Livestock Drought Management Guide

Ministry of Agriculture and Food, British Columbia

Guidebook
(August 2024)

Created in partnership with BCCA

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B.C. Ministry of Agriculture and Food
August 2024

Disclaimer:
This workbook is intended to give you some of the tools and concepts you need to make decisions on farm. It is intended to initiate thought and help focus on various management options and decisions that need to be considered on farm.

When pertaining to animal health, it is not intended to take the place of advice and guidance from your veterinarian. We strongly encourage you to engage in discussions with your veterinarian about how drought conditions impact other aspects of your herd or flock health.

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INTRODUCTION TO THE GUIDEBOOK

This workbook is broken into six main sections to help farmers focus on the important details one area at a time:

1. Gathering inventories of what you have on-hand (or project you will have soon) that will help you make decisions for your farm.
2. Livestock feeding and strategies to address shortages you may be experiencing.
3. Forage crop considerations and strategies.
4. Analyzing the business/economic decisions and/or options that are identified while looking into your livestock production and forage production situations.
5. Bringing it all together.
6. Other resource information sources to point you in the direction of more detailed information in case you want to find out more.

The workbook was developed as a companion to the series of Livestock Drought Management Workshops held by the Ministry of Agriculture and Food ("the Ministry") in 2023 and 2024. It is meant to help you gather some of the necessary farm inventory information you need to consider for your farm. It also recaps the most important concepts for managing through a drought in three key areas: Feeding, Forages, and Business/Economic Decisions. The three different presentations/discussions in the workshop are meant to be interactive. This workbook allows attendees to be fully immersed in the discussion and jot down a few notes for application at home, rather than concentrating on notetaking during the workshop.

Within each section, a discussion of strategies to consider when faced with drought conditions will be discussed. These three areas overlap and interact. Those inter-relationships must be considered when making management decisions. Decisions made while ignoring the effects in the other areas can have serious consequences. Much like an old three-legged milking stool, all three legs are equally important.

SECTION 1: INVENTORIES

The guidebook begins with asking you to reflect on your current on-farm inventories and guide your thoughts and options. This will help to lay the groundwork needed for making decisions at home.

Having a solid grasp on these numbers will help you in making decisions for the upcoming winter-feeding period and into next year's grazing season. These inventories include:

- **Current Animal Inventory:** This will be used to determine how much winter feed you will need to feed your herd/flock over the feeding period. It can also be useful to help identify groupings of animals to improve feed efficiency strategies.
- **Forage and Feed Inventory:** This is an inventory of currently available stored feed on-farm that will be used for the winter-feeding period. It is the baseline data that you need to determine whether you have enough feed, whether the quality is adequate and will lead into various strategies (e.g., sourcing additional feed, reducing herd/flock numbers, etc.).
- **Field/Pasture Inventory:** This inventory is meant to gauge available grazing areas for the grazing period. It can also be a place to note any changes in the field as a result of drought. This can be used to plan out a grazing plan for the season. Estimating standing forage yield will ensure that estimated days on grass are accurate, defining for winter feeding period to ensure enough stored feed is available to get through to the spring.

CURRENT ANIMAL INVENTORY

Animal Type	Category	Number
Beef Cattle/Bison	Cows	
	Heifers	
	Yearlings	
	Calves	
	Bulls	
Dairy Cattle	Lactating	
	Dry	
	Young stock	
Sheep	Ewes	
	Yearlings	
	Lambs	
Other		

Winter Feeding Begins (delivering feed vs grazing)
Pregnancy checks before then? Y or N _____

Normal Birthing Time (if applicable) _____

Finished Winter Feeding (return to grazing) _____

Reproductive Indicators (Open females, weaning %) _____

Herd Replacement Rate, Sire/Dam Ratio, etc. _____

Note: Use feed tag or photo of tag for inputting information for purchased feeds and/or supplements.

FORAGE AND FEED INVENTORY

Type	Cut (i.e. 1st, 2nd, other)	Species	Stage of growth at harvest	Notes	Feed Analysis?
Hay/Conserved Forage					☐
					☐
					☐
					☐
Wrapped Bales					☐
					☐
Silage					☐
					☐
Straw					☐
Other (e.g., alternatives, minerals)					☐
					☐
					☐
					☐

Note: Refer to field map or field drawing

FIELD/ PASTURE INVENTORY

Field Name	Area (Acres or Hectares)	Species	Current Standing Volume	Water Resource Available?	Still Grazing?
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐
				☐	☐

Do you have enough grazing to get you to your normal winter-feeding date?
Normal Feeding Methods/Strategies
e.g., groupings, feed delivery (mixing, dry lot), bale grazing

Normal quantity you feed (total quantity or quantity per animal).

Do you have specific areas for different phases (e.g., calving, feeding, sacrifice fields)?

INVENTORIES SUMMARY

Are there any changes noted from normal or historic levels?

- ⇒ herd size and make-up
- ⇒ feed supply

Do you have enough feed on-hand for all livestock—what is the gap? (quantity, quality)

- ⇒ What is the percent difference between “normal” and current levels (gut feel)

What are the risks of doing nothing?

OBJECTIVES

What are your objectives today to get you successfully through the next growing season?

SECTION 2: FEED & FEEDING MANAGEMENT

INTRODUCTION

Livestock need balanced diets to support their overall health and wellbeing in addition to ensuring optimum production. Each species needs a mix of different nutrients that are balanced to ensure nutritional needs are met. Optimal nutrition promotes overall health and wellbeing, allowing the animal to grow and sustain themselves.

Providing a balanced diet is necessary to ensure optimum productivity. An imbalance of nutrients in the diet can lead to lower production (lower growth rate, lower milk production, etc.), poor growth, poor reproductive performance, and a reduced immune response making them more susceptible to disease. Feed is one of the largest input costs on any livestock operation, and often investing in a nutrition program can lead to improvements in feeding efficiency, reduce feed waste and lead to improvements in performance contributing to the farm's bottom line. The economic importance of balancing rations, and your feed supply, is hugely magnified in a drought year.

The first step in reviewing a nutrition program is knowing how much feed you have (noted in the inventories) and determining the quality of that feed. To determine feed quality, forage samples must be collected and sent to an accredited lab for analysis.

COLLECTING A FORAGE SAMPLE

Equipment

The recommendation is to use a stainless-steel forage probe for taking samples to avoid cross-contamination. Check with your local feed stores, Ministry offices or other contacts for borrowing a probe. They are also available for purchase. For example, Star forage probes (Canadian-made) can be ordered online.

Hay and Wrapped Bales

Hays of different types, cuttings or even fields should be sampled as separate lots. For each lot: 15- 20 samples should be taken randomly through the curved side of round bales, or from the end between strings for square bales using a 3/8-3/4" diameter forage probe with a sharp tip. These samples should be combined into a sealed bag. For wrapped bales, cut the hole first and retape it when finished on each bale. Label each bag to ensure lots remain distinguishable from one another.

Silage Bunkers and bags

Silage samples are best taken during feedout by grabbing from the silage face as you would during feeding. It is helpful to take several samples, thoroughly mix them in a bucket and then sub-sample for a quantity to submit to the lab. Be safe near large open silage faces as silage can fall and injure and/or bury you.

Sample Handling

Seal the samples in a plastic bag and protect them from the heat. Hay samples can be kept in the fridge and silage samples can be frozen before shipping if they will not arrive overnight. If possible, samples should be taken early in the week to ensure they arrive at the lab promptly. This is especially critical when testing for nitrates as improper handling can affect values.

Table 1: A list of suggested tests from different labs

Lab	Suggested tests
Fraser Analytical	• NIR1 (A1) Basic NIR Analysis • NIR2 (A2) NIR + Wet chemistry Minerals • Can add Plus option to either for Fiber Digestibility (NDFd) • Can add nitrates
Nutrilytical	• Standard NIR + Minerals • Can add nitrates
A&L Canada Laboratories Inc.	• Package FN1: basic package • Package FN1WM: basic package with wet minerals • Package FN2WM: complete NIR with wet minerals • Nitrates code: INOD030
Central Testing Laboratory Ltd.	• Minerals done with NIR packages (1FFNIR- B & 2FFNIR-B) are done by wet chemistry.

Note for equines:

The laboratories listed above also have distinct tests geared specifically to equines. In addition to basic forage tests, equine packages often have the option to add on an analysis of the sugars within the forage. This can be important if you are feeding a horse with metabolic issues or health concerns.

BASICS OF INTERPRETING FORAGE TEST RESULTS

Forage results can come in different formats based on the lab used. This section outlines some of the most important values to consider when reviewing your results.

Feed Terms

NIR vs. Wet Chemistry: Labs conduct testing either by spectroscopy (passing light waves through the sample and measuring reflectance), or wet chemistry (lab techniques and extractions to measure values). NIR is quick and economical but requires calibration to forage type and can be less accurate than wet chemistry.

Dry Matter vs. As-Fed: Rations are balanced and forage results are compared using "Dry Matter" values, whereas feed mixing, and delivery uses "As-Fed" quantities. All values in this document are "Dry Matter" basis.

Forage results have five main sections: Moisture /Dry Matter, Protein, Energy, Fiber and Minerals.

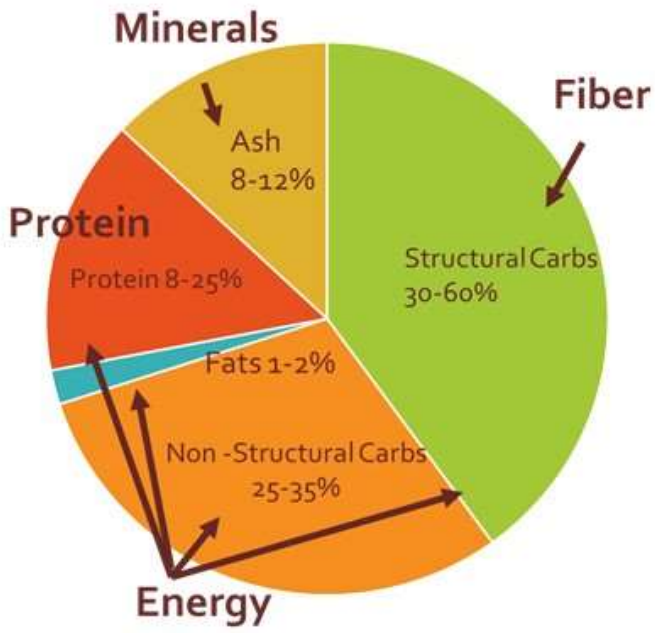

Figure 1: Components of minerals, fiber, energy and protein.

Moisture / Dry Matter %: Measure of water in the forage. For information on how this is done, refer to Microwave Method for Determining Dry Matter of Forages and Grains (msu.edu).

Crude Protein (CP): Measure of the nitrogen content of the feed, animal requirement is for amino acids. For ruminants, CP can be divided into the point of digestion and fine-tuned. Deficiency results in declines in growth rates and milk production, delayed estrus and poor conception and potential impacts on unborn calves.

- **Soluble Protein (%):** Feeds the rumen bacteria which create microbial protein. This process requires energy. Can be supplemented if deficient.
    - *Typical Range: Hay 30-55%, Silage 40-60%*
- **ADICP / ADF-CP (% of CP):** Acid Detergent Insoluble Crude Protein (ADICP) / Acid Detergent Fiber-Crude Protein (ADF-CP). Bound protein that is heat damaged and unavailable, tied up within the fiber. If enough is tied up (value over 10% of CP), an adjustment to CP must be made.

Energy: A calculated value on a forage result, depicted in many ways depending on the species and producer and nutritionist preferences. Total Digestible Nutrients (TDN) and Net Energy are commonly used for ruminants. Other species may use Digestible Energy or a modified TDN calculation. Livestock that are short energy can experience a loss in body weight, poor conception and a decline in growth and milk production.

- **TDN (%):** Total digestible nutrients. Traditionally calculated from ADF, some labs also use a new formula that accounts for fiber digestibility. Easy to compare to

animal requirements.

- **Net Energy (Mcal/lb or /kg):** Broken into net energy for maintenance, gain and lactation. Often used in ration balancing for growth or milk production.

Fiber (Structural Carbohydrates): Fiber gives the plant structure and allows the digestive system of ruminants to function properly. Within the plant, fiber consists of lignin, cellulose and hemi-cellulose. Fiber levels increase with plant maturity.

- **ADF (%):** Acid Detergent Fiber. Least digestible fiber, this is traditionally used for prediction of energy.
  - *Typical Range: 30-40%*
- **NDF (%):** Neutral Detergent Fiber. Includes all structural carbohydrates, used to predict rumen fill and intakes. Greatly influenced by maturity. Grasses generally have higher NDF than legumes. Shown as "aNDF" by some labs.
  - *Typical Range 35-70%*
- **Lignin (%):** Indigestible fiber.
  - *Typical Range 4-8%*
- **NDFd (% of NDF):** NDF digestibility. Lab analysis of digestibility at different time periods for ruminants. Greatly influenced by growing conditions and species, it is a very useful measurement in ration balancing to predict intake and to compare forages of similar NDF levels. Make sure to compare the values at the same time periods.
  - *Typical NDFd (48hr) values: Grass 40-65%, Alfalfa 40-55%, Straw 30-40%, Cereal Silage 55-60%*

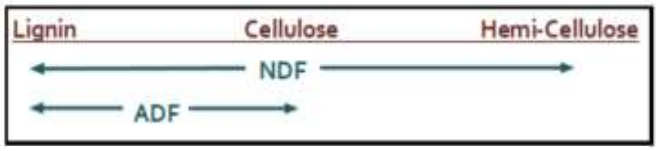

Figure 2: NDF and ADF component of lignin, cellulose and hemi-cellulose

Intake:
While not directly measured on a forage result, animal intake can range from 1.5-3.5% of body weight depending on animal class, size and stage of production. It is driven by forage quality and rate of passage, which we can measure and predict using NDF and NDFd. Low quality forages with NDF levels above 65% and low digestibility can potentially cause issues with impaction, where the movement of forage through the digestive tract slows too much. Intakes are reduced with low quality forages increasing the potential for nutrient deficiencies in the diet.

Non-Structural Carbohydrates: Non-structural carbohydrates are rapidly available energy. NSC is sometimes shown on a feed test as the calculated value "NSC"; however it is often useful to look at specific fractions including:

- **Starch:** Found in grain, corn silage, cereal silage, mature grasses (small amounts).
- **Sugar:** Can be depicted as WSC (Water soluble carbohydrates) and ESC (Ethanol soluble carbohydrates). Often high (>10%) in cool season perennial grasses.

Some equines can be sensitive to feeds high in sugars; if this is a concern for you, you can request that the lab evaluate and test the sugar levels of the forage.

Minerals

Minerals are best measured with Wet Chemistry. Some production issues suspected to be caused by mineral imbalances are best determined in conjunction with other tests such as water, soil, blood, liver biopsy and manure.

Ash (%): Everything that is left after burning the sample, includes minerals and dirt in the forage. *7-9% Typical for Alfalfa-grass >10% potentially contaminated with soil*

Macro-minerals (%):

Required in larger quantities and critical for animal growth and health, macro-mineral levels can vary depending on forage species and soil type. Results are important for selecting a mineral supplement.

- **Calcium (Ca):** Critical for milk production and bone growth. Deficiency causes milk fever. Ratio of Calcium to Phosphorus is important. (1.5:1 to 3:1) range.
- **Phosphorus (P):** Used for reproduction and growth, very common deficiency in forages. Deficiency can result in poor breeding and reduced weaning weights. Excess calcium increases the requirement for Phosphorus.
- **Magnesium (Mg):** Deficiency results in grass tetany, often from lush pasture or winter feed. Use the tetany ratio which factors in potassium and calcium to determine risk. The tetany ratio is K / (Ca + Mg)
- **Potassium (K):** Deficiency is rare, excess can be a concern for dairy dry cows.
- **Sulphur (S):** Some forage tests in BC are borderline low, larger issues come from toxicity including antagonism of uptake of Copper and Selenium.
- **Salt (Sodium Chloride, NaCl):** Livestock will actively seek out, can be used to encourage or limit intake.

Typical Mineral Ranges:

Calcium:	
Alfalfa:	1.0 – 2.0%
Grass:	0.1 – 1.0%
Grains:	0.02 – 0.1%
Phosphorous:	
Alfalfa:	0.1 – 0.4%
Grass:	0.1 – 0.4%
Grain:	0.25 – 0.5%
Ca : P Ratio:	
Alfalfa:	10:1 to 5:1
Grass:	1:1 to 2.5:1
Grains:	0.08:1 to 0.2:1
Magnesium:	0.2 – 0.5%
Potassium:	1.0 – 4.0 %
Sulphur:	0.1 – 0.3%

Figure 3: Typical mineral ranges in alfalfa, grass and grains

Purchased Minerals:

Purchased minerals are often identified as 1:1, 1:2 or 2:1, which is the ratio of Calcium to Phosphorus in the mineral. Diets that are high in alfalfa are typically balanced with a lower Ca:P ratio mineral and diets higher in cereal greenfeed / silage or grain with a higher Ca:P ratio. It is also important to consider whether salt is included and the expected feeding rate of the mineral when comparing options.

Trace minerals (%):
Required in small amounts, but still extremely important. Past feed sampling in B.C. has shown many forages are deficient in one or more trace minerals.

- **Selenium (Se):** It is very common to see deficiencies; however, there are some areas within B.C. that have very high levels in the soil. Deficiency results in retained placentas and white muscle disease. Excess selenium can be toxic and result in death. The relationship selenium has with Vitamin E is important.
- **Copper (Cu):** Very common deficiency (*<10ppm*). Important for reproduction and breeding, availability is affected by antagonists (Sulphur and Molybdenum).
- **Zinc (Zn):** Very common deficiency (*<30ppm*). Important for immune response, growth and hoof health.
- **Manganese (Mn):** Common deficiency (*<50ppm*). Deficiency results in reduced fertility.
- **Iron (Fe):** Rarely deficient but can be variable. Deficiency causes anemia, excess can be antagonistic.
- **Iodine (I):** Deficiency causes goiter, influences reproduction and hoof health.
- **Cobalt (Co):** Critical for rumen synthesis of Vitamin B12 and proper rumen function.
- **Molybdenum (Mo):** Excessive levels can be antagonistic to copper.
- **Vitamin A:** Not measured on a forage test, but important to consider as it comes from Beta-Carotene in plants. Levels are high in green forages and low in cereals, mature or drought stressed forages. Levels also decreases with storage time for dry/ cured feed.

Sheep and copper
Sheep are highly sensitive to copper toxicity and have a much lower dietary requirement for it due to their inability to manage levels in excess of their requirements.

Other Calculations and Measurements

Relative Forage Value (RFV) and Relative Forage Quality (RFQ): Not used for ration balancing but useful for comparing forages. RFV is only used for alfalfa, RFQ is used for all forages.

Above 150:	*Premium*	*90-120:*	*Fair*
120-150:	*Good / Very Good*	*Below 90:*	*Poor*

Nitrates: An important measurement to evaluate risk of feeding or grazing stressed or over fertilized forages. Pay attention to method the lab uses to report the values (Nitrate, Nitrate-N, or Potassium Nitrate) and % vs ppm**.**

	Generally Safe
NO3 (Nitrate) %	*<0.5%*
NO3 (Nitrate) ppm	*<5000ppm*
NO3-N (Nitrate Nitrogen) %	*<0.12%*
NO3-N (Nitrate Nitrogen) ppm	*<1200ppm*

For test results above these levels, it is important to discuss with a professional as it may be possible to feed to certain classes of animals, or at a reduced rate.

