Alberta Sheep Breeders' Association

2011 Alberta Sheep Symposium

October 21 to 23

Executive Royal Inn

Leduc, Alberta

Welcome to the 2011 ASBA Symposium

Friday, October 21

Registration desk open, **4 to 10 p.m.**
Trade Show, **6 to 10 p.m.**
Memorial Scholarship Silent Auction opens at **6 p.m.**
Opening remarks, **6:30 to 6:45 p.m.**
Richard Apps, ***Hope Is Not a Strategy, Plan for Success***, **6:45 to 7:45 p.m.** (*Page 1*)
Woody Lane, ***The Big Decisions: Managing High Input Costs***, **7:45 to 8:45 p.m.** (*Page 5*)
Meet all of the speakers, welcome reception, **8:45 p.m. to 10 p.m.**

Saturday, October 22

Coffee/Breakfast, **7:30 to 9 a.m.**
Memorial Scholarship Silent Auction opens at **8 a.m.**
Trade Show, **8 a.m. to 4:45 p.m.**
Registration desk opens at **7:30 a.m.**
Richard Apps, ***Capable and Confident Producers***, **9 to 9:45 a.m.** (*Page 13*)
Richard Apps, ***Wean More Lambs***, **9:45 to 1030 a.m.** (*Page 17*)
Break, **10:30 to 11 a.m.**
Sue Hosford and Tony Stolz, ***More than Traceability***, **11:00 to noon** (*Page 21*)
Lunch, **Noon to 1 p.m.**
Alberta Lamb Producers Forum, **1 to 2 p.m.**
Break 2 to 2:30 p.m.
Woody Lane, ***Intensive Forage Management***, **2:30 to 3:45 p.m.** (*Page 33*)
Louise Liebenberg, ***No Feral LGD for Me, or My Stock!***
(Training a Livestock Guardian Dog), **3:45 to 4:45 p.m.** (*Page 43*)
Break, **4:45 to 5:30 p.m.**
Banquet Program, Reception, **5:30 p.m.** (Tickets required for admission.)
Dinner, **6 p.m.**
Ben Crane, **8 p.m.**
Memorial Scholarship Auction, closes **8:45 to 9 p.m.**
Memorial Scholarship Auction successful bidders announced, **9:30 to 9:45 p.m.**

Sunday, October 23

Coffee/Breakfast, **7:30 to 9 a.m.**
Trade Show, **8 a.m. to 2 p.m.**
Woody Lane, ***Untangling the Basics of Feeding Vitamins and Minerals***, **9 to 10 a.m.** (*Page 53*)
Break, **10 to 10:45 a.m.**
Karen Bannow, ***Finding Those Empty Ewes***, **10:45 to 11:45 a.m.** (*Page 65*)
Lunch, **11:45 to 1 p.m.**
Richard Apps, ***Gain from Genetics***, **1 to 2 p.m.** (*Page 69*)
Greg McKinnon, ***Trapping Coyotes, the Keys to Success***, **2 to 3 p.m.** (*Page 73*)
Closing, **3 p.m.**

ASBA and ALP directors invite you to join them in Hospitality Room 208 for a quiet time to visit, after 10 p.m. on Friday evening, and after the Banquet Program on Saturday night. Refreshments will be available so you won't get thirsty!

SPEAKERS

Richard Apps

Hope Is Not a Strategy, Plan for Success
Capable and Confident Producers
Wean More Lambs
Gain From Genetics
Presentations sponsored by Alberta Lamb Producers, Alberta Livestock and Meat Agency Ltd. and the Government of Alberta.

Richard Apps comes from a family farming business in northern NSW running 800-1,000 head of mixed age cattle covering breeding, backgrounding and finishing. He completed a Bachelor of Rural Science degree at the University of New England. He worked in the cotton industry for a short period before an extensive period of international travel—which included Canada and about a month on a ranch at Consort, Alberta. Upon returning from travelling he joined the Agricultural Business Research Institute (*http://abri.une.edu.au*) where he spent about 10 years as an Executive Officer for a range of beef cattle seedstock societies.

From there, Richard moved to central Queensland to establish a northern beef seedstock project—Tropical Beef Technology Services (TBTS)—to deliver technical breeding program advice and development of genetic evaluation among the northern Australian beef seedstock industry—northern Australia produces about 60% of Australian beef production. The project is still running, and more recently has been extended to cover the southern Australian beef industry. Richard left TBTS and joined Meat & Livestock Australia in 2002, focussing on genetic evaluation and extension, and linking R&D outputs to delivery to sheep producers.

In 2008 he transferred internally in MLA from managing the Sheep Genetics (*www.sheepgenetics.org.au*) program (servicing some 800 ram breeders) to managing extension and adoption activity for sheep R&D nationally. This year Richard also assumed responsibility for southern beef extension and adoption activity.

Woody Lane

The Big Decisions: Managing High Input Costs
Intensive Forage Management
Untangling the Basics of Feeding Vitamins and Minerals
Presentations sponsored by Alberta Lamb Producers.

Woody Lane is a nationally-known livestock nutritionist living in Roseburg, Oregon. He owns and operates an independent consulting firm, "Lane Livestock Services," teaches courses in forages and livestock nutrition to ranchers in the area, facilitates three forage study groups for farmers, and writes a popular monthly column called "From the Feed Trough..." for The Shepherd magazine. Woody earned his Ph.D. and M.S. degrees in Animal Nutrition at Cornell University and has published over 25 scientific, peer-reviewed research articles on sheep and cattle production. He worked on the famous Allegheny Highlands Project in West Virginia from 1978-1980, and in the 1980s, was on faculty at the University of Wisconsin as the State Extension Sheep and Beef Cattle Specialist. He has made his home in Oregon since 1990.

Woody is an expert on nutrition, pasture management, and grazing techniques. He has been a featured speaker in scores of nutrition and forage workshops across the United States and Canada, and has worked internationally in New Zealand and Macedonia. In the past few years, he has helped develop the well-known "SID Sheep Produc-

tion Handbook", been the operations manager for the American National Sheep Improvement Program (NSIP), and together with the popular veterinarian Don Bailey, developed an instructional set of three videotapes called "Lambing Time Management."

Louise Liebenberg

No Feral LGD for Me, or My Stock! (Training a Livestock Guardian Dog)

Louise Liebenberg was born and raised in South Africa, where her love and interest in all animals and nature was nurtured. Her menagerie of birds, reptiles, horses and other animals included dogs which she trained to a very high level.

While travelling in Europe, where she worked on various sheep farms in Scotland and the Netherlands, she met Eric Verstappen. Together they were active in raising and training border collies, competing with them in trials all over Europe. In 1992 they started a grazing company and were hired, with their flock of sheep, to graze nature areas, dykes, military grounds, parks, golf courses, heather regions and grass lands. They built up an extensive organic grazing company and advised in many other projects of this kind. They also acquired their first livestock guardian dog in 1992 after suffering through many pet dog attacks on their sheep.

In 2008 they moved with their two children to High Prairie, Alberta, where they have established a commercial sheep ranch and continue to raise and train their border collies and Šarplaninac livestock guardian dogs. In her spare time, Louise writes freelance for a number of Dutch dog magazines and a small local agricultural newspaper in the Peace Country.

Tony Stoltz

More Than Traceability

Tony was raised on a farm north west of Calgary, Alberta. He has a BA degree from the University of Calgary and is a Certified Management Consultant. In 1999 Tony and his wife, Toby Williams, purchased 50 ewes which grew to a flock of over 200 ewes and 450 lambs before they sold in 2005. Tony was the General Manager of the Alberta Sheep and Wool Commission (now Alberta Lamb Producers) from the summer of 1998 to August 2001, at which point he began his own consulting business specializing in rural economic development and agriculture. Tony is currently a member of the Alberta Lamb Traceability Pilot Project (LTP) team working as project and analysis coordinator and analysis coordinator, exploring sheep enterprise costs of production as well as the costs and benefits of RFID management and traceability systems.

Susan Hosford

More Than Traceability

Susan has worked with Alberta Agriculture since 2002. She is currently sheep industry development specialist and has managed many sheep industry projects including: Precision Flock Management (2011-13), SheepBytes Ration Balancer, Lamb Traceability Pilot project (2007-10), SheepCentral, Lakeland Carcass Sire project (2005-08), Lacombe Sensory Trial (2006), Building Better Lambs Initiative (2002-08), Sunterra Premium Pricing Grid and Biting into Profits (2004).

Susan grew up on a dairy farm near Edmonton and graduated from the University of Alberta. She farmed mixed crops, roaster chickens, commercial crossbred and purebred Suffolk flocks near Camrose until 2002. She was involved in the Alberta Ram Test Station, Western Suffolk Reference Sire Program and managed out-of-season breeding/lambing system trials, forage and extended season grazing systems trials as well as lambing, breeding and grazing workshops.

Susan has worked on with numerous sheep industry boards and committees, including the Canadian Sheep Identification Working Group, Industry-Government Advisory Committee, Livestock Inspection Services eManifest Advisory, SheepCentral WG, National and Provincial BSE program development, On-Farm Food Safety National Advisory, Provincial On-Farm Food Safety Pilot manager, Western Canadian Flock Health Program Advisory, Western Suffolk Sire Reference Program, BC Forestry Grazing Provincial Vet Certification, Ovigene Canada Advisory, Alberta Sheep Breeders, Alberta Ram Test Station, National R.O.P Advisory, Battle River Research Group Director, Alberta Health Laboratories Sheep Committee, Olds College and Lakeland College Academic Advisory Committees, Animal Industry Advisory Committee, and the Alberta Agriculture Research Institute Pork, Poultry, Sheep Committee.

Karen Bannow

Finding Those Empty Ewes

In 2006, Karen was looking for a career change when she had an opportunity to take a beginners carcass course through the Angus association. She and her husband both took the course, and she went on to take the final in Ames, Iowa. Also that year she took a certification to load embryos in cattle. She was later approached by some sheep breeders at CWA about doing pregnancy checking in sheep flocks, which led her to Ontario to earn certification to preg check sheep.

Karen and her husband breed Angus cattle, and three years ago decided to add purebred and commercial sheep to their Southey, Saskatchewan operation. Having worked on carcass evaluation with cattle, they decided to introduce the premium meat breed, Ile de France, into their flock.

Karen is the mother of four children and the grandmother of five. She jokes, “I gave my grandchildren each a ewe and now have five hired hands.”

Greg McKinnon

Trapping Coyotes, the Keys to Success

Greg spent 26 years in the RCMP until his retirement in 2005, and has been involved in trapping and Animal Management since that time. He has also owned and operated a bear management business in northern Alberta and BC. He started trapping as a child, but was not involved with trapping as an adult until he came back to it in 2001. He has owned a registered trap line near Sundre, Alberta for the past 10 years and is partner on a second registered line near Medicine Lake. He is a resident trapper, trapping mostly coyotes and beaver in the central Alberta area.

He sat on the Board of Directors of the Alberta Trappers Association from 2007 to 2011 and is currently the chair-person for the Alberta Trappers Compensation Program. He has been contracted by the Alberta Government and the Alberta Trap and Research Development Centre to trap wolves in a trap research test program. He also teaches the Alberta Trappers Basic Course—a 28 hour course which is a requirement for first time trappers in Alberta. He has participated in many meetings with government and industry about the future of trapping in Alberta.

Greg McKinnon, RR#1, Blackfalds, Alta, Ph: 403-357-8631, email:bearguy1@telus.net

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BANQUET ENTERTAINMENT

Ben Crane

At a safe distance west of Eckville rests one of Alberta's best-kept secrets (and some secrets are best-kept). Western singer, songwriter, entertainer and cartoonist Ben Crane has been slathering his brand of clean but slightly twisted rural humour over audiences across west-ern Canada and the US for the past 30 years.

Best known for his art on the ever-popular Leanin' Tree greeting cards, Ben is a family man, travelling with his wife and youngest daughter. He loves life and, according to his mother, is actually quite harmless.

*ASBA is deeply indebted to all of those who have made the 2011 Symposium such a success. From the sponsors, to the trade fair participants, to the many who have volunteered their time and resources we say **thank you**. And we will see you again in 2013!*

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HOPE IS NOT A STRATEGY—PLAN FOR SUCCESS

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Primary producers are renowned worldwide for their work ethic and dedication to their land and livestock. However, there is also ample evidence that there is significant divergence among management practices implemented, even within similar enterprises and production environments. Similarly, there is ample evidence from farm economic benchmarking services that illustrates a significant divergence in farm profit, again, within similar enterprises and environments.

There are a number of farm benchmarking services in Australia which provide examples that over 100% variation exists for key benchmarks such as Gross Margin (Table 1) and Cost of Production. There is also clear evidence that Price Received is not the primary driver of enterprise profitability.

Table 1: Gross margins for prime lamb enterprises

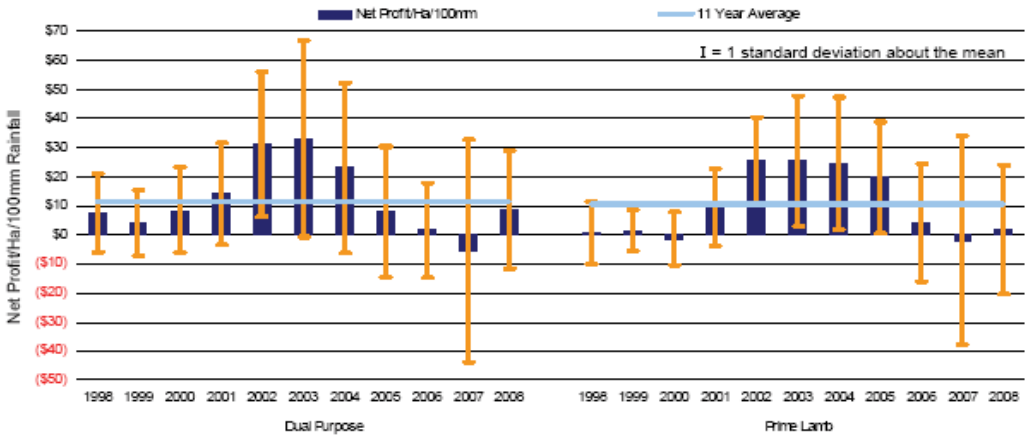
	Average	Top 20%*
Prime lamb enterprises		
Gross Margin ($/DSE)	$13	$21
Gross Margin ($/ha)	$257	$517
Gross Margin ($/ha/100mm rainfall)	$46	$94

** Top 20% ranked according to Gross Margin per hectare per 100 mm of rainfall.*
Source: Victorian DPI South West Monitor Farm Project

The Meat & Livestock Australia (MLA) commissioned '*Prime Lamb Situation Analysis*', undertaken by Holmes Sackett Pty Ltd, illustrates the variation in net profit (nominal) per hectare per 100 millimetres of rainfall for dual purpose (terminal x Merino ewe) and prime lamb (terminal x 2nd cross ewe) flocks over an eleven year period (Figure 1). While much of this year to year variation is driven by seasonal and market conditions there is significant variation within any year (illustrated by the standard error bars) that can be captured by industry.

The poorer performance of the average, and below, producers is not a function of a lack of research-based technical information to fine tune their businesses, but rather a function of social and generational family conditioning that stifles innovation and uptake of R&D outputs.

Figure 1: Nominal net profit per hectare per 100 millimetres of rainfall for dual purpose and prime lamb flocks 1998 to 2008



Source: Holmes Sackett Pty Ltd Benchmarking Database 1998 to 2008

Profit drivers

The '*Prime Lamb Situation Analysis'* summarises that the more profitable prime lamb enterprises have a superior combination of:

- Higher productivity (kg of lamb and wool per hectare); and
- Lower cost of production (they produce each kilogram cheaper).

Making More from Sheep (MMfS) specifically addresses lamb and sheep productivity drivers, which are particularly powerful for prime lamb enterprises because they are largely under producer control and because of the associated influence on the cost of production.

In the Australian context, on farm productivity is driven primarily by:

- The number of ewes run per hectare;
- The number of lambs produced per ewe run; and
- The weight of lambs when they are sold.

It should be noted that there is no individually dominant driver of productivity or profitability and that producers need to integrate a suite of management practices and decisions in their individually specific complex farm environments.

Table 2 provides an example of aligning management priorities with MMfS modules which illustrates the capacity of the program to deliver pertinent management information to producers across a priority sequence.

