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FEEDLOT ACTIVITY PLAN

Mohalabiya Beef Cattle Feedlot

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Executive Summary

USAID-*Inma* Agribusiness Program supports the Livestock-Protein Value Chain by working with livestock producers, in this case with ten feedlots, providing them with targeted technical assistance to increase productivity, to lower production and marketing costs, to increase profitability and to generate rural employment. This Feedlot Activity Plan, one in a series of ten, each directed to an individual feedlot, addresses specific problems and issues faced by one particular feedlot and at the same time provides a general handbook of best practices for feedlot management. This Feedlot Activity Plan is written for the Mohalabiya Beef Cattle Feedlot. Thus the information contained in this report is limited to cattle feeding. Other reports directed to sheep feedlots or mixed feedlots will address sheep feeding.

This report highlights the strengths of Mohalabiya Beef Cattle Feedlot as well as makes recommendations for improvements that will reduce costs, improve the efficiency of the operation, lead to healthier cattle and if carefully followed should lead Mohaliya Beef Cattle Feedlot to become a profitable and sustainable enterprise.

Background

A feedlot is a type of animal feeding operation, usually confined feeding in arranged pens, which is used in finishing (fattening) livestock, usually beef cattle and sheep prior to slaughter. Feedlots may contain thousands of livestock or may consist of just a few head. Prior to entering a feedlot, cattle and lambs spend most of their life grazing on rangeland or on irrigated pasture. Once cattle and lambs obtain an entry-level weight, about 200 kg (cattle) and 20 kg (lambs) in Iraq, they are transferred to a feedlot to be fed a nutritionally balanced and specialized diet. In Iraq the primary feed used in the USAID-*Inma* sponsored feedlots include alfalfa hay, barley, corn, wheat, wheat bran, soybean meal, cottonseed meal, vitamin/mineral supplements, and salt. Feedlot diets are usually very dense in food energy, to encourage the deposition of fat, or marbling, in the animals' muscle. The ultimate aim of the finishing process is to produce livestock that will best answer the requirements and desires of the consumer. This is accomplished through an improvement in the flavor, tenderness, and quality of the lean meat which results from marbling (intramuscular fat). In Iraq, cattle will usually gain an additional 200 kg and lambs an additional 40 kg during their time in the feedlot. Once cattle and lambs are fattened up to their finished weight, they are then sold to either local butchers or transported to a slaughterhouse where they are harvested and sold for consumption.

In late 2009 and early 2010 ten feedlots throughout Iraq finished construction and began feeding and finishing livestock. There are six located in northern Iraq (four in Ninawa Province, one in Dahuk Province, and one in Kirkuk Province). The remaining four are located in the provinces of Baghdad, Wasit, Anbar, and Babil. In the beginning, when the feedlots began operation, the following were designated as beef cattle feedlots: Bartella in Ninawa; Al-Qosh in Ninawa; Al-Juburi in Kirkuk; Blann in Dahuk; Al Fallah in Ninawa; Goba in Ninawa, and Fallujah in Anbar. The remaining feedlots of Taji in Baghdad; "Hawks of Iraq" in Babil; Saweera in Wasit were designated as sheep only feedlots. At the current time three of the feedlots have expressed interest in feeding a combination of both beef cattle and lambs. Those pursuing feeding both beef cattle and lambs include: Al-Qosh, Blann, and "Hawks of Iraq".

Some goals set forth for the feedlots by the USAID-*Inma* Agribusiness Program include: greater profitability due to better health; nutrition; animal and market management; increased investment in red meat value chain through the development and linkages with new enterprises; increased number of confined feeding operations, which will begin using USAID-*Inma* technical information in the development of various profitable enterprises; establish relationships between feedlots and meat processors; and establish relationships between feedlots and feed laboratories (USAID-*Inma* Annual Work Plan, 2010). The two major goals of the USAID-*Inma* Livestock Technical Team is for USAID-*Inma* sponsored feedlots to be at maximum livestock capacity to ensure full profit potential and for Iraq to increase self-sustainability in red meat production.

Note to Mohalabiya Beef Cattle Feedlot

Now is an exciting time to be part of the livestock industry in Iraq. As an USAID-*Inma* sponsored feedlot owner, you are a truly a pioneer in the livestock industry of Iraq in owning and operating one of only ten commercial feedlots. There is money to be made with this business venture and at the same time provide the people of Iraq with the red meat they demand. This activity plan was created to help your feedlot achieve profitability and increase

red meat production in Iraq. The plan has been developed specifically for your feedlot and addresses the issues you face. This plan will serve as a guide to help you go step by step in order to achieve success.

The first part of this report contains the results of a survey conducted of the Mohalabiya Feedlot. The second part will be the actual activity plan that will go into detail on the actual technical steps you can take in operating a successful feedlot business.

Feedlot Site Visit Summary

Due to security reasons I was unable to visit the Mohalabiya feedlot. For that reason I cannot make specific recommendations on their management and feeding programs. The manager of this feedlot did travel to Erbil and participated in our livestock nutrition training and was provided with a copy of the software. The owner of this feedlot did complete a feedlot survey that was provided to him. Selected results of this survey are listed below. This will help provide a general overview of the operation.

Selected Survey Results

Number of full-time employees: Feedlot is family owned and they employ 7 male and 2 female full time employees.

How many cattle do you feed at one time on average: 100 head

Feeding times: Twice each day at 7 AM and 4 PM

Has all the construction been completed for the feedlot and has USAID-*Inma* completed all payments: Yes

What is the average age of cattle entering the feedlot: 18 months

Average days cattle are fed until finished and what is market weight: 120 days and 300 kg

Who purchases your cattle: Butchers only

Where are your cattle purchased from: Local cattle producers

What salt and mineral supplements do you feed: Salt and a commercial multivitamin supplement are mixed with the feed ration

What form of calcium/phosphate supplementation do you provide: Dicalcium Phosphate

What diseases do your cattle suffer from most: Foot and Mouth Disease (FMD)

Protocol used when new cattle first arrive to the feedlot: Put in the isolation pen, tagged, weighed, fed a wheat straw diet, vaccinations/deworming, all data is recorded

Recommendation: The protocol is good except for the feeding of wheat straw. Please refer to Chapter 2-Receiving Cattle on how to properly feed new cattle arriving to the feedlot.

How often do you weigh (record weights) of the cattle in your feedlot: Every 10 days.

Recommendation: Start weighing your cattle every 28 days. Weighing cattle more often than once a month increases the risk of injury to the cattle and could potentially cause them to lose weight. Weighing once every 28 days is sufficient.

What are the 3 biggest problems facing your feedlot operation:
1. Feed costs are high
2. Lack of capital for purchasing cattle
3. Construction costs

Do you stock pile feed (forage and grain) when prices are low: Yes, forage and grain are purchased when prices are low and then stored in our feed warehouse.

How big of lots of cattle do you purchase at a time: 20 to 30 head at a time.

