (NEB) contributing to immune-dysfunction. Thus there is interest in nutritional strategies which minimise transition period NEB.

Multiparous (n=28) and primiparous (n=22) Holstein Friesian dairy cows were offered a medium quality grass silage until four weeks before the predicted calving date, when half the cows (treatment S+C) were moved to a mixed ration comprising grass silage plus concentrates (60:40 DM ratio, mean daily concentrate intake of 4.5 kg DM/cow/day), while the remaining cows (treatment SO) continued to be offered the grass silage diet only until calving. Postpartum, all cows were offered a common diet consisting of grass silage and concentrates (40:60 DM ratio) for ten weeks.

During the four weeks prepartum cows on S+C had a higher total DMI ($P<0.001$), gained more liveweight ($P=0.027$), tended to gain more body condition score ($P=0.060$), had a lower serum NEFA concentration ($P=0.023$) and tended to have a higher serum BHBA concentration ($P=0.074$) than cows on SO. Treatment had no effect ($P>0.1$) on total DMI, mean daily milk yield, milk composition, liveweight, body condition score, and serum NEFA or BHBA concentration postpartum. Similarly, treatment had no effect ($P>0.1$) on the phagocytic activity of neutrophils at day 14 prepartum or at days 3, 7, 14 or 21 postpartum or the oxidative burst activity of neutrophils at day 14 prepartum or at days 3, 7 or 21 postpartum. However, cows on S+C tended ($P=0.078$) to have a higher oxidative burst index at day 14 postpartum, than cows on SO.

Concentrate supplementation of a grass silage diet during the four weeks prepartum had no effects on production, metabolic or immune function *postpartum*.

The effect of age at which once-a-day feeding of milk replacer commences on the behaviour, welfare and performance of individually housed dairy calves.

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Abstract

This study aimed to determine the effect of age at which once daily feeding of milk replacer commences on the behaviour, health, welfare and performance of individually housed dairy calves through the use of multiple behavioural and physiological indicators.

Forty-eight Holstein Friesian calves were individually penned and allocated to one of three treatments: i. Once-a-day feeding commencing at day 14 (OAD14), ii. Once-a-day feeding commencing at day 28 (OAD28), iii. Twice-a-day feeding (TAD).

Calves fed milk replacer once daily displayed a strong tendency towards increased daily concentrate consumption ($P=0.052$) and had a significantly increased water intake in the pre-wean period when compared to TAD calves ($P=0.012$). Behavioural, haematological and physiological variables were used to evaluate welfare status throughout the experimental period. Transient changes were found within haematological variables, however, the results tended to reflect the effects of solid feed intake and weaning on metabolism. Lying behaviour was unaffected by treatment, however, calves across all treatments displayed a significantly increased number of lying bouts ($P<0.001$) over the period during which they were transferred to the group pen, suggesting they perceived this to be a stressful experience. Calves fed milk replacer twice daily showed a significant decrease in HRV when compared to calves fed milk replacer once daily during the period over which they were transferred to group pen ($P=0.005$). There was no significant effect of treatment on infra red eye or rectal temperature throughout the experiment, however there was a significant effect of age, with infra red temperature decreasing as calves aged.

Results from the current study suggest that milk feeding frequency can be reduced from twice to once daily from 14 days of age without detriment to dairy calf performance or health. Findings suggest that this reduction can also occur without measurable detriment to calf welfare as determined through an aggregate of novel, non-invasive technologies and haematological analysis.

Performance of individual piglets when reared on sows divergent in output potential.

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Abstract

This report aims to identify how pigs with a range of birth weights perform when reared on sows with different levels of output to help producers improve performance across the whole herd. Using data from a previous trial, sows were assigned to top quartile, mid-range or bottom quartile according to litter weight weaned. Piglets were weighed at 0, 7, 14, 21 and 28 days. Body condition score (BCS), backfat depth and sow weight were recorded at farrowing and weaning. Daily feed intake (ADFI) was also recorded. Individual pigs were categorised according to birth weight (BW) into small (<1.2kg), medium (1.2-1.8kg) or large (>1.8kg). Data was analysed using analysis of variance.

