



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
Number 4

March 1952

MARKETING POSITION OF PROPOSED IRRIGATION AREAS
IN NORTH DAKOTA

with Special Reference to the Minot Trade Area

By

Joseph C. Podany

Agricultural Experiment Station
North Dakota Agricultural College

and

Bureau of Reclamation
United States Department of the Interior

cooperating

Fargo, North Dakota

TABLE OF CONTENTS

	<u>Page</u>
INTRODUCTION	1
PURPOSE OF STUDY AND NATURE OF PROBLEM	3
DAIRY PRODUCTS	4
Area Production and Utilization of Milk	4
Area Consumption Needs of Dairy Products	11
1. Fluid Milk..	11
2. Fluid Cream.	16
3. Chocolate Milk, Buttermilk and Skim Milk	18
4. Butter	18
5. Ice Cream	20
Marketing Facilities	22
1. Capacity of Existing Facilities.	23
Whole Milk Handling Facilities	23
Butter Making Facilities	24
2. Capacity Estimates of Major Types of Equipment	24
POULTRY PRODUCTS	26
Area Production and Disposition of Poultry and Eggs	26
1. Chickens and Eggs	27
2. Turkeys	36
Poultry Processing Facilities	36
MEAT PRODUCTS	37
VEGETABLE AND BERRY PRODUCTION FOR FRESH CONSUMPTION	41
SUMMARY AND CONCLUSIONS	43

FOREWORD

This is the fourth of a series of research studies dealing with economic problems which farmers in North Dakota will be facing as irrigation developments progress.

The North Dakota Agricultural College and the Bureau of Reclamation have a direct responsibility for anticipating the many agricultural and economic problems arising from irrigation developments. In order to evaluate the economic feasibility of irrigation and the nature and scope of adjustments in farm organization and marketing practices involved, a series of research projects have been carried on under a Memorandum of Understanding between the Bureau and the College. This Memorandum includes also cooperative research work in agronomy, soils and agricultural engineering as it relates to irrigation problems.

In the field of agricultural economics, the following reports of findings from cooperative research under the Memorandum have been published.

1. Economics of Grain Farming in Renville County. By L. W. Schaffner. North Dakota Agr. Exp. Sta. Bul. 367, May 1951.
2. Present Farm Economy in Three Proposed Irrigation Areas of North Dakota. By L. W. Schaffner. Agricultural Economics Report No. 3, May 1951.
3. Prospective Marketing Position of Farm Products Adaptable to Irrigation in North Dakota. By Joseph C. Podany. Agricultural Economics Report No. 1, February 1951.
4. Marketing Position of Proposed Irrigation Areas in North Dakota - with special reference to the Minot Trade Area. By Joseph C. Podany. Agricultural Economics Report No. 4, March 1952 (this present report).

These reports can be obtained upon request from the Department of Agricultural Economics, North Dakota Agricultural College, Fargo, N. D.

Rainer Schickele, Chairman
Agricultural Economics Department

MARKETING POSITION OF PROPOSED IRRIGATION AREAS

IN NORTH DAKOTA

with Special Reference to the Minot Trade Area 1/

by
Joseph C. Podany^{2/}
North Dakota Agricultural College

INTRODUCTION

Under the proposed Missouri River Basin Project, over one million additional irrigated acres are contemplated for North Dakota. It is assumed that the state is at present producing those farm commodities in which it has the greatest comparative advantage. The big question is: Can the competitive position of the state be improved by this irrigation development? What returns will additional irrigation bring to North Dakota? Can we successfully eliminate some of the high risks of dryland farming? Can we improve the stability of agriculture?

In order to make irrigation farming pay, it will be necessary for farmers to shift from the extensive grain and grazing economy of dryland farming to higher priced crops or to high-yielding forage for intensive livestock enterprises. But production of some crops with currently higher prices does not necessarily assure greater net returns to irrigation farmers. Much depends on the market outlook for such crops. 3/

Generally, speaking, there are two types of proposed irrigation units in North Dakota: (1) those which are scattered along the river bottom lands -- commonly referred to as "shoestring" units, and (2) those that consist of a sizable amount of irrigable acreage in fairly contiguous units.

-
- 1/ This study was undertaken under a cooperative agreement between the North Dakota Agricultural Experiment Station (Project ND 701) and the Bureau of Reclamation, U. S. Department of the Interior, Region 6.
- 2/ Assistant Agricultural Economist. The author acknowledges the cooperation and valuable advice received from Rainer Schickele and other members of the Department of Agricultural Economics, from Chris Jensen and other members of the Dairy Department, from Ned Williams and other members of the Bureau of Reclamation, from the Office of the State Dairy Commissioner, and from the ~~dairy~~^{dairy} plant managers in the Minot trade area.
- 3/ For a discussion of this problem, see "Prospective Marketing Position of Farm Products Adaptable to Irrigation in North Dakota," N. D. Agr. Exp. Sta. Agricultural Economics Report No.1, February 1951, pp.14-30.

The former would serve mainly as "feed bases" for the surrounding dryland areas and contribute to the stability of such areas in dry years. It is the latter, more contiguous irrigation areas which have a significant bearing on North Dakota's competitive position in the market of farm commodities which can best be produced under irrigation.

Extensive blocks of irrigable land have been located in north central North Dakota, comprising portions of Bottineau, McHenry, Renville, and Ward counties, an area served by Minot as its main trade center. This area was selected for study. Many of the marketing problems encountered here will be found in other North Dakota area where irrigation development shows promise.

Under dryland conditions, the Minot Trade Area specializes in the growing of wheat and other small grain crops. As evidenced by census reports for 1939, 1944, and 1949, between two-thirds and three-fourths of the value of all farm products sold in the Four County Area (Bottineau, McHenry, Renville, and Ward) came from wheat and other field crops. Fruit and vegetable crops were insignificant. Only one-fourth to one-third of the farm product sales for these years were from livestock and livestock products. ^{1/} (Table 1.) The four counties accounted for about 10% of the total sales of farm products in North Dakota during 1939, 1944, and 1949.

Between 1940 and 1950 the population of the Four County Area remained about the same -- around 65,000. Within the area itself, changes consistent with national trends have occurred. Open country population decreased 21%. City and village population increased 22%. The most significant population change occurred in the city of Minot, which increases from 16,577 to 22,032, or 33%. (Table 2.)

Table 1. Farm Products Sold in the Area (Bottineau, McHenry, Renville, and Ward counties) during 1939, 1944, and 1949. *

Product Sold in Area	Percent of farm products sold		
	1939	1944	1949
Sales of crops	74	62	78
Sales of livestock and livestock products:			
Dairy products	7	14	5
Poultry products	3	4	1
Livestock	16	20	16
All livestock & livestock products	26	38	22
All farm products (percent)	100	100	100
All farm products (million dollars)	9.4	37.1	43.2

*Source: U. S. Census of Agriculture

^{1/} See also Schaffner, L. W., "Economics of Grain Farming in Renville County, North Dakota," N. D. Agr. Exp. Sta. Bul. 367, May 1951.

Table 2. Population of the Area (Bottineau, McHenry, Renville, and Ward counties) April 1, 1940 and April 1, 1950.*

Locale	Population		
	1940 Number	1950 Number	Percent change
Total Area	64,801	64,883	+ 0.1
Minot	16,577	22,032	+32.9
Other towns and villages	15,069	16,539	+10.0
Open country	33,155	26,312	-20.6

* The 1950 population estimates taken from "1950 Census of Population, Advance Reports, Population of North Dakota April 1, 1950." Series PC-8 No. 33. Bureau of Census, U. S. Dept. of Commerce, Washington, D. C., June 21, 1951.

PURPOSE OF STUDY AND NATURE OF PROBLEM

The purpose of this study is to evaluate the market outlook of the four-county area of which Minot is the trade center. From the viewpoint of favorable national demand prospects and local adaptability to production under irrigation, dairy and poultry products, meats, and a limited number of vegetable and berry crops hold good promise for this area and therefore were selected for study. The amount of local expansion in production of these commodities will, of course, be limited by the extent to which this area can compete with other established areas in supplying the local and national market. A quantitative appraisal of the Area's competitive advantage for these products would require an exhaustive study of production costs under irrigation, of transport rates, and location of competitors. ^{1/} Such data, however, change over time and would be of only limited usefulness if not kept current.

^{1/} For a discussion of some of the theoretical aspects of market areas, see: Fetter, F. A., "The Law of Market Areas," Quarterly Journal of Economics, Vol. 38, May 1924, pp. 520-529. Hyson, C. D. and Hyson, W. P., "The Economic Law of Market Areas," Quar. Jour. Econ., Vol. 64, May 1950, pp. 319-327. Waite, W. C. and Trelogan, H. C., Agricultural Market Prices, John Wiley & Sons, Inc., New York, 2nd Ed. 1951, Chapter 7.

However, it appears safe to assume that some comparative advantage should exist in the local area from the standpoint of transportation for those products in which the area is deficient, or which can be shipped to western markets.

The determination of the market outlook for a particular area involves an appraisal of the present surplus or deficit position of that area with respect to the products under consideration. In a strict sense, the determination of surpluses and deficits involves a complete accounting of in-and-out movements of these commodities. While it has not been possible to make accurate measurements of the movement of such commodities, estimates of the following factors are presented:

- (a) the size of the present local market;
- (b) the capacity of present processing and marketing facilities, and
- (c) the extent to which the present local market and processing facilities could absorb additional production, and the extent to which additional facilities would be needed to enable the local market to absorb additional production.

DAIRY PRODUCTS

Area Farm Production and Utilization of Milk

In the local as well as national market, the demand prospects for fluid milk and cream, ice cream and other dairy products except butter are quite favorable. At the same time, dairying might offer important opportunities for profitable land and labor use as irrigation develops in the Four County Area. High-yielding feed and forage crops and irrigated pasture could produce a dependable feed base on irrigated land for intensive dairy enterprises -- if the market outlets should warrant such an expansion of dairy production. For this reason, we shall survey the present production, consumption and marketing situation for dairy products in the Area and appraise the prospects for future output expansion in view of the market characteristics.

In 1949, dairy products accounted for only 5% of the farm income in the Area (Table 1). Nevertheless some marked changes in production and utilization of milk have occurred within the Area during the past decade. Among these are a substantial decrease in milk production, an expansion of fluid milk sales, a decline in cream sales, and a virtual discontinuance of farm butter sales. Such changes may be largely attributed to the following factors: (1) the unusually favorable conditions for growing crops-- both as to prices and yields--during the 1940's; (2) the increase in fluid milk consumption by inhabitants of towns and villages due to full employment at rather high wages; (3) the continued migration from farms to towns and villages and (4) the increasing reliance on the commercial milk supply on the part of village and even farm families.

