

South Dakota State University
**Open PRAIRIE: Open Public Research Access Institutional
Repository and Information Exchange**

Agricultural Experiment Station Circulars

SDSU Agricultural Experiment Station

4-1979

Ranch Management: Handling Drought

D.H. Jibben

South Dakota State University

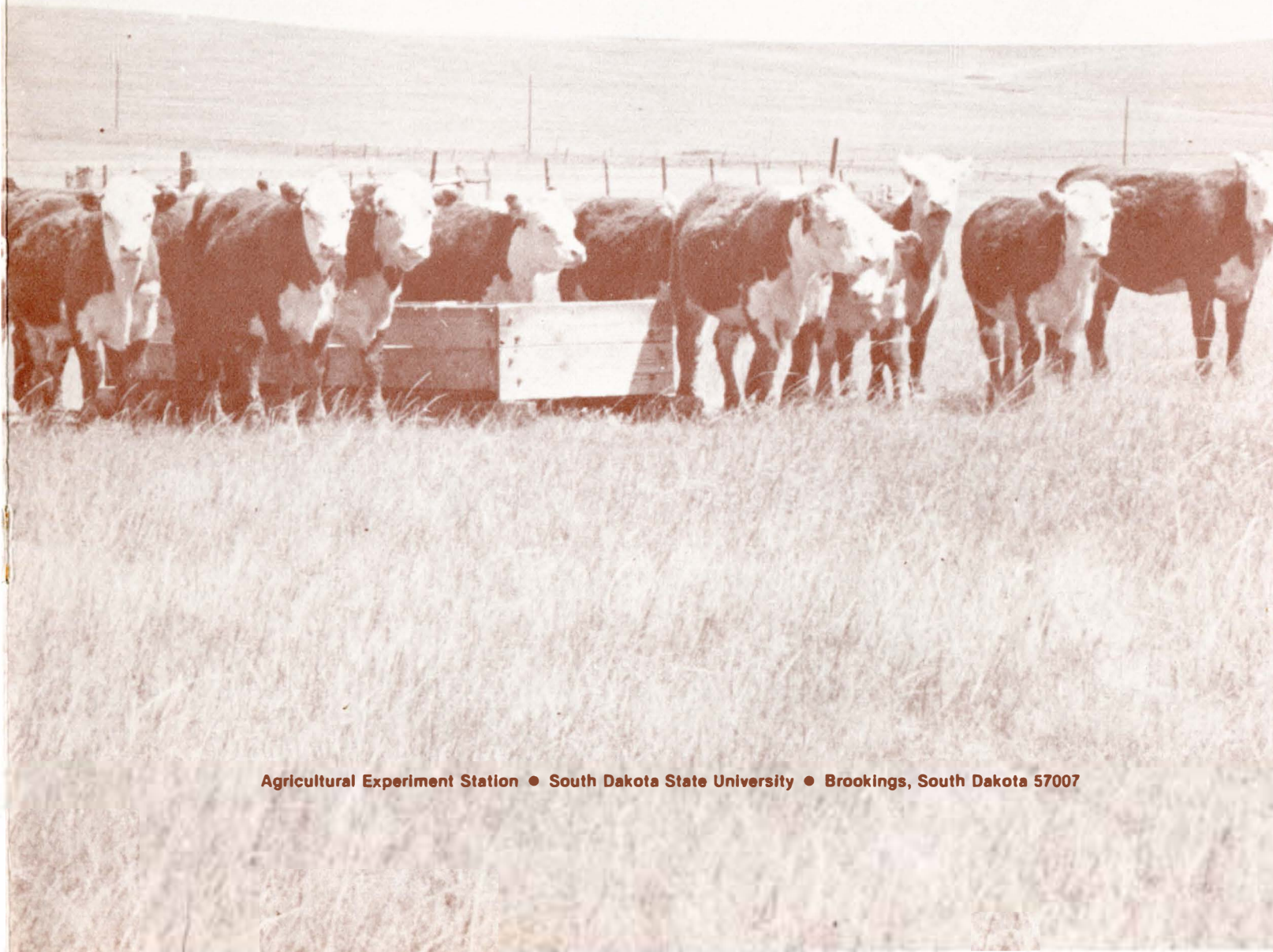
Follow this and additional works at: http://openprairie.sdstate.edu/agexperimentsta_circ