When purchasing cattle what criteria do you use: Genetics and price

Activity Plan

This Activity Plan is a step by step guide for the feedlot owner. This Activity Plan is needed as a resource for future reference. This Activity Plan will go through each phase of the feedlot process from start to finish. Each chapter of the Activity Plan provides detailed technical information that will aid the owner in their day to day operation of the feedlot. The major phases of a feedlot operation include: selecting and purchasing cattle, receiving cattle into the feedlot, purchasing feed for the animals, feeding and nutrition of the animals, feedlot animal health, and marketing fattened cattle.

Chapter 1- Purchasing Feedlot Cattle

Beef Cattle Selection

The first criteria when selecting cattle in Iraq should be health. A sick bull will not eat to its full potential and you risk the bull dying. Second, select for genetics and size. Some type of grading system is needed in order to select consistent feeder cattle. A grading system provides a common language for describing various types of cattle. In the case of feeder cattle, a grading system allows one to predict the feedlot performance and carcass characteristics of the finished cattle. I suggest you use the current United State Department of Agriculture (USDA) grading system criteria, which are based on frame size and muscle thickness (USDA, 2000) and eventually modify it to follow Iraqi cattle characteristics.

Frame (See Attachment A for illustration) Frame size is used because frame is an inherited trait that is not greatly affected by normal management practices. Larger frame cattle typically reach an equal back fat thickness at heavier weights than smaller frame cattle (please note these are the standards used in the US). In Iraq cattle normally are marketed at lighter weights than

in the US this merely serves as a guide to give you an overview of different frame size criteria that could be used. When live weights are mentioned below they are referring to the live weight when the beef animal is finished and ready for market. The beef cattle nutrition software program you were provided and trained on asks for the frame size when entering the animal information.

Large Frame: Large frame cattle are thrifty, tall and long bodied for their age. Steers would be expected to have a live weight at or exceeding 545 kg (usually .5 of an inch of external fat at the 12th rib). Heifers would be expected to have live weights at or exceeding 454 kg and external fat at the 12th rib is .5 of an inch.

Medium Frame: Medium frame cattle are thrifty and moderate in height and body length for their age. Steers would be expected to produce about .5 of an inch fat at the 12th rib and have live weights of 454 to 545 kg. Heifers would be expected to produce about .5 of an inch of fat at the 12th rib and have live weights of 385 to 454 kg.

Small Frame: Small frame cattle are thrifty but are shorter in height and body length than specified for medium frame cattle. Steers would be expected to produce about .5 of an inch fat at the 12th rib and have live weights less than 454 kg. Heifers would be expected to produce carcasses with about .5 inch of fat at the 12th rib and live weights of less than 385 kg.

Putting a Frame Grade on a Calf: The frame size portion of the grade standard must be determined by an evaluation of the animal's skeletal size in relation to its age. For example, two feeder cattle with the same height and body length but differing substantially in age would not be the same frame size. The appearance of feeder cattle can be used to estimate age. As feeder cattle mature, their ears decrease in size in relation to their heads; the muzzle becomes wider; the head becomes longer in relation to its width; and the tail increases in length and exhibits a more prominent switch (end of tail). Frame size and breed should not be automatically equated. It is very possible for the larger cattle in a small mature size breed to be as large as the smaller cattle in large mature size breed.

Muscle Thickness Scores (See Attachment B for illustration) Fat can visibly alter the perception of muscling. Therefore muscle thickness is appraised at a constant degree of fatness (slightly thin). Some feeder cattle may carry more than a thin degree of fat and should be appraised for the degree of muscling they would have possessed at a slightly thin fat cover. The four muscle thickness grades can be designated by using **Number 1**, **Number 2**, **Number 3** and **Number 4**. Thrifty refers to the apparent health of the calf, size for its age, alertness, and its estimated ability to gain weight rapidly and reach market weight quickly and efficiently.

Number 1: Number 1 muscle thickness feeder cattle typically have a high proportion of beef breeding. They must be thrifty and thick throughout. They are full in the forearm and exhibit muscularity over the back and through the loin with moderate width between the legs. Cattle can exhibit thickness with even a slightly thin covering of fat; however, cattle eligible for this grade may carry varying degrees of fat.

Number 2: Thrifty, slightly thick throughout, high proportion beef breeding and slight dairy breeding.

Number 3: Thrifty, thin through the forequarters and middle part of the rounds.

Number 4: Thrifty, less thickness than required for Number 3.

When you are doing the final overall scoring there are 13 possible grades/scores of feeder cattle:
L-1= Large Frame with moderate Muscle Thickness
L-2= Large Frame with slight Muscle Thickness
L-3= Large Frame with thin Muscle Thickness
L-4= Large Frame with less Muscle Thickness than #3

You can then use this same scoring system combination for medium and small frame cattle. The 13th score that can be used is called "Inferior". These are cattle that are in terrible body condition.

Summary

The USDA Feeder Cattle Grading System or a similar system you create yourself is a method of sorting cattle. Some type of criteria should be used for consistency. Ideally, cattle should be sorted into similar types and sizes for a uniform nutrition program for all the animals in a pen. In Iraq, sorting can best be done when purchasing the cattle. A certain amount of sorting may still need to be done when cattle arrive at the feedlot. Because of the genetic variation in cattle and the lag time associated in filling the feedlot, more than one feeding pen is recommended.

Purchase cattle that are as close to the same weight, size, and age as possible. Find a trusted source for purchasing your feedlot cattle. Purchase in large lots from the same trusted producer if possible. Find producers that have good management programs and who are serious about genetic improvement in their herds. A good feeding program will not be as effective if you are feeding genetically inferior cattle. Most feedlot owners in northern Iraq purchase cattle from Turkey in larger lots of about 100 head, but for feedlot owners in other parts of Iraq, lots of cattle ranging from 20 to 30 head are purchased until a lot size of 100 head is obtained. This usually happens within a one or two day time period. Remember that as one lot of 100 cattle is being processed into the main feedlot, another lot of 100 should be coming into the isolation pen right after them. Be sure to sanitize isolation pens and sick pens after one group of cattle leave and before another group arrives.

Cattle Transportation

The weight loss of cattle during transport is commonly called shrink. There are two types of shrink. The first type of shrink is tissue loss. The second is called exudative, which is the loss of urine and feces. Tissue loss is the loss of fluid from the cells and cattle require more time to regain this type of shrink. The following are five factors that affect the amount of shrink:

1. Distance 2. Time 3. Sex 4. Age 5. Type/Condition.

The most important factor is time spent in transportation. Truckers should deliver cattle as soon as possible. The following chart provides some estimates for shrink with respect to time (Fox et al., 1985):

Hours in a Moving truck	%Shrink	Days required to Recover Pay weight
1	2	0
2-8	4-6	4-8
8-16	6-8	8-16
16-24	8-10	16-24
24-32	10-12	24-30

Distance is included as a factor because some people think in terms of distance rather than time. One estimate is a 3% shrink for the first 100 miles and .5% to 1% for each additional 100 miles transported.