Very high levels of nitrates are extremely toxic.

DROUGHT IMPACTS ON FORAGE QUALITY

Are yields down, but quality is up?

While plant maturity still has the largest impact on forage quality, there can also be other changes (as long as you harvest at the same stage of maturity and do not delay getting more volume).

Environmental impacts can improve forage quality:

Long days and cool nights	→ Increased fiber digestibility and sugar levels
Water stressed plants	→ Less fiber (Lower NDF) and higher digestibility
Additional solar radiation (sunny days)	→ Increased sugar levels
Better haying conditions	→ Less quality loss during hay curing

Reference: 2003. Effects of Environment on Forage Quality. Western Dairy Digest.

Potential negative quality impacts:

- Nitrate accumulation
- Potentially lower phosphorus and other variable mineral levels for both macro-minerals and trace minerals
- Lower crude protein levels on alfalfa stands than normal
- Potential toxic weeds (scout your pastures as feed tests won't tell you if there are toxic plants)
- Lack of vitamin A (Beta-Carotene) in pasture and conserved forages

For these reasons, it is recommended to test your forages.

FEEDING

Energy and Protein Demands

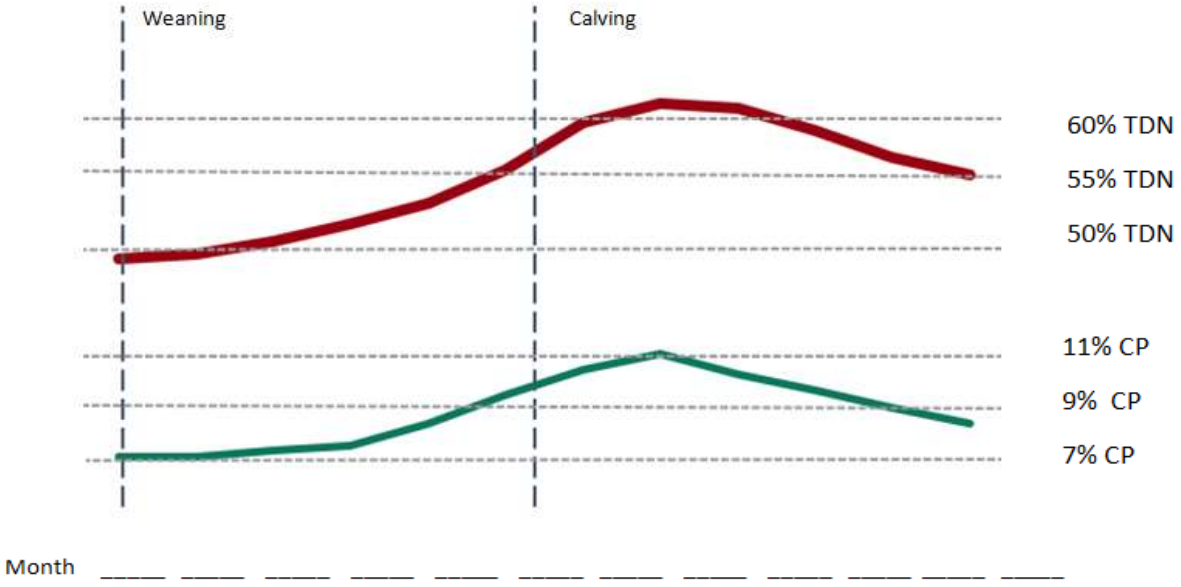

Figure 4: Energy and Protein demand by month: 1,300 lb beef cow, average to slightly above average milking ability. The spaces below the graph are to enter the months to match up the cycle to your operation and visualize how their needs change.

Cow frame size (weight) will increase the overall requirement (but energy density: TDN stays the same). Cows with superior milking ability (30 pounds of milk per cow per day) will greatly increase TDN requirement and "peak" higher on the above curve.

In the absence of required energy and protein, weight losses occur, milk production decreases and the ability to reproduce declines. This results in open cows and lightweight calves next season.

Reference: National Academies of Sciences, Engineering, and Medicine. 2016. Nutrient Requirements of Beef Cattle: Eighth Revised Edition.

Nutrient Requirements

Table 2: This table serves to help you get a general sense of how the result of a feed compare to the nutrient requirements of the animal at various stages of production. Please note, the tables below are meant to aid in the understanding of where various feeds will fit into the overall feed management on farm; they are not meant to replace ration balancing.

	Protein (CP)	Energy (TDN)		Protein (CP)	Energy (TDN)
Beef Cows (Moderate Milking)			**Sheep (Ewe)**		
Mid Pregnancy	7%	50%	Maintenance	9%	55%
Late Pregnancy	9%	54%	Breeding	9.4%	59%
After Calving	11%	58%	Late Pregnancy (single to triplets)	10-12%	60-65%
			Lactation (single to triplets)	13-14%	65%
Growing Heifers			**Sheep (Lamb)**		
Mid Pregnancy	9%	55%	Finishing (4-7 months)	10-15%	72-77%
Late Pregnancy	11%	59%			
After Calving	13%	62%			
Mature Bulls			**Goat (Does)**		
	7%	50%	Maintenance	7%	53%
			Early gestation	9-10%	53%
Growing Steers Calves			Late gestation	13-14%	53%
0.5lbs ADG	9%	52%	Lactation	12-17%	53-66%
1.5lbs ADG	11.5%	62%			
2.5lbs ADG	14.5%	72%			
Growing Yearlings			**Goats (growing kids)**		
0.5lbs ADG	7%	51%	25kg doe, gaining 100-150 g/day	12%	67%
1.5lbs ADG	9%	58%			
2.5lbs ADG	11%	65%	**Bison (Cow)**		
			Maintenance	8%	48-50%
			Late Gestation	8-10%	54-58%
Dairy Cows (Holstein)			Lactation	8-10%	54-58%
Early Lactation	17-19%	72-74%			
Mid Lactation	15-16%	69-71%	**Equine**		
Late Lactation	13-15%	66-68%	Maintenance (500 kg)	8-12%	53-56%
			Moderate work	10-13%	64-65%

Typical Feed Values

Table 3: List of crude protein and energy value of typical feeds

	Protein (CP)	Energy (TDN)
Early Harvest Alfalfa	20%	62%
Late Harvest Alfalfa	14%	50%
Mixed Alfalfa Grass*	10-12%	54%
Early Harvest Grass	15%	62%
Late Harvest Grass	7%	50%
Cereal Silage (Soft Dough)	9.5%	58%
Straw	5.5%	40%
Corn Silage	8%	70%
Rolled Barley	12%	82%

*Note: ranges will vary based on management (i.e. fertility), stand composition and geographic location.

- **Early Harvest:** Indicates early maturity (boot stage in grass or late bud / early bloom for alfalfa)
- **Late Harvest:** Indicates late maturity (after heading in grass or full bloom alfalfa)

Energy Requirements and Body Condition Score (BCS)

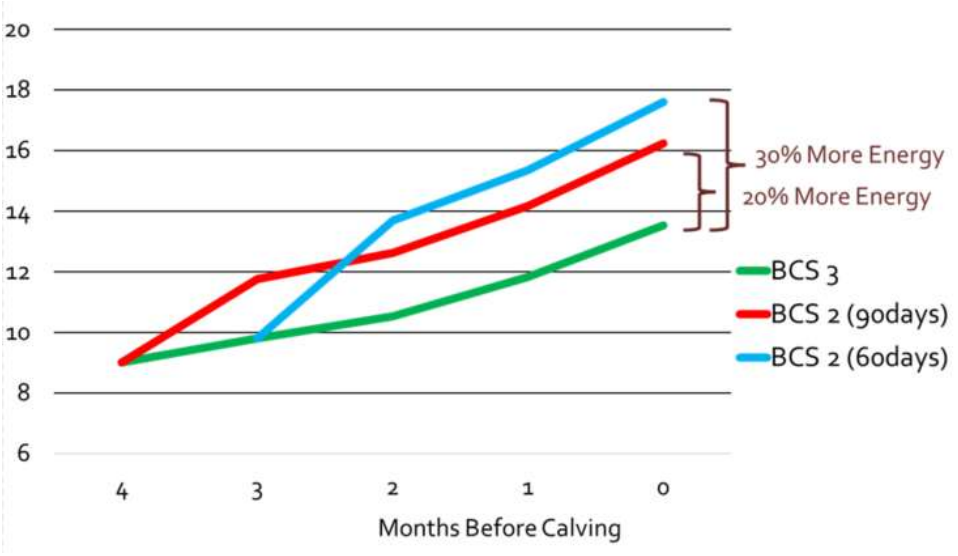

Figure 5: Additional energy density required to gain body condition from BCS 2.0 to BCS 3.0 before calving (target BCS 3.0 to avoid delayed rebreeding).

For a 1,300lb cow, nearly 200lbs of bodyweight needs to be gained from a BCS 2.0 to BCS 3.0.

⇒ BCS 2.0 to BCS 3.0 in 90 days requires 20% more energy.
⇒ BCS 2.0 to BCS 3.0 in 60 days requires 30% more energy.

In the absence of required energy and protein, condition losses occur, milk production decreases and the ability to reproduce declines. This results in open cows and lightweight calves.

Do you have animals that need to gain condition before calving?

Do you have forages of quality to allow this?

Additional Weather Requirements

Lower critical temperature for cows: between –10 and –25C depending on the animal's acclimation, hair coat, wind exposure and dryness.

Up to 20% more energy is required for temperatures 10C under the LCT, and under extreme conditions intake needs can also increase to 2.7-2.8% of bodyweight.

- *Are you likely to experience conditions where the cows have wet coats and a rapid temperature drop? Or periods of extreme cold for acclimated cattle with a good coat who are sheltered?*
- *Is it possible to create better shelter and production from elements?*
- *Consider supplementation options during these periods.*

Intake

Intake is measured and calculated from Neutral Detergent Fiber (NDF) and NDF digestibility (NDFd). When balancing rations, intakes are considered on a Dry Matter (DM) basis (versus as-fed). Intake can range from 1.5% DM of body weight for a dry cow on very poor-quality forage (high NDF and low NDFd) to over 3.0% of body weight for a high production cow.

⇒ These are only guidelines and can be influenced greatly by NDFd, plant species and any anti-quality factors.

Table 4: Typical intakes (as a % of body weight) of various species of livestock.

	Stage of Production	Typical Intake (% dry matter of body weight)
Cattle		
	Dry cows on poorer quality forages (<50% TDN and >60% NDF)	1.8% - 2.0%
	Dry cows on moderate quality forages (55% TDN and 45-60% NDF)	2.0% - 2.2%
	Lactating cows on moderate quality forages (55% TDN and 45-60% NDF)	2.2% - 2.3%
	Lactating cows and growing stock on high quality forages (60%+ TDN and under 45% NDF)	2.5%+
	Lactating dairy cattle	2.5% - 3.5%
Sheep		
	Maintenance (dry, not in production)	1.5% - 2.0%
	early to mid-gestation	2.5% - 2.7%
	late gestation (higher end for twins/ triplets)	2.5% - 3.0%
	lactation (higher end for twins/ triplets)	3.3% - 4.5%
Goats		
	Maintenance	1.8% - 2.4%
	Early gestation	2.4% - 3.0%
	Late Gestation	2.4% - 3.0%
	Lactation	2.8% - 4.6%
Bison		
	Maintenance	1.6% - 1.8%
	Late Gestation	2.0% - 2.5%
	Lactation	2.5% - 3.0%
Equines		
	Maintenance	2.0% - 3.0%

Is your forage quality such that intakes will be higher or lower than normal?

CALCULATING FEED QUANTITY

Step 1: Calculate Dry Matter Intake

Determine dry matter intake (DMI) for your various classes and species of animals. Refer to your Current Animal Inventory in Section 1 to determine animal numbers and categories. Refer to Table 4 and determine typical intakes at the weight class of your animals. Remember intakes will change during each stage of production (growth, maintenance, early gestation, late gestation, lactation).

Example Dry Matter Intake calculation:

- **Beef Cow:** A 1,300 lb cow can be expected to eat between 1.8% and 2.5% of her body weight depending on production stage and forage quality.
    - Let's pick 2.2% to show the calculation:
      1,300 lb x 0.022 = 28.6 lbs of DMI (Dry Matter Intake) per day
      (The range would be between 23.4 lb and 32.5 lb depending on production stage and feed quality; if you want a rough average use 2.2% for the whole winter-feeding period).
- **Sheep Ewe:** A 170 lb ewe can be expected to eat between 1.5% and 4.5% of her body weight depending on production stage and forage quality.
    - Let's pick 3% to show the calculation:
      170 lb x 0.03 = 5.1 lb of DMI (Dry Matter Intake) per day

Step 2: Calculate As-Fed Intake

Once Dry Matter Intake (DMI) is determined, you will need to convert it to the amount of As-Fed Intake to calculate how much feed you will need. Interpreting forage test results and calculating rations is typically done based on the dry matter of forage. To convert to As-Fed Intake, determine the dry matter of the forage (check your feed test result).

Example As-Fed Intake calculation:

- **Beef Cow** (1,300 lb cow, 28.6 lb DMI per day)**:**
    - If the DM of your forage is 87%:
      28.6 lb DMI per day / 0.87 DM = 32.9 lb As-Fed per day
- **Sheep Ewe** (170 lb ewe, 5.1 lb DMI per day)**:**
    - If the DM of your forage is 87%:
      5.1 lb DMI / 0.87 DM = 5.9 lb As-Fed per day

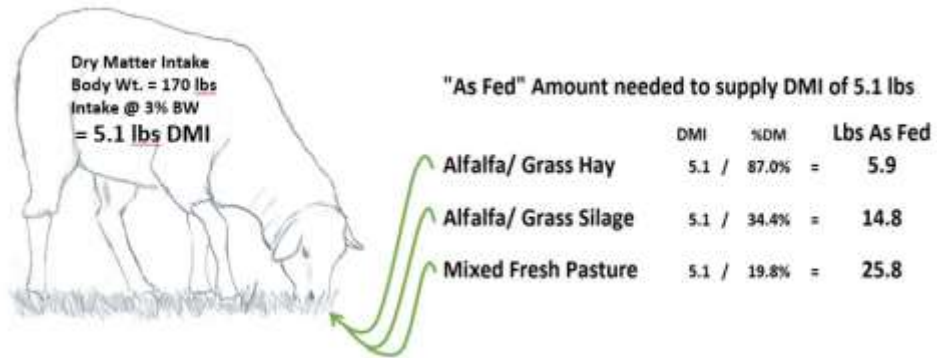

Figure 6: A sheep example of how to convert dry matter intake into "as fed" amount.

Step 3: Determine Amount of Forage Needed

Refer to your Current Animal Inventory in Section 1 to determine animal numbers and categories. To determine the length of your winter-feeding period, refer to the Current Animal Inventory for when your winter feeding begins (i.e., delivering feed versus grazing) and when it is finished (i.e. return to grazing). This will allow you to calculate the number of days forage will need to be fed in each animal's stage of production.

Reminder: Nutrient requirements will change as the animal gets closer to giving birth and into lactation.

Example Winter-Feeding Quantity calculations:

- **Beef Cow:** assume feeding 100 head cow herd and anticipating they would be on feed for 200 days. Use value from the step 2 example for As-Fed Intake.
    - 32.9 lb As-Fed per cow per day x 100 cows x 200 days = 658,000 lb of hay

  Convert from pounds to tons.
    - 658,000 lb / 2,000 lb per ton = 329 tons of hay to feed 100 cows for 200 days
- **Sheep Ewe:** assume 100 ewe flock and anticipating they would be on feed for 200 days. Use value from step 2 example for As-Fed Intake.
    - 5.9 lb As-Fed per ewe per day x 100 ewes x 200 days = 118,000 lb of hay

  Convert from pounds to tons.
    - 118,000 lb / 2,000 lb per ton = 59 tons of hay to feed 100 ewes for 200 days

Step 4: Calculate Feed Wastage

The number calculated in Step 3 is required for intake; however, in reality you will have hay losses from both storage and feeding method. Storage loss varies based on the method storage (e.g., uncovered on the ground versus stored under a roof). Feed wastage will vary based on feeding out methods. By calculating feed wastage, you can add the amount wasted in order to know how much feed is required.

*Example Feed Wastage calculation (*Assume 20% loss from feeding and storage):

- **Beef Cow:** Use value from step 3 example for amount of hay.
    - 329 tons of hay x 1.20 = 395 tons of hay required for 100 cows for a 200 day winter-feeding period
- **Sheep Ewe:** Use value from step 3 example for amount of hay.
    - 59 tons of hay x 1.20 = 71 tons of hay required for 100 ewes for a 200 day winter-feeding period

Note: See Section 6 for the link for the interactive spreadsheet referenced below, "2024 Hay Requirement and Inventory Balance Calculations"

The figure below is a screenshot of an example beef herd using the interactive spreadsheet. This spreadsheet calculates hay quantity and quality requirements for an entire beef herd for winter feeding. It also compares the inputted hay inventory to what is required to identify what quantities and qualities are needed if there is a forage production shortfall on your operation.

Total DM Example Calcs

Groups and Calcs for a 100 cow herd of 1300 lbs cows fed Oct 27-May 15th, calving mid-March

Feed Requirements From the Start of Winter Feeding to 60 Days before Calving

#	Group		DM Intake	days	Total Needed
	Body Weight multiplied by		2.0%		Tons
75	Mature Cows	Lbs	26	79	77
10	Second Calvers	Lbs	24		9
15	Bred Heifers	Lbs	21		12
20	Replacement Heifers	Lbs	13		10
	Total Tons DM (of various qualities) required for this period				108

Requirements 60 Days prior to Calving

#	Group		DM Intake	days	Total Needed
	Body Weight multiplied by		2.1%		
75	Mature Cows	Lbs	27	60	61
10	Second Calvers	Lbs	25		8
15	Bred Heifers	Lbs	22		10
20	Replacement Heifers	Lbs	15		9
	Total Tons DM (of various qualities) required for this period				88

Requirements Calving to the end of Feeding Period (Cows are lactating)

#	Group		DM Intake	days	Total Needed
	Body Weight multiplied by		2.2%		
75	Mature Cows	Lbs	29	61	66
10	Second Calvers	Lbs	26		8
15	Bred Heifers	Lbs	23		11
20	Replacement Heifers	Lbs	18		11
	Total Tons DM (of various qualities) required for this period				96

				Wastage		
Estimated Total Tons of Dry Matter (of various qualities) required			**292**	**10%**	**15%**	**20%**
Dry matter in Hay	87.0%	**Total Hay req'd**	336	**369**	**386**	**403**
Dry Matter in Silage	35.0%	**Total Silage req'd**	**834**	**918**	**959**	**1001**

Figure 7: This is an example of how all the calculations can look on a homemade spreadsheet or handwritten calculations page. Note that the DM Intakes have been refined to determine more precisely the amount of hay needed in a drought year versus the average used in the example calculations above.

Note: When feeding, make sure to convert DM back to As-Fed (see previous pages for calculation examples).

RATION BALANCING EXAMPLES

A: Beef Cow Ration Example (Start of feeding to before calving)

These examples are only to demonstrate possibilities. They make assumptions regarding cattle, forage qualities and costs. These rations also do not include the required mineral to properly balance and ensure top production and health. Every farm is different, and producers should consult with a qualified professional to design feeding strategies and rations that best fit their operation.