Top quartile sows weaned an extra 28.2kg ($P<0.001$) of litter weight and an extra piglet ($P<0.001$) compared to the bottom quartile. Top quartile sows also had a higher ADFI ($P=0.002$). There was no significant effect of sow ranking on the birth and wean CoV, sow P2 change, BCS change or weight change between farrowing and weaning. The weaning weight (WW) of medium and large pigs increased as overall litter weight increased. Although WW of small pigs increased when reared on 'mid' sows compared with 'bottom' sows, the WW did not increase further when they were reared on 'top' quartile sows.

This study indicates the potential of sows to wean over 120kg with no effect on body condition. However, at a population level, the growth potential of small pigs may become limiting compared with medium and heavy BW piglets.

Prediction of methane emissions and nitrogen excretion in sheep offered fresh perennial ryegrass (*Lolium perenne*).

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Abstract

Data was collected from 82 sheep offered fresh perennial ryegrass (*Lolium perenne*) as sole diets in 6 calorimeter chamber experiments. The sheep were of Highlander, Texel, Scottish Blackface and Swaledale breeds, between 5 and 18 months of age, and weighed between 24.5 and 62.7 kg. Grass was harvested daily from 6 swards in contrasting harvest dates (May to December). The animals were individually housed in pens for 19 days before being transferred to individual respiration chambers for 4 days with feed intake, faeces and urine outputs and CH₄ emissions measured. Linear and multiple regression techniques were used to develop prediction equations for methane (CH₄) emissions and nitrogen (N) excretion. The percentage of dietary gross energy (GE) lost as CH₄ (CH₄-E/GE) for sheep offered perennial ryegrass was 6.2%. Dry matter (DM) intake and N intake were accurate single predictors for CH₄ emissions and N excretion, respectively. Adding grass nutrient concentrations (e.g. organic matter (OM), neutral detergent fibre (NDF), water soluble carbohydrates (WSC) and N) as supporting factors improved prediction accuracy. Models based on farm level data (e.g. animal live weight (LW) and grass DM, OM, N, NDF and GE) were also developed and performed satisfactorily. Methane emissions and N excretion had negative relationships with feeding level and grass OM, WSC and Metabolizable energy (ME) concentrations, but positive relationship with grass N concentration. These prediction equations of CH₄ emissions and N excretion can help sheep producers identify management practices that increase production efficiency and reduce environmental footprint which are essential to develop sustainable sheep production systems.

Bridging the gap between science and industry – towards a more sustainable future for the Lough Neagh eel fishery

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Abstract

Lough Neagh is the largest freshwater lake in Ireland and Britain (383 km²) and supports one of the most important inland fisheries in Western Europe targeting European eel (*Anguilla anguilla*), Pollan (*Coregonus autumnalis*), Perch (*Perca fluviatilis*), Brown trout (*Salmo trutta*), cyprinids Roach (*Rutilus rutilus*), Bream (*Abramis brama*) and their hybrids. The principle fishery is for eel with an annual yellow and silver eel yield in the region of 400 tonnes making it Europe's most productive. At a local level the fishery is worth an estimated £3.5 million and provides much needed employment. However the commercial fisheries on Lough Neagh are under pressure from a range of factors, with both yellow and silver eel catches having steadily declined. Increasing concerns over decreasing catches by the Lough Neagh Fishermen's Co-operative Society paralleled with decreasing recruitment of glass eel has highlighted the need for a more sustainable approach to the juvenile eel stock to maximise future fishery yields and escapement. A current lack of data on the biology and ecology of the eel stock in particular the juvenile yellow eel cohort is constraining management of the fishery as well as having implications for the conservation of the species.

Potential methods of tackling diffuse water pollution from agriculture.