The trend in milk production in the Area has been downward since 1939 (Table 3). According to the Census of Agriculture, a total of 186 million pounds of milk was produced in the Area during 1939. By 1944, milk production had decreased to 172 million pounds. No milk production figures are available from the 1950 census. However, a conservative estimate would be about 140 million pounds in 1949.

The leading county in milk production during 1944 within the Area was Ward county with some 59 million pounds, followed by McHenry with 47 million pounds, Bottineau with 41 million pounds, and Renville with 25 million pounds. This is in the same order of ranking as by number of milk cows. For 1949, the counties probably ranked in about the same order but with decreases in milk production in each county.

There has been a 78% increase in farm sales of whole milk, a 42% decrease in the sales of butterfat, and a decrease of 99% in farm butter since 1939. Likewise, the number of farms supplying the fluid market has increased, while the number of farms selling butterfat and butter has decreased since 1939. But the rate of change in farms selling dairy products has been lower than the rate of change in volume sold. There was a 38% increase in farms selling whole milk, a 30% decrease in farms selling butterfat, and a 98% decrease in farms selling butter. Thus, the percentage increase in farms selling whole milk was about one half as great as the percentage increase in whole milk sold between 1939 and 1949, which means that the size of dairy enterprise increased on farms selling whole milk.. The decrease in farms selling butterfat was about three fourths the decrease in butterfat sold; hence, the average butterfat sale per farm declined. Butter sales and farms selling butter declined at about the same rate.

The shift in milk utilization within the Area is readily seen if the various uses of milk are expressed in percent of the total milk production for the years 1939, 1944, and 1949 (Table 4). Roughly two-thirds of the milk production was utilized for butterfat sales in 1939. By 1949 that proportion declined to somewhat more than one-half. Whole milk sales, on the other hand, increased their share from less than 4% to as high as 9%. The increase in the proportion used on farms is difficult to explain. An error in our rough estimate of 1949 total milk production would, of course, change these proportions. These data show, however, that at present cream sales are still by far the most important market outlet in the Area, despite the increasing importance of milk production for the fluid market.

Table 4, Pattern of Milk Utilization in the Area (Bottineau, McHenry, Renville, and Ward counties) 1939, 1944, and 1949.

	Percent of total		
	1939	1944	1949
Total milk production	100.0	100.0	100.0
Cream sold (in milk equivalents)	67.3	72.3	52.4
Whole milk sold	3.8	4.9	9.0
Butter sold (in milk equivalents)	0.8	--	--
Milk used on farms where produced	28.1	22.8	38.6

Table 3. Farm Milk Production and Utilization in the Area (Bottineau, McHenry, Renville, and Ward counties), 1939, 1944 and 1949. 1/

YEAR	MILK PRODUCTION		DAIRY PRODUCT SALES					MILK USED ON FARMS WHERE PRODUCED ^{6/}	NUMBER OF FARMS REPORTING			
	Number of Cows	Amount of Milk	Cream		Whole Milk	Butter Product Weight	Butter Milk Equiv. 5/		Milk Production	Sales of:		
			Butter-fat	Milk Equiv. 4/						Cream	Whole Milk	Butter
1939	43,058	186,405	4,707	125,521	7,107	70	1,490	52,286	6,216	5,544	232	406
1944	42,564	171,876	4,659	124,230	8,419	6	130	39,097	5,729	5,379	228	13
1949 2/	34,267	140,000 ^{3/}	2,750	73,338	12,671	1	21	53,970	4,632	3,376	321	10
Percent Change 1939-49	-20.4%	-24.9%	-41.6%	-41.6%	+78.1%	-98.6%	-98.6%	+3.0%	-25.5%	-30.1%	+38.2%	-97.5%

1/ Census of Agriculture

2/ Preliminary

3/ Estimated. No milk production figures have been published in preliminary census releases. In view of the fact that the Four County Area is highly specialized in grain production, it was assumed that there was no marked change in the feeding of dairy cows and resulting production per cow between 1944 and 1949. The milk production estimate of 140 million pounds is therefore a conservative estimate.

4/ Assuming a 3.75% butterfat content in milk as for North Dakota. See USDA Agricultural Statistics - Milk, Butterfat, and Butter Production on Farms, etc.

5/ Assuming a 24.5% overrun.

6/ Residual. This can be broken down further: farm household consumption as reported by BAE (op. cit.) for North Dakota divided by all farms reporting milk production (census) times number of farms with milk production in the Area results in an estimate of 18 million pounds in 1939, 15 million in 1944, and 16 million in 1949.

All four counties showed increases in fluid milk sales by farmers. But fully two-thirds of the milk sales in the Area were made by farmers in Ward county, mainly for the expanding market of Minot. Also, 78 of the 89 additional farmers who began selling whole milk between 1939 and 1949 were located in Ward county.

Milk sold as butterfat in cream within the Area decreased by 42% between 1939 and 1949. From 1939 to 1944, about the same amount of milk was sold as butterfat in spite of a decline of 7.5% in the Area's milk production. This was largely due to the fact that the sale of farm butter was practically discontinued in this period. After 1944, cream sales declined sharply, so that by 1949 only some 73 million pounds of milk were sold as butterfat in cream. Between 1939 and 1949, 1,668 of the farms in the Area stopped selling butterfat.

Census data show that in 1939 most of the cream sales come from widely scattered small herds. Fifty percent of the farms reporting milk production had herds of five to nine cows. These farms, also, accounted for 50% of the cows milked and for 50% of the total Area milk production, but accounted for only 13% of the whole milk sales by farmers. In contrast, nearly three-fourths of the whole milk sold was from 5% of the farms in the Area having herds of 15 cows or more. (Table 5). Hence, fluid milk sales were much more centralized and came from farms where dairying played an important role in the farm organization.

Subsequent data indicate that this difference between cream and fluid milk selling farms has continued and may even have widened in recent years. Milk sales by farmers increased 18% between 1939 and 1944, while the number of farms selling whole milk actually decreased by 2% between those years. From 1939 to 1949, a 79% increase in sales of whole milk was accompanied by only about one-half as great an increase (38%) in the number of farms selling whole milk.

While total milk production and cream sales declined, whole milk sales by farmers and number of farms selling milk increased as the population of cities and villages rose and per capita income increased. This indicates the relative strength of the demand position of fluid milk as urbanization and living levels advance. This arouses speculation as to what shifts in dairying might take place in the Area if and when irrigation is introduced. (1) To what extent would existing dryland producers of milk for the fluid market be displaced by new producers located on irrigated land? (2) What would be the chances of expanding the sale of fluid milk beyond the markets presently supplied by farmers in the Area as a result of further increases in village and town population? (3) What other alternatives do farmers have in dairying? Answers to these questions will be useful in appraising the future marketing potentials of dairy products in the Area.

This is an area where location with respect to markets and all-weather roads is especially important to a farm producing milk for fluid sales. As was indicated earlier, most of the fluid milk sold in the Area is for the consumption needs of Minot. Presumably the producers currently supplying the Minot milk market are rather favorably located with respect

Table 5. Number of Farms Reporting Milk Production, Number of Cows Milked, Production per Cow, Pounds of Milk Produced, Number of Farms Selling Milk, and Total Sales by Farmers, with proportions of each by herd size in the Area (Bottineau, McHenry, Renville, and Ward counties) 1939.

Size of Herd	Number of Farms Reporting Milk Production	Number of Cows Milked	Production per Cow by Herd Size (pounds)	Pounds of Milk Produced		Number of farms Reporting Whole Milk Sales		Pounds of Whole Milk Sold	Percent of Production Utilized for Whole Milk Sales by Herd Size
				(thous. lbs.)	percent	(thous. lbs.)	percent		
ALL	6,216	43,058	4,329	186,405	232	7,107		3.8	
1-4 cows	29	11	4,323	11	24	4		1.5	
5-9 cows	50	49	4,374	50	28	13		1.0	
10-14 cows	16	26	4,245	26	20	14		2.1	
15-19 cows	4	8	4,197	8	15	24		11.5	
20-29 cows	1	4	4,462	4	9	23		22.8	
30-49 cows	*	2	4,863	1	4	22		58.4	
Total	100	100	---	100	100	100		---	

* Less than 0.5%

Source: Census of Agriculture 1940, Special report Number of Dairy Cows and Milk Production on Farms.

to these factors. Since much of the proposed irrigation will be developed some distance from Minot, there would have to be a considerable improvement of the roads before new producers could come into the fluid milk market. However, there may be a good chance for some of the irrigation farmers to displace present dryland producers now serving the fluid milk needs of nearby towns.

Throughout the State there are small towns and villages which import a large part of their milk supply from Minnesota. Because of the proximity of the proposed irrigation area to a considerable number of these towns, it is possible that the milk market supplied by the local producers might be greatly expanded. Such an expansion, however, is contingent on additional all-weather roads serving the irrigated areas. This might well prove to be feasible, since irrigation of sizable blocks of land will doubtless increase population density in those areas.

Other alternatives in dairying open to irrigation farmers might be the production of milk for cheese and for butter manufacture. Cheese manufacturing can be pretty well ruled out unless two conditions are met: (1) high density of dairy cow population and (2) payment of a high enough differential price to encourage farmers to produce milk for cheese-making rather than for butter-making purposes. If cheese production is ruled out, any expansion in milk production beyond the whole milk market will have to go into butter to be sold outside the State. There is little present evidence to indicate that irrigated areas enjoy a comparative advantage in the production of butter which must be sold on a national market.

In summary, there are three major market outlets which would have to absorb any increase in dairying that might develop under irrigation farming:

- (1) Fluid milk and cream consumption in local and adjacent areas,
 - (a) meeting additional demand from an increasing nonfarm population and resulting from rising consumer incomes;
 - (b) replacing milk now imported from distant areas;
 - (c) replacing milk now sold by small herds on dryland farms.This is probably the quantitatively most important profitable outlet for additional milk production.
- (2) Milk sales for cheese manufacture; no present experience in the Area. Prospects are uncertain and depend on rather intangible factors.
- (3) Cream sales for butter manufacture; the Area is now on a surplus basis and in not too strong a competitive position.

