final report

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NIRS as a decision making tool for supplementary feeding

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milestone report

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MLA project title:	**NIRS as a decision making tool for supplementary feeding**
Project leader:	**Catherine Driver**
MLA project manager/coordinator:	**Gerald Martin**
Milestone number:	**Final Report**

Abstract

Members of the Condamine Beef Plan Group collaborated in this project by providing cattle and facilities, and modifying their grazing management. Data and samples were collected from six properties. Near infrared spectroscopy prediction equations for total nitrogen and phosphorus in cattle faeces were derived. These will enable producers to track the quality of the feed eaten by grazing cattle and allow them to identify when their animals are likely to respond to a protein or urea supplement.

Project objectives

1. To have 10 businesses, and their staff, trained in data collection and research techniques

2. To develop NIRS faecal analysis equations which can be used to determine when supplementation is likely to generate a positive response.
   a. Faecal Nitrogen
   b. Faecal Phosphorus

3. To investigate ways of predicting dry matter intake (DMI) using NIRS technology e.g. based on the relationship between DMI and Metabolic Faecal Nitrogen

4. Practical methods for
   a. collecting faecal samples
   b. transport of faecal samples.

5. To simplify and improve accuracy of decision making of supplementary feed options through a cost-benefit analysis of different options.

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Success in achieving milestone

Materials and Methods:

1. **Training in data collection and research techniques**: a meeting of the Condamine Beef Plan Group was held on 16 February, 2007 at Condamine. The group members were addressed by their UQ research counterparts who outlined the project aims, and described the methods that would be used. Particular attention was given to the grazing management requirements. These were: (1) the types of cattle (breed and type) and forage (pasture or forage crop) to be monitored at each property were to be nominated by the owner/co-operator; (2) these animals were to be stocked on the nominated forage by the owner for the whole of the measurement period; (2) each measurement period was to be of 6 weeks – 2 weeks to allow digestive tract physiology to adapt to the feeding regime, and the following 4 weeks to allow an adequate measurement of growth. The methods of sample and data collection were described.

2. **Development of faecal NIRS equations:** data was collected from herds on six properties in 2007 and from herds on two of these properties in 2008.

   - **Forage types**: included buffel grass, lime bush, bambatsi and native grass including blue grass.

   - **Cattle**: The cattle involved in the study included growers, ranging in weight from 154 kg through to 550 kg, representing ages from 6 months to 30 months. The majority of the growers on the properties were bought in cattle and the actual age of the cattle was unable to be determined due to the unknown background of these cattle.

     - Grower breeds represented Bos indicus, Bos Taurus and their crosses with Hereford, Angus, Hereford x Angus, Santa Gertrudis, Charolais, Santa x Charolais, Braford, Hereford x Charolais, and composite breeds. Male and female growers were represented within each breed.

     - Breeders included Hereford, Angus, Hereford x Angus, Charolais, Santa Gertrudis, Brahman and composites of these breeds. Whilst the breeders were involved in this study generally, they were not involved in the average daily gain (ADG) area of the trial due to various stages of pregnancy and the affect of this on the end results.

   - **Growth measurements**: cattle were weighed directly from the paddock (i.e. without any curfew). Average daily gain was calculated from weights taken before and after a 4-week growth period. Care was taken to ensure that the cattle were mustered and treated the same, on a herd basis, on consecutive weighing days.

   - **Body condition scoring (BCS):** scores were made at the two weighing times using the 9-point scale of NRC (2000).

   - **Faecal sample collection and processing:** samples were obtained from the rectum, stored in sealed plastic bags and transported to the lab for processing within 48 h of collection. Prior to NIR spectroscopy the samples were dried at 60 ^{o}C for 48 h, and then milled (0.5 mm screen).

- **Chemical methods:** dry matters were determined by drying in a forced draught oven at the 100 ^{o}C for 14 hours. Total N was determined in dried and milled faecal samples by the Dumas method (Leco N analyser, Leco Inc., Germany) and total P was determined by AES-ICP analysis.

- **NIR spectra capture and chemometrics**: the milled samples were redried (100 ^{o}C for 4 h) then read in a Bruker MPA spectrometer. Mathematical pre-processing and equation derivation were done using the OPUS software. Equations were derived and tested by cross-validation using R^2, SEP and SECV as indicators of equation quality.

3. To investigate ways of predicting dry matter intake (DMI) using NIRS technology e.g. based on the relationship between DMI and Metabolic Faecal Nitrogen

- **Cattle:** The cattle consisted of 120 *Bos indicus* steers ranging in live weights from 254-482 kg (fasted weight with a mean live weight of 389.16 kg). The cattle were housed in 12 pens at the University of Queensland Centre for Advanced Animal Science (CAAS).

- **Treatment allocation:** 4 x 3 factoral study (4 treatment x 3 replications per treatment) (Gaughan 2009). Four lick blocks were used,. The twelve pens were randomly allocated to four levels of supplementation.

- **Nutrition:** Rhodes grass hay (Table 1) was made available and fed out every morning at the same time, with refusals removed and weighed prior to each new allocation. DM, OM, N, NDF and ADF were determined on diet grab samples an refusals. The results of which are set out in Table 1.