Recommended Citation

Jibben, D.H., "Ranch Management: Handling Drought" (1979). *Agricultural Experiment Station Circulars*. Paper 174.
http://openprairie.sdstate.edu/agexperimentsta_circ/174

This Circular is brought to you for free and open access by the SDSU Agricultural Experiment Station at Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange. It has been accepted for inclusion in Agricultural Experiment Station Circulars by an authorized administrator of Open PRAIRIE: Open Public Research Access Institutional Repository and Information Exchange. For more information, please contact michael.biondo@sdstate.edu.

Ranch Management: Handling Drought



Summary

Data on a hypothetical, but typical, ranch in north-central South Dakota and three different 10-year weather patterns were fed into a computer to find the best profit options a rancher can take during drought.

A diversified land use program with small grain and alfalfa combined with a diversified livestock program was more profitable over a 10-year period than a specialized program with pasture and beef production. This was true under all weather conditions.

Irrespective of the land use program, it was profitable to reduce or eliminate the beef cow herd during periods of drought. There must be favorable price relationships to pay the

above-normal forage costs to keep the cow herd through drought.

In years of normal rainfall, this beef cow herd was maintained between 175 and 200 head.

Supplementary hog activities were selected at their maximum allowable scale under all weather conditions. Greater amounts of capital borrowing were required to survive a drought when supplementary livestock activities were not permitted or when a specialized pasture production program was employed.

Following a 3-year drought it took 2-3 years to recover an annual cash balance which was greater than zero.

A drought of the severity assumed in this study (no crops or hay at all in the third year) resulted in \$67,346 less profit over a

10-year period for a diversified crop and livestock program compared to a similar period with no drought.

A polyperiod linear programming model was used to analyze the effect of the three management strategies: (1) a beef cow herd with crop and pasture production, (2) beef cows with crop and pasture production plus hogs and sheep as supplementary operations, and (3) beef cows with supplementary hog and sheep operations and all land in pasture production.

The three weather conditions were (1) a 10-year period with no drought, (2) a 10-year period with drought in the first 3 years, and (3) a 10-year period with drought in the fourth, fifth, and sixth years. Government assistance during drought was assumed to be available.

Ranch Management: Handling Drought

D.H. Jibben and H.R. Allen*

Drought is a natural condition in north-central South Dakota. Even in periods of adequate moisture, ranchers must plan their operations for the years of low rainfall combined with high temperatures and strong winds that are bound to come.

Having something like a 10-year management strategy to reduce the economic effects of a drought can mean the difference between survival and failure of the ranching operation. The major purpose of this study was to identify management strategies which maximize profits over a 10-year period of variable weather conditions.

Ranching operations

A 2,560-acre ranch was designed for the study, with 620 acres in cropland, 1,800 acres in pasture, and 140 acres in non-productive land.

Cropland could be planted to corn, oats, barley, alfalfa hay, wheat and/or rye. Feed crops could be bought or sold to meet the needs of the ranching operation. Cash crops (wheat and rye) could only be sold. Of the pasture land, 300 acres were designated as tame pasture. All other pasture land was native, to be grazed or harvested as prairie hay.

A beef cow herd was the principal livestock enterprise. Beef calves could be sold at 425

lb or wintered and sold at 600 lb. Steers could also be summer grazed and sold off grass weighing 825 lb. Cows could be bought or sold annually on a unit basis. A beef cow unit consisted of one cow, .04 of a bull, and .16 of a replacement cow or heifer.

A sow two-litter system, limited to 15 sows producing 240 pigs annually, was a supplementary activity. The pig crop could either be sold as feeder pigs or fattened and sold as 225-lb butchers. A ewe-lamb system producing a .120% lamb crop annually was another supplementary livestock activity. Lambs were fattened and sold in July.