There is one more aspect of milk production that should be considered here. That is the matter of seasonality. Milk production for the State of North Dakota as a whole is highly seasonal. (Table 6) This is, however, understandable, since around 90% of the milk produced is sold as cream for butter making and dairying is usually a side enterprise carried mainly to provide farm household needs. But what seems difficult to comprehend is that the seasonality of milk production for the fluid market in the Area is even higher than that for total milk in the State as a whole.

Table 6. Indexes of Seasonal Milk Production, North Dakota and Ward county

Month	Index for <u>1/</u> North Dakota	Index for selected herds, <u>2/</u> Ward county 1948
January	75	80
February	78	102
March	92	131
April	103	136
May	137	146
June	158	143
July	139	122
August	113	94
September	91	78
October	80	63
November	66	53
December	68	52
Average	100	100

1/ From USDA BAE "Milk Production on Farms and Statistics of Dairy Plant Products" 1949.

2/ From DHIA records (actual) with varying number of cows milked each month.

For example, the ratio of June milk production to November production for North Dakota (1949) was 2.39, while the ratio for Ward county DHIA herds (1948) was 2.70. (Table 6) Most of these Ward county herds produced milk for fluid consumption. Presumably, this high seasonality in the Area is a reflection of climatic and economic factors, some of which might be overcome under irrigation farming.

Because there is a wide seasonal variation in milk production in the Area, it has been necessary to import milk from Minnesota during the fall and winter months even though on an annual basis the supply of milk for fluid purposes was adequate.

There may be a considerable reduction in the seasonality of milk production in the Area as a result of better feeding. Studies have indicated that "feeding can do a great deal to offset some of the seasonal declines that are characteristic under average farm conditions. For example, the slumps in production of milk that traditionally occur in late summer and fall can be reduced by improved feeding programs, including such things as rotation or aftermath pasture, production and use of high quality hay and silage, and the feeding of adequate quantities of grain. This would also tend to increase annual production per cow." ^{1/} More succulent feeds would be made available with the introduction of irrigation in the Area.

Another way seasonality of milk production might be affected is by changes made in the patterns of freshening. To accomplish this effectively, substantial seasonal differentials in milk prices may be needed. It has been the practice in the various milk markets of North Dakota to buy milk on the so-called "butterfat basis." That is, milk is paid for in a direct ratio to its butterfat content with a periodically set rate per one-tenth of one percent butterfat content. In recent years such rates were adjusted upwards with rising costs. No attempt has been made to make adjustments seasonally. Even with the availability of cheaper and better feeds, the present method of payment for milk for fluid purposes might not provide sufficient inducement to reduce seasonal output variations.

Estimates of Area Consumption Needs of Dairy Products

To appraise the potential market prospects for additional dairy products in the Area, we need to estimate present rates of local consumption, the sources of present consumption, and the net import or export position of the Area.

In theory, the consumption of a particular agricultural product in a specific area is easily determined. All that is needed is information on production, utilization, imports and exports, and the rest becomes a matter of simple arithmetic. In practice, it is very difficult to get information on utilization, imports, and exports. This is no less true with dairy products than with other agricultural products.

1. Fluid Milk

Accurate determination of the Area's consumption of fluid milk necessitates: (1) reliable figures on local milk production, both seasonal and annual; (2) the amounts of production actually utilized for fluid purposes; (3) the extent of imports, and (4) the extent of exports.

^{1/} Parsons, M. S., Frick, G. E., Pullen, W. E., and Bredo, W. "The Seasonal Adjustment of Milk Production in the Boston Milkshed. USDA, BAE, June 1950, p. 17.

Fairly reliable figures on whole milk sales by farmers are available for the Area during the years of 1939, 1944, and 1949. (Table 3) The seasonal pattern of milk deliveries is only available for dairy manufacturing plants. Deliveries to dairy manufacturing plants are so much greater than deliveries to specialized milk bottling plants and sales by producer-distributors. Therefore assuming the same seasonal pattern of deliveries to these various outlets does not introduce serious errors.

It has been more difficult to determine what proportion of the whole milk sold by farmers was actually utilized for fluid purposes. Information on the amount of ice cream manufactured in the Area and butterfat purchases by quality of cream was secured from the State Dairy Commissioner at Bismarck. It was assumed that part of the whole milk sold by farmers in the Area would be utilized in ice cream manufacture. ^{1/} The remainder of the milk was considered as utilized for fluid purposes.

The real difficulty has been to get reliable estimates of imports and exports of fluid milk for the Area. The ~~picture~~ ^{picture} is much more complicated than that involving in-and-out shipments by dairy plants located in the Area.

Milk is being supplied to towns in the eastern portion of McHenry county by plants located at Devils Lake and Carrington. At the same time, milk is supplied by plants in Minot to towns located in the eastern part of Burke county, just west of the Area. Exact estimates of these two types of movements are not available. On the basis of the population of the towns to which the milk is supplied, it is believed that the amounts involved are small and that they about cancel out.

Mention should also be made of bulk transfers of whole milk between plants. Purchases from other plants are excluded in the reports filed with the State Dairy Commissioner by dairy manufacturing plants. But sales of whole milk in bulk from one plant to another are included in the milk reportedly handled. Milk plants generally try to get what milk they can locally and look to more distant surplus areas for the rest. In view of the fact that most plants in the Area have had to import milk from Minnesota, it does not appear that they would supply bulk milk to plants located outside of the Area, except in case of unforeseen emergencies. It is believed that such sales would, therefore, be an exception rather than the rule. A careful examination of plant records over a period of years would be required to determine the exact magnitude of such out-of-Area sales.

The important milk inshipments are those made by the plants in the Area when the local supply of fluid milk is inadequate. Estimates of such inshipments were secured from the plant managers in the Area for 1949. Some 535 thousand pounds or 6.6% of the net fluid milk sales were imported from Minnesota. These milk imports are mainly for the months September to December although it is believed that some inshipments were also made during the months of January and February.

^{1/} The assumption was made that the butterfat content of ice cream was 10% or about the legal minimum for North Dakota. Calculation of requirements of milk and cream for ice cream manufacture made in accordance with tables 21 and 22 of Chapter VIII in Turnbow, G. D., Trach, P. H., and Raffetto, L. A., The Ice Cream Industry. John Wiley and Sons, New York, 2nd Ed. 1947.

In the estimation of the Area consumption of fluid milk, the inshipments were added to the adjusted local supply in order to give the total commercial supply of fluid milk. Estimates were made of farm consumption of milk on the farms reporting milk production. The sum of the commercial supply and the farm consumption of milk gave the Area consumption of milk. (Table 7).

On an average daily per capita basis, the consumption of fluid milk by those dependent on the commercial supply in the Area is likely to be somewhat less than 0.8 pounds. (Table 8) This is about equal to the milk consumption rates of Sioux City (Iowa), Omaha (Nebraska), and the average U. S. nonfarm rate. It is considerably below the milk consumption rate of Minneapolis-St. Paul (Minn.), New York City, and that of some of the other larger cities. -- The per capita farm consumption rate for the Area is estimated comes out a little higher than the average U. S. rate reported by the BAE.

Table 7. Milk supply, and per capital consumption in the Area-
(Bottineau, McHenry, Renville, and Ward Counties)-
during 1949.

	Thousand Pounds
Annual sales of fluid milk by dairy manufacturing plants:	
Plant receipts <u>1/</u>	10,966
Less: milk utilized for ice cream <u>2/</u>	1,933
Plus: inshipments <u>3/</u>	635
Net sales	9,668
Annual estimated sales of fluid milk by specialized milk bottling plants and producer-distributors	1,705
Estimated fluid milk consumption on farms where milk is produced <u>4/</u>	13,024
Estimated total fluid milk consumption	24,397
Estimated annual per capita consumption, pounds	376
Estimated daily per capita consumption, pounds	1.03

1/ Receipts of whole milk by dairy manufacturing plants as reported to the office of the State Dairy Commissioner.

2/ Estimates of milk utilized for ice cream manufacture made on basis of data supplied by BAE and the Office of the State Dairy Commissioner, Bismarck, N. Dak.

3/ Estimated milk imports from Minnesota (635,392 pounds) based in part on data provided by such plants to Dr. C. Jensen, Dairy Department, North Dakota Agricultural College and in part on estimates secured on a personal visit to those plants.

4/ Fluid milk consumption calculated as 80% of fluid milk and cream estimate in footnote 6 of Table 3. See also footnote 4, Table 30, p. 112. Misc. Publ. 691, "Consumption of Food in the United States 1909-48". USDA BAE.

Table 8. Daily per capita consumption of fluid milk in the Area- (Bottineau, McHenry, Renville, and Ward counties)-and other markets.*

		Daily per capita consumption rates of fluid milk
		- pounds -
Four County Area (1949)		
	Total	1.030
	On farms <u>1/</u>	1.356
	Cities and Villages <u>1/</u>	0.807
Minneapolis-St. Paul, Minn. (1950)		
		0.984
New York, (1950)		
		0.888
Duluth-Superior, Minn. Wisc. (1950)		
		1.082
Sioux City, Iowa (1950)		
		0.748
Omaha-Council Bluffs, Nebr., Iowa (1950)		
		0.731
Dubuque, Iowa (1950)		
		0.876
Quad, Cities, Ill.-Iowa (1950)		
		0.782
St. Louis, Mo. (1950)		
		0.785
U. S. per capita		
	Total <u>2/</u>	0.844
	Nonfarm <u>3/</u>	0.734
	Farm <u>3/</u>	1.293

* Data for other markets are from USDA BAE "Fluid Milk and Cream Report", Dec. 1951. p. 16.

- 1/ Farm consumption divided by total farm population (26,312) to get on-farm per capita consumption rate. Milk sales by farmers divided by population of cities and villages to get per capita consumption rate there.--If farm consumption is divided by estimated population on farms reporting milk production, per capita farm consumption comes to 1.872. If milk sales by farmers are divided by population in cities and villages plus estimated population on farms not reporting milk production (1761 farms not reporting milk production times 4.12 average number of persons per farm in the Area), comes to 0.680 per capita nonfarm consumption.
- 2/ The 1949 annual per capita consumption of fluid milk was 308 pounds. Fluid milk consumption calculated as 80% of fluid milk and cream rate. See footnote 4 in Table 7.
- 3/ In 1942 the per capita consumption of fluid milk by rural families was 153.2% of the average U. S. consumption, while that of nonfarm families was 86.9%. (Misc. Publ. 550, "Family Food Consumption in the United States," Table 22 and 34). These percentages were applied to the overall U. S. per capita rate.