Table 1. Nutritive value of Rhodes grass hay used in the study

Item	Value
Crude Protein, %	4.4 - 5.2
OM [1] Digestibility, %	50.2 - 51.6
ME [2] MJ/kg OM (estimated)	7.2
NDF [3]	69.7 – 74.3
ADF[4]	39.3 – 40.4
Ash	15.2

[1]OM – Organic Matter, [2] ME Metabolisable Enerby, [3] NDF Neutral Detergent fibre, [4] ADF Acid Detergent Fibre

Data Collection: Cattle were weighted on a weekly basis from 26th May 2008 to 7th August 2008. Each pen was weighed at the same time each week. Rectal faecal samples were collected three times during the trial, 25th June, 7th July and 6th August 2008. All cattle were included in the study, though samples from all cattle at each collection period were not obtained due to cattle being empty of faecal material in the rectal area.

Faecal sample analysis: All samples were dried and treated as per previous faecal samples with regard to NIRS analysis using Faecal N predictive equations. Sub-samples were taken and analysed for NDF, NDFN and calculations made for MDF.

4. **Development of practical methods of obtaining faecal samples**:

a. Faecal samples were collected both from the rectum and the paddock of the same herd on the same day. A total of 10 paddocks samples were collected as a representation of the total herd. A total of 103 rectal samples were taken. All cattle per de-pastured in the same paddock and mustered into the yard for sampling at the same time.

b. Rectal samples from 48 cattle were given a range of treatments designed to reflect possible scenarios following on-farm faecal collection of wet samples, to be transported to laboratory for analysis.

Cattle: Forty-eight head of mixed sex and breeds were used in this trial. See Table 2 below.

Table 2. Properties and cattle types used in the sample handling trial

Property	**Sample no:**	**Breed**	**Class***	**Time collected**
Wonga Dell	10	Bradford	B,C,H,S	11.30am
Grace Park	18	Hereford, Hereford Cross	C,H	1.30pm
Burradoo	20	Santa, Santa Cross, Angus	H,S	4.30pm

*B (Bull), C (Cow), H (Heifer) S (Steer)

The treatments were: (i) a control treatment in which the samples were oven-dried (60 ^{o}C for 48 h) commencing within 6 h of collection; (ii) frozen for 4 days, then thawed and oven-dried; (iii) air-dried for 4 days at ambient temperature, then oven-dried; (iv) stored in a plastic bag at ambient temperature for 4 days, then oven-dried; (v) stored in a plastic bag in a refrigerator for 4 days, then oven-dried.

Results:

1. **Training in research techniques:** the objective of this part of the project was to make potential co-operators aware of the research methods to be used, and of the constraints that this would place on the management of those cattle which were in the trials. As there was no difficulty in carrying out the individual property trials, we consider that this aspect of the project was achieved.

Collaborating producers were made aware of the OH&S limitations to rectal sampling, e.g. penetration no deeper than wrist length, also the need to validate animal identification and data recordings. Continual verification of which was a part of each data collection period.

*"We would like to be part of the trial but we understand that we have to maintain the stock on the same feed for the duration of the trial or there isn't any point in participating "*Geoff and Sue Riley. (CBPG 2008).

"The changing weather conditions and subsequent market changes make it difficult to adhere strictly to the trial conditions" Wes Sloan. (CBPG 2008).

"We understand the critical nature of adhering to the trial rules, otherwise the data just isn't valid" Nelson Neal. (CBPG 2008).

"It is important to have the same people weighing and scoring for body condition each time" Neil Coggan. (CBPG 2008).

2. **Development of faecal NIRS equations:** the mean BCS, growth rates and faecal N contents from each co-operating property on a whole of herd basis are reported in Table 1.

Table 3. BSC and Liveweight (LWT) in relation to mean Faecal N content

Property	Mean BCS Change	Mean LWT change	Mean Faecal N %
NC	0.08	-7.45	1.36
DC	0.44	17.05	1.5
MN	N/A	5.5	2.09
JC1	-0.33	0.38	1.85
WS	-0.13	-4.65	1.64
JC2	-0.94	-94.5	N/A

Attempts to predict growth rate from the faecal NIR spectral data were not successful. There was insufficient variation in BCS to allow the fitting of valid equations.

Equation statistics for growth, based on the data collected in 2007 were R^2 = 0.0517 (growth g/d; SEP = and SECV = R^2 = 0.0517 (growth g/kg$^{0.75}$ per day; all samples for 2007, SEP = and SECV =). Samples from a property collected in 2008 as there was not enough change in liveweight on each individual property, though there was between properties, but the pastures were different.

The samples collected in 2007 were used to develop equations to predict faecal total N, P, S, Na and Cu. The development of predictive equations for S, Na and Cu were not as robust as those for N and P. See figures 1-5 below.

Figure 1. Faecal N Equation.

