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# Implanting Beef Cattle

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## Introduction

Implanting nursing calves with a growth stimulant is one of the most economically justifiable practices available in the beef industry. Implants have been shown to increase weaning weights of nursing calves in hundreds of research trials. Stocker and feedlot calves exhibit even greater responses than nursing calves. Implanting returns more revenue per dollar invested than any other management practice.

Despite being approved for more than 50 years, only 33 percent of cow/calf producers nationwide use growth-promoting implants. Unless calves are marketed to a program that prohibits the use of implants, nursing calves intended for sale should be implanted prior to weaning.

Although technologies are constantly being developed to reduce the costs of beef production, cow/calf producers are often reluctant to use implants. Therefore, it is critical that manufacturers invest money into research and product development to benefit cow/calf producers.

## Implants

Implants are small pellets that contain a growth stimulant that is slowly released over a period of time. Implants work by increasing circulating levels of somatotropin and insulin-like growth-factor 1. This causes an increase in the secretion of growth hormone, which increases muscle growth.

Many implant products are available for use in nursing calves, stocker calves and feedlot calves. Most implants are specifically designed for a certain sex, age or stage of production. Always read the product label and follow the manufacturer's recommendations prior to implant use.

Implants that are approved for use in beef cattle are shown in Table 1. Of the hormones used in beef cattle implants, three are naturally occurring (estradiol, progesterone and testosterone) and two are synthetics (zeranol and trenbolone acetate). Estradiol, progesterone and zeranol are estrogenic, whereas testosterone and trenbolone acetate are androgenic. Estrogenic refers to hormones affecting female characteristics and androgenic refers to hormones affecting male characteristics. Zeranol mimics estradiol and trenbolone acetate mimics testosterone. Table 2 lists the production phase and age approvals for each implant.

## Using Implants

The U.S. Food and Drug Administration (FDA) approves and regulates the use of all growth-promoting implants. The only FDA-approved location for placement of an implant is the middle third on the back side of the ear, between the skin and the cartilage.

Optimal response to implants depends on sanitation and proper implanting techniques. Improper sanitation and technique may cause defects including abscesses, lost implants, improper placement, crushed pellets and missing pellets. Implant manufacturers market an implant gun that is specific for each implant. The implant and implant gun should be made by the same manufacturer to keep defects to a minimum. Take the following steps to minimize implant failures:

1. Restrain the animal's head in a head gate to restrict movement. Catch the animal just behind the ears. If the animal will not be calm, use a halter for the

safety of both the animal and implant technician. If the animal is moving, the needle can easily come out of the ear and the implant will be deposited on the ground.

2. Check the needle to make sure it is tightly secured to the implant gun; replace the needle when it becomes dull or damaged. Clean the needle with a disinfectant between each implant. Some implants are coated with antibiotic, which can decrease the risk of infection.

3. Clean the ear of any mud or manure and disinfect it before implanting. A commonly used disinfectant is Nolvasan® (chlorhexixine acetate), which should be mixed at 1 ounce per gallon of water.

4. Place the implant in the center one-third of the ear. To prevent crushing the pellets, slowly withdraw the needle as the implant is being administered to allow space for the implant pellets. Close the incision made by the needle by pressing down on the opening.

Examine the ear to make sure the implant was properly placed. The implant should be slightly movable if placed between the skin and cartilage. The implant will not be absorbed if it is placed in the cartilage where there is no blood flow. Avoid placing the implant in the blood vessel because the absorption rate will be higher, and the implant will be effective for a shorter period of time. Be patient and make sure the implant is correctly placed. Each implant that is improperly placed can mean $15 to $20 of lost income.