Ration Examples (lbs As-Fed): **1,300 lb Cow BCS 3, from start of feeding to 60 days pre-calving**
Requirements: 51% TDN, 7.6% CP, 26lb DM Intake

	Local Price			Ration #								
	CP(%)	**TDN (%)**	**$/lb**	**A1 (lb)**	**A2**	**A3**	**A4**	**A5**	**A6**	**A7**	**A8**	**A9**
High Quality Beef Forage	11+	62	$0.14	29.5	25 (l)	20						8.6
Moderate Quality Beef Forage	7	55	$0.11				29.5	22.5	22.4			
Low Quality Beef Forage	5.5	50	$0.11							28	28	17.2
Straw	4	45	$0.09			9.5		6	3			
Premium Alfalfa Forage	20	62	$0.20									
Barley Grain	12	83	$0.20									
Canola Meal	40	70	$0.32					1		1.75		
GSPs	11	70	$0.12									
32% Supplement	32		$0.39						4		2	
Mineral* ($/head/day)			$0.20									
	Cost per head per day			**$4.33**	**$3.70**	**$3.86**	**$3.45**	**$3.53**	**$4.49**	**$3.84**	**$4.06**	**$3.43**

CP = Crude Protein TDN = Total Digestible Nutrients GSP = Grain Screening Pellets
32% Supplement = includes minerals
(l) limit fed
* mineral cost is based on the mineral that balances with the feeds in the ration. A base amount of $0.20 per head per day was used in these calculations; however, overall costs may change depending on what mineral formulation is used.

Note: When feeding, make sure to convert DM back to As-Fed (see previous pages for calculation examples).

B: Beef Cow Ration Example (60 days pre-calving to calving)

These examples are only to demonstrate possibilities. They make assumptions regarding cattle, forage qualities and costs. These rations also do not include the required mineral to properly balance and ensure top production and health. Every farm is different, and producers should consult with a qualified professional to design feeding strategies and rations that best fit their operation.

Ration Examples (lbs As-Fed): **1,300 lb Cow BCS 3, from 60 days pre-calving to calving**
Requirements: 55% TDN, 9% CP, 27lb DM Intake

	Local Price			Ration #										
	CP	**TDN**	**$/lb**	**B1**	**B2**	**B3**	**B4**	**B5**	**B6**	**B7**	**B8**	**B9**	**B10**	**B11**
High Quality Beef Forage	11+	62	$0.14	30.25	27 (l)	24	22	18						
Moderate Quality Beef Forage	7	55	$0.11					9	28.5	25	26			
Low Quality Grass Forage	5.5	50	$0.11				10					26	25	20
Straw	4	45	$0.09			8		5						
Premium Alfalfa Forage	20	62	$0.20								4.5			12
Barley Grain	12	83	$0.20									3		
Canola Meal	40	70	$0.32						2	1		2.75	2.5	
GSPs	11	70	$0.12							4			4.5	
Mineral* ($/head/day)			$0.20											
Cost per head per day				**$4.44**	**$3.98**	**$4.28**	**$4.38**	**$4.16**	**$3.98**	**$3.75**	**$3.96**	**$4.54**	**$4.29**	**$4.80**

CP = Crude Protein TDN = Total Digestible Nutrients GSP = Grain Screening Pellets
(l) limit fed
* mineral cost is based on the mineral that balances with the feeds in the ration. A base amount of $0.20 per head per day was used in these calculations; however, overall costs may change depending on what mineral formulation is used.

Note: When feeding, make sure to convert DM back to As-Fed (see previous pages for calculation examples).

C: Beef Cow Ration Example (post calving)

These examples are only to demonstrate possibilities. They make assumptions regarding cattle, forage qualities and costs. These rations also do not include the required mineral to properly balance and ensure top production and health. Every farm is different, and producers should consult with a qualified professional to design feeding strategies and rations that best fit their operation.

Ration Examples (lbs As-Fed): **1,300 lb Cow BCS 3, Average Milking ability (25 lbs milk), post calving**
Requirements: 58% TDN, 10% CP, 29lb DM Intake

	Local Price			Ration #				
	CP	**TDN**	**$/lb**	**C1**	**C2**	**C3**	**C4**	**C5**
High Quality Beef Forage	11+	62	$0.14	33				
Moderate Quality Beef Forage	7	55	$0.11		23	27	26	
Low Quality Beef Forage	5.5	50	$0.11					15
Straw	4	45	$0.09					
Premium Alfalfa Forage	20	62	$0.20		10			15
Barley Grain	12	83	$0.20			2		2
Canola Meal	40	70	$0.32			3.5	3.5	
GSPs	11	70	$0.12				3.5	
Mineral* ($/head/day)			$0.20					
	Cost per head per day			**$4.82**	**$4.73**	**$4.69**	**$4.60**	**$5.25**

CP = Crude Protein TDN = Total Digestible Nutrients GSP = Grain Screening Pellets

* Mineral cost is based on the mineral that balances with the feeds in the ration. A base amount of $0.20 per head per day was used in these calculations; however, overall costs may change depending on what mineral formulation is used.

Note: When feeding, make sure to convert DM back to As-Fed (see previous pages for calculation examples).

D: Sheep Ration Example (winter feeding, maintenance)

These examples are only to demonstrate possibilities. They make assumptions regarding sheep, forage qualities and costs. These rations also do not include the required mineral to properly balance and ensure top production and health. Every farm is different, and producers should consult with a qualified professional to design feeding strategies and rations that best fit their operation.

Ration Examples (lbs As-Fed): **200 lb Ewe BCS 3, not pregnant**
Requirements: 55% TDN, 9% CP, 3.08lb DM Intake

	Local Price			Ration #							
	CP(%)	TDN (%)	$/lb	D1 (lb)	D2	D3	D4	D5	D6	D7	D8 (l)
Grass-Alfalfa Hay	11+	62	$0.14		3.5		2.5				
Grass Hay	7	55	$0.11	3.4					2.2		
Low Quality Forage	5.5	50	$0.11			3.5		2			
Straw	4	45	$0.09				1				
Alfalfa Hay	20	62	$0.20							3.5	3
Barley Grain	12	83	$0.20			0.2					
Sheep Text 15%	35	75	$0.17					1.5	1		
Mineral* ($/head/day)			$0.04								
	Cost per head per day			**$0.41**	**$0.53**	**$0.47**	**$0.48**	**$0.52**	**$0.45**	**$0.75**	**$0.64**

CP = Crude Protein TDN = Total Digestible Nutrients
(l) limit fed
* mineral cost is based on the mineral that balances with the feeds in the ration. A base amount of $0.04 per head per day was used in these calculations; however, overall costs may change depending on what mineral formulation is used.

Note: When feeding, make sure to convert DM back to As-Fed (see previous pages for calculation examples).

E: Sheep Ration Example (winter feeding, pre lambing, pregnant with twins)

These examples are only to demonstrate possibilities. They make assumptions regarding sheep, forage qualities and costs. These rations also do not include the required mineral to properly balance and ensure top production and health. Every farm is different, and producers should consult with a qualified professional to design feeding strategies and rations that best fit their operation.

Ration Examples (lbs As-Fed): **200 lb Ewe BCS 3, pregnant with twins, 6 weeks pre lambing**
Requirements: 60-65% TDN, 10-12% CP, 5.75lb DM Intake

	Local Price			Ration #							
	CP(%)	TDN (%)	$/lb	E1 (lb)	E2	E3	E4	E5	E6	E7	E8(l)
Grass-Alfalfa Hay	11+	62	$0.14		6		5.5				
Grass Hay	7	55	$0.11	6					4.5		
Low Quality Forage	5.5	50	$0.11			5.8		4			
Straw	4	45	$0.09				0.5				1
Alfalfa Hay	20	62	$0.20							6	4.5
Barley Grain	12	83	$0.20			1					
Sheep Text 15%	35	75	$0.17					2	2		
Mineral* ($/head/day)			$0.04								
	Cost per head per day			**$0.70**	**$0.88**	**$0.88**	**$0.86**	**$0.82**	**$0.79**	**$1.24**	**$1.03**

CP = Crude Protein TDN = Total Digestible Nutrients
(l) limit fed
* mineral cost is based on the mineral that balances with the feeds in the ration. A base amount of $0.04 per head per day was used in these calculations; however, overall costs may change depending on what mineral formulation is used.

Note: When feeding, make sure to convert DM back to As-Fed (see previous pages for calculation examples).

F: Sheep Ration Example (winter feeding, lactating ewe with twins)

These examples are only to demonstrate possibilities. They make assumptions regarding sheep, forage qualities and costs. These rations also do not include the required mineral to properly balance and ensure top production and health. Every farm is different, and producers should consult with a qualified professional to design feeding strategies and rations that best fit their operation.

Ration Examples (lbs As-Fed): **200 lb Ewe BCS 3, lactating with twin lambs**
Requirements: 65% TDN, 13-14 CP, 4.96lb DM Intake

	Local Price			Ration #		
	CP(%)	**TDN (%)**	**$/lb**	**F1 (lb)**	**F2**	**F3**
Grass-Alfalfa Hay	11+	62	$0.14		5	4.7
Grass Hay	7	55	$0.11			
Low Quality Forage	5.5	50	$0.11			
Straw	4	45	$0.09			
Alfalfa Hay	20	62	$0.20	5.1		
Barley Grain	12	83	$0.20		1.2	
Sheep Text 15%	35	75	$0.17	1		1.5
Mineral* ($/head/day)			$0.04			
	Cost per head per day			**$1.23**	**$0.98**	**$0.95**

CP = Crude Protein TDN = Total Digestible Nutrients

* mineral cost is based on the mineral that balances with the feeds in the ration. A base amount of $0.04 per head per day was used in these calculations; however, overall costs may change depending on what mineral formulation is used.

MINIMIZE THE COST OF THE RATION

Feed is the largest direct cost on livestock operations. To ensure you minimize the cost of your rations, calculate the cost per pound (lb) of the nutrient needed in your ration.

When you look back at the Ration Balancing Examples previously provided (Beef Ration Examples A through C), you can see the ranges in per head per day costs differ for the different production stages:

- **Beef Ration Example A:** lowest cost ration $3.43 and highest cost ration $4.49 ($1.06 range in per head per day cost)
- **Beef Ration Example B:** lowest cost ration $3.75 and highest cost ration $4.80 ($1.05 range in per head per day cost)
- **Beef Ration Example C:** lowest cost ration $4.60 and highest cost ration $5.25 ($0.65 range in per head per day cost)

It can also be noted where the forage matches the animal requirements it is among the lowest cost rations.

Depending on the size of the herd/flock, a relatively small difference on a per head per day basis can add up to a significant amount on your bottom line. **For instance, a difference of $0.50/head/day on a 100 animal herd/flock adds up to $10,000 over a 200 day winter-feeding period.**

That is an economic incentive to time your hay cutting to target quality to the nutritional requirements of the different classes of animals you will be feeding. More information on Forage Management Options and Considerations is provided in Section 3.

Additional Feeding Considerations

Most rations can be significantly different from what is formulated by a nutritionist to what the cow eats due to many factors including:

- Changes in bale weight
- Dry Matter content
- Sampling errors in feed samples
- Estimations of weight compared to the size of cattle
- Sorting of the ration and patterns of eating and/or aggressiveness of cows within the group

Because of this it is important to monitor:

- ✓ Intakes and refusals
- ✓ Waste
- ✓ Moisture content of the feed (especially with silage)
- ✓ Manure consistency

Note: See Section 6 for the link for the interactive spreadsheet referenced below, "2024 Feed Cost Comparison"

Once you know where your gaps are, you can look at what available feeds best meet those needs from both the nutritional and economic perspectives. The figure below is a screenshot of an example forages and prices interactive spreadsheet. This spreadsheet calculates the relative costs of different feeds per pound of nutrient (TDN or Protein). It can be observed that knowing how much TDN or Protein are in the various feeds is key to knowing which source is the least costly in your ration.

Comparing Feeds by Cost per pound of TDN

Input Analysis for TDN at 100% Dry Matter and Dry Matter percentage

GRAIN

	Oats	Barley	Feed Wheat	Screenings	Corn	Other Feed: Canola Meal
If you bought by the bushel use this to calculate the landed price/tonne and put that price into the calculation below						
Landed Price/bu	$0.00	$5.25	$0.00	$0.00	$0.00	
bu weight (lbs)	34	48	60	56	56	
Price/Tonne	$0.00	$241.13	$0.00	$0.00	$0.00	
Landed Price/tonne	$460.00	$440.00	$525.00	$265.00	$500.00	$700.00
Price/lb	$0.209	$0.200	$0.238	$0.120	$0.227	$0.318
TDN (100% DM)	74.0%	82.0%	89.0%	70.0%	93.0%	70.0%
Dry Matter	89.0%	89.0%	89.0%	89.0%	89.0%	90.0%
Cost/lb of TDN	$0.32	$0.27	$0.30	$0.19	$0.27	$0.50

(Total Wheat and Rye should not exceed 50% of grain portion of ration)

FORAGE

All hay should trade on a weight basis but often doesn't, to figure out a landed price use this calculation

Hay		Straw	
Price/bale	$150.00	Price/bale	$100.00
Bale weight	1300	Bale weight	1000
Trucking home/bale	$10.00	Trucking home/bale	$7.00
Landed Price/Ton	$246.15	Landed Price/Ton	$214.00

	Good Hay (58 - 64%TDN)	Average Hay (53-57%TDN)	Poor Hay (48-52%TDN)	Straw ** (44-46%TDN)	Greenfeed (58 - 68%TDN)	Silage/Haylage
Landed Price/Ton	$275.00	$275.00	$275.00	$225.00	$260.00	$115.00
Price/lb	$0.138	$0.138	$0.138	$0.113	$0.130	$0.058
TDN (100% DM)	58.0%	55.0%	52.0%	45.0%	63.0%	60.0%
Dry Matter	88.0%	88.0%	88.0%	87.0%	87.0%	35.0%
Cost/lb of TDN	$0.27	$0.28	$0.30	$0.29	$0.24	$0.27

Please Note that there are Nutritional Limits imposed by how much an animal can eat. This may mean that even though hay or straw may be the cheapest source, if the animal can't eat enough to meet its requirements a higher density TDN source must be substituted. **In other words the ration must be balanced.**

** Not enough TDN to meet the nutritional needs of any class of livestock. Needs supplementation.

OTHER FEEDS

	High Quality Beef H	Mod Qual Beef Hay	Low Qual Beef Hay			Premium Alf Hay
Landed Price/tonne	$308.70	$242.51	$242.51			$440.00
Price/lb	$0.140	$0.110	$0.110	$0.000	$0.000	$0.200
TDN (100% DM)	62.0%	55.0%	50.0%			62.0%
Dry Matter	88.0%	88.0%	88.0%			88.0%
Cost/lb of Protein	$0.26	$0.23	$0.25	#DIV/0!	#DIV/0!	$0.37

Figure 8: Analysis of cost per pound of Total Digestible Nutrients (TDN) in various feeds

FEEDING STRATEGIES

Change the Demand

Strategies may include:

- **Early weaning**
- **Grouping animals and feeding to match requirements.** This can include matching the forage resources on-hand to the demands based on stage of production, animals with different needs should be grouped together. Examples of groupings may include:
    i. Mature cows in good condition
    ii. Bred replacement heifers and second calf heifers
    iii. Thin, old cows

When limited in resources, it is critical that all animals are contributing in a productive manner. In addition to ensuring the resources can match the demand, steps need to be taken to ensure only revenue creating animals are being carried over the winter. Strategies may include:

- **Pregnancy checking**
- **Culling strategies:** open, unproductive and unsound animals

Increase Resources

Feeding programs should be designed to get the most benefit from on-farm feeds. **More options are available when requirements are lower (60+ days before calving for beef cattle), therefore it is easier to make changes to feeding programs to conserve on-farm resources earlier rather than later.** The use of these strategies depends on the feed cost and there can be a large range in cost per head per day. While underfeeding nutrients lowers production, overfeeding nutrients lowers return over feed costs.

Beef cow ration examples in the previous section are referenced as examples as some of these strategies. These examples are only to demonstrate possibilities. Every farm is different, and producers should consult with a qualified professional to design feeding strategies and rations that best fit their operation to ensure production goals are met and animal health is maintained.

If the producer has…	then options include…
High quality forage:	• Poorer quality forage and/or straw can be used prior to giving birth and for dry, non pregnant cows or ewes to stretch forage supplies (Beef Cow Example Rations A4, A9, B3, B4, and B5; Sheep Example Rations D3, D4)**.** • Consider limit feeding: Before calving and prior to breeding ewes it is possible to consider meeting the animal's nutritional requirements without allowing them to eat their full intake in percentage of bodyweight. This requires high quality forage, **and** enough feeding space to accommodate both the aggressive and timid animals (Rations A2, B2, D3)**.** • If short on volume but high quality: consider selling some forage and replacing it with lower priced moderate quality**.**
Moderate quality forage:	• If it is meeting the nutritional requirements, purchase additional forage of similar quality. • Extend forage with a combination of purchased poorer quality forage and supplementation (Rations A5, A6, B7, B8, D3, D5, E3, E5). • Purchase supplements for near and after calving (Rations B6, B7, C3, and C4) and near lambing and after lambing (Rations E3, E5, E6, F1, F2, F3). • Purchase premium alfalfa (Rations B8 and C2). • Purchase higher quality forage to utilize in conjunction (Rations B4 and C2).
Low quality forage:	• High quality forage can be used to extend supplies and better meet demands: Closer to calving and post calving, it is an option to purchase a premium forage such as high-quality alfalfa hay (Rations A9, B8 and C5). Low quality forage can be used in combination with supplements for non pregnant, non lactating ewes (Rations D3, D5). • Purchase supplements (Rations A7, A8, B9 and B10).

In these examples, for a 120-day winter-feeding period between starting winter feeding and calving (assuming March calving), the cost between the highest and lowest cost alternatives is approximately $1.00 per head per day. This amounts to a total of over $12,000 for a herd of 100 cows. For northern areas with a 200-day winter feeding period the total is $20,000. In either case, if you are having to buy to replace one-third of your hay in a drought year, there is a significant savings when buying the right quality.

Additional Feeding Comments:

- Many of these strategies require a producer to consider what resources are available for handling and/or feeding such as grain bins, feed bunks and options for feed processing and delivery.
- Mineral nutrition is important and supplementation requirements changes greatly depending on the ration provided.
- Ration changes should be made gradually over a few days as to allow the animal's digestive tract to adjust.
- Hay of differing qualities can be fed on alternating days rather than blending with similar results.
- Infrequent feeding of moderate level protein supplements up to 30% CP (alternate day or even twice a week) can also be considered to save labour.
- High inclusion amounts of high energy supplements should be fed with caution as it can decrease rumen pH and negatively affect fiber digestion. Alternate day feeding of energy supplements can make this worse and cause acidosis.
- Water quality also needs to be considered.

Minimize Wastage:

- Consider feeding methods and how much is wasted?
- Storage improvements
  - ⇒ Is dry forage covered by good condition tarps or in a shed?
  - ⇒ Is silage properly conserved?
    - Silage pit cover, proper cut length and packing?
    - Was an inoculant used?
- Feeding
  - ⇒ Fed in a way to minimize wasted feed?
    - Rolling or processing bales, feed bunks, bale grazing, Total Mixed Ration (TMR)?

Move Animals

After evaluating ration options, it may be more economical to move the cattle to the feed.

Transfer demand by:

- Moving young stock (e.g., heifers) to a feedlot for growing.
- Moving cows to another location to overwinter (e.g., neighbouring farm lease or custom feeding outside of province).

