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Possible Impacts of the Expected Shift From Cow-Calf to Cow-Calf-Yearling Enterprises on Beef Production and Beef Prices

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POSSIBLE IMPACTS OF THE EXPECTED SHIFT FROM COW-CALF TO COW-CALF-YEARLING ENTERPRISES ON BEEF PRODUCTION AND BEEF PRICES

by

Suliman H. Abdalla

A thesis submitted in partial fulfillment
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Suliman H. Abdalla

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Enterprises on Beef Production
and Beef Prices

by

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Utah State University, 1977

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Retention of young cattle and marketing older cattle from the range has been suggested as one of the profitable means of adjustment for the cow-calf operator. This study was to determine the impacts of the shift from cow-calf ranching operation to cow-calf-yearling operation on the feed energy budget of the ranch, cow herd size, beef production and market price of beef. Ten alternative livestock management options involving cow-calf-yearling operations were tested for these impacts, using two representative Utah size ranches (150 and 300 cow ranches).

The extra feed needed to accomodate the increased number of yearlings and the decrease required in brood cow herd size were esti-

mated. Changes in beef production in Utah, the Western eleven States, and the change on national price of beef were estimated from marketing projections of four types of beef. These projections were based on three levels of adoption for the management options by producers in each area.

Under complete retention of home grown calves, the total amount of feed required to support the typical cow-calf operation was 93 % of the total feed needed for the cow-calf short yearling and 85 % of the total feed required for the cow-calf long-yearling operation.

Only the production of long-yearlings resulted in a considerable decrease in brood cow carrying capacity (8 to 31 %).

Marketing baby-beef and grass-fed beef produced a substantial decrease in beef tonnage and a corresponding increase in beef price. Light-fed short-yearlings and heavy-fed beef (from both short and long yearlings) showed a considerable beef increase in Utah and the western region. Only the marketing of heavy-fed short-yearlings produced a positive change in the beef produced nationally and a slight decrease in beef price (0.3 to 2 %).

(100 pages)

INTRODUCTION

Since the end of World War II, the livestock industry in the United States has seen vast changes. The beef industry has become highly feed grain dependent. For most of that time the price of cattle was high relative to the price of feed, but over the past few years, the grain price picture has changed. Cattle prices have declined more, relative to feed prices, and the world demand for feed grains is likely to increase still more, forcing grain prices up. The feed concentrate-forage price ratio will therefore run higher than in the past (Skold, 1974).

These changes in the grain market have raised many questions about the future handling of beef production in the United States. The term "grass-fed" or "grass-fat" was recently revived (Acord, 1975). Most current speculation is for a greater dependence of producers on range forages and a trend favoring grass-fed beef. Grass-fed beef has already appeared on the market (Workman, 1975). The new changes in the USDA meat grading system is another factor encouraging less feed grain use by cattle.

While these changes are occuring, economists are faced with one very important economic question: How can beef producers adapt themselves to these changing conditions? Retention of young cattle has been suggested as a means of adjustment for the cow-calf operator and a way to increase his income. This can be accomplished by retaining

weaner calves and selling them as short-yearlings or long-yearlings at about 12 or 18 months of age, respectively.

The shift from a cow-calf ranching operation to a cow-calf-yearling operation will necessitate a decrease in brood cow herd size to accomodate more yearlings, causing certain impacts on the feed energy budget of the ranch. The extent of the reduction in the breeding herd size will depend mainly on the proportion of yearlings in the herd, length of period, and the time of year they are kept. Also, the increasing dependence on range lands for cattle fattening will mean slower gains resulting in the marketing of older animals. The average feeder calf will be larger in size but fed animals will be slaughtered at lighter weights and the total number of animals produced will be fewer, leading to decreased beef production. The extent of this reduction in Utah and the western livestock region needs to be known.

The purpose of this study is (1) to determine the impacts of the shift to marketing older cattle from rangelands on the feed energy budget of the ranch; (2) cow-herd carrying capacity and resulting number of calves produced; (3) beef production and market price of beef; and (4) to provide data for the selection of the best option from among the various enterprise combinations, for guiding ranchers in changing their pattern of production.

REVIEW OF LITERATURE

Few studies have been done in the past to assess impacts of the shift from cow-calf operations to cow-calf-yearling. These studies have focused on limited aspects of the total impacts of the shift. In general, they have been limited to the profitability aspect of the two operations with no attempts to assess the effects of the shift on the ranch energy budget, beef production and market price of beef.

Schwartz and Baker (1962), compared different ranching alternatives on the Wind River Indian Reservation in Wyoming. They found that when the upper limit of forage allowed by the tribal council was used, the permitted range which supported 175-brood cows under a cow-calf operation would support only 125-brood cows under a cow-calf-yearling operation, a reduction of 28.6% in brood cows in the latter operation.

Kearl (1969) studied nine livestock systems for grazing under Northern Great Plaines conditions for the periods 1945-55 and 1956-65. Comparisons between the typical cow-calf operation and the cow-yearling operation indicated a 17% reduction in brood cows for the shift from cow-calf to cow-yearling operation. Kearl, using the same data in 1972, reported the same reduction in brood cows under a cow-yearling operation and about 84 AUMs more purchased feed than in the cow-calf operation.

Gee and Skold (1970) used an average ranch in the mountain area of western Colorado and analyzed the potential effect on ranch organization

and income of various livestock and crop enterprises and management practices. The livestock enterprises considered in their study were: a cow-calf enterprise selling weaner calves; a cow-yearling enterprise selling home grown yearlings; and a yearling enterprise selling home grown calves with additional calves purchased in the fall as yearlings. In general their options are similar to this study, but they were mainly concerned with the returns from the different operations and their analysis also combined crop enterprises. The typical ranch used supported 130-head of breeding cows under a cow-calf operation. The amount of extra feed required to keep the same number of brood cows under a cow-yearling operation was 339 AUMs per year or 34.2% of the total amount of feed available on the ranch.

Gee and Pursley (1972) evaluated potential increase in ranch income through the retention of calves in eastern Colorado Plains. They compared the selling of short yearlings, long yearlings and fat cattle using a typical 200-cow ranch under a cow-calf operation. Their study reflected an 11% reduction in brood cows (22 head) under the short yearling operation and a 20% (41 head) reduction in brood cows for the long yearling operation.

Brownson et al. (1975) calculated the total energy required for a cow-calf and a cow-yearling operation. Their results showed that the cow-calf operation required 67% of the energy needed for a cow-yearling operation.

Eisgruber and Nelson (1975) reported that the same feed supply for a cow-calf operation would carry only 75% as many brood cows under a cow-yearling operation.

Beef production in the United States has almost doubled in the last quarter century. According to the United States Department of Agricultural Statistics (1973 and 1975), beef production rose from 21,185 million pounds in 1950 to 41,381 million pounds in 1972 (an increase of 95.3%) and then dropped to 40,680 million pounds in 1975.

The large expansion in beef supply matched the increased supply of feed grains with relatively low feed grain prices that prevailed in this period (Nix, 1975; Acord, 1975; Plowman, 1975; Eisgruber and Nelson, 1975; Skold, 1974; Lyng, 1975, Box, 1974; Hodgson, 1968; Nielsen, 1975; and Workman, 1975). Consumption of beef also doubled. Per capita consumption rose from 71.5 pounds in 1950 to 120.1 pounds in 1975 (USDA, 1975). Estimates by American National Cattlemen Association (1975) showed the growth in cow herd was relatively small and steady for several years but it jumped during the period of 1970-1975. The same source reported a rate of growth of 2% per year for the cow-herd (both beef and dairy cows) in the period 1969-1972 and about 4, 3, and 4% in 1972, 1973, and 1974 respectively.

In the Western region (11 western states) the increase in production was greater than the national average (USDA, 1975). Beef production in the west rose from 3,929 million pounds in 1950 to 8,309 million pounds in 1975, with the bulk of the increase occurring during the last 15 years. The West contributed 21% to the total beef production in the United States in 1975 (USDA, 1975).

Beef production in Utah has increased by 71% in the last 25 years with 22.9% of the increase occurring in the last 15 years (Utah Agricultural Statistics, 1975). Production in Utah grew less than

either the regional or the national averages during the same period. In the last five years beef production in Utah increased by only 4.7% or at an average rate of increase of approximately .9%. Utah contributed 3.2% and 0.7% to the total beef production in the region and nation respectively.

During 1975, Utah beef producers marketed 262,000 head of cattle and 111,000 head of calves (Utah Agricultural Statistics, 1976). Total beef production was 267,720,000 pounds. The same source reported a total of 201,100 head of cattle and 2,600 head of calves were slaughtered during the same year with a live weight of 320,128,000 pounds. From inspection records (Utah Agricultural Reporting Service, 1975), 214,487 head of cattle were exported. The percentage of exported calves was about the same as cattle. This indicates a greater increase in exported cattle compared to calves than what has been reported earlier by Evans et al. (1962).

During the last quarter century, cattle prices remained relatively stable,trending slightly upward until 1972 (Nix, 1975). Nix also observed a sharp increase in 1972 and 1973 and a decline in cattle prices after 1973. Studies on consumer response to beef prices in the past presented evidence that the demand for beef has become more price inelastic with time (Tomek 1965, Purcell and Raunikar 1971, Brandow 1961, Workman et al. 1971).

Tomek (1965) estimated a price elasticity of -1.0 for the period 1949-1956 and -0.9 for the period 1956-1964. A price elasticity of demand for beef of -0.95 was reported by Brandow (1961) for the period 1955-1957. Purcell and Raunikar (1971) estimated a price elasticity

of -0.74 for the period 1958-1962. A price elasticity estimate of -0.67 was obtained by Workman et al. (1971) for the period 1947-1967.

METHODS

Ten different options involving cow-calf-yearling operations were tested to determine the possible impacts of the shift from the traditional cow-calf operation for two representative size ranches in Utah (150-cow ranch and 300-cow ranch). Energy budgets for the two typical ranches were based on data prepared for the Utah area (Roberts and Gee, 1962). Basically the livestock enterprise for the two representative ranches was the traditional cow-calf operation but not a pure one. About 16% of the calves in the 150-cow ranch and 14% of the calves in the 300-cow ranch were retained and sold as yearlings. To allow for the impacts of the shift, forage balance and stock count charts for each of the representative ranches were constructed and a balance between feed available and feed required was established (Tables 2, 3, 5, and 6). The two representative ranches kept 17% of the heifers for cow herd replacement and reported 81% calf crop for the 150 cow ranch and 82% calf crop for the 300-cow ranch (calf crop % = number of calves weaned/number of cows and heifers over 2 years in January inventory).

A 15% cow herd replacement and 80% calf crop were assumed in all alternative options with calves being born in April. One bull for each 20-25 cows was run with the breeding herd from June to September. The ranches were supported by a feeding program of public and private land grazing and home grown and purchased feed (Tables 1 and 4). Cows

on the two ranches were on Bureau of Land Management (BLM) range from October through May. Part of the herd was fed hay, grain and protein supplement from December to March. A large part of the cow-herd grazed Forest Service (F.S.) range between mid-June and October 1. The rest were held on private range. Aftermath grazing provided feed in October. Calves were weaned November 1.

Livestock Management Alternatives (Figure 1)

The livestock management options considered were:

1. Cow-calf operation with calves weaned and sold November 1;

2. Cow-calf-short yearling operation with 50% of weaner calves retained on range, hay, and protein supplement and sold April 1;

3. Cow-calf-short yearling operation with 100% of weaner calves intended for sale, retained on range, hay and protein supplement and sold April 1;

4. Cow-calf-short yearling with home grown weaner calves retained and wintered, along with 25% of home grown calves, additional weaner calves purchased November 1, on range, hay, and protein supplement and sold April 1;

5. Cow-calf-short yearling with home grown weaner calves retained and wintered, along with 50% additional weaner calves purchased November 1, on range, hay and protein supplement and sold April 1;

6. Cow-calf-yearling operation with 50% of weaner calves retained, wintered as above, summered on range, and sold October 1;

7. Cow-calf-yearling operation with 100% of weaner calves retained, wintered as above, summered on range, and sold October 1;

8. Cow-calf-yearling with home grown weaner calves, wintered

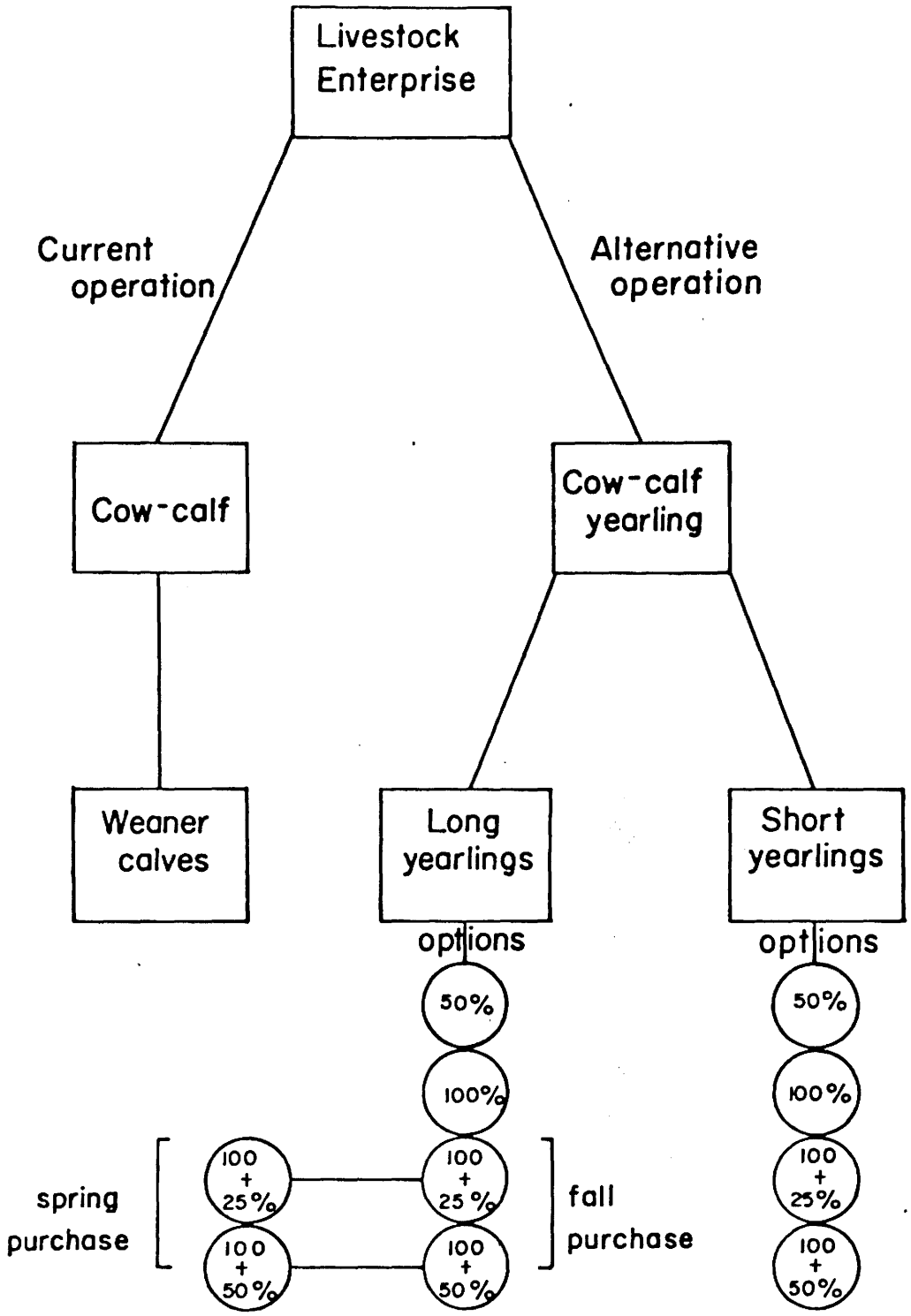

Figure 1. Livestock management options

along with 25% additional weaner calves purchased November 1, summered on range and sold October 1;

9. Cow-calf-yearling with home grown weaner calves, wintered along with 50% additional weaner calves purchased November 1, summered on range and sold October 1;

10. Cow-calf-yearling operation with home grown calves retained and wintered as above and summered on range, along with 25% additional yearlings purchased April 1 and sold October 1.