Table 2: An approach for improved productivity aligned with MMfS modules

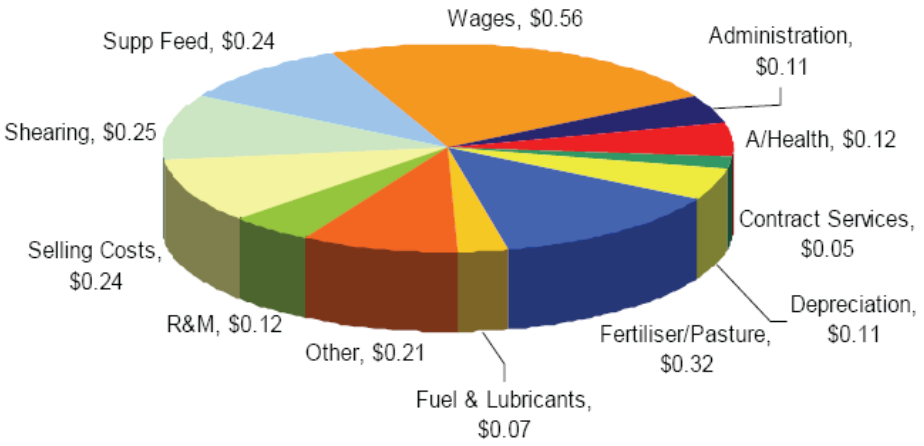
Start here and work down

Priority	Cost	Examples	MMfS Modules
1. Aligning feed supply and demand	Nil – Very Low	Late winter/spring lambing Avoid winter shearing Turn off times	1,2, 3,4, 7, 8
2. Maximising the utilisation of existing pastures	Low	Optimum stocking rates Quality genetics Low cost grazing strategies	1, 4, 5, 6, 7, 8, 9, 10 11
3. Increase productivity of existing pastures	Moderate	Increase fertilizer application Lime spreading	1, 4, 5,6,7,8
4. Further improve pasture productivity	High	Sowing new pastures Introducing new species into existing pastures	1, 4, 5,6,7,8

Cost of production (CoP)

While CoP is not the ultimate definition of farm profit, it is a key calculation and starting point for assessing enterprise performance. While the following (Figure 2) Australian pasture production based make-up of CoP may not directly translate to Alberta lamb production enterprises, the need to know your CoP and understand the management implications remains equally valid here.

Figure 2 illustrates a break-up of CoP from prime lamb production.



Source: Holmes Sackett Pty Ltd (1998-2008)

MMfS – Plan for success

The aim of the MMfS—Plan for Success module is to provide a process and tools for producers to:

1. Establish business objectives and plans.
2. Calculate their cost of production per kg of meat and/or wool.
3. Compare their business performance against industry benchmarks.
4. Quantify risks and develop a risk management plan.
5. Assess enterprise changes and new technologies.

The management transformation journey we aim to take producers on must include moving sheep and lamb production businesses from hope to strategically and tactically well planned enterprises. For this reason the *Making More from Sheep* program positions "*Plan for Success*" as the first module in the Producers Manual.

THE BIG DECISIONS: STRATEGIES FOR DEALING WITH HIGH INPUT COSTS

by Woody Lane, PhD
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1. Decisions

Of all the decisions we make in a sheep operation, our most important decision involves the numbers 15 15 6 8 8. Huh? These numbers aren't the snap count of a football quarterback. These numbers apply to ewes, and they overwhelmingly influence profit. Still don't know? Here's a hint: they add up to 52. Getting warm?

Okay, here's the scoop. These numbers describe the annual production cycle of a ewe, in weeks, and they give us a framework for balancing rations. The NRC reference tables categorize a ewe's nutritional requirements by these different periods.

Now for details: A ewe's year can be divided into her different stages of production, with each stage lasting a fixed number of weeks. These stages of production are maintenance (15 weeks), gestation (21 weeks), and lactation (16 weeks). A ewe in *Maintenance* is a dry ewe: she is neither pregnant nor lactating. She has very low nutritional requirements, because all she does all day is walk around, eat grass, grow wool, and perhaps jump a few fences. The *Gestation* period, however, is more complex. Since more than 60% of fetal growth occurs during the last trimester of pregnancy, especially during the last six weeks, nutritionists divide gestation into *Early Gestation* (15 weeks) and *Late Gestation* (6 weeks). Similarly, nutritionists divide *Lactation* into *Early Lactation* (8 weeks), which includes the period of high milk production, and *Late Lactation* (8 weeks), when milk production declines rapidly. Therefore, the phrase 15-15-6-8-8 describes the periods *Maintenance, Early Gestation, Late Gestation, Early Lactation, and Late Lactation*, respectively. Each period has its own set of nutritional requirements.

This framework gives us a blueprint for feeding our ewes, and like any blueprint, it can help us make our sheep operations more efficient.

For example, let's consider weaning, especially early weaning. We know that the nutrient requirements of ewes in late lactation are higher than ewes in maintenance. Look at the NRC requirements for a 154-pound ewe raising twins (154 lbs = 70 kg). In late lactation she requires 3.6 lbs TDN and 0.73 lbs protein each day but during maintenance she requires only 1.5 lbs TDN and 0.25 lbs protein. If we assume that her daily DM intake

(based on the NRC requirements) is 5.5 lbs during late lactation and 2.6 lbs during maintenance, her total intake during these 23 weeks is 581 lbs (= 308 + 273).

But what happens if we wean the lambs at 8 weeks of age? Early weaning eliminates the late lactation period and converts it into maintenance, therefore increasing the maintenance period from 15 to 23 weeks. Our ewe's total intake for a 23-week maintenance period would be only 419 lbs, a savings of 162 lbs DM, 118 lbs TDN, and 27 lbs protein. (Homework assignment—do these calculations yourself. Use both sides of the paper if necessary.) We would still need to feed the weaned lambs, of course, but that feed would be used more efficiently because it would go directly into the growing lambs. This is a business decision, and now we have a good handle on its nutritional implications as well as its direct feed costs and savings.

Before we continue, let's examine two crucial points. First, *what is the period of highest nutritional requirements*? I ask this question at many workshops. No one ever says Maintenance, but some folks occasionally say Late Gestation. No, it's not. Actually, the period of highest requirements is Early Lactation. Look at the reference tables for our 154-pound ewe with twins. Her daily requirements are 2.8 lbs TDN and 0.47 lbs protein for Late Gestation, and 4.0 lbs TDN and 0.92 lbs protein for Early Lactation. It's Early Lactation, no contest.

The second point is that for most sheep operations, *feed expenses represent more than 70% of the total budget.* I use "feed" in its global business sense, not just the out-of-pocket expenses for grains and mineral, but *all the expenses* necessary to provide nutrition to the sheep—the land you purchase or rent, taxes on that land, fencing to confine sheep in pastures, equipment to harvest hay and feed it, barns to store hay, labor to feed it out and haul away bedding and manure, etc. All these items add up. You can see that most of the time and resources in a sheep operation really go towards providing feed for the animals.

Which brings us back to the main topic: What is the most important decision in a sheep operation? The answer is "When is lambing?"

This answer involves our 15-15-6-8-8 framework of nutrient periods. *Because when we choose a flock's lambing date, we automatically fix all its nutritional periods and therefore most of the costs of the sheep operation*. Gestation comes just before lambing, lactation comes immediately after lambing, and maintenance occurs 8B16 weeks after lambing, depending on the weaning date.

These connections seem obvious, so what's my point?

My point is that many sheep operations in the U.S. and Canada choose to lamb during the winter. Actually, most sheep publications over the past twenty years have routinely recommended winter lambing—so that producers could market their commercial lambs before the traditional price slide during the summer and fall.

But consider this: when you choose winter lambing, *you automatically assign the ewe's periods of highest nutritional requirements to the months when you must rely on stored feeds—hay, silage, and grain*. The implications of this decision are profound. If you rely on stored feeds, then you have to store those feeds somewhere on the farm. You need to raise those feeds or buy them or both. But to meet the high nutritional requirements of gestation and lactation, you must provide good nutrition, which means that your winter feedstuffs should always be of high quality. If your home-grown forages are not high quality, then you are forced to obtain supplemental grain or high-quality forages from off the farm. How easy is it to make good-quality hay? What are the costs of obtaining good quality feeds? What are the costs of *not* obtaining them? How much risk is in this system?

Winter lambing also requires a lambing barn or shed, unless you are living in a mild-winter region like the deep South or the coast of the Pacific Northwest. A lambing barn means lots of labor, as well as higher risks for some of our favorite diseases like pneumonia and scours. A lambing barn also severely limits the size of your flock, unless you can obtain skilled labor for lambing, which in turn makes you dependent on keeping that labor.

So from a business perspective, we must ask ourselves this question: is winter lambing *really* worth it? Is the potential for higher prices worth (1) the guaranteed higher costs of feeding pregnant and lactating sheep during the winter, and (2) the inherent risks and limitations of this type of operation? And conversely, how much faith can we put in the dual assumptions of high spring prices and low summer prices? After looking over the records of monthly lamb prices during the past few years, I wouldn't want to bet the farm on such a predictable price curve, at least not in North America.

Spring lambing, on the other hand, reserves the cold months for maintenance and early gestation—periods of low nutritional demands. When ewes lamb in the spring, their early lactation period coincides with the explosive growth of high-quality spring forage, and their breeding occurs during mid-autumn, which is generally their period of highest fertility, and when heat stress is not an issue.

Am I saying spring lambing is for everyone? No, not at all. Some producers may choose winter lambing for very good reasons—such as meeting a specialized lamb market, or using available labor, or taking advantage of a climate that allows high-quality forage growth in the winter. An excellent choice based on sound business judgments.

Yogi Berra once said, "When you come to a fork in the road, take it."

So each year, when you are thinking of when to put the ram in with the ewes, you are coming to a fork in the road. You can take the early route to winter lambing or the late route to spring lambing. It's your decision.

2. The buck stops here

We're all CEOs.

That's right—Chief Executive Officers—all of us who farm and ranch. Usually we are too buried under chores to consider anything except the next task, but perhaps we should regard ourselves like the corporate executives that we are.

No, I've not been out in the sun too long. I have been thinking, however, about our role in making our operations profitable and sustainable. Farms and ranches are bottom-line businesses. A business is really a collection of resources. And the people in companies like IBM or Ford who make decisions about managing resources are corporate executives.

Frankly, when I am knee-deep in spring mud, struggling to fix a fence, the image of a CEO in a three-piece suit is not the first thing that comes to mind. On our farms, we'd rather be outdoors, getting things *done*. The reality is that we all work hard in our operations. Head down, sleeves rolled up, we dig in and get the job done. Every job, any job, whatever it is. And then we go to the next job, and then the next, etc., etc. We greatly respect the value of doing it ourselves. We feed out, we fence, we make hay and silage, we build barns, we fix machinery, we doctor animals, we drive trucks, and heck, we even shear the sheep ourselves. Not much different than the original yeoman farmers, the self-reliant minutemen who helped build this country.

We really wear *two* hats on our places—the jack-of-all-trades laborer *and* the corporate-executive-decision-maker. Although we embrace the first—the exhilarating hard work that we love—perhaps we can learn to value the second role just as much. We all say that "someone has to do that work!" But if we step back and look at the whole picture, however, our operations may benefit more if that someone isn't always us.

Let's recall the story of a CEO from a different era—Andrew Carnegie. Yes, the same guy whose name appears on libraries all across the country. At the turn of the century (or was that two centuries ago?), Andrew Carnegie made a fortune in the steel industry. In his time, he was kind of like the Bill Gates of Megahard. It was a time of great steel mills, blast furnaces, slag heaps, glowing molten iron. No one would ever, even in the most extreme moments, mistake Andrew Carnegie for a sheep producer or a cattle rancher. But did you know that he actually *didn't know much about making steel*? No, he hired specialists for that technical knowledge. What he did better than anyone else, however, was make the fundamental decisions that guided his business. He knew that his real role for making money was to make good decisions about the vast industrial empire under his control. His technical people worked on the details of making steel; he decided when and where the steel would be made and who would make it.

So instead of viewing a farm or ranch as a series of physical tasks, we may try to view it from an executive perspective—as an assemblage of resources. These resources include

land, capital, equipment, livestock, buildings, feed, hired labor, etc. Also some others that may not be so obvious, like location, history, personal preferences, relatives, relationships, calendars, and our sense of risk. And of course our main personal resources—our own time, skills, experience, and labor.

And our time is not free. In fact, time may be one of our most valuable resources. No one is making more of it, so why should we give it away?

Here's an example. Most people accept the task of feeding hay during the winter. Because, well, because it's always been done that way, or because that's what we've been taught. But let's examine this task more closely. Each decision affects other decisions. Feeding hay in winter means that we must make or buy that hay prior to the winter. We need a place to store the hay and labor to feed it out. If we choose to buy the hay, we must locate a dependable vendor. If we choose to make the hay—the most common strategy—we must reserve some of our best land for the crop, which entails closing off some fields for hay during peak growing periods. We must also obtain hay-making equipment, keep it running, and also reserve our time to make that hay. So we should ask, is this *really* the best allocation of resources? I can think of some alternatives: plant turnips or stockpile other forages for winter grazing; expand the use of corn stubble; minimize our winter nutritional needs by scheduling lambing or calving later; or even send our animals somewhere else for the winter (even into another country, although Fiji would be nice).

A farm without hay fields? Sure. It's also a farm with more acreage for grazing, maybe for longer periods during the year. It's also a place without all that iron equipment that depreciates and eats up maintenance funds. And during the summers, its owner can spend more time with the animals or managing the forages. It's our call. The buck stops here.

In New Zealand, quite a few skilled people make their living by building fences. Most farms there are well-fenced, but often the owners did not build the fencing themselves. They hired it out. New Zealand agricultural fairs often hold fence-building competitions—where teams compete in speed and skill to build a stretch of high-tensile fence. How many professional fence-building crews can we find here? Do we not also need fences? It's something to ruminate on.

Of course, all is not work—we should get paid for our efforts. If we're thinking of ourselves as corporate executives, we should at least pay ourselves an executive wage. But, you may say, we're in agriculture, not Wall Street. Who has the funds for corporate-level reimbursement? Simple. Think of stock options. We can issue options on our stock—our livestock. Maybe two shares of each ewe on the place, five shares for a steer, etc. Impressive. Then perhaps we can bid up expectations and have an IPO. The local Saturday livestock sale becomes a place for day-trading. Hopefully our stock won't split prematurely. We can even set up a website. I can see it now—*www.barnfallingdown.com*.

3. A new take on intake

When we devise a ration for sheep or cattle, we always first ask the question "how much will the animals eat?" Then we decide on a likely level of intake and build a ration based on that decision. We're not too surprised when the animals actually eat that amount of feed. But ... the diet formulation was based on our estimate of the intake, and the intake was based on the formulation of the diet. Aren't we inside a logical box?

Let's climb out of that box for a moment ...

Recently at Cornell University, Doug Hogue and some undergraduate students conducted a modest study with ewes raising triplets. Instead of guessing what the ewes would eat, they let the ewes tell them. The ewes were quite eloquent. Now we must question our own assumptions.

First, a little background on nutritional requirements: The 1985 National Research Council reference book *Nutrient Requirements of Sheep (*NRC—*the* reference source for diet formulation) lists the requirements only for ewes raising singles or twins, not triplets. We can, however, start with the listed numbers and then use our best judgment to adjust them for triplet lambs. In brief, the NRC nutrient requirements for a 144-pound ewe raising twins during early lactation are 3.85 lbs of TDN and 0.91 lbs of crude protein. The NRC tables also list the dry matter intake (DMI) at 6.0 lbs, which equates to 4.2% of body weight. The underlying assumption of those requirements is to maintain a ewe=s weight throughout her production cycle except during early lactation, when she would experience a negative energy balance. During peak lactation, the NRC expects twin-rearing and single rearing ewes *to lose* 0.13 lbs/day and 0.06 lbs/day, respectively. We would, of course, expect triplet-rearing ewes to lose even more weight than that.

Based on these NRC tables, many experienced sheep professionals suggest the following as a rule of thumb for feeding ewes in early lactation: Give the ewe one pound of 16% grain for each lamb that she is rearing, plus all the good alfalfa hay she can eat. A 144-lb ewe rearing triplets, for example, would receive a daily ration of 3 lbs of grain plus 4.0 to 4.5 lbs of alfalfa hay (assuming a DMI of 6.5 lbs = 4.5% body weight).

But Doug and his students reversed this logic. Rather than feeding a limited amount of grain and allowing unlimited access to hay, they fed a limited amount of hay and allowed unlimited access to grain. And they found that, not only did those ewes not die of acidosis, but their performance ... well, read on ...

The trial consisted of fourteen ewes all rearing triplets (Finn-Dorset crossbred ewes averaging 144 lbs). The ewes were fed a severely limited amount of hay at only 3.3 lbs/day but they were allowed to consume all the 16% grain supplement they wanted. The trial lasted for 41 days, beginning a few days after lambing—i.e. during the peak period of lactation. The lambs were sired by good black-faced bucks, so we know that those lambs had a pretty good genetic potential for growth. The lambs did not have access to

a creep feed. The hay was just an average quality grass-legume hay, and the grain pellet was a 16% commercial supplement. For the purposes of calculating DMI, let's assume that the hay and grain both contained 90% dry matter.

