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Beef Cattle Implant Update

This NebGuide discusses the mechanism of action and use strategies for growth promoting implants, including expected responses and cost analysis.

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Introduction

Growth promoting implants have been used extensively in beef production for over 30 years. Significant changes in implants and implanting strategies have occurred. Prior to 1987, available implants were estrogenic agents which metabolically enhanced nutrient use to enhance growth. These products improved feed efficiency 5-10 percent and daily gains from 5-15 percent. In 1987, the androgenic (tissue building) agent, trenbolone acetate, was approved for use in growth promoting implants. This compound had an additive effect with existing estrogenic implants. The androgenic implant enhanced muscle growth and added an additional 2-3 percent to the feed efficiency and 3-5 percent to the daily gains. The return on implant investment varies, but only in rare situations do implants return less than $5 per $1 spent. Implants are available for all cattle except calves less than 45 days old and most breeding cattle. Proper scheduling and use of implants should return in excess of $10 per $1 spent.

Today, implants have become almost designer products with varied doses and combinations of estrogenic and/or androgenic agents. While implants tend to be most effective in feed yards, implanting strategies have been effectively applied to other beef production situations. The growth promoting implants approved for use in the United States are extremely safe. Safe not only for the cattle, but for producers who use the products and for the consumers who consume the beef produced from implanted cattle.

There is ***no withdrawal time*** for any of the approved implants available in the United States.

Mechanism of Action

Cattle must have adequate nutrition before implants can positively influence feed efficiency and gain. The greatest response to implants tends to be observed in older cattle, near peak periods of lean tissue deposition. Typically these would be yearling cattle consuming high levels of high energy feed.

Estrogenic implants increase the circulating levels of somatotropin (ST) and insulin-like growth factor-1 (IGF-1). Both of these substances are produced by the animal and have a marked effect on how nutrients are used by the animal to produce muscle, bone, and fat. The approved androgenic agent, trenbolone acetate (TBA), does not seem to stimulate the production of ST, but does significantly increase the circulating levels of IGF-1 and decreases the normal loss of muscle tissue in sedentary animals. The implant response is associated with nutrients available and the level of implant growth promotant circulating in the animal.

When growth promoting implants are first placed in the animal, there is a rapid release of hormone from the implant. The level of growth promotant being released from the implant will begin to fall after a few days but will remain above an effective growth stimulating level, "threshold," for a varying length of time depending on the pharmaceutical design of the implant and the quality of technique used when administering the implant placement. Reimplanting, the administration of an additional implant, is usually scheduled to coincide with the declining level of circulating implant growth promotant, but always above threshold. The optimum reimplant time is referred to as the reimplant window. For maximum benefit, it is important to maintain the level of implant growth promotant above threshold throughout the ownership of the stocker or feeder animal. The length of time an implant releases growth promotant above threshold, "payout," varies from approximately 75 days for Ralgro® to the manufacturer's estimated 200 days for Compudose®. The improvements in rates of gain appear to follow the declining level of growth promotant released from an implant. Therefore, the highest rates of gain can be expected during the first part of the payout period.

Because implant growth promotants interact with the production of hormones produced by the animal, they have not been recommended or approved for use in breeding cattle or calves less than 45 days of age.

Implant Performance

The estrogenic implants approved for use in suckling calves will improve weaning weights 3-5 percent. Similar performance improvements can be seen in pastured stocker cattle when the base gain is above 1.5 pounds per day.

Previously implanted cattle are of concern to cattle buyers who take advantage of compensatory gain potential of cattle. Producers should receive a premium equivalent to the loss of production to consider not implanting suckling calves or stocker cattle.

In feeder cattle, estrogenic growth promoting implants improve feed efficiency and gain 5-15 percent. Implants which include TBA can provide an additional 3-5 percent improvement in feed efficiency and daily gain. A properly designed reimplant program can sustain implant associated improved performance beyond the payout that would be expected for a single implant.

For estrogenic implants used in yearling cattle fed typical Nebraska feedlot rations, at least a $5 return

above the cost of the implant can be expected for each $1 price of a bushel of corn. Adding TBA to an estrogen implant system will return an additional $2 above the cost of the implant for each $1 price of a bushel of corn. For example, if corn costs $3 per bushel, an estrogenic implant would return approximately $15. Implants containing TBA would return approximately $21 when used in cattle fed $3 corn.