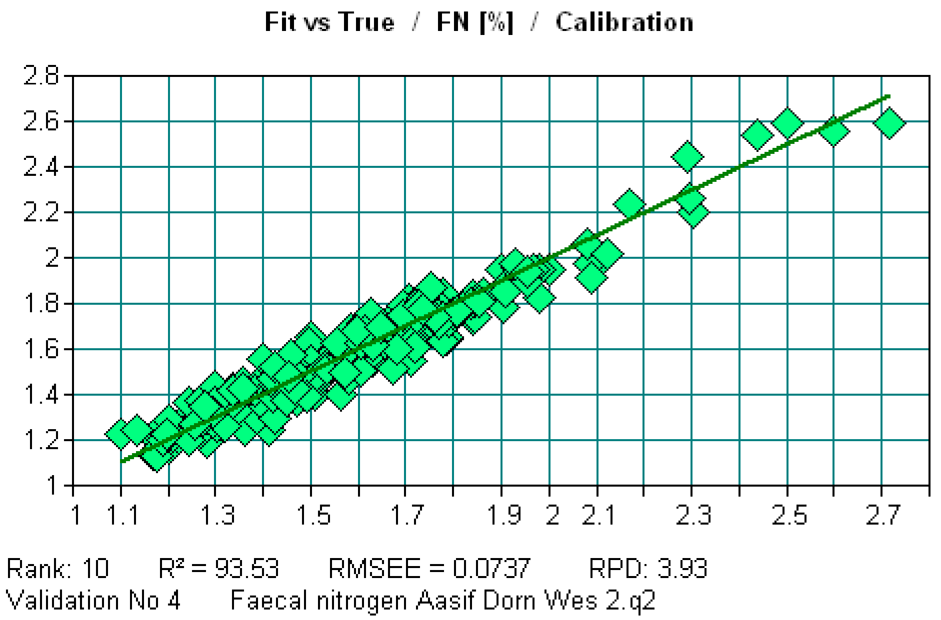


Figure 2. Faecal P Equation

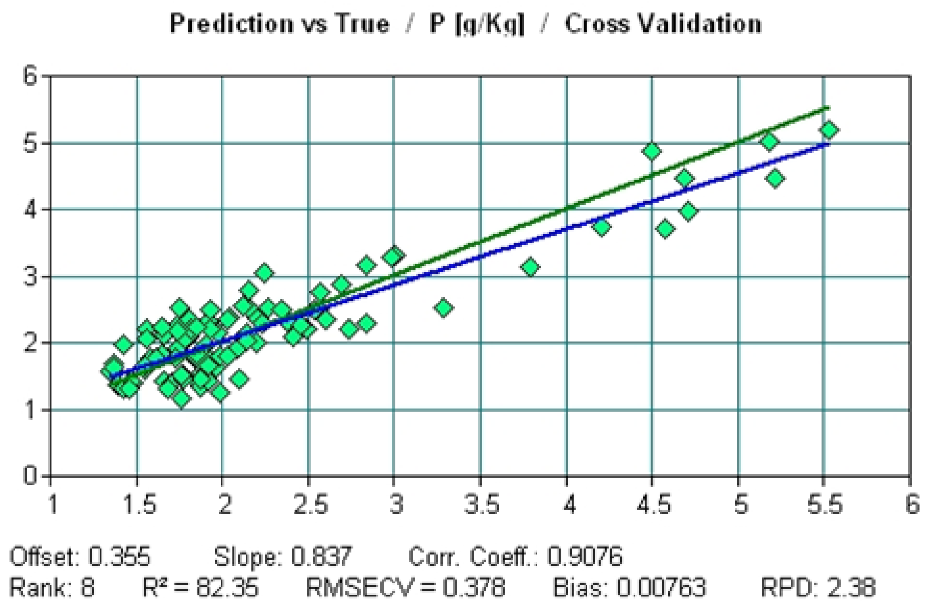


Figure 3. Faecal S Equation

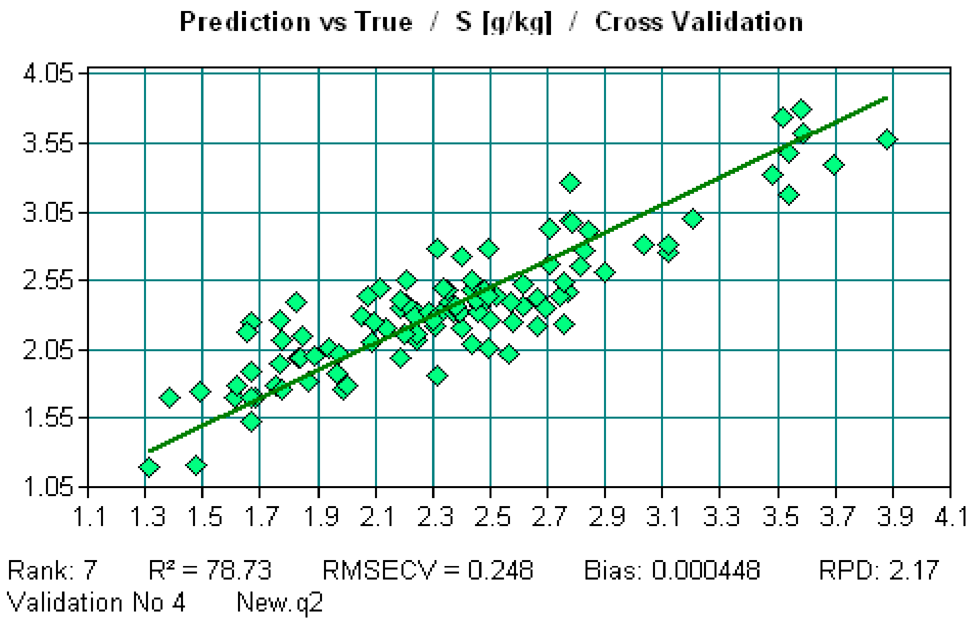