Information was secured from the office of the State Dairy Commissioner relative to deliveries of whole milk to dairy manufacturing plants by months. The pattern of monthly 1/variation in deliveries lends support to the belief that local commercial supplies of milk have been adequate during the flush season and inadequate during the fall and winter months in recent years.

However, when the milk receipts are adjusted for the amount of milk that would be used in ice cream manufacture (on the assumption that ice cream is made from available sweet cream and fluid milk only), there is some indication that the local commercial supply of fluid milk has been more inadequate than the difference between fluid milk sales and consumption would suggest.

These estimates of the per capita milk consumption rates in the Area, both for the nonfarm and farm population, appear fairly well in line with the general level of consumption elsewhere. Hence, there does not seem to be much scope for increased local fluid milk consumption per capita, unless the milk could be offered at significantly lower prices. Milk prices in Minot have, however, been somewhat higher than in areas farther east.

What increase in local demand for fluid milk could be expected as a result of (a) some decrease in milk prices, (b) a rise in average income in the Area, (c) and some population increase that might result from various resource, irrigation, and commercial developments over the next few decades?

In 1951 the retail milk price in Fargo -- both at stores and home delivered -- was 18 cents per quart January to August and 19 cents per quart September to December. This was 10% less than the price of milk at Minot, which was, respectively, 20 and 21 cents. Assuming that with local production under irrigation the retail price of milk in Minot can be reduced to what it is in Fargo, what changes in per capita milk consumption can be expected locally with this price reduction?

With income remaining at present levels and a 10% decrease in price, a 2.5% increase in per capita milk consumption could be expected. 2/ With a constant population, this means that the commercial supply of fluid milk would have to be increased from 11.4 million pounds to 11.7 million pounds. (Table 9).

1/ The 1949 monthly index of whole milk deliveries to dairy manufacturing plants in the Four County Area (Bottineau, McHenry, Renville, and Ward counties) with average month equal to 100 was:

January 82	May 116	September 92
February 85	June 114	October 94
March 106	July 107	November 91
April 107	August 106	December 100

2/ Waite, W. C. and Trelogan, H. C., Agricultural Market Prices, John Wiley & Sons, Inc., New York, 2nd Ed., 1951, p.46. The demand (price) elasticity of fluid milk is given as 0.27. For ease of calculation, the demand (price) elasticity of fluid milk was assumed to be 0.25, meaning that for every 1% decrease in retail price of milk there was a 0.25% increase in per capita fluid milk consumption.

Table 9. Fluid Milk Supplies Required to Meet Varying Consumption Needs of Fluid Milk, Fluid Cream, and Ice Cream.

Annual Consumption under specified conditions:	Consumption Met From Commercial Supplies:				Fluid Milk and Cream Consumption on farms where produced ^{3/}	Total Consumption of Fluid Milk and Cream
	Fluid Milk	Fluid Cream ^{1/}	Fluid Milk and Cream	Ice Cream ^{2/}		
-----Million pounds of milk-----						
Present (1949) ^{4/}	11.4	3.8	15.2	3.9	16.3	35.4
10% price reduction ^{5/}	11.7	3.9	15.6	3.9	16.3	35.8
10% price reduction and 20% income rise ^{6/}	12.6	5.0 ^{7/}	16.8	4.4 ^{8/}	16.3	37.5
10% price reduction and 20% income rise population increase of: ^{9/}						
1 percent	12.7	5.0	17.7	4.4	16.3	38.4
10 percent	13.9	5.5	19.4	4.8	16.3	40.5
20 percent	15.1	6.0	21.1	5.3	16.3	42.7
30 percent	16.4	6.5	22.9	5.7	16.3	44.9

- ^{1/} Assumption made that the milk equivalent of fluid cream is 25% of the total equivalent of fluid milk and cream. No assumptions made with regard to price.
- ^{2/} Assumption made that present production of ice cream is about equal to consumption needs--that is, around 60 pounds per capita (net milk equivalent basis) X 64,883 equals 3.9 million pounds milk equivalent.
- ^{3/} Estimated household consumption of fluid milk and cream on farms reporting milk production. Assumption made that consumption would not change with income and price changes or with increase in population served by commercial supply.
- ^{4/} See Table 7. The 1949 adjusted local supply plus estimated milk inshipments for the Area was used.
- ^{5/} Assuming in addition to conditions stated in ^{4/} that the retail price of milk was reduced 10%; that is, from 20 cents a quart (Minot) to 18 cents a quart (Fargo) and that the demand (price) elasticity of fluid milk is 0.25.
- ^{6/} Assuming in addition to the conditions in ^{5/} that there is a 20% rise in per capita incomes of population dependent on commercial milk supply and that the demand (income) elasticity of fluid milk is 0.40.
- ^{7/} Assuming that the demand (income) elasticity of fluid cream is 0.90. That is, with a 20% rise in per capita income there is an 18% increase in per capita consumption of fluid cream.
- ^{8/} Assuming that the demand (income) elasticity of ice cream is 0.68; that is, with a 20% rise in per capita income per capita ice cream consumption increases 13.6%.
- ^{9/} Assuming in addition to conditions in ^{6/} that there is an increase in number of people dependent upon the fluid milk, fluid cream, and ice cream supply either through increase in population within the Area or through increase in area covered.

What the seasonal pattern of fluid cream consumption in the Area was for the periods under consideration is not known. Data from reports on federally controlled milk markets in the Middle West generally show quite a pronounced seasonal variation in fluid cream sales, with sales above the 12-month average in the winter and spring months, about average in the fall months, and below average in the summer months.

Fluid cream is utilized as coffee cream, on cereal, as whipped cream on fresh fruits and other desserts, for cooking purposes, and for the manufacture of ice cream. Perhaps the most significant thing about fluid cream is that it is extremely perishable, requiring careful handling and more frequent delivery by farmers than that necessary for cream utilized in buttermaking. Because of weather and road conditions in the Area the local supply of fluid sweet cream is inadequate to meet consumption needs. The local supply would generally be adequate if the local commercial delivery of fluid milk or sweet cream by farmers were adequate. Nearly the same problems of handling and delivery are involved for these two products.

In estimating the consumption needs of fluid cream under the various conditions (Table 9) no assumptions were made with respect to price. It was assumed that the whole milk equivalent of fluid cream was equal to 25% of the total milk equivalent of fluid milk and cream. However, with a 20% increase in per capita income the increase in per capita consumption of fluid cream could be around 18%.^{1/}

3. Chocolate Milk, Buttermilk, and Skim Milk

In recent years there has been an increase in consumption of dairy products in the form of chocolate milk, cultured buttermilk, and fluid skim milk. ^{2/} However, it is believed that amounts per capita are so small in comparison with the consumption of fluid whole milk and cream as to be insignificant. Furthermore, consumption needs might be readily taken care of if local commercial milk supplies were adequate.

4. Butter

Butter is produced in surplus in the Area even though the trend in production has been downward since 1942 (Table 10). There was a 31% decrease in butter production between 1942 and 1949. However, production per capita was much more than adequate to meet local consumption needs. In 1949, about 91 pounds per capita were produced in the Area, while U. S. per capita butter consumption rate was 10 pounds for that year (Table 11). Even if local butter consumption were double that of the national average, the Area would still be in surplus butter production.

^{1/} Waite, W. C. and Trelogan, H. C., op, cit., p.41. The demand (income) elasticity of light cream is given as 0.909. For ease of calculation, the demand (income) elasticity is assumed to be 0.9, meaning that for every 1% increase in per capita income there was a 0.9% increase in per capita consumption of light cream.

^{2/} USDA, Misc. Publ. 691, op. cit., p.33.

In some years, more butterfat is utilized in butter manufacture in the Area than is sold by Area farmers. According to the census (Table 3), 4.7 million pounds of butterfat were sold by Area farmers in 1939. Assuming a 22.5% overrun in butter manufacture, about 4.8 million pounds of butterfat were required for the 5.9 million pounds of butter produced in the Area during that year (Table 11). Thus, for that year the local sales of butterfat were about equal to the needs for butter manufacture. In 1949, however, only 2.7 million pounds of butterfat were sold by Area farmers, representing about 3.4 million pounds of butter. The creameries in the Area actually manufactured 5.9 million pounds, which required 4.8 million pounds of butterfat. (Table 11).

Table 10. Milk and butterfat deliveries to plants and manufacture of butter and ice cream in the Area--(Bottineau, McHenry, Renville, and Ward counties) ^{1/}

Year	Fluid Milk ^{2/}	Sweet Butterfat	No. 1 Butterfat	Manufacture of:	
				Butter	Ice Cream
					Thousand gallons
		-Thousand pounds-			
1941	3,182	883	6,832	8,294	193
1942	3,185	976	6,375	8,554	211
1943	4,515	815	5,782	7,922	215
1944	5,299	713	5,487	7,521	265
1945	5,312	506	4,777	6,376	297
1946	6,931	539	4,487	6,158	479
1947	8,218	557	4,259	6,243	418
1948	9,613	525	4,249	5,849	346
1949	10,966	465	4,124	5,888	404

^{1/} From the Reports of the State Dairy Commissioner contained in the Biennial reports of the North Dakota State Commissioner of Agriculture and Labor 1940-1950.

^{2/} Transcribed directly from records in the Office of the State Dairy Commissioner, Bismarck, North Dakota.

Table 11. Butter Production by Dairy Manufacturing Plants in the Area (Bottineau, McHenry, Renville, and Ward counties) Production Per Capita 1939 and 1949 and Comparisons with Estimated Per Capita Consumption.

Year	Total Production <u>1/</u>	Production per Capita Area Population <u>2/</u>	Estimated Per Capita Consumption <u>3/</u>
	thousand pounds	pounds	pounds
1939	5,884 <u>4/</u>	90.8	18
1949	5,888	90.7	18

1/ North Dakota Department of Agriculture and Labor, "Biennial Reports of Agricultural Statistics."

2/ See Table 2.

3/ Managers of dairy manufacturing plants estimated that about 22% of butter manufactured was consumed in the Four County Area.

4/ July 1, 1939 to June 30, 1940.

This means that in 1949 the creameries in the Area imported about 2 million pounds of butterfat from outside of the Area in order to keep their buttermaking facilities more fully utilized. The fluctuations in the amount of butter manufactured reflect the relative success of the creameries in getting butterfat collected from farmers scattered over a rather large area.