The results: The ewes consumed 3.3 lbs of hay and *7.6 lbs of pellets each day*—a DMI of 9.8 lbs/day (after adjusting for DM percentage), which equals *6.8% of body weight*. During those 41 days, the lambs *each* gained 0.71 lbs/day and—hold on to your hats—*the ewes also gained 0.55 lbs/day.* And this was during early lactation, when the NRC expects ewes *to lose* body weight. Instead, those ewes supported 2.1 lbs of total lamb growth each day while simultaneously adding over a half pound to their own weight. Not bad.

You might be wondering about the grain pellet. Well, the pellet was not a special formulation from the depths of Cornell's laboratories. It was simply a commercial 16% high energy lamb pellet, right off the feed store shelf. It contained mostly grain, with 15% forage as fiber source, some Bovatec® to control coccidiosis, 2% limestone to balance the calcium-phosphorus ratio, and 0.5% trace mineral salt. In other words, a fairly reasonable and routine formulation. Its fiber component, however, was primarily soy hulls. Soy hulls are high in pectin, which is a type of fiber that digests quite rapidly in the rumen but still retains the fermentation characteristics of other types of fiber. This may have helped, but it certainly wasn't the whole picture.

Now turn on your calculator. If that "average" hay contained 13% protein "as fed"—a reasonable assumption—then correcting for percent dry matter gives a crude protein value of 14.4% on a dry matter basis. That kind of hay would probably contain 60% TDN. Similarly, the 16% high-energy supplement (on a dry matter basis) would contain approximately 17.7% crude protein and 85% TDN. Applying these values to a DMI of 9.8 lbs means that those ewes consumed 7.59 lbs of TDN and 1.64 lbs of protein, which are 97% and 80% higher, respectively, than the NRC requirements for twin-rearing ewes. Even if we allow an extra cushion for the higher requirements of triplet lactation, it's obvious that those ewes ate quite a bit, maybe 50% or more than their requirements, *as the NRC has defined those requirements*. But did the ewes get fat? No, they just reared triplets successfully while gaining weight at the same time.

So are the NRC requirements wrong? Probably not—the committee of scientists originally derived those requirements from lots of careful, solid experimental evidence. However, the underlying assumption of those requirements—i.e. that ewes cannot maintain body condition during early lactation—is patently wrong. Those fourteen ewes told us that. Apparently, those ewes had not read the NRC book.

It's a good thing, too, because the NRC book does not list the nutritional requirements for ewes in early lactation rearing triplets where the ewes gain 0.5 lb per day *while* providing enough milk for each of their lambs to gain 0.7 lb per day.

Perhaps we should think about reevaluating the nutritional requirements for lactating ewes, or at least reevaluating our strategies for feeding ewes during early lactation. And also reevaluating our assumptions about what a ewe can really accomplish. A 300% lamb crop without any orphan lambs or loss of body condition—that's a wonderful goal for any flock of ewes. Especially when we know how to feed them.

CAPABLE AND CONFIDENT PRODUCERS

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In the opening presentation '*Hope Is Not a Strategy—Plan for Success*' it was stated that "*The poorer performance of the average, and below, producers is not a function of a lack of research-based technical information to fine tune their businesses but rather a function of social and generational family conditioning that stifles innovation and uptake of R&D outputs.*"

Add to this the position that farming is unlike most industries, and jobs, in that for the farming family their home is their work and their work is their home. In many cases there is no '9 to 5' schedule, no rostered day off, no overtime, no four weeks leave.

Further add the often shared ownership and management structures that reach within and across generations and I hope it is very clear that capable and confident producers are integral to sustainable and profitable farming businesses.

With over 90% of Australian farms being family owned and operated, *Capable and Confident Producers* is an important module in *Making More from Sheep.*

This module focuses on the people who are important to your business, whether they are family members or others.

Investing in human capacity, capability and confidence to develop more effective communication and long-term planning will boost business performance. The aim of the *Capable and Confident Producers* module is to assist farm families and farm businesses to:

- Be clearer about 'who is responsible for what';
- Build more effective communication in the workplace;
- Increase knowledge and skills within the business; and
- Strike a better balance between work and leisure.

Scheduled 'business meetings' are not common practice in most family farming businesses. This is an important discipline to develop, one referred to as WOTB (working on the business), and is often as important as WITB (working in the business) or the day-to-day activities.

Capable and Confident Producers promotes five key procedures to focus on.

Know 'who does what' in the business

An important action for your WOTB meeting is to discuss and document who does what in the business. All members of the family and business need to clearly understand the scope of their roles and responsibilities. This should cover things such as 'outdoors' and office work, and level of decision making. In multi-enterprise businesses, consider delegation of responsibility across enterprises.

Develop more effective communication

It is all too easy to think that because a comment or statement has been made across the kitchen table at breakfast, or while loading the pickup, that the message was clear and agreed to.

There is a range of well documented communication styles and while it's easy to pass these off as simply 'academic or irrelevant' this is not the case. A small effort to seriously consider how each member of your team communicates can greatly improve how well you communicate.

The rewards for creating effective communication include improved relationships within your farm team, improved relevance—the receiver hears what you think you said, and improved respect—you understand the issue, whether you agree or not (playing the ball and not the man).

Develop a sound business purpose

It is easy, but often incorrect, to assume that each member of your farming team clearly understands yours goals and the values you apply when working towards those goals. These will encompass both personal and business issues.

A WOTB activity should be to develop clear statements from each member of your farm team and from that basis develop an agreed set of values and goals to develop a common sense of purpose within your business.

While it is much easier not to, make the effort to record and display your values and goals as a reference statement of business intent. Review and update periodically.

Build knowledge and skills in the business

How many successful businesses can you identify that do things the 'way it was always done'?

Profit is predominantly a people issue and as such it is important to foster a positive attitude to change and a commitment to bring new ideas into the business. Plan to invest in yourself—perhaps 1-2% of your gross income.

The first step is a commitment to developing knowledge and skills, and the confidence to implement change. For many, change is daunting, so support such as professional advice

or a local progressive producer group can be very valuable.

The '*Action Learning Cycle*': Plan – Do – Monitor – Review is a sound process to trial new management techniques.

Maintain a happy balance between work and family time

Creating a work-life balance is easy to say but, for many, hard to do. The balance sought needs to achieve a healthy balance of time for yourself, time for your family and time for your business.

The work-life balance challenge faced by all workers is amplified for farming families due to the farm being both the home and work place

Holiday time is a must—it is equivalent to the annual service for the tractor or header.

WEAN MORE LAMBS

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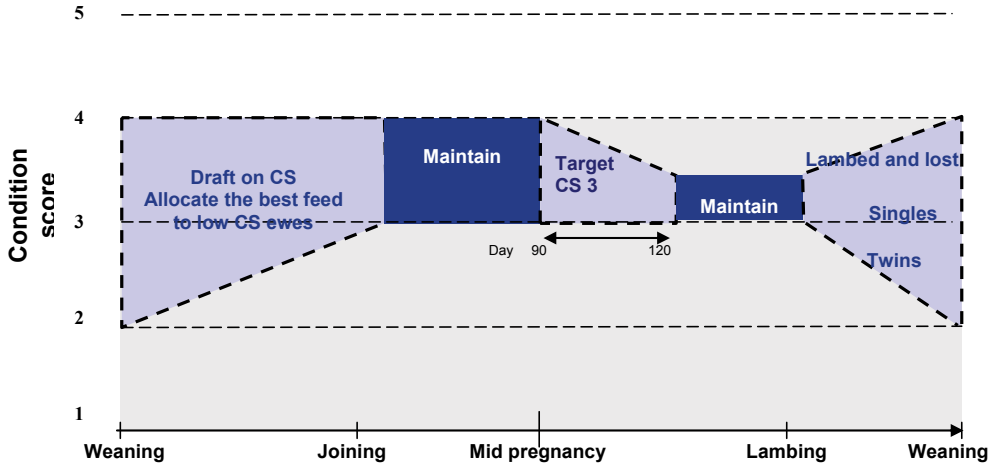
Reproductive rate, or number of lambs weaned (NLW), impacts the productivity and profitability of all sheep enterprises. As the enterprise income balance moves from wool dominant towards lamb dominant, the importance of weaning more lambs becomes increasingly important.

NLW must be defined if valid comparisons are to be made. The most common options are NLW per ewe joined or NLW per hectare (or acre). NLW per ewe joined describes the reproductive rate (combining conception and survival to weaning) being achieved in the flock while NLW per hectare is a more valuable component of enterprise profitability. This can also be taken to kilograms weaned per hectare

The management balance to be achieved is the most profitable "sweet spot" among stocking rate (ewes/ha), NLW per ewe joined and weaning weight. These factors combine to deliver kilograms of lamb weaned per hectare.

How to improve flock reproduction rates

Figure 1: Target condition score



Given a gestation length of just 150 days, the goal of each ewe weaning at least one lamb per year seems easily achievable. The opportunities for reproductive wastage between one weaning and the next are many and varied and it is seldom true that improving management in just one of these areas will dramatically improve weaning rates. Atten-

tion should be paid to management in all phases of the breeding calendar if high weaning rates are to be achieved.

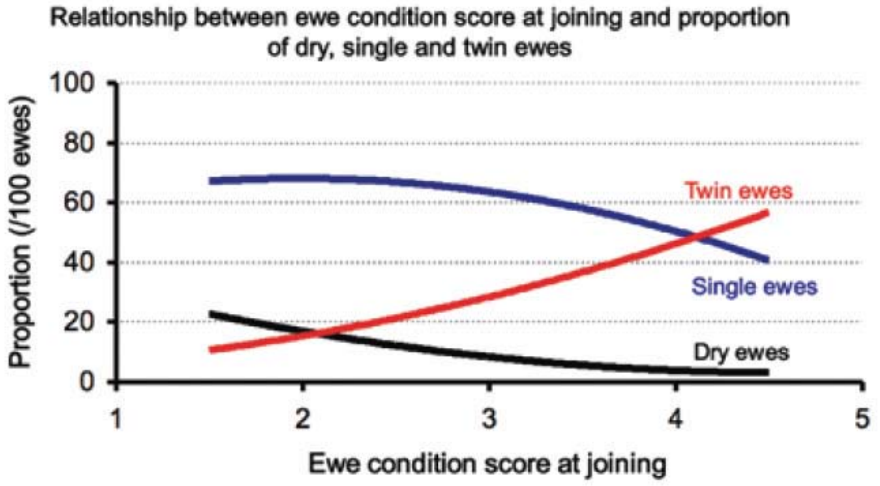
Managing the condition score profile across the production cycle is critical to achieving optimal reproductive performance.

The *Making More from Sheep—Wean More Lambs* module focuses on five key procedures for reproduction management.

Ensure most ewes get in lamb

The single most important determinant of reproductive rate is nutrition. See Figure 2. Aim to have ewes in condition score 3 at joining. In simple terms, it takes ~3kg of grain to maintain a kilogram of body weight at joining whereas it takes ~7kg to add a kilogram of body weight. Avoid the common management mistake of allowing ewes to lose too much weight before commencing feeding.

Figure 2:



Source: Lifetime Wool

Time of lambing, dictated by joining, is important to match feed demand with pasture feed supply—the cheapest feed source available. This will optimise the number of ewes run, minimise supplementary feeding and optimise the number of lambs weaned per hectare. Generally, misalignment of feed supply and demand results in a lower stocking rate and/or higher feed costs.

Manage ewes to improve lamb survival

There is a significant cost to your business when ewes are managed to get pregnant and then fail to wean a lamb. Ewe nutrition is again very important during pregnancy due to its influence on lamb birth weight and survival, and ewe health.

The target condition score is 3 for single bearing ewes and 3.3 for multiple bearing ewes.

Ultrasound scanning to identify pregnancy status provides several management options. Wet-dry scanning allows dries to be rejoined, sold early or carried over for the next joining.

Progressing from wet-dry scanning, scanning for litter size allows differential targeted feeding of single versus multiple bearing ewes. A rule of thumb under Australian conditions is that you need at least 10% twins to consider scanning for litter size. Ultimately the value of scanning depends on how the information is used.

Maximise survival to weaning

It must be noted that in Australian production systems essentially all lambing takes place outdoors and is unobserved. Lamb survival is a significant challenge at times. Mismothering, starvation, wind chill exposure and predation are the key causes of losses.

The management principles to focus on are identification of the key risks in your system and the development of management options to minimise those risks. For Australian producers the key risks occur in the first three days after lambing, when most lamb losses occur.

In our systems lamb losses after three days are minimal, the next challenge period being post weaning.

Manage weaners for lifetime productivity

This period of management is critical for achieving high weaner survival rate—in Australia the saying goes that if weaners aren't growing they're dying!

Growth rate targets of ewe weaners are often dictated by joining target weight and age. Joining ewe lambs is an option that should be considered. We have run a campaign in Australia to increase ewe lamb joining under the pitch of "45 x 7"—45 kg by seven months of age. The actual target weight will vary across breeds and is usually more accurately reflected as a proportion of mature weight. Develop your own benchmark weight and condition score for successful ewe lamb joining.

Prepare ewes for their next joining

Preparation of ewes for their next joining commences with weaning.

From a lamb nutrition perspective, by about eight weeks feed overtakes milk as the largest component of the diet and by 14 weeks milk contributes less than 10% of dietary energy.

The target weaning age will be influenced by things such as nutrition available, lamb market, annual or accelerated lambing, and ewe condition score. Ewes should be drafted by condition score to allocate feed most cost effectively to achieve joining condition score targets.

Weaning also provides a selection point to remove ewes for criteria such as age, teeth and reproductive rate. Australian research shows that ewe lambs which joined and reared lambs have higher whole-of-life reproductive rates.

Ram management

Examine rams for breeding soundness at least eight weeks before joining, to determine the number of replacement rams that need to be purchased and to allow time for them to acclimatise.

- Body condition score should be 3.5 at mating. Feed lupins or high protein feed for 50 days prior to joining to ensure maximum testes size and sperm output (up to 750 g/h/d).
- Testicles should be firm and springy on palpation, with scrotal circumference above 28 cm and with no abnormal lumps on palpation. If your rams have abnormal lumps on their testicles, get a blood test to check for ovine brucellosis.
- Examine prepuce and penis for evidence of inflammation and damage.
- Rams should be vaccinated with 6-in-1.
- Any ram that has been sick with a fever in the last eight weeks should not be used for mating as high temperature disrupts semen production.

Summary

- Know the nutritional needs of the flock.
- Set Condition Score targets—this is critical to improve NLW.
- Control Predators.
- Adopt selective culling and genetic selection of sires.
- Develop an annual program.

MORE THAN TRACEABILITY

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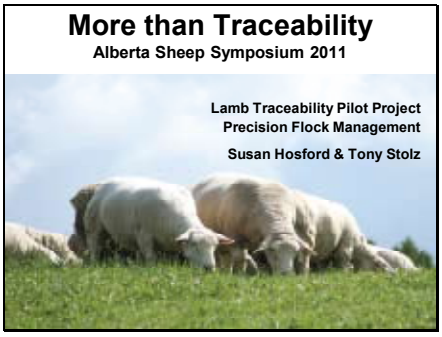
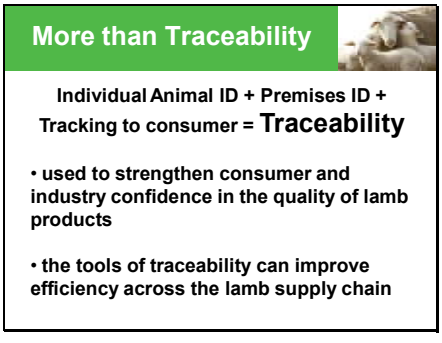
Slide 1



Slide 2



Slide 3

Slide 4

Slide 5

Slide 6

Handling and labour

- Less stress on sheep and people
- Accurate data collection
- Easier sheep handling
- Reduce labour

Electronic equipment

Slide 7

A "system" puts it together

Change is here … how to deal with it … intuition and tradition are not enough.

- ✓Information
- ✓Technology
- ✓Systems

Slide 8

Are new tools enough?

- Have good information
- Have the right tools
- Know how to use the tools
- Improve the tools

Slide 9

Why make changes?

Money in – money out = money left over

Slide 10

Tools help managers

Some things are more important than others:

- **Improve Productivity = more money in**
- **Better Feeding = less money out**
- **Reduce Labour = less money out**

Slide 11

Managing production

What is your cost / unit?

Feed is the highest flock cost, for example:

- **Feed cost to raise a lamb = $26**
- **Feed cost to keep a ewe = $52**

If the ewe produces 1 marketable lamb / year

- **Ewe feed cost = $52**
- **Lamb feed cost = $26**
- **Total feed cost = $78**
- **Feed cost / lamb sold = $78**

Slide 12

Improving production

If the ewe produces 2 marketable lambs / year:

- Ewe feed cost = $52
- Lamb feed costs = $52
- Total feed cost = $104
- Feed cost / lamb sold = $52

Difference in feed cost/lamb sold = $26

Slide 13

What matters most

#1 – Have productive ewes

#2 – Feed what they need

#3 – Use labour efficiently

Do you know how your flock is performing financially?