Figure 4. Faecal Na Equation

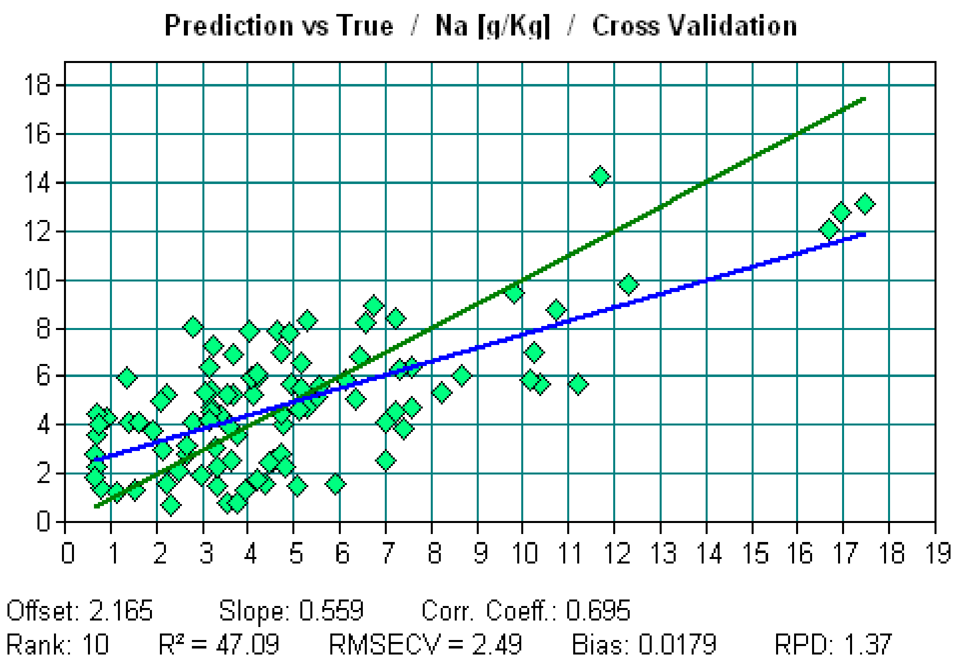
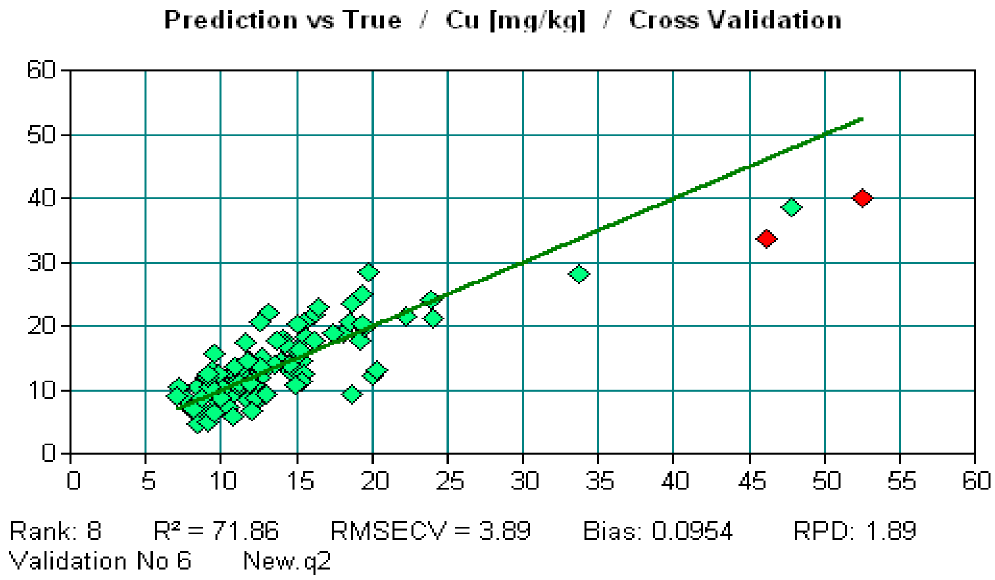
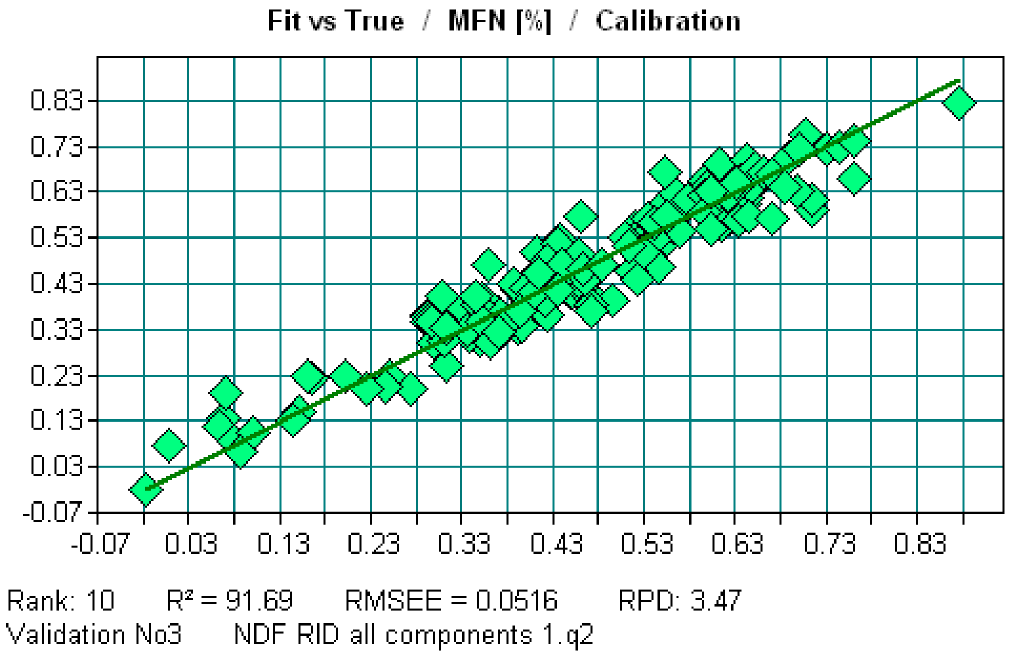


