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NEWSLETTER No 30

August 2004

SOIL NUTRIENT LOSS

A workshop in conjunction with DPI Victoria to look at
pathways of nutrient loss, water management issues and their measurement and implications

Help develop a Nutrient Index as part of the
Better Fertiliser Decisions Project

When: Wednesday 8th September 2004

Where: Liaison Centre at CSIRO from 9.00am to 1.30pm

Bring warm clothes as you'll be outside doing paddock assessment
RSVP (for lunch catering purposes) to Caroline **6778 3871** ASAP please!

A date for your diary

Friday 8th October

SELECTION INDICES FOR SHEEP AND CATTLE

Speakers will explain the use of
Breed Object
EBVs
The Falkirk Index

More details next newsletter

SMOKERS PLEASE NOTE!!!!!
RURAL FIRES REGULATION 2002 - SECT 29 Offence to light, use or carry tobacco product 29 Offence to light, use or carry tobacco product (1) A person must not, without lawful authority: (a) light any tobacco product, match or other material, or (b) use or carry any lighted tobacco product, match or other material, within 15 metres of any stack of grain, hay, corn or straw or any standing crop, dry grass or stubble field. Maximum penalty: 50 penalty units. (2) A person must not, without lawful authority, leave or deposit a lighted tobacco product, match or any incandescent material on any land, or on any bridge, wharf, pontoon or similar structure. Maximum penalty: 50 penalty units.

INTENSIVE ROTATIONAL GRAZING REDUCES NEMATODE FAECAL EGG COUNTS IN SHEEP ON THE CICERONE PROJECT

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SUMMARY
The Cicerone Project consists of 3 farmlets each with management systems contrasting in inputs (levels of fertilisers and pastures) and grazing management. Farmlet A has high input, high stocking rate, with flexible grazing using the Prograze principles. Farmlet B has moderate input, moderate stocking rate with the same grazing management as farmlet A. Farmlet C has moderate inputs and aims at high stocking density using intensive rotational grazing. This paper presents the results of analysis of nematode faecal egg counts (FEC) taken from ewes, hoggets and lambs for flock monitoring purposes over the last 4 years. There was significant interaction between the effects of farmlet and date of sampling for all classes of stock with effects of farmlet dependent on date of sampling (P>0.05). In the early part of the monitoring period, there were no consistent effects of farmlet on FEC, as grazing and pasture management began to take effect, FEC values for farmlet C were consistently lower than for the other two farmlets. This is reflected in the FECs of lambs and hoggets in early 2003 where counts for farmlets A and B were high while farmlet C FEC stayed very low (lambs: 2270, 1067, 85; hoggets: 670, 439, 115 eggs per gram for farmlets A, B and C, respectively). Farmlet A and B animals also had 2 more drenches than farmlet C, yet farmlet C sheep had consistently lower counts during 2003. The results suggest superior worm control on farmlet C associated with high intensity, short duration grazing. More detailed research has been initiated to investigate the epidemiological consequences of these 3 grazing management systems.

Keywords: worm burden, grazing management, intensive rotational grazing

INTRODUCTION
Gastrointestinal nematode infection is a substantial source of economic loss to the Australian sheep industry with an estimated cost of $220 million per annum (McLeod 1995). Over the last century, rotational grazing and set stocking have been discussed in detail in relation to control of gastrointestinal nematode infection (Morgan 1933; Gordon 1948; Gibson 1973; Barger 1997). These papers suggest that rotational grazing in temperate regions provides no better control of gastrointestinal nematode infection than set stocking. Studies, however, in a tropical environment by Banks *et al.* (1990) on *Haemonchus contortus* in Fiji showed that larvae in these regions do not survive in detectable numbers on pasture for more than 5-13 weeks. Similar short survival periods for larvae of cattle nematodes in tropical North Queensland where reported by Fabiyi *et al.* (1988). These studies led to experimentation with rotational grazing of goats in Fiji which proved to be effective in reducing worm burdens and to be especially effective against *Haemonchus contortus* (Barger *et al.*1994). Many of the early studies on rotational grazing in temperate regions (Roe *et al.,* 1959; Gibson, 1965) were based on short rotations of around 4 weeks. Donald (1967) states that there is no sound evidence that pastures should be spelled for periods shorter than 2 months. In a study by Southcott *et al.* (1976), pastures were found to be potentially infective up to 12 months after sheep where removed. This persistence of larvae on pasture is of great importance when considering rotation periods for grazing systems in temperate environments.