11. Cow-calf-yearling operation with home grown calves retained and wintered as above and summered on range, along with 50% additional yearlings purchased April 1 and sold October 1.

Construction of feed energy budgets and stock count charts

Forage balance charts for the two representative ranches (150-cow ranch and 300-cow ranch) were constructed by trial and error from the previously mentioned Utah study data (Table 2 and 5). A stock count chart for each of the representative ranches was calculated and a balance between feed availability and feed requirement for each ranch was established (Tables 3 and 6).

Using the algebraic method adopted by Workman and MacPherson (1973), stock count charts for the different options were constructed in algebraic form (Tables 7 to 16). The number of head of each animal class was expressed as a percentage of breeding cow carrying capacity (x). Feed and forage requirements were calculated on the basis of animal unit (AU). An AUM is the amount of feed required to maintain a 1,000-pound cow for one month. Animal units for animals of different

Table 1. Amount of feed available on a typical 150-cow Utah ranch.*

Area	Feed Available
Owned Land:	
Irrigated Pasture	142[a] AUMS
Rangeland	200 AUMS
Aftermath	93[a] AUMS
Total owned land	435 AUMS
Federal Permits:	
BLM	1005[b] AUMS
FS	530 AUMS
Total Federal permits	1535 AUMS
Total range and pasture	1970 AUMS
Alfalfa hay[c]	353[a] AUMS (141 tons)
Feed grains[d]	44 AUMS (234.6 cwt)
TOTAL FEED AVAILABLE	2367 AUMS

*Source of Data: Roberts and Gee (1963) and Gee's thesis (1962).

[a]Amounts of feed consumed by horses are subtracted to reflect only the amount available for cattle.

[b]This total was shown to be 1105 according to Roberts and Gee (1963). In Gee's thesis (1962), from which the data for feed availability originated, the amount of BLM permits was shown as 1005 with no indication for unused permits or surplus. This latter figure is used here as the amount of BLM permits available.

[c]Alfalfa hay is 50% TDN (400 lbs TDN are needed/animal unit/month).

[d]Barley is 75% TDN.

Table 2. Forage balance chart (AUMS) 150-cow ranch.

Month	Private Range	Meadow	After-math	F.S.	BLM	Barley	Hay	Total	Req.
Jan					85	11	93	189	182.8
Feb					85	11	90	186	182.8
Mar					85	11	90	190	182.8
Apr	40				150			190	189.7
May	40				150			190	189.7
Jun	120	22		53				195	189.7
Jul		40		159				199	189.7
Aug		40		210*				250	242.16
Sep		40		210*				250	242.16
Oct			93		150			243	242.16
Nov					205			205	182.8
Dec					95	11	80	186	182.8
TOTAL	200	142	93	632	1005	44		2469	2408.28

* 122 cow-calf pairs are permitted on federal lands and counted as only 1 AU each. However, since 4-6 month calves actually represent .43 AU, each cow-calf pair represents 1.43 AU and the permitted use amounts to 174.5 AUM. 28 dry cows and heifers are counted as 1 AU each. 6 bulls are counted as 1.25 AU each. All total 210 AUM during August and September.

Table 3. Stock count chart (AUM) 150-cow ranch under current cow-calf operation.

Month	1.24 AU		1.00 AU		.7 AU		.7 AU*		.55 AU		.43 AU		
	Bulls	AUM	Cows	AUM	Replacement heifers	AUM	Long yearlings	AUM	Short yearlings	AUM	Calves	AUM	Total
Jan	6	7.5	150	150					46	25.3			182.8
Feb	6	7.5	150	150					46	25.3			182.8
Mar	6	7.5	150	150					46	25.3			182.8
Apr	6	7.5	150	150	26	18.2	20	14					189.7
May	6	7.5	150	150	26	18.2	20	14					189.7
Jun	6	7.5	150	150	26	18.2	20	14					189.7
Jul	6	7.5	150	150	26	18.2	20	14					189.7
Aug	6	7.5	150	150	26	18.2	20	14			122	52.46	242.16
Sep	6	7.5	150	150	26	18.2	20	14			122	52.46	242.16
Oct	6	7.5	150	150	26	18.2	20	14			122	52.46	242.16
Nov	6	7.5	150	150					46	25.3			182.8
Dec	6	7.5	150	150					46	25.3			182.8
													2408.28

* 10% (20 calves) are retained and sold as yearlings.

Table 4. Amount of feed available on a typical 300-cow Utah ranch.*

Area	Feed Available
Owned Land:	
Irrigated Pasture	459[a] AUMS
Rangeland	300 AUMS
Aftermath	200 AUMS
Total owned land	959 AUMS
Federal Permits:	
BLM	825 AUMS
FS	2123[b] AUMS
Total Federal permits	2948 AUMS
Total range and pasture	
Alfalfa Hay	457 AUMS (198 tons)
Barley	135 AUMS (36 tons)
Leased land:	376 AUMS
TOTAL FEED AVAILABLE	4875 AUMS

Note: 400 lbs TDN are needed/animal unit month. Barley is 75% TDN. Alfalfa hay is 50% TDN.

*Source of Data: Roberts and Gee (1963) and Gee's thesis (1962).

[a]Amounts of feed consumed by horses are subtracted to reflect only the amount available for cattle.

[b]This total was shown to be 2335 AUM in Roberts and Gee (1963). In Gee's thesis (original data) the amount of BLM permits was recorded as 2123 AUM with no indication of unused permits. This latter amount will be used as the amount of BLM permits available.

Table 5. Forage balance chart (AUMS) 300-cow ranch.

Month	Owned and leased range	Meadow	After-math	F.S.	BLM	Barley	Hay	Total	Req.
Jan					225	35	120	380	366.6
Feb					225	35	120	380	366.6
Mar					225	35	115	375	366.6
Apr	90				300			390	379.65
May	90				300			390	379.65
Jun	195			205				400	379.65
Jul	195			205				400	379.65
Aug	106	129		265*				500	485.00
Sep		240		265*				505	485.00
Oct		90	200		200			490	485.00
Nov					410			410	366.6
Dec					238	30	105	370	366.6
TOTAL	676	459	200	940	2123	135	457	4990	4806.6

* 140 cow-calf pairs are permitted on federal lands and counted as only 1 AU each. However, since 4-6 month calves actually represent .43 AU each cow-calf pair represent 1.43 AU and the permitted use amounts to 200 AUMS. 55 dry cows and replacement heifers are counted as 1 AU each. 8 bulls represent 1.25 AU each. All total up to about 265 AUMS during August and September.

Table 6. Stock count chart (AUM) - 300-cow ranch under current cow-calf operation.

Month	1.25 AU		1.00 AU		0.7 AU		.7 AU		.55 AU		.43 AU		Total
	Bulls	AUM	Cows	AUM	Replacement Heifers	AUM	Long yearlings	AUM	Short yearlings	AUM	Calves	AUM	
Jan	15	18.75	300	300					87	47.85			366.6
Feb	15	18.75	300	300					87	47.85			366.6
Mar	15	18.75	300	300					87	47.85			366.6
Apr	15	18.75	300	300	50	35	37	25.9					379.65
May	15	18.75	300	300	50	35	37	25.9					379.65
Jun	15	18.75	300	300	50	35	37	25.9					379.65
Jul	15	18.75	300	300	50	35	37	25.9					379.65
Aug	15	18.75	300	300	50	35	37	25.9			245	105.35	485.00
Sep	15	18.75	300	300	50	35	37	25.9			245	105.35	485.00
Oct	15	18.75	300	300	50	35	37	25.9			245	105.35	485.00
Nov	15	18.75	300	300					87	47.85			366.6
Dec	15	18.75	300	300					87	47.85			366.6
													4806.6

* 14% (37 calves) are retained and sold as yearlings.

weights were computed by the formula:

$$AU = \frac{W^{.75}}{1000^{.75}}$$. Where W is the average of the beginning and ending weights of the animal class (Kearl, 1970).

The total AUMS of feed required per month were calculated in terms of (x) (Tables 7 to 16).

Cow herd adjustments

Assumptions:

1. Feed resources are limited and, therefore, cattle numbers were adjusted to home grown feed constraints with some allowance for purchased feed during winter time.

2. During spring and summer, range forage is the main source of feed for beef cattle raising and a time of year when hay is not a viable alternative to range and pasture. Commonly, supplementation of feed is practiced during winter only. Hence, supplements to forage during spring and summer were not considered effective.

3. Subject to the above assumptions any month of the year, other than winter months, can be a limiting month and cattle were adjusted to the feed available on the ranch.

Determination of the number of brood cows

Using the stock-count charts in the algebraic form (Tables 7 to 16), the brood cow carrying capacity by month was calculated for each option. This was obtained by equating the sum of the requirements for each animal class in terms of (X) to the amount of feed available

in the month and then solving for (X). The brood cow carrying capacity in the most limiting month was taken as an estimate for the year long carrying capacity of the ranch possible for the option under consideration.

The required reduction in number of brood cows, to accomodate the number of retained yearlings in each option, was the difference between the number of cows in the basic cow-calf operation and the estimated yearlong brood cow carrying capacity with retained yealings.

Calves produced

The reduction in the number of calves produced in each option was determined from the reduction in brood cows combined with average calf crop data.

Feed requirement

The amount of extra feed required to accommodate the number of retained calves without reducing the breeding herd size in the basic operation was obtained by subtracting the total feed available in the ranch from the total feed required for the option assuming no change in breeding herd size. The total feed required in each option assuming no change in breeding herd size was obtained by substituting the number of brood cows in the basic operation for the value of (X) in the total feed requirement equation.

Table 7. Stock-count chart in algebraic form for a cow-calf short yearling operation with 50%[a] of the calves wintered and sold April 1. (Option I).

Month	1.25 AU		1.00 AU		.7 AU		.55 AU		.43 AU		Total	Feed available on 150-cow ranch	B.C.C.C.[b]	Feed available on 300-cow ranch	B.C.C.C.[b]
	Bulls	AUM	Cows	AUM	Heifers coming"2s"	AUM	Yearlings	AUM	Calves	AUM					
Jan	0.05	.0625x	x	1.00x			.475x	.2612x			1.3237x	189	143[c]	380	287[c]
Feb	0.05	.0625x	x	1.00x			.475x	.2612x			1.3237x	186	141[c]	380	287[c]
Mar	0.05	.0625x	x	1.00x			.475x	.2612x			1.3237x	186	141[c]	375	283[c]
Apr	0.05	.0625x	x	1.00x	.15x	.105x					1.1675x	190	163	390	334
May	0.05	.0625x	x	1.00x	.15x	.105x					1.1675x	190	163	390	334
Jun	0.05	.0625x	x	1.00x	.15x	.105x					1.1675x	195	167	400	343
Jul	0.05	.0625x	x	1.00x	.15x	.105x					1.1675x	199	170	400	343
Aug	0.05	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	250	165	500	331
Sep	0.05	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	250	165	505	334
Oct	0.05	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	243	161	490	324
Nov	0.05	.0625x	x	1.00x			.475x	.2612x			1.3237x	205	160	410	310
Dec	0.05	.0625x	x	1.00x			.475x	.2612x			1.3237x	186	141[c]	370	280[c]
TOTAL												2469 AUM		4990 AUM	

[a] 50% of the calves intended for marketing (replacements not included).

[b] The column for brood cow carring capacity (B.C.C.C.) was obtained by equating feed available in the month to the total requirements in terms of (x) for the same month and solved for x.

[c] Limiting month.

Table 8. Stock-count chart in algebraic form for a cow-calf short-yearling operation with 100% of the calves wintered and sold April 1. (Option II).

Month	1.25 AU		1.0 AU		.7 AU		.53 AU		.43 AU		Total	Feed available on 150-cow ranch	B.C.C.C.[a]	Feed available on 300-cow ranch	B.C.C.C.[a]
	Bulls	AUM	Cows	AUM	Heifers coming "2s"	AUM	Yearlings	AUM	Calves	AUM					
Jan	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	189	126[b]	380	253[b]
Feb	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124[b]	380	253[b]
Mar	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124[b]	375	250[b]
Apr	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	190	163	390	334
May	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	190	163	390	334
Jun	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	195	167	400	343
Jul	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	199	170	400	343
Aug	0.05x	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	250	165	500	331
Sep	0.05x	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	250	165	505	334
Oct	0.05x	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	243	161	490	324
Nov	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	205	136	410	273
Dec	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124[b]	370	246[b]
TOTAL											15.717x	2469 AUM		4990 AUM	

[a] The column for brood cow carrying capacity (B.C.C.C.) was obtained by equating feed available in the month to the total requirements in terms of (x) for the same month and solved for x.

[b] Limiting month.

Table 9. Stock-count in algebraic form for a cow-calf short-yearling operation with home-grown calves retained along with 25% additional calves purchased November 1 and all sold April 1. (Option III)[a]

Month	1.25 AU		1.0 AU		.7 AU		.53 AU		.43 AU		Total	Feed available on 150-cow ranch	B.C.C.C.[b]	Feed available on 300-cow ranch	B.C.C.C.[b]
	Bulls	AUM	Cows	AUM	Heifers coming"2s"	AUM	Yearlings	AUM	Calves	AUM					
Jan	0.05x	.0625x	x	1.00x			.9625x	.529x			1.5915x	189	119[c]	380	239[c]
Feb	0.05x	.0625x	x	1.00x			.9625x	.529x			1.5915x	186	117[c]	380	239[c]
Mar	0.05x	.0625x	x	1.00x			.9625x	.529x			1.5915x	186	117[c]	375	236[c]
Apr	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	190	163	390	334
May	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	190	163	390	334
Jun	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	195	167	400	343
Jul	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	199	170	400	343
Aug	0.05x	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	250	165	500	331
Sep	0.05x	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	250	165	505	334
Oct	0.05x	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	243	161	490	324
Nov	0.05x	.0625x	x	1.00x			.9625x	.529x			1.5915x	205	129	410	258
Dec	0.05x	.0625x	x	1.00x			.9625x	.529x			1.5915x	186	117[c]	370	235[c]
TOTAL												2469 AUM		4990 AUM	

[a] Additional calves are taken as a percentage of home grown calves intended for marketing.

[b] The column for brood cow carrying capacity (B.C.C.C.) was obtained by equating feed available in the month to the total requirements in terms of (x) for the same month and solved for x.

[c] Limiting month.

Table 10. Stock-count chart in algebraic form for a cow-calf short-yearling operation with home-grown calves retained along with 25% additional calves purchased November 1 and all sold April 1. (Option IV)[a].