Age, sex, and type-condition are all related because the real factor is fat composition of the animal. The fatter the cattle are, the less shrink encountered. This is because fat contains less water than muscle. Older cattle tend to have more fat than younger animals. Larger frame cattle have a higher lean to fat ratio than medium frame cattle of the same age. Of course health of the cattle will also play a major role.

Preventing Shrink

You may not be able to prevent shrink in cattle that you purchase some distance from your feedlot but the following practices may reduce the amount of shrink and minimize the accompanying stress (Brownson, 1973):

1. Avoid loading and moving cattle during inclement weather.
2. Insure careful and non-abusive handling is practiced at loading and unloading.
3. Inform the cattle buyer or trucker that the cattle should arrive as soon as possible after loading.
4. Make sure trucks and all corral equipment are in good working order.
5. Provide adequate protection during inclement weather while in transit.
6. Dry feeds are more desirable than wet feeds for cattle prior to shipping.
7. Provide proper space allocation to each animal.

Chapter 2- Receiving Cattle

Newly purchased cattle destined for the feedlot are coming from grazing situations throughout Iraq. Normally they are not accustomed to concentrate (grain) based diets. They are also transported long distances from the point of the purchase to the feedlot. Needless to say these cattle arrive at a feedlot stressed and not accustomed to the feed ration being placed in front of them. A series of important steps are needed to make the transition from grazing to the feedlot as comfortable and smooth as possible. The most critical period for feeder cattle is the first 21 days in the feedlot.

The following steps should be followed when receiving and processing cattle:

- Provide a clean, dry comfortable quarantine pen. A dry comfortable bed in the quarantine pen for resting is essential because cattle are tired and have a low resistance to respiratory diseases.
- Process cattle in small groups so they do not have to wait a long time before going through the chute. During hot weather, process in the early morning or late evening. Work cattle slowly and calmly. Do not shout, beat, or push cattle too hard. They will already be stressed from transport. Rough handling just adds to the stress and increases the risk of sickness.
- Research has shown that processing cattle upon arrival instead of delaying processing increases rate of gain and disease resistance (Ensminger, Oldfield, Heinemann, 1990).
- When processing, weigh the cattle and make sure weights are recorded. Sort cattle into similar frame and weight lots taking age into consideration (as explained in the *Beef Cattle Selection in Chapter 1*). Sorting the cattle can be done when they are purchased by an experienced cattle buyer. This is the preferable method because the cattle can enter directly into the feedlot without any additional sorting stress. After weighing the cattle be sure to ear tag them for easy identification, to help with determining average daily gain and maintaining other important records.
- Deworm all cattle using Ivermectin, this will control internal and external parasites. If Ivermectin is not available use a high quality cattle wormer for internal parasites and a pour-on wormer for external grub and lice control.
- During processing vaccinate all cattle. The importance of vaccinations, proper handling procedures, and other information will be discussed later in this report. Give intramuscular injections in the neck. Do not give intramuscular injections in the rump area as this can cause damage and abscesses to the meat. The following is a recommended vaccination protocol to be used when receiving cattle:

    - IBR, PI-3, BVD, BRSV- (protects against the four viral agents commonly causing respiratory diseases)
    - 7-Way Clostridia vaccinations- These vaccines for clostridial diseases are available in various combinations, from two to eight agents. These diseases are common and usually cause sudden death with little time for treatment, so vaccination is usually recommended.
    - Vaccinate for the appropriate strains of Hoof and Mouth Disease.
    - *Haemophilus somnus* (optional)
    - Pasteurella vaccination (optional)

- Observe, isolate, and treat sick animals. Newly arrived cattle should be observed at least twice daily. Sick animals should be removed and treated. Treating sick animals quickly, rather than waiting, may mean the difference between life and death. Cattle that show signs of pasteurellosis also known as "shipping fever" including sunken eyes, runny nose, drooling at the mouth, labored breathing, and weaving, should be isolated into the separate sick pen.

Starter Ration

- After cattle have been processed and put in the quarantine pen they need to be put on a starter ration. Feeding a palatable ration, one that cattle will start eating soon after they are unloaded in the feedlot, will reduce the incidence of shipping fever, and make the cattle recover weight loss from transport more rapidly.
- A good quality, long stem grass and alfalfa hay mix should be fed the first day calves are in the quarantine pen in order to entice them to eat at the feed bunk. Some feedlot owners in Iraq feed alfalfa hay only for the roughage portion of the starter ration. They said that they

have been successful with this. Lower protein, long stem alfalfa hay may work, but there is always the potential of bloat or causing diarrhea if high quality, leafy alfalfa hay is fed at the beginning. Beginning with the second day in the quarantine pen, the concentrate portion of the starter ration should be sprinkled on top of the grass/alfalfa mix hay. Grinding or chopping the hay and including it directly in the receiving starter ration is preferred. Incoming cattle may be fed approximately 2 kg of concentrate per head daily, with a breakdown between protein supplement and grains as follows:

- *Protein supplement:* One kilogram of high bypass natural protein supplement such as protected soybean meal. A little cane molasses may need to be added to improve palatability. For heavily stressed cattle, the protein supplement should also contain an antibiotic, or better yet a combination of antibiotic (such as oxytetracyline) and a bactericidal agent (such as sulfamethazine). The following is a recommendation on the level of antibiotic/sulfamethazine to be used in the supplement: Feed 350 mg of antibiotic plus 350 mg of sulfamethazine per head daily to newly arrived cattle for a period of 28 days. With this treatment shipping fever will be practically eliminated. Please note: do not feed urea for the first 28 days after calves arrive.
- *Grains:* One kilogram of cereal grain per head daily, with the grain processed coarsely (not whole and not powdery). The grain level can be raised at the rate of .45 kg/head/day.

Summary

The following is the schedule to be followed for starting cattle on feed:

1. Feed long stem grass/alfalfa hay mix, automatically reducing hay consumption as the grain is increased.
   First day feed long stem grass/alfalfa hay mix. Second day add to the grass/alfalfa hay mix - 2 kg of concentrate mix (1 kg protein supplement and 1 kg grain). On the third day start to increase the grain portion of the concentrate mix, increasing it by .45/kg/head/day until cattle are receiving .45 kg/45 kg of body weight. After a level of .45 kg/45 kg of body weight is reached, make increases every third day as follows:
   Calves: .11 kg increase
   Yearlings: .22 kg increase
   2 year olds: .45 kg increase

   Keep increasing grain and concentrate mix and decreasing hay until you reach a ratio of 75% concentrate mix and 25% alfalfa hay.

   It is important to note that incoming cattle are usually hungry for minerals, especially if they have been on dry range forage. They should have access either to a mineral mixture consisting of two parts of dicalcium phosphate and one part salt, or to a good commercial mineral mix.

