PREFACE

In the total quality management of an operation, it is desirable that all program areas develop guidelines for production practices in order to promote efficiencies and effectiveness. In 1997, the Alberta Cattle Feeders' Association (ACFA) in conjunction with the Canadian Cattlemen Quality Starts Here4 program, funded through the Beef Industry Development Fund, published the *Beef Quality Improvement - Recommended Operating Procedures for Feedlot Animal Health (Crandall and Van Donkersgoed)*. Following in this format is the important area of feeding and controlling feed quality. This document will address feeding and feed quality as it relates to beef quality and food safety.

The good production practices contained in this document apply to most beef feedlot operations. The objective is to provide cattle feeders in Alberta and Canada with an information tool to be used as a guideline. It will serve as the framework to develop and implement good production practices for the handling and feeding of various commodities available to cattle feeding operations. In essence, the intent of this document is to assist the cattle feeding industry to strive for and achieve consistent feeding and feed preparation practices to provide a safe, quality beef product.

The contents of this manual are intended to suggest practices to the feedlot management and staff that are voluntary in nature. As with previous manuals, the Quality Starts Here4 program suggests that those involved in the production of beef need to use common sense, reasonable management skills appropriate for the operation, and accepted scientific knowledge to avoid defects in the product delivered to the consumer.

The authors do not assume responsibility to anyone for the information contained within this document, nor shall the authors be held liable for damage caused to any person using the information. The procedures in this document do not guarantee any changes in outcome measures. The user of this information should verify the accuracy of the information independently with a professional.

THIS PAGE INTENTIONALLY LEFT BLANK.

TABLE OF CONTENTS

INTRODUCTION

BACKGROUND AND PURPOSE TO BEEF QUALITY IMPROVEMENT (BQI) PROGRAMS

The history of quality assurance (QA) stems back many years and within many industries from the military to space exploration. Quality assurance programs are predominant in all aspects of food production, including meat, fruit, and vegetable markets. Quality assurance and quality improvement programs have been introduced and promoted to the Canadian beef industry over several years through programs such as Canadian Cattlemen "Quality Starts Here4", of which manuals such as the Good Productions Practices for Feedlots and Cow/Calf Producers (1996/97), and the Recommended Operating Procedures for Feedlot Animal Health (1997) were produced. In 1996 the "Feedlot Management Guide (1997)" was developed by the Alberta Feeders' Association and Alberta Agriculture and focused significantly on nutritional management. All of these manuals have been updated and revised for 2000.

There are many reasons for beef quality improvement programs in the feeding sector of the beef industry:

- To promote the use of consistent feeding practices by all producers.
- To increase consumers' knowledge of beef as a wholesome food product through sound production practices related to feeding.
- To promote operating practices that strive to alleviate, control and prevent potential chemical, biological and physical hazards (HACCP) that affect the food safety of beef products; thus, promoting consumer confidence and trust.
- To influence consumer-eating habits to assure proper intake of red meats as a regular part of a well balanced diet; thus, increasing beef's competitive market share.
- To monitor, track, review, and analyze data gathered by BQI programs to contribute to further research in the industry.
- To address the introduction of regulations by government with producer-driven initiatives relative to medicated feeds.
- To provide information for mitigating potential liability issues in the event of a food safety related issue.
- To reduce carcass quality discounts such as over/under sized carcasses, liver abscesses, tongue condemnations, poor marbling, yellow or excess fat, all of which cost the industry significant dollars annually.
- To promote strategic alliances with preferred buyer-supplier relationships based on quality assurance and improvement programs.

In addition to the benefits of BQI programs, this manual provides an outline for producers to guide their own feedlot operating practices, monitor performance and train staff. It is important that every employee is trained to know, understand and identify areas where possible hazards such as physical, bacterial or chemical contaminants or defects may occur. As well, anyone who supplies services, feedstuff/commodities or products to a feedlot must understand the feedlots' quality improvement objectives (nutritionist, veterinarian, commodity suppliers, etc.). The overall process of BQI programming is to ensure that all areas of the organization are working together to achieve common goals.

Canada, primarily Alberta, is acknowledged as one of the dominant cattle feeding and beef exporting regions of the world. To maintain this position the industry must have a strong commitment to quality assurance/improvement and the production of a safe and consistent food product. It is imperative to remember that the producer is responsible, through the process of feeding cattle, to provide a food product that consumers will eat with confidence. In order to produce a consistent end product (beef), cattle must be fed consistent, quality feed products.

The feeding and the utilization of commodities have many major components. These include:

- Producing quality feeds,
- Purchasing (sourcing), receiving and storing commodities/feedstuffs,
- Receiving and inspecting feeds and the subsequent handling and testing of commodities/feedstuffs,
- Processing, ration formulation, batching and mixing of feeds,
- Following the label and any regulations relative to the use of medications in feed,
- Equipment management procedures and delivery of feed to the bunks,
- Inventory control of feed and commodities,
- Quality assurance and improvement mechanisms for all of these components.

The main objective of the feeding and feedstuffs sector is to ensure that all feed rations meet specifications, that feeding is timely and consistent, that feed is safe and is of good quality and that HACCP-based principles have been identified and followed.

HACCP AND QUALITY FEEDING PROGRAMS

HACCP stands for Hazard Analysis Critical Control Points. This program was initially designed in the United States by the Pillsbury Company in the 1960's to control food safety in the NASA program for space astronauts. The principle of HACCP programs is to identify key areas to prevent known sources of chemical, biological and physical contamination in the final food product. HACCP based programs have seven principle steps of management:

Hazard Analysis:
4 Identification of potential hazards/risks (chemical, biological and physical).

Identification of Critical Control Points:
4 Determine what points in the process are critical and need to be controlled.

Establish a Critical Limit:
4 Determine a critical limit for safe processing.

Monitoring:
4 Implement monitoring procedures to keep within critical limits.

Corrective Action:
4 Identify actions to take when problems occur.

Verification:
4 Install a record keeping system for the process identified.

Record Keeping:
4 Determine how to verify if procedures have worked.

In order to identify critical control points, it is important to understand the three hazard areas:

Chemical Hazards – occur when a chemical is introduced to an animal and remains until slaughter as a residue. Cattle may be exposed to chemical residues through the improper use of vaccinations, medicating ingredients, implants and insecticides. This is controlled through proper application and adherence to withdrawal times. Chemicals can also enter cattle through products related to feeding, such as fertilizers, herbicides, insecticides and pesticides. This can be controlled through proper production, purchasing, receiving and testing of feed products.

Biological Hazards – occur from pathogenic microorganisms that can lead to foodborne disease. These pathogens, such as E.Coli 0157:H7 and Salmonella, are found in the intestinal tracts of cattle. This is one of the more difficult areas to control on farm, but the risks are minimized with proper bedding and pen cleaning procedures, which will reduce the amount of manure contamination on the hide of the animal before reaching the processing plant. One highly publicized crisis in the past few years was BSE (Bovine Sprongiform Encephalopathy). This neurological degenerative disease incident occurred in Britain in 1996. It decimated the British beef industry. Canada has been diligent in preventing this disease with regulatory and surveillance programs, including a regulation preventing the use of ruminant protein by-products in ruminant feed.

Physical Hazards – involve items that can appear in carcasses such as broken needles, buckshot and assorted metals (nails, broken implements, etc). Practices related to careful vaccination, treatment protocols and feedlot clean up and maintenance can eliminate most of these hazards.

Producers rely on feed manufacturers to provide a reliable and consistent supply of safe, nutritionally balanced feed for their animals. The Animal Nutrition Association of Canada (formerly Canadian Feed Industry Association) has taken an active role in the "Agri-Food Chain" with the development of Good Manufacturing Practice (GMP's) (Appendix 5) based on HACCP principles. The feed industry envisions this chain to include:

- Ingredient suppliers,
- Commercial and noncommercial feed manufacturers,
- Producers, and
- Food processors.

The essence of the feed industry program is to ensure the commitment of their suppliers to the demand for quality and safe feed products.

THE NEED FOR QUALITY FEEDING PROGRAMS

Cattlemen have long recognized that feed related costs represent approximately 75 to 80 percent of the total cost of gain for feedlot cattle. When an animal gains 500 pounds of net live weight in a feedlot, somewhere between 3,000 and 4,000 pounds of feed is typically utilized. Feed quality and related quality control factors associated with feedstuffs and feeding greatly influence both animal performance and competitive profitability. Feeding safe, quality feed products help assure the ultimate production of a wholesome, quality beef product.

Whenever the price for a feed commodity is negotiated, feed quality standards are either stipulated or implied between the buyer and seller. These apparently obvious factors are

critical to the ultimate success of a profitable cattle feeding industry and safe beef. Yet these obvious factors are at times poorly managed or even misunderstood by both buyers and sellers of feed commodities.

Consider that each of the several hundred feedstuffs routinely fed to cattle in Canada will vary in actual feeding value for a multitude of reasons. For example, a single feed source of the same general description, such as barley silage, is not created equal in nature. Varietial, seasonal, harvesting, processing and preservation differences of barley silage, as well as other feeds, may greatly influence the ultimate metabolic potential of each feedstuff. All feedstuffs differ in their chemical composition, and hence their ultimate nutrient potential. Many questions can arise with regard to nutrient potential:

- What is the moisture content of the feed product in assessment of the market price?
- What post-harvest processing must be imposed upon feeds?
- How compatible are different feeds when mixed into a single ration?
- What is the 'bunk-life' or the propensity of feeds to create 'fines' in the feedbunk?
- How consistent is the quality of each load of a commodity purchased from a given supplier?

These are only a few variables which must be factored into the assumed value for each and every feedstuff - whether purchased on the open market or home grown. Each of the above variables, plus others, contributes to the ultimate quality, or market value of all feedstuffs. How then does an individual cattle feeder properly manage feed investments to their best advantage when so many subtle differences in feed quality exist? The answer is quality control through good production practices in feeding.

Quality control starts at the beginning of feed production and manufacturing and continues throughout subsequent harvesting, storage, sales, distribution, processing, analytical and feeding techniques to which each feed is subjected. Farmers, plant breeders, equipment and implement dealers, fertilizer and chemical suppliers, elevator operators, commodity brokers, truckers, and feedlot managers are major players in this chain of events influencing the quality and safety of feedstuffs and the resulting rations formulated and fed to cattle.

Good feeding practices are closely related to aspects of food safety. Issues include proper mixing of medicated feeds, commodity sampling and testing, and the proper utilization of pesticide, herbicide and fungicide products, and control of cross contamination.

Therefore, the objective of this document, Good Production Practices for Controlling Feed Quality, is:

- To assist cattle feeders in Canada to better understand the need for quality control of feeds.
- To address complex feed mixing issues with direct, uncomplicated and easy to apply protocols.
- To achieve more consistent feedstuffs and rations to result in more predictable cattle performance.
- To increase profitability by decreasing the number of carcass quality defects such as over/undersized carcasses, liver abscesses, tongue condemnations, poor marbling, yellow or excess fat.
- To ensure the production of a safe, quality, food product through the implementation of good production practices related to the feeding process and feed quality.

TRAINING PROGRAMS FOR CONTROLLING QUALITY FEED

Ongoing education, training and awareness for staff involved in the process of feeding and handling of feedstuffs is imperative to controlling feed quality.

This is not necessary to improve efficiencies, but for the proper utilization of feeds and feeding equipment and for the prevention of unsafe feed contamination.

Tools which will assist in training feed crew personnel include:

- Proper orientation to the job and the job site.
- Written job description.
- Training sessions with a nutritionist.
- Courses and videos related to feed management, mixing and nutrition.
- Ongoing communication, supervision and evaluation of staff.
- Training of replacement or part-time staff and overall role awareness.

The organization's dedication to on-going training and education of staff will assist in ensuring that quality control and good production practices guide the organization at all times.

CRITICAL MANAGEMENT PRACTICES IN QUALITY FEEDING PROGRAMS

Inherent to this document will be certain practices that are critical to quality feeding programs. These practices would be considered essential to ensure the wholesome supply of beef products to consumers. As new information is made available through research, additional management practices and strategies may be identified that reduce chemical, biological and physical hazards from entering the food chain. Producers are encouraged to ensure operating procedures are in place at their feedlot to monitor and document information related to these critical management practices. If problems occur, corrective action should be taken immediately.

By adhering to the following management practices, consumers of beef products can be assured that producers are doing their part in producing wholesome beef.

- Establish a consulting relationship with a nutritionist.
- Document information on all suppliers of feed and feed sources.
- Document receiving information such as shipper of feed and quality of feed received.
- Purchase feed and feed supply products from reputable suppliers that follow good manufacturing practices.
- Use feed additive products according to label directions with prescriptions where necessary.
- Adhere to withdrawal times for medicated feed ingredients.
- Ensure representative feed sampling and testing procedures are in place and completed.
- Identify, record and safely store medicated and concentrated products.
- Maintain records on feed purchases, inspection, mixing and processing procedures and the feeding of rations to animals.
- Ensure equipment for handling and feeding of feedstuffs and storage areas for feedstuffs are properly maintained and clean from residues that may cause contamination.
- Dispose of any outdated or contaminated feed products in an environmentally responsible manner.
- Train staff on a regular basis on the importance of proper practices related to feeding, mixing and the handling of feedstuffs.

CONTROLLING FEED QUALITY

Controlling feed quality is important to all cattle feeders since the assessment of any feeding program is expressed by the performance, and ultimately, the potential profitability of the cattle. No cattle feeder is immune to the reality of taking the initiative to control feed quality and the ultimate production of a wholesome beef product. All producers from the smallest farmer feeder to the largest commercial feedlots share in this industry wide responsibility.

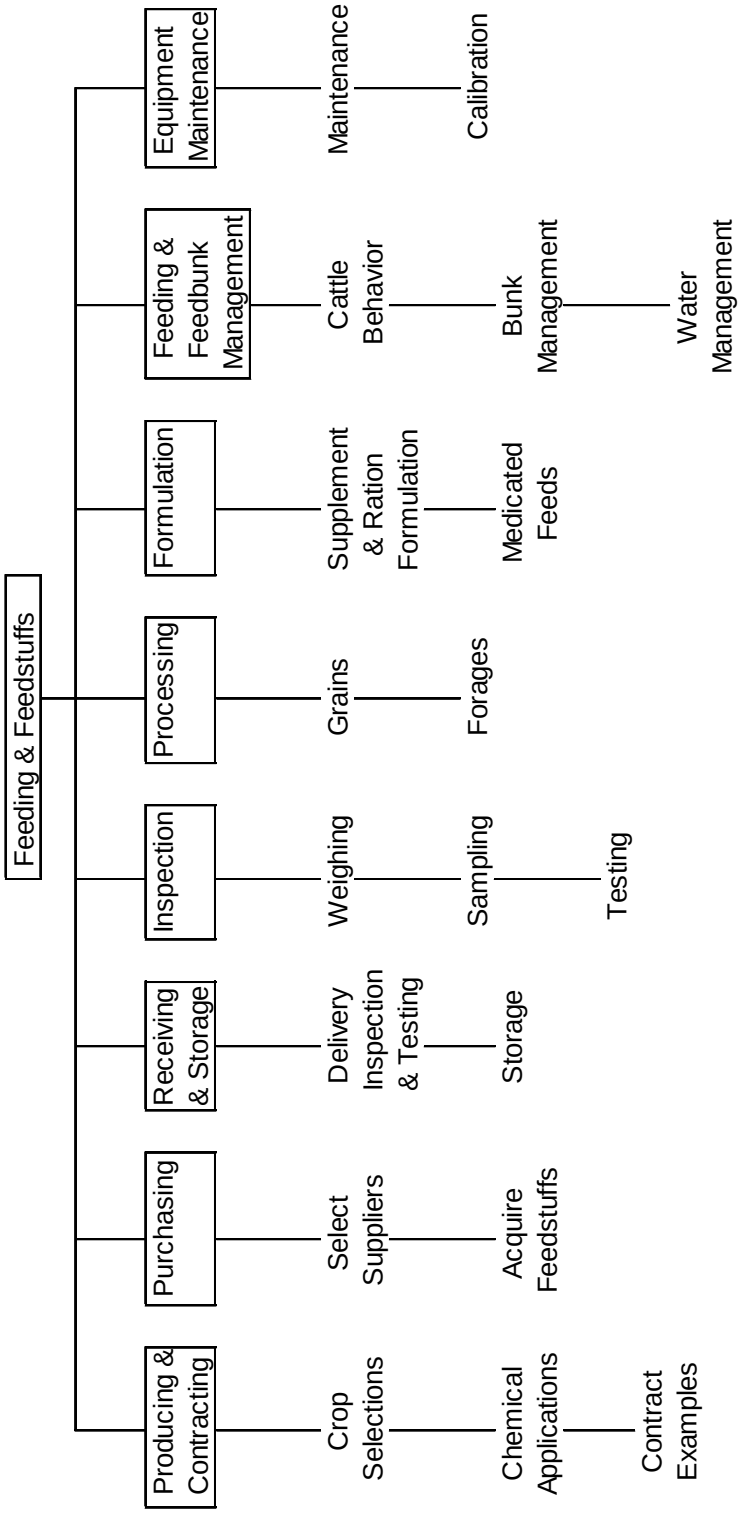
This is not to say that collective efforts to implement feed quality control practices are not warranted. For example, it may well be desirable for trade associations, commercial feed industry entities and government agencies to work in concert to establish and implement feed quality standards. The cattle feeding industry may be served in conducting regional feed quality control workshops designed to train employees at all levels and to assist in transforming these concepts into actual every day practice.