Figure 5. Faecal Cu Equation



3. To investigate ways of predicting dry matter intake (DMI) using NIRS technology e.g. based on the relationship between DMI and Metabolic Faecal Nitrogen.

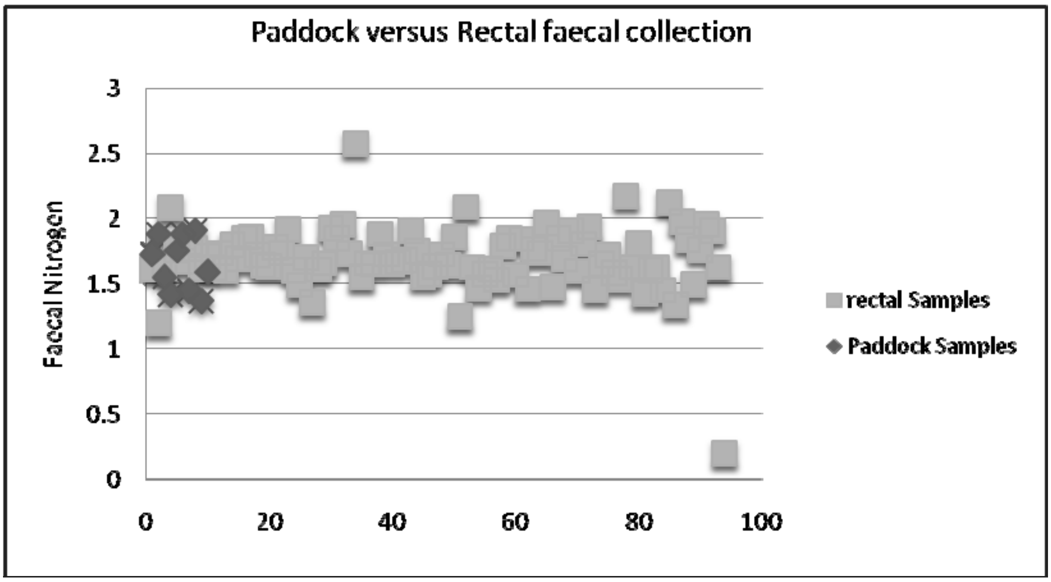
Figure 8. Faecal MFN Equation



4. Development of practical methods of obtaining faecal samples:

    a. There was no significant difference between the faecal N content of samples taken from the paddock as opposed to rectal sampling as shown in Figure 6 below.

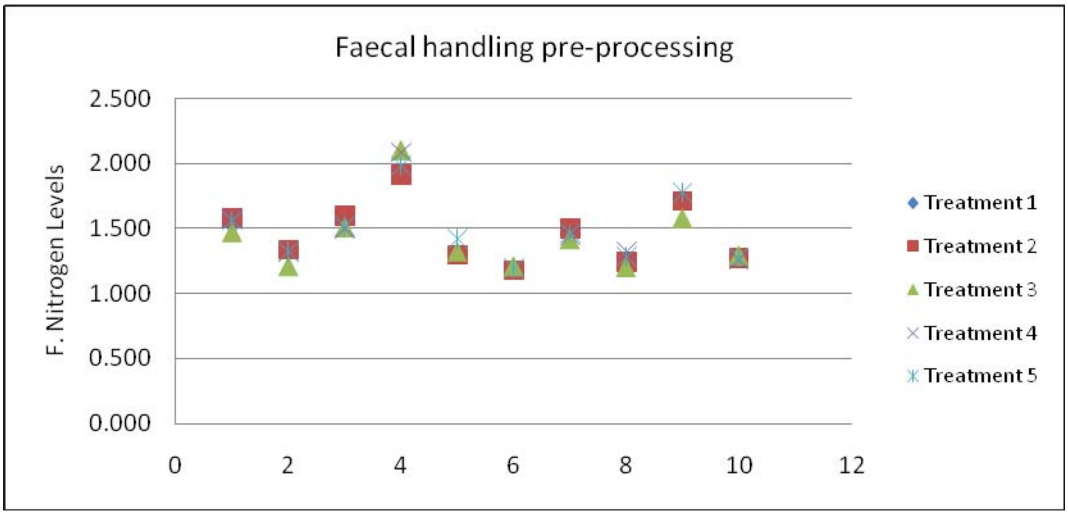
Figure 6. Paddock versus rectal faecal collection faecal N content.



The Faecal Nitrogen levels (determined by the Dumas method) from the paddock samples ranged from 1.367% to 1.907% Nitrogen (AVE 1.671%, STDEV 0.205%). The samples collected fresh from the rectum ranged from 1.198% to 2.575% Nitrogen (AVE 1.710%, STDEV 0.202%).

    b. There was no significant difference (P = 0.017) between post-collection pre-processing treatments on individual faecal N levels (as determined by the Dumas method) See figure 7 below.