2. The following table is a summary of a mixed ration of chopped grass/alfalfa hay and concentrate, with the proportion of roughage decreased and the grain increased according to the following schedule:

Day	Kind of Feed	Percent of Roughage
1	Long stem grass/alfalfa hay mix	100
2-4	Long stem grass/alfalfa hay plus concentrate	60-90
5-14	Chopped grass/alfalfa hay plus concentrate	40-60
15-21	Alfalfa hay plus concentrate	25-40
22-Market	Finisher ration (use alfalfa hay for the roughage portion)	25

Among the problems encountered in new cattle are feed and water refusal, acidosis, bloat, and diarrhea. Refusal of feed and water is generally due to the fact that the animals are not accustomed to troughs and/or the feed is so different. Acidosis generally results from feeding hungry cattle excessive levels of rapidly fermentable feeds such as grains. Acidosis is characterized by an accumulation of lactic acid in the rumen and a lowering of the pH in the blood and urine. The problem can be greatly minimized by starting cattle on a high-roughage ration (such as outlined above).

Feedlot design and layout

The key to a successful feedlot design is to create a series of alleyways, chutes, and holding pens where animals can easily be contained in order to weigh, vaccinate, and tag. This will simplify labor and provide less stress on the cattle. Always ensure that feed bunks stay clean. Any old, stale feed should be cleaned out of the feed bunks and water troughs should always be clean. Make a habit of cleaning water troughs at least weekly. Water is the most important nutrient for livestock. If clean water is not available at all times your cattle will go off feed (stop eating) and in the heat of the Iraq summer could easily dehydrate and die.

My recommendation is that a series of chutes be constructed in order to easily and efficiently move your cattle from the quarantine pen to the main feedlot. In your sick pen construct containment chutes that firmly contain the animal while you treat it.

Most of the feedlots USAID-*Inma* has sponsored have built shelters over the feed bunks. A recommendation is to do this especially before summer comes. This will provide much needed shade from the summer heat and protect feed from bad weather during the winter.

Chapter 3- Purchasing Feed

Next only to purchase price, feed prices will account for the bulk of the expense when finishing cattle. A good feedlot operator learns quickly what feed is available in their area and at what price it is being sold. They also learn to be creative in their feed selection. For example ground dates may provide as much energy, or even more energy, in the feed ration than the traditionally fed wheat bran. The goal is to find quality feed that will meet the nutritional demands of the feedlot animals at the lowest price possible. Lower daily feed costs net higher profits when the cattle are marketed and sold.

The most important thing to remember when purchasing feed is to purchase high quality feeds in bulk when the prices are low and store them in your warehouse. When going to purchase feed all you need is a notebook, a list of nutrient values (Crude Protein and TDN/Energy) and a hand held calculator. With these tools you can quickly decide which feeds will provide the most nutrients at the lowest cost. Crude Protein and Total Digestible Nutrient (TDN) values for feeds can be taken from the livestock nutrition software you were provided. Crude Protein and energy values such as TDN can be found on the main menu under "Tab F, Feed Library" and then under Standard Feed Library. Record the Crude Protein and TDN values in your notebook for the various feeds you will be considering to buy.

Calculating Nutrient Costs (Crude Protein and TDN/Energy)

Straw appears to be a favorite roughage among livestock producers in Iraq. Interviews with livestock producers here in Iraq show their reasoning for feeding straw instead of alfalfa hay is that straw is cheaper. It is true that straw is cheaper per ton than alfalfa hay but when you calculate the cost per kilogram of crude protein (CP) for straw and alfalfa hay you will find that feeding alfalfa hay will actually cost you almost half the price of feeding straw. Calculating nutrient costs is the simplest and most accurate method for determining the true costs of feeds.

Example

The following example will show you how to calculate the cost per kilogram of crude protein in roughage:

Let's say that barley straw is $100 per ton. Barley straw has approximately 4% CP. Crude Protein values for feeds can be taken from the livestock nutrition software. Crude Protein and energy values such as TDN can be found on the main menu under "Tab F, Feed Library" and then under Standard Feed Library. Now, let us consider alfalfa hay at $250 per ton. Alfalfa hay will be a minimum of 18% CP.

For the barley straw divide $100 by .04, this equals $2500 per ton, then divide $2500 into 1000 (1000 kg in one ton) and you get $2.50 per kilogram of CP for barley straw. For the alfalfa hay take $250 and divide by .18, this equals $1380 per ton of CP, then divide $1380 into 1000 (1000 kg in one ton) and you get $1.38 per kilogram of CP for alfalfa hay. We now see that alfalfa hay is actually almost half the price of straw. There should never be a reason to substitute straw for alfalfa hay. Price can no longer be used as a reason.

Example

The same calculations can be used to determine the nutrient cost for energy in roughage.

The best way to do this is to calculate energy using Total Digestible Nutrients (TDN). The following example will show you how to calculate the cost per kilogram of energy (TDN):
Again let us say that barley straw is $100 per ton. Barley straw has approximately 44% TDN. Now let us consider alfalfa hay at $250 per ton. Alfalfa hay will have a value of approximately 60% TDN.

For the barley straw divide $100 by .44, this equals $227 per ton for TDN, then divide $227 into 1000 (1000 kg in one ton) and you get 22.7 cents per kilogram of TDN. For the alfalfa hay take $250 and divide by .60, this equals $416 per ton of TDN, then divide $416 into 1000 (1000 kg in one ton) and you get 41.6 cents per kilogram of TDN for alfalfa hay.

Your first reaction will be that straw is what you will buy because, according to this calculation for energy, it is actually cheaper than alfalfa hay. This assumption would be incorrect. Again, use common sense when feeding livestock. A finishing bull needs a minimum of 63% TDN in their diet. Straw only has 44% TDN. There is no way that a finishing bull could physically consume enough straw to meet the energy requirement of 63%. Combine this with the fact that the same finishing bull has a Crude Protein (CP) requirement of about 10% CP and straw only provides 4% CP. Basically, you will be spending large amounts of money to feed a bull that will eventually die or not gain weight because of the poor quality of straw. In addition, straw does not meet the calcium, phosphorous, or vitamin/mineral requirements for livestock. Alfalfa hay meets the CP requirement, comes close to meeting the energy requirement (little supplementation would be needed compared to feeding straw), and meets the calcium, phosphorous, and vitamin/mineral requirements. Remember we are feeding cattle in a feedlot for rapid gains in a short amount of time. For this reason you were trained on the nutrition computer software program to achieve a balanced ration that will give your cattle the most rapid weight gains in the shortest amount of time at the lowest cost.

When going to purchase grains the same type of calculations made for Crude Protein can be made for energy in the form of TDN. Forages like alfalfa hay are considered protein feeds so therefore you would calculate the Crude Protein costs for forages. Feeds such as grains are energy feeds so you would calculate nutrient costs for grains based on TDN.

Example

Let us now compare the energy cost between barley grain and wheat grain.

