Summary of current research by Massey University’s Sheep Research Group 2016-2017

SHEEP RESEARCH

Survey of farm management tools use by NZ sheep farmers (Funded by AgriOne)
A survey was sent to ~14,000 New Zealand sheep farmers to investigate the use of farm management tools. In addition, an attempt was made to determine the reasons for not using particular tools. A total of 1,662 surveys were returned.

Survey of aspects of sheep management: Fly, Lice, Tailing and castration (Funded by The New Zealand Merino Company)
In October 2016, a survey was sent to ~14,000 New Zealand sheep farmers to investigate the farmer practices relating to the prevention of fly and lice and the methods used for tailing and castration of lambs. Farmers were asked their opinion on the importance of fly and lice prevention and the reasons for choosing different tailing methods. Responses were received from 1,253 farmers.

Early weaning of twin-born lambs using a herb mix (Funded by Beef + Lamb NZ)
In 2014 and 2015, a study was undertaken to investigate the use of the herb mix to allow the early weaning of twin-born lambs. At approximately 8 weeks of age twin lambs that weighed at least 16 kg were either left un-weaned and both the ewe and lamb were offered ryegrass pasture, were left un-weaned and both the ewe and lamb were offered the herb mix or were weaned and the lamb was offered the herb mix and the ewe ryegrass pasture. The live weight of the ewes and lambs was monitored until weaning of the previously un-weaned lambs at approximately 12 weeks of age.

A follow-up study was undertaken in 2016 to determine if the effect of early weaning lighter lambs (minimum of 14 kg) and the impacts of pasture cover at lambing. This study will be repeated in spring 2017.

Post-weaning ewe lamb growth (Funded by Beef + Lamb NZ)
In autumn of 2015 and 2016, ewe hoggets were offered either ryegrass pasture, a herb mix or Lucerne for one month prior to start of breeding. The live weight of the ewes was monitored during the feeding period. In addition, the impact of these feeding treatments on pregnancy and fecundity rates will be examined.

Post-weaning lamb growth (Funded by Beef + Lamb NZ)
In autumn of 2016 and 2017, a study was undertaken to investigate the use of herb mix compared to traditional hill country pasture for finishing lambs. Male and female lambs in two weight ranges (23-29 kg; Light and 32-40 kg; Heavy) were grazed on either a herb mix or hill country pasture for 7 weeks. The liveweight gain of the lambs was monitored and at the end of the study all lambs >36 kg were slaughtered and slaughter data was collected.
Forage, growth rate and weaning strategy on carcass and meat quality.
Utilising lambs from studies investigating early weaning and post weaning growth on different forages, the carcass characteristics and meat quality will be measured. The study will provide understanding of how farm systems can be orientated to create a meat product that meets the requirements of the discerning consumer. From lambs in various studies (outlined above), the hind leg will be collected and dissected to establish muscle to bone ratio, muscularity and dissectible fat content. The semitendinosus, semimembranosus, quadriceps, biceps femoris and adductor muscles will be utilised to measure meat quality characteristics including collagen content, collagen solubility and intramuscular fat content.

Twin-bearing ewe lambing on alternative herbages (Funded by Beef + Lamb NZ)
Twin-bearing ewe hoggets were offered alternative herbages during the 2015 and 2016 lambing periods. Ewe hoggets identified as bearing twin lambs were offered either ryegrass pastures, a herb mix or Lucerne from set-socking until weaning at approximately 80 days of age. The live weight of the hogget and her lambs was monitored throughout the lactation period.

Lamb performance on plantain based swards during autumn (Funded by Massey University)
Commercial farmers consistently report poor performance of livestock grazing plantain based swards during autumn. In autumn of 2017, lamb liveweight will be monitored on three commercial farms situated across Wairarapa and Manawatu. Herbage samples will be collected in order to assess herbage on offer, dry matter percentage, herbage quality and secondary chemical content. This herbage data will then be linked together with the lamb live weight data.

Ewe diet selection in pasture brome sward mixes (Funded by C. Alma Baker Trust)
Ewe hogget diet selection and grazing behaviour will be monitored on pasture brome sward mixes across the seasons during 2017 and 2018. This will provide some preliminary evidence as to the suitability of pasture brome sward mixes under New Zealand grazing conditions.

