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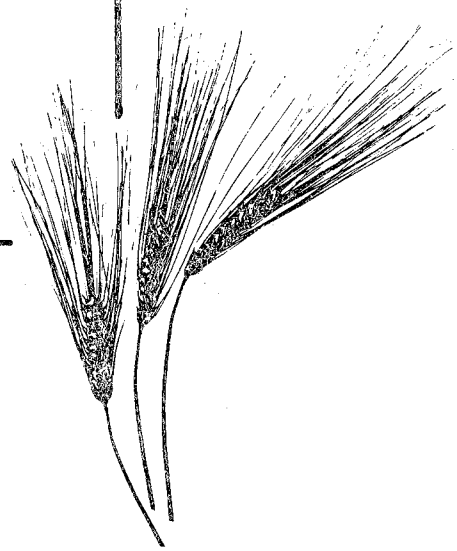
Beef vs Wheat Production

IN
SOUTH CENTRAL NORTH DAKOTA



by
RONALD D. KRENZ and BERNARD G. DANIELSON

Department of Agricultural Economics
Agricultural Experiment Station
North Dakota State University
Fargo, North Dakota
in cooperation with
Commodity Economics Division
Economic Research Service
U. S. Department of Agriculture

FOREWORD

This project was initiated to determine what potential exists in North Dakota to expand livestock production without seriously affecting crop production. Also, there was interest in determining if various types of governmental agricultural programs would be needed or even useful in encouraging livestock production. Funding for this project was provided jointly by the Economic Research Service, U.S. Department of Agriculture, and the North Dakota Agricultural Experiment Station.

This report will hopefully be useful both to producers in the study area and to public policymakers concerned with the grain and livestock economy.

The authors wish to thank all of the individuals who aided in this study through providing data and through review of the manuscript, particularly F. Larry Leistritz, LeRoy Schaffner, and Robert Carver. Specific thanks go to Roger Johnson who supervised the rewriting and final preparation of this report after the authors had transferred.

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BEEF VERSUS WHEAT PRODUCTION IN SOUTH CENTRAL NORTH DAKOTA

by
Ronald D. Krenz and Bernard G. Danielson*

Farmers have always been faced with the problem, "What should I grow on my farm?" The answer depends on the quantities and types of the resources available; the prices of the various products he can produce; and, in some cases, it depends on what he likes to produce. In the last few years farm product prices have been unusually volatile, making the decision of "what to grow" a much harder one.

Between September, 1971, and September, 1973, the price of 350-500 pound feeder steers at West Fargo, North Dakota, rose from about $39 per cwt. to $64 per cwt. This stirred widespread interest in expansion of beef production. Then, during 1973 wheat prices rose from about $2.30 per bushel in January to near $5.00 in July. Hence, what should a farmer do--raise beef or wheat?

More important than the current price are the long-run price expectations. But who can predict the future with much accuracy? We expect that the long-run demand for beef in the United States will be favorable, but foreign demand for wheat and other grains might also be favorable (although probably less stable and harder to predict).

One thing that is predictable is that it is harder to expand beef production than grain production. Grassland can be plowed up and seeded to wheat and production of wheat expanded in one year. But to expand beef, one must seed grass and wait a year or two to get a good stand; one must also buy or keep back more heifers, grow them out, breed them, and a year later get one more calf; maybe invest in more buildings, fences, and equipment. Hence, beef expansion is a slow process. It is not an "in-and-out" proposition.

Government economic policymakers are faced with some similar dilemmas. Should they try to encourage expansion of beef or grains? High beef prices raise food costs. The consumer is also a taxpayer and voter. Should expansion of beef production be encouraged or should exports of grain be encouraged to help the international balance of payments; strengthen the dollar; and, thereby, decrease inflationary pressures? Expansion of either beef or grain production would help the consumer.

Both the policymaker and the farmer are dependent upon the relative profitability of enterprises on the farm. At various alternative wheat or beef prices, just which is most profitable? This study is designed to examine this question for a limited study area in North Dakota. Profit maximizing farm plans will be developed for a variety of wheat and beef prices as guides both to the farmer and to policymakers. Also, alternative farm programs which could be used to add incentives for beef production will be examined.

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*Dr. Krenz is an agricultural economist, Commodity Economics Division, Economic Research Service, U.S. Department of Agriculture, formerly stationed at North Dakota State University; Danielson was formerly a research assistant with the Agricultural Economics Department at North Dakota State University.

Area of Study

The area chosen for analysis is a six-county area in south central North Dakota (Sheridan, Burleigh, Kidder, Emmons, Logan, and McIntosh counties) (see Figure 1). This area includes about 4,800 farms of which 80 percent had cattle in 1969.[1] The farms in this area have a total of 4.5 million acres of land, 61 percent of which is cropland and much of the remainder is useful for livestock purposes.

The land resources of the area indicate that this is the type of area where shifting between crop and livestock production can likely occur.

The farms in this area had a total of about 227,000 head of beef cattle in 1960 and 313,400 head in 1970, a 38 percent increase.[2] On those farms that had cattle, the average herd size on January 1, 1970, was 82 head. In 1969 the average farm consisted of 944 total acres of which 579 acres were cropland. Thus, most farms in the area have some land that is usable only for livestock.

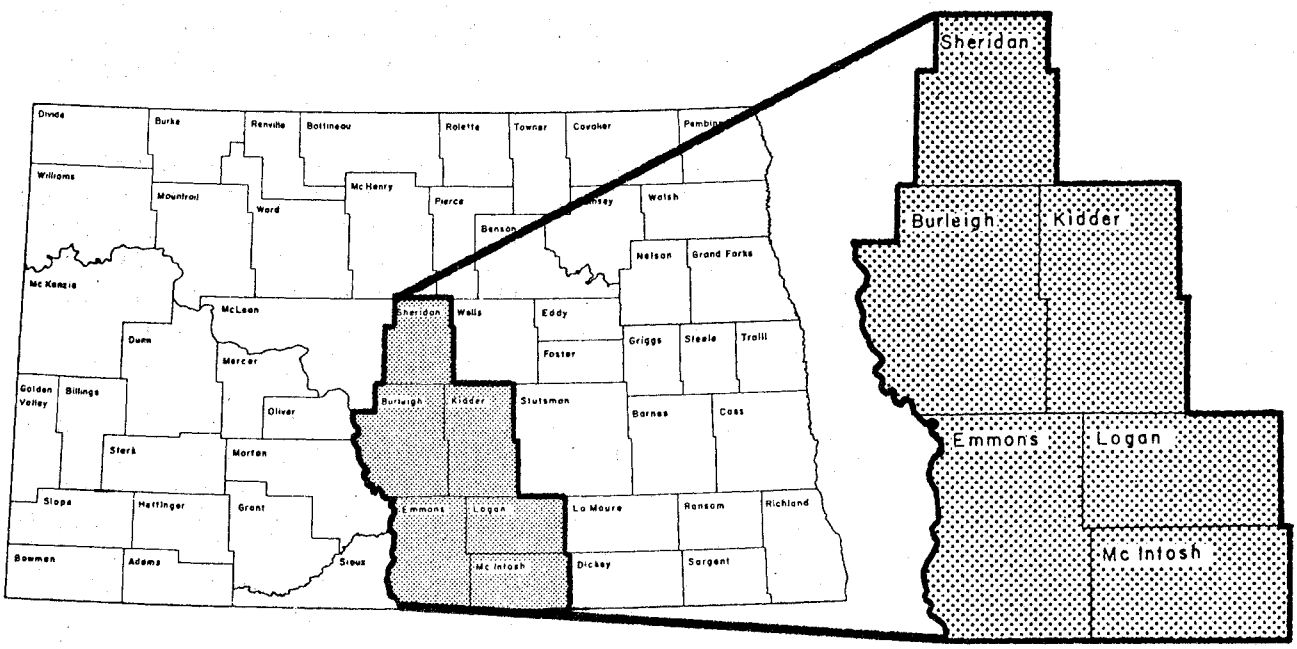

Figure 1. Area of Study, South Central North Dakota

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[1]U.S. Bureau of the Census, Census of Agriculture, 1969, U.S. Government Printing Office, Washington, D.C., 1972.

[2]USDA, Statistical Reporting Service, and Agricultural Experiment Station, North Dakota State University, North Dakota Crop and Livestock Statistics, various issues.

Procedures

The basic methodology used in this study area was linear programming. Linear programming is a form of computerized budgeting. Given information on the farm resources, the enterprise costs, and yields and prices, this procedure will examine all possible production alternatives and choose that plan which gives the highest income. This technique was used to determine optimal farm production plans for three model farms over a wide range of wheat and beef cattle prices and with several alternative government farm programs.

Model Farms

For the area as a whole, the farms average about 944 acres in total size, consisting of about 579 acres of cropland and 350 acres of native pasture and wild hayland. These farms, of course, vary in size and in proportion of land that is tillable.

In this study three model farms were studied (Table 1). These model farms were selected as "typical" operations. They are not strictly the "average farm" in the area. The major portion of this analysis applies to a farm of 818 acres of cropland, 435 acres of native pasture, and 67 acres of native hay (Model A). For this acreage of cropland, a domestic wheat allotment of 65 acres (in 1972) and a conservation base of 54 acres is considered.

TABLE 1. LAND RESOURCES OF MODEL FARMS

Land Resource	Units	Model Farm A	Model Farm B	Model Farm C
Cropland	Acres	818	818	400
Native Pasture	Acres	435	135	500
Native Hay	Acres	67	67	100
Domestic Wheat Allotment	Acres	65	65	50
Conservation Base	Acres	54	54	50

Source: Derived from U.S. Census of Agriculture and various ASCS data.

Model Farm "B" has only 135 acres of native pasture, but otherwise has the same resources as Model A. Model C has much less cropland, only 400 acres, but has 500 acres of native pasture and 100 acres of native hayland.

These variations in resources were examined primarily to determine if differences in ratios of cropland to noncropland would affect the response in beef production to beef or grain prices.

These model farms are assumed to be one-man family farms. The operator was assumed to supply 2,045 hours of labor per year. This estimate

was obtained by assuming a 32-hour week during the period November to March 31, 40 hours per week from April 1 to May 10, 48 hours per week from May 11 to September 9, and 40 hours per week from September 10 to October 31. Additional labor could be hired at a rate of $1.75 per hour. This was the average rate being paid for hourly farm workers when this study was initiated in mid-1972.

Capital for investments in crop or livestock operations was assumed to be available without limit as long as the rate of return was at least 7.5 percent on intermediate-term investments and 9 percent on short-term investments. Investments in cropping machinery, livestock and livestock equipment, and buildings are considered as intermediate-term. Expenses for seed, fertilizer, feed and miscellaneous expenses, and fuel are considered as short-term investments. Since the amount of land farmed remained constant under all plans, no interest is charged on land investments.

Cropping Alternatives

The basic crops produced in the area include wheat, barley, oats, flax, silage corn, and alfalfa. These were arranged into a variety of rotations with summer fallow as follows:

Wheat-fallow - (W-F)
Wheat-corn (silage) - (W-C)
Barley-corn (silage) - (B-C)
Wheat-wheat-fallow - (W-W-F)
Wheat-barley-fallow - (W-B-F)
Wheat-oats-fallow - (W-O-F)
Wheat-corn (silage)-fallow) - (W-C-F)
Wheat-flax-fallow - (W-FL-F)
Wheat-wheat-flax-fallow - (W-W-FL-F)
Wheat-barley-flax-fallow - (W-B-FL-F)
Wheat-oats-oats-fallow - (W-O-O-F)

These rotations were allowed to be mixed in the optimal plan to give a wide variety of plans. Notice that fallow acreage can vary from zero with the wheat-corn or barley-corn rotation to 50 percent with the wheat-fallow rotation.