Month	1.25 AU		1.0 AU		.7 AU		.53 AU		.43 AU		Total	Feed available on 150-cow ranch	B.C.C.C.[b]	Feed available on 300-cow ranch	B.C.C.C.[b]
	Bulls	AUM	Cows	AUM	Heifers coming"2s"	AUM	Yearlings	AUM	Calves	AUM					
Jan	0.05x	.0625x	x	1.00x			1.125x	.619x			1.6815x	189	112[c]	380	226[c]
Feb	0.05x	.0625x	x	1.00x			1.125x	.619x			1.6815x	186	111[c]	380	226[c]
Mar	0.05x	.0625x	x	1.00x			1.125x	.619x			1.6815x	186	111[c]	375	223[c]
Apr	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	190	163	390	334
May	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	190	163	390	334
Jun	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	195	167	400	343
Jul	0.05x	.0625x	x	1.00x	.15x	.105x					1.1675x	199	170	400	343
Aug	0.05x	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	250	165	500	331
Sep	0.05x	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	250	165	505	334
Oct	0.05x	.0625x	x	1.00x	.15x	.105x			.8x	.344x	1.5115x	243	161	490	324
Nov	0.05x	.0625x	x	1.00x			1.125x	.619x			1.6815x	205	122	410	243
Dec	0.05x	.0625x	x	1.00x			1.125x	.619x			1.6815x	186	111[c]	370	220[c]
TOTAL												2469 AUM		4990 AUM	

[a] Additional calves are taken as a percentage of home grown calves intended for marketing.

[b] The column for brood cow carrying capacity (B.C.C.C.) was obtained by equating feed available in the month to the total requirements in terms of (x) for the same month and solved for x.

[c] Limiting month.

Table 11. Stock-count chart in algebraic form for a cow-calf long-yearling operation with 50% of the calves wintered, summered and sold October 1. (Option V).

Month	1.25 AU		1.0 AU		.7 AU		.53 AU		.43 AU		Total	Feed available on 150-cow ranch	B.C.C.C.[a]	Feed available on 300-cow ranch	B.C.C.C.[a]
	Bulls	AUM	Cows	AUM	Heifers coming"2s"	AUM	Yearlings	AUM	Calves	AUM					
Jan	0.05x	.0625x	x	1.00x			.475x	.2612x			1.3237x	189	143	380	287
Feb	0.05x	.0625x	x	1.00x			.475x	.2612x			1.3237x	196	140	380	287
Mar	0.05x	.0625x	x	1.00x			.475x	.2612x			1.3237x	196	140	375	283
Apr	0.05x	.0625x	x	1.00x	.475x	.3325x					1.395x	190	136[b]	390	280[b]
May	0.05x	.0625x	x	1.00x	.475x	.3325x					1.395x	190	136[b]	390	280[b]
Jun	0.05x	.0625x	x	1.00x	.475x	.3325x					1.395x	195	140	400	287
Jul	0.05x	.0625x	x	1.00x	.475x	.3325x					1.395x	199	143	400	287
Aug	0.05x	.0625x	x	1.00x	.475x	.3325x			.8x	.344x	1.729x	250	145	500	289
Sep	0.05x	.0625x	x	1.00x	.475x	.3325x			.8x	.344x	1.729x	250	145	505	292
Oct	0.05x	.0625x	x	1.00x	.475x	.3325x			.8x	.344x	1.5115x	243	161	490	324
Nov	0.05x	.0625x	x	1.00x			.475x	.2612x			1.3237x	205	155	410	310
Dec	0.05x	.0625x	x	1.00x			.475x	.2612x			1.3237x	186	140	370	280
TOTAL												2469 AUM		4990 AUM	

[a] The column for brood cow carring capacity (B.C.C.C.) was obtained by equating feed available in the month to the total requirements in terms of (x) for the same month and solved for x.

[b] Limiting month.

Table 12. Stock-count chart in algebraic form for a cow-calf long-yearling operation with 100% of the calves wintered, summered and sold October 1. (Option VI).

Month	1.25 AU		1.0 AU		.7 AU		.53 AU		.43 AU		Total	Feed available on 150-cow ranch	B.C.C.C.[a]	Feed available on 300-cow ranch	B.C.C.C.[a]
	Bulls	AUM	Cows	AUM	Heifers coming"2s"	AUM	Yearlings	AUM	Calves	AUM					
Jan	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	189	126	380	253
Feb	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124	380	253
Mar	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124	375	250
Apr	0.05x	.0625x	x	1.00x	.8x	.56x					1.6225x	190	117[b]	390	240[b]
May	0.05x	.0625x	x	1.00x	.8x	.56x					1.6225x	190	117[b]	390	240[b]
Jun	0.05x	.0625x	x	1.00x	.8x	.56x					1.6225x	195	120	400	247
Jul	0.05x	.0625x	x	1.00x	.8x	.56x					1.6225x	199	123	400	247
Aug	0.05x	.0625x	x	1.00x	.8x	.56x			.8x	.344x	1.9665x	250	127	500	254
Sep	0.05x	.0625x	x	1.00x	.8x	.56x			.8x	.344x	1.9665x	250	127	505	257
Oct	0.05x	.0625x	x	1.00x	.8x	.56x			.8x	.344x	1.5115x	243	161	490	324
Nov	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	205	136	410	273
Dec	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124	370	246
TOTAL											19.447x	2469 AUM		4990 AUM	

[a] The column for brood cow carring capacity (B.C.C.C.) was obtained by equating feed available in the month to the total requirements in terms of (x) for the same month and solved for x.

[b] Limiting month.

Table 13. Stock-count chart in algebraic form for a cow-calf long-yearling operation with home-grown calves retained plus 25% additional calves purchased November 1, wintered, summered and sold October 1. (Option VII)[a].

Month	1.25 AU		1.0 AU		.7 AU		.53 AU		.43 AU		Total	Feed available on 150-cow ranch	B.C.C.C.[b]	Feed available on 300-cow ranch	B.C.C.C.[b]
	Bulls	AUM	Cows	AUM	Heifers coming"2s"	AUM	Yearlings	AUM	Calves	AUM					
Jan	0.05x	.0625x	x	1.00x			.7625	.579x			1.5915x	189	119	380	239
Feb	0.05x	.0625x	x	1.00x			.7625x	.579x			1.5915x	186	117	380	239
Mar	0.05x	.0625x	x	1.00x			.7625x	.579x			1.5915x	186	117	375	236
Apr	0.05x	.0625x	x	1.00x	.7625x	.644x					1.7365x	190	109[c]	390	225[c]
May	0.05x	.0625x	x	1.00x	.7625x	.644x					1.7365x	190	109[c]	390	225[c]
Jun	0.05x	.0625x	x	1.00x	.7625x	.644x					1.7365x	195	112	400	230
Jul	0.05x	.0625x	x	1.00x	.7625x	.644x					1.7365x	199	115	400	230
Aug	0.05x	.0625x	x	1.00x	.7625x	.644x			.8x	.344x	2.0805x	250	120	500	240
Sep	0.05x	.0625x	x	1.00x	.7625x	.644x			.8x	.344x	2.0805x	250	120	505	243
Oct	0.05x	.0625x	x	1.00x	.7625x	.644x			.8x	.344x	1.5115x	243	161	490	324
Nov	0.05x	.0625x	x	1.00x			.7625x	.579x			1.5915x	205	129	410	258
Dec	0.05x	.0625x	x	1.00x			.7625x	.579x			1.5915x	186	117	370	233
TOTAL												2469 AUM		4990 AUM	

[a] Additional calves are taken as a percentage of home grown calves intended for marketing.

[b] The column for brood cow carrying capacity (B.C.C.C.) was obtained by equating feed available in the month to the total requirements in terms of (x) for the same month and solved for x.

[c] Limiting month.

Table 14. Stock count chart in algebraic form for a cow-calf long-yearling operation with home-grown calves retained plus 50% additional calves purchased November 1, wintered, summered and sold October 1. (Option VIII).

Month	1.25 AU		1.0 AU		.7 AU		.51 AU		.43 AU		Total	Feed available on 150-cow ranch	B.C.C.C.[a]	Feed available on 300-cow ranch	B.C.C.C.[a]
	Bulls	AUM	Cows	AUM	Heifers coming "2s"	AUM	Yearlings	AUM	Calves	AUM					
Jan	0.05x	.0625x	x	1.00x			1.125x	.619x			1.6815x	189	112	380	226
Feb	0.05x	.0625x	x	1.00x			1.125x	.619x			1.6815x	186	111	380	226
Mar	0.05x	.0625x	x	1.00x			1.125x	.619x			1.6815x	186	111	375	223
Apr	0.05x	.0625x	x	1.00x	1.25x	.7875x					1.85x	190	103[b]	390	211[b]
May	0.05x	.0625x	x	1.00x	1.25x	.7875x					1.85x	190	103[b]	390	211[b]
Jun	0.05x	.0625x	x	1.00x	1.25x	.7875x					1.85x	195	105	400	216
Jul	0.05x	.0625x	x	1.00x	1.25x	.7875x					1.85x	199	108	400	216
Aug	0.05x	.0625x	x	1.00x	1.25x	.7875x			.8x	.344x	2.194x	250	114	500	228
Sep	0.05x	.0625x	x	1.00x	1.25x	.7875x			.8x	.344x	2.194x	250	114	505	230
Oct	0.05x	.0625x	x	1.00x	1.25x	.7875x			.8x	.344x	1.5115x	243	161	490	324
Nov	0.05x	.0625x	x	1.00x			1.125x	.619x			1.6815x	205	122	410	244
Dec	0.05x	.0625x	x	1.00x			1.125x	.619x			1.6815x	186	111	370	220
TOTAL												2469 AUM		4990 AUM	

[a] The column for brood cow carrying capacity (B.C.C.C.) was obtained by equating feed available in the month to the total requirements in terms of (x) for the same month and solved for x.

[b] Limiting month.

Table 15. Stock-count chart in algebraic form for a cow-calf long-yearling operation with home-grown calves retained plus 25% additional purchased yearlings (April 1), wintered, summered and sold October 1. (Option X).

Month	1.25 AU		1.0 AU		.7 AU		.53 AU		.43 AU		Total	Feed available on 150-cow ranch	B.C.C.C.[a]	Feed available on 300-cow ranch	B.C.C.C.[a]
	Bulls	AUM	Cows	AUM	Heifers coming"2s"	AUM	Yearlings	AUM	Calves	AUM					
Jan	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	189	126	380	253
Feb	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124	380	253
Mar	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124	375	250
Apr	0.05x	.0625x	x	1.00x	.9625x	.674x					1.7365x	190	109[b]	390	225[b]
May	0.05x	.0625x	x	1.00x	.9625x	.674x					1.7365x	190	109[b]	390	225[b]
Jun	0.05x	.0625x	x	1.00x	.9625x	.674x					1.7365x	195	112	400	230
Jul	0.05x	.0625x	x	1.00x	.9625x	.674x					1.7365x	199	115	400	230
Aug	0.05x	.0625x	x	1.00x	.9625x	.674x			.8x	.344x	2.0805x	250	120	500	240
Sep	0.05x	.0625x	x	1.00x	.9625x	.674x			.8x	.344x	2.0805x	250	120	505	243
Oct	0.05x	.0625x	x	1.00x	.9625x	.674x			.8x	.344x	1.5115x	243	161	490	324
Nov	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	205	136	410	273
Dec	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124	370	246
TOTAL												2469 AUM		4990 AUM	

[a]The column for brood cow carrying capacity (B.C.C.C.) was obtained by equating feed available in the month to the total requirements in terms of (x) for the same month and solved for x.

[b]Limiting month.

Table 16. Stock-count chart in algebraic form for a cow-calf long-yearling operation with home-grown calves retained plus 50% additional purchased yearlings (April 1) wintered, summered and sold October 1. (Option XI).

Month	1.25 AU		1.0 AU		.7 AU		.53 AU		.43 AU		Total	Feed available on 150-cow ranch	B.C.C.C.[a]	Feed available on 300-cow ranch	B.C.C.C.[a]
	Bulls	AUM	Cows	AUM	Heifers & steers coming "2s"	AUM	Yearlings	AUM	Calves	AUM					
Jan	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	189	126	380	253
Feb	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124	380	253
Mar	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124	375	250
Apr	0.05x	.0625x	x	1.00x	1.125x	.7875x					1.85x	190	103[b]	390	211[b]
May	0.05x	.0625x	x	1.00x	1.125x	.7875x					1.85x	190	102[b]	390	211[b]
Jun	0.05x	.0625x	x	1.00x	1.125x	.7875x					1.85x	195	105	400	216
Jul	0.05x	.0625x	x	1.00x	1.125x	.7875x					1.85x	199	108	400	216
Aug	0.05x	.0625x	x	1.00x	1.125x	.7875x			.8x	.344x	2.194x	250	114	500	228
Sep	0.05x	.0625x	x	1.00x	1.125x	.7875x			.8x	.344x	1.194x	250	114	505	230
Oct	0.05x	.0625x	x	1.00x	1.125x	.7875x			.8x	.344x	1.5115x	243	161	490	324
Nov	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	205	136	410	273
Dec	0.05x	.0625x	x	1.00x			.8x	.44x			1.5025x	186	124	370	246
TOTAL												2469 AUM		4990 AUM	

[a] The column for brood cow carrying capacity (B.C.C.C.) was obtained by equating feed available in the month to the total requirements in terms of (x) for the same month and solved for x.

[b] Limiting month.

Beef Production (Figure 2)

Determination of the change in beef tonnage in Utah, the western region and the nation was based on 1975 beef production figures (Table 17). The western region as defined here includes the following 11 states: Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, and California. Change in beef production was examined by the marketing of four types of beef: a) Baby-beef; b) grass-fed beef; c) light-fed beef; and d) heavy-fed beef.

These marketings were based on the assumption that only a certain percentage of Utah or the Western region ranchers will adopt each option. The levels of adoptions projected were as follows: For options I, II, V and VI, 25%, 50% and 100% of Utah ranchers will retain 50% and 100% of their weaner calves; for options III, IV, VII, VIII, IX and X, 25% and 50% of Utah ranchers will retain 100% of home grown calves and purchase an additional quantity equal to 25% or 50% of the home grown component.

Baby beef is meat from short-yearling calves marketed at weights between 350 and 500 pounds and fed mostly mother's milk and grass. Grass-fed beef is meat from long-yearling calves fed only on range or pasture or receiving a limited ration of grain before being marketed at weights between 550 and 750 pounds. Light-fed beef is meat from cattle fed on range or pasture and finished on grain to weights between 800 and 1000 pounds. Heavy-fed beef is meat from cattle fed on range or pasture and finished on grain to average weight of 1,100 pounds.

Animals marketed under options I, II, III and IV with no additional feeding were classified as baby beef with an average weight

Table 17. Cattle, calves and beef production in the 11 western states and the contribution of each state to the total beef production in the region and the nation -- 1975*.