- Do you know how your ewes are doing now?
- Do you know how your ewes could be doing?

Slide 14

Know your flock

RFID systems and tools help managers:

• know your flock better

• improve flock performance

Precision Flock Management tools:

- Collect, analyze and make better use of data
- Generate reports that tell you what you need to know
- Combine flock productivity with financial performance
- Provide data to use to fine-tune flock performance

Slide 15

PFM tools

- Individually identify all animals using RFID tags
- Accurately weigh & sort / draft
- Measure and evaluate animals on their own merit
- Accurately record all data
- Generate performance reports
- Improve individual animals to improve flock

Slide 16

PFM goals

- More money
  - More lambs sold
  - Higher value of animals and of flock as a whole
  - Lambs better fit market criteria, earn more / head
- Lower costs
  - Accurate feeding of groups, reduce waste
  - Lower labour costs for handling, weighing, sorting
- Accurate data, rapid analysis, ability to compare
- General management – genetic selection, flock health
- Meet requirements of Canadian traceability program

Slide 17

Key numbers

How are your ewes doing?

- Conception rate:
  - # ewes bred, # ewes lambed
- Lambing percent :
  - # ewes lambed, # lambs
- Lamb survival rate to weaning
  - # lambs born / # died

How many lambs go to market?

Slide 18

Flock Snapshot tool

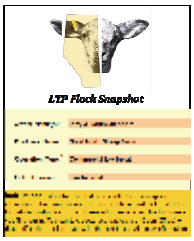
The Flock Snapshot is an analysis tool.

It can analyze:

- Productivity
- Costs
- Incomes

How "could" your flock be doing?

- Your targets



Slide 19

Numbers that work for you

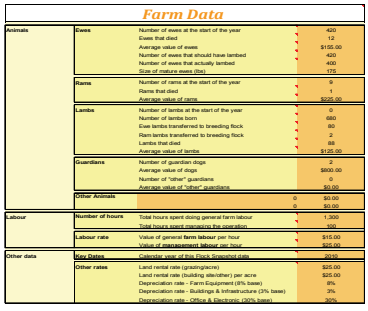
Set your flock targets:

- Set the targets that work for you and your operation
- Aim for your target and the dollars you want

Use guidelines or benchmarks:

- Set by others (industry averages, etc.)
- Aim for the target and the guideline dollars

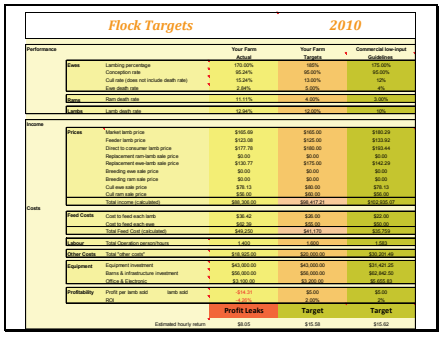
Slide 20



Farm Data

Animals	Ewes	Number of ewes at the start of the year	420
		Ewes that died	12
		Average value of ewes	$155.00
		Number of ewes that should have lambed	420
		Number of ewes that actually lambed	400
		Size of mature ewes (lbs)	175
	Rams	Number of rams at the start of the year	9
		Rams that died	1
		Average value of rams	$225.00
	Lambs	Number of lambs at the start of the year	0
		Number of lambs born	680
		Ewe lambs transferred to breeding flock	80
		Ram lambs transferred to breeding flock	2
		Lambs that died	68
		Average value of lambs	$125.00
	Guardians	Number of guardian dogs	2
		Average value of dogs	$800.00
		Number of "other" guardians	0
		Average value of "other" guardians	$0.00
	Other Animals	0	$0.00
		0	$0.00
Labour	Number of hours	Total hours spent doing general farm labour	1,300
		Total hours spent managing the operation	100
	Labour rate	Value of general farm labour per hour	$15.00
		Value of management labour per hour	$25.00
Other data	Key Dates	Calendar year of this Flock Snapshot data	2010
	Other rates	Land rental rate (grazing/acre)	$25.00
		Land rental rate (building site/other) per acre	$25.00
		Depreciation rate - Farm Equipment (8% base)	8%
		Depreciation rate - Buildings & Infrastructure (3% base)	3%
		Depreciation rate - Office & Electronic (30% base)	30%

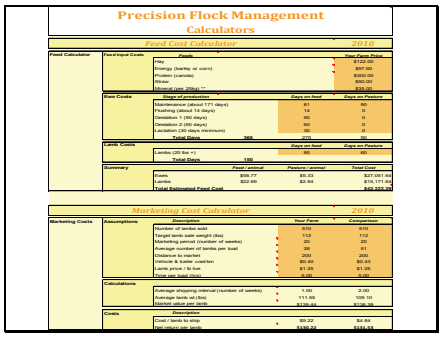
Slide 21



Flock Targets 2010

			Your Farm Actual	Your Farm Targets	Commercial low-input Guidelines
Performance	Ewes	Lambing percentage	170.00%	180%	175-200%
		Conception rate	95.24%	95.00%	95.00%
		Cull rate (does not include death rate)	15.24%	13.00%	12%
		Ewe death rate	2.84%	5.00%	4%
	Rams	Ram death rate	11.11%	4.00%	3.00%
	Lambs	Lamb death rate	12.94%	12.00%	10%
Income	Prices	Market lamb price	$165.69	$165.00	$180.29
		Feeder lamb price	$123.08	$125.00	$133.92
		Direct to consumer lamb price	$177.78	$180.00	$193.44
		Replacement ram-lamb sale price	$0.00	$0.00	$0.00
		Replacement ewe-lamb sale price	$130.77	$175.00	$142.29
		Breeding ewe sale price	$0.00	$0.00	$0.00
		Breeding ram sale price	$0.00	$0.00	$0.00
		Cull ewe sale price	$78.13	$80.00	$78.15
		Cull ram sale price	$78.00	$80.00	$85.00
		Total income (calculated)	$89,308.00	$98,417.21	$102,995.07
Costs	Feed Costs	Cost to feed each lamb	$36.42	$36.00	$22.00
		Cost to feed each ewe	$82.39	$95.00	$50.00
		Total Feed Cost (calculated)	$49,230	$41,170	$30,759
	Labour	Total Operation person/hours	1,400	1,600	1,083
	Other Costs	Total "other costs"	$16,825.60	$20,000.00	$20,299.49
	Equipment	Equipment investment	$43,000.00	$43,000.00	$31,421.25
		Barns & infrastructure investment	$56,000.00	$56,000.00	$42,842.50
		Office & Electronic	$3,100.00	$3,200.00	$6,666.83
	Profitability	Profit per lamb sold lamb sold	-$14.31	$0.00	$0.00
		ROA	-1.66%	2.20%	2%
			Profit Leaks	Target	Target
		Estimated hourly return	$8.05	$15.58	$15.62

Slide 22



Precision Flock Management Calculators

Feed Cost Calculator 2010

			Costs	Your Farm Price
Feed Calculator	Feed Input Costs	Hay		$150.00
		Energy (barley or corn)		$97.60
		Protein (canola)		$300.00
		Straw		$50.00
		Mineral (per 25lbs) **		$35.00

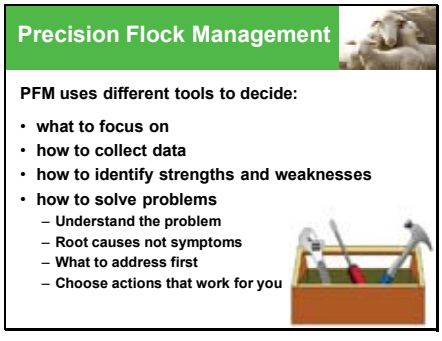
		Stage of production	Days on feed	Days on Pasture
	Ewe Costs	Maintenance (about 171 days)	91	80
		Flushing (about 14 days)	14	0
		Gestation 1 (90 days)	60	0
		Gestation 2 (60 days)	60	0
		Lactation (30 days minimum)	30	0
		Total Days	275	80
	Lamb Costs		Days on feed	Days on Pasture
		Lambs (20 lbs +)	60	60
		Total Days	60	60

			Feed / animal	Pasture / animal	Total Cost
	Summary	Ewes	$99.77	$5.33	$27,091.60
		Lambs	$52.69	$2.94	$19,177.60
		Total Estimated Feed Cost			$46,223.20

Marketing Cost Calculator 2010

		Description	Your Farm	Comparison
Marketing Costs	Assumptions	Number of lambs sold	570	570
		Target lamb sale weight (lbs)	112	112
		Marketing period (number of weeks)	20	20
		Average number of lambs per load	26	51
		Distance to market	200	200
		Vehicle & trailer cost/km	$0.40	$0.43
		Lamb price / lb live	$1.28	$1.28
		Trips per load (truck)	3.00	3.00
	Calculations	Average shipping interval (number of weeks)	1.00	2.00
		Average lamb wt (lbs)	111.89	109.70
		Market value per lamb	$136.44	$136.36
	Costs	Description		
		Cost / lamb to ship	$5.22	$4.84
		Net return per lamb	$130.72	$131.53

Slide 23



Slide 24

How PFM works

It's flu season …

- **You have the flu!**
- **How do you know you have the flu?**
- **How did you get the flu?**

Looking at solutions? First, know the problem!

- **The root cause:** influenza is caused by viruses
- **What needs to be addressed?** How to avoid flu viruses
- **Take action:** wash hands often, eat / sleep well, avoid sick people, consider a flu vaccination

Slide 25

PFM Ewe Productivity

Precision Flock Management
Ewe Productivity Guide

GOAL: Increase the number of marketable lambs per ewe

- **Issues**
- **Symptoms**
- **Causes**
- **Root Causes**
- **What needs to be addressed**
- **Actions**

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Ewe productivity #1

C. Ewes were not having enough lambs? No __ Yes X
If Yes, then why?

•A low-prolific breed or breed cross was used? No_ Yes_
If Yes, then why?

•Ewes were not selected for prolificacy? No__ Yes__
If Yes, then why?
i) Prolific ewes were not identified?
ii) Prolificacy was not a selection criteria?

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Ewe productivity #2

C. Ewes were not having enough lambs? No __ Yes X
If Yes, then why?

•A low-prolific breed or breed cross was used? No _Yes_
If Yes, then why?

•Ewes were not selected for prolificacy? No__ Yes X
If Yes, then why?
i) Prolific ewes were not identified?
ii) Prolificacy was not a selection criteria?

Slide 28

Ewe productivity - #3

C. Ewes were not having enough lambs? No __ Yes X
If Yes, then why?

•A low-prolific breed or breed cross was used? No _ Yes_
If Yes, then why?

•Ewes were not selected for prolificacy? No__ Yes X
If Yes, then why?
i) Prolific ewes were not identified?
ii) Prolificacy was not a selection criteria?

Slide 29

Ewe productivity #4 = Action

PFM Improving ewe productivity

• **What needs to be addressed?** – A flock record keeping system must implemented that is able to track and report individual ewe productivity.

• **Actions** (example)

- **Individual ewe records will be kept to track the number of lambs born, and weaned for every ewe.**
- **Reports will be created listing which ewes produce the most lambs.**
- **Ewes producing under 3 lambs over 2 years will be culled.**
- **High productivity ewes will be bred to maternal sire rams for replacements.**

Slide 30

Make more from your flock

Summary:

- **Focus on the things that matter**
- **Know how your business is doing**
- **Know how your business could be doing**

Slide 31

In appreciation …

This project has been possible through the collaboration of your 'Partners in Building Better Lambs':

Project funders:

- Alberta Agriculture (AARD)
- Alberta Livestock & Meat Agency (ALMA)
- Growing Forward
- Agriculture & Agri-Food Canada (AAFC)

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INTENSIVE FORAGE MANAGEMENT: FORAGES AND TECHNIQUES TO FILL FEED HOLES

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1. Filling in the holes

A couple of years ago, I wrote here about some interesting forages that we grow in western Oregon. Italian ryegrass was a big deal, and so were Sorghum-Sudangrass and the new high-sugar varieties of Perennial Ryegrass. Things have evolved since then, and I'd like to bring you up to date. Forages that we're using here may very well begin turning up in other places soon.

First some background: Western Oregon lies on the rainy, west side of the Cascade Mountains and enjoys a mild maritime climate. Rain falls between October and June—30+ inches in the Willamette Valley, up to 80 inches in the surrounding hills and along the Pacific coast. Summers are warm and bone dry. We have two main growing seasons—a short one during the fall after the rains start, and then the long spring which supports a tidal wave of forage growth. After the rains end in May or June, all fields turn parched yellow until fall, unless there is irrigation. Winters are wet and usually mild. How mild? Here's a perspective: we don't bury our pipes. The bottom line is that, with irrigation and good winter management, we can actually grow forages 365 days a year.

Our typical improved pastures contain orchardgrass, perennial and annual ryegrass, endophyte-free tall fescue, and weeds like bentgrass and various foxtails. For legumes, we generally use white clover, subclover (subterranean clover—a winter annual), and more and more, red clover. (For brevity, this month I won't list all the formal Latin species names. Brevity makes easier reading).

We can grow a lot of forage here, but it's seasonal. As we like to say, anyone here can grow forage in March, April and May. The trick is to grow feed during the tough months when the alternatives of stored feed are very expensive.

But we are fortunate: A hundred years of university research has demonstrated one irrefutable fact—that sheep and cattle and goats have legs. They can walk to their feed and graze it. Our task, therefore, is to find ways of providing feed for those legs—to use growing forages to fill calendar "holes" that otherwise would need to be plugged with expensive hay or silage.

So how are we doing this? Here are some of the newer forages we now routinely use to fill the holes:

We are perhaps most excited about the new forage brassicas. *Brassicas* are in the large mustard family which includes turnips, rape, kale, swedes, cabbage, radish, Brussels sprouts, horseradish, and watercress. Actually, no one here is growing horseradish for sheep, although that *would* be an interesting use of prepackaged flavors. Also, I'm not referring to the new varieties of bulb turnips which are often discussed around the country. These varieties are indeed more leafy than the older turnips, but they still have large bulbs that look like, uh, turnips.

No, the plants we are excited about are the *hybrid forage brassicas*. These are leafy high-yielding plants designed for multiple grazings. They are all annuals although they can sometimes last 15 months or so. An early hybrid brassica was Tyfon—a cross between a stubble turnip and Chinese cabbage. *Tyfon* gave one or two regrowths in the summer, which was an improvement over the bulb turnips, but we have much better varieties now. Like *Winfred*, a cross between turnip and kale, and *Hunter* and *Pasja*, which are crosses between turnip and rape. And there are others. These come up quickly, provide grazing in 45 days after seeding and then again and again every 30 days or so, as long as there is enough moisture.

We also use a surprise brassica: the new *Graza Grazing Radish*. This is no run-of-the-mill garden variety radish. *Graza* is a complex hybrid between a vegetable garden radish, a seaside radish, and cabbage. *Graza* comes up fast and keeps going. It has taken this area by storm.

Hybrid brassicas serve us in three ways. Firstly, these plants provide lots of high-energy, high-protein feed for our most productive animals. The leaves contain much higher levels of protein than the starchy bulbs, and these hybrids are nearly all leaf. Secondly, we can plant these brassicas into a field we want to renovate, spray out noxious grass weeds multiple times, and still keep that field productive throughout the season. Then afterwards, we can plant a good grass/clover seed mixture into a clean field free of unwanted grasses. And thirdly, as these brassicas are annuals, they help break the cycle of internal parasites, which reduces our need for anthelmintics.

Another major new forage for us is *Plantain* —not the small weed everyone sees in their lawns. We use an improved leafy variety of Narrowleaf Plantain (*Plantago lanceolata*) called *Tonic Plantain*, although other commercial varieties are now beginning to hit the market. Big upstanding leaves, soft like lettuce, extremely high quality and extremely palatable, and a deep taproot (Plantain is a herb similar to chicory). A perennial, Tonic Plantain grows in a wide range of soil pH and moisture conditions, and it will spread year after year. Its aggressive seed can even be broadcast on top of the ground and trampled in. Many ranchers now include it in their seed mixes for mixed pastures. Plantain

especially fills two feed holes—it provides winter feed because it does not go dormant in the cold months, and it responds brilliantly to good soil fertility and competes with our best forages like annual ryegrass.

You might ask, why not *Chicory* (*Cichorium intybus*), which is a popular forage herb in other parts of the country? Two main reasons. Chicory (*Puna* is the original commercial variety) goes dormant during the winter. While winter dormancy helps it survive cold winters in other parts of the continent, winter dormancy means no winter feed here. Also, chicory generally likes to bolt during the heat of the summer, which makes its summer management complex. In contrast, plantain has neither of these drawbacks.

In past articles, I've discussed *Italian Ryegrass*, and I'll mention it briefly again because it's so important. Italian Ryegrass, which is a type of annual ryegrass, can act like a biennial when planted in the spring. Normally, annual ryegrasses go to seed in their planting year, but if we plant an Italian Ryegrass in the spring, it will grow vegetatively through its first year and only go to seed in its *second* summer. That gives us one full spring and summer of lush, high-quality leafy growth plus a second season. The seed is also relatively inexpensive compared to perennials. We use the Italian Ryegrasses quite a bit, because its biennial impermanence often fits a rancher's plans for a field better than anything else.