In the rotations wheat was assumed to yield 27.6 bushels per acre after fallow and 19.3 after corn or small grains. Wheat is the only crop assumed to be grown after fallow. Barley is assumed to yield 32.8 bushels per acre, oats yields were converted to barley equivalents and yield 25.1 bushels of barley equivalent. Corn silage yields 5.0 tons per acre. Flax yields 10.6 bushels per acre. All crops were assumed to produce 0.1 AUM's (animal unit months) of aftermath grazing per acre of crop during October.

In addition to these grain crops, cropland could be used for alfalfa hay, alfalfa-brome pasture, crested wheatgrass pasture, or sudan grass pasture.

These forage crops, plus various methods of use of native hay and pasture land, are described in Table 2. Cropland could be used to grow alfalfa for hay, in alfalfa-brome pasture, or crested wheatgrass pasture in six-year rotations with oats as a nurse crop the first year (five years

TABLE 2. FORAGE AND PASTURE ENTERPRISES (INPUTS AND YIELDS)

	Alfalfa Hay	Alfalfa Brome Pasture	Crested Wheatgrass Pasture	Sudan Grass Pasture	Native Hay	Native Pasture	Native Deferred	Native Fertilized
Type of Land	Cropland	Cropland	Cropland	Cropland	Native	Native	Native	Native
Rotation	6 Yr.	6 Yr.	6 Yr.	1 Yr.	Perm.	Perm.	Perm.	Perm.
Hay Yield Per Acre	1.7 Ton				.87 Ton			
Pasture Yields:[a] (AUM's Per Acre)								
May 1-31		.3	.9			.1		.15
June 1-July 31		.9	.8	.7		.4	.5	.6
Aug. 1-Sep. 30	.2	.2		1.2	.15	.2	.3	.4
Oct. 1-Oct. 31			.1			.05	.1	.1
Total Yield	.2	1.4	1.8	1.9	.15	.75	.9	1.15

[a]Pasture yield estimates based on private correspondence with Duane Dodds, Extension Conservationist, North Dakota State University, Fargo, North Dakota.

of forage). No fertilizer was assumed to be applied to the alfalfa crops, but the crested wheatgrass enterprise included a cost of $4.50 per year for application of 50 pounds of nitrogen.

Sudan grass, an annual crop, was included to supply late summer pasture. The yield of 1.9 AUM's per acre is based on annual costs of $4.50 for fertilizer, $5.00 for seed, and $3.00 machinery costs.

Both the alfalfa hay and native hay enterprises were assumed to produce a small amount of aftermath grazing during the period August 1 to September 30.

Native pasture could be utilized in three ways--usual full-season grazing produced a total of .75 AUM's per acre, deferment of grazing with production increased to .9 AUM's per acre, or fertilization with 50 pounds of nitrogen per year with an output of 1.15 AUM's per acre.

All pasture enterprises were charged $.75 per acre per year for fencing costs.

Livestock Enterprises

Only three livestock enterprises were considered. These included a cow-calf enterprise with the production of a 400-pound weaned calf on November 1. A calving percentage of 90 and a death loss of 2 percent were assumed.

A second beef enterprise involves wintering the calf on a grain and hay ration to gain 1 2/3 pounds per day and selling it on May 1 at 700 pounds.

A third enterprise carries the calf over winter on a restricted grain ration to gain 1.12 pounds per day. The calves are placed on pasture in spring and sold off pasture in July at 750 pounds. This third enterprise requires 9.6 AUM's per cow per year compared to 8.1 AUM's for the first two systems. Additional description of the beef enterprises is provided in Table 3.

Price Assumptions

Input and product prices were assumed which generally reflect 1972 conditions. However, optimal plans were developed for three prices of wheat--$1.40, $1.60, and $2.00 per bushel--and beef prices were varied with the price of calves ranging from $25 to $65 per cwt.[3] Price relationships among calves, yearlings, and cows are based upon the average of 1967 to 1972 prices.

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[3]The prices of all classes of cattle were varied proportionately, along with calf prices; but for ease of presentation we will refer only to prices of beef calves. The price per cwt. of yearlings sold in May was set at 89 percent of the price of calves, and yearlings sold in July were priced at 94 percent of calf prices.

TABLE 3. BEEF ENTERPRISES

	Cow-Calf #1	Cow-Calf #2	Cow-Calf #3
Selling Date	Nov. 1	May 1	July 1
Selling Weight (Steers)	400 lbs.	700 lbs.	750 lbs.
Feed Inputs			
Feed Grain (Bu.)	5	35	25
Pasture (AUM's)	8.1	8.1	9.6
Hay (Tons)	2.0	2.5	2.77
Annual Labor Requirement (Hours)	20.0	28.5	31.0
Expenses			
Veterinarian and Medicine	$ 3.00	$ 4.00	$ 4.00
Mineral and Salt	1.80	2.10	2.10
Building Repairs	1.00	1.25	1.25
Equipment Repairs	.75	.90	.90
Investment			
Breeding Cows	$196.00	$196.00	$196.00
Bull	20.00	20.00	20.00
Replacement Heifers	32.00	32.00	32.00
Buildings	12.50	18.00	18.00
Equipment	7.50	12.00	12.00
	$268.00	$278.00	$278.00

Source: Based on budgets available in "Farm Management Planning Guide for North Dakota," Circular FM-167, Cooperative Extension Service, North Dakota State University, August, 1967. Also from "Guide Posts for Planning a Farm or Ranch Business," Extension Circular 633 (Rev.), Cooperative Extension Service, South Dakota State University, and from consultation with members of the Animal Science Department, North Dakota State University, Fargo, North Dakota.

Barley was held at $1.10 per bushel and flax at $2.75 per bushel in the entire analysis. No hay could be purchased or sold; however, hayland could be left idle if not needed for livestock.

Government Programs

In the initial analysis optimal plans are determined assuming the 1972 wheat program. The 1972 wheat program required operators to set aside (not harvest crops from) an acreage equal to 83 percent of the farm's domestic wheat allotment in addition to the normal conserving base (see Table 1). Summer fallow qualified as set-aside acreage. Summer fallow and hay or pasture qualified for conserving base.

Fulfillment of the required set-aside would qualify producers for loan rates on all wheat produced of about $1.25 per bushel and wheat

certificates for the normal yield on the domestic allotment. Normal ASCS yields in the study area averaged 21.9 bushels per acre and the value of the certificates would be the difference between the average market value and $3.02 per bushel. On Model Farm A with a 65-acre domestic wheat allotment, the total value of wheat certificates would be worth $2,306.20, with a $1.40 average market price.

In addition to the required set-aside, added set-aside was an option open to wheat producers in 1972. Under this provision they could set aside additional acreage (equal to as much as 100 percent of their domestic wheat allotment) for which they would receive payments of $.94 per bushel times their normal ASCS wheat yield or an average of $20.59 per acre.

In later phases of this study, variations in farm programs will be examined. These variations will be explained at that point in the report.

Resulting Optimal Plans for Model Farm A

Table 4 presents a series of optimal production plans for $1.40 market price of wheat and with beef calf prices ranging from $25 to $65 per cwt.[4]

Cropping Programs--The optimal crop rotation at all beef prices and with wheat at $1.40 was found to be a wheat-barley-flax-fallow rotation. This rotation produces the feed grain needed for the cattle enterprises and some fall aftermath pasture. With the fallow from this rotation and the hay or pasture included for livestock, sufficient acreage is in conserving uses to satisfy the conserving base and required set-aside for the wheat program and for added set-aside payments.

As beef prices are raised, livestock numbers are increased and cropland is shifted from the W-B-FL-F rotation first to alfalfa hay and then to crested wheat pasture and finally a small amount to sudan grass pasture. These cropland uses are directly related to the livestock needs for forage and to the supplies of native hay and pasture available.

Use of Native Hay and Pasture--In most of the plans developed, the full 67 acres of native hay is harvested. Plan B (see Table 4) calls for no use of native hay due to slightly higher per ton harvest costs on native hay versus alfalfa. The 67 acres of native hay produce enough hay for about 24 cows and, hence, any additional hay must come from alfalfa.

Options were included for three methods of using native range as described earlier. The native pasture provides sufficient forage for about 34 beef cows for the full season of grazing. To increase cow numbers, crested wheatgrass is added for early spring grazing to allow

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[4]Throughout the remainder of this report, where we refer to beef prices, we mean the price of beef calves. The price of other types of beef, such as yearlings, cull calves, etc., is assumed to move with the price of beef calves.

TABLE 4. OPTIMAL FARM PLANS FOR MODEL FARM A WITH WHEAT AT $1.40 AND 1972 WHEAT PROGRAM

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.) 25	26-27	28-31	32-36	37-38	39-41	42-65
Plan		A	B	C	D	E	F	G
Cropland Use								
W-B-FL-F	Acres	818	757	798	728	707	695	641
Alfalfa Hay	Acres	--	61	20	38	44	47	64
Crested Wheat Pasture	Acres	--	--	--	52	67	76	91
Sudan Grass	Acres	--	--	--	--	--	--	22
Wild Hay	Acres	3	--	67	67	67	67	67
Use of Native Pasture								
Full-Season	Acres	12	392	398	126	43	--	--
Deferred	Acres	1	43	37	309	392	435	435
Livestock								
Cow-Winter Calf	Head	1	35	36	47	50	52	62
Labor Use								
Hired	Hours	222	476	515	553	613	654	961
Operator	Hours	881	1,743	1,759	2,010	2,038	2,043	2,045
Total	Hours	1,103	2,219	2,274	2,563	2,651	2,697	3,006
Capital Investment								
Short-Term	Dols.	7,198	7,558	7,876	8,003	8,041	8,062	8,275
Intermediate-Term	Dols.	30,000	41,156	43,550	44,226	44,431	44,539	46,559
Grain Sold								
Wheat	Bu.	5,644	5,225	5,505	5,023	4,876	4,799	4,423
Barley	Bu.	6,669	5,215	5,361	4,709	4,511	4,406	3,736
Flax	Bu.	2,168	2,007	2,114	1,929	1,873	1,843	1,699
Range in Income[a]	Dols.	11,467	11,573	12,001	12,860	14,237	14,827	15,767
	Dols.	--	11,780	12,631	13,948	14,527	15,427	24,047
Income with Beef Calf Price of:								
$25	Dols.	11,467	11,366	11,371	10,956	10,751	10,623	9,643
$35	Dols.	11,531	13,439	13,472	13,674	13,656	13,627	13,245
$45	Dols.	11,595	15,512	15,573	16,392	16,561	16,631	16,847

[a]Income varies with the range in beef prices shown at the top of each column. Income is return to land, capital, operator labor, and management.

deferment of native pasture for later summer grazing. With 62 cows, pasture also becomes in short supply during July-August and 22 acres of sudan grass are added to balance out the feed supply.

Livestock Program--The only livestock enterprise included in these optimal plans was the system which called for cows with wintering calves. The availability of feed grains and labor made this more profitable than selling weaning calves in the fall. In this analysis it was assumed that if the price of calves increased, the price of 700-pound yearlings increased accordingly. This is not always the case. In some years a 400-pound calf will sell for more than a 700-pound yearling will six months later. This price risk may deter some producers from this operation.

The system calling for keeping calves over summer on pasture as yearlings was never included in any optimal plan developed here because of the large pasture requirements for such a system.

In practice, if in the spring a farmer felt that due to abnormally good moisture he had sufficient pasture for his cow herd and for yearlings, he could, of course, pasture his yearlings during the summer instead of selling them. But under normal weather conditions, this practice was found not to be competitive with the other systems examined.