Family labor was divided into six bi-monthly time periods of 1,000 hours each in every year. This labor was available to the ranching operation at no cost to the operator. No hired labor was allowed in this study.

Source of data and method

Data for calculating livestock costs and returns were obtained from previous research work at SDSU.¹ Information on farm prices came from the South Dakota Crop and Livestock Reporting Service and the USDA Market News publication. Productivity records for native, short-season, and full-season pasture programs came from research work at the Pasture Research Center near Norbeck. Crop yields are based on Faulk County yields as reported by the South Dakota Crop and Livestock Reporting Service.

All this data was fed into a computer using a polyperiod

linear programming technique. The management strategy which returned the greatest profits was considered the best strategy under the prescribed circumstances.

It was assumed that the ranch operator had perfect knowledge of all production costs, yields, and product prices.

The supplementary hog activities were limited to 15 sows producing 240 pigs annually because of space requirements. All buildings and facilities necessary for supplementary hog and sheep activities were available.

Government assistance during drought was assumed to be available and was incorporated into production data during drought periods. Additional pasture acreage was available at a cost of \$8.50 per AUM (animal unit month) during the third drought year to maintain the cow herd from the previous year. This may be viewed as the cost of obtaining additional forage in whatever manner it might be obtained. It may involve moving the cow herd to distant pastures, buying hay, or a variety of other possibilities.

Ranch profits were defined as total cash income from production activities less all production and fixed expenses. Fixed expenses included an annual allowance for living expenses* for the ranch family, an annual land payment of \$14,520, and other ranch

*David J. Jibben, formerly assistant in farm management research, is now with the South Dakota State Department of Agriculture. Herbert R. Allen is professor of economics.

*Adequate support of a farm family included living expenses of \$7,200 per year escalated at 6% per year over the 10-year period.

expenses for building depreciation, building and land taxes, building insurance, and repairs.

Cash flow restrictions required that annual ranch cash receipts equal or surpass annual cash disbursements. Capital borrowing was permitted to guarantee this cash flow requirement.

Equity capital at the beginning of the 10-year period was assumed to include a line of machinery to perform all crop and livestock activities selected in the first year of the 10-year period.

Basic strategies included (1) a beef cow enterprise with diversified crop production and native and tame pastures as the land use program, (2) a beef cow enterprise with supplementary hog and sheep enterprises, diversified crop production and native pasture, and (3) a diversified livestock program with all cropland devoted to pastures. Each of these strategies was tested under one no-drought and two drought situations.

Ranch organization under a no-drought situation

Actual 1966-1975 Faulk County, South Dakota, production data were used to simulate a 10-year no-drought weather condition.**

Results are summarized in Table 1. The 10-year average beef cow herd size with all land in pasture was 239 head. In the other two strategies with diversified land use the cow herd averaged 182 head over a 10-year period. In most years the heifer calves were wintered and sold. Steer calves were wintered and summer grazed. In a few instances both steers and heifers were sold as calves.

**For more details of this study see Jibben, David. Polyperiod analysis of profit maximizing strategies with beef cow herds under variable weather conditions in north central South Dakota. Unpublished M.S. thesis, SDSU, 1978.

Hog production was consistently maintained at the maximum allowable scale in all strategies. Hog production did not adversely affect the size of the cow herd. The advantages hogs offered were increased net profits, less capital borrowing, and fuller use of labor.

Sheep entered the plan in 2 years out of 10 when supplementary livestock activities were permitted. In the fifth year a supplementary sheep flock of 11 ewes was included. In the ninth year there was a sharp drop in beef prices, putting beef production in a relatively unfavorable position. Cows were

reduced from the previous year by 68 head. Ewes producing lambs that were fattened and sold in July became part of the most profitable plan in the ninth year.

Labor was not fully used except in the September-October time period of the third, fourth, and seventh years with the two strategies which included crop production. When crop production was not permitted the need for labor decreased during spring and fall months. With all strategies less than one full-time worker was required in at least three of the time periods of each year; in other words, in at least

Table 1. Summary of ranch organization under various management strategies with no-drought conditions.

