AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Agricultural Economics Report No. 129 May, 1978

Credit Availability For Potential Irrigators In North Dakota

by

Jerry I. Anheluk, Roger G. Johnson, and Fred R. Taylor

Department of Agricultural Economics
North Dakota Agricultural Experiment Station
North Dakota State University
Fargo, North Dakota

FOREWORD

The authors express their sincere appreciation to the agricultural lenders and irrigation equipment dealers for their cooperation in providing information for this study. It is hoped that the study will offer a broader knowledge of capital requirements for sprinkler irrigation installation and irrigated production to farmers and lenders. The lender evaluation is intended to inform agricultural credit suppliers of various local and regional practices currently used in integrating sprinkler irrigation into a dryland farm. It is hoped that through this work increased cooperative efforts between the various financial sources will provide for a more efficient transfer of risk capital to young, low equity farmers with potential for irrigation development. The study was funded by North Dakota Agricultural Experiment Station Project H-03-36, Credit Problems of North Dakota Agriculture.

Highlights

Thirty-five credit institutions in the Oakes-LaMoure area and 20 credit institutions in the Middle Souris-Karlsruhe area evaluated irrigation loan requests for three age groups of farmers. Personal and financial situations of farmers from the two areas were developed for each age group. A balance sheet, income statement, and a cash flow statement accompanied each profile.

An electric drive center pivot irrigation system was budgeted for corn production in the Oakes-LaMoure area. Initial investment requirements for the irrigation system were $49,915. Additional labor and operating capital requirements for irrigation were added to the initial investment requirements for a total loan request of $63,042.

A hydraulic water driven center pivot irrigation system was budgeted for production of alfalfa hay in the Middle Souris-Karlsruhe area. Initial investment requirements were $41,584. Additional production and labor requirements for irrigation brought the total loan request to $49,616.

Evaluation of the under age 35 profile in the Oakes-LaMoure area by nongovernmental credit agencies with adequate loan limits indicated that only 30 percent directly approved the loan request. All of the eligible nongovernmental institutions approved the same loan request for the 35-44 age Oakes-LaMoure farmer profile. Eighty-one percent of the institutions approved the credit request for the oldest Oakes-LaMoure farmer profile.

Only 6 percent (one commercial bank) of the nongovernmental credit agencies in the Middle Souris-Karlsruhe area with adequate loan limits approved the loan request for the under age 35 area profile. The identical loan request received 100 percent loan approval for the 35-44 age profile. Only 20 percent of the institutions approved the loan for the 45-54 age profile.

Security and adequate dryland income were factors emphasized by the nongovernmental institutions in loan approval/disapproval. In both areas the Farmers Home Administration approved the irrigation loan request for the under age 35 farmer profile.

Three lease companies also evaluated the profiles. The lease companies emphasized sufficient equity and proven financial progress as important factors in making a lease decision.

Results of this study point to a need for modification of current lending practices if private or cooperative credit agencies are to provide capital for irrigation by young, low equity farmers.

CREDIT AVAILABILITY FOR POTENTIAL IRRIGATORS IN NORTH DAKOTA

by
Jerry I. Anheluk, Roger G. Johnson, and Fred R. Taylor*

The availability of water from groundwater reserves or the development of the Garrison Diversion Project will change the composition of many North Dakota farms. Many farmers in the near future will not be operating just a dryland farm, but an integrated farm of dryland and irrigated acres.

The increase in total irrigated acres in North Dakota from 1974 to 1976 is shown in Table 1. Sprinkler irrigation more than doubled between 1974 and 1976 and now exceeds the acreage of gravity type irrigation. The most popular type of sprinkler irrigator is the center pivot system. Its popularity stems from the small amount of labor needed to operate the system. However, the capital requirements of a center pivot irrigation system are high.

TABLE 1. TOTAL IRRIGATED ACRES IN NORTH DAKOTA, 1974 TO 1976

Year	Total Irrigated Acres	Sprinkler Irrigated Acres	Gravity Irrigated Acres
1974	73,536	29,633	43,903
1975	91,910	48,589	43,321
1976	114,998	69,632	45,366
1977	136,811	87,744	49,067

SOURCE: Lundstrom, Darnell, "North Dakota Irrigation Acreage Survey, 1974-1977," Agricultural Engineering, Cooperative Extension Service, North Dakota State University, Fargo.

The potential irrigator is concerned with capital sources and availability to initiate or expand irrigation projects. Because irrigation is new to most farmers, the needed credit will be considered risk capital by lenders. The allocation of risk capital to potential irrigators introduces a problem of source, rate, and supply of capital in local irrigation areas.

---

*The authors are, respectively, former graduate assistant, professor, and professor and chairman, Department of Agricultural Economics.

The objective of this study was to analyze irrigation financing and credit availability for center pivot sprinkler irrigation by potential irrigators in North Dakota. The specific objectives were:

1. To assess the current investment requirements and annual production costs for center pivot irrigation of corn grain and alfalfa hay.
2. To establish the availability of credit from various financial sources for potential irrigator profiles.

Method and Scope of Study

Investment requirements for center pivot irrigation development were determined from dealer estimates of equipment costs. The requirements assumed that a surface water source for irrigation was available from a canal or lateral works adjacent to a quarter section of irrigable land. Irrigation fixed costs and annual operating costs for various water level applications were established. These data, plus 1977 crop production costs, were used in a budget analysis to establish total production costs. The difference between dryland and irrigated production costs was used as an additional operating capital requirement. Financing needs were developed assuming all additional capital was borrowed. The total loan request includes initial investment in irrigation equipment and additional annual operating capital needed for irrigation production.

Representative farm situations were developed. The profiles contained biographical and financial information of farmers in three age groups: under age 35, age 35 to 44, and from age 45 to 54. Financial information was developed from group averages taken from a study of area farmers who planned to irrigate.[1] The averages were indexed to represent financial profiles as of January 1, 1977.

The updated profiles were associated with enterprises usually selected by area farmers to utilize irrigable lands. A personal survey was conducted during July and August of 1977 where local credit agencies evaluated respective area profiles for an irrigation credit request.

The Oakes-LaMoure and Middle Souris-Karlsruhe areas of the Garrison Conservancy District were chosen as the study areas. The geographical area of the financial offices surveyed is shown in Figure 1. The distribution of financial offices for each study area is shown in Table 2.

---

[1]Gullickson, Mark E., Potential Irrigator Profiles in North Dakota, unpublished M.S. thesis, Department of Agricultural Economics, North Dakota State University, Fargo, 1974.

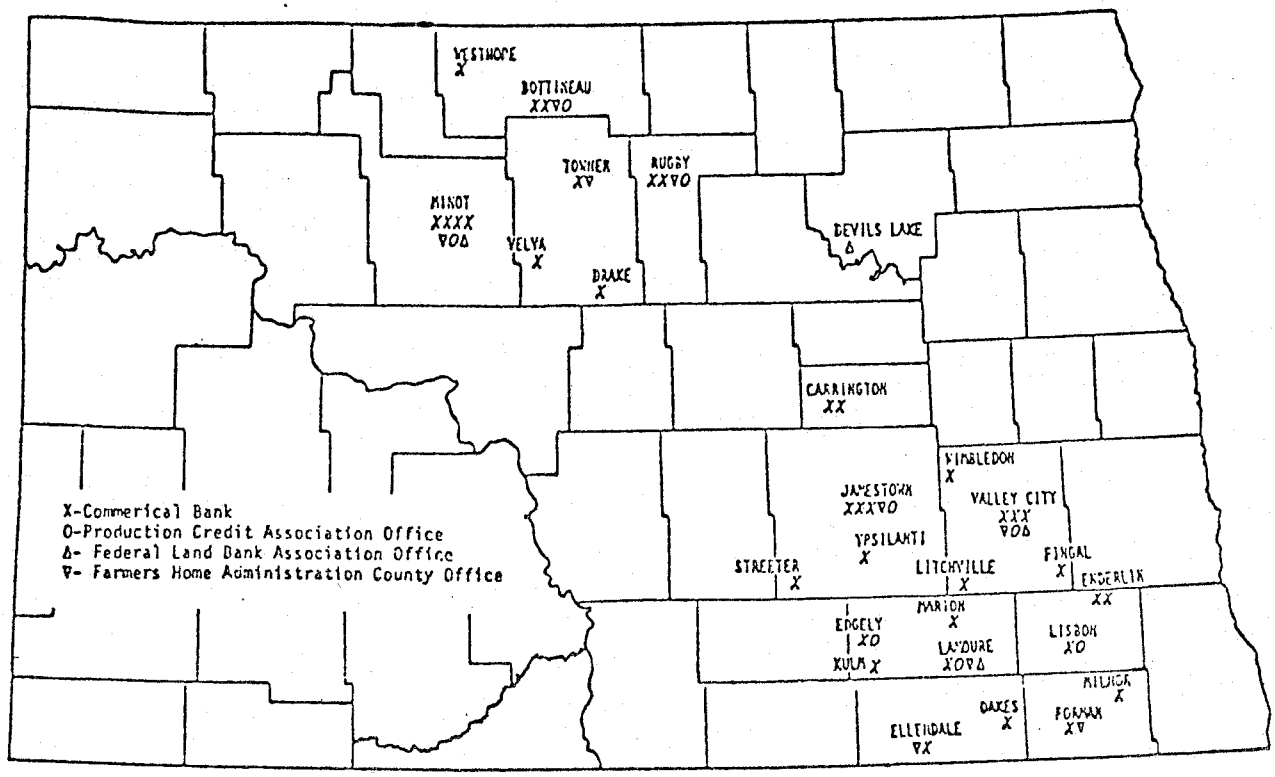

Figure 1. Location of Lending Offices Serving The Study Areas

TABLE 2. FINANCIAL OFFICES BY STUDY AREA, IRRIGATION CREDIT STUDY, 1977

Offices	Oakes-LaMoure	Middle Souris-Karlsruhe	Total
Production Credit Association	5	3	8
Federal Land Bank Association	2	2	4
Farmers Home Administration	5	4	9
Commercial Bank	24	12	36
Totals	36	21	57

The coincidental location of irrigable soils and availability of suitable groundwater supplies has resulted in a major expansion of irrigation development in parts of the Oakes-LaMoure area. The Middle Souris-Karlsruhe area has not experienced the amount of private irrigation development occurring in the Oakes-LaMoure area.