The Cicerone Project provides a unique opportunity to compare typical Northern Tablelands grazing practices, with different levels of inputs, with an intensive rotational grazing system involving extended rest periods. The main outcome of research carried out on the Cicerone Project is to provide valuable extension material to its members to aid in the decision making process on farm.
The purpose of this paper is to review the parasitology data from the last 4 years of the Cicerone Project to test the general hypothesis that faecal egg count (FEC) is significantly influenced by the management systems compared on the Cicerone farmlets. The data presented in the paper are from routine monitoring

of FEC, rather than from critical experimentation. The review of this data should provide insights into the effects of levels of inputs and grazing management on the Cicerone Farms which can form the basis of detailed critical experimentation into the future.

MATERIALS AND METHODS

The Cicerone farmlets

The Cicerone Project farm is located at "Chiswick" CSIRO, some 18 km south of Armidale NSW (lat: S 30.52, long: E 151.67). The Farm was divided into 3 farmlets of 50 ha each in 2000 (Gaden *et al.* 2004)Cattle were run as well as superfine merino ewes in a flexible 15:85 ratio on the basis of DSE. Stocking rates on the farmlets have been similar since measurements started in 2000 (approx. 7-9 DSE/ha) up until 2003.Each farmlet is described below.

Farmlet A-high input, high stocking rate. Farmlet A consists of 8 paddocks, and flexible grazing is achieved using Prograze principles where stock movement is based on estimated pasture availability. With high inputs, the initial aim in 2000 was to achieve a minimum average of 15 DSE per hectare within 5 years. The stocking rate for farmlet A was increased in early 2003 to 16 DSE/ha from 7-9 DSE/ha. Nutritional supplementation was fed to all farmlet A ewes and lambs during the drought period to reach desired target weights. The sowing of pasture is aimed at having 100% of pastures sown to deep rooted grasses and persistent legumes. During recent years, a high percentage of farmlet A has been re-sown reducing options for stock movements. The target soil phosphorus and sulfur levels of farmlet A are 60 and 10ppm, respectively.

Farmlet B- medium input, moderate stocking rate. Farmlet B also consists of 8 paddocks, and employs grazing management similar to that used on farmlet A. This farmlet aims to carry 7.5 DSE/ha. In recent years, no sowing of pastures has taken place. The target soil phosphorus and sulfur levels for farmlet B are 20 and 6.5ppm, respectively. Farmlet B ewes and lambs received periodic supplementary feed in the form of lupins during the drought.

Farmlet C-medium input, high stocking rate. Farmlet C is an intensive rotational grazing system based on high utilisation with high stocking density followed by long rest periods. The original 16 paddocks were further divided into 32 paddocks to ensure appropriate grazing pressure, pasture utilisation and rest periods. Grazing periods were 3 days on average, with the average rest period being 108 days. No recent sowings of pasture have taken place on farmlet C, but clover is at times broadcast with fertiliser applications. The target for soil phosphorus and sulfur levels on farmlet C are the same as farmlet B. Farmlet C ewes and lambs were also fed lupins over 2002/2003.

Measurements

Faecal sampling for worm egg counts occurred for monitoring purposes. Faecal egg count (FEC, eggs/g/faeces) was determined using the modified McMaster technique (MAFF, 1986) at the Elders Ltd Check-Up laboratory and from July 2002 at Veterinary Health Research, Armidale. Not all farmlets, nor all classes, were sampled at each sampling period as this was dependent on the date of the last treatment.