Wheat grain:
TDN: 88% Cost: $350 per ton
Take $350 and divide by .88= $397 per ton then divide by 1000 (number of kg in ton) to get .397 or 39.7 cents per kilogram (cost of energy for wheat)

Barley grain:
TDN: 80% Cost $300 per ton
Take $300 and divide by .80= $375 per ton then divide by 1000 (number of kg in ton) to get .375 or 37.5 cents per kilogram (cost of energy for barley)

We find that barley is cheaper than wheat so barley should be purchased. Simple calculations like this can be made between all energy feeds/grains to determine the most economical feeds for your livestock.

Chapter 4- Feeding

After the cattle transition to full feed in the feedlot, it is time to maximize gains and shorten the finishing period. The recommendation is to feed a Total Mixed Ration (TMR) where the forage, concentrate, salt, calcium, phosphorous, and other vitamins and minerals are all mixed together. The alfalfa hay will need to be chopped first and then mixed with the concentrate portion of the ration. With your feed mill you have the capability of mixing your feed in order to provide a TMR. When mixing, make the ration as coarse as possible. Do not grind the ration to a powder. The coarser the ration is the better. Try to keep a 75% concentrate and 25% forage (good alfalfa hay) ratio for your ration. This will decrease the chances of acidosis as well as providing the much needed calcium, vitamins, and minerals. Use the livestock nutrition software provided to you to balance a full feed ration at the lowest daily cost. Remember to balance rations in phases using the software. Balance a new ration after every 50 kg of gain. The software will tell you how much to feed per head per day. A common value is that cattle will consume a daily amount equal to 2.5 to 3.0% of their live weight. Age has an effect on feed efficiency. For medium frame cattle expect the following (Ensminger et al, 1990):

Calves: 7.5 kg of feed per 1 kg of gain
Yearlings: 8.0 kg of feed per 1 kg of gain
2-year olds and older: 8.5 kg of feed per 1 kg of gain

Feeding a balanced ration that has been calculated from the nutrition software should bring an average of 1 to 1.3 kg per day daily gain. Obtaining this average daily gain will enable you to purchase a 150 to 180 kilogram calf and feed for 7 months to reach a market weight of approximately 350 to 400 kilograms. Cattle should be weighed every 28 days to determine average daily gains.

By minimizing digestive disorders we can keep cattle on feed and maximize performance. Poor bunk management, not the ration being fed, can be a major cause in digestive disturbances such as bloat, acidosis, and liver abscesses. Feedlot owners should strive to have uniform day to day consumption of fresh, high-quality feed. The bunk management tools described below can help prevent large fluctuations in intake caused by acidosis. Determining how much feed to offer requires a certain amount of skill and good judgment. You have been trained to use the nutrition software, but remember it is a tool and not perfect. Nothing can replace experience and common sense when feeding cattle. Cattle are ruminants, which mean they are basically big fermentation vats. Ruminants work best under constant conditions.

Feed Mixing

The mixed ration should look the same throughout the bunk or in the self-feeder. While inadequate mixing can be a common problem, you can also mix too long in a vertical mixer. Sorting out can occur due to differences in particle size and weight of the various feedstuffs. Ingredients that are added in small amounts (for example: vitamins and minerals) should be mixed with one or two buckets of grain before being added to the mixer. Roughage (hay) should be chopped before adding to the feed mix. The following is a recommended method of adding supplements to a vertical grinder mixer:

1. Add half the grain.

2. Add the supplement.

3. Add the rest of the grain.

4. Add the roughage.

5. Mix for five minutes at the feeding site to eliminate separation occurring during travel to the feeding location.

Rescheduling the use of selected equipment for peak demand periods to off-peak periods or manually shutting off some of the equipment with large motors can save charges. Be careful to avoid frequent starts and stops which can damage equipment.

Feed Bunk Scoring System

Feeding cattle can become a type of art and not an exact science. Some feedlot managers are true experts in feeding cattle because they have learned from trial and error over many years. Others like the feedlot owners in Iraq are just beginning. For this reason a scoring system can be followed to guide you through the first year or two, before your managers gain the experience they need in properly feeding cattle. One method of monitoring intake and determining how much to feed is to use a feed bunk-scoring system on a scale from zero to five (Pritchard, 1993). A score of zero implies that the feed bunk is empty or "slick". A score of zero-minus (0-) means the bunk has been empty for more than an hour. A score of zero-plus (0+) means the bunk is empty except for a few fines or clumps of feed. A score of one means something less than or equal to one inch of feed is left in the bottom of the bunk. A score of 2 means that two inches of feed is left in the bottom of the bunk. A score of 3 means that three inches is left in the bottom of the bunk and so on.

Feed bunk scoring system

Score	Bunk Description
0 -	Empty for more than 1 hour
0	Empty bunk for less than 1 hour
0 +	A few fines or clumps in bunk
1 -	Thin layer, 1 kernel deep
1	Less than 1 inch (2.54 cm) of feed in bunk
2	Less than 2 inches (5.08 cm) of feed in bunk
3	Less than 3 inches (7.62 cm) of feed in bunk

Normally, if the score is zero for two consecutive days, increase the feed delivered to cattle by 5-10 percent. If the score is two or more, reduce the feed offered by 5-10 percent.

There should be a bunk sign constructed at each feedlot pen. The sign should have a place for date, pen of cattle, amount of feed delivered and a bunk score. A feeder should utilize at least

4 days of records when determining how much feed to put in the bunk (Pritchard, 1993). Scoring bunks should be done at the same time each day. A review of the bunk score, combined with the amount of feed provided can tell you if intakes are going up, coming down or holding steady. Scores constantly in the 2 to 3 range may lead to wasted fed and reduced feed efficiency due to the possibility of large fluctuations in feed intake.

Besides monitoring the bunks a good feeder also monitors the cattle. When looking at the cattle and the feed bunk is empty, make a decision on whether the cattle look like they are hungry or do they act like they are full.

Cattle Monitoring

Cattle Observation: You also need to be looking at the cattle when you make a decision on feeding. If the bunk is empty, does the cattle look like they are hungry or do they look full? If they look full, wait for a second or third day of empty bunks before increasing the amount of feed. A small storm front or cool night can cause cattle to empty a bunk that normally would not be emptied. Increasing the feed delivery may only cause them to back off feed in the next 3 days. If they really appear hungry, increase the feed delivered 5% today and hold it there tomorrow to find out if they can actually handle the extra feed. If they do handle the feed, try increasing it again on the third day.

Weather Conditions: Changing weather causes erratic intake patterns in cattle. Severe cold is not an issue in Iraq. Heat will be the major problem cattle face in this country. Shade is extremely important in your feedlots. Intake frequently increases prior to a storm, declines during the storm, and increases after the storm. Cattle may consume their daily allotment of feed within as little as a two hour time frame, after not eating any significant amount of feed for 10 to 20 hours. A situation for bloat or acidosis exists even though 24-hour consumption patterns look fairly regular.