Factors associated with lamb loss in hoggets (Funded by C. Alma Baker Trust)
Single-bearing ewe hoggets on a hill country station were monitored during the lambing season in 2016 and newborn lambs will be tagged and weighed. Any dead ewe hoggets and lambs will be necropsied. Associations between hogget weight, body condition and lamb losses were evaluated.

The effect of vaccination with Androvax on ewe hogget reproductive performance (Funded by AgResearch)
In autumn of 2017, ewe hoggets will be vaccinated with Androvax at either: 10 and 6 weeks prior to breeding or at 8 and 4 weeks prior. All ewe lambs that achieve a target live weight of 40kg at the start of the breeding period will be exposed to the ram for a 34 day period. Approximately 90 days after the start of the breeding period pregnancy diagnosis will be conducted to determine pregnancy
status (pregnant or not pregnant) and the number of fetuses conceived. The ewes will be followed through lambing to determine the number of lambs born and lamb survival.

**Ewe longevity in commercial flocks (Funded by Beef + Lamb NZ, Massey University and C. Alma Baker Trust)**
A long-term research programme is underway to monitor the longevity of four age-cohorts of ewes Farm A 2010-born and 2011-born, Farm B 2011-born and Farm C 2014-born in commercial ewe flocks. Each year ewe live weights and body condition scores are recorded on four occasions. In addition, pregnancy scanning is conducted each year to determine reproductive status. Records of culled ewes are also maintained.

**Sheep behaviours as indicators of welfare (Funded by The New Zealand Merino Company)**
Recent advances in technology and data processing have made it possible to remotely electronically track individual animal location, movement, temperature and proximity to other animals. This information will enable behaviour and well-being indicators to be monitored in extensive grazing systems and be linked with welfare outcomes. This project will be the first step in the development of a remote sensor technology to monitor the welfare of sheep.

**Can triplet ewes count to three? (Funded by Massey University)**
The behaviour of triplet-bearing ewes and their lambs was observed during the first three days after birth using activity monitors and video recordings. In particular the suckling behaviour of the ewe will be investigated and the reason for terminating suckling events will be determined. Differences in ewe behaviour depending on if one, two or three lambs are attempting to suck is being examined.

**Developmental programming in sheep (Funded by Gravida, a Centre of Research Excellence)**
Developmental programming refers to the adaptation of various bodily systems or metabolic and physiological processes in the offspring due to the influence of a stressor encountered during pregnancy and/or the neonatal period. To date we have investigated maternal pregnancy nutrition, maternal physical size, maternal age/maturity, and fetal number. These studies are long-term and ongoing with the broad aim of investigating the impact of pregnancy and/or early life interventions on offspring performance and productivity.

**Understanding early embryo growth (Funded by Gravida, a Centre of Research Excellence)**
This study utilises two sheep models (dam size and embryo number) that investigate early pregnancy embryo growth and maternal-conceptus interactions in early gestation. Both of these paradigms have demonstrated that embryo growth can be influenced by the in utero environment as early as day 19-21 of gestation. We are investigating the relationship between embryo size and maternal uterine signalling. This is an across site study with involvement from Massey University, Auckland University and Otago University.

**Copy number variation of genes in the sheep genome and their association with quantitative traits (Funded by AgriOne and Massey University)**
Utilising 50K SNP chip genotype data on 385 sheep belonging to six genetic groups, CNV were detected employing three algorithms. Huge differences in CNV were evident between the six genetic groups. Current research pertains to the following three areas namely: detection of selection
signatures in two divergent selection lines of Romney sheep (nematode resistant versus resilient),
detection of CNV using whole genome sequencing data and detection of somatic cell mosaicism of
CNV among different adult as well as foetal sheep tissues

**Role of skin thickness and subcutaneous fat in thermoregulatory capacity of new-born lambs**
*(Funded by Massey University)*
Initially, utilising ultrasound scan data on 6600 hoggets (at 8-10 months, over six years) from a ram
breeding scheme, genetic parameters for skin thickness and related traits were estimated. Skin
thickness was found to have a moderate heritability of 0.26, with genetic correlations of 0.27, -0.21
and 0.27 with survival at weaning, weaning weight, and 12-month fleece weight, respectively.
Current research on this topic is focussed on the following two areas. Testing the role of skin
thickness on thermoregulatory capacity of new-born lambs through changes in heat dissipation from
skin and investigating changes in skin thickness from birth to 8 months of age, which will also allow
the calculation of correlations between skin thickness measured at birth and the corresponding
monthly measurements until 8 months of age.