Anthelmintic treatment

Drenching was carried out on the basis of routine FEC monitoring although some treatments were given without a FEC monitor. All sheep on the Cicerone farmlets were given a quarantine drench prior to moving to the CSIRO shed for Shearing. The numbers of drenches given for each farmlet are given in Table 1.

Table 1: Number of Drenches given to each class on the Cicerone farmlets, Aug 2000 – June 2003

Class	Farmlet A	Farmlet B	Farmlet C
Ewes	12	13	12
Hoggets	13	10	7
Lambs	11	11	9
TOTAL	**36**	**34**	**28**

Analyses

The faecal egg count data were not normally distributed so were cube-root transformed (CubFEC) to normalise the data prior to analysis. Data selected for analysis included only those for which one or more classes of sheep (ewes, hoggets or lambs) were sampled in the same week on all 3 farmlets. CubFEC was subjected to analysis of variance (AOV, SuperAnova, Abacus Concepts, Ca. USA) within sheep class.

The effects tested in the AOV model were farmlet (A, B, C), date of sampling and the interaction between farmlet and date of sampling. Where significant main effects occurred, means were separated using Duncan's New Multiple Range test. Significant interactions between the 2 main effects were investigated by AOV for the effect of farmlet within sampling periods. A significance level of $P<0.05$ is used throughout, and means were backtransformed for presentation (with or without SE).

RESULTS

Faecal egg counts

There was highly significant interaction between the effects of farmlet and date of sampling for all 3 classes of stock, indicating that there were significant differences between farmlets, but that these were dependant upon date of sampling (Figure 1). The effect of farmlet was greatest for lambs, with lambs on farmlet C having lower mean FEC over all sampling periods than those on farmlets A or B (33, 99,144 respectively).

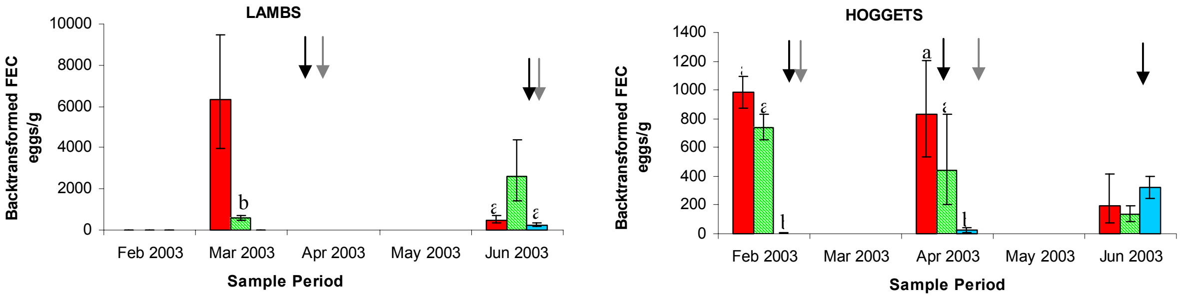

Figure 1: Mean (±SE) faecal egg count (FEC, back-transformed means) for lamb and hogget classes of sheep on Cicerone farmlets during early 2003. Farmlet A Farmlet B Farmlet C. **Point at which drench was given:** Farmlet A ↓ Farmlet B ↓ (Columns within the same sampling period not sharing the same letter are significantly different)

Larval Cultures

The larval culture results for farmlets A and B for February, March and April of 2003 in both lambs and hoggets showed that the infection was almost purely *Haemonchus contortus*. Farmlet C hoggets had 20% and 60% *H.contortus* larvae in February and April 2003, respectively. Zero larvae were recovered for farmlet C lambs in March 2003 with 93% *H.contortus* larvae recovered in June 2003.