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Abstract

The aim of this research is to evaluate a new theoretical governance methodology in Northern Ireland, to address the issue of diffuse water pollution from agriculture as it eludes traditional legal command and control approaches. The nature of diffuse pollution is that it is discharged into the water environment in unidentifiable pathways which renders the traditional legal approach inept as it is based on establishing causality. Currently there are no methods to control or monitor diffuse pollution effectively; where there is a likelihood that farmers will get caught and penalised. Thus there are no incentives for farmers to change their behaviour, despite legal regulation.

This is a 'Commons' dilemma because water is a common pool resources, where farmers cannot be excluded from it and additional pollution in the water environment diminishes the water quality for others' use. Diffuse pollution mostly occurs through farmers' inappropriate use of land management practices where excess nutrients enter water ways to ensure yields and private profits. This is an inefficient position as farmers lose valuable nutrients, which harm the biodiversity within the water environment, reduces its amenity value and causes a social cost in treating the polluted water. This is a social dilemma, which makes farmers' compliance crucial to its mitigation. Thus theories on social governance such as collective action, will be used to determine whether there are alternative methods of ensuring farmers' compliance.

Economic and Environmental Implications of European Union Milk Quota Abolition for the Agri-Food Sector in the Island of Ireland.

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Abstract

The milk quota system of the European Union (EU) was introduced in 1984 to control total milk production, limit public expenditure on support for the dairy sector, and stabilise milk prices and incomes of milk producers. The abolition of the quota system in 2015 raised fundamental questions about the economic and environmental implications for the island of Ireland, where two different quota trading systems were in operation during the quota years; that is, the relatively restrictive model in the Republic of Ireland and the more open approach in Northern Ireland which benefitted from the flexibility in the management of the UK quota system. The aim of this study is to analyse the economic and environmental impact of the milk quota abolition across different regions in the island of Ireland. The analysis will be based on the Positive Mathematical Programming (PMP) modelling framework and the OECD/Eurostat Methodology for Nutrient Budgets analysis. A regionally disaggregated PMP model, unlike an econometric model, allows for explicit modelling of differences between regions within the island of Ireland and specification of disaggregated land and nitrate regulations constraints which may become a significant limiting factor for the dairy sector with the abolition of the milk quota. This presentation will consider the methodological requirements underlying this approach and present historical data on economic and environmental indicators which reflect the impact of the different quota regimes within the island of Ireland.

Effects of Land use Practices on Carbon Sequestration and their implications for tackling GHG emissions for the Agri-Food sector in Northern Ireland.

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Abstract

Devolved administrations in the UK are committed to reducing GHG emissions under several international agreements. Assessments of Land Use, Land Use Change and Forestry (LULUCF) are calculated from basic Tier 1 and occasionally Tier 2 protocols from the IPPC. Land use in Northern Ireland (NI) is largely agricultural with around 80% of this being grasslands surrounded by hedgerows which cover an important surface with carbon sequestration potential. LULUCF inventories have shown grasslands in NI to be a small net source of CO₂, without quantifying the impact of grassland cultivation on CO₂ exchange and excluding other sources of activity data such as hedgerows that may benefit the inventory for NI. Through previous AFBI research (Laidlaw, 2010), The Department of Agriculture and Rural Development (DARD) have identified research needs for the understanding of factors that influence rates of C sequestration and C loss from NI grasslands. There is increasing evidence to suggest that intensive management practices, increasing crop residues, manure and fertilizer treatments have the ability to sequester more carbon than less intensive practices (Moxley *et al* 2014). Research will focus on the dairy sector in NI due to its high grassland use and impacts on Carbon footprint.

Methods used to determine C flux from grasslands involve Eddy Covariance measurements to evaluate changing land use practices in NI. Two grassland fields of similar size and composition have been selected; the first will be operating under current intensive grassland ploughing and reseeded practices, the second under minimum tillage practices. Use of static chambers will provide point source estimates of flux to use in conjunction with eddy data.