	Beef cows with diversified land use				Diversified livestock and land use				Diversified livestock; all land in pasture			
	Yr	No	Yr	No	Yr	No	Yr	No	Yr	No	Yr	No
Beef cow herd	1	= 199	6	= 219	1	= 201	6	= 212	1	= 272	6	= 289
	2	= 199	7	= 196	2	= 200	7	= 188	2	= 268	7	= 249
	3	= 168	8	= 191	3	= 196	8	= 190	3	= 212	8	= 255
	4	= 172	9	= 129	4	= 164	9	= 122	4	= 223	9	= 162
	5	= 205	10	= 154	5	= 203	10	= 147	5	= 265	10	= 195
Calf program	In most years heifers were wintered; steers wintered and summer grazed.				In most years heifers were wintered; steers wintered and summer grazed.				In most years heifers were wintered; steers wintered and summer grazed.			
Hogs	None.				240 pigs were, farrowed, finished, and sold each year.				240 pigs were, farrowed, finished, and sold each year.			
Sheep	None.				11 ewes producing lambs kept in yr 5; 177 ewes kept in yr 9.				11 ewes producing lambs kept in yr 5; 177 ewes kept in yr 9.			
Pasture	All pasture (1,800 acres) was completely used each year.				All pasture (1,800 acres) was completely used each year.				All pasture (2,420 acres) was completely used each year.			
Crops	Small grains and alfalfa hay dominated the program.				Small grains and alfalfa hay dominated the program.				None.			
Capital borrowing	Required in yr 1, 2, 4, 5, 6. Peaked at \$24,943 in yr 5.				Required in yr 5 and 6. Peaked at \$10,456 in yr 6.				Required in yrs 1, 2, 5 and 6. Peaked at \$21,990 in yr 5.			
Labor used	Completely used in Sept-Oct of yrs 3, 4 and 7. Less than 500 hrs used bimonthly in 6 mo of each year.				Completely used in Sept-Oct of yrs 3, 4 and 7. Less than 500 hrs used bimonthly in 6 mo of each year.				Never used full amount available. Spring and fall were slack periods.			
Annual profits	Ranged from -\$10,519 in yr 4 to \$27,708 in yr 8. Total profit over 10 yrs was \$3,606.				Ranged from -\$3,052 in yr 4 to \$44,320 in yr 8. Total profit over 10 yrs was \$78,812.				Ranged from -\$17,424 in yr 9 to \$25,898 in yr 8. Total profit over 10 yrs was -\$9,217.			

6 months of the year only one full-time worker was required to do the work.

The strategy with diversified livestock and land use proved to be best for maximizing profits.

Ranch organization under an immediate drought situation

Ten years without drought in some form is not realistic in north-central South Dakota. Immediate adjustments can be made in ranch operations during drought, but they always should be made in terms of long-range goals.

The same three organizational strategies (beef cows with

Table 2. Yield pattern per acre for crop activities under immediate drought conditions.

Year	Corn bu	Oats bu	Barley bu	Al- falfa		Wheat bu	Rye bu
				Hay ton	Prairie ton		
1	25.0	30.0	25.0	1.0	.75	15.0	25.0
2	15.0	20.0	15.0	.5	.5	10.0	15.0
3	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Table 3. AUM production for three pasture systems under immediate drought conditions.

Native pasture			
Time period	Year 1	Year 2	Year 3
	AUM's		
April 16-May 15	.266	.177	0
May 16-July 15	.266	.177	0
July 16-Aug 31	.205	.137	0
Sept 1-Oct 31	.266	.186	0
Nov 1-April 15	.013		
Short-season tame pasture			
Time period	Year 1	Year 2	Year 3
	AUM's		
April 16-May 15			
May 16-July 15	.392	.300	0
July 16-Aug 31	.362	.271	0
Sept 1-Oct 31	.246	.179	0
Nov 1-April 15			
Full-season tame pasture			
Time period	Year 1	Year 2	Year 3
	AUM's		
April 16-May 15	.155	.093	.093
May 16-July 15	.393	.236	0
July 16-Aug 31	.303	.181	0
Sept 1-Oct 31	.399	.240	0
Nov 1-April 15			

diversified land use, diversified livestock and land use, and diversified livestock and all land in pasture) were tested over a 10-year period with drought occurring in the first 3 years of the period. Production data were adjusted to reflect this (tables 2 and 3).