DISCUSSION

The general hypothesis that faecal egg count (FEC) is significantly influenced by grazing and pasture management on the Cicerone project is supported by this study. The most marked and consistent effect of farmlet is seen in the latter part of the monitoring period in lambs and hoggets. All 2002 drop lambs were treated with anthelmintic (moxidectin) in December 2002. Lambs on farmlets A and B then had 2 more drenches in April and June 2003 when their faecal egg counts increased dramatically with simultaneous persistent rains. In contrast farmlet C lambs had zero FEC in late March 2003 and low nematode faecal egg counts in June 2003, 214 days after their only anthelmintic treatment. The hoggets followed a similar trend to the lambs with all farmlets having a drench in October 2002, FEC remained low until February 2003 where farmlet A and B had high FECs whilst farmlet C FEC remained very low. Farmlet A and B hoggets received a drench in February and when retested in April, again showed significantly higher FECs than farmlet C. The shorter graze periods on farmlet C probably see sheep removed before nematode eggs develop into infective larvae on many occasions (Gibson and Everett, 1976). An increase in larval mortality may also occur with greater exposure to temperature and moisture fluctuations in the shorter pasture. The long rest periods of Farmlet C probably resulted in the death of most of the infective larvae (Donald, 1967), so infection rate is low when sheep return to graze, this and drought conditions in 2002 would have contributed to low larval availability and reduced infection rate in farmlet C. The high level of *Haemonchus contortus* infection in Farmlet A and B lambs and hoggets in early 2003, and the low to moderate levels of *H. contortus* in Farmlet C suggest that the intensive rotational grazing system is especially effective against *Haemonchus* infections. This observation is significant as the incidence of *H.contortus* resistance to Closantal (one of the only chemicals that effectively control *H.contortus*) is rapidly on the increase.

Improved protein nutrition has been shown to reduce worm burdens in sheep (Steel, 2003). This phenomenon, however, does not seem to be a likely explanation for the lower FEC observed in Farmlet C lambs and hoggets. Farmlet C has a moderate input of fertiliser and no recently sown pastures, where as Farmlet A has high inputs of sulphur and phosphorus fertiliser onto sown pastures, which will increase digestibility and palatability of the pasture on this Farmlet. In-depth pasture studies of each Farmlet are currently under way.

Prior to 2003, there was no consistent pattern of farmlet effect on FEC, with all farmlets being lower or higher at different times. There was a long term trend, however, for FEC to increase over time. This can be attributed to the fact that the site for the farmlets was "clean" when the sheep arrived, as sheep had not grazed these pastures for many months. Thus, FEC rose slowly as the infectivity of the pastures increased. As FEC increased on the Cicerone farmlets so did the need to drench, with divergence in drenching patterns between farms beginning in November 2001. The fact that FECs stayed low on the farmlets until 2003 can also be attributed to drought conditions prevailing during 2002 and early 2003. The rainfall received in the New England region in late February and March 2003 is reflected in the FECs for the lambs and hoggets, which peaked at this time. This rise in FEC of lambs and hoggets on farmlet A also coincided with a doubling of stocking rate on this farmlet in early 2003 from around 8 DSE to 16 DSE.

These early results, whilst they show superiority of worm control on farmlet C, need to be interpreted in the light of contrasting data on animal liveweight change and wool growth, both of which tend to be higher on farmlets A and B (Gaden *et al.*2004). Ultimately, the Cicerone Project aims to determine the whole-farm consequences of these different management strategies so that graziers will better understand some of the complex interactions that occur when both the pasture feedbase and grazing management are altered. These integrative analyses will be the subject of future work which will determine how best to integrate parasite management strategies for the control of economically important nematodes into whole farm practices.

AKNOWLEDGMENTS
Our thanks go to Mr. Justin Hoad, the farm manager of the Cicerone Project Farmlets for collection of the faecal samples and maintenance of the records of treatments. Alison Healey is supported by an Australian Sheep Industry CRC scholarship and the Cicerone Project is supported by the Australian Wool Innovation.