State	All cows that calved Jan.1 (1000 head)	Calf crop (1000 head)	Deaths (1000 head)	Calves weaned[a] (1000 head)	Replacements (1000 head)	Calf-product marketed[b] (1000 head)	Beef cows that have calved (1000 head)	Calves weaned from beef cows[c] (1000 head)	Cattle Marketings			Beef Production (1000 lbs)	Contribution to the region (%)	Contribution to the nation
									Cattle (1000 head)	Calves (1000 head)	Total (1000 head)			
Montana	1,720	1,680	180	1,500	310	1,190	1,692	1,476	1,069	645	1,714	963,050	11.6	2.4
Idaho	870	770	100	670	213	457	721	555	859	202	1,061	661,275	8.0	1.6
Wyoming	819	760	75	685	163	522	806	674	710	218	928	515,070	6.2	1.3
Colorado	1,125	1,020	110	910	328	582	1,050	849	2,583	140	2.723	1,838,830	22.1	4.5
N. Mexico	745	590	45	545	135	410	714	522	1,397	114	1,511	562,460	6.8	1.4
Arizona	436	316	25	291	66	225	372	248	947	79	1,026	567,775	6.8	1.4
Utah	428	390	30	360	102	258	349	294	262	111	373	267,720	3.2	0.7
Nevada	352	285	20	265	60	205	338	255	175	125	300	190,220	2.3	0.5
Washington	584	527	80	447	201	246	403	309	415	131	546	416,780	5.0	1.0
Oregon	708	658	50	608	144	464	617	530	439	233	672	471,715	5.7	1.2
California	1,897	1,620	175	1,445	571	874	1,097	836	2,904	345	3,249	1,853,800	22.2	4.6
TOTAL 11 STATES	9,684	8,616	890	7,726	2,293	5,433	8,159	6,548	11,760	2,343	14,103	8,308,695	100.0	20.6
TOTAL U.S.												40,680,069		

* Source of data: 1) USDA Statistical Reporting Service 1975. Livestock and Meat Statistics Suppl. 1975. P: 28, 29 and 107.
2) Crop Reporting Board, SRS, USDA, 1976.

a Obtained by subtracting the deaths from calf crop.

b Obtained by subtracting the replacements from calves weaned.

c Obtained by multiplying the percentage of calves weaned, based on all cows that have calved, times the number of beef cows that have calved.

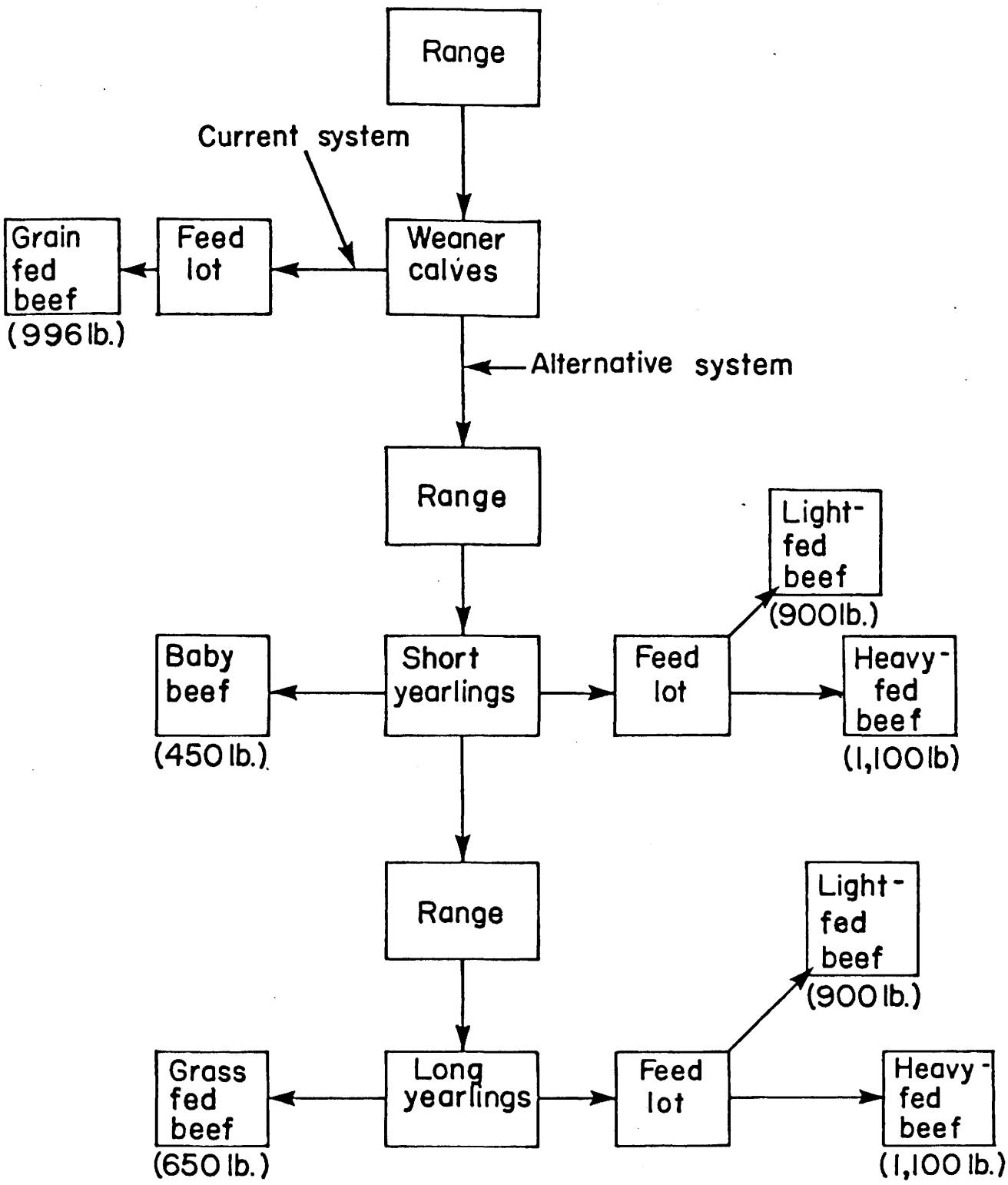

Figure 2. Beef production and marketing systems

of 450 pounds. Animals marketed under options V, VI, VII, VIII, IX and X without additional feeding were classified as grass-fed beef, weighing an average of 650 pounds. Animals produced under any of the 11 options and finished in feed lots were classified as light-fed, averaging 900 pounds or heavy-fed, averaging 1,100 pounds.

Calves produced, calf-numbers marketed and reduction in calf-numbers marketed (See Appendix B)

Based on the percentage of adopting ranchers, the base number of calves produced under the existing cow-calf operation was estimated from calf-crop figures for 1975 (USDA Statistical Reporting Service and Utah State Department of Agriculture, 1975). Calf-numbers marketed was obtained by subtracting deaths and replacements from the calf crop.

Reduction in calf-numbers marketed was the difference between the base calf-numbers marketed under the cow-calf operation and under the adopted operation.

Determination of the changes in beef production

Beef production figures for 1975 were used to represent the basic production levels under the existing market system (Table 17). Two factors are responsible for the change in beef production: 1) weight of animals marketed, and 2) number of animals marketed.

Change in marketing weight per head was obtained by the difference between the assumed marketing weight for the projected type of beef marketed and the current average marketing weight for beef cattle in

the geographic area under consideration. The current average weights of marketed animals in Utah and the western region was estimated by taking the average beef production per animal marketed in Utah and the average production per animal marketed in the region (for the calculations, see Appendix B). The production per animal marketed was obtained by dividing the base production by the total number of animals marketed in the base period.

A weight of 996 pounds was used as the national average weight of slaughtered cattle in the nation under the existing market system (Appendix B).

The change in number of animals marketed was the difference between the number of calves produced and marketed under the adopted management option and the number of animals marketed under the cow-calf operation.

Total change in beef production was the difference between the production under the existing management and marketing systems and the production under the adopted management and marketing options (see Appendix C for calculations).

Beef prices

The impacts on beef prices due to each of the possible reductions in beef supply were determined using the concept of elasticity of demand for beef. It is a measure of the percentage increase/decrease in the quantity purchased of a product resulting from a 1 percent decrease/increase in the price of the product.

In algebraic terms: $E = \frac{\Delta Q}{Q} \div \frac{\Delta P}{P}$ or $\frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$

where E is the elasticity coefficient and Δ denotes "change in." Demand for a product is said to be inelastic when either; (1) a 1% in its price results in a less than 1% decrease in the quantity purchased; or (2) a 1% decrease in its price results in a less than 1% increase in its purchase. An estimated value of -.67 for the elasticity coefficient made by Workman et al. (1972) was used to predict changes in beef prices due to the reductions in beef supply resulting from the adoption of the different options.

RESULTS AND DISCUSSION

Effect on feed energy budget of the ranch

Impact on feed energy budget due to the adoption of the proposed management options was similar in both representative size ranches used (Table 18). Implementation of the ten alternative options required (from 2 to 32 % of the total feed available on the 150-cow ranch and 1.0 to 31 % on the 300-cow ranch) extra feed to accomodate the increased number of yearlings, without the reduction of brood cows. The amount of extra feed required in each option increased with the increase in number of retained calves, length of the period calves were kept and age of retained calves. Thus, it was obvious that options involving the retention of home-grown calves with additional purchased calves, had greater impact than those involving the retention of only half or all home grown calves (Figure 3). Also options selling long yearlings (options V to X) reflected greater feed requirements than those selling short yearlings (options I to IV).

Of the ten alternative options tested, option VIII selling long yearlings from retained home-grown calves and 50 percent additional calves purchased November 1, produced the greatest impact. Approximately 31 % more feed was needed than was available on the ranch. Option X selling the same number of calves as the above option but the purchase of additional calves made later on April 1, reflected a relatively lower requirement of 26% more feed than was available

Table 18. Number of brood cows, reduction in brood cows and calves produced and the amount of extra feed required to accomodate retained calves in each option for the 150 and 300 cow ranches.

	150-cow ranch										300-cow ranch									
Option	Number of brood cows	Reduction in brood cows		Reduction in calves produced		Extra feed required[b]					Number of brood cows	Reduction in brood cows		Reduction in calves produced		Extra feed required				
		(head)	(%)	(head)	(%)	Winter[c] AUM	Spring[d] AUM	Summer[e] AUM	Total AUM	Percent		(head)	(%)	(head)	(%)	Winter AUM	Spring AUM	Summer AUM	Total Aum	Percent
*	150	0	0	0	0	0	0	0	0	0	300	0	0	0	0	0	0	0	0	0
I[a]	150	0	0	0	0	41	0	0	41	1.7	300	0	0	0	0	71	0	0	71	1.4
II[a]	150	0	0	0	0	175	0	0	175	7.1	300	0	0	0	0	339	0	0	339	6.8
III[a]	150	0	0	0	0	242	0	0	242	9.8	300	0	0	0	0	472	0	0	472	9.5
IV[a]	150	0	0	0	0	309	0	0	309	12.5	300	0	0	0	0	607	0	0	607	12.2
V	136	14	9.3	11	9.3	41	39	27	107	4.3	280	20	6.7	16	6.7	71	57	33	161	3.2
VI	117	33	22.0	26	22.0	175	107	166	448	18.1	240	60	20.0	48	20.0	339	194	312	845	16.9
VII	109	41	27.3	33	27.3	242	141	235	618	25.0	225	75	25.0	50	25.0	472	262	449	1183	23.7
VIII	103	47	31.3	38	31.3	309	175	303	787	31.9	211	89	29.7	71	29.7	607	330	585	1522	30.5
IX	109	41	27.3	33	27.3	175	141	235	551	22.3	225	75	25.0	60	25.0	339	262	449	1050	21.0
X	103	47	31.3	38	31.3	175	175	303	653	26.4	211	89	29.7	71	29.7	339	330	585	1254	25.1

* The basic operation.

a No reduction in brood cows since winter feeds were assumed to be available (see methods) and the rancher can supply the shortage.

b The amount of extra feed required for each season was obtained by subtracting the total feed available in the season from the amount of feed required per season expressed in terms of (x), where x is valued as the original brood cow number in the basic operation.

c Winter feeding season was assumed to begin November 1 and end March 30.

d Spring season was assumed to begin April 1 until May 30.

e Summer season was assumed to begin June 1 and end October 30.

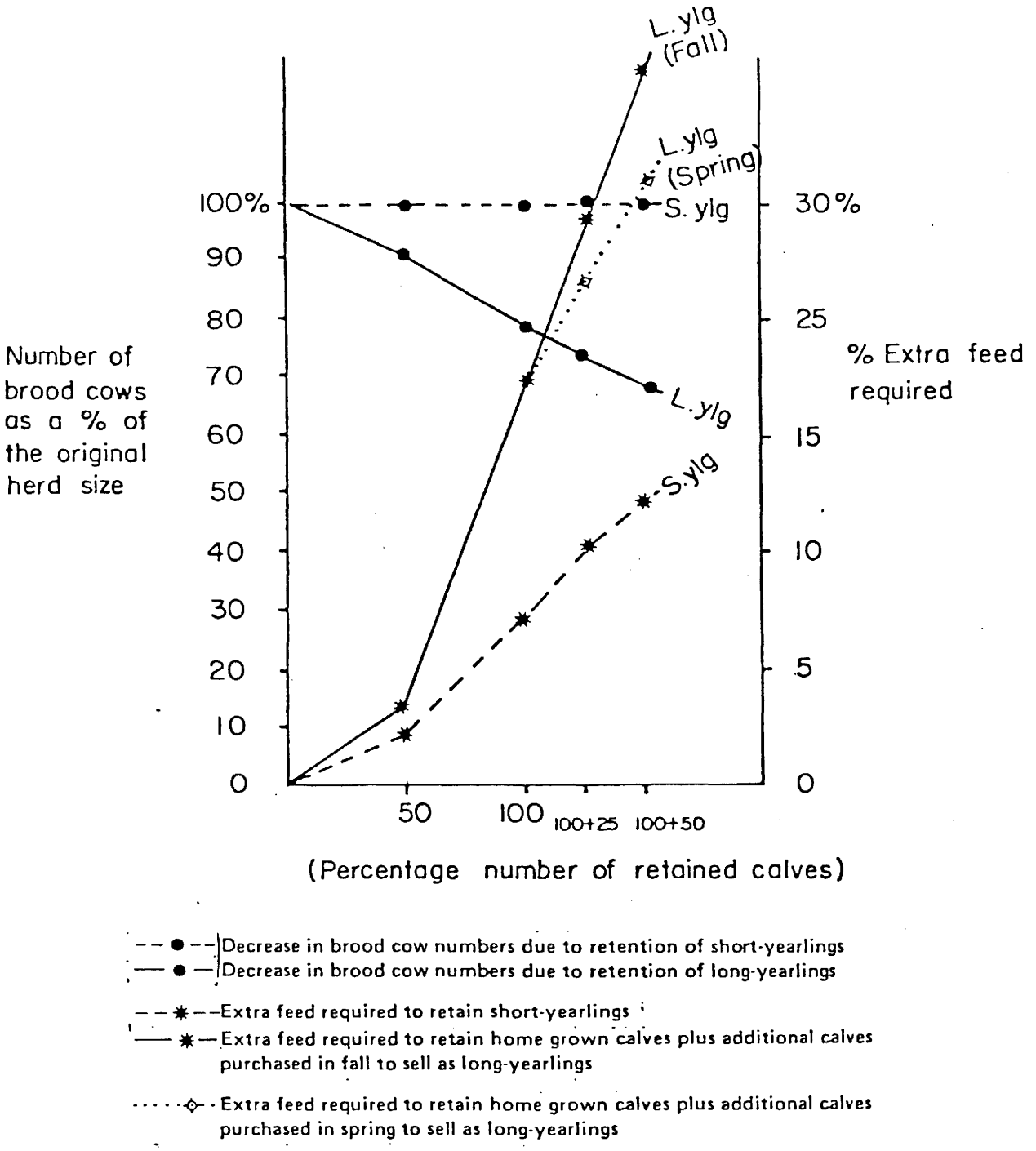

Figure 3. Decrease in brood-cow numbers and the amount of extra feed required to accommodate yearling

on the ranch. Also, selling of the same number of calves as in these options but as short yearlings (option IV) required only 12% more feed than was available on the ranch.

Complete retention of home-grown calves and the selling of long yearlings (option VI) required 18% more feed compared to 7% more feed required by selling the same number of calves as short yearlings (option II). These results indicated that the total feed required to support the typical cow-calf operation was 93% of the total feed needed for a cow-calf short-yearling operation and 85% of the total feed required for a cow-calf long-yearling operation. Comparison between the cow-calf long-yearling and the basic cow-calf operation reflected a higher feed requirement for the basic operation than the 75% reported by Gee and Skold (1975) and the 67% reported by Brownson (1975). The differences are likely attributable to the mixture of the typical cow-calf operation used in these studies. In the present study, 14 to 16% of the calves with the "cow-calf" operation were actually sold as long-yearlings.