**Table 1.** Implants approved for use in beef cattle.

| Trade Name | Company | Active Ingredient |
|---|---|---|
| Ralgro® | Schering-Plough | 36 mg zeranol |
| Ralgro Magnum® | Schering-Plough | 72 mg zeranol |
| Synovex-C® | Fort Dodge | 10 mg estradiol benzoate, 100 mg progesterone |
| Synovex-S® | Fort Dodge | 20 mg estradiol benzoate, 200 mg progesterone |
| Synovex-H® | Fort Dodge | 20 mg estradiol benzoate, 200 mg testosterone |
| Synovex-Plus® | Fort Dodge | 28 mg estradiol benzoate, 200 mg trenbolone acetate |
| Synovex-Choice® | Fort Dodge | 14 mg estradiol, 100 mg trenbolone acetate |
| Revalor-G® | Intervet | 8 mg estradiol, 40 mg trenbolone acetate |
| Revalor-S® | Intervet | 24 mg estradiol, 120 mg trenbolone acetate |
| Revalor-H® | Intervet | 14 mg estradiol, 140 mg trenbolone acetate |
| Revalor-IS® | Intervet | 16 mg estradiol, 80 mg trenbolone acetate |
| Revalor-IH® | Intervet | 8 mg estradiol, 80 mg trenbolone acetate |
| Revalor-200® | Intervet | 20 mg estradiol, 200 mg trenbolone acetate |
| Finaplix-H® | Intervet | 200 mg trenbolone acetate |
| Encore® | Vetlife | 43.9 mg estradiol |
| Compudose® | Vetlife | 25.7 mg estradiol |
| Component E-C® | Vetlife | 10 mg estradiol benzoate, 100 mg progesterone |
| Component E-S® | Vetlife | 20 mg estradiol benzoate, 200 mg progesterone |
| Component E-H® | Vetlife | 20 mg estradiol benzoate, 200 mg testosterone |
| Component TE-G® | Vetlife | 8 mg estradiol, 40 mg trenbolone acetate |
| Component TE-S® | Vetlife | 24 mg estradiol, 120 mg trenbolone acetate |
| Component TE-H® | Vetlife | 14 mg estradiol, 140 mg trenbolone acetate |
| Component T-S® | Vetlife | 140 mg trenbolone acetate |
| Component T-H® | Vetlife | 200 mg trenbolone acetate |
| Component TE-IS® | Vetlife | 16 mg estradiol, 80 mg trenbolone acetate |
| Component TE-IH® | Vetlife | 8 mg estradiol, 80 mg trenbolone acetate |
| Component TE-200® | Vetlife | 20 mg estradiol, 20 mg trenbolone acetate |

**Table 2.** Approved implants by sex and production phase.

| Trade Name | Nursing steers | Nursing heifers | Stocker steers | Stocker heifers | Feedlot steers | Feedlot heifers |
|---|---|---|---|---|---|---|
| Ralgro® | X | X[a] | X | X | X | X |
| Ralgro Magnum® | | | | | X | |
| Synovex-C® | X | X[b] | | | | |
| Synovex-S® | | | X | | X | |
| Synovex-H® | | | | X | | X |
| Synovex-Plus® | | | | | X | X |
| Synovex-Choice® | | | | | X | |
| Revalor-G® | | | X | X | | |
| Revalor-S® | | | | | X | |
| Revalor-H® | | | | | | X |
| Revalor-IS® | | | | | X | |
| Revalor-IH® | | | | | | X |
| Revalor-200® | | | | | X | X |
| Finaplix-H® | | | | | | X |
| Encore® | X | | X | | X | X |
| Compudose® | X | | X | | X | X |
| Component E-C® | X | X[b] | | | | |
| Component E-S® | | | X | | X | |
| Component E-H® | | | | X | | X |
| Component TE-G® | | | X | X | X | X |
| Component TE-S® | | | | | X | |
| Component TE-H® | | | | | | X |
| Component T-S® | | | | | X | |
| Component T-H® | | | | | | X |
| Component TE-IS® | | | | | X | |
| Component TE-IH® | | | | | | X |
| Component TE-200® | | | | | X | |

[a]Do not implant heifers prior to 30 days of age.
[b]Do not implant heifers prior to 45 days of age.

## Nursing Calf Performance

Calves (steers and cull heifers) that are destined for finishing and sale to a terminal market should be implanted. Heifers intended for breeding require specific implant recommendations to avoid reproductive failures, which are discussed in a later section of this publication. Several research trials have shown that implanting nursing beef calves once will improve daily gains from birth to weaning by four to six percent. Growth response to implants is about 20 percent greater in heifers than steers.

