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ECONOMIC IMPACT

of Alternative Growth Promotant Strategies on the United States Beef Industry

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Economic Impact of Alternative Growth Promotant Strategies on the United States Beef Industry

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Preface

This bulletin analyzes economic impacts of alternative growth promotant strategies on the United States (U.S.) beef industry at the cow/calf, stocker, feedlot, wholesale, and retail levels. Production scenarios included implanting at each production level, never implanting, implanting at the cow/calf level only, implanting at the cow/calf and stocker levels, implanting at the feedlot level only, and implanting at the stocker and feedlot levels. The production scenarios were evaluated for the same number of days on feed and feeding to the same slaughter weight.

Estimates of the physical effects of alternative implant strategies were obtained by use of the Beef Cattle Growth Model developed at Texas A&M University. Information developed by the model included live, carcass, and retail product weights, carcass fat percentages, feed consumed, and estimated U.S. yield and quality grades by alternative implant scenarios. The study also provides estimates of changes in net returns to producers and cattle feeders and in wholesale and retail gross revenues as implant strategies undergo change.

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Introduction

The beef and meat industry in the United States is undergoing rapid change in response to consumer health and diet concerns, and technological advances in production, processing, and marketing. Closer fat trimming, vertical and horizontal integration, hybridization and restructuring of the grading system are examples of recent industry changes.

Removing fat to 1/4 inch or less and decoupling United States Department of Agriculture (USDA) quality and yield grades to accommodate hot fat trimming have created a more acceptable product for the consuming public. Further, increased vertical integration and advancements in genetics have aided in the development and selection of cattle that yield leaner carcasses and require less feed to reach slaughter weight. Another means to this end has been the development and usage of anabolic implants.

In the thirty years since Food and Drug Administration (FDA) approval, use of anabolic agents in beef production has expanded to include approximately 90 percent of fed cattle in the United States (Koch and Algeo, 1983). Growth promoting agents in beef production improve feed efficiency and increase the rate of gain (Honeyfield et al., 1985). Such cattle require less feed and fewer days on feed to achieve slaughter weight compared with cattle produced without growth promotants. This is accomplished by repartitioning nutrients from fat to lean deposition (Byers, 1988). Carcasses from such cattle yield more retail product with less trimmable waste. These factors increase output per unit of input, thereby enabling beef to remain competitive with alternative protein sources (Byers and Schelling, 1985).

Problem

Per capita beef consumption was at a 22 year low in the United States in 1988 (Knutson and Schuck, 1988). A more health conscious consumer is generating questions about cholesterol, antibiotic, and implant residues. The public perception of a health safety problem persists in light of scientific findings to the contrary (Food Chemical News (28), 1987).

Animals implanted with anabolic implants yield leaner carcasses. Alternative implant strategies may affect the fat content of beef. This could cause consumers to weigh potential harm, if any, from the higher fat content against the perceived reduction in risk from residues of implants. To put the content of residues in perspective, it has been shown that a three ounce serving of meat from implanted cattle contains 1.9 nanograms of the natural occurring hormone, estrogen. A comparable serving of meat from animals fed without implants contains 1.2 nanograms of estrogen (TCFA, 1990). These statistics are given further meaning when it is considered that the average adult man produces 136,000 nanograms of estrogen daily and a single birth control pill contains 35,000 nanograms of estrogen (TCFA, 1990).

Drs. Gerald B. Guest and Suzanne C. Fitzpatrick of the Center for Veterinary Medicine state that the FDA "has concluded that, although regulatory analytical methods for monitoring the residues of animal drugs, considered to be carcinogenic, are normally required, in the unique case of these endogenous hormones a regulatory method is not needed for an assurance of safety because the maximum increased exposure to hormones, even considering misuse of the drug, is demonstrated to be far below those concentrations considered unsafe," (Food Chemical News (29), 1987).

The beef industry is becoming more dependent upon the export market. Recent developments in the European Economic Community (EEC) concerning implant usage suggests that foreign markets may "use" implants to impose artificial trade barriers to impede competition from major suppliers, such as the U.S. This potential action could cost the beef industry $100 million in exports to the EEC. The possibility of this type of action spreading to other markets exists and poses a financial risk to U.S. agricultural industries.

This study is designed to evaluate economic effects of alternative levels of growth implants within the cattle industry on U.S. consumers, producers, and allied industries. The analysis examines potential quantity, quality and price level changes of beef, changes in production costs and returns to producers, and retail price adjustments. The analysis was designed to focus on the cow/calf, stocker/background, and cattle feedlot production phases under alternative production scenarios.

Methodology

Evaluation of the physical effects of various implant strategies for steers and heifers was accomplished by using the Beef Cattle Growth Model developed at Texas A&M University. The Beef Cattle Growth Model is designed to estimate various parameters including body composition (yield and quality grades, retail product, carcass characteristics, fat levels), live weights, feed utilization, and the number of days on feed for given alternative implant scenarios and feeding strategies. Major emphasis in this study was placed on such factors as initial and ending live weights, carcass fat percent, carcass weight, pounds of retail product, yield and quality grades, days on feed, and feed consumed per head.

A base scenario was developed to reflect cattle implanted at all levels of production including the cow/calf, stocker, and feedlot levels. Subsequent scenarios were designed to systematically determine the physical and economic effects for comparison with the base scenario as implant usage levels were altered. Five alternative production scenarios were designed and evaluated by use of the Beef Cattle Growth Model. The five scenarios included:

Production Scenario 1:	Implanting at the cow/calf level only.
Production Scenario 2:	Implanting at the cow/calf and stocker levels.

Production Scenario 3: Implanting at the stocker and feedlot levels.

Production Scenario 4: Implanting at the feedlot level only.

Production Scenario 5: No implants used at any level.

The five scenarios were evaluated over a range of mature sizes. Mature size, in the Beef Cattle Growth Model, is used to account for breed and frame size effects on the estimated parameters and is not reflective of slaughter weights. The mature sizes used in this study were:

Designation	Mature Size (lbs.)
Steers I	1050
Steers II	1100
Steers III	1150
Heifers I	900
Heifers II	950
Heifers III	1000

For purposes of discovering the effects of these implant strategies at the cow/calf and stocker levels, it was assumed that calves are weaned at 205 days and are then in the stocker phase for 180 days. At the feedlot phase, the scenarios were designed to measure differences in performance at both a common number of days on feed and at a common slaughter weight. The number of days on feed were varied to include 120, 140, 160, and 180 for steers and heifers. The heifer program also included a 100 day feeding period. In an alternative management practice of feeding to a common slaughter weight, steers and heifers were evaluated at 1075 pounds and 975 pounds, respectively.

The economic analysis utilized 1989-90 prices for calves, stocker and live cattle, carcasses, and retail product as a base for analyzing economic impacts of alternative implant strategies, Table 1. Partial budgeting techniques were used to estimate the changes in net returns associated with the various implant strategies at the cow/calf, stocker, and feedlot levels. Texas Livestock Enterprise Budgets for 1989, developed by the Texas Agricultural Extension Service, were used to obtain production costs for cow/calf and stocker operations. Production costs at the feedlot level were obtained from the Great Plains cattle feeding budgets generated by the U.S. Department of Agriculture. The analysis of the wholesale and retail levels reflect gross returns because of the difficulty of establishing reliable and consistent production cost figures.

Calf and stocker price changes only reflect weight changes. The price changes of slaughter cattle and wholesale and retail product contain a value-added component reflective of yield and quality grade differences, as well as changes caused by weight differentials. Price quotations as reported by the Texas Cattle Feeders Association for the first full sale week of each month from July 1989 through June 1990 were used to establish the base cattle prices. Weight brackets that were established included:

Steer Calves	:	Medium 1	400-500 lbs.
Heifer Calves	:	Medium 1	300-400 lbs.
Stocker Steers	:	Medium 1	600-700 lbs.
Stocker Heifers	:	Medium 1	500-600 lbs.

The price change per 100 pounds was determined for each weight bracket and then converted to price

Table 1. Prices and costs by production level, sex, quality grade, and implant practice, 1989-90.

Production Level		Prices Steers	Prices Heifers		Production Costs
		— — — — ($/cwt)— — — —			($/head)
Cow\Calf (a)		98.95	94.00	Implanted	440.32
				Not Implanted	439.32
Stocker (b)		87.27	81.97	Implanted	492.85
				Not Implanted	491.85
Slaughter (c)	Choice	74.31	74.68	Implanted	840.66
	Select	71.96	71.07	Not Implanted	839.66
Wholesale (d)	Choice	108.82	108.86		
	Select	101.82	101.86		
		— — — — (cents/lb.)— — — —			
Retail (e)	Choice	272.05	272.15		

Sources:

(a) & (b) Prices, Texas Cattle Feeders Assn.; Costs, Texas Agricultural Extension Service 1989 Livestock Enterprise Budgets.
(c) Prices, USDA Livestock and Poultry Situation and Outlook Report, July 1990; Costs, USDA Great Plains Cattle Feeding Budgets, July 1989-June 1990.
(d) Prices, National Provisioner, various 1989-1990 issues.
(e) Prices, USDA Livestock and Poultry Situation and Outlook Report, July 1990.

change per pound of live weight for that particular category. These figures were then applied to the Beef Cattle Growth Model estimates.