Only 2 and 4% more feed were required for options I and V respectively. In these options, half of the home-grown calves were retained and sold as short yearlings in the first, and as long yearlings in the second option. Depending on the number of calves retained, selling long yearlings required twice the extra feed as selling of short yearlings.

Decrease in breeding herd size and calf numbers

As in the case of feed requirement, the decrease in breeding herd size was determined by the number of retained calves, the amount of feed available on the ranch and, more important, the season during which calves were kept (results are given in Table 18).

The year-long brood-cow carrying capacities, based on the limiting months method, are summarized in Table 19. Under the assumption of fixed ranch feed resources, the factors determining brood-cow herd size were the number of calves retained and the time of the year calves were kept. As expected, the greatest decrease in brood-cow carrying capacity matched the critical time of feed availability. Spring-grazing season (April and May) was observed to be the most limiting part of the year for range forage. April and May 5 is the time of the early growing season, a period when plants are lush and supplements to forage such as hay are not effective. Hay is less palatable during this time. Also the muddy and damp conditions in confinements cause calf scours, and feeding of hay on the range might result in the picking of poisonous plants by grazing animals.

Comparing seasons, the greatest decrease in brood-cow numbers occurred when retained calves were carried over spring and summer. Thus, options involving the selling of long yearling (Figure 3) showed a greater reduction (from 8 to 31% in brood cow numbers) than options selling short yearling (zero reduction). The larger the percentage of retained calves during the same part of the year, the lower brood-cow carrying capacity.

Although changes in brood-cow carrying capacity were closely

Table 19. Brood cow carrying capacity under the different management options.*

	Option	Brood cow carrying capacity		Decrease in brood cow carrying capacity		
		150-cow ranch (head)	300-cow ranch (head)	150-cow ranch (%)	300-cow ranch (%)	Combined Average (%)
0	Basic cow-calf operation	150	300	0	0	0
I	50% of the calves retained and sold as short-yearlings	150	300	0	0	0
II	100% of the calves retained and sold as short-yearlings	150	300	0	0	0
III	100% of the calves retained with 25% additional calves purchased and sold as short-yearlings	150	300	0	0	0
IV	100% of the calves retained with 50% additional calves purchased and sold as short-yearlings	150	300	0	0	0
V	50% of the calves retained and sold as long-yearlings	136	280	9.3	6.7	8.0
VI	100% of the calves retained and sold as long-yearlings	117	240	22.0	20.0	21.0
VII	100% of the calves retained with 25% additional calves purchased (Nov. 1) and sold as long-yearlings	109	225	27.3	25.0	26.2

	Options	Brood cow carrying capacity		Decrease in brood cow carrying capacity		
		150-cow ranch (head)	300-cow ranch (head)	150-cow ranch (%)	300-cow ranch (%)	Combined Average (%)
VIII	100% of the calves retained with 50% additional calves purchased (Nov. 1) and sold as long-yearlings	103	211	31.3	29.7	30.5
IX	100% of the calves retained with 25% additional calves purchased (Apr. 1) and sold as long-yearlings	109	225	27.3	25.0	26.2
X	100% of the calves retained with 50% additional calves purchased (Apr. 1) and sold as long-yearlings	103	211	31.3	29.7	30.5

* The calculations were based on the limiting month method.

related to the feed energy budget, some options with substantial differences in feed requirement showed equal carrying capacity. The greatest reduction (31%) in brood cow numbers occurred with the adoption of options VIII and X. All home-grown calves, plus 50% additional purchased calves were retained and sold as long yearlings in the two options. The only difference was the time of purchase of additional calves (November in VIII and April in X). The same options showed the greatest impacts on feed energy budget of the ranch but the extra feed required by option VIII (31%) was greater than the amount required by option X (26%). The equal carrying capacity reflected by the two options was a result of the limiting month method used to calculate the yearlong carrying capacity. Since spring was the most limiting season and the same number of calves in each option was on the ranch during this time (the latest purchasing date of calves is April 1), the limiting month was still April 1. Accordingly, the purchase of calves before or during the limiting month would not affect the estimated capacity if calves were to be carried through the limiting season.

Options VII and IX selling long yearlings by retaining home-grown calves, and 25% additional calves resulted in equal carrying capacity and the second greatest reduction on brood-cow number (26%). Similarly these options reflected the second largest impact on feed-energy budget but the extent of their impacts was different due to the difference in the purchase time of additional calves which again had no effect on brood-cow carrying capacity in these options.

Options I to IV involving the selling of short yearlings caused no reductions in brood-cow numbers. This was expected since calves were carried only through the winter. Feed shortage during winter was considered less critical under the assumption that purchased grain and hay supplements were available to the rancher to augment his home-grown feed sources. Due to the effect of seasonality on feed availability, as reflected by the above assumption, a 4% feed requirement in option V (selling long yearlings) resulted in an 8% reduction in brood cow numbers, while a 12% feed requirement in option IV (selling short yearlings) caused no reduction in brood-cow numbers.

Retaining home-grown calves and selling short yearlings (option II) also resulted in no reduction in brood-cow carrying capacity compared to the 11% reduction reported by Gee and Pursely (1972). As previously mentioned, the zero reduction was due to the assumption of feed availability for supplementation during this time.

On the other hand, the retention of home-grown calves and selling long yearlings (option VI) resulted in a 21% reduction in brood-cow numbers, about the same as the 20% reported by Gee and Pursely (1972). Most reductions reported in the literature varied from 17% to 25%. In practice conditions under the typical ranches used in such studies are not completely representative of the whole complex of ranches in one state and the differences are even greater when comparing studies made in different states or regions. However, in the aggregate, all these results seem to converge at about 20%.

Change in beef production in Utah

The implementation of the ten management options and marketing weights of 450, 650, 900, and 1,100 pounds for six marketing situations were examined under three adoption levels to estimate the change in beef production in Utah (results in Tables 20 and 21). Details of the calculations are in Appendix C.

Beef production in Utah for 1975 was 267,720,000 pounds (Table 17). The combined average weight for cattle and calves marketed in Utah was 718 lbs/head. Utah contributed 0.7% to the total beef production in the nation (Table 17).

Changes in beef production in Utah due to the adoption of the ten management options and six marketing situations were summarized in Tables 22 and 23.

Obviously, the extent of change in beef production in Utah was related to the number of ranch managers implementing the various options (adoption level), change in number and weight of animals marketed or the combination of all three factors. Total Utah production decreased by marketing baby beef, grass-fed beef, and light-fed beef from long yearlings. Marketing baby beef showed the greatest decrease compared to the other two marketing situations under all management options and adoption levels. Depending on management option and adoption level, the extent of reduction in beef produced by marketing baby beef varied from 3 to 25%. Next to baby beef, marketing grass-fed beef resulted in 2 to 19% decrease in beef production depending on management option and adoption level. The smallest decrease was caused by marketing light-fed beef from long yearlings.

Table 20. Estimated change in beef production in Utah due to the adoption of the different management and marketing options by Utah ranchers - comparison between baby-fed vs. light-fed beef and heavy-fed beef from long yearlings.

Option	Ave. reduct. in calves produced in adopted opt.	Calves produced & marketed by adopting ranchers	25% Adoption level: Reduction in calf-product marketed in Utah		Calves marketed under the adopted marketing situation			Ave. marketing wt. per head (lb)	Change in marketing wt per head (lb)	Change in beef production in Utah				Change in beef prod. at 50% adoption level (%)	Change in beef prod. at 100% adoption level (%)
			Head	%	Home Grown	Purchased	Total			Change due to marketing weight	Change due to reduced calf numbers	Total 1000#	Total %		
	%	Head													
0 Basic Option	0	62,475	0	0	62,475	---	62,475	718	0	0	0	0	0	0	0
Baby-Beef															
I	0	62,475	0	0	31,238	---	31,238	450	-268	-8,372	---	-8,372	-3.1	-6.2	-12.4
II	0	62,475	0	0	62,475	---	62,475	450	-268	-16,743	---	-16,743	-6.2	-12.4	-24.8
III	0	62,475	0	0	62,475	15,619	78,094	450	-268	-20,929	---	-20,929	-7.8	-15.6	
IV	0	62,475	0	0	62,475	31,238	93,713	450	-268	-25,115	---	-25,115	-9.4	-18.8	
Light-fed Beef (from short-yearlings)															
I	0	62,475	0	0	31,238	---	31,238	900	182	5,685	---	5,685	2.1	4.2	8.4
II	0	62,475	0	0	62,475	---	62.475	900	182	11,370	---	11,370	4.2	8.4	16.8
III	0	62,475	0	0	62,475	15,619	78,094	900	182	14,213	---	14,213	5.3	10.6	
IV	0	62,475	0	0	62,475	31,238	93.713	900	182	17,056	---	17,056	6.4	12.8	
Heavy-fed Beef (from short-yearlings)															
I	0	62,475	0	0	31,238	---	31,238	1100	382	11,033	---	11,933	4.5	9.0	18.0
II	0	62,475	0	0	62,475	---	62,475	1100	382	23,865	---	23,865	8.9	17.8	35.6
III	0	62,475	0	0	62,475	15,619	78,094	1100	382	29,832	---	29,832	11.1	22.2	
IV	0	62,475	0	0	62,475	31,238	93,713	1100	382	35,798	---	35,798	13.4	26.8	

Table 21. Estimated change in beef production in Utah due to the adoption of the different management and marketing by Utah ranchers - comparison between grass-fed beef vs. light-fed and heavy-fed beef from long yearlings.

Option	Ave. reduction in calves produced in adopted option	Calves produced and marketed by adopting ranchers	25% Adoption level												
			Reduction in calf-product marketed in Utah		Calves marketed under the adopted marketing situation			Average marketing weight (lbs)	Change in marketing weight/head (lb)	Change in beef production in Utah				Change at 50% adoption level (%)	Change at 100% adoption level (%)
										Change due to marketing wt.	Change due to reduction in calf numbers	Total			
	%	Head	Head	Percent	Home Grown	Purchased	Total			(1000 lb)	(1000)	1000 lbs	%		
0 Basic Option		62,475	0	0	62,475	--	62,475	718	0	0	0	0	0	0	0
Grass-fed beef															
V	8.0	57,477	4,998	1.9	28,739	--	28,739	650	-68	-1,954	-3,589	-5,543	-2.1	-4.7	-8.4
VI	21.0	49,355	13,120	5.1	49,355	--	49,355	650	-68	-3.356	-9,420	-12,776	-4.8	-9.6	-19.2
VII	26.2	46,107	15,368	6.3	46,107	11,527	57,634	650	-68	-3,919	-11,752	-15,671	-5.9	-11.8	
VIII	30.5	43,420	19,055	7.4	43,420	21,710	64,130	650	-68	-4,429	-13,681	-18,110	-6.8	-13.6	
IX	26.2	46,107	16,368	6.3	46,107	11,527	57,634	650	-68	-3,919	-11,752	-15,671	-5.9	-11.8	
X	30.5	43,420	19,055	7.4	43,420	21,710	65,130	650	-68	-4,429	-13,681	-18,100	-6.8	-13.6	
Light-fed beef (from long-yearlings)															
V	8.0	57,477	4,998	1.9	28,739	--	28,739	900	182	5,230	-3,589	1,641	0.6	1.2	2.4
VI	21.0	49,355	13,120	5.1	49,355	--	49,355	900	182	8,983	-9,420	-437	-0.2	-0.4	-0.8
VII	26.2	46,107	15,368	6.3	46,107	11,527	57,634	900	182	10,489	-11,752	-1,263	-0.5	-1.0	
VIII	30.5	43,420	19,055	7.4	43,420	21,710	65,130	900	182	11,854	-13,681	-1,827	-0.7	-1.4	
IX	26.2	46,107	16,368	6.3	46,107	11,527	57,634	900	182	10,489	-11,752	-1,263	-0.5	-1.0	
X	30.5	43,420	19,055	7.4	43,420	21,710	65,130	900	182	11,854	-13,681	-1,827	-0.7	-1.4	
Heavy-fed beef (from long-yearlings)															
V	8.0	57,477	4,998	1.9	28,739	--	28,739	1,100	382	10,978	-3,589	7,389	2.6	5.2	10.4
VI	21.0	49,355	13,120	5.1	49,355	--	49,355	1,100	382	18,854	-9,420	9,434	3.5	7.0	14.0
VII	25.2	46,107	16,368	6.3	46,107	11,527	57,534	1,100	382	22,016	-11,752	10,264	3.8	7.6	
VIII	30.5	43,420	19,055	7.4	43,420	21,710	65,130	1,100	382	24,880	-13,681	11,199	4.2	8.4	
IX	26.2	46,107	16,368	6.3	46,107	11,527	57,534	1,100	382	22,016	-11,752	10,264	3.8	7.6	
X	30.5	43,420	19,055	7.4	43,420	21,710	65,130	1,100	382	24,880	-11,199	11,199	4.2	8.4	

Table 22. Estimated change in beef production in Utah due to the adoption of the different management and marketing options by Utah ranchers - summary of the comparison between the marketing of baby-beef vs. light-fed beef and heavy-fed beef from short-yearlings in Table 20.

Option	Percentage change in beef tonnage								
	25% adoption level			50% adoption level			100% adoption level		
	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef
0. Basic option	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I. 50% of the calves retained and sold as short-yearlings.	-3.1	2.1	4.5	-6.2	4.2	9.0	-12.4	8.4	18.0
II. 100% of the calves retained and sold as short-yearlings.	-6.2	4.2	9.9	-12.4	8.4	17.8	-24.8	16.8	35.6
III. 100% of the calves retained with 25% additional purchased calves, all sold as short-yearlings.	-7.8	5.3	11.1	-15.6	10.6	22.2	--	--	--
IV. 100% of the calves retained with 50% additional purchased calves, all sold as short-yearlings.	-9.4	6.4	13.4	-18.8	12.8	26.8	--	--	--

Table 23. Estimated change in beef production in Utah due to the adoption of the different management and marketing options by Utah ranchers - summary of the comparison between grass-fed beef vs. light-fed beef and heavy-fed beef from long yearlings in Table 21.

Option		Percentage change in beef tonnage								
		25% adoption level			50% adoption level			100% adoption level		
		Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef
0.	Basic Option	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V.	50% of the calves retained and sold as long-yearlings	-2.1	0.6	2.6	-4.2	1.2	5.2	-8.4	2.4	10.4
VI.	100% of the calves retained and sold as long-yearlings	-4.8	-0.2	3.5	-9.6	-0.4	7.0	-19.2	-0.8	14.0
VII.	100% of the calves retained with 25% additional calves purchased (Nov. 1) and sold as long-yearlings	-5.9	-0.5	3.8	-11.8	-1.0	7.6	---	---	---
VIII.	100% of the calves retained with 50% additional calves purchased (Nov. 1) and sold as long-yearlings	-6.8	-0.7	4.2	-13.6	-1.4	8.4	---	---	---
IX.	100% of the calves retained with 25% additional calves purchased (Apr. 1) and sold as long-yearlings	-5.9	-0.5	3.8	-11.8	-1.0	7.6	---	---	---
X.	100% of the calves retained with 50% additional calves purchased (Apr. 1) and sold as long-yearlings.	-6.8	-0.7	4.2	-13.6	-1.4	8.4	---	---	---

This amounted to less than 1% reduction in beef production.