It was learned from interviews with plant managers of dairy manufacturing plants in the Area that about 22% of the butter was marketed locally and 78% was shipped out of the Area (1949). Thus, roughly (1/5) of the butter manufactured is locally consumed. Disregarding butter production on farms, the local per capita butter consumption rate would be around 18 pounds for 1949.

The seasonal pattern of butter consumption in the Area is not known. However, the 1948 urban consumption studies suggest that consumption is rather stable throughout the year.

5. Ice Cream

Ice cream production in the Area has definitely shown an upward trend since 1941 (Table 10). With production for that year at about 193,000 gallons, it was more than doubled by 1949, to 404,000 gallons.

Production per capita of Area population was around 2 gallons in 1939 and around 6 gallons in 1949 (Table 12). By way of a comparison, the U. S. per capita consumption of ice cream (product weight basis) was 2.3 gallons in 1939 and 3.6 gallons in 1949. If per capita ice cream consumption in the Area was about at the average U. S. level, it appears that the Area has been surplus in ice cream production. This probably has been true since 1944.

Table 12. Ice Cream Production by Dairy Manufacturing Plants in the Area (Bottineau, McHenry, Renville, and Ward Counties), Production Per Capita for Total Area Population, and Comparisons with U.S. Per Capita Consumption during 1939 and 1949.

Year	Total Production ^{1/}	Production Per Capita Area Population ^{2/}	U. S. Per Capita Consumption ^{3/}
	thousand gallons	gallons	gallons
1939	132 ^{4/}	2.0	2.3
1949	404	6.2	3.6

^{1/} North Dakota Department of Agriculture and Labor, "Biennial Reports of Agricultural Statistics."

^{2/} See Table 2.

^{3/} USDA Misc. Publ. 691, "Consumption of Food in the United States 1909-48 and Supplements," Table 8.

^{4/} July 1, 1939 to June 30, 1940.

A newspaper article ^{1/} and interviews with managers of dairy manufacturing plants lend support to the idea that ice cream is being produced in surplus and shipped out of the Area. According to these sources of information, two of the largest dairy manufacturing plants maintain routes into the four northwesternmost counties of North Dakota besides selling ice cream within the Area. This apparent surplus position of the Area is not as clear-cut as it might appear. Plants located in counties directly to the east, southeast, and to the south of the Area have been supplying ice cream to retail stores in the Area.

^{1/} Minot Daily News, January 18, 1951. Article devoted to a discussion of the Minot creameries.

Thus, although it cannot be definitely established that there is a substantial surplus of ice cream produced in the Area, it need not arouse much concern about the occurrence of shortages. For ice cream is a product that apparently can be made almost equally well in a number of ways. Other milk products are used in ice cream making. Sweet cream and whole milk can be used during periods of surplus. These usually coincide with peaks of ice cream consumption -- but not always. Sweet cream may also be frozen and stored in periods of peak plant deliveries and utilized when fresh supplies are inadequate. Use can also be made of butter, condensed and evaporated milk, dried milk, and ice cream mixes prepared elsewhere and shipped in.

Dairy Marketing Facilities

In 1939, some 55% of the fluid milk sold by farmers in the Four County Area was delivered directly to consumers or to retail stores. The remaining 45% was sold to dairy manufacturing plants, who in turn distributed milk direct to consumers by means of retail routes or through stores by means of wholesale routes. The milk distributed by farmers direct to consumers or through retail stores was "raw" milk, while the milk distributed by ~~dairy~~^{dairy} manufacturing plants was pasteurized. With the continued switch from "raw" milk to pasteurized and (in more recent years) homogenized milk, the ~~dairy~~^{dairy} manufacturing plants have assumed a larger part of the milk distribution functions. By 1949, about 87% of the fluid milk sold by farmers was to the dairy manufacturing plants.

It is presumed that fluid cream (in addition to that taken off by dairy plants by standardization) was marketed in the same manner as whole milk. No figures are available to show this for the Area, however, since the census reports all cream sales in terms of butterfat.

Farmers selling cream for butter making have a number of choices in marketing their product. They can sell their cream: (1) through dairy manufacturing plants in the Area; (2) through cream stations in the Area affiliated with dairy plants in the Area as well as outside of the Area; (3) by shipping direct to Mandan, Fargo, and other points in the State or to Minneapolis and other points outside of the State. Because of this it is difficult to measure accurately the relative importance of the local dairy manufacturing plants in the marketing of cream for butter-making in the Area.

The picture is further complicated because the local dairy manufacturing plants get part of their supply of butterfat from outside of the Area -- either through cream stations or from farmers shipping direct.

About 70% of the butterfat purchased by dairy manufacturing plants in 1949 was either delivered at the plant door or shipped direct by farmers. The remaining 30% was purchased through cream stations. While it is not known what proportion of this was locally produced, it appears that the dairy manufacturing plants in the Area are rather important in the marketing of locally produced butterfat.

1. Capacity of Existing Facilities

How much additional production can existing facilities take care of? Would expansion of facilities be needed if milk production in the Area were to increase as a result of irrigation development? These are questions that are raised whenever expansion of production is contemplated or expected.

In the summer of 1950 an attempt was made by interviewing plant managers to get information on facilities for handling dairy products. Information was sought on plant ownership, type of plant, number of years in operation; physical volume of purchases and sales in 1949; the maximum physical volume that could be handled with present facilities by month and by year; proportion of supply received from farmers, receiving stations, and out-of-Area; proportion of sales to local retail; local wholesale and outshipment, and an inventory of some of the crucial items of equipment.

With one or two exceptions, the plants visited were what the State Dairy Commissioner classifies as dairy manufacturing plants. No information was sought from producer-distributors in the Area for two reasons: (1) there was no way to determine their number beforehand, and (2) wherever producer-distributors were known to operate they handled only "raw" milk and cream.

A total of 18 dairy plants were visited for the purpose of securing information relating to plant volume and capacity. The plants visited included all dairy manufacturing and specialized milk plants in the Area but excluded all cream stations. Of these 18 plants visited, 16 provided enough information that could be used for the purposes of estimating plant capacities. Twelve plants handled fluid milk and manufactured butter. Three manufactured butter only. One handled milk only.

Whole milk handling facilities -- Although an attempt was made to get separate estimates for milk received by the plants and milk sold by these plants as whole milk, none of the plant managers was able to make a distinction between the two estimates without considerable digging through sales slips, if indeed such plant records were kept. The figures which they gave were in all probability on the amount of milk received into the plants for all purposes.

The total volume of milk handled by these plants during 1949 was estimated to be around 11.3 million pounds, while the amount of milk that could be handled with existing facilities was estimated at 17.7 million pounds -- indicating that on an annual basis less than 2/3 of the existing capacity was being utilized. However, during months of peak milk production about 80% of the existing capacity was utilized (Table 13). Hence, only about a 25% increase could be handled with present seasonal production patterns. With irrigation, oil, and lignite development, increase in incomes and population growth might possibly bring this about during the next few decades.

Buttermaking facilities -- The total volume of butter manufactured by the 15 plants in 1949 was estimated at 6.2 million pounds, while the estimated plant capacity was 16.7 million pounds -- again indicating that plant capacity was not being utilized by a considerable margin. From the estimates supplied by plant managers, it appears that on an annual basis only about 1/3 of the plant capacity is utilized, while in the months of peak milk production a little over 1/2 of the existing capacity is utilized (Table 13). This means that nearly a 100% increase in production could be handled with present seasonal production patterns. This excess capacity could readily absorb any expansion of dairying under irrigation. 1/

2. Capacity Estimates of Major Types of Equipment

An inventory was taken of the equipment deemed necessary for the handling or manufacture of each product. For milk and cream handling, this included cream separators, pasteurizers, milk coolers, bottling machinery, bottle washers, and can washers. For buttermaking, this included flash and vat pasteurizers and churns. The study of these inventory items was useful in appraising the accuracy of capacity estimates.

Varying degrees of success were encountered in the listing of the plant equipment. Most plant managers were well aware of the capacity of pasteurizing vats for handling fluid milk in their plants but were not so sure about the capacities of the other items of equipment. The plant managers, however, stated that such equipment was synchronized with the pasteurizers according to instruction from dairy plant equipment companies. Very little difficulty was encountered in getting information on the capacity of buttermaking equipment. Most plant managers were able to give the capacity of the churns in their plants readily. Vat pasteurizers were more frequently used than flash pasteurizers.

It appears that key items of equipment may be used as indicators of plant capacity if a number of assumptions are made regarding the organization and operation of plants; for example: (1) that the present arrangement would not be materially changed and would enable plants to operate at capacity with low operating costs, (2) that all equipment for handling the products in question would be synchronized so as to prevent "bottle necks"; and (3) that getting the raw material to the plant and disposing of the finished product would not limit plant capacity.

On the basis of reports by plant managers, it appears that pasteurizing vats may be the best indicators of a plant's capacity for handling milk, while a churn is probably the best single indicator of plant capacity for the manufacture of butter.

1/ The butter and milk figures as reported to the Dairy Commissioner's Office were checked against those estimated by the plant managers at the time of the survey. While there were wide discrepancies in some individual cases, the total volume of milk handled (plant receipts) in 1949 as estimated by the plant managers during the survey fell short of that reported to the Dairy Commissioner's Office by about 10%. On the other hand, the total volume of butter manufactured in 1949 as estimated by the plant managers exceeded that reported to the Dairy Commissioner's Office by 7%.

Table 13. Capacity of Dairy Plants in the Area (Bottineau, McHenry, Renville, and Ward Counties) 1949.

	Estimates by Plant Managers		Capacity of Present Equipment ^{1/}	Additional Volume that Could Be Handled with Present Equipment:	
	Volume 1949	Capacity		As Estimated by Plant Managers	As Estimated from Equipment Use
	- - - million pounds - - -			%	%
WHOLE MILK					
Annual ^{2/}	11.3	17.7	19.7	+57	+74
Peak Months:					
May ^{3/}	1.2	1.503	1.7	+25	+41
June ^{3/}	1.2	1.455	1.6	+21	+33
July ^{3/}	1.1	1.503	1.7	+37	+55
BUTTER					
Annual ^{2/}	6.2	18.7	21.8	+202	+252
Peak Months:					
May ^{3/}	.67	1.56	1.82	+133	+172
June ^{3/}	.83	1.56	1.82	+88	+119
July ^{3/}	.80	1.56	1.82	+95	+127

^{1/} In the calculation of present equipment capacity; (1) pasteurizing vats were used as indicators of plant capacity for whole milk, and (2) churns were used as indicators of plant capacity for butter manufacture.