In order to achieve the objectives of this document, numerous technical and industry documents have been reviewed. Wherever possible these sources of information have been cited as footnotes or referenced to further assist the reader in developing a system of controlling feed quality unique to the needs of a specific feedlot.

Suggested industry trade standards for feedstuffs are presented and whenever possible actual 'How to' examples are presented with illustrations. It is strongly recommended that a system of feed quality control be initiated for all feed commodities. Grain quality receives a major emphasis in these discussions, consistent with its prominence in cattle feeding. Benefits resulting from a system of feed quality control as outlined here will not only advance the cattle feeding industry, but will also assist in an orderly and improved flow of feed commodities throughout the feed industry.

Furthermore, this document is designed to reflect the typical progression of events, that influence feed quality from feed production to its ultimate consumption as a ration in the feedbunk. The Table of Contents and Feeding and Feed Quality Flowchart will assist the reader with a quick overview of the major topics presented. Each primary part leads off with 'key concepts' as a guide to the reader.

CONTROLLING FEED QUALITY FLOWCHART



THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 1

PRODUCING AND CONTRACTING QUALITY FEEDS

PRODUCING AND CONTRACTING QUALITY FEEDS

The production and contracting of quality feeds is an essential first step in the continuum of a quality-feeding program. Producing quality feeds starts with the selection of plant varieties adapted to the local farm or ranch environment. This represents one of the major advantages of the typical farmer feeder compared to commercial feedlots. Here plant varieties may be selected with both agronomic and nutrient characteristics in mind to result in the optimum yield of nutrients per acre. The resulting feeds may be selected, cultured, harvested, stored and processed with complete quality control over each of these processes as opposed to acquiring similar feedstuffs on the open market. This section recommends strategies to achieve optimum results:

Benefits of producing and contracting quality feeds:

- Optimum production of feedstuffs with optimum dry matter conversion of feed to beef.
- Selection of various varieties best suited to the application based on years of growing and production knowledge.
- If contracting, the establishment of a relationship with a grower who will consistently produce the desired feed.
- To ensure a quality feedstuff that will contribute to good performance and decreased carcass quality shortfalls.

PRODUCTION AND CONTRACTING PRACTICES

Key Concepts:

✞crop variety selection; ✞manure credits; ✞contractual arrangements; ✞establishing price.

- Place a higher than previous emphasis upon crop variety selection, nutrient content and nutrient preservation characteristics of feeds to be grown. Consult with seed dealers and their in-house plant breeders regarding these matters. Seek data on nutrient content, digestibility, nutrient preservation characteristics, and the ease and cost of post-harvest processing of all harvested plant materials.

- Keep informed on research in crop varieties; watch for major advances in the area of plant research in the near future, largely influenced by the tools of biotechnology. Soon it will be possible to design plants with greater precision.

- Farmer feeders must properly apply and manage plant chemical sprays and fumigants so that occurrence of residues in beef products can be avoided. Certain restrictions apply to livestock grazing and feeding of certain crop varieties once chemicals have been used. Questions in this area should be referred to a professional toxicologist or other appropriate professionals in industry and government agencies. (See Appendix 1).

- Producers need to be aware of the possibility of moulds and fungal levels in soil that can arise from minimum or no-till farming practices. Proper crop rotations and alternative tillage practices can alleviate the occurrence of this factor (Forage Innovator, March 1999 – Pioneer Hi-Bred Ltd.).
- Commercial feedlots should position themselves with contractual arrangements. Commercial feeders may contract with farmers to grow specific hybrid varieties for their needs. Silage and other roughage needs should represent the first feedstuffs covered by these arrangements, largely because their bulk and/or high moisture content renders them relatively more expensive to transport long distances compared to concentrates.
- Contracts should include provisions for feedlot manure credits to expedite nutrient management needs. An example contract is included as Appendix 3.
- Price establishment per tonne of silage is frequently based upon the value of the grain at the time of harvest. As an example, assume the following:

  Dry matter of silage @ 30%*
  Grain content of the silage @40%*
  Price of corn (grain) $3.78/bu.*

  (1) 1 ton = 2000 lb. of whole plant silage:
  2000 x .30% = 600 lb. dry matter/ton

  (2) 600 lb. of dry matter and grain content is 40%
  600 x .40% = 240 lb. of corn

  (3) 240 lb. of grain on dry matter:
  $\frac{240}{.88}$ = 272.7 lb. of as-fed corn
  272.7/56 = 4.87 bu of corn

  (4) 4.87 bu of corn, $3.78 bushel for corn:
  4.87 x 3.78 = 18.41 cost of silage. **

  *These values can change due to the market, growing conditions and the grain type of silage.
  **Cost does not include harvesting cost, storage and shrink.

  Cost of silage 'as-fed' at the feedlot must also include all other related cost such as adjustments for inventory shrinkage while in storage, plus inventory losses associated with milling and distribution. Other feedstuffs acquired by contractual arrangements could follow similar adjustments to establish the purchase price.

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE AND SOLUTION:

PROBLEM: Improper use of plant chemical sprays and fumigants that could cause chemical residues in beef carcasses.

SOLUTION: Ensure an understanding of the label directions for chemical usage by clarification from the product sales representative, manufacturer or professional toxicologist. Keep apprised of all the latest information on chemical usage and take courses as offered. If contracting the feedstuff, ensure that there is a record to document proper utilization.

SECTION 2

PURCHASING QUALITY FEEDS

PURCHASING QUALITY FEEDS

Most cattle feeds are purchased on the open market. Many feeds and feedstuffs consist of blends of feeds from several sources, representing numerous varieties, producers and dealers. Under these conditions considerable variability in feeding value may be experienced from one feed delivery to another. Herein lies one of the major obstacles when purchases are made on the open market raising the need for strict quality control measures. Premiums must be assigned when warranted, just as discounts should be given when quality standards are not met. Unscrupulous dealings (inaccurate weight, shorting a load, excess moisture, etc.) must also be scrutinized and evaluated to achieve quality control of feeds and ultimate cost effectiveness. The key to success in managing these issues is to develop a spirit of teamwork across the industry. To assist in overcoming these obstacles, this section recommends strategies to select and acquire feedstuffs from suppliers.

Benefits of purchasing, selecting and acquiring quality feeds:

- Good feed purchasing and purchasing records will assist for traceback information purposes.
- Dealing with a reputable and reliable supplier will give confidence that if there are any problems with a product, the supplier will deal with the issue in an ethical manner.
- Suppliers that can attest to the importance of feed quality assurance programs will strengthen the feedlots' quality assurance activities.
- Purchasing quality feeds equates to cost effectiveness.

SELECTION OF FEED SUPPLIERS

Key Concepts:

✞variations in feed quality; ✞feed supplier selection; ✞feedstuff acquisition; ✞procedures for receiving and storing grain; ✞meals; ✞fats; ✞oils; ✞molasses; ✞roughages; ✞by-products and supplements; ✞inspection of incoming feeds; ✞frequency of analyzing feed samples; ✞moisture determination; ✞feed quality standards; ✞price adjustments based upon premiums and discounts.

- Identify one individual on the feedlot staff, such as a 'Managing Director of Feed Procurement' to be responsible for maintaining files and overseeing other details on all incoming feedstuffs.

- Conduct business with suppliers having historical records of providing satisfactory products and services. Whether the feedstuff is provided by a single source or from multi-sources, each new supplier should be asked by the Managing Director to provide data on their historical records of delivering feeds. These records should meet or exceed specified minimum quality standards.

SELECTION OF FEED SUPPLIERS (CONT'D)

- Ensure suppliers document their system of quality control. The Managing Director should have authority to select worthy vendors based upon these criteria and their past records of performance.
- Visiting the supplier's premises may be required for the feedlot to verify the supplier's ability to provide appropriate quality control, analysis and documentation of products delivered.
- Document quality characteristics of all incoming feedstuffs. Any deficiencies in feed quality from any feed supplier should be recorded and placed in the supplier's file along with the request for any corrective action. Likewise, similar records must be maintained and filed regarding subsequent adjustments on deficient deliveries.
- Ensure adequate delivery standards i.e. what kind of trucks deliver the commodity and are the trucks used for anything else that may be a hazard or require proper cleaning i.e., fertilizer or manure.
- Establish a list of reliable suppliers from whom bids would be offered to procure purchased feeds.

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE & SOLUTION:

PROBLEM: Supplier cannot provide historical information or indicate presence of any quality control measures.

SOLUTION: Consider the use of other suppliers who can produce feed production information and who will have a sense of the importance of quality assurance issues.

ACQUIRING FEEDSTUFFS

The intent of this section is to develop criteria to ensure that all feeds purchased from reliable suppliers conform to the stated specifications and standards of the feedlot. In all instances, it is assumed that legal truck scales are available at each feedlot purchasing feeds from suppliers. A key concept in this area is purchase order specifications. The following items are of primary importance in acquiring quality feeds:

- The consulting nutritionist is to provide ration feed ingredients with associated cost effectiveness to the feedlot manager. This information should be considered with the following factors: known inventories, storage capacities of feeds to arrive, and supplier predictability to deliver product in a timely manner.

ACQUIRING FEEDSTUFFS (CONT'D)

4 Purchase orders should be used in the acquisition of all feedstuffs and are extremely important for trace-back information related to the order specifications. The purchase order should contain, as a minimum, the following information and specifications to be provided to each supplier for bidding purposes.

- Þ feed name and description,
- Þ quantity required,
- Þ inspection instructions (tests, weighing conditions, etc.),
- Þ date of first and subsequent deliveries,
- Þ shipper information,
- Þ delivery instructions (date, time, after hours, etc.),
- Þ receiving standards that supplier must conform to such as: desired percent crude protein, nil residue of organophosphates, chlorides, etc.,
- Þ space to record bid price per unit and payment terms with comments or exceptions when supplier returns bid to feedlot.

An example is included as Appendix 4 – Feedstuff Purchase Order.

4 After the appropriate feedlot personnel review the bid contract for adequacy and accuracy, it should be signed and returned to the supplier. A copy must be retained for the feedlot files. If there are any questions regarding the conditions of purchase, they should be addressed with the supplier prior to signing and accepting the bid contract.

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE AND SOLUTION:

PROBLEM: Absence of a purchase order and applicable detail on an incoming commodity.

SOLUTION: Review the procedure with the Managing Director as to why a purchase order was not done and emphasize the importance of having a purchase order for <u>every</u> purchase. This is to ensure that what was ordered is what was delivered.

SECTION 3

RECEIVING AND STORAGE OF QUALITY FEEDS

RECEIVING AND STORAGE OF QUALITY FEEDS

The following points address those practices for receiving and storing feedstuffs that will assist in obtaining quality feeds and maintaining feed quality while stored at the feedlot. The receiving and storage of grains should adhere to the following protocols in the order presented in this section. Information on laboratory analytical schedules for each feedstuff is provided in *Feed Samples – Analytical Laboratory Schedules* (Table 1).

Benefits of proper receiving and storage of quality feeds:

- Verification that the grain received is what was ordered and meets all specifications.
- Ensure a process where proper weigh-in procedures are followed.
- Ensure product samples are taken for further analysis in order to verify product quality.
- Outline the procedure involved when a grain delivery does not meet specification.
- Prevent feed contamination through elimination of any possible chemical residues (pesticides and mycotoxins).

A. GRAINS

Key Concepts:

✞delivery dockets; ✞incoming grain inspection; ✞weigh-in and out procedures; ✞sample collection; ✞and proper storage to maintain quality.

Receiving

- Upon arrival of the carrier, the relevant purchase order must be verified against the delivery docket to ensure that the grain came from the supplier that the grain was ordered from. When these two conditions are met, the carrier will be allowed to weigh-in and record weight on scale docket.

- Inspect grain for contaminants (i.e. treated product, fertilizer, excessive gravel and dirt or foreign material such as bird and rodent droppings as a source of disease, etc.).

- Inspect and test for moisture, test-weight, broken kernels, temperature, odour, colour, mould, etc., prior to unloading as described below.

- If grain meets the receiving standards, approval should be documented by the appropriate feedlot employee initialing and dating the grain receiving form illustrated in *Grain Receival Record* (Table 7).

Receiving (Cont'd)

4 Weigh-out carrier and calculate net weight of load received. Record net weight for grain upon delivery on the scale docket for later processing.

4 Ensure that medicated feeds are received and stored separately from all other feedstuffs.

4 Store a representative one pound or larger sample of grain obtained from each load with other samples taken during each week of deliveries in a cool, dark and secure location. The grain from each supplier will be used to form:

(1) a sub-sample for chemical residue monitoring and related purposes, and

(2) the weekly composite sample of grain. Send properly labelled sub-sample of the composite sample to analytical laboratory for analysis. Remit copy of analytical results to consulting nutritionist for evaluation. Additional samples may be retained in storage based upon individual feedlot references in consultation with the consulting nutritionist.

4 In the event that a delivery of grain is rejected, the feedlot Managing Director of Feed Procurement must report the action directly to the feedlot manager for appropriate corrective action.

4 Ensure all equipment used for receiving feedstuffs is clean (not previously used to load manure or haul dead animals).

Storage

4 Proper storage procedures are also essential to maintain quality of purchased grains and for the prevention of contamination of feedstuffs. Following are the points to remember regarding grain storage:

Þ All grain should be cleaned by passing over a scalper or aspirator before being placed in storage to allow maintenance of its quality. If higher than approved maximum moisture level grains are accepted, that grain should be used immediately following assignment of price discounts as part of acceptance agreement. If higher than maximum moisture level grains cannot be immediately fed, the grain must be dried to prevent harmful mould growth, possible mycotoxin production, and heat damage.

Storage (Cont'd)

- Moisture and temperature probes greatly assist in the efficient use of aerators or heated air in maintaining a proper environment for the grain.
- Silos and bins used for storage of grain must be cleaned as often as possible to prevent accumulation of fines, moulds and other foreign materials. Always follow manufacturer's safety instructions when cleaning these structures. Periodic inspection of grain in silos or bins is also essential to ensure proper preservation.
- An important aspect of periodic grain inspections is the concern for the presence of insect and rodent infestations. If detected, chemical fumigation or baiting may be required. Ensure that the date of treatment is recorded and that proper withholding intervals are followed in accordance with manufacturer and provincial regulations. The receiving and storage areas are to be cleaned daily for spilled grain to reduce accumulation of dust, fines, and other foreign materials, while at the same time reducing the opportunity for insect and rodent infestation.
- Ensure feed storage facilities are sound in construction and in good repair.