FEEDING CONSIDERATIONS AND FEEDING STRATEGIES

Options if FORAGE QUANTITY is not adequate

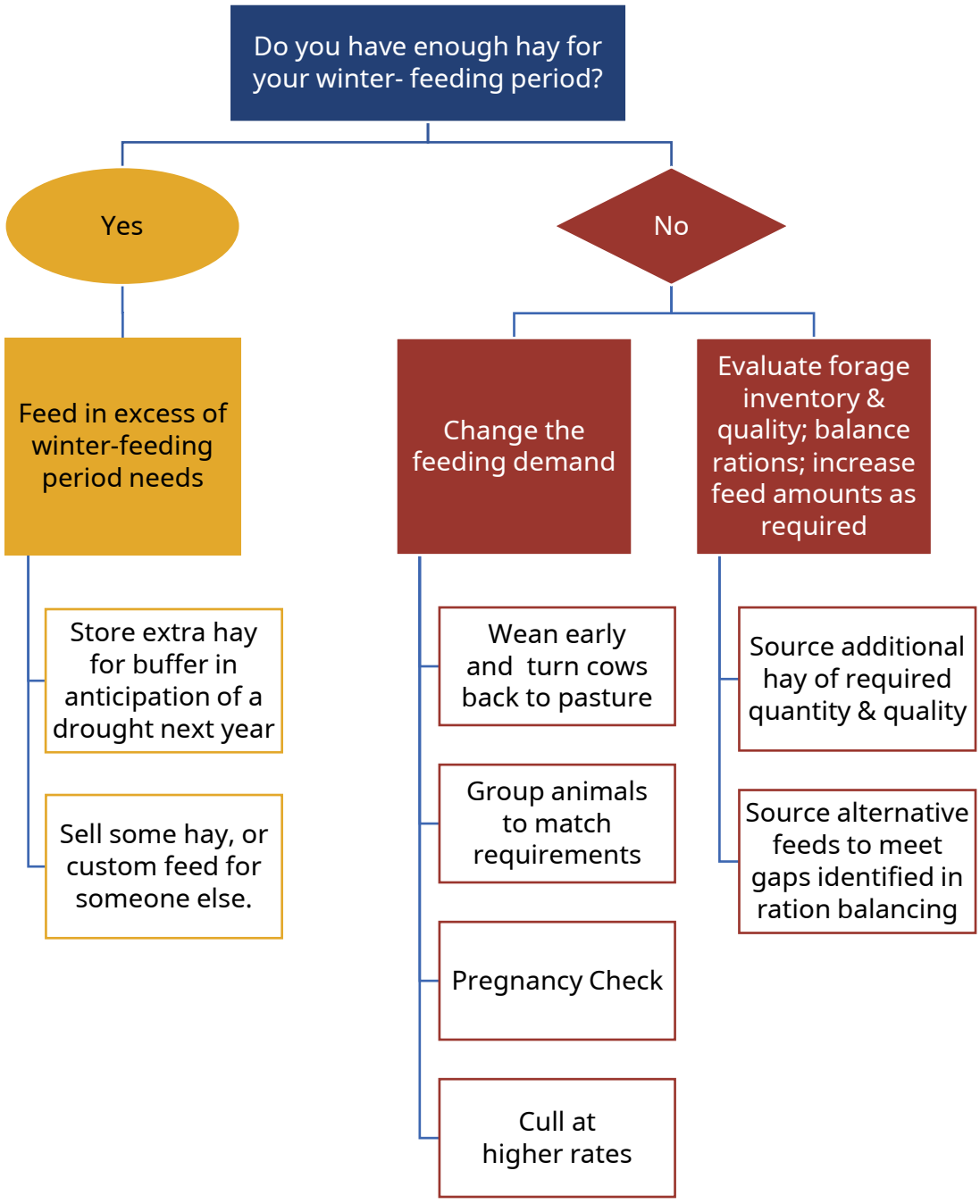

Figure 9: Options to consider if you do not have the forage quantity needed for your herd / flock. See Feeding Strategies section for a more detailed discussion about various strategies to consider.

FEEDING CONSIDERATIONS AND FEEDING STRATEGIES

Options if FORAGE QUALITY is not adequate

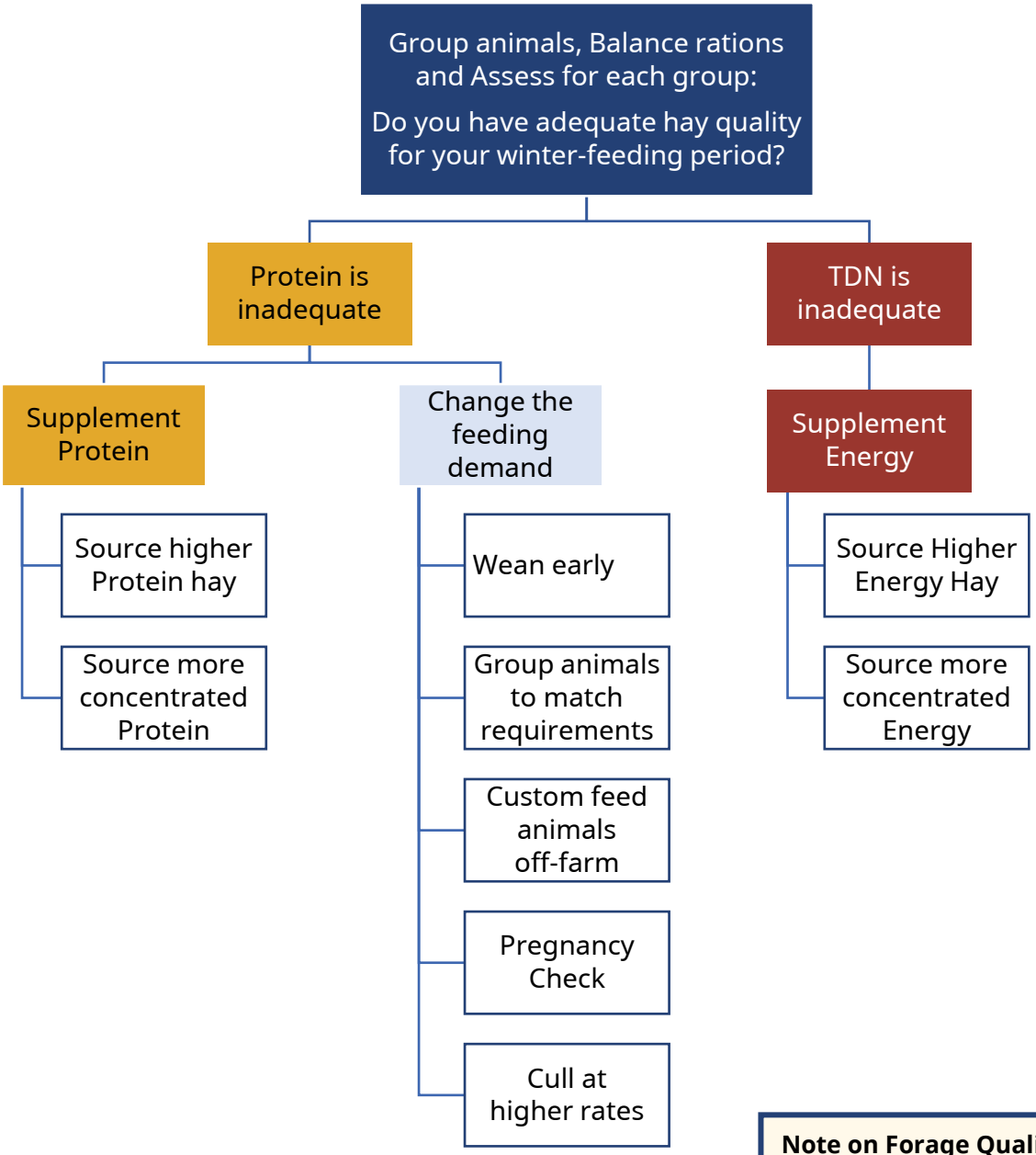

Figure 10: Options to consider if your forage is lacking the quality you need to optimize performance of your herd/flock. More concentrated energy samples include:

- **Protein:** Check for locally available products such as canola meal, peas, alfalfa pellets, supplement pellets, soybean meal, distiller's grains, faba beans, urea, grain screening pellets.
- **Energy:** grain, culled potatoes, molasses, by-product feeds.

Note: The quality of ingredients is variable. It is recommended that they be tested before being incorporated into your ration.

Note on Forage Quality:
When forage quality matches the animals' requirements, it is among the lowest cost ration – this should serve as an economic incentive to time your hay cutting to target quality to the nutritional requirements of the different classes of animal you are feeding whenever possible.

NOTES

NOTES

SECTION 3: FORAGE MANAGEMENT OPTIONS AND CONSIDERATIONS

INTRODUCTION

Whether you have forage fields or pastures, it is important to get out and walk the land to evaluate what is happening throughout the growing season. A quick look at soil health and moisture, along with plant vigour and productivity can help you evaluate what is going on and make decisions on next steps. Decisions on modifications or treatments may impact your overall crop yields, livestock health and productivity, and overall profitability.

FORAGE MANAGEMENT CONSIDERATIONS

What should we consider or look at for forages?	
Status or vigour of perennial stands	○ Youngest or new stands ○ Older stands ○ Stands planned to be renovated
Status of annual forage stands	○ Harvested and stored already ○ Potential to be grazed or harvested (fall or spring)
Vigour of perennial pastures	○ Native ○ Improved or cultivated
Where are we going to winter feed and how	○ Rolling or spreading hay ○ Feeding in bunks ○ Bale grazing ○ Feedlot ○ Or ???
What areas will you be using for calving and early lactation?	
Is access to water a concern for any areas?	
Would a farm map or outline be of assistance?	

What fields or stands are currently being stressed this year?

For example:

- Has lack of soil moisture resulted in stands having little or no chance to regrow?
- Do any stands have little to no vegetative cover going into the winter?
- Are pasture and/or crops being grazed heavily enough to reduce cover, reduce root growth and/or reduce the opportunity for plants to set themselves up for the winter?
- Prior to drought induced dormancy or winter, did your grass stands have an opportunity to photosynthesize and/or move energy from leaves to tillers, thereby ensuring early and vigorous growth next spring?

- Did your alfalfa have enough growth and/or time to enable good root energy levels?
- Will livestock be on stands long enough to cause trampling damage, cause crown damage or snow compaction potentially reducing the ability of plants to respire? This scenario could increase the risk of winter injury and plant loss.

What might happen if perennial stands are stressed?

- There may be later and slower growth than normal in the spring.
- A reduction of desirable species might occur.
  - You may see an increase in "weedy" species, a loss of legumes and high producing grass species.
  - Overall stand productivity and possibly forage quality could be reduced. Also, lower first cut volume and regrowth after harvest or grazing may be noticed.
- If root growth was slowed or reduced, subsequent stand management may need to be adjusted to encourage root growth. Large "strong" root systems are integral to plant vigour and resiliency.
- Increased bare soil might be evident - fewer than 3 actively growing plants per square foot indicates there is an opportunity to reseed or inter-seed to improve productivity.
- Some stands may need renovation sooner than expected, e.g., less desirable species are increasingly present and/or the stand's vigour and productivity are reduced, resulting in rejuvenation being required before the expected time.
- If palatable forages are in shorter supply due to drought, livestock might choose to graze plants they typically avoid – this can include toxic plants. The receding water in waterbodies during a dry year can also expose toxic plants making them more accessible to livestock.
  - Know what toxic plants to watch out for in your region or conditions that increase risk.

Discussion of possible options:

First, let's reflect a bit. If all or any of the impacts have occurred, does that mean you are in big trouble i.e., your perennials are in desperate condition, lots of reseeding is on your horizon or next year's yields will be terrible? **No**, at least not necessarily. What it does indicate is that we need to adjust or manage our stands to enhance their vigour right from the "get-go".

Let's look at some options or things to consider as we move through the year.

Spring:

- Is there an opportunity to establish annual forage stands to fill your anticipated forage gaps?
  - Consider a polyculture (multiple species mix incorporating cool and warm season forbs, legumes and grasses) to promote soil system growth and nutrient cycling.
  - Consider employing species that will regrow following a harvest (e.g., annual ryegrass, suitable warm season species, winter annuals, etc.) that fit your needs.

- Consider seeding an annual stand early in the spring, specifically to take grazing pressure off perennial pastures.
- Would holding off reseeding to a perennial stand provide any benefits?

Early summer or after first cut:

- Assess how your pastures and existing perennial stands are doing. If vigour is good, look at where, when and how you can harvest or graze them to maintain and/or continue to improve their health and vigour.
    - Picture or forecast what the remaining seasons growth or production will look like.
- Is there enough time and moisture to seed a perennial stand?
- Is there an opportunity to seed another annual forage stand to provide more forage and flexibility?
- Would seeding winter annuals provide fall and spring forage that would be beneficial?

Late summer – early Fall:

- Confirm your summer assessments and harvest and/or graze as planned or adjust as necessary.
- Is there time and moisture to quickly plant an annual forage stand?
    - A spring annual to provide fall and early winter grazing?
    - A winter annual to establish and provide early spring grazing and/or an early season crop to harvest?
- What fields/stands are appropriate to reseed to perennials next spring?
    - Particularly on heavy soils, seeding alfalfa stands right back to alfalfa typically fails (autotoxicity).
    - Success requires at least a one, if not two, seasons of other species prior to planting back to alfalfa.
    - Select species that do well in your environment and meet your feed requirements. Would a polyculture style of seed mix work for you?
    - Remember to evaluate your soil's fertility status.

Late fall and winter:

- Consider when and where you will be feeding your livestock.
- Can you move or place your livestock in ways that reduce further stress to your stands, thereby reducing the risk of winter injury and setting them up for vigorous spring growth?
- Can you rotate livestock around your fields to reduce the possibility of crown or growing point damage, reduce snow compaction or even soil compaction?
- Are there fields or stands that you can identify as stands that will be renovated next spring?
    - These can be slated to take the brunt of this year's current livestock impacts.
    - Would any of these be a candidate for bale grazing?

ANNUALS CHARACTERISTICS IN BRIEF

Note: for more detailed information on cover cropping and the characteristics of annual species, please refer to the Cover Cropping Guide for BC

Winter Annuals:

- **Fall Rye:** Most winter hardy, earliest spring growth. Hybrid varieties have better yield and quality
- **Winter Triticale:** Forage specific reduced awn varieties, reduced to no allelopathy, if planted in summer can harvest multiple times
- **Winter Barley:** New varieties (genetics) show promise, winter hardiness is poor
- **Winter Peas:** New varieties (genetics) show promise, winter hardiness is poor
- **Hairy Vetch:** Winter annual legume, can be toxic to livestock after seed set, seeds are toxic to chickens

Summer Annuals:

- **Barley, Oats, Triticale, Wheat**
- **Peas**
- **Annual Ryegrass:** Good regrowth after harvest or grazing, grows into the winter
    - *Westerwold*: True annual, will produce a seed head, slower to regrow
    - *Italian*: Biennial that can over winter in warm areas, needs cold temperatures to induce a seed head
    - *Tetraploids*: Larger seed size, larger leaves, fewer bigger tillers, higher feed quality
    - *Diploids*: Smaller seed size, narrower leaves, denser stands, more tillers, more hardy
- **Annual Clover:** Legume
- **Short lived Clovers:** e.g., Red, white
- **Yellow Blossom Sweet Clover:** Biennial legume, possible health concern with dicoumoral (low level varieties available)
- **Brassicas:** e.g., Forage Rape, Kale, Turnips, Forage Radishes
- **Hairy Vetch:** Winter annual legume can be treated as a summer annual. Note: if it over winters and sets seed it could reestablish itself (possible toxicity concerns).
- **Warm Season Annual Grasses**
    - *Single cut:* Forage sorghum, grain sorghum
    - *Multi-cut:* Sudan grass, Sorghum-Sudan grass (prussic acid concerns), improved millets (German, Foxtail, Pearl, Japanese), Teff
- **Warm Season Legumes**
    - *Single cut*: Cowpeas, forage soybean, Sunn Hemp
    - *Multi-cut*: Lespedeza
- **Faba beans**
- **Warm season Broadleaves**
    - *Single cut:* Buckwheat, sunflowers

Caution!
When using these species please consider the possibility that they could cause some health concerns, e.g., nitrate accumulation, potential for digestive upsets or toxicity in certain situations.

FORAGE STAND CHARACTERISTICS AND ASSESSMENT TOOLS

Vigorous stands - some aspects consider:

- Plants need to respire throughout the winter period.
    - Did the plants enter with good energy reserves?
    - Are growing points protected (e.g., snow cover, plant cover) from cold temperatures?
    - Did compacted snow/ice reduce their ability to respire?
    - Does the presence of livestock make them susceptible to trampling damage?
- Spring growth has enough time to ensure energy reserves are replenished.
- Resilient stands are comprised of vigorous plants and healthy soil systems.
    - Well aggregated soils (good soil structure) with good organic matter levels increases water infiltration and storage.
    - Frequent or aggressive tillage can reduce soil aggregation and organic matter.
    - Healthy and active microbes (e.g., fungi, bacteria, etc.) are present.
    - Photosynthetic activity feeds the plants, microbes and supports root growth.
    - Multiple species stands (polycultures) support nutrient sharing, diverse root systems and photosynthetic activity throughout the growing season.

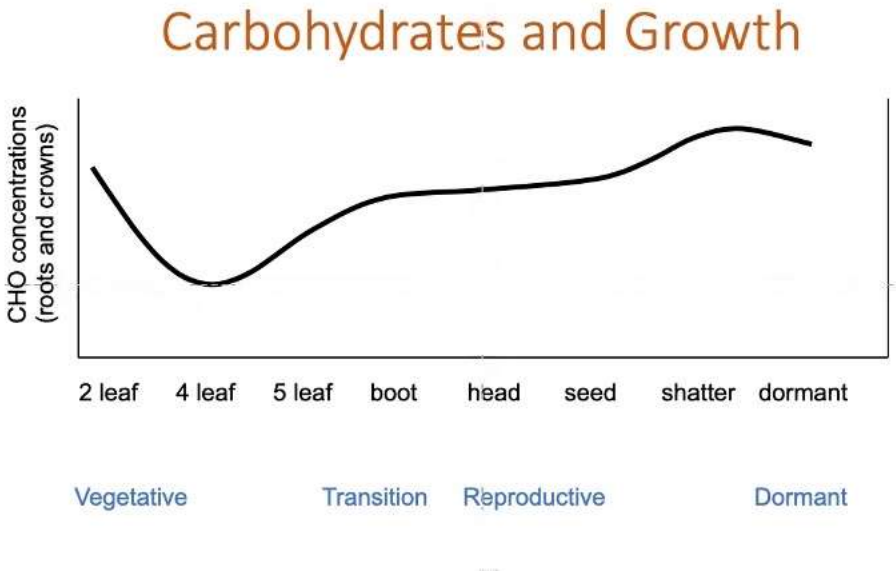

Figure 11: Typical energy levels through the season. This diagram outlines the drawdown and replenishment of stored plant energy through an uninterupted growing season.