Production costs for crop and pasture activities were also adjusted in the third drought year because of the lack of harvest operations.

Table 4 presents a summary of ranch organization under immediate drought conditions. The cow herd was severely reduced during the 3-year drought in all situations.

The only strategy which completely eliminated the cow herd in the drought period was the strategy with beef cows as the only livestock program. However, the diversified livestock programs reduced the cow herd to 31 head when crop production was involved and 56 head when all land was in pasture.

An important question at this point is whether or not it would be profitable to rent or buy forage to maintain the beef cow herd.

Through the use of parametric programming, the cost of pasture in the third year of drought was allowed to rise until the most

Table 4. Summary of ranch organization under various management strategies with immediate drought conditions.

	Beef cows with diversified land use	Diversified livestock and land use	Diversified livestock; all land in pasture
Beef cow herd	Yr 1 = 160 head Yr 2 = 112 head Yr 3 = 0 head Yr 4 = 172 head Yrs 5-10: Range = 129-219 head Average = 182 head	Yr 1 = 161 head Yr 2 = 112 head Yr 3 = 31 head Yr 4 = 164 head Yrs 5-10: Range = 121-212 head Average = 177 head	Yr 1 = 218 head Yr 2 = 149 head Yr 3 = 56 head Yr 4 = 223 head Yrs 5-10: Range = 162-289 head Average = 236 head
Calf program	In most years heifers were wintered; steers wintered and summer grazed.	In most years heifers were wintered; steers wintered and summer grazed.	In most years heifers were wintered; steers wintered and summer grazed.
Hogs	None.	240 pigs were farrowed, finished, and sold each year.	240 pigs were farrowed, finished, and sold each year.
Sheep	None.	11 ewes producing lambs kept in yr 5 177 ewes kept in yr 9.	11 ewes producing lambs kept in yr 5. 177 ewes kept in yr 9.
Pasture	All pasture (1,800 acres) was completely used yrs 1, 2, 4-10.	All pasture (1,800 acres) used in yrs 1, 2, 4-10. In yr 3, 310 acres rented.	All pasture (2,420 acres) used in yrs 1, 2, 4-10. In yr 3, 551 acres rented.
Crops	Small grains and alfalfa hay dominated.	Small grains and alfalfa hay dominated.	None.
Capital borrowing	Required in yrs 1-6. Peaked at \$77,380 in yr 5.	Required in yrs 1-6. Peaked at \$56,132 in yr 5.	Required in yrs 1, 2, 4-6. Peaked at \$70,435 in yr 5.
Labor use	Completely used in Sept-Oct of yrs 4 and 7. Less than 500 hrs used bimonthly in 6 mo of each year.	Completely used in Sept-Oct of yrs 4 and 7. Less than 500 hrs used bimonthly in 6 mo of each year.	Never used full amount available. Spring and fall were slack periods.
Annual profits	Ranged from -\$34,859 in yr 3 to \$27,708 in yr 8. Total profit over 10 yrs was -\$71,253.	Ranged from -\$30,606 in yr 3 to \$44,320 in yr 8. Total profit over 10 yrs was -\$8,881.	Ranged from -\$26,718 in yr. 3 to \$25,898 in yr 8. Total profit over 10 yrs was -\$48,840.

profitable plan no longer included the beef cow herd. When total annual forage costs (hay plus pasture) reached \$103.60, the cow herd began to be reduced in size. It was further reduced in size as forage costs increased until they reached an annual total cost of \$121.60.

This figure represents a 17% rise in total forage cost per cow unit. At this level the cow herd was eliminated from the most profitable plan. These costs result when hay is \$23 per ton and pasture costs move from \$7.75 per AUM to \$10 per AUM. The price of 425-lb steers was \$32 per cwt.