An assumption was made that each pasteurizing vat would be filled twice during a full day of plant operation. Each plant's daily capacity multiplied by 365 to get the annual rate and by days in May, June, and July to get peak months' rate. Then figures of 13 plants combined, to give total capacity

An assumption was made that 3 churnings would be made during each day's operation. Each plant's daily churning multiplied by 312 (6 days per week x 52 weeks) to get annual rate and by number of days excluding Sundays in May, June, and July to give peak months' rate. Then figures of 15 plants combined to give total capacity.

^{2/} The whole milk estimates of dairy manufacturing plants (12) included here were 10% less than the amount of milk they reported handling to the State Dairy Commissioner's office. The estimates for the most part were made without reference to plant records, so it is believed these were errors of estimate rather than indicators of utilization of whole milk for fluid purposes. (This appears to be particularly true since estimates fluctuated both up and down from what plants actually reported to the State Dairy Commissioner's office.)

The estimates of butter production for the plants included here were 7% more than the amount of butter production reported to the Dairy Commissioner's office. This discrepancy may be explained as resulting from the fact that the estimates were made without reference to plant records.

^{3/} From office records of State Dairy Commissioner.

Assuming that each milk pasteurizing vat must be filled twice a day for each plant to operate at capacity and that each plant could operate 365 days a year, the total capacity of the plants in handling milk on the basis of utilization of equipment exceeds that as estimated by plant managers by a little over 10%. 1/ (Table 13)

Somewhat similar computations can be made in estimating butter manufacturing capacity on the basis of utilization of equipment. Assuming that 3 churnings are made a day and each plant is operating 6 days a week for 52 weeks a year, the capacity for all plants would be as indicated in Table 13. These estimates exceed those made by plant managers by 17% for 3 churnings a day. 2/

Because there is likely to be a considerable time lapse between now and when irrigation is actually established in the Area, it appears that plant capacity for the handling of dairy products might easily keep pace with any needs for such capacity that might arise. This would hold true, especially, with respect to fluid milk and butter production. In regard to cheese production, it would necessitate installation of additional equipment in plants already in operation. Such investment would, however, be small in proportion to what already has been invested or would be invested anyway with changing technology.

POULTRY PRODUCTS

Area Farm Production and Disposition of Poultry and Eggs

Among the various farm enterprises which might be expected to utilize additional feed and labor profitably under irrigation farming is the poultry enterprise. What are the marketing prospects for expanded poultry production in the Area?

1/ This difference is really not significant if it is remembered that the former estimate was based on plant operations that would exist if plant arrangements, operating efficiency, synchronization of equipment, etc., were "ideal" while the latter estimate is based on plant operations under existing (not entirely "ideal") conditions.

2/ This difference is largely due to the fact that plant managers generally thought of plant capacity in terms of how they actually operated, which was not more than 2 churnings a day.

1. Chickens and Eggs

Some 80% of the farms in the Area reported chickens on hand in 1939 and 1944. In 1949 only about two-thirds reported chickens on hand. The average number of birds per farm reporting chickens on hand was 54 in 1939, 82 in 1944, and 60 in 1949 (Table 14). A more detailed breakdown by size of flock for 1939 showed that practically all farms reporting chickens on hand, eggs produced, chickens raised, and chickens sold has less than 200 hens (Table 15). No comparable data are available for 1944 and 1949, but it is believed that the picture for these years is not much different. Production of chickens and eggs in the Area, then, as elsewhere in North Dakota, is nearly all from farm flocks.

This means that production of chickens and eggs is largely a side-enterprise, making use of otherwise waste feed and unused family labor (largely that of the farm housewife). However, to the extent it is necessary to buy feed and to which there are alternatives for the use of labor, production of chickens and eggs is affected by the profitableness of the poultry enterprises. That is, it is related "directly to the cost-price relationships for poultry and eggs as compared with the cost-price relationship of other crops that compete for the farmer's labor, capital and land." 1/

The two cost-price relationships that best reflect the profitableness of chicken and egg production are the egg-feed and chicken-feed price ratios. The former is the pounds of poultry ration equivalent in price to 1 dozen eggs, and the latter is the pounds of poultry ration equivalent in price to 1 pound of chicken.

"The number of farm chickens raised each year is a joint response to the expected prices for both eggs and farm chickens, and the number of pullets saved for layers can vary within rather wide limits without any change in the number of chickens raised. Changes in technology in the last quarter-century, including commercial hatching and sexed chicks, have increased this flexibility."

"The development of the commercial broiler industry over this whole period has prevented the demand for farm chickens from rising as much as has the demand for eggs. The demand for eggs has become relatively more influential in determining the number of chickens raised and in determining the proportion to be saved for layers." 2/

Thus, the egg-feed price ratio as an approximate measure of the profitableness of egg production is the best general indicator of changes to be expected in subsequent number of chickens raised. In turn, the number of chickens raised affects the number that will be available for the laying flock at the beginning of the following year and the resulting egg production during that year (Table 16). It is believed that the production of chickens and eggs in North Dakota and the Four County Area changes in a way similar to such production in the West North Central Region as a whole.

1/ Christensen, R. P. and Mighell, R. L., "Competitive Position of Chicken and Egg Production in the United States," USDA Tech. Bul. 1018, Aug. 1940, p. 4.

2/ Ibid., pp. 12-13.

Table 14. Production of poultry products in the Area
(Bottineau, McHenry, Renville and Ward Counties)

Year	Chickens on hand <u>1/</u>	Chickens Raised	Eggs Produced	Turkeys Raised
	thousands	thousands	dozens	thousands
1939	338	537	1,885	151
1944	464	779	2,590	47
1949	257	326 <u>2/</u>	1,899 <u>3/</u>	19
Percent Change, 1939-1949	-24.0	-39.0	+1.0	-87.0
	Percent of Farms Reporting			
1939	81	75	77	43
1944	82	79	79	15
1949	67	—	—	5

1/ Chickens on hand as of April 1, 1940 and 1950, and as of January 1, 1945.

2/ Estimated. This figure (326,023) is the sum of number of chickens sold 119,571 as reported in the preliminary 1950 census reports, the number consumed--on farms--estimated from BAE and Census data at 40 chickens per farm X farms reporting chickens on hand in the Area and a BAE estimate of flock replacements due to death loss of 13.9 percent for North Dakota.

3/ Estimated. This figure 1,898,782 is the sum of 1,015,099 dozen eggs sold as reported in the preliminary 1950 Census and the number of eggs consumed on farms--estimated from BAE and Census data at 207 eggs X farms reporting chickens on hand in the Area.

Table 15. Chickens on Hand, Chickens Raised, Chickens Sold, and Eggs Produced by Size of Flock in the Area (Bottineau, McHenry, Renville and Ward Counties) 1939.

Size of Flock (No. of birds)	Chickens on Hand April 1, 1940		Eggs Produced 1939		Chickens Raised 1939		Chickens Sold 1939	
	Percent of Farms Reporting	Percent of All Chickens	Percent of Farms Reporting	Percent of Egg Prod.	Percent of Farms Reporting	Percent of Chickens Raised	Percent of Farms Reporting	Percent of Chickens Sold
Under 25	13.2	3.9	12.3	4.2	11.2	5.7	6.9	7.0
25-49	34.9	22.2	34.8	22.9	34.6	23.7	27.5	19.5
50-99	40.2	47.0	40.7	46.7	41.9	47.1	48.2	47.0
100-199	10.7	23.0	11.2	22.3	11.3	20.5	16.2	23.0
200 and over	1.0	3.9	1.0	3.9	1.0	3.0	1.2	3.5
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Total Number of Farms Reporting	6238		5919		5818		2827	
Total Number of Chickens and Dozens of Eggs (thousands)		338		1885		537		148

Source: U. S. Census, Special Poultry Report 1940.

Table 16. Egg-feed price ratio and chickens raised in the West North Central Region and North Dakota 1941 to 1951. 1/

Year	West North Central		North Dakota <u>3/</u>
	Egg-feed price Ratio <u>2/</u>	Chickens raised	Chickens raised
	-pounds-	-millions-	-millions-
1941	10.8	211	8.7
1942	13.9	246	12.6
1943	15.3	286	14.5
1944	11.8	239	12.3
1945	12.9	259	10.5
1946	12.1	215	9.7
1947	11.0	216	8.9
1948	8.8	163	6.4
1949	12.5	195	7.4
1950	9.2	175	6.5
1951	10.7	182	<u>4/</u>

1/ From USDA BAE Poultry and Egg Situation September-October 1951, Table 3 p. 9.

2/ Weighted average of monthly ratios as follows: preceding November, 1; preceding December, 2; January, 3; February, 4; March, 5; April, 3, May, 1; except for the year 1941 which is based on months January to May only. The egg-feed ratio is the pounds poultry equivalent in price to dozen eggs.

3/ From USDA BAE, Agricultural Statistics.

4/ Not available.

On an annual basis, all the states comprising the West North Central Region are surplus producers of chicken meat and eggs. For example, the 1945-49 average production per capita 1/ of chicken meat in percent of the average U. S. per capita consumption of chicken meat for those years was 340 for South Dakota, 290 for Iowa, 275 for Nebraska, 192 for North Dakota, 188 for Minnesota, 172 for Kansas, and 125 for Missouri. Average production per capita 1/ of eggs for 1945-49 in percent of U. S. per capita consumption of eggs was 434 for Minnesota, 431 for South Dakota, 368 for Nebraska, 344 for Minnesota, 279 for Kansas, 240 for North Dakota, and 185 for Missouri. However, the extent that production per capita exceeds the national average per capita consumption for chicken meat and eggs is not an exact indication of a state's surplus position of these products. The per capita consumption rates of chicken meat and eggs in the West North Central States are not necessarily the same as the average U. S. per capita consumption rates. It is, however, well known that these states on an annual basis produce a sizable surplus of chicken meat and eggs.

Because production of both (farm flock) chicken meat and eggs varies seasonally, a particular region's surplus-deficit position also varies seasonally. For example, over 50% of the poultry meat is marketed during the months of August through November in the West North Central Region. 2/ Egg production shows a somewhat different seasonal production pattern -- with very pronounced peaks occurring from March through June and very marked lows in the fall and winter months. 3/

1/ The 1945-49 average production of chicken meat and eggs of each state divided by its 1950 population.

