EXTENSION

An Introduction to Finishing Beef

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The beef industry has basically three type of producers; cow-calf, stocker/growers and feedlots. Many cow-calf producers sell their calves at weaning, which moves those calves on down the line to the stocker/growers and then to the feedlot before slaughter. With time, there has been an increasing interest from cow-calf producers to retain a few of those calves to stay on the farm and be fed out to either fill the freezer or sell locally finished beef.

This may be a new venture for some producers and the lack of experience produces many questions. Start this venture with the understanding that there are many different strategies to finishing out your own beef. Work with what you have and be aware of realistic expectations. Some realistic examples include:

- it will take a much longer feeding period for a 600-pound calf than a calf starting at 900 pounds;
- small-framed calves will have a lower finishing weight than larger-framed calves at the same point of fat thickness;
- steers will have a better feed efficiency than heifers; and
- calves finished on pasture tend to have lower gains, less fat and marbling and lower dressing percentage than calves finished in a dry lot.

In addition, the breed of the animal influences everything from carcass merit to feed efficiency. A good example of genetic difference in finishing is that dairy breeds often are less feed-efficient than beef breeds and may take longer to reach the same finishing endpoint. Therefore, it is important to select the right genetics whether raising the calf or buying it. Expected progeny differences (EPD's) are the tools needed to select animals with known genetics for carcass weight, marbling, percent intramuscular fat and several other measurements to predict carcass merit (Spangler, 2019).

Every producer has different circumstances influencing the strategy of finishing beef, but the areas that absolutely must be addressed are the animal's health, supplied nutrition and available technologies to improve efficiency.

Nutrition

Water is the most overlooked nutrient but is the most essential. The amount of water required by finishing cattle is a function of the animal's dry matter intake and the ambient temperature (Table 1.). Providing an adequate amount of clean water is imperative not only to the calf's health, but the animal's performance as well.

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Table 1. Approximate daily water intake (gallons) for finishing cattle.

	Temperature, °F					
Weight	*40*	*50*	*60*	*70*	*80*	*90*
600	6.0	6.5	7.4	8.7	10.0	14.3
800	7.3	7.9	9.1	10.7	12.3	17.4
1,000	8.7	9.4	10.8	12.6	14.5	20.6

Adapted from Winchester and Morris, 1956.
Water intake is a function of dry matter intake and ambient temperatures.

The goal of any growing or finishing diet is to provide adequate amount of crude protein (CP) and energy to achieve the desired average daily gains (ADG) and desired carcass quality. As ADG increases, crude protein requirements increase, but crude protein requirements decrease as the animal grows and gets closer to slaughter. As it gets closer to slaughter weight, fat becomes a larger part of the body weight gain and muscle becomes less of the weight gained.

Energy is expressed in the Net Energy system by feedlot nutritionist and is broken down into requirements for Net Energy for Maintenance (NEm) and Net Energy for Gain (NEg). The simplest way to calculate energy requirements is by using the TDN requirements. Energy requirements increase both as the animal is growing and as the desired ADG increases (See Table 2). As growth continues, nutrient requirements increase along with feed intake. On average, finishing cattle will consume 2% to 3% (dry matter basis) of their body weight in feed. It is suggested that finishing calves be fed twice a day to help avoid digestive upset and allow for increased intake.

Because finishing rations typically contain high levels cereal grains, such as corn, and animals on pasture are grown on a forage-based diet, an adaptation period is needed to allow the rumen to adjust from forage to grain. When introducing calves to a finishing ration, it is recommended to start the calf at 1% of their body weight in feed per day along with long-stem hay and increase the amount of feed over the next three to four weeks. This is done by increasing the amount of feed in one

Table 2. Nutrient Requirements of Calf Finishing at 1,300 pounds.