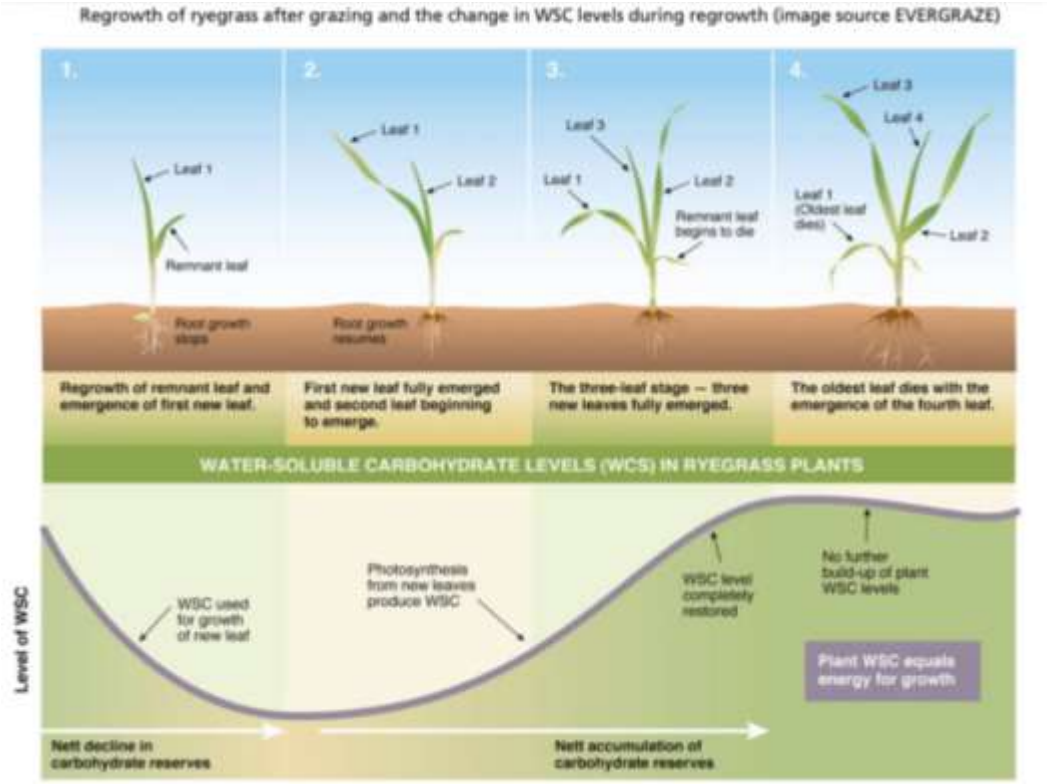

Figure 12: Typical energy draw-down and replacement in spring. *As ryegrass grows through each leaf there is a change in water soluble carbohydrates.* A similar process occurs following harvest or grazing, especially when growing points are removed or the remaining leaf area is short.

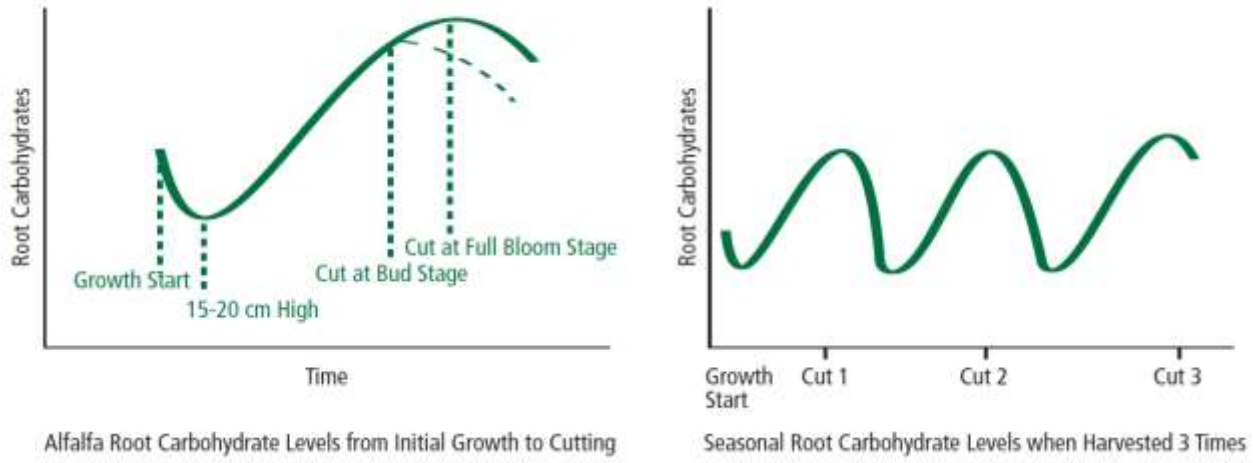

Figure 13: Alfalfa root carbohydrate levels. These diagrams show: 1) the small difference in root reserves between the bud and full bloom stages. Earlier harvest equates to increased forage quality and 2) following each harvest, the plant draws down its root reserves to support regrowth from crown buds.

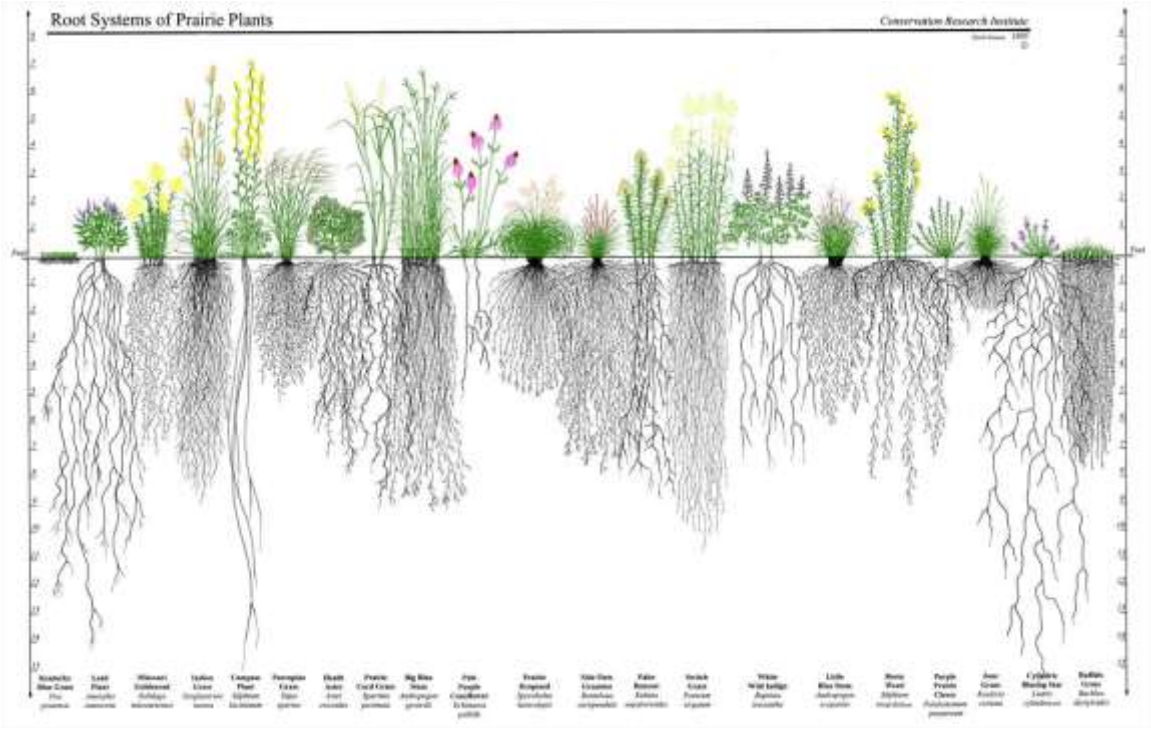

Figure 14: Diagram of different root growth patterns. Different rooting depth, rooting profiles and stages of growth depicting how a mix of species may support nutrient uptake and photosynthetic activity throughout the season.

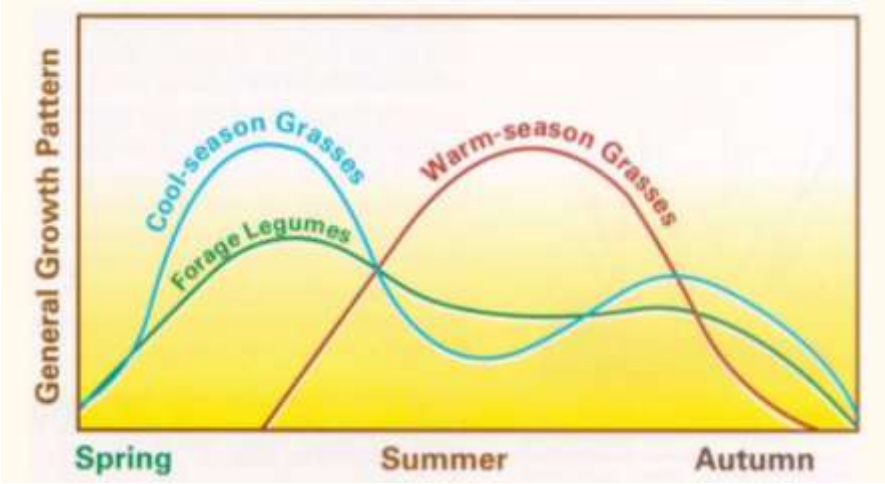

Figure 15: Diagram showing typical production levels through the growing season
"Pasture plants can vary greatly in their pattern of growth. Some producers find that pasture production is more uniform when legumes are grown with grasses, or when a warm season grass is available for summer grazing."
Reference: Iowa State University. 2018. Pasture Management Guide for Livestock Producers.

With predominantly cool season grass stands, this simply confirms that the bulk of our production comes from first cut. It does hint that warm season species may be beneficial if our summers are "hot". They are more efficient water users and are heat tolerant, so as a component of a stand could provide a boost in production. They are, however, quite susceptible to cool temperatures. That be seen as reduced performance and or frost damage.

ALFALFA: EVALUATION OF PLANT VIGOUR OR HEALTH

In the fall: Using the numerical rating 0 - 5, (see pictures below), look at numerous plants across the stand. Healthy stands should have fewer than 30% of the plants rated as 3 & 4. Stands with a high percentage of severe injury (greater than 50% rated as 4 & 5) should be considered for renovation.

In the spring: If the healthy plants' stems are less than 25 - 30 stems per square foot or there are less than 3 plants per square foot, renovation to achieve good yields is indicated. You can reseed entirely or consider inter-seeding a grass or annuals to achieve your yield goals.

Note: In the spring alfalfa plants (e.g., rating 5) can initiate growth then stall and discontinue growing. Growth in those instances is from energy reserves in the crown. This occurs when the living tissue connection from the crown to the tap root has been broken. The plant subsequently dies. This is often first seen when some plants are obviously smaller than their neighbours, so dig some and check their status.

Rating: **0 -- excellent**
(healthy plant)

1 -- excellent
(some discolouration)

Rating: 2 -- good
(moderate discolouration & rot)

3 -- marginal to severe
(significant discolouration & rot)

Rating: 4 – severe winter kill
(greater than 50% discolouration)

5 – already dead

Reference: American Society of Agronomy, Crop Science Society of America, Soil Science Society of America. 2011. Alfalfa Management Guide.

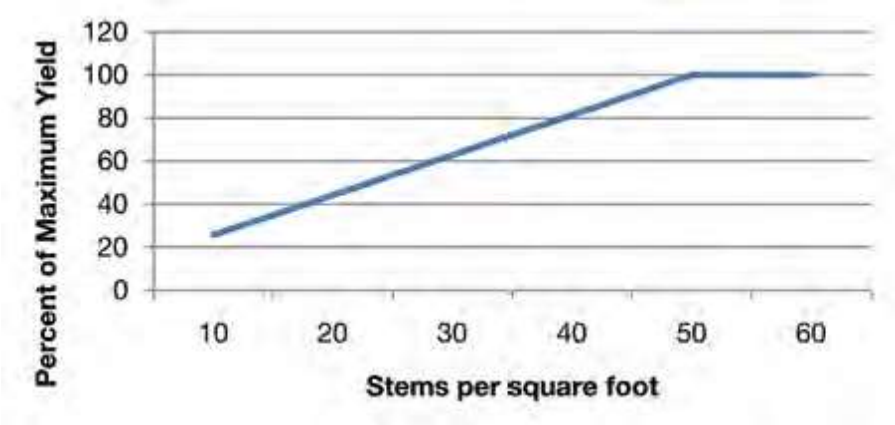

Figure 16: Alfalfa stem count and yield potential.

Reference: Undersander and Cosgrove, University of Wisconsin. 1992.

The stem count per square foot may need to be adjusted to properly reflect your situation. However, as stem counts fall so does yield and at less than 40 (in this case) stand rejuvenation may be beneficial. From a plant count perspective, having 4 to 5 or more healthy plants per square indicates a productive stand.

GROUND COVER

Ground cover values and examples: Stands with less than 40% ground cover are candidates for inter-seeding or renovation

20% ground cover

- Run-off water loss = 160mm/year
- Soil loss = 8.5mm/year
- Poor plant production and sustainability
- Low green leaf and plant vigour
- Low water infiltration
- Plants exposed to temperature extremes
- Low litter levels
- Low microbial activity
- Poor organic matter content
- Poor soil structure and surface sealing of soil

40% ground cover

- Still too low
- Run-off water loss = 90mm/year
- Soil loss = 4.0mm/year
- Poor pasture and soil loss

70% ground cover

- Run-off water loss = 10mm/year
- Soil loss = 0.3 mm/year
- Good plant production and sustainability
- High green leaf and plant vigour
- High water infiltration
- Plants' bases protected from temperature extremes
- High litter levels
- Good microbial activity
- High organic matter content
- Good soil structure and soft soil surface

90% ground cover

- 90% ground cover further reduces run-off, soil loss and evaporation losses
- Paddocks with ground cover of 90% or more provide rotational grazing opportunities and rest for paddocks with poor ground cover

Reference: Meat and Livestock Australia. Maintain Ground Cover

These photos are intended to give you an idea of what low plant numbers per square foot or low percent ground cover looks like. In general:

- Perennials can be successfully introduced to less than 40% cover and very easily into the 20% via direct seeding (no till or a conventional seeder that can get the seed into the soil).
- Annuals would also be successful inter-seeded at less than 40% cover. They would provide increased forage that year, versus perennials, but the bare ground would still be present once their growth period is complete. They could also add value and some production to less than 70% cover, especially if the existing stand vigour is low.
- If those living plants happen to be alfalfa, remember alfalfa autotoxicity i.e., alfalfa does not establish well if at all when living alfalfa plants are present. Use a grass or a different legume.

PLANT VIGOUR AND RESILIENCE, MANAGEMENT CONSIDERATIONS

Forage stands with **good vigour** have:

- "Strong" root systems
- Abundant leaf area
- Good density of the desired species
- Little to no symptoms of stress (i.e., nutrient deficiencies, slow/reduced growth, pest impacts, etc.)
- Vegetative cover (particularly perennials) going into winter".

Resilience speaks to the ability of stands to withstand stresses, such as dry or droughty conditions, without showing dramatic reductions in productivity (they will be lower), stand composition, winter survival or, weather permitting, regrowth. What follows are some key aspects that should assist your stands to maintain or increase their vigour. This is not an exhaustive list of considerations.

Photosynthetic Activity

Plant roots and the soil environment or ecosystem are supported by active plant growth. Energy from photosynthesis supports root growth and feeds the soil biome (bacteria, fungi etc.). That biological soil environment is where the plants derive their nutrients to support growth and hence yield. There is a lot going on down there but, in general, managing stands to ensure photosynthetic energy flows into the system supporting microbial activity and good root growth is key. Root growth slows or stops when too much leaf area (greater than 50% - 60%) is removed and can be perpetuated if that removal is ongoing. As Figure 12 shows, plants draw on energy reserves to reinitiate leaf growth. Another defoliation prior to replacing that energy will progressively weaken the plants and prolong their inability to support root growth.

Plant Nutrition/Fertility

Productive stands require attention be given to fertility or their nutrition. Your management approach or strategy, ("conventional", "organic", "regenerative" or other), will guide you as regards to your options. Paying attention to your stands' nutrient needs, especially deficiencies, can pay dividends when it comes to achieving good yields. Soil testing, whether that be via labs that measure physical attributes, biological attributes or both, can provide you with good insights into what may be needed. Taking samples over the years, making notes of any adjustments made and monitoring results will further help you achieve good, and hopefully, cost-effective production.

Grazing Management

Grazing pressure on stands has the potential to be beneficial to plant vigour and stand health or not. The FIO Principle provides a nice perspective which addresses three key aspects of grazing impacts.

1) Frequency refers to the number of times plants are defoliated during the grazing period. Essentially the longer livestock graze the same area the more potential for plants to be repeatedly grazed or defoliated, often referred to as the "second bite". That can result in plants using stored energy to initiate leaf growth which if bitten off too soon results in the need for addition energy reserves drawn upon.

2) Intensity refers to the amount of leaf material remaining after grazing. In this instance if there is more than 40% - 50% for the leaf area remaining there is typically enough photosynthetic area for the plants to continue to support above and below ground growth. As mentioned earlier, less leaf area can result root growth slowing or stopping until the leaf area can provide enough energy to reinitiate root growth.

3) Opportunity refers to the amount of time plants have that supports growth or regrowth, often referred to as rest or recovery period. It is considered the most important of the three. With the opportunity to grow or regrow the plants provide energy for above and below ground growth, which supports/increases their vigour.

In general, grazing rotations that have short grazing periods or duration, leave adequate leaf area to support photosynthesis and provide adequate periods of grow or regrowth will support vigorous stands. Grazing can stimulate photosynthesis and allow for the capture of nutrients livestock leave behind. Often these types of strategies will provide increased forage (over time) and extend the length of the grazing season.

Benefits of Regrowth

Following harvest or grazing (within the growing season), providing time for adequate regrowth becomes critical to support root growth, as well as their soil environment or ecosystem. A healthy root system also supports the soil structure, i.e., the development of soil aggregation. Fields with vegetative cover and aggregated soils provide increased water infiltration and storage, thereby making more effective use of rainfall and potentially snow melt. This would also support plants to have good energy reserves and facilitate plant survival during winter or droughty conditions.

Getting Ready for Winter

Managing your stands to be vigorous sets them up well to go through winter and enter spring with the energy and plant population necessary to initiate strong and productive growth. As daylength shortens and temperatures cool down with frost approaching, managing stands to ensure they are set up for winter is important. Grasses in particular shift their resources towards ensuring next year's growing points have the energy reserves needed to support respiration through the winter and initiate growth in the spring. Legumes, especially alfalfa, need to enter

winter with good energy reserves as well. In that regard, the last harvest or grazing needs to allow enough time for regrowth to occur and replenish energy reserves, or not allow for regrowth so there is no late season drawdown of stored energy. In general, that means the last harvest should be made so that there are 8 – 12 inches of foliage (regrowth) or 4 – 6 weeks of growth before the first killing frost. Predicting that can be challenging. Leaving some above ground vegetative cover will also assist by providing insulation and an avenue for air to get into the soil to support plant respiration. That is especially important if you will be feeding livestock on the area or if there is snow compaction or melt followed by a freeze. Consideration could be given to putting those pressures on stands slated for renovation or reducing the time livestock are able to impact individual stands.

Forage Quality Linked to Time of Harvest – Perennials

Stage of growth at harvest is the most important factor affecting forage quality. The more mature the forage, the lower its quality or nutritional value. Factors such as soil fertility, fertilization, temperatures during forage growth, species/varieties and management after cutting can also influence forage quality. Testing forage by field, lot and/or harvest times will ensure you know the nutritional value of your feed, allowing you to provide forage that best matches your livestock's performance goals and/or production cycle.

Note on Forage Quality:

When forage quality matches the animals' requirements, it is among the lowest cost ration – this should serve as an economic incentive to time your hay cutting to target quality to the nutritional requirements of the different classes of animal you are feeding whenever possible.

Although legumes and grasses both lose quality as they mature, there are some notable differences. Grasses typically have lower crude protein values, which drop faster than legumes as they mature. Energy levels in grasses are typically higher and drop off slower than legumes as they mature. If you are in an area where multiple cuts can be taken, these reductions occur more quickly during the first two cuts than following cuts. Also with increased maturity, yield increases. Although if taken too far, i.e., seed set or beyond, leaf losses may result in reduced yield.