The estimated price changes for live cattle and for wholesale and retail product reflect the value-added by implants through improved yield and quality grades, as well as weight changes. Slaughter plants, feedlot managers, and cattle buyers were interviewed to determine premiums and discounts for cattle and carcasses on a yield/quality grade basis. Using Choice, Yield Grade three as a base, the following premiums/discounts were established:

	Cattle	
Yield Grade 3-2:	$ 2.00	premium
Yield Grade 3-4:	$ 7.00	discount
Yield Grade 3-5:	$12.00	discount
	Carcasses	
Yield Grade 3-2:	$ 1.00	premium
Yield Grade 3-4:	$ 9.25	discount
Yield Grade 3-5:	$14.25	discount

Quality Grade discounts were estimated using slaughter cattle prices for the 1989-90 period. The U.S. Choice to Select discount was estimated as $2.35 and $3.61 for steers and heifers, respectively. A $7.00 Choice-Select discount was estimated for carcasses. Retail prices were estimated using a regression model (ordinary least squares) to be 2.5 times the wholesale/carcass price.

Impact of Alternative Implant Strategies on Weights and Grades

Cattle Weights

Analyses of selected implant strategies revealed that implanted cattle were heavier than cattle without implants at the cow/calf, stocker, and feedlot levels, respectively, Tables 2 and 3, Figure 1. For example, implanted steers at the cow/calf level were 34 pounds heavier than non-implanted steers while implanted heifers were 33 pounds heavier than their counterparts, Table 2. These results suggest that ranchers not implanting have less total product to sell. Producers may have difficulty overcoming such weight differences since pasture acreage, range conditions, and rebreeding schedules dictate the timing of weaning and sale of calves. Costs of gain may prohibit producers from keeping calves longer to recoup this lost gain.

Differences in gains are even more dramatic for implants versus non-implants at the stocker level, Table 3. The biggest loss of gain occurred when implants were not used in either the cow/calf or stocker phases. Not implanting in either the stocker or cow/calf level resulted in a loss of 65 pounds of gain in steers and a 56 pound loss in heifers compared with implanting at all production levels. Implanting only at the cow/calf level resulted in a 31 pound loss while implanting at the stocker level only showed a loss of 34 pounds. This suggests that a residual or carry-over effect exists between levels of production. Implanted calves were heavier going into the stocker operation and also heavier coming out of the stocker program.

Table 2.Comparison of implanted and non-implanted calf weaning weights by sex, evaluated at 205 days of age.

Sex	Type of Growth Promotant Program		
	IMPLANTED WEIGHT	NON-IMPLANTED WEIGHT	IMPLANT EFFECT
(pounds)	(pounds)	(pounds)	
STEERS	438.0	404.0	34.0
HEIFERS	430.0	397.0	33.0

Table 3. Comparison of stocker out-weights by sex and type of growth promotant program, evaluated at a common age (385 days).

Sex	BASE SCENARIO[1]	Alternative Implant Strategy		
		NEVER IMPLANTED	COW/CALF ONLY	STOCKER ONLY
	(pounds)	Variation from Base Scenario (pounds)		
STEERS	670.0	-65.0	-31.0	-34.0
HEIFERS	632.0	-56.0	-23.0	-33.0

[1]Base Scenario is defined as implanting at each production level.

Figure 1. Comparison of steer slaughter weights by type of growth promotant program, evaluated at common days on feed.

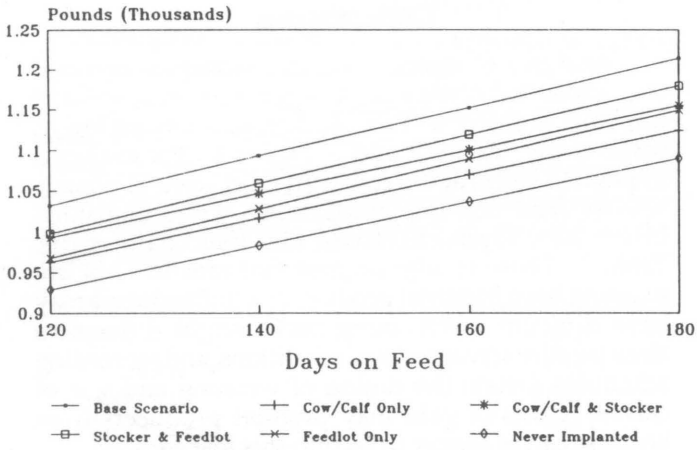
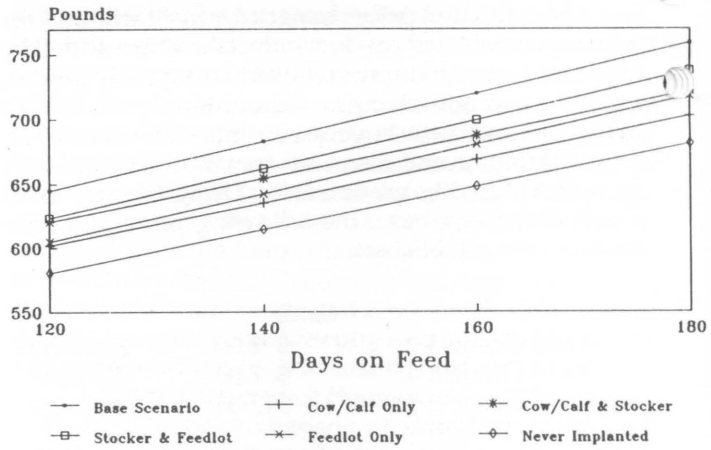


Figure 2. Comparison of steer carcass weights by type of growth promotant program, evaluated at common days on feed.



The greatest variation in live weights was at the feedlot level, Figure 1 (for detailed weight data, see Appendix A, Table A-1). When cattle were evaluated at the same number of days on feed, differences in steer market weights ranged from 34 to 124 pounds less for alternative implant strategies compared with the base scenario where implanting was performed at all production phases. Similarly, differences in weight gains for heifers ranged from 24 to 99 pounds less for alternative implant strategies compared to the base scenario.

The feedlot results suggest that implanting at two production levels is better than only implanting at one, or none. Cattle fed the same number of days, but implanted only at the cow/calf level or only at the feedlot level, weighed substantially less than those receiving implants at more than one production phase. While feedlots may be able to recoup such differences in weight gain by feeding cattle longer, such practices tend to reduce turnover rates and increase costs of gain.

Carcass Weights

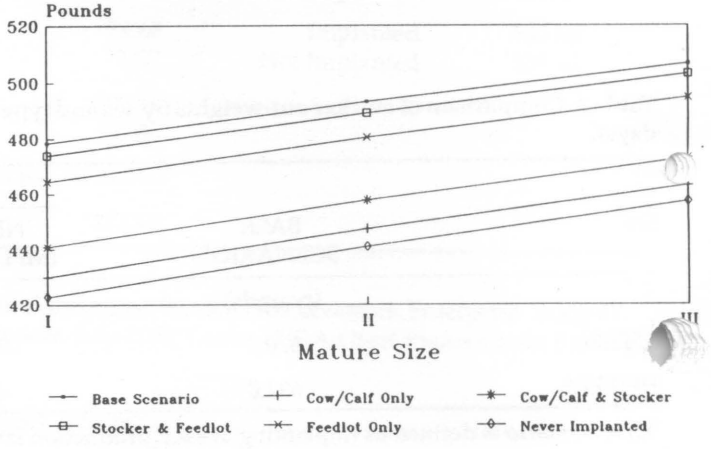
The Beef Cattle Growth Model was designed to estimate carcass weight as a constant percent of live weight. Therefore, the practice of feeding to a common slaughter weight revealed no difference in the carcass weights. However, when evaluated at a common number of days on feed, the differences may be sizeable as seen in Figure 2 (Table A-2). Base scenario steer carcass weights were estimated to be 645, 683.1, 720 and 758.8 pounds at 120, 140, 160, and 180 days on feed, respectively. Carcasses of steers not implanted at one or more growth stages were from 20.6 to 77.5 pounds lighter compared with carcasses from steers implanted at all production levels. Heifer carcass weights ranged from 560.6 pounds at 100 days on feed to 692.5 pounds at 180 days on feed in the base scenario. Heifers subjected to the alternative implant strategies were estimated to produce carcasses that were 15 to 61.9 pounds lighter compared with those fed under the implant strategy posited in the base scenario.