Labor Use--On this size of farm the labor required for the cropping operation about equals the operator labor available during the spring and fall crop season. For Plan A (practically no livestock) only 222 hours of hired labor would be needed. Labor would be hired during April, May, and June and a very small amount (24 hours) in August and September. With Plan A, very little labor is used during the November-March period.

As livestock is added, the total labor requirement increases considerably. Plan B with 35 cows takes twice as much labor in total as Plan A--with the bulk of the increase occurring during the winter months. Plan B calls for use of 529 hours of operator labor during the winter months compared to only 16 for Plan A. With 50 cows, labor has to be hired during the winter months; and, with 62 cows, total hired labor equals 961 hours and total operator labor equals 2,045 hours.

In the calculations no charge was placed on operator labor, but all hired labor was priced at $1.75 per hour. Income figures presented are net after payment for hired labor. Hence, a plan which calls for hired labor would have to pay the cost of this labor at $1.75 per hour. However, much of the increase in income between the various plans is due to the added operator labor input. For instance, with beef calves at $35, Plan D would give $2,143 more income than Plan A but would require 1,129 hours more operator labor. The operator would be getting $1.90 per hour for his added labor. Hence, livestock is a way to employ more operator labor and obtain a return for it.

Income--In Table 4 and following, where a plan applies to only one beef price, only one income figure is given; but where a range in beef price is given, a range is also given in the estimated income.

These income figures include government wheat certificate payments and payments for added set-aside. Payments for added set-aside equal $1,338 for Model Farm A. The value of wheat certificates varies with the price of wheat from $1,452 to $2,306. The wheat certificate system was designed to give a return equal to 100 percent of parity ($3.02 per bushel) for wheat grown on the domestic wheat allotment; hence, as market price goes up the value of the certificates diminishes.

This income figure represents a return to land, capital, operator labor, and to risk and management. The investment figures given in the tables represent investment in operating capital, livestock, and machinery. In addition, the land investment would be approximately $71 per acre on 1,360 acres or nearly $100,000.[5] Hence, if a 6 percent interest charge on land investments were subtracted, returns to operator labor, management, and risk would range from $5,467 to $18,041 for the plans in Table 4.

Most of the difference in income of the plans in Table 4 is due to the changes in the price of beef. Estimates given at the bottom of Table 4 illustrate what incomes would be for the various production plans for three levels of beef price. Table 5 presents estimates of income foregone if one has the "wrong" production plan. For instance, the optimal plan for $35 beef calves calls for 47 cows (Plan D) with wintering the calves and produces an income of $13,674 at a $35 beef price. If a producer had been operating with Plan C, which is optimal for $28-31 beef prices, he would only have had 36 cows and his income would have been about $202 less. On the other hand, if the producer stayed with Plan D (47 cows) and the price of beef rose to $45, his income would be $16,392, which is only $455 less than if he had chosen the optimal plan for $45 beef or 62 cows.

In practice a producer cannot change production plans rapidly even if he is quite sure beef prices are going to change. With livestock production, one could reduce herd size quite quickly. One could cull heavily and keep no replacement heifers and reduce the size of the cow herd by 20-30 percent in a year if he wanted to. For instance, if he had been operating with Plan D (the optimal plan for $35 beef calves) and he expected beef prices to drop to $30, he would be somewhat better off to reduce his cow herd by about 11 head and expand his grain production. He could make this change in one year.[6] However, a shift in the opposite direction takes more time. An increase of 20 percent in two years is difficult to make through changing culling rates and holding more heifers. Also, one needs time to increase hay and pasture acreage.

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[5]The 1972 land values were estimated at $71 based on a reported 1971 average price of $68 per acre plus 4 percent appreciation in 1972.

[6]This decision would have to be made in the spring before breeding season and then be followed through with higher culling in the fall after weaning.

TABLE 5. INCOME FOREGONE IF WRONG PLAN CHOSEN, MODEL FARM A, WHEAT @ $1.40

If Producer Has Plan:	Income Foregone If Actual Beef Calf Price Is: $35	$40	$45
"C" (36 Cows)	$202	$738	$1,274
"D" (47 Cows)	--	92	455
"E" (50 Cows)	18	20	286
"F" (52 Cows)	47	--	216
"G" (62 Cows)	429	83	--

An alternative to this is to pick one plan that would be best or give the least amount of loss over time for the entire range of cattle prices one expects. If a producer expects calf prices to stay within the range of $35 to $45, he has four plans to pick from--Plans D, E, F, or G. If he picks D, he would be foregoing about $455 per year in years when prices were $45. On the other hand, if he chooses Plan G and prices are only $35, he foregoes about $429. From Table 5 one can see the small effect on income of the change in plan. As long as calf prices stay within the range of $35-45, the most income foregone due to having the wrong production plan is only $455 if one chooses one of these four production plans. Actually, with this expected price range, one could minimize the loss in any one year by choosing Plan F with 52 cows and the most income foregone in any one year would be $216.

Wheat = $1.60

With wheat prices at $1.60, we get practically the same optimal farm plans as were obtained with $1.40 wheat except at slightly higher beef prices (Table 6). With $1.60 wheat, the beef price must be about $1-2 per cwt. higher to compete with crops for the land resource. Other than this, the results are about the same. Incomes are slightly higher due to the higher price of wheat.

Wheat = $2.00

With wheat at $2.00, a new set of production plans was obtained (Table 7). At $2.00 wheat, the wheat-fallow rotation is generally chosen as most profitable. Feed grain for livestock is provided by a wheat-barley-fallow rotation and a wheat-barley-flax-fallow rotation.

Below a beef calf price of $28, the livestock system consists of selling calves at weaning weights; but at $28 and above, the calves are all wintered.

Most of the native pasture is used for the full season with cow numbers at 36 head or less. As cow numbers are expanded beyond 36 head, crested wheat pasture is added and more native pasture is shifted to deferred use and much of it is fertilized at high beef prices.

TABLE 6. OPTIMAL FARM PLANS FOR MODEL FARM A WITH WHEAT AT $1.60 AND 1972 WHEAT PROGRAM

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.)					
		25	26-33	34-37	38-39	40-42	43-65
Plan		A	B	C	D	E	F
Cropland Use							
W-B-FL-F	Acres	818	798	728	707	695	641
Alfalfa Hay	Acres	--	20	38	44	47	64
Crested Wheat Pasture	Acres	--	--	52	67	76	91
Sudan Grass	Acres	--	--	--	--	--	22
Native Hay	Acres	3	67	67	67	67	67
Use of Native Pasture							
Full Season	Acres	12	398	126	43	--	--
Deferred	Acres	1	37	309	392	435	435
Livestock							
Cow-Winter Calf	Head	1	36	47	50	52	62
Labor Use							
Hired	Hours	222	515	553	613	654	961
Operator	Hours	881	1,759	2,010	2,038	2,043	2,045
Total	Hours	1,103	2,274	2,563	2,651	2,697	3,006
Capital Investment							
Short-Term	Dols.	7,198	7,876	8,003	8,041	8,062	8,275
Intermediate-Term	Dols.	30,000	43,550	44,226	44,431	44,539	46,559
Grain Sold							
Wheat	Bu.	5,644	5,505	5,023	4,876	4,799	4,423
Barley	Bu.	6,669	5,361	4,709	4,511	4,406	3,736
Flax	Bu.	2,168	2,114	1,929	1,873	1,843	1,699
Range in Income	Dols.	12,311	12,397	14,124	15,217	15,802	16,726
	Dols.	--	13,867	14,940	15,507	16,402	24,650
Income with Beef Calf Price of:							
$25	Dols.	12,311	12,187	11,667	11,447	11,287	10,246
$35	Dols.	12,351	14,287	14,397	14,347	14,297	13,846
$45	Dols.	12,391	16,387	17,127	17,247	17,307	17,446

TABLE 7. OPTIMAL FARM PLANS FOR MODEL FARM A WITH WHEAT AT $2.00 AND 1972 WHEAT PROGRAM

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.) 25-26	27	28	29-38	39-43	44-46	47-50	51-53	54-60	61-65
Plan		A	B	C	D	E	F	G	H	I	J
Cropland Use											
W-F	Acres	812	805	740	690	630	594	526	--	--	--
W-W-F	Acres	--	--	--	--	--	--	--	509	391	--
W-B-F	Acres	6	13	78	108	126	127	--	--	--	--
W-B-FL-F	Acres	--	--	--	--	--	--	176	203	206	216
W-W-FL-F	Acres	--	--	--	--	--	--	--	--	116	501
Alfalfa Hay	Acres	--	--	--	20	38	46	53	61	62	67
Crested Wheat Past.	Acres	--	--	--	--	24	51	63	45	43	36
Native Hay	Acres	29	67	67	67	67	67	67	67	67	67
Use of Native Pasture											
Full-Season	Acres	136	321	267	398	211	79	--	--	--	--
Deferred	Acres	15	34	23	37	138	288	346	216	202	154
Fertilized	Acres	--	--	--	--	85	67	89	219	233	281
Livestock											
Cow-Calf	Head	12	29	--	--	--	--	--	--	--	--
Cow-Winter Calf	Head	--	--	24	36	47	51	55	60	61	63
Labor Use											
Hired	Hours	306	455	417	509	566	645	740	953	961	1,026
Operator	Hours	991	1,251	1,403	1,700	1,961	2,001	2,028	2,033	2,045	2,045
Total	Hours	1,297	1,711	1,802	2,209	2,527	2,646	2,768	2,986	3,006	3,071
Capital Investment											
Short-Term	Dols.	5,382	5,730	5,885	6,136	6,786	6,851	7,183	9,147	9,227	9,493
Intermediate-Term	Dols.	30,000	36,602	35,882	40,096	42,508	42,078	43,353	49,686	49,765	50,029
Grain Sold											
Wheat	Bu.	11,262	11,227	10,931	10,513	9,856	9,367	8,474	9,580	9,107	7,527
Flax	Bu.	--	--	--	--	--	--	467	538	852	1,900
Range in Income	Dols.	15,175	15,313	15,455	15,664	17,843	19,227	20,165	21,537	22,592	25,087
	Dols.	15,225	--	--	17,555	18,930	19,834	21,127	22,237	24,713	26,543
Income with Beef Calf Price of:											
$25	Dols.	15,175	15,079	15,032	14,824	14,035	13,565	13,103	12,437	12,355	11,979
$35	Dols.	15,675	16,249	16,442	16,924	16,755	16,545	16,313	15,937	15,885	15,620
$45	Dols.	16,175	17,419	17,852	19,024	19,475	19,525	19,523	19,437	19,415	19,261

Table 7 presents income estimates for these plans for $25, $35, and $45 beef prices to facilitate comparisons of the differences in income between plans. Note particularly that at a beef price of $35 the range between the optimal plan for $35 (Plan D) and any other plan listed is only $1,300. Hence, at $35 beef any of the plans would be fairly satisfactory. There is, however, a big difference in the labor requirements of these plans as shown in Table 7.

The shift in cropping systems from a W-B-FL-F rotation to a W-F or the other rotations given in Table 7 would occur at a wheat price of about $1.75. Below $1.75, the W-B-FL-F systems give more profit given the feed grains and flax prices used.

Wheat Versus Beef

The 67 acres of native hayland produce sufficient hay for about 24 cows. At the $1.40 and $1.60 wheat prices, cropland is shifted to hay production at a $26.00 beef price. With wheat at $2.00, beef prices of $29.00 are needed to shift any cropland to hay production.

The native pasture available is sufficient for about 36 cows. Crested wheatgrass pasture has to be added before cow numbers can expand beyond 36 head. At $1.40 wheat, the beef price must be $32.00 to draw cropland into pasture production. Similarly, at $1.60 wheat, the beef price must be $34; and at $2.00 wheat, the beef price must be $39.00.