	Requirements, lb./d			*Ration*	
Weight	*CP*	*TDN*	*Feed Intake ~2.5%*	*CP*	*TDN*
715	2.5	13.4	17.9	14.0%	75.0%
780	2.5	14.3	19.5	12.8%	73.3%
845	2.5	15.2	21.1	11.8%	72.0%
910	2.5	16.0	22.8	11.0%	70.3%
975	2.5	16.9	24.4	10.3%	69.3%
1,040	2.4	17.7	26.0	9.2%	68.1%

Adapted from OSU Extension Circular E-974, Nutrient Requirements of Beef Cattle.
Requirements for calf gaining 3.2 pounds per day.
Feed intake calculated at 2.5% of body weight on a dry matter basis

Rule of Thumb: A 21-day adaptation period is industry standard.

to two pound increments every couple of days until you reach 2% to 3% (dry matter basis) of their body weight, reducing the long-stem hay as feed is introduced. Once calves are adapted to the finishing ration, it is reasonable to expect them to gain 2.5 pounds to 4 pounds each day. Gain will vary according the genetics and health of the animal, but most cattle will finish at 1,250 to 1,400 pounds. To maintain rumen health throughout the feeding phase, diets should always contain some form of roughage, such as access to pasture, hay or ingredients such as cottonseed hulls. With very close feed management, the roughage in finishing diets can be reduced to less than 10%. If feeding management and experience is lacking or feed delivery is not managed closely, then roughage levels should be increased (up to 15% roughage may be utilized with only small reductions in performance).

In large commercial feedlots, all grain is usually processed extensively. In a small operation, processing corn may not provide adequate returns over the cost of processing. Corn digestibility is improved by 5% to 10% by rolling or grinding; steam flaking in large feedlots can improve it by 5% more. Feed grains such as grain sorghum, millet or wheat must be processed to increase digestibility. If these smaller grains are not processed, their smaller size will allow passage whole from the rumen, resulting in very low digestibility.

As an example, let's start with a 715-pound steer that will finish at a target weight of 1,300 pounds in approximately six months. This will require the calf to gain 3.25 pounds per day, with 180 days to hit the target finish weight.

Initially, a good strategy is to start this calf on a growing ration, which is typically 14% to 16% CP and over the feeding period begin to increase the amount of corn in the diet. This will decrease the protein of the ration and increase the energy. Most finishing rations contain approximately 50% to 60% corn in the final diet, but high-quality digestible fiber byproduct feeds (such as corn gluten feed, soybean hulls and distiller's grains) can be effectively used to finish calves, with the added benefit of improved safety margin for digestive upsets.

Table 2 shows changes in this animal's CP and TDN requirements, the calf's estimated feed intake at 2.5% of body weight (dry matter basis), as well as the required ration nutrient concentration. Since the animal's feed intake increases with body weight, it is consuming more pounds of nutrients requiring lower concentration of nutrients in the total diet. A key point of understanding is that as a beef animal matures, it begins to deposit less muscle and more fat, which is why the CP requirement as a percentage of the ration decreases with weight gain (see Table 2). Even though this occurs, finishing rations typically contain at least 12% CP. A custom ration could be formulated for this process, but many feed manufacturers in Oklahoma produce a retail product that will certainly meet the criteria for this process. Again, work with what you have or what you have available in your specific location.

There are a variety of environmental factors that may hinder or reduce the efficiency of cattle during the finishing period. Excessive heat will limit feed intake and increase water requirements during the summer. During the winter and spring, excessive mud will limit performance as well. A well-designed, dry, shady feeding pen is warranted.

The last nutrition consideration is to provide a good source of vitamins and minerals. These nutrients easily can be added to the animal's diet by offering a mineral mixture feed choice, mixing it in the ration or even top dressing it on the feed. A suggested mineral would be one that contains a calcium/phosphorus ratio of 2:1 as well as supplies a balance of other macro and micro minerals. A well-balanced mineral package in the diet will ensure to maximize the animal's health and growth.

Health

Concepts of health and selection can be important in choosing an animal to put on feed. For producers who have been focused on selling calves at weaning, knowledge of genetics—specifically carcass merit—may not have been necessary in the past and may be unknown. However, calves retained from your herd have a health advantage due to known health history and vaccination status. When choosing a calf, producers should consider the lifetime health of the animal. Positive health status is attained by an animal that receives adequate colostrum as a newborn, proper nutrition while suckling the dam and experiences little or no sickness or disease during the growing stage through weaning. Evidence industry wide shows that proper health steps taken while the calf is still on the dam will have a huge impact on growing and finishing performance. By using these simple parameters, a calf will be selected with the best chance to produce the high-quality beef product that is desired.

