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Agricultural Economics Miscellaneous Report No. 110 September 1987

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Benefits of Irrigation in Mitigating the Impacts of Drought in a Range Livestock Economy

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Preface

A sequential multiyear linear programing model is used to examine the economic benefits of irrigation on a case study ranch in southeastern South Dakota. This report presents the findings of the study and demonstrates a method by which the impacts of other irrigation projects can be evaluated. Financial support for this study was provided by the Bureau of Reclamation, U.S. Department of Interior.

The authors wish to thank George H. Pfeiffer, Department of Agricultural Economics, University of Nebraska for the use of MPS-PC linear programming software; Sam Kennedy and George St. George, Bureau of Reclamation for providing data and helpful suggestions; William C. Nelson, F. Larry Leistritz, Brenda L. Ekstrom, and Duane L. Dodds for providing useful comments on prior drafts of this report; and Shelly Swandal and Carol Jensen for typing the manuscript.

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Highlights

The benefits of irrigation are primarily considered to be of importance in the year applied. In ranch operations, drought can result in forage shortages that require the liquidation of the breeding herd. Liquidation is often at depressed prices and replacement may be during elevated prices. In this study, 31 years (1955-1985) of two ranch operations in the Lake Andes-Wagner irrigation unit, southeastern South Dakota, are simulated for both irrigated and dryland situations. The Bureau of Reclamation plan would supply water to 45,000 acres, most of which is currently in cropland. The main objective of the study is to determine the impacts of irrigation on herd size and ranch income over the 31-year period.

The difference in benefits between a dynamic model and a static model is illustrated for the model ranches. For the static analysis, a one-year model using the 31-year average yields, levels of production, and prices was run for the irrigated and nonirrigated situation. Differences between the irrigated and nonirrigated return above variable costs are the static model's benefits of irrigation. The same comparison was made using a dynamic model. Fixed irrigation costs are unchanged between the static and dynamic model. The dynamic model calculates return above variable costs for each of 31 years, so results for both dryland and irrigation were divided by 31 to get average benefits of irrigation over the period. Comparing irrigation benefits from the one-year model with the dynamic model illustrated the difference between approaches.

The study used a sequential multiyear maximizing linear programming model to trace the effect of drought cycles and irrigation benefits on ranch profitability. Separate models were developed for dryland and irrigation situations. Each model maximizes expected returns for two decision periods per year.

Results depended upon the resource endowments of the ranches modeled. Ranch model I, representing the Lakes Andes-Wagner Unit average, had pasture for 60 to 70 beef cows and 730 tillable acres of which 220 were irrigated. The increased returns above variable costs from irrigation were $59,341 annually from the static model and $57,926 from the dynamic model. Reasons for the small difference in irrigation benefits are: (1) the beef enterprise was overshadowed by crops, (2) crop aftermath was available in years of low pasture yields, and (3) herd reduction and repurchases occurred during years of depressed beef profitability.

Ranch model II, representing a more specialized beef ranch, had pasture for 140 to 160 cows with 480 tillable acres of which 145 were irrigated. The increased return above variable costs from irrigation were $36,516 annually for the static model and $39,830 from the dynamic model. Reasons for the dynamic model's larger increase in irrigation benefits are: (1) larger average size of herd, (2) fewer cows sold and repurchased, and (3) less expensive forage.

Benefits of Irrigation in Mitigating the Impacts of Drought in a Range Livestock Economy

Johnson, Watt, Ali, and Schluntz*

The main objective of this research effort is to show how management strategies are altered by irrigated production of feed in an area where livestock are traditionally raised on range forage and hay is grown under dryland conditions subject to periodic drought. Although the hypothesis would apply to both public and private irrigation development, the objective of this particular effort is to evaluate the impacts of public development. Specifically, the research demonstrates the additional NED (National Economic Development) benefits to irrigation above those available under the "Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies" (U.S. Water Resources Council). NED benefits are the increases in net value of the national output of goods and services, expressed in monetary units. These guidelines are intended to ensure proper and consistent planning by federal agencies in the formulation and evaluation of projects.

The analysis examines factors that are not usually considered in the typical static farm budget analysis used in evaluating NED benefits. For example, drought adversely affects livestock producers by forcing them to market productive cows as slaughter animals at low prices and to purchase high priced replacement cattle to rebuild herds. A dynamic model is needed to capture the effect of drought cycles on ranch organization and profitability over time. The nature of droughts in the western United States requires a model that covers at least 30 years.

The working hypothesis is that the calculated benefits of irrigation of a western beef cow ranch are understated by comparing average net returns with and without irrigation. A model which includes changes in ranch organization due to droughts will more accurately measure the total benefits of irrigation over time. The higher benefits are due to more optimum use of forage and increased efficiency in the operation of the beef cow herd. Increased year-to-year income stability is another benefit demonstrated in the dynamic model but not explicitly included in added benefits.

The specific irrigation benefits to a beef cow ranch that are hypothesized to be better captured in a dynamic model than in a static model are as follows:

1. A longer cow life because disposal of productive cows due to drought can be reduced or eliminated.

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2. Fewer purchases of replacement animals, because with a stable herd size all replacements are raised. This assumes that raised replacements are less expensive than purchased ones because labor and facilities for replacement stock exist on the ranch.

3. Replacements purchased to rebuild herd after drought are at higher prices than were received for cows sold early because of drought.

4. More beef sold at higher prices (or less at lower prices) to the extent herd liquidation due to drought is widespread enough to influence market prices.

5. Greater use of labor and facilities by eliminating herd reduction because of drought.

6. A larger percentage of calves backgrounded and/or finished because adequate forage is available every year.

7. Fewer purchases of hay at higher than average prices and fewer sales of hay at below average prices.

8. Reduced loss of hay due to deterioration in storage from high-yield years to low-yield years. This occurs because dryland ranches put up and store hay for more than one year as a precaution against drought.

9. Less switching among forage sources, such as corn silage and supplementing pasture with hay, that results in more costly rations in drought years.

10. A higher pasture stocking rate because under dryland conditions a winter forage shortage results in fewer cows on pasture the following spring and summer.

11. More optimum use of crop aftermath because herd size remains more constant from year to year.

Description of Area

The project area is located in southeastern South Dakota in Charles Mix County (Figure 1). The Lake Andes-Wagner Unit lies on an upland plain bounded by Choteau Creek on the east, by Lake Andes (a natural lake) on the west and northwest, and by the lower slopes of a high ridge on the southwest and south. The elevation of the lowest portion of the natural Lake Andes is about 1,427 feet. The streambed of Choteau Creek at the southern end of the unit is approximately at elevation 1,362.

The Missouri River is the area's major source of surface water. The river is impounded by Fort Randall Dam approximately 12 miles south of Lake Andes. Lake Andes covers about 4,100 acres. Because of past drought conditions, siltation, and an outlet ditch, the lake is currently no more than a large marsh. The only other source of surface water of any significance in

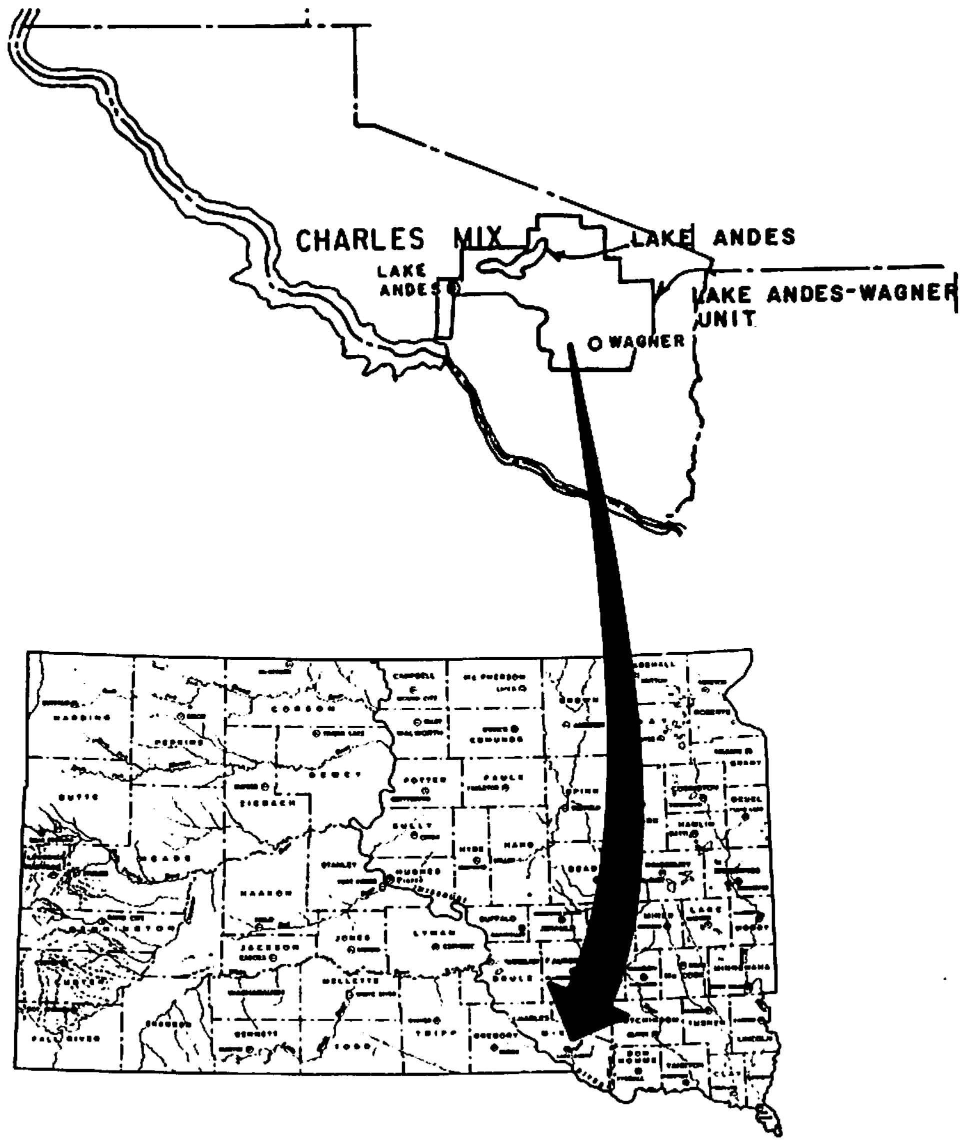

Figure 1. Study Area, Charles Mix County, South Dakota

the area is Choteau Creek. The Lake Andes-Wagner Unit is largely underlain by the Choteau Aquifer. This aquifer contains over 2,000,000 acre-feet of water.

The climate can be described as midcontinental, semiarid to dry-subhumid, characterized by four distinct seasons and frequent daily fluctuations in the weather. Average annual temperature is about 48° F., with extreme temperatures of over 100° F. occasionally in the summer and below zero during the winter. Annual average precipitation is 20 inches. On the average, 70 to 80 percent of the precipitation occurs from April through September.

Lake Andes-Wagner Unit lies on a glacial till plain formed over a buried preglacial valley. The stone-free silty surface soils suggest that the glacial drift was covered by 1 to 2 feet of loess (wind deposited soil). Silt loam is the dominant texture of surface soils, while subsoils below 14 to 20 inches vary from loam to silty clay loam. Slight depressional areas, which are sometimes nonarable, usually have finer textured subsoils. Subsoils are usually slight to moderately saline. Under irrigation with adequate drainage, the salts would move out of these saline soils into the drainage water without any detriment to the soils or the crops. The topography of the area is smooth but irregular, with a gentle overall gradient toward Choteau Creek or Lake Andes. The surface is mildly undulating with low humps, shallow drainways, and a complexity of slopes. This topography is generally favorable for irrigation.

The area's present land use is a mixture of row crops, alfalfa, small grains, and native and tame grasses. The project area contains about 76,600 acres of cropland, 1,580 acres of wetlands, 17,030 acres of grasslands, and 1,560 acres of woodlands (primarily multirow shelterbelts). Native vegetation consists primarily of tall and short grass types except in the extensive wetland areas, such as around Lake Andes. Originally there was little native woody cover except along the Missouri River, but numerous shelterbelts have been established since the 1930s.

Under the preferred plan, water would be supplied to 45,000 acres. Isolated parcels and undrainable lands would not be served. About 220 acres of woodland, 650 acres of wetlands, and 4,290 acres of grasslands would be changed to irrigated cropland. Most of the irrigable lands in the project area are identified as prime farmland.

The population in Charles Mix County has declined since 1940 with a modest upward trend in the last decade (beginning in 1970). The major service centers are Lake Andes (population - 1,136) and Wagner (population - 1,665). Native Americans of the Yankton Sioux Tribe comprise about 20 percent of Charles Mix County's population.

Model Ranches

Two model ranches were developed to demonstrate the model under different resource situations. Model I represents the average size and cropland-rangeland mix for the Lake Andes-Wagner Irrigation Unit. Model II represents a more specialized beef-cow ranch with only supplemental cash cropping. The second model ranch was developed to test the usefulness of the programming model for ranch situations more typical in the western United States than the Lake Andes-Wagner average.

Model ranch I had 880 acres, which represents the expected size in the study area by 1995 (U.S. Deptartment of Interior). Dryland and irrigated land use is summarized in Table 1. Labor supply consisted of 2,500 hours by the ranch operator, which was equally divided between the summer and winter period. Additional hired labor was available at $4.50 per hour.

The beef cow herd consisted of a maximum of 60 cows for dryland and 70 cows with irrigation. These limits were based on the carrying capacity of the pasture and aftermath grazing.[1] Under irrigation some supplemental feeding of hay on pasture would be required in most years. A 92 percent calf crop was assumed. Cow culling rate was 16 percent. Calves could be sold at weaning at 425 lbs. for steers and 375 lbs. for heifers or could be backgrounded for 150

TABLE 1. LAND USE FOR DRYLAND AND IRRIGATION MODEL RANCH I and II, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA

Land Use	Model Ranch I		Model Ranch II	
	Dryland	Irrigated	Dryland	Irrigated
	acres			
Rangeland pasture	123.0	123.0	493.0	493.0
Farmstead and waste	27.0	27.0	27.0	27.0
Total nontillable	150.0	150.0	520.0	520.0
Dryland alfalfa	50.0	50.0	120.0	65.0
Dryland tame pasture	75.0	75.0	50.0	50.0
Other dryland crops[a]	605.4	385.4	310.0	220.0
Total dryland tillable	730.4	510.4	480.0	335.0
Irrigated alfalfa	0.0	26.0	0.0	60.0
Other irrigated crops[b]	0.0	194.0	0.0	85.0
Total irrigated	0.0	220.0	0.0	145.0
Total land in ranch	880.4	880.4	1000.0	1000.0

[a]Corn, sorghum, wheat, and oats.
[b]Corn, soybeans, and potatoes.

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[1]The economic assessment for the Lake Andes-Wagner Unit (U.S. Department of Interior) assumed an 80-cow herd size based on pasture, crop aftermath, and hay production. This necessitated the feeding of hay during the pasture season in normal years, a situation not deemed appropriate for this study.

days and sold as yearlings at 650 lbs. for steers and 600 lbs. for heifers. Under irrigation, the option of feeding the cattle out to market weight was also available.

Model ranch II had 973 acres nearly equally divided between rangeland and cropland. Dryland and irrigated land use is summarized in Table 1. Labor supply was the same as in Model I.

The beef cow herd consisted of a maximum of 140 cows for dryland and 163 cows with irrigation. These limits were based on the average carrying capacity of the pasture and aftermath grazing. As with Model I, some supplemental feeding of hay on pasture would be required most years under irrigation. The performance of the beef herd is identical to the Model I ranch.

Theory and Methods

The benefits of irrigation on farm and ranch income are normally modeled by comparing average net returns to a typical farm with and without irrigation. Depending upon the purpose of the analysis and the irrigation project involved, a point in time is selected to make the comparison based upon projected yields and normalized costs and prices. The discounted present value of the returns over the life of the project is used to calculate the agricultural benefits of the irrigation project. The same dryland-irrigated comparison is made in this analysis, except the net return for both the dryland and irrigated situation is calculated each year over a 31-year period.

The difference in benefits between a dynamic model and a static model is illustrated for the model ranches. For the static analysis, a one-year model using the 31-year average yields, levels of production, and prices will be run for both the irrigated and nonirrigated situations. The difference between the irrigated and nonirrigated net return is the static model's benefit of irrigation. The same comparison is made using the dynamic model. The dynamic model calculates return for 31 years, so the results for the dryland and irrigation situations are divided by 31 to get the average benefits of irrigation over 31 years. Comparing the "average year" benefits from the one-year model with the dynamic model illustrates the usefulness of the model. The present discounted value can be obtained by using current procedures and starting with the dynamic model's average difference rather than that of a static model.

It is not recommended that the difference between irrigated and nonirrigated returns each year in the dynamic model be discounted to present value since the timing of the onset of a drought period would have a large effect on results. Since the timing of drought onset is not known, the procedure outlined above is recommended.

A sequential multiyear maximizing linear programming model is used in this analysis. The model is sequential in that individual linear programming models are solved for winter and summer periods for each year of the simulation. Only the information available to the producer at the simulated time is permitted to impact the solution. In each matrix, an accounting row provides the cash transactions that would take place. Therefore, the economic decision and the actual cash impacts are separated. The modeling process is sequential because the solution values of importance from each period's model is passed to the following period as shown in Figure 2. Exogenous events of weather (for yields) and market (for prices) are provided by historical data sets. The historical data sets used are presented in the data section of this report, specifically in Tables 6, 9, 10, 11, 15, and 16. The linear programming alogrithm used was the "MPS-PC Linear Programming System, Version 2.1" by George Pfeiffer. The alogrithm is written in Basic, the original code was modified to handle sequential programming and compiled with the Quickbasic compiler Ver. 2.01. Transfers are accomplished by subroutines included in the model (Appendix B). Separate models are developed for dryland and irrigated situations. Each model maximizes expected return for two decision periods per year. The model can run for as many years as desired or for which data are available. The Lake Andes-Wagner application was run for 31 years.

The summer period runs from May through October. During this period decisions are made concerning what crops to produce based on anticipated profitability subject to limitations imposed by rotational considerations, labor, and/or machinery constraints. The size of the beef cow herd can also be increased to a maximum or decreased, based upon the carrying capacity of the pasture and the amount of hay carry-over from the winter period. The grazing period is divided into early grazing (May to August) and late grazing (September and October). The late grazing period includes the use of small grains aftermath grazing. For the irrigation situation, backgrounded calves are fed to slaughter weight during the summer period. The cattle finishing decision is based on feed availability and profitability of feeding considering feed prices and expected slaughter steer prices.

The winter period encompasses November through April. During this period crop decisions are made to bale straw for feed, make corn silage, and purchase hay. Decisions concerning livestock include whether to sell producing cows based on winter feed available and whether to sell weaning calves or feed through the winter on a backgrounding ration. Under irrigation, the decision whether to hold backgrounded calves into summer to finish is also made in the winter period. Alfalfa hay sales are only allowed in the irrigation model.

The program keeps track of cattle and feed inventories and transfers these quantities from one period to the next and from one year to the next. Forage losses associated with storage are specified in the program.

An accounting of actual income and variable costs is made each period. The accounting income is based upon actual prices and yields. In contrast, management decisions are based on planning prices and average yields. Planning prices are used in the objective function of the linear programming model. A detailed presentation of the linear programming tableau is given in the following section.

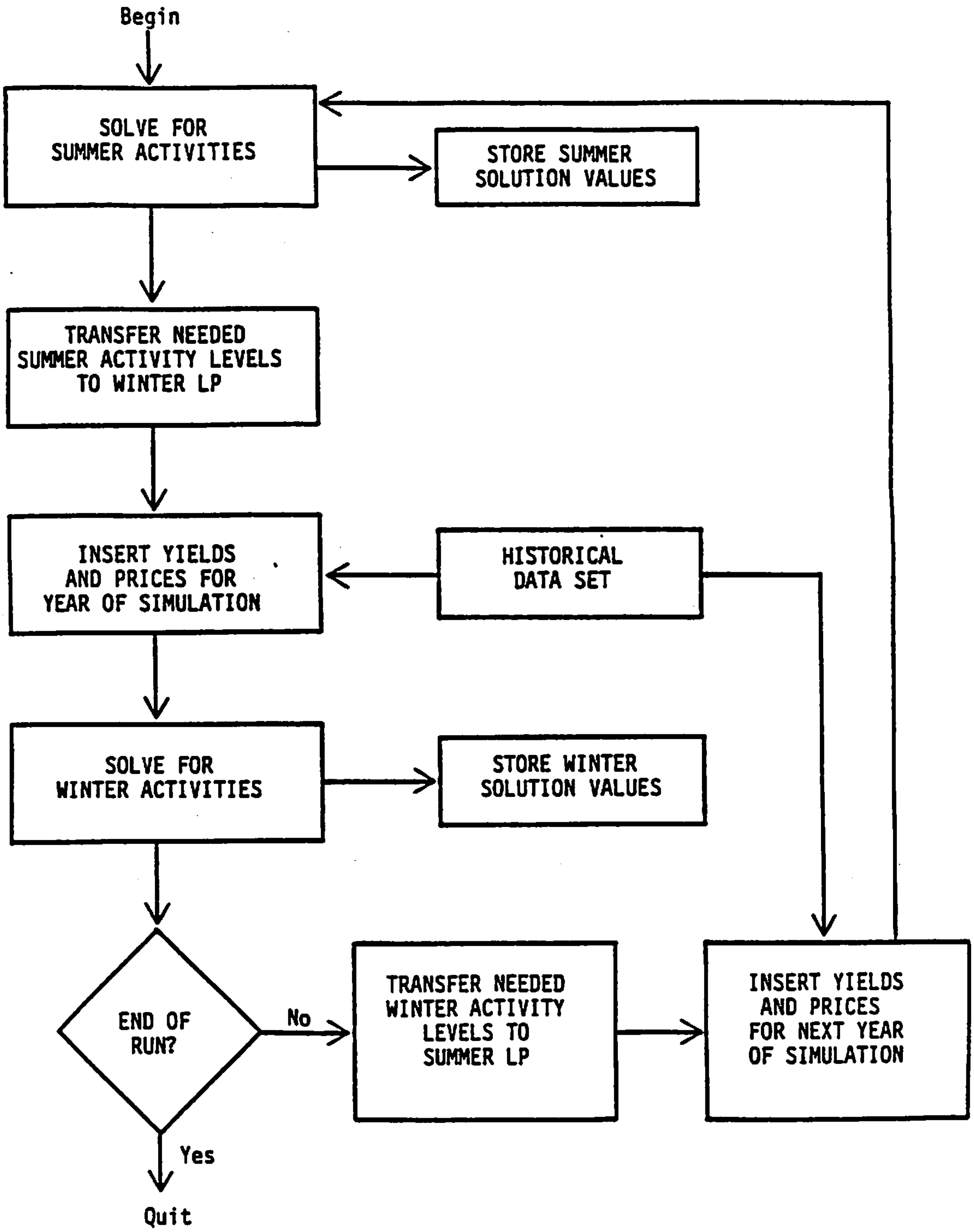

Figure 2. Schematic Diagram of Multiyear Sequential Linear Programming Model, Lake Andes-Wagner Irrigation Study

Linear Programming Model[2]

The structure of the dryland and irrigated linear programming models for both the summer and winter period are presented in Figures 3 to 6. Numbers that may change between period in the dynamic model are identified. Identification of rows and columns including units of measurement are given in Tables 2 through 5. The models including the coefficients used in the static model for Model ranch I are presented in Appendix A. Specification of the period-to-period changes for the dynamic model are shown in Appendix B.

Summer Dryland

Each column (activity) of the model is explained in terms of the row constraints. The accounting inventory (ACCTINV) column sums cost for each activity in the solution. No sales are recorded during this period.

The beef cow activity has a maximum (COWMAX), which is based on the pasture-carrying capacity in an average year. The cow inventory row (COWINV) is used to adjust cow numbers. Initial inventory (RHS) plus purchases minus sales equals number of cows that can be supported by pasture plus any alfalfa hay carry-over. Replacement heifers (REPHFR) are set at 18 percent of the maximum number of cows. Therefore, if cow numbers are reduced, a larger percentage of calves are kept for replacements. Early (ESUPPFOR) and late (LSUPPFOR) supplemental forage comes from alfalfa inventory so the activity has no accounting cost. However, a cost in the objective function forces pasture use before feeding hay.

Rangeland (GRAZRANG) and cropland pasture (GRCLPAST) provide both early and late season pasture in a normal year. Small grains aftermath (GRSGAFT) provides only late season grazing. The purchase of cows has an accounting cost equal to the difference in value of a replacement cow and a utility grade slaughter cow. Cow sales are divided into three activities. The first group of cows sold (SELLCOW1) are cows that are culled one year sooner than normal. The loss is a one-year depreciation. The second group of cows sold are the next one-third, which are cows culled two to three years earlier than normal; this action results in a larger depreciation charge. The third group of cows represents selling the youngest half of the herd. The cow transfer (COWT) and replacement heifer transfer (REPHFT) activities simply count the number of these animals that go into the winter period. These activities are also used to determine the amount of small grains straw that needs to be baled for bedding.

Alfalfa transfer (ALFT) takes the remaining previous year's alfalfa hay and transfers it to the winter period after deducting a 20 percent storage loss.

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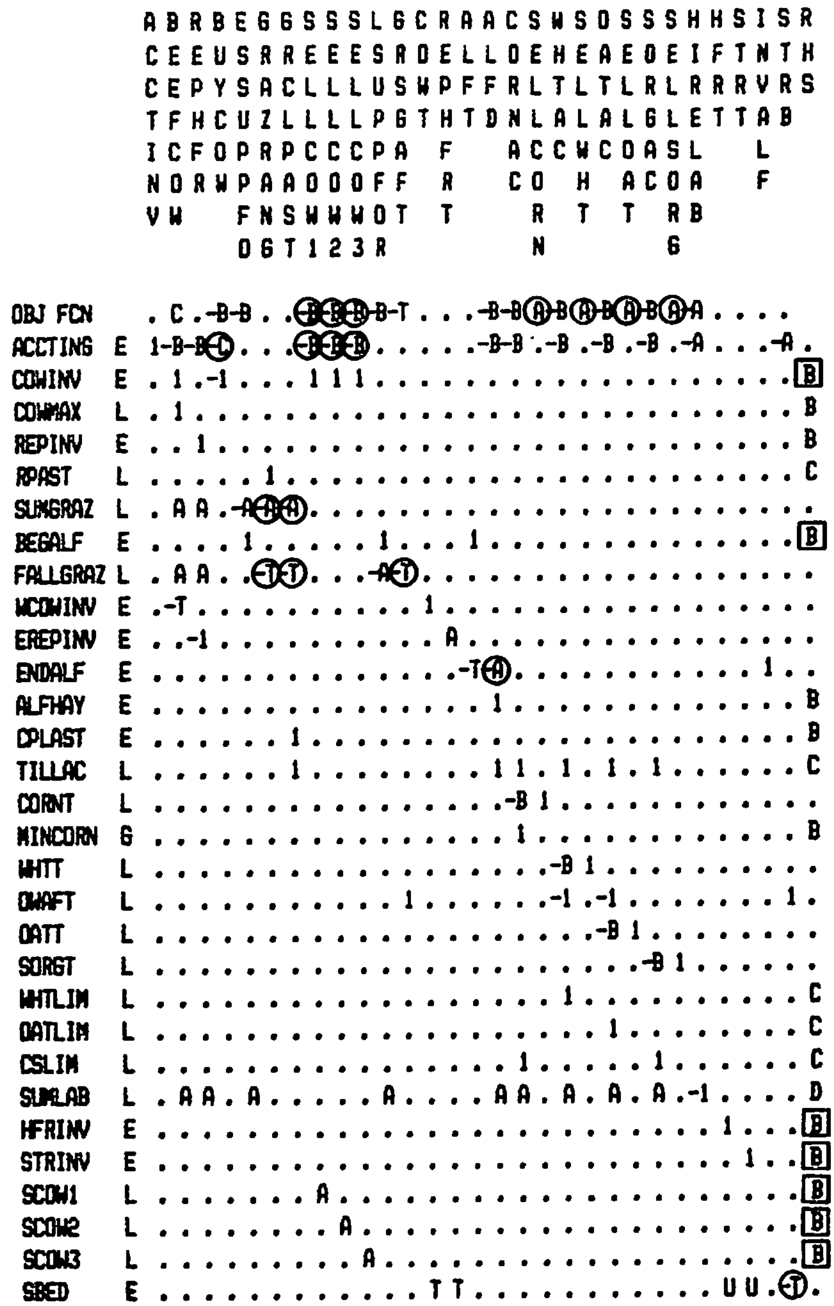
[2]The discussion assumes a basic understanding of linear programming. Readers without this knowledge may want to skip to the Crop Data section.

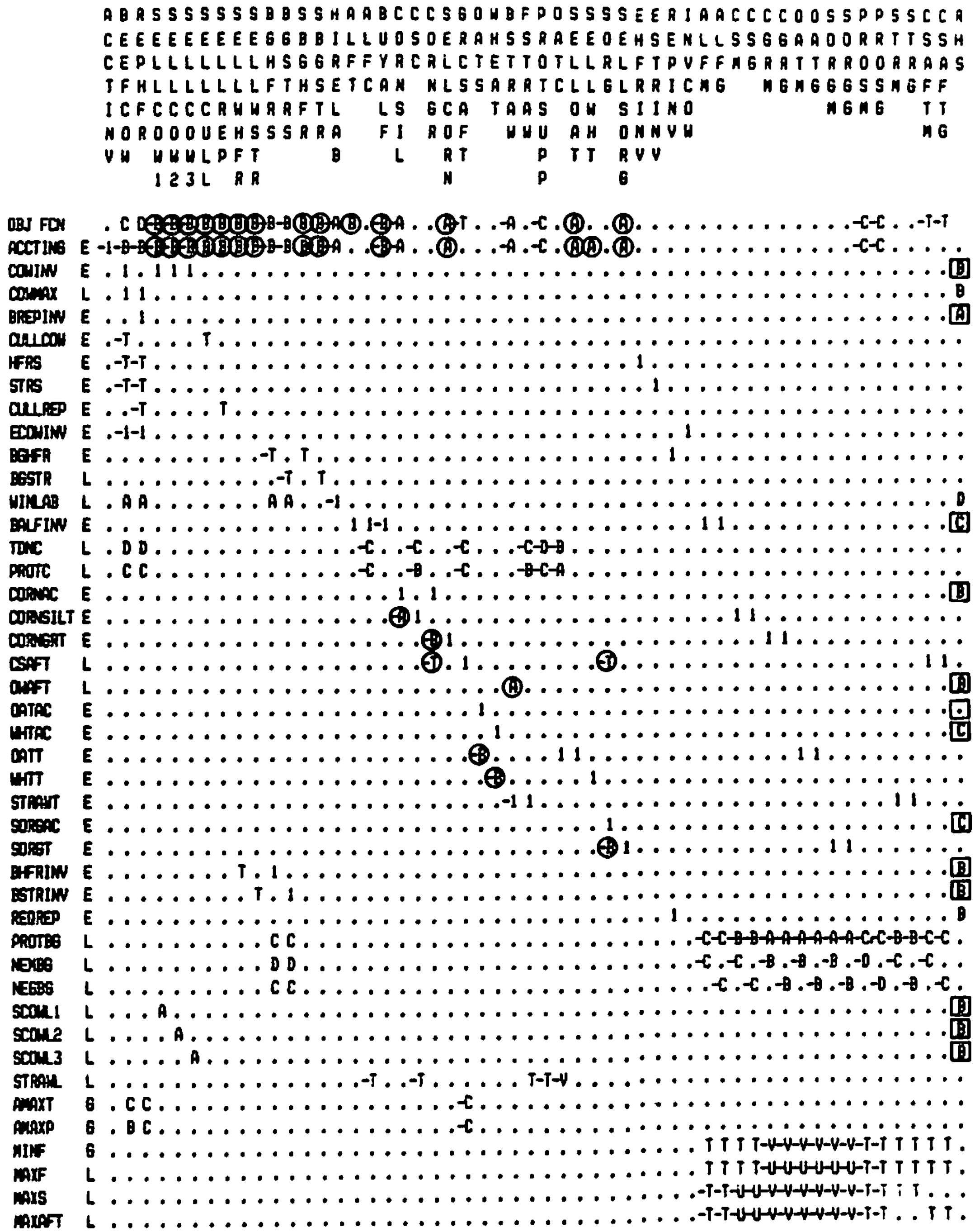


SYMBOL	AT LEAST	LESS THAN	SYMBOL	AT LEAST	LESS THAN
.	0.000000	0.000000	A	1.000001	10.00000
U	0.010000	0.099999	B	10.00001	100.0000
T	0.100000	0.999999	C	100.0001	1000.000
1	1.000000	1.000000	C	1000.001	10000.00

○ Coefficients that change each year obtained from historical data file

□ Coefficients that change each year obtained from prior model solution

Figure 3. Summer Dryland Model, Lake Andes-Wagner Irrigation Study

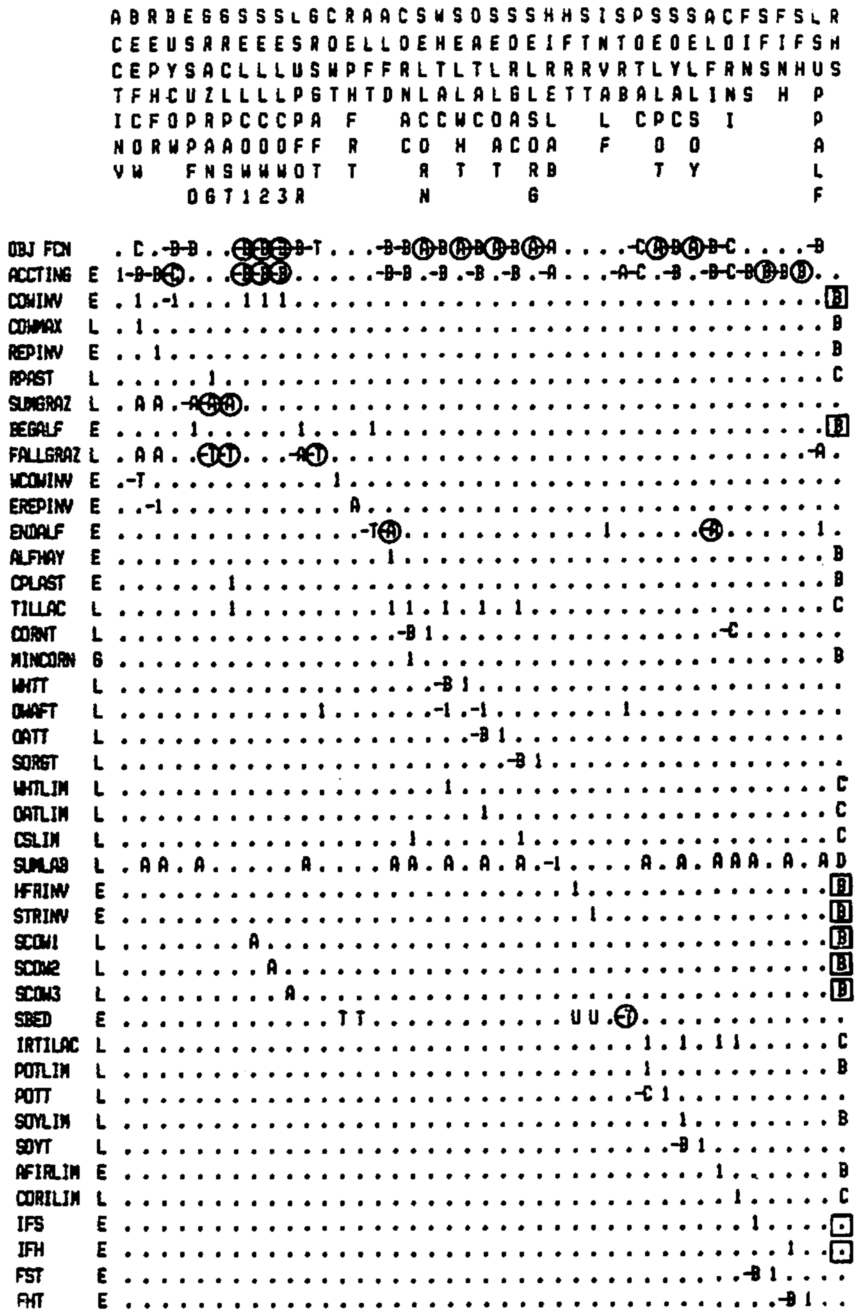


SYMBOL	AT LEAST	LESS THAN	SYMBOL	AT LEAST	LESS THAN
.	0.000000	0.000000	A	1.000001	10.00000
U	0.010000	0.099999	B	10.00001	100.0000
T	0.100000	0.999999	C	100.0001	1000.000
1	1.000000	1.000000	C	1000.001	10000.00

○ Coefficients that change each year obtained from historical data file

□ Coefficients that change each year obtained from prior model solution

Figure 4. Winter Dryland Model, Lake Andes-Wagner Irrigation Study

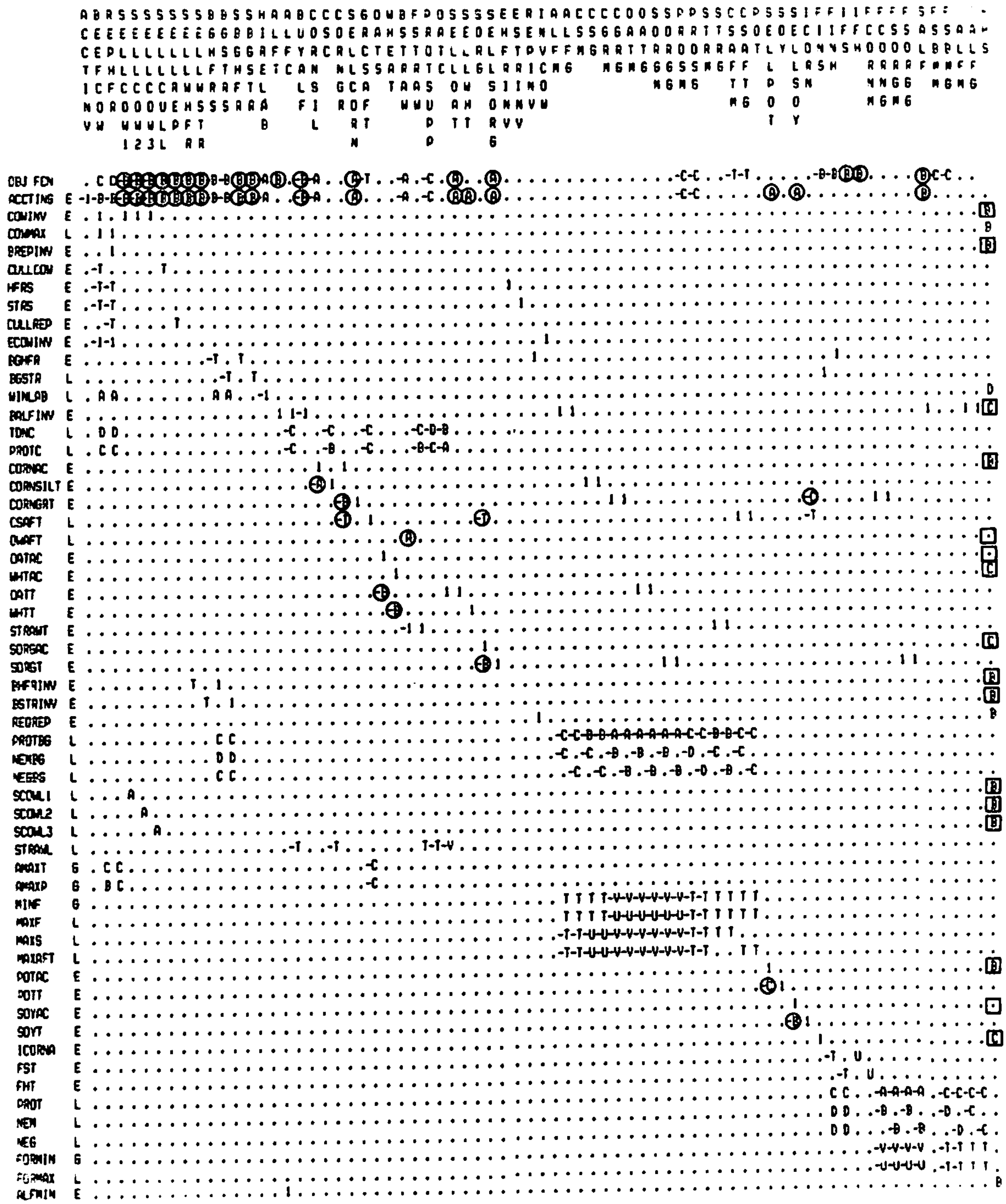


SYMBOL	AT LEAST	LESS THAN	SYMBOL	AT LEAST	LESS THAN
*	0.000000	0.000000	A	1.000001	10.00000
U	0.010000	0.099999	B	10.00001	100.0000
T	0.100000	0.999999	C	100.0001	1000.000
1	1.000000	1.000000	C	1000.001	10000.00

○ Coefficients that change each year obtained from historical data file

□ Coefficients that change each year obtained from prior model solution

Figure 5. Summer Irrigated Model, Lake Andes-Wagner Irrigation Study



SYMBOL	AT LEAST	LESS THAN	SYMBOL	AT LEAST	LESS THAN
•	0.000000	0.000000	A	1.000001	10.00000
U	0.010000	0.099999	B	10.00001	100.0000
T	0.100000	0.999999	C	100.0001	1000.000
1	1.000000	1.000000	C	1000.001	10000.00

○ Coefficients that change each year obtained from historical data file

□ Coefficients that change each year obtained from prior model solution

Figure 6. Winter Irrigated Model, Lake Andes-Wagner Irrigation Study

TABLE 2. DESCRIPTION OF LP ROWS FOR THE SUMMER PERIOD

No.	Item	Unit	Description
	OBJ FCN	$	Return over variable costs
Rows			
1	ACCTING	$	Accounting of variable costs (-)
2	COWINV	Hd.	Inventory of cows (beginning)
3	COWMAX	Hd.	Cows maximum
4	REPINV	Hd.	Inventory of replacements (beginning)
5	RPAST	Ac.	Rangeland pasture
6	SUMGRAZ	AUM	Summer grazing - 4 months
7	BEGALF	Ton	Beginning inventory of alfalfa hay
8	FALLGRAZ	AUM	Fall grazing - 2 months
9	WCOWINV	Hd.	Winter inventory of cows
10	EREPINV	Hd.	Ending replacement heifers inventory
11	ENDALF	Ton	Ending inventory of alfalfa hay
12	ALFHAY	Ac.	Alfalfa hay acreage
13	CLPAST	Ac.	Cropland pasture acreage
14	TILLAC	Ac.	Tillable acres
15	CORNT	Bu.	Corn transfer
16	MINCORN	Ac.	Minimum acreage for corn
17	WHTT	Bu.	Wheat transfer
18	OWAFT	Ac.	Oats and wheat aftermath
19	OATT	Bu.	Oats transfer
20	SORGT	Bu.	Sorghum transfer
21	WHTLIM	Ac.	Wheat acreage maximum
22	OATLIM	Ac.	Oats acreage maximum
23	CSLIM	Ac.	Corn and sorghum acreage maximum
24	SUMLAB	Hrs.	Summer labor
25	HFRINV	Hd.	Inventory of heifer calves
26	STRINV	Hd.	Inventory of steer calves
27	SCOW1	Hd.	Sell productive cows, 6 years old
28	SCOW2	Hd.	Sell productive cows, 4 and 5 years old
29	SCOW3	Hd.	Sell productive cows, 1 to 3 years old
30	SBED	Ton	Straw required for bedding
Additional Rows Used in LP with Irrigation			
31	IRTILAC	Ac.	Irrigated acreage of tillable land
32	POTLIM	Ac.	Potatoes acreage limit
33	POTT	Cwt.	Potatoes transfer
34	SOYLIM	Ac.	Soybeans acreage limit
35	SOYT	Bu.	Soybeans transfer
36	AFIRLIM	Ac.	Alfalfa hay irrigated acreage limit
37	CORILIM	Ac.	Irrigated corn limit
38	IFS	Hd.	Inventory backgrounded steers
39	IFH	Hd.	Inventory backgrounded heifers
40	FST	Cwt.	Fed steers transfer
41	FHT	Cwt.	Fed heifers transfer