Implanting a nursing calf once will increase weaning weight by approximately 15 to 30 pounds. Most calves are not weaned, however, until seven to eight months of age, and the majority of implants lose effectiveness within 120 days of implanting. If calves are implanted at birth or before two months of age, the implant will lose effectiveness three to four months before weaning. Research has shown that re-implanting nursing calves increased weight gains by 1 to 8 pounds.

A summary of several research studies revealed that implanting steer calves only once improved daily gains by 0.10 pounds per day, and implanting twice increased daily gains by 0.13 pounds per day when compared to calves receiving no implants. Table 3 shows results of implanting nursing steers either once or twice with either an estrogen-progesterone implant or with Zeranol.

**Table 3.** Percentage improvement in daily gain over non-implanted nursing steers for nursing steers implanted either once or twice.

| Implant type | One implant | Two implants |
|---|---|---|
| Estrogen-Progesterone | 5.6 | 5.7 |
| Zeranol | 5.1 | 6.7 |

Adapted from Selk, 1997.

Implanting twice with the estrogen-progesterone implant showed no additional benefit as the percentage increase over non-implanted calves was virtually the same with one or two implants. Implanting twice with Zeranol improved gains by 6.7 percent compared to 5.1 percent with only one implant. This would result in an increase in weaning weight of approximately 8 pounds after implanting twice with Zeranol. Implanting twice prior to weaning will be more cost effective when calf prices are high. Two implants, Compudose® and En-core®, are approved to be effective for 200 (Compudose®) to 400 (Encore®) days. Use these implants only once prior to weaning. If calves are implanted from birth to three months of age with an implant having an effectiveness of 120 days or less, a second implant can be administered approximately 90 days prior to weaning. As previously discussed, the implant type will influence the effectiveness of a second implant. If calves are three months or older at the time of the first implant, then a second implant is not recommended prior to weaning.

Calves must have adequate nutrition to realize improved daily gains from an implant. Calves nursing heavier milking cows and calves that are creep fed have been shown to have a greater response to implants. Fall-born calves may have little or no access to high-quality forage. If fall-born calves are creep fed, however, or allowed to graze winter annual forages via creep grazing, implants would be more effective in fall-born calves. Late winter- and spring-born calves should have sufficient nutrition to allow optimum implant response unless a drought occurs, but creep feeding or creep grazing can increase the implant response.

## Stocker Calf Performance

Implanting stocker calves improves daily gains by 10 to 20 percent over non-implanted calves. A greater response occurs in stocker calves compared to nursing calves. Steers will usually have a greater growth response than heifers. There are more implant options available for stocker calves than nursing calves (Table 2).

Stocker calves can be implanted every 90 to 100 days depending on the specific implant used. If calves will be stockered longer than 130 to 140 days, then a second implant should be economical, provided adequate nutrition is available. Growth response to an implant will be greater in calves on a higher plane of nutrition. Some studies have shown that a second implant was not effective when calves were gaining 0.96 pounds per day with no supplementation. When calves were fed 5 to 7 pounds of supplemental feed, however, the growth response to a second implant was 5 percent. Research clearly shows a greater response to implants with an increasing nutritional level, but implanting calves that are gaining slowly will not negatively affect growth rates.

Implants will not decrease the benefits of feeding ionophores. Table 4 shows the additive effects on gain from feeding a supplement and the ionophore Rumensin®. The combined growth response to feeding an ionophore, supplement and implant was 41 percent greater than the control group. Use of supplemental energy and protein will depend upon supplement price, desired gain and forage quality. Supplements will improve implant response when forage alone cannot support gains of at least 1.5 pounds per day.

**Table 4.** Daily gain response to use of an implant, energy supplement and ionophore.

| Treatment | Daily gain | Growth response, % |
|---|---|---|
| Control | 1.22 | ----- |
| Implant[a] | 1.39 | 13.9 |
| Control | 1.35 | 10.7 |
| Supplement + ionophore[b] | 1.45 | 18.9 |
| Implant, supplement and ionophore | 1.72 | 41.0 |

[a]Compudose®
[b]Rumensin®
Adapted from Kuhl, 1997.