Stool Observation: Flat brown stools indicate that cattle are consuming higher amounts of grain but do not have digestive upsets. Flat gray stools are a sign of acidosis. Flat gray stools may be observed before an actual drop in feed intake occurs. Tall firm stools are a sign the cattle are consuming significant levels of roughage. Pens that have a majority of flat brown stools and a few gray stools are a sign that cattle are doing well and eating at optimal levels.

Feed Monitoring

Feed Mixing: If every handful of feed coming out of the bunk is not uniform, the cattle are not all on the same diet. This situation can cause some cattle to go off feed within groups. Differences in cattle condition may appear that are not explained by genetic composition of the cattle. When feeding urea, poor mixing can increase the risk of toxicity.

Number of Feedings per Day: Standard practice in Iraq is to feed twice daily. Never let feed bunks be empty for more than one hour. In the heat of the Iraqi summer feed early in the morning and late at night. Dry feeds will be fresher for cattle if fed twice a day during rainy weather. High moisture rations such as those based on silage or high moisture corn may need to be fed twice daily to avoid molding and spoiling during hot weather.

Feed Accumulations: Feed should not be allowed to accumulate from feeding to feeding. Dry matter intake will decline if this is allowed to occur for very long. Upon cleaning out large accumulations of stale feed, cattle may engorge themselves on the new, fresh feed and some cases of "grain bloat" may occur. The other scenario that may occur is the cattle will engorge themselves on the fresh feed in a short amount of time, empty the bunk and then not consume the next batch of feed. Clumps of feed in an otherwise empty bunk will probably not be consumed by the cattle and thus should be cleaned out before fresh feed is added. Refer back to the Feed Bunk Scoring System; clumps of feed in a bunk that has been empty for less than an hour would receive a score of zero/plus (0+). A bunk receives a score of zero/minus (0-) if it has been empty for more than hour and contains clumps of feed.

Slick (Empty) Bunks: It is not considered poor management to have cattle clean the bunks once a day, as long as cattle are not out of feed to the extent they become restless or engorge when fed again. If the bunk is empty for much longer than one hour on a high-energy diet, there is risk of overeating, acidosis and irregular intake patterns.

Fines: Take time to investigate the type of material in the bottom of the bunk. Make sure finely ground ingredients and heavy ingredients such as minerals are not all falling to the bottom of the bunk. This can happen when small particle feeds such as ground protein or mineral are fed with large particle feeds such as whole shelled corn or ground hay. If such fines do appear in the bottom of the bunk, consider adding moisture in the form of silage, molasses, water or other wet products to help hold the fines in suspension.

Water: Feed intake is related to water intake. A slow water fountain during hot weather will reduce intake. Nonfunctioning water fountains shut off intake. Clean water fountains on a regular basis. If irregular feed intake becomes a problem, check the water quality, the flow rate and also check the fountain for stray voltage from an electrical source.

Chapter 5- Feedlot Animal Health

Common Diseases in Feedlots

Pasteurellosis or "Shipping Fever"

Shipping fever is one of the most significant diseases in a feedlot operation and one of the most significant of the respiratory diseases. It is caused by a bacterium, *Pasteurella multocida*, and a virus, *Parainfluenza*-3 (PI-3), working together at a time of stress. The most common stress is that of moving animals from one location to another, sometimes over great distances, hence the name shipping fever. Shipping fever can be quite contagious. The earliest sign is a high fever with a temperature higher than 40 degrees Celsius, then lack of appetite, coughing and nasal and eye discharge. As the disease progresses, breathing becomes rapid and shallow.

Animals in most extreme conditions are reluctant to move and will stand literally gasping for air.

Treatment

Fortunately the disease responds well to early treatment. Several antibiotics, penicillin and its synthetic derivatives are all reasonably effective. The best treatment is prevention. The most important step in prevention is to start with healthy cattle in the first place. That is why I mentioned the most important thing to consider in purchasing cattle in Iraq is their health status.

Acidosis

Acidosis is the most important nutritional disorder in feedlots today. Caused by a rapid production and absorption of acids from the rumen when cattle consume too much starch (primarily grain) or sugar in a short period of time, acidosis causes cattle to be stressed. As long as cattle are finished on grain, acidosis will be a problem. Cattle evolved digesting roughages that ferment slowly in the rumen. The rumen microbes of a forage-fed animal are selected for fiber digestion. Adjusting cattle to high grain diets from predominantly forage diets disrupts the normal microbial environment and increases acidosis.

Acidosis is not just one disorder; it has various levels of seriousness and contributes to a degree to other issues. Effects of acidosis can be as slight as a feed intake reduction, or as severe as the death of an animal. Several acidosis-related problems occurring in the feedlot are:

1. sudden death syndrome;
2. founder;
3. rumenitis;
4. liver abscesses;
5. malabsorption;
6. clostridial outbreaks;
7. off-feed or reduced feed intakes.

Acute Acidosis

Although acidosis can manifest itself at various levels or degrees, for simplicity it can be divided into acute and sub-acute acidosis. Most feedlot managers readily recognize the effects of acute acidosis. Many cattle diagnosed as "sudden death" may have died from acute acidosis. Managers sometimes observe cattle that are wandering aimlessly in the pen or cannot stand and appear to have brain damage. Acute acidosis can have other, less obvious effects, as well. During acute acidosis ruminal pH drops to levels between four and five, as opposed to the more normal pH of 6.5. The lining of the ruminal wall is damaged, and abomasal and intestinal linings are severely inflamed.

As mentioned earlier, animals may die suddenly or die later due to other acidosis-related problems. Destruction of papillae (finger-like projections lining the rumen wall that aid in absorbing nutrients) in the rumen and damage to the linings of the intestines may result in poor absorption of nutrients, resulting in low gains and poor feed efficiencies. Foundered cattle are an indication acute acidosis occurred 40 to 60 days previously. Most of the problems associated with acute acidosis can be minimized with proper bunk management.

Sub-acute Acidosis

Sub-acute acidosis occurs more frequently, but is seldom recognized by the cattle feeder. The major response by the animal suffering sub-acute acidosis is reduced feed intake with an accompanying reduction in performance.

When cattle are fed in larger groups of 100 to 200 head, such as in your feedlot, identification of individual animals with sub-acute acidosis becomes difficult. It is not until the entire pen is going off feed that low feed intakes or strange intake patterns are observed. Some additional animal signs of sub-acute acidosis may be panting, excessive salivation, kicking at their belly, eating dirt, and diarrhea.

There is a high possibility that most animals in the feedlot will experience sub-acute acidosis at least once during the feeding period because it is an important natural function in adapting to high-grain finishing rations. In addition, any interruption in the normal consumption pattern of cattle can cause acidosis.