The Oakes-LaMoure has financial institutions located in Stutsman, Barnes, LaMoure, Ransom, Dickey, and Sargent counties. Two commercial banks in Carrington were included in this area. One commercial bank was not surveyed because the bank at the time of the survey was moving into a new building and an interview date could not be scheduled. Commercial banks accounted for two-thirds of the credit agencies surveyed. For the Production Credit Association and Farmers Home Administration, each branch office or county office is counted as one institution.

Credit agencies contacted in the Middle Souris-Karlsruhe area were in Ward, McHenry, Pierce, and Bottineau counties. A Federal Land Bank Association office at Devils Lake was included in this area. One Production Credit Association branch office was not contacted because an appointment for the interview date could not be established during the study period. Commercial banks accounted for three-fourths of the observations. of private, cooperative, and federal institutions was similar among areas.

Leasing companies and irrigation equipment dealers were also contracted. They were contacted by telephone for information regarding leasing trends. Most evaluation of lease financing for irrigation equipment is done out of North Dakota. For this reason, the number of observations was small. Only one lease officer and two irrigation dealers were personally surveyed to evaluate the profiles and prequalify them for lease financing.

Cost Analysis and Loan Request

Two basic types of center pivot systems were analyzed. Gullickson[2] reported that irrigators in the Oakes-LaMoure area intended to use irrigable lands primarily for the production of tame hay and corn grain. A majority of responses from the potential irrigators in the Middle Souris-Karlsruhe area favored production of tame hay on the developed irrigable acres. An electric drive self-propelled sprinkler system was budgeted for corn grain production. The flexibility to irrigate several the reason for selecting this system in the more intensively farmed Oakes-LaMoure area. The hydraulic water-driven pivot system was budgeted for the production of alfalfa hay in the Middle Souris-Karlsruhe area. The more northern location of this area allows for fewer crop alternatives under irrigation.

---

[2] Ibid.

Both the electrical and hydraulic systems will irrigate approximately 135 acres out of a 160-acre quarter section. The central pivoting nature of the distribution unit usually does not provide coverage of corners in a square field as illustrated in Figure 2. The number of acres irrigated in the square quarter section may be increased depending on the numerous end adapters and cornering devices that any particular system may have. The quoted acres that can be irrigated are approximate coverages given by various equipment dealers. The number may be more or less depending on the particular system and its optional end and cornering devices.

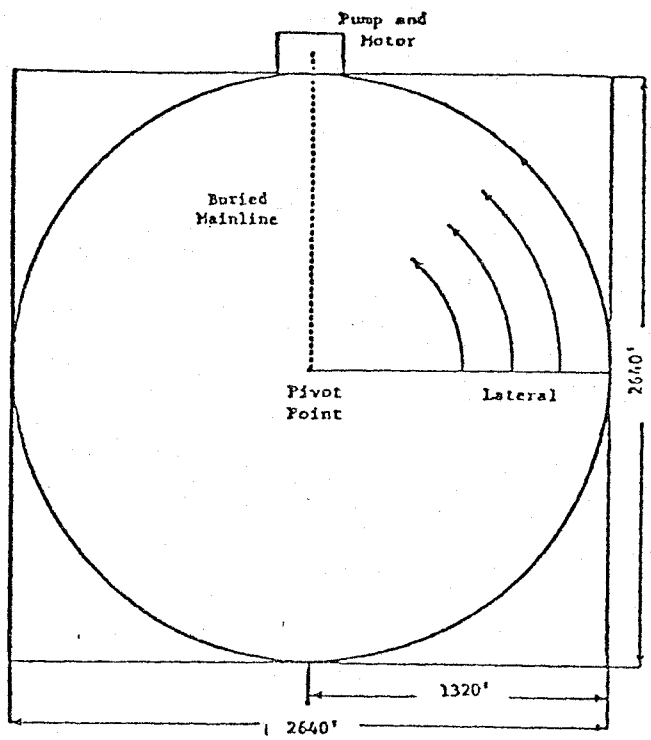

Figure 2. One Sprinkler Unit on One Quarter Section

Investment Requirements

The initial investment needed to irrigate 135 acres of land assumed that a canal or river was adjacent to the land to provide for the water source.[3] The initial investment costs for irrigation equipment include the

---

[3]According to Darnell Lundstrom, Extension Agricultural Engineer, North Dakota State University, development of a 100-foot well would increase initial investment approximately $10,000. Increased pump and engine capacity are needed and would cost an additional $4,000. Consideration must also be given to the amount of mainline needed with well irrigation. However, the annual water charge levied by the Garrison Diversion Conservancy District would not be included in the production costs using a private well.

distribution unit, pump, motor, pipe for mainline, and land leveling. Equipment costs for the two center pivot systems were based on quotations received directly from North Dakota irrigation dealers. Estimates of initial investment requirements were developed from their recommendations. The cost estimates were verified with agricultural engineers at North Dakota State University.

The cost estimates are presented in Tables 3 and 4 for the hydraulic and electric systems, respectively. The costs are not presented in detail because of the variability in the degree of sophistication that is possible for each individual irrigation set-up.

TABLE 3. INVESTMENT REQUIREMENTS FOR SELF-PROPELLED HYDRAULICALLY POWERED CIRCULAR SPRINKLERS, 135 ACRES IRRIGATED, 1977

Item	Approximate Cost
Sprinkler unit	
Eleven tower--1,291 feet lateral	$22,900
Freight	750
Installation	2,200
Pivot pad	350
Pump and motor	
Centrifugal pump (950 GPM) and 75 HP motor	6,000
Pump panel and wiring	1,500
Mainline (buried)	
1,320 feet--8" PVC, 160 p.s.i.	6,000
Miscellaneous items	1,000
Land leveling	---
Sales tax--3% on mainline, 2% on the rest	884
TOTAL INVESTMENT[a]	$41,584
Investment per acre	$ 308

[a]Estimated costs obtained from two dealers for "package" installation.

TABLE 4. INVESTMENT REQUIREMENTS FOR SELF-PROPELLED ELECTRICALLY POWERED CIRCULAR SPRINKLERS, 135 ACRES IRRIGATED, 1977

Item	Approximate Cost
Sprinkler unit	
Seven tower--1,289 feet lateral	$29,750
Freight	750
Installation	2,200
Pivot pad	350
Pump and motor	
Centrifugal pump (950 GPM) and 75 HP motor	6,000
Pump panel and wiring	2,000
Mainline (buried)	
1,320 feet--8" PVC, 160 p.s.i.	6,000
Miscellaneous items	1,000
Electric cable	
1,350 feet--three phase service	810
Land leveling	---
Sales tax--3% on mainline and cable, 2% on the rest	1,055
TOTAL INVESTMENT[a]	$49,915
Investment per acre	$ 370

[a]Estimated costs obtained from two dealers for "package" installation.

The total investment for the hydraulic system was calculated at $41,584. The electric system was estimated at $49,915. A breakdown of the initial investment requirements for each irrigation system is given in Tables 3 and 4. The increased investment for the electric system is due to a more expensive sprinkler unit and extra electric cable needed to power the unit. The investment per acre for the hydraulic and electric system is $308 and $370, respectively.

Annual Fixed Cost for Center Pivot Irrigation

The cost analysis for center pivot irrigation was divided into two parts--fixed costs and variable costs. Fixed costs are the costs associated with the ownership of machinery and equipment which occur regardless of the amount of use. Fixed costs per unit will decrease as these costs are spread

out over more units of output. The largest ownership or fixed costs were depreciation and interest on investments as shown in Table 5.

TABLE 5. ANNUAL FIXED COSTS FOR CIRCULAR SELF-PROPELLED SPRINKLER SYSTEMS, 135 ACRES IRRIGATED, 1977

Item	Approximate Cost
HYDRAULIC SYSTEM	
Depreciation	
Entire unit minus mainline cost (15-year life and 10 percent salvage)[a]	$2,062
Mainline (20-year life, no salvage)	360
Interest @ 9.5 percent	2,138
Insurance[b]	203
Total fixed costs	$4,763
Fixed costs per acre	$ 35.28
ELECTRICAL SYSTEM	
Depreciation	
Entire unit minus mainline and buried electrical cable (15-year life and 10 percent salvage)[a]	$2,512
Mainline and electrical cable (20-year life, no salvage)	402
Interest @ 9.5 percent	2,570
Insurance[b]	203
Total fixed costs	$5,687
Fixed costs per acre	$ 42.12

[a]A well source of water may shorten depreciation schedules because sand and water depths increase machine wear and stress.
[b]The insurance cost of $1.50 per irrigable acre may vary depending on the farm insurance policy and the insurance company the farmer decides to use.

Depreciation was calculated by the straight line method allowing 10 percent for salvage value on all items, except the mainline pipe and buried electric cable. The entire unit, less the buried mainline pipe and electric cable, were depreciated over 15 years. The mainline pipe and buried electric cable (for the electric drive system) were depreciated over 20 years with no salvage value. These estimates of useful life were based on opinions of irrigation dealers and agricultural engineers at North Dakota State University. Individual cases might reflect longer or shorter lives resulting in lower or higher annual costs.

Taxes were not charged on the equipment in this study because state laws of North Dakota do not require farm machinery to be assessed and taxed yearly. The sales tax paid by the farmer at the time of purcahse is included in the purchase price of the equipment.

Annual Operating Cost for Center Pivot Irrigation

Cost items that vary with amount of use were grouped into five categories: repair and maintenance, fuel, irrigation water, wages, and interest on operating capital. The cost items for operating the electrical and the hydraulic center pivot irrigation systems at the Oakes-LaMoure and the Middle Souris-Karlsruhe areas, respectively, are given in Tables 6 and 7. These cost items are summed to give the total annual operating cost for each irrigation system.

Repair and maintenance on irrigation equipment was computed at an annual rate of 1.5 percent times the initial cost of the irrigation equipment.