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Growth of cattle in early life affects their future

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Research confirms that cattle are amazingly resilient animals. If they receive early growth setbacks they may lose some of their future growth potential, but the lasting effects on carcase yield and meat quality are very small after cattle recover on good nutrition.

This is good news for producers – it gives them the flexibility to push their growing cattle quite hard at times, knowing that setbacks need to be quite severe before they are doing serious permanent damage to their future performance or meat quality.

These were some of the conclusions from a recent meeting of key research staff from the Cooperative Research Centre for Cattle and Beef Quality (Beef Quality CRC), who have been studying these growth path effects in some detail.

Beef Quality CRC growth studies

In the 1990s, NSW Agriculture, as part of the CRC, studied the future impact of different growth rates pre-weaning and post-weaning. They followed the animals through and measured their performance in normal finishing systems on grass or in the feedlot, and conducted full analysis of carcase and meat quality.

Further experiments currently in progress in the CRC network throughout Australia are beginning to produce more practical information for producers. Here is a summary of some well-known principles and some of the new messages emerging from current work.

Compensatory growth

When cattle are held back for a period by inadequate nutrition, they lose weight, but are generally able to fully recover if they are given enough time on good feed. While they are recovering, they generally grow faster than cattle which haven't been held back previously. This is known as compensatory growth, and is well known by the practical people in the industry. For example, feedlots like to buy yearling cattle which have been held in store condition because they will gain weight faster on good feed in the feedlot.

The problem comes if the growth restriction is very severe, or happens early in life when the animal's growth potential is still sensitive to influence. In this case, permanent damage may be done, and the animal may not be able to fully compensate.

Importance of pre-weaning growth

In their first few months of life, while calves are usually on the cow, nutritional setback can be quite costly for producers. Two sets of experiments, one in NSW involving cows on low nutrition and the other in Queensland with early weaned calves, clearly showed that if calves grow at less than 0.6kg/day they will show permanent reduction in their growth potential, and be unable to show full compensatory growth. This growth rate would be equivalent to a weaning weight of about 180kg at 8-9 months.

Calves below this target will have limited ability to catch up with compensatory growth, and usually take longer to grow out on pasture to a target weight. Some calves appear to be better able to cope with setback than others, resulting in a more variable group.

The danger for producers is that apart from being poor performers, they may exceed the age limits for some markets (for example they might cut their 2 or 4 teeth before reaching feedlot entry weight). Many people have had this experience after buying lightweight coastal weaners.

Fatter or leaner after setback?

Scientists at the CRC believe that these calves suffering early setback may end up fatter later in life, compared to their well-nourished mates, if are put straight onto high energy feedlot or fattening pasture diets while recovering from early setback.

This fits the experience of feedlot operators and Victorian grass finishers buying small weaners from coastal NSW, who are familiar with them producing overfat carcases at light weights.

In Queensland or other areas where growth rates during recovery are generally slower and recovery is over a longer period, these cattle do not show the tendency to finish any fatter.

A large experiment in progress at NSW Agriculture's Grafton and Glen Innes Research Stations is studying growth restriction both before and after birth to help clarify the long term effects on growth, carcase and meat quality.

Do animals suffering setback produce tougher beef?

Many in the industry would expect a growth setback, especially if it is severe and happens early in life, to produce tougher beef. An interesting finding from the research is that when animals are finished and compared at the same age, consumers can only detect a very small effect on meat quality (tenderness) in striploin steaks.
The other side of this story is that animals with severe setback usually take longer to grow out, and if they are compared at the same slaughter weight, the setback cattle will be older. Extra age may become the significant factor accounting for any change in eating quality. Older animals produce tougher beef, but the "sweet cuts" like striploin and scotch fillet change only slightly as animals get older, while the harder working muscles with more connective tissue get significantly tougher. Extra age could have financial implications for producers aiming to meet markets with upper age (dentition) limits or to meet MSA quality specifications.