TABLE 3. DESCRIPTION OF LP COLUMNS FOR THE SUMMER PERIOD

No.	Item	Unit	Description
Columns			
1	ACCTING	$	Accounting [actual gross income (+) or variable costs (-)]
2	BEEFCOW	Hd.	Beef cows
3	REPHFR	Hd.	Replacement heifers
4	BUYCOW	Hd.	Buy cows
5	ESUPPFOR	Ton	Early supplemental forage
6	GRAZRANG	Ac.	Graze rangeland
7	GRCLPAST	Ac.	Graze cropland pasture
8	SELLCOW1	Hd.	Sell cows, 6 years old
9	SELLCOW2	Hd.	Sell cows, 4 and 5 years old
10	SELLCOW3	Hd.	Sell cows, 1 to 3 years old
11	LSUPPFOR	Ton	Late supplemental forage
12	GRSGAFT	Ac.	Graze small grains aftermath
13	COWT	Hd.	Transfer cows to winter
14	REPHFRT	Hd.	Transfer replacement heifers to winter
15	ALFT	Ton	Transfer inventory of alfalfa hay to winter
16	ALFD	Ac.	Alfalfa hay
17	CORNAC	Ac.	Corn acreage
18	SELLCORN	Bu.	Sell corn
19	WHTAC	Ac.	Wheat acreage
20	SELLWHT	Bu.	Sell wheat
21	OATAC	Ac.	Oats acreage
22	SELLOAT	Bu.	Sell oats
23	SORGAC	Ac.	Sorghum acreage
24	SELLSORG	Bu.	Sell sorghum
25	HIRELAB	Hr.	Hire summer labor
26	HFRT	Hd.	Transfer heifer calves to winter
27	STRT	Hd.	Transfer steer calves to winter
28	INVALF	Ton	Inventory of alfalfa hay
29	STRB	Ac.	Bale straw for bedding
Additional Columns Used in LP with Irrigation			
30	POTAC	Ac.	Potatoes acreage
31	SELLPOT	Cwt.	Sell potatoes
32	SOYAC	Ac.	Soybeans acreage
33	SELLSOY	Bu.	Sell soybeans
34	ALFI	Ac.	Alfalfa hay irrigated
35	CORNI	Ac.	Corn irrigated
36	FINS	Hd.	Finish steers
37	SFS	Cwt.	Sell finished steers
38	FINH	Hd.	Finish heifers
39	SFH	Cwt.	Sell finished heifers
40	LSUPALF	Ton	Use current year alfalfa to supplement late season grazing

TABLE 4. DESCRIPTION OF LP ROWS FOR THE WINTER PERIOD

No.	Item	Unit	Description
	OBJ FCN	$	Return over variable costs
Rows			
1	ACCTING	$	Accounting [actual gross income (+) or variable costs (-)]
2	COWINV	Hd.	Inventory of cows
3	COWMAX	Hd.	Cows maximum
4	BREPINV	Hd.	Beginning inventory of replacements
5	CULLCOW	Hd.	Cull cows
6	HFRS	Hd.	Heifer calves (just born)
7	STRS	Hd.	Steer calves (just born)
8	CULLREP	Hd.	Cull replacements
9	ECOWINV	Hd.	Ending inventory of cows
10	BGHFR	Hd.	Background heifers
11	BGSTR	Hd.	Background steers
12	WINLAB	Hr.	Winter labor
13	BALFINV	Ton	Beginning inventory of alfalfa hay
14	TDNC	Lb.	Total digestible nutrients for cows
15	PROTC	Lb.	Proteins for cows
16	CORNAC	Ac.	Corn acreage
17	CORNSILT	Ton	Corn silage transfer
18	CORNGRT	Bu.	Corn grain transfer
19	CSAFT	Ton	Corn and sorghum aftermath
20	OWAFT	Ac.	Oats and wheat aftermath (remaining after summer)
21	OATAC	Ac.	Oats acreage
22	WHTAC	Ac.	Wheat acreage
23	OATT	Bu.	Oats transfer
24	WHTT	Bu.	Wheat transfer
25	STRAWT	Ton	Straw transfer
26	SORGAC	Ac.	Sorghum acreage
27	SORGT	Bu.	Sorghum transfer
28	BHFRINV	Hd.	Beginning inventory of heifers (weaned)
29	BSTRINV	Hd.	Beginning inventory of steers (weaned)
30	REQREP	Hd.	Required replacements
31	PROTBG	Lb.	Protein required for backgrounding
32	NEMBG	Mcal.	Net energy for maintenance - backgrounding
33	NEGBG	Mcal.	Net energy for gain - backgrounding
34	SCOWL1	Hd.	Limit on cow sales, 6 years old
35	SCOWL2	Hd.	Limit on cow sales, 4 and 5 years old

- CONTINUED -

TABLE 4. DESCRIPTION OF LP ROWS FOR THE WINTER PERIOD (CONTINUED)

No.	Item	Unit	Description
36	SCOWL3	Hd.	Limit on cow sales, 1 to 3 years old
37	STRAWL	Ton	Limit on straw fed cows and replacements
38	AMAXT	Lb.	Limit on TDN to cows from corn-sorghum aftermath
39	AMAXP	Lb.	Limit on protein to cows for corn-sorghum aftermath
40	MINF	Pct.	Minimum forage in backgrounding ration
41	MAXF	Pct.	Maximum forage in backgrounding ration
42	MAXS	Pct.	Maximum straw in backgrounding ration
43	MAXAFT	Pct.	Maximum corn-sorghum aftermath to calves
Additional Rows Used in LP with Irrigation			
44	POTAC	Ac.	Potatoes acreage
45	POTT	Cwt.	Potatoes transfer
46	SOYAC	Ac.	Soybean acreage
47	SOYT	Bu.	Soybean transfer
48	ICORNA	Ac.	Irrigated corn acreage
49	FST	Hd.	Finished steer transfer
50	FHI	Hd.	Finished heifer transfer
51	PROT	Lb.	Protein needs of finishing cattle
52	NEM	Mcal.	Net energy for maintenance--finishing
53	NEG	Mcal.	Net energy for growth--finishing
54	FORMIN	Pct.	Minimum forage for finishing
55	FORMAX	Pct.	Maximum forage for finishing
56	ALFMIN	Ton	Minimum alfalfa transferred to summer

TABLE 5. DESCRIPTION OF LP COLUMNS FOR THE WINTER PERIOD

No.	Item	Unit	Description
Columns			
1	ACCTING	$	Accounting [actual gross income (+) or variable costs (-)]
2	BEEFCOW	Hd.	Beef cows
3	REPHFR	Hd.	Replacement heifers
4	SELLPCOW1	Hd.	Sell productive cows, 6 years old
5	SELLPCOW2	Hd.	Sell productive cows, 4 and 5 years old
6	SELLPCOW3	Hd.	Sell productive cows, 1 to 3 years old
7	SELLCULL	Cwt.	Sell cull cows
8	SELLREP	Cwt.	Sell cull replacement heifers
9	SELLWHFR	Cwt.	Sell weaned heifers
10	SELLWSTR	Cwt.	Sell weaned steers
11	BGHFRS	Hd.	Background heifers
12	BGSTRS	Hd.	Background steers
13	SBGHFR	Cwt.	Sell backgrounded heifers
14	SBGSTR	Cwt.	Sell backgrounded steers
15	HIRELAB	Hr.	Hire winter labor
16	ALFT	Ton	Transfer alfalfa hay to ending inventory
17	ALFC	Ton	Feed alfalfa hay to cows
18	BUYALF	Ton	Buy alfalfa hay
19	CORNSIL	Ac.	Corn silage acreage
20	CSC	Ton	Feed corn silage to cows
21	CORNGR	Ac.	Corn grain acreage
22	SELLCORN	Bu.	Sell corn
23	GRCSAFT	Ton	Graze corn sorghum aftermath
24	OATS	Ac.	Oats acreage
25	WHEAT	Ac.	Wheat acreage
26	BSTRAW	Ton	Bale straw
27	FSTRAW	Ton	Feed straw to cows
28	PROTSUPP	Cwt.	Buy protein supplement for cows
29	OATC	Bu.	Feed oats to cows
30	SELLOAT	Bu.	Sell oats
31	SELLWHT	Bu.	Sell wheat
32	SORG	Ac.	Sorghum acreage
33	SELLSORG	Bu.	Sell sorghum
34	EHFRINV	Hd.	Ending inventory of heifers
35	ESTRINV	Hd.	Ending inventory of steers
36	REPINV	Hd.	Inventory of replacement heifers
37	INVCOW	Hd.	Inventory of cows going to summer
38	ALFM	Ton	Feed calves alfalfa hay for maintenance
39	ALFG	Ton	Feed calves alfalfa hay for gain
40	CSM	Ton	Feed calves corn silage for maintenance

- CONTINUED -

TABLE 5. DESCRIPTION OF LP COLUMNS FOR THE WINTER PERIOD (CONTINUED)

No.	Item	Unit	Description
41	CSG	Ton	Feed calves corn silage for gain
42	CGRM	Bu.	Feed calves corn grain for maintenance
43	CGRG	Bu.	Feed calves corn grain for gain
44	OATM	Bu.	Feed calves oats for maintenance
45	OATG	Bu.	Feed calves oats for gain
46	SORGM	Bu.	Feed calves sorghum for maintenance
47	SORGG	Bu.	Feed calves sorghum for gain
48	PROSM	Ton	Protein supplement for maintenance to calves
49	PROSG	Ton	Protein supplement for gain to calves
50	STRM	Ton	Feed calves straw for maintenance
51	STRG	Ton	Feed calves straw for growth
52	CSAFTM	Ton	Feed calves corn-sorghum aftermath for maintenance
53	CSAFTG	Ton	Feed calves corn-sorghum aftermath for growth
Additional Columns Used in LP with Irrigation			
54	POT	Ac.	Potatoes acreage
55	SELLPOT	Cwt.	Sell potatoes
56	SOY	Bu.	Soybeans acreage
57	SELLSOY	Bu.	Sell soybeans
58	ICORN	Ac.	Irrigated corn
59	FINS	Hd.	Finish steers
60	FINH	Hd.	Finish heifers
61	IFS	Cwt.	Inventory finishing steers
62	IFH	Cwt.	Inventory finishing heifers
63	FCORNM	Bu.	Feed corn to finishing cattle for maintenance
64	FCORNG	Bu.	Feed corn to finishing cattle for growth
65	FSORGM	Bu.	Feed sorghum to finishing cattle for maintenance
66	FSORGG	Bu.	Feed sorghum to finishing cattle for growth
67	SALF	Ton	Sell alfalfa
68	FSBMM	Ton	Feed soybean meal to finishing cattle for maintenance
69	FSBMG	Ton	Feed soybean meal to finishing cattle for growth
70	FALFM	Ton	Feed alfalfa to finishing cattle for maintenance
71	FALFG	Ton	Feed alfalfa to finishing cattle for growth

Alfalfa acreage (ALFD) is fixed to provide sufficient forage in a normal year. Alfalfa production (ENDALFROW) in the dynamic model is based on yield each year. Other crop production and sale activities determine acreage planted to each crop based on expected profitability and rotational limitations. Yields are detrended average yields. Planning prices in the objective function change each year in the dynamic model. A minimum acreage is planted to corn to cover potential silage needs. Wheat and oats are limited to half the dryland acreage not in forage crops. Corn and sorghum combined are limited to two-thirds the nonforage dryland acres. Straw for bedding (STRB) for the cow herd and young stock reduces the aftermath acreage available for grazing in the late summer or straw available to be transferred (STRT) to the winter period for feed.

<u>Winter Dryland</u>

The accounting column (ACCTINV) counts the return above variable costs for the winter period. All sales occur in this period so the costs from the summer period have to be subtracted to obtain return above variable costs for a year.

Beef cow activity is for cows remaining after culling 16 percent (summer period cow transfers [COWT] activity level). Sales of cull cows are recorded this period (SELLCULL). First calf heifers (REPHFR) are handled as a separate activity from cows and are those replacement heifers left after culling. In addition to cull cows and cull replacement heifers, output from the beef cow and replacement heifers activities are heifer and steer calves. Requirements are labor and feed. Feed requirements are expressed in total digestable nutrients (TDNC) and protein (PROTC) for the winter feeding period. The beef cow herd may be reduced during this period (SELLCOW 1,2,3) if winter forage supplies are inadequate to support the herd size transferred from the previous summer and the purchase of alfalfa hay is not economical. Increasing the herd size is not an option during the winter period.

Heifer and steer calves can be sold at weaning (SELLWHR, SELLWSTR) or backgrounded (BGHFRS, BGSTRS) and sold in the spring as yearlings (SBGHFR, SBGSTR). Feed requirements for backgrounding are expressed in protein (PROTBG), net energy for growth (NEMBG), and net energy for maintenance (NEGBG).

Feeds available for cows are alfalfa (ALFC), corn silage (CSC), corn and/or sorghum aftermath (GRCSAFT), straw (FSTRAW), purchased protein supplement (PROTSUPP), and oats (OATC). Corn or sorghum aftermath is limited to two months' grazing, and straw is limited to 55 percent of the ration. Corn silage (CORNSIL) reduces corn acreage available for grain. Straw for winter feed (BSTRAW) is limited to acres of small grains aftermath remaining after bedding and grazing in the summer period have been satisfied (OWAFTROW).

Corn, oats, wheat, and sorghum production activities are based on acreages from the summer model. Yields and accounting row prices vary each year in the dynamic model based on actual yields and prices.

Ending inventory of replacement heifers (REPINV) is forced in at 18 percent of maximum herd size to prevent selling backgrounded heifers needed for herd replacement.

Feeds available to the backgrounding operation for either growth or maintenance are alfalfa, corn silage, corn grain, oats, sorghum, protein supplement, straw, and corn or sorghum aftermath. The backgrounding ration is restrained to include a minimum of 25 percent and a maximum of 70 percent roughages. Straw was further constrained to a maximum of 20 percent of the ration. The corn or sorghum aftermath was limited to 25 percent of the backgrounding ration.

Summer Irrigated

Irrigated crops of corn, soybeans, potatoes, and alfalfa are added to dryland crop choices. Irrigated alfalfa is fixed and maximum acres of of potatoes are allowed. Irrigated corn, soybean, and potato acreages are determined by relative profitability based upon anticipated yields (the detrended average) and planning prices.

Finishing steers (FINS) and/or heifers (FINH) to slaughter weight is an option added in the irrigation model. The decision to finish cattle is made in the winter period based upon planning prices of slaughter steers and heifers relative to calf and backgrounded calf prices. The actual finishing of cattle is done during the summer period.

Supplemental forage for late season grazing (LSUPPALF) from current alfalfa production is an activity allowed in the irrigated model but not in the dryland model.

Winter Irrigated

Irrigated corn, potatoes, and soybean production activities are based on acreages from the summer model. Yields and accounting row prices vary each year.

Steer (FINS) and heifer (FINH) finishing decisions are made based on planning prices (IFS, IFH) and feed costs. Feed requirements for finishing are protein (PROT), net energy for maintenance (NEM), and net energy for growth (NEG). A forage minimum of 15 percent and a maximum of 45 percent is also imposed on finishing cattle. Feed choices for finishing cattle are corn grain, sorghum, soybean meal, and alfalfa.

A minimum number of tons of alfalfa are transferred to the summer period. The remainder of the alfalfa is sold (SALF).

Crop Data

Crop Yields

Crop yields in most cases were those reported for Charles Mix County (South Dakota Crop and Livestock Reporting Service). Yield data were obtained for years 1955 to 1985. Irrigated potatoes and soybean yields were not available at the county level. Therefore, yields for potatoes at the state level and yields for irrigated soybeans reported for Knox County, Nebraska, were used (Nebraska Crop and Livestock Reporting Service). Knox County, Nebraska, is adjacent to Charles Mix County, South Dakota.

Yields for some crops were missing for certain years. The yields for missing years were predicted using linear trend regression based on available yield data (for details, refer to Appendix C, Table 1). In the case of irrigated corn and irrigated alfalfa hay, yields reported for Knox County, Nebraska, were used for the missing years.

This study used production costs based on 1985 input levels and crop prices adjusted to 1985 dollar values. Therefore, the historical crop yields need to be adjusted (detrended) to reflect 1985 technology. For this purpose, a linear regression function was developed for each crop using year as a proxy for technology (trend). A significant trend (better than .05 significance level) was found in all crop yields with the exception of dryland alfalfa and wild hay. The trend explained the variation in yields (R-square) from 0.23 for corn silage to 0.81 for irrigated corn grain. The regression functions are as follows (note that numbers in parentheses are t-values):

Wheat yield = (bu./acre)	10.7509 + 0.5108 (year - 1954) (6.26) (5.46)	$R^2 = 0.51$
Oats yield = (bu./acre)	20.7315 + 0.8748 (year - 1954) (5.37) (4.15)	$R^2 = 0.37$
Sorghum grain yield = (bu./acre)	27.2787 + 0.8412 (year - 1954) (6.78) (3.83)	$R^2 = 0.34$
Corn grain yield = (bu./acre)	17.7960 + 1.0740 (year - 1954) (4.31) (4.77)	$R^2 = 0.44$
Corn grain yield, irrigated = (bu./acre)	57.0272 + 2.8185 (year - 1954) (12.43) (11.26)	$R^2 = 0.81$
Corn silage yield = (tons/acre)	4.3447 + 0.1139 (year - 1954) (6.11) (2.94)	$R^2 = 0.23$
Soybean yield, irrigated = (bu./acre)	26.5755 + 0.4027 (year - 1954) (17.03) (4.73)	$R^2 = 0.44$

Potato yield, irrigated = (cwt./acre)	118.7182 + 5.5045 (year - 1954) (7.20) (4.11)	$R^2 = 0.50$
Alfalfa hay yield, irrigated = (tons/acre)	2.7348 + 0.0746 (year - 1954) (10.11) (5.06)	$R^2 = 0.47$

The regression functions listed above were used to detrend the historical yields. The detrended yield is equal to 1985 predicted yield plus or minus the difference between actual and predicted yields for a specific year (residual). For illustration purposes, oats is used to show actual yields, trend line, and detrended yields for 1985 technology in Figure 7. The detrended yields are used for the purpose of accounting in the winter model; yields predicted for 1985 are used for planning purposes in the summer model. Because no trend was found in dryland alfalfa and wild hay yields, the historical yields were not detrended. The expected yields for these crops are the mean over the 31-year period. The detrended and expected crop yields are given in Table 6.

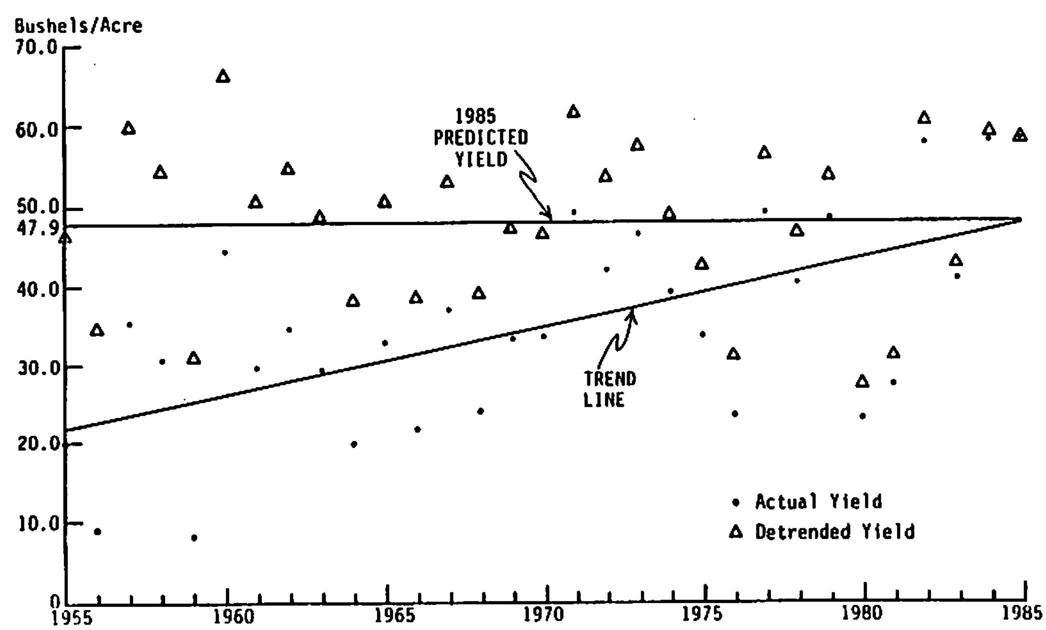


Figure 7. Actual Yields, Trend Line, and Detrended Yields for Oats, 1985 Technology

TABLE 6. DETRENDED CROP YIELDS[1] FOR 1985 TECHNOLOGY, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA

Year	Dryland Crops							Irrigated Crops			
	Wheat	Oats	Corn Grain	Sorghum Grain	Corn Silage	Alfalfa Hay	Wild Hay	Corn Grain	Soybean	Potatoes	Alfalfa Hay
	bu./ac.				tons/ac.			bu./ac.		cwt./ac.	tons/ac.
1955	26.28	46.29	47.23	44.24	7.07	1.45	0.53	124.10	39.63	252.12	4.39
1956	21.15	34.51	49.11	46.40	7.33	1.00	0.44	119.01	27.11	311.67	5.12
1957	33.65	59.86	61.90	57.56	8.96	1.90	0.78	145.59	44.61	297.67	6.14
1958	33.20	54.07	52.33	52.22	7.78	1.80	0.69	130.37	39.90	291.66	4.07
1959	19.17	30.90	38.17	41.88	6.02	0.95	0.52	117.55	36.60	252.16	3.99
1960	34.63	66.16	55.96	62.03	8.28	1.80	1.09	149.73	33.00	324.25	5.02
1961	27.54	50.45	58.80	62.19	8.66	1.75	0.90	146.91	40.70	294.25	4.74
1962	23.40	54.75	68.44	77.85	9.89	2.50	1.21	162.09	37.69	309.55	4.67
1963	22.17	48.28	62.40	60.51	9.15	1.95	0.89	133.28	42.89	263.54	5.39
1964	22.00	38.04	48.07	58.67	7.37	1.40	0.64	130.46	37.49	256.64	5.22
1965	26.96	50.25	41.97	40.83	6.62	1.55	0.84	145.64	35.08	323.03	4.44
1966	23.10	38.21	50.14	50.99	7.67	1.10	0.86	145.82	40.58	280.23	4.87
1967	30.87	52.68	38.17	39.65	6.19	1.40	0.61	155.00	36.28	249.12	4.19
1968	26.80	38.81	41.80	44.30	6.67	1.45	0.58	144.18	30.88	249.62	6.22
1969	26.66	47.06	54.94	60.46	8.34	1.90	0.98	152.37	45.47	255.71	4.15
1970	25.65	46.31	39.03	48.62	6.36	1.90	0.91	130.55	38.07	291.11	7.17
1971	30.09	61.30	53.89	54.28	10.60	1.70	0.88	137.73	39.67	370.10	5.90
1972	26.41	53.33	69.81	71.94	11.28	2.70	1.03	161.91	42.27	291.60	6.02
1973	33.13	57.05	59.24	64.10	9.87	2.20	1.01	154.09	41.86	296.10	5.35
1974	25.52	48.72	32.77	37.26	5.96	1.60	0.69	138.27	36.46	290.59	5.67
1975	20.81	42.16	38.29	36.11	5.34	1.71	0.86	141.58	39.06	256.64	4.80
1976	19.85	30.99	37.57	38.58	3.83	1.15	0.78	133.62	34.66	324.25	4.42
1977	32.75	56.11	59.08	62.33	9.72	1.46	0.95	146.18	43.25	263.54	4.55
1978	25.07	46.29	61.21	71.49	11.90	1.97	1.23	150.71	36.85	309.54	4.67
1979	30.87	53.66	59.63	61.55	9.79	1.93	1.22	149.00	41.45	311.67	5.10
1980	19.86	27.04	27.01	43.11	5.67	1.19	0.84	132.12	35.04	252.12	5.12
1981	23.55	30.71	48.11	50.57	8.06	0.84	0.66	137.54	34.64	291.66	4.75
1982	30.04	60.25	56.30	50.33	8.95	2.73	1.39	139.40	43.24	294.25	4.98
1983	23.13	42.32	45.65	54.69	5.83	2.29	1.13	121.64	34.84	291.66	4.60
1984	27.81	58.81	60.08	54.34	6.12	2.29	1.13	118.09	33.43	309.54	4.33
1985	32.15	57.99	67.00	55.10	9.00	1.80	0.97	135.27	38.09	311.67	4.95
Predicted yield in 1985	26.59	47.85	51.10	53.36	7.88	1.72	0.88	139.67	38.09	289.40	5.05

[1]All yields are reported as an average moisture basis rather than a dry matter basis.

Crop Variable Production Costs

Variable production costs were estimated for wheat, oats, sorghum, corn grain, corn silage, soybeans, potatoes, alfalfa, and wild hay. The budgets developed by St. George in a study of the Lake Andes-Wagner Unit (1985) served as the basis for production costs.

An interest rate of 8.375 percent was charged on all operating expenses for six months. Yearly storage variable cost was $0.04 per bushel for all crops except for corn silage and potatoes. The storage cost charged for corn silage was $0.21 per ton per year. It was assumed potatoes were stored for four months. The monthly storage cost for potatoes was figured at $.0887 per cwt. (Coon et al. 1986). Since hired labor is treated in the LP model as an activity, the labor cost is not included in the crop budgets. The variable production costs for the selected crops with and without irrigation are given in Tables 7 and 8.

Crop Prices

Crop prices were the seasonal average prices (Appendix C, Table 2) reported for South Dakota (South Dakota Crop and Livestock Reporting Service). These prices were adjusted to reflect 1985 dollar values using the United States Index of Prices Received for All Farm Products (USDA). The adjusted crop prices hereafter will be referred to as actual prices.

The planning crop prices were weighted prices lagged for three years. The rationale for weighted lagged prices was to capture the idea that farmers plan based on their most recent experience. The formula used to compute the planning price follows:

Planning price in year t = 3/6 (adjusted price in year t-1)

+ 2/6 (adjusted price in year t-2)

+ 1/6 (adjusted price in year t-3)

The actual and planning prices for selected crops used in this study are given in Tables 9 and 10.

Livestock Data

A cow-calf operation is the typical livestock enterprise in the study area. Based on the amount of available pasture (includes supplemental cropland pasture in addition to rangeland pasture and aftermath), an intial herd size of 60 cows was used for the dryland model. Because of more assured forage supplies, a 70-cow herd size was used for the irrigated ranch. The cow-calf operation included the following efficiency assumptions (Allen):

1. a 92 percent weaning rate,
2. a 16 percent cull rate for cows,
3. an 18 percent retention rate of heifer calves for replacements,
4. a 2 percent allowance for replacement heifers lost for reproductive purposes, either because of death or sold for failure to breed,
5. a ratio of 25 cows to one bull, and
6. weaning weight of 425 lbs. for steers and 375 lbs. for heifers.

TABLE 7. VARIABLE PRODUCTION COSTS OF SELECTED CROPS WITHOUT IRRIGATION, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA, 1985

Item	Wheat	Oats	Sorghum Grain	Corn Grain	Corn Silage	Alfalfa Hay	Cropland Pasture	Straw
	--------------	--------------	--------------	$/acre	--------------	--------------	--------------	--------------
Variable costs:								
Seed	8.50	8.70	2.12	11.07	11.07	2.34	2.34	0.00
Fertilizer	9.80	5.49	12.00	10.43	11.10	1.82	1.45	0.00
Chemicals	4.88	4.88	4.88	4.88	4.88	0.00	0.00	0.00
Drying	0.00	0.00	0.00	2.56	0.00	0.00	0.00	0.00
Storage	1.07	1.92	2.13	2.04	1.66	0.00	0.00	0.00
Twine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.91
Repairs	9.69	10.13	14.20	15.48	19.60	9.36	0.92	2.30
Fuel and lube	5.92	5.88	6.54	9.01	9.90	3.70	0.41	0.90
Interest	1.67	1.55	1.75	2.32	2.44	0.72	0.21	0.15
Total	41.53	38.55	43.62	57.79	60.65	17.94	5.33	

SOURCE: U.S. Department of Interior, Bureau of Reclamation, Upper Missouri Region, 1985.

TABLE 8. VARIABLE PRODUCTION COSTS OF SELECTED IRRIGATED CROPS, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA, 1985

Item	Corn Grain	Potatoes	Soybean	Alfalfa Hay
	--------------	--------------	$/acre	--------------
Variable costs:				
Seed	21.09	144.00	10.81	5.70
Fertilizer	45.92	84.60	4.16	16.25
Chemicals	28.40	55.00	28.40	4.88
Drying	7.00	0.00	0.00	0.00
Storage	5.60	91.41	0.00	0.00
Twine	0.00	0.00	0.00	0.00
Repairs	16.47	24.55	17.52	30.95
Fuel and lube	19.28	8.94	7.02	11.42
Interest	6.02	14.32	2.84	2.90
Total	149.78	422.82	70.75	72.10

SOURCE: U.S. Department of Interior, Bureau of Reclamation, Upper Missouri Region, 1985.

TABLE 9. PLANNING PRICES USED FOR SELECTED CROPS EXPRESSED IN 1985 DOLLAR VALUES, SOUTH DAKOTA

Year	Wheat	Oats	Sorghum	Corn Grain	Soybean	Potatoes	Alfalfa Hay	Wild Hay
	$/bu.					$/cwt.	$/ton	
1955	4.94	1.52	2.68	3.12	5.75	4.50	39.75	29.75
1956	5.16	1.41	2.57	3.24	5.59	4.76	43.48	33.24
1957	5.18	1.48	2.54	3.13	5.36	4.25	44.94	35.69
1958	5.05	1.38	2.31	2.70	5.03	5.18	37.17	29.96
1959	4.61	1.28	2.20	2.40	4.70	4.13	30.76	25.58
1960	4.47	1.32	2.04	2.31	4.54	4.62	40.14	33.17
1961	4.39	1.30	1.93	2.24	4.77	4.41	43.82	36.44
1962	4.67	1.35	2.01	2.32	5.11	3.91	45.40	38.38
1963	4.90	1.33	2.07	2.38	5.28	3.61	39.40	33.21
1964	4.82	1.35	2.09	2.39	5.54	3.48	37.64	32.75
1965	4.15	1.39	2.20	2.55	5.87	6.43	42.80	39.03
1966	3.69	1.37	2.21	2.63	5.96	6.21	44.64	39.45
1967	3.60	1.36	2.21	2.65	5.94	5.54	45.77	39.50
1968	3.45	1.38	2.17	2.53	5.81	4.47	45.24	38.32
1969	3.22	1.34	2.10	2.44	5.61	4.16	46.18	37.08
1970	3.04	1.27	2.03	2.33	5.24	4.36	44.74	35.96
1971	3.03	1.23	2.10	2.44	5.47	4.46	42.39	33.68
1972	2.89	1.17	2.00	2.33	5.93	3.94	40.12	32.84
1973	3.12	1.20	2.12	2.44	7.05	4.11	37.23	31.47
1974	4.36	1.33	2.42	2.77	7.27	4.11	40.03	34.26
1975	5.07	1.59	3.00	3.32	7.69	4.20	49.59	42.88
1976	5.20	1.76	3.05	3.30	6.69	4.22	56.66	48.13
1977	4.29	1.89	2.74	3.03	7.45	4.14	67.99	58.40
1978	3.56	1.59	2.38	2.61	7.36	4.02	60.48	51.61
1979	3.19	1.36	2.04	2.31	7.33	3.67	47.06	38.54
1980	3.34	1.21	1.85	2.11	6.44	3.27	37.70	32.20
1981	3.73	1.40	2.08	2.38	6.51	3.39	49.38	40.97
1982	3.59	1.59	1.98	2.30	5.87	3.41	60.51	47.96
1983	3.56	1.50	2.03	2.37	5.44	3.45	51.59	40.95
1984	3.47	1.49	2.14	2.63	5.84	3.49	42.61	33.55
1985	3.31	1.41	1.61	2.48	5.48	3.38	38.65	30.93
Average	4.03	1.40	2.22	2.59	5.93	4.23	44.96	37.29

TABLE 10. ACTUAL PRICES USED FOR SELECTED CROPS EXPRESSED IN 1985 DOLLAR VALUES, SOUTH DAKOTA

Year	Wheat	Oats	Sorghum	Corn Grain	Soybean	Potatoes	Alfalfa Hay	Wild Hay
	----------	----------	$/bu.	----------	----------	--$/cwt.--	-----$/ton	-----
1955	5.23	1.29	2.48	3.31	5.35	5.46	47.84	37.28
1956	5.12	1.61	2.55	3.01	5.27	3.34	45.05	36.89
1957	4.94	1.27	2.09	2.29	4.76	6.31	28.35	22.89
1958	4.22	1.17	2.16	2.27	4.45	2.95	27.50	23.51
1959	4.47	1.44	1.95	2.34	4.52	5.15	52.50	43.05
1960	4.39	1.25	1.84	2.16	5.05	4.41	43.64	36.48
1961	4.93	1.39	2.15	2.42	5.35	3.15	44.15	38.04
1962	5.04	1.32	2.09	2.43	5.31	3.65	34.82	28.92
1963	4.63	1.35	2.07	2.36	5.76	3.47	37.28	33.47
1964	3.54	1.43	2.32	2.72	6.13	9.32	49.15	46.14
1965	3.47	1.34	2.18	2.65	5.91	5.09	44.15	37.07
1966	3.71	1.35	2.20	2.62	5.90	4.55	45.68	38.84
1967	3.28	1.41	2.16	2.44	5.72	4.20	45.31	38.39
1968	3.01	1.29	2.02	2.39	5.45	4.00	46.93	35.62
1969	2.97	1.20	1.99	2.25	4.94	4.66	43.10	35.36
1970	3.08	1.22	2.20	2.59	5.82	4.49	40.38	31.91
1971	2.73	1.13	1.88	2.19	6.34	3.34	38.93	32.59
1972	3.39	1.24	2.25	2.56	7.94	4.49	35.03	30.57
1973	5.56	1.46	2.71	3.11	7.14	4.13	43.69	37.26
1974	5.31	1.80	3.44	3.72	7.97	4.14	58.43	50.77
1975	5.01	1.84	2.91	3.10	5.70	4.30	59.90	50.09
1976	3.47	1.96	2.40	2.75	8.42	4.04	76.57	66.47
1977	3.13	1.26	2.19	2.35	7.22	3.91	50.06	42.32
1978	3.14	1.22	1.81	2.14	7.02	3.39	35.04	26.56
1979	3.54	1.20	1.75	2.01	5.79	2.97	35.25	32.49
1980	4.05	1.60	2.39	2.71	6.80	3.67	63.59	51.46
1981	3.31	1.71	1.79	2.13	5.28	3.38	67.07	50.92
1982	3.55	1.32	2.08	2.41	5.09	3.42	37.29	30.79
1983	3.48	1.52	2.30	2.95	6.53	3.57	37.80	29.46
1984	3.12	1.37	0.99	2.20	4.93	3.25	39.67	31.94
1985	3.36	1.10	1.82	2.25	4.95	3.40	47.25	37.92
Average	3.94	1.39	2.17	2.54	5.90	4.18	45.21	37.60

The selling weights and rate of gain assumptions for the backgrounding and finishing calves were

1. backgrounding for 1.5 lbs. daily gain for 150 days,
   (a) steers from 425 to 650 lbs.
   (b) heifers from 375 to 600 lbs.

2. finishing to market weights
   (a) steers from 650 to 1,150 lbs. in 182 days for 2.75 lbs. daily gain
   (b) heifers from 600 to 1,050 lbs. in 180 days for 2.5 lbs. daily gain

Pasture, Straw, and Aftermath Production

Pasture yields for the study area were not available. However, both wild and alfalfa hay yields were available for the area. The procedure used by the Soil Conservation Service (Appendix C, Table 3) was used to convert hay yields to equivalent animal unit months (AUMs) of pasture. Wild hay yields in tons per acre were multiplied by 1.67 to obtain AUMs for continuous grazing of native pasture. Tame pasture was assumed to be a legume-grass mixture. Statewide data for South Dakota indicate other tame hay to yield about three-fourths that of alfalfa hay. Therefore, the relevant hay yield to convert to AUMs of pasture was assumed to be three-fourths that of alfalfa hay.

The grazing season was divided into a first four-month period and a second two-month period. The following calculations were used to divide the AUMs of grazing between the two periods.

Normal year: 5/6 first period, 1/6 second period
Dry year: 100 percent first period, none in second period

A dry year is defined as one in which hay production is below 85 percent of normal.

The production of forage is not uniform throughout the year. More production occurs in the spring and summer periods than in the fall. For this reason the two-month fall period is given only one-sixth of annual production. No fall production is credited in a dry year since it is assumed that overgrazing will occur during the summer of a dry year, leaving no harvestable surplus for the fall.

Straw yields and aftermath production were estimated based on secondary data and personal communication with St. George. The straw yields (tons per acre) were calculated by multiplying 0.016 times wheat yields (a ratio between straw yield in tons and wheat yield in bushels per acre). The production of small grains aftermath (AUMs per acre) was 1.03 times the straw yields. The factor 1.03 was determined by multiplying the harvesting efficiency factor used for pasture (1.67) by the percent total digestable nutrients (TDN) that straw is of alfalfa hay (.62). Corn and sorghum aftermath production (stover) in tons per acre was calculated from corn silage yields times 0.073. The factor 0.073 was based on the following assumptions: (1) A factor of .33 converts corn silage yield to hay equivalent, (2) 44 percent of hay equivalent yield gives stalk and leaves (Nevens et al.), and (3) 50 percent of stalk and leaves were consumed (grazing efficiency). A 33 percent grazing efficiency was used for irrigated corn. The calculated pasture, straw yields, and aftermath production are given in Table 11.

Feed Requirements and Feed Nutrient Values

Nutritional requirements by animal type were determined based on the information provided by the National Research Council (1984). The council also provided the United States-Canadian nutritional values of feed crops. This information is given in Tables 12 and 13. Appendix D provides a detailed summary of calculations.

For the purpose of body maintenance, reproduction, and growth, cows and bred replacement heifers had feed choices of oats, alfalfa, corn silage, soybean meal, corn or sorghum aftermath grazing, and straw. Aftermath grazing was limited to two months. Straw was limited to 45 percent of the ration.

The backgrounding animals were allowed feed choices of corn grain, oats, sorghum, alfalfa, corn silage, protein supplement, straw, and corn or sorghum aftermath grazing. Finishing steers and heifers had ration choices of corn grain, sorghum, alfalfa and soybean meal. The total energy requirements (Mcal.) for backgrounding and finishing livestock classes were given separately for net energy required for maintenance (NE_m) and net energy required for gain (NE_g), whereas total energy requirements were expressed as TDN (total digestible nutrients) for cows and bred replacement heifers. The backgrounding ration was constrained to a 25 percent minimum and a 75 percent maximum for forage. In addition, straw was limited to 20 percent of ration, and corn or sorghum aftermath grazing was limited to six weeks.

By providing nutritional needs for each animal type, nutritional values of feed, and protein supplement, the LP model is able to select the lowest cost quantity and combination of feed inputs required for the cattle herd. The selection of a particular feed and its quantity was based on the availability and price of that feed.

The price used for buying alfalfa hay was the actual price plus transportation cost. The average cost of transporting alfalfa hay was estimated to be $28.60 per ton (based on personal communication with St. George).

Livestock Variable Production Costs

Variable production costs were estimated for each class of cattle using 1985 input prices. These cost estimates were based on "Budgets for Major Livestock Enterprises in South Dakota" (Allen 1986) and the budgets developed

TABLE 11. ESTIMATED PASTURE, STRAW, AND AFTERMATH PRODUCTION, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA

Year	Native Pasture First Period	Native Pasture Second Period	Tame Pasture First Period	Tame Pasture Second Period	Small Grain Aftermath	Corn & Sorghum Aftermath (Stover)	Straw
	AUM's/acre					tons/acre	
1955	0.89	0.00	1.81	0.00	0.43	0.52	0.42
1956	0.73	0.00	1.25	0.00	0.35	0.54	0.34
1957	1.09	0.22	1.98	0.40	0.56	0.65	0.54
1958	1.15	0.00	1.88	0.38	0.55	0.57	0.53
1959	0.87	0.00	1.19	0.00	0.32	0.44	0.31
1960	1.52	0.30	1.88	0.38	0.57	0.60	0.55
1961	1.25	0.25	1.83	0.37	0.45	0.63	0.44
1962	1.68	0.34	2.61	0.52	0.38	0.72	0.37
1963	1.24	0.25	2.04	0.41	0.36	0.68	0.35
1964	1.07	0.00	1.75	0.00	0.36	0.54	0.35
1965	1.17	0.23	1.62	0.32	0.44	0.48	0.43
1966	1.20	0.24	1.38	0.00	0.38	0.56	0.37
1967	1.01	0.00	1.75	0.00	0.50	0.45	0.49
1968	0.97	0.00	1.81	0.00	0.44	0.49	0.43
1969	1.36	0.27	1.98	0.40	0.44	0.61	0.43
1970	1.27	0.25	1.98	0.40	0.42	0.46	0.41
1971	1.22	0.24	1.77	0.35	0.49	0.77	0.48
1972	1.43	0.29	2.82	0.56	0.43	0.82	0.42
1973	1.41	0.28	2.30	0.46	0.55	0.72	0.53
1974	1.15	0.00	1.67	0.33	0.42	0.44	0.41
1975	1.20	0.24	1.78	0.36	0.34	0.39	0.33
1976	1.09	0.22	1.44	0.00	0.33	0.28	0.32
1977	1.32	0.26	1.83	0.00	0.54	0.71	0.52
1978	1.71	0.34	2.06	0.41	0.41	0.87	0.40
1979	1.70	0.34	2.01	0.40	0.50	0.71	0.49
1980	1.17	0.23	1.49	0.00	0.33	0.41	0.32
1981	1.10	0.00	1.05	0.00	0.39	0.59	0.38
1982	1.93	0.39	2.85	0.57	0.49	0.65	0.48
1983	1.57	0.31	2.39	0.48	0.38	0.43	0.37
1984	1.57	0.31	2.39	0.48	0.45	0.45	0.44
1985	1.35	0.27	1.88	0.38	0.53	0.66	0.51
Average	1.22	0.24	1.80	0.36	0.44	0.58	0.43

TABLE 12. WINTER FEED REQUIREMENTS FOR BEEF CATTLE

Item	Cows[1]	Replacement Heifers[1]	Backgrounding		Finishing	
			Steers	Heifers	Steers	Heifers
	lbs./head					
Total digestible nutrients	1,931.2	2,213.0	-	-	-	-
Proteins	298.4	316.7	207.3	187.5	377.3	313.6
	Mcal./head					
Net energy-maintenance	-	-	1,295.1	1,276.3	2,914.5	2,793.8
Net energy-gain	-	-	769.0	779.9	1,851.1	1,829.3

[1]Includes feed requirements for 1/25 of a bull (cow requirement x 1.04).

SOURCE: National Research Council 1984.

TABLE 13. COMPOSITION OF SELECTED BEEF CATTLE FEEDS

Item	Corn Grain	Oats	Sorghum	Soybean Meal	Corn Silage	Wheat Straw	Alfalfa Hay	Corn Stover
	lbs/bu.			lbs./ton				
Total digestible nutrients	44.37	21.71	40.49	1,480.30	396.90	620.30	991.80	824.50
Proteins	4.98	3.75	4.87	879.70	49.60	54.47	312.90	108.83
	Mcal./bu.			Mcal./ton				
Net energy-maintenance	50.22	23.71	45.21	1,650.06	411.29	880.29	964.52	727.06
Net energy-gain	34.73	15.61	30.61	1,121.40	251.00	488.29	529.96	314.81

SOURCE: National Research Council 1984.

by St. George for the Lake Andes-Wagner Unit (1985). An interest rate of 8.375 percent was charged on all operating expenses and livestock investment. The livestock investment was based on the beginning value of livestock. It also included an investment of one bull for 25 cows. Each bull was kept for four years. The itemized variable costs for a cow-calf unit, backgrounding steers, backgrounding heifers, and young replacement heifers are given in Table 14. Since the LP model had two periods, the cow-calf budgets are also shown separately for the summer and winter periods. Bedding requirements were .15 tons of straw per head for cows and finishing heifers and .08 tons per head for backgrounding calves.

Livestock Prices

Livestock prices used were all expressed in 1985 dollars using the U.S. Index of Prices Received for All Farm Products (USDA) these prices were based on "Sioux City Quotations" shown in Appendix C, Table 4 for different classes of cattle (USDA, Market News Service). All the prices were averaged for three months (September, October, and November) with the exception of 600 to 700 lbs. steers and heifers (average of March, April, and May prices). These prices will be referred to as actual prices (Table 15).

TABLE 14. LIVESTOCK VARIABLE COSTS EXCLUDING FEED, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA, 1985

Item	Cow-Calf[1]			Backgrounding		Finishing	
	Total	Summer	Winter	Steer (5 mos.)	Heifer[2] (5 mos.)	Steer (6 mos.)	Heifer (6 mos.)
	$/head						
Variable costs:							
Veterinary medicine	10.00	5.00	5.00	3.50	4.00	2.00	2.00
Salt and minerals	6.00	3.00	3.00	1.00	0.90	1.50	1.50
Bull replacement	22.00	11.00	1.00	0.00	0.00	0.00	0.00
Repairs	0.96	0.00	0.96	1.05	1.05	1.94	1.94
Marketing and hauling	6.00	3.00	3.00	10.50	10.50	15.00	13.50
Fuel & lube	5.08	1.69	3.39	2.54	2.54	1.26	1.26
Interest on oper. cost	0.92	0.31	0.61	0.14	0.15	0.14	0.14
Interest on livestock	40.20[3]	20.10	0.10	10.27	7.72	16.94	13.91
Total	91.16	44.10	47.06	29.00	26.86	38.78	34.25

[1]The same costs were assumed for the winter period for replacement heifers calving with the cow herd.
[2]Replacement heifers assumed to have same cost as that of backgrounding heifers.
[3]Included interest on 1/25 of a bull.

SOURCE: Allen 1986.