Of course, many factors will influence the decision to eliminate or maintain the beef cow herd. Higher and more favorable price relationships than those assumed in the preceding analysis will bring different results. When hay was at \$21.60 per ton and 425-lb steers were at \$39.50 per cwt, the pasture rental rate rose to \$14.50 per AUM before beef cows were eliminated from the most profitable plan. At this price level total forage costs amounted to \$154.90. This represented a 45% rise in forage cost. Individual operators also may be willing to accept higher costs to keep valuable breeding stock. However, this analysis indicated that favorable cost-price relationships must exist to pay the above-average forage costs to maintain a cow herd during periods of severe drought.

The calf backgrounding activities, the hog activities, and the sheep activities entered the optimum plan in a way very similar to the no-drought situation. In most years the heifers were wintered and sold with the steers wintered and summer grazed. In some years the heifers were sold in the fall weighing 375 lb, rather than wintered. Hogs entered every plan to the maximum of 15 sows and 240 butcher hogs. Eleven ewes with fat lambs sold in July entered the most profitable plan

in year 5. In year 9 177 ewes were kept.

Small grain and alfalfa dominated the cropping program. This included rye, wheat and oats. Corn was included in one or two years in some of the strategies.

Ranch organization under a future drought situation

The most effective way of dealing with drought is to plan for it during periods of adequate moisture.

A linear programming model simulating an expected future drought situation provided a 3-year planning period before

the beginning of the drought. Production data for 1966-1975 were adjusted to reflect drought in the fourth, fifth and sixth years of a 10-year period. Crop and pasture yields were reduced during these years in the same manner as indicated in Tables 2 and 3. Production costs during the sixth year were also reduced because of lack of harvest operations.

The beef cow herd, while reduced during the 3-year drought, was maintained at 111 head during the worst year of the drought. In most other respects the high profit enterprise combination was similar to that under an immediate drought situation.

Table 5. Summary of ranch organization under various management strategies with future drought conditions.

	Beef cows with diversified land use	Diversified livestock and land use	Diversified livestock; all land in pasture
Beef cow herd	Yr 1-2 = 198-199 head Yr 3 = 168 head Yr 5-6 = 114 head Yr 7-10 = 129-195 head	Yr 1-3 = 195-200 head Yr 4 = 162 head Yr 5-6 = 111 head Yr 7-10 = 121-189 head	Yr 1-5 = 149-271 head Yr 6 = 154 head Yr 7-10 = 161-255 head
Calf program	In most years heifers were wintered and sold; steers wintered and summer grazed.	In most years heifers were wintered and sold; steers wintered and summer grazed.	In most years heifers were wintered and sold; steers wintered and summer grazed.
Hogs	None.	240 pigs were farrowed, finished, and sold each year	240 pigs were farrowed, finished, and sold each year.
Sheep	None	177 ewes producing lambs were kept in yr 9.	177 ewes producing lambs were kept in yr 9.
Pasture	All pasture (1,800 acres) used in yrs 1-5, 7-10. Rented 1,201 acres in yr 6.	All pasture (1,800 acres) was used in yrs 1-5, 7-10. Rented 1,174 acres in yr 6.	All pasture (2,420 acres) was used in 1-5, 7-10. Rented 1,581 acres in yr 6.
Crops	Small grains and alfalfa hay dominated.	Small grains and alfalfa hay dominated.	None.
Borrowed capital	Required in yrs 1, 2, 4-7. Peaked at \$50,118 in yr 7.	Required in yrs 5, 6 and 7. Peaked at \$40,226 in yr 7.	Required in yrs 1, 2, 5-7. Peaked at \$51,216 in yr 7.
Labor used	Completely used in Sept-Oct of yr 1, 3, and 7. Less than 500 hrs used bimonthly in 6 mo each year.	Completely used in Sept-Oct of yr 3 and 7. Less than 500 hrs used bimonthly in 6 mo each year.	Never used full amount available. Spring and fall were slack periods.
Annual profits	Ranged from -\$38,109 in yr 6 to \$27,708 in yr 8. Total profit over 10 yrs was -\$65,647.	Ranged from -\$34,229 in yr 6 to \$44,320 in yr 8. Total profit over 10 yrs was \$11,466.	Ranged from -\$28,708 in yr 6 to \$25,898 in yr 8. Total profit over 10 yrs was -\$57,384.