Retail Weights

Figure 3 (Table A-3) presents the estimated changes in retail weight per carcass by implant strategy when cattle are fed to a common slaughter weight on a retail weight basis. Steers that were implanted at each phase (base scenario) and fed to 1075 pounds produced from 478.4 to 506.7 pounds of retail product at mature sizes I, II, and III. Fed steers, under the alternative implant strategies, produced from 3.6 to 55.5 pounds less retail product on a per carcass basis compared with those in the base scenario where implanting was conducted at all levels. Similarly, heifers fed under the base scenario to slaughter weights of 975 pounds were projected to produce from 419.9 to 450.1 pounds of retail product at mature sizes I, II, and III. Estimates indicate that alternative heifer implant strategies would yield 6 to 51.3 fewer pounds of retail product per head compared with the base scenario.

Feeding cattle to a common number of days under alternative implant strategies provided similar results as feeding to a common slaughter weight. Retail product weights varied from 472.3 for the lightest weight,

Figure 3. Comparison of retail product by mature size and type of growth promotant program, evaluated at a common slaughter weight.

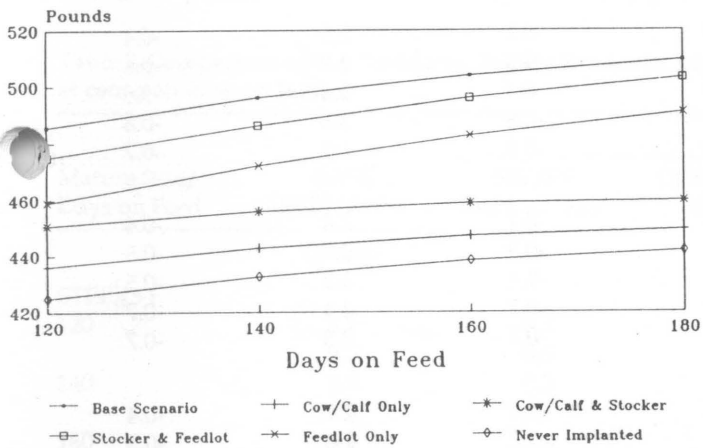


shortest fed steer to 527.5 for the heaviest weight, longest fed steer in the base model, Figure 4 (Table A-4). Compared with alternative implant strategies, the base scenario cattle produced from 5.3 to 68.8 more pounds of retail product when fed for a common number of days. The results in Figure 3 (Table A-3) provide an important observation. In terms of retail product, it was more beneficial to implant only at the feedlot rather than only at the cow/calf and stocker phases for steers. Similar results were noted for heifers of mature sizes II and III.

Research shows that anabolic implants aid in reducing trimmable fat. The Beef Cattle Growth Model was also designed to estimate the percentage of carcass fat. When cattle are fed to a common slaughter weight, the base scenario produced a carcass with the lowest fat percent, Table 4. As expected, these findings indicate that cattle implanted on a continuous basis will produce leaner carcasses, thus creating a product with less trimmable fat.

However, when steers and heifers were fed for a common number of days, cattle implanted only at the stocker and feedlot, as well as those implanted only at the feedlot phase, produced lower fat percentages than those in the base scenario, Table 5. Although the majority of fat deposition occurs at the feedlot phase, cattle implanted at each phase, as opposed to being implanted at only the feedlot phase, are heavier at each level compared with non-implants and, therefore, begin producing fat earlier in the feeding period.

Figure 4. Comparison of retail product (Steers II) by type of growth promotant program, evaluated at common days on feed.



U.S. Quality and Yield Grades

U.S. yield grades are indicators of cutability and refer to the pounds of boneless, closely trimmed, retail cuts. Yield grades are the product of four criteria: amount of fat over the ribeye, kidney-pelvic-heart fat, area of ribeye muscle, and hot carcass weight. Yield grades are ranked from 1 to 5 with 1 representing the highest percent of boneless, closely trimmed, retail cuts.

U.S. Quality grades are used to measure the tenderness, juiciness and flavor of beef (Taylor, 1984). Quality grades are also dependent upon four criteria: bone maturity, marbling, lean color, and firmness of the lean. Bone maturity and lean color are indicators of age while marbling and firmness of the lean are used to evaluate tenderness. Typically, an inverse relationship exits between age and tenderness. The Beef Cattle Growth Model was designed to estimate U.S. Yield and Quality grades based primarily upon estimated carcass fat percentages.

Tables 6 and 7 present the estimated U.S. yield and quality grades when cattle are fed to a common slaughter weight and a common number of days on feed, respectively. When a common slaughter weight was used, continuous implanting (base scenario) resulted in lower quality and yield grades compared to other programs analyzed. In terms of yield grades, these results were likely caused by the production of leaner

Table 4. Comparison of carcass fat percentages by mature size, sex, and type of growth promotant program, evaluated at a common slaughter weight.

Slaughter Weight/ Mature Size	BASE SCENARIO[1]	Alternative Implant Strategy: NEVER IMPLANTED	COW/CALF ONLY	STOCKER & COW/CALF	FEEDLOT ONLY	STOCKER & FEEDLOT
	(percent)	Variation from Base Scenario (percent)				
Steers @ 1075						
I	34.1	7.6	6.7	5.2	1.9	0.6
II	32.0	7.2	6.3	4.9	1.8	0.6
III	30.2	6.8	6.0	4.6	1.6	0.5
Heifers @ 975						
I	36.2	7.8	6.7	5.1	2.4	1.1
II	33.8	7.3	6.3	4.8	2.2	1.0
III	31.6	6.8	5.9	4.5	2.0	0.9

[1]Base Scenario defined as implanting at each production level.

Table 5. Comparison of carcass fat percentages by mature size, sex, and type of growth promotant program, evaluated at common days on feed.

Mature Size/ Dayes of Feed	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	FEEDLOT ONLY	COW/CALF & STOCKER	STOCKER & FEEDLOT
	(percent)	Variation from Base Scenario (percent)				
STEERS I						
120	32.2	2.0	2.7	-0.6	2.6	-0.8
140	34.8	2.1	2.9	-0.8	2.9	-0.8
160	37.5	2.2	3.0	-1.0	3.1	-0.9
180	40.3	2.2	3.1	-1.2	3.3	-1.1
STEERS II						
120	30.3	1.9	2.6	-0.5	2.5	-0.8
140	32.7	2.1	2.8	-0.8	2.8	-0.8
160	35.2	2.2	2.9	-0.9	3.0	-0.9
180	37.9	2.1	2.9	-1.2	3.2	-1.0
STEERS III						
120	28.5	1.9	2.5	-0.5	2.4	-0.8
140	30.8	2.0	2.7	-0.7	2.6	-0.8
160	33.2	2.1	2.8	-0.8	2.8	-0.9
180	35.6	2.0	2.8	-1.1	3.0	-1.0
HEIFERS I						
100	32.2	2.3	2.8	-0.1	2.5	-0.4
120	34.9	2.3	3.1	-0.3	2.9	-0.6
140	37.6	2.6	3.5	-0.4	3.4	-0.6
160	40.4	2.7	3.6	-0.8	3.6	-0.8
180	43.2	(a)	(b)	-0.8	(c)	-0.7
HEIFERS II						
100	30.1	2.2	2.7	-0.1	2.4	-0.4
120	32.6	2.2	2.9	-0.3	2.7	-0.5
140	35.1	2.5	3.3	-0.4	3.2	-0.5
160	37.7	2.5	3.4	-0.7	3.4	-0.7
180	40.3	2.7	3.7	-0.7	3.8	-0.7
HEIFERS III						
100	28.2	2.1	2.6	0.0	2.3	-0.4
120	30.5	2.1	2.8	-0.2	2.6	-0.5
140	32.8	2.4	3.2	-0.3	3.0	-0.5
160	35.2	2.4	3.2	-0.7	3.2	-0.7
180	37.6	2.6	3.5	-0.7	3.6	-0.7

(a), (b) and (c) The percentage of fat in gain exceeded 100%.

carcasses, which yielded more retail cuts with less fat cover in the continuous implanting program compared to alternative implant programs. The relatively lower amount of marbling generally results in lowering the quality grades of implanted animals. However, all cattle in the base scenario were estimated to grade high U.S.D.A. Select to Low Choice.

When cattle were fed for a common number of days, cattle implanted only at the stocker and feedlot phases, as well as those only implanted at the feedlot phase, exhibited the lowest yield and quality grades. The cattle in these scenarios were lighter when they entered the feedlot and, therefore, consumed less feed. This also resulted in the base model cattle being nearer slaughter composition at an earlier point in time compared to cattle not implanted at all production phases. Over-all the yield and quality grades were less varied between models in this scenario than in the case of a common slaughter weight.