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE AND SOLUTION:

PROBLEM: Feedstuff received does not meet receiving specifications in one category or another.

SOLUTION: Depending on the area that is not meeting the specification, decide what course of action needs to be taken with the delivery i.e. return to supplier, apply prearranged discount, etc.

B. MEALS, FATS, OILS, LIQUIDS, ROUGHAGES, BY-PRODUCTS, SUPPLEMENTS AND OTHER INGREDIENTS

The receiving procedures outlined above for grains can also be followed for other feedstuffs with a few noted exceptions. When any high moisture feedstuff (i.e. silage) is received and sampled, the sample should be refrigerated or frozen to prevent spoilage before being sent to the analytical laboratory. When a liquid sample is stored in a bottle, allow an inch or more of air space above the liquid to accommodate the formation of gas resulting from fermentation. Store individual samples of each liquid, fat and supplement representing each load delivered from suppliers (no composite sample is obtained). Baled hay requires a hay probe to acquire a representative sample. Table 1 outlines an appropriate schedule for laboratory analytical procedures of each feedstuff.

MEALS, FATS, OILS, LIQUIDS, ROUGHAGES (CONT'D)

Proper storage of supplements, meals, oils, fats, minerals, roughage and various by-product feeds, either bagged or bulk, often require unique considerations compared to grains. The most notable differences are:

- Ensure that all feedstuffs received have been certified by the supplier as safe to feed (free from chemical and physical contaminants).
- Meals, supplements and other bulk dry ingredients are to be unloaded into the appropriate designated bay except when meals contain higher than allowed moisture (but purchased after assigning appropriate dockage) in which case they should be stored in a bay where they may be mixed and fed as soon as possible. This procedure is recommended only as an exception to the routine to reduce the potential for mould and mycotoxin production, which may cause animal ill health.
- Bulk liquid ingredients such as supplements, fats, oils and molasses should be unloaded into designated bulk storage tanks. Verify that the supplier has added an antioxidant to fats and oils prior to delivery.
- Bagged ingredients should be stored in accordance with manufacturer's recommendations in a manner that allows older ingredients to be consumed first, thus ensuring stock rotation - 'First-in, First-out'. To assist with this protocol be certain that bags are identified by ingredient name (e.g. vitamins) with the designated expiration date to prevent incorrect or out-of-date ingredients to be added to a ration. Any ingredient found to be beyond the expiration date should be removed from the inventory and properly disposed of by assigned personnel.
- Roughages such as hays, straws, hulls and silage are notorious for high inventory losses during handling and storage. Hulls, hays and straws should be unloaded in designated covered area. If stored outside, consideration should be given to provide a cover such as plastic sheeting to reduce inventory loss, mould growth, dust accumulation and moisture uptake.
- Silage of about 3/8 to 1/2 inch theoretical cut should be unloaded into designated horizontal (pit, bunker, bag) or vertical (tower silo) structures. Obtain a representative sample from each load of all roughage delivered for analytical analysis and for on-site moisture determinations. Convert moisture analysis to dry matter to obtain initial dry matter inventory and cost per ton of all roughage. Generally acceptable moisture levels for proper ensiling in typical structures are as follows: Bunker or pit - 65 to 72%, Silopress type bag - 62 to 65%, round bale - 50 to 60%, oxygen limited structure - 45 to 55% and conventional upright tower silo - 62 to 65%.

MEALS, FATS, OILS, LIQUIDS, ROUGHAGES (CONT'D)

4 Fill all silos as rapidly as possible. Adequate compaction of the silage to reduce presence of oxygen is essential for desired preservation. This is most difficult to achieve on exposed surfaces and at the edges of a structure. Fill horizontal silos as a progressive wedge shape from rear to front while providing continuous packing with heavy, yet safely operated equipment. The packing process should be continued two to three days after the last load has been delivered. Consider application of inoculant and/or organic acid products to silage at the time of filling, especially for grass and legume silage with low soluble carbohydrate levels. The desired outcome for ensiled products is to rapidly achieve a pH below 5 (at least within 15 days of storage), enhance organic acid production and to reduce mould growth and inventory losses. The use of a pH meter to evaluate silage is suggested. Horizontal silos should be covered with plastic sheets and weighted with tires to decrease surface losses. Dark brown or black "tobacco" smelling silage suggests poor preservation and loss of nutrients.

4 Remember to always clean feedstuff storage and handling areas and associated equipment including feeding equipment to reduce dust and cross contamination of ingredients, discourage rodents and other infestations, while at the same time providing a safer work environment for all feedlot employees.

Throughout the preceding information on receiving and storing feedstuffs emphasis has been placed upon obtaining feed samples for analytical and related purposes. This procedure is a major element in obtaining control over feed quality at any feedlot and is therefore summarized in specific detail to assist feedlot managers and employees. The minimum sample size should represent about 500 grams for these purposes. Date of each activity should be recorded upon the sample and in a specified logbook.

FEED SAMPLES - ANALYTICAL LABORATORY SCHEDULES (TABLE 1)

Ration or Ingredient	Required Laboratory Analysis	Frequency of Sampling	Frequency of Testing	Number of Samples Required per Test
Whole grains	Moisture %	On arrival-all deliveries	Each load	One composite per delivery
Tempered Grains	Moisture %	Post- tempering, Per hour	Once per hour	One per hour
Reconstituted grains	Moisture %	Post-tempering per hour	Once per hour	One per hour
	Moisture %	Post- reconstitute	Daily	One composite per day
Steam flaked grains	Moisture %	Post-rolled each day	Daily	Once per day per roll
	Test weight	Post-rolled each hour	Hourly	Once every hour
	Gelantini-sation	Monthly	Monthly	One composite per day
Protein meals	Moisture %	On arrival- all deliveries	Each load	One composite per delivery
	Moisture %	On arrival-all deliveries	Weekly	One composite per week
	Crude protein %	On arrival-all deliveries	Weekly	One composite per week
	Fat %	On arrival-all deliveries	Weekly	One composite per week
Hays, straws & hulls	Moisture %	On arrival-all deliveries	Each delivery	One composite per delivery
	Crude protein %	Monthly-all deliveries	Monthly	One composite per month
	AFD %	Monthly-all deliveries	Monthly	One composite per month
Silages	Moisture %	Pre-harvest	Pre-harvest	One composite per crop
	Moisture %	On arrival-all deliveries	Each delivery	One composite per delivery
	Moisture %	Daily per silo in use	Daily	One composite per silo
	Crude protein %	Monthly per silo in use	Monthly	One composite per silo
	AFD %	Monthly per silo in use	Monthly	One composite per silo
Supplement	Moisture %	On arrival-all deliveries	Monthly	One composite per week
	Crude protein %	On arrival-all deliveries	Monthly	One composite per week
	Calcium %	On arrival-all deliveries	Monthly	One composite per week
	Ionophore	On arrival-all deliveries	Monthly	One composite per week
Liquid supplement	Dispersion	On arrival-all deliveries	As required	Maintain for 100 days
Fats, oils & Fats	Free fatty acids	On arrival-all deliveries	Monthly	One composite per month
	Impurities	On arrival-all deliveries	Each delivery	One composite per delivery
Mixed rations	Moisture %	Daily per ration	Daily per ration	One per ration
	Crude protein %	Weekly per ration	Weekly	One per ration
	ADF %	Weekly per ration	Weekly	One per ration

Recommendations presented represent minimums, additional analyses and/or sampling may be required under some conditions (adapted from the Australian Feedlot NSA Feed Quality System).

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE AND SOLUTION:

PROBLEM: A feedstuff is beginning to show some evidence of mould.

SOLUTION: Have the feedstuff tested for the presence of mycotoxins. If the problem is not significant, feed the remainder as soon as possible. Ensure the storage area is cleaned before the new product comes in. Review the rotation or utilization of the product to ensure that the product is used in a timely manner.

SECTION 4

INSPECTION OF INCOMING GRAINS & OTHER FEEDSTUFFS

A. INSPECTION OF INCOMING GRAINS & OTHER FEEDSTUFFS

To ensure accuracy in the inspection process of grain and other feedstuffs received at a feedlot the following guidelines are recommended. As in all quality control systems, deliberate attention must be paid to details with accuracy being absolutely essential. Recommended inspection procedures for grains will be presented first, followed by a similar presentation for other feedstuffs to include procedures to determine moisture levels. Receiving standards for grains, meals, liquids and roughage also follow.

Benefits of proper inspection of incoming feedstuffs:

- Determine if various feed quality levels meet standards or if discounts will apply.
- Verify if delivery weights match bill of lading weights.
- Obtain samples on arrival to test for quality.

INSPECTION PROCEDURES

Grain Inspection Procedures

- All incoming trucks should be inspected at the scale after weigh-in and before unloading. Remove the tarp to inspect grain for live insects and excessive trash. If found, reject the load. Likewise, if odours indicate presence of mould or pesticides, reject the load. Immediately report all rejected grain deliveries to the feedlot manager, or other assigned personnel for follow-up action and completion the of *Receiving Non-Conformance Report* (Table 9).

- Obtain a minimum of five (5) grain samples from the front, middle, and back of the load with a grain spear, reaching the bottom of the truck bed. Place samples into a bucket, mix and obtain the composite sample. Obtain and store another one pound sample of grain from each accepted delivery with other samples for future analytical analysis.

- Fill a container, preferably a condrometer, of 1/2 to 1 litre of grain until it is level with the top and read it for test weight determination. Then determine admixture percentages by emptying contents of the condrometer cup or suitable container into corresponding sieves as given in *Grain Receival Standards* (Table 3). If admixture percentages for its components (foreign matter, screenings, and/or trash) exceed maximum levels by volume, reject the load. Observe sieved grain for weed, foreign and toxic seeds. Compare against the visual display of toxic seeds. If unfamiliar seeds are present, send them to an external seed laboratory for identification. The grain should be rejected if the amount of foreign material is over the expectable limit.

- Any excessive foreign material such as rocks, glass, bird droppings, among others, must be observed and noted with appropriate follow-up. Determine the moisture content of the grain as outlined in Table 2. If the bushel weight of grain is below the standard as given in Table 3, the load may be rejected.

Grain Inspection Procedures (Cont'd)

4 Record all grain delivery (each load) inspection results and load details on the *Grain Receival Record* form (Table 7). For all grain deliveries that are accepted, record the bin or silo number where grain was stored and sign the form to verify that all activities were properly completed.

It should next be determined if price and weight adjustments are warranted on all grain shipments based upon the receiving standards as given in Table 3. This process of grain premiums and discounts is presented below and outlined in Table 4. For example, assume that a shipment of 61,500 pounds of barley is delivered to a feedlot at a sale price $4.20/hundredweight. The grain sample report indicates 14.3% moisture with a test weight of 50.0 pounds per bushel, 8.3% foreign matter admixture, 0.5% heat damage and 13.1% total damaged grain. Discount and premium calculations would then proceed as follows:

- Moisture exceeded the standard by 1.3% (14.3% - 13% = 1.3%). Test weight exceeded the standard of 48.0 pounds per bushel, hence no discount is assigned. Foreign matter admixture was 0.3% over the combined standard of 8% (8.3% - 8.0% = 0.3%). In this foreign matter admixture discount shown in Table 3, Part A, items a, b, c, and d are added to establish the assigned discount. Heat damage exceeded the maximum standard by 0.2% (0.5% - 0.3% = 0.2%) and total damage exceeded the standard of 11% by 2.1% (13.1% - 11% = 2.1%). Total damage is determined by adding items e, f and g as indicated in Table 3.

- The adjusted moisture discount becomes 1.95% (1.3% x 1.5 units = 1.95%) for this delivery of barley. The weight discount for this 61,500 pound shipment then becomes 1,199 pounds (61,500 pounds x 1.95% = 1,199 pounds). The pay weight for this delivery of barley is 60,301 pounds or (61,500 pounds - 1,199 pounds = pay weight of 60,301 pounds).

- Price adjustments are also assigned based upon receiving standards given in Table 3. Foreign matter admixture exceeded the allowance by 0.3%. Since any fraction of a percentage unit falling between 8 and 10% carries a $0.02 discount, a $0.02 discount is assigned. Heat damage exceeded the standard by 0.2%. Therefore, the price discount for heat damage also becomes $0.02. Total damage exceeded the receiving standard of 11%. This adjustment (13.1% - 11% = 2.1%) of 2.1% for total damage carries a $0.06 discount. These three price discounts for foreign matter admixture, heat damage and total damage are added ($0.02 + $0.02 + $0.06 = $0.10) establishing a payment price of $4.10/hundredweight ($4.20 - $0.10 = $4.10) for this barley.

Grain Inspection Procedures (Cont'd)

- Final payment is calculated by multiplying the pay weight of 60,301 pounds x payment price of $4.10. Final payment becomes $2,472.34 (603.01 hundredweights x $4.10/hundredweight = $2,472.34) rather than the unadjusted contract price of $2,583.00 (615 hundredweight's x $4.20/hundredweight = $2,583.00). This discount of $110.66 ($2,583.00 - $2,472.34 = $110.66) is implemented to reflect the actual feeding value of the barley, and to encourage more uniform grain trading conditions.

Meal Inspection Procedures

Meal inspection procedures follow the same general protocol as for grains. After a truck has weighed-in, but before unloading, obtain a minimum of five (5) samples by spearing front, middle and back of the truck (or pallet if in bags). Be certain that the spear touches the bottom of truck bed. Mix samples into a bucket and obtain a sub-sample for moisture determination as described below. Compare the results against the *Meal Receiving Standards* (Table 5). Reject the load if it is not to standard. Record the results on the *Ingredient Receival Record Meals and Other Feedstuffs* (Table 8).

Fat, Oils and Molasses Inspection Procedures

Fats, oils and molasses inspection procedures require that each delivery be sampled and checked for 'off-odours', proper colour, excess water, and/or improper texture as given in Table 6. Inspect fats and oils for impurities by placing a sample portion in a graduated cylinder to determine the actual percentage. If impurities exceed 0.05%, reject the delivery; notify the proper feedlot personnel and record the results as required in Table 9. Record the results of all deliveries approved for purchase on the *Ingredient Receival Record Meals and Other Feedstuffs* (Table 8). Deliveries of fats and oils which fall out-of-range but are deemed suitable to be fed may be discounted on price as outlined below.

- Assume a 20T delivery of Yellow Tallow at a contract price of $150.00/T, was guaranteed at 98% TFM (minimum Total Fatty Matter) and 2% MIU (maximum Moisture, Insoluble and Unsaponifable matter). However, actual analysis shows a TFM of 88% with 8% M (moisture) plus 4% I (insoluble matter) and U (unsaponifiable matter). Thus the TFM deficiency equals 10 percentage units (98 - 88 = 10) while M is 6 percentage units over the guarantee and I and U are 2 percentage units over the guarantee.

Fat, Oils and Molasses Inspection Procedures (Cont'd)

- Cost per unit of TFM is $1.53 ($150/T divided by 98). The adjustment for M is 5 units at 1 times and 1 unit at 3 times. I and U are adjusted for 2 units at 1 times. The total price discount then becomes:

Moisture, 5 units x $1.53 =	$ 7.65/T
Moisture, 1 unit x 3 x $1.53 =	$ 4.59/T
Insoluble and Unsaponifiable, 2 units x $1.53 =	$ 3.06/T
Total correction =	$15.30/T

- A total of $306.00 (20T x $15.30/T) is then deducted from the invoice total of $3,000.00 (20T x $150.00/T) or $3,000.00 - $306.00 = $2,694.00 as the correct adjusted price for this 20T delivery of Yellow Tallow.

Hay, Straw and Silage Inspection Procedures

Hay, straw and silage deliveries must also be inspected immediately following weighing and prior to unloading. Collect a representative sample of each load of all roughage by either inserting an arm or hay probe deep into the load. Acquire at least five (5) samples representing the front, middle and back of the truck. Place these five samples into a bucket, mix and obtain a representative composite sample. Perform moisture analysis on the composite sample as outlined in Table 2. Follow all established rejection reporting and recording procedures. Note all 'off-odours', improper colour, and/or texture, including particle length. Record all load details and inspection results on the *Ingredient Receival Record Meals and Other Feedstuffs* (Table 8).