For example, storms can disrupt feed intake by causing cattle to consume a greater amount of feed before and after a storm. Other environmental effects include mud and heat. Mud and heat reduce feed intake and alter intake patterns. Extreme heat conditions may force cattle to eat a greater proportion of their feed at night, rather than during the day. The design of the feedlot, location and operation of water fountains, are also important factors that can impair feed intake. Obviously, the level of roughage is an extremely important factor affecting acidosis. In general, as the level of roughage increases, the incidence of acidosis decreases. However, cost of gain usually increases as the level of roughage increases because roughage is poorly digested in high-grain finishing diets. The roughage should be coarsely chopped to stimulate chewing and rumination, which in turn stimulates saliva production. Saliva contains bicarbonate, which buffers the acidic conditions of the rumen and helps reduce acidosis.

In typical feedlot diets, grain is the single most important factor affecting acidosis. Grains fed to cattle may vary in rate, site and extent of starch digestion within the animal's digestive tract. Any grain processing that reduces particle size and/or causes gelatinization of the starch granules increases the possibility of acidosis. The fine powdery consistency of concentrates in the rations in Iraq greatly increases the risk of animals getting acidosis.

Treatment

Treatment of acidosis should be done by a qualified veterinarian.

Bloat

Bloat occurs when rumen gas production exceeds the rate of gas elimination. Gas then accumulates causing distention of the rumen. Bloat can be a medical emergency, and timely intervention may be necessary to prevent losses. It is a common cause of sudden death. It can be caused by animals feeding on green lush pastures when they have been feeding on high concentrate diets.

Treatment

Simple passage of a stomach tube may be effective at relieving free gas bloat. Inserting a needle into the abdomen is a life-saving procedure that should only be attempted as a last resort and performed by a veterinarian.

Laminitis (Founder)

Affected animals appear lame and are hesitant to stand or move. It is a form of acidosis; laminitis is caused by the release of toxins within the bloodstream following consumption of excessive dietary energy or protein. Affected animals may recover within several days.

Treatment

Treatment is to remove the animal from the feedlot and feed good quality hay.

Urinary Calculi

Urinary calculi or "water belly" is a common metabolic disease of feedlot cattle and sheep. The disease occurs when calculi (stones), usually comprised of phosphate salts, lodge in the urinary tract and prevent normal urination. Normally, phosphorus is recycled through saliva and excreted via feces in ruminants. High grain, low roughage diets decrease the formation of saliva and therefore increase the amount of phosphorus excreted in the urine.

The primary cause of urinary calculi is feeding concentrate diets which are excessive in phosphorus and magnesium and/or have an imbalance of calcium and phosphorus. Lack of water and water sources that are high in minerals are also contributing factors. Affected animals show colicky pain such as kicking at the belly, treading with their hind feet, and switching the tail. Attempts to urinate are frequent with straining and grating the teeth. Urine is not able to pass, and is often blood tinged. The worst case scenario is that urine is completely absent. When the obstruction is complete, the urethra or bladder ruptures. Rupture of the bladder can cause immediate pain relief but urine accumulating in the abdomen (thus the name "water belly") causes a toxemia and death in about 48 hours.

Treatment

Severe cases need to be treated by a veterinarian. The best treatment is, of course, prevention. Be sure to include good alfalfa hay in the ration. In addition, roughage will increase salivation and rumination which will increase the amount of phosphate excreted in the urine. Also always include salt as part of the ration and make sure there is always clean water available.

Vaccines

The use of vaccine to protect against costly losses from disease in the feedlot is an essential part of good overall cattle management. These vaccines must be handled and stored properly if they are to be effective. Good handling and storage procedures will ensure that you have few problems. The following are recommendations for proper vaccination handling:

- Buy vaccines from dealers who have good storage and handling practices. Purchase vaccines from reputable companies, preferably from companies from the U.S and Europe. Vaccines from these countries are available in Iraq.
- After purchase, store vaccine in a cool, dark place such as a refrigerator. Avoid heat and direct sunlight. Vaccines deteriorate rapidly in warm temperatures and light. Care should be taken to ensure that the vaccine does not freeze, because this can ruin most vaccines.
- Vaccines should be properly stored until they are ready for use. Expose only what vaccine is needed or will be used in about an hour. If there are several animals to be processed, keep vaccines in a cool insulated container and take them out as needed.

- Alcohol or any disinfectant applied to the needle between animals can kill a modified live vaccine if only a drop remains in the needle. For this reason, when you use a modified live vaccine refrain from disinfecting the needle between animals. You should use disposable needles.
- If you are using a syringe and needle to make the diluent transfer, use a clean syringe for this purpose to avoid contamination of the entire vial with the syringe you are using to inject the animals. You should also maintain a clean needle for withdrawing vaccine from the vial, avoiding the possibility of contaminating the vial by using the needle you are using to inject the animals.
- It is important to read and follow all label directions on the vaccine. Proper handling and storage of vaccines will enhance the development of a strong immunity to the diseases for which you are vaccinating.

Live and killed vaccines are both available and each has distinct advantages and disadvantages. Modified-live virus (MLV) vaccines tend to stimulate protection sooner than killed vaccines and may do so in a susceptible animal with one dose. MLV vaccines are generally cheaper than killed virus vaccines but require a normal immune system to be effective. Killed vaccines usually require at least two doses three to four weeks apart for optimal protection but are free from potential contaminants such as free live virus. Killed virus vaccines generally do not cause the immune suppression sometimes seen with live vaccines and are usually safe in pregnancy. Poor vaccine handling techniques can kill modified-live virus vaccines. Any vaccine can become contaminated and make them dangerous to use.

Feedlot owners must know the proper injection sites when administering vaccinations or injections of any kind to their animals. Attachment C provides a diagram of the proper injection sites for beef cattle.

Chapter 6- Marketing

Feedlot operations are a business. The end goal is to market and sell animals and make a profit in order to maintain a viable business. A good feedlot operator knows every cost incurred during each phase of the feedlot process. Costs or expenses have to be known in order to determine if a profit has been made once the cattle have been sold. Commercial cattle buyers are knowledgeable of costs and returns, skillful buyers and sellers, and keenly aware of market trends and cattle prices.

A simple way to evaluate cattle feeding and marketing alternatives is to use "break-even" analysis. This is a way of comparing total cost and total return at various output levels. When returns equal cost, the operation is breaking even. To calculate a break-even point, use the following formula:

$[(IW \times IP) + (G \times C)]/FW = FP$

IW is the initial weight purchased

IP is the initial price of the animal going into the program

G is the expected pounds of gain during the feeding program

C is the cost per pound of gain

FW is the final weight sold

FP is the final price needed to break-even on the investment

Example 1:

Let us say, a 225 kg feeder bull that cost $1.72 per kilogram is fed to make a net gain of 90 kg at an expected cost of $1.10 per kilogram of gain. The resulting final weight will be 315 kg. What is the final price needed to cover the cost of investment?

IW = 225 IP = $1.72 G = 90 C = $1.10 FW = 315 FP = ?