Days on Feed

By feeding cattle to a common slaughter weight while allowing the number of days on feed to vary, it was possible to evaluate the effects of implanting on the length of the feeding period. Table 8 is a comparison of days on feed required for the base scenario and cattle fed under alternative implant strategies to reach a

Table 6. Comparison of U.S. Yield and Quality Grades by mature size, sex, and type of growth promotant program, evaluated at a common slaughter weight.

Slaughter Weight/ Mature Size	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(grade)	Variation from Base Scenario (grade)				
STEERS @ 1075						
I	3.4[1]	1.2	1.0	0.8	0.3	0.1
	10.3[2]	1.8	1.6	1.2	0.5	0.2
II	3.1	1.1	1.0	0.7	0.3	0.1
	9.9	1.6	1.4	1.1	0.4	0.1
III	2.8	1.1	0.9	0.7	0.3	0.1
	9.4	1.6	1.4	1.1	0.4	0.2
HEIFERS @ 975						
I	3.7	1.2	1.0	0.8	0.4	0.2
	10.8	1.8	1.6	1.2	0.6	0.3
II	3.4	1.1	0.9	0.7	0.3	0.1
	10.3	1.6	1.4	1.1	0.5	0.2
III	3.0	1.1	0.9	0.7	0.3	0.2
	9.8	1.5	1.3	1.0	0.4	0.2

[1]U.S. Yield Grade.
[2]U.S. Quality Grade: 8=Select, 9=Select+, 10=Choice-, 11=Choice, 12=Choice+.

Table 7. Comparison of U.S. Yield and Quality Grades by mature size, sex, and type of growth promotant program, evaluated at common days on feed.

Mature Size/ Days on Feed	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(grade)	Variation from Base Scenario (grade)				
STEERS I						
120	3.1[1]	0.3	0.4	0.4	-0.1	-0.1
	9.9[2]	0.5	0.6	0.6	-0.1	-0.2
140	3.5	0.3	0.4	0.4	-0.1	-0.1
	10.5	0.5	0.7	0.7	-0.2	-0.2
160	3.9	0.3	0.5	0.5	-0.1	-0.1
	11.1	0.5	0.7	0.7	-0.2	-0.2
180	4.4	0.3	0.5	0.5	-0.2	-0.2
	11.8	0.5	0.7	0.8	-0.3	-0.2
STEERS II						
120	2.8	0.3	0.4	0.4	-0.1	-0.1
	9.5	0.4	0.6	0.6	-0.1	-0.2
140	3.2	0.3	0.4	0.4	-0.1	-0.1
	10.0	0.5	0.6	0.6	-0.2	-0.2
160	3.6	0.3	0.4	0.5	-0.1	-0.1
	10.6	0.5	0.7	0.7	-0.2	-0.2
180	4.0	0.3	0.4	0.5	-0.2	-0.1
	11.2	0.5	0.7	0.7	-0.3	-0.2
STEERS III						
120	2.6	0.3	0.4	0.4	-0.1	-0.1
	9.1	0.4	0.6	0.5	-0.1	-0.2
140	2.9	0.3	0.4	0.4	-0.1	-0.1
	9.6	0.5	0.6	0.6	-0.2	-0.2
160	3.3	0.3	0.4	0.4	-0.1	-0.1
	10.1	0.5	0.6	0.6	-0.2	-0.2
180	3.6	0.3	0.4	0.5	-0.2	-0.1
	10.7	0.5	0.7	0.7	-0.3	-0.2

Table 7. Continued

Mature Size/ Days on Feed	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(grade)	Variation from Base Scenario (grade)				
HEIFERS I						
100	3.1	0.3	0.4	0.4	0.0	-0.1
	9.9	0.5	0.7	0.6	0.0	-0.1
120	3.5	0.4	0.5	0.4	-0.1	-0.1
	10.5	0.5	0.7	0.7	-0.1	-0.1
140	3.9	0.4	0.5	0.5	-0.1	-0.1
	11.2	0.6	0.8	0.8	-0.1	-0.1
160	4.4	0.4	0.5	0.5	-0.1	-0.1
	11.8	0.6	0.8	0.8	-0.2	-0.2
180	4.8	(a)	(b)	(c)	-0.1	-0.1
	12.5	—	—	—	-0.2	-0.2
HEIFERS II						
100	2.8	0.3	0.4	0.4	0.0	-0.1
	9.4	0.5	0.6	0.6	0.0	-0.1
120	3.2	0.3	0.4	0.4	0.0	-0.1
	10.0	0.5	0.7	0.6	-0.1	-0.1
140	3.6	0.4	0.5	0.5	-0.1	-0.1
	10.6	0.6	0.8	0.7	-0.1	-0.1
160	4.0	0.4	0.5	0.5	-0.1	-0.1
	11.2	0.6	0.8	0.8	-0.2	-0.2
180	4.3	0.4	0.6	0.6	-0.1	-0.1
	11.8	0.6	0.9	0.9	-0.2	-0.2
HEIFERS III						
100	2.5	0.3	0.4	0.3	0.0	-0.1
	9.0	0.5	0.6	0.5	0.0	-0.1
120	2.9	0.3	0.4	0.4	0.0	-0.1
	9.5	0.5	0.7	0.6	-0.1	-0.1
140	3.2	0.4	0.5	0.4	-0.1	-0.1
	10.0	0.6	0.7	0.7	-0.1	-0.1
160	3.6	0.4	0.5	0.5	-0.1	-0.1
	10.6	0.6	0.7	0.7	-0.2	-0.2
180	3.9	0.4	0.5	0.5	-0.1	-0.1
	11.2	0.6	0.8	0.8	-0.2	-0.2

(a), (b) and (c) The percentage of fat in gain exceeded 100%.
[1]U.S. Yield Grade.
[2]U.S. Quality Grade: 8=Select, 9=Select+, 10=Choice-, 11=Choice, 12=Choice+.

Table 8. Comparison of days on feed by mature size, sex, and type of growth promotant program, evaluated at a common slaughter weight.

Slaughter Weight	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(days)	Variation from Base Scenario (days)				
STEERS @ 1075	134	40	28	16	22	11
HEIFERS @ 975	130	36	22	13	21	12

slaughter weight of 1075 and 975 pounds for steers and heifers, respectively. Cattle that are never implanted may require an additional month to reach the prescribed slaughter weight compared to the base scenario. These figures become critical in the turnover rate of feedlots. At 134 days on feed, base scenario cattle could be moved through the feedlot at turnover rates of 2.7 and 2.8 animals per year for steers and heifers, respectively. In contrast, cattle which are never implanted turnover at a rate of only 2.1 and 2.2 annually for steers and heifers, respectively. In this scenario, a loss of six-tenths of a steer is equivalent to losing 645 pounds of product. A similar loss on heifers would equate to 585 pounds of live weight per year. This reduction in output could increase costs per unit of output, as well as creating the need for additional facilities in order to maintain similar annual numbers of cattle on feed as depicted in the base scenario. Cattle remaining in feedlots longer, other things equal, consume more feed.

Feed Consumed

The greatest cost in cattle feeding, with the exception of the cattle themselves, is feed. Therefore, the amount of feed consumed by cattle is of paramount importance. The evaluation of feed consumed, on an as-fed basis, was done at a common slaughter weight and at common days on feed. The results between the two management practices were vastly different.

In the case of feeding cattle to a common slaughter weight, base scenario cattle consumed from 237 to 1145 pounds less feed than cattle fed under the alternative implant strategies, Table 9. This additional feed requirement could result in greater feed storage capacity requirements, higher feeding costs, higher interest costs, etc.

The alternative practice, feeding for a common number of days, produced contrasting results. Table 10 shows, with the exception of Production Scenario 2, base scenario cattle requiring a greater amount of feed. Cattle implanted at each phase would consume from 98 pounds less feed, in the case of 900-pound heifers fed 140 days, to 370 pounds more feed for 1050-pound steers fed 180 days.

The differences between the two results may be explained by the size of the cattle entering the feedlot. Large cattle consume more feed than small cattle. Therefore, when cattle are fed to a common slaughter weight, the base scenario cattle are heavier going into the feedlot and, thereby, reach a predetermined weight quicker, consuming less feed. However, when live weight is allowed to vary, the base scenario cattle are still larger and, therefore, tend to consume more feed at any point in time. The exception to this was cattle implanted only at the cow/calf and stocker levels. These animals enter the feedlot at the same weight as base scenario cattle but were not implanted in the feedlot phase resulting in poorer feed utilization. This loss in efficiency results in cattle implanted only at the cow/calf and stocker phases weighing from 24 to 59 pounds less than base scenario cattle after the same number of days on feed.

Economic Impact of Alternative Implant Strategies

Implanted cattle, in general, are heavier, leaner, and produce heavier, leaner carcasses that yield more pounds of retail product. Thus, scenarios with lower levels of implant usage imply higher prices caused by lower sale weights, but such cattle may also receive price discounts due to being fatter and poorer yielding. The magnitude of this price change is of paramount importance to producers as they make production decisions.