Another new forage we use is *Gala Grazing Brome* (*Bromus stamineus*). Originally from Chile and bred by New Zealand scientists for yield and persistence, Gala is a perennial grass that produces a low, dense sward excellent for intensive grazing and hard use. It also grows well in both the winter and the hot summer—two of our primary feed holes. Gala likes well-drained soils and good fertility. Some ranchers here have maintained Gala in their fields for more than ten years, even after trampling those fields as sacrifice areas. More and more ranchers are beginning to include it in their renovation plans.

I'll just mention a couple of other forages we currently use:

Red River Crabgrass (*Digitaria ciliaris)*, an improved, leafy variety of the southern crabgrass. A warm-season self-seeding annual with potential for explosive summer growth and good persistence, we are just trying it out on some commercial pastures. Also *Big Trefoil* (*Lotus pedunculatus*), a relative of the common Birdsfoot Trefoil, but this species has rhizomes and can grow in our heavy, wet soils of low pH. Another intriguing forage is *Persian Clover* (*Trifolium resupinatum*), a winter annual legume that also grows well in wet soils of low pH. Yes, western Oregon has a lot of heavy wet soils with low pH. Persian Clover interests us because it flowers quite late and thus can provide vegetative growth into the early summer. And last but certainly not least, *Reed Canarygrass* (*Phalaris arundinacea*), which grows in wet soils *and* sandy soils, responds incredibly well to fertilizer, and spreads aggressively with extensive rhizomes. Unfortunately, Reed Canarygrass can also outgrow most management, and it has gained a dismal reputation for

low palatability and poor nutritional quality. But good management can overcome these problems. We are working on ways to manage Reed Canarygrass properly so we can use it where wants to grow.

If forages are our tools, and we have holes to fill, it's good to have a toolbox with lots of good tools.

2. Animals and acres

In every grazing workshop, someone asks, "How many sheep can I put on my pasture?" Or "How much space does my flock need for grazing?" Or "How long can my flock graze in a 10-acre field?"

These are really all variations of the same question. Let's discuss two principles of pasture growth and then describe a method for calculating a reasonable answer.

Principle #1: Forage grows in stages. When grasses and clovers first come out of the ground, the tiny plants spend their time and energy collecting sunlight, transporting sugars down to the roots, and constructing more solar panels, which we call leaves. Because young plants only have a couple of scrawny leaves, this process takes time. Once enough photosynthetic machinery is in place, however, the carbohydrate assembly line kicks into high gear. Then, with enough sunlight and root-supplied nutrients, these plants make lots of sugars and protein, build more leaves, and grow profusely. Finally the forage plants become tall enough to shade out their lower leaves, which die. New plant growth then just about equals senescence, so the net effect is little or no additional high quality tissue. From a grazier's perspective, those plants may be healthy but the pasture is actually gaining very little nutritional mass.

These stages, or "phases," are called *Phase I, Phase II, and Phase III*. For any pasture, we can identify the phase by measuring the amount of dry matter in an acre. As I described last month, pasture height is not the best measure of growth. We really need to describe a pasture in terms of pounds of dry matter. Pastures with less than 1,000-1,200 lbs/acre are in Phase I. Pastures containing more than 3,500-4,000 lbs/acre are usually in Phase III. Everything in between is Phase II.

These are rough estimates, of course. Different types of pastures have different numbers. Height can be misleading. Species that specialize in prostrate growth—like Kentucky bluegrass, Gala grazing brome, and some varieties of white clover, birdsfoot trefoil, and perennial ryegrass—contain more of their biomass in the lower inches of growth than upright forages like tall fescue, orchardgrass, and Ladino clover.

Phase I is a preparatory phase, a lag phase. Plants in Phase I are highly nutritious, but their growth is very slow. Phase II is the grow-like-gangbusters phase. Plants in Phase II are large and robust and still have high nutritional value. Phase III is the inefficient, too-

tall-for-good-grazing phase. Hay is almost always Phase III forage. But the initial questions were about grazing, which is definitely not the same as making hay.

In a system of sustainable, controlled grazing, we'd ideally like to keep our pastures oscillating between the high and low ends of Phase II. If possible, we should put animals into a paddock *just before* the plants reach Phase III and take them off *just before* the plants are reduced to Phase I.

Principle #2: My "Five Day Rule": Don't keep animals in a tightly fenced paddock for more than five days. Reason? Because grazing animals eat the most delectable forages first. Consider some of the new, improved forage varieties—bred for palatability and quick growth. Five days after they are munched, if given water and nutrients, these plants will begin to send out new shoots. These are *precisely* the forages that we want in our pastures. But if our sheep are still inside that paddock, what do you think that they will eat? Animals spend all day searching for those new shoots. Yummy! But re-defoliating plants so quickly puts them under severe stress, which ultimately exerts a steady selection pressure *against* the very species that we want to encourage. The answer is really simple: move livestock *before* they can eat those new shoots.

Now the main question: how large an area for our sheep? Let's approach the problem in discrete, logical steps: How many sheep are in the mob? How much do they weigh? How much do they eat (dry matter intake—DMI ? And how much forage dry matter is available for grazing? Then we match the answers, find a balance, and stir in the 5-day constraint.

Our hypothetical flock consists of 25 adult Targhee ewes and their month-old lambs, mostly twins. Let's guess that the ewes weigh approximately 175 pounds. A reference table in the SID Sheep Production Handbook lists an expected DMI at 6.6 lbs, which is 3.8% of their body weight. But that DMI is based on feeding some grain. In reality, I would expect that ewes on pasture would consume (and also stomp and soil) approximately 5% of the body weight, or maybe even 6%. Let's use 5% for this example, which means that the total daily DMI of the entire flock, including stompage, would be 219 pounds (25 x 175 x 0.05).

On the pasture side of the equation, our field contains smooth brome, orchardgrass, and white clover, with 2,800 lbs of total dry matter per acre. We'd like to move the sheep off the pasture at the low end of Phase II, so let's decide to leave a residual of 1,200 lbs. By subtraction, therefore, our pasture contains 1,600 lbs of available dry matter. If our ewes use 219 lbs/day, one acre of this pasture will last the flock 7.3 days (7 days, 7 hours, 20 minutes, and 30 seconds). This is longer than our 5-day rule. One acre, therefore, is clearly too large.

In five days, our sheep would use 1,095 lbs of DM (5 x 219), which is available from 0.68 acres of pasture. But if we wanted to move our sheep after only 3 days (more reasonable)

and still leave 1,200 pounds of residual, then our flock would need only 657 lbs of DM (3 x 219), which equates to only 0.4 acres. For a three day movement, that's where we could put our fence.

Pasture management: fire up the calculator, move fence, and watch the sheep graze. But one word of warning: although your attention may be focused on pasture weights and grazing areas, just remember that before you move the electric fence, first turn it off.

3. Fuzzy logic

One word can make a difference.

Recently I attended a seminar where the speaker said "Stocking rate, stocking density … whatever"—as if these words meant the same thing. They don't. For intensive graziers, one describes a powerful tool and the other refers to a kind of fuzzy concept that is not very useful at all.

Let's first talk about Stocking Rate—that venerable workhorse term used in many reports and government documents. Stocking Rate means, simply, the number of animals that graze in an area over a period of time. Notice that stocking rate includes the concept of a time period.

People often use this concept in questions like, "What is the stocking rate on your farm?" Meaning, how many animals do you run on the place? Typical answers would be one cow per acre or 1.5 cows per acre or, in dry range country, maybe one cow per fifty acres.

Cows? What about sheep and horses and yearling steers? Since in the U.S., stocking rate is usually expressed in terms of cows, we need adjustment factors to convert sheep to cows or horses to cows (but we shouldn't tell our animals—they would get offended). There are lots of published reference lists, but typical conversion factors are that one cow equals 5 sheep or 1.7 weaned calves or 0.8 adult horses or 1.0 yearling horses or 5 deer. This standardized cow is legally called an animal unit, defined as a 1,000 pound adult cow with a calf by her side. Of course, there is the issue of really large cows like Chianinas. I suppose that purists would want to convert those cows to cows, but that gets a little weird.

Without doubt, however, stocking rate is a valuable concept for range operations, where ranchers have little control over vegetation. One of their few tools for manipulating forage growth is to adjust the number of animals in a grazing area. In a broad sense, stocking rate relates to the amount of forage produced in an area during a growing season and thus the number of animals that can harvest that forage. This concept nicely applies to rangeland where animals generally remain in the same area for an entire grazing season.

But for intensively managed grazing operations, with smaller, fenced paddocks, where forages can be improved, fertilized, renovated, irrigated, and grazed with many types of

management strategies, the stocking rate concept simply falls apart. Mainly because on these operations, everything is fluid, and a good manager can manipulate so many factors during the growing period.

Let's say that I ask you about the stocking rate on your property. If you set stock your animals, you would give me one number. But if you renovate and fertilize so that forage yields triple, you would give me a very different number. Which one is correct?

Also, stocking rate implies that all feed comes from forages grown on that land. What if you supplement your animals with grain? Or with purchased hay? Let's take this to the extreme: what is the stocking rate of a cattle feedyard?

Things can get even more complex. What if you buy and sell groups of animals to take advantage of seasonal growth patterns of your forage? For example, you bring in a load of old crop lambs to graze the spring flush of grass, or you allow a neighbor to put his steers on your land to graze a summer forage like sudangrass. Now the calculations for stocking rate become very complicated indeed. If we consider animal movement, feed supplementation, and seasonal confinements in barns, the stocking rate concept becomes so fuzzy that, even if somehow we could derive a stocking rate number, what would that number really mean?

Now let's talk about Stocking Density. We define stocking density as the amount of biomass grazing a given area at a single point in time, expressed as pounds per acre. Note that stocking density applies only to grazing animals; it does not involve hay or silage or fallow land. In effect, stocking density is a snapshot of a grazing situation. It's a precise number, easily calculated. For example, a stocking density of 25,000 lb means that an acre contains 25,000 lb of grazing animals—which could be twenty-five 1,000 lb cows, or one hundred 250 lb ewes, or possibly one cow weighing 25,000 lb (not likely, even with crossbreeding).

We can use stocking density on a day to day basis to describe the grazing pressure on a specific area and also compare grazing strategies over time and with other farms, regardless of the size of the operations or the type of grazing strategies. Stocking density automatically takes these factors into account.

Here's an example: if I set stock 200 ewes averaging 160 lb on 15 acres, my stocking density would be 2,133 lb, which is quite low. But if I confine those same 200 ewes on one acre with temporary electric fence, the stocking density rises to 32,000 lb on that acre. I could achieve the same stocking density by putting thirty-two 1,000 lb cows on that acre. Of course, I wouldn't leave those animals on that acre for very long. When the forage was grazed down to my target residual mass, I would move them to the next grazing cell.

But let's think for a moment—which stocking density allows animals the luxury of consuming only their favorite plants? Which stocking density takes out weeds and results

in an even distribution of manure? Stocking density gives us no nonsense numbers to analyze situations and make precise recommendations.

Even small operations can effectively use stocking density to manipulate forage. Periodically on my place, I graze a flock of 20 ewes, averaging 160 pounds (a biomass of 3,200 lb). My pastures also contain patches of unpalatable tall fescue, which are clumpy, wasteful eyesores. My sheep refuse to eat tall fescue when they can graze tasty plants like white clover and perennial ryegrass. If I fence the flock on one full acre, the stocking density is only 3,200 lb, and the tall fescue remains defiantly untouched. But if I section off a clumpy area with electric netting to create a tiny 1/10 acre paddock (66 feet x 66 feet), I've increased the stocking density to 32,000 lb in that small area. Which is enough to convince the sheep that tall fescue isn't so bad after all. And of course I then must move the animals before they eat the rest of the forage into the ground.

We also routinely use the stocking density concept in pasture renovation. One unconventional but extremely practical technique for planting forage seed is the tread in method, also affectionately known as the hoof and tooth method. Basically, we broadcast seed onto unprepared ground—usually at twice the standard seeding rate (or more)—and allow the animals to graze that area heavily, and we hope their hooves will plant the seed. Sometimes it works; sometimes it doesn't. But one rule of thumb seems to give the best results—we need a stocking density of 30,000-40,000 lb. Otherwise, there are too few hooves per square foot to drive enough seed into the ground properly.

Stocking rate, stocking density. Two terms, two meanings. It's good to know the difference.

4. Grain on grass—let's do the numbers

Okay, raise your hand—how many of you have supplemented grain to animals while they were grazing on pasture and were disappointed with the response? Don't be shy. Keep your hands up. Well, you're not alone. Twice during the past year I've read scientific papers that reported the same thing, and those researchers were not only disappointed but also puzzled. After all, why wouldn't extra grain provide enough surplus energy to overcome intake problems and increase daily gain or milk production?

Because you wouldn't expect it.

First, the standard answer. In every university course called "Livestock Nutrition 101," in one lecture during this course, the instructor carefully intones students about feeding extra grain to grazing animals. Essentially, the message is that grain will "replace" some of the forage and therefore will not provide as much extra nutrition as you'd expect. Therefore, the instructor continues, if a ewe was consuming 3 kg of forage, adding 1 kg of corn will not simply boost her intake to 4 kg. Most of the corn will *replace* some of the forage, and total feed intake will rise only 250 g or so. Since the TDN value of corn is 88% (all nutritional values are on a dry matter basis), and the TDN value of the for-

age is, say, 65%, the net effect of all this supplement is only a modest increase in nutrient intake—and certainly not as much as the 792 g of TDN that you'd expect from 1 kg of corn (90% DM at 88% TDN). The students dutifully write this down and perhaps ask a question or two. Then the instructor then moves on to the next topic, maybe something about the effects of chewing gum on hippopotamus growth or whatever.

Elementary, my dear Watson, elementary.

Now, let's move beyond this simplistic explanation and look at grain supplementation in more depth. Grain doesn't just "replace" forage. Grain also profoundly changes the rumen environment, and these changes can sometimes offset much of the extra energy supplied by the grain. Nutrition textbooks typically list this phenomenon as the *Associative Effects*, but here let's see what these effects really mean. Oh yes, you can put your hands down now.

We need to make four assumptions: (1) the supplement consists of corn or barley or a multi-grain mixture and does not contain any added buffer such as sodium bicarbonate, (2) a significant amount of grain is offered, (3) the pasture is reasonable quality with a TDN value of 65%, and (4) the grain is offered only once each day, which is the typical procedure on most farms. These assumptions, of course, imply the following: that the grain supplement is primarily starch, that the supplement does not contain lots of salt to limit intake, and that the supplement is consumed rapidly. The last assumption is fairly obvious to anyone who has ever fed corn on pasture. Aside from protecting yourself against being run over, you'll always observe that the animals will nearly *inhale* the supplement—they gobble it up as fast as their mouths can move. No dainty manners here. In all the years of feeding supplements, I've *never* seen animals step back to save some grain for a future late-night snack.

So here's what happens when this grain is supplemented to grazing ruminants: The starch in the grain enters the rumen and ferments at a very fast rate, much faster than fiber. The rumen bacteria that ferment this starch produce end-product acids (*VFAs—volatile fatty acids*) so quickly that these acids overcome some of the buffering capacity of the rumen, driving down the rumen pH from its normal level of 6.2-6.5 to less than 5.8, at least for a few hours each day.

The lower rumen pH causes problems for the species of bacteria that ferment fiber. The lower rumen pH reduces their populations and activities, thus slowing down the rate of fiber digestion. Because the undigested fiber remains longer in the rumen, sensors in the rumen wall alert the animal's neural feedback system that the rumen is still full. Which tells the animal to reduce its feed intake. Since we assume that the animal eats all its supplemental grain, any reduction of feed intake must come from the amount of grazed forage.

Therefore, grain supplementation on pasture results in a lower intake of forage *and also*

a lower digestibility of that forage. And for those who are still following me, this effect would be more pronounced with grass than with a legume such as clover or alfalfa. Why? Because grass contains higher levels of potentially-digestible fiber than legumes, and it's the fermentation of this potentially-digestible fiber that is most depressed by the feeding of starch.

Let's do the numbers. Our example will be a 70 kg ewe suckling twins in early lactation (using the 1985 NRC Nutrient Requirements). This ewe requires 1.82 kg of TDN to support her milk production and minimize her early-lactation weight loss. If she grazes pasture containing 65% TDN with a daily dry matter intake of 4.0% of her body weight, she would eat 2.8 kg of dry matter (4% of 70) containing 1.82 kg of TDN, which nicely meets her requirements.

But … let's say that we want to increase milk production or prevent loss of body weight, so we'll offer this ewe a daily supplement of 1 kg of corn (0.9 kg of dry matter). Since corn is 88% TDN, this supplement will provide 0.792 kg TDN. And of course, our ewe will gladly eat all the corn quite rapidly.