Propane, diesel, gas, or electricity may be used to power a center pivot sprinkler system. The model assumed electrical power for the irrigation systems. The power rate used is 2¢/KWH + $12.50/HP.[4] The actual power cost is computed as follows:

Power Cost = (#HR times $12.50/HP) + (75KW/Hr) ($.02/KWH)

Both the hydraulic and electric center pivot systems used a 75 HP engine. Since alfalfa hay was produced with the hydraulic system, 1,200 hours of pumping time per year were calculated to give coverage of 16 net inches of

---

[4]Interview with Darnell Lundstrom, Extension Agricultural Engineer, North Dakota State University, Fargo, June, 1977.

TABLE 6. ESTIMATED ANNUAL OPERATING COSTS FOR ELECTRICALLY POWERED, SELF-PROPELLED SPRINKLER SYSTEM FOR CORN IN OAKES-LAMOURE AREA, 135 ACRES IRRIGATED, 1977

Item	Costs
Maintenance: .015 times initial investment	$ 748.70
Electricity: (rate) 2¢/KWH + $12.50/HP	
75 HP motor	937.50
900 hours pumping time per year (adequate for 12 net inches of water)	1,350.00
Irrigation water: (allows 24 acre inches of water to be used)	
Construction repayment cost, $1.26/acre	a
Operation and maintenance cost, $8.15/acre	1,100.25
Labor: (general operation and maintenance) .75 hour/acre times wage rate of $3/hour	303.75
Interest on operating capital: 9.5 percent for six months	210.90
Total cost	$4,651.10
Total operating cost per acre of irrigation	$ 34.45

[a]Construction repayment cost, $1.26 per acre, will be charged by the Garrison Conservancy District after 10 years of irrigation.

water.[5] The corn grain production with the electrical irrigation system required a net application of 12 inches of water. This application would require approximately 900 hours of pumping time per year.[6]

[5]Lundstrom, Darnell, "Exercise in Irrigation Crop Selection," Irrigation Handbook, Cooperative Extension Service, North Dakota State University, Fargo, November, 1977, Section 17.

[6]Ibid.

TABLE 7. ESTIMATED ANNUAL OPERATING COST FOR HYDRAULICALLY POWERED, SELF-PROPELLED SPRINKLER SYSTEM FOR ALFALFA IN MIDDLE SOURIS-KARLSRUHE AREA, 135 ACRES IRRIGATED, 1977

Item	Costs
Maintenance: .015 times initial investment	$ 623.75
Electricity: (rate) 2¢/KWH + $12.50/HP	
75 HP motor	937.50
1,200 hours pumping time per year (adequate for 16 net inches of water)	1,800.00
Irrigation water: (allows 24 acre inches of water to be used)	
Construction repayment cost, $1.40/acre	a
Operation and maintenance cost, $6.85/acre	924.75
Labor: (general operation and maintenance) .75 hour/acre times wage rate of $3/hour	303.75
Interest on operating capital: 9.5 percent for 6 months	218.00
Total cost	$4,807.75
Total operating cost per acre of irrigation	$ 35.61

[a]Construction repayment cost, $1.40 per acre, will be charged by the Garrison Conservancy District after 10 years of irrigation.

The cost of water used for irrigating varied by area. The Bureau of Reclamation calculates the water charges based upon their cost estimates. The charge for water for the first 10 years of irrigation is called "operation and maintenance cost." After 10 years of irrigation, the farmer would face an additional charge called the "construction repayment cost." The operation and maintenance cost for the Oakes-LaMoure area and Middle Souris-Karlsruhe area is $8.15 per acre and $6.85 per acre, respectively.[7] These costs may vary from one year to the next.

The labor requirements for general operation and maintenance were calculated at .75 hour per acre.[8] A wage rate of $3 per hour was used.

Farms usually require large amounts of capital to meet expenses during the time lag from initial production and product sales. Such funds involve a cost charged at the prevailing interest rate on short-term credit. A rate of 9.5 percent was assumed to be representative of short-term interest rates. Capital was considered to be used for approximately six months.

The annual operating cost of the electrical center pivot system for the production of corn grain in the Oakes-LaMoure area was $34.45 per acre. Operating cost was $35.61 per acre for producing alfalfa hay using the hydraulic center pivot system in the Middle Souris-Karlsruhe area.

Enterprise Budget Analysis

Costs and returns to produce corn grain and alfalfa hay were budgeted. Budgets given in Tables 8 through 11 show the per acre production costs for each crop enterprise on dryland and under sprinkler irrigation. The budgets provide estimates of expected costs and returns for both dryland and sprinkler irrigation production with above average management.

The expected corn grain yield for dryland is 50 bushels per acre and with irrigation 120 bushels per acre in the Oakes-LaMoure area. The expected annual yield of alfalfa in the Middle Souris-Karlsruhe area for dryland is two tons per acre, and with sprinkler irrigation the yield is five tons per acre.

---

[7] Interview with Homer M. Engelhorn, Manager, Garrison Diversion Conservancy District, Carrington, North Dakota, June, 1977.

[8] Interview with Darnell Lundstrom, op. cit.

TABLE 8. BUDGET FOR DRYLAND CORN GRAIN, OPTIMUM MANAGEMENT, OAKES-LAMOURE AREA, ANNUAL PER ACRE BASIS, 1977

Category	Units	Price	Quantity	Value
Production:				
Corn receipts	bu.	$2.35	50.00	$117.50
Operating inputs:				
Corn seed	lbs.	0.56	13.50	7.56
Nitrogen	lbs.	0.17	35.00	5.95
Phosphate	lbs.	0.14	35.00	4.90
Rootworm control	lbs.	0.60	0.75	0.45
Herbicide	lbs.	2.95	2.50	7.37
Corn drying	bu.	0.13	50.00	6.50
Fertilizer spreader	dol.	1.15	1.00	1.15
Machinery fuel, lube, and repair cost	acre			11.90
Total operating cost				$ 45.78
Returns to land, labor, capital, machinery, overhead, risk, and management				$ 71.71
Labor cost	hr.	3.00	1.99	5.98
Capital cost:				
Annual operation capital		0.095	21.15	2.01
Machinery investment		0.095	67.24	6.39
Total interest charge				$ 8.40
Returns to land, machinery, overhead, risk, and management				$ 57.34
Machinery ownership cost (depreciation, taxes, insurance)				8.79
Returns to land, overhead, risk, and management				$ 48.55

Field Practices: Shred stalks, October or November; plow-pack, April; pre-plant herbicide, April 25-May 15; plant, May 1-15; Harvest (combine), October 1-December 1; dry to 15.5 percent moisture.

Principal Machinery: Tractors--50 horsepower and 100 horsepower, stalk shredder, M.B. plow, sprayer, planter, combine S/P, cornhead, pickup, trucks (2) 2 ton. (Machinery investment--$97,000.)

Price and quantity figures were taken from the following sources:

"MIP" Interdisciplinary Research Team, Second Annual Report on Marketing Irrigation Production, "MIP" Report No. 2, Department of Agricultural Economics, North Dakota State University, Fargo, June, 1975.

Carkner, Richard W., "Crop Selection Under Irrigation in North Dakota," Farm Management Planning Guide, Section VI, No. 9, Cooperative Extension Service, North Dakota State University, Fargo, December, 1976, p. 9.

TABLE 9. BUDGET FOR IRRIGATED CORN GRAIN, OPTIMUM MANAGEMENT, OAKES-LAMOURE AREA, ANNUAL PER ACRE BASIS, 1977

Category	Units	Price	Quantity	Value
Production:				
Corn receipts	bu.	$2.35	120.00	$282.00
Operating inputs:				
Corn seed	lbs.	0.56	26.00	14.56
Nitrogen	lbs.	0.17	170.00	28.90
Phosphate	lbs.	0.14	65.00	9.10
Rootworm control	lbs.	0.60	0.75	0.47
Herbicide	lbs.	2.95	2.50	7.37
Corn drying	bu.	0.13	150.00	19.50
Fertilizer spreader	dol.	1.15	1.00	1.15
Water cost	dol.	8.15	1.00	8.15
Machinery fuel, lube, and repair cost	acre			22.25
Irrigator fuel and lube	acre			16.95
Irrigator repair cost	acre			5.55
Total operating cost				$133.86
Returns to land, labor, capital, machinery, overhead, risk, and management				148.14
Labor cost:				
Machinery labor	hr.	3.00	4.30	12.89
Irrigation labor	hr.	3.00	0.75	2.25
Total labor cost			5.05	$ 15.14
Capital cost:				
Annual operating capital		0.095	58.71	5.58
Machinery investment		0.095	147.04	13.97
Irrigation system investment		0.095	200.53	19.05
Total interest charge				$ 38.60
Returns to land, machinery, overhead, risk, and management				94.40
Ownership cost (depreciation, taxes, insurance):				
Machinery				18.50
Irrigation system				23.10
Total ownership cost				$ 41.61
Returns to land, overhead, risk, and management				52.80

Field Practices: Shred stalks, October or November; plow-pack, April; pre-plant herbicide, April 25-May 15; plant, May 1-15; harvest (combine), October 1-December 1; dry to 15.5 percent moisture.

Principal Machinery: Tractors--50 horsepower and 100 horsepower, stalk shredder, M.B. plow, sprayer, planter, combine S/P, cornhead, pickup, trucks (2) 2 ton. (Machinery investment--$97,000.)

Price and quantity figures were taken from the following sources:

"MIP" Interdisciplinary Research Team, Second Annual Report on Marketing Irrigation Production, "MIP" Report No. 2, Department of Agricultural Economics, North Dakota State University, Fargo, June, 1975.

Carkner, Richard W., "Crop Selection Under Irrigation in North Dakota," Farm Management Planning Guide, Section VI, No. 9, Cooperative Extension Service, North Dakota State University, Fargo, December, 1976, p. 9.