The decrease in beef production under any of the above three marketing conditions, of course, increased with adoption level and number of calves retained and marketed under the marketing situation. Hence, retention of few calves and lower adoption levels had less impact than complete retention of calves with higher adoption levels. Keeping half the home-grown calves reflected a positive increase by the marketing of light-fed beef from long yearlings under all adoption levels. The increase varied from 1 to 2% , depending on adoption level. The reduction in beef production by the marketing baby beef was about one and a half times the reduction from marketing grass-fed beef and more than ten times the reduction from marketing light fed long yearlings under all options and adoption levels.

The decrease in beef production by marketing baby beef was mainly a result of reduced marketing weight from the current average of marketed animals in Utah (718 lb./head) to the assumed weight of 450 lb./head for baby beef. Reduction in beef production attributed to the marketing grass-fed beef was a combined effect of reduced marketing weight (from 718 to 650 lb./head) and reduction in number of calves produced amounting to 8 to 31%, depending on management option and adoption level. The smallest decrease observed by marketing light-fed beef from long yearling was due to the decrease in number of calves produced which offset the increase due to marketing weight (from 718 to 900 lb./head).

Marketing heavy fed and light-fed beef from short yearlings and marketing heavy-fed beef from long yearlings all resulted in a con-

siderable increase in beef production in Utah (Table 22). Thirty-six % increase was obtained by marketing heavy-fed beef from short yearlings when 100% of the home-grown calves were retained by all the ranches in Utah. Marketing of light-fed beef from short yearlings and heavy-fed beef from long yearlings produced 17% and 14% increases, respectively, under the same management option and adoption level. The relatively smaller increase from marketing heavy-fed beef from long yearlings was attributable to the reduction in calves produced and, hence, the number of animals marketed. The 14% maximum increase observed by marketing heavy-fed beef from long yearlings could be produced by marketing light-fed beef from short-yearlings under 50% adoption level and the retention of home-grown calves plus 50% additional purchased calves (option IV). Also the same increase could be produced by marketing heavy-fed beef from short yearlings if only half of the home grown calves were retained by all ranchers in Utah. Depending on management option and adoption level, the range of increase in beef production by marketing heavy-fed beef from short yearlings (5 to 36%) was more than twice the range of increase by marketing light-fed beef from short yearlings (2 to 17%) and about two and a half times the marketing of heavy-fed beef from long yearlings (3 to 14%). Out of these marketing situations, marketing of light-fed beef from short yearlings seems to be the most practical option. Compared to options other than the basic option it has the least impact on ranch organization and probably production costs with only a small decrease in beef production.

Change in beef production in the Western region

The Western region (11 western states) contributed about 21% of the total beef production in the nation in 1975 (Table 17). Base production in the region was 8,308,695 thousand pounds (Table 17). The combined average weight for cattle and calves marketed in the region was 692 pounds per head (Appendix B).

As in Utah, projected marketings of baby beef and grass-fed beef caused a decline in beef production in the Western region but in contrast to Utah marketing light-fed from long yearlings in the region produced an increase in total beef produced amounting from 0.1% to 3% depending on option and adoption level (Tables 24 and 25). The decrease in beef production in the region varied from 2 to 16% when marketing baby beef, and 1 to 12% when marketing grass-fed beef, depending on management option and adoption level (Tables 26 and 27). These reductions were smaller than those for Utah using the same projections. This was attributable to the relatively smaller current average weight of animals marketed in the region (682 lb./head) compared to the current average in Utah (718 lb./head).

Marketing heavy-fed and light-fed beef from short yearlings, and the marketing heavy-fed beef from long yearlings caused a considerable increase in beef production in the region. Depending on management option and adoption level, the increase in the Western region amounted to from 3 to 27% when marketing heavy-fed beef from short yearlings, 2 to 14% by marketing light-fed beef from short yearlings, and 2 to 12% by marketing heavy feed beef from long yearlings. The increase in beef production in the region, due to

Table 24. Estimated change in beef production in the Western region due to the adoption of the different management and marketing options by the Western region ranchers - comparison between baby-beef vs. light-fed and heavy-fed beef from short yearlings.

Option	25% Adoption level													Change at 50% adoption level (%)	Change at 100% adoption level (%)
	Ave. reduction in calves produced in adopted option	Calves produced & marketed by adopting market	Reduction in calf-product marketed in the region		Calves marketed under the adopted marketing situation			Average marketing weight/ head (lbs)	Change in marketing wt/ head (lbs).	Change in beef production in the region					
			Head	Percent	Home Grown	Purchased	Total			Change due to marketing wt. (1000 lb)	Change due to reduction in calf numbers (1000)	Total 1000 lb	Total %		
	%	Head													
0 Basic Option	0	1,391	0	0	1,391	--	1,391	692	0	0	0	0	0	0	0
Baby-fed beef															
I	0	1,391	0	0	696	--	696	450	-242	-168,432	---	-168,432	-2.0	-4.0	-8.0
II	0	1,391	0	0	1,391	--	1,391	450	-242	-336,622	---	-336,622	-4.0	-8.0	-16.0
III	0	1,391	0	0	1,391	348	1,739	450	-242	-420,838	---	-420,838	-5.1	-10.2	
IV	0	1,391	0	0	1,391	696	2,087	450	-242	-505,054	---	-505,054	-6.1	-12.2	
Light-fed beef (from short-yearlings)															
I	0	1,391	0	0	696	--	696	900	208	144,768	---	144,768	1.7	3.4	6.8
II	0	1,391	0	0	1,391	--	1,391	900	208	289,328	---	-289,328	3.5	7.0	14.0
III	0	1,391	0	0	1,391	348	1,739	900	208	361,712	---	361,712	4.3	8.6	
IV	0	1,391	0	0	1,391	696	2,087	900	208	434,096	---	434,096	5.2	10.4	
Heavy-fed beef (from short-yearlings)															
I	0	1,391	0	0	696	--	696	1,100	408	283,968	---	283,968	3.4	6.8	13.6
II	0	1,391	0	0	1,391	--	1,391	1,100	408	567,528	---	567,528	6.8	13.6	27.2
III	0	1,391	0	0	1,391	348	1,739	1,100	408	709,512	---	709,512	8.5	17.0	
IV	0	1,391	0	0	1,391	696	2,087	1,100	408	851,496	---	851,496	10.2	20.4	

Table 25. Estimated change in beef production in the Western region due to the adoption of the different management and marketing options by the Western region ranchers - comparison between baby beef vs. light-fed and heavy-fed from short yearlings in Table 24.

Option	25% Adoption level													Change at 50% adoption level (%)	Change at 100% adoption level
	Ave. reduction in calves produced in adopted option.(%)	Calves produced and marketed by adopting rancher	Reduction in calf-product marketed in the Region.		Calves marketed under the adopted marketing situation			Average marketing weight/head (lb)	Change in marketing weight/head (lb)	Change in beef production in the region					
			1000 Head	Percent	Home Grown	Purchased	Total			Change due to marketing wt. 1000 lb	Change due to reduction in calf numbers	Total 1000 lb	Total %		
0 Basic Option	0	1,391	0	0	1,391	--	1,391	692	0	0	0	0	0	0	0
Grass-fed beef															
V	8.0	1,280	111	2.0	640	--	640	650	-42	-26,880	-76,812	-103,692	-1.2	-2.4	-4.8
VI	21.0	1,099	292	5.2	1,099	--	1,099	650	-42	-46,158	-202,064	-248,222	-3.0	-6.0	-12.0
VII	26.2	1,027	364	6.5	1,027	257	1,284	650	-42	-53,928	-251,888	-305,816	-3.7	-7.4	
VIII	30.5	967	424	7.6	967	484	1,451	650	-42	-60,942	-293,408	-354,350	-4.3	08.6	
IX	26.2	1,027	364	6.5	1,027	257	1,284	650	-42	-53,928	-251,888	-305,816	-3.7	-7.4	
X	30.5	967	424	7.6	967	484	1,451	650	-42	-60,942	-293,408	-354,350	-4.3	-8.6	
Light-fed beef (from long-yearlings)															
V	8.0	1,280	111	2.0	640	--	640	900	208	133,120	-76,812	56,308	0.7	1.4	2.8
VI	21.0	1,099	292	5.2	1,099	--	1,099	900	208	228,592	-202,064	26,528	0.3	0.6	1.2
VII	26.2	1,027	364	6.5	1,027	257	1,284	900	208	267,072	-251,888	15,184	0.2	0.4	
VIII	30.5	967	424	7.6	967	484	1,451	900	208	301,808	-293,408	8,400	0.1	0.2	
IX	26.2	1,027	364	6.5	1,027	257	1,284	900	208	267,072	-251,888	15,184	0.2	0.4	
X	30.5	967	424	7.6	967	484	1,451	900	208	301,808	-293,403	8,400	0.1	0.2	
Heavy-fed beef (from long-yearlings)															
V	8.0	1,280	111	2.0	640	--	640	1,100	408	261,120	-76,812	184,308	2.2	4.4	8.8
VI	21.0	1,099	292	5.2	1,099	--	1,099	1,100	408	448,392	-202,064	246,328	3.0	6.0	12.0
VII	26.2	1,027	364	6.5	1,027	257	1,284	1,100	408	523,872	-251,888	271,984	3.3	6.6	
VIII	30.5	967	424	7.6	967	484	1,451	1,100	408	592,008	-293,408	298,600	3.6	7.2	
IX	26.2	1,027	364	6.5	1,027	257	1,284	1,100	408	523,872	-251,888	271,984	3.3	6.6	
X	30.5	967	424	7.6	967	484	1,451	1,100	408	592,088	-293,408	298,600	3.6	7.2	

Table 26. Estimated change in beef production in the Western region due to the adoption of the different management and marketing options by Western region ranchers - summary of the comparison between baby beef. vs. light-fed and heavy-fed beef from short yearlings in Table 24.

Option	Percentage change in beef tonnage								
	25% adoption level			50% adoption level			100% adoption level		
	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef
0. Basic option	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I. 50% of the calves retained and sold as short-yearlings	-2.0	1.7	3.4	-4.0	3.4	6.8	-8.0	6.8	13.6
II. 100% of the calves retained and sold as short-yearlings	-4.0	3.5	6.8	-8.0	7.0	13.6	-16.0	14.0	27.2
III. 100% of the calves retained with 25% additional calves purchased (Nov. 1) and sold as short-yearlings	-5.1	4.3	8.5	-10.2	8.6	17.0	--	--	--
IV. 100% of the calves retained with 50% additional calves purchased (Nov. 1) and sold as short-yearlings.	-6.1	5.2	10.2	-12.2	10.4	20.0	--	--	--

Table 27. Estimated change in beef production in the Western region due to the adoption of the different management and marketing options by Western region ranchers - summary of the comparison between grass-fed beef vs. light fed and heavy-fed beef from long yearlings in Table 25.

Option		Percentage change in beef tonnage								
		25% adoption level			50% adoption level			100% adoption level		
		Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef
0.	Basic option	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V.	50% of the calves retained and sold as long-yearlings.	-1.2	0.7	2.2	-2.4	1.4	4.4	-4.8	2.8	8.8
VI.	100% of the calves retained and sold as long-yearlings,	-3.0	0.3	3.0	-6.0	0.6	6.0	-12.0	1.2	12.0
VII.	100% of the calves retained with 25% additional calves purchased (Nov. 1) and sold as long-yearlings.	-3.7	0.2	3.3	-7.4	0.4	6.6	--	--	--
VIII.	100% of the calves retained with 50% additional calves purchased (Nov. 1) and sold as long-	-4.3	0.1	3.8	-8.6	0.2	7.2	--	--	--
IX.	100% of the calves retained with 25% additional calves purchased (Apr.1) and sold as long-yearlings.	-3.7	0.1	3.3	-7.4	0.4	6.6	--	--	--
X.	100% of the calves retained with 50% additional calves purchased (Apr.1) and sold as long-yearlings.	-4.3	0.2	3.6	-8.6	0.2	7.2	--	--	--

to the above marketing situations, was smaller than the increase in Utah using the same projections. This difference was most likely due to the contribution of all ranchers to beef production in each area. In Utah total beef production comes from locally raised calves while in the region, production includes a considerable number of imported calves.

Change in beef production in the United States

Beef production for the nation was 40.68 billion pounds (Table 17). Utah contributed less than 1% to this total for the nation. Hence, even a 100% reduction in beef production in Utah would have no major effect on the level of production in the nation. Accordingly, the effect on beef production in the nation due to the adoption of the proposed management options and marketing situations by Utah producers was ignored and only the effect of those projections adopted by the regional producers was estimated. Results of the estimated change in beef production in the nation due to the adoption of the different management options and marketing situations by the Western region producers are in Tables 28 and 29. Unlike the effects in Utah and the region, the adoption of the projected marketing situations by the regional producers indicated a decrease in beef production for the nation under all proposed management options and adoption levels with the exception of the marketing of heavy-fed beef from short-yearlings which produced slight increases of 0.2 to 2% Table 30). This was due to the assumed current average

Table 28. Estimated change in beef production in the United States due to the adoption of the different management and marketing-operations by Western region ranchers - comparison between baby beef vs. light-fed and heavy-fed beef from short yearlings.

Option	Calves produced and marketed by adopting ranchers (1000 head)	25% Adoption level											Change at 50% adoption level (%)	Change at 100% adoption level (%)
		Reduction in calf-product marketed in the region		Calves marketed under the adopted marketing situation			Average marketing weight/head (lbs)	Change in marketing weight/head (lbs)	Change in beef tonnage in the nation					
		Head	%	Home Grown	Purchased	Total			Change due to marketing weight	Change due to reduced calf numbers	Total 1000#	Total %		
0 Basic Option	1,391	0	0	1,391	---	1,391	996	0	0	0	0	0	0	0
Baby-beef														
I	1,391	0	0	696	---	696	450	-546	-380,016	---	-380.016	- .9	-1.8	-3.5
II	1,391	0	0	1,391	---	1,391	450	-546	-759,496	---	-759,486	-1.9	-3.8	-7.8
III	1,391	0	0	1,391	348	1,739	450	-546	-949,494	---	-949,494	-2.3	-4.6	
IV	1,391	0	0	1,391	696	2,087	450	-546	-1,139,502	---	-1,139,502	-2.8	-5.6	
Light-fed Beef (from short-yearlings)														
I	1,391	0	0	696	---	696	900	-96	- 66,816	---	- 66.816	- .2	- .4	- .8
II	1,391	0	0	1,391	---	1,391	900	-96	-133,536	---	-133,536	- .3	- .6	-1.2
III	1,391	0	0	1,391	348	1,739	900	-96	-166,944	---	-166,944	- .4	- .8	
IV	1,391	0	0	1,391	696	2,087	900	-96	-200,352	---	-200,352	- .5	-1.0	
Heavy-fed Beef (from short-yearlings)														
I	1,391	0	0	696	---	696	1100	104	72,384	0	72,384	0.2	0.4	0.8
II	1,391	0	0	1,391	---	1,391	1100	104	144,664	0	144,664	0.4	0.8	1.6
III	1,391	0	0	1,391	348	1,739	1100	104	180,856	0	180,856	0.4	0.8	
IV	1,391	0	0	1,391	696	2,087	1100	104	217,048	0	217,048	0.5	1.0	

Table 29. Estimated change in beef production in the United States due to the adoption of the different management and marketing options by the Western region ranchers - comparison between grass-fed vs. light-fed and heavy-fed beef from long yearlings.