When cow numbers reach 36 head, labor begins to be in short supply at several times of the year. Hence, higher beef prices are needed to pay for the hired labor needed to allow expansion of the beef herd.

Another feature of these optimal plans is that the expansion in beef production due to rising beef prices is accompanied by a smaller relative reduction in wheat or other grains. For instance, in Table 4 expansion of beef cows from 35 to 62 head (Plan B versus Plan G), a 77 percent increase, is accompanied by only a 22 percent reduction in sales of wheat and flax and a 44 percent reduction in sales of barley. In Table 7 expansion from 24 cows to 63 cows (Plan J versus Plan C), an increase of 163 percent, is accompanied by a 31 percent reduction in sales of wheat, while flax sales actually increase from zero to 1,900 bushels.

This means that expansion in beef does not come primarily at a cost in terms of reduction in grain production, but as a result of more intensive use of resources, primarily labor, and added fertilization and added investment. Hence, land is not as limiting a resource as one might first think.

Figure 2 illustrates the effects of the prices of wheat and beef on optimal beef cow numbers on Model Farm A. Generally, the higher the wheat price, the higher the beef price needed to get the same number of cows. The movement of wheat prices from $1.40 to $1.60 requires about a $1.00 increase in the price of beef to keep beef competitive with grain production. When wheat prices move up from $1.60 to $2.00, beef prices must advance $3.00-6.00 to keep beef competitive.

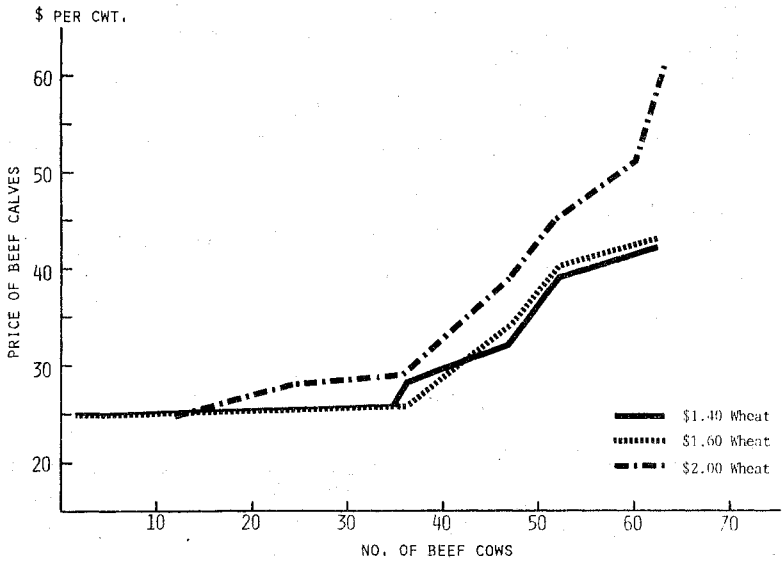

Figure 2. Beef Cow Numbers on Model Farm A as Affected by Beef Calf Prices and Wheat Prices Under the 1972 Wheat Program

Results for Model Farm B

Model Farm B has the same cropland resources as Farm A, but only 135 acres of native pasture compared to 435 acres on Farm A.

The same price situations were examined for both model farms. The resulting optimal plans parallel those for Farm A, except that with less native pasture available the maximum size beef herd for Farm B was found to be 43 cows compared to 63 on Farm A (Table 8). With less native pasture, more cropland has to be used for pasture and, hence, a higher beef price is needed. For instance, with $1.40 wheat and $32.00 beef, we obtained 47 cows on Farm A; on Farm B a beef price of $35.00 is needed to bring in 43 cows.

With Model Farm B, sufficient native hay is available on the 67 acres for 24 cows; but the native pasture available will only support 12 cows. Hence, to get more than 12 cows, cropland has to be shifted to crested wheatgrass pasture. This shift requires a beef price of $32.00 at $1.40 wheat, $33.00 at $1.60 wheat, and $37.00 at $2.00 wheat. When both hay and pasture become limiting, the beef price must be $35.00 at $1.40 wheat, $36.00 at $1.60 wheat, and $41.00 at $2.00 wheat. Some of the native hay is not utilized in some of the plans presented in Tables 8, 9, and 10 because pasture is more limiting than hay. In practice this hayland could be utilized for pasture.

With $2 wheat, the plans for Farm B are similar to those for Farm A in regard to rotation; but again livestock numbers are lower and a higher beef price is needed to shift cropland into pasture use (Table 10). On Model A we obtained 36 cows with a beef price of $29, whereas on Farm B we would need a beef price of $43 to get 35 cows.

TABLE 8. OPTIMAL FARM PLANS FOR MODEL FARM B WITH WHEAT AT $1.40 AND 1972 WHEAT PROGRAM

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.)				
		25	26-27	28-31	32-34	35-65
Plan		A	B	C	D	E
Cropland Use						
W-B-FL-F	Acres	818	799	818	794	667
Alfalfa Hay	Acres	--	19	--	--	32
Crested Wheat Pasture	Acres	--	--	--	24	63
Sudan Grass	Acres	--	--	--	--	56
Native Hay	Acres	3	--	31	45	67
Use of Native Pasture						
Full-Season	Acres	12	122	124	--	--
Deferred	Acres	2	13	11	135	135
Livestock						
Cow-Winter Calf	Head	1	11	12	16	43
Labor Use						
Hired	Hours	221	295	312	337	493
Operator	Hours	881	1,130	1,136	1,256	1,912
Total	Hours	1,102	1,425	1,448	1,593	2,405
Capital Investment						
Short-Term	Dols.	7,198	7,292	7,440	7,563	8,217
Intermediate-Term	Dols.	30,000	33,145	34,258	35,063	41,052
Grain Sold						
Wheat	Bu.	5,644	5,514	5,644	5,479	4,600
Barley	Bu.	6,669	6,244	6,312	6,042	4,360
Flax	Bu.	2,168	2,118	2,168	2,104	1,767
Range in Income	Dols.	11,467	11,502	11,637	11,914	12,360
	Dols.	--	11,566	11,835	12,104	19,854
Income with Beef Calf Price of:						
$25	Dols.	11,467	11,438	11,436	11,249	9,862
$35	Dols.	11,531	12,081	12,095	12,196	12,360
$45	Dols.	11,595	12,724	12,751	13,143	14,858

TABLE 9. OPTIMAL FARM PLANS FOR MODEL FARM B WITH WHEAT AT $1.60 AND 1972 WHEAT PROGRAM

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.) 25	26-32	33-34	35	36-65
Plan		A	B	C	D	E
Cropland Use						
W-B-FL-F	Acres	818	818	794	766	667
Alfalfa Hay	Acres	--	--	--	--	32
Crested Wheat Pasture	Acres	--	--	24	35	63
Sudan Grass	Acres	--	--	--	17	56
Native Hay	Acres	3	31	45	67	67
Use of Native Pasture						
Full-Season	Acres	12	124	--	--	--
Deferred	Acres	2	11	135	135	135
Livestock						
Cow-Winter Calf	Head	1	12	16	24	43
Labor Use						
Hired	Hours	221	312	337	391	493
Operator	Hours	881	1,136	1,356	1,454	1,912
Total	Hours	1,102	1,448	1,593	1,845	2,405
Capital Investment						
Short-Term	Dols.	7,198	7,440	7,563	7,830	8,217
Intermediate-Term	Dols.	30,000	34,258	35,063	37,382	41,052
Grain Sold						
Wheat	Bu.	5,644	5,644	5,479	5,284	4,600
Barley	Bu.	6,669	6,312	6,042	5,579	4,360
Flax	Bu.	2,168	2,168	2,104	2,029	1,767
Range in Income	Dols.	--	12,350	12,819	13,025	13,244
	Dols.	12,310	12,743	12,914	--	20,494
Income with Beef Calf Price of:						
$25	Dols.	12,310	12,284	12,062	11,614	10,494
$35	Dols.	12,370	12,940	13,009	13,025	12,994
$45	Dols.	12,430	13,596	13,956	14,436	15,494

TABLE 10. OPTIMAL FARM PLANS FOR MODEL FARM B WITH WHEAT AT $2.00 AND 1972 WHEAT PROGRAM

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.) 25-26	27-36	37-38	39-40	41-42	43-47	48	49-65
Plan		A	B	C	D	E	F	G	H
Cropland Use									
W-F	Acres	813	782	745	730	658	620	--	--
W-W-F	Acres	--	--	--	--	--	--	575	--
W-B-F	Acres	5	36	68	74	94	--	--	--
W-W-FL-F	Acres	--	--	--	--	--	--	--	553
W-B-FL-F	Acres	--	--	--	--	--	128	142	150
Alfalfa Hay	Acres	--	--	--	--	17	18	28	32
Crested Wheat Past.	Acres	--	--	5	9	23	24	33	37
Sudan Grass	Acres	--	--	--	5	26	28	40	46
Native Hay	Acres	25	31	60	67	67	67	67	67
Use of Native Pasture									
Full-Season	Acres	122	124	--	--	--	--	--	--
Deferred	Acres	13	11	--	--	--	--	--	--
Fertilized	Acres	--	--	135	135	135	135	135	135
Livestock									
Cow-Calf	Head	11	--	--	--	--	--	--	--
Cow-Winter Calf	Head	--	11	22	24	34	35	41	43
Labor Use									
Hired	Hours	294	299	379	397	453	452	568	530
Operator	Hours	969	1,077	1,337	1,402	1,647	1,679	1,789	1,907
Total	Hours	1,263	1,376	1,716	1,799	2,100	2,131	2,357	2,437
Capital Investment									
Short-Term	Dols.	5,355	5,479	6,421	6,545	6,926	7,054	8,739	8,840
Intermediate-Term	Dols.	29,480	30,120	34,249	35,097	37,466	37,616	43,305	42,893
Grain Sold									
Wheat	Bu.	11,265	11,122	10,910	10,754	9,944	9,425	10,206	7,703
Flax	Bu.	--	--	--	--	--	339	379	1,864
Range in Income	Dols.	15,142	15,272	16,011	16,277	16,625	17,033	18,129	18,371
	Dols.	15,186	15,870	16,137	16,418	16,823	17,849	--	22,403
Income with Beef Calf Price of:									
$25	Dols.	15,142	15,140	14,499	14,303	13,457	13,361	12,678	12,323
$35	Dols.	15,583	15,804	15,759	15,713	15,437	15,401	15,048	14,843
$45	Dols.	16,024	16,466	17,019	17,213	17,417	17,441	17,418	17,363

The tables showing the results for Model Farm B (Tables 8, 9, and 10) include estimates of income for each plan for beef priced at $25, $35, and $45. These estimates serve to demonstrate the range of income of each plan as determined by the price of beef and also should aid in selecting a production plan that is best over a wide range of beef prices. In Table 8, for instance, Plan A has about the same income over a wide range in beef prices because it has essentially no livestock (in practice, a farmer would not keep just one cow).

One can ask, "Which plan is best when beef prices are expected to vary between $25 and $45?" Plan A is best if beef prices stayed at $25, but it is the poorest plan if beef prices exceed that level. Plan E is best if beef prices stayed above $35. With Plan E, however, income drops considerably if beef prices are only $25. Some producers might choose to go with Plan D. It gives an income of $1,387 more than Plan E at $25 beef prices and $1,715 less income than Plan E at $45 beef, but only $164 less at $35 beef. Plan D uses only 24 acres of cropland for livestock and, hence, wheat production is still near maximum levels. Plan E uses 151 acres of cropland for livestock. Here wheat production is cut almost 20 percent. Hence, Plans D or E are the most likely choices.