TABLE 15. LIVESTOCK ACTUAL PRICES EXPRESSED IN 1985 DOLLAR VALUES, SIOUX CITY[1]

Year	Utility Grade Cows	4-500# Steers	4-500# Heifers	6-700# Steers	6-700# Heifers	7-800# Heifers	11-1200# Steers	11-1200# Heifers
	----------	----------	----------	----------	$/cwt.	----------	----------	----------
1955	25.34	52.31	35.26	56.31	38.72	46.07	54.07	51.72
1956	26.07	52.18	35.04	46.27	35.60	48.05	65.90	58.82
1957	34.58	64.35	45.89	50.52	39.60	51.25	60.64	57.08
1958	43.48	82.89	60.67	61.73	52.94	56.70	60.96	61.28
1959	38.05	77.96	59.71	67.94	61.10	57.38	64.04	60.87
1960	34.73	66.26	60.41	69.25	63.79	51.91	60.20	56.98
1961	36.83	69.51	54.59	59.21	50.71	52.98	58.85	56.07
1962	37.19	76.86	69.18	64.50	60.20	58.75	70.32	64.99
1963	35.30	70.36	63.80	63.54	58.11	50.90	56.51	54.32
1964	31.91	59.67	54.46	55.63	50.69	47.71	60.23	56.60
1965	35.55	66.25	59.00	56.43	50.22	51.86	61.51	56.84
1966	38.87	70.68	61.46	63.12	57.19	49.24	54.92	52.18
1967	39.24	73.69	64.23	62.84	56.19	54.91	61.40	58.33
1968	40.31	73.21	63.30	65.19	59.03	55.65	63.15	59.16
1969	42.19	77.86	68.47	70.68	63.20	53.48	61.43	57.80
1970	43.19	83.22	73.48	74.91	67.01	54.14	60.55	58.05
1971	44.57	84.87	75.57	71.04	64.91	60.04	68.00	65.43
1972	48.55	93.48	82.95	74.83	67.28	58.48	64.04	61.45
1973	44.33	81.36	70.89	71.30	61.55	50.15	54.18	52.54
1974	24.33	37.93	32.64	53.38	47.49	43.38	48.24	46.32
1975	27.86	45.27	36.63	40.15	34.43	50.16	61.17	57.75
1976	28.75	51.66	42.86	54.48	46.73	43.46	47.28	46.32
1977	33.50	58.70	50.23	53.63	46.75	47.33	53.11	50.56
1978	45.42	82.23	72.36	63.76	57.50	55.63	60.78	58.18
1979	45.39	94.94	83.74	85.00	76.87	59.96	64.88	62.68
1980	43.01	79.91	69.92	69.27	61.95	59.34	63.96	61.49
1981	37.02	63.51	55.50	62.56	56.74	53.75	57.85	55.61
1982	37.39	67.17	59.79	64.44	58.53	53.40	57.84	55.51
1983	36.64	61.30	54.53	63.82	58.78	52.34	57.00	54.89
1984	35.94	60.89	53.95	58.46	52.03	52.94	57.38	56.01
1985	35.44	65.32	58.29	66.64	60.73	53.73	58.65	57.33
Average	37.13	69.22	58.99	62.24	55.37	52.74	59.65	56.88

[1]Average of monthly prices for September, October, and November, except for 6-700# steers and heifers, March, April, and May prices were used.

Decisions to sell cows or background them and to sell backgrounded yearlings or finish them were made six months in advance. Ranchers tend to make these decisions based on current prices adjusted for normal seasonal price changes. The planning prices for different classes of cattle used in the winter LP model (Table 16) were calculated as follows: the planning prices for backgrounded calves sold in the spring were the average of September, October, and November prices in the previous fall which were adjusted using the seasonal price index.[3] On the other hand, the finished cattle marketed in the fall were the average of March, April, and May prices adjusted for the seasonal differences.

No price series was available for replacement cows. As an alternative, a cow value series was developed based on prices of feeder calves and cull cows. The value of a beef cow for breeding purposes was determined by the discounted value of the returns generated over her useful life plus her salvage value. The use of discounted present value to evaluate a depreciable asset is explained in detail by Aplen et al.

The formula is as follows:

$$V = \frac{A_1}{(1 + r)} + \frac{A_2}{(1 + r)^2} \cdots + \frac{A_n}{(1 + r)^n} + \frac{S}{(1 + r)^n} \qquad (1)$$

where

V = present value of replacement cow
$A_1, A_2 \ldots A_n$ = per cow cash inflows from beef enterprise each year
r = the discount rate
n = expected economic life in years
S = cow salvage value in year n

A 4 percent discount rate is used. This approximates the long-term rate of return to farm assets (USDA 1986). The expected economic life is six years. Salvage value is a weighted average of current year and past two year's slaughter values for utility grade cows. It is assumed that cash inflows expected are constant over the six years at the predicted current year rate. These assumptions simplify the equation into

$$V = 5.24A + .7903S \qquad (2)$$

The number 5.24 is the present value of $1 received annually for six years at a 4 percent discount rate, and .7903 is the value of $1 received at the end of six years at a 4 percent discount rate.

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[3] Personal communication with Timothy A. Petry, associate professor, Department of Agricultural Economics, North Dakota State University, Fargo.

TABLE 16. FED CATTLE PLANNING PRICES AND REPLACEMENT COW VALUES EXPRESSED IN 1985 DOLLAR VALUES, SIOUX CITY

Year	6-700# Steers[1]	6-700# Heifers[1]	11-1200# Steers[2]	11-1200# Heifers[2]	Replacement Cow[3]
	----------	----------	$/cwt.	----------	--$/head---
1955	50.61	39.29	57.75	53.23	253.40
1956	50.61	39.29	47.75	44.52	260.70
1957	53.16	37.12	52.22	49.90	345.80
1958	55.66	45.04	63.92	59.67	450.72
1959	64.45	56.91	66.51	63.48	572.07
1960	64.90	58.18	63.14	61.24	510.71
1961	62.91	58.47	56.20	54.52	447.25
1962	59.42	52.48	59.64	58.26	511.84
1963	70.43	65.65	51.29	50.59	507.88
1964	62.98	58.32	48.06	47.61	384.60
1965	55.81	51.35	55.92	53.47	367.20
1966	63.16	56.80	56.34	54.13	437.23
1967	63.22	58.39	53.31	51.33	526.93
1968	66.86	61.52	57.67	55.44	567.20
1969	67.75	61.96	63.71	61.09	632.38
1970	71.26	63.70	60.79	59.60	719.02
1971	75.35	67.79	63.02	61.78	795.88
1972	76.73	72.11	61.81	59.63	927.30
1973	84.06	75.55	55.89	54.16	869.59
1974	73.99	65.78	46.28	46.31	322.15
1975	38.50	32.40	51.06	48.60	278.60
1976	49.36	41.86	47.45	45.87	287.50
1977	48.35	42.90	47.82	46.10	335.00
1978	55.08	48.26	55.94	53.47	493.82
1979	74.32	67.12	67.59	65.46	808.85
1980	84.38	74.07	57.85	56.32	832.73
1981	73.73	65.18	55.49	54.41	602.37
1982	61.82	56.00	63.57	61.23	475.46
1983	64.62	57.80	60.82	57.98	387.62
1984	57.90	51.77	58.04	55.79	359.40
1985	59.41	53.52	55.83	54.36	363.30
Average	63.25	56.02	56.86	54.82	504.34

[1]Average monthly prices for September, October, and November (one-year lagged) adjusted by seasonal price index to obtain March, April, and May period planning prices.
[2]Average monthly prices for March, April, and May adjusted by seasonal price index to obtain September, October, and November period planning prices.
[3]Based on discounted present value of beef enterprise return per cow or slaughter value, whichever was higher.

Cash inflows per cow (A) are calculated using the following formula:

$$A = 195.50P_s + 108.75P_h + 160P_c - C \quad (3)$$

where

- A = cash inflow per cow per year
- P_s = price/cwt. of steer calves, three-year weighted average
- P_h = price/cwt. of heifer calves, three-year weighted average
- P_c = price/cwt. of utility grade cows, three-year weighted average
- C = cost of production per cow excluding interest on cows

All prices are in 1985 dollars. The cost of production used was $226 per cow (Allen). It is assumed that ranchers use the profitability of the beef cow enterprise based on current livestock prices modified by their recent experience. The following weights were applied to livestock prices to arrive at estimated cash inflows: current year .5, last year .33, two years ago .17. The same weights are used to predict the salvage value of the cow. Substituting equation 3 into equation 2 and simplifying gives the following replacement cow value prediction model:

$$\text{Replacement Cow Value } (V) = 10.24P_s + 5.70P_h + 16.29P_c - 1{,}187.38$$

In years where this model predicts cow value below current year utility grade cow values, the utility grade cow value is used.

Labor Requirements

Crop labor requirements (hours per acre) used in this study were those estimated by St. George. The estimated man hours for all crops were increased by 20 percent to account for miscellaneous jobs (such as time required for adjusting equipment, lubrication, maintenance, etc.).

Livestock labor requirements were obtained from "Budgets for Major Livestock Enterprises in South Dakota" (Allen 1986). Estimated man hours for all livestock classes were increased by 15 percent to account for miscellaneous jobs.

The labor requirements for all crops were included in the summer period. Livestock labor was included in the winter period with the exception of cow-calf enterprise and cattle finishing. The labor requirement for beef cows was divided between the summer and winter periods. Labor consists of operators' plus hired labor. Operators' labor was assumed to be highly skilled and supervisory. In the LP program, only hired labor was used as an activity, assuming operators' labor as a fixed cost. The wage rate used was $4.50 per hour of hired labor (Farm Labor, USDA/SRS). In the model, labor was only hired when crop and livestock requirements exceeded the labor contributed by the farm operator (2,500 hours per year). The total labor hours required by selected crops and livestock are given in Table 17.

TABLE 17. LABOR REQUIREMENTS FOR SELECTED CROPS AND LIVESTOCK, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA

Item	Hours/Unit	
		Summer
Dryland crops (hours/acre):		
Alfalfa hay		1.1
Corn grain		2.6
Corn silage		3.4
Straw		0.6
Oats		1.7
Sorghum		1.8
Pasture		0.1
Wheat		1.6
Irrigated crops (hours/acre):		
Alfalfa hay		4.0
Corn grain		4.0
Soybeans		4.8
Potatoes		6.5
Supplemental hay on pasture (hours/ton)		0.3
	Winter	Summer
Livestock (hours/head):		
Cow-calf	5.7	2.0
Replacement heifers	5.7	1.5
Backgrounding steers	4.0	--
Backgrounding heifers	4.0	--
Finishing steers	--	1.8
Finishing heifers	--	1.6

SOURCE: U.S. Department of Interior, Bureau of Reclamation, Upper Missouri River, 1985.

Results

The dryland ranch comparison between the static and dynamic models is presented in Table 18 for ranch I and Table 21 for ranch II. The single solution based on average prices and yields is presented for the static model, while the 31-year mean and the range in results are shown for the dynamic model. The static solutions and a summary of the year-to-year solutions are presented in Appendices E and G. The irrigated ranch model comparisons are presented in Tables 20 and 21. Appendices F and H provide details for both the static and dynamic solutions.

Model Ranch I

Cow numbers for the dryland ranch were reduced to 37 in 1956 due to a lack of summer grazing and the exhaustion of stored hay supplies. A longer but less severe drought from 1965 through 1968 required a herd reduction to around 54 cows for the four-year period. The other herd reduction occurred in 2 976 when seven cows had to be sold due to lack of summer forage. The major herd reductions in 1956 and 1976 did not have a large effect on net returns because beef prices were low in both years and productive cows sold had a discounted present value no more than cull cow values for slaughter. Cows were repurchased in 1957, 1969, and 1977 to bring herd size to normal 60 cows. In both 1957 and 1977 the cost of replacement cows was at cull cow values. However, in 1969, a premium was paid for cows to replenish the herd.

Alfalfa hay carried over a second year was given a 20 percent storage loss. Corn silage is a high-cost forage source for beef cows. Both carry-over alfalfa and corn silage (high cost forage supplies) were used more in the dynamic model. It was found profitable in the dynamic model to background calves 14 of the 31 years. Also, the mix of crops produced changed from year to year based on anticipated profits.

The additional return from backgrounding calves when profitable and switching to more profitable crops offset the reduced profits in the beef cow herd due to the forced herd reduction and higher cost forage supplies. The dynamic model mean shows $22 higher return above variable costs that the static model.

TABLE 18. STATIC AND DYNAMIC MODEL DRYLAND RANCH I ORGANIZATION AND INCOME COMPARISONS, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA

Item	Unit	Static Solution	Dynamic Solution Mean	Dynamic Solution Range
Beef cows	hd.	60.0	58.3	37 - 60
Backgrounded calves for sale	hd.	0.0	16.6	0 - 44
Supplemental forage on pasture	tons	0.0	4.9	0 - 40
Small grains aftermath grazed	ac.	141.0	152.2	57 - 268
Corn or sorghum aftermath grazed	tons	54.0	61.1	38 - 79
Alfalfa carried over to summer	tons	34.0	42.1	0 - 148
Straw fed	tons	14.3	22.8	0 - 55
Corn grain	ac.	44.0	82.0	44 - 400
Corn silage	ac.	0.0	6.4	0 - 38
Sorghum	ac.	356.0	281.5	0 - 356
Wheat	ac.	205.4	235.5	205 - 300
Alfalfa	ac.	50.0	50.0	50 - 50
Hired labor	hrs.	233.0	70.0	0 - 310
Return above variable costs	$	49,521	49,543	27,458-91,963

TABLE 19. STATIC AND DYNAMIC MODEL IRRIGATED RANCH I ORGANIZATION AND INCOME COMPARISONS, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA

Item	Unit	Static Solution	Dynamic Solution Mean	Dynamic Solution Range
Beef cows	hd.	70.0	69.9	67 - 70
Backgrounded calves for sale	hd.	0	20.5	0 - 52
Finished cattle	hd.	0	5.6	0 - 51
Supplemental forage on pasture	tons	17.1	22.1	0 - 44
Small grains aftermath grazed	ac.	163.6	134.7	97 - 170
Corn or sorghum aftermath grazed	tons	62.2	72.8	60 - 92
Alfalfa carried over summer	tons	26.9	21.9	0 - 44
Straw fed	tons	0	1.6	0 - 24
Alfalfa hay sold	tons	165.1	113.1	0 - 256
Dryland crops				
Corn grain	ac.	16.7	48.5	0 - 220
Corn silage	ac.	27.3	17.9	0 - 44
Sorghum	ac.	141.4	143.2	0 - 176
Wheat	ac.	200.0	175.7	165 - 200
Alfalfa	ac.	50.0	50.0	50 - 50
Irrigated crops				
Potatoes	ac.	60.0	60.0	60 - 60
Corn	ac.	134.0	127.5	67 - 134
Soybeans	ac.	0	7.5	0 - 67
Alfalfa	ac.	26.0	26.0	26 - 26
Hired labor	hrs.	749.0	821.0	683 - 1,116
Return above variable costs	$	108,862	107,469	66,541-173,817

Forage available from irrigated alfalfa virtually eliminated variability in the beef cow herd for the irrigated ranch even at the higher stocking rate. However, supplemental forage on pasture was needed in all but five of the 31 years. Calves were backgrounded for sale 15 years and finished for slaughter 5 of the 31 years. Some corn was harvested for silage most years and fed to both cows and backgrounding calves.

Potatoes, the most profitable irrigated crop, were produced every year. Irrigated soybeans were substituted for part of irrigated corn acres in four years.

Return above variable costs in the dynamic model was $1,393 lower than in the static model. Reduced returns in the dynamic model came from more supplementation of pasture with alfalfa hay, less alfalfa hay sales, and a small reduction in the cow herd one year. Profits from backgrounding and finishing cattle in the years it was judged profitable and substitutions of soybeans for corn when profitable were not sufficient to offset the reduced returns.

The increased returns above variable costs from irrigation were $59,341 annually from the static model and $57,926 from the dynamic model. The $1,415 lower irrigation benefit from the dynamic model was not in the direction hypothesized.

Reasons model ranch I showed little difference in irrigation benefits between a static and a dynamic model were (1) the beef enterprise was overshadowed in importance by crop enterprises, (2) forage available in large amounts from crop aftermath was a major factor in mitigating variability in pasture yields, and (3) herd reduction and repurchases that did occur were mostly during years of depressed beef profitability when replacement cows were worth only their slaughter values.

Model Ranch II

Cow numbers for the dryland situation were severely reduced in 1956 and 1959 due to a lack of summer grazing and exhaustion of stored hay supplies. Smaller reductions occurred periodically in the summer throughout the period. Cows were sold in the winter period in 1974 and 1976 due to a lack of forage. Cow numbers by year are graphed in Figure 8. Hay prices were too high relative to losses from selling cows to make hay purchases profitable in 1976; however, in 1974 a combination of hay purchases and sale of cows was selected by the model. Some hay was also purchased in 1981. Over 30 cows were purchased in 1957, 1960, and 1977. However, only in 1960 were producing cows selling at a premium over their slaughter value. All but one of the five years of fewer than 30 cow purchases were years in which replacement cows sold at a premium.

Forage use was mixed between the static and dynamic models. Although the dynamic model resulted in less hay carried over summer with its accompanying storage losses, the dynamic model fed more corn silage, a high cost feed source for cows.

It was profitable to background calves 10 of the 31 years in the dynamic model. As in Model I, the mix of crops produced among wheat, corn, and sorghum changed from year to year based on anticipated profits.

The reduced profits in the beef cow herd due to forced herd reductions and purchases of replacement cows more than offset the additional returns from backgrounding calves when profitable and switching to more profitable crops. The dynamic model mean shows a $6,000 lower return above variable costs than the static model.

The irrigated ranches, even at the higher stocking rate, show almost no variation in herd size due to forage availability from irrigation. However, supplemented forage on pasture was needed nearly every year. Calves were backgrounded for sale 9 years and finished for slaughter 2 of the 31 years. Some corn was harvested for silage 19 years and fed to both cows and calves.

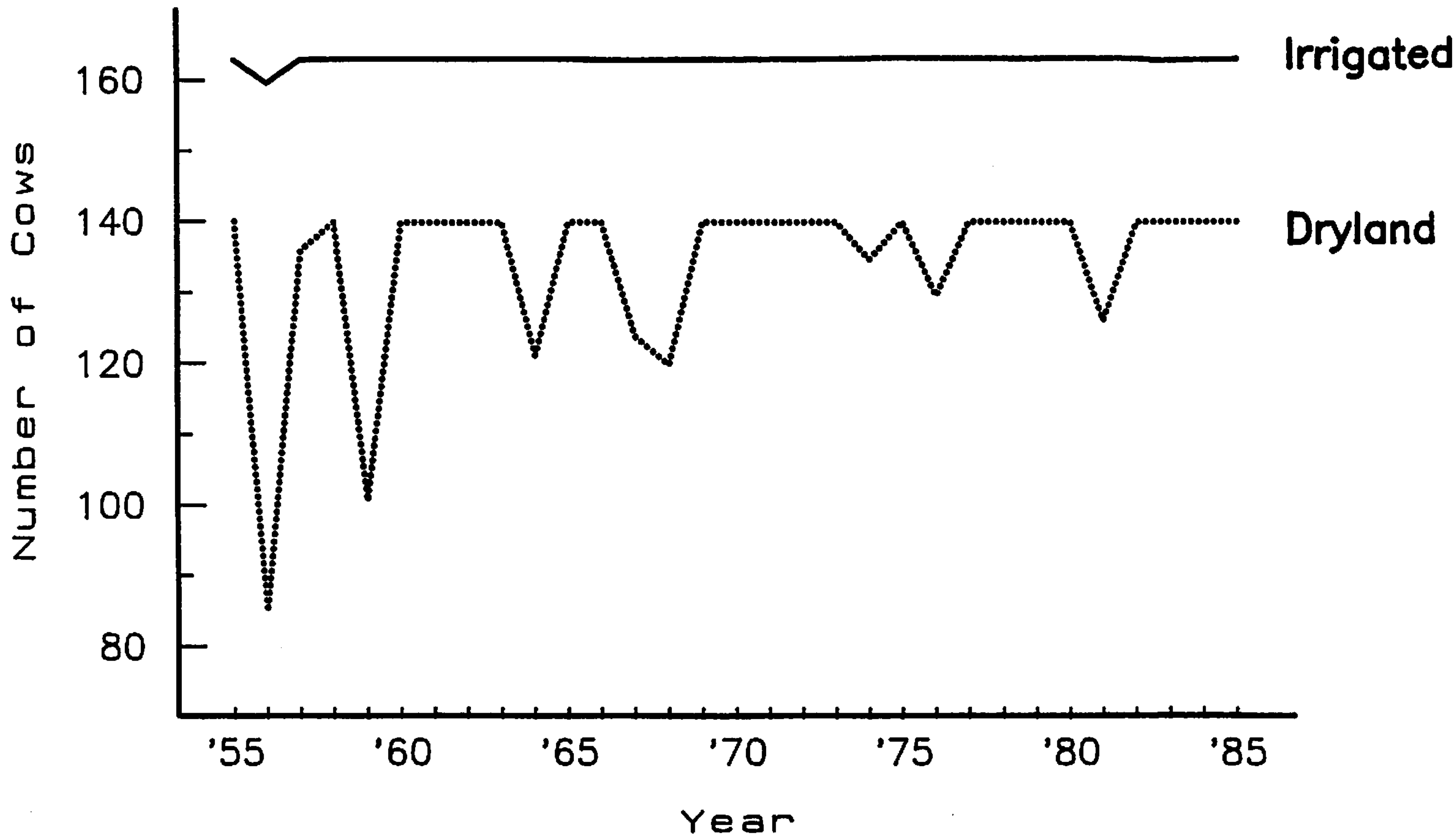

Figure 8. Comparison of Cow Numbers Under Dryland and Irrigation, Ranch Model II, Lake Andes-Wagner Unit, South Dakota, 1955 - 1985

TABLE 20. STATIC AND DYNAMIC MODEL DRYLAND RANCH II ORGANIZATION AND INCOME COMPARISONS, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA

Item	Unit	Static Solution	Dynamic Solution Mean	Dynamic Solution Range
Beef cows	hd.	140.0	134.1	85 - 140
Backgrounded calves for sale	hd.	0.0	22.6	0 - 103
Supplemental forage on pasture	tons	39.0	9.0	0 - 84
Small grains aftermath grazed	ac.	53.2	73.6	36 - 116
Corn or sorghum aftermath grazed	tons	111.7	83.9	13 - 112
Alfalfa carried over to summer	tons	45.0	6.9	0 - 62
Straw fed	tons	0.0	0.0	0 - 0
Corn grain	ac.	60.0	94.1	60 - 208
Corn silage	ac.	0.0	25.7	0 - 56
Sorghum	ac.	148.0	93.4	0 - 148
Wheat	ac.	102.0	122.0	102 - 155
Alfalfa	ac.	120.0	120.0	120 - 120
Hired labor	hrs.	0.0	2.0	0 - 63
Return above variable costs	$	37,583	31,583	

Potatoes were produced every year. Irrigated soybeans were substituted for part of the irrigated corn acres in 3 years.

Return above variable costs in the dynamic model was $2.687 lower than in the static model. Reduced returns in the dynamic model came from less alfalfa hay sales, more corn silage fed, and a small herd reduction in one year. Profits from backgrounding and finishing cattle and substitutions of irrigated soybeans for corn when profitable were not sufficient to offset the reduced returns.

The increased returns above variable costs from irrigation were $36,518 annually from the static model and $39,831 from the dynamic model. The $3,313 (39,831-$36,518) higher irrigation benefit from the dynamic model was as hypothesized.

Model ranch II showed greater irrigation benefits from the dynamic model because of large reductions in cow number during periods of drought and some purchases of hay. The crop enterprises were less important and did not provide sufficient aftermath to mitigate reduced production from dryland pasture and hay. Under irrigation however, the irrigated forages were sufficient to virtually eliminate herd size variability.

Static and Dynamic Model Comparison

A comparison of the benefits from irrigation between the static and dynamic models is presented in Table 22. The hypothesized benefits of the

TABLE 21. STATIC AND DYNAMIC MODEL IRRIGATED RANCH II ORGANIZATION AND INCOME COMPARISONS, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA

Item	Unit	Static Solution	Dynamic Solution	
			Mean	Range
Beef cows	hd.	163.0	162.9	160 - 163
Backgrounded calves for sale	hd.	0.0	17.9	0 - 120
Finished cattle	hd.	0.0	2.5	0 - 79
Supplemental forage on pasture	tons	77.3	75.0	24 - 108
Small grains aftermath grazed	ac.	53.1	50.8	31 - 65
Corn or sorghum aftermath grazed	tons	98.5	79.1	22 - 124
Alfalfa carried over summer	tons	30.7	33.1	12 - 84
Straw fed	tons	0.0	0.0	0 - 0
Alfalfa hay sold	tons	48.8	92.6	0 - 461
Dryland crops				
Corn grain	ac.	60.0	66.5	60 - 110
Corn silage	ac.	0.0	26.7	0 - 60
Sorghum	ac.	50.0	43.6	50 - 50
Wheat	ac.	82.5	82.5	83 - 83
Alfalfa	ac.	65.0	65.0	65 - 65
Irrigated crops				
Potatoes	ac.	40.0	40.0	40 - 40
Corn	ac.	45.0	40.8	2 - 45
Soybeans	ac.	0.0	4.2	0 - 43
Alfalfa	ac.	60.0	60.0	60 - 60
Hired labor	hrs.	319.4	360.7	307 - 729
Return above variable costs	$	74,101	71,414	38,601-113,573

dynamic model delineated at the beginning of this report are tested with this data.

1. The reduction in sales of productive cows in the dynamic model showed the longer average productive cow life with irrigation.

2. The reduction in purchase of replacement cows in the dynamic model illustrated this advantage of irrigation.

3. The lower cow replacement cost with irrigation was due to greater herd stability. The premium paid for replacement cows in some of the years purchased plus the loss from selling some cows one to two years before the end of their normal productive life were captured in the dynamic model.

4. Reduced calf production due to cow liquidation in the dynamic dryland model occurred during periods of below-average calf prices resulting in slightly higher calf values under dryland than under irrigation.

TABLE 22. COMPARISON OF ANNUAL IRRIGATION BENEFITS BETWEEN STATIC AND DYNAMIC MODELS, LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA

Item	Unit	Ranch I Benefits[a] Static	Ranch I Benefits[a] Dynamic	Ranch II Benefits[a] Static	Ranch II Benefits[a] Dynamic
Beef cow number	hd.	+10.0	+11.6	+23.0	+28.9
Sales of productive cows	hd.	0	-1.1	0	-6.3
Purchase of replacement cows	hd.	0	-.9	0	-5.4
Cow sale and purchase costs[b]	$	0	-93.38	0	-366.46
Value of steer calves[c]	$/cwt.	0	-.03	0	-.18
Value of heifer calves[c]	$/cwt.	0	-.11	0	-.37
Calves backgrounded	hd.	0	+3.9	0	-4.7
Calves finished	hd.	0	+5.6	0	+2.5
Price of hay sold	$/ton	0	+1.72	0	+1.72
Hay purchased	tons	0	0	0	-3.9
Alfalfa carried over summer	tons	-7.1	-20.2	-14.3	+26.2
Hay fed with pasture	tons	+17.1	+17.2	+38.6	+82.2
Stocking rate[d]	Au/ac.	+.06	+.07	+.05	+.06
Small grain aftermath grazed	ac.	+22.6	-17.5	0	-22.8
Corn or sorghum aftermath fed	tons	8.2	11.7	-13.3	-4.8
Return above variable cost	$	$59,341	$57,926	$36,518	$39,831

[a]Irrigated ranch linear programming solution minus dryland ranch solution. For the dynamic model the 31-year mean solution was used.
[b]Sum of losses from early culling and depreciation cost of purchased replacements divided by 32.
[c]Average price of calves produced under irrigation minus price under dryland.
[d]Number of cows and replacements heifers per acre of rangeland and cropland pasture.

5. Herd size increase was greater with the dynamic model resulting in better use of labor and facilities.

6. A greater number of calves were backgrounded and finished with irrigation in the dynamic model for ranch I, but fewer calves were backgrounded for ranch II. These results indicate the potential for better showing this effect of irrigation in the dynamic model.

7. The price of hay sold was higher under irrigation in the dynamic model. This indicates the effect of selling more hay when its price is higher and feeding more when hay price relative to livestock planning price was low. A reduction in hay purchases with irrigation occurred for ranch II.

8. Alfalfa carried over through the summer for ranch I was reduced with the dynamic model because of irrigation. The dynamic model was able to follow the buildup and drawdown of hay inventories under dryland conditions. Hay supplies tended to be chronically

short under dryland for ranch II so there was an increase in hay carryover under irrigation. A 20 percent hay storage loss was specified in the model.

9. There was was some increase in supplemental hay fed with pasture between the static and dynamic models especially for ranch II.

10. Stocking rate increase was slightly higher in the dynamic model than for the static model.

11. Use of small grain aftermath was less under irrigation in the dynamic model due mainly to less small grain acreage. However, corn and sorghum aftermath use did increase more under irrigation for ranch I in the dynamic model than in the static model. Reduced acreage of corn and sorghum was the reason for less use of this aftermath for ranch II.

The difference between the static and dynamic model depends upon the ranch situation being modeled. Some of the hypothesized benefits of irrigation are increased under a dynamic model but not all. In a few cases irrigation benefits are actually less in the dynamic model. The two ranch situations modeled suggest added benefits are shown in a dynamic model when livestock are more important relative to crops. Livestock number variations due to drought appear to be the most important variable better modeled in a dynamic contex. This would suggest the improved measurements from a dynamic model would increase in more extreme drought areas than eastern South Dakota.

APPENDIX A

LINEAR PROGRAMMING MODELS

APPENDIX TABLE 1. LINEAR PROGRAMMING MODEL FOR SUMMER DRYLAND, RANCH MODEL I

************ TRANCOL OF LP MATRIX ************

LP PROBLEM FILE NAME: sumdry
PROBLEM TYPE: MAX

ROW		ACCTINV	BEEFCOW	REPHFR	BUYCOW	ESSUPPFD	GRAZRANG	GRCLPAST	SELLCOW1	SELLCOW2	SELLCOW3	LSUPPFOR
OBJ FCN		.	170.0000	.	-22.1600	-45.2100	.	.	-22.1600	-55.4200	-99.7500	-45.2100
ACCTING	E	1.0000	-44.1000	-44.1000	-133.0400	.	.	.	-22.1600	-55.4200	-99.7500	.
COWINV	E	.	1.0000	.	-1.0000	.	.	.	1.0000	1.0000	1.0000	.
COWMAX	L	.	1.0000	.	.	.	.	.	.	.	.	.
REPINV	E	.	.	1.0000	.	.	.	.	.	.	.	.
RPAST	L	.	.	.	.	.	1.0000	.	.	.	.	.
SUMGRAZ	L	.	4.2000	2.6000	.	-3.0000	-1.2200	-1.8000	.	.	.	.
BEGALF	E	.	.	.	.	1.0000	.	.	.	.	.	1.0000
FALLGRAZ	L	.	1.7800	1.0900	.	.	-0.2400	-0.3600	.	.	.	-3.0000
WCOWINV	E	.	-0.8400	.	.	.	.	.	.	.	.	.
EREPINV	E	.	.	-1.0000	.	.	.	.	.	.	.	.
ENDALF	E	.	.	.	.	.	.	.	.	.	.	.
ALFHAY	E	.	.	.	.	.	.	.	.	.	.	.
CPLAST	E	.	.	.	.	.	.	1.0000	.	.	.	.
TILLAC	L	.	.	.	.	.	.	1.0000	.	.	.	.
CORNT	L	.	.	.	.	.	.	.	.	.	.	.
MINCORN	G	.	.	.	.	.	.	.	.	.	.	.
WHTT	L	.	.	.	.	.	.	.	.	.	.	.
OWAFT	L	.	.	.	.	.	.	.	.	.	.	.
OATT	L	.	.	.	.	.	.	.	.	.	.	.
SORGT	L	.	.	.	.	.	.	.	.	.	.	.
WHTLIM	L	.	.	.	.	.	.	.	.	.	.	.
OATLIM	L	.	.	.	.	.	.	.	.	.	.	.
CSLIM	L	.	.	.	.	.	.	.	.	.	.	.
SUMLAB	L	.	2.0000	1.5000	.	3.9000	.	.	.	.	.	3.9000
HFRINV	E	.	.	.	.	.	.	.	.	.	.	.
STRINV	E	.	.	.	.	.	.	.	.	.	.	.
SCOW1	L	.	.	.	.	.	.	.	6.0000	.	.	.
SCOW2	L	.	.	.	.	.	.	.	.	3.0000	.	.
SCOW3	L	.	.	.	.	.	.	.	.	.	2.0000	.
SBED	E	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 1. LINEAR PROGRAMMING MODEL FOR SUMMER DRYLAND, RANCH MODEL I (CONTINUED)

ROW		GRSGAFT	COWT	REPHFRT	ALFT	ALFD	CORNAC	SELLCORN	WHTAC	SELLWHT	OATAC	SELLOAT
OBJ FCN		-0.1000	.	.	.	-17.9400	-57.9700	2.5900	-41.5300	4.0300	-38.5500	1.400
ACCTING	E	.	.	.	.	-17.9400	-57.9700	.	-41.5300	.	-38.5500	.
COWINV	E	.	.	.	.	.	.	.	.	.	.	.
COWMAX	L	.	.	.	.	.	.	.	.	.	.	.
REPINV	E	.	.	.	.	.	.	.	.	.	.	.
RPAST	L	.	.	.	.	.	.	.	.	.	.	.
SUMGRAZ	L	.	.	.	.	.	.	.	.	.	.	.
BEGALF	E	.	.	.	1.0000	.	.	.	.	.	.	.
FALLGRAZ	L	-0.4400	.	.	.	.	.	.	.	.	.	.
WCOWINV	E	.	1.0000	.	.	.	.	.	.	.	.	.
EREPINV	E	.	.	1.1250	.	.	.	.	.	.	.	.
ENDALF	E	.	.	.	-0.8000	-1.7200	.	.	.	.	.	.
ALFHAY	E	.	.	.	.	1.8000	.	.	.	.	.	.
CPLAST	E	.	.	.	.	.	.	.	.	.	.	.
TILLAC	L	.	.	.	.	1.0000	1.0000	.	1.0000	.	1.0000	.
CORNT	L	.	.	.	.	.	-51.1000	1.0000	.	.	.	.
MINCORN	G	.	.	.	.	.	1.0000	.	.	.	.	.
WHTT	L	.	.	.	.	.	.	.	-25.5900	1.0000	.	.
OWAFT	L	1.0000	.	.	.	.	.	.	-1.0000	.	-1.0000	.
OATT	L	.	.	.	.	.	.	.	.	.	-47.8500	1.000
SORGT	L	.	.	.	.	.	.	.	.	.	.	.
WHTLIM	L	.	.	.	.	.	.	.	1.0000	.	.	.
OATLIM	L	.	.	.	.	.	.	.	.	.	1.0000	.
CSLIM	L	.	.	.	.	.	1.0000	.	.	.	.	.
SUMLAB	L	.	.	.	.	1.1000	2.6000	.	1.6000	.	1.7000	.
HFRINV	E	.	.	.	.	.	.	.	.	.	.	.
STRINV	E	.	.	.	.	.	.	.	.	.	.	.
SCOW1	L	.	.	.	.	.	.	.	.	.	.	.
SCOW2	L	.	.	.	.	.	.	.	.	.	.	.
SCOW3	L	.	.	.	.	.	.	.	.	.	.	.
SBED	E	.	0.1500	0.1500	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 1. LINEAR PROGRAMMING MODEL FOR SUMMER DRYLAND, RANCH MODEL I (CONTINUED)

ROW		SORGAC	SELLSORG	HIRELAB	HFRT	STRT	INVALF	STRB	R H S
OBJ FCN		-43.6200	2.2200	-4.5000	.	.	.	.	########
ACCTING	E	-43.6200	.	-4.5000	.	.	.	-3.3400	.
COWINV	E	.	.	.	.	.	.	.	60.0000
COWMAX	L	.	.	.	.	.	.	.	60.0000
REPINV	E	.	.	.	.	.	.	.	10.8000
RPAST	L	.	.	.	.	.	.	.	123.2000
SUMGRAZ	L	.	.	.	.	.	.	.	.
BEGALF	E	.	.	.	.	.	.	.	34.0000
FALLGRAZ	L	.	.	.	.	.	.	.	.
WCOWINV	E	.	.	.	.	.	.	.	.
EREPINV	E	.	.	.	.	.	.	.	.
ENDALF	E	.	.	.	.	.	1.0000	.	.
ALFHAY	E	.	.	.	.	.	.	.	50.0000
CPLAST	E	.	.	.	.	.	.	.	75.0000
TILLAC	L	1.0000	.	.	.	.	.	.	730.4000
CORNT	L	.	.	.	.	.	.	.	.
MINCORN	G	.	.	.	.	.	.	.	44.0000
WHTT	L	.	.	.	.	.	.	.	.
OWAFT	L	.	.	.	.	.	.	1.0000	.
OATT	L	.	.	.	.	.	.	.	.
SORGT	L	-53.3600	1.0000	.	.	.	.	.	.
WHTLIM	L	.	.	.	.	.	.	.	300.0000
OATLIM	L	.	.	.	.	.	.	.	300.0000
CSLIM	L	1.0000	.	.	.	.	.	.	400.0000
SUMLAB	L	1.0000	.	-1.0000	.	.	.	.	1250.0000
HFRINV	E	.	.	.	1.0000	.	.	.	27.6000
STRINV	E	.	.	.	.	1.0000	.	.	27.6000
SCOW1	L	.	.	.	.	.	.	.	60.0000
SCOW2	L	.	.	.	.	.	.	.	60.0000
SCOW3	L	.	.	.	.	.	.	.	60.0000
SBED	E	.	.	.	0.0800	0.0800	.	-0.4300	.

APPENDIX TABLE 2. LINEAR PROGRAMMING MODEL FOR WINTER DRYLAND, RANCH MODEL I

************ TRANCOL OF LP MATRIX ************

LP PROBLEM FILE NAME: wintdry
PROBLEM TYPE: MAX

ROW		ACCTINV	BEEFCOW	REPHFR	SELLCOW1	SELLCOW2	SELLCOW3	SELLCULL	SELLREP	SELLWHFR	SELLWSTR	BGHFRS
OBJ FCN		.	133.0000	133.0000	-22.1600	-55.4200	-99.7500	37.1300	52.7400	58.9900	69.2200	-26.860
ACCTING	E	-1.0000	-47.0600	-47.0600	-22.1600	-55.4200	-99.7500	37.1300	52.7400	58.9900	69.2200	-26.860
COWINV	E	.	1.0000	.	1.0000	1.0000	1.0000	.	.	.	.	.
COWMAX	L	.	1.0000	1.0000	.	.	.	.	.	.	.	.
BREPINV	E	.	.	1.0000	.	.	.	.	.	.	.	.
CULLCOW	E	.	-0.1900	.	.	.	.	0.1000	.	.	.	.
HFRS	E	.	-0.4600	-0.4600	.	.	.	.	.	.	.	.
STRS	E	.	-0.4600	-0.4600	.	.	.	.	.	.	.	.
CULLREP	E	.	.	-0.1100	.	.	.	.	0.1100	.	.	.
ECOWINV	E	.	-1.0000	-1.0000	.	.	.	.	.	.	.	.
BGHFR	E	.	.	.	.	.	.	.	.	.	.	-0.985
BGSTR	L	.	.	.	.	.	.	.	.	.	.	.
WINLAB	L	.	5.7000	5.7000	.	.	.	.	.	.	.	4.000
BALFINV	E	.	.	.	.	.	.	.	.	.	.	.
TDNC	L	.	1931.2000	2213.0000	.	.	.	.	.	.	.	.
PROTC	L	.	298.4000	316.7000	.	.	.	.	.	.	.	.
CORNAC	E	.	.	.	.	.	.	.	.	.	.	.
CORNSILT	E	.	.	.	.	.	.	.	.	.	.	.
CORNGRT	E	.	.	.	.	.	.	.	.	.	.	.
CSAFT	L	.	.	.	.	.	.	.	.	.	.	.
OWAFT	L	.	.	.	.	.	.	.	.	.	.	.
OATAC	E	.	.	.	.	.	.	.	.	.	.	.
WHTAC	E	.	.	.	.	.	.	.	.	.	.	.
OATT	E	.	.	.	.	.	.	.	.	.	.	.
WHTT	E	.	.	.	.	.	.	.	.	.	.	.
STRAWT	E	.	.	.	.	.	.	.	.	.	.	.
SORGAC	E	.	.	.	.	.	.	.	.	.	.	.
SORGT	E	.	.	.	.	.	.	.	.	.	.	.
BHFRINV	E	.	.	.	.	.	.	.	.	0.2670	.	1.0000
BSTRINV	E	.	.	.	.	.	.	.	.	.	0.2350	.
REQREP	E	.	.	.	.	.	.	.	.	.	.	.
PROTBG	L	.	.	.	.	.	.	.	.	.	.	187.5000
NEMBG	L	.	.	.	.	.	.	.	.	.	.	1276.3001
NEGBG	L	.	.	.	.	.	.	.	.	.	.	779.9000
SCOWL1	L	.	.	.	6.0000	.	.	.	.	.	.	.
SCOWL2	L	.	.	.	.	3.0000	.	.	.	.	.	.
SCOWL3	L	.	.	.	.	.	2.0000	.	.	.	.	.
STRAWL	L	.	.	.	.	.	.	.	.	.	.	.
AMAXT	G	.	643.0000	737.0000	.	.	.	.	.	.	.	.
AMAXP	G	.	99.3600	105.4000	.	.	.	.	.	.	.	.
MINF	G	.	.	.	.	.	.	.	.	.	.	.
MAXF	L	.	.	.	.	.	.	.	.	.	.	.
MAXS	L	.	.	.	.	.	.	.	.	.	.	.
MAXAFT	L	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 2. LINEAR PROGRAMMING MODEL FOR WINTER DRYLAND, RANCH MODEL I (CONTINUED)

ROW		BGSTRS	SBGHFR	SBGSTR	HIRELAB	ALFT	ALFC	BUYALF	CORNSIL	CSC	CORNGR	SELLCORN
OBJ FCN		-29.0000	56.0200	63.2500	-4.5000	36.1600	.	-73.8100	-2.8600	.	.	2.5400
ACCTING	E	-29.0000	55.3700	62.2400	-4.5000	.	.	-73.8100	-2.8600	.	.	2.5400
COWINV	E	.	.	.	.	.	.	.	.	.	.	.
COWMAX	L	.	.	.	.	.	.	.	.	.	.	.
BREPINV	E	.	.	.	.	.	.	.	.	.	.	.
CULLCOW	E	.	.	.	.	.	.	.	.	.	.	.
HFRS	E	.	.	.	.	.	.	.	.	.	.	.
STRS	E	.	.	.	.	.	.	.	.	.	.	.
CULLREP	E	.	.	.	.	.	.	.	.	.	.	.
ECOWINV	E	.	.	.	.	.	.	.	.	.	.	.
BGHFR	E	.	0.1670	.	.	.	.	.	.	.	.	.
BGSTR	L	-0.9850	.	0.1540	.	.	.	.	.	.	.	.
WINLAB	L	4.0000	.	.	-1.0000	.	.	.	.	.	.	.
BALFINV	E	.	.	.	.	1.0000	1.0000	-1.0000	.	.	.	.
TDNC	L	.	.	.	.	.	-991.8000	.	.	-396.9000	.	.
PROTC	L	.	.	.	.	.	-290.7000	.	.	-49.6000	.	.
CORNAC	E	.	.	.	.	.	.	.	1.0000	.	1.0000	.
CORNSILT	E	.	.	.	.	.	.	.	-7.8000	1.0000	.	.
CORNGRT	E	.	.	.	.	.	.	.	.	.	-51.1000	1.0000
CSAFT	L	.	.	.	.	.	.	.	.	.	-0.5800	.
OWAFT	L	.	.	.	.	.	.	.	.	.	.	.
OATAC	E	.	.	.	.	.	.	.	.	.	.	.
WHTAC	E	.	.	.	.	.	.	.	.	.	.	.
OATT	E	.	.	.	.	.	.	.	.	.	.	.
WHTT	E	.	.	.	.	.	.	.	.	.	.	.
STRAWT	E	.	.	.	.	.	.	.	.	.	.	.
SORGAC	E	.	.	.	.	.	.	.	.	.	.	.
SORGT	E	.	.	.	.	.	.	.	.	.	.	.
BHFRINV	E	.	.	.	.	.	.	.	.	.	.	.
BSTRINV	E	1.0000	.	.	.	.	.	.	.	.	.	.
REQREP	E	.	.	.	.	.	.	.	.	.	.	.
PROTBG	L	207.3000	.	.	.	.	.	.	.	.	.	.
NEMBG	L	1295.1000	.	.	.	.	.	.	.	.	.	.
NEGBG	L	769.0000	.	.	.	.	.	.	.	.	.	.
SCOWL1	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL2	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL3	L	.	.	.	.	.	.	.	.	.	.	.
STRAWL	L	.	.	.	.	.	-0.5500	.	.	-0.1800	.	.
AMAXT	G	.	.	.	.	.	.	.	.	.	.	.
AMAXP	G	.	.	.	.	.	.	.	.	.	.	.
MINF	G	.	.	.	.	.	.	.	.	.	.	.
MAXF	L	.	.	.	.	.	.	.	.	.	.	.
MAXS	L	.	.	.	.	.	.	.	.	.	.	.
MAXAFT	L	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 2. LINEAR PROGRAMMING MO... ... WINTER DRYLAND, RANCH MODEL I (CONTINUED)