Assessment of hedgerows to determine seasonal biomass increment, carbon content and carbon flux will be used to provide landscape level estimates of farmland woody biomass and sequestration potential. Flux will be determined by using non-steady state chambers to give direct point measurements. Estimates of hedgerow stock and growth increment can be determined using destructive testing.

Life cycle analysis will be conducted with regards to NI milk output, considering both direct and indirect effects of production using a cradle to market approach.

It is expected through preliminary results from static chambers that differences may be detected in C flux between management practices. Hedgerow carbon content may prove significant storage potential on landscape level having implications for LULUCF inventories. LCA will provide multiple scenarios for farming systems and suggest best practice for C sequestration, GHG mitigation and economic potential. Combining of these data will provide a more robust estimate of sequestration and GHG release in the farming sector and have implications for UK policies regarding emissions reporting.

Development and assessment of potential diagnostic and biocontrol measures against soft rot in vegetables.

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Abstract

Soft rot caused by the bacterial genus *Pectobacterium* is one of the most devastating and difficult to control diseases of crops, causing severe post-harvest losses on a wide range of vegetables, fruits and ornamentals. There is currently no treatment for soft rot, and control is largely based on the use of sanitary growing practices. This poster presents results from the first year of a PhD project that aims to develop and assess a new biocontrol for *Pectobacterium* spp. based on viruses known as bacteriophages. An update is provided on ongoing work to characterize bacterial strains isolated from soft-rotting vegetables originating from across N. Ireland from different crops (potato, carrot and onion) to subspecies level using a combination of different PCR methods. Also provided is an update on the characterization of a number of bacteriophages that have been extracted and isolated from samples of potato processing water and screened against isolated bacterial strains in vitro. Work is ongoing to characterize these bacteriophages using transmission electron microscopy. Information on a number of recently planted field trials will also be provided. These field trials aim to assess the efficacy of bacteriophage treatments, such as vacuum infiltration, sprays and liquid immersion, on the incidence of soft rot in potato, carrot and onion. These field trials will be assessed for plant emergence, yield, incidence of soft rot and persistence of bacteriophage in progeny.

Consumer perceptions of beef - a comparison of consumers from different regions.

Shien Chong, F.^{1*}, Farmer, L.¹, Hagan, T.¹, Kerry, J.², O'Sullivan, M.²

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***Presenting author**

Abstract

Ireland, both North and South, is a major exporter of beef to Great Britain. Consequently, the beef industry is keen to understand if the consumer preferences of different consumer groups both within Ireland and between Ireland and Great Britain differ. Some previous research showed that consumer preferences differ between countries. Other research stated that consumers judge beef similarly provided that they receive beef cooked to the endpoint they prefer.

Two beef joints, rump and sirloin, with differing sensory qualities will be assessed by consumers. The beef samples will be provided by various Department of Agriculture, Food and Marine (DAFM) projects. Consumer panels will be conducted in Ireland, Northern Ireland and Great Britain using Meat Standard Australian Protocol (MSA). Sensory profiling will also be performed on the same beef samples in Belfast by trained panellists. Advanced statistical methods such as Internal Preference Mapping will be used to analyse all the data to enable identification of the similarities and differences between consumers from different regions.

This research project will also evaluate the methods for routine sensory assessment of beef quality. There are a range of processes and techniques recommended by researchers and meat bodies. A selection of these methods, used for beef quality assurance within the industry, will be assessed with a view to identifying a consistent system, which is both economic and easy to implement.