Table 9 presents plans for $1.60 wheat. At this wheat price, Plan D with 24 cows is optimal only for a $35.00 price; but it appears to give a good income over the range of $25.00 to $45.00 beef prices.

Table 10 presents plans for $2 wheat prices. A wide variety of plans was developed from 11 cows to 43 cows.[7] At the high end of the price range (with Plans G and H particularly) income would be considerably less if beef prices are only $25. This is because the acreage of crops is cut substantially to allow expansion of forage production. Plans A through F are possible choices for beef prices ranging from $25 to $45. With Plan D and 24 cows, income foregone at $25 or at $45 beef prices would be relatively small compared to the other plans presented.

Optimal Plans for Model Farm C

The land resources of Model Farm C are quite different from those of Farms A and B. Farm C has only 400 acres of cropland, 100 acres of native hayland, and 500 acres of native pasture. Hence, forage is fairly abundant on this farm compared to the cropland resources.

Due to the large acreage of native forage available, the optimal plan for this farm with wheat at $1.40 or $1.60 calls for 37 cows with practically full use of the cropland for crop production (Table 11). The 100 acres of native hayland supply the hay needs of about 36 cows. The 500 acres of native pasture meet the pasture needs of 37 cows with most of it utilized full season and some utilized on a deferred system. When cow numbers are expanded beyond 37 head, some cropland must be shifted to pasture and hay production. About 1.7 acres of alfalfa and 5.7 acres of crested wheatgrass are needed for each

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[7] A large number of plans result because as cow numbers increase, labor becomes limited in various periods and beef prices have to be increased to pay added costs of hired labor.

TABLE 11. OPTIMAL FARM PLANS FOR MODEL FARM C WITH WHEAT AT $1.40 AND 1972 WHEAT PROGRAM[a]

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.) 25	26-33	34-38	39-65
Plan		A	B	C	D
Cropland Use					
W-B-FL-F	Acres	400	398	325	305
Alfalfa Hay	Acres	--	2	18	22
Crested Wheat Pasture	Acres	--	--	57	73
Native Hay	Acres	100	100	100	100
Use of Native Pasture					
Full-Season	Acres	399	409	86	--
Deferred	Acres	81	91	414	500
Livestock					
Cow-Winter Calf	Head	36	37	47	49
Labor Use					
Hired	Hours	167	173	206	253
Operator	Hours	1,587	1,613	1,833	1,855
Total	Hours	1,754	1,786	2,039	2,108
Capital Investment					
Short-Term	Dols.	4,366	4,376	4,493	4,525
Intermediate-Term	Dols.	29,620	29,921	30,000	30,021
Grain Sold					
Wheat	Bu.	2,760	2,749	2,243	2,107
Barley	Bu.	2,011	1,973	1,342	1,173
Flax	Bu.	1,060	1,056	861	809
Range in Income	Dols.	8,073	8,302	10,062	11,435
	Dols.	--	9,813	11,150	18,888
Income with Beef Calf Price of:					
$25	Dols.	8,072	8,086	7,616	7,420
$35	Dols.	10,179	10,245	10,334	10,287
$45	Dols.	12,286	12,404	13,052	13,154

[a]These same plans were found to be optimal for $1.60 wheat prices at slightly different beef prices as follows: Plan A optimal for $25 beef, Plan B for beef price of $26-35, Plan C for $36-39, and Plan D for $40-65. With higher wheat prices, the income would be slightly higher.

additional cow after the native hay and pasture is utilized. Hence, a total of 7.4 acres is needed for each additional beef cow.

All of the plans in Table 11 give approximately the same income for a given beef calf price. At $35 beef prices the difference in income between any of the plans presented is only $155. When cropland has to be shifted to hay and pasture, the income gains from livestock are about offset by losses from grain production, at least as long as beef prices are below $40.

With wheat at $2, the cropping system is changed to W-F, W-W-F, or W-W-FL-F to increase wheat production at the expense of barley and flax production (Table 12). The beef system remains about the same. The first 37 cows are supported by the native hay and pasture.[8] Above 37 cows, all additional hay and pasture must come from cropland. A beef price of $41 is needed to encourage expansion beyond 37 cows when wheat is at $2 compared to $36 with $1.60 wheat and $34 with $1.40.

With $2 wheat, barley production is discouraged; and, hence, no calves are wintered below a beef price of $27.

Plan E with 37 cows is optimal for $35-40 beef calf prices and produces almost as much income as Plan G with $45 beef prices. In Table 12 several plans are shown to produce more income than Plan A with $25 beef although Plan A is said to be optimal at a $25 beef price. The apparent contradiction can be explained by the fact that these other plans require more capital. Capital had to pay an interest charge in obtaining an optimum plan, but the interest charge has not been deducted from the income figures reported. Hence, for the resources used, Plan A gives best results. Overall, Plan E would be a fairly good plan for beef prices ranging from $25 to $45.

Comparisons of Model Farms

Figure 3 shows the difference in cow numbers for the three model farms studied at $2 wheat and various beef prices. As a quick review, Model Farm A had 818 acres of cropland and 500 acres native grass. Model B had the same acreage of cropland, but 300 acres less native grass; while Model C had 400 acres of cropland and 600 acres of native grass.

The number of cows on Farm B is less than on Farm A at all beef price levels due to the much smaller supply of native pasture.

At low beef prices Model Farm C had the most cows because it had more native pasture; but after 36 cows are provided for by the native pasture, further expansion would require substantially higher beef prices. Farm A, on the other hand, had more crop aftermath pasture available and could allow expansion of cow numbers at a lower cost.

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[8]The need for pasture in late fall, which is provided primarily by crop aftermath, causes some shifting in crop production between 22 and 37 cows.

TABLE 12. OPTIMAL FARM PLANS FOR MODEL FARM C WITH WHEAT AT $2.00 AND 1972 WHEAT PROGRAMS

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.)						
		25	26	27	28-34	35-40	41-44	45-65
Plan		A	B	C	D	E	F	G
Cropland Use								
W-F	Acres	387	380	254	15	--	--	--
W-W-F	Acres	--	--	--	231	--	--	--
W-W-FL-F	Acres	--	--	--	--	241	164	143
W-B-FL-F	Acres	13	20	146	154	158	161	162
Alfalfa Hay	Acres	--	--	--	--	1	18	22
Crested Wheat Pasture	Acres	--	--	--	--	--	57	73
Native Hay	Acres	50	75	95	100	100	100	100
Use of Native Pasture								
Full-Season	Acres	240	361	377	398	409	86	--
Deferred	Acres	26	139	123	102	91	414	500
Livestock								
Cow-Calf	Head	22	33	--	--	--	--	--
Cow-Winter Calf	Head	--	--	34	36	37	47	49
Labor Use								
Hired	Hours	72	151	159	200	173	206	253
Operator	Hours	953	1,154	1,510	1,552	1,613	1,833	1,855
Total	Hours	1,025	1,305	1,669	1,752	1,786	2,039	2,108
Capital Investment								
Short-Term	Dols.	2,969	3,201	3,684	4,334	4,404	4,512	4,541
Intermediate-Term	Dols.	20,858	25,279	27,442	30,000	30,053	30,090	30,100
Grain Sold								
Wheat	Bu.	5,428	5,328	4,511	4,979	3,989	3,086	2,844
Flax	Bu.	35	53	387	409	1,056	861	809
Range in Income	Dols.	8,957	9,318	9,640	10,003	11,487	12,818	13,908
	Dols.	--	--	--	11,264	12,566	13,634	19,642
Income with Beef Calf Price of:								
$25	Dols.	8,957	9,186	9,242	9,373	9,328	8,470	8,174
$35	Dols.	9,833	10,503	11,233	11,474	11,487	11,188	11,041
$45	Dols.	10,709	11,820	13,224	13,575	13,646	13,906	13,908

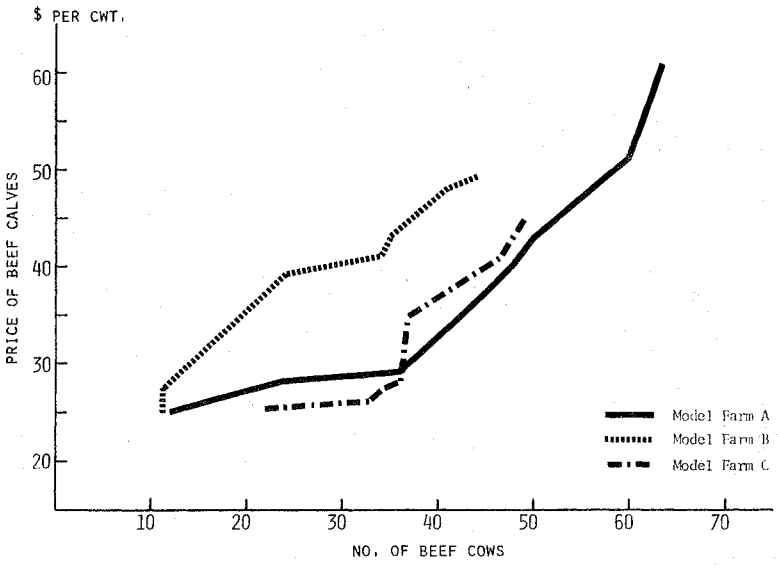

Figure 3. Beef Cow Numbers as Affected by Beef Calf Prices for Three Model Farms with $2.00 Per Bushel Wheat and the 1972 Wheat Program

These results indicate the complementary nature of crops and livestock production. The amount of native grass and hayland available determines to a large extent the size of the beef herd; but cropland contributes considerably to the beef herd through crop aftermath pasture, through the crested wheatgrass and alfalfa pasture, and in providing the needed feed grains.

In this comparison note that Farm A has the highest ratio of cropland to noncropland. This is also the farm that can expand beef production the most at high beef prices.

Wheat-Beef Break-Even Price Ratios

Although the relative profitability of beef versus wheat was found to differ slightly on the three model farms, there was a lot of similarity. Figure 4 depicts a projection of the break-even ratio of prices of beef and wheat for average farms in the study area. This figure applies to situations representing no government production controls or incentive programs. Along the line in Figure 4, returns to cropland are about the same whether cropland is used for wheat or for pasture for a beef enterprise consisting of cows and wintering calves.

Three points have been drawn on Figure 4 representing the North Dakota state average prices received for wheat and beef calves in the years 1969, 1972, and 1973. In 1969 the average cash wheat price (no certificate values included) was $1.35 per bushel and the average price of beef calves was $32.80. This point is close to the break-even line indicating that profits from beef or wheat were very similar with only a slight edge for beef. Actually the value of wheat certificates in 1969 would have moved the point up to the other side of the line and favored wheat production. In 1972 wheat returned $1.79 per bushel and beef calves were $46.70. If these prices prevailed, over time producers would be better off to shift out of wheat and into grass production for beef. However, in 1973 these same prices were $4.80 for wheat and $60.10

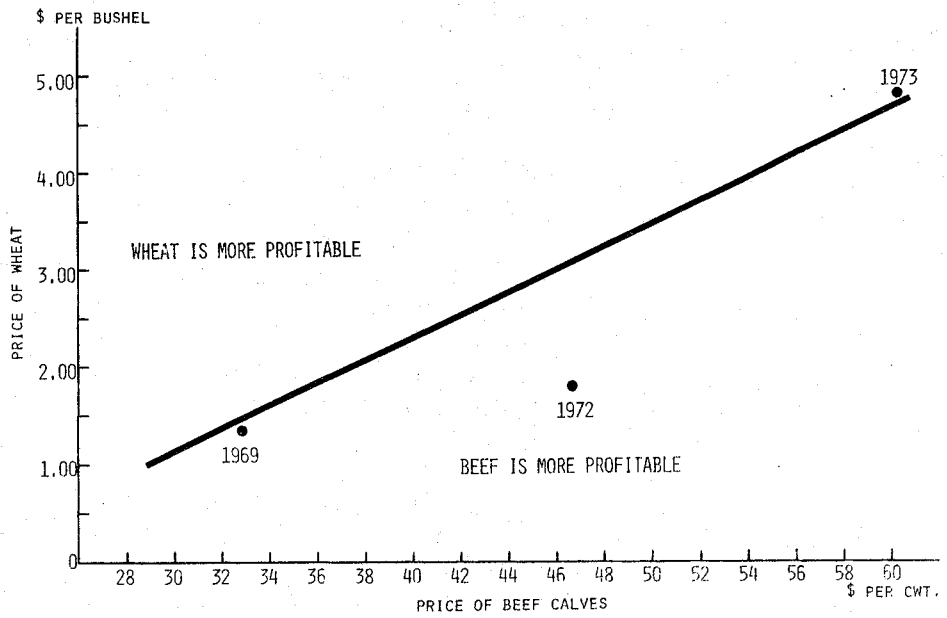

Figure 4. Long-Run Break-Even Ratio in Profitability of Production of Wheat Versus Beef

for beef calves giving a point just on the "wheat side" of the break-even line. It is obvious that these prices must be expected to prevail over a fairly long period before they will cause production shifts.