2/ Monthly percentages of farm chicken marketings in the West North Central Region for 1949 were as follows.:

Month	percent	Month	percent	Month	percent
Jan.	1.6	May	6.3	Sept.	18.8
Feb.	2.1	June	8.3	Oct.	19.3
March	2.0	July	9.9	Nov.	10.4
April	2.6	Aug.	13.0	Dec.	5.7

Average month - 8.3%. No comparable data are available by the individual states of the Region.

Source: Poultry and Egg Situation, USDA, BAE, April 1950, Table 5, p.10.

3/ The index of monthly egg production for the West North Central States and North Dakota for 1949 was as follows:

Month	W.N.C.	N.D.	Month	W.N.C.	N.D.	Month	W.N.C.	N.D.
Jan.	99	86	May	132	148	Sept.	70	80
Feb.	102	91	June	111	125	Oct.	72	66
March	133	123	July	93	109	Nov.	77	59
April	136	141	Aug.	79	93	Dec.	96	79

Source: Crops and Markets, 1950 Ed., USDA, BAE, p. 67.

On the other hand, the per capita consumption of chicken meat and eggs is rather stable seasonally, with the peak in consumption of chicken meat occurring during the summer months and peaks in egg consumption occurring during the spring months. 1/

The surplus position of the West North Central Region with respect to fresh chicken meat and eggs, therefore, appears to be more certain during the months of peak production than other months of the year. Evidently production of poultry meats and eggs is much more seasonal in certain local areas within the West North Central Region than in others. This certainly appears to be true for North Dakota. For Benton, writing in 1927, stated that "....in North Dakota sufficient eggs are not produced at all times of the year to meet consumptive demand of the cities and towns. Some eggs are shipped in from out-of-state points during the winter months and varying amounts are distributed to small towns from the larger centers September to March." 2/

There have been important changes in North Dakota's egg production during the 25 years since Benton wrote. From an average production per hen of 106 eggs in 1925, production per hen had increased to 150 eggs, or 42%, in 1949. The seasonal pattern of production has, also, leveled off somewhat in recent years as a result of improved breeding, management, feeding, and housing. But poultry continues to be a minor enterprise in the State, with low-volume production on most farms, and the seasonality of production is much greater in North Dakota than in states which have greater volume of production, less rigorous weather, and more improved roads.

1/ The adjusted seasonal indexes of average purchased quantities of fresh chicken and eggs used at home per household of city families in 1948 were:

	<u>Fresh Chicken</u>	<u>Eggs</u>
Winter (Dec.-March)	97	104
Spring (April-June)	98	108
Summer (July-Aug.)	110	92
Fall (Sept.-Nov.)	95	96
Yearly average	100	100

Source: USDA, Bur. Human Nutrition & Home Ec., "Seasonal Patterns of Food Consumption, City Families, 1948." Spec. Report No. 3, Feb. 1951.

2/ Benton, A. H. "Poultry and Egg Marketing In North Dakota," N. D. Agr. Exp. Sta. Bul. 215, Feb. 1928, p. 12.

The seasonal distribution of chicks hatched provides some clues to the seasonal marketings of chicken meat. North Dakota has, indeed, one of the most pronounced seasonal producing patterns in the West North Central Region. Practically all the chicks are hatched in the State between February and July, with about 2/3 of them hatched in April and May. ^{1/} Of course, chicks are also imported into North Dakota from surrounding states. Most of such imports are likely to be made during the same months chicks are hatched within the State. Chances are that the seasonality of marketings of young chickens is almost as pronounced as that of hatchings.

On an annual per capita basis, the Four County Area production of eggs was 112% of U. S. per capita egg consumption in 1939 but only 92% in 1949 (Table 17). The annual per capita production of chicken meat was 175% of the annual U. S. per capita consumption rate in 1939 but was only 69% in 1949. Assuming that the Area per capita consumption of both eggs and chicken meat was equal to the U. S. per capita consumption of these products, there has been a shift from an export to an import position of the Area.

With incomes remaining at present levels and a 10% decrease in price, a 9% increase in per capita consumption of chicken meat and a 4% increase in per capita consumption of eggs could be expected. ^{2/} With a constant population, this means that the commercial supply of chicken meat would have to be increased from 1.2 to 1.3 million pounds and the commercial supply of eggs from 1.5 to 1.6 million dozen (Table 18).

If there is in addition a rise in per capita income for the population dependent on the commercial supply of chicken meat and eggs, a further increase in per capita chicken meat and egg consumption could be expected.

^{1/} Percent of chicks hatched by months during 1949 in the West North Central States and North Dakota.

<u>Month</u>	<u>W.N.C.</u>	<u>N.D.</u>	<u>Month</u>	<u>W.N.C.</u>	<u>N.D.</u>	<u>Month</u>	<u>W.N.C.</u>	<u>N.D.</u>
	<u>%</u>	<u>%</u>		<u>%</u>	<u>%</u>		<u>%</u>	<u>%</u>
Jan.	1.9	0	May	26.7	36.5	Sept.	1.4	0
Feb.	6.4	0	June	6.8	13.5	Oct.	1.5	0
March.	21.0	0.3	July	1.4	0	Nov.	1.1	0
April	29.6	35.0	Aug.	1.3	0	Dec.	0.9	0

Source: Crops and Markets, 1950 Ed., USDA, BAE, p. 69.

^{2/} Mehren, G., "Comparative Costs of Agricultural Price Supports in 1949," American Economic Review, Papers and Proceedings, Vol. XLI, No.2, May 1951, p. 722. The demand (price) elasticity of chicken meat is given as -0.89 and that for eggs as -0.42. For ease of calculation the demand (price) elasticity was assumed to be -0.90 for chicken meat and -0.40 for eggs, meaning that for every 10% decrease in price there is a 9% increase in per capita consumption of chicken meat and a 4% increase in per capita consumption of eggs.

For example, if a per capita rise of 20% in these incomes occurs along with a 10% price reduction, the per capita increase in consumption could be 12% for chicken meat and 4% for eggs. 1/

If in addition to a 10% reduction in the local retail price and a 20% increase in per capita income, there is also an increase in population of, say, 10%, the commercial supply of chicken meat and eggs needed for local consumption would have to be increased from 1.2 to 1.6 million pounds of chicken meat or by 33%, and from 1.5 to 1.9 million dozen eggs, or by 27% (Table 18) .

Table 17. Production per Capita of Eggs and Chicken in the Area (Bottineau, McHenry, Renville, and Ward counties) 1939 and 1949, and Comparisons with Average U. S. Per Capita Consumption of Eggs and Chicken:

	Unit	1939	1949
Eggs produced per capita in Area <u>1/</u>	number	349	351
U. S. per capita consumption of eggs	number	311	381
Per capita egg production in Area as a percent of U. S. per capita consumption	percent	112	92
Chicken produced per capita in Area, dressed weight	pounds	32.8	17.7
U. S. per capita consumption of chicken, dressed weight	pounds	18.7	25.5
Per capita chicken production in Area as a percent of U. S. per capita consumption	percent	175	69

1/ Eggs produced taken from Table 14 and divided by total population of Area -- 64,801 in 1940 and 64,883 in 1950.

2/ Dressed weight of chicken calculated as follows: Deduction for estimated flock replacements made for chickens raised in Table 14. The net figure was taken times (4.5 pounds x 88% dressed weight) divided by total population of Area for years 1940 and 1950.

1/ Waite, W. C. and Trelogan, H. C., op. cit., p. 41. The demand (income) elasticity for chicken meat (poultry) is given as 0.636 and for eggs as 0.217. For east of calculation the demand (income) elasticity was assumed to be 0.60 for chicken meat and 0.20 for eggs, meaning that for every 20% in per capita income there is a 12% increase in per capita consumption of chicken meat and a 4% increase in per capita consumption of eggs.

Table 18. Estimated Supplies of Chicken Meat and Eggs Required to Meet Varying Consumption Needs.

Annual Consumption Under Specified Conditions	Consumption Met From Commercial Supply		Consumption on Farms Where Produced ^{1/}		Total Consumption	
	Chicken Meat	Eggs	Chicken Meat	Eggs	Chicken Meat	Eggs
- - - - - Million Pounds or Dozens - - - - -						
Present 1949 ^{2/}	1.2	1.5	0.6	0.9	1.8	2.4
10% Price Reduction ^{3/}	1.3	1.6	0.6	0.9	1.9	2.5
10% Price Reduction and 20% Per Capita Income Rise ^{4/}	1.5	1.7	0.6	0.9	2.1	2.6
Population Increase of: ^{5/}						
1 Percent	1.5	1.7	0.6	0.9	2.1	2.6
10 Percent	1.6	1.9	0.6	0.9	2.2	2.8
20 Percent	1.8	2.0	0.6	0.9	2.4	2.9
30 Percent	1.9	2.2	0.6	0.9	2.5	3.1

^{1/} Consumption in farm households as reported by BAE Agricultural Statistics for North Dakota divided by all farms reporting chickens on hand (census) times number of farms reporting chickens on hand in the Area.

^{2/} Assumption made that population dependent on commercial supply of chicken meat and eggs consists of the population of cities and villages (38,571) plus population on farms not reporting chickens on hand (2,214 farms not having chickens times 4.12 persons per farm).

Further assumption is made that per capita consumption of chicken meat and eggs for this population is equal to 1949 U. S. average rates (25.5 pounds of chicken meat and 381 eggs per person) Figures then rounded to nearest 0.5 million.

^{3/} Assuming a demand (price) elasticity of -0.90 for chicken meat and 0.40 for eggs.

^{4/} Assuming a demand (income) elasticity of 0.60 for chicken meat and 0.20 for eggs.

^{5/} Assuming in addition to conditions in ^{4/} that there is an increase in number of people dependent on the commercial supplies of chicken meat and eggs.

Irrigation might bring about an increase in production of eggs and chicken meat in the Area. Irrigation farming requires more labor per acre, and a greater diversification in farming enterprises might become necessary in order to improve the distribution of labor requirements throughout the year. More diversity of farm operations might take the form of introduction or expansion of such enterprises as poultry.

Available data on existing irrigation projects, however, show no greater poultry production on irrigated farms than on dryland farms in the same locality. For example, the average number of chickens on hand per farm on the Lower Yellowstone Irrigation Project during 1949 was 39. The average number of chickens on hand per farm in McKenzie County, North Dakota, on April 1, 1950 was 34. Other examples could be cited but they are similar in nature. However, there are many more irrigated farms per unit of land area.