Figure 7. Faecal pre-processing effects on faecal N content.



The faecal N ranged from 1.187% to 2.007% (average) between individual samples. STDEV 0.017 to 0.09 between treatments for individual samples.

5. To simplify and improve accuracy of decision making of supplementary feed options through a cost-benefit analysis of different options.

   The group were unable to follow through on the monitoring of liveweight changes based on supplementation decisions as all members were subjected to drought conditions for the duration of the trial.

   This restricted the ability of collaborators to maintain animals on the same paddock/pasture for more than the four to six week period needed for the initial trial phase.

   However, the level of faecal N gives an indication of whether the cattle would respond to urea supplementation (Winks et. Al. 1979). The faecal N across the trial ranged from 1.10% - 2.96%, with animals recording below 1.3% unable to maintain liveweight.

   According to Winks et. al. 1979,these animals would positively respond to a supplementation of urea. At a cost of $1.50 per week to supply loose lick supplementation which supplies 300gm per day consisting of 20% urea, 30% salt, 2.2% phosphorus, 4.4% calcium, 3% sulphur, 30% copra meal and a mineral mix.

   The Eastern Young Cattle Index (EYCI) during June 2007 was 335 cents. With steers dressing an average of 54% this would mean that cattle would only need to put on 0.829 kg per week to break even with the cost of the above supplementation. Any gains in liveweight over this would be a profit.

   Whilst no direct cost-benefit observations were made, one member had experienced a loss of 120 breeders from their herd during the trial period. This loss could have been avoided with optimal supplementation.

With supplementation calculated at $1.50 per head per week. In a herd of 500 head this equates to $39,000 per annum. .

A 5% loss of breeders would be considered on the high side. Yet using this figure a saving of 95 breeders (120 head less the 'normal' 5% loss of 25 head) at an average of $500 per head would have resulted in a saving of $47,500 in breeders and $26,600 in weaners, at an 80% weaning rate.

Therefore the cost of $39,000 in supplementation could have saved $74,100 in losses giving a cost benefit of 1:1.9, or almost double the benefit for each dollar invested in nutrition.

Discussion:

We have not yet successfully predicted growth rate from the NIR spectra. Coates (2004) who generated an equation for grazing cattle with R^2 = 0.88 but an SEP = 0.2 kg/d. Dixon (2008) and Dixon and Coates (2008) found that they could not predict growth accurately if cattle were grazing pastures different to those in the calibration data set.

It is possible that more data collected from a wider variety of forages may give a better equation, but this has yet to be tested. Other potential confounding factors include pasture height and bulk density, forage nutritive value, the animal's individual post-ingestive feedback experience, compensatory growth, and physiological status.

One of the limitations to on-site data collection for live weight changes was the differences between management styles and equipment for weighing cattle. Equipment ranged from ad hoc scales to full crush scales. The latter being the more accurate as they did not depend on the animal's being totally centred in the crush itself.

It was also evident that the more stress the animals were subjected to the greater the possibility of voiding prior to reaching the scales for weighing. Therefore confounding the validity of the liveweight change due to digestive tract fill.

While these factors do not invalidate the possibility of using F.NIRS in predicting growth, they suggest that equations may be quite specific in their application. It is concluded that NIR prediction equations for liveweight change are not global, but highly local on a per property basis.

We have successfully developed an equation to predict total N in faeces, and this facility has been made available to the Beef Plan group members (members were notified at a meeting of the Group at The Gums on August, 2008). Members will be able to monitor the N content of their animals' selected diets and decide when to implement an N supplementation program.

The underlying principle is that grazing cattle are likely to respond positively to supplements which provide ruminally available N (either urea and other NPN supplements, or supplements rich in ruminally degradable protein) when faecal N contents fall below 1.3 to 1.4 % (DM basis) (Bredon et al 1963; Arman et al 1975; Winks et al 1979; Addison et al 1984; Foster and Blight 1984; Van Soest 1994; Wehausen 1995). This faecal monitoring approach to supplement management is not widely used because standard "wet-chemical" faecal analysis methods are timeconsuming and expensive. NIR spectrometry is a rapid and inexpensive alternative if suitable prediction equations are available.

The Dry Matter Intake (DMI) of steers has been shown to have a direct relationship with the Metabolic Faecal Nitrogen output (Hutchinson and Morris 1936, Titus 1927). Titus observed a relationship of 0.34g/100g DMI though Hutchinson and Morris reported the relationship was more in the range of 0.45g/100g DMI.

Hutchinson and Morris further observed that MFN varied with liveweight in cows at the rate of 0.039g/kg of liveweight.

Therefore it would be reasonable to assume that a sound relationship between MDF and DMI could be developed which would assist producers in the prediction of liveweight gains based on both DMI and faecal N content.

Rectal sampling was used throughout this project to ensure the integrity of the samples tested, but this technique is not suitable for routine use. There is a small risk to the animal, and the animals must be restrained. In practice, faecal profiling will be based on samples collected from the paddock. For this to be accurate, we need to know if there are important changes in faecal chemistry between voiding and collection, and between collection and arrival at the NIR lab.

Comparison of the average faecal N content between samples collected direct from the rectum and those collected from the paddock where the same animals were de-pastured showed no significant difference. Therefore it is expected that fresh paddock samples are able to be used for the purpose of determining the faecal N status of the herd.