The prevalence and trends of economically important production diseases in Northern Ireland

Brush, N.^{1,2*}, Borobia Belsue, J.³, Sparrow, D.³, Power, U.² and McKillen, J.¹

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Abattoir surveillance data is an important tool for disease monitoring and the detection of animal welfare conditions. The Northern Ireland voluntary pig health scheme, co-ordinated by Pig Regen, has recorded the presence of macroscopic lesions detected in the pluck and on the skin of slaughter pigs since 2005. Eight lesions are assessed by veterinary inspection as part of the scheme and include enzootic pneumonia-like lesions, pleurisy, pleuropneumonia, lung abscess, milk spot livers, papular dermatitis, pericarditis and tail bite. These pathologies are associated with performance indicators and often result significant in financial losses to the pig industry. Meat inspection post-slaughter provides an ideal opportunity for overall pig herd health to be assessed.

Over a 6 year period from 2009-2014, a total of 207,994 pigs from 2711 herds were examined for the presence of lesions at slaughter. A descriptive analysis of the data set was compiled and used to calculate the observed prevalences, correlations and trends associated with each lesion. All data was statistically analysed using the programme Genstat (Release 16.2), VSN International Ltd., Hemel Hempstead, UK.

Milk spot lesions were found to be the most common condition with an average prevalence of 16.1% amongst slaughter pigs, enzootic pneumonia-like lesions were found in an average of 10.34% of pigs, followed closely by pleurisy with 9.91% of pigs with lesions. All other lesions were observed in <5% of pigs. The most prevalent herd-level lesion was pleurisy, which was an average of 73.6%. Enzootic pneumonia was found to be the second most prevalent herd-level condition at 66.93%, followed by milk spot lesions at 61.98% and pericarditis at 61.76%. All other lesions were observed in <16% of herds. Correlations between lesions at slaughter were observed. Pleurisy was found to be correlated with the presence of enzootic pneumonia-like lesions ($r=0.2584$, $p<0.001$) and pericarditis ($r=0.3716$, $p<0.001$), and pleuropneumonia was found to be associated with lung abscesses ($r=0.287$, $p<0.001$). Time trend analysis revealed a negative trend in the prevalence of enzootic pneumonia-like lesions ($p<0.001$) and in the prevalence of lung abscesses ($p=0.007$) over time, whereas a positive trend was found for pericarditis lesions with an increase in prevalence observed over time ($p=0.003$).

The prevalences of respiratory lesions amongst pigs in NI are similar to those observed for the rest of the UK, with the exception of enzootic pneumonia, which is significantly lower in prevalence. The high prevalence of milk spot lesions indicates that parasitic infection remains a problem within the pig sector in NI. An observed association between respiratory lesions was expected due to their likely shared causal factors. A decrease in enzootic-pneumonia-like lesions and lung abscesses has been observed over time, which may be attributed to a greater uptake in vaccination against *Mycoplasma hyopneumoniae*. This data can be used to provide pig processors and producers with detailed herd health information that can potentially contribute to reduced economic losses and lead to higher animal welfare standards.

Investigation into the effects of fatty acids in the diet of swine on immune response and microfauna.

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Abstract

Pig farming is one of the most significant agricultural activities across the European Union, and is of considerable importance to the economy in Northern Ireland. Previously, in-feed antibiotics were used to enhance performance gains, however; an EU-wide ban prohibiting the use of antibiotics as growth promoters came into effect in 2006 as the final step in phasing out the use of antibiotics for non-medical purposes. As such, there is an urgent requirement to find an innovative, and long-term solution that will not only boost pig performance and efficiency but will also direct the production of safe, wholesome and sustainable food products in this post-antibiotic era. Various natural feed additives have been shown to affect the balance of fatty acids within the swine intestinal tract, having downstream effects on the composition of gut flora as well as exerting a range of metabolic and immunomodulatory functions. Furthermore previous research has indicated that the inclusion of novel fatty acid mixtures in pig diet has a positive effect; increasing growth rate and enhancing performance.