**Effects of maternal nutrition on wool follicle development** *(Funded by the Chinese Ministry of
Science and Technology)*
With our Chinese partners we are examining the effects of maternal nutrition, both level and timing
of nutrition during pregnancy, on wool follicle development of the fetus. The aim is to determine in
fine woolled sheep if we can use nutrition in pregnancy to alter wool characteristics of offspring.

**Ewe nutrition during pregnancy to optimise fetal growth and lamb birth weight** *(Funded by
Gravida, a Centre of Research Excellence)*
Using a meta-analysis approach of reviewing all existing literature and field studies the aim of the
project is to determine both the level and timing of pregnancy nutrition to optimise fetal growth and
birth weight and lamb liveweight to weaning.

**The role of milk in early lamb growth** *(Funded by Gravida, a Centre of Research Excellence)*
This project aims to determine factors affecting ewe milk production and its impact on lamb growth.
Additionally the project aims to understand rumen development and the role of energy intake on
the growth of the pre-ruminant lambs.

**The effect of Kea on high country Merino** *(Funded by Massey University)*
This project will investigate the effect Kea have on high country merino and look at whether this is a
learned behaviour spread from particular individuals or a more generalised activity. High country
farmers will be surveyed and field work done to look at how a behaviour spreads through a group of
Kea.

**Marker for vagina prolapse in ewes** *(Funded by Massey University)*
This project is looking for a marker to identify ewes susceptible to prolapsed vagina (‘bearings’)

**Effect of slaughter age on lamb meat quality** *(Funded by Massey University)*
Lambs will be slaughtered at 5, 8 and 14 months of age. Meat samples will undergo meat quality
testing and a key aspect of the study is the development of an assay that can accurately measure
total and soluble collagen. An outcome of the study will be an understanding of the possibility of extending lamb meat trade to include older animals than currently classified and to identify the critical age point at which meat quality declines and hence, the point at which intervention becomes more important.

**Genomic selection for age at puberty**
This experiment uses a population of genotyped ewe lambs, which will be assessed for onset of puberty. This will identify ewe lambs that reach puberty at an early age or light weight, and genetic markers for puberty and hogget reproductive success can be investigated.

**Genetics of body condition Score**
Genetic parameters for body condition score of ewes will be calculated, along with genetic relationships between BCS and production traits. The performance of ewes of high and low genetic merit for BCS will be compared under ad libitum and restricted feeding conditions to test for genetic by environment interactions.

**Genetic links to carcass and meat quality characteristics with emphasis on intramuscular fat and collagen**
A population of genotyped ram lambs will be assessed for their carcass and meat quality characteristics. Individuals that have desirable meat quality attributes, in particular high soluble collagen and high intramuscular fat will be identified and genetic markers for meat quality investigated.

**Sheep udder abnormalities (Funded by Beef + Lamb NZ, Massey University and C. Alma Baker Trust)**
Examination of udder abnormalities, udder size, shape and teat size on lamb survival and growth. Twelve hundred commercially farmed two- and four–tooth ewes will be examined four times a year, over two consecutive years, to assess udder traits and relate to lamb survival and growth.

**The behaviour, nutrition and welfare of milk-fed lambs (funded by MBIE through AgResearch)**
Artificially reared lambs are being studied to determine appropriate nutrition and management systems. Growth rates and behaviour parameters are being analysed.

**Production and welfare of dairy ewes (funded by MBIE through AgResearch)**
Trials at Spring Sheep Dairy aim to compare effects of different management systems on production, health and welfare of ewes.