Purchasing from a familiar source may allow selection of an animal with more known about its health and genetic makeup or EPD's. From a health and genetics perspective,

Rule of Thumb: A calf's finishing weight would be approximately the same weight as its dam when she is a body condition score of 6.

less may be known about a calf purchased from an unknown source such as a livestock market or the internet. A buyer should strive to find out as much as they can about the health status of a purchased animal and, in turn, provide vaccinations and anthelmintic treatments as necessary. It is recommended to seek the advice from a local consulting veterinarian about what treatments are most appropriate.

Regardless of whether an animal is purchased or retained, a strong vaccination program is key to preparing calves for the stages of weaning, growing, finishing and the production of a quality beef product. Weaning can be a particularly stressful event for calves. Animals that undergo this stress with a weak immune system are more likely to get sick. Moreover, proper timing of vaccinations is essential to preparing the immune system for any health events that might occur.

Preconditioning programs are a great guideline for calf health. Most preconditioning programs ensure calves have been weaned (45 or more days), vaccinated (clostridial and viral vaccines), castrated, dehorned and acclimated to feed and water (Lalman et. al 2010). The Oklahoma Quality Beef Network is a preconditioning program that offers a clear and simple guide to vaccinate and prepare an animal for weaning, which will set them up for success in the growing and finishing stage. Visit the OQBN website for program requirements, vaccination schedules and certified sale dates http://oqbn.okstate.edu/oqbn-vac-45/ .

When finishing cattle, there are a variety of health issues a producer may encounter. Calves fed in confinement can experience digestive disorders such as bloat and acidosis. Acidosis is defined as a rapid decline in ruminal pH due to the over-consumption of starch or grain. Bloat is the accumulation of gases due to the overconsumption of highly digestible protein and/or starch. Furthermore, any abrupt changes in the diet can lead to acidosis and/or bloat. Each of these disorders can depress intake and in more severe cases, cause death. Another common ailment of feedlot cattle is foot rot, which can develop in confinement or on grass. Parasitism also is an issue that must be managed. Internal and external parasites can silently erode performance from an animal that otherwise appears normal. Parasitism causes reduced performance due to blood loss, irritation and stress (VTMD-7000, Beef Cattle Ectoparasites). It is not realistic to eliminate these pests; however, timely application of targeted insecticides can effectively keep them at or below threshold levels and prevent resistance

Rule of Thumb: All beef producers should use production practices supported by Beef Quality Assurance (BQA). BQA is an extensive guide to providing beef producers direction in the practices of nutrition, health, and management. To become BQA certified or review online resources visit https://www.bqa.org/bqa-certification.

Rule of Thumb: Most digestive disorders can be prevented by slowly adapting cattle to any changes that are being made in the diet and managing daily feed delivery effectively.

to any one product (AFS-3260, A Planning Calendar for Beef Cattle Herd Health). For any health issues, promptly consult a local veterinarian to resolve the situation before animal performance or wellbeing is impacted.

Rule of Thumb: To prevent resistance in insecticide control products, be sure to rotate insecticides based on the active ingredient rather than the brand name.

Implants and Ionophores

Beef production uses a variety of technologies to boost gain and improve efficiency. Two of those technologies commonly used in the finishing phase of beef production are implants and ionophores.

Since 1957, the beef industry has been using growth-promoting implants to increase daily gain and efficiency of all phases of cattle production. Growth-promoting implants are small compressed pellets placed under the skin of the ear. These pellets contain very small amounts of estrogenic or androgenic hormones, which are released at a constant rate with time. Implants increase production of muscle tissue but often decrease body fat production, which influences quality grade and palatability. They are available for the suckling, stocker and finishing phases of beef cattle production. Growth responses to implants are greater during the finishing phase opposed to the suckling and stocker phases. Most implants are specifically designed for a certain age, sex or stage of production. Some implants available commercially are Ralgro®, Synovex®, Compudose® and Revalor®. A comprehensive list of implants can be found in AFS-3290, Implants and Their Use in Beef Cattle Production.