Cow/Calf Producer

At the cow/calf level, the decision to *NOT* implant would decrease weaning weights of calves, resulting in estimated price increases of $3.26/hundredweight and $2.36/hundredweight for steers and heifers, respectively, when based on 1989-90 prices, Table 11. It should

Table 9. Comparison of as-fed feed consumed by mature size, sex, and type of growth promotant program, evaluated at a common slaughter weight.

Slaughter Weight/ Mature Size	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(pounds)	Variation from Base Scenario (pounds)				
STEERS @ 1075						
I	3799	1145	857	599	473	253
II	3669	1106	831	579	462	247
III	3556	1069	800	555	444	237
HEIFERS @ 975						
I	3485	988	709	514	433	260
II	3351	946	679	487	416	251
III	3231	907	649	467	400	239

Table 10.Comparison of as-fed feed consumed by mature size, sex, and type of growth promotant program, evaluated at common days on feed.

Mature Size/ Days on Feed	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(pounds)	Variation from Base Scenario (pounds)				
STEERS I						
120	3312	-189	-65	34	-212	-123
140	4006	-237	-97	24	-267	-135
160	4719	-274	-129	15	-286	-155
180	5511	-370	-186	-6	-359	-196
STEERS II						
120	3200	-180	-64	33	-202	-116
140	3871	-227	-95	23	-254	-132
160	4560	-266	-125	11	-277	-150
180	5320	-354	-179	-4	-342	-185
STEERS III						
120	3099	-173	-60	31	-191	-112
140	3748	-221	-93	22	-246	-123
160	4415	-259	-122	10	-262	-140
180	5152	-346	-176	-11	-332	-180
HEIFERS I						
100	2568	-129	-21	66	-186	-111
120	3186	-172	-33	71	-222	-133
140	3818	-185	-23	98	-247	-144
160	4509	-243	-62	88	-320	-177
180	5227	(a)	(b)	(c)	-324	-191
HEIFERS II						
100	2467	-124	-21	64	-175	-103
120	3062	-163	-33	65	-209	-127
140	3670	-179	-24	88	-236	-136
160	4332	-235	-62	80	-307	-170
180	5022	-259	-60	87	-314	-186
HEIFERS III						
100	2380	-122	-23	57	-167	-101
120	2954	-162	-35	60	-203	-124
140	3537	-174	-25	82	-225	-133
160	4175	-227	-62	75	-293	-161
180	4836	-250	-60	83	-295	-171

(a), (b) and (c) The percentage of fat in gain exceeded 100%.

be noted that this adjustment to price only reflects fluctuation caused by changes in weaning weights and not any allowance for quality discounts/premiums.

Of importance to cow/calf producers is the impact on net revenue associated with price and weaning weight changes. Table 11 reveals that while prices increase as weaning weights declined, such price increases were not large enough to offset weaning weight decreases resulting in reduced net revenue. For example, ranchers could lose $19.47 per steer and $20.65 per heifer by not implanting.

Stocker Operator

There are four potential implant strategies at the stocker level. Cattle are either implanted at the cow/calf and stocker levels, (base scenario), the cow/calf level only, the stocker level only, or are not implanted at either level. The effects of these strategies on the price received for stocker cattle are shown in Table 12. The greatest change in price, as compared with implanting at the cow/calf and stocker levels, is when implants are not used in either phase. Not using implants resulted in $3.52/hundredweight and $3.60/hundredweight increases in price for steers and heifers, respectively. The same caveat as before applies, such estimated changes in price only reflected changes due to weight decreases.

Table 12 shows that even with the increased prices, net revenue declined in each of the alternative scenarios. Not implanting at all, reduced the net revenue of stocker operators by $34.43 and $24.17 per steer and heifer, respectively.

Table 11. Comparison of net calf returns and calf prices by sex and type of growth promotant program, evaluated at a common age (205 days).

Sex		Type of Growth Promotant Program		
		IMPLANTED	NON-IMPLANTED	COMPARISON
STEERS	Net Rt.[1]	-6.92	-26.39	-19.47
	Price[2]	98.95	102.21	+3.26
HEIFERS	Net Rt.	-36.12	-56.77	-20.65
	Price	94.00	96.36	+2.36

[1]Net returns are dollars per head.
[2]Prices are dollars per hundredweight.

Table 12. Comparison of net stocker returns and stocker prices by sex, and type of growth promotant program, evaluated at a common age (385 days).

Sex		BASE SCENARIO	Alternative Implant Strategy		
			NEVER IMPLANTED	COW/CALF ONLY	STOCKER ONLY
			Variation from Base Scenario		
STEERS	Net Rt.[1]	91.86	-34.43	-15.32	-17.97
	Price [2]	87.27	+3.52	+1.68	+1.84
HEIFERS	Net Rt.	25.20	-24.17	-8.84	-14.35
	Price	81.97	+3.60	+1.48	+2.12

[1]Net returns are dollars per head.
[2]Prices are dollars per hundredweight.

Implications: Cow/Calf and Stocker

The use of implants results in increased muscle and bone growth with less fat deposition. Thus, unimplanted cattle from good milking cows and/or cattle in good grazing conditions may have a propensity to carry a larger amount of fleshiness than implanted cattle. Typically, this extra fleshiness is discounted in the pricing process. This discount could lower producer returns to an even greater degree than shown in Tables 11 and 12.

If implants were not available to, or used by, producers, it is possible that some producers may leave the industry because of lower or negative returns. With much of the acreage used in cattle ranching/grazing being unsuitable for alternative uses, the potential exists for a concentration at the cow/calf and stocker levels into fewer and larger operations.

Cattle Feeding

The feedlot analysis was performed to account for quantity changes and also to quantify the premiums/discounts resulting from quality differences as implant strategies were varied. Thus, the value-added scheme of pricing cattle according to weight, quality grade, and yield grade was used.

Feeding to a Common Slaughter Weight

The comparison of the price fluctuations when cattle are fed to a common slaughter weight is shown in Table 13. With four exceptions, prices declined for cattle fed under alternative implant strategies by as much as $6.93/hundredweight, compared to the base scenario. The four price increases are noteworthy. In these four cases, the Choice/Select premium was able to compensate for the discount on poorer yielding animals. The cattle in these categories, Steers II and Heifers III, which were implanted at the feedlot and stocker levels and at the feedlot only, graded Choice while the base scenario cattle graded Select. The base scenario cattle have lower, more desirable yield grades but that premium was not enough to offset the Choice/Select differential. In each of the other cases, the increased cutability of the base scenario was more than adequate to offset the associated lower quality grade.

These price fluctuations manifest themselves when net returns are analyzed. The four cases of increased prices discussed in the previous paragraph resulted in increased net returns while net returns declined for all other implant strategies, Table 14. Cattle which are never implanted could, in the extreme, reduce returns by as much as 100 percent compared to the base scenario.

Table 13. Comparison of slaughter cattle price differences by mature size, sex, and type of growth promotant program, evaluated at a common slaughter weight, 1989-90.

Slaughter Weight/ Mature Size	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(dollars/cwt)	Variation from Base Scenario (dollars/cwt)				
STEERS @ 1075						
I	71.51	-7.20	-6.20	-3.20	-2.10	-0.70
II	71.26	-4.95	-4.45	-2.55	0.25	1.65
III	72.36	-4.35	-2.95	-1.55	-1.10	-0.20
HEIFERS @ 975						
I	69.78	-6.60	-5.60	-4.60	-2.60	-1.40
II	71.88	-6.70	-5.70	-4.70	-2.10	-0.70
III	71.07	-3.89	-2.69	-1.29	1.51	2.21

Table 14. Comparison of net returns to cattle feeders by mature size, sex, and type of growth promotant program, evaluated at a common slaughter weight.

Slaughter Weight/ Mature Size	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(dollars/head)	Variation from Base Scenario (dollars/head)				
STEERS @ 1075						
I	-71.93	-76.40	-65.65	-33.40	-22.58	-7.53
II	-74.62	-52.21	-46.84	-26.41	2.69	17.74
III	-62.79	-45.76	-30.71	-15.66	-11.83	-2.15
HEIFERS @ 975						
I	-160.30	-63.35	-53.60	-43.85	-25.35	-13.65
II	-139.83	-64.32	-54.57	-44.82	-20.48	-6.82
III	-147.73	-36.93	-25.23	-11.58	14.72	21.55

Feeding for the Same Number of Days

Table 15 exhibits price level changes when cattle are fed for the same number of days under alternative implant strategies. Typically, cattle implanted at the stocker and feedlot or only at the feedlot are projected to command higher prices. The exceptions in these two production scenarios are attributable to cattle that, compared with the base scenario, were discounted for quality grade to such an extent that their advantage in yield grade could not compensate for the quality discount. Price changes in all other models were predominately negative except for those cattle whose quality grade premium exceeded discounts for yield grade.