As with other ingredients, roughages are also subject to price and quality adjustments based upon delivery standards to assist in quality control. Assume that a contract for 100T of baled alfalfa hay @ $70.00/T is stipulated a minimum of 17% crude protein and a maximum of 34% acid detergent fiber (ADF)(on dry matter basis), with a 14% moisture allowance in accordance with the Southwest Alfalfa Trading Standards. Quality adjustments for crude protein and ADF are 3 times the stipulated minimum and maximum percentages. Moisture adjustments are made independent of quality adjustments with a premium given for hays within the 10 to 14% moisture range and a discount assigned between 14 and 20%. The buyer reserves the right to reject hay with over 20% moisture, greater than 20% foreign material or with any injurious foreign material, objectionable foreign odour, heating, heat damaged, and/or moulds. Analytical data on this alfalfa hay indicate a 15% moisture content (85% dry matter), 16.2% crude protein and 30% ADF. Calculations required to implement these adjustments are as follows.

Hay, Straw and Silage Inspection Procedures (Cont'd)

- Both crude protein and ADF values must be converted to 100% dry matter. The crude protein analysis of 16.2% divided by 85% dry matter x 100 = 19% crude protein on a dry matter basis. Likewise, adjusted ADF content becomes 30% divided by 85% x 100 = 35% ADF on a dry matter basis.
- Moisture content of this hay was 1 percentage unit over the standard (15% - 14% = 1%) which carries a corresponding reduction in the purchase price, or $0.70/T (1% x $70.00 = $0.70). Crude protein was 2 percentage units over the minimum requirement (19% - 17% = 2%) and represents a premium of 6% (2% x 3 = 6%). ADF was 1 percentage unit over the maximum allowance (35% - 34% = 1%) and represents a discount of 3%. The quality adjustment for price is a plus 1.5% obtained by averaging the numerical difference between premiums and discounts (subtracting the negative 3% from 6% equals 3%. 3% divided by 2 = 1.5%) Therefore, the quality adjustment for the price of this hay represents a premium of $1.05/T ($70/T x 1.5% = $1.05/T).
- Payment price for this 100T of hay represents a premium of $0.35/T (a negative $0.70/T discount for moisture + $1.05/T premium for quality factors). Adjusted price becomes $70.35/T ($70.00/T + $0.35/T). Final payment is then $7,035 ($70.35 x 100T = $7,035) for this delivery of alfalfa hay.

For each of the above outlined feedstuffs, store a sample of each load received with other samples to form a composite sample for subsequent analytical analysis as previously outlined in Table 1.

Following the critical control problem example, are Tables 2, 3, 4, 5 and 6.

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE AND SOLUTION:

PROBLEM: Feedstuff is acceptable, but moisture levels are considerably higher or lower.

SOLUTION: Speak to supplier about moisture issues and price adjustment as per the trading standards previously agreed to with the supplier and outlined in this manual. Consider this variation in the ration formulation.

MOISTURE DETERMINATION (ALL INGREDIENTS) (TABLE 2)

FORCED AIR OVEN PROCEDURE[1]

Procedural Sequence and Description

1. Accurately weigh tray or bottle where sample is to be placed. Tare the weight and record.

2. Place 'as-fed' ingredient sample of at least 200 grams into a tray or bottle and weigh accurately and record.

3. Place in forced-air drying oven overnight at approximately 105 degrees centigrade.

4. Weigh the cooled sample and record the results. Calculate the percent dry matter after subtracting the weight of the tray or bottle and then divide the remainder by the original sample weight.

   Example:

   - 'As-fed' sample weight - Tare weight = 'As-fed' net weight of sample
   - Dry sample weight - Tare weight = 'Dry' net weight of sample
   - ('As-fed' net weight of sample divided by 'Dry' net weight of sample) x 100 = percent dry matter of sample ingredient.

5. Calculate percent moisture by subtracting percent dry matter from 100.

---

[1] Other moisture determination techniques are also available to include digital, microwave, kernel testers, plus others. In all cases follow the manufacturer's recommended procedures in concert with insights from a consulting nutritionist.

GRAIN RECEIVAL STANDARDS
GRAIN CHARACTERISTICS[1][2]
(TABLE 3)

Description	Barley Sound	Corn Sound	Wheat Sound
	Mature grain, reasonably sweet – 2 or 6 row varieties	Mature grain, cool and sweet	Mature grain, moderately free of damage`
Moisture	13%	14%	13%
Test Weight	48.0 lb/bu	54.0 lb/bu	58.0 lb/bu
Admixture	8%	8%	8%
(Total volume = a+b+c+d, maximum allowed)			
(a) Foreign Matter	3.5%	5%	4%
(all matter retained on following screen)	#6 Riddle	#12 Round hole	#25 Riddle
(b) Screenings	5%	5%	4%
(all matter passing through screen)	#5 Slotted	#12 Round hole	#4.5 Slotted
(c) Trash	4%	4%	4%
(all trash retained on following screen)	#4.5 Round hole	#12 Round hole	#5 Buckwheat
(d) Broken kernels or thins	(add to foreign matter)	(add to foreign matter)	(add to foreign matter)
Total damage (e+f+g)			
(e) Sprouted	10%	5%	2.5%
(f) Heated, rotted and severely mildewed	1.0%		1.0%
(g) Frost damaged Wild oats and thin kernel	5%		5%
Heat damage	.3%	.3%	.3%
Vomitoxin	5 ppm	5 ppm	5 ppm
Altatoxin		300 ppm	
Fumonisin		50 ppm	
Ergot	.1%		.10%
Sclerotia	.01		.10%

GRAIN RECEIVAL STANDARDS
SUGGESTED PURCHASE ADJUSTMENTS (1)
(TABLE 4)

Trading basis	Barley	Corn	Wheat
Premiums – (2) Discounts	**$.15 for #1**	**$.15 for #1**	**None**
1. Moisture	1.5 times for each percentage > 13% applied on net weight before other discounts (buyer option to reject above 14% test moisture)	1.5 times for each percentage > 15.5% applied on net weight before other discounts	1.5 times for each percentage >13.5 applied on net weight before other discounts (buyer option to reject above 14% test moisture)
2. Test Weight	$.02 for each pound or fraction thereof from 47.9 to 47.1; $.04 for each pound or fraction thereof below 37 to 46.3 lb; 8 cents for each lb or fraction thereof below 46.3 lb (buyer option to reject loads 48% or below)	$.02 for each pound or fraction thereof from 53.9 to 53.0; $.04 for each pound or fraction thereof below 52.9 to 52.0 lb; 8 cents for each lb or fraction below 52.0 (buyer option to reject below 54.0 lb test weight)	$.02 for each pound or fraction thereof from 57.9 to 57.0; $.05 for each pound or fraction thereof below 56.0 lb; 8 cents for each lb or fraction thereof below 56.0 lb (buyer option to reject below 58 lb test weight)
3. Foreign material admix with broken kernels	$.02 for each 1% or fraction thereof from 8.1% to 10%; $.04 for each 1% or fraction thereof from 10.1 to 20%	$.02 for each 1% or fraction thereof from 5.1% to 10%; $.04 for each 1% or fraction thereof from 10.1% to 20%	$.20 for each 1% or fraction thereof from 4.1% to 10%: $.04 for each 1% or fraction thereof from 10.1% to 20%
4. Heat damage	$.01 for each 0.1% from .2% through 2%	$.01 for each 0.1% from .2% through 2%	$.01 for each 0.1% from .2% through 2%
5. Total damage	$.02 for each 1% or fraction thereof from 11.1% to 20%; $.04 for each 1% threafter	$.02 for each 1% of fraction thereof from 5.1 to 15%; $.04 for each 1% from 15.1 to 20%	$.02 for each 1% or fraction thereof from 8.1% to 12%; $.04 for each 1% from 12.1% to 20%
6. Heating	$.05 per hundred-weight	$.05 per hundred-weight	$.10 per hundred-weight
7. Musty	$.10 per hundred-weight	$.10 per hundred-weight	$.10 per hundred-weight
8. Sour	$.10 per hundred-weight	$.10 per hundred-weight	$.10 per hundred-weight
9. Weevily	$.10 per hundred-weight	$.10 per hundred-weight	$.10 per hundred-weight
10. Thins	$.10 per hundred-weight	$.10 per hundred-weight	$.10 per hundred-weight

(1) Adapted from the Southwest Scale of Grain Premiums and Discounts, 1978 and 1996. If grain is musty, sour or weevily, buyer may apply discounts or return grain to seller at seller's expense. Any required discounts not covered by the above criteria may be negotiated between seller and buyer, or return the grain at sellers expense.

(2) Human Food Grade Quality

MEAL RECEIVING STANDARDS (TABLE 5)

	Canola meal	**Soybean meal**
Description	Solvent extracted with hulls	Solvent extracted with hulls added
Moisture (maximum)	12%	11%
Crude fiber	15%	7%
Crude protein (minimum)	34% or as specified	44% or as specified
Fat and oil (minimum)	0.5%	0.5%
Test weight	40-47 kg/hL (32-38lb/bu)	43-48 kg/hL (35-38lb/bu)
Colour	Medium to dark brown	Yellow to light brown
Odour	Not offensive	Not offensive

Do not accept any feedstuff which contains prohibited or toxic matter or chemicals such as those outlined in Saskatchewan Agriculture and Food: Crop Production Guide, 1997. Levels of tolerance of +/- 0.5% are permitted to allow for accuracy of testing equipment. Never accept substandard meals without approval from the consulting nutritionist.

RECEIVAL STANDARDS FOR LIQUIDS AND FATS (TABLE 6)

	Molasses	**Tallow**[1]	**Vegetable Oil**
Description	Syrup resulting from removal of crystallisable sugar from raw sugar liquor	Beef, pork and mutton fat obtained from rendering slaughtered animals	Oil obtained from oil seeds - cotton, canola, soybean, sunflower, safflower and their mixtures
Moisture	Maximum 26%	(See below)	Maximum 0.5%
Crude protein	5 - 6 % of dry matter	N/A	N/A
Calcium	0.8 - 1.2% of dry matter	N/A	N/A
Brix	Minimum 84 degrees	N/A	N/A
Free fatty acids (FFA)	N/A	Maximum 12.5%	Maximum 2%
Impurities	N/A	Maximum 0.5%	Maximum 0.5%
Colour	Dark brown	Medium to dark honey. Creamy appearance not acceptable.	Golden brown appearance
Texture	Sticky viscous syrup	Characteristic smooth oil feel. A watery feel is not acceptable.	Free of solid particles, froth and bubbles
Odour	Slight sweet odour	Must not be rancid	Must not be rancid
Total fatty matter (TFM)	N/A	Minimum 99%	N/A
Moisture, insoluble and unsaponifiable matter (MIU)	N/A	Maximum 1%	N/A

(1) Standards adapted from the California Cattle Feeders Association Fat Trading Standards. Fat blends are guaranteed by supplier to contain a specific percentage of animal tallow and vegetable oil. Resulting analytical data may be compared to tallow and vegetable oil standards given above in corresponding proportions. Levels of tolerance of +/- 0.5% are permitted to allow for accuracy of testing equipment. Always verify with supplier that any fat product be free of polychlorinated biphenyls (PCB), chlorinated hydrocarbons (CHC), pesticides, herbicides, heavy metals, salmonella and tall oil (hydrocorbons). Contact your consulting nutritionist for more details.

B. FEEDSTUFF PURCHASING FORMS

Key Concepts:

✞managing feed purchase records; ✞receiving record for grains; ✞meals and other feedstuffs; ✞non-conformance report; ✞reasons for rejection.

The following three forms (Tables 7, 8 and 9) are presented as guides in the development of a feedlot feed quality control system. These forms are an essential component of a comprehensive feed quality control protocol. Not only will the records resulting from the proper maintenance of these forms support day-to-day feedlot management, but they are also essential for long range planning and decision making. Each form is presented as self-explanatory, with hope that they will be freely copied and or modified to fit the specific needs for utilization in feedlots.

Benefits of feed purchase order forms:

- Ensure the consistency of all the information collected every time a commodity is delivered to the feedlot.
- Provide a trail of information that can be referred to for traceback reasons.

The utilization of forms will ensure the consistency of information with regard to the purchasing of feedstuffs. Keep the following in mind when setting up your record keeping system.

- Design a form that will include all of the information needed to keep a history about the particulars of a certain feedstuff purchase deal.
- Ensure the form is used for every deal made on a feedstuff or other commodity, such as wood chips or shavings.
- Historical information on each supplier can assist in determining whether a feedlot wants to continue with a certain supplier and provide details on the particular feedstuff that is being supplied.

Following are:

- *Grain Receiving Record* (Table 7)
- *Ingredient Receiving Record – Meals and Other Feedstuffs* (Table 8)
- *Receiving Non-conformance Report – All Feedstuffs* (Table 9), which include examples of purchase order forms and the variability of information that is required for purchasing feedstuffs.

GRAIN RECEIVAL RECORD (TABLE 7)

Delivery Date	Grain Type	Weigh Bridge Docket	Supplier	Carrier	Quantity Delivered	Tests-Moisture %	Test-Weight kg/hl	Inspect			Inspect				Approv @ Yes	Approv @ No	Sample Stored	Sample Lab	Stored Silo Bin or Pad	Initials of Staff
								No live Insects	No off Colour	No off Odour	Foreign Matter	Screenings	Trash	Weed Seeds						

INGREDIENT RECEIVAL RECORD MEALS AND OTHER FEEDSTUFFS (TABLE 8)

Delivery Date	Ingredient Name	Weigh Bridge Docket	Supplier	Carrier	Quantity Delivered	Tests- Mois- ture	Tests- Molas- ses Brix Degrees	Tests- Fats & Oil Impuri- ties	Inspection			Approv @ Yes	Approv @ No	Sample Stored	Sample Lab	Initials of Staff
									No Off Odour	No Off Colour	Proper Texture					

RECEIVING NON-CONFORMANCE REPORT ALL FEEDSTUFFS (TABLE 9)

Ingredient name _____ NRC Register Number _____

Supplier _____ Date NRC Received _____

Carrier _____ Report by _____

Driver's name _____ Contract # _____

Reason(s) Ingredient Rejected

Moisture % > std. ☐	Weed seeds > std ☐	Mycotoxins ☐
Test weight < std ☐	Foreign seeds > std ☐	Nutrient <or> spec. ☐
Admixture > std. ☐	Toxic seeds > std ☐	Brix < std. ☐
Foreign matter > std. ☐	Chemicals ☐	Impurities > std. ☐
Screenings > std. ☐	Improper texture ☐	Rodent contamination ☐
Trash > std. ☐	Off colour ☐	Moldy ingredient ☐
Live insects ☐	Off odour ☐	Other ☐

Test results and comments: _____

_____

Immediate corrective action: _____

_____

Approved by: _____

Cost of NRC: $

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 5

PROCESSING FEEDSTUFFS

FEED PROCESSING PROCEDURES

Post-harvest processing of feed grains for feedlot cattle is widely recognized as a means of transforming more grain nutrients into efficient weight gain when viewed either in biological, monetary or cultural energy [1, 6]. Over 20 different types of grain processing techniques have been reported in the literature. The techniques outlined below represent those most widely used in feedlots in Canada. Each processing technique has unique responses and potential applications. Some are better suited for larger rather than smaller feedlots, and others are better adapted to commercial feeders rather then farmer feeders. Contact a qualified consulting nutritionist or researcher to assist you with decisions related to your circumstances. To achieve the potential benefits of any one processing technique, certain specific details of grain processing must be followed. All grain processing techniques require clean grain free of trash and other foreign matter to fully express desirable responses. It is the objective of this section to describe those details of grain processing, in near chronological order, to assure optimum results.

Benefits of processing quality feeds:

- Consistent ration formulations.
- Optimal use of feedstuffs.
- Cost effectiveness.
- Increased performance.

A. GRAIN PROCESSING

Key Concepts:

why process?; dry rolling; tempering; reconstitution; steam flaking; grain processing standards; forage processing; and the Total Mixed Ration (TMR) concept.