If we assume that the ewe's dry matter intake will rise slightly—to 3.1 kg—then her forage intake will be 2.2 kg (3.1 minus 0.9 of corn). If we *ignore* the associative effects of the starch and assume that the original nutritional value of the forage remains unchanged at 65% TDN, we calculate that 2.2 kg of forage will provide 1.43 kg TDN (65% of 2.2), giving a total TDN intake of 2.22 kg—which is a 22% increase of digestible energy intake due to grain supplementation. Hmm, so far, 22% looks pretty good.

But we can't ignore the associative effects of starch on fiber digestion, can we? Of course not. Therefore, if we accept that associative effects apply to our situation, then we must reduce the TDN value of the forage from 65% to, say, 55%. Now let's redo the numbers with this new TDN value.

Our ewe consuming 2.2 kg of this forage will now only receive 1.21 kg of TDN from it (55% of 2.2). Adding the 0.792 kg TDN from the corn gives her a total daily intake of 2.00 kg TDN, *which is only 10% above her original energy requirements*. Not exactly something to write home about. In the highly variable world of real time grazing, a TDN boost of only 10% would be lost in the normal background variation.

Let's put this in perspective. In our example, the supplementary grain provided +400 g TDN when we *didn't* include associative effects in our calculations but only +180 g TDN when we *did* include them. The difference between these two numbers represents a 55% drop in supplemental TDN from the corn (220 g TDN). Which number is correct? Well, how many times have you been disappointed by the performance of grain-supplemented animals on pasture?

But even if the animals didn't perform as well as expected, at least we can be assured that they were happier with all that corn.

NO FERAL LGD FOR ME, OR MY STOCK!
(TRAINING A LIVESTOCK GUARDIAN DOG)

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1. History of guardian dog breeds

Most livestock guardian dog (LGD) breeds originated in mountainous or rugged areas of Europe suitable for grazing small livestock. Shepherds needed big, strong, protective dogs to keep the sheep safe from predators. Each region, country or even mountain range had its local "breed" that was used to guard sheep. Villagers would shepherd their sheep on the high summer pastures, and bring them back into the valleys for the winter months. During this transhumance, the dogs would live and move with the sheep and their shepherds.

These breeds were introduced into America and Canada to help prevent predation, but somewhere along the way information about how to raise and handle these dogs became lost. For some reason, many came to believe in a completely hands off method of raising these breeds (no handling, no petting, no attention), forgetting that in Europe they had always been raised from puppyhood under the guidance of the shepherds, with constant supervision, living with the villagers and their families in the winter months, and often taking on the role of property guardian.

Most LDGs are large, fairly aggressive and often (but not always) white. They live with the stock. They are **not** herding dogs.

2. Selection

When you select a new guardian dog pup, there are a number of factors to consider:

- Breed—purebred or mix? Some breeds are "close" guardians, others more perimeter guards. Some are more aggressive, more athletic, long coated, short coated, and so on.
- Health considerations (hips, elbows, etc.)
- Cost
- Sex
- Type of work required (range, cut blocks, small ranch)
- Sociability—will your dog need to interact with other dogs, children, visitors?
- Number of guardian dogs you need to have at the flock to provide adequate protection
- Predator load

Your decision to acquire a new LGD puppy must be well thought out. Do your research, speak with breeders, and mentally prepare yourself to start a new pup, knowing that it will require a big investment of time and effort for the next 18-24 months.

Your future guardian dog pup will be a breed or mix you know will suit your needs, have parents who work on a stock farm, and be of sound temperament. You must trust the breeder. Make arrangements to collect the 9-12 week old pup when it has had all its initial vaccinations and been dewormed a number of times. Make an appointment at your vet to finish the vaccination program and plan a spay/neuter date.

3. Training

The young pup

Your baby pup has had an initial start in becoming a LGD, as its mother works on a stock farm—she smells like the stock, and your pup has been raised and allowed to interact with the sheep and other stock up until you collect it.

If your pup is to grow up to be a successful guardian it must first learn the basic commands every dog should respond to—it must know its name, walk on a lead, accept being tied up, and come when called.

Before the pup arrives, make a puppy proof kennel or run in among, or adjacent to, the stock it is going to guard as an adult dog. This kennel must be very well fenced and

escape proof. It is important that the pup never learns to escape from this pen, so that it grows up not knowing that it can escape from any fenced area. You can allow the puppy access to the stock by making a small puppy door.

The pup must be able to see, smell and hear the livestock at all times and if you have an older dog, to see how that dog interacts with the stock. The stock also needs to become accustomed to the new pup. When you are doing chores around the stock let the pup run free and interact with the animals, under supervision. Correct all unwanted behaviour, especially playful behaviour towards the livestock—chasing stock, pulling wool, chewing on legs or ears, or barking. Be strict and direct: this is **not** acceptable behaviour. Butt smelling and submissive behaviour to the stock (rolling on back, small squinty eyes, no direct eye contact, moving away) are appropriate behaviours in a young pup.

It is your job to protect the pup from stock that will hurt or bully it. To start out, give the pup a few quiet, older, non-aggressive and also non-playful stock to bond to. Young playful stock will encourage chase behaviour. The pup needs to feel safe and confident with the animals in order to bond with them. A hurt pup will become fearful and may either run away or react aggressively. The pup also needs to learn to respect the stock and not just barge through them. Often an older, well trained guardian dog will teach the pup manners but if you do not have such a dog it is up to you to teach it the rules of interaction.

Most problems with LGDs arise if they are not supervised enough, allowing bad traits to develop. As the pup grows, allow it more space and interaction with the stock, but remember that it is not a guardian dog until it is at least two years old. (As a rough guide, compare each month in age of the pup to one year in a child. You would also not expect a nine year old child to have to protect your home from intruders. You cannot expect that from a nine month old pup either!)

I believe in interaction with your LGD to help create a bond with you, the dog and the livestock. I do **not** believe in half feral guardian dogs that cannot be handled. However, all the interaction with the dog has to take place at the sheep. Its life is centred around the livestock. Do not bring the pup to the house for playtime as this will encourage it to leave the sheep to look for a good time away from the stock. Take it for walks, but only in the sheep and stock pastures so that it knows the boundaries.

All these tips will help teach your dog to stay with the stock, in the pastures. Don't let a young dog make mistakes; make the right thing easy to do. Spend about 10 to 15 minutes, three to four times a day, "working" with it.

The older pup (five months to adolescence)

If you have reliable, non-aggressive stock, you can greatly stimulate the bonding process by placing the young dog in a small pasture with a few ewes/goats/rams, under supervision to prevent the pup "playing'' with the stock. A guardian dog should not be raised with young lambs or bottle animals as the pup outgrows these lambs very quickly, becoming too strong and rough in its interactions with the lambs. Older and larger animals that treat the pup kindly but do not accept any rough behaviour are preferred. Normally the pup can be left unsupervised with the stock at around six to eight months, but use your own judgment. It is a good sign when the pup stays behind with the sheep when you leave. A young, four to six month old pup left in a distant pasture can easily become a target for predators and is defenceless against them. The pup could also feel abandoned, encouraging it to look for a way to escape back to the farm, yard or even to other dogs.

Teach the pup to respect electric fencing when it is about six months old. Place the sheep and dog in a small pasture surrounded by electric sheep fencing, walk away (keeping an eye on things) and leave the pup to learn that the fence can hurt. You do not want the pup to associate the fence with you.

Teach the pup not to barge through gates, but to wait until invited to leave or to follow the stock out. It is **vitally important** that your dog stays on your farm, for your neighbour's sake and your own, so learning to respect fences is important. The dog must never figure out that it can escape. If you have other dogs that roam, they will teach the pup to

go roaming and together they could become problematic. Should the pup escape or wander too far away, reprimand it and send it back to the stock. Once it is back where it should be, calm down—then go and fix the fence!

Remember, the pup is allowed to patrol the pasture perimeter as part of its guarding duties. However, the perimeter of the pasture is not two miles away at the neighbor's farm.

Warn people and sign post your property that you have a guardian dog on patrol.

The adolescent (anywhere from eight months to 18 months old)

The pup (like a human child) will go through puberty. This can happen any time from eight months old until two years of age. During this phase you can expect a whole range of unwanted behaviours, as he often stops being a reliable dog and becomes rough with the stock—wool pulling, chasing, chewing ears, escaping, and so on. Go back to placing the teenager under close supervision and chaining him (in the pasture with the stock) when you are not around. He may need a drag or dangle stick for a while until this phase passes. Try to be understanding of this pubescent behaviour but be firm and consistent. Secure him at night, and work with him during the day.

While barking is the first line of defence—guardian dogs bark at everything they regard as unusual, new or out of place—nuisance barking does need correcting. Through learning and experience, the dog will come to know what and what not to bark at.

The adult

If all has gone well you now have a reliable, balanced and calm guardian dog. Remember that most guardian dogs take about two years to mature, so consider starting another pup in good time.

4. Other training considerations

Feeding

Always feed the pup in its own area away from the stock. Sheep and goats seem to love dog food and will bully the pup away from his feed, resulting in unwanted food aggression behaviour. The dog needs its own space to rest and eat. I like to feed my dogs a large portion of their diet in the form of raw meaty bones and offal, but I do supplement with commercial dog food a number of days in the week.

Lambing

Your young guardian dog is not ready to be around new-borns, baby lambs and kids. Interaction with these babies should only be allowed once it is reliable with the stock and has matured, normally after two years. The sight and smell of blood and afterbirths could encourage inappropriate behaviour, so only mature and trustworthy dogs should be around during birthing. Introduce the young dog to lambs, but under supervision.

Handy things your guardian dog should know

- Travelling and going to various places with the flock
- Staying behind electric nets
- Being moved between groups of sheep and other stock
- Working with other dogs in different groups
- Allowing herding dogs to work the stock

Warning signs

No dog escalates from nothing to killing in a moment; there are always warning signs. Watch for these signs:

- Dog being rude
- Barging through stock
- Snapping or growling at stock
- Tufts of wool on the sheep
- Stock panting, cornered
- Staring, stalking, or “eyeing” stock
- Paws on stock
- Leg nipping
- Barking at stock
- Play bowing at the stock
- Over-interest in a certain animal—staring, stalking, keeping it separated from flock

What behaviour does the dog display when reprimanded? Is it silly, goofy, playful, disrespectful of you, fearful? Does it barge into you or nip you? How your dog treats you is also often a hint of what he will do with the stock.

Injuring or killing stock most often happens during rough play. The animals most often injured are young, sick, old or new animals. It is always good stock management to remove such animals from the herd and away from the young dog.

Good signs

These include:

- Soft eyes
- Respect to the stock
- Politeness
- Walking quietly through the flock
- Submissiveness (licking mouth, moving out the way)
- Lying close to the stock
- Calmness
- Butt smelling
- Following sheep out to the pastures
- Interest but not over-interest
- Stops unwanted behaviour immediately and shows "remorse" when reprimanded

5. Economics

A well raised LGD is an investment in your ranching business. LDGs provide 24 hour surveillance and are regarded as one of the best predation deterrents. The Alberta government manual "Coyote Predation Control Manual and Study Guide" states:

"The first consideration, when conflict exists between livestock and coyotes, is the management of livestock to prevent situations that induce or invite predation. Sound husbandry practices reduce interactions between livestock and coyotes. Land use practices must be analyzed and the best use patterns considered before coyote conflicts arise."

It goes on to describe other ways to reduce coyote predation, but concludes that: **"Guard dogs are the most useful tool for reducing livestock losses to predators."**

The cheapest option is often to buy a pup and raise it yourself. Buying a well started dog will cost you more, but will require less immediate input from you.

If you opt to buy an adult dog, remember that, as is the case with a good stock dog, good LDGs don't come cheap. Be careful where you buy it from. Most **good** guardian dogs do not get sold unless the rancher is quitting, moving or giving up the sheep business. Older dogs are offered on sites

like Kijiji because they were either not raised well or have become problem dogs. Beware.

A last piece of advice: if you do use other forms of lethal predator control please consider that poisons like 1080 and snares are **deadly** to dogs. Anyone using guardian dogs should not consider using these options. The well trained and good working guard dog is too valuable to be lost in such a way.

UNTANGLING THE BASICS OF FEEDING MINERALS AND VITAMINS

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1. Double trouble

We often go to great extremes to do the best for our animals. We build enormous barns, we manage topnotch pastures, we feed tasty grain supplements, we give medicines and vaccines, we stay up long nights teaching orphans how to drink from bottles, and we provide minerals and vitamins. And sometimes our well-meaning efforts get us into nutritional hot water, especially concerning minerals and vitamins. Actually more often than you would imagine. Perhaps the most common problem is something that I call *Double Trouble*.

The basic principle of minerals and vitamins is quite simple: livestock should get enough of them each day. Because only *some* minerals and vitamins are stored effectively in the body, our best strategy is to give them access to a mineral mixture daily—either free-choice or in prepackaged amounts—and assume that the mixture takes care of their needs. There is not enough room in this month's article to go into details about individual minerals, but there is a common belief among some folks that our livestock have some sort of internal "nutritional wisdom" about minerals and vitamins. Let me say this unambiguously: with one important exception, livestock *do not* have nutritional wisdom to choose minerals and vitamins properly. If offered a selection of trays, each containing an individual mineral, our animals would not select what they need in the correct amounts. In fact, since many mineral compounds are quite unpalatable, animals will stubbornly avoid those trays, even when they are dying of those mineral deficiencies.

The one clear exception is *white salt*—which means old-fashioned *sodium chloride*. In fact, "salt" is the official and legal feedtag name for sodium chloride. Livestock obviously relish salt. They seek it out when they need it, and they won't over-consume it to toxicity as long as they drink enough water to excrete the excess. The feed industry universally recognizes this feature, and companies mix salt with other less palatable minerals (and vitamins and drugs), selling the product as a *Trace Mineral (TM) Mixture*. The percentage of salt in this mixture is not as critical as you might think. I've seen successful TM mixtures with salt levels ranging from 4% up to 96%. Each company formulates its own recipes, and each mineral recipe is carefully designed for a specific expected

level of intake. In any case, the underlying concept for these TM mixtures is that *salt is the driving force of the mineral intake.*

And this results in the problem I call *Double Trouble*. If you offer animals two or more sources of salt (the "Double" in Double Trouble), what will happen to the intake of your main TM mixture? Either (a) mineral intake will go down or (b) mineral intake will become more variable—either over time (some days very little, some days very high) or within the flock or herd (individual animals responding differently to these choices). Or all of the above. You will have lost control of your mineral intake. And if you depend on that TM mixture to provide specific dosages of critical minerals like selenium or drugs like Bovatec® or other antibiotics, what will happen to the dosages of those ingredients? The dosages will decrease or become more variable—which will increase the risks of mineral deficiencies, reduce drug effectiveness, and increase microbial resistance to drugs.

Now let's talk about some Double Trouble scenarios that occur on farms and ranches in the real-world.

The most obvious scenario is to feed extra white salt. Yes, some people do this because they think (1) their TM mixture doesn't contain enough (or any) salt, or (2) to save money ("hey, my animals eat less of that expensive mineral when I offer white salt"), or (3) they have simply "heard" that white salt is a good thing. A variation of this scenario is to offer three or four or even more mineral mixtures—just to "make sure." One quick cure for this problem is to read the feedtag of the original TM mixture. If the feedtag specifically gives directions to feed white salt, then of course follow the directions. But if there are no such directions, then study the list of ingredients. If you see the term "salt," then you know that the feed company has already included sodium chloride in its original mixture, and you don't have to supply any additional salt. But if you feed extra white salt to reduce the intake of those minerals, you actually *dilute* the intake of the original mineral mixture, and you defeat the goals of the company nutritionists and expose your animals to all those health risks. And if you offer three or four different mineral mixtures at the same time, mineral nutrition *really* becomes a tangled mess.

Another Double Trouble scenario occurs when some folks routinely feed a grain or protein supplement. Sometimes this supplementation is necessary for production, sometimes not; but in either case, look at the feedtag of that supplement. Straight corn or oats or other grain don't contain salt, but a commercially-prepared grain mixture *may*. Grain mixtures are always *very* palatable. If animals eat one pound of a yummy supplement that contains salt, they're also consuming that extra salt. Again, how will this affect the consumption of your free-choice TM mixture? Many times I have visited a ranch where the owner proudly shows me how he feeds a little of this, a little of that, a scoop of this other stuff, and also a cupful of a special mix from that bag in the corner. Oh my.

Another variation: do you use a lick tank to provide extra energy or protein? A lick tank

usually contains molasses and urea and perhaps some other ingredients or drugs. But you should read the label—does it also contain salt?