When these price fluctuations are translated into net returns, compared with the base scenario, all alternative models have lower net revenues, Table 16. Generally, when the estimated price was higher than the base scenario price, it was not enough of an increase to offset the reduction in live weight. The results also showed that the longer cattle were on feed, up to 180 days, the greater were net returns. These results may be attributable, in part, to cattle having improved quality grades with yield grades not offsetting the gains in quality grades.

Implications: Cattle Feeding

Results from the two cattle feeding practices, fed to the same slaughter weight and fed for the same number of days, tend to indicate that removal of implants would result in the feeding of cattle with larger mature sizes for longer periods of time to minimize losses. Three potential implications of feeding larger cattle are packaging concerns, consumer demands, and the adjustment of breeding practices. Larger framed, heavier cattle will produce larger cuts of meat that may not "fit in the box." Conventional boxed beef systems are susceptible to limitations concerning the size and amount of the product that may be packed and shipped. Thus, increasing the size of cuts could ultimately stress or render present handling systems inadequate.

Further, present consumption trends indicate American consumers are demanding smaller, leaner, more convenient cuts of meat. The production of larger cuts of meat could further erode consumer acceptance of beef in their diets. Bigger cattle do tend to be leaner than small or medium framed cattle of similar age. However, the longer large cattle are on feed the greater will be their fat deposition, violating another consumer demand for a leaner product.

Table 15. Comparison of slaughter cattle price differences by mature size, sex, and type of growth promotant program, evaluated at common days on feed, 1989-90.

Mature Size/ Days on Feed	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(dollars/cwt)	Variation from Base Scenario (dollars/cwt)				
STEERS I						
120	71.26	0.25	-0.45	-0.45	0.70	0.70
140	70.81	-2.80	-3.50	-3.50	0.70	0.70
160	68.01	-2.20	-2.70	-2.70	0.70	0.70
180	65.31	-1.50	-2.00	-2.50	1.00	1.00
STEERS II						
120	72.36	-1.10	0.55	0.55	0.00	0.20
140	72.91	-2.10	-2.80	-2.80	-1.65	-1.65
160	70.11	-2.10	-2.85	-2.95	0.70	0.70
180	67.31	-1.50	-2.00	-2.50	1.40	1.40
STEERS III						
120	72.76	-0.60	-0.80	-0.60	0.20	0.20
140	72.16	0.75	0.05	0.05	0.20	0.20
160	72.21	-2.10	-2.80	-2.80	-1.65	-1.65
180	70.11	-2.80	-3.30	-3.30	0.70	0.70
HEIFERS I						
100	70.37	0.81	0.11	0.81	0.00	0.00
120	71.18	-2.80	-8.50	-3.50	0.00	0.00
140	68.38	-2.20	-3.20	-2.70	0.00	0.00
160	65.68	-2.00	-2.50	-2.50	0.50	0.50
180	63.68	(a)	(b)	(c)	0.50	0.50
HEIFERS II						
100	71.47	-1.10	1.81	-1.80	0.00	0.00
120	73.28	-2.10	-2.80	-2.80	-3.61	-2.91
140	70.48	-2.10	-3.30	-2.80	0.70	0.70
160	67.68	-1.50	-2.50	-2.50	1.40	1.40
180	66.18	-2.50	-3.00	-3.00	0.50	0.50
HEIFERS III						
100	72.07	-0.60	-0.80	-0.80	0.00	0.00
120	71.27	2.01	1.31	1.31	0.20	0.20
140	73.28	-2.80	-3.50	-3.50	-3.61	-2.91
160	70.48	-2.10	-3.30	-3.30	0.70	0.70
180	68.38	-2.20	-3.20	-3.20	0.70	0.70

(a), (b) & (c) The percentage of fat in gain exceeded 100%.

At the producer level, cowmen could face adjustment towards breeding for large framed calves. Breeding for increased frame size could, ultimately, result in a larger framed cow herd. These bigger cows would increase production costs due to increased feed requirements. Feeding such cattle for longer periods would reduce the turn-over rate of feedlots. With fewer cattle being moved through the feedlots feeding costs could increase resulting in even lower net returns than previously estimated.

Wholesale Sector

As with slaughter cattle, the effects at the wholesale or carcass level were analyzed from the perspectives of feeding to the same slaughter weight (live basis) and feeding for the same number of days. While these two alternatives represent quite different production practices, their economic effects upon wholesale price levels and gross revenues are similar. The wholesale analysis was performed using the value-added approach, based on estimated yield and quality grades and estimated carcass weight.

Table 16. Comparison of net returns to cattle feeders by mature size, sex, and type of growth promotant program, evaluated at common days on feed.

Mature Size/ Days on Feed	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(dollars/head)	Variation from Base Scenario (dollars/head)				
STEERS I						
120	-105.26	-70.08	-52.50	-31.26	-38.83	-17.24
140	-66.71	-104.41	-88.41	-68.22	-38.83	-16.66
160	-57.18	-100.03	-83.66	-64.07	-35.22	-14.61
180	-47.80	-96.33	-80.26	-66.41	-30.96	-10.41
STEERS II						
120	-93.90	-83.75	-43.63	-21.76	-46.31	-22.61
140	-43.75	-99.84	-82.89	-61.85	-64.35	-42.26
160	-32.99	-101.40	-86.99	-67.91	-36.55	-15.30
180	-23.52	-98.81	-82.06	-67.59	-27.67	-6.37
STEERS III						
120	-89.78	-79.52	-56.91	-33.33	-44.63	-22.74
140	-51.95	-71.00	-53.33	-31.67	-44.85	-22.42
160	-8.80	-103.82	-88.17	-67.35	-63.46	-42.29
180	10.48	-116.46	-99.19	-78.48	-37.53	-15.58
HEIFERS I						
100	-209.44	-48.68	-31.14	-8.82	-39.41	-23.22
120	-164.45	-83.72	-112.34	-51.88	-39.86	-23.49
140	-155.49	-79.94	-67.56	-47.73	-38.29	-22.57
160	-147.74	-80.60	-64.55	-49.38	-33.11	-16.56
180	-135.09	(a)	(b)	(c)	-30.40	-15.64
HEIFERS II						
100	-199.57	-65.16	-17.21	-31.87	-40.02	-23.59
120	-144.50	-79.45	-62.25	-46.04	-73.31	-50.87
140	-134.45	-80.90	-69.69	-49.39	-32.85	-16.48
160	-126.64	-77.70	-65.79	-50.14	-25.30	-8.03
180	-107.39	-89.74	-73.94	-59.41	-31.80	-16.46
HEIFERS III						
100	-194.19	-61.56	-39.67	-23.28	-40.36	-23.78
120	-163.60	-42.19	-24.30	-7.60	-38.12	-21.69
140	-106.39	-89.78	-73.15	-57.10	-75.19	-52.38
160	-97.10	-86.12	-75.47	-59.34	-33.90	-16.10
180	-83.01	-88.89	-77.47	-62.48	-30.93	-15.04

(a), (b) & (c) The percentage of fat in gain exceeded 100%.

Feeding to the Same Slaughter Weight

The Beef Cattle Growth Model estimates carcass weight as a constant percentage of live weight. Therefore, carcass weights are equal at 671.9 lbs. and 609.4 lbs. for steers and heifers, respectively. As a result of these common weights, all estimated value differences are solely attributed to variations in yield and quality grades.

Table 17 presents the comparison, with the base scenario, of changes in wholesale gross revenues of the alternative implant strategies. Typically, the highest gross revenues were associated with the base scenario. The exceptions were reflective of the alternative implant strategies generating higher quality grades without substantially decreasing their cutability. Also, these higher gross revenues were generated by cattle of larger mature sizes.

Feeding for the Same Number of Days

Carcass weight fluctuated along with estimated yield and quality grades when cattle were fed for the same number of days. The comparison of wholesale gross revenues for alternative implant strategies with the base scenario is shown in Table 18. With five exceptions, wholesale gross revenues for the alternative implant strategies were lower than the gross revenues generated by the base scenario. The exceptions, all involving carcasses from cattle that were implanted

Table 17. Comparison of wholesale gross revenue by mature size, sex, and type of growth promotant program, evaluated at a common slaughter weight.

Slaughter Weight Mature Weight/	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(dollars/head)	Variation from Base Scenario (dollars/head)				
STEERS @ 1075						
I	706.30	-57.45	-50.73	-44.01	-18.65	-6.22
II	677.91	-15.62	-12.26	3.53	28.39	40.82
III	685.47	-10.25	2.18	14.61	-7.56	-0.67
HEIFERS @ 975						
I	623.93	-44.33	-38.24	-32.15	-19.96	-11.27
II	640.85	-49.06	-42.96	-36.87	-16.91	-5.64
III	620.73	-16.76	-8.07	3.20	25.75	31.38

Table 18. Comparison of wholesale gross revenue by mature size, sex, and type of growth promotant program, evaluated at common days on feed.