Dry Rolling Grain

- Dry rolling of grain is a widely adapted processing technique that both enhances cattle performance and results in improved physical ration characteristics as compared to feeding the grain as whole grain. Dry grinding, while similar as a physical process to dry rolling, is less widely applied in the industry because it offers fewer nutritional benefits than dry rolling. Both techniques require proper maintenance and servicing of the milling equipment. Before starting to roll or grind grain, perform proper equipment maintenance, calibration and servicing as suggested in Tables 11, 12 and 13. Always check roll adjustments and roller corrugations as frequently as possible and record results of services performed. Proper setting of the rolls is absolutely essential in achieving desired results in animal performance.

Dry Rolling Grain (Cont'd)

Always store processed grain in proper bins and be certain that the 'First-in, First-out' protocol is followed to ensure that freshly processed grain is being fed. Proceed to roll grain following manufacturer's instructions for roller mill and related equipment. Inspect rolled or ground grains during processing by monitoring samples by visual inspection against a reference sample (kept in a bottle). Adjust the grain intake rate into the mill, roll rotation and distance as required to obtain the desired physical characteristics. In all cases, advise the appropriate feedlot personnel if improper functioning occurs to determine immediate corrective action.

Tempering of Grain

4 Tempering of feed grains involves short-term treatment of grain with water prior to further processing to improve milling characteristics and assure that the grain meets feedlot standards. Tempering holds the potential to improve mill throughout, stabilize moisture, and decrease ration fines, while at the same time, reducing inventory shrink. Prior to starting the tempering process, follow the maintenance and calibration procedures outlined in Tables 11 and 12 on water metering related equipment. Whenever surfactants or other conditioning products are added to the tempered water to improve the moisture uptake of the grain, check the calibration of the surfactant dosing equipment at least daily. Always use at least two nozzles to apply surfactants. Calculate the quantity of water (litres/minute or litres/kg) to be added to achieve target grain moisture. In-line grain moisture content can be estimated based upon the moisture of the grain when placed into the storage unit. Proceed to temper grain by spraying a solution of water and surfactant on the grain in the mixing auger. Attempt to maintain a minimum 70% level of grain in the auger at all times to enhance mixing action. Allow for at least 4-12 hours of 'soak time' for tempered grain prior to final processing. Collect samples for moisture determination at specified intervals as outlined in Table 1 and adjust the rate of water application accordingly.

Reconstitution of Grain

4 Reconstitution of grain is a process whereby grain is stored in oxygen restricted structures for at least 14 to 21 days at moisture levels between 20 and 30 % to enhance digestibility and animal performance. The same benefits associated with tempering of grain are also achieved with reconstitution, plus major improvements in grain digestibility. Initiate the reconstitution process by first following proper maintenance and calibration procedures on all grain handling equipment from scalper, dosing and water spraying units,

Reconstitution of Grain (Cont'd)

grain structures with associated augers and roller mill. It is preferable to add water in two stages - before entering the tempering tower for two or more hours, and before entering the oxygen restricted structure. Collect grain samples from the table of the tempering tower on the schedule suggested in Table 1. Adjust the addition of water to achieve a uniform grain moisture level. Proceed to fill the structure within two days to minimize the moist grain exposure to oxygen. Initiate the rolling of the grain as outlined for dry rolled grain after 14 or more days of storage. In cold weather, only roll one or two days in advance the needed supply of grain to prevent it from going out of condition.

Steam Flaking of Grain

4 Steam flaking of grain is generally accepted as a highly desirable method of processing for commercial feedlots, since both a positive grain inventory results, as well as favorable animal performance. Uniform grain moisture levels are conducive to achieving a desired level of gelatinization of starch allowing for improvements in grain digestibility and feed conversion. Prior to steam flaking, the proper maintenance and calibration of dosing equipment, boiler, steam chamber and roller mill as outlined in Tables 11 and 12 should be followed. Temper grain prior to steaming and rolling as outlined above. Start the boiler following manufacturer's instructions. Adjust the pressure to 45 to 100 psi (3 - 14 KPA). Lower pressures of 50-70 psi will increase grain moisture uptake by 4 to 6 percent, conversely, less grain moisture is obtained at psi levels of 80 to 100. Note the daily boiler performance on the *Flake - Roll Quality Control Record* (Table 10). In order to avoid low quality flakes on startup, fill the steam chamber with grain for initial cooking for at least 45 minutes, or until the steam belch-out at the bottom of the peg feeder, with chamber steam ports opened 1/3 on the top, 2/3 in middle and fully open at the bottom prior to milling. Monitor the rate of discharge through the steam chamber window. Allow about 20 to 40 minutes cooking time for barley and wheat and 40 to 50 minutes for corn. Maintain the steam temperature throughout the chamber as close to 100 degrees centigrade as possible. Measure the temperature of steam every hour at the top and bottom of the chamber and record the results on the form presented in Table 10. Each ideal flake should represent one grain as a resilient (elastic) flake (no particles). Adjust the rollers and the peg feeder to achieve flake requirements. Allow flakes to dry 5 to 10 minutes prior to testing to reflect density weight as wet flakes of about 2.5 to 5 kg/hl heavier than the dry ones. Flake density from both sides of the roller should be within 2kg/hL of one another. Analyze the flakes for the percent of gelatinization of flaked grain as an indicator of

Steam Flaking of Grain (Cont'd)

starch hydrolysis as presented in Table 1. Always handle steam flaked grain to minimize breakage of the flake. Whenever substandard flaked grain is observed due to improper equipment functioning beyond the operator's ability to adjust, then the appropriate feedlot personnel or the consulting nutritionist should be informed for corrective action.

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE AND SOLUTION:

PROBLEM: Erratic consumption of feed by cattle.

SOLUTION: Check for:

(i) Variable grain moisture.
(ii) Rollers are not adjusted right.
(iii) Reduced fines.

FLAKE-ROLL QUALITY CONTROL RECORD
(TABLE 10)

Roller # _____ Date _____ Initial Operator _____

Roller Use	Test hour					
Stop	Test Weight	Left				
Start	Out of Roll	Right				
Total hours		Center				
Total Grain Milled	Chamber Temp.	Top				
	Centigrade	Middle				
		Bottom				
Ton_____ Type_____	% Moisture					
Ton_____ Type_____	Visual Appraisal Yes___ No ___					

This table is a suggested example for use in the establishment of a standard related to flake-roll quality control.

B. FORAGE PROCESSING

Proper processing of forages is yet another link in the chain of controlling the quality of feedstuffs. Silage, hay and various by-products each require special consideration whether homegrown or purchased. Roughages all share a common disadvantage to grains--their relatively large inventory losses through the handling and mixing process. Every effort must be made to reduce these losses in an attempt to achieve improved economic efficiencies.

Benefits for proper forage processing of quality feeds:

- Reduction in inventory losses through proper processing of forages.
- Proper processing (reduction of particle size) will achieve TMR (Total Mixed Ration) thus achieving optimum nutrient utilization.
- Achievement of good TMR will ultimately effect cattle performance.
- Improved economic efficiencies.
- Processed roughage can be stored for processed feedstuffs over a period of time prior to feeding.
- Allows a combination of other processed feed ingredients in a uniform ration.
- Accomplishment of “steady state” feed conditions.

Forage Processing Practices:

Key Concepts:

✞inventory losses; ✞over-processing; ✞particle size; ✞TMR; ✞uniform rations; ✞steady-state environments.

- Unlike long hay, processed forages including pellets, cubes and some by-product roughages, such as cottonseed hulls require no further processing. Silage requires no further processing once successfully placed into storage, but they can undergo large inventory losses while in storage.

- Long hays require chopping or grinding prior to their incorporation into TMR’s, which further add to their inventory losses. Chopping and grinding hays in an enclosure will aid in reducing inventory losses. One advantage processed roughages have over other processed feedstuffs is that they may be stored for considerable time intervals prior to feeding. A practical guide to other aspects of roughage processing is available in Chapter 12 of *Cattle Feeding: A Guide to Management*[(2)].

- The ultimate objective of all roughage processing is to reduce the particle size to allow for mechanical mixing and distribution to accommodate the TMR concept and to enhance nutrient utilization. TMR is a concept central to quality control of rations, which directly influences cattle performance. By

Forage Processing Practices (Cont'd):

reducing particle size of roughage, it is possible to combine them with other processed feed ingredients resulting in uniform ration characteristics as opposed to feeding roughages, such as hays, separately. When these conditions are achieved, it is technically possible to have consistency in each and every mouthful of feed consumed by cattle. This becomes extremely important in achieving a near 'steady state' environment to support normal (and optimum) reticulo-rumen functions of cattle.

4 One key element is not over processing roughage. Roughage processed too finely not only increases ration fines, which disrupt the desired 'steady state' feed conditions for cattle and exacerbate excess inventory losses, but also reduces the roughage action desired in the reticulo-rumen of cattle. These considerations accentuate the need to properly process hays and silage. As with all feed processing equipment, employee safety, proper maintenance and calibration are essential. Refer to Tables 11, 12, and13.

4 Emphasis must also be placed upon the maintenance of work sites free of debris that is commonly associated with roughage handling systems. Daily clean up schedules are best followed in accomplishing this goal.

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE AND SOLUTION:

PROBLEM: Cattle do not appear to be achieving targeted performance.

SOLUTION: Check to see how rations are created such as:
(i) Silage chopped too long for proper compaction in silo, resulting in pockets of spoiled silage,
(ii) Hay ground too fine, resulting in bloat and sub-acute acidosis.

SECTION 6

SUPPLEMENTS AND PRE-MIXES IN RATION FORMULATION

SUPPLEMENTS AND RATION FORMULATION

Supplement composition and quality is extremely important to the success of any cattle feeding investment. Supplement selection falls into the following two broad categories: (1) commercial and (2) customized products. In both cases premixes and supplements can be obtained from a feed or pharmaceutical manufacturer.

Supplements are designed to complement the composition of other ration ingredients and specific feeding requirements as determined by a professional nutritionist. Supplements or premixes formulated specifically for feedstuffs of known composition hold the advantage of improved animal performance at reduced cost.

Benefits of proper use of supplements and ration formulation:

- Proper supplement composition and ration formulation equates directly with cost of gain. These products are valuable and must be used properly.
- Proper formulated rations can contribute to improved animal performance.
- Proper formulated rations can contribute to improved animal health.
- Feed additives properly applied can enhance cattle performance.

Supplement and Ration Formulation Practices:

Key Concepts:

✞supplement types and selection; ✞the "Keep It Simple" concept illustrated.

- Most supplement products may be purchased as granular meals, pellets or liquids. Supplements, while often representing the smallest single ingredient added to a ration at a feedlot, are of the utmost importance in achieving success. Various additives, medications and micronutrients are included to allow for the optimum biological and economic performance of cattle.
- Today's rations are formulated by computers capable of assisting in decisions ranging from ingredient selection to optimizing cattle performance. Optimized ration formulation is fundamental to the process.
- Most feedlots should strive to have as few rations as possible to improve the opportunity for quality control. An excessive number of rations not only requires more supplement storage bins and related support equipment, but it greatly increases the opportunity for improper ingredient combinations. This consideration represents a good example of the 'Keep It Simple' concept. One or two starter, grower, and finisher rations should be sufficient for most feedlots.
- Seeking the advice of a consulting nutritionist is recommended when managing this aspect of a cattle-feeding investment. Greater detail on these considerations are provided in Chapters 11 and 14 in *Cattle Feeding: A Guide to Management*.

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE AND SOLUTION:

PROBLEM: Drop in animal performance.

SOLUTION: Check the supplement used or the amount applied to the particular ration. Supplements must be formulated to fit specific rations.

SUPPLEMENTS AND RATION FORMULATION – MEDICATED FEEDS

The following is adapted from the manual *Beef Quality Improvement – Recommended Operating Procedures for Feedlot Animal Health* (1997/2000 – Crandall and Van Donkersgoed) with regard to Medicated Feeds.

Medicated feeds are commonly used in feed yards to improve animal performance and health. As with any form of medication, improper handling of feed additives can contribute to drug residue problems. Thus, the handling of feed medication additives must be monitored closely so that problems can be prevented. Non-standard supplies include by-product feed ingredients. Cattle are more likely to be free of residues and defects if fed ingredients that are free of residue causing contaminants. Refer to the *Good Manufacturing Practices for the Canadian Feed Industry, 1997* (Animal Nutrition Association of Canada), of which a reference is attached as Appendix 5.

Benefits of good feed medication additive practices:

- Reduces risk of drug residues and associated condemnations of carcass and liability issues.
- Ensures efficacy of products.
- Reduces risk of negative side effects from toxicity.
- Reduces risk of product contamination.
- Reduces waste of product and associated dollar losses.
- Reduces environmental contamination and protects other animals from toxicity.
- Reduces risk of under feeding product, thereby reducing effectiveness.

Feed Medication Additive Procedures:

Note: *While these recommendations are current, producers should be aware that "Regulations Respecting the Making of Medicated Feed" are in the final stages of development. Updated information will be provided when the regulations* come into effect.

- Refer to the Canadian Cattlemen Quality Starts Here **4** *Medicine Reference for Beef Producers*. The intent of this reference guide is to assist the Canadian Cattle industry to strive and achieve consistent animal health activities and to continue to provide a safe, quality beef product.

Feed Medication Additive Procedures (Cont'd):

- Purchase only approved feed medications as listed in the *Compendium of Medicating Ingredient Brochures* (CMIB) for use in cattle and follow the Canadian Feed Act & Regulations.
- Use feed medications according to the *Compendium of Medicating Ingredient Brochures* (CMIB) or valid veterinarian prescription. See Appendix 6 for reference information on the CMIB. Consult the compendium for which drugs require registration and adherence to regulatory practices.
- The use of the correct medicating ingredient and the correct animal weight are important.
- Obtain a written Veterinary feed prescription when using medicating ingredients at a level or for a purpose not listed in the CMIB. A valid Veterinarian-Client-Patient Relationship (VCPR) is required before a veterinary feed prescription is written.
- Ensure that Veterinary prescription feeds are labelled with:
  - (i) Name and address of the manufacturer.
  - (ii) Name of the client, for whom the feed is manufactured and used.
  - (iii) Name and signature of the Veterinarian who issued the prescription (keep veterinary feed prescriptions on file for two years).
  - (iv) Date of prescription.
  - (v) Name of the feed including the amount of medicating ingredients.
  - (vi) Directions for use, including duration of feeding.
  - (vii) Warning and caution statements,
    - -- Weight of the feed.
    - -- Mean weight on cattle.
    - -- Name and/or description of lot, pen or animal identification and sex of cattle that medicated ingredient will be used for.
    - -- A statement signed by the person receiving and using the medicated feed, indicating an understanding of the directions and implications for use of the product.

An example of a feed prescription is included as Appendix 7.

- Ensure staff are trained in the handling and mixing of medicated feeds, and in the importance of ensuring the correct amount of medicated ingredient is used.
- Receive medicated feeds according to the requirements and documentation for other feedstuffs. Record on the *Ingredient Receival Record* (Table 8).