Implants have also been shown to reduce the negative effects of endophyte-infected tall fescue. In a Kansas study, stocker steers were implanted with Ralro® and allowed to graze either high (82 percent infected) or low (20 percent infected) endophyte-infected pastures. Implanting improved daily gain by 12 to 16 percent on the low endophyte-infected fescue; however, the response was much greater on the high endophyte-infected pasture, in which gains were improved 37 to 46 percent. In addition, weaning weights of implanted nursing calves have been increased more when grazing on 70 percent versus 40 to 45 percent infected fescue.

## Feedlot Calf Performance

Virtually all feedlot calves are implanted at least once during the finishing phase. Growth responses to implants are greater during the feedlot phase than in the nursing or stocker phases. Most implants are approved for use in feedlot calves (Table 2). Increases in daily gains of 15 to 20 percent can be expected in feedlot calves receiving an implant. Greater gains are observed when using combination estrogen/androgen implants, and the lowest gains are observed when using only estrogen implants. Feed efficiency is improved 6 to 14 percent with combination estrogen/androgen implants, which improve feed efficiency to a greater extent than estrogen-only implants.

Implants generally reduce marbling scores by 4 percent and increase ribeye area by 3 to 4 percent. In addition, implanting increases carcass weight when compared to equal days fed or the same fat thickness as a non-implanted calf. Many implant protocols recommend a lower potency implant at feedlot entry followed by a high potency combination implant at approximately 100 days from slaughter. Consult with manufacturer representatives to develop an implant strategy that will minimize negative effects on carcass marbling.

## Implanting Bulls

No implants are approved for use in bulls. Implants will reduce testicular development, semen quality and libido. Do not implant a bull calf until it is castrated.

## Lifetime Effects of Implanting

Transfer of ownership of most cattle occurs at each stage of the production chain. Implant choices are usually based upon maximizing returns at each production level. It is possible that implanting at one stage of production will impact performance at the next stage. Calves may receive from four to six implants during their lifetime if implanted on a regular basis from birth to slaughter. With more producers retaining ownership through slaughter, impacts of lifetime implant strategies on feedlot performance and carcass characteristics are becoming more important.

Implanting calves during the nursing phase has not been shown to decrease subsequent performance or affect carcass characteristics. Calves should not be discounted at weaning if they have been administered an implant. Studies have shown that calves implanted prior to weaning and three times during the finishing phase did not show any decrease in performance compared with calves administered implants only during the finishing period.

Implant programs used during the finishing phase affect performance and carcass characteristics greater than implants used during the nursing and stocker phase. Calves implanted prior to weaning and then implanted approximately 90 days before slaughter should show no adverse affects in performance compared with unimplanted calves.

The effect of each implant is additive and the value at each segment will be increased, which reduces total costs of beef production. Implant potency should increase at each stage of production. Repeated use of low-potency implants in the stocker and finishing phases negatively affects feed efficiency in the finishing phase. Once calves are on an implant program, they should be implanted at regular intervals to maintain blood hormone levels to attain optimal response to the implanting regime. It is important that calves are always on a positive plane of nutrition when implants are administered. Calves that are growing slowly or maintaining weight will have a reduced response to the implant, which can have permanent negative effects on marbling. When growing slowly, calves will use all available energy for bone and muscle growth, which limits the animal's ability to deposit fat.

## Implanting Replacement Heifers

Using growth-promoting implants is one of the most economical production practices to improve performance in nursing calves. There is no doubt steer calves should be implanted, but the picture is not so clear with potential replacement heifers. Some producers have been reluctant to implant replacement heifers because of possible negative effects on reproduction.

Prior to using any implant in replacement heifers, carefully read label instructions to determine if the implant is approved for heifer calves and to identify the proper age to administer the implant. Implanting at the wrong age can have substantial negative effects on future reproductive performance. For example, administering an implant containing Zeranol at birth has been shown to reduce pregnancy rates by 35 percent. However, giving the same implant between 1 and 10 months of age showed no negative effects on reproductive performance.