ROW		GRCSAFT	OATS	WHEAT	BSTRAW	FSTRAW	PROTSUPP	OATC	SELLOAT	SELLWHT	SORG	SELLSORG
OBJ FCN		-0.1000	.	.	-7.9900	.	-200.0000	.	1.3900	.	.	2.1700
ACCTING	E	.	.	.	-7.9900	.	-200.0000	.	1.3900	3.9400	.	2.1700
COWINV	E	.	.	.	.	.	.	.	.	.	.	.
COWMAX	L	.	.	.	.	.	.	.	.	.	.	.
BREPINV	E	.	.	.	.	.	.	.	.	.	.	.
CULLCOW	E	.	.	.	.	.	.	.	.	.	.	.
HFRS	E	.	.	.	.	.	.	.	.	.	.	.
STRS	E	.	.	.	.	.	.	.	.	.	.	.
CULLREP	E	.	.	.	.	.	.	.	.	.	.	.
ECOWINV	E	.	.	.	.	.	.	.	.	.	.	.
BGHFR	E	.	.	.	.	.	.	.	.	.	.	.
BGSTR	L	.	.	.	.	.	.	.	.	.	.	.
WINLAB	L	.	.	.	.	.	.	.	.	.	.	.
BALFINV	E	.	.	.	.	.	.	.	.	.	.	.
TDNC	L	-824.5000	.	.	.	-620.3000	-1400.5000	-21.7000	.	.	.	.
PROTC	L	-100.8300	.	.	.	-54.4700	-879.3000	-3.7500	.	.	.	.
CORNAC	E	.	.	.	.	.	.	.	.	.	.	.
CORNSILT	E	.	.	.	.	.	.	.	.	.	.	.
CORNGRT	E	.	.	.	.	.	.	.	.	.	.	.
CSAFT	L	1.0000	.	.	.	.	.	.	.	.	-0.5000	.
OWAFT	L	.	.	.	2.3200	.	.	.	.	.	.	.
OATAC	E	.	1.0000	.	.	.	.	.	.	.	.	.
WHTAC	E	.	.	1.0000	.	.	.	.	.	.	.	.
OATT	E	.	-47.8500	.	.	.	.	1.0000	1.0000	.	.	.
WHTT	E	.	.	-26.5900	.	.	.	.	.	1.0000	.	.
STRAWT	E	.	.	.	-1.0000	1.0000	.	.	.	.	.	.
SORGAC	E	.	.	.	.	.	.	.	.	.	1.0000	.
SORGT	E	.	.	.	.	.	.	.	.	.	-53.3600	1.0000
BHFRINV	E	.	.	.	.	.	.	.	.	.	.	.
BSTRINV	E	.	.	.	.	.	.	.	.	.	.	.
REDREP	E	.	.	.	.	.	.	.	.	.	.	.
PROTBG	L	.	.	.	.	.	.	.	.	.	.	.
NEMBG	L	.	.	.	.	.	.	.	.	.	.	.
NEGBG	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL1	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL2	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL3	L	.	.	.	.	.	.	.	.	.	.	.
STRAWL	L	.	.	.	.	0.4500	-0.5500	-0.8000	.	.	.	.
AMAXT	G	-824.5000	.	.	.	.	.	.	.	.	.	.
AMAXP	G	-100.8300	.	.	.	.	.	.	.	.	.	.
MINF	G	.	.	.	.	.	.	.	.	.	.	.
MAXF	L	.	.	.	.	.	.	.	.	.	.	.
MAXS	L	.	.	.	.	.	.	.	.	.	.	.
MAXAFT	L	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 2. LINEAR PROGRAMMING MODEL FOR WINTER DRYLAND, RANCH MODEL I (CONTINUED)

ROW		EHFRINV	ESTRINV	REPINV	INVCOW	ALFM	ALFG	CSM	CSG	CGRM	CGRG	OATM
OBJ FCN		.	.	.	.	.	.	.	.	.	.	.
ACCTING	E	.	.	.	.	.	.	.	.	.	.	.
COWINV	E	.	.	.	.	.	.	.	.	.	.	.
COWMAX	L	.	.	.	.	.	.	.	.	.	.	.
BREPINV	E	.	.	.	.	.	.	.	.	.	.	.
CULLCOW	E	.	.	.	.	.	.	.	.	.	.	.
HFRS	E	1.0000	.	.	.	.	.	.	.	.	.	.
STRS	E	.	1.0000	.	.	.	.	.	.	.	.	.
CULLREP	E	.	.	.	.	.	.	.	.	.	.	.
ECOWINV	E	.	.	.	1.0000	.	.	.	.	.	.	.
BGHFR	E	.	.	1.0000	.	.	.	.	.	.	.	.
BGSTR	L	.	.	.	.	.	.	.	.	.	.	.
WINLAB	L	.	.	.	.	.	.	.	.	.	.	.
BALFINV	E	.	.	.	.	1.0000	1.0000	.	.	.	.	.
TDNC	L	.	.	.	.	.	.	.	.	.	.	.
PROTC	L	.	.	.	.	.	.	.	.	.	.	.
CORNAC	E	.	.	.	.	.	.	.	.	.	.	.
CORNSILT	E	.	.	.	.	.	.	1.0000	1.0000	.	.	.
CORNGRT	E	.	.	.	.	.	.	.	.	1.0000	1.0000	.
CSAFT	L	.	.	.	.	.	.	.	.	.	.	.
OWAFT	L	.	.	.	.	.	.	.	.	.	.	.
OATAC	E	.	.	.	.	.	.	.	.	.	.	.
WHTAC	E	.	.	.	.	.	.	.	.	.	.	.
OATT	E	.	.	.	.	.	.	.	.	.	.	1.0000
WHTT	E	.	.	.	.	.	.	.	.	.	.	.
STRAWT	E	.	.	.	.	.	.	.	.	.	.	.
SORGAC	E	.	.	.	.	.	.	.	.	.	.	.
SORGT	E	.	.	.	.	.	.	.	.	.	.	.
BHFRINV	E	.	.	.	.	.	.	.	.	.	.	.
BSTRINV	E	.	.	.	.	.	.	.	.	.	.	.
REQREP	E	.	.	1.0000	.	.	.	.	.	.	.	.
PROTBG	L	.	.	.	.	-290.7000	-290.7000	-49.6000	-49.6000	-4.9300	-4.9300	-3.7500
NEMBG	L	.	.	.	.	-961.8000	.	-410.5500	.	-49.5600	.	-23.6600
NEGBG	L	.	.	.	.	.	-527.4400	.	-249.5800	.	-34.2900	.
SCOWL1	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL2	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL3	L	.	.	.	.	.	.	.	.	.	.	.
STRAWL	L	.	.	.	.	.	.	.	.	.	.	.
AMAXT	G	.	.	.	.	.	.	.	.	.	.	.
AMAXP	G	.	.	.	.	.	.	.	.	.	.	.
MINF	G	.	.	.	.	0.7500	0.7500	0.2500	0.2500	-0.0070	-0.0070	-0.0040
MAXF	L	.	.	.	.	0.3000	0.3000	0.1000	0.1000	-0.0196	-0.0196	-0.0112
MAXS	L	.	.	.	.	-0.2000	-0.2000	-0.0700	-0.0700	-0.0056	-0.0056	-0.0032
MAXAFT	L	.	.	.	.	-0.2500	-0.2500	-0.0800	-0.0800	-0.0070	-0.0070	-0.0040

- CONTINUED -

APPENDIX TABLE 2. LINEAR PROGRAMMING MODEL FOR WINTER DRYLAND, RANCH MODEL I (CONTINUED)

ROW		OATG	SORGM	SORGG	PROSM	PROSG	STRM	STRG	CSAFTM	CSAFTG	R H S
OBJ FCN		.	.	.	-200.0000	-200.0000	.	.	-0.1000	-0.1000	########
ACCTING	E	.	.	.	-200.0000	-200.0000	.	.	.	.	.
COWINV	E	.	.	.	.	.	.	.	.	.	50.4000
COWMAX	L	.	.	.	.	.	.	.	.	.	60.0000
BREPINV	E	.	.	.	.	.	.	.	.	.	9.6000
CULLCOW	E	.	.	.	.	.	.	.	.	.	.
HFRS	E	.	.	.	.	.	.	.	.	.	.
STRS	E	.	.	.	.	.	.	.	.	.	.
CULLREP	E	.	.	.	.	.	.	.	.	.	.
ECOWINV	E	.	.	.	.	.	.	.	.	.	.
BGHFR	E	.	.	.	.	.	.	.	.	.	.
BGSTR	L	.	.	.	.	.	.	.	.	.	.
WINLAB	L	.	.	.	.	.	.	.	.	.	1250.0000
BALFINV	E	.	.	.	.	.	.	.	.	.	113.2000
TDNC	L	.	.	.	.	.	.	.	.	.	.
PROTC	L	.	.	.	.	.	.	.	.	.	.
CORNAC	E	.	.	.	.	.	.	.	.	.	44.0000
CORNSILT	E	.	.	.	.	.	.	.	.	.	.
CORNGRT	E	.	.	.	.	.	.	.	.	.	.
CSAFT	L	.	.	.	.	.	.	.	1.0000	1.0000	.
OWAFT	L	.	.	.	.	.	.	.	.	.	33.3000
OATAC	E	.	.	.	.	.	.	.	.	.	.
WHTAC	E	.	.	.	.	.	.	.	.	.	205.4000
OATT	E	1.0000	.	.	.	.	.	.	.	.	.
WHTT	E	.	.	.	.	.	.	.	.	.	.
STRAWT	E	.	.	.	.	.	1.0000	1.0000	.	.	.
SORGAC	E	.	.	.	.	.	.	.	.	.	356.0000
SORGT	E	.	1.0000	1.0000	.	.	.	.	.	.	.
BHFRINV	E	.	.	.	.	.	.	.	.	.	27.6000
BSTRINV	E	.	.	.	.	.	.	.	.	.	27.6000
REDREP	E	.	.	.	.	.	.	.	.	.	10.8000
PROTBG	L	-3.7500	-4.8700	-4.8700	-879.3000	-879.3000	-54.4700	-54.4700	-108.8300	-108.8300	.
NEXBG	L	.	-45.0400	.	-1646.6000	.	-439.2000	.	-725.5400	.	.
NEGBG	L	-15.6000	.	-30.6100	.	-1118.9600	.	-75.4900	.	-314.1500	.
SCOWL1	L	.	.	.	.	.	.	.	.	.	60.0000
SCOWL2	L	.	.	.	.	.	.	.	.	.	60.0000
SCOWL3	L	.	.	.	.	.	.	.	.	.	60.0000
STRAWL	L	.	.	.	.	.	.	.	.	.	.
AMAXT	G	.	.	.	.	.	.	.	.	.	.
AMAXP	G	.	.	.	.	.	.	.	.	.	.
MINF	G	-0.0040	-0.0070	-0.0070	-0.2500	-0.2500	0.7500	0.7500	0.7500	0.7500	.
MAXF	L	-0.0112	-0.0196	-0.0196	-0.7000	-0.7000	0.3000	0.3000	0.3000	0.3000	.
MAXS	L	-0.0032	-0.0056	-0.0056	-0.2000	-0.2000	0.8000	0.8000	.	.	.
MAXAFT	L	-0.0040	-0.0070	-0.0070	-0.2500	-0.2500	.	.	0.7500	0.7500	.

APPENDIX TABLE 3. LINEAR PROGRAMMING MODEL FOR SUMMER IRRIGATED, RANCH MODEL I

************ TRANCOL OF LP MATRIX ************

LP PROBLEM FILE NAME: sumirrig
PROBLEM TYPE: MAX

ROW		ACCTINV	BEEFCOW	REPHFR	BUYCOW	ESSUPPFD	GRAZRANG	GRCLPAST	SELLCOW1	SELLCOW2	SELLCOW3	LSUPPFOR
OBJ FCN		.	170.0000	.	-22.1600	-45.2100	.	.	-22.1600	-55.4200	-99.7500	-44.2100
ACCTING	E	1.0000	-44.1000	-44.1000	-133.0400	.	.	.	-22.1600	-55.4200	-99.7500	.
COWINV	E	.	1.0000	.	-1.0000	.	.	.	1.0000	1.0000	1.0000	.
COWMAX	L	.	1.0000	.	.	.	.	.	.	.	.	.
REPINV	E	.	.	1.0000	.	.	.	.	.	.	.	.
RPAST	L	.	.	.	.	.	1.0000	.	.	.	.	.
SUMGRAZ	L	.	4.2000	2.6000	.	-3.0000	-1.2200	-1.8000	.	.	.	.
BEGALF	E	.	.	.	.	1.0000	.	.	.	.	.	1.0000
FALLGRAZ	L	.	1.7800	1.0900	.	.	-0.2400	-0.3600	.	.	.	-3.0000
WCOWINV	E	.	-0.8400	.	.	.	.	.	.	.	.	.
EREPINV	E	.	.	-1.0000	.	.	.	.	.	.	.	.
ENDALF	E	.	.	.	.	.	.	.	.	.	.	.
ALFHAY	E	.	.	.	.	.	.	.	.	.	.	.
CPLAST	E	.	.	.	.	.	.	1.0000	.	.	.	.
TILLAC	L	.	.	.	.	.	.	1.0000	.	.	.	.
CORNT	L	.	.	.	.	.	.	.	.	.	.	.
MINCORN	G	.	.	.	.	.	.	.	.	.	.	.
WHTT	L	.	.	.	.	.	.	.	.	.	.	.
OWAFT	L	.	.	.	.	.	.	.	.	.	.	.
OATT	L	.	.	.	.	.	.	.	.	.	.	.
SORGT	L	.	.	.	.	.	.	.	.	.	.	.
WHTLIM	L	.	.	.	.	.	.	.	.	.	.	.
OATLIM	L	.	.	.	.	.	.	.	.	.	.	.
CSLIM	L	.	.	.	.	.	.	.	.	.	.	.
SUMLAB	L	.	2.0000	1.5000	.	3.9000	.	.	.	.	.	3.9000
HFRINV	E	.	.	.	.	.	.	.	.	.	.	.
STRINV	E	.	.	.	.	.	.	.	.	.	.	.
SCOW1	L	.	.	.	.	.	.	.	6.0000	.	.	.
SCOW2	L	.	.	.	.	.	.	.	.	3.0000	.	.
SCOW3	L	.	.	.	.	.	.	.	.	.	2.0000	.
SBED	E	.	.	.	.	.	.	.	.	.	.	.
IRTILAC	L	.	.	.	.	.	.	.	.	.	.	.
POTLIM	L	.	.	.	.	.	.	.	.	.	.	.
POTT	L	.	.	.	.	.	.	.	.	.	.	.
SOYLIM	L	.	.	.	.	.	.	.	.	.	.	.
SOYT	L	.	.	.	.	.	.	.	.	.	.	.
AFIRLIM	E	.	.	.	.	.	.	.	.	.	.	.
CORILIM	L	.	.	.	.	.	.	.	.	.	.	.
IFS	E	.	.	.	.	.	.	.	.	.	.	.
IFH	E	.	.	.	.	.	.	.	.	.	.	.
FST	E	.	.	.	.	.	.	.	.	.	.	.
FHT	E	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 3. LINEAR PROGRAMMING MODEL FOR SUMMER IRRIGATED, RANCH MODEL I (CONTINUED)

ROW		GRSSAFT	COWT	REPHFRT	ALFT	ALFD	CORNAC	SELLCORN	WHTAC	SELLWHT	OATAC	SELLOAT
OBJ FCN		-0.1000	.	.	.	-17.9400	-57.9700	2.5900	-41.5300	4.0300	-38.5500	1.4000
ACCTING	E	.	.	.	.	-17.9400	-57.9700	.	-41.5300	.	-38.5500	.
COWINV	E	.	.	.	.	.	.	.	.	.	.	.
COWMAX	L	.	.	.	.	.	.	.	.	.	.	.
REPINV	E	.	.	.	.	.	.	.	.	.	.	.
RPAST	L	.	.	.	.	.	.	.	.	.	.	.
SUMGRAZ	L	.	.	.	.	.	.	.	.	.	.	.
BEGALF	E	.	.	.	1.0000	.	.	.	.	.	.	.
FALLGRAZ	L	-0.4400	.	.	.	.	.	.	.	.	.	.
WCOWINV	E	.	1.0000	.	.	.	.	.	.	.	.	.
EREPINV	E	.	.	1.1250	.	.	.	.	.	.	.	.
ENDALF	E	.	.	.	-0.8000	-1.7200	.	.	.	.	.	.
ALFHAY	E	.	.	.	.	1.0000	.	.	.	.	.	.
CPLAST	E	.	.	.	.	.	.	.	.	.	.	.
TILLAC	L	.	.	.	.	1.0000	1.0000	.	1.0000	.	1.0000	.
CORNT	L	.	.	.	.	.	-51.1000	1.0000	.	.	.	.
MINCORN	G	.	.	.	.	.	1.0000	.	.	.	.	.
WHTT	L	.	.	.	.	.	.	.	-26.5900	1.0000	.	.
OWAFT	L	1.0000	.	.	.	.	.	.	-1.0000	.	-1.0000	.
OATT	L	.	.	.	.	.	.	.	.	.	-47.8500	1.0000
SORGT	L	.	.	.	.	.	.	.	.	.	.	.
WHTLIM	L	.	.	.	.	.	.	.	1.0000	.	.	.
OATLIM	L	.	.	.	.	.	.	.	.	.	1.0000	.
CSLIM	L	.	.	.	.	.	1.0000	.	.	.	.	.
SUMLAB	L	.	.	.	.	1.1000	2.6000	.	1.6000	.	1.7000	.
HFRINV	E	.	.	.	.	.	.	.	.	.	.	.
STRINV	E	.	.	.	.	.	.	.	.	.	.	.
SCOW1	L	.	.	.	.	.	.	.	.	.	.	.
SCOW2	L	.	.	.	.	.	.	.	.	.	.	.
SCOW3	L	.	.	.	.	.	.	.	.	.	.	.
SBED	E	.	0.1500	0.1500	.	.	.	.	.	.	.	.
IRTILAC	L	.	.	.	.	.	.	.	.	.	.	.
POTLIM	L	.	.	.	.	.	.	.	.	.	.	.
POTT	L	.	.	.	.	.	.	.	.	.	.	.
SOYLIM	L	.	.	.	.	.	.	.	.	.	.	.
SOYT	L	.	.	.	.	.	.	.	.	.	.	.
AFIRLIM	E	.	.	.	.	.	.	.	.	.	.	.
CORILIM	L	.	.	.	.	.	.	.	.	.	.	.
IFS	E	.	.	.	.	.	.	.	.	.	.	.
IFH	E	.	.	.	.	.	.	.	.	.	.	.
FST	E	.	.	.	.	.	.	.	.	.	.	.
FHT	E	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 3. LINEAR PROGRAMMING MODEL FOR SUMMER IRRIGATED, RANCH MODEL I (CONTINUED)

ROW		SORGAC	SELLSORG	HIRELAB	HFRT	STRT	INVALF	STRB	POTAC	SELLPOT	SOYAC	SELLSOY
OBJ FCN		-43.6200	2.2200	-4.5000	.	.	.	.	-422.8200	4.2300	-70.7500	5.9300
ACCTING	E	-43.6200	.	-4.5000	.	.	.	-3.3400	-422.8200	.	-70.7500	.
COWINV	E	.	.	.	.	.	.	.	.	.	.	.
COWMAX	L	.	.	.	.	.	.	.	.	.	.	.
REPINV	E	.	.	.	.	.	.	.	.	.	.	.
RPAST	L	.	.	.	.	.	.	.	.	.	.	.
SUMGRAZ	L	.	.	.	.	.	.	.	.	.	.	.
BEGALF	E	.	.	.	.	.	.	.	.	.	.	.
FALLGRAZ	L	.	.	.	.	.	.	.	.	.	.	.
WCOWINV	E	.	.	.	.	.	.	.	.	.	.	.
EREPINV	E	.	.	.	.	.	.	.	.	.	.	.
ENDALF	E	.	.	.	.	.	1.0000	.	.	.	.	.
ALFHAY	E	.	.	.	.	.	.	.	.	.	.	.
CPLAST	E	.	.	.	.	.	.	.	.	.	.	.
TILLAC	L	1.0000	.	.	.	.	.	.	.	.	.	.
CORNT	L	.	.	.	.	.	.	.	.	.	.	.
MINCORN	G	.	.	.	.	.	.	.	.	.	.	.
WHTT	L	.	.	.	.	.	.	.	.	.	.	.
OWAFT	L	.	.	.	.	.	.	1.0000	.	.	.	.
OATT	L	.	.	.	.	.	.	.	.	.	.	.
SORGT	L	-53.3600	1.0000	.	.	.	.	.	.	.	.	.
WHTLIM	L	.	.	.	.	.	.	.	.	.	.	.
OATLIM	L	.	.	.	.	.	.	.	.	.	.	.
CSLIM	L	1.0000	.	.	.	.	.	.	.	.	.	.
SUMLAB	L	1.0000	.	-1.0000	.	.	.	.	6.5000	.	4.0000	.
HFRINV	E	.	.	.	1.0000	.	.	.	.	.	.	.
STRINV	E	.	.	.	.	1.0000	.	.	.	.	.	.
SCOW1	L	.	.	.	.	.	.	.	.	.	.	.
SCOW2	L	.	.	.	.	.	.	.	.	.	.	.
SCOW3	L	.	.	.	.	.	.	.	.	.	.	.
SBED	E	.	.	.	0.0800	0.0300	.	-0.4300	.	.	.	.
IRTILAC	L	.	.	.	.	.	.	.	1.0000	.	1.0000	.
POTLIM	L	.	.	.	.	.	.	.	1.0000	.	.	.
POTT	L	.	.	.	.	.	.	.	-289.4000	1.0000	.	.
SOYLIM	L	.	.	.	.	.	.	.	.	.	1.0000	.
SOYT	L	.	.	.	.	.	.	.	.	.	-30.0900	1.0000
AFIRLIM	E	.	.	.	.	.	.	.	.	.	.	.
CORILIM	L	.	.	.	.	.	.	.	.	.	.	.
IFS	E	.	.	.	.	.	.	.	.	.	.	.
IFH	E	.	.	.	.	.	.	.	.	.	.	.
FST	E	.	.	.	.	.	.	.	.	.	.	.
FHT	E	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 3. LINEAR PROGRAMMING MODEL FOR SUMMER IRRIGATED, RANCH MODEL I (CONTINUED)

ROW		ALFI	CORNI	FINS	SFS	FINH	SFH	LSUPPALF	R H S
OBJ FCN		-72.1000	-149.7800	.	.	.	.	-45.2100	########
ACCTING	E	-72.1000	-149.7800	-38.7800	59.6500	-34.2500	56.8800	.	.
COWINV	E	.	.	.	.	.	.	.	70.0000
COWMAX	L	.	.	.	.	.	.	.	70.0000
REPINV	E	.	.	.	.	.	.	.	12.6000
RPAST	L	.	.	.	.	.	.	.	123.2000
SUMGRAZ	L	.	.	.	.	.	.	.	.
BEGALF	E	.	.	.	.	.	.	.	44.0000
FALLGRAZ	L	.	.	.	.	.	.	-3.0000	.
WCOWINV	E	.	.	.	.	.	.	.	.
EREPINV	E	.	.	.	.	.	.	.	.
ENDALF	E	-5.0500	.	.	.	.	.	1.0000	.
ALFHAY	E	.	.	.	.	.	.	.	50.0000
CPLAST	E	.	.	.	.	.	.	.	75.0000
TILLAC	L	.	.	.	.	.	.	.	510.4000
CORNT	L	.	-139.6700	.	.	.	.	.	.
MINCORN	G	.	.	.	.	.	.	.	44.0000
WHTT	L	.	.	.	.	.	.	.	.
OWAFT	L	.	.	.	.	.	.	.	.
OATT	L	.	.	.	.	.	.	.	.
SORGT	L	.	.	.	.	.	.	.	.
WHTLIM	L	.	.	.	.	.	.	.	200.0000
OATLIM	L	.	.	.	.	.	.	.	200.0000
CSLIM	L	.	.	.	.	.	.	.	220.0000
SUMLAB	L	4.0000	4.0000	1.8000	.	1.6000	.	3.9000	1250.0000
HFRINV	E	.	.	.	.	.	.	.	32.2000
STRINV	E	.	.	.	.	.	.	.	32.2000
SCOW1	L	.	.	.	.	.	.	.	70.0000
SCOW2	L	.	.	.	.	.	.	.	70.0000
SCOW3	L	.	.	.	.	.	.	.	70.0000
SBED	E	.	.	.	.	.	.	.	.
IRTILAC	L	1.0000	1.0000	.	.	.	.	.	220.0000
POTLIM	L	.	.	.	.	.	.	.	60.0000
POTT	L	.	.	.	.	.	.	.	.
SOYLIM	L	.	.	.	.	.	.	.	67.0000
SOYT	L	.	.	.	.	.	.	.	.
AFIRLIM	E	1.0000	.	.	.	.	.	.	26.0000
CORILIM	L	.	1.0000	.	.	.	.	.	134.0000
IFS	E	.	.	1.0000	.	.	.	.	.
IFH	E	.	.	.	.	1.0000	.	.	.
FST	E	.	.	-11.5000	1.0000	.	.	.	.
FHT	E	.	.	.	.	-10.5000	1.0000	.	.

APPENDIX TABLE 4. LINEAR PROGRAMMING MODEL FOR WINTER IRRIGATED, RANCH MODEL I

LP PROBLEM FILE NAME: wintirri
PROBLEM TYPE: MAX

ROW		ACCTINV	BEEFCOW	REPHFR	SELLCOW1	SELLCOW2	SELLCOW3	SELLCULL	SELLREP	SELLWHFR	SELLWSTR	BGHFRS
OBJ FCN		.	133.0000	133.0000	-22.1600	-55.4200	-99.7500	37.1300	52.7400	58.9900	69.2200	-26.8600
ACCTING	E	-1.0000	-47.0600	-47.0600	-22.1600	-55.4200	-99.7500	37.1300	52.7400	58.9900	69.2200	-26.8600
COWINV	E	.	1.0000	.	1.0000	1.0008	1.0000	.	.	.	.	.
COWMAX	L	.	1.0000	1.0000	.	.	.	.	.	.	.	.
BREPINV	E	.	.	1.0000	.	.	.	.	.	.	.	.
CULLCOW	E	.	-0.1900	.	.	.	.	0.1000	.	.	.	.
HFRS	E	.	-0.4600	-0.4600	.	.	.	.	.	.	.	.
STRS	E	.	-0.4600	-0.4600	.	.	.	.	.	.	.	.
CULLREP	E	.	.	-0.1100	.	.	.	.	0.1100	.	.	.
ECOWINV	E	.	-1.0000	-1.0000	.	.	.	.	.	.	.	.
BGHFR	E	.	.	.	.	.	.	.	.	.	.	-0.9850
BGSTR	L	.	.	.	.	.	.	.	.	.	.	.
WINLAB	L	.	5.7000	5.7000	.	.	.	.	.	.	.	4.0000
BALFINV	E	.	.	.	.	.	.	.	.	.	.	.
TDNC	L	.	1931.2000	2213.0000	.	.	.	.	.	.	.	.
PROTC	L	.	298.4000	316.7000	.	.	.	.	.	.	.	.
CORNAC	E	.	.	.	.	.	.	.	.	.	.	.
CORNSILT	E	.	.	.	.	.	.	.	.	.	.	.
CORNGRT	E	.	.	.	.	.	.	.	.	.	.	.
CSAFT	L	.	.	.	.	.	.	.	.	.	.	.
OWAFT	L	.	.	.	.	.	.	.	.	.	.	.
OATAC	E	.	.	.	.	.	.	.	.	.	.	.
WHTAC	E	.	.	.	.	.	.	.	.	.	.	.
OATT	E	.	.	.	.	.	.	.	.	.	.	.
WHTT	E	.	.	.	.	.	.	.	.	.	.	.
STRAWT	E	.	.	.	.	.	.	.	.	.	.	.
SORGAC	E	.	.	.	.	.	.	.	.	.	.	.
SORGT	E	.	.	.	.	.	.	.	.	.	.	.
BHFRINV	E	.	.	.	.	.	.	.	.	0.2670	.	1.0000
BSTRINV	E	.	.	.	.	.	.	.	.	.	0.2350	.
REGREP	E	.	.	.	.	.	.	.	.	.	.	.
PROTBG	L	.	.	.	.	.	.	.	.	.	.	187.5000
NEMBG	L	.	.	.	.	.	.	.	.	.	.	1276.3001
NEGBG	L	.	.	.	.	.	.	.	.	.	.	779.9000
SCOWL1	L	.	.	.	6.0000	.	.	.	.	.	.	.
SCOWL2	L	.	.	.	.	3.0000	.	.	.	.	.	.
SCOWL3	L	.	.	.	.	.	2.0000	.	.	.	.	.
STRAWL	L	.	.	.	.	.	.	.	.	.	.	.
AMAXT	G	.	643.0000	737.0000	.	.	.	.	.	.	.	.
AMAXP	G	.	99.3600	105.4000	.	.	.	.	.	.	.	.
MINF	G	.	.	.	.	.	.	.	.	.	.	.
MAXF	L	.	.	.	.	.	.	.	.	.	.	.
MAXS	L	.	.	.	.	.	.	.	.	.	.	.
MAXAFT	L	.	.	.	.	.	.	.	.	.	.	.
POTAC	E	.	.	.	.	.	.	.	.	.	.	.
POTT	E	.	.	.	.	.	.	.	.	.	.	.
SOYAC	E	.	.	.	.	.	.	.	.	.	.	.
SOYT	E	.	.	.	.	.	.	.	.	.	.	.
ICORNA	E	.	.	.	.	.	.	.	.	.	.	.
FST	E	.	.	.	.	.	.	.	.	.	.	.
FHT	E	.	.	.	.	.	.	.	.	.	.	.
PROT	L	.	.	.	.	.	.	.	.	.	.	.
NEM	L	.	.	.	.	.	.	.	.	.	.	.
NEG	L	.	.	.	.	.	.	.	.	.	.	.
FORMIN	G	.	.	.	.	.	.	.	.	.	.	.
FORMAX	L	.	.	.	.	.	.	.	.	.	.	.
ALFMIN	E	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 4. LINEAR PROGRAMMING MODEL FOR WINTER IRRIGATED, RANCH MODEL I (CONTINUED)

ROW		BGSTRS	SBGHFR	SBGSTR	HIRELAB	ALFT	ALFC	BUYALF	CORNSIL	CSC	CORNGR	SELLCORN
OBJ FCN		-29.0000	56.0200	63.2500	-4.5000	36.1600	.	-73.0100	-2.8600	.	.	2.5400
ACCTING	E	-29.0000	55.3700	62.2400	-4.5000	.	.	-73.0100	-2.8600	.	.	2.5400
COWINV	E	.	.	.	.	.	.	.	.	.	.	.
COWMAX	L	.	.	.	.	.	.	.	.	.	.	.
BREPINV	E	.	.	.	.	.	.	.	.	.	.	.
CULLCOW	E	.	.	.	.	.	.	.	.	.	.	.
HFRS	E	.	.	.	.	.	.	.	.	.	.	.
STRS	E	.	.	.	.	.	.	.	.	.	.	.
CULLREP	E	.	.	.	.	.	.	.	.	.	.	.
ECOWINV	E	.	.	.	.	.	.	.	.	.	.	.
BGHFR	E	.	0.1670	.	.	.	.	.	.	.	.	.
BGSTR	L	-0.9850	.	0.1540	.	.	.	.	.	.	.	.
WINLAB	L	4.0000	.	.	-1.0000	.	.	.	.	.	.	.
BALFINV	E	.	.	.	.	1.0000	1.0000	-1.0000	.	.	.	.
TDNC	L	.	.	.	.	.	-991.8000	.	.	-396.9000	.	.
PROTC	L	.	.	.	.	.	-298.7000	.	.	-49.6000	.	.
CORNAC	E	.	.	.	.	.	.	.	1.0000	.	1.0000	.
CORNSILT	E	.	.	.	.	.	.	.	-7.8800	1.0000	.	.
CORNGRT	E	.	.	.	.	.	.	.	.	.	-51.1000	1.0000
CSAFT	L	.	.	.	.	.	.	.	.	.	-0.5000	.
OWAFT	L	.	.	.	.	.	.	.	.	.	.	.
OATAC	E	.	.	.	.	.	.	.	.	.	.	.
WHTAC	E	.	.	.	.	.	.	.	.	.	.	.
OATT	E	.	.	.	.	.	.	.	.	.	.	.
WHTT	E	.	.	.	.	.	.	.	.	.	.	.
STRAWT	E	.	.	.	.	.	.	.	.	.	.	.
SORGAC	E	.	.	.	.	.	.	.	.	.	.	.
SORGT	E	.	.	.	.	.	.	.	.	.	.	.
BHFRINV	E	.	.	.	.	.	.	.	.	.	.	.
BSTRINV	E	1.0000	.	.	.	.	.	.	.	.	.	.
REDREP	E	.	.	.	.	.	.	.	.	.	.	.
PROTBG	L	207.3000	.	.	.	.	.	.	.	.	.	.
NEXBG	L	1295.1000	.	.	.	.	.	.	.	.	.	.
NEGBG	L	769.0000	.	.	.	.	.	.	.	.	.	.
SCOWL1	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL2	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL3	L	.	.	.	.	.	.	.	.	.	.	.
STRAWL	L	.	.	.	.	.	-0.5500	.	.	-0.1800	.	.
AMAXT	G	.	.	.	.	.	.	.	.	.	.	.
AMAXP	G	.	.	.	.	.	.	.	.	.	.	.
MINF	G	.	.	.	.	.	.	.	.	.	.	.
MAXF	L	.	.	.	.	.	.	.	.	.	.	.
MAXS	L	.	.	.	.	.	.	.	.	.	.	.
MAXAFT	L	.	.	.	.	.	.	.	.	.	.	.
POTAC	E	.	.	.	.	.	.	.	.	.	.	.
POTT	E	.	.	.	.	.	.	.	.	.	.	.
SOYAC	E	.	.	.	.	.	.	.	.	.	.	.
SOYT	E	.	.	.	.	.	.	.	.	.	.	.
ICORNA	E	.	.	.	.	.	.	.	.	.	.	.
FST	E	.	.	.	.	.	.	.	.	.	.	.
FHT	E	.	.	.	.	.	.	.	.	.	.	.
PROT	L	.	.	.	.	.	.	.	.	.	.	.
NEM	L	.	.	.	.	.	.	.	.	.	.	.
NEG	L	.	.	.	.	.	.	.	.	.	.	.
FORMIN	G	.	.	.	.	.	.	.	.	.	.	.
FORMAX	L	.	.	.	.	.	.	.	.	.	.	.
ALFMIN	E	.	.	.	.	1.0000	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 4. LINEAR PROGRAMMING MODEL FOR WINTER IRRIGATED, RANCH MODEL I (CONTINUED)

ROW		GRCSAFT	OATS	WHEAT	BSTRAW	FSTRAW	PROTSUPP	OATC	SELLOAT	SELLWHT	SORG	SELLSORG
OBJ FCN		-0.1000	.	.	-7.9900	.	-200.0000	.	1.3900	.	.	2.1700
ACCTING	E	.	.	.	-7.9900	.	-200.0000	.	1.3900	3.9400	.	2.1700
COWINV	E	.	.	.	.	.	.	.	.	.	.	.
COWMAX	L	.	.	.	.	.	.	.	.	.	.	.
BREPINV	E	.	.	.	.	.	.	.	.	.	.	.
CULLCOW	E	.	.	.	.	.	.	.	.	.	.	.
HFRS	E	.	.	.	.	.	.	.	.	.	.	.
STRS	E	.	.	.	.	.	.	.	.	.	.	.
CULLREP	E	.	.	.	.	.	.	.	.	.	.	.
ECOWINV	E	.	.	.	.	.	.	.	.	.	.	.
BGHFR	E	.	.	.	.	.	.	.	.	.	.	.
BGSTR	L	.	.	.	.	.	.	.	.	.	.	.
WINLAB	L	.	.	.	.	.	.	.	.	.	.	.
BALFINV	E	.	.	.	.	.	.	.	.	.	.	.
TDNC	L	-824.5000	.	.	.	-620.3000	-1480.5000	-21.7000	.	.	.	.
PROTC	L	-100.8300	.	.	.	-54.4700	-879.3000	-3.7500	.	.	.	.
CORNAC	E	.	.	.	.	.	.	.	.	.	.	.
CORNSILT	E	.	.	.	.	.	.	.	.	.	.	.
CORNGRT	E	.	.	.	.	.	.	.	.	.	.	.
CSAFT	L	1.0000	.	.	.	.	.	.	.	.	-0.5800	.
OWAFT	L	.	.	.	2.3200	.	.	.	.	.	.	.
OATAC	E	.	1.0000	.	.	.	.	.	.	.	.	.
WHTAC	E	.	.	1.0000	.	.	.	.	.	.	.	.
OATT	E	.	-47.8500	.	.	.	.	1.0000	1.0000	.	.	.
WHTT	E	.	.	-26.5900	.	.	.	.	.	1.0000	.	.
STRAWT	E	.	.	.	-1.0000	1.0000	.	.	.	.	.	.
SORGAC	E	.	.	.	.	.	.	.	.	.	1.0000	.
SORST	E	.	.	.	.	.	.	.	.	.	-53.3600	1.0000
BHFRINV	E	.	.	.	.	.	.	.	.	.	.	.
BSTRINV	E	.	.	.	.	.	.	.	.	.	.	.
REQREP	E	.	.	.	.	.	.	.	.	.	.	.
PROTBG	L	.	.	.	.	.	.	.	.	.	.	.
NEMBG	L	.	.	.	.	.	.	.	.	.	.	.
NEGBG	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL1	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL2	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL3	L	.	.	.	.	.	.	.	.	.	.	.
STRAWL	L	.	.	.	.	0.4500	-0.5500	-0.8000	.	.	.	.
AMAXT	G	-824.5000	.	.	.	.	.	.	.	.	.	.
AMAXP	G	-100.8300	.	.	.	.	.	.	.	.	.	.
MINF	G	.	.	.	.	.	.	.	.	.	.	.
MAXF	L	.	.	.	.	.	.	.	.	.	.	.
MAXS	L	.	.	.	.	.	.	.	.	.	.	.
MAXAFT	L	.	.	.	.	.	.	.	.	.	.	.
POTAC	E	.	.	.	.	.	.	.	.	.	.	.
POTT	E	.	.	.	.	.	.	.	.	.	.	.
SOYAC	E	.	.	.	.	.	.	.	.	.	.	.
SOYT	E	.	.	.	.	.	.	.	.	.	.	.
ICORNA	E	.	.	.	.	.	.	.	.	.	.	.
FST	E	.	.	.	.	.	.	.	.	.	.	.
FHT	E	.	.	.	.	.	.	.	.	.	.	.
PROT	L	.	.	.	.	.	.	.	.	.	.	.
NEM	L	.	.	.	.	.	.	.	.	.	.	.
NEB	L	.	.	.	.	.	.	.	.	.	.	.
FORMIN	G	.	.	.	.	.	.	.	.	.	.	.
FORMAX	L	.	.	.	.	.	.	.	.	.	.	.
ALFMIN	E	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 4. LINEAR PROGRAMMING MODEL FOR WINTER IRRIGATED, RANCH MODEL I (CONTINUED)

ROW		EHFRINV	ESTRINV	REPINV	INVCOW	ALFM	ALFG	CSM	CSG	CGRM	CGRG	OATM
OBJ FCN		.	.	.	.	.	.	.	.	.	.	.
ACCTING	E	.	.	.	.	.	.	.	.	.	.	.
COWINV	E	.	.	.	.	.	.	.	.	.	.	.
COWMAX	L	.	.	.	.	.	.	.	.	.	.	.
BREPINV	E	.	.	.	.	.	.	.	.	.	.	.
CULLCOW	E	.	.	.	.	.	.	.	.	.	.	.
HFRS	E	1.0000	.	.	.	.	.	.	.	.	.	.
STRS	E	.	1.0000	.	.	.	.	.	.	.	.	.
CULLREP	E	.	.	.	.	.	.	.	.	.	.	.
ECOWINV	E	.	.	.	1.0000	.	.	.	.	.	.	.
BGHFR	E	.	.	1.0000	.	.	.	.	.	.	.	.
BGSTR	L	.	.	.	.	.	.	.	.	.	.	.
WINLAB	L	.	.	.	.	.	.	.	.	.	.	.
BALFINV	E	.	.	.	.	1.0000	1.0000	.	.	.	.	.
TDNC	L	.	.	.	.	.	.	.	.	.	.	.
PROTC	L	.	.	.	.	.	.	.	.	.	.	.
CORNAC	E	.	.	.	.	.	.	.	.	.	.	.
CORNSILT	E	.	.	.	.	.	.	1.0000	1.0000	.	.	.
CORNGRT	E	.	.	.	.	.	.	.	.	1.0000	1.0000	.
CSAFT	L	.	.	.	.	.	.	.	.	.	.	.
OWAFT	L	.	.	.	.	.	.	.	.	.	.	.
OATAC	E	.	.	.	.	.	.	.	.	.	.	.
WHTAC	E	.	.	.	.	.	.	.	.	.	.	.
OATT	E	.	.	.	.	.	.	.	.	.	.	1.0000
WHTT	E	.	.	.	.	.	.	.	.	.	.	.
STRAWT	E	.	.	.	.	.	.	.	.	.	.	.
SORGAC	E	.	.	.	.	.	.	.	.	.	.	.
SORGT	E	.	.	.	.	.	.	.	.	.	.	.
BHFRINV	E	.	.	.	.	.	.	.	.	.	.	.
BSTRINV	E	.	.	.	.	.	.	.	.	.	.	.
REQREP	E	.	.	1.0000	.	.	.	.	.	.	.	.
PROTBG	L	.	.	.	.	-290.7000	-290.7000	-49.6000	-49.6000	-4.9300	-4.9300	-3.7500
NEMBG	L	.	.	.	.	-961.8000	.	-410.5500	.	-49.5600	.	-23.6600
NEGBG	L	.	.	.	.	.	-527.4400	.	-249.5800	.	-34.2900	.
SCOWL1	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL2	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL3	L	.	.	.	.	.	.	.	.	.	.	.
STRAWL	L	.	.	.	.	.	.	.	.	.	.	.
AMAXT	G	.	.	.	.	.	.	.	.	.	.	.
AMAXP	G	.	.	.	.	.	.	.	.	.	.	.
MINF	G	.	.	.	.	0.7500	0.7500	0.2500	0.2500	-0.0070	-0.0070	-0.0040
MAXF	L	.	.	.	.	0.3000	0.3000	0.1000	0.1000	-0.0196	-0.0196	-0.0112
MAXS	L	.	.	.	.	-0.2000	-0.2000	-0.0700	-0.0700	-0.0056	-0.0056	-0.0032
MAXAFT	L	.	.	.	.	-0.2500	-0.2500	-0.0800	-0.0800	-0.0070	-0.0070	-0.0040
POTAC	E	.	.	.	.	.	.	.	.	.	.	.
POTT	E	.	.	.	.	.	.	.	.	.	.	.
SOYAC	E	.	.	.	.	.	.	.	.	.	.	.
SOYT	E	.	.	.	.	.	.	.	.	.	.	.
ICORNA	E	.	.	.	.	.	.	.	.	.	.	.
FST	E	.	.	.	.	.	.	.	.	.	.	.
FHT	E	.	.	.	.	.	.	.	.	.	.	.
PROT	L	.	.	.	.	.	.	.	.	.	.	.
NEM	L	.	.	.	.	.	.	.	.	.	.	.
NEG	L	.	.	.	.	.	.	.	.	.	.	.
FORMIN	G	.	.	.	.	.	.	.	.	.	.	.
FORMAX	L	.	.	.	.	.	.	.	.	.	.	.
ALFMIN	E	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 4. LINEAR PROGRAMMING MODEL FOR WINTER IRRIGATED, RANCH MODEL I (CONTINUED)