TABLE 10. BUDGET FOR DRYLAND ALFALFA HAY, OPTIMUM MANAGEMENT, MIDDLE SOURIS-KARLSRUHE AREA, ANNUAL PER ACRE BASIS, 1977

Category	Units	Price	Quantity	Value
Production:				
Alfalfa receipts	tons	$52.50	2.00	$105.00
Operating inputs:				
Alfalfa seed	lbs.	1.78	2.00	3.56
Oat seed	bu.	3.46	0.33	1.14
Nitrogen	lbs.	0.17	3.50	0.42
Phosphate	lbs.	0.14	30.00	4.20
Potash	lbs.	0.09	75.00	6.75
Herbicide	lbs.	2.35	0.06	0.14
Fertilizer spreader	dol.	1.15	1.00	1.15
Bale moving	tons	2.39	2.00	4.78
Machinery fuel, lube, and repair cost	acre			7.91
Total operating cost				$ 30.05
Returns to land, labor, capital, machinery, overhead, risk, and management				74.95
Labor cost	hr.	3.00	1.80	5.41
Capital cost:				
Annual operating capital		0.095	16.26	1.54
Machinery investment		0.095	53.30	5.06
Total interest charge				$ 6.61
Returns to land, machinery, overhead, risk, and management				62.93
Machinery ownership cost (depreciation, taxes, insurance)				7.16
Returns to land, overhead, risk, and management				55.77

Field Practices: Disk twice, spray, and plant April 1-May 31; first harvest June 15-30; second harvest July 15-31; third harvest September 1-10.

Principal Machinery: Tractors--40 horsepower, 70 horsepower, and 100 horsepower; tandem disk; drill; S/P swather, big baler. (Machinery investment--$49,770.)

Price and quantity figures were taken from the following sources:

"MIP" Interdisciplinary Research Team, Second Annual Report on Marketing Irrigation Production, "MIP" Report No. 2, Department of Agricultural Economics, North Dakota State University, Fargo, June, 1975.

Carkner, Richard W., "Crop Selection Under Irrigation in North Dakota," Farm Management Planning Guide, Section VI, No. 9, Cooperative Extension Service, North Dakota State University, Fargo, December, 1976, p. 9.

Dodds, Duaine L., and Dwain W. Meyer, Establishment of Dryland and Irrigated Forages, Circular R563 Rev., Cooperative Extension Service, North Dakota State University, Fargo, February, 1976.

TABLE 11. BUDGET FOR IRRIGATED ALFALFA HAY, OPTIMUM MANAGEMENT, MIDDLE SOURIS-KARLSRUHE AREA, ANNUAL PER ACRE BASIS, 1977

Category	Units	Price	Quantity	Value
Production:				
Alfalfa receipts	tons	52.50	$ 5.00	$262.50
Operating inputs:				
Alfalfa seed	lbs.	1.78	3.00	5.34
Nitrogen	lbs.	0.17	2.50	0.42
Phosphate	lbs.	0.14	70.00	9.80
Potash	lbs.	0.09	150.00	13.50
Herbicide	lbs.	2.35	0.75	1.76
Fertilizer spreader	dol.	1.15	1.00	1.15
Bale moving	tons	2.39	5.00	11.95
Water cost	dol.	6.85	1.00	6.85
Machinery fuel, lube, and repair cost	acre			10.16
Irrigator fuel and lube	acre			20.44
Irrigator repair cost	acre			4.58
Total operating cost				$ 85.96
Returns to land, labor, capital, machinery, overhead, risk, and management				176.54
Labor cost:				
Machinery labor	hr.	3.00	2.25	6.75
Irrigation labor	hr.	3.00	0.75	2.25
Total labor cost			3.00	9.00
Capital cost:				
Annual operating capital		0.095	42.79	4.07
Machinery investment		0.095	73.00	6.93
Irrigation system investment		0.095	166.87	15.85
Total interest charge				$ 26.85
Returns to land, machinery, overhead, risk, and management				140.68
Ownership cost (depreciation, taxes, insurance):				
Machinery				9.79
Irrigation system				19.48
Total ownership cost				29.27
Returns to land, overhead, risk, and management				111.41

Field Practices: Disk twice, spray, and plant April 1-May 31; first harvest June 15-30; second harvest July 15-31; third harvest September 1-10.

Principal Machinery: Tractors--40 horsepower, 70 horsepower, and 100 horsepower; tandem disk; drill; S/P swather, big baler. (Machinery investment--$49,770.)

Price and quantity figures were taken from the following sources:

"MIP" Interdisciplinary Research Team, Second Annual Report on Marketing Irrigation Production, "MIP" Report No. 2, Department of Agricultural Economics, North Dakota State University, Fargo, June, 1975.

Carkner, Richard W., "Crop Selection Under Irrigation in North Dakota," Farm Management Planning Guide, Section VI, No. 9, Cooperative Extension Service, North Dakota State University, Fargo, December, 1976, p. 9.

Dodds, Duaine L., and Dwain Meyer, Establishment of Dryland and Irrigated Forages, Circular R-563 Rev., Cooperative Extension Service, North Dakota State University, Fargo, February, 1976.

The annual operating capital used for the production of each enterprise is the sum of the cost of the total operating inputs and the labor cost. Labor cost was included for the capital outlay because typical farms in the area utilize some hired labor for present dryland operations. Costs of operating inputs for dryland corn and irrigated corn were $45.78 per acre and $133.86 per acre, respectively. Labor costs per acre for dryland corn and irrigated corn were $5.98 and $15.14, respectively (Table 12).

TABLE 12. CORN GRAIN: PER ACRE COST AND RETURNS FOR DRYLAND AND IRRIGATION, OAKES-LAMOURE AREA, 1977

Item	Dryland	Center Pivot Irrigation	Difference
Expected returns			
Yield per acre	50 bu.	120 bu.	70 bu.
Expected costs			
Total operating costs	$45.78	$133.86	$88.08
Total labor cost	5.98	15.14	9.16
TOTAL	$51.76	$149.00	$97.24
LOAN REQUEST: Initial investment in irrigation system			$49,915
Additional operating capital and labor ($97.24 x 135)			13,127
TOTAL			$63,042

The loan request for proposed irrigation of corn grain is shown in Table 12. The loan request was calculated by summing the initial investment requirements and the additional operating capital needed for irrigation. The initial investment of $49,915 plus the $13,127 additional operating capital resulted in a $63,042 loan request for the Oakes-Lamoure area farmers.

Operating inputs for the production of dryland and irrigated alfalfa hay are $30.05 and $85.96, respectively (Table 13). Labor costs for the two types of production practices are $5.41 and $9.00, respectively. The costs are calculated on the basis of leaving the alfalfa for four years. Expected first year and subsequent yields and production costs are differentiated in Table 13 assuming the entire 135 acres are prepared for alfalfa hay production the

TABLE 13. ALFALFA HAY: PER ACRE COST AND RETURNS FOR DRYLAND AND IRRIGATION, MIDDLE SOURIS-KARLSRUHE AREA, 1977

Item	Dryland	Center Pivot Irrigation	Difference
Expected returns			
Yield per acre (first year)	1½ ton (oats hay)	2 ton	.5 ton
Yield per acre (second year)	2 ton	6 ton	4.0 ton
Average yield per acre (four years)	2 ton	5 ton	3.0 ton
Expected costs			
Total operating costs	$30.05	$85.96	$55.91
Total labor cost	5.41	9.00	3.59
Total annual average	$35.46	$94.96	$59.50
Total first year	$35.46	$110.00	$75.54

LOAN REQUEST:	Initial investment	$41,584	
	Additional operating capital and labor	8,032	($14,985 first year)
	TOTAL	$49,616	

first year. On an average annual basis, the per acre capital requirement for production of irrigated alfalfa hay was $94.96; while on a first year basis if the total 135-acre field were prepared, the cost would be $111 per acre with a smaller average cost thereafter. Dryland production capital requirements were $35.46 on an average annual basis.

The average difference in operating capital requirements between dryland and irrigated production of alfalfa hay on 135 acres results in an additional operating capital requirement of $8,032. The initial investment required for the purchase of a hydraulic center pivot distribution system is $41,584. The sum of the additional operating capital and the initial investment gave a loan request of $49,616.

Potential Irrigator Profiles

Potential irrigator profiles were compiled by age group. Certain assumptions could be made on the basis of age, which would justify the separation of potential irrigators into distinct age groups. The younger farmers were assumed to have smaller, younger families and less farming experience than

older farmers. The income received by younger farmers was assumed to be less than that received by older, established farmers. It follows that younger farmers having farmed a relatively short period of time have a smaller net worth and heavier debt load than older, more experienced farmers.

Since younger farmers have less time and capital available with which to expand the size of their farming operation, the farm size of young potential irrigators is less than that of older potential irrigators. The type of financing required by younger potential irrigators would be different than that required by older potential irrigators, because of the differences in financial position.

Each profile consisted of farm and family characteristics; a January 1, 1977, balance sheet; and 1977 income and cash flow statements.[9] The study assumed that the irrigation equipment would be installed during the fall of 1977. It was further assumed that the operator had a water permit issued by the State Water Commission and that the operator has previous experience and necessary machinery for dryland production of corn grain in the Oakes-LaMoure area and alfalfa hay in the Middle Souris-Karlsruhe area. The operators were characterized as having above average management in their respective dryland operations, but were without any irrigation experience.

The potential irrigator profiles were compiled into three age groups: under 35, 35 to 44, and 45 to 54, for each study area. Potential irrigator profiles for the three age groups are given in Tables 14 and 15 for the Oakes-LaMoure and Middle Souris-Karlsruhe area farmers, respectively.

The potential Oakes-LaMoure irrigator in the under age 35 group has seven years of farming experience. He has a small, young family and rents more than half of his farm unit. His past years in farming have realized appreciated real estate values which contribute to his favorable net worth. The relatively low gross farm income is in part the result of crop share land rental. His total net income is supplemented by a modest nonfarm income contributed by either his wife or himself.

---

[9]Anheluk, Jerry, Credit Availability for Potential Irrigators in North Dakota, unpublished M.S. thesis, Department of Agricultural Economics, North Dakota State University, Fargo, November, 1977.