While cull cows are not typical feeders, limited data suggest they respond to implants at or above the level of younger feeder animals, especially to TBA. Most cull cows are not fed long enough to consider a reimplanting program.

Implant Use

Regulations governing the use of implants are set by the U.S. Food and Drug Administration (FDA). Always read and follow the manufacturer's directions before implanting any cattle.

The only approved location for implant administration is the middle third of the back side of the ear. All implants must be located within this area (*Figure 1*). If part of the ear has been lost because of frost bite or injury, the implant should be placed in the last third of the ear. This should place the implant outside the cartilage ring at the base of the ear. Implants should never be placed in locations other than the ear.

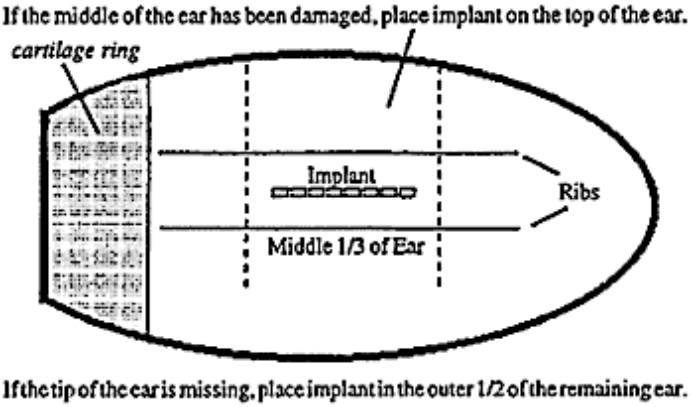


Figure 1.

Implanting technique defects are a serious economic concern because of suspected associated performance loss. Defects of concern include abscesses, expelled implants, cartilage embedment, crushed pellets, missing pellets, and bunched pellets. Identification of these defects can be hard to determine. Generally abscesses will be enlarged and will feel doughy. If the abscess ruptures, the implant will be expelled leaving a very small ring of scar tissue. Some implant sites will accumulate fluid that is not associated with an infection and do not seem to be associated with implanting technique. Cartilage embedment should be suspected when the implant feels firmly attached to the deeper tissues of the ear or when you cannot feel the roughened edge of the implant. While no published data are available to validate an associated economic loss from these defects, unpublished data from work conducted at the University of Nebraska Great Plains Veterinary Educational Center during the summer of 1996 suggest abnormal implants are associated with 0.17 pound reduction in carcass gain in cattle fed 150 days[1]. Common sense suggests better performance could be expected in cattle free of implant defects.

The loss of implants before payout can be avoided if the implants are properly located in a dry ear with a clean implanting needle. If the ear is wet, it should be dried before implanting. If the ear is covered with wet manure or mud, the filth should be scraped or washed off and the ear dried. The needle should be cleaned between each animal with a diluted disinfectant. If the needle slips over the surface of the ear, it should be cleaned before continuing. The tissue irritation caused by an undiluted disinfectant can cause the expulsion of an implant or the formation of scar tissue which could interfere with the effective release of growth promotant from the implant. Care should be taken when selecting an implant needle cleaning solution. One ounce of chlorhexidine, the blue disinfectant, per gallon of water is an effective implant needle cleaning solution while ***alcohol is not***. Some feedyards coat the cleaned implanting needle with an approved, non-irritating antibiotic between animals as an additional safeguard to help prevent implant site infections. Visit with your veterinarian about the selection, dilution, and use of a disinfectant.

Developing a light touch and slightly rotating the needle when implanting is the best defense against cartilage embedment. A properly placed implant will be slightly movable.

Missing or bunching of implant pellets can be avoided by carefully restraining the animal and slowly withdrawing the implant needle as the implant is being administered. Implant guns and needles are available from the companies that manufacture growth promoting implants. All implants can be effectively administered with the implant gun designed for the associated implant. It is important to visually inspect and physically palpate the implant site after the implant is administered to ensure the implant is properly placed and all the pellets in the pelleted implants are properly aligned. As part of the inspection, the implant needle opening should be closed by pressing down on the hole. Most of the problems with implant guns can be avoided by closely following the manufacturer's directions.