It is thought that fatty acids play an important role in improving digestion and also function to alter the microbial balance within the intestinal tract. They are known immunomodulators, effecting cytokine profiling, lymphocyte proliferation and phagocytic activity amongst other immune system components. However; the mechanism through which these fatty acids work to alter the immune response is not well understood and this project aims to fulfil this knowledge-gap; to discover the mechanisms behind the observed beneficial effects of fatty-acid based nutritional intervention in pigs. The objective involves collaborating with the feed industry, with a view of investigating the link between swine health and nutrition; more specifically the aim is to produce industry-relevant information regarding the strategic use of fatty acids as a swine health supplement. This research will ultimately evaluate the effects of fatty-acids on swine immunology, virology and microbiology in order to create a safe, wholesome feed product with advantages to animal health and welfare as well as benefits that will reverberate through the supply chain and help improve the performance and sustainability of the agri-food sector here in Northern Ireland. The improved knowledge base generated from this project will help direct the NI pig-meat sector towards its outlined growth aims whilst also holding the potential to provide a competitive international advantage in the animal feed market.

The effect of floor type on the performance of growing dairy origin bulls

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Abstract

The aim of this study was to evaluate the effect of floor type on the performance of dairy origin bulls during the growing period, following a summer at pasture. Forty dairy origin bulls with a mean initial live weight of 224 kg (SD=29.6 kg) were divided according to live weight and breed into 10 blocks, each of four animals. They were randomly assigned within blocks to one of two floor types, a fully slatted floor or a fully slatted floor covered with rubber strips for a growing period of 100 days. Bulls were at pasture from June 2015, receiving 2.0 kg concentrates/head/day until they were housed in October 2015, at an average age of 8 months. Bulls were offered *ad libitum* grass silage and supplemented with 2.0 kg concentrates/head/day which was increased by 0.5 kg/week until intake reached 8.5 kg/head/day on day 100. Animal live weights were measured on two consecutive days before allocation to treatment, every 14 days thereafter and finally on two consecutive days at the end of the growing period. Animals were also scanned for back fat depth monthly and cleanliness scored on day 5, 50 and 100. Data were analysed with linear mixed model methodology using REML estimation with Pen as a random effect and Treatment as a fixed effect in all analyses. There was no significant effect of floor type on animal performance. Average daily gain of bulls accommodated on fully slatted flooring was 1.31 kg/day and those accommodated on a fully slatted floor covered with rubber strips was 1.35 kg/day. There was no significant effect of floor type on back fat depth during the growing period or cleanliness of bulls on day 5 and 100 ($P > 0.05$). Bulls accommodated on fully slatted flooring were significantly dirtier than those on fully slatted flooring covered with rubber strips on day 50 ($P < 0.05$). The findings from this study demonstrate that growing bulls reared on fully slatted flooring perform equally to those accommodated on fully slatted flooring covered with rubber strips.

Evaluation of perennial ryegrass variety performance on Irish farms

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Abstract

Increasing grass utilisation on-farm has favourable consequences for the environmental and financial sustainability of Irish farms. It is essential that a robust evaluation process exists to identify suitable grass varieties that perform well on commercial farms. Plant breeders aim to develop varieties which excel within recommended list evaluations but ultimately variety performance needs to be quantified in 'real life' commercial situations. Current plot-based evaluations expose cultivars to minimal stress under controlled test procedures. On-farm variety evaluations have the ability to determine the true agronomic potential of varieties due to greater exposure to stress imposed across a wider array of environments and management systems. The objective of this study was to establish the phenotypic DM yield performance of a range of perennial ryegrass varieties under commercial farm conditions. This study and future on-farm variety evaluations will provide improved direction to plant breeders in developing superior varieties with enhanced on-farm performance. For this study, monocultures of varieties were sown on 68 commercial farms across Ireland with a control variety established on each farm. Varieties were evaluated over 3 years. No significant difference in total DM yield existed among varieties although the range between the highest and lowest yielding varieties was 1.3t DM/ha. On-farm evaluations allow for improved understanding of traits which can affect grass utilisation and lifetime productivity.