TABLE 14. BIOGRAPHICAL DATA AND FINANCIAL CHARACTERISTICS BY AGE GROUP OF POTENTIAL IRRIGATORS, OAKES-LAMOURE AREA, NORTH DAKOTA, 1977

Potential Irrigator Characteristics (Average)	Age Group		
	Under 35	35-44	45-54
Biographical Data			
Years of farming experience	7	19	29
Years of irrigation experience	0	0	0
Education	13	13	12
Family size	3	4	6
Number of sons	1	1	2
Average age of sons (years)	7	9	14
Months of labor hired	3	4	2
Farm Size			
Acres owned	530	900	870
Acres rented	570	360	420
Total farm size	1,100	1,260	1,290
Tillable acres	940	1,030	940
Beef cowherd size	25	65	82
Income			
Gross farm income	$ 44,400	$136,700	$ 90,000
Total net income	15,400[a]	86,700	43,000
Assets			
Current assets	44,000[b]	99,000[b]	91,000[b]
Livestock and machinery	64,000	134,000	115,000
Land and buildings	248,000	357,000	339,000
Total assets	$356,000	$590,000	$545,000
Liabilities			
Current liabilities	13,000[b]	73,000[b]	73,000[b]
Intermediate liabilities	32,000	28,000	6,000
Long-term liabilities	76,000	12,000	39,000
Total liabilities	$121,000	$113,000	$118,000
Net Worth	$235,000	$477,000	$427,000

[a]The total net income includes $4,000 nonfarm income for the under age 35 profile, and $3,000 nonfarm income for the 35 to 44 age profile.
[b]A major portion of the current assets or liabilities represents stored grain under CCC loans.

TABLE 15. BIOGRAPHICAL DATA, FINANCIAL CHARACTERISTICS BY AGE GROUP OF POTENTIAL IRRIGATORS, MIDDLE SOURIS-KARLSRUHE AREA, NORTH DAKOTA, 1977

Potential Irrigator Characteristics (Average)	Age Group		
	Under 35	35-44	45-54
Biographical Data			
Years of farming experience	10	20	25
Years of irrigation experience	0	0	0
Education	14	9	13
Family size	5	6	8
Number of sons	2	2	3
Average age of sons	7	13	14
Months of labor hired	2	4	7
Farm Size			
Acres owned	530	890	690
Acres rented	420	500	910
Total farm size	950	1,390	1,600
Tillable acres	710	1,090	930
Beef cowherd size	50	60	55
Income			
Gross farm income	$ 25,250	$ 58,000	$ 50,800
Total net income	8,250[a]	23,000	13,800[a]
Assets			
Current assets	7,000	41,000	26,000
Livestock and machinery	58,000	78,000	76,000
Land and buildings	129,000	263,000	191,000
Total assets	$194,000	$382,000	$293,000
Liabilities			
Current liabilities	6,000	4,000	22,000
Intermediate liabilities	9,000	6,000	0
Long-term liabilities	43,000	43,000	29,000
Total liabilities	$ 58,000	$ 53,000	$ 51,000
Net Worth	$136,000	$329,000	$242,000

[a]The total net income includes $4,000 nonfarm income for the under age 35 profile, and $6,000 nonfarm income for the 45-54 age profile.

The counterpart to the younger profile is in the 35 to 44 age group. The farmers in this age group have approximately 12 more years of farming experience than their peers in the younger age group. The additional years of farming attribute to a significantly larger, nearly double, net worth than the younger profile. The very high income is supplemented by a small nonfarm income and indicates high farm profitability.

The oldest farmer age group has almost 30 years of farming experience. Average age of sons indicates that at some time in the near future the sons will be old enough to become more actively involved in the farm business. Net worth for this age group is slightly smaller than for the 35 to 44 age group. A lower net income indicates that farm profitability for the given net worth is noticeably smaller than the younger, seemingly more aggressive middle age counterpart.

The youngest age group farmer in the Middle Souris-Karlsruhe area has an average of 10 years of farming experience. This representative farmer has a young, growing family of several children. Almost half of his farming unit is rented. A nonfarm income source significantly contributes to his total income which is quite meager.

The 35 to 44 age profile has 10 more years of experience than his previously discussed counterpart. This representative farmer operates a larger farm unit which yields a modest net income and results in a substantial net worth. The increased net worth and net income establish a relatively more financially secure profile than the under age 35 farmer.

The oldest profile in the Middle Souris-Karlsruhe area has five more years farming experience than the middle aged profile. The older profile has a larger, older family. Over half of the farm unit is rented. It follows that a rather large farm unit has only a small net worth for the farm operator. The farming operation realizes a very limited net income. A major nonfarm source of income contributes to the small farm income.

Lenders' Evaluation of Profiles

The lenders were asked to comment on the realism of the farmer profiles presented. Approximately, 40 percent of the loan officers in the Oakes-LaMoure area and 50 percent in the Middle Souris-Karlsruhe area who offered a comment thought the under 35 and 35 to 44 age profiles were representative of area customers. Nearly all lenders indicated that the oldest group appeared representative.

The next most common response was that the two youngest profiles represented above average equity for the age category. This was suggested by 26 percent of the Oakes-LaMoure lenders and 33 percent of the Middle Souris-Karlsruhe lenders. This is in agreement with the finding by Gullickson which indicated that farmers intending to irrigate had above average equity for their age.

Area Credit Practices

The irrigation loan analysis survey revealed that loan to deposit ratios for the area commercial banks during July, 1977, varied from .23 to .89. The number of banks by loan to deposit ratio range is given in Table 16. The loan to deposit interval with the largest number of banks was an interval from .66 to .75. Approximately 50 percent of all commercial banks in each area had loan to deposit ratios greater than .66.

TABLE 16. LOAN TO DEPOSIT RATIOS OF COMMERCIAL BANKS SURVEYED BY AREA, JULY, 1977

Loan to Deposit Ratio	Oakes-LaMoure	Middle Souris-Karlsruhe	Total
.00 through .25	1	0	1
.26 through .35	4	0	4
.36 through .45	0	1	1
.46 through .55	1	2	3
.56 through .65	4	3	7
.66 through .75	7	5	12
.76 through .89	6	1	7
Totals	23	12	35

All except seven commercial banks, two in the Oakes-LaMoure area and five in the Middle Souris-Karlsruhe area, were using overline credit sources. Many banks had more than one overline credit source and as many as three have been listed. The Bank of North Dakota was the most frequently mentioned source of overline credit in each study area (Table 17). Other major overline sources cited were at Jamestown, Minneapolis, and Sioux Falls. It is interesting that some banks in the Oakes-LaMoure area were selling notes to Production Credit Associations. This seems to be a recently developed practice and one that may experience future growth.

TABLE 17. OVERLINE CREDIT SOURCES USED BY AREA, COMMERCIAL BANKS, IRRIGATION CREDIT SURVEY, 1977

Source	Oakes-LaMoure	Middle Souris-Karlsruhe	Total
Bismarck (Bank of North Dakota)	6	3	9
Fargo	6	2	8
Jamestown	5	0	5
Minneapolis	5	2	7
Sioux Falls	2	1	3
Production Credit Association	3	0	3
Other	6	3	9

A comparison of numbers of customers irrigating and systems financed between the two study areas reveals that irrigation farming is much more predominant in the Oakes-LaMoure area than in the Middle Souris-Karlsruhe area. The data in Table 18 show the number of credit institution customers irrigating, while the data in Table 19 indicate the number of systems financed by each institution. The occurrence of more customers irrigating than sprinkler systems financed per institution concedes that many customers have more than one institution to carry out financial business and that some irrigation equipment is personally financed, leased, or dealer financed.

TABLE 18. CUSTOMERS IRRIGATING BY FINANCIAL OFFICE, TWO AREAS OF NORTH DAKOTA, 1977

Office	Oakes-LaMoure		Middle Souris-Karlsruhe	
	Total Customers	Average Per Office	Total Customers	Average Per Office
Production Credit Association	44	8.80	7	3.50
Federal Land Bank Association	87	43.50	12	6.00
Farmers Home Administration	36	7.20	5	1.25
Commercial Bank	121	5.26	52	2.50

The average number of sprinkler irrigators financed by type of financial office for each study area is shown in Table 19. Financing in the Oakes-LaMoure area where center pivot irrigation is quite popular shows that Federal Land Bank Associations are the leading lenders in providing credit

TABLE 19. SPRINKLER SYSTEMS FINANCED BY FINANCIAL OFFICES, TWO AREAS OF NORTH DAKOTA, 1977

Office	Oakes-LaMoure		Middle Souris-Karlsruhe	
	Total Sprinkler Systems	Average Per Office	Total Sprinkler Systems	Average Per Office
Production Credit Association	13	2.60	8	4.00
Federal Land Bank Association	77	38.50	5	2.50
Farmers Home Administration	31	6.20	2	.50
Commercial Bank	31	1.35	6	.50

for center pivot irrigation development. One Federal Land Bank Association office in the Oakes-LaMoure area had over 75 center pivot irrigators financed. Most irrigation systems financed by Production Credit Associations in the Middle Souris-Karlsruhe area were small sprinkler units, either tow line or big gun systems, which did not require large capital investments.

Production Credit Associations and commercial banks have the least credit outstanding per office or bank for center pivot irrigation development. These institutions are primarily short-term or intermediate-term credit market agencies. Long-term credit or real estate loans are usually carried by the Federal Land Bank Association and the Farmers Home Administration. It is apparent from Table 19 that most center pivot irrigation financing is carried by long-term credit institutions, usually as part of the real estate debt.

Lender Credit Evaluation

Loan Evaluation, Oakes-LaMoure Profile, Under Age 35

The percent of loan approvals by institution for the under age 35 Oakes-LaMoure farmer profiles is shown in Table 20. Of five Production Credit Association branch offices in the Oakes-LaMoure area, only one indicated credit approval for the loan request of $63,042. Amortizing the loan plus other debt and living obligation would not be possible considering the income situation presented. The Production Credit Association branch office approving the loan request assumed 1) optimal management, 2) a substantial cattle feeding enterprise, and 3) the option of rewriting the note under long-term conditions with the Federal Land Bank Association or the Farmers Home Administration if necessary. Final approval or disapproval of the irrigation loan rests with the head office located in Fargo since the branch offices are limited to the

TABLE 20. PERCENT LOAN APPROVALS FOR OAKES-LAMOURE AREA FARMER PROFILE, UNDER AGE 35

Office	Total Interviews	Percent Approvals
Production Credit Association	5	20
Federal Land Bank Association	2	0
Farmers Home Administration	5	100
Commercial Banks	23	30[a]
Total	35	

[a]One banker would make the loan approval only if the farmer was feeding cattle.

amount of funds that they can loan out to one individual. The recommendation of the branch office, however, is a major factor in determining final loan approval.