Other studies have examined the effects on pregnancy rates of administering two implants between 1 and 11 months of age. Pregnancy rates were quite variable between the implanted and non-implanted heifers, and several studies showed significant reductions in pregnancy rates in implanted heifers.

Research has shown that implanting heifer calves will increase yearling pelvic area, but the difference is negligible by calving time, and implanting does not appear to affect age of puberty. In addition, heifers that have been implanted have similar rates of dystocia as heifers that have not been implanted. However, heifers that were implanted twice (at 2 and 6 months of age) had lower pregnancy rates.

Replacement heifers that are identified early in life should not be implanted. There is no advantage in dystocia or age at puberty; therefore, there is little benefit to implanting replacement heifers. Heifers that are destined for finishing should be implanted to take advantage of the added weight gain. Heifers that are not yet identified as replacements can be implanted once if label directions are carefully followed. Implanting according to the manufacturer's recommendations should have very minimal effects on reproduction, and will allow the producer to take advantage of added weight gains in the heifers sold at weaning time. Using an approved product and administering it according to label directions is extremely important when using implants in potential replacement heifers.

## Side Effects

Side effects such as raised tailheads, udder development, bulling, and vaginal and rectal prolapses have been cited as reasons not to use implants. These conditions usually occur when improper implanting techniques are used, particularly crushing an implant. Side effects are rare and of little economic significance in terms of additional weight gain achieved with implants.

## Implant Safety

Implants replace or supplement existing hormones in the animal's body. Implants have been approved for use since 1954. Before any implant is sold, the Food and Drug Administration must approve it to be safe and effective. There is no such thing as "hormone-free" beef or any other meat, as all meat products contain hormones. Hormones are produced by all humans and animals for normal body functioning and maturation.

The hormones used in beef cattle implants include three naturally occurring hormones (estradiol, progesterone and testosterone) and two synthetic hormones (zeranol and trenbolone acetate). Zeranol mimics estradiol and trenbolone acetate mimics testosterone. All of these have been used without any effects on public health for many years. A 3-ounce serving of beef from an implanted steer has 1.9 nanograms of estradiol, and a 3-ounce serving of beef from a non-implanted calf has 1.3 nanograms. There are 28 billion nanograms in 1 ounce; therefore, the difference in estradiol is extremely minuscule.

Table 5 shows the nanograms of estrogenic activity in 1 pound of common foods. Other foods eaten every day have much greater amounts of estrogen than beef does.

**Table 5.** Estrogenic activity of common foods.

| Food | Estrogenic activity in nanograms/lb of food |
|---|---|
| Soybean oil | 908,000 |
| Cabbage | 10,896 |
| Eggs | 15,890 |
| Milk | 59 |
| Beef from pregnant cow | 636 |
| Beef from implanted cattle | 10 |
| Beef from non-implanted cattle | 7 |

Adapted from Preston, 1997.

Table 6 shows the daily production of estrogen in humans and the amount in implanted beef. The amount of estrogen consumed from eating beef is minuscule compared to what we produce in our bodies every day. The FDA has concluded that the estradiol content in implanted beef is insignificant and of no safety risk. In addition, the FDA requires no withdrawal period prior to slaughter.

**Table 6.** Estrogen produced, nanograms per day.

| Item | Estrogen produced, nanograms/day |
|---|---|
| Pregnant woman | 90,000,000 |
| Non-pregnant woman | 5,000,000 |
| Adult man | 100,000 |
| Pre-pubertal children | 40,000 |
| 3 ozs. beef from implanted cow | 1.9 |

Adapted from Preston, 1997.

## Summary

Implanting nursing calves is one of the most underutilized but proven management practices in the beef industry. Implants have been shown to increase weaning weights of suckling calves in hundreds of research trials. Many studies have shown that implanted steers have the same growth rate as bull calves. Implanting is economical (implants cost about $1.00) and can be completed when other procedures such as vaccinating, castrating and dehorning are performed on the calves. Using an approved product and administering it according to label directions can improve profitability at all stages of beef production.

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**Bulletin 1302** **Reviewed March 2013**