ROW		OATG	SORGM	SORGG	PROSM	PROSG	STRM	STRG	CSAFTM	CSAFTG	POT	SELLPOT
OBJ FCN		.	.	.	-200.0000	-200.0000	.	.	-0.1000	-0.1000	.	.
ACCTING	E	.	.	.	-200.0000	-200.0000	.	.	.	.	.	4.1000
COWINV	E	.	.	.	.	.	.	.	.	.	.	.
COWMAX	L	.	.	.	.	.	.	.	.	.	.	.
BREPINV	E	.	.	.	.	.	.	.	.	.	.	.
CULLCOW	E	.	.	.	.	.	.	.	.	.	.	.
HFRS	E	.	.	.	.	.	.	.	.	.	.	.
STRS	E	.	.	.	.	.	.	.	.	.	.	.
CULLREP	E	.	.	.	.	.	.	.	.	.	.	.
ECOWINV	E	.	.	.	.	.	.	.	.	.	.	.
BGHFR	E	.	.	.	.	.	.	.	.	.	.	.
BGSTR	L	.	.	.	.	.	.	.	.	.	.	.
WINLAB	L	.	.	.	.	.	.	.	.	.	.	.
BALFINV	E	.	.	.	.	.	.	.	.	.	.	.
TDAC	L	.	.	.	.	.	.	.	.	.	.	.
PROTC	L	.	.	.	.	.	.	.	.	.	.	.
CORNAC	E	.	.	.	.	.	.	.	.	.	.	.
CORNSILT	E	.	.	.	.	.	.	.	.	.	.	.
CORNGRT	E	.	.	.	.	.	.	.	.	.	.	.
CSAFT	L	.	.	.	.	.	.	.	1.0000	1.0000	.	.
OWAFT	L	.	.	.	.	.	.	.	.	.	.	.
OATAC	E	.	.	.	.	.	.	.	.	.	.	.
WHTAC	E	.	.	.	.	.	.	.	.	.	.	.
OATT	E	1.0000	.	.	.	.	.	.	.	.	.	.
WHTT	E	.	.	.	.	.	.	.	.	.	.	.
STRAWT	E	.	.	.	.	.	1.0000	1.0000	.	.	.	.
SORGAC	E	.	.	.	.	.	.	.	.	.	.	.
SORGT	E	.	1.0000	1.0000	.	.	.	.	.	.	.	.
BHFRINV	E	.	.	.	.	.	.	.	.	.	.	.
BSTRINV	E	.	.	.	.	.	.	.	.	.	.	.
REQREP	E	.	.	.	.	.	.	.	.	.	.	.
PROTBG	L	-3.7500	-4.8700	-4.8700	-879.3000	-879.3000	-54.4700	-54.4700	-108.8300	-108.8300	.	.
NEMBG	L	.	-45.0400	.	-1646.6000	.	-439.2000	.	-725.5400	.	.	.
NEGBG	L	-15.6000	.	-30.6100	.	-1118.9600	.	-75.4900	.	-314.1500	.	.
SCOWL1	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL2	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL3	L	.	.	.	.	.	.	.	.	.	.	.
STRAWL	L	.	.	.	.	.	.	.	.	.	.	.
AMAXT	G	.	.	.	.	.	.	.	.	.	.	.
AMAXP	G	.	.	.	.	.	.	.	.	.	.	.
MINF	G	-0.0040	-0.0070	-0.0070	-0.2500	-0.2500	0.7500	0.7500	0.7500	0.7500	.	.
MAXF	L	-0.0112	-0.0196	-0.0196	-0.7000	-0.7000	0.3000	0.3000	0.3000	0.3000	.	.
MAXS	L	-0.0032	-0.0056	-0.0056	-0.2000	-0.2000	0.8000	0.8000	.	.	.	.
MAXAFT	L	-0.0040	-0.0070	-0.0070	-0.2500	-0.2500	.	.	0.7500	0.7500	.	.
POTAC	E	.	.	.	.	.	.	.	.	.	1.0000	.
POTT	E	.	.	.	.	.	.	.	.	.	-289.4000	1.0000
SOYAC	E	.	.	.	.	.	.	.	.	.	.	.
SOYT	E	.	.	.	.	.	.	.	.	.	.	.
ICORNA	E	.	.	.	.	.	.	.	.	.	.	.
FST	E	.	.	.	.	.	.	.	.	.	.	.
FHT	E	.	.	.	.	.	.	.	.	.	.	.
PROT	L	.	.	.	.	.	.	.	.	.	.	.
NEM	L	.	.	.	.	.	.	.	.	.	.	.
NEG	L	.	.	.	.	.	.	.	.	.	.	.
FORMIN	G	.	.	.	.	.	.	.	.	.	.	.
FORMAX	L	.	.	.	.	.	.	.	.	.	.	.
ALFMIN	E	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 4. LINEAR PROGRAMMING MODEL FOR WINTER IRRIGATED, RANCH MODEL I (CONTINUED)

ROW		SOY	SELLSOY	ICORN	FINS	FINH	IFS	IFH	FCORNM	FCORNG	FSORGM	FSORGG
OBJ FCN		.	.	.	-37.7800	-34.2500	56.8600	54.8200	.	.	.	.
ACCTING	E	.	5.9000	.	.	.	.	.	.	.	.	.
COWINV	E	.	.	.	.	.	.	.	.	.	.	.
COWMAX	L	.	.	.	.	.	.	.	.	.	.	.
BREPINV	E	.	.	.	.	.	.	.	.	.	.	.
CULLCOW	E	.	.	.	.	.	.	.	.	.	.	.
HFRS	E	.	.	.	.	.	.	.	.	.	.	.
STRS	E	.	.	.	.	.	.	.	.	.	.	.
CULLREP	E	.	.	.	.	.	.	.	.	.	.	.
ECOWINV	E	.	.	.	.	.	.	.	.	.	.	.
BGHFR	E	.	.	.	.	1.0000	.	.	.	.	.	.
BGSTR	L	.	.	.	1.0000	.	.	.	.	.	.	.
WINLAB	L	.	.	.	.	.	.	.	.	.	.	.
BALFINV	E	.	.	.	.	.	.	.	.	.	.	.
TDNC	L	.	.	.	.	.	.	.	.	.	.	.
PROTC	L	.	.	.	.	.	.	.	.	.	.	.
CORNAC	E	.	.	.	.	.	.	.	.	.	.	.
CORNSILT	E	.	.	.	.	.	.	.	.	.	.	.
CORNGRT	E	.	.	-139.6700	.	.	.	.	1.0000	1.0000	.	.
CSAFT	L	.	.	-0.7700	.	.	.	.	.	.	.	.
OWAFT	L	.	.	.	.	.	.	.	.	.	.	.
OATAC	E	.	.	.	.	.	.	.	.	.	.	.
WHTAC	E	.	.	.	.	.	.	.	.	.	.	.
OATT	E	.	.	.	.	.	.	.	.	.	.	.
WHTT	E	.	.	.	.	.	.	.	.	.	.	.
STRAWT	E	.	.	.	.	.	.	.	.	.	.	.
SORGAC	E	.	.	.	.	.	.	.	.	.	.	.
SORGT	E	.	.	.	.	.	.	.	.	.	1.0000	1.0000
BHFRINV	E	.	.	.	.	.	.	.	.	.	.	.
BSTRINV	E	.	.	.	.	.	.	.	.	.	.	.
REQREP	E	.	.	.	.	.	.	.	.	.	.	.
PROTBG	L	.	.	.	.	.	.	.	.	.	.	.
NEMBG	L	.	.	.	.	.	.	.	.	.	.	.
NEGBG	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL1	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL2	L	.	.	.	.	.	.	.	.	.	.	.
SCOWL3	L	.	.	.	.	.	.	.	.	.	.	.
STRAWL	L	.	.	.	.	.	.	.	.	.	.	.
AMAXT	G	.	.	.	.	.	.	.	.	.	.	.
AMAXP	G	.	.	.	.	.	.	.	.	.	.	.
MINF	G	.	.	.	.	.	.	.	.	.	.	.
MAXF	L	.	.	.	.	.	.	.	.	.	.	.
MAXS	L	.	.	.	.	.	.	.	.	.	.	.
MAXAFT	L	.	.	.	.	.	.	.	.	.	.	.
POTAC	E	.	.	.	.	.	.	.	.	.	.	.
POTT	E	.	.	.	.	.	.	.	.	.	.	.
SOYAC	E	1.0000	.	.	.	.	.	.	.	.	.	.
SOYT	E	-30.0900	1.0000	.	.	.	.	.	.	.	.	.
ICORNA	E	.	.	1.0000	.	.	.	.	.	.	.	.
FST	E	.	.	.	-0.9900	.	0.0670	.	.	.	.	.
FHT	E	.	.	.	.	-0.9900	.	0.0952	.	.	.	.
PROT	L	.	.	.	377.3000	313.6000	.	.	-4.9800	-4.9800	-4.8700	-4.8700
NEM	L	.	.	.	2914.5000	2793.8000	.	.	-50.2200	.	-45.2100	.
NEG	L	.	.	.	1851.1000	1829.3001	.	.	.	-34.7300	.	-30.5700
FORMIN	G	.	.	.	.	.	.	.	-0.0042	-0.0042	-0.0042	-0.0042
FORMAX	L	.	.	.	.	.	.	.	-0.0126	-0.0126	-0.0126	-0.0126
ALFMIN	E	.	.	.	.	.	.	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 4. LINEAR PROGRAMMING MODEL FOR WINTER IRRIGATED, RANCH MODEL I (CONTINUED)

ROW		SALF	FSBMM	FSBMG	FALFM	FALFG	R H S
OBJ FCN		44.9500	-200.0000	-200.0000	.	.	********
ACCTING	E	45.2100	.	.	.	.	.
COWINV	E	.	.	.	.	.	50.0000
COWMAX	L	.	.	.	.	.	70.0000
BREPINV	E	.	.	.	.	.	11.2000
CULLCOW	E	.	.	.	.	.	.
HFRS	E	.	.	.	.	.	.
STRS	E	.	.	.	.	.	.
CULLREP	E	.	.	.	.	.	.
ECOWINV	E	.	.	.	.	.	.
BGHFR	E	.	.	.	.	.	.
BGSTR	L	.	.	.	.	.	.
WINLAB	L	.	.	.	.	.	1250.0000
BALFINV	E	1.0000	.	.	1.0000	1.0000	230.0000
TDNC	L	.	.	.	.	.	.
PROTC	L	.	.	.	.	.	.
CORNAC	E	.	.	.	.	.	44.0000
CORNSILT	E	.	.	.	.	.	.
CORNGRT	E	.	.	.	.	.	.
CSAFT	L	.	.	.	.	.	.
GWAFT	L	.	.	.	.	.	.
OATAC	E	.	.	.	.	.	.
WHTAC	E	.	.	.	.	.	200.0000
OATT	E	.	.	.	.	.	.
WHTT	E	.	.	.	.	.	.
STRAWT	E	.	.	.	.	.	.
SORGAC	E	.	.	.	.	.	141.4000
SORGT	E	.	.	.	.	.	.
BHFRINV	E	.	.	.	.	.	32.2000
BSTRINV	E	.	.	.	.	.	32.2000
REDREP	E	.	.	.	.	.	12.6000
PROTBG	L	.	.	.	.	.	.
NEMBG	L	.	.	.	.	.	.
NEGBG	L	.	.	.	.	.	.
SCOWL1	L	.	.	.	.	.	70.0000
SCOWL2	L	.	.	.	.	.	70.0000
SCOWL3	L	.	.	.	.	.	70.0000
STRAWL	L	.	.	.	.	.	.
AMAXT	G	.	.	.	.	.	.
AMAXP	G	.	.	.	.	.	.
MINF	G	.	.	.	.	.	.
MAXF	L	.	.	.	.	.	.
MAXS	L	.	.	.	.	.	.
MAXAFT	L	.	.	.	.	.	.
POTAC	E	.	.	.	.	.	60.0000
POTT	E	.	.	.	.	.	.
SOYAC	E	.	.	.	.	.	.
SOYT	E	.	.	.	.	.	.
ICORNA	E	.	.	.	.	.	134.0000
FST	E	.	.	.	.	.	.
FHT	E	.	.	.	.	.	.
PROT	L	.	-879.3000	-879.3000	-290.7000	-290.7000	.
NEM	L	.	-1646.6000	.	-961.8000	.	.
NEG	L	.	.	-1118.9600	.	-527.4400	.
FORMIN	G	.	-0.1500	-0.1500	0.8500	0.8500	.
FORMAX	L	.	-0.4500	-0.4500	0.5500	0.5500	.
ALFMIN	E	.	.	.	.	.	44.0000

APPENDIX B

LINKAGES BETWEEN PERIODS IN THE DYNAMIC MODEL

APPENDIX B

LINKAGES BETWEEN PERIODS IN THE DYNAMIC MODEL

Linkages Between Periods in Dynamic Model

The source for values which change period to period (circled coefficients in Figures 1-4 of text) are presented here. For the first year 1955, summer model all right-hand side values are from the static model (Appendix A). Values for the objective function and A_{ij}'s are determined as shown.

APPENDIX TABLE 1. LINKAGES TO SUMMER DRYLAND AND IRRIGATED DYNAMIC MODELS

Row	Column		Source[a]
			Dryland and Irrigated
OBJ FCN	8	SELLCOW1	$= \frac{10(\text{utility grade cow, T15}) - \text{replacement cow, T16}}{6}$
	9	SELLCOW2	$= \frac{10(\text{utility grade cow, T15}) - \text{replacement cow, T16}}{2.38}$
	10	SELLCOW3	$= \frac{10(\text{utility grade cow, T15}) - \text{replacement cow, T16}}{1.33}$
	18	SELLCORN	= corn grain planning price, T9
	20	SELLWHT	= wheat planning price, T9
	22	SELLOAT	= oat planning price, T9
	24	SELLSORG	= sorghum planning price, T9
			Irrigated Only
	31	SELLPOT	= potato planning price, T9
	33	SELLSOY	= soybean planning price, T9

- CONTINUED -

APPENDIX TABLE 1. LINKAGES TO SUMMER DRYLAND AND IRRIGATED DYNAMIC MODELS (CONTINUED)

Row	Column		Source[a]
			Dryland and Irrigated
ACCTING	4	BUYCOW	= (-) replacement cow - 10(utility $cow_{(t+6)}$)[b]
	8	SELLCOW1	See formula under objective function
	9	SELLCOW2	See formula under objective function
	10	SELLCOW3	See formula under objective function
6 SUMGRAZ	6	GRAZRANG	= (-) native pasture first period, T11
	7	GRCLPAST	= (-) tame pasture first period, T11
8 FALLGRAZ	6	GRAZRANG	= (-) native pasture second period, T11
	7	GRCLPAST	= (-) tame pasture second period, T11
	12	GRSGAFT	= (-) small grains aftermath, T11
11 ENDALF	16	ALFD	= (-) dryland alfalfa hay yield, T6
30 SBED	29	STRB	= (-) straw yield, T11
31 LLSUPALP	16	ALFD	= (-) dryland alfalfa hay yield, T6
			Irrigated Only
ACCTING	37	SFS	= 11-1,200 lb. steer price, T15
	39	SFH	= 11-1,200 lb. heifer price, T15
11 ENDALF	34	ALFI	= (-) irrigated alfalfa hay yield, T6

[a]Values are for the year being modeled--1955 for first year, 1956 for second, 1985 for last year.
[b](t+6) is six years in future so, for example, in 1955 utility cow price in 1961 is used. Because the data set ends in 1985, the first six years of the data set, 1955-1960, were used as proxies for cow prices in 1986-1990, (t+6) cow prices for 1980 used 1955 utility cow prices, (t+6) cow prices for 1981 used 1956 utility cow prices, etc.

APPENDIX TABLE 2. LINKAGES TO WINTER DRYLAND AND IRRIGATED DYNAMIC MODELS

Row		Column		Source[a]
				Dryland and Irrigated
2	COWINV	RHS		= COWT (13) activity level
4	BREPINV			= REPHFRT (14) activity level
13	BALFINV			= INVALF (28)activity level
16	CORNAC			= CORNAC (17)activity level
20	OWAFT			= WHTAC(19) + OATAC (21) - GRSGAFT (12) - STRB(29) activity level
21	OATAC			= OATAC (21) activity level
22	WHTAC			= WHTAC (19) activity level
26	SORGAC			= SORGAC (23) activity level
28	BHFRINV			= HFRT (26) activity level
29	BSTRINV			= STRT (27) activity level
34	SCOW 1			= BEEF COW (2) activity level
35	SCOW 2			= BEEF COW (2) activity level
36	SCOW 3			= BEEF COW (2) activity level
				Irrigated Only
44	POTAC			= POTAC (30) activity level
46	SOYAC			= SOYAC (32) activity level
48	ICORNA			= CORNI (35) activity level
				Dryland and Irrigated
OBJ FCN		4	SELLCOW1	= see formula from summer period
		5	SELLCOW2	= see formula from summer period
		6	SELLCOW3	= see formula from summer period
		7	SELLCULL	= utility grade cow, T15
		8	SELLREP	= 7-800 lb. heifers, T15
		9	SELLWHFR	= 4-500 lb. heifers, T15
		10	SELLWSTR	= 4-500 lb. steers, T15
		13	SBGHFR	= 6-700 lb. heifers, T16
		14	SBGSTR	= 6-700 lb. steers, T16
		16	ALFT	= (.8) alfalfa hay price, T9
		18	BUYALF	= (-) alfalfa hay price , T9 + 28.60
		22	SELLCORN	= corn grain price, T9
		30	SELLOAT	= oat prices, T9
		33	SELLSORG	= sorghum prices, T9
				Irrigated Only
		61	IFS	= 11-1,200 lb. steers, T16
		62	IFH	= 11-1,200 lb. heifers, T16
		67	SALF	= alfalfa hay price, T9

- CONTINUED -

APPENDIX TABLE 2. LINKAGES TO WINTER DRYLAND AND IRRIGATED DYNAMIC MODELS (CONTINUED)

Row	Column		Source[a]
			Dryland and Irrigated
1 ACCTING			
	4	SELLCOW1	= see formula from summer period
	5	SELLCOW2	= see formula from summer period
	6	SELLCOW3	= see formula from summer period
	7	SELLCULL	= utility grade cow, T15
	8	SELLREP	= 7-800 lb. heifers, T15
	9	SELLWHFR	= 4-500 lb. heifers, T15
	10	SELLWSTR	= 4-500 lb. steers, T15
	13	SBGHFR	= 6-700 lb. heifers, T15
	14	SBGSTR	= 6-700 lb. steers, T15
	18	BUYALF	= (-) alfalfa hay price, T10 + 28.60
	22	SELLCORN	= corn grain price, T10
	30	SELLOAT	= oat price, T10
	31	SELLWHT	= wheat price, T10
	33	SELLSORG	= sorghum price, T10
			Irrigated Only
	55	SELLPOT	= potato price, T10
	57	SELLSOY	= soybean price, T10
	67	SALF	= alfalfa hay price, T10
			Dryland and Irrigated
17 CORNSILT	19	CORNSIL	= (-) corn silage yield, T6
18 CORNGRT	21	CORNGR	= (-) corn grain yield, T6
19 CSAFT	21	CORNGR	= (-) corn or sorghum aftermath, T11
	32	SORG	= (-) corn or sorghum aftermath, T11
20 OWAFT	26	BSTRAW	= 1/straw yield, T11
23 OATT	24	OATS	= (-) oats yield, T6
24 WHTT	25	WHEAT	= (-) wheat yield, T6
27 SORGT	32	SORG	= (-) sorghum yield, T6
			Irrigated Only
18 CORNGRT	58	ICORN	= (-) irrigated corn grain yield, T6
45 POTT	54	POT	= (-) potato yield, T6
47 SOYT	56	SOY	= (-) soybean yield, T6

[a]Values are for the year being modeled--1955 for first year, 1956 for second, 1985 for last year.

APPENDIX TABLE 3. ADDITIONAL LINKAGES FOR SUBSEQUENT YEARS TO SUMMER DRYLAND AND IRRIGATED MODELS

Row		Column	Source[a]
		Dryland and Irrigated	
2	COWINV	RHS	= INVCOW (37) activity level
7	BEGALF		= ALFT (16) activity level
25	HFRINV		= EHFRINV (34) activity level
26	STRINV		= ESTRINV (35) activity level
27	SCOW1		= INVCOW (37) activity level
28	SCOW2		= INVCOW (37) activity level
29	SCOW3		= INVCOW (37) activity level
		Irrigated Only	
38	IFS		= FINS (59) activity level
38	IFH		= FINH (60) activity level

[a]Values are from previous year's winter solution; for example, summer 1956 values are from 1955 winter solution, etc.

APPENDIX C

YIELD AND PRICE DATA

APPENDIX TABLE 1. HISTORICAL CROP YIELDS USED FOR LAKE ANDES-WAGNER UNIT, SOUTH DAKOTA

Year	Dryland Crops							Irrigated Crop Yields			
	Wheat	Oats	Corn Grain	Sorghum Grain	Corn Silage[1]	Alfalfa Hay[2]	Wild Hay[2]	Corn Grain[3]	Soybean[4]	Potatoes[5]	Alfalfa Hay[6]
	bu./acre				tons/acre			bu./acre		tons/acre	
1955	10.95	20.05	15.00	19.00	3.65	1.45	0.53	44.28	28.50	124.22	2.20
1956	6.33	9.14	17.96	14.54	4.02	1.00	0.44	42.00	16.40	152.00	3.00
1957	19.35	35.36	31.82	27.88	5.77	1.90	0.78	71.40	34.30	143.50	4.10
1958	19.40	30.45	23.32	26.18	4.70	1.80	0.69	59.00	30.00	143.00	2.10
1959	5.89	8.16	10.24	15.13	3.05	0.95	0.52	49.00	27.10	109.00	2.10
1960	21.85	44.29	29.10	35.31	5.43	1.80	1.09	84.00	23.90	186.60	3.20
1961	15.28	29.46	33.02	34.36	5.92	1.75	0.90	84.00	32.00	162.10	3.00
1962	11.65	34.63	43.73	43.93	7.27	2.50	1.21	102.00	29.40	182.90	3.00
1963	10.93	29.04	38.76	39.50	6.64	1.95	0.89	76.00	35.00	142.40	3.80
1964	11.27	19.67	25.51	36.48	4.97	1.40	0.64	76.00	30.00	141.00	3.70
1965	16.74	32.76	20.48	21.66	4.34	1.55	0.84	94.00	28.00	212.90	3.00
1966	13.39	21.59	29.73	28.34	5.51	1.10	0.86	97.00	33.90	175.60	3.50
1967	21.67	36.93	18.83	20.98	4.13	1.40	0.61	109.00	30.00	150.00	2.90
1968	18.11	23.95	23.54	25.22	4.73	1.45	0.58	101.00	25.00	156.00	5.00
1969	18.48	33.07	37.75	39.40	6.52	1.90	0.98	112.00	40.00	167.60	3.00
1970	17.99	33.19	22.91	32.62	4.65	1.90	0.91	93.00	33.00	208.50	6.10
1971	22.93	49.05	38.85	39.49	9.00	1.70	0.88	103.00	35.00	293.00	4.90
1972	19.76	41.96	55.84	58.71	9.80	2.70	1.03	130.00	38.00	220.00	5.10
1973	27.00	46.55	46.35	51.30	8.50	2.20	1.01	125.00	38.00	230.00	4.50
1974	19.90	39.10	20.95	26.88	4.70	1.60	0.69	112.00	33.00	230.00	4.90
1975	15.70	33.41	27.55	19.63	4.20	1.71	0.86	118.12	36.00	234.30	4.10
1976	15.25	23.12	27.90	26.21	2.80	1.15	0.78	112.99	32.00	239.80	3.80
1977	28.66	49.11	50.48	51.97	8.80	1.46	0.95	128.36	41.00	245.30	4.00
1978	21.49	40.17	53.69	60.25	11.10	1.97	1.23	135.71	35.00	250.80	4.20
1979	27.80	48.41	53.18	53.25	9.10	1.93	1.22	136.82	40.00	256.30	4.70
1980	17.30	22.66	21.64	36.55	5.10	1.19	0.84	122.76	34.00	261.80	4.80
1981	21.51	27.21	43.81	43.42	7.60	0.84	0.66	131.00	34.00	267.30	4.50
1982	28.51	57.62	53.07	45.76	8.60	2.73	1.39	135.68	43.00	272.80	4.80
1983	22.10	40.57	43.50	51.53	5.60	2.29	0.67	120.73	35.00	278.40	4.50
1984	27.29	57.93	59.00	44.46	6.00	2.29	0.67	120.00	34.00	283.90	4.30
1985	32.15	57.99	67.00	53.43	9.00	1.80	0.66	140.00	39.10	289.40	5.00

[1]Corn silage yields were not available for the years 1955 to 1970. The regression function used to predict silage yields for the missing years is as follows:

corn silage yield = 1.7602 + .126 (corn grain yield)
(1.19) (3.95) R^2 = .55

[2]Hay yields for Charles Mix County missing for 1983 to 1985 were predicted by using the following regression functions: wild hay yield = 0.4383 + .5336 (wild hay yield, South Dakota)
(2.05) (2.52) R^2 = .39

alfalfa hay yield = .3919 + .8259 (alfalfa hay yield, South Dakota)
(.72) (2.6) R^2 = .40

[3]Corn grain yields (irrigated) were not available for the years 1955 and 1975 to 1982. The relationship between corn grain yields for Charles Mix County and for Knox County (Nebraska) was developed to predict the yields for missing years:

corn grain yield = -1.4177 + .8917 (corn grain yield, Knox County) + 1.1063 (year - 1954)
(-.07) (3.15) (1.61) R^2 = .80

[4]Soybean yields (irrigated) reported for Knox County (Nebraska) were used. The yields were not available for years 1955 to 1957, 1959, 1960, 1962, and 1966. Therefore, irrigated soybean yields reported for South Dakota were used for these years.

[5]Potato yields (irrigated) were reported at the state level. The yields were missing for the years 1955 and 1975 to 1985. A regression function was developed based on yields data from 1956 to 1974. A random number generator program was run on residuals (difference between actual and predicted yields) to predict the yield for missing years.

[6]Alfalfa hay yields (irrigated) reported for Knox County (Nebraska) were used for the missing years 1955 and 1975 to 1985.

SOURCE: South Dakota Crop and Livestock Reporting Service, Various Issues, 1955-1985. Nebraska Crop and Livestock Reporting Service, Various Issues, 1955-1985.

APPENDIX TABLE 2. HISTORICAL SEASONAL PRICES FOR SOUTH DAKOTA, 1955-1985

Year	Wheat	Oats	Sorghum	Corn Grain	Soybean	Potatoes	Alfalfa Hay	Wild Hay	Index Price Received for All Farm Products
	$/bu.					$/cwt.	$/ton		1910-14=100
1955	2.07	0.51	0.98	1.31	2.12	2.16	18.94	14.76	232
1956	2.01	0.63	1.00	1.18	2.07	1.31	17.68	14.48	230
1957	1.98	0.51	0.84	0.92	1.91	2.53	11.37	9.18	235
1958	1.80	0.50	0.92	0.97	1.90	1.26	11.73	10.13	250
1959	1.83	0.59	0.80	0.96	1.85	2.11	21.50	17.63	240
1960	1.79	0.51	0.75	0.88	2.06	1.80	17.80	14.88	239
1961	2.02	0.57	0.88	0.99	2.19	1.29	18.08	15.58	240
1962	2.10	0.55	0.87	1.01	2.21	1.52	14.50	12.04	244
1963	1.92	0.56	0.86	0.98	2.39	1.44	15.46	13.88	243
1964	1.43	0.58	0.94	1.10	2.48	3.77	19.88	18.66	237
1965	1.45	0.56	0.91	1.11	2.47	2.13	18.46	15.50	245
1966	1.67	0.61	0.99	1.18	2.66	2.05	20.58	17.50	264
1967	1.40	0.60	0.92	1.04	2.44	1.79	19.33	16.38	250
1968	1.31	0.56	0.88	1.04	2.37	1.74	20.43	15.50	255
1969	1.36	0.55	0.91	1.03	2.26	2.13	19.71	16.17	268
1970	1.44	0.57	1.03	1.21	2.72	2.10	18.88	14.92	274
1971	1.31	0.54	0.90	1.05	3.04	1.60	18.67	15.63	281
1972	1.81	0.66	1.20	1.37	4.24	2.40	18.71	16.33	313
1973	4.24	1.11	2.07	2.37	5.45	3.15	33.33	28.42	447
1974	4.36	1.48	2.82	3.05	6.54	3.40	47.96	41.67	481
1975	3.96	1.45	2.30	2.45	4.50	3.40	47.33	39.58	463
1976	2.75	1.55	1.90	2.18	6.67	3.20	60.63	52.63	464
1977	2.44	0.98	1.71	1.83	5.63	3.05	39.04	33.00	457
1978	2.81	1.09	1.62	1.91	6.28	3.03	31.33	23.75	524
1979	3.64	1.23	1.80	2.07	5.95	3.05	36.21	33.38	602
1980	4.24	1.68	2.50	2.84	7.13	3.85	66.63	53.92	614
1981	3.58	1.85	1.93	2.30	5.70	3.65	72.45	55.00	633
1982	3.69	1.37	2.16	2.50	5.29	3.55	38.75	32.00	609
1983	3.65	1.60	2.41	3.10	6.85	3.75	39.67	30.92	615
1984	3.46	1.52	1.10	2.44	5.47	3.60	44.00	35.43	650
1985	3.36	1.10	1.82	2.25	4.95	3.40	47.25	37.92	586

SOURCE: South Dakota Crop and Livestock Reporting Service, Various Issues, 1955-1985. U.S. Department of Agriculture, Various Issues, 1955-1985.

APPENDIX TABLE 3. CONVERSION OF HAY YIELD TO ANIMAL UNIT DAYS (AUD) OR ANIMAL UNIT MONTHS (AUM'S) OF GRAZING

A. Divide hay yield in pounds by 40 to obtain AUD for continuous grazing.

(4,000 pounds divided by 40 = 100 A.U. days of grazing)

B. Multiply hay yield in tons by 1.67 to obtain AUM for continuous grazing

(2 ton hay x 1.67 = 3.34 AUM grazing)

C. Divide hay yield in pounds by 35 to obtain AUD for rotation grazing of improved grass-legume pasture

(4,000 pounds divided by 35 = 114 A.U. days of grazing)

D. Multiply hay yield in tons by 1.9 to obtain AUM for rotation grazing of improved grass-legume pasture

(2 ton hay x 1.9 = 3.9 AUM grazing)

SOURCE: SCS Technical Guide.

APPENDIX TABLE 4. HISTORICAL PRICES BY CLASSES OF CATTLE BASED ON SIOUX CITY QUOTATIONS, 1955-1985

Year	7-800# Heifers Sept	7-800# Heifers Oct	7-800# Heifers Nov	Utility Gr Cows Sept	Utility Gr Cows Oct	Utility Gr Cows Nov
1955	18.93	18.52	17.27	10.65	10.33	9.12
1956	19.82	18.97	17.78	10.59	10.49	9.62
1957	20.36	20.12	21.17	13.80	13.82	13.98
1958	23.88	24.02	24.67	18.51	18.54	18.60
1959	24.12	23.45	22.92	16.78	15.62	14.35
1960	20.75	20.76	22.00	14.62	13.77	14.10
1961	21.36	21.48	22.25	15.20	15.18	14.86
1962	24.20	24.16	25.02	16.52	15.34	14.59
1963	21.76	21.09	20.46	15.20	15.01	13.70
1964	20.93	20.06	16.89	14.11	12.30	12.30
1965	21.71	21.65	21.68	15.44	14.89	14.25
1966	22.85	22.00	21.69	18.75	17.70	16.05
1967	23.97	23.40	22.91	17.40	16.97	15.85
1968	24.32	23.90	24.43	18.32	17.68	16.62
1969	24.86	24.22	24.28	20.15	19.39	18.34
1970	26.04	25.47	24.42	20.75	20.54	19.29
1971	28.01	28.68	29.70	21.59	21.84	20.70
1972	31.32	31.43	30.96	26.36	26.41	25.04
1973	41.31	37.14	36.31	35.50	34.26	31.68
1974	36.48	35.79	34.58	22.76	20.14	17.02
1975	38.32	40.67	39.87	23.06	22.36	20.60
1976	33.52	34.30	35.40	23.88	23.02	21.39
1977	36.24	37.29	37.23	26.95	25.95	25.49
1978	49.47	50.29	49.51	40.03	41.62	40.23
1979	62.18	60.99	61.70	47.96	46.84	45.15
1980	63.92	62.83	59.85	46.78	46.10	42.36
1981	60.03	57.68	56.41	42.63	39.78	37.51
1982	56.34	54.88	55.32	40.28	39.15	37.18
1983	54.72	54.45	55.60	39.75	38.88	36.70
1984	58.71	56.64	60.72	40.12	40.20	39.20
1985	48.72	55.65	56.81	36.35	36.05	33.88

- CONTINUED -

APPENDIX TABLE 4. HISTORICAL PRICES RY CLASSES OF CATTLE BASED ON SIOUX CITY OUOTATIONS, 1955-1985 (CONTINUED)

Year	4-500# Steers Sept	4-500# Steers Oct	4-500# Steers Nov	4-500# Heifers Sept	4-500# Heifers Oct	4-500# Heifers Nov
1955	20.64	21.05	20.44	13.81	14.22	13.85
1956	20.45	20.66	20.33	14.90	13.55	12.81
1957	24.16	26.44	26.81	18.00	18.58	18.62
1958	35.20	34.94	35.95	25.75	25.50	26.40
1959	33.38	31.94	30.46	25.92	24.32	23.11
1960	26.56	26.60	27.91	24.52	23.94	25.45
1961	27.75	28.59	29.05	21.62	22.44	23.00
1962	31.00	32.00	33.00	28.50	28.90	29.00
1963	29.15	29.05	29.31	26.49	26.30	26.56
1964	24.65	23.80	23.94	22.65	21.72	21.69
1965	27.40	27.69	28.00	24.98	24.52	24.50
1966	32.12	31.94	31.45	28.06	27.75	27.25
1967	31.56	31.50	31.25	27.88	27.50	26.82
1968	32.00	31.70	31.88	28.00	27.45	27.19
1969	35.50	35.80	35.50	31.06	31.55	31.31
1970	39.60	39.50	37.62	35.25	35.19	32.62
1971	39.00	41.00	42.12	34.50	36.68	37.56
1972	48.75	50.75	50.30	43.75	44.88	44.30
1973	65.46	61.86	58.85	55.70	54.42	52.10
1974	32.25	30.80	30.38	28.62	26.90	24.88
1975	33.44	35.10	38.74	29.50	28.55	28.75
1976	40.10	40.44	42.16	33.90	33.75	34.16
1977	45.25	45.62	46.50	39.50	39.25	38.80
1978	73.38	72.88	74.40	64.25	64.62	65.30
1979	102.38	96.95	93.38	90.75	85.45	82.00
1980	83.50	84.80	83.00	74.25	74.00	71.62
1981	69.90	68.12	67.75	63.30	58.38	58.12
1982	72.10	69.12	68.25	64.70	61.62	60.12
1983	63.00	64.38	65.60	56.88	57.38	57.40
1984	68.00	67.90	66.62	62.00	59.80	57.62
1985	64.38	66.20	65.38	57.88	59.50	57.50

- CONTINUED -

APPENDIX TABLE 4. HISTORICAL PRICES BY CLASSES OF CATTLE BASED ON SIOUX CITY QUOTATIONS, 1955-1985 (CONTINUED)

Year	6-700# Steers Mar	6-700# Steers Apr	6-700# Steers May	6-700# Steers Sept	6-700# Steers Oct	6-700# Steers Nov
1955	22.19	22.89	21.80	20.10	19.96	18.73
1956	17.48	18.25	18.75	21.48	20.42	19.33
1957	19.41	20.34	21.02	22.23	21.51	21.75
1958	25.88	26.22	26.90	26.75	27.19	26.75
1959	27.25	27.84	28.38	26.92	26.01	25.06
1960	28.65	28.08	28.00	25.09	24.56	25.64
1961	24.76	24.38	23.60	23.82	23.83	23.75
1962	26.75	26.81	27.00	28.25	28.55	29.25
1963	27.00	26.65	25.38	25.90	25.35	25.38
1964	24.00	22.23	21.25	22.35	21.88	22.00
1965	22.40	23.62	24.75	25.80	25.69	26.00
1966	29.30	28.12	27.88	28.56	27.76	27.25
1967	26.60	26.38	27.45	28.25	28.00	27.46
1968	28.00	28.44	28.67	28.75	28.65	29.12
1969	30.25	31.95	34.75	32.00	32.00	31.62
1970	34.88	35.00	35.19	35.50	35.38	32.50
1971	34.40	33.88	33.94	35.50	35.75	36.75
1972	39.25	39.62	41.05	42.50	45.12	44.15
1973	54.08	54.20	54.88	57.81	54.78	53.04
1974	45.42	45.35	40.72	31.25	31.00	30.50
1975	28.62	30.90	35.62	37.31	38.58	38.52
1976	41.18	45.31	42.91	37.50	37.69	37.16
1977	40.30	42.81	42.38	41.88	42.69	41.50
1978	52.90	55.69	62.50	65.00	64.38	65.70
1979	84.50	89.38	88.20	87.00	84.10	83.38
1980	77.88	70.20	69.75	77.00	75.30	74.50
1981	68.50	69.30	64.88	66.90	64.00	65.00
1982	65.70	66.75	68.50	67.50	64.88	64.75
1983	67.90	66.38	66.62	57.62	59.38	61.30
1984	66.12	64.50	63.80	64.62	63.80	64.88
1985	66.50	66.12	67.30	58.88	61.80	61.62

- CONTINUED -

APPENDIX TABLE 4. HISTORICAL PRICES BY CLASSES OF CATTLE BASED ON SIOUX CITY QUOTATIONS, 1955-1985 (CONTINUED)

Year	6-700# Heifers Mar	6-700# Heifers Apr	6-700# Heifers May	6-700# Heifers Sept	6-700# Heifers Oct	6-700# Heifers Nov
1955	14.50	16.00	15.48	15.56	15.48	14.61
1956	12.35	14.50	15.06	15.44	14.11	13.20
1957	14.92	15.97	16.74	17.92	17.43	17.65
1958	21.15	22.79	23.82	23.75	23.75	23.75
1959	24.56	25.00	25.50	24.81	22.96	22.14
1960	26.05	26.00	26.00	23.38	23.00	23.60
1961	20.83	21.12	20.35	20.88	21.19	21.00
1962	24.75	24.94	25.50	26.50	26.70	27.00
1963	24.08	24.19	24.00	24.07	23.50	23.38
1964	21.50	20.18	19.81	20.75	20.15	20.03
1965	19.80	20.88	22.31	23.18	23.25	23.25
1966	26.40	25.50	25.38	26.19	25.75	25.25
1967	24.20	23.56	24.15	26.25	26.19	24.58
1968	25.38	25.78	25.90	26.50	26.50	26.12
1969	26.88	28.70	31.12	28.92	28.50	28.06
1970	31.25	31.30	31.44	32.00	32.00	29.00
1971	31.45	31.00	30.94	36.25	32.19	33.05
1972	35.10	36.12	36.60	38.88	40.50	39.05
1973	46.70	45.70	48.44	50.34	48.66	48.25
1974	40.28	39.90	36.78	27.38	26.30	24.38
1975	24.62	26.35	30.62	33.50	31.90	31.62
1976	34.38	39.50	37.12	33.30	33.62	32.76
1977	34.40	37.75	37.25	37.38	37.38	35.70
1978	47.00	50.69	56.60	59.00	58.88	58.30
1979	75.62	82.00	79.40	78.38	72.90	72.12
1980	69.62	62.20	63.00	68.12	67.00	65.38
1981	62.62	62.70	58.50	61.70	58.38	57.38
1982	59.90	60.25	62.38	61.20	58.12	57.00
1983	62.80	61.75	60.50	52.38	52.75	54.30
1984	59.38	57.38	56.30	58.75	57.00	58.38
1985	61.62	59.88	60.70	53.50	56.00	54.62

- CONTINUED -

APPENDIX TABLE 4. HISTORICAL PRICES BY CLASSES OF CATTLE BASED ON SIOUX CITY QUOTATIONS, 1955-1985 (CONTINUED)

Year	11-1200# Steers Mar	11-1200# Steers Apr	11-1200# Steers May	11-1200# Steers Sept	11-1200# Steers Oct	11-1200# Steers Nov
1955	25.68	24.70	22.42	22.25	21.75	20.22
1956	19.72	20.04	19.91	27.63	26.42	23.54
1957	21.43	22.44	22.80	24.50	24.08	24.36
1958	29.32	29.25	28.26	26.15	25.81	26.06
1959	28.32	29.52	28.88	27.13	26.14	25.40
1960	27.49	27.64	26.86	24.23	24.22	25.21
1961	25.31	24.83	23.14	23.78	23.80	24.72
1962	26.33	27.11	25.62	29.48	28.88	29.47
1963	22.70	23.04	21.97	23.94	23.58	22.76
1964	21.09	20.52	20.27	25.37	24.16	23.54
1965	23.29	24.90	26.24	26.58	25.58	24.99
1966	28.16	26.69	25.96	25.70	24.70	23.81
1967	23.82	23.85	24.75	26.95	26.18	25.45
1968	26.78	26.68	26.44	27.74	27.04	27.66
1969	28.86	30.57	33.32	29.02	27.71	27.54
1970	30.52	30.51	29.46	29.37	28.50	27.05
1971	31.75	32.19	32.30	32.56	31.96	33.32
1972	35.16	34.34	35.63	34.72	34.68	33.23
1973	45.17	44.52	46.06	45.08	40.56	38.34
1974	40.96	40.39	39.62	41.27	39.90	37.64
1975	36.26	42.82	49.33	50.44	48.61	45.91
1976	36.14	43.22	40.26	36.28	37.09	38.93
1977	37.36	40.10	41.31	40.48	42.22	41.58
1978	48.88	52.67	57.76	54.64	54.98	53.48
1979	71.57	75.51	74.11	68.00	65.76	66.27
1980	66.36	62.73	64.00	70.41	67.34	63.39
1981	59.62	64.39	66.80	66.40	60.94	60.08
1982	66.95	69.97	73.50	61.54	59.48	59.34
1983	65.18	69.35	68.68	59.61	60.10	59.71
1984	69.64	68.78	66.46	63.04	62.10	65.70
1985	60.28	59.57	57.92	52.18	59.54	64.23

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APPENDIX TABLE 4. HISTORICAL PRICES BY CLASSES OF CATTLE BASED ON SIOUX CITY QUOTATIONS, 1955-1985 (CONTINUED)

Year	10-1100# Heifers Mar	10-1100# Heifers Apr	10-1100# Heifers May	10-1100# Heifers Sept	10-1100# Heifers Oct	10-1100# Heifers Nov
1955	22.98	22.76	21.36	21.46	20.65	19.31
1956	17.51	18.65	19.47	24.12	23.46	21.67
1957	19.88	21.64	22.19	22.77	22.37	23.52
1958	26.48	27.20	27.37	25.38	25.25	27.80
1959	26.81	27.89	28.07	25.82	24.90	24.06
1960	26.53	26.71	26.28	22.94	22.86	23.91
1961	24.30	23.93	22.86	22.76	22.77	23.35
1962	25.87	26.27	25.09	26.69	26.72	27.76
1963	22.33	22.51	21.94	23.12	22.52	21.92
1964	20.88	20.42	20.00	23.67	22.57	22.42
1965	22.19	23.59	25.40	24.27	23.58	23.44
1966	26.76	25.72	25.15	24.24	23.47	22.81
1967	23.00	22.91	23.81	25.69	24.76	24.21
1968	25.72	25.55	25.55	25.73	25.44	26.06
1969	27.69	29.21	32.04	27.01	26.07	26.20
1970	29.80	29.87	29.05	28.11	27.34	25.96
1971	30.95	31.63	31.76	30.61	31.01	32.53
1972	34.09	33.60	33.73	32.99	33.19	32.30
1973	43.94	43.13	44.48	43.50	39.06	37.67
1974	41.22	40.57	39.26	39.56	38.13	36.40
1975	34.61	40.55	47.06	46.74	45.76	44.34
1976	34.54	41.45	39.64	35.71	36.63	37.69
1977	35.81	38.46	40.22	38.39	40.05	39.87
1978	46.17	50.70	55.41	51.90	52.53	51.70
1979	68.69	73.12	72.40	65.19	63.67	64.41
1980	64.76	61.05	62.15	66.69	65.16	61.52
1981	59.23	62.46	65.40	62.92	59.15	58.08
1982	64.44	67.25	70.96	58.72	57.16	57.23
1983	62.35	65.94	65.44	57.47	57.12	58.20
1984	66.42	65.88	64.63	61.60	60.29	64.41
1985	58.70	57.62	56.75	50.91	58.14	62.94

APPENDIX D

CALCULATIONS FOR COMPOSITIONS OF FEEDS AND NUTRIENT REQUIREMENTS

APPENDIX TABLE 1. CALCULATIONS FOR COMPOSITION OF SELECTED FEEDS

Feeds	Dry Matter	Total Digestible Nutrients	Protein	Net Energy Maintenance	Net Energy Gain
	----------lbs.----------			----------Mcal.----------	
Corn grain (bu.)[1]	48.78 (56 x .88 x .99)	--	4.93 (48.78 x .101)	49.56 (48.78 x 2.24/2.2046)	34.29 (48.78 x 1.55/2.2046)
Oats (bu.)[2]	28.20 (32 x .99 x .89)	21.71 (28.2 x .77)	3.75 (28.2 x .133)	23.66 (28.2 x 1.85/2.2046)	15.60 (28.2 x 1.22/2.2046)
Sorghum (bu.)[3]	48.20 (56 x .99 x .87)	--	4.87 (48.2 x .101)	45.04 (48.2 x 2.06/2.2046)	30.61 (48.2 x 1.4/2.2046)
Soybean meal (ton)[4]	1,762.20 (2,000 x .99 x .89)	1,480.25 (1,762.2 x .84)	879.34 (1,762.2 x .499)	1,646.62 (1,762.2 x 2.06/2.2046)	1,118.96 (1,762.2 x 1.4/2.2046)
Corn silage (ton)[5]	601.40 (2,000 x .97 x .31)	396.9 (601.4 x .66)	49.61 (601.4 x .0825)	410.55 (601.4 x 1.505/2.2046)	249.58 (601.4 x .915/2.2046)
Wheat straw (ton)[6]	1,513.00 (2,000 x .85 x .89)	620.3 (1,513 x .41)	54.47 (1,513 x .036)	439.22 (1,513 x .64/2.2046)	75.49 (1,513 x .11/2.2046)
Alfalfa hay (ton)[7]	1,710.00 (2,000 x .95 x .9)	991.8 (1,710 x .58)	290.70 (1,710 x .17)	961.80 (1,710 x 1.24/2.2046)	527.44 (1,710 x .68/2.2046)
Corn stover--corn or sorghum aftermath (ton)[8]	1,649.00 (2,000 x .97 x .85)	824.5 (1,649 x .5)	108.83 (1,649 x .066)	725.54 (1,649 x .97/2.2046)	314.15 (1,649 x .42/2.2046)

[1]Corn grain--dent yellow, grade 2, good feed management, and concrete bunks, wastage 1%.
[2]Oats--good feed management and concrete bunks, wastage 1%.
[3]Sorghum--8 to 10% protein, wastage 1%.
[4]Soybean meal--wastage 1%.
[5]Corn silage--average of few ears and well-eared, good feed management using feed bunks, wastage 3%.
[6]Wheat straw--wastage 15%.
[7]Alfalfa hay--sun-cured, mid bloom, good feed management, wastage 5%.
[8]Corn stover (aftermath)--wastage 3%.