Mature Size/ Days on Feed	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(dollars/carcass)	Variation from Base Scenario (dollars/carcass)				
STEERS I						
120	650.77	-40.45	-23.62	-4.14	-34.76	-15.62
140	711.76	-94.31	-78.89	-60.17	-36.36	-15.97
160	723.56	-87.97	-71.02	-52.77	-33.30	-14.23
180	740.36	-85.84	-68.98	-54.05	-32.53	-13.41
STEERS II						
120	658.03	-72.23	-14.18	5.83	-40.81	-21.00
140	730.71	-90.54	-74.33	-54.91	-82.46	-62.89
160	743.54	-92.24	-77.62	-59.00	-34.39	-14.80
180	755.54	-87.39	-70.11	-54.79	-27.24	-7.56
STEERS III						
120	659.32	-67.57	-46.46	-26.80	-40.28	-21.05
140	696.22	-38.99	-22.19	-2.26	-40.74	-20.95
160	763.52	-94.23	-79.04	-59.90	-83.13	-64.33
180	783.61	-105.24	-87.65	-68.43	-35.39	-15.17
HEIFERS I						
100	565.84	-33.62	-16.96	2.86	-35.33	-20.79
120	618.95	-75.46	-59.84	-45.59	-36.48	-21.58
140	629.65	-69.84	-55.44	-38.52	-35.19	-20.81
160	643.64	-69.98	-53.39	-39.12	-32.32	-16.91
180	662.10	(a)	(b)	(c)	-30.18	-16.34
HEIFERS II						
100	572.15	-21.03	-3.60	11.70	-35.72	-21.02
120	635.43	-71.93	-55.55	-40.77	-76.57	-56.97
140	647.03	-73.38	-60.99	-45.00	-30.69	-15.78
160	656.83	-68.17	-54.16	-39.60	-24.63	-8.70
180	679.41	-76.50	-59.96	-46.36	-31.05	-16.85
HEIFERS III						
100	573.83	-52.71	-32.12	-17.54	-35.83	-21.09
120	605.44	-26.94	-9.98	5.19	-35.13	-20.53
140	670.20	-80.72	-64.80	-50.16	-78.84	-58.94
160	681.23	-78.02	-66.15	-51.28	-31.74	-15.37
180	696.20	-77.52	-63.73	-49.84	-29.11	-14.50

(a), (b) & (c) The percentage of fat in gain exceeded 100%.

at the cow/calf and stocker levels only, occurred when the base scenario carcasses graded Select while their counterparts graded Choice. The base scenario carcasses, although higher yielding, could not compensate for grading Select, which resulted in lower gross revenues. Estimated wholesale gross revenues were maximized by feeding to the 180 day level.

Retail Sector

The retail projections of price and gross revenues were accomplished under the practices of feeding to the same slaughter weight and feeding for the same number of days. Retail prices were based on a percent markup of wholesale price. Estimated yield and quality grades, which varied by implant strategy, impact retail price and gross revenue by their effects at the wholesale level.

Feeding to the Same Slaughter Weight

Retail prices in the alternative implant strategies ranged from 22.25 cents/pound lower to 10.56 cents/pound higher as compared with the base scenario, Table 19. The higher retail prices, as in the wholesale sector, are reflective of the premium for Choice product being greater than the associated discount for being fatter. Meanwhile, the lower retail prices, in the alternative implant strategies, are an indication that the cutability premium offsets lower quality grades in the base scenario.

These price fluctuations manifested themselves to a lesser degree when retail gross revenues were analyzed. In all but four of the cases of increased prices, the lower retail poundage offset the higher price, resulting in lower gross revenues, Table 20. The four cases involve mature size II steers and mature size III heifers, which were either implanted at the stocker and feedlot phases only or were implanted at the feedlot only. Each of the other alternative implant strategies and mature sizes resulted in decreased gross revenues as compared with the base scenario.

Feeding for the Same Number of Days

Retail price results are multiples of the estimated wholesale prices with similar interpretations. Therefore, emphasis was placed on evaluating the effects of

Table 19. Comparison of retail price level changes by mature size, sex, and type of growth promotant program, evaluated at a common slaughter weight, 1989-90.

		Alternative Implant Strategy				
Slaughter Weight/ Mature Size	BASE SCENARIO	NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(cents/pound)	Variation from Base Scenario (cents/pound)				
STEERS @ 1075						
I	262.80	-21.37	-18.87	-16.37	-6.94	-2.31
II	252.24	-5.81	-4.56	1.31	10.56	15.19
III	255.05	-3.81	0.81	5.44	-2.81	-0.25
HEIFERS @ 975						
I	255.96	-18.19	-15.69	-13.19	-8.19	-4.62
II	262.90	-20.12	-17.62	-15.12	-6.94	-2.31
III	254.65	-6.88	-3.31	1.31	10.56	12.87

Table 20. Comparison of retail gross revenue by mature size, sex, and type of growth promotant program, evaluated at a common slaughter weight.

		Alternative Implant Strategy				
Slaughter Weight/ Mature Size	BASE SCENARIO	NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(dollars/head)	Variation from Base Scenario (dollars/head)				
STEERS @ 1075						
I	1257.24	-236.25	-208.36	-170.75	-68.50	-22.52
II	1244.29	-157.80	-136.19	-83.54	18.20	63.96
III	1292.34	-143.43	-107.18	-60.23	-44.52	-10.44
HEIFERS @ 975						
I	1074.79	-198.35	-171.35	-137.43	-73.28	-38.02
II	1145.98	-204.01	-177.88	-144.47	-67.10	-27.54
III	1146.18	-141.70	-112.18	-66.53	12.27	41.90

those prices on retail gross revenues rather than on the prices themselves. As opposed to the wholesale analysis, the retail base scenario gross revenues exceed gross revenues of the alternative implant strategies with one exception. The exception is a steer of mature size II, fed for 180 days and implanted at the stocker and feedlot levels. This product was slightly better yielding with only a small decrease in pounds of retail product, which produced a slightly higher gross revenue than the base scenario. The range of gains to losses were from +$7.76 to -$225.34 per head, Table 21. Retail gross revenues were maximum at 120-140 days on feed for cattle implanted at the cow/calf level only, at the cow/calf and stocker levels only, or not implanted at all. Maximum gross revenues occurred between 140-160 days on feed for the base scenario, and for cattle implanted at the stocker plus feedlot levels, or for cattle implanted at the feedlot only.

Implications: Wholesale and Retail Sectors

As compared with the base scenario, carcasses and retail product produced under alternative implant strategies, in most cases, commanded a lower price and generated lower gross revenues. This, in the value-added pricing scheme, was attributable to a poorer yielding, fatter product. Also, in the case of feeding for the same number of days, it was estimated that fewer total pounds of beef would be produced. These two factors could result in higher wholesale and retail production costs with possible beef supply shortages. With the potential for increasing costs and shortages of

Table 21.Comparison of retail gross revenue by mature size, sex, and type of growth promotant program, evaluated at common days on feed.

Mature Size/ Days on Feed	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(dollars/head)	Variation from Base Scenario (dollars/head)				
STEERS I						
120	1219.91	-109.57	-91.60	-53.99	-55.02	-14.62
140	1282.22	-206.32	-192.27	-160.40	-49.70	-12.84
160	1250.58	-191.36	-177.02	-149.05	-39.38	-6.66
180	1221.67	-181.10	-170.37	-152.51	-29.62	-0.85
STEERS II						
120	1268.51	-170.77	-74.28	-34.30	-69.47	-26.73
140	1358.81	-204.90	-188.17	-153.54	-139.16	-102.48
160	1331.90	-204.04	-192.25	-162.17	-44.09	-8.88
180	1298.20	-189.02	-175.94	-155.85	-23.65	7.76
STEERS III						
120	1302.66	-164.29	-134.91	-94.36	-71.02	-28.32
140	1331.19	-110.94	-91.91	-54.98	-64.51	-25.86
160	1411.13	-212.73	-198.84	-166.09	-137.91	-102.59
180	1394.56	-225.34	-210.16	-182.00	-40.32	-6.45
HEIFERS I						
100	1060.96	-96.60	-74.74	-34.16	-65.12	-32.30
120	1113.53	-170.79	-155.23	-127.69	-60.84	-29.62
140	1086.36	-160.83	-150.62	-121.56	-53.79	-26.25
160	1059.75	-157.07	-145.72	-124.54	-39.53	-14.66
180	1039.01	(a)	(b)	(c)	-33.93	-12.53
HEIFERS II						
100	1105.97	-73.66	-49.36	-15.67	-68.19	-34.23
120	1183.99	-168.66	-150.43	-120.81	-138.64	-97.71
140	1161.83	-171.22	-162.93	-133.69	-48.57	-18.95
160	1131.70	-158.45	-149.47	-126.35	-29.63	-2.10
180	1121.94	-172.02	-162.62	-142.90	-38.21	-14.98
HEIFERS III						
100	1139.09	-134.76	-102.59	-69.44	-70.75	-35.90
120	1162.83	-85.95	-65.39	-33.61	-63.66	-31.26
140	1245.36	-188.78	-173.08	-144.78	-140.86	-100.67
160	1220.02	-179.73	-173.16	-148.04	-44.58	-14.96
180	1200.89	-178.41	-171.92	-150.30	-38.04	-12.59

(a), (b)& (c) The percentage of fat in gain exceeded 100%.

product to be fabricated, additional concentration, particularly at the wholesale level, would be possible.