[(225 x 1.72) + (90 x $1.10)] / 315= $1.54

The equation for developing a break-even price is actually quite simple. Determining accurate numbers is another matter. Gain projections may need to be obtained from personal experience or you might check with other producers that have similar feeding programs. The real calculations that need to be worked out are the cost of gain. Standard components in cost of gain are feed, veterinarian fees, electricity, labor costs, marketing, and other overhead charges.

References

Brownson, R. 1973. *Shrinkage in beef cattle.* Cooperative Extension Service-Great Plains States. GPE-4002.

Ensminger, Oldfield, Heinemann. 1990. *Feeds & Nutrition*. The Ensminger Publishing Company. Clovis, CA. p. 779.

Fox, D.G., C.J. Sniffen, P.J. VanSoest, P.D. George, J.R. Russell, and M.J. Thonney. 1985. Cornell cattle systems I. Northeast Regional Agricultural Engineering Service.

Pritchard, R.H. 1993a. *Bunk management.* Land O'Lakes Beef Feed. p. 4**.**

USAID-*Inma*. 2010. *USAID-Inma Agribusiness Program Annual Work Plan 2010-2011*. USAID *Inma*, Baghad, Iraq

USDA. 2000. *U.S. Standards for grades of feeder cattle*. Agricultural Marketing Service. Retrieved on January 5, 2011: http://www.ams.usda.gov/AMSv1.0/getfile?dDocName=STELDEV3067030

ATTACHMENT A:

Adapted from Official United States Standards for Feeder Cattle (October 2000), United States Department of Agriculture, Agricultural Marketing Service

Frame Size with Estimated Slaughter Weight

Large (Figure 2.12a)

Steers
1,250 pounds and above

Heifers
1,150 pounds and above

(Figure 2.12a)

Medium (Figure 2.12b)

Steers
1,100-1,250 pounds

Heifers
1,000-1,150 pounds

(Figure 2.12b)

Small (Figure 2.12c)

Steers
1,100 pounds and below

Heifers
1,000 pounds and below

(Figure 2.12c)

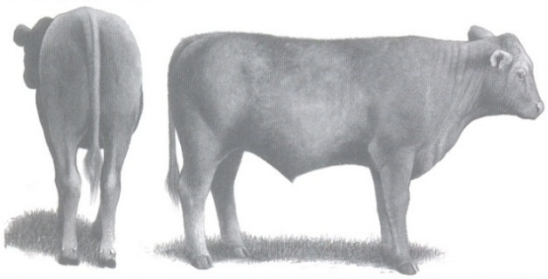
Large and medium frame pictures depict grade requirements.
The small frame picture represents an animal typical of the grade.

ATTACHMENT B:

Adapted from Official United States Standards for Feeder Cattle (October 2000)

Muscle Thickness Scores

No. 1



(Figure 2.13a)

No. 1

- Moderately thick muscled throughout
- Predominate beef breeding
- Thrifty

No. 2

(Figure 2.13b)

No. 2

- Slightly thick muscled throughout
- High proportion beef breeding and slight dairy breeding
- Thrifty

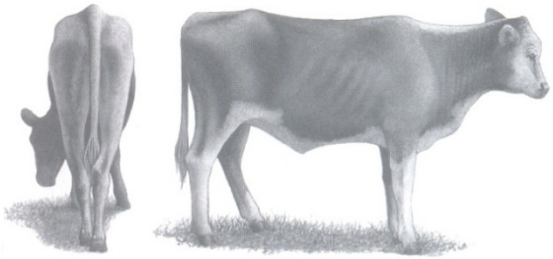
No. 3

(Figure 2.13c)

No. 3

- Thin through the forequarter and middle part of the rounds
- Thrifty

No. 4



(Figure 2.13d)

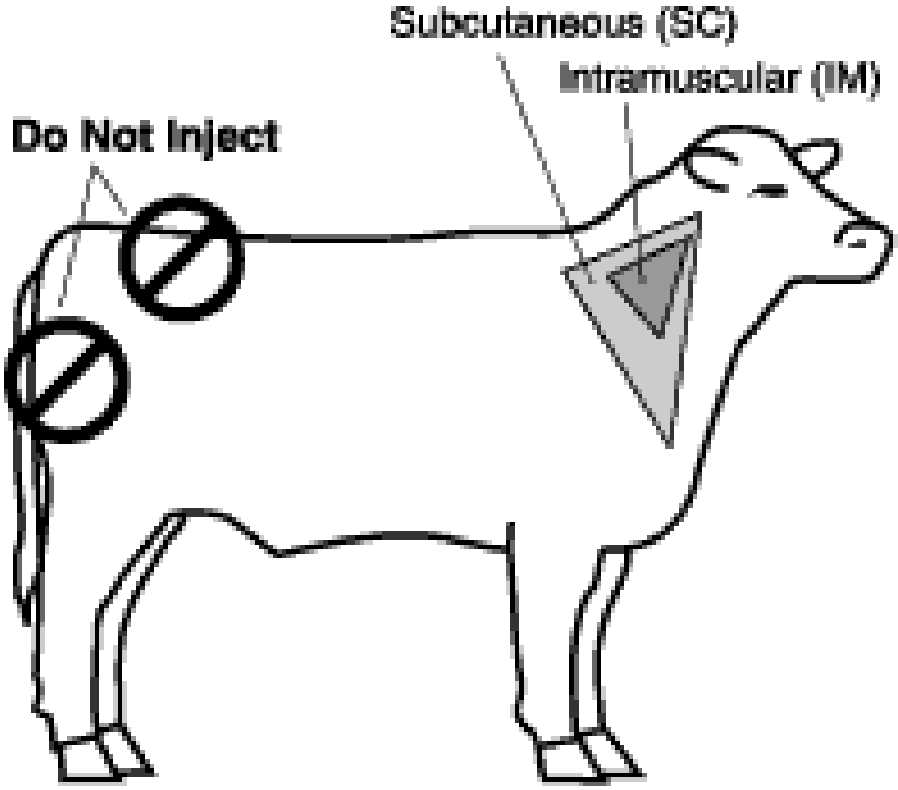
No. 4

- Less thickness than minimum required for No. 3
- Thrifty

No. 1, No. 2, and No. 3 thickness pictures depict minimum grade requirements. The No. 4 picture represents an animal typical of the grade.

ATTACHMENT C:

Proper injection sites for beef cattle
Adapted from North Dakota State University Extension



Correct Needle Size

	Subcutaneous			**Intramuscular**		
	½ to ¾ inch needle			**1 to 1 ½ inch needle**		
	Cattle Weight (kg)			**Cattle weight (kg)**		
Injection Viscosity	**<130**	**130-300**	**>300**	**<130**	**130-300**	**>300**
Thin (needle gauge)	18	18-16	16	20-18	18-16	18-16
Example: Saline solution						
Thick (needle gauge)	18-16	18-16	16	18	16	16
Example: Oxytetracycline						