Option	25% Adoption level													
	Calves produced and marketed by adopting rancher	Reduction in calf-product marketed in the region		Calves marketed under the adopted marketing situation			Average marketing weight/head (lbs)	Change in marketing weight/head (lbs)	Change in beef production in the nation				Change at 50% adoption level (%)	Change at 100% adoption level (%)
		1000 Head	Percent	Home Grown	Purchased	Total			Change due to marketing wt. (1000/lb)	Change due to reduction in calf numbers	Total 1000/lbs	Total %		
0 Basic Option	1,391	0	0.0	1,391	--	1,391	996	0	0	0	0	0	0	0
Grass-fed beef														
V	1,280	111	2.0	640	--	640	650	-346	-221,400	-110,556	-331,995	-0.8	-1.6	-3.2
VI	1,099	292	5.2	1,099	--	1,099	650	-346	-380,254	-290,832	-671,086	-1.6	-3.2	-6.4
VII	1,027	365	6.5	1,027	257	1,284	650	-346	-444,264	-362,544	-805.808	-2.0	-4.0	
VIII	967	424	.6	967	484	1,451	650	-346	-502,046	-422,304	-924,350	-2.3	-4.6	
IX	1,027	364	6.5	1,027	257	1,284	650	-346	-577,800	-400,400	-806,808	-2.0	-4.0	
X	967	424	7.6	967	484	1,451	650	-346	-652,950	-466,400	-924,350	-2.3	-4.6	
Light-fed beef (from long-yearlings)														
V	1,280	111	2.0	640	--	640	900	-96	- 61,440	-110,556	-171,996	-0.4	-0.8	-1.6
VI	1,099	292	5.2	1,099	--	1,099	900	-96	-105,504	-290,832	-396,336	-1.0	-2.0	-4.0
VII	1,027	364	6.5	1,027	257	1,284	900	-96	-123,264	-362,544	-485,808	-1.2	-2.4	
VIII	967	424	7.6	962	484	1,451	900	-96	-139,296	-422,304	-561,600	-1.4	-2.8	
IX	1,027	364	6.5	1,027	257	1,284	900	-96	-123,264	-362,544	-485,808	-1.2	-2.4	
X	967	424	7.6	967	484	1,451	900	-96	-139,296	-422,304	-561,600	-1.4	-2.8	
Heavy-fed beef (from long-yearlings)														
V	1,280	111	2.0	640	--	640	1,100	104	66,650	-110,566	- 43,906	-0.1	-0.2	-0.4
VI	1,099	292	5.2	1,099	--	1,099	1,100	104	114,295	-290,832	-176,537	-0.4	-0.8	-1.6
VII	1,027	364	6.5	1,027	257	1,284	1,100	104	133,536	-362,544	-229,008	-0.6	-1.2	
VIII	967	424	7.6	967	484	1,451	1,100	104	150,904	-422,304	-271,400	-0.7	-1.4	
IX	1,027	364	6.5	1,027	257	1,284	1,100	104	133,536	-362,544	-229,008	-0.6	-1.2	
X	967	424	7.6	967	484	1,451	1,100	104	150,904	-422,304	-271,400	-0.7	-1.4	

Table 30. Estimated change in beef production in the U.S. due to the adoption of the different management and marketing options by the Western Region ranchers. Summary of the comparison between the marketing of baby-beef vs. light-fed and heavy-fed beef from short-yearlings in Table 28.

Option		Percentage change in beef tonnage								
		25% adoption level			50% adoption level			100% adoption level		
		Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef
0.	Basic option	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I.	50% of the calves retained and sold as short-yearlings	-0.9	-0.2	0.2	-1.8	-0.4	0.4	-3.6	-0.8	0.8
II.	100% of the calves retained and sold as short-yearlings	-1.9	-0.3	0.4	-3.8	-0.6	0.8	-7.6	-1.2	1.6
III.	100% of the calves retained with 25% additional calves purchased (Nov. 1) and sold as short yearlings	-2.3	-0.4	0.4	-4.6	-0.8	0.8	--	--	--
IV.	100% of the calves retained with 50% additional purchased calves, all sold as short-yearlings	-2.8	-0.5	0.5	-5.6	-1.0	1.0	--	--	--

Table 31. Estimated change in beef production in the United States due to the adoption of the different management and marketing options by the Western region ranchers - summary of the comparison between grass-fed beef, vs. light-fed and heavy-fed beef from long yearlings.

Option		Percentage change in beef tonnage								
		25% adoption level			50% adoption level			100% adoption level		
		Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef
0.	Basic option	0.0	0.0	0.0	0.0	0.0	0.0	0 0	0.0	0.0
V.	50% of the calves retained and sold as long-yearlings	-0.8	-0.4	-0.1	-1.6	-0.8	-0.2	-3.2	-1.6	-0.4
VI.	100% of the calves retained and sold as long-yearlings	-1.6	-1.0	-0.4	-3.2	-2.0	-0.8	-6.4	-4.0	-1.6
VII.	100% of the calves retained with 25% additional calves purchased (Nov. 1) and sold as long-yearlings	-2.0	-1.2	-0.6	-4.0	-2.4	-1.2	--	--	--
VIII.	100% of the calves retained with 50% additional calves purchased (Nov. 1) and sold as long-yearlings	-2.3	-1.4	-0.7	-4.6	-2.8	-1.4	--	--	--
IX.	100% of the calves retained with 25% additional calves purchased (Apr. 1) and sold as long-yearlings.	-2.0	-1.2	-0.6	-4.0	-2.4	-1.2	--	--	--
X.	100% of the calves retained with 50% additional calves purchased (Apr. 1) and sold as long-yearlings	-2.3	-1.4	-0.7	-4.6	-2.8	-1.4	--	--	--

weight of beef cattle in the nation (996 lb./head) which was greater than the assumed weights of baby-beef, grass-fed beef, light-fed beef and less only to the weight of heavy-fed beef. Even when the proposed marketing weight was greater than the current national average (996 lbs), as in the case of marketing heavy-fed from long yearlings, the reduction in animals marketed was responsible for the decrease in beef production. Marketing baby beef and grass-fed beef produced about equal decreases in beef production in the nation. Depending on management option and adoption level, the decrease in the nation amounted from 1 to 8 % by marketing baby beef in the region and 1 to 7 % by marketing grass-fed beef in the region. This was almost twice the decrease by marketing light-fed from long yearlings and five times the decrease by marketing light-fed from short yearlings.

As previously mentioned, only marketing heavy-fed beef from short yearlings in the region produced a positive change in the nation's production of beef. This was obvious since the same number of animals marketed in the basic operation were marketed at a higher weight than the current national average weight of beef cattle.

Comparisions of the changes in beef production in the state, region and nation

Calculations for the purpose of comparing changes in beef production in Utah, the Western region and the nation at 25% adoption level of the proposed management and marketing options are illustrated in Table 32. Comparisons for higher adoption levels can be

Table 32. Comparison of the changes in beef production in Utah, the Western region and the United States based on 25% adoption level for the different management and marketing options - baby beef vs. grass fed, light-fed and heavy-fed beef.

Option	% Change in beef tonnage											
	Marketing of Baby beef			Marketing of Grass-fed beef			Marketing of Light-fed beef			Marketing of heavy-fed beef		
	State	Region	Nation	State	Region	Nation	State	Region	Nation	State	Region	Nation
0. Basic option	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
OPTIONS SELLING SHORT-YEARLINGS												
I. 50% of the calves retained	-3.1	-2.0	-0.9	--	--	--	2.1	1.7	-0.2	4.5	3.4	0.2
II. 100% of the calves retained	-6.2	-4.0	-1.9	--	--	--	4.2	3.5	-0.3	8.9	6.8	0.4
III. 100% of the calves retained with 25% additional purchased calves.	-7.8	-5.1	-2.3	--	--	--	5.3	4.3	-0.4	11.1	8.5	0.4
IV. 100% of the calves retained with 50% additional purchased.	-9.4	-6.1	-2.8	--	--	--	6.4	5.2	-0.5	13.4	10.2	0.5
OPTIONS SELLING LONG-YEARLINGS												
V. 50% of the calves retained	--	--	--	-2.1	-1.2	-0.8	0.6	0.7	-0.4	2.6	2.2	-0.1
VI. 100% of the calves retained	--	--	--	-4.8	-3.0	-1.6	-0.2	0.3	-1.0	3.5	3.0	-0.4
VII. 100% of the calves retained with 25% additional calves purchased November 1.	--	--	--	-5.9	-3.7	-2.0	-0.5	0.2	-1.2	3.8	3.3	-0.6
VIII. 100% of the calves retained with 50% additional calves purchased November 1.	--	--	--	-6.8	-4.3	-2.3	-0.7	0.1	-1.4	4.2	3.6	-0.7
IX. 100% of the calves retained with 25% additional calves purchased April 1.	--	--	--	-5.9	-3.7	-2.0	-0.5	0.2	-1.2	3.8	3.3	-0.6
X. 100% of the calves retained with 50% additional calves purchased April 1.	--	--	--	-6.8	-6.8	-2.3	-0.7	0.1	-1.4	4.2	3.6	-0.7

* Change in beef production in the nation was based on the adoption of the different management and marketing options by the western region producers.

obtained by simple multiplication of the figures in the 25 % adoption level.

Marketing of baby beef vs. light-fed beef and heavy-fed beef - from short yearlings (Table 32)

Marketing baby beef brought a decrease in beef production in the state, region and the nation under all management options as compared to the existing marketing system. Depending on management option, the decrease in Utah by marketing baby beef amounted from 3 to 9 % under 25% adoption level compared with 2 to 6% decrease in the region by marketing baby beef under the same adoption level by the region producers (Table 32). The decline in the nation's production caused by marketing baby beef in the region was about half the reduction in the region. Since the region contributed 21% of the beef produced nationally the decline in the nation's production (50% of the reduction in the region) was expected to be only one fifth (21%) of the reduction in the region. The higher observed reduction in the nation was due to the greater decrease in marketing weight from the national average (996 lbs) compared to the relative decrease in marketing weight for the region (692 lbs). In practice, a considerable portion of the calves raised in the Western region is finished in other states outside the region. The additional beef on these feeder calves was reflected in the national average weight of beef cattle but not in the average weight of animals marketed in the region. Thus, the observed reduction in national beef production caused by marketing baby beef in the Western region reflects the true

contribution in terms of production in the region and the indirect contribution by the supply of feeder calves to other states outside the region.

Marketing of light-fed and heavy-fed animals from short yearlings both produced an increase in beef production in Utah and the region. Depending on management option and adoption level the percentage increase in Utah by marketing the two types of beef was only slightly greater than the increase in the region by marketing the same types. The increase by marketing heavy-fed beef from short yearlings in both Utah and the region was double the increase by marketing light-fed beef. In contrast to Utah and the regional impacts, marketing of light-fed beef and heavy-fed beef in the region either produced a decrease or caused slight increase in the nation's production. Marketing of light-fed short-yearlings in the region produced less than 1% decrease in the nation's production under 25% adoption level for all management options. Marketing of heavy-fed beef in the region produced a slight increase in the nation's production. The increase in Utah and the region was mainly a result of the marketing weights assumed for light fed and heavy fed which were higher than the current average weights of animals marketed in each of the two areas. The reverse is true for the decrease in the nation.

Grass fed vs. light fed and heavy-fed beef - from long yearlings (Table 32)

As in the case of baby beef, marketing of grass-fed beef caused a decline in beef production in all three geographic areas. Depending on management options the percentage decrease in Utah, under 25%

adoption level, ranged from 2 to 7% compared to 1 to 4% in the region and 1 to 2% in the nation, respectively, under the same adoption level. Again, the relatively higher reduction in the nation as a result of marketing grass-fed beef in the region reflects the true contribution of the region to the total beef production in the nation.

Unlike the marketing of light-fed beef from short yearlings, marketing of light-fed beef from long yearlings produced a decrease in beef production in Utah amounting to less than 1% under the 25% adoption level for all options. The beef production increase in the region caused by marketing light-fed animals from long yearlings was not substantial (less than 1% under 25% adoption level for all options). The national level decrease caused by marketing light-fed beef from long yearlings in the Western region was less than 2% under the 25% adoption level.

Similar to the marketing of heavy-fed beef from short yearlings, marketing of heavy-fed beef from long yearlings caused an increase in beef production in Utah and the region but reflected a decrease in the national production. Depending on management option, the percentage increase in Utah, under 25% adoption level, varied from 3 to 4% compared to 2 to 4% in the region and a decrease of less than 1% in the nation's production.

Comparison between the marketing of baby beef, light-fed and heavy-fed beef, produced from short yearlings vs. the marketing of grass-fed beef, light-fed and heavy-fed beef, produced from long yearlings

Marketing of grass-fed beef showed only slightly smaller decrease in beef production than the marketing of baby beef in Utah and the region and about the same in the nation. Except when only half of the calves were retained, the increase in beef production by marketing of heavy-fed beef from long yearlings in Utah and the region. The decrease in beef production at the national level caused by marketing light-fed beef from short yearlings in the Western region was also smaller than the decrease by marketing light-fed beef from long yearlings. This was mainly a result of the reduction in calves produced and, hence, animals marketed under long-yearling operations. Marketing of light-fed animals from long yearlings reflected only a slight increase (less than 1%) in the region and a decrease in beef production in Utah and the nation.

The marketing of heavy-fed beef from short yearlings showed a 4 to 13% increase in Utah, 3 to 10% in the region and less than 1% increase in the nation, under 25% adoption level.

Except when only half of the calves were retained, the increase under the above marketing situation was more than double the increase by marketing heavy-fed animals from long yearlings and light-fed beef from short yearlings. Again, the smaller increase by marketing heavy-fed beef from long yearlings was a result of the reduction in calves produced in the adopted options.

Beef prices

Using an estimated price elasticity of demand of -.67, the expected changes in beef market price in the United States due to the adoption of the different management options and marketing situations by the Western region producers are shown in Tables 33 and 34.

The projected marketing situations in the region when instituted, resulted in a positive increase in beef market prices except when marketing heavy-fed beef from short yearlings (Table 33). As expected changes in beef price followed the changes in beef production in the nation. Marketing of baby beef and grass-fed beef caused the highest increase (10 to 11% under 100% retention of calves, and 100 % adoption level (options II and VI). Next to the above marketing situations in price increase was the marketing of light-fed beef from long-yearlings, followed by the marketing of light-fed beef from short yearlings. These latter marketing situations produced an increase in beef prices of 6 % and 2% respectively under 100% retention of calves and 100% adoption level.

Similar to the decrease in beef production the marketing of baby beef and grass-fed beef in the region reflected an increase in beef market price that amounted to more than four times the increase by marketing light fed from short yearlings and about twice the increase by marketing light-fed beef from long yearlings, depending on management option and adoption level. Higher adoption levels and complete retention of calves, of course, produced greater increase in beef market price than lower adoption levels and partial retention of calves.

Table 33. Expected increase in beef market price due to the adoption of the different management and marketing options by the western region ranchers. Comparison between the marketing of baby-beef vs. the marketing of light-fed and heavy-fed beef from short-yearlings.

Option	Percentage change in beef price								
	25% adoption level			50% adoption level			100% adoption level		
	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef
0. Basic option	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
I. 50% of the calves retained and sold as short-yearlings.	1.3	0.3	-0.3	2.6	0.6	-0.6	5.2	1.2	-1.2
II. 100% of the calves retained and sold as short-yearlings.	2.8	0.6	-0.6	5.6	1.2	-1.2	11.2	2.4	-2.4
III. 100% of the calves retained plus 25% additional purchased calves all sold as short-yearlings.	3.4	0.6	-0.6	6.8	1.2	-1.2	--	--	0.0
IV. 100% of the calves retained plus 50% additional purchased calves all sold as short-yearlings.	4.2	0.7	-0.7	8.4	1.4	-1.4	--	--	0.0

Table 34. Expected increase in beef market price in the United States due to the adoption of the different management and marketing options by the Western region ranchers - comparison between the marketing of grass-fed beef vs. light-fed and heavy-fed beef from long yearlings.