**Mastitis in hill-country ewes (funded by Massey University)**
Over 1800 commercial Manawatu hill-country ewes were examined and post-mortem samples collected from approximately 50 to determine the incidence and types of mastitis. Samples from ewes in Southland are also being examined.
**BEEF RESEARCH**

**Cow efficiency and stayability (Funded by Beef + Lamb NZ)**
In this project, four groups representing large or small beef cows and high or low milk production potential (Angus, Angus-Friesian, Angus-Jersey, and Angus-Friesian-Jersey) are being evaluated over their lifetime. The study measures the effects of cow size and milking ability on onset of puberty in heifers, reproductive performance (including return to oestrus after first calving), calculated feed intake and efficiency of calf production, as well as lifetime productivity, longevity and cow wastage. The first three cohorts of progeny from these cows have been finished and assessed for growth rate, carcass conformation and meat quality.

**Environmental impact of beef cows on hill country (Funded by Beef + Lamb NZ)**
This project aims to quantify the impact of beef breeding cows in hill country on the environment through measurements of run-off and soil damage, as well as measurements of cow activity, body condition score and production. This project is linked with the cow efficiency project so that the environmental impact of large and small cows can be compared.

**Theileria orientalis (ikeda) impact on bull fertility (Funded by Beef+Lamb NZ)**
Theileria orientalis (ikeda) is a tick-borne haemoproteozoan parasite that causes regenerative anaemia in cattle. There have been reports of clinical cases of anaemia in both beef and dairy herds, and death of a small percentage of affected cattle. In addition to the clinical cases, many other cattle are likely to suffer subclincial infection. This project examines the potential impact of subclinical Theileria Ikeda infection on the fertility of bulls to determine whether there is a risk to pregnancy rates of introducing naïve bulls into infected herds just prior to the breeding season.

**Improving reproductive performance in tropical cattle (funded by Massey University)**
The use of a hormonal protocol and fixed-time insemination is being evaluated in the Muturu breed of cattle in Nigeria.

**Genetic susceptibility to Theileria orientalis (ikeda) (Funded by C. Alma Baker Trust)**
Theileria orientalis (ikeda) is a tick-borne haemoproteozoan parasite that causes regenerative anaemia in cattle. There have been reports of clinical cases of anaemia in both beef and dairy herds, and death of a small percentage of affected cattle. Anecdotally, there appears to be marked variation in the severity of infection among lines of cattle. This experiment aims to compare the parasite burden of chronically infected calves from different sire lines to determine whether there is sufficient genetic variation to warrant genetic selection for resistance.

**Dairy beef progeny test (Funded by Beef + Lamb NZ Genetics)**
Surplus calves from the dairy industry are a key component of New Zealand’s beef industry, and are a resource that could be used more extensively in beef production. This project aims to identify beef bulls with desirable characteristics for breeding with dairy cows to produce progeny that perform well as finishing cattle, whilst also providing the easy calving, short gestation traits desirable in a dairy herd. This project has links with the beef progeny test to explore the relative performance of sires when bred with dairy or beef cows.
Role of beef meat structure on feeding behaviour of cats (Funded by Massey University and Wageningen University)

Beef by-products and off-cuts are used by the pet food industry and pet owners are increasingly providing their pets with natural, raw meat diets. To understand the role of raw beef in the cats diet and the potential to add-value to beef as a pet food, a study is being undertaken with Wageningen University in the Netherlands to look at beef meat structure (purée vs cubes) on preference, feeding behaviour and intake of cats.

Sheep and beef cattle scientists at Massey University

Professor Steve Morris  S.T.Morris@massey.ac.nz
Professor Paul Kenyon  P.R.Kenyon@massey.ac.nz
Associate Professor Rebecca Hickson  R.Hickson@massey.ac.nz
Associate Professor Anne Ridler  A.L.Ridler@massey.ac.nz
Dr René Corner-Thomas  R.Cornert@massey.ac.nz
Dr Nicola Schreurs  N.M.Schreurs@massey.ac.nz
Dr Lydia Cranston  L.Cranston@massey.ac.nz
Kate Griffiths  K.J.Griffiths@massey.ac.nz
Dr Rao Dukkipati  r.dukkipati@massey.ac.nz
Professor Hugh Blair  h.blair@massey.ac.nz
Dr Sam Peterson  S.Peterson@massey.ac.nz