Summary

The beef industry has undergone significant changes over the past 30 years. Improved technology has altered the way beef is processed, packaged and, in the case of anabolic implants, has affected the metabolic processes of cattle. Implanted cattle are typically heavier, leaner, and more efficient converters of feed to pounds of gain. These factors result in more saleable product at the retail level. In spite of these benefits, some American consumers remain skeptical of the merits of implant usage.

Changing U.S. consumer preferences are affecting the beef market. As consumers become more active and sophisticated in expressing these new preferences, so must the beef industry be more aware in marketing its product to meet consumer preferences. One area of consumer concern is the perceived problem of implant residues in beef. The potential losses from regulatory control could change the structure of the beef industry. This study analyzes the economic and physical impact of alternative implant strategies on various sectors of the beef industry.

Beef Cattle Growth Model Estimates

- Live weights in the base scenario, implanting at each production phase, were higher as compared with the alternative implant strategies. Calves, stockers, and slaughter cattle were from 33 to 124 pounds heavier under the base scenario.
- Base scenario carcass and retail weights were also greater than those in alternative implant strategies. Estimated carcass weights were from 15 to 77 pounds heavier when evaluated with the base scenario assumptions.
- When cattle were fed to the same slaughter weight, estimated U.S. yield and quality grades were lowest in the base scenario because of lower carcass fat levels. Feeding for the same number of days resulted in lower quality and yield grades when cattle were implanted at the stocker and feedlot levels and only at the feedlot level, as compared with the base scenario.
- Cattle fed under the base scenario required from 11 to 40 fewer days on feed to reach designated slaughter weights than cattle fed under the alternative implant strategies.
- Cattle implanted at all production phases required from 237 to 1145 fewer pounds of feed to reach designated slaughter weights as compared with alternative implant strategies.

Economic Summary

- Net returns to cow/calf producers, stocker operations, and feedlots declined for alternative implant strategies as compared with the base scenario. The reduction in net returns was from $2 to $209 per head.
- Wholesale gross revenues for the same slaughter weight and same days on feed scenarios were from $0.67 to $105 per head greater in the base scenario when compared with alternative implant strategies.
- Base scenario retail gross revenues were $0.85 to $236 per head higher when compared with alternative implant strategies.
- If implants were not used and cattle were fed for the same number of days, an additional 3.9 million head of cattle could be required to maintain retail supplies of beef, as compared with the base model. These 3.9 million head could cost the feeding sector $3.2 billion to produce.

Appendix A
Supplementary Tables

Table A-1. Comparison of slaughter cattle weights by sex, and type of growth promotant program, evaluated at common days on feed.

Sex/ Days on Feed	BASE SCENARIO[1]	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(pounds)	Variation from Base Scenario (pounds)				
STEERS						
120	1032.0	-103.0	-69.0	-39.0	-64.0	-34.0
140	1093.0	-110.0	-76.0	-46.0	-65.0	-34.0
160	1152.0	-115.0	-82.0	-52.0	-63.0	-33.0
180	1214.0	-124.0	-90.0	-59.0	-65.0	-34.0
HEIFERS						
100	897.0	-80.0	-47.0	-24.0	-56.0	-33.0
120	950.0	-85.0	-52.0	-29.0	-56.0	-33.0
140	1002.0	-89.0	-56.0	-33.0	-56.0	-33.0
160	1055.0	-95.0	-62.0	-38.0	-58.0	-33.0
180	1108.0	-99.0	-66.0	-43.0	-56.0	-33.0

[1]Base Scenario is defined as implanting at each production level.

Table A-2. Comparison of carcass weight differences by sex, and type of growth promotant program, evaluated at common days on feed.

Sex/ Days on Feed	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(pounds)	Variation from Base Scenario (pounds)				
STEERS						
120	645.0	-64.4	-43.1	-24.4	-40.0	-21.2
140	683.1	-68.7	-47.5	-28.7	-40.6	-21.2
160	720.0	-71.9	-51.2	-32.5	-39.4	-20.6
180	758.8	-77.5	-56.3	-36.9	-40.7	-21.3
HEIFERS						
100	560.6	-50.0	-29.3	-15.0	-35.0	-20.6
120	593.8	-53.2	-32.5	-18.2	-35.0	-20.7
140	626.3	-55.7	-35.0	-20.7	-35.0	-20.7
160	659.4	-59.4	-38.8	-23.8	-36.3	-20.6
180	692.5	-61.9	-41.2	-26.9	-35.0	-20.6

Table A-3. Comparison of retail product by mature size, sex, and type of growth promotant program, evaluated at a common slaughter weight.

Slaughter Weight/ Mature Size	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(pounds)	Variation from Base Scenario (pounds)				
STEERS @ 1075						
I	478.4	-55.5	-48.4	-37.5	-13.8	-4.4
II	493.3	-52.4	-45.9	-35.5	-12.9	-4.1
III	506.7	-49.4	-43.5	-33.7	-12.0	-3.6
HEIFERS @ 975						
I	419.9	-51.3	-43.9	-33.8	-15.7	-7.4
II	435.9	-47.9	-41.2	-31.7	-14.4	-6.7
III	450.1	-44.7	-38.7	-28.3	-13.3	-6.0

Table A-4. Comparison of retail product differences by mature size, sex, and type of growth promotant program, evaluated at common days on feed.

Mature Size/ Days on Feed	BASE SCENARIO	Alternative Implant Strategy				
		NEVER IMPLANTED	COW/CALF ONLY	COW/CALF & STOCKER	FEEDLOT ONLY	STOCKER & FEEDLOT
	(pounds)	Variation from Base Scenario (pounds)				
STEERS I						
120	472.3	-59.7	-49.3	-35.2	-25.4	-9.9
140	480.7	-62.5	-53.1	-40.6	-22.7	-9.0
160	486.1	-64.2	-56.3	-45.1	-19.6	-7.0
180	489.1	-66.0	-59.4	-49.8	-16.7	-5.3
STEERS II						
120	485.7	-60.7	-49.6	-35.0	-26.6	-10.7
140	496.2	-63.6	-53.4	-40.3	-24.0	-9.8
160	503.8	-65.4	-56.7	-44.9	-21.0	-7.8
180	509.3	-67.5	-60.0	-49.6	-18.4	-6.3
STEERS III						
120	497.8	-61.5	-49.8	-34.7	-27.6	-11.3
140	510.2	-64.6	-53.7	-40.1	-25.2	-10.4
160	519.8	-66.5	-57.1	-44.6	-22.3	-8.5
180	527.5	-68.8	-60.5	-49.4	-19.8	-7.1
HEIFERS I						
100	410.6	-49.2	-37.7	-25.8	-25.2	-12.5
120	417.3	-51.0	-41.5	-30.7	-22.8	-11.1
140	422.1	-53.6	-45.7	-36.0	-20.9	-10.2
160	424.1	-55.3	-48.7	-40.0	-17.9	-8.0
180	424.5	(a)	(b)	(c)	-16.0	-7.3
HEIFERS II						
100	423.3	-49.7	-37.6	-25.3	-26.1	-13.1
120	432.2	-51.7	-41.4	-30.2	-23.9	-11.8
140	439.3	-54.4	-45.6	-35.3	-22.1	-11.0
160	443.8	-56.3	-48.7	-39.4	-19.5	-8.9
180	446.7	-58.6	-52.7	-44.6	-17.4	-8.2
HEIFERS III						
100	434.7	-50.3	-37.6	-24.9	-27.0	-13.7
120	445.5	-52.4	-41.4	-29.7	-24.8	-12.4
140	454.6	-55.1	-45.5	-34.7	-23.2	-11.6
160	461.3	-57.1	-48.7	-38.8	-20.8	-9.7
180	466.6	-59.5	-52.7	-44.0	-18.9	-9.1

(a), (b) and (c) The percentage of fat in gain exceeded 100%.

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