Implants improve average daily gain and feed efficiency. The response of increasing weight gain is greater in animals with a higher genetic potential for gain and proper management. Implants can complement good management but do not compensate for poor management or nutrition. Strategies for implanting must consider the resources available, cattle type and age at slaughter.

Growth-promoting implants are a common management tool applied when cattle are initially processed when entering a feedlot. In 2013, the U.S. Department of Agriculture (USDA) Animal and Plant health Inspection Service (APHIS) reported 90% of all cattle placed in feedlots were implanted at least once. According to a 2015 feedlot consultant survey, 70.5% of feedlot clients were utilizing two implants during the finishing period (Samuelson et al. 2016). Since the finishing phase ranges from 120 days to 240 days, it may allow for two implants to achieve optimum performance. Implant programs can improve daily gains up to 20% and improve feed conversion up to 10%, which

Rule of Thumb: Adequate nutrition is needed for an implant to enhance calf growth, performance, and carcass quality.

can produce a significant economic return (AFS-3290, Implants and Their Use in Beef Cattle Production). Greater gains are noted when using combination estrogen/androgen implants, and the lowest gains when using estrogen only implants. An implant program for finishing cattle must consider numerous factors, including number of times to implant, ingredient and timing of implant.

Implanting improves carcass weight and ribeye area when compared to equal days fed or the same fat thickness as a non-implanted calf. Implants generally reduce marbling scores, but research indicates altered timing of implant administration in relation to slaughter can reduce the effects of implanting on quality grade.

There is no withdrawal period prior to slaughter for approved implants. Hormones are naturally occurring substances present in most foods of plant and animal origin. The Food and Drug Administration and several other health organizations have concluded that implants pose no health risks to the consumers of meat from implanted beef cattle. Growth-promoting technologies have been used for many years to sustainably produce a safe and healthy product, but if you are marketing beef as "organic" or "all-natural" these should not be used.

Ionophores are feed additives that were developed to improve feed efficiency and prevent coccidiosis. According a 2015 feedlot consultant survey, nutritionists representing 14 million cattle on feed reported that 97.3% of feedlots utilize an ionophore in finishing diets (Samuelson et al. 2016). In addition to the improvement of efficiency and gain, ionophores have a derived benefit of preventing and controlling digestive disorders such as acidosis and bloat. This is very valuable when finishing cattle due to the increased likelihood of these conditions. Ionophores improve feed efficiency by increasing the amount of energy available to the animal through selection of more efficient microorganisms in the ruminant digestive system (Felix, 2017). The two most common ionophores utilized are monensin (Rumensin® or Monovet®) and lasalocid (Bovatec®).

Ionophores can be included in a variety of feedstuffs such as mineral mixes, free choice feeds and pellet supplements. Some retail locations may not offer ionophores in stock feed mixes but most can be accessed with a custom or special order. Pure forms of ionophores are very potent and require extreme precision when added to blended feeds and supplements; label instructions should be strictly followed. Keep in mind, monensin is toxic to equine and most monogastric species. Ionophores can be toxic to any animal when overconsumed.

Rule of Thumb: In feedlot cattle, Rumensin® will provide an average 4% improvement in feed efficiency (Elanco Animal Health, 2020).

For these reasons, most small producers will not purchase ionophores to mix themselves. They would rather benefit from purchasing mineral and feed supplements already including ionophores at the proper dosage. These supplements increase feeding accuracy and reduce the guesswork for producers feeding smaller amounts of feed. Most retail feed locations can include ionophores in a blended feed or ration upon request. Regardless of whether ionophores are fed in a pure form or within a supplement, label instructions should always be strictly followed.

Ionophores are considered antibiotics, not because they kill bacteria, but by limiting the functionality and preventing reproduction of certain types bacteria in the rumen. Although they are antibiotics, ionophores are not limited by the Veterinary Feed Directive (VFD) because they are not used in medically relevant applications for humans (VTMD-9136, Veterinary Feed Directive).

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