Pasture growth, structure and morphology of tetraploid and diploid swards sown with or without white clover during the winter

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Abstract

White clover (*Trifolium repens* L.) is at a competitive disadvantage to perennial ryegrass (*Lolium perenne* L.) due to its limited cold tolerance and low growth rate at lower temperatures. The effect of both ploidy and autumn closing cover on clover morphology and growth over-winter, and its subsequent recovery in spring and the following growing season is little understood. Thus, identifying the morphological characteristics that contribute to winter growth and survival is important. Such knowledge could indicate key plant and management factors that enhance spring growth potential. Two experiments were undertaken with the objective of understanding the key drivers in clover winter survival and its subsequent grazing seasons' productivity.

In the first experiment it was found that using different ryegrass ploidy treatments had no effect on pasture mass and sward clover content over-winter. However, the inclusion of clover caused a significant decrease in pasture mass and tiller density during this period. The preliminary results of the second experiment indicate that lower ryegrass biomass at the latter end of the growing season may enhance clover survival over the winter period. Along with this, spring clover content increased as spring progressed. Opening pastures later in the spring did not cause an increase in pasture available for grazing. Therefore, including white clover in a ryegrass sward can alter winter sward dynamics, potentially causing difficulties in subsequent spring management and performance. Further studies should be undertaken to investigate the influence of poor winter growth on subsequent grazing season productivity in regards grass-clover swards.

Effect of a grass only, grass-white clover or total mixed ration diet on dairy cow milk production

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Abstract

Diet can impact on milk yield and milk solids yield. It is well recognised that cows fed a total mixed ration (TMR) have higher milk production than those fed on grass based diets. Research indicates that incorporating white clover (*Trifolium repens* L.) into grass swards can have a positive impact on milk production. The objective of this experiment was to examine the effect of diet on dairy cow milk yield and milk solids (MS) yield. The experiment had three treatments – TMR (grass silage, maize silage, concentrate), grass only receiving 250 kg N/ha/year (GO) and grass-white clover receiving 250 kg N/ha/year (GC). Total concentrate fed was 285 kg/cow for GO and GC, and 2910 kg/cow for TMR. The GO treatment (15909 kg DM/ha) had significantly greater ($P < 0.05$) cumulative herbage production than GC (14122 kg DM/ha). There was a significant effect ($P < 0.05$) on milk yield and MS yield per cow whereby the TMR treatment had the highest cumulative milk and MS yield (7815 kg/cow and 631 kg/cow, respectively). This was significantly greater than the GC treatment (6880 kg milk yield and 554 kg MS) and the GO treatment (6139 kg milk yield and 515 kg MS). Incorporating white clover into the grass sward increased milk production per cow (+741 kg milk yield and +39 kg MS/cow) compared to grass only.

Digestible energy intake during gestation and associated sow reproductive performance.

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Abstract

Experimental gestation feeding records for 831 multiparous sows on trials at Teagasc Moorepark and AFBI Hillsborough, between the years 2005 and 2014 were used to examine the relationship between gestational digestible energy intake (DEI) and sow performance. DEI (MJ/Day) for each sow was categorised into 1) Medium (32.0-33.0) or Low (29.0-30.0) during early gestation (day 0-24), 2) High (43.0-46.0) or Low (29.9-33.0) during mid gestation (day 25-80) and 3) High (44.0-45.3), Medium (39.4-40.6), Low (32.2-34.7) or Very Low (29.9) during late gestation (day 81-114). The association between total born (TB), born alive (BA), born dead (BD) and piglet birth weight (BWT) with DEI was determined using mixed models, with all stages of gestation included in the model simultaneously. Parity and year of farrowing were included as fixed effects; sow was included as a repeated effect. DEI in early and late gestation was not associated with TB, BA or BD. Average TB was 12.8 and 12.3; mean BA was 11.5 and 10.9 while mean BD was 1.1 and 1.3 respectively for medium and low levels of DEI in early gestation. Average TB was 12.5, 12.6, 12.8 and 12.3; mean BA was 10.9, 11.4, 11.5 and 11.0 while mean BD was 1.5, 1.0, 1.2 and 1.1 respectively for high, medium, low and very low levels of DEI in late gestation. There was a significant relationship between DEI during mid gestation and TB, BA and BD, however a biological interpretation of this result was not possible as the majority of data represented the low DEI category (Low=785 vs. High=85). There was a significant relationship between DEI during late gestation and BWT ($P < 0.05$) which was not seen with early or mid DEI. Mean BWT was 1.61, 1.62, 1.52 and 1.55 for high, medium, low and very low levels of DEI in late gestation. This study suggests that changing the DEI of sows in early or late gestation has no impact on TB, BA or BD. Increasing DEI in late gestation may increase BWT however this result needs further investigation. As a result of this analysis, crude protein, fibre and feed intake during gestation will be analysed to explore possible relationships with subsequent reproductive performance.