Implant restraint bars or plates have become common on processing chutes. They effectively hold the animal's head still, making it much easier to properly place the implant. However, implant restraint bars and plates will cause the loss of four to six inches of exposed neck available for injection making it more difficult to properly give neck injections. Because injection site damage in the rump and round is a serious concern of the beef industry, we recommend giving all antibiotic and vaccine injections in the neck and, therefore, do not recommend the use of implant restraint bars or plates. If cattle are caught properly, just behind the ears, in an unmodified head gate, implanting restraint bars or plates are not needed to properly place implants.

Routine inspection of implant and vaccine sites should be done every time animals are handled through a chute and at periodic quality audits performed at packing houses. A practical and consistent inspection can be accomplished on each animal that enters the hospital.

Table I. Available Implants

Name	Estrogen (mg/implant)	Progesterone (mg/implant)	Androgenic (mg/implant)	Target Cattle	Reimplant Window	Estimated Payout
Ralgro®	36 mg zeranol[a]			Stocker/feeders over 45 days of age	45 - 90 days	70 - 100 days
Synovex-C®	10 mg E_2 benzoate[b]	100 mg progesterone		Calves between 45 days age and weaning	45 - 90 days	100 - 140 days
Calfoid®	10 mg E_2 benzoate[b]	100 mg progesterone		Calves between 45 days age and weaning	45 - 90 days	100 - 140 days
Revalor-G®	8 mg E_2 - 17β [c]		40 mg trenbolone acetate[d]	Pastured stocker and feeder steers	120 days	100 - 140 days
Magnum®	72 mg zeranol[a]			Weaned stocker and feeder cattle	70 - 100 days	100 - 120 days
Compudose®	24 mg E_2 - 17β [c]			Calves, stockers, and feeder cattle	140 - 170 days	170 - 200 days
Synovex-S®	20 mg E_2 benzoate[b]	200 mg progesterone		Weaned stocker and feeder steers	70 - 100 days	100 - 140 days
Implus-S®	20 mg E_2 benzoate[b]	200 mg progesterone		Weaned stocker and feeder steers	70 - 100 days	100 - 140 days

Revalor-S®	24 mg E_2 - 17β [c]		120 mg trenbolone acetate[d]	Weaned stocker and feeder steers	90 - 100 days	100 - 140 days
Finaplix-S®			140 mg trenbolone acetate[d]	Weaned stocker and feeder steers	70 - 100 days	60 - 100 days
Synovex-H®	20 mg E_2 benzoate[b]		200 mg testosterone	Weaned stocker and feeder heifers	70 - 100 days	100 - 140 days
Implus-H®	20 mg E_2 benzoate[b]		200 mg testosterone	Weaned stocker and feeder heifers	70 - 100 days	100 - 140 days
Revalor-H®	14 mg E_2 - 17β [c]		140 mg trenbolone acetate[d]	Weaned stocker and feeder heifers	90 - 100 days	100 - 140 days
Finaplix-H®			200 mg trenbolone acetate[d]	Weaned stocker and feeder heifers	70 - 100 days	60 - 100 days
Synovex Plus®	28 mg E_2 benzoate[b]		200 mg trenbolone acetate[d]	Weaned stocker and feeder steers	90 - 100 days	100 - 140 days

[a]zeranol contains 30-33% the estrogenic activity of Estradiol-17β (E_2 - 17β).

[b]E_2 benzoate is approximately 72% the estrogenic activity of Estradiol-17β (E_2 - 17β).

[c]Estradiol-17β.

[d] Trenbolone acetate is often abbreviated as TBA.

Compudose is a trademark of Elanco.
Ralgro and Magnum are trademarks of Mallinckrodt Veterinary, Inc.
Synovex-C, -S, -H, and Plus are trademarks of Fort Dodge Animal Health.
Finaplix-S, -H, Revalor-S, -H, -G are trademarks of Hoechst-Roussel Agri-Vet Co.
Calfoid, Implus-S and -H are trademarks of the Up-John Co.