Option	Percentage change in beef								
	25% adoption level			50% adoption level			100% adoption level		
	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef	Marketing of baby beef	Marketing of light-fed beef	Marketing of heavy-fed beef
0. Basic option	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
V. 50% of the calves retained and sold as long-yearlings	1.2	0.6	0.2	2.4	1.2	0.4	4.8	2.4	0.8
VI. 100% of the calves retained and sold as long-yearlings.	2.4	1.5	0.6	4.8	3.0	1.2	9.6	6.0	2.4
VII. 100% of the calves retained with 25% additional calves purchased (Nov. 1) and sold as long-yearlings.	3.0	1.8	0.9	6.0	3.6	1.8	--	--	--
VIII. 100% of the calves retianed with 50% additional calves purchased (Nov. 1) and sold as long-yearlings.	3.4	2.1	1.0	6.8	4.2	2.0	--	--	--
IX. 100% of the calves retained with 25% additional calves purchased (Apr. 1) and sold as long-yearlings.	3.0	1.8	0.9	6.0	3.6	1.8	--	--	--
X. 100% of the calves retained with 50% additional calves purchased (Apr. 1) and sold as long-yearlings.	3.4	2.1	1.0	6.8	4.2	2.0			

As mentioned earlier, only the marketing of heavy-fed beef from short yearlings in the region caused a decrease in national beef market price. This was a result of marketing the same number of animals currently produced under the typical cow-calf operation at a higher weight than the current national average for beef cattle. The increase in beef market price due to the other marketing situations was obviously a result of either a decrease in marketing weight from the current national average weight, a reduction in number of animals marketed as a result of reduced calf numbers due to the adopted option or a combination of the two factors.

SUMMARY AND CONCLUSIONS

During the last five years, economic crises in the beef industry in the United States have prompted a great deal of interest in the relative profitability of different livestock management systems. Most of the suggested alternatives promise a greater dependence of producers on range forages for beef production in the future. The retention of weaner calves and marketing of yearlings from the range has been suggested as one of the more profitable means of adjustment for the cow-calf operator. The impact of such an adjustment on feed requirements, cow herd carrying capacity, beef production, and market price of beef have received little attention.

The purpose of this study was to determine the effect of the shift from cow-calf ranching operations to cow-calf-yearling operations on the feed energy budget of the ranch and on total beef production in Utah. Other objectives were to consider the effect on beef production in the eleven western states and the effect on the market price of beef in the United States due to a similar shift to cow-calf-yearling operations by the western region producers.

Impacts on feed energy budget and cow herd capacity were tested, using two representative Utah size ranches (150 and 300 cow ranches). Retained weaner calves to sell as short-yearling required from 2 to 7% extra feed while 12% more feed was required when purchase of additional calves was involved. Selling of long-yearlings required more than double the additional feed needed when selling short-

yearlings. Under 100% retention of home grown calves, the total amount of feed required to support the typical cow-calf operation was 93% of the total feed needed for the cow-calf short yearling and 85% of the total feed required for the cow-calf long yearling operation.

Required decreases in breeding herd size followed the impacts on feed requirements. In addition to the number of calves retained and amount of feed available on the ranch, the season during which calves were kept was one of the more important factors determining extent of reduction in brood cow carrying-capacity. The greatest decrease in brood cow numbers (8 to 31%) occurred when retained calves were carried through both the spring and summer seasons. Thus selling short-yearling showed no effect in brood cow carrying capacity since the selling of these animals is prior to the spring forage bottleneck.

Changes in beef production in Utah, the eleven western states, and the nation were estimated from the projected marketing of baby-beef (450 lb/head), grass-fed beef (650 lb/head), light-fed beef (900 lb/head), or heavy-fed beef (1,100 lb/head). Of the four types of marketing, baby-beef and grass-fed beef produced a substantial decrease in beef production in all three geographic levels. The beef decrease by marketing baby-beef in Utah (3 to 25%) and the western region (2 to 15%) was only slightly greater than the decrease by marketing grass-fed beef in these two areas and there was no difference between the two types in terms of decrease in national production (1 to 7%).

Marketing light-fed beef from short yearlings produced beef increase of 2 to 17% in Utah, a 2 to 14% beef increase in the region and only a slight decrease in the beef produced nationally (0.2 to 1%). This was only slightly greater than the increase when marketing heavy-fed beef from long yearlings. Marketing heavy-fed beef from short-yearlings brought an increase in beef production which was about twice the increase by marketing light-fed short yearlings or heavy-fed long yearlings.

Changes in beef price due to projected marketing followed the impacts of beef production. Marketing heavy-fed beef from short yearlings was the only marketing condition which resulted in a decrease in beef price (0.3 to 2%). The greatest increase in price of beef (1 to 11%) was from marketing baby-beef and grass-fed beef which resulted in about equal increases in beef prices.

For consumers, the current livestock production system is clearly superior to all others studied except for marketing of heavy-fed beef from short yearlings. Given the current high grain prices and economic difficulties in the beef industry, the existing system can probably not be maintained. Feeding short yearlings to produce heavy-fed beef would require almost as much grain as that required by current production methods. On the other hand, marketing yearlings as baby-beef or grass-fed beef would result in a substantial decrease in beef production and corresponding increase in beef price. As long as feed grains are available it is unlikely that either of these options will be adopted by ranchers and feeders. The choice options by producers and feeders will continue to depend on economic feasibility. Marketing short

yearlings as light-fed beef and long-yearlings as heavy-fed beef would reduce grain dependence and nearly maintain national beef supply. These options will likely be adopted if feed-grain prices remain high relative to beef prices. Also, even if these last two marketing situations are adopted in the western region a moderate increase of probably 2 to 3% in beef price is likely unavoidable.

This study has been based partly on ranch organization data gathered for Utah in 1962. Whether a basic change has taken place in the conditions existing on the representative ranches studied is unknown. The major limitations of the study are the problem of representing the whole complex of ranches in the western region by the selected typical ranches and the assumptions made for certain unavailable data. These data needs should be considered as subjects for future studies. Beef production operation systems in Utah and the western region should be investigated for size, adoption levels, feed energy budgets, and contribution to the production process. Also, the interstate movements of various classes of marketable animals and the true contribution of the western region to the nation's production should be determined.

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APPENDICES

APPENDIX A

Determination of calves produced, number of calves marketed and reduction in number of calves marketed in Utah

Example: Take Option V where 50% of the calves are retained, wintered, summered and sold as long-yearlings.

1. From Table the total number of cavles weaned from beef cows = 294,000 head.

2. Calves weaned under the existing management operation by:

   25% of the ranches in Utah - .25 x 294,000 = 73,500 head

   50% of the ranches in Utah = 2 x 73,500 = 147,000 head

   100% of the ranches in Utah = 2 x 147,000 = 294,000 head

3. Number of calves marketed by same proportion of ranchers under the existing operation:

   Calves marketed by 25% of ranchers = calves weaned - 15% replacements = 73,500 - 11,025 = 62,576 head

   Calves marketed by 50% of ranchers = 2 x 62,576 = 124,950 head.

   Calves marketed by 100% of ranchers = 2 x 124,950 = 249,900 head.

4. Average reduction in calves marketed by adopting the option = average reduction in calves produced by taking the weighed average reduction in the two representative ranches =

$$\frac{9.3 + 6.7}{2} = 8.0\% \quad \text{(Table 19)}$$

5. Calves marketed under the adopted option (V):

at 25% adoption level = .92 x 62,475 = 57,477 head

at 50% adoption level = .92 x 124,950 = 114,954 head

at 100% adoption level = .92 x 249,900 = 229,908 head

6. Reduction in number of calves marketed due to the adopted option:

at 25% adoption level = 62,475 - 57,477 = 4,998 head

at 50% adoption level = 2 x 4,998 = 9,996 head

at 100% adoption level = 2 x 9,996 = 19,992 head

APPENDIX B

Calculations of beef production per animal marketed

Beef production in Utah and the western region comes from a diversity of animal classes. These include: cull cows and bulls (from both dairy and beef cattle), light-fed and heavy-fed cattle, grass-fed cattle, yearlings and weaner calves (from both dairy and beef cows). The proportions of these animal classes are not available but it is almost certain that light-fed and heav-fed cattle, grass-fed, yearlings and weaner calves are responsible for the bulk of the production in each of the two areas. Originally, these animals come from annually produced beef calves and only a small portion comes from dairy calves.

Since changes in beef production are taken with consideration to the total production, the average production per animal marketed is a reasonable approximation for the production per beef calf sold.

1. Beef production per animal marketed in Utah

   Base production in Utah = 267,720,000 pounds.

   Animals marketed in Utah = 373,000 head

   Average production/animal marketed = $\frac{267,720,000}{373,000}$ = 718 lb per head

2. Beef production per aqimal marketed for the 11 western states

   Base production for the region = 8,308,695 thousand pounds.

   Animal marketing in some of the states in the region include

some inshipments from within the region. Hence, the adding up of marketing in the 11 states will result in double counting because of the interstate inshipments. California, Colorado, Arizona and New Mexico are responsible for 85% of the inshipments (USDA Livestock and Meat Statistics, 1975). According to Abel and Caponer (1965), other interstate inshipments are most likely inter-pasture movements with no change in ownership. Thus, only the interstate market movements by these four states to avoid the double counting of these animals which are already counted in their states of origin. Abel and Capener (1965) estimated the percentages of interstate inshipments by California, Colorado, Arizona and New Mexico to be: 58%, 33%, 23% and 32% respectively. Total interstate inshipments by these states for 1975 were as follows:

State	Total Inshipment	Interstate Inshipments	
	1000 head	1000 head	Percent
California	1,750	1,015	58
Colorado	1,768	583	33
Arizona	880	202	23
New Mexico	938	303	32
TOTAL	5,336	2,100	85%

Total number of marketings in the 11 states = 14,103 head

Total interstate market inshipments = -2,100

Estimated number of animals marketed in the region =

12,003 thousand head

$$\text{Production/animal marketed} = \frac{8,308,695}{12,003} = 692 \text{ lb/head}$$

3. Beef production per animal slaughtered in the nation

When considering production in the nation, the final supply of beef comes from slaughtered animals. In 1975, the number of commercial animals slaughtered in the United States was 36,904 (thousand) head of cattle and 3,894 (thousand) head of calves (USDA, Livestock and Meat Statistics, 1975). Calves constituted about 11% of the total number of slaughtered beef cattle. Since the large portion of slaughtered calves is most likely to come from dairy calves, only the average production for slaughtered cattle was taken as an estimate for beef production per animal slaughtered in the nation. According to USDA Livestock and Meat Statistics for 1975:

Commercial cattle slaughter (liveweight) = 40,733,073 (thousand pounds)

Total number of commercial cattle slaughtered = 40,911 (thousand) head

$$\text{Average production/animal slaughtered} = \frac{40,733,073}{40,911} = 996 \text{ lb/head.}$$

APPENDIX C

Calculations of the change in beef production

Assumptions:

Let Q_{oo} = amount of beef produced under the existing management and marketing systems.

Q_{xy} = amount of beef produced under the proposed management option (y) and marketing situation (x).

W_o = average marketing weight under the existing marketing system (production per animal marketed).

W_x = average marketing weight in the projected marketing situation (x).

M_o = number of calves marketed by ranchers under the existing management operation.

M_y = number of calves marketed by ranchers after adopting the alternative option (y).

a = proportion of M_y marketed under the projected marketing situation x.

(1-a)= proportion of M_y marketed under the existing marketing system.

Change in beef production due to the adoption of the different management and marketing options was calculated as follows:

1. Amount of beef produced by ranchers under the existing management and marketing systems = $Q_{oo} = W_o \cdot M_o$ (1)

2. Amount of beef produced by ranchers after adopting option (y) and marketing situation (x) = $Q_{xy} = a M_y \cdot W_x + (1-a)M_y \cdot W_o$. (2)

3. Change in beef production due to the adoption of option (y) and marketing situation (x) = $dQ_{oo} = W_x \cdot aM_y + W_o \cdot (1-a)M_y - W_o \cdot M_o$ (3) (equation 2 minus 1)

Example: Change in beef production in Utah under 25% adoption level for option V (50% of the calves retained, wintered, summered and sold as long-yearlings) and the marketing of grass-fed beef.

1. Average marketing weight in Utah under the existing marketing system = W_o = 7.8 lbs/head (Appendix B).

2. Average marketing weight of grass-fed beef = W_x = 650 lb/head.

3. Basic number of calves marketed by 25% of Utah ranchers under the existing management system = M_o = 62,576 (thousand) head (Appendix A, No. 3).

4. Number of calves marketed by the same number of ranchers (25%) when adopting management option V = M_y = 57,477 (thousand) head (Appendix A, No. 5).

5. Basic production originated by the 25% ranchers = $M_o \cdot W_o$ = 62,475 x 718 = 44,857,050 pounds beef.

6. Beef produced under 25% adoption level of option V and the marketing of grass-fed beef:

a) Total number of calves marketed by 25% adopting ranchers for option V = M_y = 57,477 head

b) Proportion of calves marketed as grass-fed beef = 50% = .5 x 57,477 = 28,739 head

c) Proportion of calves marketed under the existing marketing system = 57,477 - 28,739 = 28,738 head

d) Total production by the adoption of option V and the marketing of grass-fed beef = 28,739 x 650 + 28,738 x 718

= 18,680,350 + 20,633,884

= 39,314,234 pounds

7. Change in beef production in Utah = No. 6 - No. 5.

= 39,314,234 - 44,857,050

= -5,542,816 pounds

The change in beef production was mainly due to two factors:

1. Change in weight of animals marketed, and
2. Number of animals marketed.

Using the above example, the amount of change attributable to each factor was calculated as follows:

A. Change in beef production due to change in marketing weight.

1. Change in average marketing weight by marketing grass-fed beef = $W_x - W_o$ = 650 - 718 = -68 lb/head
2. Number of animals marketed as grass-fed = 28,739 head
3. Change in beef production due to marketing weight = -68 x 28,739 = -1,954,252 lbs.

B. Change in beef production due to change in number of animals

marketed.

1. Change in number of animals marketed = $M_y - M_o$ = 57,477 - 62,475 = -4,998 (Appendix A, No. 3 and 5).
2. Change in beef production due to reduction in animals marketed = -4,998 x 718 = -3,588,564 lbs.

Total change in beef production = A + B = (-1,954,252) + (-3,588,564) = -5,542,816 pounds.

The change in beef production due to the adoption of the other management options and marketing situations was calculated similarly for the projected levels of adoption.

VITA

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Candidate for the Degree of

Master of Science

Thesis: Possible Impacts of the Expected Shift from Cow-calf to Cow-calf-yearling Enterprises on Beef Production and Beef Prices

Major Field: Range Science

Biographical Information:

Personal Data: Born at Abu Zabad, Kordofan, Sudan, January 1, 1945, son of Hussein Abdalla and Fatoma Adam; married Fathia B. Khur El Seed July 5, 1974; one daughter Amel, born in Logan, Utah June 21, 1975.

Education: Attended elementary school in Abu Zabad and intermediate school in El Fula, Kordofan; graduated from El Fasher Secondary School, Dar Fur in 1964; received the Bachelor of Science degree in agriculture with honor from Khartoum University, in 1969, completed requirements for the Master of Science, specializing in Range Science, at Utah State University, with a minor in Economics, in 1976.

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