Although neither of the Federal Land Bank Associations would directly finance the loan request, they would participate with Farmers Home Administration providing that the Federal Land Bank would have first mortgage on real estate. The reason cited for the apprehensiveness was that the dryland profits were not adequate to cover the annual principal and interest on the loan financing the system. The Federal Land Bank Association offices projected corn prices at $2.40 per bushel. The Federal Land Bank Association at LaMoure, which has financed over 75 center pivot irrigation systems, projected first-year irrigated corn yields at 80 bushels per acre. The Association office discounted average corn yields to 100 bushels per acre for long-run loan analysis.

The Farmers Home Administration indicated loan approval for the Oakes-LaMoure farmer profile under age 35. Upon analyzing the profile, the Farmers Home Administration indicated that they would prefer to participate with the Federal Land Bank Association or with the Bank of North Dakota with such a profile and loan request. However, if necessary, Farmers Home Administration could finance the entire project. Farmers Home Administration officers stressed the feasibility of irrigation to promote a more viable farm operation for the beginning farmer by stabilizing feed supplies for livestock enterprises and/or releasing other land resources for various enterprises.

Only 30 percent of the commercial banks indicated a willingness to finance the irrigation loan for the under age 35 profile. Most of the bankers indicated that they were not seeking long-term or real estate financing. Operators' repayment capacity dictated that the loan would have to be handled on a long-term basis.

An effort to determine if the bank's loan to deposit ratio was related to the loan approval or disapproval failed to show any relationship. In various cases a high loan to deposit ratio indicated that a bank was quite liberal in extending credit. Such cases readily prompted loan approval for irrigation equipment. However, in several other cases where bankers had a high loan to deposit ratio, a more cautious attitude was exhibited by extending credit for irrigation development to only the well-secured profiles. Those institutions with low loan deposit ratios who were seeking more business extended credit more readily to the more marginally secured profiles. Again many other bankers who had low loan deposit ratios elected to remain in such standing and would service only the very secure profiles for irrigation development.

Bank size did not have a strong relationship to loan approval or disapproval. The policy set forth by the board of directors seemed to dictate the willingness to extend credit. Many small bankers showed an effort to hold present customers by offering a more full line of bank service including real estate financing. Lines of credit approved by smaller banks for center pivot irrigation development usually showed more favorable repayment terms than did larger banks.

The various interest rates and years of repayment established by the credit agencies approving the loan request are shown in Table 21.

TABLE 21. INTEREST RATE AND YEARS OF REPAYMENT BY INSTITUTION FOR CENTER PIVOT IRRIGATION EQUIPMENT, OAKES-LAMOURE AREA FARMER PROFILE, UNDER AGE 35

	Interest Rate Per Repayment Years[a]										
	.05 / 20	.05 / 40	.077 / 7	.09 / 7	.0925 / 20	.095 / 8	.095 / 10	.095 / 15	.10 / 5	.11 / 12	Total Approvals
FHA	1	4	0	0	0	0	0	0	0	0	5
PCA	0	0	1	0	0	0	0	0	0	0	1
BANK	0	0	0	1	1	1	1	1	1	1	7

[a]Interest rates are given on the top line and repayment years are shown in the bottom figures.

Farmers Home Administration entered the initial loan investment of $49,915 at the lowest interest rate, 5 percent, and longest repayment terms, 40 years. A second mortgage on real estate was required as security. A loan carried on these terms is called a "Farm Ownership Loan." Loan limits for the "Farm Ownership Loan" are $100,000 for real estate and $50,000 for chattel purposes. Farmers Home Administration eligibility requirements provide that the farmer must not have more than $225,000 of liabilities outstanding for real estate.

Farmers Home Administration could also make the loan on a "Soil and Water Loan" classification at a 5 percent interest rate using only the irrigation system as security. Repayments are then spread over the estimated life of the center pivot sprinkler system. This life span is determined by the local loan officer and is usually between 10 and 20 years. A limit of $60,000 can be borrowed under SW classification if no real estate is used as security. The loan limit is not in effect if real estate is used as security. The additional operating capital of $13,129 would be carried at 8 percent interest on an annual basis. The operating request could be extended or rewritten to initiate the irrigation program in the beginning years.

Should the Production Credit Association finance the under age 35 Oakes-LaMoure area profile, a variable loan interest rate set initially at 7.7 percent would be used for the initial investment and the additional operating capital. The variable interest rate allows the cost of capital to the farmer to fluctuate according to the cost of capital the Federal Intermediate Banking System incurs in obtaining its funds. The loan would be secured by existing chattel and irrigation equipment.

The loan terms established by commercial banks approving the request varied greatly. Interest was usually 9.25 or 9.5 percent but ranged from 9 to 11 percent. The higher interest rates were secured only by either a chattel arrangement or second real estate mortgage. Five of the seven banks approving the loan request would use a first mortgage on real estate. Repayment years varied from 5 to 20 years. Some banks with lower repayment years indicated that the notes could be rewritten or extended if need be.

Eleven responses of the loan officers disapproving the loan request emphasized the inadequate ability to retire the loan as the major reason for loan disapproval. The commercial banks not interested in real estate financing often indicated that the current and intermediate asset-liability position could not support the debt load needed to establish irrigation farming. Three

bank officers expressed concern over the security arrangements under the present real estate debt. A more secure loan could be made and loan approval may be granted if the present liability was such that the bank could establish a first mortgage on real estate. The decision to disapprove the loan request may be reversed with exceptional and proven managerial ability.

Four Production Credit Association offices disapproved the loan request because their seven-year intermediate credit conditions would warrant too high annual payments. Amortizing the loan plus other debt and living obligations would not be possible considering the income situation presented.

Loan Evaluation, Middle Souris-Karlsruhe Profile, Under Age 35

Nongovernmental credit agencies interviewed would not finance the loan request, except for one commercial bank, as is indicated by Table 22. The four Farmers Home Administration offices indicated a willingness to directly finance center pivot irrigation development. Federal Land Bank officers indicated that they would participate on 50 percent of the loan request with Farmers Home Administration if they were financing the current real estate debt and could assume first mortgage on the real estate. If Farmers Home Administration carried the current real estate liability, the Federal Land Bank would finance the entire loan request of $49,616 if they held a first mortgage on the real estate.

TABLE 22. PERCENT LOAN APPROVALS FOR MIDDLE SOURIS-KARLSRUHE AREA FARMER PROFILE, UNDER AGE 35

Office	Total Interviews	Percent Approvals
Production Credit Association	2	0
Federal Land Bank Association	2	0
Farmers Home Administration	4	100
Commercial Banks	12	8
Total	20	

Factors considered by the four Farmers Home Administration officers and one bank official for approving the loan were above average management and a situation where irrigation would promote a more viable farm operation, especially through stabilizing livestock feed supplies.

The financial institutions that rejected the loan request cited inadequate loan repayability as a major reason. In much of the irrigation equipment loan analysis, adequate loan repayability was determined if present dryland income could cover the initial investment payments. Extra income from irrigation was discounted to cover the additional operating expense generated from irrigation.

Loan Evaluation, Oakes-LaMoure Profile, Age 35-44

Farmer profiles from the Oakes-LaMoure area between ages 35 and 44 obtained loan approval for initiation of center pivot irrigation as shown in Table 23. The five Farmers Home Administration officers said that the situations given by the 35-44 age profile were not applicable to their analysis since it was evident that credit could be obtained through commercial channels. Only three commercial banks with inadequate loan limits were unable to service the credit request.

TABLE 23. PERCENT LOAN APPROVALS FOR OAKES-LAMOURE AREA FARMER PROFILES, AGE 35-44

Office	Total Interviews	Percent Approvals
Production Credit Association	5	100
Federal Land Bank Association	2	100
Farmers Home Administration	NA[a]	NA[a]
Commercial Banks	23	87
Total	30	

[a]Not applicable.

General terms regarding years of repayment and interest rate for the loan approvals for the Oakes-LaMoure area, 35-44 age, profile are given in Table 24.

Interest rates varied from 7.7 percent plus stock from the Production Credit Association to 10 percent from a commercial bank. Likewise, years for repayment vary from 30 years from Federal Land Bank Associations to five years from various commercial banks. Many different security arrangements could be established. Fourteen commercial banks used only a chattel mortgage and the irrigation system as security for the loan.

TABLE 24. INTEREST RATE AND YEARS OF REPAYMENT BY INSTITUTION FOR CENTER PIVOT IRRIGATION EQUIPMENT LOAN, OAKES-LAMOURE AREA FARMER PROFILE, AGE 35-44

	Interest Rate Per Repayment Years[a]												
	.077 / 7	.0825 / 30	.09 / 5	.09 / 7	.09 / 10	.0925 / 5	.095 / 5	.095 / 7	.095 / 10	.095 / 15	.095 / 20	.1 / 10	Total Approvals
FLBA	0	2	0	0	0	0	0	0	0	0	0	0	2
PCA	5	0	0	0	0	0	0	0	0	0	0	0	5
BANK	0	0	1	2	1	1	3	5	4	1	1	1	20

[a]Interest rates are given on the top line and repayment years are shown in the bottom figures.

The Federal Land Banks in this area took a first mortgage on real estate with a 30-year repayment period. If in event that the first mortgage on real estate was not sufficient security, Federal Land Bank could also secure the system but the repayment term would be changed from 30 to 20 years. Federal Land Bank charges a variable interest rate. The rate at the time of the study was 8.25 percent. Additional charges for carrying stock in the Federal Land Bank Association are included with the initial loan request. The additional amount borrowed for stock is 5 percent of the initial loan request. A small amount, proportional to the loan request, is also added to the total borrowed sum for a loan closing fee. The amount borrowed for stock in the Federal Land Bank Association can be withdrawn after the last loan payment is made.