Here's something that may be a specialty of the Pacific Northwest—although I suspect it is used elsewhere—*salted hay.* On the west side of the Cascade Mountains we sometimes get a bit of rain during the haymaking season (that's a joke. Laugh. We *always* get rain during the haymaking season). Sometimes the square bales are too wet to stack safely in the barn, so we do this: after laying down a layer of damp hay bales in the barn, we generously sprinkle white salt on top of that layer. We do this for each layer of hay. Our hope, of course, is that the salt will draw enough moisture out of the bales to prevent the barn from exploding in flame. The existence of long-standing barns in the Pacific Northwest is kind of a backhanded proof that this technique works. But a secondary result of this technique is that the hay contains salt. When that hay is fed months or years later, folks may have long forgotten about the salt, but soon the animals begin suffering from unexpected mineral deficiencies. Double Trouble, again.

A variation of this scenario occurs when salted hay is *sold*. The unsuspecting buyer gets a truckload of hay, feeds it out, and unexpectedly runs into mineral problems like selenium deficiency. As a hay buyer, how can you protect yourself? Well, since hay does not usually come with a user guide, the most practical way is to monitor your animals' intake of the minerals. If mineral intake suddenly goes awry when a new source of hay is fed, you should become concerned. (The official recommendation, of course, would be to test that hay in a lab. That's fine and dandy—as long as your sampling technique is good enough that you can fully depend on the results.)

Here's another interesting Double Trouble scenario: the ocean. It's a big world out there, with more than 70% of it covered in water. Salt water. All along the coastline of North America, fields are exposed to ocean fog, spray, and wind. When I work near the ocean, I like to take a grab sample of the growing forage and analyze it for minerals, especially sodium. I generally expect to see background sodium levels lower than 0.20%, dry matter basis. A sodium level higher than 0.40% is a red flag. Salt in growing grass is still salt, and it's something to watch.

This Double Trouble theme has nearly endless variations, such as salt licks, bloat blocks, high-salt streams, etc. But once we identify the problem, what can we *do* about it? Some scenarios are quite easy to fix—for example, it's easy to stop feeding the extra bag of white salt. But what about those situations where we can't easily eliminate the second source of salt?

Let's return to the original concept of trace mineral mixtures. If mineral intake is driven by salt, and something interferes with the effectiveness of salt as an intake stimulus, then we should try changing the driving force of intake. Find an alternative TM mixture that contains other tasty ingredients, like flavor additives or molasses. This new mixture will probably also include salt, but the salt is only along for the ride, just like any other

required nutrient. The real intake stimulant is something else. Something that can get you out of Double Trouble.

2. Copper redux

If you own sheep ... you know about copper. Every shepherd, it seems, can tell horror stories about unfortunate producers who've lost sheep to chronic copper toxicity (CCT). So the word is out, "Toxic! Toxic! Avoid Copper At All Costs!" Simple and easy to repeat, like a mantra, but unfortunately, it's not quite true, nor is it easily followed. Yes, copper is readily toxic to sheep, but it is also a *required nutrient* for them, and the difference between the two levels is rather small. And new research may make it harder to keep sheep away from high levels of it. Oh, the tangled web it weaves!

This topic is fairly involved, so let's all get on the same page. Most livestock species need 6B11 ppm copper in their total diet. Copper deficiencies show up as neurological problems (*swayback* in newborn lambs), loss of pigment in hair and wool, reduced immune function, reduced fertility, spontaneous bone fractures, etc. *High levels* of certain other minerals like molybdenum, sulfur, or iron will interfere with copper absorption across the gut wall. Conversely, *very low levels* of these minerals will potentiate copper absorption—i.e., make copper *more* available to an animal. And some geographical regions are actually *copper deficient*, either because the forage levels of copper are too low, or because the levels of molybdenum, sulfur, and/or iron are too high. Therefore, any feed analysis that doesn't list all four minerals is generally worthless for determining the true copper status of a ration.

Some additional points: The liver stores excess copper and then releases it for excretion or metabolic use. Blood is just the transport system. Insufficient dietary copper may indeed reduce blood copper levels, but ironically, high levels of dietary copper will *not* increase blood copper, at least at first, because the liver sequesters extra copper away from the blood until the last stages of toxicity. Although blood copper levels may be useful for detecting a copper deficiency, they are useless for predicting a copper toxicity.

Finally—and this is *the* well-known sheep fact—sheep are particularly sensitive to CCT because, over time, sheep tend to accumulate copper in their livers faster than other livestock species. CCT ends in metabolic disaster. When liver copper reaches a toxic threshold (usually above 800 ppm dry weight), the liver suffers catastrophic damage and dumps huge amounts of copper directly into the blood, causing a sudden rise of blood copper levels and the classic *hemolytic crisis*, which includes jaundice and death.

So sheep producers hear one recommendation over and over: feed "sheep salt" to their sheep rather than a standard trace mineral mixture designed for beef cattle. Actually, sheep salt is really just a standard TM mixture *without any added copper.* This recommendation is okay in areas where forages contain sufficient copper (or low levels of molybdenum), because TM mixtures designed for beef cattle all contain copper, and if

these mixtures are fed to sheep, they may add too much copper to the sheep ration. But many producers, especially those who run both sheep and cattle, have historically never stocked two different minerals. For years, they've fed the same beef cattle TM mixture to *all* their livestock without incident. But things are changing in the cattle world, and this feeding strategy may now cause problems for sheep.

Among its many metabolic roles, copper is used by a number of enzymes in the immune system. Over the past ten years, researchers have observed better immune responses in dairy cattle that were fed diets containing more than 10 ppm copper. In response to this data, the new 2001 NRC (National Research Council) *Nutrient Requirements of Dairy Cattle* recommends 12-16 ppm copper in the total diet for dairy animals. In an analogous situation with beef cattle, some university bulletins now recommend that free-choice TM mixtures for beef cattle should contain *1,000-2,000 ppm copper*, and I've even seen recommendations as high as *5,000 ppm*. Some feed companies have already increased copper levels in their cattle mineral mixtures.

What do these new recommendations mean for people who raise sheep? Simple—it's now much riskier to offer sheep any mineral mixtures designed for cattle. Some cattle mineral mixtures may now contain much higher levels of copper than in previous years. If sheep consume these new cattle mineral mixtures containing copper at 1,000 ppm or more, well, quite a few sheep producers may become distressingly acquainted with the details of copper toxicity.

I say *may*, because not all cattle minerals contain these higher levels of copper. It depends on the company and the region. Usually, these higher copper levels are listed on the feedtag, maybe even with a warning "Do Not Feed to Sheep." But not always.

What about the neighbor who says, "Heck, I've fed the same mineral to my sheep and cattle for years, and I've never seen a problem"? Well, that was then and this is now. Back then he probably fed trace mineral mixtures with lower levels of copper. In today's world, commercial mineral mixtures may routinely contain very high levels of copper.

Today, any shepherd who wants to feed a beef cattle mineral to sheep should read the feedtag *very* carefully, and also know the background levels of copper, molybdenum, sulfur, and iron in the rest of the diet.

What about operations which run *both* sheep and cattle? Unlike sheep, cattle can handle the extra copper and are fairly resistant to CCT. But if we must feed both species at the same time, we do have some options. First, know the mineral levels in the total ration. Then you can decide which minerals are needed in the supplementary TM mixture and which ones should be avoided. Secondly, plan to feed two different mineral mixtures—one to the cattle, one to the sheep. This plan, of course, may be easier said than done, given the complexities of running a ranch or farm. Thirdly, look at other options for supplementing copper to cattle. Veterinary supply houses now carry slow-release boluses

that contain tiny needles of copper oxide. These boluses lodge in the rumen and release their copper over six months or more. The boluses aren't cheap, but they may be less expensive than extra fence or labor, or losing sheep.

The alternative—of simply feeding a cattle TM mixture to sheep and taking a wait-and-see approach—is *not* a good idea. Remember that CCT develops slowly. Excess copper insidiously accumulates in the liver over months or years, with no overt symptoms. By the time the first sheep shows a hemolytic crisis, all the other sheep in the flock may also have livers loaded with copper and are just waiting for the other shoe to drop. Copper toxicity in sheep is very bad news. Avoid it at all costs.

3. Vitamins through the rumen

Everyone knows about vitamins, right? We need them, we buy them, we feed them, and then our animals become healthy and happy. Well, maybe but maybe not. Our animals are not humans. They're ruminants or alpacas or horses, and their peculiar digestive anatomies mean that we often worry about things that we *don't* need to worry about, and that we may miss things that we *should* worry about. So let's engage in some straight talk about feeding vitamins to livestock and see where it leads.

From my nutritional perspective, there are three fundamental categories of vitamins—fat-soluble vitamins, water-soluble vitamins, and vitamin C. The practical questions are relatively simple. Should we include these vitamins in diets? If so, when? If not, why not? I'll discuss these categories in reverse order.

First an important note: in this article I am referring primarily to *ruminants*—sheep, goats, cattle, deer, elk, giraffes, bison, musk-oxen, etc. These all have a rumen, complete with a few zillion rumen microbes that are quite capable of manufacturing certain compounds the host animal can later absorb into its own blood. I'm also talking about those rumen-like animals called *camelids*—alpacas, llamas, camels, and such—which chew cud and boast a rumen with said rumen attributes, but do not have cloven-hooves or a fore-stomach compartment called the *omasum*. Weird, but it works. And I'm also talking about *horses*, which most definitely *do not* have a rumen. But horses *do* have a huge large intestine which effectively plays the corresponding role of a rumen—it contains rumen bugs that manufacture useful compounds that the horse can absorb into its bloodstream.

Now on to vitamin C. Properly called *ascorbic acid*, vitamin C is the well-known anti-oxidant found in citrus fruits. It's also known as the scurvy vitamin—the reason why the British navy inventoried citrus fruits on their sailing ships, why British seamen are forever known as *limeys*. Vitamin C is actually a small molecule derived from glucose using the enzyme *L-gulonolactone oxidase* which most animals possess. Only a few species lack this enzyme—humans, some higher primates, some fruit-eating bats, guinea pigs, and the red-vented bulbul bird. An exquisitely select club to be sure—and they all require vitamin C in their diet. But ruminants are *not* in this club. Ruminants possess this critical

enzyme and happily manufacture their own vitamin C. Therefore, we don't need to feed vitamin C to our livestock. Not unless you are trying to raise a herd of chimpanzees.

Next are the water-soluble vitamins. These are the famous B-vitamins. Whoa! I can almost hear folks exclaim, "You mean B-complex?" Well, without getting too complex, that terminology actually refers to a commercial injection that is a cocktail containing many different B-vitamin compounds. The reality is that there is no single "B-complex" vitamin. The B-vitamins are actually a group of eight unrelated compounds: thiamin, riboflavin, niacin, biotin, folic acid, B6 (also known as pyridoxine), pantothenic acid, and B12. All these compounds are soluble in water, and all are needed daily by our livestock.

Here's the good news: *rumen microbes can make all of these B-vitamins*. That is, during the fermentation process, the rumen bacteria synthesize these molecules, which then can be absorbed by the host animal and used for its own metabolism. Which means that, under normal conditions, *we don't need to add B-vitamins to ruminant diets*. Based on solid research conducted over the past 80 years, we think that a healthy population of rumen microbes makes enough B-vitamins to supply the needs of the host sheep or cow or musk-ox. This principle also applies to camelids, and, as far as we know, generally to horses.

The one exception, kind of, is vitamin B12. This molecule is a bit of a nutritional oddity. Rumen bacteria are actually quite capable of making it, but they need a critical component first. This component is the element *cobalt*. The formal chemical name for vitamin B12 is *cobalamin*. The "cobal" indicates that the molecule contains cobalt, which means that the microbes require some cobalt to manufacture B12. And in practice, this is exactly how we meet the ruminant requirements for vitamin B12—we include cobalt in our trace mineral mixtures to provide it to the rumen microbes. We don't need to add pre-formed B12 to our ruminant diets or TM mixtures. In regions where plant cobalt levels are low, we can include 40 ppm cobalt or so in our TM mixtures and stop worrying about it. Interestingly, this is not the only nutritional strategy for supplying B12 to ruminants. In some countries, farmers effectively approach the B12 problem by applying cobalt directly to pastures in fertilizers or by using slow-release cobalt boluses, but these techniques are not practiced in North America.

I would add a practical caveat to ruminant B-vitamin nutrition—rumen microbes function well when they function well. Any syndrome that impairs rumen function, like acidosis, or any severe stress or disease that reduces feed intake may greatly alter microbial activity and thus reduce B-vitamin synthesis. Also, some toxic plants contain compounds that specifically target certain rumen vitamin pathways, like bracken fern *thiaminase* which may destroy rumen thiamin before it can be absorbed by the animal. Under normal, steady-state conditions, a healthy rumen cranks out B-vitamins without problem. But under other conditions, all bets are off: call a nutritionist.

So what's left? The fat-soluble vitamins: A, D, E, and K. These molecules are unrelated

to each other, so I'll discuss them individually. With one exception, animals can't synthesize them. The exception is—you guessed it—vitamin D. When exposed to ultraviolet light, specialized enzymes in the skin will transform cholesterol into a vitamin D precursor called *cholecalciferol*. The blood then transports this compound to the liver and kidneys, where it is ultimately converted to the active form of vitamin D called *1, 25-dihydroxycholecalciferol*. A similar precursor can be found in bleached hay. The bottom line is that if our livestock roam outdoors in the sunlight for a reasonable period each day, they won't suffer from vitamin D deficiency. Of course, some animals such as orphan lambs, orphan calves, barn-housed horses, and confined dairy cows don't see much sunlight. For those situations, we definitely need to add vitamin D to their diets.

What about vitamin K? Usually getting sufficient vitamin K is not a problem because there's lots of it in green forage. Also, some rumen microbes can synthesize it in reasonable amounts. Either way, animals usually receive enough vitamin K to satisfy their requirements, so we don't need to worry about it. That is, unless our animals consume some really unusual feeds that contain antagonists of vitamin K, like moldy sweetclover hay (*Melilotus alba* and *M. officinalis*), certain sulfa drugs, or Warfarin rat poison. But that is a story for another time.

For vitamin E ... well, historically, we thought that vitamin E was used by livestock in ways similar to selenium, and that green forages contained enough vitamin E to satisfy most requirements. But we are learning that we have probably underestimated vitamin E requirements, especially for certain classes of animals, like high-producing animals, animals under stress, animals grazing mature forages, and confined animals fed high-grain diets. So now we are increasing the requirements and also routinely adding extra vitamin E to some diets and TM mixtures.

Finally, vitamin A. Fresh green forages usually contain lots of vitamin A (actually its precursor, the *carotenoids*). But deficiencies can occur in confined animals or animals grazing bleached, drought-stricken pastures. Also, hay that has been stored for a year or longer probably contains no vitamin A or vitamin E activity. These vitamins oxidize over time and lose their potency, even if the hay remains green. One good thing, however, is that unlike other vitamins, vitamin A is stored in the liver, and when animals come off an extended period of grazing green pasture, their livers contain 3+ months of vitamin A in reserve. In many cases, this reserve quietly gets them through a deficient period. But if they become deficient, we can always make sure that the TM mixture contains vitamin A, and as a last resort, inject livestock with a single megadose of vitamins A and D.

Vitamin A, however, is the only vitamin that we need to worry about toxicity, at least in theory. For example, if a 150 lb ewe requires 3,648 IU of vitamin A, a toxic dose would be more than 409,000 IU. This toxic level is generally hard to reach. But ... but ... recall that vitamin A is fat-soluble and accumulates in livers. Well, fish oils and seal livers contain lots of vitamin A. Who eats fish and seals? Polar bears. And sure enough, polar bear

livers contain toxic amounts of vitamin A. The Eskimos knew this and avoided eating polar bear livers. So if your local feedstore advertises a sale price on ground polar bear liver, don't buy it.

4. K as in coagulation

This is a story of bureaucratic bungling, a Nobel prize, three brilliant scientists, two countries, moldy hay, and rat poison. I am talking, of course, about the discovery of Vitamin K.

Before we start, I'll point out something—a very important something—about a uniquely American feature found in scientific papers from our land grant universities. The next time you read a scientific article in a research journal like the *Journal of Animal Science* or *Journal of Dairy Science*, look at the footnotes at the bottom of the first page. Among the usual items acknowledging the funding agencies and listing the authors= current addresses, look for a footnote with the words "Published with the approval of the Director of the [...state...] Experiment Station as Publication No. [...number...]." Although this type of footnote was more common years ago, you still occasionally see it today. I always thought it was just boilerplate fluff. Until now.

Back to the story. In the 1920s, farmers across the high plains were coming into their veterinary clinics carrying buckets of blood that wouldn't clot. They described a strange hemorrhagic syndrome in which their livestock, especially cattle, bled to death from the slightest wounds. No one knew the cause, but the main commonality between these farms was that the affected animals had been fed moldy hay made from a popular legume called sweetclover (*Melilotus alba* and *Melilotus officinalis*).

During this same period, poultry producers reported a strange bleeding disease in their chickens. These producers were beginning to follow the modern practice of raising chickens in wire cages, and they observed that some caged chickens suffered from a hemorrhagic syndrome that kind of resembled scurvy. Again, no one knew the cause.