Feed Medication Additive Procedures (Cont'd):

- Ensure that all incoming feed medication ingredients are properly labelled and contain a feed tag with label instructions, including the name of the drug and how to use the product. For concentrates, the tag should also show the lot number and expiry date. Keep medicated feed tags on file for one to two years.
- Store bags of feed medication in a clean and dry, well lighted, adequately sized area, free of rodents, birds and insects. Keep feed additives in original packages, and store them in labelled, closed containers such as plasticgarbage cans. Ensure that pesticides, fertilizers, herbicides and other poisons are not mixed with the same equipment or stored on the same premises as feed ingredients. Ensure all spills are cleaned up immediately.
- Dispose of outdated feed medications through the manufacturer or supplier.
- Clean mixer, micro-hopper and augers after making a medicated feed, whether manually or by flushing with another feed ingredient i.e., calcium or barley to clean our residual medications. Be sure to dispose of these ingredients and do not dump in a place where it may be used as feed.
- Consider using a separate auger system to deliver medicated supplements or clean it between medicated and non-medicated feeds to prevent drug carry-over.
- Document the process for mixing feed medication additives (recipe), including the length of mixing. Monitor the process regularly. A proper feed mixing sequence will reduce the potential of drug carry-over. Mixer validation tests should be done on a regular basis.
- Closely follow the manufacturer's recommendations for mixing times and validate by the mixer efficiency test. Document mixing times and closely monitor.
- Consider mixing down low inclusion level medication with some type of carrier. This will achieve better mixing and more consistency in total mixed rations.
- Clearly document feeding procedures. Use feed sequencing of medicated and non-medicated rations to flush out the equipment to prevent drug carry-over.
- When feasible, use a separate auger system and feed truck to feed medicated starter rations.
- Keep an accurate and up-to-date inventory of feed medication. Store inventory records of medication for two years.
- Closely monitor all withdrawal times for feed medications and cross check records before shipment of live cattle.

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE AND SOLUTION:

PROBLEM: Drug residue found in carcasses due to medicated feeds.

SOLUTION: Check all procedures and documentation with regard to the feeding and withdrawal times related to the use of medicated feeds. Check with the person responsible for feeding and for shipping the cattle in question. Ensure that all know in the future that this is not acceptable.

SECTION 7

FEEDING AND FEEDBUNK MANAGEMENT

FEEDING AND FEEDBUNK MANAGEMENT

After all feedstuffs are obtained, processed, properly mixed into a ration and ready to deliver to the feedbunk, actual feeding of cattle may begin. This interface between man, cattle and technology is critical for success. Consider the importance of practical day-to-day decisions confronting the feed truck driver:

- Changing, adverse weather
- Stressed cattle
- Excessive ration fines in the feedbunk
- Previous days feed consumption
- Cattle behaviour
- Mechanical delays and disruptions

among many others. All of these factors can be at play in addition to determining when to feed a given amount of ration to each pen of cattle in a feedlot and attempting to optimize animal performance. The ability of the feed truck driver and the bunk caller to properly anticipate these variables and properly 'read' the status of the cattle presents a major challenge in successfully feeding cattle.

Benefits of proper feeding and feedbunk management:

- Optimal performance of cattle.
- Cost efficiencies in good feedbunk management practices.
- Reading cattle behaviour as it relates to feedbunk management.
- Water management practices to eliminate water contamination.

Feeding and Feedbunk Management Practices:

Key Concepts:

importance of "reading" cattle and feedbunk; optimum feed intake; guidelines for successful feed truck drivers; remember the water trough!

It is essentially impossible to over-emphasize the importance of understanding both cattle behaviour and the practical aspects of nutrition in this consideration. Perhaps a useful analogy would be to think of feedlot cattle as an 'open book' to be read. Cattle are always attempting to tell us things about their well being and appetites if only we are astute enough to 'read' what they are saying.

Feeding and Feedbunk Management Practices (Cont'd):

Behavioural indicators may be as follows:

- the manner in which cattle disperse themselves about the pen at various times of the day under differing weather conditions,
- how aggressive they are when fed,
- the difference between the 'mentality' of the herd versus a few isolated individuals,
- the condition of their manure,
- how they relax when lying down or if they stretch upon rising, and
- how long and frequently they regurgitate, and how rapidly they chew their cud.

These are all but a few of the examples that illustrate the complexities of 'reading' this open book when observing feedlot cattle. Experience will benefit the dedicated student (bunk readers and feed truck drivers) in translating these behaviours into practical decision making aids related to feeding cattle.

4 Feed intake of cattle is routinely expressed as pounds of ration dry matter consumed per 24-hour day. Intake may be rather accurately predicted by knowing the live weight of the cattle and the ration composition. As an example:

- An 800 pound steer fed a finishing ration would consume about 2.2% of its body weight as feed dry matter per day, or 17.6 pounds (800 x 2.2% = 17.6 pounds).

This calculation may be extended to estimate feed intake for a pen of cattle or an entire feedlot to include feed purchase requirements over any interval of time as well as predicting animal performance. This estimate is quite accurate for purposes of predicting average consumption over a feeding period but becomes little more than a guide for calling the day-to-day feedbunk assignment for a specific pen of cattle.

4 Animal weight, body condition, sex, background previous to the feedlot, health, social status and breeding are known to influence intake and cattle performance [3, 6]. Additionally, almost everything associated with the feedlot such as weather, length of photo-period, ration, staff and feeding techniques, feedbunk availability and feedbunk construction, also add variation to daily feed intakes. Obtaining optimum feed intake is essential to maximize rumen fermentation and cattle performance.

Feeding and Feedbunk Management Practices (Cont'd):

4 The emphasis placed on proper bunk management by nutritionists is well founded. They know that each additional pound of daily feed intake above maintenance results in about a 2% increase in efficiency of feed utilization. Each feedlot should work with its nutritionist to develop a structured feeding protocol that works for them. A system that works well for one feedlot may not work well for another. Some feedlots are better qualified to implement 'clean bunk' feeding techniques, while others may have greater success with plateau, limit, or ad lib feeding techniques. The following items are offered by the author[4] as a general guideline in developing a structured feeding protocol.

1. Label pens and/or bunks with a unique identification number.
2. Maintain accurate records for each pen of cattle on feed to develop a 5 to 7 day running average on feed dry matter intake. Input data for this quality control management tool includes pounds of ration fed each day, ration dry matter, number of head, gender, in-weight, current weight, days on feed and pen and lot numbers. Always note changes in head count, weather, ration fed, clean bunks or other variables.
3. Do not increase or decrease the daily ration allowance more than 10% from the previous day i.e. excessive ration changes disrupt the desired 'steady state' feed intake concept for feeding cattle causing digestive upsets, including acidosis (overloads and bloat) followed by reduced animal performance with higher cost of gains.
4. When a decreased amount of ration is to be fed, reduce only the morning feeding since trimming feed assignments with the afternoon feeding often results in clean bunks the next morning setting into motion an undesirable 'roller coaster like' response upon feed intakes.
5. Deliver feed evenly along the entire bunk. Cattle tend to eat at the same bunk location each day, and uneven feed distribution patterns can only add to a fluctuation in feed intake for individual cattle. Run feed from the feed truck with the truck moving forward, not while backing to reduce the incidence of uneven feed distribution.
6. Feed a properly mixed TMR so cattle cannot sort out ration ingredients or particles of various sizes to prevent erratic intakes and inconsistent gains.
7. Clean feedbunks regularly to keep them free of inferior feed, mould build-up, feces, rocks and any other debris to allow for maximum feed intakes. Allow 9.5 to 10 inches of bunk space per head for larger cattle that are well on-feed and 12 inches for calves still learning to eat under feedlot conditions.

8. Always maintain a keen eye on the weather. This may require delayed feeding to allow cattle time to clean-up feed that was rained on the night before or more frequent feedings on rainy days to keep the feed fresher, or perhaps switching to lower energy rations during extremely cold weather. This is well founded advice since lower energy rations (with more roughage) are less likely to result in digestive upsets during intervals of anticipated erratic intakes. An added benefit is the greater heat of metabolism associated with the fermentation of roughage, which provide warmth to the body during extremely cold weather.

9. Continue with the next ration when they are consuming between 2.5 to 3.0% of their body weight. Strive to have cattle on the finishing ration in 21 to 35 days. Younger cattle typically take longer than yearlings.

10. When changing rations, feed the lower energy ration in the morning and the higher energy ration in the afternoon for a few days before proceeding completely with the higher energy ration. Use more intermediate rations if cattle are fed only once per day. Closely monitor intake, health, behaviour and feces of cattle more closely than usual when changing rations.

11. Make certain that the entire feeding crew, including weekend and part-time staff, fully understands all feeding principles and bunk management protocols. This will result in fewer errors in delivering quality-controlled feeds to the cattle.

12. Flag pens fed special medicated feed or when withdrawal rations are being utilized.

A. FEED PREPARATION

In Canada, many cattle feeders mix and deliver feeds for their cattle in a box mixer of some description. This system has proven successful even over a stationary feedmill when certain production practices are combined with strict adherence to manufacturer's recommendations. Since most of the mixing of feed ingredients takes place in either a truck mounted or tractor pulled box mixer, greater than usual responsibility is placed in the hands of the driver compared to those drivers delivering completely milled rations.

Key elements to consider in accomplishing successful cattle feeding with box mixer equipment includes the following points:

4 Always follow all maintenance, repair and load requirements of the manufacturer.

FEED PREPARATION (CONT'D)

- Never allow any carryover of rations to remain in the box mixer from one delivery to the next. Not only will this greatly reduce the concern for cross-contamination of feeds and additives, but it will at the same time improve the accuracy of weighing, inventory control and enhance animal performance.
- Tare the scale first. Never start adding ingredients into the box mixer without first completing this essential step.
- After the scale has been properly tared, add ingredients into the box mixer in the following sequence:
  1st Processed barley
  2nd Supplement
  3rd Chopped hay
  4th Silage
- Only record the actual measured weights, either under or over the called amount, on all ingredients. If the ration calls for 350 kg of hay, but you actually add 365 kg, record the actual measured weight of 365 kg. Sufficient training time must be allowed to cover these important points in detail for all new drivers. Again, improved feed inventory control and cattle management result when this policy is followed. Whenever in doubt on how to proceed if more than a 5% weight variance results, contact a consulting nutritionist. Common remedies in this event include adjusting the load size, switching to another ration or even off-loading a portion of an ingredients by hand. Regardless, always be truthful, and report weight errors to the management.
- Following the addition of the last ingredient to the box mixer, allow for the specified mixing time to lapse before proceeding to the designated pen. Use of watches with second hands or timers are recommended for this purpose.
- Proceed to the designated pen, stop and DOUBLE CHECK to confirm that this is where the present load is to be delivered. Whenever the incorrect ration is fed to a pen of cattle, immediately inform the supervisor or the yard manager, and then proceed to remove the feed from the bunk. Like every aspect of cattle feeding, errors such as improper feeding, mixing or recording can be expressed by cattle in any combination of digestive upsets, over or under aggressive eating habits, or ultimately diminished performance and reduced potential profits.

Remembering these few simple details of accuracy in producing TMR, will go a long way to allow delivery of safe and consistent rations to cattle when combined with other proven management routines, such as proper bunk management.

B. WATER MANAGEMENT

- Not to be overlooked in proper feedbunk management is the water trough, the source of the least expensive non-energy-yielding nutrient. Three factors of major importance have been identified to adequately provide water to feedlot cattle[5]:
  (1) Water quality and quantity.
  (2) Trough space allowance.
  (3) Trough cleanliness.

- Water samples should be analyzed routinely for impurities and mineral status which may adversely influence feed intake and animal performance. To ensure adequate water intake under all conditions, sufficient water trough space must always be provided. Generally 1.2 inches of linear trough space is recommended per head assigned to each pen. A typical 125 head capacity pen should provide at least 150 inches (1.2 inches x 125 head = 150 inches) or 12.5 feet of linear trough space. The most desirable water trough location is within the front third and center of each pen.

- Water troughs in pens with newly arrived cattle and in the hospital areas should be cleaned daily to ensure adequate water consumption. Daily inspection of troughs is suggested to ensure that the heaters and water flow valves are functioning properly.

- Electrical problems in the form of stray current can occur with watering units and cause low level shocks to cattle. It is important to watch to see that the cattle are drinking and not shying away from the water. Repair the water tank immediately if problems arise.

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE AND SOLUTION:

PROBLEM: A large amount of feed in the bunk during morning call. Upon further examination, animals are not drinking from the water tank and are wandering the pen.

SOLUTION: Since water is one of the single most important nutrients to sustain life, water tanks need to be inspected for cleanliness and proper maintenance. If there is water in the tank, ensure that it is chemical free and free from stray voltage.

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 8

EQUIPMENT MANAGEMENT

EQUIPMENT MANAGEMENT PROCEDURES

Most feed handling and processing systems are heavily dependent upon machinery and mechanical means. Whenever mechanics are involved, regular and particular maintenance programs are necessary and can directly influence feed quality and safety. Described in the first section of this chapter are practices to ensure that all feed equipment related to storage, processing, loading, mixing and delivery of quality feed to the feedbunk is maintained, calibrated and labelled for proper functioning. This preventive maintenance program should ensure the longevity of equipment and alleviate feed contamination possibilities.

Benefits of proper feeding equipment management:

- Ensures correct processing of feedstuffs to meet required ration formulations.
- Increased longevity of feeding equipment.
- Prevention of feed contamination.
- Prevention of injury to feeding crew and cattle.

Equipment Management Practices:

Key Concepts:

✞feeding related equipment; ✞feed inspection and testing equipment; ✞maintenance and calibration schedules; ✞equipment checklist and records.

- All relevant equipment used for feed preparation should be listed on the *Equipment Maintenance and Calibration Chart* (Table 11). Equipment details such as:
  - capacity,
  - proper usage,
  - service maintenance schedules,
  - permitted tolerances and, where applicable,
  - frequency of external and internal calibration,

  should be recorded and made available to all appropriate employees.

- When feasible, each item of equipment should be labelled with the date of the last external service maintenance along with the anticipated date of the next required servicing. Equipment should not be used after the external service due date elapses.

- Regular maintenance and equipment inspection will alleviate the incidence of leaks such as motor coolant, oil, etc., that may get mixed in and cause contamination of feeds.

Equipment Management Practices (Cont'd):

4 Records of internal maintenance procedures, along with internal and external servicing are to be kept by assigned personnel. Internal maintenance check-ups are to be performed by equipment operators or other assigned personnel prior to the use of the equipment as designated in Table 13. Service maintenance check-ups should be conducted following manufacturer's instructions. Results of each service maintenance review are to be recorded in the corresponding *Equipment Calibration Chart* (Table 12), by the equipment operator. The equipment operator should either approve equipment for use or reject it if problems are detected. Corrective action with corresponding dates should be noted.

The remaining portion of this section deals with equipment used in the inspection and testing of feeds and the testing and calibration of all feedlot equipment. The objective is to ensure that all inspection and testing of equipment is maintained, calibrated and labelled for safe and proper functioning.

4 All relevant equipment used in the feedlot for inspection, testing and calibration of measuring equipment should be listed in the form outlined in Table 11. Detail equipment capacity, proper usage, permitted tolerances, maintenance schedules and frequency of internal and external calibrations by the designated feedlot employee. Where feasible, each item of equipment should be labelled with the date of the last external calibration and the service performed along with the anticipated date of the next required service. Equipment is not to be used after the due date for servicing when the calibration has expired.

4 Records of calibration procedures, internal and external calibrations and servicing are to be maintained in the *Inspection and Test Equipment File* by assigned feedlot personnel. Internal calibration check-ups are to be performed by the equipment operator as indicated on the *Equipment Maintenance and Calibration Chart* (Table 11) prior to the use of testing and inspection equipment. Calibration check-ups are to be conducted following the methods listed with corresponding instructions where equipment is to be used. Scale tolerances are derived by dividing the scale capacity by 3000 to obtain the minimum graduation. The weight tolerance allowed is within plus or minus 1.5 graduations of the full load of reference weights. Results of each calibration check-up are to be recorded in the corresponding *Equipment Calibration Chart* (Table 12).

FEED QUALITY PRODUCTION PRACTICE PROBLEM EXAMPLE AND SOLUTION:

PROBLEM: Spots of oil are noticed on the feedbunk during bunk reading.

SOLUTION: Check feeding equipment for the possible need of maintenance.