Table 5: Forage quality linked to time of harvest section – Perennials

	First Cut – When to Harvest		Second Cut – When to harvest	
Targeting	**Alfalfa**	**Grass**	**Alfalfa**	**Grass**
High Quality Forage	Harvest at, or shortly after, the early bud stage	Harvest at the flag leaf stage or early head emergence	Harvest at 28 – 33 days after first cut*	Harvest at 27 – 30 days after first cut*
Moderate Quality Forage	Harvest from early bloom to 40% bloom	Harvest from head emergence to pollen shed	Harvest at 28 – 33 days after first cut for high quality or stretched out by 5 or so days to capture moderate quality and slightly higher yield. Season permitting, of course.	Harvest at 27 – 30 days after first cut for high quality or stretched out by 5 or so days to capture moderate quality and slightly higher yield. Season permitting, of course.
Low Quality Forage	Harvest after 40% bloom	Harvest past pollen shed or into seed development	If the time between cuts exceeds 50+ days or lack of moisture inhibits active growth. However, drought conditions do not always result in low energy levels (TDN), particularly if you capture a high leaf to stem ratio.	If the time between cuts exceeds 40+ days or lack of moisture inhibits active growth. However, drought conditions do not always result in low energy levels (TDN), particularly in grasses. High sugar levels may still occur and keep energy levels relatively high.

*If you are in a multiple cut area those intervals can be lengthened by 4 – 5 days after the second cut. Forage quality does not drop off as quickly later in the growing season.

Post cutting management is important, as leaf losses in the process of making hay or poor ensiling can result in further and often significant drops in the forage quality available to be fed. Some key practices to strive for are:

- **Hay:** Strive for a short drying time by having wide swaths or windrows, thereby reducing respiration, which consumes energy (sugars and non-structural carbohydrates). Use a roller conditioner or flail to break the waxy layer on stems. Rake to avoid leaf losses (>40% moisture for alfalfa and >25% moisture for grasses).
- **Silage:** Ensile at 70% to 50% moisture. Choose the optimal chop length for the crop (e.g., 3/8 to ½ inch for legumes, ¾ inch for whole plant corn). Consider using an inoculant to enhance fermentation. Pack and cover silage well to exclude air.
- **Haylage:** Make firm dense bales. Wrap at 40% to 60% moisture (moisture for good quality silage comes from the plant, versus dew or rain). Wrap or seal shortly after baling (same day). Consider using an inoculant to enhance fermentation. Use four layers of plastic and repair tears.

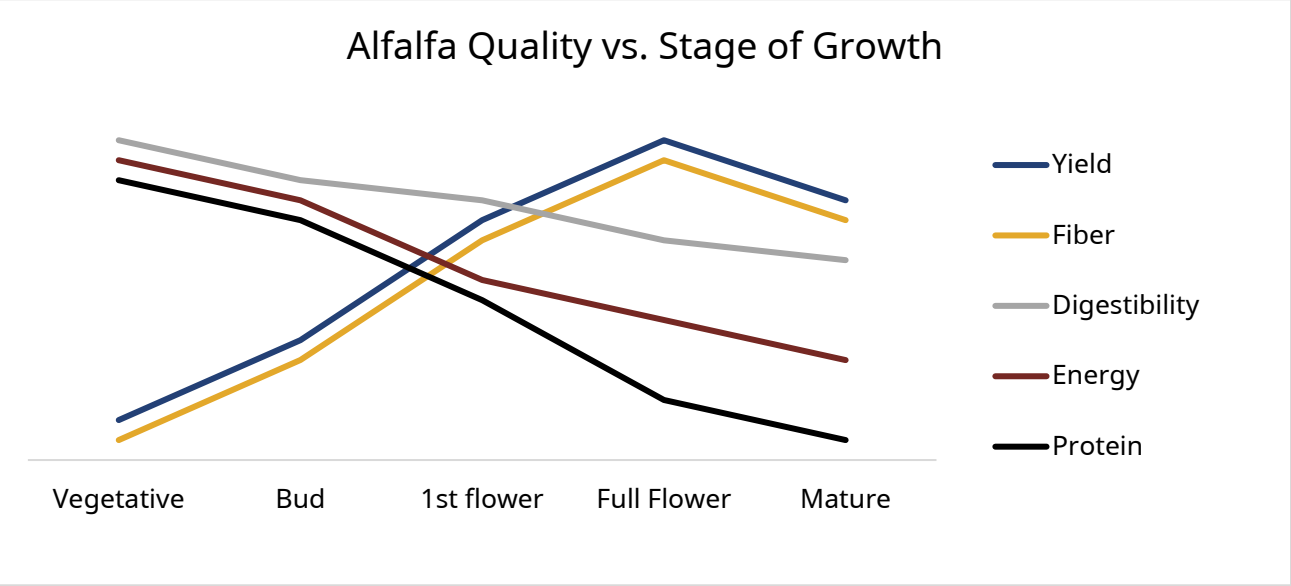

Figure 17: Alfalfa Quality (yield, fiber, digestibility, energy and protein) changes as the plant grows.
Note: Values used are estimates used for demonstration purposes.

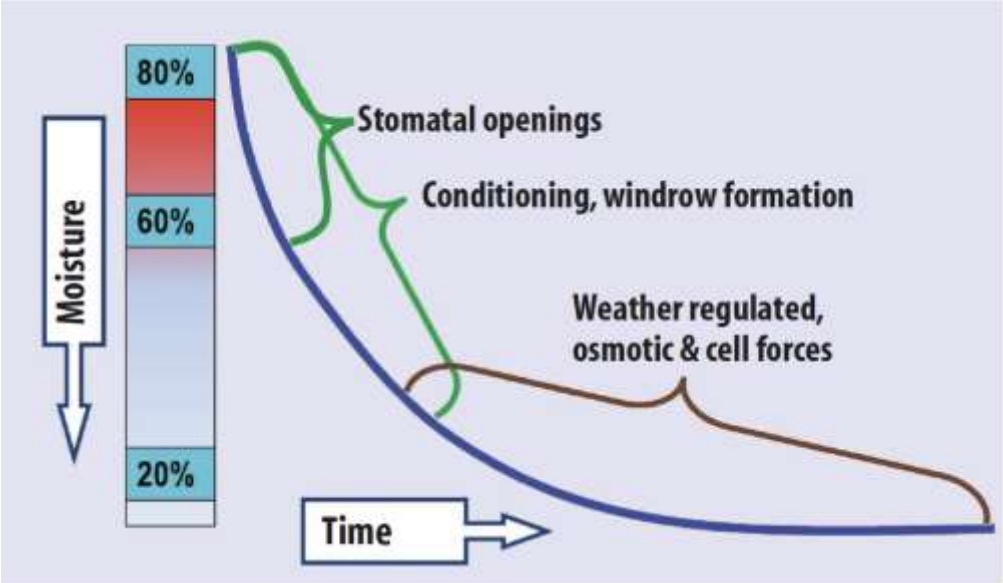

Figure 18: Typical drying time and stages:
Initially, open stomata, conditioning and drying in a wide swath promote rapid water loss. Later in the drying period, the rate of water loss is much less because osmotic forces hold water in the plant cells and weather conditions hinder water vapour movement from the stem.

Reference: University of Wisconsin-Madison. 2011. Best Practices to Hasten Field Drying of Grasses and Alfalfa.

Forage Quality Linked to Time of Harvest – Annuals

Harvesting annuals at the right stage optimises their nutritional quality and avoids health risks. Nutrient quality is primarily reduced as plant maturity increases resulting in higher seed shattering and/or losses along with a reduction in green leaf material.

Table 6: Harvest Stage of Annual Crops for Annuals for Greenfeed or Silage

Crop	Harvest Stage
Oats	Late milk
Barley	Soft dough
Spring/Fall Rye	Early dough
Spring/Winter Triticale	Soft dough
Spring/Winter Wheat	Early dough
Peas	First pods wrinkle
Pea/cereal mixture	At cereal stage
Foxtail, Siberian & Proso Millets	Early heading
Sorghum	Mid dough
Sorghum Sudan Hybrids	Dough
Faba beans	10% – 20% pods black
Sunflowers	35% – 45% moisture
Corn (whole plant)	65% – 70% moisture

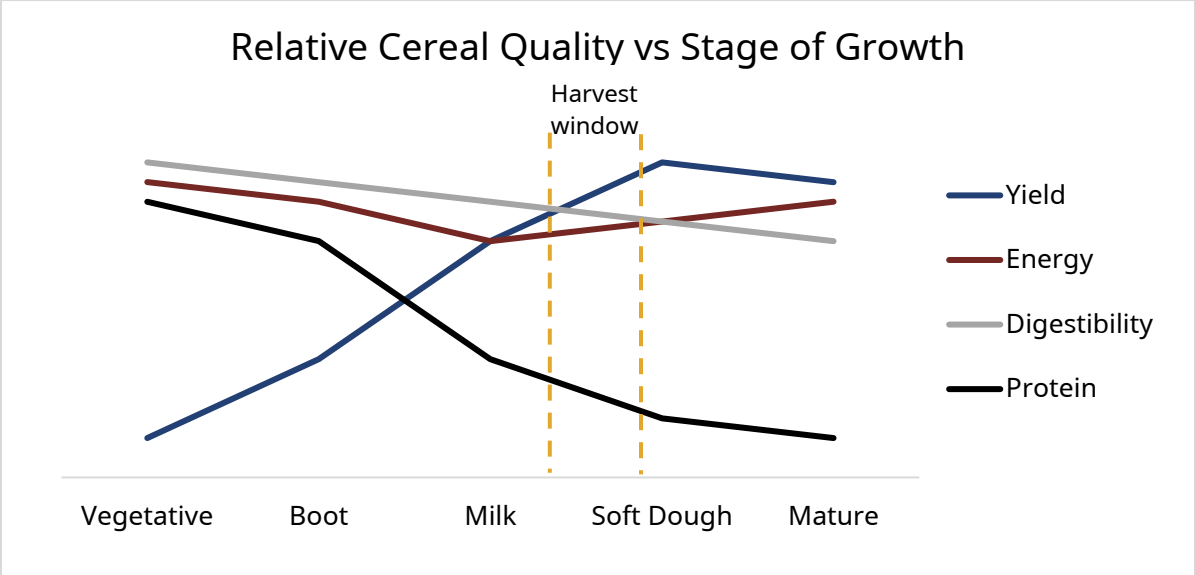

Figure 19: Cereal quality (yield, fiber, digestibility, energy and protein) changes as the plant grows. Note that these values will change if there are seed or product losses.

Corn:

There is no sure linkage between stage of maturity and percent moisture as that ultimately depends upon a variety of environmental factors. Traditional recommendations for harvest are ½ to 2/3 kernel milkline. However, with the variability in moisture levels, this becomes a good stage or time to start monitoring whole plant moisture. Use a Koster Tester, microwave or laboratory to determine percent dry matter.

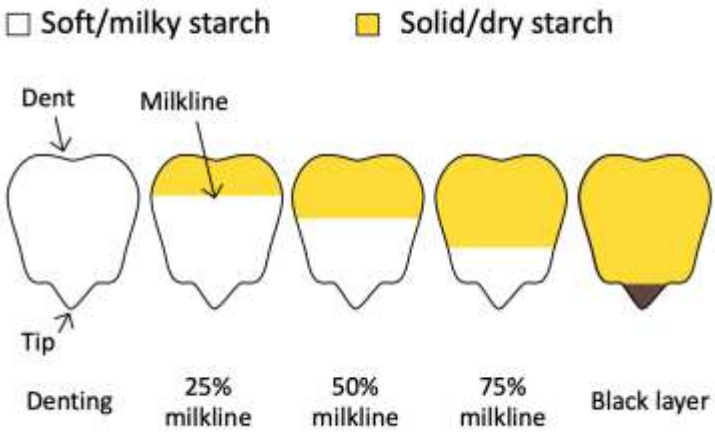

Figure 20: Kernel milkline development.

Reference: Ontario Ministry of Agriculture, Food and Rural Affairs. 2022. Guide to Forage Production

NOTES

NOTES

SECTION 4: Business/Economic Decisions

INTRODUCTION

From a Farm Business Management perspective, the financial strategies for managing through drought do not change from the long-term economic viability objectives. Those objectives are universal and can be described as: maximizing profit, utilizing sustainable agricultural practices, utilizing resources efficiently, actively managing risks, and providing a livelihood for the farm family. However, depending on the length and severity of the drought the focus may temporarily change from maximizing profits to minimizing losses of capital and resources. To do that you must make decisions that maximize revenues, and/or minimize expenses.

The best business/economic decisions are based on production and financial numbers that are pulled from the operation; NOT based on industry or local averages. While inferences can be drawn from those averages, they cannot reflect the unique attributes, realities and management style on your operation. Only your financial and production records can do that. It does not matter if you chose to keep those financial and production records digitally or manually. What does matter is that they are accurate, up to date, and accessible when you need them to aid in your decisions. Hopefully you have scheduled yourself a regular time to keep those records up to date, but you also need to set some time aside to look at and analyze the implications of those numbers.

Filling out the Inventory Sheets in this guidebook gathers the information that you may have recorded in several different places and puts the critical production information at your fingertips. Now you can collate it with your financial records to inform your business/economic decisions.

Time is limited, you cannot possibly analyze every option in a few hours. To be effective and efficient you need to boil it down to two to four options for comparison that will fit your unique operation. This section provides five steps to get you started.

COMPARING THE ECONOMICS OF YOUR OPTIONS

Step 1: Know the goals for your business

Knowing your end goals for your operation (what you want to accomplish with your livestock business) helps you decide what actions/options are right for it. Those end goals help set the parameters/guidelines by which you are willing to operate. For instance, if you want to be “the premier organic purebred livestock breeder in the province” you will have a different set of parameters/guidelines to help you achieve that, than the operation down the road that wants to “raise a profitable commercial herd that provides our family with an honest living”. That means that while both businesses may be facing the same drought/feed shortage, you will have different priorities, different options available and make different choices that are right for your unique operation.

- A formal Business Plan sets out your vision for what you want your farm business to look like and how it will operate. That vision is the fundamental reason you are producing your product. Whether beef, dairy, lamb, bison, hay or other crops, it will help guide how you react to the challenges and opportunities you face.
- If you do not have a business plan, set aside some time and at least write your goals/desired outcomes for your business. If you want help doing a formal Business Plan see the resources at the B.C. Agri-Business Planning Program webpage.

  Use that vision to narrow down the options that could fit your operation and choose which ones to analyze.

Step 2: Choose the method for your analysis/comparison

Remember that whatever method you choose, the result is only as accurate as the numbers and assumptions you put into it. On the other hand, if you do not already have a good record keeping system, then now might not be the best time to try to set that up. However, it may be a great incentive to get started.

- **Cost of Production (COP) and Unit Cost of Production (UCOP)**
  Modelling with your actual numbers is the most accurate method of analysis. It calculates all the effects of a change on the farm's total production and profitability. Many linkages are already built into the model so you cannot forget or ignore them. To see how the change affects your bottom line, simply put your production and financial numbers into a template.
- **Comparing Benchmark Numbers**
  Modelling with benchmark numbers is less accurate but can give you a rough idea how the options may work. Replacing benchmark numbers with yours where possible improves accuracy somewhat. If you are interested in more current benchmark numbers and you participate in the AgriStability Business Risk Management Program, you may want to consider signing up for the Towards Increased Profits (TIP) Report.
- **Partial Budgets**
  Partial Budgets simplify analysis by focusing on the change and related costs and benefits. This includes assumptions and/or biases that may overlook linkages. It can also miss how that change fits in with the rest of the farm's overall production and profitability.

A Note on Assumptions

Regardless of the analysis or comparison method, you will need to choose assumptions that most accurately reflect the situation. Assumptions may make a significant difference in accuracy or how the option plays out financially.

For example, imagine you have come across a new technology that claims to increase the number of pounds of calf produced and sold by 10%. To do an accurate analysis you need to determine how it does that. If you assume those extra pounds to sell come from heavier calves, you will get a different result than if you assume you have more live calves to sell. The figure below outlines the calculations for potential revenues in these two situations. You need to compare the total value per head and number of head, which involves factoring in the current market slide.

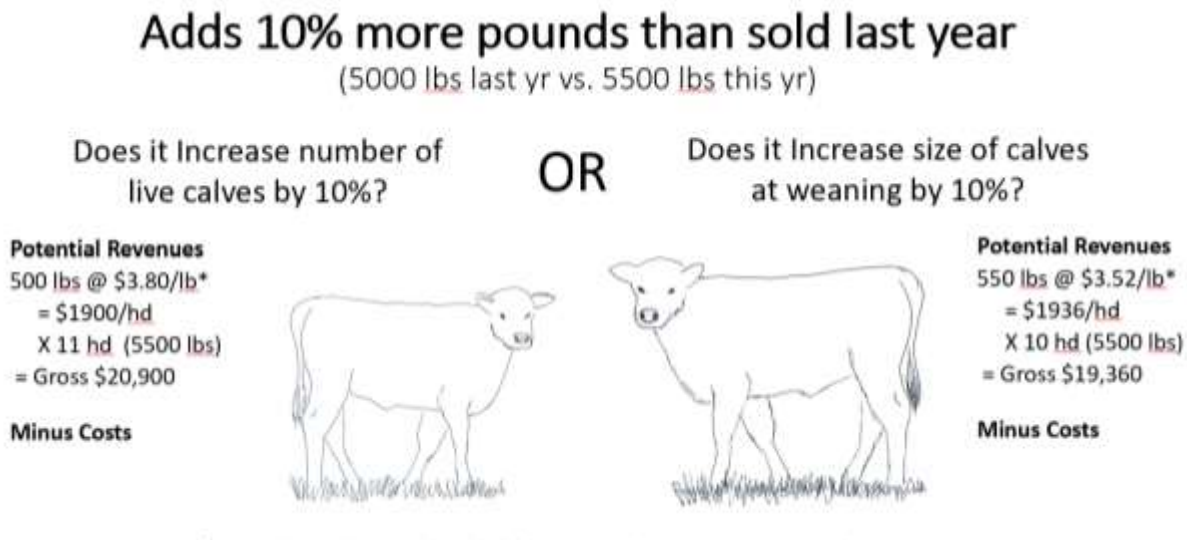

Figure 21: Comparing how the extra pounds are produced.

Important: When accounting for the increase in number of calves produced and sold, you will need to account for the extra marketing and transportation costs. Also remember to include in your analysis the costs of the new technology and your time and effort to use it.

* For more information see this article on Understanding the Cattle Market Sliding Scale. The market slide adjusts depending on cost of gain and market factors.

A. Unit Cost of Production (UCOP)

The Unit Cost of Production (UCOP) boils all the costs and productivity of your farm into one number. It is basically a breakeven, but for your whole operation. The ultimate advantage is that it allows you to quickly compare your costs to the current market prices to tell if you are profitable or not. You can also compare it to futures prices, adjusted to a local price, to project probable profitability.