The effect of perennial ryegrass (*Lolium perenne* L.) cultivars differing in sward structure on sward utilisation, milk production and grazing efficiency of lactating dairy cows at two herbage allowances

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Abstract

Perennial ryegrass cultivars form the basis of pasture production in many temperate regions. Sward structure can vary between cultivars and has been shown to affect sward utilisation and milk production of grazing dairy cows, though significant effect on milk production does not always occur. The objective of this study was to investigate the effect of four cultivars on sward utilisation, milk production and grazing efficiency of lactating dairy cows at two daily herbage allowances. Four cultivars were used: AstonEnergy, Delphin, Glenroyal and Tyrella. Seven cows were assigned to each cultivar from 1 July-28 July at two herbage allowance: 15 and 20 kg DM/cow/day. This resulted in 8 treatments (4 cultivars × 2 allowances). There was no interaction between allowance and cultivar. Increased grass allowance reduced sward utilisation ($P < 0.001$: -23%) and increased milk yield ($P < 0.001$: +1.6 kg/cow/day). AstonEnergy had longer free-leaf-lamina ($P < 0.001$), higher leaf ($P < 0.001$) and lower stem ($P < 0.05$) contents than Glenroyal resulting in cows achieving higher sward utilisation ($P < 0.001$: +12%), supporting higher milk yield (+1 kg/cow/d; $P < 0.05$), milk solids (+0.1 kg/cow/d; $P < 0.05$) and requiring significantly less grazing bites ($P < 0.001$: -7000 bites/day). Cultivars differing in leaf: stem ratio and free-leaf-lamina length induce sward utilisation, milk production and grazing efficiency differences in grazing cows.

Cattle and badger dynamics in relation to the potential transmission of *Mycobacterium bovis*

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Abstract

The European badger, *Meles meles*, is known to be a maintenance host of *Mycobacterium bovis* infection. By sub-typing strains of infected badger road kill, the same strain of *M. bovis* has been confirmed in badgers and local cattle herds. Research has looked at the risk of close contact between wildlife hosts and cattle which would allow direct aerosol spread; so far no definitive link has been proven. Bacilli have been shown to be excreted in animal urine and faeces, which could mean a possibility of indirect disease transmission at fomites.

The aim of the current PhD study is to help clarify the factors involved in the spread of bTB within and between cattle and badger populations, adding to the scientific evidence available to policy makers. The bTB eradication programme cost Northern Ireland £317M during the 15 years up to March 2011. Studies within the 100km² area of the 'Test, Vaccinate, Remove' (TVR) project in Co. Down will attempt to answer the following questions: 1) Do badgers and cattle come into indirect contact at setts, latrines, badger runs, water troughs, feed stores and buildings? 2) How many days during the grazing season are herds at risk of nose to nose contact with neighbouring cattle? 3) Do badgers avoid entering fields with cattle present? 4) Does inquisitive behaviour by cattle (e.g. dominance/age) affect bTB status? It is hoped this project will contribute to increases in both the efficiency and cost-effectiveness of the bTB programme.