SOURCE: National Research Council 1984.

APPENDIX TABLE 2. WINTER NUTRIENT REQUIREMENTS FOR A COW AND BULL

Item	DM (1)	TDN (2)	PROT (3)	Days (4)	Total Requirements DM (1 x 4)	TDN (2 x 4)	PROT (3 x 4)
	-----lbs./day-----			--no.-	------------lbs.------------		
Cow (1,000 lb.)							
Middle third	18.1	8.8	1.3	56.7	1,026.3	499.0	73.7
Last third	19.6	10.5	1.6	94.3	1,848.3	990.2	150.9
Nursing	20.2	11.5	2.0	30.0	606.0	345.0	60.0
Total				181.0	3,480.6	1,834.2	284.6
Bull (1,700 lb.)							
	27.7	13.4	1.9	181.0	5,013.7	2,425.4	343.9
Nutrient requirements for one cow and 1/25 of a bull:							
Cow					3,480.6	1,834.2	284.6
Bull 1/25					200.5	97.0	13.8
Total					3,681.1	1,931.2	298.4

SOURCE: National Research Council 1984.

APPENDIX TABLE 3. WINTER NUTRIENT REQUIREMENTS FOR A REPLACEMENT HEIFER AND BULL

Item	DM (1)	TDN (2)	PROT (3)	NE_m (4)	NE_g (5)	Days (6)	Total Requirements DM (7= 1 x 6)	TDN (2 x 6)	PROT (3 x 6)	NE_m (4 x 7)	NE_g (5 x 7)
	----lbs./day----			Mcal./lb.		-no.-	------------lbs.------------			------Mcal.-------	
Replacement heifer:											
800 lb.	18.3	11.7	1.57	0.65	0.39	56.7	1,037.6	663.4	89.0	674.5	404.7
Last third	19.0	11.3	1.60	0.58	0.32	94.3	1,791.7	1,065.6	150.9	1,039.2	573.3
Nursing	20.8	12.9	2.10	0.62	0.36	30.0	624.0	387.0	63.0	386.9	224.6
Total						181.0	3,453.3	2,116.0	302.9	2,100.5	1,202.7
Nutrient requirements for one replacement heifer and 1/25 of a bull:											
Heifer							3,453.3	2,116.0	302.9	2,100.5	1,202.7
Bull 1/25							200.5	97.0	13.8	0.0	0.0
Total							3,653.8	2,213.0	316.7	2,100.5	1,202.7

SOURCE: National Research Council 1984.

APPENDIX TABLE 4. NUTRIENT REQUIREMENTS FOR BACKGROUNDING STEERS AND HEIFERS

Weight	DM (1)	PROT (2)	NE_m (3)	NE_g (4)	Days (5)	Total Requirements: DM (6= 1 x 5)	PROT (2 x 6)	NE_m (3 x 6)	NE_g (4 x 6)
-lbs.-	lbs./day	%	Mcal./lb.		no.	-------lbs.-------		------Mcal.-----	
Steers (medium frame, 1.5 ADG):									
462.5	12.04	10.88	0.64	0.38	50.0	602.0	65.5	385.3	228.8
550.0	13.75	10.15	0.64	0.38	66.7	917.1	93.1	586.9	348.5
625.0	15.15	9.65	0.64	0.38	33.3	504.5	48.7	322.9	191.7
Total					150.0	2,023.6	207.3	1,295.1	769.0
Heifers (medium frame, 1.5 ADG):									
387.5	9.95	12.88	0.72	0.44	16.6	165.2	21.3	118.9	72.7
450.0	11.15	10.85	0.72	0.44	66.7	743.7	80.7	535.5	327.2
550.0	12.95	9.95	0.72	0.44	66.7	863.7	85.5	621.9	380.6
Total					150.0	1,772.6	187.5	1,276.3	779.9

SOURCE: National Research Council 1984.

APPENDIX TABLE 5. NUTRIENT REQUIREMENTS FOR FINISHING STEERS AND HEIFERS

Weight	DM (1)	PROT (2)	NE_m (3)	NE_g (4)	Days (5)	Total Requirements: DM (6= 1 x 5)	PROT (2 x 6)	NE_m (3 x 6)	NE_g (4 x 6)
-lbs.-	lbs./day	%	Mcal./lb.		no.	-------lbs.-------		------Mcal.-------	
Steers (compensating medium frame, 2.75 ADG):									
675	17.5	1.93	0.74	0.47	18.2	318.5	35.1	235.7	149.7
750	18.9	1.98	0.74	0.47	36.4	688.0	72.1	509.1	323.3
850	20.8	2.04	0.74	0.47	36.4	757.1	74.3	560.3	355.8
950	22.7	2.11	0.74	0.47	36.4	826.3	76.8	611.4	388.4
1,050	24.4	2.17	0.74	0.47	36.4	888.2	79.0	657.2	417.4
1,125	25.3	2.20	0.74	0.47	18.2	460.5	40.0	340.7	216.4
Total					182.0	3,938.5	377.3	2,914.5	1,851.1
Heifers (compensating medium frame, 2.5 ADG):									
650	15.5	1.65	0.84	0.55	40.0	620.0	66.0	520.8	341.0
750	17.2	1.71	0.84	0.55	40.0	688.0	68.4	577.9	378.4
850	18.9	1.76	0.84	0.55	40.0	756.0	70.4	635.0	415.8
950	20.6	1.80	0.84	0.55	40.0	824.0	72.0	692.2	453.2
1,025	21.9	1.84	0.84	0.55	40.0	438.0	36.8	367.9	240.9
Total					180.0	3,326.0	313.6	2,793.8	1,829.3

SOURCE: National Research Council 1984.

APPENDIX E

STATIC AND DYNAMIC SOLUTIONS FOR DRYLAND RANCH MODEL I

APPENDIX TABLE 1. STATIC SOLUTIONS FOR SUMMER DRYLAND RANCH MODEL I

OBJECTIVE FUNCTION= 52571.59294

SECTION 1 - ROWS

NUMBER	TYPE	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1.	E	ACCTING	EQ	.	.	.	.	.
2.	E	COWINV	EQ	60.00000	.	60.00000	60.00000	-22.16000
3.	L	COWMAX	UL	60.00000	.	NONE	60.00000	182.75545
4.	E	REPINV	EQ	10.80000	.	10.80000	10.80000	-6.99773
5.	L	RPAST	UL	123.20000	.	NONE	123.20000	0.85455
6.	L	SUMGRAZ	BS	-5.22401	5.22401	NONE	.	.
7.	E	BEGALF	EQ	34.00000	.	34.00000	34.00000	.
8.	L	FALLGRAZ	UL	.	.	NONE	.	0.22727
9.	E	WCOWINV	EQ	.	.	.	.	.
10.	E	EREPINV	EQ	.	.	.	.	.
11.	E	ENDALF	EQ	.	.	.	.	.
12.	E	ALFHAY	EQ	50.00000	.	50.00000	50.00000	-81.31771
13.	E	CPLAST	EQ	75.00000	.	75.00000	75.00000	-56.34589
14.	L	TILLAC	UL	730.40002	.	NONE	730.40002	58.42771
15.	L	CORNT	UL	.	.	NONE	.	2.59000
16.	G	MINCORN	LL	44.00000	.	44.00000	NONE	-4.86021
17.	L	WHTT	UL	.	.	NONE	.	4.03000
18.	L	OWAFT	BS	-33.28184	33.28184	NONE	.	.
19.	L	OATT	UL	.	.	NONE	.	1.40000
20.	L	SORGT	UL	.	.	NONE	.	2.22000
21.	L	WHTLIM	BS	205.40002	94.59998	NONE	300.00000	.
22.	L	OATLIM	BS	.	300.00000	NONE	300.00000	.
23.	L	CSLIM	UL	400.00000	.	NONE	400.00000	0.31150
24.	L	SUMLAB	UL	1250.00000	.	NONE	1250.00000	4.50000
25.	E	HFRINV	EQ	27.60000	.	27.60000	27.60000	.
26.	E	STRINV	EQ	27.60000	.	27.60000	27.60000	.
27.	L	SCOW1	BS	.	60.00000	NONE	60.00000	.
28.	L	SCOW2	BS	.	60.00000	NONE	60.00000	.
29.	L	SCOW3	BS	.	60.00000	NONE	60.00000	.
30.	E	SBED	EQ	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 1. STATIC SOLUTIONS FOR SUMMER DRYLAND RANCH MODEL I (CONTINUED)

SECTION 2 - COLUMNS

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT.	..UPPER LIMIT.	.REDUCED COST.
1.	ACCTINV	BS	30845.83047	.	.	NONE	.
2.	BEEFCOW	BS	60.00000	170.00000	.	NONE	.
3.	REPHFR	BS	10.80000	.	.	NONE	.
4.	BUYCOW	LL	.	-22.16000	.	NONE	-44.32000
5.	ESSUPPFO	LL	.	-45.21000	.	NONE	-62.76000
6.	GRAZRANG	BS	123.20000	.	.	NONE	.
7.	GRCLPAST	BS	75.00000	.	.	NONE	.
8.	SELLCOW1	BS	.	-22.16000	.	NONE	.
9.	SELLCOW2	LL	.	-55.42000	.	NONE	-33.26000
10.	SELLCOW3	LL	.	-99.75000	.	NONE	-77.59000
11.	LSUPPFOR	LL	.	-45.21000	.	NONE	-62.07818
12.	GRSGAFT	BS	140.91818	-0.10000	.	NONE	.
13.	COWT	BS	50.40000	.	.	NONE	.
14.	REPHFRT	BS	9.60000	.	.	NONE	.
15.	ALFT	BS	34.00000	.	.	NONE	.
16.	ALFD	BS	50.00000	-17.94000	.	NONE	.
17.	CORNAC	BS	44.00000	-57.97000	.	NONE	.
18.	SELLCORN	BS	2248.39993	2.59000	.	NONE	.
19.	WHTAC	BS	205.40002	-41.53000	.	NONE	.
20.	SELLWHT	BS	5461.58668	4.03000	.	NONE	.
21.	OATAC	LL	.	-38.55000	.	NONE	-37.63771
22.	SELLOAT	BS	.	1.40000	.	NONE	.
23.	SORGAC	BS	356.00000	-43.62000	.	NONE	.
24.	SELLSORG	BS	18996.16022	2.22000	.	NONE	.
25.	HIRELAB	BS	25.04002	-4.50000	.	NONE	.
26.	HFRT	BS	27.60000	.	.	NONE	.
27.	STRT	BS	27.60000	.	.	NONE	.
28.	INVALF	BS	113.20000	.	.	NONE	.
29.	STRB	BS	31.20000	.	.	NONE	.

APPENDIX TABLE 2. STATIC SOLUTIONS FOR WINTER DRYLAND RANCH MODEL I

OBJECTIVE FUNCTION= 70900.00831

SECTION 1 - ROWS

NUMBER	TYPE	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1.	E	ACCTING	EQ	.	.	.	.	.
2.	E	COWINV	EQ	50.40000	.	50.40000	50.40000	-22.16000
3.	L	COWMAX	UL	60.00000	.	NONE	60.00000	178.66258
4.	E	BREPINV	EQ	9.60000	.	9.60000	9.60000	-50.42287
5.	E	CULLCOW	EQ	.	.	.	.	371.30201
6.	E	HFRS	EQ	.	.	.	.	.
7.	E	STRS	EQ	.	.	.	.	.
8.	E	CULLREP	EQ	.	.	.	.	446.94916
9.	E	ECOWINV	EQ	.	.	.	.	.
10.	E	BGHFR	EQ	.	.	.	.	340.94234
11.	L	BGSTR	UL	.	.	NONE	.	417.81720
12.	L	WINLAB	BS	385.85786	864.14214	NONE	1250.00000	.
13.	E	BALFINV	EQ	113.20000	.	113.20000	113.20000	36.16000
14.	L	TONC	UL	.	.	NONE	.	0.83646
15.	L	PROTC	BS	-8488.67882	8488.67882	NONE	.	.
16.	E	CORNAC	EQ	44.00000	.	44.00000	44.00000	129.79399
17.	E	CORNSILT	EQ	.	.	.	.	16.83425
18.	E	CORNGRT	EQ	.	.	.	.	2.54000
19.	L	CSAFT	BS	-178.01177	178.01177	NONE	.	.
20.	L	OWAFT	UL	33.30000	.	NONE	33.30000	6.30409
21.	E	OATAC	EQ	.	.	.	.	66.51150
22.	E	WHTAC	EQ	205.39999	.	205.39999	205.39999	.
23.	E	OATT	EQ	.	.	.	.	1.39000
24.	E	WHTT	EQ	.	.	.	.	.
25.	E	STRAWT	EQ	.	.	.	.	22.61549
26.	E	SORGAC	EQ	356.00000	.	356.00000	356.00000	115.79121
27.	E	SORGT	EQ	.	.	.	.	2.17000
28.	E	BHFRINV	EQ	27.60000	.	27.60000	27.60000	220.93634
29.	E	BSTRINV	EQ	27.60000	.	27.60000	27.60000	294.55320
30.	E	REQREP	EQ	10.80000	.	10.80000	10.80000	-340.94234
31.	L	PROTBG	BS	-3074.53400	3074.53400	NONE	.	.
32.	L	NEMBG	UL	.	.	NONE	.	0.03262
33.	L	NEGBG	UL	.	.	NONE	.	0.05949
34.	L	SCOWL1	BS	0.00001	59.99999	NONE	60.00000	.
35.	L	SCOWL2	BS	.	60.00000	NONE	60.00000	.
36.	L	SCOWL3	BS	.	60.00000	NONE	60.00000	.
37.	L	STRAWL	BS	-32.46861	32.46861	NONE	.	.
38.	G	AMAXT	LL	.	.	.	NONE	-0.03534
39.	G	AMAXP	BS	808.09870	-808.09870	.	NONE	.
40.	G	MINF	BS	10.98314	-10.98314	.	NONE	.
41.	L	MAXF	UL	.	.	NONE	.	7.68282
42.	L	MAXS	BS	-3.66105	3.66105	NONE	.	.
43.	L	MAXAFT	UL	.	.	NONE	.	28.35251

- CONTINUED -

APPENDIX TABLE 2. STATIC SOLUTIONS FOR WINTER DRYLAND RANCH MODEL I (CONTINUED)

SECTION 2 - COLUMNS

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT.	..UPPER LIMIT.	.REDUCED COST.
1.	ACCTINV	BS	80483.61102	.	.	NONE	.
2.	BEEFCOW	BS	50.40000	133.00000	.	NONE	.
3.	REPHFR	BS	9.60000	133.00000	.	NONE	.
4.	SELLCOW1	BS	.	-22.16000	.	NONE	.
5.	SELLCOW2	LL	.	-55.42000	.	NONE	-33.26000
6.	SELLCOW3	LL	.	-99.75000	.	NONE	-77.59000
7.	SELLCULL	BS	95.76000	37.13000	.	NONE	.
8.	SELLREP	BS	8.94915	52.74000	.	NONE	.
9.	SELLWHFR	BS	62.30537	58.99000	.	NONE	.
10.	SELLWSTR	BS	117.44681	69.22000	.	NONE	.
11.	BGHFRS	BS	10.96447	-26.86000	.	NONE	.
12.	BGSTRS	BS	.	-29.00000	.	NONE	.
13.	SBGHFR	LL	.	56.02000	.	NONE	-0.91737
14.	SBGSTR	LL	.	63.25000	.	NONE	-1.09385
15.	HIRELAB	LL	.	-4.50000	.	NONE	-4.50000
16.	ALFT	BS	31.43929	36.16000	.	NONE	.
17.	ALFC	BS	70.77757	.	.	NONE	.
18.	BUYALF	LL	.	-73.81000	.	NONE	-37.65000
19.	CORNSIL	BS	.	-2.86000	.	NONE	.
20.	CSC	LL	.	.	.	NONE	-2.36370
21.	CORNGR	BS	44.00000	.	.	NONE	.
22.	SELLCORN	BS	2240.39993	2.54000	.	NONE	.
23.	GRCSAFT	BS	47.88640	-0.10000	.	NONE	.
24.	OATS	BS	.	.	.	NONE	.
25.	WHEAT	BS	205.39999	.	.	NONE	.
26.	BSTRAW	BS	14.35345	-7.99000	.	NONE	.
27.	FSTRAW	BS	14.35345	.	.	NONE	.
28.	PROTSUPP	LL	.	-200.00000	.	NONE	-146.02250
29.	OATC	LL	.	.	.	NONE	-0.53864
30.	SELLOAT	BS	.	1.39000	.	NONE	.
31.	SELLWHT	BS	5461.58587	.	.	NONE	.
32.	SORG	BS	356.00000	.	.	NONE	.
33.	SELLSORG	BS	10734.65695	2.17000	.	NONE	.
34.	EHFRINV	BS	27.60000	.	.	NONE	.
35.	ESTRINV	BS	27.60000	.	.	NONE	.
36.	REPINV	BS	10.00000	.	.	NONE	.
37.	INVCOW	BS	60.00000	.	.	NONE	.
38.	ALFM	BS	9.94686	.	.	NONE	.
39.	ALFG	BS	1.03620	.	.	NONE	.
40.	CSM	LL	.	.	.	NONE	-1.94101
41.	CSG	LL	.	.	.	NONE	-0.40715
42.	CGRM	LL	.	.	.	NONE	-0.57416
43.	CGRG	LL	.	.	.	NONE	-0.15100
44.	OATM	LL	.	.	.	NONE	-0.41860
45.	OATG	LL	.	.	.	NONE	-0.26252
46.	SORGM	LL	.	.	.	NONE	-0.35161
47.	SORGG	BS	261.50327	.	.	NONE	.
48.	PROSM	LL	.	-200.00000	.	NONE	-133.81700
49.	PROSG	LL	.	-200.00000	.	NONE	-120.96842
50.	STRM	LL	.	.	.	NONE	-10.59236
51.	STRG	LL	.	.	.	NONE	-20.42954
52.	CSAFTM	BS	6.10174	-0.10000	.	NONE	.
53.	CSAFTG	LL	.	-0.10000	.	NONE	-4.90085

APPENDIX TABLE 3. DYNAMIC SOLUTIONS FOR SUMMER DRYLAND RANCH MODEL I

Dryland (Summer solutions)

	1	2	3	4	5	6	7	8	9	11	12	15
	ACCTING	BEECOW	REPHFR	BUYCOW	ESUPPFOR	GRAZRANG	GRCLPAST	SELLCOW1	SELLCOW2	LSUPPFOR	GRSGAFT	ALFT
1955	30,788	60	10.8	0	11.56	123.2	75	0	0	1.1	268.06	21.34
1956	35,020	37.05	10.8	0	0	123.2	75	10	12.95	0	222.06	0
1957	37,345	60	10.8	19.28	0	123.2	75	0	0	0	109.76	0
1958	30,543	60	10.8	0	0	120.94	75	0	0	0	163.77	29.83
1959	31,306	60	10.8	0	27.88	123.2	75	0	0	12.14	256.72	18.66
1960	30,540	60	10.8	0	0	123.2	75	0	0	0	93.18	0
1961	30,561	60	10.8	0	0	123.2	75	0	0	0	133.38	1.43
1962	30,580	60	10.8	0	0	123.2	75	0	0	0	99.17	18.49
1963	30,587	60	10.8	0	0	123.2	75	0	0	0	158.39	85.98
1964	30,829	60	10.8	0	5.67	123.2	75	0	0	8.12	261.67	40.07
1965	30,667	56.56	10.8	0	0	123.2	75	3.44	0	0	136.63	0
1966	30,468	53.16	10.8	0	0	123.2	75	3.96	0	0.89	195.12	0
1967	30,410	54.19	10.8	0	0	123.2	75	0.06	0	0	216.46	0
1968	30,348	54.09	10.8	0	0	123.2	75	1.03	0	0	245.57	0
1969	32,600	60	10.8	4.97	0	123.2	75	0	0	0	125.7	0
1970	30,851	60	10.8	0	0	123.2	75	0	0	0	137.55	28.52
1971	30,835	60	10.8	0	0	123.2	75	0	0	0	128.07	36.09
1972	30,848	60	10.8	0	0	123.2	75	0	0	0	94.99	92.71
1973	30,826	60	10.8	0	0	123.2	75	0	0	0	90.14	122.38
1974	31,052	60	10.8	0	4.38	123.2	75	0	0	7.1	172.68	91.21
1975	30,912	60	10.8	0	0	123.2	75	0	0	2	164.75	19.03
1976	30,681	52.88	10.8	0	2.63	123.2	75	7.12	0	7.98	166.28	0
1977	31,013	60	10.8	5.98	0	123.2	75	0	0	0	160.26	0
1978	30,854	60	10.8	0	0	123.2	75	0	0	0	112.03	53.66
1979	30,833	60	10.8	0	0	123.2	75	0	0	0	93.37	120.22
1980	31,235	60	10.8	0	8.06	123.2	75	0	0	12.1	163.48	148.89
1981	31,559	60	10.8	0	21.94	123.2	75	0	0	17.41	170.09	8.63
1982	30,835	60	10.8	0	0	123.2	75	0	0	0	56.68	31.01
1983	30,863	60	10.8	0	0	123.2	75	0	0	0	116.79	136.16
1984	37,234	60	10.8	0	0	123.2	75	0	0	0	98.62	100.51
1985	37,220	60	10.8	0	0	123.2	75	0	0	0	107.18	99.69
average	31,620	58.32	10.80	0.98	2.65	123.13	75.00	0.83	0.42	2.22	152.21	42.08
std. dev.	2,028	4.46	0.00	3.60	6.47	0.40	0.00	2.26	2.29	4.51	55.37	47.39

- CONTINUED -

APPENDIX TABLE 3. DYNAMIC SOLUTIONS FOR SUMMER DRYLAND RANCH MODEL I (CONTINUED)

Dryland (Summer solutions)

	16	17	19	23	25	26	27	28	29
	ALFD	CORNAC	WHTAC	SORGAC	HIRELAB	HFRT	STRT	INVALF	STRB
1955	50	44.0	300.0	261.4	56	27.6	27.6	89.6	31.9
1956	50	352.4	253.0	0.0	216	27.6	27.6	50.0	31.0
1957	50	400.0	205.4	0.0	310	18.7	18.7	95.0	22.2
1958	50	44.0	300.0	261.4	6	27.6	27.6	113.9	25.3
1959	50	44.0	300.0	261.4	162	27.6	27.6	62.4	43.3
1960	50	44.0	300.0	261.4	6	27.6	27.6	90.0	24.4
1961	50	44.0	300.0	261.4	6	27.6	27.6	88.7	30.5
1962	50	44.0	300.0	261.4	6	27.6	27.6	139.8	36.3
1963	50	44.0	300.0	261.4	6	27.6	27.6	166.3	38.3
1964	50	44.0	300.0	261.4	60	27.6	27.6	102.1	38.3
1965	50	44.0	205.4	356.0	18	27.6	27.6	77.5	30.2
1966	50	44.0	228.5	332.9	10	26.3	26.3	55.0	33.4
1967	50	44.0	241.5	319.9	6	25.0	25.0	70.0	25.0
1968	50	44.0	274.2	287.2	0	25.4	25.4	72.5	28.6
1969	50	44.0	205.4	356.0	25	25.3	25.3	95.0	30.4
1970	50	44.0	205.4	356.0	25	27.6	27.6	117.8	32.7
1971	50	44.0	205.4	356.0	25	27.6	27.6	113.9	28.0
1972	50	44.0	205.4	356.0	25	27.6	27.6	209.2	31.9
1973	50	44.0	205.4	356.0	25	27.6	27.6	207.9	25.3
1974	50	44.0	205.4	356.0	70	27.6	27.6	153.0	32.7
1975	50	44.0	205.4	356.0	33	27.6	27.6	100.7	40.7
1976	50	44.0	205.4	356.0	52	27.6	27.6	57.5	39.1
1977	50	44.0	205.4	356.0	25	24.9	24.9	73.0	25.0
1978	50	44.0	205.4	356.0	25	27.6	27.6	141.4	33.5
1979	50	44.0	205.4	356.0	25	27.6	27.6	192.7	27.4
1980	50	44.0	205.4	356.0	104	27.6	27.6	178.6	41.9
1981	50	44.0	205.4	356.0	179	27.6	27.6	48.9	35.3
1982	50	44.0	205.4	356.0	25	27.6	27.6	161.3	28.0
1983	50	44.0	205.4	356.0	25	27.6	27.6	223.4	36.3
1984	50	400.0	205.4	0.0	310	27.6	27.6	194.9	30.5
1985	50	400.0	205.4	0.0	310	27.6	27.6	169.8	26.3
average	50.00	88.4	235.5	281.5	70	27.0	27.0	119.7	31.7
std. dev.	0.00	115.6	41.1	115.4	94	1.7	1.7	52.0	5.5

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER DRYLAND RANCH MODEL I

DLWINTER OUTPUT								DLWINTER OUTPUT					
	1	2	3	7	8	9	10	11	12	13	14	16
	ACCTING	BEEFCOW	REPHFR	SELLCULL	SELLREP	SELLWHFR	SELLWSTR	BGHFRS	BGSTRS	SBGHFR	SBGSTR	ALFT
1955	84,147	50.4	9.6	95.8	9.0	62.3	117.5	11.0	0.0	0.0	0.0	0.0
1956	86,059	31.1	9.6	59.1	9.0	62.3	117.5	11.0	0.0	0.0	0.0	0.0
1957	97,073	50.4	9.6	95.8	9.0	29.1	79.7	11.0	0.0	0.0	0.0	29.8
1958	90,798	50.4	9.6	95.8	9.0	62.3	117.5	11.0	0.0	0.0	0.0	58.7
1959	63,755	50.4	9.6	95.8	9.0	0.0	117.5	27.6	0.0	98.1	0.0	0.0
1960	95,485	50.4	9.6	95.8	9.0	0.0	0.0	27.6	27.6	98.1	176.5	1.4
1961	93,585	50.4	9.6	95.8	9.0	0.0	117.5	27.6	0.0	98.1	0.0	18.5
1962	98,480	50.4	9.6	95.8	9.0	62.3	117.5	11.0	0.0	0.0	0.0	86.0
1963	83,391	50.4	9.6	95.8	9.0	0.0	0.0	27.6	27.6	98.1	176.5	53.9
1964	74,112	50.4	9.6	95.8	9.0	0.0	0.0	27.6	27.6	98.1	176.5	0.0
1965	67,242	47.5	9.6	90.3	9.0	62.3	117.5	11.0	0.0	0.0	0.0	0.9
1966	73,226	44.7	9.6	84.8	9.0	57.3	111.8	11.0	0.0	0.0	0.0	0.0
1967	67,031	45.5	9.6	86.5	9.0	52.4	106.2	11.0	0.0	0.0	0.0	0.0
1968	63,405	45.4	9.6	86.3	9.0	0.0	0.0	25.4	25.4	84.9	162.2	0.0
1969	76,911	50.4	9.6	95.8	9.0	53.8	107.7	11.0	0.0	0.0	0.0	28.5
1970	73,918	50.4	9.6	95.8	9.0	62.3	117.5	11.0	0.0	0.0	0.0	36.1
1971	72,360	50.4	9.6	95.8	9.0	0.0	0.0	27.6	27.6	98.1	176.5	92.7
1972	101,320	50.4	9.6	95.8	9.0	0.0	117.5	27.6	0.0	98.1	0.0	122.4
1973	122,789	50.4	9.6	95.8	9.0	0.0	0.0	27.6	27.6	98.1	176.5	102.7
1974	86,641	50.4	9.6	95.8	9.0	0.0	0.0	27.6	27.6	98.1	176.5	21.0
1975	70,878	50.4	9.6	95.8	9.0	62.3	117.5	11.0	0.0	0.0	0.0	10.6
1976	58,139	44.4	9.6	84.4	9.0	62.3	117.5	11.0	0.0	0.0	0.0	0.0
1977	82,105	50.4	9.6	95.8	9.0	52.0	105.7	11.0	0.0	0.0	0.0	53.7
1978	81,714	50.4	9.6	95.8	9.0	62.3	117.5	11.0	0.0	0.0	0.0	120.2
1979	82,134	50.4	9.6	95.8	9.0	62.3	117.5	11.0	0.0	0.0	0.0	169.1
1980	71,745	50.4	9.6	95.8	9.0	0.0	0.0	27.6	27.6	98.1	176.5	48.0
1981	62,905	50.4	9.6	95.8	9.0	0.0	0.0	27.6	27.6	98.1	176.5	31.0
1982	75,500	50.4	9.6	95.8	9.0	62.3	117.5	11.0	0.0	0.0	0.0	136.2
1983	80,702	50.4	9.6	95.8	9.0	0.0	0.0	27.6	27.6	98.1	176.5	100.5
1984	82,193	50.4	9.6	95.8	9.0	62.3	0.0	11.0	27.6	0.0	176.5	99.7
1985	93,700	50.4	9.6	95.8	9.0	62.3	117.5	11.0	0.0	0.0	0.0	102.6
average	81,079	49.0	9.6	93.1	9.0	34.0	73.3	17.9	9.7	40.7	62.2	49.2
std. dev.	13,602	3.7	.0	7.1	.0	29.5	54.8	8.1	13.1	48.0	83.9	49.2

- CONTINUED -

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER DRYLAND RANCH MODEL I (CONTINUED)

DLWINTER OUTPUT

	17	19	20	21	22	23	26	27	31	33	34	35	37
	ALFC	CORNSIL	CSC	CORNGR	SELLCORN	GRCSAFT	BSTRAW	FSTRAW	SELLWHT	SELLSORG	EHFRINV	ESTRINV	INVCOW
1955	79.8	0.1	0.0	43.9	2074	47.9	0.0	0.0	7884	11285	27.6	27.6	60.0
1956	50.0	5.5	11.8	346.9	16812	32.9	0.0	0.0	5351	0	18.7	18.7	40.7
1957	55.0	0.1	0.0	400.0	24511	47.9	39.7	39.7	6912	0	27.6	27.6	60.0
1958	45.2	0.0	0.0	44.0	2053	47.9	55.9	55.2	9960	13650	27.6	27.6	60.0
1959	62.4	19.7	43.3	24.3	927	47.9	0.0	0.0	5751	10355	27.6	27.6	60.0
1960	45.2	0.0	0.0	44.0	2462	47.9	-75.9	55.2	10389	14813	27.6	27.6	60.0
1961	45.2	0.0	0.0	44.0	2587	47.9	59.9	55.2	8262	15579	27.6	27.6	60.0
1962	45.2	0.0	0.0	44.0	3011	47.9	59.3	55.2	7020	20072	27.6	27.6	60.0
1963	57.1	0.0	0.0	44.0	2746	47.9	36.2	36.2	6651	14501	27.6	27.6	60.0
1964	79.8	12.2	0.0	31.8	1529	47.9	0.0	0.0	6600	14100	27.6	27.6	60.0
1965	65.6	0.0	0.0	44.0	1847	45.6	16.6	16.6	5538	14274	26.3	26.3	57.1
1966	55.0	9.5	43.2	34.5	1728	43.4	0.0	0.0	5278	16740	25.0	25.0	54.3
1967	70.0	6.2	8.5	37.8	1442	44.1	0.0	0.0	7455	12449	25.4	25.4	55.1
1968	72.5	21.1	2.0	22.9	958	44.0	0.0	0.0	7349	11634	25.3	25.3	55.0
1969	66.5	3.6	0.0	40.4	2220	47.9	21.2	21.2	5476	21288	27.6	27.6	60.0
1970	70.7	0.0	0.0	44.0	1717	47.9	14.4	14.4	5269	17047	27.6	27.6	60.0
1971	21.2	24.5	109.3	19.5	1048	47.9	23.7	23.7	6180	18139	27.6	27.6	60.0
1972	59.1	0.0	0.0	44.0	3072	47.9	33.0	33.0	5425	24952	27.6	27.6	60.0
1973	49.9	0.0	0.0	44.0	2607	47.9	47.7	47.7	6805	21503	27.6	27.6	60.0
1974	79.8	0.0	0.0	44.0	199	47.9	0.0	0.0	5242	13265	27.6	27.6	60.0
1975	79.8	0.0	0.0	44.0	1438	47.9	0.0	0.0	4274	12855	27.6	27.6	60.0
1976	57.5	9.5	36.2	34.6	1258	43.2	0.0	0.0	4077	13222	24.9	24.9	54.0
1977	19.3	16.8	134.5	27.2	1385	47.9	10.5	10.5	6727	22189	27.6	27.6	60.0
1978	21.2	11.7	108.9	32.3	1979	47.9	23.9	23.9	5149	25215	27.6	27.6	60.0
1979	23.6	10.8	75.4	33.2	1982	47.9	41.5	41.5	6341	21676	27.6	27.6	60.0
1980	79.8	2.0	0.0	42.0	1133	47.9	0.0	0.0	4079	14045	27.6	27.6	60.0
1981	17.9	37.9	154.6	6.1	294	47.9	0.0	0.0	4837	16818	27.6	27.6	60.0
1982	25.2	8.8	54.4	35.3	1985	47.9	56.4	52.5	6170	17660	27.6	27.6	60.0
1983	67.6	0.0	0.0	44.0	2009	47.9	19.4	19.4	4751	18153	27.6	27.6	60.0
1984	58.8	0.0	0.0	400.0	23164	47.9	33.6	33.6	5712	0	27.6	27.6	60.0
1985	56.8	0.0	0.0	400.0	26553	47.9	36.7	36.7	6604	0	27.6	27.6	60.0
average	54.3	6.4	25.2	82.0	4476	46.8	22.8	21.7	6242	14435	27.0	27.0	58.6
standard	19.3	9.2	44.0	117.9	7190	2.9	22.8	20.8	1471	6728	1.7	1.7	3.7

- CONTINUED -

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER DRYLAND RANCH MODEL I (CONTINUED)

DLWINTER OUTPUT

	38	39	40	43	46	47	50	52	TOTAL
	ALFM	ALFG	CSM	CGRG	SORGM	SORGG	STRM	CSAFTM	INCOME
1955	9.8	0.0	1.6	0	0	279	0.0	5.9	53,359
1956	0.0	0.0	25.0	224	0	0	0.0	5.1	51,039
1957	10.2	0.0	0.0	246	0	0	0.0	5.8	59,728
1958	10.0	0.0	0.0	249	0	0	0.7	5.7	60,255
1959	0.0	0.0	61.8	0	0	592	0.0	13.6	32,450
1960	43.4	0.0	0.0	0	5	1397	20.7	27.5	64,945
1961	23.5	1.5	0.0	0	0	677	4.7	14.6	63,024
1962	8.6	0.1	0.0	0	0	278	4.1	5.5	67,900
1963	50.6	4.7	0.0	0	0	1316	0.0	30.7	52,804
1964	22.3	0.0	70.2	0	0	1237	0.0	28.6	43,284
1965	10.0	1.0	0.0	0	0	262	0.0	6.1	36,575
1966	0.0	0.0	24.6	0	0	235	0.0	5.4	42,757
1967	0.0	0.0	24.6	0	0	235	0.0	5.4	36,621
1968	0.0	0.0	114.7	0	0	1089	0.0	24.9	33,056
1969	0.0	0.0	24.6	0	0	235	0.0	5.4	44,312
1970	10.0	1.0	0.0	0	0	262	0.0	6.1	43,067
1971	0.0	0.0	124.9	0	0	1185	0.0	27.2	41,525
1972	25.0	2.6	0.0	0	0	658	0.0	15.4	70,472
1973	50.6	4.7	0.0	0	0	1316	0.0	30.7	91,963
1974	51.9	0.3	0.0	1243	0	0	0.0	29.0	55,589
1975	10.2	0.2	0.0	247	0	0	0.0	5.8	39,966
1976	0.0	0.0	0.0	0	234	279	0.0	4.8	27,458
1977	0.0	0.0	25.0	224	0	0	0.0	5.1	51,092
1978	0.0	0.0	24.6	0	0	235	0.0	5.4	50,860
1979	0.0	0.0	24.6	0	0	235	0.0	5.4	51,301
1980	50.9	0.0	0.0	0	0	1302	0.0	30.4	40,509
1981	0.0	0.0	124.9	0	0	1185	0.0	27.2	31,354
1982	0.0	0.0	21.2	0	0	257	3.9	5.0	44,665
1983	50.6	4.7	0.0	0	0	1316	0.0	30.7	49,839
1984	36.4	.0	0.0	868	0	0	0.0	20.3	44,959
1985	10.2	0.2	0.0	247	0	0	0.0	5.8	56,480
average	15.6	0.7	22.3	114	8	518	1.1	14.3	$49,458
std. dev.	18.9	1.4	37.0	269	41	508	3.8	10.6	13,303
							Inventory Adj.		84
							Adjusted Income		$49,543

APPENDIX F

STATIC AND DYNAMIC SOLUTIONS FOR IRRIGATED RANCH MODEL I

APPENDIX TABLE 1. STATIC SOLUTIONS FOR SUMMER IRRIGATED RANCH MODEL I

OBJECTIVE FUNCTION= 108435.05852

SECTION 1 - ROWS

NUMBER	TYPE	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1.	E	ACCTING	EQ	.	.	.	.	.
2.	E	COWINV	EQ	70.00000	.	70.00000	70.00000	22.16000
3.	L	COWMAX	UL	70.00000	.	NONE	70.00000	11.70680
4.	E	REPINV	EQ	12.60000	.	12.60000	12.60000	-86.35918
5.	L	RPAST	UL	123.20000	.	NONE	123.20000	30.46320
6.	L	SUMGRAZ	UL	.	.	NONE	.	20.92000
7.	E	BEGALF	EQ	44.00000	.	44.00000	44.00000	.
8.	L	FALLGRAZ	UL	.	.	NONE	.	20.58667
9.	E	WCOWINV	EQ	.	.	.	.	-3.12493
10.	E	EREPINV	EQ	.	.	.	.	-2.77772
11.	E	ENDALF	EQ	.	.	.	.	.
12.	E	ALFHAY	EQ	50.00000	.	50.00000	50.00000	-89.62920
13.	E	CPLAST	EQ	75.00000	.	75.00000	75.00000	-21.67201
14.	L	TILLAC	UL	510.39999	.	NONE	510.39999	66.73920
15.	L	CORNT	UL	.	.	NONE	.	2.55000
16.	G	MINCORN	LL	44.00000	.	44.00000	NONE	-4.06021
17.	L	WHTT	UL	.	.	NONE	.	4.03000
18.	L	DWAFT	UL	.	.	NONE	.	8.95813
19.	L	OATT	UL	.	.	NONE	.	1.40000
20.	L	SORGT	UL	.	.	NONE	.	2.22000
21.	L	WHTLIM	UL	200.00000	.	NONE	200.00000	0.64664
22.	L	OATLIM	BS	.	200.00000	NONE	200.00000	.
23.	L	CSLIM	BS	185.39999	34.60001	NONE	220.00000	.
24.	L	SUMLAB	UL	1250.00000	.	NONE	1250.00000	4.50000
25.	E	HFRINV	EQ	32.20000	.	32.20000	32.20000	-1.66663
26.	E	STRINV	EQ	32.20000	.	32.20000	32.20000	-1.66663
27.	L	SCOW1	BS	.	70.00000	NONE	70.00000	.
28.	L	SCOW2	BS	.	70.00000	NONE	70.00000	.
29.	L	SCOW3	BS	.	70.00000	NONE	70.00000	.
30.	E	SBED	EQ	.	.	.	.	20.83287
31.	L	IRTILAC	UL	220.00000	.	NONE	220.00000	193.96528
32.	L	POTLIM	UL	60.00000	.	NONE	60.00000	578.12669
33.	L	POTT	UL	.	.	NONE	.	4.23000
34.	L	SOYLIM	BS	.	67.00000	NONE	67.00000	.
35.	L	SOYT	UL	.	.	NONE	.	5.93000
36.	E	AFIRLIM	EQ	26.30000	.	26.30000	26.30000	-284.06528
37.	L	CORILIM	UL	134.00000	.	NONE	134.00000	.
38.	E	IFS	EQ	.	.	.	.	-8.10000
39.	E	IFH	EQ	.	.	.	.	-7.20000
40.	E	FST	EQ	.	.	.	.	.
41.	E	FHT	EQ	.	.	.	.	.