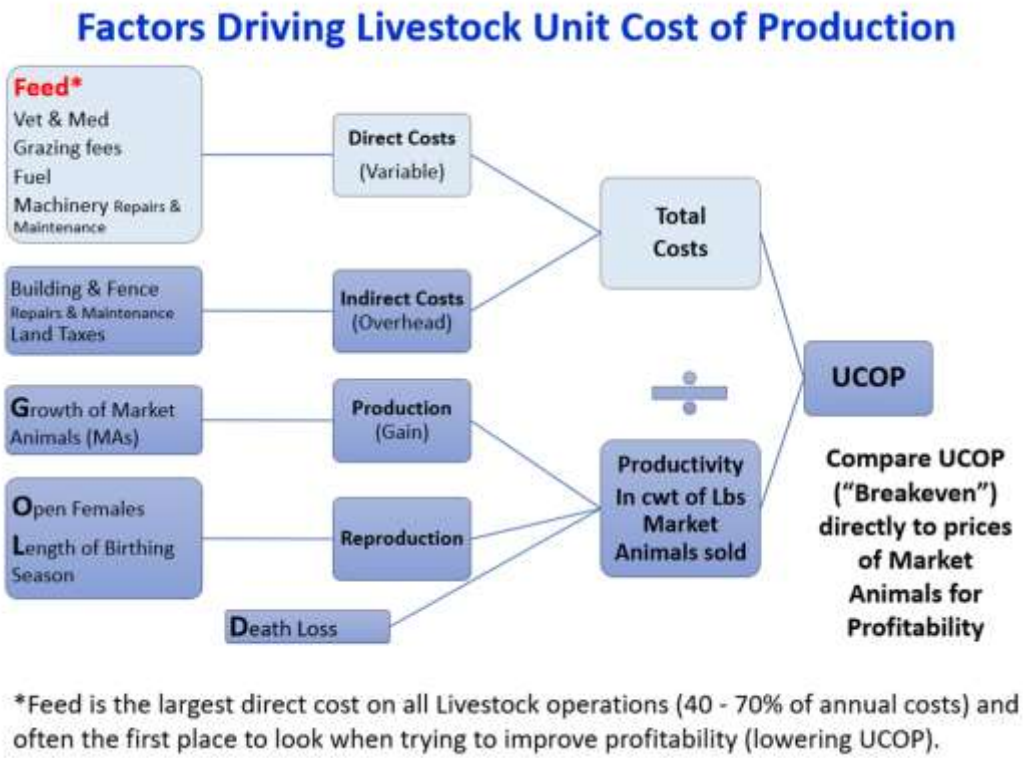

Figure 22: Factors driving livestock unit cost of production

There is a UCOP template from the Ministry available in Section 6. It requires some knowledge of computers and takes some time to input your data from the Inventory Sheets in this guidebook. You can save multiple copies of your data and model multiple scenarios with relative ease. If you know how, you can set up sensitivity analysis tables to compare multiple factors automatically.

Most often farmers will look at the profitability of the whole farm as it is simpler and relates to what they need to file for annual Income Taxes. This leads to farmers looking at their farm as a single business. Enterprises are simply potential profit centers within that business. Almost all livestock farms have multiple enterprises – parts of that business that create things they can sell or use as inputs for other business opportunities. See the "Note on Enterprises" on the following pages for more information.

If you don't have all the numbers to do a precise calculation, doing a ***"Quick & Coarse"* UCOP** calculation can indicate whether you were a **Low, Medium or High UCOP producer** last year. It also helps you estimate where you are this year to help inform what options you should (or shouldn't) consider.

Take your total costs from your Previous Year's **Income Tax Form** (as per the light blue bubble in the diagram below).

- From your 2023 sales slips add up all the pounds of your primary product (calves for beef producers). Do not include the weights from cull animals as you are wanting to compare against calf prices. Put the total pounds sold in the slot below. Divide by 100 to calculate the number of hundred-weight (cwt) sold. (*If you prefer to think in pounds then do so, but remember to convert the market prices to $/pound*)
- Divide the total costs by the number of cwt sold (*or pounds if you prefer*) to get your 2023 UCOP.
- Compare your 2023 UCOP to the average 2023 calf prices for your calves at the time you sold. If the Market price minus your UCOP is positive you were profitable in 2023.

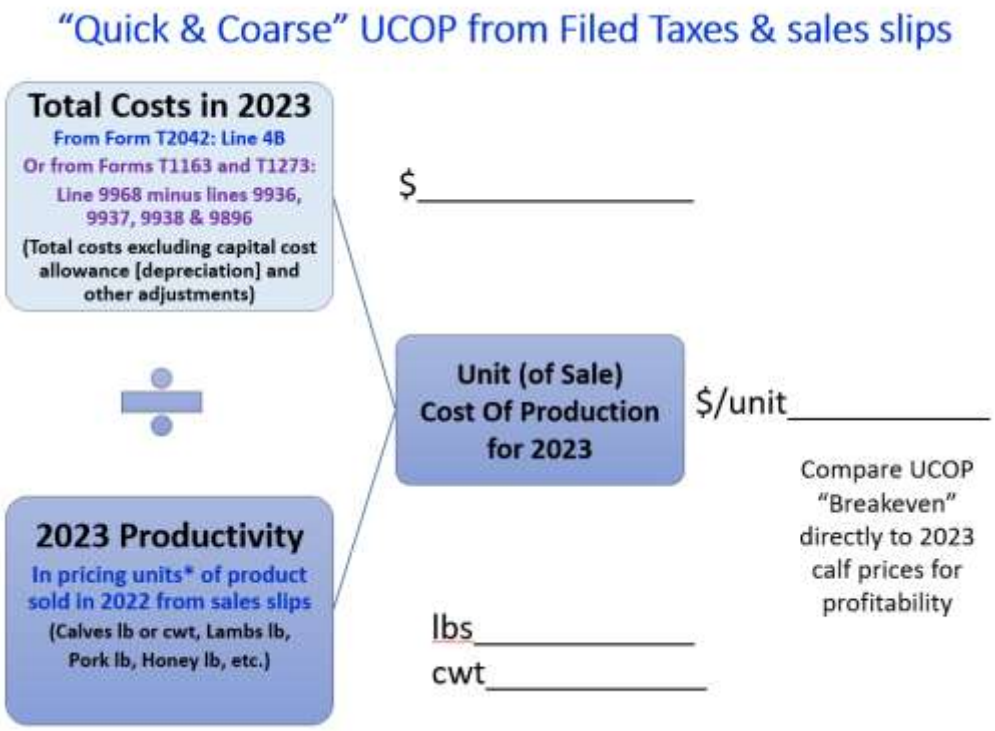

Figure 23: Unit Cost of Production form

Judging whether you are a High, Medium, or Low UCOP producer is a little subjective because we do not have a database to analyze and set benchmarks for the industry. As well, the brackets change every year as input costs do not remain static.

For a general guideline from 2023:

Below $200 per cwt:	Low UCOP (profitable most years)
$201-$220 per cwt:	Medium UCOP (profitable half the time)
Above $221 per cwt:	High UCOP (rarely profitable, only in years of peak prices)

The numbers are subject to change due to inflation. In general, if you have a low UCOP structure, then you are more profitable. This provides more financial room to maneuver when dealing with the effects of drought.

Were you a high UCOP (low profit) producer in 2023?

Have you made any significant changes that would help you become a medium or low UCOP (higher profit) producer this year? If not, the drought will make it that much harder to make decisions that save your equity.

A Note on "Enterprises"

Enterprises are profit centers within a farm. Almost all livestock farms have multiple enterprises. For instance, a regular livestock operation generally has four enterprises producing items that can be sold or used by the business as inputs for another enterprise:

1. weaned animals for sale (produced by the main herd/flock),
2. raising replacement animals (feeding replacement animals for your herd/flock or for sale),
3. forage for grazing, (as an input for your main herd/flock or for sale) and
4. stored forage (as an input for your main herd/flock).

When producers start asking questions like:

- "How much does it cost me to make hay?", or
- "Should I raise my replacements or buy them?", or
- "Am I better off to run fewer animals and sell hay?" (or the opposite?)

It requires doing some Enterprise Analysis or Enterprise Budgets to get the answers.

Doing that enterprise analysis is simply searching through your records and assigning all the direct revenues and direct costs to that enterprise and then calculating a **Contribution Margin** (a Contribution Margin is how much profit or loss that the enterprise contributes to the overall business). Calculating Contribution Margins involves transferring the product of one enterprise to the next at Fair Market Value (FMV). This can indicate if there are areas of your farm that are contributing to, or detracting from, your overall business profitability.

Additional enterprises like feeders/ backgrounders, purebreds, hay sales, pasture rental, custom grazing, custom feeding, and direct marketing*, can add complexity to the analysis process. To get a clearer picture you will need to separate out those additional enterprises. To ensure you attribute revenues to the correct enterprise, you will have to transfer animals from one enterprise to the next at fair market value (FMV). You will also have to apportion the direct and indirect costs to each enterprise to better gauge each enterprise.

Creating some extra subcategories in your financial record system can be very helpful in splitting out costs utilized for those enterprise purposes.

*Direct marketing enterprises often involve additional specialized equipment (freezer/refrigeration for storage, display, &/or transportation, etc.), labour, management time, etc. that are very distinct from farm activities, and should be accounted for separately from farm activities. Also, if harvesting livestock and marketing year-round this can affect production efficiencies and care should be taken when comparing with COP data from traditional production herds/flocks. In general, it tends to be more efficient manage in large uniform groups in a single stage of production, whereas year-round marketing requires having smaller groups at multiple stages of production so that the marketing volumes are spread out to address the year-round consumer demand for the end product.

B. Cost of Production (COP)

The COP method is based on calculating **Revenue** (see diagram below), and then deducts the **Total Direct Costs**. It then divides by the number of females bred. Then you can compare your numbers to industry benchmarks on a per female basis. COP also treats your indirect costs separately. This is an advantage when it comes to analyzing enterprises (see note on previous page). However, then the indirect costs must be added in to be able to look at your overall profitability. Even so, COP is still a good indicator when modeling the effects of making a change.

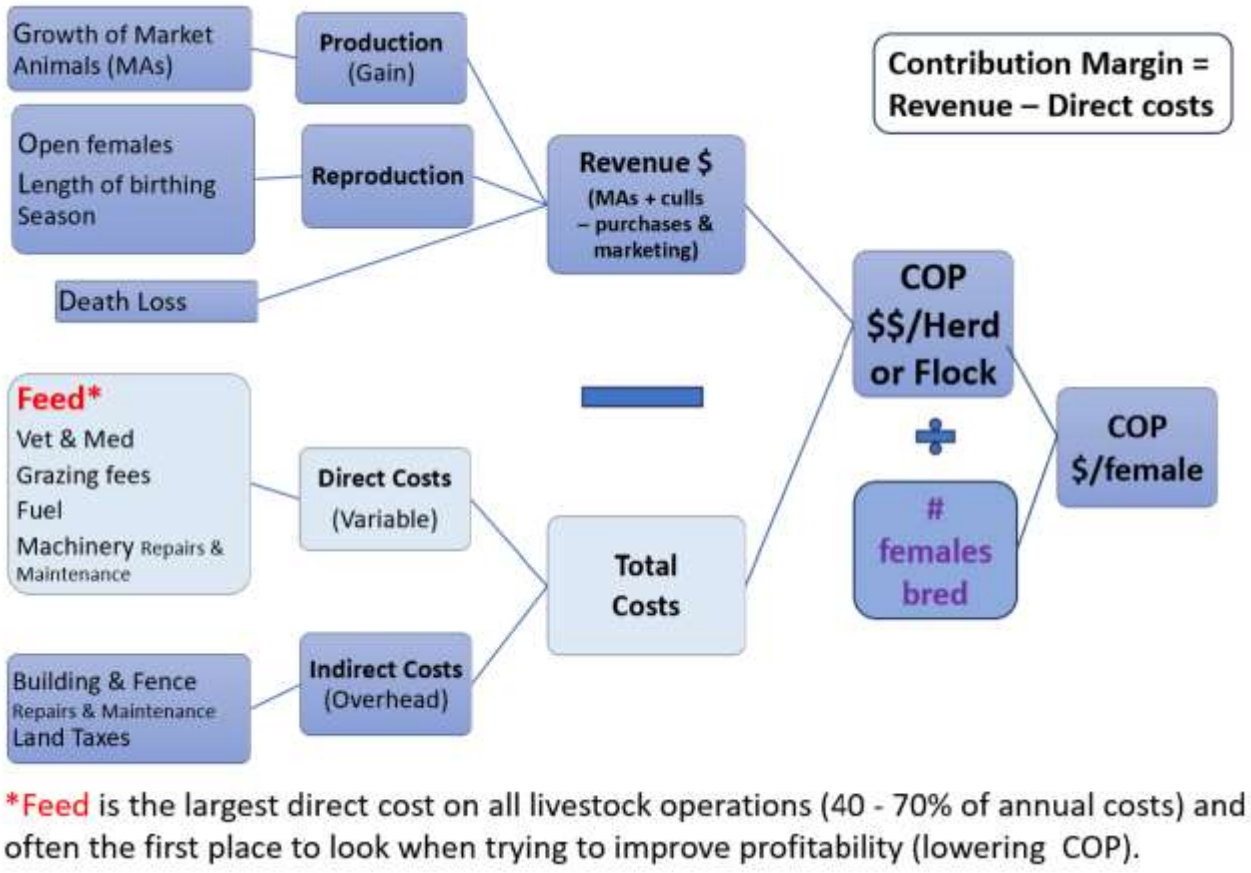

Figure 24: Factors Driving Livestock Cost of Production

There are many COP templates available online from Beef Cattle Research Council (BCRC) and various jurisdictions. Cost of Production (COP) templates are also available via the Ministry. Any template and/or spreadsheet (available in Section 6) you use require some computer knowledge and take time to input your data. However, once the data is inputted, you can save multiple versions and model multiple scenarios with relative ease. If you know how, you can set up Sensitivity Analysis tables to automatically compare multiple factors.

C. Partial Budget

The Partial Budget is commonly used on farms. That is because it does not require the same level of record keeping and time to set up as a UCOP or COP. The main drawback is that it can be less precise and subject to personal biases. However, when used correctly, it is a systematic way to identify and evaluate the positives and negatives of a proposed change. The more objective you can be when categorizing and quantifying the effects, the better this analysis will reflect financial reality.

A partial budget helps the user to analyze the net financial benefit of a proposed change based on the principles of identifying and quantifying the effects of a change in the following categories:

- Increases in Income attributable to the change
- Reductions in Income attributable to the change
- Increases in Costs attributable to the change
- Reductions in Costs attributable to the change

After that it is a matter of adding up the numbers in the two columns. If it ends up positive then your farm income can benefit from the change, and if it is negative, it is time to look at analyzing a different scenario.

1. Start by describing the proposed change you want to analyze versus the current situation.
2. Then start with the main reason you are considering the change. Is it adding Income or reducing Costs? Put that in the corresponding category, then list all the things you can think of that will result if you undertake that change.
3. Finally, categorize them according to the effect they will have.

Don't worry if you don't have the numbers nailed down yet, it is more important to get the concepts down on the paper to start with. It may also help to have someone else read over it and provide their ideas. Some topics may end up on both sides depending on the perspective you examine it from, such as genetics in the example on the next page. That is okay, but you will need to look at those more closely. Make sure you get solid numbers to help discern which perspective is more important financially.

Proposed change:

Main Reason you are considering the change:

Note: See Section 6 for the link for the interactive spreadsheet referenced below, "Partial Budget Template"

Date:	Fall 2024			
Proposed change:	Sell 35% of breeding herd in 2024 (in Prescibed Drought Region for Livestock Tax Deferral provision so can defer 90% of income until next year & reduce the taxable amount if I buy back breeding stock in 2025.)			
Increases in net income			**Decreases in net income**	
Added income due to change			**Added costs due to change**	
90% of net sales on breeding animals	$ -		Buy back bred heifers spring 2025	$ -
Sell 10% of hay crop	$ -			$ -
	$ -			$ -
Chance to improve genetic selection on production records (because you have to go beyond the usual culling of open, injured & poor temperment).	$ -		Loss of genetics (What is that actually worth to you??? Are you a Purebred operator? It also depends on how you do it.)	$ -
	$ -			$ -
Total added income	$ -		**Total added costs**	$ -
Reduced costs due to change			**Reduced income due to change**	
Feeding fewer animals	$ -		Fewer calves to sell fall of 2025 unless buy back bred animals	$ -
Animals grouped to make more efficient use of feed on hand.	$ -			$ -
No interest on money borrowed to buy feed.	$ -		Increased taxes if you don't replace breeding animals.	$ -
Fewer animals on fall pasture, less impacts or costs to rent more				
	$ -			$ -
Total reduced costs	$ -		**Total reduced income**	$ -
Total added income and reduced costs	$ -		**Total added costs and reduced income**	$ -
Net change in profit	$ -			

*Completed Partial Budgets can be saved with a name you'll remember so you can modify or refer to it later. Just "Save as" and name it (e.g. '2024 P_Budget_Buy feed')

Figure 25: Partial budget basics

Partial budgeting can be done with paper, a pencil, and a calculator. It can be as detailed or simple as desired, provided it captures all the necessary impacts and linkages. Using a spreadsheet can minimize the time necessary to calculate multiple scenarios by hand or go back and add in a forgotten or new impact.

Now that you have reviewed the different methods for your financial analysis/comparison (Unit Cost of Production, Cost of Production, and Partial Budgets) it is time to choose a method that will work best for your farm.

Which method will you use and Why?
(being able to point out why you chose a particular method may help impress on a potential lender that it was a deliberate choice that fits your operation and management style.)

Step 3: Gather the Numbers and look at the big picture

Each method outlined in Step 2 relies on a slightly different set of numbers. It may take some time to dig up the numbers you need from your herd and/or farm records. The Inventory pages at the beginning of this Guidebook give you a head start. It also takes time finding the market intelligence and projections you trust or to make your own projections. These numbers affect your choices and make or save you thousands of dollars, so it is worth the effort to put some time into it. Talking with the person from your usual marketing method is a good place to start; however, that should not be your only source or you may be missing out on the big picture.

Some good general sources include:

A. Industry/Association Publications*
B. Provincial and Federal Agricultural Agencies*
C. Research facilities with specialization in various Agricultural sectors*
D. Farm Credit Canada
    a. Financial calculators at Calculators | FCC (fcc-fac.ca)
    b. Markets Market Prices | FCC (fcc-fac.ca)
E. Western Producer
F. News and opinions from pundits Agriculture News Canada, Podcasts & Videos | The Western Producer

* For more details see references in Section 6.

Out of necessity some assumptions for your analysis will rely on projections. Always remember that the futures markets are basically the 'best guess' at the current time. They can and will change as more information becomes available. Like the weather forecast, the closer in to today, the higher the probability the projection is correct. But there are no guarantees. The futures markets only go out about 18 months. If your analysis requires longer term projections, you are definitely guessing all on your own. Knowing how the Price/Production Cycle works for your sector can help at least a little. All agricultural commodities have cycles in their markets because of the interaction between biological production cycles, supply and demand, and the perishability of agricultural products. Not all of the cycles are readily evident. Supply Management is a system that moderates the highs and lows of the cycles in those industry sectors.

When making your own projections it is best to run the numbers with three scenarios: *the most likely case, the best case, and the worst case*.

- What would it look like if outside factors like a global recession or a trade dispute threw those projections off? That way you can have a look at the impact if your projections don't meet current expectations and prepare for the possibility.
- Consider how you can manage that risk and make a plan to address it.
    - Is it small enough that you can retain that risk? Or are you able to transfer the risk through insurance?
    - Are there ways to mitigate the risk, or do you need to avoid that risk altogether?

Helpful Resources: Farm Management Canada and their Agrishield (myagrishield.ca) online platform.

The beef sector and hog sector have access to the Livestock Price Insurance Program (LPI). This program, regardless of whether you are purchasing insurance, provides valuable market intelligence and an easy-to-use forecast of price.