Growth after weaning

Once calves have had a good start in life and have reached about 250kg without growth restriction, they are much more able to handle a setback and compensate fully. CRC studies confirm that a moderate backgrounding growth (around 0.5kg/day) between weaning and feedlot entry results in faster gains as they compensate in the feedlot, compared to groups backgrounded at a faster growth rate (0.8 kg/day).
A Queensland experiment showed that growth restriction after weaning needed to be severe (no gain for 4 months) before it limited their capacity for compensatory gain.
A significant finding is that after cattle are finished, there is very little final difference in meat quality or proportion of saleable meat in the carcase, caused by fast or slow backgrounding growth. Any meat quality differences are mostly due to the groups with slow backgrounding growth taking longer to reach feedlot entry weight, and being older at slaughter.
The Beef Quality CRC has a series of experiments in progress across southern Australia studying a range of practical questions. See their web site www.beef.crc.org.au or contact the CRC Ph 02 6773 3501 for a summary of research findings of interest to beef producers.

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Remember the footrot trial where we looked at strains of footrot which were lab-virulent but appeared to be field-benign?

(The results of Phase I were reported in Newsletter 8, page 7, and Phase II were in Newsletter 11, page 1.)
The DNA test that was being developed by Brian Cheetham has made great progress and the following is the abstract of the paper published in Aust Sheep Vet Soc (2004) Vol 14, pages 1-5.

THE APPLICATION OF MOLECULAR BIOLOGY RESEARCH TO FOOTROT DIAGNOSIS – DEVELOPMENT OF AN *intA* DNA TEST

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Abstract
Footrot of sheep is a contagious disease caused by a mixture of bacteria with *Dichelobacter nodosus* the essential transmitting agent. Different strains of *D. nodosus* cause disease of differing severity, ranging from mild (benign) to severe (virulent) footrot. In NSW, only virulent footrot is subject to quarantine. In the initial stages of the infection, or under poor climatic conditions, it is difficult to distinguish between benign and virulent footrot. The gelatin gel test is the most widely used laboratory test in footrot control programs. This test measures the thermostability of proteases produced by the bacterium – the proteases of virulent strains are more stable after heating (gel-stable) than the proteases of benign strains. However, in NSW, gelatin gel-stable isolates which do not cause virulent footrot have been

identified. We have been using DNA technology to identify genetic differences between virulent and benign strains, and have devised a DNA test based on hybridisation to the intA gene which distinguishes gel-stable, benign isolates from gel-stable, virulent isolates. For gel-stable isolates, there is a very strong correlation between virulence and a positive result in this DNA test.

RURAL FIRES ACT 1997 - SECT 63 Duties of public authorities and owners and occupiers of land to prevent bush fires
(1) It is the duty of a public authority to take the notified steps (if any) and any other practicable steps to prevent the occurrence of bush fires on, and to minimise the danger of the spread of a bush fire on or from:

(a) any land vested in or under its control or management, or (b) any highway, road, street, land or thoroughfare, the maintenance of which is charged on the authority.
(2) It is the duty of the owner or occupier of land to take the notified steps (if any) and any other practicable steps to prevent the occurrence of bush fires on, and to minimise the danger of the spread of bush fires on or from, that land. (3) A public authority or owner or occupier is liable for the costs incurred by it in performing the duty imposed by this section.
(4) The Bush Fire Co-ordinating Committee may advise a person on whom a duty is imposed by this section of any steps (whether or not included in a bush fire risk management plan) that are necessary for the proper performance of the duty.
(5) In this section: "notified steps" means: (a) any steps that the Bush Fire Co-ordinating Committee advises a person to take under subsection (4), or (b) any steps that are included in a bush fire risk management plan applying to the land.

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