- CONTINUED -

APPENDIX TABLE 1. STATIC SOLUTIONS FOR SUMMER IRRIGATED RANCH MODEL I (CONTINUED)

SECTION 2 - COLUMNS

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT.	..UPPER LIMIT.	.REDUCED COST.
1.	ACCTINV	BS	72372.53572	.	.	NONE	.
2.	BEEFCOW	BS	70.00000	170.00000	.	NONE	.
3.	REPHFR	BS	12.60000	.	.	NONE	.
4.	BUYCOW	BS	.	-22.16000	.	NONE	.
5.	ESSUPPFD	BS	13.81866	-45.21000	.	NONE	.
6.	GRAZRANG	BS	123.20000	.	.	NONE	.
7.	GRCLPAST	BS	75.00000	.	.	NONE	.
8.	SELLCOW1	LL	.	-22.16000	.	NONE	-44.32000
9.	SELLCOW2	LL	.	-55.42000	.	NONE	-77.58000
10.	SELLCOW3	LL	.	-99.75000	.	NONE	-121.91000
11.	LSUPPFOR	BS	3.26067	-44.21000	.	NONE	.
12.	GRSGAFT	BS	163.60000	-0.10000	.	NONE	.
13.	COWT	BS	58.80000	.	.	NONE	.
14.	REPHFRT	BS	11.20000	.	.	NONE	.
15.	ALFT	BS	26.92067	.	.	NONE	.
16.	ALFD	BS	50.00000	-17.94000	.	NONE	.
17.	CORNAC	BS	44.00000	-57.97000	.	NONE	.
18.	SELLCORN	BS	20964.17969	2.59000	.	NONE	.
19.	WHTAC	BS	200.00000	-41.53000	.	NONE	.
20.	SELLWHT	BS	5318.00003	4.03000	.	NONE	.
21.	OATAC	LL	.	-38.55000	.	NONE	-36.99107
22.	SELLOAT	BS	.	1.40000	.	NONE	.
23.	SORGAC	BS	141.39999	-43.62000	.	NONE	.
24.	SELLSORG	BS	7545.10376	2.22000	.	NONE	.
25.	HIRELAB	BS	749.42937	-4.50000	.	NONE	.
26.	HFRT	BS	32.20000	.	.	NONE	.
27.	STRT	BS	32.20000	.	.	NONE	.
28.	INVALF	BS	238.83654	.	.	NONE	.
29.	STRB	BS	36.40000	.	.	NONE	.
30.	POTAC	BS	60.00000	-422.82001	.	NONE	.
31.	SELLPOT	BS	17363.99963	4.23000	.	NONE	.
32.	SOYAC	LL	.	-70.75000	.	NONE	-60.44159
33.	SELLSOY	BS	.	5.93000	.	NONE	.
34.	ALFI	BS	25.00000	-72.10000	.	NONE	.
35.	CORNI	BS	134.00000	-149.78000	.	NONE	.
36.	FINS	BS	.	.	.	NONE	.
37.	SFS	BS	.	.	.	NONE	.
38.	FINH	BS	.	.	.	NONE	.
39.	SFH	BS	.	.	.	NONE	.
40.	LSUPPALF	LL	.	-45.21000	.	NONE	-1.00000

- CONTINUED -

APPENDIX TABLE 2. STATIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL I

OBJECTIVE FUNCTION= 101848.36330

SECTION 1 - ROWS

NUMBER	TYPE	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1.	E	ACCTING	EQ	.	.	.	.	.
2.	E	COWINV	EQ	58.00000	.	58.00000	58.00000	147.91914
3.	L	COWMAX	BS	70.00000	.	NONE	70.00000	.
4.	E	BREPINV	EQ	11.20000	.	11.20000	11.20000	118.84055
5.	E	CULLCOW	EQ	.	.	.	.	371.30001
6.	E	HFRS	EQ	.	.	.	.	.
7.	E	STRS	EQ	.	.	.	.	.
8.	E	CULLREP	EQ	.	.	.	.	446.94916
9.	E	ECOWINV	EQ	.	.	.	.	.
10.	E	BGHFR	EQ	.	.	.	.	345.59929
11.	L	BGSTR	UL	.	.	NONE	.	422.54176
12.	L	WINLAB	BS	450.16749	799.83251	NONE	1250.00000	.
13.	E	BALFINV	EQ	230.00000	.	230.00000	230.00000	44.96000
14.	L	TDNC	UL	.	.	NONE	.	0.04025
15.	L	PROTC	UL	.	.	NONE	.	0.01735
16.	E	CORNAC	EQ	44.00000	.	44.00000	44.00000	129.79339
17.	E	CORNSILT	EQ	.	.	.	.	16.83426
18.	E	CORNGRT	EQ	.	.	.	.	2.54000
19.	L	CSAFT	BS	-132.70663	132.70663	NONE	.	.
20.	L	OWAFT	UL	.	.	NONE	.	7.72402
21.	E	OATAC	EQ	.	.	.	.	66.51150
22.	E	WHTAC	EQ	200.00000	.	200.00000	200.00000	.
23.	E	OATT	EQ	.	.	.	.	1.39000
24.	E	WHTT	EQ	.	.	.	.	.
25.	E	STRAWT	EQ	.	.	.	.	25.90972
26.	E	SORGAC	EQ	141.39999	.	141.39999	141.39999	115.79121
27.	E	SORGT	EQ	.	.	.	.	2.17000
28.	E	BHFRINV	EQ	32.20000	.	32.20000	32.20000	220.93634
29.	E	BSTRINV	EQ	32.20000	.	32.20000	32.20000	294.55320
30.	E	REDREP	EQ	12.60000	.	12.60000	12.60000	-345.59929
31.	L	PROTBG	BS	-1356.66905	1356.66905	NONE	.	.
32.	L	NEMBG	UL	.	.	NONE	.	0.03619
33.	L	NEGBG	UL	.	.	NONE	.	0.25953
34.	L	SCOWL1	BS	.	70.00000	NONE	70.00000	.
35.	L	SCOWL2	BS	.	70.00000	NONE	70.00000	.
36.	L	SCOWL3	BS	.	70.00000	NONE	70.00000	.
37.	L	STRAWL	BS	-43.94350	43.94350	NONE	.	.
38.	G	AMAXT	LL	.	.	.	NONE	-0.04242
39.	G	AXAXP	BS	942.78181	-942.78181	.	NONE	.
40.	G	MINF	BS	11.53239	-11.53239	.	NONE	.
41.	L	MAXF	UL	.	.	NONE	.	6.16585
42.	L	MAXS	BS	-3.98392	3.98392	NONE	.	.
43.	L	MAXAFT	UL	.	.	NONE	.	32.41052
44.	E	POTAC	EQ	60.00000	.	60.00000	60.00000	.
45.	E	POTT	EQ	.	.	.	.	.
46.	E	SOYAC	EQ	.	.	.	.	.
47.	E	SOYT	EQ	.	.	.	.	.
48.	E	ICORNA	EQ	134.00000	.	134.00000	134.00000	354.76179
49.	E	FST	EQ	.	.	.	.	736.65908
50.	E	FHT	EQ	.	.	.	.	648.02217
51.	L	PROT	BS	.	.	NONE	.	.
52.	L	NEM	UL	.	.	NONE	.	0.04759
53.	L	NEG	UL	.	.	NONE	.	0.07038
54.	G	FORMIN	BS	.	.	.	NONE	.
55.	L	FORMAX	UL	.	.	NONE	.	1.47264
56.	E	ALFMIN	EQ	44.00000	.	44.00000	44.00000	-0.00000

- CONTINUED -

APPENDIX TABLE 2. STATIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL I (CONTINUED)

SECTION 2 - COLUMNS

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT.	..UPPER LIMIT.	.REDUCED COST.
1.	ACCTINV	BS	181235.05746	.	.	NONE	.
2.	BEEFCOW	BS	58.00000	133.00000	.	NONE	.
3.	REPHFR	BS	11.20000	133.20000	.	NONE	.
4.	SELLCOW1	LL	.	-22.16000	.	NONE	-170.07914
5.	SELLCOW2	LL	.	-55.42000	.	NONE	-203.33914
6.	SELLCOW3	LL	.	-99.75200	.	NONE	-247.66914
7.	SELLCULL	BS	111.72000	37.13200	.	NONE	.
8.	SELLREP	BS	10.44068	52.74000	.	NONE	.
9.	SELLWHFR	BS	72.68960	58.99000	.	NONE	.
10.	SELLWSTR	BS	137.02120	69.22000	.	NONE	.
11.	BGHFRS	BS	12.79100	-26.85000	.	NONE	.
12.	BGSTRS	BS	.	-29.00000	.	NONE	.
13.	SBGHFR	LL	.	56.02000	.	NONE	-1.69500
14.	SBGSTR	LL	.	63.25000	.	NONE	-1.82143
15.	HIRELAB	LL	.	-4.50000	.	NONE	-4.50000
16.	ALFT	BS	44.00000	36.16000	.	NONE	.
17.	ALFC	BS	20.07052	.	.	NONE	.
18.	BUYALF	LL	.	-73.81220	.	NONE	-28.85000
19.	CORNSIL	BS	27.32312	-2.86000	.	NONE	.
20.	CSC	BS	100.35952	.	.	NONE	.
21.	CORNGR	BS	16.67600	.	.	NONE	.
22.	SELLCORN	BS	19557.96043	2.54000	.	NONE	.
23.	GRCSAFT	BS	53.86755	-0.10000	.	NONE	.
24.	OATS	BS	.	.	.	NONE	.
25.	WHEAT	BS	200.00000	.	.	NONE	.
26.	BSTRAW	BS	.	-7.99000	.	NONE	.
27.	FSTRAW	BS	.	.	.	NONE	.
28.	PROTSUPP	LL	.	-200.00000	.	NONE	-125.15083
29.	OATC	LL	.	.	.	NONE	-0.45159
30.	SELLOAT	BS	.	1.39000	.	NONE	.
31.	SELLWHT	BS	5318.00003	.	.	NONE	.
32.	SORG	BS	141.39999	.	.	NONE	.
33.	SELLSORG	BS	7270.52294	2.17000	.	NONE	.
34.	EHFRINV	BS	32.20000	.	.	NONE	.
35.	ESTRINV	BS	32.20000	.	.	NONE	.
36.	REPINV	BS	12.60000	.	.	NONE	.
37.	INVCOW	BS	70.00000	.	.	NONE	.
38.	ALFM	LL	.	.	.	NONE	-3.69911
39.	ALFG	LL	.	.	.	NONE	-7.30754
40.	CSM	BS	20.65020	.	.	NONE	.
41.	CSG	BS	6.29645	.	.	NONE	.
42.	CGRM	LL	.	.	.	NONE	-0.39867
43.	CGRG	LL	.	.	.	NONE	-0.15092
44.	OATM	LL	.	.	.	NONE	-0.33583
45.	OATG	LL	.	.	.	NONE	-0.26260
46.	SORGM	LL	.	.	.	NONE	-0.19225
47.	SORGG	BS	274.56082	.	.	NONE	.
48.	PROSM	LL	.	-200.20000	.	NONE	-127.99001
49.	PROSG	LL	.	-200.00000	.	NONE	-120.36731
50.	STRM	LL	.	.	.	NONE	-11.86461

- CONTINUED -

APPENDIX TABLE 2. STATIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL I (CONTINUED)

SECTION 2 - COLUMNS

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT.	..UPPER LIMIT.	.REDUCED COST.
51.	STRG	LL	.	.	.	NONE	-23.26540
52.	CSAFTM	BS	6.29040	-0.10000	.	NONE	.
53.	CSAFTG	LL	.	-0.10000	.	NONE	-7.55566
54.	POT	BS	60.00000	.	.	NONE	.
55.	SELLPOT	BS	17363.99963	.	.	NONE	.
56.	SOY	BS	.	.	.	NONE	.
57.	SELLSOY	BS	.	.	.	NONE	.
58.	ICORN	BS	134.00000	.	.	NONE	.
59.	FINS	BS	.	-37.78000	.	NONE	.
60.	FINH	BS	.	-34.25000	.	NONE	.
61.	IFS	LL	.	56.86000	.	NONE	-7.22934
62.	IFH	LL	.	54.82000	.	NONE	-6.87171
63.	FCORNM	LL	.	.	.	NONE	-0.13158
64.	FCORNG	LL	.	.	.	NONE	-0.07723
65.	FSORGM	BS	.	.	.	NONE	.
66.	FSORGG	BS	.	.	.	NONE	.
67.	SALF	BS	165.12948	44.96000	.	NONE	.
68.	FSBNM	LL	.	-200.00000	.	NONE	-120.97923
69.	FSBNG	LL	.	-200.00000	.	NONE	-120.58754
70.	FALFM	BS	.	.	.	NONE	.
71.	FALFG	LL	.	.	.	NONE	-8.64996

APPENDIX TABLE 3. DYNAMIC SOLUTIONS FOR SUMMER IRRIGATED RANCH MODEL I

SUMIRRIG (Summer Irrigated) SUMIRRIG (Summer Irrigated)

	1	2	4	5	8	11	12	15	17	19	23	25	26
	ACCTING	BEECOW	BUYCOW	ESUPPFOR	SELLCOW1	LSUPPFOR	GRSGAFT	ALFT	CORNAC	WHTAC	SORGAC	HIRELAB	HFRT
1955	72,952	70	0	27	0	17	163	0	44	200	141	877	32.2
1956	76,532	67	0	44	3	0	120	0	220	165	0	1,116	32.2
1957	75,400	70	2	15	0	0	145	29	212	174	0	879	31.2
1958	72,402	70	0	15	0	5	170	24	44	200	141	761	32.2
1959	62,795	70	0	43	0	1	150	0	44	200	141	1,000	32.2
1960	43,820	70	0	0	0	0	128	44	44	200	141	771	32.2
1961	40,487	70	0	12	0	2	164	30	44	200	141	824	32.2
1962	72,093	70	0	0	0	0	151	44	44	200	141	683	32.2
1963	72,346	70	0	7	0	7	155	30	44	200	141	737	32.2
1964	72,955	70	0	21	0	23	155	0	44	200	141	873	32.2
1965	72,512	70	0	20	0	5	164	19	44	200	141	780	32.2
1966	73,000	70	0	25	0	19	123	0	44	165	176	868	32.2
1967	72,996	70	0	24	0	20	133	0	44	165	176	875	32.2
1968	73,072	70	0	24	0	20	129	0	44	165	176	889	32.2
1969	72,346	70	0	4	0	6	129	34	44	165	176	727	32.2
1970	72,451	70	0	7	0	0	127	29	44	165	176	749	32.2
1971	72,521	70	0	15	0	6	133	24	44	165	176	769	32.2
1972	72,211	70	0	0	0	2	128	42	44	165	176	697	32.2
1973	67,100	70	0	0	0	0	126	44	44	165	176	743	32.2
1974	72,884	70	0	20	0	20	127	4	44	165	176	846	32.2
1975	72,722	70	0	15	0	14	118	15	44	165	176	803	32.2
1976	73,138	70	0	20	0	16	116	0	44	165	176	894	32.2
1977	72,507	70	0	9	0	11	135	24	44	165	176	768	32.2
1978	72,267	70	0	0	0	5	126	39	44	165	176	700	32.2
1979	67,100	70	0	0	0	0	133	44	44	165	176	743	32.2
1980	58,400	70	0	24	0	20	116	0	44	165	176	959	32.2
1981	73,376	70	0	30	0	7	124	0	44	165	176	953	32.2
1982	72,164	70	0	0	0	0	97	44	44	165	176	690	32.2
1983	51,550	70	0	0	0	6	123	38	44	165	176	769	32.2
1984	75,366	70	0	0	0	2	130	42	220	165	0	838	32.2
1985	75,460	70	0	6	0	2	135	36	220	165	0	863	32.2
average	69,256	69.9	0.1	14.3	0.1	7.8	134.7	21.9	66.4	175.7	143.2	821	32
std. dev.	8,718	0.5	0.4	13.1	0.5	7.7	16.7	17.6	58.3	15.6	57.2	98	0

- CONTINUED -

APPENDIX TABLE 3. DYNAMIC SOLUTIONS FOR SUMMER IRRIGATED RANCH MODEL I (CONTINUED)

SUMIRRIG (Summer Irrigated)										SUMIRRIG (Summer Irrigated)		
	27	28	29	30	32	34	35	36	37	38	39	40
	STRT	INVALF	STRB	POTAC	SOYAC	ALFI	CORNI	FINS	SFS	FINH	SFH	LSUPALF
1955	32.2	189.8	37.3	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	5.9
1956	32.2	140.9	45.1	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	30.5
1957	31.2	258.6	28.7	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1958	32.2	244.9	29.5	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1959	32.2	133.3	50.5	60.0	0.0	26.0	134.0	0.0	0.0	19.1	200.7	29.6
1960	32.2	251.8	28.5	60.0	0.0	26.0	134.0	31.7	364.8	19.1	200.7	0.0
1961	32.2	220.6	35.6	60.0	0.0	26.0	134.0	31.7	364.8	19.1	200.7	0.0
1962	32.2	321.9	42.3	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1963	32.2	229.4	44.7	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1964	32.2	251.7	44.7	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	4.7
1965	32.2	246.1	36.4	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1966	32.2	209.7	42.3	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	1.8
1967	32.2	205.5	31.9	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	3.6
1968	32.2	212.9	36.4	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	7.0
1969	32.2	247.3	36.4	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1970	32.2	232.9	38.2	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1971	32.2	222.2	32.6	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1972	32.2	290.2	37.3	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1973	32.2	277.8	29.5	60.0	67.0	26.0	67.0	0.0	0.0	0.0	0.0	0.0
1974	32.2	216.3	38.2	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1975	32.2	221.0	47.4	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1976	32.2	178.6	48.9	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	8.4
1977	32.2	211.8	30.1	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1978	32.2	242.6	39.1	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1979	32.2	260.4	31.9	60.0	67.0	26.0	67.0	0.0	0.0	0.0	0.0	0.0
1980	32.2	170.2	48.9	60.0	67.0	26.0	67.0	0.0	0.0	19.1	200.7	3.5
1981	32.2	151.7	41.2	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	23.5
1982	32.2	331.3	32.6	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1983	32.2	250.9	42.3	60.0	0.0	26.0	134.0	31.7	364.8	0.0	0.0	0.0
1984	32.2	251.9	35.6	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
1985	32.2	249.2	30.7	60.0	0.0	26.0	134.0	0.0	0.0	0.0	0.0	0.0
average	32.2	229.8	37.9	60.0	6.5	26.0	127.5	3.1	35.3	2.5	25.9	3.8
std. dev.	0.2	45.0	6.4	0.0	19.8	0.0	19.8	9.4	107.8	6.4	67.3	8.3

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL I

WINTIRRI OUTPUT | WINTIRRI OUTPUT

	1	2	3	7	8	9	10	11	12	13	14	16	17
	ACCTING	BEEFCOW	REPHFR	SELLCULL	SELLREP	SELLWHFR	SELLWSTR	BGHFRS	BGSTRS	SBGHFR	SBGSTR	ALFT	ALFC
1955	198,000	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	93.0
1956	169,226	56.6	11.2	107.5	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	90.2
1957	230,164	58.8	11.2	111.7	10.4	68.9	132.7	12.8	0.0	0.0	0.0	44	20.9
1958	149,431	58.8	11.2	111.7	10.4	0.0	137.0	32.2	0.0	0.0	0.0	44	93.0
1959	129,335	58.8	11.2	111.7	10.4	0.0	0.0	32.2	32.2	0.0	0.0	44	57.5
1960	169,263	58.8	11.2	111.7	10.4	0.0	0.0	32.2	32.2	0.0	0.0	44	24.2
1961	172,306	58.8	11.2	111.7	10.4	0.0	137.0	32.2	0.0	114.5	0.0	44	20.9
1962	195,915	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	21.2
1963	158,723	58.8	11.2	111.7	10.4	0.0	0.0	32.2	32.2	114.5	206.0	44	93.0
1964	246,772	58.8	11.2	111.7	10.4	0.0	0.0	32.2	32.2	114.5	206.0	44	93.0
1965	204,414	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	93.0
1966	185,012	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	20.9
1967	167,903	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	20.9
1968	150,619	58.8	11.2	111.7	10.4	0.0	97.8	32.2	9.2	114.5	58.9	44	20.9
1969	178,476	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	20.9
1970	181,232	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	20.9
1971	173,363	58.8	11.2	111.7	10.4	0.0	0.0	32.2	32.2	114.5	206.0	44	20.9
1972	210,677	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	93.0
1973	216,037	58.8	11.2	111.7	10.4	0.0	0.0	32.2	32.2	114.5	206.0	44	89.8
1974	201,634	58.8	11.2	111.7	10.4	0.0	0.0	32.2	32.2	114.5	206.0	44	93.0
1975	178,261	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	93.0
1976	172,037	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	93.0
1977	170,866	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	20.9
1978	169,588	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	20.9
1979	146,812	58.8	11.2	111.7	10.4	0.0	137.0	32.2	0.0	0.0	0.0	44	20.9
1980	149,144	58.8	11.2	111.7	10.4	0.0	0.0	32.2	32.2	114.5	206.0	44	63.6
1981	149,408	58.8	11.2	111.7	10.4	0.0	0.0	32.2	32.2	114.5	206.0	44	20.9
1982	147,331	58.8	11.2	111.7	10.4	72.7	0.0	12.8	32.2	0.0	0.0	44	23.3
1983	169,657	58.8	11.2	111.7	10.4	0.0	0.0	32.2	32.2	114.5	206.0	44	93.0
1984	155,242	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	93.0
1985	173,546	58.8	11.2	111.7	10.4	72.7	137.0	12.8	0.0	0.0	0.0	44	93.0
average	176,725	58.7	11.2	111.6	10.4	39.7	87.8	21.6	11.7	36.9	55.0	44.00	56.0
std. dev.	25,731	0.4	.0	0.7	0.0	36.1	64.9	9.7	15.3	53.5	89.6	0.00	34.5

- CONTINUED -

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL I (CONTINUED)

WINTIRRI OUTPUT

	19	20	21	22	23	26	27	31	33	34	35	37	38
	CORNSIL	CSC	CORNGR	SELLCORN	GRCSAFT	BSTRAW	FSTRAW	SELLWHT	SELLSORG	EHFRINV	ESTRINV	INVCOW	ALFM
1955	0.0	0.0	44.0	18700	55.9	0.0	0.0	5256	5950	32.2	32.2	70.0	11.6
1956	2.0	0.0	218.0	26377	54.1	0.0	0.0	3498	0	31.2	31.2	67.8	6.8
1957	23.8	180.3	187.8	30874	55.9	0.0	0.0	5846	0	32.2	32.2	70.0	0.0
1958	0.2	0.0	43.9	17601	55.9	0.0	0.0	6640	7384	32.2	32.2	70.0	30.0
1959	44.0	88.9	0.0	14807	55.9	0.0	0.0	3834	0	32.2	32.2	70.0	0.0
1960	37.5	134.5	6.5	20428	55.9	24.0	24.0	6926	1696	32.2	32.2	70.0	0.0
1961	31.0	180.3	13.0	20451	55.9	0.0	0.0	5508	8102	32.2	32.2	70.0	0.0
1962	21.3	175.7	22.7	23274	55.9	2.4	2.4	4680	10733	32.2	32.2	70.0	0.0
1963	1.5	0.0	42.5	20513	55.9	0.0	0.0	4434	7037	32.2	32.2	70.0	59.4
1964	0.0	0.0	44.0	19597	55.9	0.0	0.0	4400	6760	32.2	32.2	70.0	59.1
1965	5.3	0.0	38.7	21141	55.9	0.0	0.0	5392	5499	32.2	32.2	70.0	0.0
1966	28.1	180.3	15.9	20339	55.9	0.0	0.0	3821	8700	32.2	32.2	70.0	0.0
1967	34.8	180.3	9.2	21122	55.9	0.0	0.0	5106	6704	32.2	32.2	70.0	0.0
1968	44.0	180.3	0.0	19320	55.9	0.0	0.0	4433	6908	32.2	32.2	70.0	0.0
1969	25.8	180.3	18.2	21417	55.9	0.0	0.0	4410	10366	32.2	32.2	70.0	0.0
1970	33.9	180.3	10.2	17890	55.9	0.0	0.0	4243	8283	32.2	32.2	70.0	0.0
1971	33.6	180.3	10.4	19016	55.9	0.0	0.0	4977	8171	32.2	32.2	70.0	0.0
1972	3.1	0.0	40.9	24551	55.9	0.0	0.0	4368	12387	32.2	32.2	70.0	0.0
1973	0.0	0.0	44.0	12931	55.9	5.2	5.2	5400	9746	32.2	32.2	70.0	59.1
1974	0.0	0.0	44.0	18520	55.9	0.0	0.0	4221	6558	32.2	32.2	70.0	60.6
1975	0.0	0.0	44.0	20368	55.9	0.0	0.0	3442	6355	32.2	32.2	70.0	11.9
1976	0.0	0.0	44.0	19558	55.9	0.0	0.0	3283	6192	32.2	32.2	70.0	0.0
1977	22.0	180.3	22.0	20628	55.9	0.0	0.0	5417	10970	32.2	32.2	70.0	0.0
1978	18.1	180.3	25.9	21781	55.9	0.0	0.0	4147	12308	32.2	32.2	70.0	0.0
1979	27.4	179.8	16.7	10976	55.9	0.3	0.3	5106	8037	32.2	32.2	70.0	0.0
1980	44.0	73.5	0.0	8852	55.9	0.0	0.0	3285	6205	32.2	32.2	70.0	0.0
1981	44.0	180.3	0.0	18430	55.9	0.0	0.0	3895	7504	32.2	32.2	70.0	0.0
1982	30.2	147.6	13.8	19455	55.9	17.2	17.2	4969	4304	32.2	32.2	70.0	0.0
1983	0.0	0.0	44.0	18388	55.9	0.0	0.0	3826	7996	32.2	32.2	70.0	59.6
1984	0.0	0.0	220.0	28751	55.9	0.0	0.0	4600	0	32.2	32.2	70.0	11.9
1985	0.1	0.0	220.0	32575	55.9	0.0	0.0	5318	0	32.2	32.2	70.0	11.9
average	17.9	89.8	48.5	20276	55.8✓	1.6	1.6	4670	6479	32.2	32.2	69.9	12.3
std. dev.	16.7	85.0	64.8	4872	0.3	5.2	5.2	890	3559	0.2	0.2	0.4	21.6

- CONTINUED -

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL I (CONTINUED)

WINTIRRI OUTPUT WINTIRRI OUTPUT

	39	40	41	43	46	47	52	55	57	63	64	65	66
	ALFG	CSM	CSG	CGRG	SORGM	SORGG	CSAFTM	SELLPOT	SELLSOY	FCORNM	FCORNG	FSORGM	FSORGG
1955	1.2	0.0	0.0	0	0	305	7.1	15127.2	0	0	0	0	0
1956	0.0	12.7	2.0	276	0	0	6.4	18700.2	0	0	0	0	0
1957	0.0	29.2	4.1	261	0	0	6.0	17860.2	0	0	0	0	0
1958	0.0	0.0	1.2	724	0	0	16.9	17499.6	0	432	1007	0	0
1959	0.0	145.7	30.3	0	0	1383	31.7	15129.6	0	0	945	2548	1991
1960	0.0	145.7	30.3	0	0	1383	31.7	19455.0	0	0	0	2628	3065
1961	0.0	72.1	15.9	0	0	691	15.8	17655.0	0	0	0	0	0
1962	0.0	28.7	6.3	0	0	275	6.3	18573.0	0	0	0	0	0
1963	0.0	0.0	13.5	0	0	1520	35.4	15812.4	0	0	0	0	0
1964	5.4	0.0	0.0	0	0	1536	35.8	15398.4	0	0	0	0	0
1965	0.0	28.7	6.3	0	0	275	6.3	19381.8	0	0	0	0	0
1966	0.0	28.7	6.3	0	0	275	6.3	16813.8	0	0	0	0	0
1967	0.0	28.7	6.3	0	0	275	6.3	14947.2	0	0	0	0	0
1968	0.0	93.2	20.0	0	0	889	20.4	14977.2	0	0	0	0	0
1969	0.0	28.7	6.3	0	0	275	6.3	15342.6	0	0	0	0	0
1970	0.0	28.7	6.3	0	0	275	6.3	17466.6	0	0	0	0	0
1971	0.0	145.7	30.3	0	0	1383	31.7	22206.0	0	0	0	0	0
1972	0.0	28.7	6.3	0	0	275	6.3	17496.0	0	0	0	0	0
1973	5.4	0.0	0.0	0	0	1536	35.8	17766.0	2805	0	0	0	0
1974	0.3	0.0	0.0	1450	0	0	33.8	17435.4	0	0	0	0	0
1975	0.2	0.0	0.0	288	0	0	6.7	15398.4	0	0	0	0	0
1976	0.0	0.0	0.0	0	273	326	5.6	19455.0	0	0	0	0	0
1977	0.0	29.2	4.1	261	0	0	6.0	15812.4	0	0	0	0	0
1978	0.0	28.7	6.3	0	0	275	6.3	18572.4	0	0	0	0	0
1979	0.0	72.1	15.9	0	0	691	15.8	18700.2	2777	0	0	960	1144
1980	0.0	145.7	30.3	0	0	1383	31.7	15127.2	2348	0	0	0	0
1981	0.0	145.8	28.5	0	0	1397	31.6	17499.6	0	0	0	0	0
1982	0.0	102.2	20.7	0	0	966	22.1	17655.0	0	0	0	1667	1921
1983	0.0	0.0	0.0	0	0	1629	35.1	17499.6	0	0	0	0	0
1984	0.0	0.0	0.0	291	0	0	6.7	18572.4	0	0	0	0	0
1985	0.0	0.0	0.5	287	0	0	6.7	18700.2	0	0	0	0	0
								0.0					
average	0.4	44.1	9.6	124	9	620	17.0	17356.0	256	14	63	252	262
std. dev.	1.3	52.0	10.6	290	48	592	12.2	1705.1	784	76	240	699	723

- CONTINUED -

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL I (CONTINUED)

WINTIRRI OUTPUT

	67 SALF	70 FBLFM	TOTAL INCOME
1955	40.0	0.0	125,128
1956	0.0	0.0	92,694
1957	193.7	0.0	154,756
1958	44.9	33.0	77,029
1959	0.0	31.9	-66,541
1960	155.5	28.1	125,443
1961	155.8	0.0	131,819
1962	256.7	0.0	123,823
1963	33.0	0.0	86,377
1964	50.2	0.0	173,817
1965	109.0	0.0	131,902
1966	144.8	0.0	112,012
1967	140.7	0.0	94,907
1968	148.0	0.0	85,547
1969	182.4	0.0	106,130
1970	168.0	0.0	100,782
1971	157.3	0.0	100,842
1972	153.1	0.0	138,465
1973	79.5	0.0	140,938
1974	18.4	0.0	128,750
1975	71.8	0.0	105,539
1976	41.5	0.0	90,899
1977	146.9	0.0	90,359
1978	177.7	0.0	97,321
1979	185.1	10.4	79,704
1980	62.5	0.0	90,736
1981	86.8	0.0	76,032
1982	246.4	17.7	75,167
1983	54.2	0.0	118,108
1984	103.0	0.0	79,876
1985	100.2	0.0	90,086
average	113.1	3.9	107,469
std. dev.	68.0	9.6	25,491
Inventory Adj.			0
Adjusted Income			107,469

APPENDIX G

STATIC AND DYNAMIC SOLUTIONS FOR DRYLAND RANCH MODEL II

APPENDIX TABLE 1. STATIC SOLUTIONS FOR SUMMER DRYLAND RANCH MODEL II

OBJECTIVE FUNCTION= 42464.74751

SECTION 1 - ROWS

NUMBER	TYPE	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1.	E	ACCTING	EQ	.	.	.	.	
2.	E	COWINV	EQ	140.00000	.	140.00000	-22.16000	
3.	L	COWMAX	UL	140.00000	.	NONE	169.17397	
4.	E	REPINV	EQ	25.20000	.	25.20000	-14.75570	
5.	L	RPAST	UL	493.00000	.	NONE	2.89360	
6.	L	SUMGRAZ	BS	-37.94004	37.94004	NONE	.	
7.	E	BEGALF	EQ	84.00000	.	84.00000	.	
8.	L	FALLGRAZ	UL	.	.	NONE	12.05667	
9.	E	WCOWINV	EQ	.	.	.	-1.81567	
10.	E	EREPINV	EQ	.	.	.	-1.61393	
11.	E	ENDALF	EQ	.	.	.	.	
12.	E	ALFHAY	EQ	120.00000	.	120.00000	-88.77264	
13.	E	CPLAST	EQ	50.00000	.	50.00000	-66.49224	
14.	L	TILLAC	UL	480.00000	.	NONE	70.83264	
15.	L	CORNT	UL	.	.	NONE	2.59000	
16.	G	MINCORN	LL	60.00000	.	60.00000	NONE	-0.46021
17.	L	WHTT	UL	.	.	NONE	4.03000	
18.	L	OWAFT	UL	.	.	NONE	5.20493	
19.	L	OATT	UL	.	.	NONE	1.40000	
20.	L	SORGT	UL	.	.	NONE	2.22000	
21.	L	WHTLIM	BS	102.00000	53.00000	NONE	.	
22.	L	OATLIM	BS	.	155.00000	NONE	.	
23.	L	CSLIM	UL	208.00000	.	NONE	4.00656	
24.	L	SUMLAB	BS	1047.09563	202.90437	NONE	.	
25.	E	HFRINV	EQ	64.40000	.	64.40000	.	
26.	E	STRINV	EQ	64.40000	.	64.40000	.	
27.	L	SCOW1	BS	.	140.00000	NONE	.	
28.	L	SCOW2	BS	.	140.00000	NONE	.	
29.	L	SCOW3	BS	.	140.00000	NONE	.	
30.	E	SBED	EQ	.	.	.	12.10450	
31.	L	LLSUPALF	BS	-242.41164	242.41164	NONE	.	

- CONTINUED -

APPENDIX TABLE 1. STATIC SOLUTIONS FOR SUMMER DRYLAND RANCH MODEL II (CONTINUED)

SECTION 2 - COLUMNS

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT.	..UPPER LIMIT.	.REDUCED COST.
1.	ACCTINV	BS	23771.25591	.	.	NONE	.
2.	BEEFCOW	BS	140.00000	170.00000	.	NONE	.
3.	REPHFR	BS	25.20000	.	.	NONE	.
4.	BUYCOW	LL	.	-22.16000	.	NONE	-44.32000
5.	ESSUPPFO	LL	.	-45.21000	.	NONE	-45.21000
6.	GRAZRANG	BS	493.00000	.	.	NONE	.
7.	GRCLPAST	BS	50.00000	.	.	NONE	.
8.	SELLCOW1	BS	.	-22.16000	.	NONE	.
9.	SELLCOW2	LL	.	-55.42000	.	NONE	-33.26000
10.	SELLCOW3	LL	.	-99.75000	.	NONE	-77.59000
11.	LSUPPFOR	BS	38.98546	-36.17000	.	NONE	.
12.	GRSGAFT	BS	53.16279	-0.10000	.	NONE	.
13.	COWT	BS	117.60000	.	.	NONE	.
14.	REPHFRT	BS	22.40000	.	.	NONE	.
15.	ALFT	BS	45.01454	.	.	NONE	.
16.	ALFD	BS	120.00000	-17.94000	.	NONE	.
17.	CORNAC	BS	60.00000	-57.97000	.	NONE	.
18.	SELLCORN	BS	3065.99991	2.59000	.	NONE	.
19.	WHTAC	BS	102.00000	-41.53000	.	NONE	.
20.	SELLWHT	BS	2712.18002	4.03000	.	NONE	.
21.	OATAC	LL	.	-38.55000	.	NONE	-37.18771
22.	SELLOAT	BS	.	1.40000	.	NONE	.
23.	SORGAC	BS	148.00000	-43.62000	.	NONE	.
24.	SELLSORG	BS	7897.20009	2.22000	.	NONE	.
25.	HIRELAB	LL	.	-4.50000	.	NONE	-4.50000
26.	HFRT	BS	64.40000	.	.	NONE	.
27.	STRT	BS	64.40000	.	.	NONE	.
28.	INVALF	BS	242.41164	.	.	NONE	.
29.	STRB	BS	48.83721	.	.	NONE	.
30.	LSUPPALF	LL	.	-45.21000	.	NONE	-9.04000

APPENDIX TABLE 2. STATIC SOLUTIONS FOR WINTER DRYLAND RANCH MODEL II

OBJECTIVE FUNCTION= 79429.29840

NUMBER	TYPE	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1.	E	ACCTING	EQ	.	.	.	.	
2.	E	COWINV	EQ	117.60000	.	117.60000	135.41869	
3.	L	COWMAX	BS	140.00000	.	NONE	.	
4.	E	BREPINV	EQ	22.40000	.	22.40000	104.09545	
5.	E	CULLCOW	EQ	.	.	.	371.30001	
6.	E	HFRS	EQ	.	.	.	.	
7.	E	STRS	EQ	.	.	.	.	
8.	E	CULLREP	EQ	.	.	.	446.94916	
9.	E	ECOWINV	EQ	.	.	.	.	
10.	E	BGHFR	EQ	.	.	.	356.21662	
11.	L	BGSTR	UL	.	.	NONE	433.08538	
12.	L	WINLAB	BS	900.33499	349.66501	NONE	.	
13.	E	BALFINV	EQ	242.39999	.	242.39999	36.16000	
14.	L	TDNC	UL	.	.	NONE	0.03646	
15.	L	PROTC	BS	-24067.83866	24067.83866	NONE	.	
16.	E	CORNAC	EQ	60.00000	.	60.00000	145.47444	
17.	E	CORNSILT	EQ	.	.	.	17.19160	
18.	E	CORNGRT	EQ	.	.	.	2.54000	
19.	L	CSAFT	UL	.	.	NONE	27.03525	
20.	L	OWAFT	UL	.	.	NONE	6.30409	
21.	E	OATAC	EQ	.	.	.	66.51150	
22.	E	WHTAC	EQ	102.00000	.	102.00000	.	
23.	E	OATT	EQ	.	.	.	1.39000	
24.	E	WHTT	EQ	.	.	.	.	
25.	E	STRAWT	EQ	.	.	.	22.61549	
26.	E	SORGAC	EQ	148.00000	.	148.00000	131.47165	
27.	E	SORGT	EQ	.	.	.	2.17000	
28.	E	BHFRINV	EQ	64.40000	.	64.40000	220.93634	
29.	E	BSTRINV	EQ	64.40000	.	64.40000	294.55320	
30.	E	REGREP	EQ	25.20000	.	25.20000	-356.21662	
31.	L	PROTBG	BS	-7890.37150	7890.37150	NONE	.	
32.	L	NEMBG	UL	.	.	NONE	0.03820	
33.	L	NEGBG	UL	.	.	NONE	0.06566	
34.	L	SCOWL1	BS	.	140.00000	NONE	.	
35.	L	SCOWL2	BS	.	140.00000	NONE	.	
36.	L	SCOWL3	BS	.	140.00000	NONE	.	
37.	L	STRAWL	BS	-102.34432	102.34432	NONE	.	
38.	G	AMAXT	LL	.	.	.	NONE	-0.00355
39.	G	AMAXP	BS	1885.56362	-1885.56362	.	NONE	.
40.	G	MINF	BS	25.18137	-25.18137	.	NONE	.
41.	L	MAXF	UL	.	.	NONE	1.93062	
42.	L	MAXS	BS	-9.41074	9.41074	NONE	.	
43.	L	MAXAFT	BS	-5.08477	5.08477	NONE	.	

- CONTINUED -

APPENDIX TABLE 2. STATIC SOLUTIONS FOR WINTER DRYLAND RANCH MODEL II (CONTINUED)

SECTION 2 - COLUMNS

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT.	..UPPER LIMIT.	.REDUCED COST.
1.	ACCTINV	BS	63976.86535	.	.	NONE	.
2.	BEEFCOW	BS	117.60000	133.00000	.	NONE	.
3.	REPHFR	BS	22.40000	133.00000	.	NONE	.
4.	SELLCOW1	LL	.	-22.16000	.	NONE	-157.57869
5.	SELLCOW2	LL	.	-55.42000	.	NONE	-190.83660
6.	SELLCOW3	LL	.	-99.75000	.	NONE	-235.16869
7.	SELLCULL	BS	223.43999	37.13000	.	NONE	.
8.	SELLREP	BS	20.00136	52.74000	.	NONE	.
9.	SELLWHFR	BS	145.37920	58.99000	.	NONE	.
10.	SELLWSTR	BS	274.04256	69.22000	.	NONE	.
11.	BGHFRS	BS	25.58376	-26.86000	.	NONE	.
12.	BGSTRS	BS	.	-29.00000	.	NONE	.
13.	SBGHFR	LL	.	56.02000	.	NONE	-3.46017
14.	SBGSTR	LL	.	63.25000	.	NONE	-3.44515
15.	HIRELAB	LL	.	-4.50000	.	NONE	-4.50000
16.	ALFT	BS	26.05328	36.16000	.	NONE	.
17.	ALFC	BS	186.00057	.	.	NONE	.
18.	BUYALF	LL	.	-73.81000	.	NONE	-37.65000
19.	CORNSIL	LL	.	-2.86000	.	NONE	-12.06463
20.	CSC	LL	.	.	.	NONE	-2.72104
21.	CORNGR	BS	60.00000	.	.	NONE	.
22.	SELLCORN	BS	3065.99991	2.54000	.	NONE	.
23.	GRCSAFT	BS	111.73511	-0.10000	.	NONE	.
24.	OATS	BS	.	.	.	NONE	.
25.	WHEAT	BS	102.00000	.	.	NONE	.
26.	BSTRAW	BS	.	-7.95000	.	NONE	.
27.	FSTRAW	BS	.	.	.	NONE	.
28.	PROTSUPP	LL	.	-200.00000	.	NONE	-146.02250
29.	OATC	LL	.	.	.	NONE	-0.59804
30.	SELLOAT	BS	.	1.39000	.	NONE	.
31.	SELLWHT	BS	2712.18002	.	.	NONE	.
32.	SORG	BS	140.00000	.	.	NONE	.
33.	SELLSORG	BS	7297.72357	2.17000	.	NONE	.
34.	EHFRINV	BS	64.40000	.	.	NONE	.
35.	ESTRINV	BS	64.40000	.	.	NONE	.
36.	REPINV	BS	25.20000	.	.	NONE	.
37.	INVCOW	BS	140.00000	.	.	NONE	.
38.	ALFM	BS	27.23196	.	.	NONE	.
39.	ALFG	BS	3.03418	.	.	NONE	.
40.	CSM	LL	.	.	.	NONE	-1.70232
41.	CSG	BS	.	.	.	NONE	.
42.	CGRM	LL	.	.	.	NONE	-0.60905
43.	CGRG	LL	.	.	.	NONE	-0.11367
44.	OATM	LL	.	.	.	NONE	-0.46460
45.	OATG	LL	.	.	.	NONE	-0.28175
46.	SORGM	LL	.	.	.	NONE	-0.41171
47.	SORGG	BS	599.55652	.	.	NONE	.
48.	PROSM	LL	.	-200.00000	.	NONE	-135.75115
49.	PROSG	LL	.	-200.00000	.	NONE	-120.70667
50.	STRM	LL	.	.	.	NONE	-6.41796
51.	STRG	LL	.	.	.	NONE	-17.93637
52.	CSAFTM	BS	8.90489	-0.10000	.	NONE	.
53.	CSAFTG	LL	.	-0.10000	.	NONE	-5.83211

APPENDIX TABLE 3. DYNAMIC SOLUTIONS FOR SUMMER DRYLAND RANCH MODEL II

Dryland (Summer Solutions)

	1	2	3	4	5	6	7	8	9	11	12	15
Year	ACCTING	BEECOW	REPHFR	BUYCOW	ESUPPFOR	GRAZRANG	GRCLPAST	SELLCOW1	SELLCOW2	LSUPPFOR	GRSGAFT	ALFT
1955	25,899	140	25.2	0	41.42	493	50	0	0	42.58	52	0
1956	23,443	85	25.2	0	0	493	50	23.33	31.7	0	61	0
1957	25,111	136	25.2	42.14	0	493	50	0	0	0	117	0
1958	25,444	140	25.2	3.43	0	486.54	50	0	0	0	115	0
1959	23,968	101	25.2	0	0	493	50	23.33	15.98	0	103	0
1960	27,654	140	25.2	33.02	0	493	50	0	0	0	117	0
1961	23,657	140	25.2	0	0	493	50	0	0	0	107	0
1962	23,687	140	25.2	0	0	493	50	0	0	0	98	0
1963	23,698	140	25.2	0	0	493	50	0	0	32.91	95	28
1964	23,048	121	25.2	0	0	454.85	50	18.89	0	0	102	0
1965	24,906	140	25.2	15.87	0	493	50	0	0	0	106	0
1966	25,922	140	25.2	0	0	493	50	0	0	0	45	0
1967	25,189	124	25.2	0	0	493	50	16.21	0	0	83	0
1968	23,001	120	25.2	0	0	493	50	6.57	0	0	78	0
1969	29,772	140	25.2	16.96	0	493	50	0	0	0	53	0
1970	23,779	140	25.2	0	0	493	50	0	0	0	51	0
1971	23,754	140	25.2	0	0	493	50	0	0	0	58	0
1972	23,775	140	25.2	0	0	493	50	0	0	0	52	0
1973	23,740	140	25.2	0	0	493	50	0	0	27.11	62	19
1974	23,498	135	25.2	0	0	476.19	50	5.33	0	0	105	0
1975	24,836	140	25.2	11.09	0	493	50	0	0	0	38	0
1976	23,350	129	25.2	0	0	493	50	10.51	0	0	41	0
1977	24,859	140	25.2	35.55	0	493	50	0	0	0	62	0
1978	23,783	140	25.2	0	0	493	50	0	0	22.75	50	33
1979	23,751	140	25.2	0	0	493	50	0	0	19.83	59	57
1980	23,827	140	25.2	0	0.74	493	50	0	0	50.42	36	16
1981	23,530	126	25.2	0	0	493	50	13.98	0	0	116	0
1982	25,277	140	25.2	11.74	0	493	50	0	0	0	58	0
1983	23,798	140	25.2	0	0	493	50	0	0	27.55	45	63
1984	25,891	140	25.2	0	0	493	50	0	0	0	54	0
1985	25,869	140	25.2	0	0	493	50	0	0	12.53	61	0
Average =	24,572	134.08	25.20	5.48	1.36	491.02	50.00	3.81	1.54	7.60	74	6.92
Std Dev =	1,430	12.53	.00	11.38	7.32	7.31	0.00	7.26	6.19	14.15	27	16.15

- CONTINUED -

APPENDIX TABLE 3. DYNAMIC SOLUTIONS FOR SUMMER DRYLAND RANCH MODEL II (CONTINUED)

Dryland (Summer Solutions)

	16	17	19	23	25	26	27	28	29
Year	ALFD	CORNAC	WHTAC	SORGAC	HIRELAB	HFRT	STRT	INVALF	STRB
1955	120	208	102	0	0	64.4	64.4	131.8	50.0
1956	120	208	102	0	0	64.4	64.4	67.5	41.4
1957	120	155	155	0	0	43.1	43.1	202.9	37.9
1958	120	155	155	0	0	62.8	62.8	151.3	39.6
1959	120	60	155	95	0	64.4	64.4	56.1	51.8
1960	120	60	155	95	0	49.2	49.2	201.6	38.2
1961	120	60	155	95	0	64.4	64.4	181.1	47.7
1962	120	60	155	95	0	64.4	64.4	284.8	56.8
1963	120	60	155	95	0	64.4	64.4	256.1	60.0
1964	120	60	155	95	0	64.4	64.4	99.2	53.2
1965	120	60	155	95	0	57.1	57.1	152.5	48.8
1966	120	208	102	0	0	64.4	64.4	85.0	56.8
1967	120	188	122	0	0	64.4	64.4	99.2	38.7
1968	120	60	121	129	0	58.1	58.1	105.2	42.9
1969	120	60	102	148	0	56.6	56.6	194.6	48.8
1970	120	60	102	148	0	64.4	64.4	190.6	51.2
1971	120	60	102	148	0	64.4	64.4	166.6	43.8
1972	120	60	102	148	0	64.4	64.4	296.2	50.0
1973	120	60	102	148	0	64.4	64.4	278.8	39.6
1974	120	60	155	95	0	64.4	64.4	123.2	49.6
1975	120	60	102	148	0	59.3	59.3	162.8	63.6
1976	120	60	102	148	0	64.4	64.4	92.6	61.5
1977	120	60	102	148	0	48.1	48.1	136.8	40.4
1978	120	60	102	148	0	64.4	64.4	262.5	52.5
1979	120	60	102	148	0	64.4	64.4	276.9	42.9
1980	120	60	102	148	0	64.4	64.4	155.9	65.6
1981	120	60	155	83	0	64.4	64.4	32.0	50.6
1982	120	60	102	148	0	59.0	59.0	318.5	43.8
1983	120	60	102	148	0	64.4	64.4	324.9	56.8
1984	120	208	102	0	0	64.4	64.4	249.7	47.7
1985	120	208	102	0	0	64.4	64.4	197.8	41.2
Average =	120	94	122	93	0	61.6	61.6	178.5	48.8
Std Dev =	0	59	25	60	0	5.5	5.5	79.9	7.7