Other Considerations

Implanting heifers intended to enter the breeding herd is controversial. The mixed results from research trials suggest detailed management considerations must be adhered to before considering an implant program for replacement heifers. Highlights of these considerations include selecting an implant approved for use in replacement heifers, providing adequate nutrition for growth, and leaving adequate time between implanting and breeding.

Implanting replacement breeding bull calves is not approved or recommended.

Implanting Strategies

It is important to implant cattle as soon as practical. In suckling calves, the traditional branding time in Nebraska provides an excellent opportunity to implant and vaccinate most of the calves in the herd. Prior to bull turn out, the preferred procedures include vaccination with subcutaneously administered modified live four way viral and clostridial vaccines, and implanting calves older than 45 days old with a product designed for suckling calves. It is important not to implant replacement heifers and never implant bull calves intended to be kept for breeding purposes unless strict adherence to manufacturer's directions are followed.

Calves at weaning not intended for breeding should be implanted again with a more aggressive implant. The feeder implant can be either an estrogenic implant or a combination estrogenic-trenbolone implant. It appears to be important to finish the feeding period with the most potent implant selected in the implanting program (*Table II*). Therefore, if a combination estrogenic-trenbolone implant is selected as the first implant, it should be used again in subsequent implantings. If an estrogenic implant without trenbolone is selected as the first implant, a similar product can be selected for subsequent implanting or an estrogenic-trenbolone implant may be selected.

Table 2. **Implant Relative Potency and Payout Rank**

Name	Hormonal Activity	Relative Potency	Re-Implant Window [c]	Optimum Payout Period (days)
Ralgro	Estrogen [ab]	Low	45 – 90 days	60 – 90 days
Synovex-C	Estrogen [ab]	Low	45 – 90 days	60 – 90 days
Calfoid	Estrogen [ab]	Low	45 – 90 days	60 – 90 days
Duralease	Estrogen [ab]	Moderate	70 –100 days	80 – 120 days
Magnum	Estrogen [ab]	Moderate	70 –100 days	80 – 120 days
Synovex-S/H	Estrogen [ab]	Moderate	70 –100 days	80 – 120 days
Implus-S/H	Estrogen [ab]	Moderate	70 –100 days	80 – 120 days
Finaplix-S/H	Androgen [ab]	Moderate	60 –80 days	60 – 80 days
Revalor-IS/IH	Androgen [ab] Estrogen [ab]	Moderate	70 –100 days	90 –120 days
Synovex Choice	Androgen [ab] Estrogen [ab]	Moderate	70 –100 days	120 –140 days
Finaplix-S/H	Androgen [ab] Estrogen [ab]	High	90 –100 days	90 – 110 days
Revalor-S/H	Androgen [ab] Estrogen [ab]	High	90 –100 days	90 – 120 days
Synovex Plus	Androgen [ab] Estrogen [ab]	High	90 –100 days	90 – 120 days

[a] See notations for Table 1. [b] Androgen and Estrogen is denoted as A and E in the Figure 2. [c] Re-implanting prior to the shortest days listed in the re-implant window can lead to severe side effects such as prolapses and decrease in gain and / or efficiency performance.

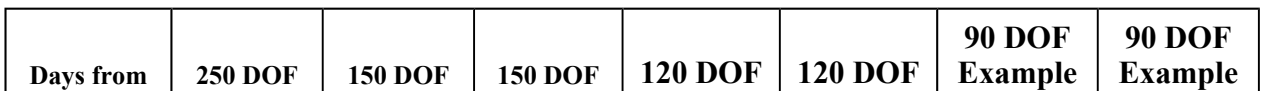
Reimplant schedules should be developed to reflect the targeted finish date, the historic grade price spreads, the genetic potential of the cattle, and the feeding program available. From the projected finish date, reimplanting should be scheduled by back calculating the payout days of the last implant intended for use.

For example, if 550-pound medium to large frame weaned steer calves enter the feedyard the first of October, an estrogenic product such as Magnum®, Synovex-S®, or Implus-S® can be selected as the initial implant. If the cattle are projected to gain 3 pounds per day and be marketed at 1,100 pounds, the estimated sale date would be the first two weeks of April. Back calculating the 120-day payout of a combination estrogenic-trenbolone implant from the middle of April, reimplanting would be scheduled for the middle to the end of December.