Table 5 presents a summary of ranch organization under three different strategies. Hogs entered the program at a maximum level in all instances. Sheep came into the plan in the ninth year only. Small grain and alfalfa hay dominated the land use program.

The diversified crop and livestock strategy was the only strategy which provided a positive net profit over the 10-year period.

Analysis and conclusions

Diversified livestock and land use was the best strategy for maximizing profit under all conditions tested.

Total profit over a 10-year period for different management strategies are given in Table 6. Ranch profit is defined as total cash income from production activities less all production and fixed expenses. Fixed expenses included an annual allowance for living expenses and an annual land payment of \$14,520.

Table 6. Total profits over a 10-year period for different management strategies under three planning situations.

Planning situation	Management Strategies		
	Beef cows with diversified land use	Diversified livestock and land use	Diversified livestock; all land in pasture
No drought	\$ 3,606.22	\$78,812.68	-\$9,217.21
Immediate drought	-71,253.11	8,881.22	-48,840.60
Future drought	-65,647.58	11,466.53	-57,384.89

Under future drought conditions the profit for a diversified crop and livestock program totaled \$11,466.53 over a 10-year period. This compares to \$78,812.68 under a no-drought situation. The difference in profit amounts to \$67,346.15. Drought effects on profit were severe under all strategies tested.

Diversified livestock production resulted in greater profit when combined with crop

production rather than with all land in pasture. The additional acres of pasture, while permitting a larger cow herd, could not replace the loss of income from 620 acres of cropland.

Capital borrowing was used to meet the cash flow requirements for all fixed and variable expenses. The necessity for capital borrowing was an indicator of the length of the drought recovery period. It required 2-3 years following a drought to recover an annual cash flow sufficient to meet cash flow expenses.

When drought occurred in the middle years of a 10-year period, cash flow accumulations reduced the necessity of capital borrowing both before and during the drought. This indicates that a ranch operation should be planned with the expectation of drought. Although you cannot know when a drought will occur, you can expect it sometime. Planning for additional cash flow when needed and building up reserves of capital are important to the survival of the ranch.

A major conclusion of this study was that a diversified livestock and land use program helped maintain cash flow, lowered capital borrowing, and increased annual profits during a drought.

Under favorable price relationships it may be profitable to pay above average forage costs to maintain the cow herd through a drought. Data in this study indicated that a rise in forage costs between 17 and 45% was required before beef cows were eliminated from the most profitable plan. The higher forage costs may be sustained when beef prices rise relative to forage costs.

There are other realistic strategies for survival that have not been discussed. These include taking an off-farm job (full-time or part-time), spouse working off the farm, or beginning or expanding some business or service.

References

1. Allen, H.R., and D. Jibben. 1977. Budgets for major livestock enterprises in South Dakota. Brookings: SD AES Circ 220
2. Beneke, R.R., and R. Winterboer. 1973. Linear programming applications to agriculture. Ames, IA: Iowa State University Press.
3. Boykin, C.C. 1964. Cattle ranch adjustments to drought in the southern plains, report no 2. Texas AES and USDA.
4. _____, J.R. Gray, and D.D. Caton. 1962. Ranch production adjustments to drought in eastern New Mexico. New Mexico AES and USDA. Bul 470.
5. Derscheid, L.A., W.C. Aanderud, and H.R. Allen. 1976. Market prices for net profit. Brookings: SD CES EMC 723.
6. Helmers, G.A., and C.W. Lentz. 1973. Polyperiod analysis of investment strategy for Nebraska grain-livestock farms. Lincoln, NB AES Res Bul 257
7. Loftsgard, L.D., and E.O. Heady. Application of dynamic linear programming models for optimum farm and home plans. J of Farm Econ 41 51-62