However, recommendations from laboratory technicians (Symbio 2008) suggest it is sufficient to dry the samples on site and then mix the samples to enable a small sub-sample of the faeces to be sent to the lab for analysis.

It is recommended that this procedure would not give a sample indicative of the whole herd, as the range in faecal N can be significant within the herd and the ability to sufficiently ‘mix’ the dried samples to give a representation of the ‘herd average’ is in doubt.

Validation of the uniformity of faecal N content across the whole of the sample has not been made. Though initial sub-sampling has shown differences within the same sample which compounds the sub-sampling of on farm paddock sample collections. This needs further investigation.

Our preliminary testing of the effects of sample handling methods supports data published by American workers (Jenks *et al* 1990; Leite and Stuth 1994) that there is little change in faecal chemistry for up to 24 days after voiding. However, this work was done with deer and goat pelleted faeces. Faecal stability was tested under Queensland environmental conditions as Coates (1998) reported that cattle NIR predictions may change when samples are transported for long periods under tropical conditions.

Faecal samples left on a bench in a temperature range of 28^{o}-30^{o} C showed no significant difference in faecal N content with samples from the same animal sent directly to be processed as per laboratory specifications.

We have not yet validated the cost-benefit of faecal N monitoring though we have hypothesised. However, if responses in southern Queensland are similar to those reported from users of F.NIRS profiling in the USA, we can expect that there will be an annual benefit equivalent to at least $30 per breeder (Eilers 1999), even without allowing for the marked increase in supplement costs in the last ten years.

From the producer's point of view

The aims and desires of the group were to develop a tool where the condition of the cattle could be assessed via a faecal sampling technique, to identify nutritional deficiencies in feed before it is easily observed through visual assessment.

Most producers are familiar with Body Condition Scoring (BCS) and whilst they are confident in using this technique for grown stock, it is considered inefficient when growing out young cattle.

Moving cattle through yards and weighing them monthly is also considered a costly exercise both due to the labour involved and the disruption to the normal feeding pattern of the animals.

However, it is important to maintain weight gain when optimising returns from young cattle, both for profitability of the enterprise and meat quality.

The group focused on the development of an equation which would directly relate animal growth to facecal sampling. It was then envisaged that this equation would identify when animal nutrition was inadequate and supplementation would benefit the animals.

"I want to find a simple tool I can use to let me know when the cattle are not going ahead so I can sort the problem out quickly" Murray Nitschke.

"If one BCS is worth 50+kg of weight then I am already behind the eight ball by the time I can see the weight loss in my breeders" Catherine Driver

"We put lick out as a matter of course, but how do I know when it is a waste of money and when it isn't?" Clifford Neal

These types of questions were what the group was trying to answer through this PIRD.

Did the group achieve the results they were looking for?

The answer is yes and no. We were looking for an equation which would tell us if there was a likely weight change, in which direction and at what rate.

What we managed to do was develop an equation which gave a guide to the animal's nutritional status for maintaining weight, based on past research findings of the faecal nitrogen levels.

We managed to show that we can pick up fresh manure in the paddock, have it analysed and from that determine if the animals are receiving a level of nutrition adequate for weight gain.

What we could not do was to develop an equation which told us the rate of weight change. Therefore, the level of supplementation that was required to reach a specific weight gain target was not possible through faecal sampling.

However, what the research did give us was a tool which can be used to determine at what point in the season the nutritional levels fall below maintenance level, and therefore, when supplementation would be critical for maintaining body condition.

This has been useful when seasonal conditions have changed and the expected 'normal' seasonal response is in doubt. The use of faecal profiling to determine the change in the pasture nutritional status builds on the experience that cattle producers gain from past experience.

There are some producers who access agistment country on a regular basis, often this country has unknown nutritional qualities. The group concluded that assessing the faecal samples one to two weeks after placing stock on new country would enable them to assess the nutritional status of that country and correct any deficiencies well before visual assessment indicated a problem.

This is particularly useful where there are several land types in the one paddock and it is not viable to do soil tests or pasture sampling to determine the nutritional status of the pasture.

Faecal sampling also gets around the problem of determining what an animal selects to graze on. A past PIRD project undertaken at "Booka", Morven by Michael McKellar showed that whilst cattle had access to a predominately Buffel grass pasture, their dietary intake included up to 25% of browse.

What changes members have made as a result of doing the project?

Some of the members saw the research as a failure, in that the results did not come out the way we all wanted.

Understanding that research does not always give a favourable result was a revelation to most of the group members. Consequently some members saw the exercise as a ‘waste of time’.

Especially as individual members production systems were interrupted from their involvement in the trial which required them to withhold supplementation to stock included in the trial. This disrupted production targets for the length of the trial.

Many members are reluctant to be involved in further research trials without some assurance of the outcomes. However, not all members held this view as there were those who understood the complexities of research and the inability to predict the outcome of research.

Some members understood that research also included trials which enabled options to be excluded from research parameters. All those members who participated in the trial became more aware of the time and procedures necessary to undertake research and how the weather can play a part in sabotaging the best plans.

Group members have reacted differently to the findings of the trial. Generally members have acknowledged that optimising production requires a sound knowledge of animal nutrition. Not everyone was confident they were able to gain the required knowledge to drive their own systems.

Whilst all have had to take a serious look at their individual production systems, some have utilised the expertise of qualified nutritionist to formulate individual supplementation rations to increase production targets.