Results with Land Retirement Programs

High beef prices in 1972-73 did at least two things, they increased farmers' interests in expanding beef production and they also brought pressure from consumers to change government production control programs to encourage more beef production. An example of this was the option to graze set-aside land during the 1973 crop year. In previous years grazing was not permitted on set-aside land during the five principal growing months. Under the 1973 grazing option producers that grazed set-aside land were required to take a 30 percent reduction in their set-aside payment.

The 1973 grazing option was examined in this study, but it gave too low a return to be included in any optimal plan. This occurred for several reasons. In this study the yield of wheat after fallow was assumed to be 27.6 bushels compared to 19.3 after crop. This is an 8.3 bushel difference, which at $1.40 per bushel is $11.62. Production on fallow also requires less nitrogen fertilizer. Hence, profits of over $12.00 per acre are foregone if set-aside land is used for grazing instead of being summer fallowed. In addition, with a one-year grazing program, only annual crops, such as small grains or sudan grass, could be utilized on the set-aside land. The seeding and fertilizer costs of sudan grass are estimated to be about $12.50 per acre. Hence, the value of 1.9 AUM's of grazing from an acre of sudan grass would have to be worth the $12.50 per acre costs plus profits foregone of at least $12.00 or a total of at least $24.50 before it could compete with wheat. This amounts to almost $13.00 per AUM of grazing.

Permanent Land Retirement--To further explore the effect of government programs on beef production, a permanent land retirement program was devised with and without options for grazing and hay harvest. This program was similar to the old soil bank program in that land was assumed to be retired from all crop production for a number of years. This differs considerably from set-aside features of recent years in that in the set-aside program fallow land was considered eligible for set-aside payments, although it is still a part of the normal cropping rotation and would be available for crop production the following year. In the land retirement program proposed here, this acreage is assumed to be somewhat permanently retired from the cropping program.

With a grazing option, this retired land was assumed available for alfalfa and crested wheatgrass rotations for grazing or hay production.

Land Retirement Without Grazing Options--A land retirement program without grazing options can be analyzed by examining the results obtained earlier. Land retirement would be a profitable option to a producer only if the payment rate is high enough to give a return to land that is competitive with what he would get from crop production. The linear programming routine produces estimates of the value of additional units of any limiting resources. Hence, we have taken the results reported in Tables 4, 6, and 7 for Model Farm A to develop Figure 5. Here we have plotted the return to land as influenced by the price of beef and the price of wheat.

With beef prices below $35-38, the return to land is strictly a function of returns from crop production. At $1.40 wheat, land gave a return of about $5.10 per acre per year on Model Farm A. At $1.60 wheat, the annual return to land is about $6.50 per acre; and at $2.00 wheat, the land return is about $10.80 per acre.

When beef prices reach the $35-38 level, beef production begins to compete with crop production, but labor supplies are limited. Adding land would not increase profits unless additional labor is also available. Hence,

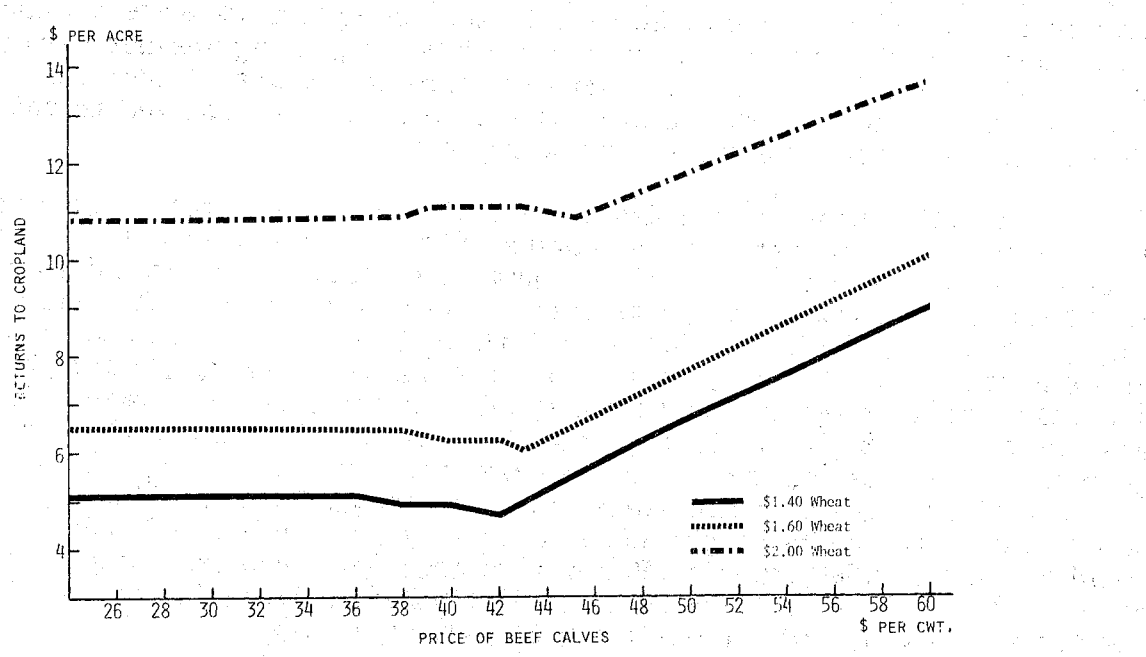

Figure 5. Returns to Land as Affected by Beef Calf Prices and Wheat Prices on Model Farm A

the return to land actually decreases slightly. When beef prices reach $42-45, returns from beef are high enough to pay to hire additional labor; and, hence, land is shifted to livestock uses. As beef prices continue to rise, the return to land would continue to rise. With $1.60 wheat and $50 beef, for instance, the annual return to cropland would be about $7.70 per acre.

One can understand that a farmer would not put land into a land retirement program unless the payment rates were equal to or greater than what he could get from farming. From Figure 5 we can see that the minimum payment necessary to interest a farmer in a land retirement program depends upon what prices he expects for both wheat and beef. The same would be true for other prices. If we had varied the price of barley or flax, similar curves could be estimated. Thus, with a land retirement payment of $7.50 per acre and no grazing option, farmers would likely consider land retirement only if the expected wheat price was below about $1.65 and beef prices below $49.00.

Hence, Figure 5 depicts the minimum prices needed to retire a farmer in land retirement under a land-return program with no grazing option.

These are break-even situations so the retirement program would have to offer higher payments to provide any incentive to retire land. The amount of added incentive needed would vary with the individual farmer.

Land Retirement With Grazing Options--Optimal farm plans were developed for Model Farm A with options to use retired land for grazing and hay production.

Plans were developed for the following price combinations:

A. $1.40 wheat and $5.00 per acre land retirement payments.
B. $1.40 wheat and $7.50 per acre land retirement payments.
C. $1.60 wheat and $7.50 per acre land retirement payments.
D. $2.00 wheat and $5.00 per acre land retirement payments.
E. $2.00 wheat and $10.00 per acre land retirement payments.

Tables presenting these optimal plans can be found in the Appendix.

$1.40 Wheat and $5.00 Per Acre Land Retirement Payments (Combination A)--At this price combination it is more profitable to grow wheat than to retire land. As beef prices are increased from $25 up to $65, wheat production is gradually reduced in favor of land retirement with the retired land being used to produce hay and pasture for beef production. At the 56-cow level, land retirement interferes with grain production needed for the livestock enterprise. Hence, to go beyond 56 head, land retirement actually has to be reduced in order to provide the feed grain needed for wintering the calves.

$1.40 Wheat and $7.50 Per Acre Land Retirement Payments (Combination B)--Land retirement is more profitable than wheat production at this price combination. Much of the retired land is left idle and not used for grazing; hence, as beef prices are increased and cow numbers increase, land must be taken out of retirement and again put into pasture and hay and into grain production needed for wintering calves.

$1.60 Wheat and $7.50 Per Acre Land Retirement Payments (Combination C)--At these prices land retirement is at about a break-even situation with wheat production. About half of the land is used for crop production and about half for land retirement--a part of which is used for producing hay and pasture for cattle. As calf prices are increased, crop production actually has to increase with a reduction in land retirement in order to provide the feed grains needed for the wintering operation.

$2.00 Wheat and $5.00 Per Acre Land Retirement Payments (Combination D)--At this price combination, land retirement is not attractive. The bulk of the land is used for crop production at the low beef prices. As beef prices are raised, the only land put into retirement is what is needed to produce the hay and pasture for the beef enterprise.

$2.00 Wheat and $10.00 Per Acre Land Retirement Payments (Combination E)--This price combination produced results similar to Combination D except that the higher retirement payments encouraged more beef production at lower beef prices.

With all of the above price combinations, it is interesting to note that when the herd size reaches 62 cows, approximately the same farm plan is called for regardless of the price of wheat or the land retirement payment. This, of course, is due to the physical production possibilities on the farm studied. Sixty-two cows require a certain amount of pasture and feed grains, which require a certain acreage or cropland use and pasture use.

Effects of Land Retirement on Beef Production--Figure 6 gives a picture of the effects of land retirement options on beef production. Here we have graphed the results for Model Farm A for $1.60 wheat prices.

Under these price conditions the land retirement program with no grazing option gives almost the same results as with no land retirement program until we reach a level of 52 cows. At that point, we are short of late summer pasture and would have to add some sudan grass. If land is being retired, it competes with sudan grass for the use of cropland. Hence, the retirement payment must be offset by a higher beef price. Hence, above 52 cows, a higher beef price ($45) is needed for further expansion.

With land retirement and with a grazing option, cow numbers are greater than without land retirement at any given beef price until we get up to 57 cows. At the 57-cow level we have 242 acres of land in retirement, all of it being used for alfalfa hay and pasture and crested wheatgrass pasture. But again, cropland must be used for sudan grass to provide late summer pasture for further expansion and the land retirement payment raises the cost of the late summer pasture and, hence, the beef price needed for profitable expansion.

So in the medium-herd sizes (40 to 57 head), the grazing option encourages beef production; and land retirement without grazing discourages beef production. But maximum herd size can be profitably attained best with neither land retirement program. The need for sudan grass and crop aftermath pasture for maximum beef production raises costs with either land retirement option.