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER DRYLAND RANCH MODEL II

Dryland (Winter Solutions)

	1	2	3	7	8	9	10	11	12	13	14	16
Year	ACCTING	BEEFCOW	REPHFR	SELLCULL	SELLREP	SELLWHFR	SELLWSTR	BGHFRS	SBGSTR	SBGHFR	SBGSTR	ALFT
1955	57,505	118	22.4	223.4	20.9	145.4	274.0	25.6	0.0	0.0	0.0	0.0
1956	54,677	71	22.4	135.6	20.9	145.4	274.0	25.6	0.0	0.0	0.0	0.0
1957	61,827	114	22.4	216.9	20.9	65.7	183.6	25.6	0.0	0.0	0.0	0.0
1958	69,084	118	22.4	223.4	20.9	139.5	267.3	25.6	0.0	0.0	0.0	0.0
1959	50,747	85	22.4	160.7	20.9	145.4	274.0	25.6	0.0	0.0	0.0	0.0
1960	61,455	118	22.4	223.4	20.9	88.5	0.0	25.6	49.2	0.0	314.8	0.0
1961	67,542	118	22.4	223.4	20.9	145.4	274.0	25.6	0.0	0.0	0.0	0.0
1962	75,881	118	22.4	223.4	20.9	145.4	274.0	25.6	0.0	0.0	0.0	60.6
1963	63,938	118	22.4	223.4	20.9	59.2	0.0	48.6	64.4	135.8	411.9	0.0
1964	50,314	102	22.4	193.3	20.9	145.4	274.0	25.6	0.0	0.0	0.0	0.0
1965	48,151	118	22.4	223.4	20.9	118.1	243.0	25.6	0.0	0.0	0.0	0.0
1966	58,633	118	22.4	223.4	20.9	145.4	274.0	25.6	0.0	0.0	0.0	0.0
1967	55,005	104	22.4	197.6	20.9	145.4	274.0	25.6	0.0	0.0	0.0	0.0
1968	49,862	101	22.4	191.2	20.9	121.9	247.4	25.6	0.0	0.0	0.0	0.0
1969	61,405	118	22.4	223.4	20,9	116.2	240.8	25.6	0.0	0.0	0.0	0.0
1970	63,561	118	22.4	223.4	20.9	145.4	274.0	25.6	0.0	0.0	0.0	0.0
1971	65,198	118	22.4	223.4	20.9	59.2	0.0	48.6	64.4	135.8	411.9	0.0
1972	85,127	118	22.4	223.4	20.9	0.0	274.0	64.4	0.0	229.0	0.0	45.6
1973	89,418	118	22.4	223.4	20.9	59.2	0.0	48.6	64.4	135.8	411.9	0.0
1974	40,564	107	22.4	202.4	20.9	0.0	0.0	64.4	64.4	229.0	411.9	0.0
1975	42,205	118	22.4	223.4	20.9	126.3	252.3	25.6	0.0	0.0	0.0	0.0
1976	37,860	82	22.4	155.9	20.9	145.4	274.0	25.6	0.0	0.0	0.0	0.0
1977	50,402	118	22.4	223.4	20.9	84.1	204.5	25.6	0.0	0.0	0.0	55.4
1978	70,348	118	22.4	223.4	20.9	145.4	274.0	25.6	0.0	0.0	0.0	76.5
1979	75,459	118	22.4	223.4	20.9	145.4	274.0	25.6	0.0	0.0	0.0	67.5
1980	53,256	118	22.4	223.4	20.9	0.0	0.0	64.4	64.4	229.0	411.9	0.0
1981	44,297	106	22.4	201.1	20.9	145.4	0.0	25.6	64.4	0.0	411.9	0.0
1982	60,575	118	22.4	223.4	20.9	125.2	180.5	25.6	16.6	0.0	106.1	90.2
1983	64,021	118	22.4	223.4	20.9	145.4	1.2	25.6	64.1	0.0	410.1	0.0
1984	61,521	118	22.4	223.4	20.9	145.4	274.0	25.6	0.0	0.0	0.0	12.5
1985	68,693	118	22.4	223.4	20.9	145.4	274.0	25.6	0.0	0.0	0.0	0.0
Average =	59,953	112	22.40	211.9	20.9	112.5	191.3	31.6	16.7	35.3	106.5	13.2
Std Dev =	11,973	12	.00	22.5	0.0	47.0	115.4	12.7	27.3	74.9	174.6	26.7

- CONTINUED -

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER DRYLAND RANCH MODEL II (CONTINUED)

Dryland (Winter Solutions)

	17	19	20	21	22	23	26	27	31	33
Year	ALFC	CORNSIL	CSC	CORNGR	SELLCORN	GRCSAFT	BSTRAW	FSTRAW	SELLWHT	SELLSORG
1955	131.8	37.2	183.2	170.8	7487	88.8	0	0	2681	0
1956	67.5	29.0	146.3	179.0	8267	75.7	0	0	2157	0
1957	191.8	6.0	0.0	149.0	8643	96.9	0	0	5216	0
1958	151.3	32.6	174.2	122.4	5823	69.8	0	0	5146	0
1959	56.1	55.9	305.6	4.1	158	43.6	0	0	2971	2882
1960	201.6	12.8	16.1	47.2	2642	85.3	0	0	5368	2684
1961	181.1	9.8	54.5	50.2	2949	91.5	0	0	4269	4811
1962	186.2	0.0	0.0	60.0	4106	111.6	0	0	3627	6814
1963	191.4	0.0	0.0	60.0	3744	105.4	0	0	3436	1047
1964	99.2	36.6	239.2	23.4	1124	63.9	0	0	3410	4477
1965	152.5	34.2	195.6	25.8	1083	58.0	0	0	4179	2782
1966	85.0	49.6	300.5	158.5	7363	88.7	0	0	2356	0
1967	99.2	54.5	257.7	134.0	4533	60.3	0	0	3751	0
1968	105.2	42.2	202.2	17.8	742	71.9	0	0	3241	5066
1969	186.1	4.5	0.0	55.5	3048	111.7	0	0	2719	8296
1970	190.6	18.8	39.9	41.2	1609	87.0	0	0	2616	6544
1971	166.6	42.1	48.8	17.9	965	111.7	0	0	3069	5760
1972	186.1	0.0	0.0	60.0	4189	111.7	0	0	2694	9111
1973	186.1	13.0	0.0	47.0	2784	111.7	0	0	3379	6974
1974	222.6	60.0	0.0	0.0	0	41.8	0	0	3956	0
1975	162.8	33.1	148.7	26.9	22	68.2	0	0	2123	5344
1976	92.6	60.0	229.8	0.0	0	30.3	0	0	2025	4513
1977	81.4	33.8	261.7	26.2	1027	111.7	0	0	3341	9225
1978	186.1	5.9	0.0	54.1	3313	111.7	0	0	2557	10031
1979	186.1	0.6	0.0	59.4	3541	111.7	0	0	3149	8506
1980	155.9	60.0	181.6	0.0	0	60.7	0	0	2026	891
1981	43.6	60.0	483.6	0.0	0	13.2	0	0	3650	0
1982	186.1	0.0	0.0	60.0	3378	111.7	0	0	3064	6443
1983	204.6	0.0	0.0	60.0	2739	89.4	0	0	2359	5832
1984	201.2	0.0	0.0	208.0	11946	93.6	0	0	2837	0
1985	186.1	3.8	0.0	204.2	13132	111.7	0	0	3279	0
Average =	152.4	25.7	111.9	68.5	3560	83.9	0.00	0.00	3247	3808
Std Dev =	49.8	22.0	127.1	62.4	3413	27.1	0.00	0.00	883	3360

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER DRYLAND RANCH MODEL II (CONTINUED)

Dryland (Winter Solutions)

Year	34 EHFRINV	35 ESTRINV	37 INCOW	38 ALFM	39 ALFG	40 CSM	43 CGRG	46 SORGG	47 STRM	50 CSAFTM	52 CSAFTM	TOTAL INCOME
1955	64.4	64.4	140.0	0.0	0.0	79.5	582	0	0	0	0	31,606
1956	43.1	43.1	93.8	0.0	0.0	58.4	523	0	0	0	12	31,234
1957	62.8	62.8	136.6	11.1	0.0	53.5	582	0	0	0	0	36,716
1958	64.4	64.4	140.0	0.0	0.0	79.5	582	0	0	0	0	43,640
1959	49.2	49.2	107.0	0.0	0.0	30.7	0	445	652	0	0	26,779
1960	64.4	64.4	140.0	0.0	0.0	89.9	0	1321	1888	0	0	33,801
1961	64.4	64.4	140.0	0.0	0.0	30.7	0	445	652	0	0	43,886
1962	64.4	64.4	140.0	34.0	4.1	0.0	0	0	582	0	0	52,194
1963	64.4	64.4	140.0	64.8	0.0	0.0	0	1846	2856	0	0	40,240
1964	57.1	57.1	124.1	0.0	0.0	30.7	0	445	652	0	0	27,265
1965	64.4	64.4	140.0	0.0	0.0	30.7	0	445	652	0	0	23,245
1966	64.4	64.4	140.0	0.0	0.0	79.5	582	0	0	0	0	32,711
1967	58.1	58.1	126.4	0.0	0.0	79.5	582	0	0	0	0	29,816
1968	56.6	56.6	123.0	0.0	0.0	79.5	0	0	652	0	0	26,861
1969	64.4	64.4	140.0	8.5	0.0	37.7	0	0	652	0	12	31,633
1970	64.4	64.4	140.0	0.0	0.0	79.5	0	0	652	0	0	39,782
1971	64.4	64.4	140.0	0.0	0.0	326.0	0	0	2273	0	16	41,443
1972	64.4	64.4	140.0	58.4	6.1	0.0	0	0	1536	0	36	61,352
1973	64.4	64.4	140.0	92.7	0.0	86.3	0	0	2513	0	29	65,678
1974	59.3	59.3	128.9	6.4	0.0	357.6	0	281	3259	0	0	17,066
1975	64.4	64.4	140.0	0.0	0.0	28.2	582	0	0	0	0	17,369
1976	48.1	48.1	104.5	0.0	0.0	0.0	0	545	652	0	11	14,510
1977	64.4	64.4	140.0	0.0	0.0	58.4	523	0	0	0	12	25,543
1978	64.4	64.4	140.0	0.0	0.0	57.3	0	0	549	0	13	46,565
1979	64.4	64.4	140.0	23.4	0.0	0.0	0	0	603	0	14	51,708
1980	64.4	64.4	140.0	0.0	0.0	158.6	0	2231	3259	0	0	29,429
1981	59.0	59.0	128.3	3.4	0.0	0.0	0	1928	2270	0	36	20,767
1982	64.4	64.4	140.0	38.6	3.7	0.0	0	0	1006	0	23	35,298
1983	64.4	64.4	140.0	120.3	0.0	0.0	0	0	2262	0	0	40,223
1984	64.4	64.4	140.0	34.0	2.0	0.0	551	0	0	0	0	35,630
1985	64.4	64.4	140.0	11.7	0.0	29.8	548	0	0	0	13	42,824
Average =	61.6	61.6	134.0	16.4	0.5	62.6	182	320	970	0.00	7	35,381
Std Dev =	5.5	5.5	11.9	29.6	1.4	82.5	264	618	1037	0.00	11	11,988

APPENDIX H

STATIC AND DYNAMIC SOLUTIONS FOR

IRRIGATED RANCH MODEL II

APPENDIX TABLE 1. STATIC SOLUTIONS FOR SUMMER IRRIGATED RANCH MODEL II

OBJECTIVE FUNCTION= 73763.83573

SECTION 1 - ROWS

NUMBER	TYPE	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1.	E	ACCTING	EQ	.	.	.	.	
2.	E	COWINV	EQ	163.00000	.	163.00000	22.16000	
3.	L	COWMAX	UL	163.00000	.	NONE	49.81095	
4.	E	REPINV	EQ	29.34000	.	29.34000	-62.40959	
5.	L	RPAST	UL	493.00000	.	NONE	21.93600	
6.	L	SUMGRAZ	UL	.	.	NONE	15.52000	
7.	E	BEGALF	EQ	108.00000	.	108.00000	.	
8.	L	FALLGRAZ	UL	.	.	NONE	12.50667	
9.	E	WCOWINV	EQ	.	.	.	-1.88474	
10.	E	EREPINV	EQ	.	.	.	-1.67533	
11.	E	ENDALF	EQ	.	.	.	.	
12.	E	ALFHAY	EQ	65.00000	.	65.00000	-49.08293	
13.	E	CPLAST	EQ	50.00000	.	50.00000	6.24547	
14.	L	TILLAC	UL	335.00000	.	NONE	26.19293	
15.	L	CORNT	UL	.	.	NONE	2.59000	
16.	G	MINCORN	LL	60.00000	.	60.00000	NONE	-4.06021
17.	L	WHTT	UL	.	.	NONE	4.03000	
18.	L	OWAFT	UL	.	.	NONE	5.40293	
19.	L	OATT	UL	.	.	NONE	1.40000	
20.	L	SORGT	UL	.	.	NONE	2.22000	
21.	L	WHTLIM	UL	82.50000	.	NONE	37.63771	
22.	L	OATLIM	BS	27.50000	55.00000	NONE	.	
23.	L	CSLIM	UL	110.00000	.	NONE	40.54627	
24.	L	SUMLAB	UL	1250.00000	.	NONE	4.50000	
25.	E	HFRINV	EQ	74.98000	.	74.98000	.	
26.	E	STRINV	EQ	74.98000	.	74.98000	.	
27.	L	SCOW1	BS	.	163.00000	NONE	.	
28.	L	SCOW2	BS	.	163.00000	NONE	.	
29.	L	SCOW3	BS	.	163.00000	NONE	.	
30.	E	SBED	EQ	.	.	.	12.56496	
31.	L	IRTILAC	UL	145.00000	.	NONE	193.96528	
32.	L	POTLIM	UL	40.00000	.	NONE	578.12669	
33.	L	POTT	UL	.	.	NONE	4.23000	
34.	L	SOYLIM	BS	.	43.00000	NONE	.	
35.	L	SOYT	UL	.	.	NONE	5.93000	
36.	E	AFIRLIM	EQ	60.00000	.	60.00000	-284.26528	
37.	L	CORILIM	BS	45.00000	40.00000	NONE	.	
38.	E	IFS	EQ	.	.	.	-8.10000	
39.	E	IFH	EQ	.	.	.	-7.20000	
40.	E	FST	EQ	.	.	.	.	
41.	E	FHT	EQ	.	.	.	.	

- CONTINUED -

APPENDIX TABLE 1. STATIC SOLUTIONS FOR SUMMER IRRIGATED RANCH MODEL II (CONTINUED)

SECTION 2 - COLUMNS

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT.	..UPPER LIMIT.	.REDUCED COST.
1.	ACCTINV	BS	49400.15715	.	.	NONE	.
2.	BEEFCOW	BS	163.00000	170.00000	.	NONE	.
3.	REPHFR	BS	29.34000	.	.	NONE	.
4.	BUYCOW	BS	.	-22.16000	.	NONE	.
5.	ESSUPPFO	BS	23.14132	-45.21000	.	NONE	.
6.	GRAZRANG	BS	493.00000	.	.	NONE	.
7.	GRCLPAST	BS	50.00000	.	.	NONE	.
8.	SELLCOW1	LL	.	-22.16000	.	NONE	-44.32000
9.	SELLCOW2	LL	.	-55.42000	.	NONE	-77.58000
10.	SELLCOW3	LL	.	-99.75000	.	NONE	-121.91000
11.	LSUPPFOR	BS	54.13973	-36.17000	.	NONE	.
12.	GRSGAFT	BS	53.13954	-0.10000	.	NONE	.
13.	COWT	BS	136.92000	.	.	NONE	.
14.	REPHFRT	BS	26.08000	.	.	NONE	.
15.	ALFT	BS	30.71895	.	.	NONE	.
16.	ALFD	BS	65.00000	-17.94000	.	NONE	.
17.	CORNAC	BS	60.00000	-57.97000	.	NONE	.
18.	SELLCORN	BS	9351.14983	2.59000	.	NONE	.
19.	WHTAC	BS	82.50000	-41.53000	.	NONE	.
20.	SELLWHT	BS	2193.67501	4.03000	.	NONE	.
21.	OATAC	BS	27.50000	-38.55000	.	NONE	.
22.	SELLOAT	BS	1315.87495	1.40000	.	NONE	.
23.	SORGAC	BS	50.00000	-43.62000	.	NONE	.
24.	SELLSORG	BS	2660.00003	2.22000	.	NONE	.
25.	HIRELAB	BS	319.44431	-4.50000	.	NONE	.
26.	HFRT	BS	74.98000	.	.	NONE	.
27.	STRT	BS	74.98000	.	.	NONE	.
28.	INVALF	BS	439.37517	.	.	NONE	.
29.	STRB	BS	56.86046	.	.	NONE	.
30.	POTAC	BS	40.00000	-422.82001	.	NONE	.
31.	SELLPOT	BS	11575.99976	4.23000	.	NONE	.
32.	SOYAC	LL	.	-70.75000	.	NONE	-60.44159
33.	SELLSOY	BS	.	5.93000	.	NONE	.
34.	ALFI	BS	60.00000	-72.10000	.	NONE	.
35.	CORNI	BS	45.20000	-149.76000	.	NONE	.
36.	FINS	BS	.	.	.	NONE	.
37.	SFS	BS	.	.	.	NONE	.
38.	FINH	BS	.	.	.	NONE	.
39.	SFH	BS	.	.	.	NONE	.
40.	LSUPPALF	LL	.	-45.21000	.	NONE	-9.04000

APPENDIX TABLE 2. STATIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL II

OBJECTIVE FUNCTION= 99707.087[illegible]

SECTION 1 - ROWS

NUMBER	TYPE	...ROW..	AT	...ACTIVITY...	SLACK ACTIVITY	..LOWER LIMIT.	..UPPER LIMIT.	.DUAL ACTIVITY
1.	E	ACCTING	EQ	.	.	.	.	
2.	E	COWINV	EQ	136.92000	.	136.92000	116.00239	
3.	L	COWMAX	BS	163.00000	.	NONE	.	
4.	E	BREPINV	EQ	26.00000	.	26.00000	81.84531	
5.	E	CULLCOW	EQ	.	.	.	371.30001	
6.	E	HFRS	EQ	.	.	.	.	
7.	E	STRS	EQ	.	.	.	.	
8.	E	CULLREP	EQ	.	.	.	446.94916	
9.	E	ECOWINV	EQ	.	.	.	.	
10.	E	BGHFR	EQ	.	.	.	368.27849	
11.	L	BGSTR	UL	.	.	NONE	410.71429	
12.	L	WINLAB	BS	1048.24717	201.75283	NONE	.	
13.	E	BALFINV	EQ	439.37000	.	439.37000	44.96000	
14.	L	TDNC	UL	.	.	NONE	0.04533	
15.	L	PROTC	BS	-32224.91438	32224.91438	NONE	.	
16.	E	CORNAC	EQ	60.00000	.	60.00000	151.41408	
17.	E	CORNSILT	EQ	.	.	.	19.57793	
18.	E	CORNGRT	EQ	.	.	.	2.54000	
19.	L	CSAFT	UL	.	.	NONE	37.27600	
20.	L	OWAFT	UL	.	.	NONE	8.67641	
21.	E	OATAC	EQ	27.50000	.	27.50000	66.51150	
22.	E	WHTAC	EQ	82.50000	.	82.50000	.	
23.	E	OATT	EQ	.	.	.	1.39000	
24.	E	WHTT	EQ	.	.	.	.	
25.	E	STRAWT	EQ	.	.	.	28.11927	
26.	E	SORGAC	EQ	50.00000	.	50.00000	137.41129	
27.	E	SORGT	EQ	.	.	.	2.17000	
28.	E	BHFRINV	EQ	74.98000	.	74.98000	220.93634	
29.	E	BSTRINV	EQ	74.98000	.	74.98000	294.55320	
30.	E	REQREP	EQ	29.34000	.	29.34000	-368.27849	
31.	L	PROTBG	BS	-9601.39206	9601.39206	NONE	.	
32.	L	NEMBG	UL	.	.	NONE	0.04675	
33.	L	NEGBG	UL	.	.	NONE	0.07089	
34.	L	SCOWL1	BS	.	163.00000	NONE	.	
35.	L	SCOWL2	BS	.	163.00000	NONE	.	
36.	L	SCOWL3	BS	.	163.00000	NONE	.	
37.	L	STRAWL	BS	-133.62533	133.62533	NONE	.	
38.	G	AMAXT	BS	26088.49599	-26088.49599	.	NONE	
39.	G	AMAXP	BS	5638.88975	-5638.88975	.	NONE	
40.	G	MINF	BS	24.33263	-24.33263	.	NONE	
41.	L	MAXF	BS	-3.01690	3.01690	NONE	.	
42.	L	MAXS	BS	-12.15535	12.15535	NONE	.	
43.	L	MAXAFT	BS	-15.19419	15.19419	NONE	.	
44.	E	POTAC	EQ	40.00000	.	40.00000	.	
45.	E	POTT	EQ	.	.	.	.	
46.	E	SOYAC	EQ	.	.	.	.	
47.	E	SOYT	EQ	.	.	.	.	
48.	E	ICORNA	EQ	45.00000	.	45.00000	383.46431	
49.	E	FST	EQ	.	.	.	653.56324	
50.	E	FHT	EQ	.	.	.	575.84032	
51.	L	PROT	UL	.	.	NONE	0.11902	
52.	L	NEM	UL	.	.	NONE	0.02718	
53.	L	NEG	UL	.	.	NONE	0.04020	
54.	G	FORMIN	BS	.	.	.	NONE	
55.	L	FORMAX	UL	.	.	NONE	28.69356	
56.	E	ALFMIN	EQ	108.10000	.	108.10000	-8.80000	

- CONTINUED -

APPENDIX TABLE 2. STATIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL II (CONTINUED)

SECTION 2 - COLUMNS

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT.	..UPPER LIMIT.	.REDUCED COST.
1.	ACCTINV	BS	123501.21015	.	.	NONE	.
2.	BEEFCOW	BS	136.92000	133.00000	.	NONE	.
3.	REPHFR	BS	26.00000	133.00000	.	NONE	.
4.	SELLCOW1	LL	.	-22.16000	.	NONE	-138.16238
5.	SELLCOW2	LL	.	-55.42000	.	NONE	-171.42238
6.	SELLCOW3	LL	.	-99.75000	.	NONE	-215.75239
7.	SELLCULL	BS	260.14799	37.13000	.	NONE	.
8.	SELLREP	BS	24.31186	52.74000	.	NONE	.
9.	SELLWHFR	BS	169.26293	58.99000	.	NONE	.
10.	SELLWSTR	BS	319.06384	69.22000	.	NONE	.
11.	BGHFRS	BS	29.78680	-26.86000	.	NONE	.
12.	BGSTRS	LL	.	-29.00000	.	NONE	-34.05580
13.	SBGHFR	LL	.	56.82000	.	NONE	-5.48117
14.	SBGSTR	BS	.	63.25000	.	NONE	.
15.	HIRELAB	LL	.	-4.50000	.	NONE	-4.50000
16.	ALFT	BS	108.10000	36.16000	.	NONE	.
17.	ALFC	BS	242.95515	.	.	NONE	.
18.	BUYALF	LL	.	-73.81000	.	NONE	-28.85000
19.	CORNSIL	BS	.	-2.86200	.	NONE	.
20.	CSC	LL	.	.	.	NONE	-1.58577
21.	CORNGR	BS	60.00000	.	.	NONE	.
22.	SELLCORN	BS	9351.14983	2.54000	.	NONE	.
23.	GRCSAFT	BS	98.45000	-0.10000	.	NONE	.
24.	OATS	BS	27.50000	.	.	NONE	.
25.	WHEAT	BS	82.50000	.	.	NONE	.
26.	BSTRAW	BS	.	-7.99000	.	NONE	.
27.	FSTRAW	BS	.	.	.	NONE	.
28.	PROTSUPP	LL	.	-200.00000	.	NONE	-132.88639
29.	OATC	LL	.	.	.	NONE	-0.40630
30.	SELLOAT	BS	1315.87496	1.39000	.	NONE	.
31.	SELLWHT	BS	2193.67501	.	.	NONE	.
32.	SORG	BS	50.00000	.	.	NONE	.
33.	SELLSORG	BS	1909.07396	2.17000	.	NONE	.
34.	EWFRINV	BS	74.98000	.	.	NONE	.
35.	ESTRINV	BS	74.98000	.	.	NONE	.
36.	REPINV	BS	29.34000	.	.	NONE	.
37.	INVCOW	BS	163.00000	.	.	NONE	.
38.	ALFM	BS	39.52682	.	.	NONE	.
39.	ALFG	LL	.	.	.	NONE	-7.56879
40.	CSM	LL	.	.	.	NONE	-0.38649
41.	CSG	LL	.	.	.	NONE	-1.88474
42.	CGRM	LL	.	.	.	NONE	-0.22328
43.	CGRG	LL	.	.	.	NONE	-0.10912
44.	OATM	LL	.	.	.	NONE	-0.28400
45.	OATG	LL	.	.	.	NONE	-0.28409
46.	SORGM	LL	.	.	.	NONE	-0.06457
47.	SORGG	BS	758.92607	.	.	NONE	.
48.	PROSM	LL	.	-200.00000	.	NONE	-123.02856
49.	PROSG	LL	.	-200.00000	.	NONE	-120.67484
50.	STRM	LL	.	.	.	NONE	-7.58856

- CONTINUED -

APPENDIX TABLE 2. STATIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL II (CONTINUED)

SECTION 2 - COLUMNS

NUMBER	.COLUMN.	AT	...ACTIVITY...	..INPUT COST..	..LOWER LIMIT.	..UPPER LIMIT.	.REDUCED COST.
51.	STRG	LL	.	.	.	NONE	-22.76764
52.	CSAFTM	LL	.	-0.10000	.	NONE	-3.46014
53.	CSAFTG	LL	.	-0.10000	.	NONE	-15.10532
54.	POT	BS	40.00000	.	.	NONE	.
55.	SELLPOT	BS	11575.99976	.	.	NONE	.
56.	SOY	BS	.	.	.	NONE	.
57.	SELLSOY	BS	.	.	.	NONE	.
58.	ICORN	BS	45.00000	.	.	NONE	.
59.	FINS	BS	.	-37.78000	.	NONE	.
60.	FINH	LL	.	-34.25000	.	NONE	-19.23331
61.	IFS	BS	.	56.86000	.	NONE	.
62.	IFH	BS	.	54.82000	.	NONE	.
63.	FCORNM	LL	.	.	.	NONE	-0.22073
64.	FCORNG	LL	.	.	.	NONE	-0.18969
65.	FSORGM	BS	.	.	.	NONE	.
66.	FSORGG	BS	.	.	.	NONE	.
67.	SALF	BS	48.78803	44.96000	.	NONE	.
68.	FSBMM	LL	.	-200.00000	.	NONE	-37.67785
69.	FSBMG	LL	.	-200.00000	.	NONE	-37.45413
70.	FALFM	BS	.	.	.	NONE	.
71.	FALFG	LL	.	.	.	NONE	-4.94057

END OF SOLUTION OUTPUT
SAVING WIIR:63A.ACT

APPENDIX TABLE 3. DYNAMIC SOLUTIONS FOR SUMMER IRRIGATED RANCH MODEL II

Irrigated (Summer Solutions) 163 cow herd

	1	2	4	5	8	11	12	15	17	19	23	25
Year	ACCTING	BEECOW	BUYCOW	ESUPPFOR	SELLCOW1	LSUPPFOR	GRSGAFT	ALFT	CORNAC	WHTAC	SORGAC	HIRELAB
1955	49,540	163	0	77	0	31	52	0	60	83	50	349
1956	50,342	160	0	108	3	0	39	0	110	83	0	392
1957	50,302	163	3	42	0	52	65	14	110	83	0	364
1958	49,426	163	0	33	0	75	64	0	60	83	50	333
1959	49,632	163	0	91	0	17	31	0	60	83	50	355
1960	46,843	163	0	0	0	39	66	69	60	83	50	316
1961	699	163	0	18	0	52	54	38	60	83	50	450
1962	49,377	163	0	0	0	37	44	71	60	83	50	307
1963	49,434	163	0	16	0	55	40	38	60	83	50	317
1964	49,543	163	0	49	0	59	40	0	60	83	50	342
1965	49,418	163	0	34	0	56	53	17	60	83	50	324
1966	49,456	163	0	33	0	62	44	12	60	83	50	325
1967	49,483	163	0	58	0	50	60	0	60	83	50	343
1968	49,517	163	0	64	0	44	53	0	60	83	50	345
1969	49,361	163	0	0	0	49	53	60	60	83	50	311
1970	49,392	163	0	12	0	53	50	44	60	83	50	316
1971	49,379	163	0	24	0	52	59	32	60	83	50	319
1972	49,358	163	0	0	0	43	52	65	60	83	50	309
1973	46,073	163	0	0	0	42	64	66	60	83	50	343
1974	49,483	163	0	37	0	71	50	0	60	83	50	336
1975	49,468	163	0	27	0	58	36	23	60	83	50	322
1976	49,520	163	0	51	0	58	34	0	60	83	50	332
1977	49,343	163	0	6	0	53	63	49	60	83	50	314
1978	49,361	163	0	0	0	38	49	70	60	83	50	308
1979	46,076	163	0	0	0	35	60	73	60	83	50	341
1980	46,256	163	0	37	0	66	34	6	60	83	50	361
1981	49,533	163	0	55	0	53	46	0	60	83	50	343
1982	49,309	163	0	0	0	24	59	84	60	83	50	304
1983	49,385	163	0	0	0	43	44	65	60	83	50	309
1984	50,243	163	0	0	0	40	54	68	110	83	0	348
1985	50,226	163	0	0	0	46	62	62	110	83	0	350
Average =	47,573	162.89	0.09	28.12	0.11	46.89	50.78	33.09	66.45	82.50	43.55	336
Std Dev =	8,633	0.60	0.50	29.36	0.60	15.09	10.02	29.73	16.76	0.00	16.76	29

- CONTINUED -

APPENDIX TABLE 3. DYNAMIC SOLUTIONS FOR SUMMER IRRIGATED RANCH MODEL II (CONTINUED)

Irrigated (Summer Solutions) 163 cow herd

	26	27	28	29	30	32	34	35	36	37	38	39	40
Year	HFRT	STRT	INVALF	STRB	POTAC	SOYAC	ALFI	CORNI	FINS	SFS	FINH	SFH	LSUPALF
1955	74.98	74.98	309.5	58.2	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	69.2
1956	74.98	74.98	244.4	70.7	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	100.8
1957	73.67	73.67	458.2	45.3	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1958	74.98	74.98	415.7	46.1	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	14.5
1959	74.98	74.98	241.4	78.9	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	86.8
1960	74.98	74.98	464.3	44.5	40.0	0.0	60.0	45.0	0.0	0.0	4.9	51.1	0.0
1961	74.98	74.98	395.9	55.6	40.0	0.0	60.0	45.0	73.9	849.3	0.0	0.0	0.0
1962	74.98	74.98	592.4	66.1	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1963	74.98	74.98	405.8	69.9	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1964	74.98	74.98	478.1	69.9	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	43.1
1965	74.98	74.98	468.6	56.9	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1966	74.98	74.98	442.5	66.1	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1967	74.98	74.98	364.3	49.9	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	47.7
1968	74.98	74.98	378.9	56.9	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	55.5
1969	74.98	74.98	459.2	56.9	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1970	74.98	74.98	423.6	59.6	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1971	74.98	74.98	409.1	50.9	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1972	74.98	74.98	507.8	58.2	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1973	74.98	74.98	501.9	46.1	40.0	43.0	60.0	2.0	0.0	0.0	0.0	0.0	0.0
1974	74.98	74.98	387.7	59.6	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	23.5
1975	74.98	74.98	414.9	74.1	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1976	74.98	74.98	363.6	76.4	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	9.9
1977	74.98	74.98	409.8	47.0	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1978	74.98	74.98	443.9	61.1	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1979	74.98	74.98	481.1	49.9	40.0	43.0	60.0	2.0	0.0	0.0	0.0	0.0	0.0
1980	74.98	74.98	345.3	76.4	40.0	43.0	60.0	2.0	0.0	0.0	0.0	0.0	0.0
1981	74.98	74.98	313.1	64.3	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	48.7
1982	74.98	74.98	613.0	50.9	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1983	74.98	74.98	445.2	66.1	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1984	74.98	74.98	442.5	55.6	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
1985	74.98	74.98	467.8	47.9	40.0	0.0	60.0	45.0	0.0	0.0	0.0	0.0	0.0
Average =	74.94	74.94	422.2	59.2	40.0	4.2	60.0	40.8	2.4	27.4	0.2	1.6	16.1
Std Dev =	0.23	0.23	80.8	10.0	0.0	12.7	0.0	12.7	13.0	150.1	0.9	9.0	28.3

- CONTINUED -

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL II

Irrigated (Winter Solutions) 163 cow herd

	1	2	3	7	8	9	10	11	12	13	14	16
Year	ACCTING	BEEFCOW	REPHFR	SELLCULL	SELLREP	SELLWHFR	SELLWSTR	BGHFRS	BGSTRS	SBGHFR	SBGSTR	ALFT
1955	116,260	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1956	95,892	134.08	26.08	254.75	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1957	151,035	136.92	26.08	260.15	24.31	164.37	313.51	29.79	0.0	0.0	0.0	108
1958	113,860	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1959	107,886	136.92	26.08	260.15	24.31	150.76	319.06	34.73	0.0	0.0	0.0	108
1960	85,444	136.92	26.08	260.15	24.31	169.26	0	29.79	75.0	0.0	0.0	108
1961	113,709	136.92	26.08	260.15	24.31	141.37	319.06	37.24	0.0	43.9	0.0	108
1962	137,235	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1963	109,108	136.92	26.08	260.15	24.31	169.26	104.43	29.79	50.4	0.0	322.6	108
1964	163,116	136.92	26.08	260.15	24.31	169.26	104.43	29.79	50.4	0.0	322.6	108
1965	138,378	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1966	126,587	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1967	113,292	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1968	109,084	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1969	126,196	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1970	129,133	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1971	129,562	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1972	151,659	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1973	140,423	136.92	26.08	260.15	24.31	169.26	0	29.79	75.0	0.0	479.6	108
1974	107,708	136.92	26.08	260.15	24.31	0	0	74.98	75.0	266.6	479.6	108
1975	105,961	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1976	105,477	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1977	112,382	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1978	123,976	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1979	121,537	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1980	99,083	136.92	26.08	260.15	24.31	169.26	104.43	29.79	50.4	0.0	322.6	108
1981	99,616	136.92	26.08	260.15	24.31	0	0	74.98	75.0	266.6	479.6	108
1982	118,581	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1983	111,194	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1984	106,668	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
1985	118,562	136.92	26.08	260.15	24.31	169.26	319.06	29.79	0.0	0.0	0.0	108
Average =	118,987	136.83	26.08	259.98	24.31	156.69	256.94	33.11	14.6	18.6	77.6	108
Std Dev =	17,176	0.50	0.00	0.95	0.00	41.56	117.20	11.11	27.6	65.6	162.2	0

- CONTINUED -

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL II (CONTINUED)

Irrigated (Winter Solutions) 163 cow herd

	17	19	20	21	22	23	26	27
Year	ALFC	CORNSIL	CSC	CORNGR	SELLCORN	GRCSAFT	BSTRAW	FSTRAW
1955	201.4	14.0	63.1	46.0	7758	84.6	0	0
1956	136.3	57.1	325.8	52.9	7277	63.2	0	0
1957	242.1	10.3	0.0	99.7	12043	99.4	0	0
1958	243.9	0.0	0.0	60.0	8329	97.4	0	0
1959	116.1	60.0	361.2	0.0	5290	56.7	0	0
1960	261.0	39.8	0.0	20.3	1902	76.8	0	0
1961	238.4	0.0	0.0	60.0	10139	104.0	0	0
1962	230.2	0.0	0.0	60.0	11400	113.9	0	0
1963	233.8	0.0	0.0	60.0	9742	109.5	0	0
1964	246.6	0.0	0.0	60.0	8755	94.1	0	0
1965	252.1	0.0	0.0	60.0	9072	87.5	0	0
1966	244.8	0.0	0.0	60.0	9570	96.3	0	0
1967	165.7	60.0	278.8	0.0	6975	57.2	0	0
1968	256.8	13.9	0.0	46.1	8416	81.8	0	0
1969	84.7	60.0	464.6	0.0	6857	65.2	0	0
1970	259.5	14.6	0.0	45.4	7648	78.6	0	0
1971	50.6	60.0	533.3	0.0	6198	73.2	0	0
1972	221.0	0.0	0.0	60.0	11475	124.9	0	0
1973	261.2	5.8	0.0	54.2	3517	76.5	0	0
1974	277.7	60.0	0.0	0.0	1943	56.7	0	0
1975	260.3	0.0	0.0	60.0	7991	77.6	0	0
1976	243.1	21.0	80.6	39.0	7477	59.6	0	0
1977	50.7	60.0	539.2	0.0	5498	70.2	0	0
1978	50.2	52.5	510.3	7.5	7242	84.7	0	0
1979	73.3	60.0	551.6	0.0	298	37.0	0	0
1980	237.2	60.0	173.1	0.0	0	22.0	0	0
1981	146.2	60.0	313.0	0.0	2624	64.2	0	0
1982	43.8	60.0	501.2	0.0	6273	67.2	0	0
1983	256.7	0.0	0.0	60.0	8213	82.0	0	0
1984	254.8	0.0	0.0	110.0	11245	84.2	0	0
1985	235.6	0.0	0.0	110.0	12780	107.3	0	0
Average =	196.0	26.7	151.5	39.7	7224	79.1	0.00	0.00
Std Dev =	77.2	27.0	208.6	33.7	3296	21.9	0.00	0.00

- CONTINUED -

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL II (CONTINUED)

Irrigated (Winter Solutions) 163 cow herd

	31	33	34	35	37	38	39	40	41	43	46
Year	SELLWHT	SELLSORG	EHFRINV	ESTROMV	INVCOW	ALFM	ALFG	CSM	CSG	CGRG	SORGM
1955	2168	935	75.0	75.0	163.0	0.0	0.0	35.8	0.0	0	518
1956	1745	0	73.7	73.7	160.2	0.0	0.0	92.6	0.0	677	0
1957	2776	0	75.0	75.0	163.0	0.0	0.0	92.6	0.0	677	0
1958	2739	2611	75.0	75.0	163.0	39.5	0.0	0.0	0.0	677	0
1959	1582	0	75.0	75.0	163.0	14.5	0.0	0.0	0.0	0	674
1960	2857	0	75.0	75.0	163.0	0.0	0.0	329.1	0.0	2033	0
1961	2272	2161	75.0	75.0	163.0	49.4	0.0	0.0	0.0	0	0
1962	1931	2556	75.0	75.0	163.0	12.5	0.0	0.0	0.0	0	578
1963	1829	70	75.0	75.0	163.0	63.9	0.0	0.0	0.0	0	929
1964	1815	1109	75.0	75.0	163.0	107.4	11.7	0.0	0.0	0	0
1965	2224	1283	75.0	75.0	163.0	39.5	0.0	0.0	0.0	0	0
1966	1906	1791	75.0	75.0	163.0	39.5	0.0	0.0	0.0	0	0
1967	2547	1224	75.0	75.0	163.0	0.0	0.0	92.6	0.0	0	0
1968	2211	1456	75.0	75.0	163.0	0.0	0.0	92.6	0.0	0	0
1969	2199	1746	75.0	75.0	163.0	0.0	0.0	35.8	0.0	0	518
1970	2116	1672	75.0	75.0	163.0	0.0	0.0	92.6	0.0	0	0
1971	2482	2038	75.0	75.0	163.0	0.0	0.0	92.6	10.1	0	0
1972	2179	2838	75.0	75.0	163.0	39.5	0.0	0.0	0.0	0	0
1973	2733	881	75.0	75.0	163.0	132.6	0.0	18.4	39.1	0	0
1974	2105	1863	75.0	75.0	163.0	1.9	0.0	357.6	0.0	3387	0
1975	1717	1806	75.0	75.0	163.0	39.5	0.0	0.0	0.0	677	0
1976	1638	592	75.0	75.0	163.0	12.5	0.0	0.0	0.0	0	578
1977	2702	3117	75.0	75.0	163.0	0.0	0.0	44.0	0.0	677	0
1978	2068	2992	75.0	75.0	163.0	0.0	0.0	92.6	21.6	0	0
1979	2547	1800	75.0	75.0	163.0	0.0	0.0	35.8	0.0	0	518
1980	1638	0	75.0	75.0	163.0	0.0	0.0	167.1	0.0	264	425
1981	1943	0	75.0	75.0	163.0	0.0	0.0	170.6	0.0	3387	2529
1982	2478	1239	75.0	75.0	163.0	0.0	0.0	35.8	0.0	0	518
1983	1908	1398	75.0	75.0	163.0	12.5	0.0	0.0	0.0	0	578
1984	2294	0	75.0	75.0	163.0	39.5	0.0	0.0	0.0	677	0
1985	2652	0	75.0	75.0	163.0	39.5	0.0	0.0	0.0	677	0
	2194	1264	74.9	74.9	162.9	22.1	0.4	60.6	2.3	446	270
	372	990	0.2	0.2	0.5	32.2	0.0	89.2	7.9	884	499

- CONTINUED -

APPENDIX TABLE 4. DYNAMIC SOLUTIONS FOR WINTER IRRIGATED RANCH MODEL II (CONTINUED)

Irrigated (Winter Solutions) 163 cow herd

	47	52	55	57	63	64	65	66	67	70	
Year	SORGG	CSAFTM	SELLPOT	SELLSOY	FCORNM	FCORNG	FSORGM	FSORGG	SALF	FGLFM	TOTAL INCOME
1955	759	0	10085	0	0	0	0	0	0.0	0.0	66,721
1956	0	0	12467	0	0	0	0	0	0.0	0.0	45,550
1957	0	0	11907	0	0	0	0	0	108.0	0.0	100,733
1958	0	0	11666	0	0	0	0	0	24.2	0.0	64,435
1959	885	0	10086	0	0	0	244	291	0.0	2.7	58,254
1960	366	0	12970	0	0	3936	2736	0	0.0	95.2	38,601
1961	949	0	11770	0	0	0	0	0	0.0	0.0	113,010
1962	759	0	12382	0	0	0	0	0	241.6	0.0	87,858
1963	2026	0	10542	0	0	0	0	0	0.0	0.0	59,674
1964	1824	0	10266	0	0	0	0	0	4.2	0.0	113,573
1965	759	0	12921	0	0	0	0	0	68.9	0.0	88,960
1966	759	0	11209	0	0	0	0	0	50.1	0.0	77,131
1967	759	0	9965	0	0	0	0	0	90.4	0.0	63,809
1968	759	0	9985	0	0	0	0	0	14.0	0.0	59,567
1969	759	0	10228	0	0	0	0	0	266.4	0.0	76,835
1970	759	0	11644	0	0	0	0	0	56.0	0.0	79,740
1971	676	0	14804	0	0	0	0	0	250.4	0.0	80,184
1972	759	0	11664	0	0	0	0	0	139.2	0.0	102,301
1973	2324	0	11844	1800	0	0	0	0	0.0	0.0	94,350
1974	0	0	11624	0	0	0	0	0	0.0	0.0	58,225
1975	0	0	10266	0	0	0	0	0	7.0	0.0	56,493
1976	759	0	12970	0	0	0	0	0	0.0	0.0	55,957
1977	0	0	10542	0	0	0	0	0	251.0	0.0	63,038
1978	583	0	12382	0	0	0	0	0	285.7	0.0	74,615
1979	759	0	12467	1782	0	0	0	0	299.7	0.0	75,461
1980	1730	0	10085	1507	0	0	0	0	0.0	0.0	52,827
1981	0	0	11666	0	0	0	0	0	58.8	0.0	50,084
1982	759	0	11770	0	0	0	0	0	461.1	0.0	69,272
1983	759	0	11666	0	0	0	0	0	68.0	0.0	61,809
1984	0	0	12382	0	0	0	0	0	40.1	0.0	56,425
1985	0	0	12467	0	0	0	0	0	84.5	0.0	68,337
Mean=	685	0	11571	164	0	127	96	9	92.6	3.2	71,414
Std Dev=	606	0	1137	503	0	696	484	51	119.2	16.8	18,685

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