Calf

Alberta Premium Table as of : 13-Jun-2024

Note: These premiums and coverage levels change on a daily basis.

	Premium ($/cwt)				
Insured	16 weeks	20 weeks	24 weeks	32 weeks	36 weeks
Index ($/cwt)	07-Oct-24	04-Nov-24	02-Dec-24	27-Jan-25	24-Feb-25
382					9.70
380	5.48				9.21
378	5.08				8.74
376	4.71				8.29
374	4.37			8.92	7.85
372	4.06	6.11	7.37	8.43	7.44
370	3.76	5.7	6.91	7.96	7.05
368	3.49	5.32	6.47	7.52	6.67

Expected Prices = divide corresponding "Insured Index price" (on left) by 0.95

	=380/.95	=372/.95	=372/.95	=374/.95	$_____/.95
Expected Price	$ 400.00	$ 391.58	$ 391.58	$ 393.68	$_____

Figure 26: Example LPI premium table to get an indication of where the market is likely heading**.**

Note: LPI already considers the Chicago Mercantile Exchange (CME) futures market for Live Fed Cattle and the US$/CDN$ exchange rates, as well as the historical basis. However, it only provides year-round coverage on Fed and Feeder cattle and only out 36 weeks (see LPI-Program-Guide.pdf for more details). Because of that and knowing that the fed market drives the feeder and calf markets (they generally move in tandem with some seasonal divergence), you can use the Fed (or Feeder) premiums to see where the market is heading and calculate the expected price 36 weeks from now. Once you have done that you can also check the CME to see if the trend is likely to carry out farther.

Step 4: Cashflow Projections

Now that you have identified that a change has the potential to add net income, the next question is, "Do you have the cash at the right time to be able to do it?" You may have identified the amount needed in your partial budget. You may have realized that you will need to borrow money and calculated an interest cost. On the other hand, it could be that the revenues from this year's higher priced calves can finance the change as well as the other bills that need to be paid. If this fall's production revenues will not cover your current and future cash needs, then you may need to borrow money or look at other options. If you need a loan, you will also need to calculate the interest. You can use a loan calculator from your banking or Farm Credit Canada website to calculate the amount. Then you can go back and update your analysis to see if it is still positive before proceeding.

A more formalized way of looking at this issue is to do a Cashflow Projection. Simply split your expected annual revenues and expenses from your projection into the months where they will be received or spent. Or you can go weekly if that level of detail is needed. That way you can see the timing of the money coming in and going out. You'll have to ensure that your business account will stay positive. If not, you'll need upfront funds from another source to be able to take advantage of the change, and the expected positive net income from it.

Here is a basic outline of a Cashflow Projection. You can start one at any point depending on when you are doing it and why. It can be as simple as including only the Total Cash Inflow, minus the Total Cash Outflow, which equals the Net Cashflow. Then add in the Bank balance from Previous Month, to get the Cumulative Cash Flow for each month. Or it can be as complex as including every revenue & expenditure from each column in your General Ledger of Accounts. Choose the level of detail that makes sense for you (*and for your lender if you are going to need financing!*).

Please Note:
A *Cashflow Statement* is a formal Financial Statement. It is used to measure the current strength, profitability and outlook of a business on an annualized basis. It generally includes both the previous fiscal years' actual revenues and expenses and forecasts them for the next year or two. The forecasts generally assume current conditions.

On the other hand, a *Cashflow Projection* like the one in Figure 27 on the next page, is a budgeting/forecasting tool. It does not include the previous years' numbers but it does use the historical data from the Cashflow Statement as a base to predict/project the effects of the change on the revenue & expenses. These projections use assumptions related to the anticipated change out into the future. (hence the flexibility to start at any time).

Note: See Section 6 for the link for the interactive spreadsheet referenced below, "Livestock Cash Flow Projection Template"

Cash Flow Projection for: (Farm Name)

Year:	2024				2025								
	September	October	November	December	January	February	March	April	May	June	July	August	Total
Revenues													
Livestock sales													
- livestock purchases													
Other													
Other Sources of Cash													
Owner Contributions													
Proceeds of: Term Loans													
Operating loans													
Program/Crop Ins. PMTS													
Total Cash Inflows	0	0	0	0	0	0	0	0	0	0	0	0	0
Direct Expenses (Variable costs)													
Costs to make own Feed													
Purchased Feed													
Grazing													
Vet & Med													
Livestock Supplies													
Marketing & trucking													
Etc.													
Total Direct Expenses	0	0	0	0	0	0	0	0	0	0	0	0	0
In-direct Expenses (Overhead costs)													
Building & fence repairs													
Legal, Acting, Insurance													
Land Taxes & Utilities													
Miscellaneous													
Term Loan Interest													
Operating Interest													
Etc.													
Total In-direct Expenses	0	0	0	0	0	0	0	0	0	0	0	0	0
Other Disbursements													
Loan Repayments													
Income tax, GST remittance													
Total Other Disbursements	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Cash Outflow	0	0	0	0	0	0	0	0	0	0	0	0	0
NET CASHFLOW (Cash In - Cash Out)	0	0	0	0	0	0	0	0	0	0	0	0	0
Cash from Previous Month	0	0	0	0	0	0	0	0	0	0	0	0	0
Cummulative Cash Flow (Must be +)	0	0	0	0	0	0	0	0	0	0	0	0	0

Figure 27: Cash Flow Projection Template.

Related resources:

Why farmers rely on cash flow projections (Farm Credit Canada)
How cash flow planning can benefit your business (Farm Credit Canada)
Farm Financial Records: A Guide to Managing For Success (National Farm Business Management Centre)

Step 5: Finding the cash to make the change

If this fall's production revenues will not cover your current and future cash needs, then you may need to borrow money or look at other options.

Do not forget to look beyond the banks and Farm Credit Canada for other sources of funding. For some projects involving younger stock you may want to look into your nearest Breeder and Feeder Association for a loan (bcbfa | BC Breeder and Feeder Association). Or perhaps you have a lead on someone who is looking to be a silent investor and wants a reasonable rate of return (interest). You never know until you ask around in your circles of acquaintances. Be ready with an investment package as per #2 below.

Inflation, wars, and the current Bank of Canada interest rates have all contributed to economic uncertainty. This makes bankers nervous, and banks have tightened up on their lending policies. Selling unused assets, or even part of the breeding herd, while not optimal, may be preferable to taking on too much debt. This may be the only alternative to generate cash if the lender will not approve a loan. If you are going to approach a lender, take the time to get properly prepared. It can mean the difference between a long unproductive meeting, or a relatively short and successful one.

Preparing to Talk with your Lender

1. Know your Credit Score!

Your lender will have looked at it so you should know what it is too, and – it does NOT affect your Credit Score when you check it (called a soft inquiry). However, if you shop your loan request around to several lenders (who make hard inquiries) it can affect your Credit Score. Or if you have history of successive loan requests (hard inquiries) that can reduce your Credit Score.

If you have accounts with a major Bank and do online banking, you will likely have free access to a Credit Score through TransUnion that looks like this:

Figure 28: Credit Score example from Transunion (www.transunion.ca)

Each bank has their Credit Score link in a different spot on their webpages, if you can't find it ask a bank employee.

According to some sources, if your Credit Score is below 720 it may be harder to get a loan, and you are more likely pay a higher interest rate. (Each lender will have their own policies regarding the Score). Knowing yours can help you strategize how you will approach negotiations over terms (or if you should just take that first offer). For more details go to the TransUnion website:
Do you know your credit score? | TransUnion Canada

A WARNING: Be wary of other websites that that will obtain your Credit Score for you for "Free", you are allowing them access to your personal data that they might turn around and sell.

2. Know Your Numbers and Bring the Supporting Paperwork.

Does the lender know agriculture? If not, be prepared to explain things in greater detail and show the lender that you know your business well.

Here is a list of things to help prepare an investment package, and bring to the appointment with the lender that show you know your business and can make an appointment for loan request easier.

- A positive attitude.
- Your Business Plan – it can help convey your vision, objectives resources and strategies for making your business successful and worthy of investment.
- Financial Statements (Balance Sheet, Income Statement [also known as a P&L], Statement of Owner's Equity [also known as a Net Worth Statement], Cashflow Statement). If they are prepared by your accountant, make sure you understand what is in them and where it is located.
- Last year's Income Tax form and/or Notice of Assessment. They might request more than just last year.
- An investment proposal including the description of what you want to do, your analysis, Cash Flow Projection, the amount necessary to take advantage of the opportunity, type and terms of financing requested, proposed repayment schedule, collateral of equal or greater value you are willing to pledge, etc.
  State it in terms like, "*I/we are looking for $XX,XXX of financing through a (type of loan i.e. operating, mortgage, equipment) loan to take advantage of an opportunity to…, that is expected to add…*"
- If you or your partner have an off-farm job, the lender will likely like want to see a recent paystub and/or last year's T4.

As this list will take some time you will want to have it completed before making an appointment, then if you get an appointment right away it conveys that you are on top of managing your business.

Summary

Now that you have the overview of what needs to be done from the financial perspective, and how to do it, it is time to put the process into practice.

Set aside some time on a regular basis to look at production options and/or solutions for your operation. This guidebook has provided several options; however, it does not matter if you heard it at an agricultural event, read it in a trade publication, brainstormed ideas with family, friends and/or employees, or you had an epiphany while baling hay, additional ideas may be worth considering. Write out (or type) those ideas and questions that have been rolling around in your head. Then sit down and give each one some thought to help narrow it down to options that are worth doing further analysis on:

- ✓ Will the change fit with your operating guidelines and desired outcomes?
- ✓ Does it have the potential to be a significant benefit?
- ✓ Has it worked elsewhere under similar circumstances?
- ✓ What are the advantages and disadvantages? Etc.

If it rates at least a "maybe", then choose an analysis method that will work for you. Get out the pencil, paper and calculator, or fire up the computer and experiment with the spreadsheets that you have been given access to. Dig into those financial books and production records and crunch some numbers on the potential revenues and costs. When you identify knowledge gaps, do some research so that you can have confidence in the numbers, expectations, assumptions, etc. Do the 'worst case', 'best case', and 'most probable case' scenario calculations so that you can decide on the level of risk and a possible contingency plan. If it looks like it will be a benefit for your operation, then you need to make sure you can cash flow it or find financing to help implement it.

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Section 5: Bringing it all Together

This Guidebook is written to help producers apply a problem-solving process to identify and manage for the effects of an existing drought. In this case the process focussed on an existing drought, but it can also be used for the effects other external events on an agricultural operation as well. The steps of this process included:

1) **Identify the problem:** This is done by collecting and examining your production inventories (especially including the quality of the feeds you have produced), and reproductive indicators, to determine the extent of the impacts and which ones are priority issues for your operation.
2) **Identify potential strategies:** Several strategies are outlined in the Feeding and Forage sections. Many of them are regular practices that are the hallmarks of successful livestock operations. These are only suggested strategies and do not feel limited by these options. You or your team may come up with another valuable option when you have the facts and put your minds to finding solutions.
3) **Analyze the solutions:** This is done by narrowing down which strategies you will run through the financial filtering (analysis) process to identify options that help to improve profitability, or preserve capital, and ensure longer term financial sustainability of your farm business.
4) **Choose the option(s)** that will benefit your operation.
5) **Implement** those options and **monitor** their success and/or usefulness.

Returning our example of an old milk stool, the three legs (Feeding, Forage, and Business/Economics), each were described in more detail in each section. By going through each section, it will become apparent the inter-relationships between the different topics and where they fit together in the overall process.

This process is iterative and is a useful method to approaching any problem-solving situation or assessment of opportunities on individual operations. No one knows for sure when the next drought, economic recession, or industry sector consolidation phase will come along, but the ability to follow this process can help producers adapt to the effects, and in some cases take advantage of the new opportunities that may come along with the effects.

This guidebook is meant to be used as a standalone document or to complement the content of workshops. If you haven't been to a workshop, watch for them in your region.

For additional follow up, please contact the B.C. Ministry of Agriculture and Food through AgriService B.C. at AgriServiceBC@gov.bc.ca

WHAT ARE 2-4 STRATEGIES YOU WANT TO HAVE A CLOSER LOOK AT?

Feed and Feeding Management

Forage Management Options and Considerations

Business and Economic Considerations

SECTION 6: RESOURCES

GENERAL DROUGHT RESOURCES

The 2024 Quick Guide to Drought Resources available on the B.C. Ministry of Agriculture and Food's webpage were circulated to producers through industry associations and staff networks. It includes links to factsheets, online tools, funding programs and B.C. drought information from other government agencies.

The B.C. Drought in Agriculture website has further information and tools, including:

- Drought Resources
    - Key drought management tips
    - Forage crops and irrigation management
    - Livestock management during droughts
        - Drought Resources for Livestock Producers
    - Drought impacts on soil
    - Irrigation decisions with limited water
    - Water storage
    - Provincial drought information
- Online Tools
    - B.C. Agriculture Water Calculator
    - B.C. Irrigation Water Use Calculator
    - Weather stations and the Farmwest Evapotranspiration (ET) Calculator
    - Agricultural Irrigation Scheduling Calculator
    - Agriculture Water Demand Model
- Training and Workshops
- Video Resources
    - Farm Water Fix video series
    - Irrigate Better video series
- Financial assistance for agricultural producers impacted by fire and drought
- Health and wellness preparedness for producers
- Legal requirements for B.C.'s water resources

The Beef Cattle Research Council (BCRC) drought resources:

- Experts Respond to Drought Questions (August 10, 2021, includes webinar)
- Drought Management Strategies contains various topics including managing through a drought, forage, feeding, herd management, water sources, economic factors, preparing for a drought and recovering from a drought.
- Drought-Related Resources for Cattle Producers

RESOURCES LINKED TO GUIDEBOOK SECTIONS

Inventories

Field/ Pasture Inventory

- Managing Grazing Lands During Drought (BC)

Feeding

Interactive Spreadsheets

- Hay Requirements
- Feed Cost Comparison

Nutrition and Feeding Resources

- Sampling Feed For Analysis (North Dakota State University)
- Feed Quality, Testing & Analysis for Beef Cattle (Beef Cattle Research Council, BCRC)
- Know Your Feed Terms (Alberta)
- Beef Ration Rules of Thumb (Alberta)
- Balancing Rations for Sheep and Goats (University of Arkansas)
- Canadian Feed Testing Labs (BCRC)
- Drought is More Than a Summer Challenge (BCRC)
- Winter Feed Cost Comparison Calculator – Managing Variable Costs (BCRC)
    - Winter Feed Cost Comparison Calculator (BCRC)
- Stretching Feed Supplies (BCRC)
- Eleven Ways to Avoid Feed Waste this Winter (BCRC)
- Effects of Environment on Forage Quality (Western Dairy Digest)
- Tips for Feeding Horses During a Drought (University of Arkansas)
- Basic Nutrition of Bison (Saskatchewan)
- Beef Cow Rations and Winter Feeding Guidelines (Saskatchewan)
- Don't let high winter feed costs stall your herd's reproductive momentum (BCRC)
- Winter Feeding Program for Beef Cows and Calves (Alberta)
- What's in a Feed Test – A Vocabulary Enhancer (BC)
- Alternative Feeds (BCRC)

Water

- Drought, water quality, and livestock health (BC)
- Is it OK to use Snow as the Only Water Source for Cattle (BCRC)
- Livestock Watering Requirements – Quality and Quantity (BC)
- B.C. Livestock Watering Handbook (BC)
- Water Systems for Beef Cattle (BCRC)
- Water Systems Calculator (BCRC)

Body Condition Scoring

- Body Condition (BCRC)
- What's the Score: Beef Cow Body Condition Scoring Guide (Alberta)
- What's the Score: Sheep Body Condition Scoring Guide (Alberta)
- What's the Score: Bison Body Condition Scoring Guide (Alberta)

Pregnancy checking

- Economics of Preg-Checking: A 2017 update (BCRC)

Forage Management and Pasture

- Forage U-Pick – An interactive forage species selection tool for Canada
- BC Rangeland Seeding Manual (BC)
- FarmWest (BC)
- Strategies for Rejuvenating Forage and Pasture Lands Impacted by Drought (BC)

Business/ Economic Decisions

Interactive Spreadsheets

- BCMAL 2024 Partial Budget Template
- Cash Flow Projection Template
- Cow Calf UCOP 2023
- 2019 BC Cow Calf COP Budget

Comparing the Economics of your Operation

- Costs and Returns of Sample Ranching Businesses in Various Areas of BC - 2013 (BC)
- B.C. Agri-Business Planning Program (BC)
- Western Producer (Canada)
- Farm Credit Canada
  - Calculators (FCC)
  - Market Prices & Information (FCC)
  - Why Farmers Rely on Cash Flow Projections (FCC)
  - Cash flow planning on your farm (FCC)
- Farm Management Canada
  - AgriShield (FMC)
  - Farm Financial Records: A guide to managing for Success (link to order)
- BC Breeder and Feeder Association
- Do you Know Your Credit Score? (TransUnion)

Multi-species Market related information

- Agriculture and Agri-Food Canada
  - Red meat and livestock price reports (AAFC)
  - Stocks, production, supply and disposition (AAFC)
  - Red meat and livestock slaughter and carcass weights (AAFC)
- One Page Planning Tool (Meat and Livestock Australia)
- Livestock Marketing Information Center (US)

Beef Market Intelligence Sources

- Cattle Market Information: Canfax
  - A membership funded, non-profit organization providing cattle market data & analysis.
  - An emailed Weekly Report (Subscription $175/yr for Cow-calf and Backgrounder operations) as well as access to their famous charts and spreadsheets.
  - "Trends, Cycles, and Seasonality in the Cattle Industry" ($15, order form)
  - Free Reports/Factsheets like: Whole Herd Management through the Cattle Cycle

    - View other reports of interest at: CRS Fact Sheets
    - Canadian Cow-Calf Cost of Production Network
    - Listing of Livestock Auctions: Auction Market Links
- Livestock Price Insurance Program (LPI)
    - Program market intelligence is available for price forecasting. LPI's top premium level is set at 95% of the expected price for that period based on the Chicago Mercantile Exchange's Cattle Futures markets and adjusted for the Canadian dollar exchange rate and basis.
    - Program Guide (LPI)
    - Premiums (you can sign up to have them emailed to you directly)
    - Market Information (LPI)
        - As their graphs only reflect the current settlements and futures markets, it helps to keep the trends in cattle inventories in mind as well.
- Canadian Cattlemen Magazine
    - News and opinions from pundits: Beef Watch
    - Markets at a glance
- Cattle/Beef and Veal (Agriculture and Agri-Food Canada)
- Understanding the cattle market sliding scale (Alberta)

Sheep Market Intelligence Sources

- Lamb Market Reports (Alberta Lamb Producers)
- Sheep and Lamb (Agriculture and Agri-Food Canada)
- Price Predictions for Lambs in the Next 4 Weeks (Ontario Sheep)
- U.S. Baseline Lamb Cost of Production Analysis (American Sheep Industry Association)

Bison Market Intelligence Sources

- Canadian Bison Association
    - Auction Markets (CBA)
    - Bison Production Performance (CBA)
- Other livestock (Agriculture and Agri-Food Canada)

Dairy Market Intelligence Sources

- Notice to Industry - CDC Price Increase Announced (BC Milk Marketing Board)
- Canadian Dairy Information Centre (Agriculture and Agri-Food Canada)
- Milk Cost of Production Estimates (US Department of Agriculture)

Strategies

- Beef Cow-Calf Operation Reduction Strategies (Alberta)
- Culling Cattle for Drought (Canadian Cattlemen)

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