The favorable financial status of the profile in long-term and short-term security and adequate dryland income to establish immediate lona repayability were all factors which led to the unamimous loan approvals.

Loan Evaluation, Middle Souris-Karlsruhe Profile, Age 35-44

The various credit agencies that evaluated the $49,616 loan request by the 35 to 44 age profile for Middle Souris-Karlsruhe area indicated an immediate willingness to approve the loan as shown in Table 25. The only disapproval of the loan request came from a bank with an inadequate individual loan limit. The Farmers Home Administration offices considered the profile eligible for credit through commercial channels.

TABLE 25. PERCENT LOAN APPROVALS FOR MIDDLE SOURIS-KARLSRUHE AREA FARMER PROFILE, AGE 35-44

Office	Total Interviews	Percent Approvals
Production Credit Association	2	100
Federal Land Bank Association	2	100
Farmers Home Administration	NA[a]	NA[a]
Commercial Banks	12	91
Total	16	

[a]Not applicable.

General terms indicating years of repayment and interest rates are given in Table 26. Much variation was shown in interest rates and years of repayment from one type of institution to another. The commercial banks' effort to provide only short-term and intermediate-term credit is quite apparent. Eight banks used chattel and system arrangements for securing the loan and six banks established repayment terms for seven years or less.

TABLE 26. INTEREST RATE AND YEARS OF REPAYMENT, BY INSTITUTION FOR CENTER PIVOT IRRIGATION EQUIPMENT LOAN, MIDDLE SOURIS-KARLSRUHE AREA FARMER PROFILE, AGE 35-44

	Interest Rate Per Repayment Years[a]								
	.082 / 7	.0825 / 30	.09 / 5	.09 / 7	.09 / 15	.095 / 6	.095 / 7	.095 / 10	Total Approvals
PCA	2	0	0	0	0	0	0	0	2
FLBA	0	2	0	0	0	0	0	0	2
BANK	0	0	1	2	1	1	3	3	11

[a]Interest rates are given on the top line and repayment years are shown in the bottom figures.

An adequate real estate security margin was very important to 14 of the respondents although only two commercial banks used real estate for security. Should the loan ever be renegotiated because of adverse economic or production circumstances, the bankers feel confident and more willing to extend credit if this "safety" margin exists.

Loan Evaluation, Oakes-LaMoure Profile, Age 45-54

The most divergent decisions in the loan analysis centered on the profiles in the 45-54 age group. The response of various lending institutions for a $63,042 loan request to initiate center pivot irrigation by the Oakes-LaMoure farmer profile of age 45-54 is given in Table 27. Only one Production Credit Association branch office approved the loan request. The two Federal Land Bank Association offices interviewed were split in their decision to approve the loan request. The Farmers Home Administration officers indicated that the profile should be able to obtain credit elsewhere. All commerical banks expressed credit approval except for three that had inadequate loan limits.

TABLE 27. PERCENT LOAN APPROVALS FOR OAKES-LAMOURE AREA FARMER PROFILE, AGE 45-54

Office	Total Interviews	Percent Approvals
Production Credit Association	5	20
Federal Land Bank Association	2	50
Farmers Home Administration	NA[a]	NA[a]
Commercial Banks	23	87
Total	30	

[a]Not applicable.

The various security arrangements, years of repayment, and interest rates for the loan terms for the Oakes-LaMoure profile of age 45-54 were similar to those quoted for the 35 to 44 age profile. Fourteen commercial banks that approved the loan request favored use of chattel and system for security. Twelve banks considered repayment in seven years or less.

Those loan officers indicating approval of the $63,042 loan request based their decision on emphasis placed on security. This was indicated by a large number of responses citing the favorable current-intermediate position and the real estate security margin of the profile. Production factors as management, stabilizing a feed supply for a livestock enterprise, and expansion of the farm operation with sons were not considered as frequently as were the security factors.

The loan officers who disapproved the loan based their decision on marginal loan repayment capacity resulting from a low total farm income. From the lower net farm income it was implied that general management may also be weaker. This implication brought out the possibility of future management related problems involved with irrigation farming. One lender commented that if the irrigation development was neccessary to promote a more viable operation by stabilizing feed supplies for livestock production, the loan decision may change to an approval.

Loan Evaluation, Middle Souris-Karlsruhe Profile, Age 45-54

Only three of the 12 commercial banks indicated a willingness to finance the Middle Souris-Karlsruhe profile of age 45-54 (Table 28). The banks indicating loan approval for the profile all used real estate for security at an interest rate of 9.5 percent. Two banks scheduled repayment for ten years and one scheduled repayment for seven years.

TABLE 28. PERCENT LOAN APPROVALS FOR MIDDLE SOURIS-KARLSRUHE AREA FARMER PROFILE, AGE 45-54

Office	Total Interviews	Percent Approvals
Production Credit Association	2	0
Federal Land Bank Association	2	0
Farmers Home Administration	NA[a]	NA[a]
Commercial Banks	12	25
Total	16	

[a]Not applicable.

Of the various factors that the financial officers considered in evaluating the loan request was the very marginal loan repayment capacity of the profile associated with an unusually low net farm income. This situation, with consideration given for age, seemed to indicate to the lenders that management may be weak and, hence, a limiting factor for successful irrigation farming. Concern was also expressed with the contract conditions and longevity of the rented farmland. More information was also needed to determine the role of the son(s) in the farming operation and the actual farming enterprises in the current and future farm plan. Four loan officers stated that with a $20,000 annual net farm income the decision to finance the irrigation equipment would become favorable.

Analysis of Lease Financing

Many leasing companies actively market their financial services for irrigation customers in North Dakota. The leasing companies fall into two distinct groups. There are vendor owned leasing companies and independent leasing companies which sell their services to vendors of irrigation equipment. An independent lease company has no special purchase arrangement with a vendor or manufacturer. It is the lessee's responsibility to negotiate a price with a vendor before the independent lease company can document a lease and purchase the equipment.

A personal survey of seven irrigation equipment dealers conducted in Oakes-LaMoure and the Middle Souris-Karlsruhe areas revealed that 15-20 percent of all irrigation equipment sales in 1976-77 were financed through a lease arrangement with either a vender-owned leasing company or an independent leasing company. All respondents said that the trends to lease irrigation equipment are increasing at a rapid rate from previous years when approximately 5 percent of sales were negotiated by lease. One dealer noted that as commodity prices tend to decline, leasing practices seem to be increasing.

There are three possible financing plans available for financing irrigation equipment. These plans[10] are 1) true lease, 2) lease purchase, and 3) conditional sales.

True Lease Plan

A true lease will provide equipment use for the minimum initial cash outlay. According to Internal Revenue Service guidelines, the hallmark of a true lease is the fair market value residual purchase option which assures that the lessor bears the risk of ownership. True lease financing allows investment tax credit to be passed on to the equipment user or it can be kept by the leasing company. True lease payments are strictly rents and as such establish no equity in the equipment for the lessee. True lease payments are treated as a direct expense on an operating statement.

---

[10]Personal letter written by James G. Beck, Marketing Representative, Lease Northwest, Inc., Northwestern Bank Building, Minneapolis, Minnesota, to the author, March 25, 1977.

Key advantages used to promote true lease financing are that it offers virtually 100 percent financing, keeps bank working capital free, and accurately matches the costs and use of equipment.[11] The true lease also allows treatment of lease payment as an expense and it usually allows competitive payments compared with other financing forms. The farmer conserves cash by avoiding large down payments and deferring sales taxes. Depreciation schedules are eliminated. Often the true lease can meet budget constraint and flexible payment schedules where other forms of financing cannot.

A deferred payment plan may be used with the true lease to allow the lessee to take delivery of the equipment for a minimum cash outlay at a time when cash on hand is short and cash inflow is low. The deferred payment plan can help the lessee avoid the spring crunch by allowing him to take delivery in the fall. By taking off season delivery, the lessee may also be able to avoid a yearly manufacturer's price increase. The investment tax credit may be retained or passed as in all true leases. The initial payment (approximately 10 percent) of equipment cost is remitted to the lease company with the signed lease document to be applied toward the first annual payment. The lessee remits the balance of the first annual payment within six months after delivery. Thereafter, the lessee selects any date within 12 months after delivery of the equipment to begin making full annual payments.

It should be noted that under similar plans which utilize a security deposit instead of a partial lease payment, the security deposit cannot be considered as a direct rent expense for tax purposes. Security deposits can have the limited effect of lowering the lease payment because of decreased risk to the lessor. However, it should be noted that while the lessor may pay interest on the security deposit at a rate equivalent to a bank savings program, most agricultural operations can create an even higher rate of return on this money by reinvesting it in other portions of the business.

There are three lessee options at the end of the true lease and/or deferred payment true lease. The lessee may purchase the irrigation equipment at fair market value, renew the lease at a negotiated rate, or upon request have the irrigation equipment removed by the lease company.

---

[11] Ibid.

Lease-Purchase Plan

A lease purchase plan provides a fixed purchase option of a certain percent (for example 10 percent) at the end of the lease term. Unlike the true lease, investment tax credit always mut be passed to the lessee under the lease purchase plan. The lease purchase is designed specifically for those who are concerned about fair market residual values.

Under the lease purchase plan, the equipment must be depreciated by the lessee and only the interest portion of the payment may be treated as direct expense. The lessee has full benefits of ownership including rapid depreciation options since the lease company does not treat the lease purchase plan as a true lease.

The lessee has three otpions at the end of the lease purchase plan. The lessee may purchase the equipment at a specified percent of the original costs, renew the lease at a smaller specified percent of the original cost per year in advance, or return the equipment to the lease company.

Conditional Sales Contract

The "conditional sale features automatic ownership at the end of the term. Investment tax credit is always passed on to the debtor under this plan. A down payment of 10 percent of the equipment cost is usually satisfactory for most transactions. Sales tax amounts, type of payments, and length of term can cause down payment percentages to vary.