Maintaining implanting schedules can be very difficult, but tremendous performance advantages can be achieved if properly managed. If you have any questions, seek the advice of a qualified feedlot nutritionist or veterinarian.

Figure 2 **Implant Program Relative To Days From The Packer To Achieve Desired Finish End Point (DFEP)**

Note: The diagram is interpreted bottom to top. Each column represents an individual example of the length of days the animal will be finished – Days On Feed (DOF). All protocols should be designed so that the implant has been use up by the time the animal is scheduled to go to the packer. NEVER, give an implant before any previous implant has met the re-implant window.



the packer	Example	Example A	example B	example A	example B	A	B
Day 0	↑	↑	↑	↑	↑	↑	↑
	↑	↑	↑	↑	↑	↑	↑
	↑	↑	↑	↑	↑	↑	↑
Day 70	↑	↑	↑	↑	HP	↑	↑
Day 80	↑	↑	HP	HP	↑	↑	↑
Day 90	↑	↑	↑	↑	↑	MP	HP
Day 100	HP	HP	↑	↑	↑		
	↑	↑	↑	↑	↑		
Day 120	↑	↑	↑	LP	MP		
	↑	↑	↑				
	↑	↑	↑				
Day 150	↑	LP	MP				
	↑						
	↑			LP =	Low	Potency	(E)
Day 190	MP			MP =	Moderate	Potency	(E)
	↑			HP =	High	Potency	(E + A)
	↑						
Day 250	LP or MP						

Ration Considerations

Although no special ration considerations are needed for maximal implant performance, it is important to feed a balanced high quality ration. All approved feed additives used in an approved manner are appropriate to consider in a feeding program for implanted cattle. Performance improvements associated with approved feed medications are additive to the expected performance improvements from implants.

Side Effects

Heavy carcass weight can be a problem when feeding large frame exotic long yearlings. Typically, implanted cattle will be heavier when finished and with the same quality grade as non-implanted cattle. Weight discounts in the magnitude of 15 percent of the carcass value can be applied to carcasses that weighed over 950 pounds or live cattle that weighed over 1,500 pounds. This problem can be minimized if cattle start on feed at a lighter weight, using only estrogenic implants or targeting the finishing to achieve the select grade instead of choice grade.

Poor yield grades have been reported in heifers implanted with combination estrogenic-trenbolone implants and concurrently fed the feed additive melengestrerol acetate (MGA). These observations were made in studies designed to evaluate the benefits of a combination implant. It is likely the heifers were overfed. It is important in any feedlot management program to evaluate cattle near their target finishing date, and market the cattle as soon as the cattle reach the most economical degree of finish.

Poor quality grades can be a problem if implanting schedules are not properly designed to match the age, weight, genetics, and nutritional management of the cattle. It is always important to consider the historic quality grade price spreads at the targeted finishing date.

An increase in the buller rate has been reported with the use of some implants. Crushing implants has also been blamed on the increased buller rate in some groups of implanted animals. With the modern implanting tools available today, this problem seems unlikely. The effects of climatic changes, ambient temperature, animal handling, commingling, feed stuffs containing fungal or plant estrogens, and implant technique seem more likely to play a role in these observations.

Vaginal and rectal prolapses have been reported as an implant side effect. If hormones are involved in these occurrences, it is possible additional estrogenic compounds from the feed are also involved. These compounds could come from feed molds or from some classes of feeds such as legumes containing phytoestrogens. Other suspected causes include improper implanting technique or improper implant scheduling.

High tailheads, sunken loins, udder development, and heavy hide weights have also been reported. These problems are generally rare or have minor economic significance when compared to the performance benefit realized from the use of implants.

Conclusions

Using growth promoting implants is one of the most cost effective methods of enhancing cattle gain and efficiency of gain. Implants enhance protein deposition while diminishing fat accretion. Properly designed implant programs should take into account animal age, sex, weight, breed and market objectives. Meat and animal products from cattle implanted with growth promotants are as safe and acceptable as comparable products derived from nonimplanted cattle.

[1]This data was presented at the 1996 Academy of Veterinary Consultants Meeting.

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