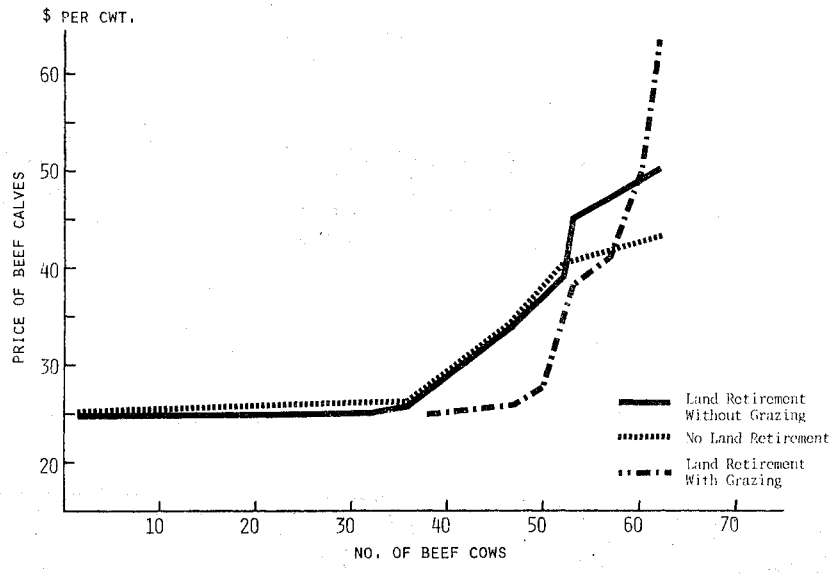

Figure 6. Beef Cow Numbers on Model Farm A as Affected by Beef Calf Prices and Land Retirement Options--$1.60 Wheat and $7.50 Per Acre Land Retirement Program

What would be the effect of higher or lower payment rates for land retirement? Without the grazing option, a higher land retirement payment results in less beef produced or a higher beef price needed to make beef profitable. On the other hand, with the grazing option, a higher land retirement payment results in more beef production or the same production at lower beef prices. The exception is at maximum herd sizes where land retirement would interfere with production of annual pasture necessary for large herds.

In this programming model a limited number of forage supplying enterprises were considered. In practice, perhaps other sources besides sudan grass could be found to provide pasture in August and September, such as more deferment of native grasses, so that retired land could be used for full season grazing.

These results do indicate, however, the relative shortage of late summer grazing capacity and the value of even high cost forage sources. In some of the results since pasture supplies in late summer limited the entire size of the operation, it was found that it would be profitable to pay as much as $15-20 per AUM for pasture during this period.

Reduction in Payments With Grazing Options--The question could also be raised, "If options to graze were offered, what reduction in payment rate would be equitable considering the additional returns possible from grazing?"

A comparison of incomes and production plans for Model Farm A at $1.60 wheat prices are presented in Table 13. Here we compare the results for no land retirement program with results for retirement programs with and without grazing options. Government payments are itemized to show their contribution to total income.

These results include government payments under the 1972 program of $2,022 for wheat certificates and $1,338 as payment for added set-aside. With the land retirement options, no wheat certificate payments are included and,

TABLE 13. COMPARISON OF PRODUCTION PLANS AND INCOME FOR MODEL FARM A AT $1.60 WHEAT, AT THREE BEEF CALF PRICES AND THREE LAND RETIREMENT OPTIONS

Beef Calf Price	Item	No Land Retirement (1972 Program)	Land Retirement Without Grazing Option $7.50 Payment	Land Retirement With Grazing Option $7.50 Payment
$25	No. of Beef Cows	1	32	38
	Bushels of Wheat Produced	5,644	3,237	3,032
	Hours of Labor Used	1,103	1,695	2,030
	Capital Invested (Exc. Land)	$37,198	$34,883	$35,407
	Acres of Cropland Retired	--	336	379
	Government Payment[a]	$ 3,360	$ 2,520	$ 2,843
	Other Income	$ 8,951	$ 6,500	$ 6,543
	Total Cash Income	$12,311	$ 9,020	$ 9,386
$35	No. of Beef Cows	47	47	51
	Bushels of Wheat Produced	5,023	3,064	2,931
	Hours of Labor Used	2,563	2,193	2,337
	Capital Invested (Exc. Land)	$52,229	$39,489	$39,480
	Acres of Cropland Retired	--	284	393
	Government Payment[a]	$ 3,360	$ 2,130	$ 2,947
	Other Income	$11,036	$ 9,090	$ 9,310
	Total Cash Income	$14,396	$11,220	$12,257
$45	No. of Beef Cows	62	53	57
	Bushels of Wheat Produced	4,423	3,268	3,976
	Hours of Labor Used	3,006	2,474	2,755
	Capital Invested (Exc. Land)	$54,834	$43,452	$48,783
	Acres of Cropland Retired	--	213	242
	Government Payment[a]	$ 3,360	$ 1,598	$ 1,815
	Other Income	$14,086	$12,572	$13,654
	Total Cash Income	$17,446	$14,170	$15,469

[a]Includes wheat certificate payments of $2,022 and payments for added set-aside of $1,338.

hence, incomes are considerably lower. If policymakers felt that income support payments are needed, wheat certificate payments could be continued with this land retirement option. In all cases examined the plans include production of at least the domestic wheat allotment acreage.

However, to examine the question of a reduction in payment due to the grazing option, we need to compare only the last two columns in Table 13--those with and without grazing options.

At a beef calf price of $25, the grazing option increases income by only $366 ($9,386 versus $9,020). Acreage in land retirement increases from 336 acres to 379 acres. To make incomes equal under these two options, a reduction in payment of about $1.00 per acre (from $7.50 without grazing to $6.50 with grazing) would equalize income.

At a beef calf price of $35, income is $1,037 higher with the grazing option. Here a reduction in payment of about $2.65 per acre would equalize incomes.

At a beef calf price of $45, the income differential is $1,299. With 242 acres retired, a differential of $5.37 would be needed to equalize income; or payments without grazing would be $7.50 per acre and payments with grazing would be $2.13 per acre.

Such a reduction in payments would make the two sets of plans produce equal income and, presumably, some farmers would choose one and some the other. But if more production of beef is to be encouraged and production of grains is to be discouraged, some added incentive should be indicated. Hence, the reduction in payment should be less than estimated above.

A more serious problem presents itself if one examines these plans in a little more detail. The grazing option causes an increase in beef production, but it also results in use of more labor and more capital. At the $25 beef price, inclusion of the grazing option causes an increase in cow numbers from 32 to 38. Total labor use expands from 1,695 hours to 2,030 hours. Some of this is hired labor for which costs have already been included, but the operator labor input is increased from 1,531 hours to 1,827 hours or an increase of 296 hours. The operator should expect to get extra income for his extra hours of labor. With no reduction in payments for the grazing option, income is increased by only $366. Hence, it is unlikely that the farmer would be willing to work the added 296 hours unless he got the full $366 added income. Thus, if payments were reduced at all due to the grazing option, he might well choose the other plan.

At $35 beef calf prices the comparable situation is that unpaid operator labor is increased by only 53 hours. Hired labor is increased by 91 hours, but this cost has already been paid. Since income increased by $1,037 with only 53 hours additional labor, some reduction in payment seems possible. Instead of reducing payments by $2.65 at this price level as earlier estimated, a reduction of about $2.25 would allow about $3.00 per hour for the added operator labor.

At $45 beef calf prices the plan with the grazing option requires 28 hours more operator labor. Income is $1,299 higher; thus, a considerable reduction in payment is possible.

In conclusion, some reduction in payment due to the grazing option would likely be possible; but the amount of reduction is influenced considerably by the price of beef. At $25 beef prices no reduction is possible, but at $45 beef the payment could be reduced by as much as two-thirds. Understandably, the higher the price of beef the more value would exist in the grazing option and the more reduction possible. Any reduction in payment would, of course, lessen the incentive for producers to use the option and expand beef production.

The best incentive that can be devised to expand beef production is still higher beef prices. The land retirement programs examined would in some respects encourage beef production, assuming this goal is desirable; but maximum herd size was never any greater than what would result from a situation, including no land retirement and higher beef prices. The complementary relationship between beef and grain production indicated that maximum herd size was attainable where the farmer could use his land to his best advantage to make a profit without special land use programs.

Summary and Conclusions

In the south central area of North Dakota most farms have a substantial acreage of land that is not suited for crop production. All optimal plans thus, included some beef cattle--even at a beef calf price as low as $25 per cwt. In almost all cases examined, the most profitable beef enterprise was a system calling for wintering the calves on a grain ration to gain 1 2/3 pounds per day and selling the calves in the spring. Cropland is profitably used to grow hay and pasture for livestock if beef calf prices are high enough. If native pasture is available, hay should be grown on cropland if beef prices are above $26.00 at a $1.40 wheat price and $29.00 at a $2.00 wheat price. To shift cropland to pasture, a beef price of $32.00 is needed when wheat is $1.40 and $39.00 when wheat is $2.00. At such prices, cropland would be profitably used for crested wheatgrass for early spring grazing to allow deferment and, hence, greater output from native pasture.

Fertilization of native pasture was not found to be generally profitable. It was called for only when wheat prices were $2 per bushel and beef calf prices were $39. At lower wheat prices, forage could be obtained cheaper by growing more acres of tame pasture on cropland.

In most situations a small acreage of sudan grass was added to provide late summer pasture when beef calf prices got up to $42-43. Costs per AUM are quite high with this enterprise, but late summer pasture was particularly limiting in many plans.

Maximum herd sizes of 50 to 60 cows per farm required beef calf prices of about $42.00 at $1.40 wheat prices and about $50.00 at $2.00 wheat. At maximum herd sizes labor supplies and late summer and fall pasture both became quite scarce.

The expansion of the beef enterprise with higher beef prices was found to reduce crop production proportionately less than the increase in

beef production. Crops provided much needed fall aftermath pasture and feed grains for the wintering ration. Expansion of livestock allowed use of operator labor during the winter months, which was otherwise unused and also called for considerable expansion in investment. In fact, much of the added income from livestock is due to the added labor input during winter months.

Examination of long-term land retirement options to encourage livestock production reveals that land retirement without grazing options tends to reduce livestock production, while grazing options would increase livestock production to some extent. Maximum herd sizes are hindered by land retirement programs, even with grazing options, since they compete with annual pasture needed for late summer grazing. The best incentive for expansion of beef appears to be high beef prices rather than special land use programs.