EQUIPMENT MAINTENANCE AND CALIBRATION CHART (TABLE 11)

Equipment	Proper Use	Capacity	Tolerance	Internal calibration		External calibration		Internal maintenance		External maintenance	
Name & ID			(+ or -)	frequency	Responsible employee	frequency	Responsible employee	frequency	Responsible employee	frequency	employee
					Operator						
Scale		60 MT	(+ or -)	Daily	Operator	6 months					
			30kg/load								
Feed truck				Daily	Driver			Daily	Driver	10,000 k	
Front end		N/A	N/A								
loaders											
Tub grinder		N/A	N/A								
Moisture				Weekly							
meter											
Condrometer				Weekly							
Forced air				N/A							
oven											
Roller mill				Daily							
Steam boiler											
Tempering											
system											
other items											

Approved by:_____

Date:

EQUIPMENT CALIBRATION CHART (TABLE 12)

Equipment: _____

Reference Item: _____

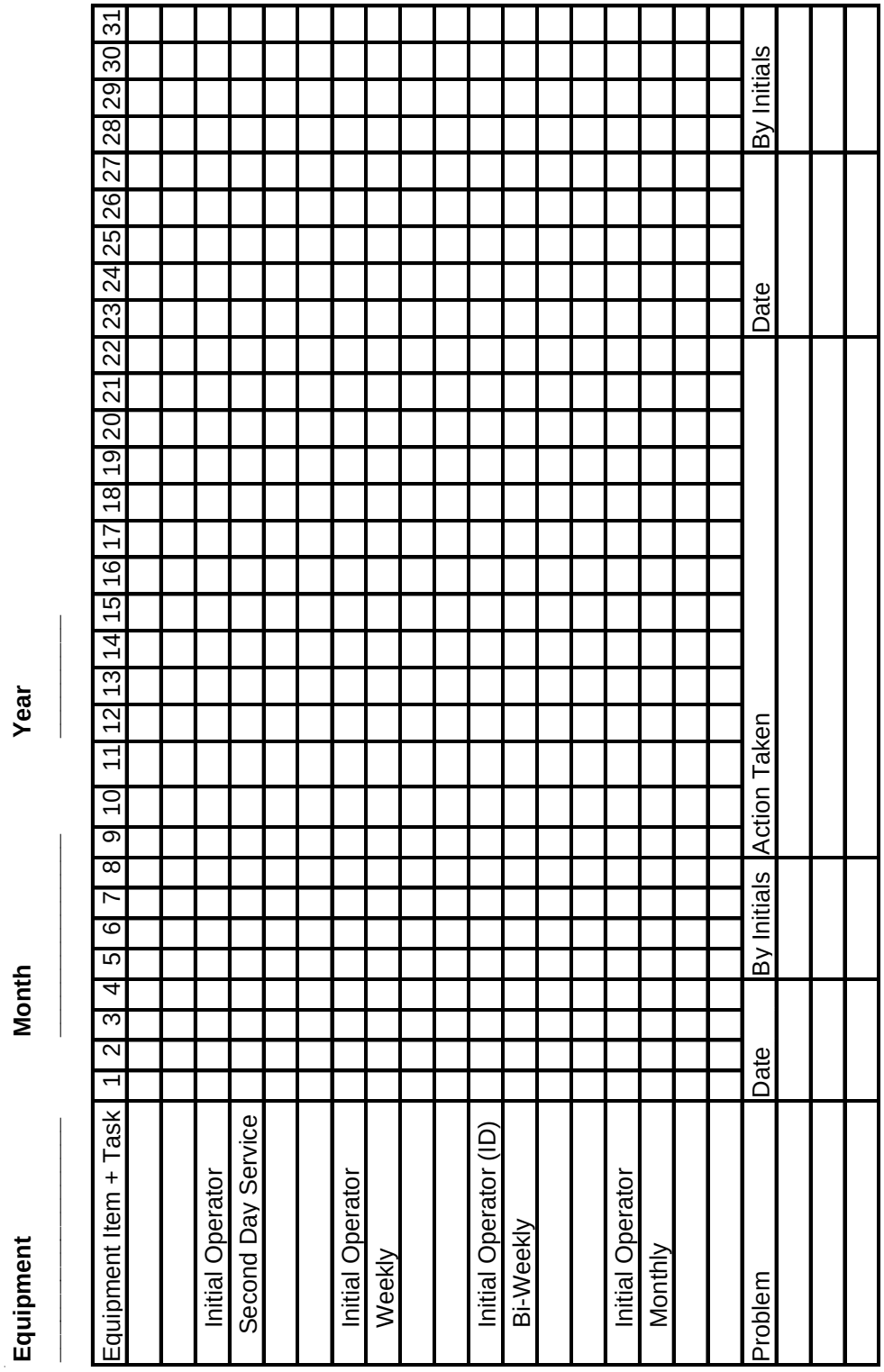
Task Instruction: _____

Tolerance Accepted: _____

Frequency of Check-ups: _____

Check Date	Measure Expected	Measure Obtained	Difference (+) or (-)	Approved Yes or No	Correction, action/date	Initialed by:

SERVICE MAINTENANCE CHECKLIST (TABLE 13)



SECTION 9

GLOSSARY OF COMMON TERMS USED IN FEED MANAGEMENT

GLOSSARY OF COMMON TERMS USED IN FEED MANAGEMENT

Acid Detergent Fiber - Boiling with an acid detergent hydrolyzes the hemicellulose that is free and when is combined with lignin, leaving behind the cellulose and lignin.

Acidosis - Higher than normal acid conditions of the rumen (lower pH). Acute metabolic condition caused by life-threatening sudden engorgement of grain or other easily fermentable substances by cattle not accustomed to such amounts of these feeds.

Additive - Micronutrient, drug or medication added to other ration ingredients to fulfill specific requirements of cattle.

Aerial Portion - The above ground portion of a plant.

Anaerobic - An organism living in the absence of air or molecular oxygen, such those bacteria which produce organic acids in silage or reside in the reticulo-rumen of cattle.

As-fed - Descriptive term denoting the dry matter content of feeds when they were fed to cattle.

Average Daily Gain - ADG, daily net liveweight gain calculated from pay-weight to pay-weight.

Balanced Ration - A diet or ration possessing known required nutrients in proper quantities for the normal physiological functions of an animal.

Bovine - Refers to species of cattle.

Brix - Originally used to describe molasses sucrose content when each 1% sucrose equaled one Brix. Today specific gravity of molasses is used to closely approximate Brix content.

Chemicals - Substances applied to crops or feedstuffs such as pesticides, herbicides, surfactants or preservatives; substances applied to or fed to cattle such as ionophores, dips, sprays and medications. Most have strict application limits; all should be used in accordance with the recommendations of the manufacturer. All unused portions must be properly disposed.

Cleaned Grain - Grain subjected to scalping, aspiration, magnet or other techniques to remove foreign materials which may be either injurious to cattle or have no nutritional value, i.e. nails, rocks, dirt, etc.

GLOSSARY OF COMMON TERMS USED IN FEED MANAGEMENT (CONT'D)

Concentrate - Feedstuffs with less than 20% crude protein and less than 20% fat. Considered a concentrated source of energy such as grains and molasses.

Condrometer - Device used to determine bushel weight of feed grains expressed in kg/hL or lb/bu.

Cooked - Feedstuffs heated in presence of moisture to alter chemical and/or physical characteristics to aid in digestive processes.

Cooled - Temperature of feedstuffs reduced by air movement, often associated with drying.

Cracked - Kernel of dry grain reduced into coarse size particles by breaking and crushing action of roller mill.

Crimped - Kernel of grain rolled by use of corrugated rollers often proceeded by tempering or cooking.

Crude Fat - A feedstuff component soluble in ether or alcohol; insoluble in water. Referred to as 'ether extract'. Recognized as processing 2.25 times more feed energy than concentrates.

Crude Fiber - Feedstuff component represented by the relatively less digestible structural plant carbohydrates of lignin, cellulose and hemicellulose as compared to the rapidly digestible carbohydrates of starch.

Crude Protein - Nitrogen of feedstuff proteins x 6.25, derived from the fact that wheat protein contained about 16% nitrogen on average (100 divided by 16 = 6.25).

Days-on-Feed - Interval cattle are fed expressed in days. A calf that arrived in a feedlot on July 1 and departed July 31 of the same year represents 30 days on feed. (Not 31 days, as the first and last days are only fractions of a day).

Dehulled - Removal of outer covering of grains or other seeds.

Dry Matter - The weight of a sample remaining after subjected to a standardized procedure of drying removing all moisture (water). All nutrients are contained in the remaining dry matter.

GLOSSARY OF COMMON TERMS USED IN FEED MANAGEMENT (CONT'D)

Energy - Feed energy is the major nutrient (in quantity) present in feedlot rations. All nutrients, except water and minerals, yield energy following digestion, adsorption and metabolism by cattle. Feed energy is measured in various units with Total Digestible Nutrients (TDN), Net Energy for maintenance (NEm) and Net Energy for gain (NEg) most commonly used for beef cattle.

Extracted - The process of removing fats and oils (lipids) from oil seeds such as flax and canola with solvents and pressure. Hulls and meals remain as primary products after lipids are extracted.

Fatty Acid - A specific group of lipids characterized by a relatively long carbon chain with one or more carboxyl groups. Fatty acids such as acetic and butyric acids result from the fermentive digestion processes of microbes in the reticulo-rumen of cattle.

Feed Conversion - The quantity of feed dry matter required to produce one unit (pound or kilogram) of net liveweight gain in cattle.

Feed Mark-up - A per tonne charge assigned to the feed to cover feedlot operational cost and services that are provided to cattle and clients of commercial feedlots.

Flakes - Kernels of grain steam conditioned prior to extensive rolling to result in thin flat particles.

Flushing - Passing of a substance through equipment to clean out a previous substance.

Forage - Crops and range grasses used as pasture, hay, haylage, silage, or green chop for cattle feed.

Foreign Matter - Any substance not specified as part of the primary product, such as the presence of rocks in grain.

Gelatinisation - Disruption of the integrity of starch molecules common to the process of steam flaking of grains to enhance digestibility.

Groat - Grain from which the seed coat or hull has been removed, such as oat groats.

Ground - Reduction of grain or forage into smaller particles by impact, shearing or attrition.

GLOSSARY OF COMMON TERMS USED IN FEED MANAGEMENT (CONT'D)

Haylage - Medium moisture silage of 40 to 60% moisture conserved by controlled fermentation in near anaerobic (oxygen limited) conditions.

Head Days - The number of days represented by a lot of cattle on-feed. Calculated by multiplying days on feed by number of head represented.

Hulls - Outer protective covering of grain or other seeds.

Ingredient - Term used to describe individual feedstuffs and other constituents of a ration.

Metabolic Heat - The heat produced by the body of cattle as metabolic processes proceed. This heat is potentially desirable to warm the animal in cold weather, but becomes a liability in hot weather.

Microingredients - Ingredients, such as vitamins and trace minerals, added to a ration in relatively small quantities measured in mg/kg, International units (IU), or parts per million (ppm).

Mycotoxin - Toxins produced by fungi or bacteria, sometimes present in mouldy or other out-of-condition feeds.

Neutral Detergent Fiber - Boiling the sample with neutral detergent solubilizes the cell contents and pectin leaving behind the cell-wall fraction containing cellulose, hemicellulose and lignin.

Nutrient - Anything nutritious; that which supports life functions through metabolic and physiological processes.

Pay-weight - The weight of cattle when purchased or sold. Either natural (biological) or calculated (pencil) shrinkage of 3 to 5% is commonly applied to the scale weight in calculating pay-weight.

Pellets - Feeds formed into a cylindrical shape by grinding followed by steaming and compacting while passing through die openings. Improve physical handling and mixing characteristics of many feeds.

Premix - A uniform mixture of micro-ingredients combined with a dilutent and/or carrier to facilitate uniform dispersion of micro-ingredients in feeds.

GLOSSARY OF COMMON TERMS USED IN FEED MANAGEMENT (CONT'D)

Protein - Substance composed of many amino acids, such as muscle tissue and legume seeds. Also required for growth and development of cattle. Feeds with greater than 20% crude protein is classified as protein supplements.

Quality - Attributes seen as advantageous to success such as feed quality controls.

Ration - Amount of total feed allowed per animal per day most accurately expressed in pounds of ration dry matter.

Refractometer - An instrument designed to measure refraction (bending of light rays) of liquid supplements to determine if separation of components has occurred.

Reconstitution - The process of adding water to feeds to restore them to a previous moisture level to enhance nutritional characteristics.

Reticulo-rumen - The first and second compartments of the stomach of cattle where most of the fermentative digestion takes place, allowing cattle to digest large amounts of roughage in the presence of microorganisms.

Rolled - Kernels of grain compressed between rollers reducing particle size as a means of enhancing digestibility. May be proceeded by tempering or conditioning.

Roughage - Any feedstuff with greater than 20% crude fiber such as hay, silage and grasses.

Salmonella - A pathogenic organism sometimes present in contaminated feeds.

Scalped - The process of removing large foreign objects and materials from feeds by screening.

Screened - Separation of feeds into various size portions by passing them over or through screens.

Screenings - Weed seeds, broken and undersized grain and other materials within grain which pass through screens of a specific dimension.

Silage - Aerial portion of living plants harvested, chopped and compacted into a silo as a means of preserving livestock feeds dating from Egyptian times.

GLOSSARY OF COMMON TERMS USED IN FEED MANAGEMENT (CONT'D)

Starch - Combination of complex sugar molecules common to grains, which provide readily fermentable energy to cattle upon digestion.

Steady-State - Refers to the consistency of feed and feeding conditions.

Steamed - Grains treated with steam while passing through a chamber to enhance their nutritional characteristics.

Supplement - Any feed or combination of feeds to improve the nutritional characteristics of the primary diet or feedstuffs.

Tempered - Grains exposed to water by mixing and soaking for short intervals of time prior to rolling or grinding to enhance nutritional characteristics of the grain.

Test Weight - Commercial grain industry measure of density (purity) of grains expressed as kg/hL or lb/bu as measured with an approved condrometer.

TFM - Total Fatty Matter.

TMR - Total Mixed Ration.

Trace Minerals - Minerals required by cattle in minute or micro quantities measured in mg/kg or smaller units.

Trash - Straw, chaff, leaves etc. retained on a specified screen when screening grain, expressed as a percentage by volume.

Unsaponifiable Matter - Either soluble material extractable after complete reaction with strong alkali.

Vitamin - A vital nutrient. Organic compounds that function as part of biological enzyme systems essential to normal metabolic subcellular functioning of cattle, especially energy transformation and metabolic regulations.

Weevily - Presence of insect damage to the feedstuff.

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 10

REFERENCES

REFERENCE CITED AND REFERENCE LIST

In order to achieve the objectives of this document, numerous technical and industry documents have been drawn upon. When possible these sources of information have been cited as footnotes or references to further assist the reader in developing a system of controlling feed quality unique to the needs of a specific feedlot. Dr. Schake's cattle feeding experiences from around the world have served as the base for transforming technical data and concepts into functional and practical working realities for the cattle feeding industry of Canada.

REFERENCES CITED:

1. Schake, L. M., F. M. Byers and K. L. Bull. 1982. Energy and economic evaluation for corn and grain sorghum processing for cattle. Energy in Agriculture 1:185-195.

2. Richardson, C. R. 1996. Cattle Feeding: A guide to management. 2nd Ed. Chapter 12, p.129 - 144. Albin and Thompson, Editors. Trafton Printing, Inc., Amarillo, TX.

3. Schake, L. M., S. J. Bartle and W. L. Mies. 1993. Performance of cattle fed in commercial feedlots, 1980 to 1990. Department of Animal Science and Food Technology Research Report, Texas Tech University, Lubbock, p. 120 - 124.

4. Schake, L. S. and C. Heddins. 1995 (April). Directions to the bunk reader. Cattlemen, p. 40.

5. Horton, J. M. 1996. Cattle Feeding: A guide to management. 2nd Ed. Chapter 13, p. 145 - 157. Albin and Thompson, Editors. Trafton Printing, Inc., Amarillo, TX.

6. Schake, L. S., W. L. Mies, N. K. Chirase and L. M. Schake. 1995. Estimates of economic, biological and cultural energy efficiencies in lean beef production. Department of Animal Science and Food Technology Research Report, Texas Tech University, Lubbock, p.49 - 51.

REFERENCE LIST:

ACFA (Alberta Cattle Feeders' Association). (1997). *Beef Quality Improvement Recommended Operating Procedures for Feedlot Animal Health*.