Conditional sales contracts are essentially a method of securing credit that legally differs significantly from loans.[12] In the case of a loan, ownership of the property passes to the borrower, whereas with a purchase contract title to the property remains with the seller to be delivered at some future date or upon payment of a specified sum. No mortgage is involved because the borrower is not the owner and, hence, cannot give a mortgage.

The borrower gets possession and the lender retains title in conditional sales contracts. The advantage to the lender is that if the terms of the contract are not fulfilled it is possible for the lender to regain possession without necessity of foreclosure. The advantage to the borrower is that he can purchase equipment and the like with a smaller down payment.

---

[12] Nelson, A. G., L. F. Warren, and W. G. Murray, Agricultural Finance, Sixth Edition, Iowa State University Press, Ames, 1973, pp. 95-96, 223.

Lease Financing Requirements

The following guidelines were listed by a leasing company as minimum requirements necessary to initiate irrigation lease financing by a prospective customer: 1) the lessee's net worth should be twice the dollar amount of the equipment he expects to lease, 2) the lessee should have a proven record with a minimum of four years farming experience. In addition to a completed lease application form, one lease company[13] asked for the following financial data: 1) the lessee's last two tax returns including schedule F and schedule D, 2) a signed and dated current balance sheet showing all assets and liabilities, and 3) a projection of the year's profit and loss after the irrigation system has been installed.

Much concern has been expressed of late regarding water permits since irrigation systems without a legal water supply have a place utility to no one. Currently some of the leasing companies require a copy of the irrigation water permit from the appropriate state agency (North Dakota State Water Commission) as part of the lease documentation.

The equipment eligible for leasing includes all readily removable items and includes freight and installation charges. The costs of drilling a well and/or the costs of the mainline pipe is not usually included in the lease. Some leasing companies may include a portion of the underground pipe in the lease plan. The buried mainline pipe and/or well development would have to be financed separately from the lease arrangement for the sprinkler distribution system. With the initial lease payment, additional operating capital, and requirements for nonremovable items, the initial capital outlay needed for irrigation with leasing may be similar to that under a loan.

Lease Financing Terms

Three companies active in leasing center pivot irrigation equipment evaluated the profiles. All of the Oakes-LaMoure profiles that were evaluated were declared eligible for lease financing. The farmer profile between the ages of 35 and 44 years was the only profile in the Middle Souris-Karlsruhe area to be approved for lease financing.

---

[13] Beck, op. cit., p. 1.

The three lease companies would use the true lease plan to finance the center pivot irrigation equipment. The two dealer affiliated lease companies gave the most lenient terms with a 10-year lease plan at interest rate equivalents of 7.7 and 8.5 percent. Investment tax credit and depreciation were retained by the lessor. The independent lease company was reluctant to quote an interest rate equivalent to the present lease rate. The independent lease company would lease only on a five-year plan with a possible two-year extension. The farmer has three options previously discussed in the true lease at the end of the lease term.

In general, the lease companies emphasized sufficient equity and proven financial progress as important factors in approving lease financing. The factors seemed to be favorable for the Oakes-LaMoure farmer profiles. The low equity position related with years of farming experience and the marginal current position for the Middle Souris-Karlsruhe profile under age 35 and between 45-54 were reasons for lease finance disapproval. Varying amounts of mainline were included in the lease plan, but for the less financially secure profile, only a limited amount of mainline would be financed. The difficulty in salvaging buried mainline is the primary reason for this concern.

Conclusion

Results from the study imply that most irrigation development will be done by the financially secure farmer. Most irrigation financing is carried on a long-term basis with the Federal Land Bank Association, a major credit source for such loans. Repayment terms established by the commercial banks and Production Credit Associations are usually between five and seven years to meet current and intermediate credit needs. Only the farmer with adequate dryland income can meet the short repayment terms established by the commerical banks and the Production Credit Associations. In order for these credit sources to become more active in lending irrigation capital, longer term financing would be necessary. Longer term financing can make repayment and other farm expansion possible.

It is clear from the study, that Farmers Home Administration will be the primary source of financing for most operators with equity less than or near that of the under age 35 profiles. Increased demand for capital from Farmers Home Administration will likely occur as young operators seek to establish center pivot irrigation systems and farm ownership. It is questionable if Farmers Home Administration can supply all the needed capital. Farmers

Home Administration financing is currently just able to meet the present demand for capital and, even at the present time, delays in loan negotiation are noticed because of the lack of funds. Funds from Farm Ownership Loans and Soil and Water loans are the most applicable for use in establishing irrigation farming. These funds become available upon annual Congressional appropriations.

The large capital requirements for sprinkler irrigation and land ownership can often exceed Farmers Home Administration loan limits. This is a deterent in implementing a successful family farm with a potential for irrigation development. Increased participation by commercial credit channels and the Bank of North Dakota with the Farmers Home Administration appears to be necessary for more effective transfer of capital. Cooperative efforts between lease financing companies and Farmers Home Administration may provide new sources of capital for irrigation development. In every instance it appears that a federal and/or state government program working with local area lenders is necessary to provide the additional risk capital resources for farmers who wish to convert to irrigation farming, particularly the young farmers and small operators who are unable to get credit through usual commercial channels.

Pending Development That May Expedite Capital Transfer

Because irrigation is a new technique in the program of most farmers, the needed capital is treated as risk capital for the following reasons: 1) concern over operation and management abilities, 2) obsolescence of equipment, 3) availability and cost of the water resource, and 4) lack of information on projected cost and returns. The increased risk associated with irrigation financing makes bank participation more appealing as risk can be shared and, hence, reduced for each individual lender.

All of the interviewed lenders expected to see a more active future role by the Bank of North Dakota through participation in irrigation financing. Currently the Industrial Commission may issue debentures not to exceed $10,000,000 through the Bank of North Dakota. The debentures are to provide capital for loans to enable residents of the state, especially low equity farmers, to purchase and finance irrigation distribution systems and related agricultural facilities and enterprises. Such loans must be made on a participating basis with other banks and lending agencies.

As of yet the Bank of North Dakota has been quite inactive in financing irrigation needs. Two reasons were given. The bank was understaffed to adequately address the new program and there does not seem to be a very strong demand for these funds, especially in consideration of the present state of the Garrison Diversion Project.

Presently the Bank of North Dakota does participate with Farmers Home Administration on a small number of farm loans. The Bank can participate to 55 percent of a loan. The Bank of North Dakota can establish a real estate loan to farmers on a direct basis as long as a first mortgage on real estate does not exceed one-half of the appraised real estate value. Repayment is scheduled from 20 to 25 years at 8.5 percent interest.

The Bank of North Dakota can initiate an irrigation equipment loan not secured by a first mortgage on real estate by participating with the customer's local credit source. The loan is scheduled to be paid back in a five- to seven-year period. Interest rate may vary from 8.75 to 10 percent. The interest rate to the participating bank depends upon the local bank's equity and the general soundness of the loan.

Bank of North Dakota officials examined the loan requests and were willing to extend credit to all the profiles if local commercial banks would participate. The Bank was also willing to participate on operating capital for larger operators or those who had requests in excess of $10,000.

Concern was expressed by the area lenders about the need, cost, and availability of irrigation management services on lands in the Garrison Diversion Conservancy District. The Bureau of Reclamation would like to see the service offered by private industry. However, the need to forecast future water use to maintain adequate supply may necessitate government services from Irrigation Management Services (IMS). IMS, Department of Interior--a management service of the Department of Interior, operates a Control Data CYBER 74 computer at the Federal Center in Denver. Currently IMS services many farms in Idaho and Wyoming. Other states, including Washington, Colorado, Oregon, California, Arizona, New Mexico, Utah, Nebraska, Texas, and Kansas are also included in the program. Terminal facilities are currently on order at Bismarck.

The IMS program will at least be used to initiate the irrigation farming during the beginning stages of irrigation from the Garrison Diversion Project. Future requirements by electric power companies may also require services similar to IMS to increase efficiency by better coordinating peak energy uses

and heavy irrigation needs. The use of IMS or other irrigation management services may reduce some dimensions of risk and uncertainty associated with management-production related problems.

More satisfactory terms of financing and a more rapid shift from lending strictly on a colateral basis with respect to returns, repayment capacity, and management ability are sought to promote family farms with irrigation potential. In this era of dwindling farm numbers, new technology requires high rates of capital accumulation to preserve the firm's economic viability. New policies and government credit programs appear to be necessary for transferring risk capital for irrigation to young, low equity operators.

Literature Cited

Anheluk, Jerry I., Credit Availability for Potential Irrigators in North Dakota, unpublished M.S. thesis, Department of Agricultural Economics, North Dakota State University, Fargo, November, 1977.

Carkner, Richard W., "Crop Selection Under Irrigation in North Dakota," Farm Management Planning Guide, Section VI, Number 9, Cooperative Extension Service, North Dakota State University, Fargo, December, 1976, p. 9.

Dodds, Duaine L., and Dwain W. Meyer, Establishment of Dryland and Irrigated Forages, Circular R-563 Rev., Cooperative Extension Service, North Dakota State University, Fargo, February, 1976.

Gullickson, Mark E., Potential Irrigator Profiles in North Dakota, unpublished M.S. thesis, Department of Agricultural Economics, North Dakota State University, Fargo, December, 1974.

Interdisciplinary Research Team, Marketing Irrigation Production (Reports 2, 3, 4), North Dakota State University, Fargo, June, 1975-77.

Letter written by James G. Beck, Marketing Representative, Lease Northwest, Inc., Northwestern Bank Building, Minneapolis, Minnesota, to the author, March 25, 1977.

Lundstrom, Darnell, "Exercise in Irrigation Crop Selection," Irrigation Handbook, Cooperative Extension Service, North Dakota State University, Fargo, November, 1977, Section 17.

Lundstrom, Darnell, "North Dakota Irrigated Acreage Survey, 1971-1976," Agricultural Engineering, Cooperative Extension Service, North Dakota State University, Fargo, North Dakota.

Nelson, A. G., L. F. Warren, and W. G. Murray, Agricultural Finance, Sixth Edition, The Iowa State University Press, Ames, 1973, pp. 95-96, 223.