Appendix

Optimal Farm Plans for Model Farm A With Land Retirement and Grazing Options

APPENDIX TABLE 1. OPTIMAL FARM PLANS FOR MODEL FARM A WITH LAND RETIREMENT AT $5.00 PER ACRE WITH GRAZING OPTIONS ($1.40 WHEAT)

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.)							
		25-26	27-29	30-31	32-33	34-35	36-45	46-58	59-65
Cropland Use									
W-B-FL-F	Acres	757	684	661	582	469	576	607	641
Alfalfa Hay	Acres	61	80	84	87	89	97	103	64
Alfalfa Pasture	Acres	--	--	--	--	27	92	--	--
Crested Wheat	Acres	--	54	73	75	68	53	88	91
Idle	Acres	--	--	--	74	165	--	--	--
Sudan Grass	Acres	--	--	--	--	--	--	20	22
Land Retirement	Acres	61	134	157	236	349	242	191	155
Native Hay	Acres	--	--	--	--	--	--	--	67
Use of Native Pasture									
Full-Season	Acres	392	108	10	--	--	--	--	--
Deferred	Acres	43	327	425	435	435	435	435	435
Livestock									
Cow-Calf	Head	--	--	6	--	--	--	--	--
Cow-Winter Calf	Head	36	47	44	51	53	57	60	62
Labor Use									
Hired	Hours	479	519	533	604	446	710	872	961
Operator	Hours	1,793	2,006	2,033	2,035	2,014	2,045	2,045	2,045
Total	Hours	2,273	2,526	2,566	2,639	2,460	2,755	2,917	3,006
Capital Investment									
Short-Term	Dols.	7,558	7,691	7,726	6,154	6,154	7,221	7,933	8,275
Intermediate-Term	Dols.	41,157	41,862	42,050	36,056	36,057	41,562	43,950	46,559
Grain Sold									
Wheat	Bu.	5,225	4,721	4,563	4,017	3,238	3,976	4,190	4,423
Barley	Bu.	5,215	4,533	4,504	3,665	2,776	3,743	3,669	3,736
Flax	Bu.	2,007	1,813	1,752	1,543	1,243	1,527	1,609	1,699
Range in Income	Dols.	8,024	8,504	9,323	9,868	10,424	11,090	14,446	19,020
	Dols.	8,232	9,048	9,605	10,164	10,731	14,070	18,648	21,180
Income with Beef Calf Price of:									
$25	Dols.	8,025	7,960	7,913	7,792	7,665	7,448	7,092	6,772
$35	Dols.	10,305	10,678	10,730	10,756	10,731	10,759	10,594	10,374
$45	Dols.	12,378	13,396	13,547	13,720	13,797	14,070	14,096	13,976

APPENDIX TABLE 2. OPTIMAL FARM PLANS FOR MODEL FARM A WITH LAND RETIREMENT OF $7.50 PER ACRE WITH GRAZING OPTIONS ($1.40 WHEAT)

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.)					
		25-31	32-33	34-43	44-46	47-51	52-65
Cropland Use							
W-B-FL-F	Acres	356	392	417	469	576	607
Alfalfa Hay	Acres	80	84	86	89	97	103
Alfalfa Pasture	Acres	--	--	--	27	92	--
Crested Wheat Pasture	Acres	70	72	74	68	53	88
Idle	Acres	312	270	241	165	--	--
Sudan Grass	Acres	--	--	--	--	--	20
Land Retirement	Acres	462	426	401	349	242	191
Use of Native Pasture							
Deferred	Acres	435	435	435	435	435	435
Livestock							
Cow-Calf	Head	1	--	--	--	--	--
Cow-Winter Calf	Head	46	49	51	53	57	60
Labor Use							
Hired	Hours	226	289	335	446	710	872
Operator	Hours	1,891	1,949	1,978	2,014	2,045	2,045
Total	Hours	2,117	2,238	2,313	2,460	2,755	2,917
Capital Investment							
Short-Term	Dols.	4,964	5,358	5,624	6,154	7,221	7,933
Intermediate-Term	Dols.	30,000	31,987	33,330	36,057	41,562	43,950
Grain Sold							
Wheat	Bu.	2,454	2,703	2,807	3,238	3,976	4,190
Barley	Bu.	1,921	2,141	2,317	2,776	3,743	3,669
Flax	Bu.	942	1,038	1,104	1,243	1,527	1,609
Range in Income	Dols.	8,852	10,972	11,377	14,361	15,336	17,025
	Dols.	10,493	11,079	14,023	14,975	16,660	21,575
Income with Beef Calf Price of:							
$25	Dols.	8,852	8,786	8,731	8,528	8,054	7,575
$35	Dols.	11,589	11,653	11,671	11,598	11,364	11,075
$45	Dols.	14,326	14,520	14,611	14,668	14,674	14,575

APPENDIX TABLE 3. OPTIMAL PLANS FOR MODEL FARM A WITH LAND RETIREMENT AT $7.50 PER ACRE WITH GRAZING OPTIONS ($1.60 WHEAT)

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.)							
		25	26-27	28-31	32-37	38-40	41-49	40-62	63-65
Cropland Use									
W-B-FL-F	Acres	439	430	417	425	469	576	607	641
Alfalfa Hay	Acres	65	79	84	87	89	97	103	64
Alfalfa Pasture	Acres	--	--	--	--	27	92	--	--
Crested Wheat Past.	Acres	12	54	74	74	68	53	88	91
Idle	Acres	302	255	243	232	165	--	--	--
Sudan Grass	Acres	--	--	--	--	--	--	20	22
Land Retirement	Acres	379	388	401	393	349	242	191	155
Native Hay	Acres	--	--	--	--	--	--	--	67
Use of Native Pasture									
Full-Season	Acres	326	108	--	--	--	--	--	--
Deferred	Acres	109	327	435	435	435	435	435	435
Livestock									
Cow-Calf	Head	--	--	7	--	--	--	--	--
Cow-Winter Calf	Head	38	47	44	51	53	57	60	62
Labor Use									
Hired	Hours	203	258	279	353	446	710	872	961
Operator	Hours	1,827	1,934	1,973	1,984	2,014	2,045	2,045	2,045
Total	Hours	2,030	2,192	2,252	2,337	2,460	2,755	2,917	3,006
Capital Investment									
Short-Term	Dols.	4,951	5,459	5,600	5,711	6,154	7,221	7,933	8,375
Intermediate-Term	Dols.	30,456	32,669	33,207	33,769	36,057	41,562	43,950	46,559
Grain Sold									
Wheat	Bu.	3,032	2,964	2,878	2,931	3,238	3,976	4,190	4,423
Barley	Bu.	2,590	2,446	2,512	2,375	2,776	3,743	3,669	3,736
Flax	Bu.	1,164	1,139	1,105	1,125	1,243	1,527	1,609	1,699
Range in Income	Dols.	9,386	9,673	10,229	11,369	13,169	14,145	17,162	21,733
	Dols.	--	9,945	11,075	12,849	13,783	16,793	21,364	22,453
Income with Beef Calf Price of:									
$25	Dols.	9,386	9,401	9,383	9,297	9,178	8,849	8,412	8,045
$35	Dols.	11,609	12,121	12,303	12,257	12,248	12,519	11,912	11,647
$45	Dols.	13,832	14,841	15,023	15,217	15,318	15,469	15,412	15,249

APPENDIX TABLE 4. OPTIMAL PLANS FOR MODEL FARM A WITH LAND RETIREMENT AT $5.00 PER ACRE WITH GRAZING OPTIONS ($2.00 WHEAT)

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.)								
		25-26	27-32	33-39	40-43	44-46	47-50	51-53	54-60	61-65
Cropland Use										
W-F	Acres	812	666	613	577	560	510	--	--	--
W-B-F	Acres	6	91	115	118	123	--	--	--	--
W-W-F	Acres	--	--	--	--	--	--	473	277	--
W-W-FL-F	Acres	--	--	--	--	--	--	--	189	456
W-B-FL-F	Acres	--	--	--	--	--	167	180	182	185
Alfalfa Hay	Acres	--	61	38	47	51	53	61	62	64
Crested Wheat Past.	Acres	--	--	52	76	79	81	88	89	91
Sudan Grass	Acres	--	--	--	--	5	7	17	19	22
Land Retirement	Acres	--	61	90	123	130	134	148	151	155
Native Hay	Acres	28	--	67	67	67	67	67	67	67
Use of Native Pasture										
Full-Season	Acres	136	392	126	--	--	--	--	--	--
Deferred	Acres	15	43	309	435	435	435	435	435	435
Livestock										
Cow-Calf	Head	12	--	--	--	--	--	--	--	--
Cow-Winter Calf	Head	--	36	47	52	54	55	60	61	62
Labor Use										
Hired	Hours	306	472	550	642	705	730	914	922	961
Operator	Hours	991	1,687	1,955	2,001	2,008	2,025	2,026	2,045	2,045
Total	Hours	1,297	2,159	2,505	2,643	2,713	2,755	2,940	2,967	3,006
Capital Investment										
Short-Term	Dols.	5,382	5,879	6,455	6,603	6,691	6,859	8,245	8,280	8,328
Intermediate-Term	Dols.	30,000	37,784	41,208	41,723	42,269	42,466	47,148	47,008	46,809
Grain Sold										
Wheat	Bu.	11,262	10,031	9,515	9,052	8,866	8,188	8,829	7,977	6,769
Flax	Bu.	--	--	--	--	--	444	476	982	1,699
Range in Income	Dols.	12,383	12,551	13,836	15,820	17,027	17,976	19,328	20,375	22,855
	Dols.	12,433	13,588	15,468	16,720	17,655	18,939	20,024	22,493	24,295
Income with Beef Calf Price of:										
$25	Dols.	12,383	12,136	11,662	11,312	11,069	10,920	10,280	10,138	9,895
$35	Dols.	12,381	14,209	14,380	14,316	14,205	14,127	13,760	13,668	13,495
$45	Dols.	13,379	16,282	17,098	17,320	17,341	17,334	17,240	17,198	17,095

APPENDIX TABLE 5. OPTIMAL PLANS FOR MODEL FARM A WITH LAND RETIREMENT AT $10.00 PER ACRE WITH GRAZING OPTIONS ($2.00 WHEAT)

Enterprise or Resource	Units	Beef Calf Price ($ Per Cwt.) 25-26	27	28	29-34	35-40	41-46	47-50	51-57	58-61	62-65
Cropland Use											
W-F	Acres	768	666	587	578	553	503	--	--	--	--
W-W-F	Acres	--	--	--	--	--	--	471	164	--	--
W-B-F	Acres	--	91	98	82	100	--	--	--	--	--
W-W-FL-F	Acres	--	--	--	--	--	--	--	290	447	456
W-B-FL-F	Acres	--	--	--	--	--	131	123	158	160	185
Alfalfa Hay	Acres	50	61	79	84	87	90	95	101	103	64
Alfalfa Pasture	Acres	--	--	--	--	4	25	71	--	--	--
Crested Pasture	Acres	--	--	54	74	74	69	58	87	88	91
Sudan Grass	Acres	--	--	--	--	--	--	--	18	20	22
Land Retirement	Acres	50	61	133	158	165	184	224	188	191	155
Native Hay	Acres	--	--	--	--	--	--	--	--	--	67
Use of Native Pasture											
Full-Season	Acres	387	392	108	--	--	--	--	--	--	--
Deferred	Acres	48	43	327	435	435	435	435	435	435	435
Livestock											
Cow-Calf	Head	34	--	--	7	--	--	--	--	--	--
Cow-Winter Calf	Head	1	36	47	44	51	53	56	59	60	62
Labor Use											
Hired	Hours	468	472	514	529	596	610	723	849	872	961
Operator	Hours	1,360	1,687	1,955	1,988	1,996	1,998	2,002	2,045	2,045	2,045
Total	Hours	1,828	2,159	2,469	2,517	2,592	2,608	2,725	2,894	2,917	3,006
Capital Investment											
Short-Term	Dols.	5,567	5,879	6,212	6,273	6,324	6,338	7,353	7,957	7,986	8,328
Intermediate-Term	Dols.	36,424	37,784	38,947	39,102	39,380	39,250	42,690	44,314	44,196	46,809
Grain Sold											
Wheat	Bu.	10,595	10,031	8,989	8,712	8,545	7,849	8,420	7,207	6,494	6,769
Flax	Bu.	--	--	--	--	--	347	327	1,186	1,609	1,699
Range in Income	Dols.	12,499	12,854	13,126	13,407	15,117	16,931	18,820	20,144	22,570	23,990
	Dols.	12,642	--	--	14,822	16,607	18,461	19,789	22,220	23,620	25,070
Income with Beef Calf Price of:											
$25	Dols	12,499	12,440	12,310	12,277	12,138	12,037	11,710	11,148	11,014	10,666
$35	Dols.	13,931	14,513	15,028	15,105	15,117	15,096	14,942	14,608	14,516	14,267
$45	Dols.	15,363	16,586	17,774	17,933	18,096	18,155	18,174	18,068	18,018	17,868