Bechtol, D. Smith, R. & Pollereisz, J. (1991). *Quality Control In Beef Starts Early, Continues Through Slaughter*. Feedstuffs article.

Broyles, R. (1995). *Preparing For Conducting and Reacting To Feed Mill Inspections*. 1995 Feed Additives Compendium.

CCA (Canadian Cattlemen's Association). (1997). *Good Production Practices for Feedlots*.

Canadian Federation of Agriculture. (n/d). *On Farm Food Safety Practices.*

Pioneer. (1999). *Managing Molds for Lowest Impact*. The Forage Innovator (March, Vol. 1, No.2).

Golla, S. (n/d). *Pre-Harvest Food Safety Model: HACCFP in Beef Cattle Production*. Department of Animal Science, Texas A&M University.

Griffin, Dr. D. (1997). NC-BQA Cow-Calf Checklist. University of Nebraska, Great Plains Veterinary Educational Center.

Jones, F. (1995). *Mixing Feeds and Mixer Test Procedures for Batch Mixers.* 1995 Feed Additives Compendium.

Pritchard, Dr. R. (n/d). *Bunk Management Influences on Production Efficiencies*. South Dakota State University.

Pritchard, Dr. R. (1995). *Limit Feeding in Beef Feedlots*. South Dakota State University.

Sellers, R. (1995). *Current Good Manufacturing Practice Regulations for Medicated Feeds*. 1995 Feed Additive Compendium.

Sellers, R. (1995). *Current Good Management Practice Regulations for Type A Articles*. 1995 Feed Additive Compendium.

Southwest Scale of Grain Premiums and Discounts. (1978)

Stanton, Tim. (1996). *Feedbunk Management Presentation Notes*.

TCFA (Texas Cattle Feeders Association. (n/d). TCFA Beef Quality Assurance Handbook.

THIS PAGE INTENTIONALLY LEFT BLANK.

SECTION 11

ACKNOWLEDGMENTS

ACKNOWLEDGMENTS

Appreciation is expressed to the many individuals who assisted in the preparation of this document. The contributions of Dr. Lowell M. Schake are acknowledged with thanks. He was instrumental in assisting with drafting and editing this manuscript. His insights gained from 50 years of cattle feeding industry activity were invaluable to this effort. Appreciation also is expressed to my many colleagues in Nutrition Service Associates of Hereford, Texas and Greeley, Colorado, the Alberta Cattle Feeders Association, the Canadian Cattlemen's Association, Joyce Van Donkersgoed, DVM, Neil G. Miller, P.Ag. AAF&RD, Raylene Coggette, United Feeds, Nick Van Geest, DVM (vet script), J.F. Burlett, DVM and all others that have reviewed this document.

About the authors . . .

L. Scott Schake, Ph.D.

L. Scott Schake, Ph. D. is a nutritionist with Nutrition Service Associates-Canada of Okotoks, Alberta since 1995. He has life long experiences within the livestock feeding industry. His Masters degree incorporated an internship with emphasis upon feedmilling with Tyson Foods of Springdale, Arkansas. His Ph.D. research was conducted in the heart of North America's cattle feeding industry near Amarillo, Texas. Today he consults with numerous feedlots and related industries in Western Canada. Scott earned his Ph.D. degree in Beef Cattle Nutrition and Management at Texas A&M University, College Station, Texas and has he had many commercial beef cattle industry experiences plus research and publications. He holds professional memberships in the American Society of Animal Science, is a certified Professional Animal Scientist in the American Registry of Professional Animal Scientists and a full member of the Plains Nutrition Council.

Joyce Crandall, MSW

Joyce Crandall holds a Masters degree in Social Services Management (1992) from the University of Calgary. Her work for 15 years in the public service areas of Alberta Social Services and Health, were primarily in the area of supervisory and management. During this time, Joyce participated in two human health care facility accreditation survey reviews. This direct experience provided an understanding of the Total Quality Management process for organizations. Joyce, along with her husband Miles, owns and operates a 20,000 head backgrounding feedlot in the Ponoka area. Over the past three years, Joyce has worked with the CCA and the ACFA to develop BQI programs for the beef industry. The most recent was the completion of the BQI manual of *Recommended Operating Procedures for Feedlot Animal Health*, written in conjunction with Dr. J. Van Donkersgoed and under the auspices of the ACFA and the CCA.

SECTION 12

APPENDICES

APPENDIX 1

CROP PROTECTION 1999

WEED IDENTIFICATION IN ALBERTA (AAF&RD)

CROP PROTECTION 1999
Herbicides Insecticides Fungicides Rodenticides

Alberta Agriculture, Food and Rural Development
(AGDEX 606-1)

Contact:
Alberta Agriculture, Food and Rural Development
Publications Offce
7000 - 113 Street
Edmonton, AB T6H 5T6
Phone: (780) 427-0391 FAX: (780) 422-8835
Toll Free in Canada only: 1-800-292-5697

WEED IDENTIFICATION IN ALBERTA

A booklet developed by Telus (Alberta Environmental Protection, Ducks Unlimited & Agriculture Industry Fieldmen) through contributions by Debbie Bigelow, Dr. B. Vanden Born, and Dr. S. Bayley

This booklet can be obtained through any Alberta County Municipal offices, or by contacting:

Alberta Environment, Information Centre
Main Floor, 9920 - 108 Street
Edmonton, Alberta T5K 2M4
Phone: (780) 422-2079 FAX: (780) 427-4407

APPENDIX 2

HERBICIDES WITH GRAZING AND FEEDING RESTRICTIONS 1999

This list may be incomplete. Always read and follow label instructions.

Notes:
* Besides the label, current information is available in the yearly updated Alberta Agriculture, Food and Rural Development's "**Crop Protection 1999**" book (the blue book).
Complete grazing and feeding restriction information is also available on the AAFRD Internet site at "The Herbicide Selector" http://www.agric.gov.ab.ca/agpesticide.html

Accent	Dyvel DS	Platinum
Accord	Edge DC	Poast Ultra
Achieve	Embutox, Calibre,	Poast FlaxMax
Advance 10G	Eptam	Prestige
Ally	Estaprop	Princep Nine-T
Amber	Express Pack	Primextra Light
Amitrol - T	Fortress	Prevail
Assert 300-SC	Fusion	Puma
AssureII	Gramoxone	Puma Super
Atrazine	Harmony Total	Pursuit
Attain	Heritage	Refine Extra
Avadex BW	Hoe-Grass	Reglone A
Avenge 200C	Hoe-Grass II	Rival
Banvel/Banvel H	Horizon	Roundup, Laredo,
Basagran	Kerb 50W	Wrangler, Victor
Bladex	Laser DF	Rustler
Bonanza	Lexone	Select
Buctril M	Liberty	Sencor
Casoran	Linuron	Stampede EDF
Champion Extra	Lorox	Target
Champion Plus	MCPA	Thumper
Cobutox, 2,4-DB	Matavan L	Touchdown
Compitox	Mecoprop	Treflan
Crossfire	Muster	Triumph Plus
Curtail M	Muster Gold	Tropotox Plus
2,4-D	Muster Gold II	Unity
Diphenoprop	Odyssey	Velpar
Dual	Pardner	Venture
Dyvel	Pea Pack *200	Weedone CB

Prepared by:
Neil G. Miller P.Ag.
Crop Specialist, Pulse and Special Crops
Alberta Agriculture, Food and Rural Development
Lacombe AB

APPENDIX 3

BARLEY SILAGE CONTRACT EXAMPLE

Example Contract for Barley Silage with Manure Credits

This agreement made_____(month and day) of 20__, between **FEEDLOT Ltd**. of Alberta, Canada **(BUYER**) and_____of_____,Alberta, Canada **(SELLER**) shall comply with the following terms:

1. Seller agrees to plant, fertilize and care for_____acres of barley located on the following described tract(s) of land _____.

2. Seller shall plant a variety of seed barley approved by both Buyer and Seller as stipulated herein; variety_____.

3. Seller agrees to plant, fertilize and care for crop in a manner that will allow for good growth. Barley should be planted at such time as to facilitate prompt delivery to FEEDLOT Ltd. within the desired time range of_____(month and date) of __.

4. Seller agrees that all barley silage shall be of good quality as stipulated for Cereal Silage in **Controlling Feed Quality, 1999,** being free of toxic weeds, foreign crops, damage by insects, water or from other sources. Seller agrees not to apply, or otherwise mismanage, any chemicals or herbicides to the barley crop that would render it unsuitable for use as livestock feed. Buyer has the right to inspect the growing crop at their discretion.

5. Buyer agrees to purchase from Seller all contracted acres of barley silage delivered to FEEDLOT, Ltd. silo(s) for $____per tonne for the first window period ending_____(month and day), ____, and ____ $ per tonne for the second window ending on _____(month and day), ____. Buyer has right of refusal on any silage not meeting requirements or not delivered by expiration of second window period. Initial weight of silage will be based on weights as measured across certified FEEDLOT, Ltd. scales.

6. Moisture of barley silage shall be determined by Buyer with sampling and testing performed at FEEDLOT, Ltd. in accordance with sampling and moisture determination protocols, and with pricing based upon grain content, both presented in **Controlling Feed Quality, 1999.** Should additional testing be performed by a certified laboratory, Buyer and Seller shall split cost evenly. If analytical variations of 1% or greater occur, laboratory results will take precedence.

7. All silage purchases are based upon 60% moisture (40% dry matter). Weight adjustments will be made daily to account for moisture changes. Assume a 30,000 pound silage delivery arrives at 64% moisture, the pay weight becomes 27,000 pounds or 0.90 (36% dry matter divided by 40% dry matter) X 30,000 pounds. Buyer has right of refusal of any silage over 70% or under 55% moisture.

8. Seller agrees to deliver silage to FEEDLOT Ltd. free and clear of all liens or encumbrances. Exceptions must be divulged by Seller prior to entering into this contract.

9. Seller acknowledges that Buyer is not responsible for harvesting, freight, or any other cost or liabilities associated with the production, harvest or delivery of this crop.

10. If so initialed by both Buyer and Seller, Seller will be eligible for a $1.00 per tonne rebate for each tonne of manure hauled from buyers pens for every tonne of silage purchased by Buyer. Manure should not be hauled in the same trucks as the silage due to contamination. BUYER____ SELLER___.

11. Buyer will pay Seller in full for total adjusted tonnage of silage delivered to FEEDLOT, Ltd. upon completion of harvest. Should Seller desire to receive delayed payment, the Buyer will pay interest on the amount due based upon the prime interest rate at time of completion of contract.

12. This contract may only be cancelled due to acts of God, or by mutual or written agreement of both parties.

SELLER: Name:_____ Address:_____

Signature:_____

BUYER: Name_____ Address:_____

Signature:_____

APPENDIX 4

FEEDSTUFF PURCHASE ORDER FORM EXAMPLE

Feedlot Name/Address: _____

Supplier Name/Address: _____

Date of Order:_____ Proposed Date of Delivery:_____

Product Name/Description:_____

Quantity Required:_____

Shipper Name/Address:_____

Delivery Instructions: _____

Supplier Receiving Standards (ingredient description(s)): _____

Bid/Payment Terms:_____

Feedlot Receiving Verification Information (receiver use only):

Date Received/subsequent deliveries:_____

Delivery Inspection/Results:_____

Weights obtained upon delivery: yes____ no ____

Weigh Slips supplied by shipper/supplier: yes____ no ____

Invoice/Statement #:_____

Notations:_____

APPENDIX 5

GOOD MANFACTURING PRACTICES FOR THE CANADIAN FEED INDUSTRY

1997

Animal Nutrition Association of Canada
(formerly Canadian Feed Industry Association)

Contact:
Animal Nutrition Association of Canada
325 Dalhousie Street
Suite 625
Ottawa, Ontario K1N 7G2
Fax: (613) 241-7970

APPENDIX 6

COMPENDIUM OF MEDICATING INGREDIENT BROCHURES (CMIB)

The Compendium of Medicating Ingredient Brochures (CMIB) is a listing of those medicating ingredients that are permitted by Canadian regulation to be added to livestock feed. This document specifies the species of livestock, the level of medication, the directions for feeding and the purpose for which each medicating ingredient may legally be used as well as the brand of each medicating ingredient that is approved for use in Canada. All medicated feed manufactured, used, or sold in Canada must be prepared in such a way as to adhere to the specifications of the CMIB, in order to comply with the Feeds Regulations. The sole exception is feeds prepared according to a veterinarian's prescription.

The 8th edition of the CMIB is available from the Canada Communication Group Inc. (CCGI). Orders can be placed by mail, phone, facsimile or by e-mail at the following:

Mail: Canada Communications Group Inc.
Distribution Logistics Service
45 Sacré-Coeur Blvd., Rm B1001
Hull, Quebec, Canada K1A 0S9
Phone: 1-888-562-5561 Fax: 1-819-779-2833

e-mail: Disorderdesk@ccgsjc.com

The prices for the CMIB are as follows:

Hard copy	$29.95 each (excludes applicable taxes)
Diskette copy	$19.95 (excludes applicable taxes)
CD-ROM copy	$49.95 (excludes applicable taxes)

Payment must be made in advance using cheque, money order, VISA, or MASTERCARD. Cheques and money orders are to be made payable to Canada Communications Group Inc.

For orders from outside Canada, prices are in U.S. currency.

A standing order service is available for periodic updates to the CMIB. Please ensure to request this service should it be desired. The 8th edition of the CMIB is also available on the World Wide Web in download format only at the following addresses:

http://www.cfia-acia.agr.ca/english/animal/feeds/feede.html
http://www.cfia-acia-agr.ca/francais/animal/feeds/feedf.html

For additional information, please contact:
Feeds Section, Animal Health & Production Division
Canadian Food Inspection Agency
59 Camelot Drive
Nepean, Ontario, Canada K1A 0Y9
Phone: 613-225-2342 Fax: 613-228-6614

APPENDIX 7

MEDICINE REFERENCE FOR BEEF PRODUCERS

Canadian Cattlemen
Quality Starts Here

Medicine Reference for Beef Producers

Funded in part

Canada
Agriculture and Agri-Food Canada / Agriculture et Agroalimentaire Canada

February 2000

Contact:
Canadian Cattlemen's Association
215, 6715 - 8th Street NE
Calgary, Alberta T2E 7H7
Phone: (403) 275-8558 Fax: (403) 274-5686

APPENDIX 8

FEED PRESCRIPTION

Owner_____ Address_____
Veterinarian_____ Address_____
Type of cattle_____ Sex_____ Age_____ Breed_____
No. animals_____ Weight_____
Type of Feed_____ Amount_____

Generic Name of Active Ingredients	Trade Name	grams of Active Ingredient	grams of Product
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

Mixing Directions_____
Feeding Instructions_____
Cautions_____
Warnings_____
Manufacturing Instructions_____
Repeat: Once____ Twice____ or _____ times
Date_____ Signed: _____ DVM
Owner/Veterinarians Signature_____
_____

Prescription feeds are medicated feeds that are manufactured according to a written prescription by a licensed veterinarian. Veterinarians may prescribe levels or combinations of medications different from those approved in the Compendium of Medicating Ingredient Brochures. This should only be for a limited period in the treatment of specific, diagnosed disease conditions. The general standards in the feed regulations must still be met, and the withdrawal period stated on the prescription must prevent harmful residues.

The Feeds Regulations require that the veterinary feed prescription contain the following information: 1) date on which prescription was written, 2) name and address of person for whom the feed is to be mixed and intended for use, 3) name and level of medicating ingredient(s), 4) name and amount of medicated feed, 5) number, kind, class, age or weight of livestock to be fed, 6) special manufacturing instructions, if any, 7) feeding directions, including period of time medicated feed is to be used, 8) necessary warning and caution statements, 9) signature of veterinarian, and 10) a statement signed by the person receiving and using the medicated feed indicating that they understand the instructions (if the veterinarian issues the prescription directly to the feed manufacturer and is satisfied that the producer is knowledgeable about the instructions, this statement is not necessary. [Reference: Compendium of Veterinary Products]