Let's put these reports into a historical perspective. The early years of the 20th century was a period of explosive growth in scientific technology, especially in nutrition and biochemistry. Researchers developed powerful laboratory techniques for identifying toxins and other biochemical agents. It was during this period that scientists discovered the nutritional factors called *vitamins*, and vitamin research was all the rage.

These two bleeding syndromes, however, were puzzling, and researchers from many countries raced to discover solutions. In 1929, a prominent Danish biochemist named Henrik Dam published a paper that thoroughly described the bleeding syndrome in chicks. After additional research, Dam published another paper in 1934 in which he contended that no known vitamins were involved in this syndrome. Two Kansas researchers, Romayne Cribbett and John Correll, reached the same conclusion in their 1934 paper "On a Scurvy-like Disease in Chicks."

Meanwhile, at the University of California in Berkeley, S.F. Cook and K.G. Scott were conducting experiments with chickens and in 1935, they postulated that this bleeding syndrome was caused by some sort of unknown toxin in fishmeal (because feeding meat meal did not cause the problem). Their paper didn't make the fishing industry happy, but it did seem to point in a logical direction.

At the same time on that campus, a young scientist named Herman Almquist was also working on this bleeding problem in chicks. After earning a Ph.D. in organic chemistry, he had recently joined the Division of Poultry Husbandry in the College of Agriculture (yes, Berkeley had an agricultural school back then). In a series of brilliant experiments, he demonstrated that this bleeding syndrome involved a "factor" that was soluble in fat and that could be produced by bacterial growth in feedstuffs. He showed that he could prevent the bleeding syndrome by adding this factor back into purified diets, even diets containing fishmeal. Almquist concluded that this preventive factor which was somehow associated with the clotting process was a new, yet-undiscovered vitamin.

This was great investigative work, but then he tried to publish it. Remember that footnote I mentioned earlier? Well, the routine procedure for scientists on the Berkeley campus was, prior to sending their papers to research journals for publication, to submit their manuscripts to the Experiment Station Director's office for "approval."

But the university administrators had a serious problem with Almquist's paper—they didn't agree with his conclusions. Very strongly. They noted that senior scientists on their campus had found a different result (the possibility of a toxin) and also that respected scientists in other institutions had already concluded that no vitamins were involved in this bleeding syndrome. So these Berkeley administrators, in their wisdom, were afraid that Almquist's outlandish paper would embarrass their institution. They felt so strongly about it that they ordered Almquist to stop submitting research manuscripts until the matter was resolved within the university.

So ... while Almquist fought to obtain approval from his university administrators, his landmark paper sat on a shelf waiting to be published in a scientific journal.

But the world did not wait for the University of California. In Denmark, Henrik Dam was actively researching the same syndrome, and in 1935, *he* published a paper in the journal *Nature* entitled "The Antihemorrhagic Vitamin of the Chick. Occurrence and Chemical Nature," with essentially the same results as Almquist. Although Dam and Almquist had both reached the same conclusions about this clotting factor, Dam published his paper first. And since the Germanic term for blood clotting is *Koagulation* spelled with a "K," Dam named this factor *Vitamin K*.

In 1943 Henrik Dam was awarded the Nobel Prize for his discovery of Vitamin K. Eventually, Herman Almquist won his argument with the university system and published his

paper in *Nature*—a few months after Dam. But the damage was done. Almquist lost out because he couldn't get his paper published first.

But that's not the end of my story. Remember that other hemorrhagic problem in cattle fed sweetclover hay? Well, Vitamin K is an integral part of the clotting process. Sweetclover naturally contains a compound called *coumarin*. Although coumarin is harmless, its derivative is not. When sweetclover is made into hay, and if that hay gets wet so that mold grows on it, the mold converts coumarin into *dicoumarol*. Dicoumarol interferes with the function of Vitamin K, and this interferes with the clotting process. Hence the bleeding syndrome in livestock fed moldy sweetclover hay.

After the discovery of Vitamin K, a Wisconsin scientist named Karl Link worked on this hemorrhagic disease of sweetclover and in 1941 successfully characterized dicoumarol and its anticoagulant properties. His laboratory then synthesized other similar compounds with anticoagulant properties, trying to find a commercial blood-thinning drug. Because of the financial profit potential of such a compound, the University of Wisconsin was very interested in his work, In fact, like many universities that administer the licenses and royalties from the commercial products of university research, the University of Wisconsin had set up a separate funding organization called the *Wisconsin Alumni Research Foundation (WARF).*

One compound that Karl Link synthesized from coumarin was particularly effective as an anticoagulant, far more powerful and dependable than dicoumarol. This compound was soon commercialized as a rat poison. In fact, it has become one of the most widely used rodenticides in the world, as well as a premier anticoagulant drug in human medicine. We know it as *warfarin*. But think for a moment about its name ... Karl Link had cleverly combined the acronym of his university foundation with the name of the base compound—*WARF* plus coum*arin*.

So there we have it. University bureaucrats delay the publication of a breakthrough paper on Vitamin K because they wish to avoid institutional embarrassment, and in doing so they deprive a fine scientist of a Nobel Prize. Years later, after working on a compound linked to Vitamin K, another fine scientist in a different state names a rat poison after his university's funding organization.

Life is filled with little ironies.

FINDING THOSE EMPTY EWES

by Karen Bannow, Certified Ultrasound Technician
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Pregnancy scanning

When pregnancy scanning is done within the recommended time frame, the accuracy of identifying animals that are not pregnant and your ability to count the number of fetuses is very high. Accuracy of the scanning results is adversely affected when the animals presented are outside the recommended time frame or when there are large numbers of fetuses.

Why scan your ewes?

- To identify, and manage accordingly, those ewes that are open (not pregnant)
- To group ewes for feeding management according to fetus count
- To improve newborn survival through improved feeding management
- To determine appropriate dry-off time in dairy sheep.

For pregnancy scanning to be accurate and of the most benefit, you need to know what **not** to do. The following conditions will adversely affect the technician's ability to provide you with accurate results:

- Animals with a full rumen (fresh off pasture)
- Sheep who are dirty in the crutch-udder area.
- Fat sheep
- Wild, jumpy sheep
- Ewes being presented for scan outside of the ideal 78 day window (below 55 and above 100 days)
- Doing too much to the sheep while they are being scanned (marking, hand recording animal ID, drafting off scanned animals), with too few people available to get it all done.

The presence of prolific ewes (carrying triplets, quads, etc.) will also affect scanning accuracy.

What you can do to be as successful as possible

- Book your appointment as early as possible.
- Know your facts:
    1. When ram(s) went into the breeding group
    2. When the ram(s) were removed from the breeding group
- Plan to scan the ewes between 70 and 90 days of gestation.
- Ask the scanner what their protocol is.
- Take the sheep off feed 24 hours before the scan is scheduled to occur.
- Have adequate labour available.
- **Do not** plan to do "other" jobs while the scanning is being done.
- Provide a means for equipment clean-up.

What is the cost/benefit of pregnancy scanning?

For the purposes of our calculations, consider a flock of 200 ewes with a typical open rate of 5%.

1. Those ewes that are found to be open can then either:
    - Be culled, taking advantage of typically strong seasonal cull prices, or
    - Moved into the next breeding group and exposed again.
2. Improved management of feed resources (growing or stored) can be achieved by sorting ewes according to the number of lambs that they are carrying. For example, through better management of feeding, producers can ensure that singles will be smaller at birth and multiple lambs will be larger. It takes very little reduction in lamb mortality to significantly affect profitability.

   By using ultrasound pregnancy scanning as a management tool it is possible to improve breeding program management, feeding management, and lamb survival—all of which put dollars in your pocket.

Cost	Per Item	Total
Cost of scanning (200 ewes @ $2 per ewe)	$400.00	
Mileage	$100.00	
Extra labour hired	$100.00	
		$600.00

Income from Sale of Culls	Open Ewes	Av. Wt.	$/lb.	Income
Open ewes (5% of 200 ewes)	10			
Average weight of ewes (lbs)		145		
Price of culls per pound			$0.60	
				$870.00

Feed Savings	Days	Open Ewes	Amt Fed, lbs	Cost Per Tonne	$
Difference in days between culling after scan results and culling after lambing completed	60				
Open ewes		10			
Hay fed per head per day (lbs)			5		
Cost of hay per tonne				$80.00	
Hay savings					
Grain fed per head per day (lbs)			1.5		
Cost of grain per tonne				$165.00	
Grain Saving					
Feed Savings					**$176.19**

Net Position	Income $	Expense $	Net $
Cost of Scanning		$600.00	
Sale of Culls	$870.00		
Feed Savings	$176.19		
			$446.19

Savings from Improved Lamb Survival through Better Feed Management	Number	Lambs	$	$
Pregnant ewes to lamb	190			
Number of dead lambs @ average lamb mortality (12 %)		42.18		
Number of dead lambs at your target lamb mortality (10 %)		35.15		
Extra lambs to wean due to reduced mortality		7.03		
Market price for slaughter lambs			$185.00	
Value of improved lamb survival				**$1,300.55**

Pregnancy Scanning Management Calendar

Rams In	Rams Out	Scan Date	Due Date
1-Jul	12-Aug	24-Sep	25-Nov
10-Jul	21-Aug	3-Oct	4-Dec
20-Jul	31-Aug	13-Oct	14-Dec
30-Jul	10-Sep	23-Oct	24-Dec
9-Aug	20-Sep	2-Nov	3-Jan
19-Aug	30-Sep	12-Nov	13-Jan
29-Aug	10-Oct	22-Nov	23-Jan
8-Sep	20-Oct	2-Dec	2-Feb
18-Sep	30-Oct	12-Dec	12-Feb
28-Sep	9-Nov	22-Dec	22-Feb
8-Oct	19-Nov	1-Jan	4-Mar
18-Oct	29-Nov	11-Jan	14-Mar
28-Oct	9-Dec	21-Jan	24-Mar
7-Nov	19-Dec	31-Jan	3-Apr
17-Nov	29-Dec	10-Feb	13-Apr
27-Nov	8-Jan	20-Feb	23-Apr
7-Dec	18-Jan	2-Mar	3-May
17-Dec	28-Jan	12-Mar	13-May
27-Dec	7-Feb	22-Mar	23-May
6-Jan	17-Feb	1-Apr	2-Jun
16-Jan	27-Feb	11-Apr	12-Jun
26-Jan	9-Mar	21-Apr	22-Jun
5-Feb	19-Mar	1-May	2-Jul
15-Feb	29-Mar	11-May	12-Jul
25-Feb	8-Apr	21-May	22-Jul
7-Mar	18-Apr	31-May	1-Aug
17-Mar	28-Apr	10-Jun	11-Aug
27-Mar	8-May	20-Jun	21-Aug
6-Apr	18-May	30-Jun	31-Aug
16-Apr	28-May	10-Jul	10-Sep
26-Apr	7-Jun	20-Jul	20-Sep
6-May	17-Jun	30-Jul	30-Sep
16-May	27-Jun	9-Aug	10-Oct
26-May	7-Jul	19-Aug	20-Oct
5-Jun	17-Jul	29-Aug	30-Oct
15-Jun	27-Jul	8-Sep	9-Nov
25-Jun	6-Aug	18-Sep	19-Nov

GAIN FROM GENETICS

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Selecting and buying rams is an important business decision which should be treated as an enterprise input, just like fertiliser, pasture improvement or supplementary feeding. Unfortunately many ram buyers, and breeders, struggle to approach this decision with the objectivity they could—and should—apply. It is very important to make this decision well because the rams introduced to your flock set the production (genetic) potential for your flock. Management then realises that potential.

Animal selection

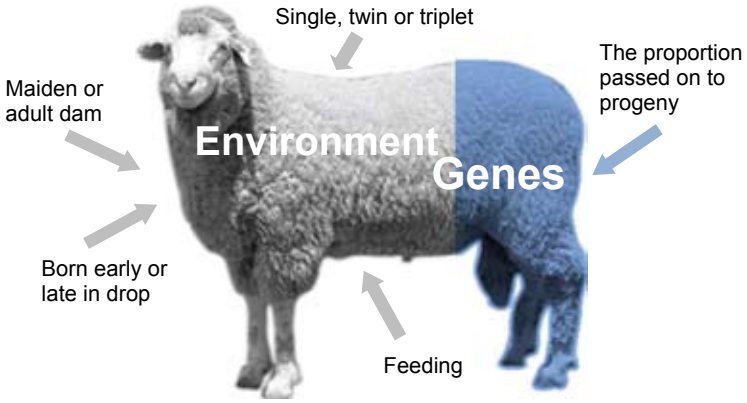
The basic principles underlying animal selection decisions are:

1. Identifying differences between animals for commercially desired traits; and
2. Selecting and breeding from those animals that have the best overall combination of characteristics to achieve your breeding objective.

In practice, the process is more difficult than stated because the differences you identify between animals must be genetic if those desirable characteristics are to be passed onto their progeny. You can only take home the genetic component of the desirable attributes you identify in an animal.

When you buy a ram, you are purchasing its genes and it is important to understand that performance expressed reflects the interaction of his genes and the environment.

This can be summarised as: **Performance = Genes + Environment**



The ram you buy will only pass on his genes—not his own performance. His own performance is largely influenced by the environment he has been reared in. It is for this reason that genetic information—breeding values—is a very important tool for animal breeding decisions.

Breeding values describe an animal's genetic potential independent of the rearing conditions and how the ram is presented for sale. Breeding values are the only way to objectively describe genetic differences between rams across years, across flocks within a breed and, potentially, across breeds.

It is for these reasons that breeding values are widely used in livestock industries—beef, dairy, pigs and sheep. Australian ram breeders submit performance data on some 350,000 seedstock animals each year.

The Australian lamb industry is fortunate to have access the largest genetic evaluation program in the world and has used this information to drive significant genetic change.

Rate of genetic improvement

Four key factors influence the rate of genetic improvement, or response to selection. They are the:

1. Heritability of the trait;
2. generation interval;
3. selection differential; and
4. genetic variation of the trait.

Heritability: The heritability of a trait is the proportion of the difference between animals, after adjusting for known non-genetic influences, which can be passed on to their progeny. Traits with a higher heritability are easier to select for.

Generation interval: The time interval between generations, defined as the average age of parents when their progeny are born.

Selection differential and genetic variation: The selection differential is the difference between the average genetic merit of the parents selected and the average of the population from which they come. There is potential for greater selection differential among those traits which have a greater genetic variation.

The selection differential is influenced by the number of animals that you need to select. The fewer the animals required, the higher your potential selection differential. There is much greater potential selection differential when selecting rams as opposed to replacement ewes, with the exception of ET (embryo transfer) or JIVET (juvenile in-vitro embryo transfer) programs for seedstock breeders.

The opportunity

In considering these drivers of the rate of genetic improvement we are restricted. Breeders cannot change the heritability or variation of a trait; however we need to understand their role in selection decisions. Seedstock breeders can influence (reduce) generation interval by using mainly young sires and technologies such as JIVET, but a short generation interval alone will not necessarily lead to genetic improvement.

Selection differential is the key tool for both seedstock and commercial sheep producers. Good genetic information is the best tool available to achieve this goal.

Proof of value—a field trial example

A commercial scale trial was conducted in a 2000 first cross ewe flock (Border Leicester x Merino) to validate the impact of growth rate breeding values. Terminal sire teams representing high, medium and low growth potential, as rated by LAMBPLAN, were mated to randomly allocated ewe mobs.

The production target was the proportion of lambs reaching 43 kg live-weight (20 kg cwt—Australian supermarket target weight), or heavier, by 16 weeks of age. The results in Table 1 clearly illustrate that LAMBPLAN correctly ranked the sire teams and the additional productivity delivered by the genetically high growth potential sire team.

Table 1: Percentage of lambs 43kg or heavier at 16 weeks

Sire Group	% 43 kg plus
High growth	46.6
Medium Growth	18.0
Low Growth	11.6

The lambs from the high growth ram team gained 50 g per day more than lambs from the low growth team. At 16 weeks this produced 2.5 kg extra carcase weight, which at current prices ($5.00/kg cwt) equates to $12.50 per lamb.

Additionally, over four times as many lambs met market specifications at 16 weeks of age.

Key messages

- Identify the key production traits that drive your sheep enterprise profit.
- Identify the genetic opportunities to improve key production traits (and management to optimise expression).
- Select the best genetics for your business—use genetic information in conjunction with visual assessment.

TRAPPING COYOTES, THE KEYS TO SUCCESS

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Notes

Alberta Sheep Breeders' Association

ASBA

Trade Show Participants

- Action for Agriculture
- Alberta Agriculture & Rural Development
  - *Body Conditioning Score*
  - *Feed Testing*
  - *Precision Flock Management*
  - *Sheep Bytes*
- Alberta Lamb Producers
- Allflex
- Canadian Cooperative Wool Growers
- Canadian Lamb Cooperative
- Custom Woolen Mills
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