Those members which were more confident in their ability to learn the necessary skills to manage the nutritional status of their herds indicated their willingness to utilise faecal profiling using NIR as a tool to aid in when to supplement and, with the aid of nutritional advice, what to supplement with.

“I can see the benefit of doing faecal sampling as the pasture changes to make sure I have the right lick out and stop the cattle losing weight” Murray Nitschke .

“I will likely use the faecal sampling to see how cattle go on new agistment country to make sure I have the right lick out and that the cattle don’t go backwards” Andrew Pauli.

Changing your bottom line

Becoming more aware of the impact of nutrition on the production system has mean all members have re-evaluated the emphasis they put on the quality and composition of supplementation.

One member had experienced a loss of 120 breeders from their herd during the trial period. This loss could have been avoided with optimal supplementation.

With supplementation calculated at $1.50 per head per week. In a herd of 500 head this equates to $39,000 per annum. .

A 5% loss of breeders would be considered on the high side. Yet using this figure a saving of 95 breeders at an average of $500 per head would have resulted in a saving of $47,500 in breeders and $26,600 in weaners, at an 80% weaning rate.

Therefore the cost of $39,000 in supplementation could have saved $74,100 in losses giving a cost benefit of 1:1.9, or almost double the benefit for each dollar invested in nutrition.

Seminar

A seminar on the outcomes of the trial was held at the Condamine hotel and was open to the group members as well as the public.

A presentation of the significance of the research findings and how they can be applied on farm, was given by Catherine Driver. Steve Banney, MLA, attended the day along with several non-member producers.

A simple scenario where cattle had lost one BCS and then had to make this up through supplementation, was presented to the group. The cost of different options and the time it took to regain this weight was a significant incentive for producers to re-evaluate NIR as a management tool.

Sampling kits for faecal profiling from Symbio Alliance were handed out at the meeting with an example of the typical analysis undertaken at the lab and the way the results are interpreted and recommendations made to the producer.

Producers were encouraged to learn to read the results themselves to build on their own skills. However there was a strong sentiment that the recommendations would be left to the ‘skilled animal nutritionists’ and that the sampling could certainly enhance this process.

Comment on the organisation and management of PIRD.

It was the groups experience that the PIRD was supported by Gerald Martin on behalf of MLA in a very professional manner.

However, the organisation and management of the trial itself was undertaken by Dr Gordon Dryden from University of Queensland Gatton Campus, and it is not possible to ascertain how the PIRD would have been managed differently by MLA directly.

As the research officer for the group, I would not recommend another group undertaking their own trials without a clear commitment from all group members, including an understanding imparted to each member of the potential disappointment in not achieving a positive outcome.

Trials which involve more easily understood technology would have greater impact on group members. Where there are simple cause and effect type trials, e.g. wind break widths on pasture establishment or longevity.

I am of the opinion that when a major part of the trials are actually undertaken off farm, then the results are hard to grasp and the impact of the trial itself not appreciated.

Also, trials which involve high levels of technology require more rigid experimental design and therefore the need for more exact replications. This trial showed that the best intentions and most careful planning does not ensure successful outcomes.

The group is not interested in running any further trials at this time. It would only be an option where the group had a burning desire to answer a question which was local and relevant.

Doing it differently

An alternative trial program would have been to follow two group members production systems of similar nature e.g. backgrounding steers, and doing faecal profiling on a monthly basis for one year. Coupling this with pasture sampling and soil tests, and monthly cattle weighings.

Faecal profiling would have been fresh out of the paddock from a representative sample rather than rectally as this would have created less disruption to the cattle.

More regular weighings would have minimised the gut effect of the cattle on weights. Also the cattle would have become less stressed with the process over time and therefore voided less prior to weighing.

Selecting only properties using a weighing system which weighed the whole crush, rather than having to wait until the animal settled and stood still long enough to have their weight taken.

The properties would then become PDS which would have been investigated with regard to how the faecal profiling helped in decision making. The cost benefit analysis could then have been very specific as each decision alternative would have been costed and the benefits specific rather than general.

It is my opinion that this would have given the group members a more concrete experience which they would have been more involved with and taken an active role in. This would have had a ‘real experience’ effect, which is what PIRD’s are all about.

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Overall progress of the project

Funding available from two other projects, not funded by MLA, has allowed extension of the original scope of this PIRD and consequential testing of these samples.

In addition to total N, we have developed equations to predict faecal P and S concentration and MDFN.

Recommendations

It is recommended that PIRD trials be based more on a hands-on basis, much more in the line of Producer Demonstration Sites (PDS), where individual decisions are made on a whole of group basis.

That the concept of research where a positive outcome equates to success, is thoroughly understood by all group members, through the training process. That the science basis of the project be translated into lay man terms, to the extent that it is clearly understood.

That in the design of the project, the cost-benefit analysis be strongly developed and that this is used as the main drive of all projects, and therefore group meetings and decision makings in regard to the project be centred around this focal point.

With regard to further research it is recommended that the work done on MDF using NIRS technology be further investigated especially to further validate the relationship between MDF faecal content and DMI.

Considering the work CSIRO is undertaking with regard to Methane output from livestock production, and the initial correlations between DMI and Methane production, it would appear that NIRS technology could cheaply be used to monitor Methane production on an individual property basis.
MDF faecal content could also have a relationship to growth rates and pasture supply, which also needs to be further investigated.