Of course, poultry production could become more specialized, but specialized poultry production is "a type of farm production which in many respects resembles manufacturing. Comparatively little land area is needed other than as sites for buildings and equipment. The raw materials can be readily obtained at any location and the whole matter hangs heavily on the factor of alternative uses of labor." ^{1/} Specialization in poultry production, therefore, means greater volume of production and that in turn implies a favorable location with respect to market outlets. It implies location near or within easy access of population centers. Unless irrigation development is accompanied by a sizable increase in nonfarm population, it offers few advantages in chicken and egg production that could not be provided equally well under dryland conditions either within the proposed irrigation area or elsewhere.

2. Turkeys

The trend in turkey production within the Area has been downward (Table 14). Although the census data do not clearly show this to be the case, turkey production is very much a specialized operation. Production until now, however, has been very seasonal. It has been mainly for the holiday market (Thanksgiving, Christmas, and New Year's). The same conditions for expansion would hold as for chicken and egg production.

Poultry Processing Facilities

In the summer of 1950 a personal visit was made to 9 firms which handled poultry products. Six of these were creameries handling poultry and eggs as a side line. Most of the plants visited handled only eggs and live poultry and therefore did not have a large outlay of equipment. However, four plants visited were equipped to process poultry New York dressed style; that is, only blood and feathers were removed in processing. None

^{1/} Christensen, R. P. and Mighell, R. L., Tech. Bul. 1031, op. cit., p. 15.

of the processing plants had eviscerating equipment. Estimates of present plant volume and plant capacity were obtained from only three of the processing plants. The managers indicated that they could process twice as much poultry as they actually had been processing in 1949. The fourth plant has since ceased poultry processing operations, presumably because of the lack of sufficient volume. In view of this and the fact that the other three plants are operating at 50% of their capacities, the existing overall capacity could well take care of any increase in poultry processing as now done that might occur as a result of irrigation. Changes in technology in poultry processing would, of course, involve the installation of up-to-date equipment. This could be done in the course of regular business operations and would occur fast enough to take care of any expansion in poultry products under irrigation.

MEAT PRODUCTS

Irrigation in North Dakota will provide farmers with an opportunity to increase, improve, and stabilize their feed base for livestock breeding and feeding enterprises. Quite apart from the technical production conditions in irrigation farming, the profitability of expanded livestock production will depend a good deal on the competitive position of the Area in supplying livestock or meat products to more distant markets. This market position, in turn, will be affected by transportation costs. A brief survey of the present marketing position of the Area with respect to livestock products is useful for appraising the future market potentials.

Data on livestock sales and slaughter on anything less than a state basis are very limited. On a county basis, only census data are available. These data show the number and kind of livestock sold and number of farms reporting sales. No information is given as to the purpose of livestock sales (slaughter, feeder, etc.) or the weights. Census data also give the number of livestock for farm slaughter by kind (sheep and lambs excepted) and number of farms reporting such slaughter. No information is given on the weights of such livestock. There are therefore very few data as to meat distribution and consumption in the Area (Table 19).

By the end of the thirties, farm slaughtering had become largely limited to that for home consumption. But in more recent years, farmers again have sold carcasses or parts of carcasses to townspeople who keep meat in cold storage lockers. In many cases, however, the slaughtering of animals is performed by locker plants.

Retail slaughterers who used to operate in towns and villages and obtain their supply of meat by buying live animals locally and doing their own slaughtering are no longer an important factor in the market. Now, they usually buy carcasses and cuts from animals slaughtered in commercial establishments.

Table 19. Livestock Sold Alive and Farm Slaughter in the Area (Bottineau, McHenry, Renville, and Ward counties).

	Number of Livestock Sold from Farms				Pct. of All Farms Reporting Sale of Livestock				Farm Slaughter				Percent of All Farms Reporting Farm Slaughter			
	Cattle and Calves	Hogs and Pigs	Sheep and Lambs	and	Cattle and Calves	Hogs and Pigs	Sheep and Lambs	and	Cattle (excl. calves)	Calves	Hogs and Pigs	Cattle (excl. calves)	Calves	Hogs and Pigs		
1939	33,526	23,682	28,046		62	28	11		2,104	1,682	18,321	22	14	68		
1944	59,787	70,959	38,787		76	61	12		2,828	1,027	13,455	33	11	70		
1949	47,325	24,292	17,720		74	35	7		1,976	1,761	9,498	26	22	57		
Percentage Change 1939-49	+41.0%	+3.0%	-37.0%		--	--	--		-6.0%	+5.0%	-48.0%	--	--	--		

Source: U. S. Census of Agriculture.

The wholesale meat distribution by the regional and national packers dominates the market, even in relatively small cities and towns. These generally sell meats through several different channels. Sales may be made through the wholesale department at the packing plant, through branch houses, by car routes, by truck routes, and through brokers and jobbers. 1/

A large part of the fresh and processed meat in the Area is currently supplied by two national packers and one regional packer. All of these maintain wholesale distribution houses in Fargo and have truck routes operating from branch houses. One of the two national packers also has a branch house located in Grand Forks. The other has car routes operating from its branch house at South St. Paul. Sales are also made by the branch house to the wholesale departments of local and regional chain stores which in turn distribute such meat products to their respective retail stores. There is also one small meat processing plant located in Minot.

In recent years, about 24 frozen food locker plants have become established in the Area. For the most part, these are storage plants rather than processing plants. But to the extent that they have taken over slaughtering and processing functions they make it possible for local townspeople to purchase more of their meat from local producers. They could become more important in meat distribution locally as irrigation develops.

The present freight rate structure on livestock and meat products as it relates to Minot and competitive points is rather involved (Table 20). It is one thing for the westbound shipments and another thing for the eastbound shipments.

On westbound shipments the structure is the same as for the Western Trunk Line Rate Territory 2/ as a whole. Westbound transcontinental commodity 3/ rates, such as for fresh meats and other packinghouse products, are quoted from groups of points in the Western Trunk Line Territory to groups of points in the Transcontinental Rate Territory. 4/ Rates on meat products apply only in one direction and are quoted by large groups of points. This means that the same rate applies from points that are a considerable distance from each other and those the farthest from market have the same location advantage as those that are closer to the market outlets. Rates on livestock apply in both directions and are quoted by small groups of points. The distance principle applies.

1/ Dowell, A. A. and Bjorka, K., Livestock Marketing, McGraw-Hill Book Co. Inc., New York, 1941, pp.486-8.

2/ Includes Iowa, Kansas, Minn., Nebr., N. Dak., Wisc., and portions of Ill., Ind., Mich., Mo., and Wyo.

3/ Rates that are placed directly on a particular commodity or a group of closely related commodities because of their special characteristics and because they are being continuously produced in a large volume.

4/ Includes Oregon, Wash., Calif., Ariz., Nev. and the western parts of Utah and N. Mex., and northern Idaho. This territory is divided into the North Coast Territory and the South Coast Territory by an east-west boundary line passing through northern California. There is a separate grouping of points in the Western Trunk Line Territory from which westbound freight rates are quoted to groups of points in each subdivision of the Transcontinental Rate Territory.

Table 20. Freight Rates for Livestock and Livestock Products from Minot and Other Competitive Shipping Points

	Live Animals, Freight Rates per 100 lb. of dressed wt. equivalent <u>1/</u> carload shipments				Fresh Meats <u>2/</u>	Other Packing House Products ^{3/}
	Cattle	Calves	Hogs	Sheep		
<u>To Portland, Seattle,</u>						
Tacoma from:						
Minot	\$2.12	\$2.24	\$1.64	\$2.51	\$2.57	\$2.13
Bismarck	2.22	2.35	1.72	2.63	2.57	2.13
Fargo <u>4/</u>	2.45	2.58	1.89	2.90	2.57	2.13
St. Paul	2.59	2.73	2.00	3.06	2.42	2.02
<u>To San Francisco from</u>						
Minot	2.72	2.87	2.11	3.22	2.67	2.22
Bismarck	2.72	2.87	2.11	3.22	2.67	2.22
Fargo	2.93	3.09	2.27	3.47	2.67	2.22
St. Paul	3.03	3.20	2.35	3.59	2.67	2.22
<u>To Los Angeles from</u>						
Minot	2.86	3.02	2.22	3.39	2.67	2.22
Bismarck	2.86	3.02	2.22	3.39	2.67	2.22
Fargo	3.09	3.25	2.39	3.65	2.67	2.22
St. Paul	3.03	3.20	2.35	3.59	2.67	2.22
<u>To St. Paul from</u>						
Minot <u>5/</u>	1.13	1.20	0.88	1.34	1.88	1.02
Bismarck	1.03	1.09	0.80	1.22	1.81	0.98
Fargo	0.83	0.87	0.64	0.98	0.45	0.45
<u>To Chicago from</u>						
Minot <u>5/</u>	1.79	1.89	1.39	2.12	2.70	1.46
Bismarck	1.59	1.67	1.23	1.88	2.70	1.45
Fargo	1.38	1.45	1.07	1.63	0.96	0.84

Source: Dreesen, W. H., "Transportation Rates on Livestock and Meat Products in Western States," Oreg. Agr. Exp. Sta. Bul. 496, March 1951.

- 1/ Rates per dressed equivalents of livestock consist of the rate per 100 pounds live weight divided by dressing percentages. The dressing percentages used were: cattle 58, calves 55, hogs 75, sheep 49. Rates on livestock (dressed equivalents) apply to either direction central points and west coast points. Rates on fresh meats and other packing house products apply only in direction indicated.
- 2/ The fresh meats group are meats fresh, not salted, or certain boneless meat hams, shoulders, sides, carcasses, and part carcasses. Minimum carload weight is 21,000 pounds.
- 3/ The other packing house products are primarily processed meats, cooked, cured, salted, pickled, dried, and frozen. Minimum carload weight is 30,000 pounds.
- 4/ Freight rates per 100 pounds (carload lots) from West Fargo are \$2.42 for fresh meats and \$2.02 for other packing house products.
- 5/ Freight rates supplied by John I. Finsness, Commerce Counsel of the Chamber of Commerce, Fargo, N. Dak.

Rates on meat products from Minot and competitive points to the West Coast generally are cheaper than on live animals (hogs being the main exception). But Minot does not enjoy a freight rate advantage over eastern points with respect to western markets (Table 20). In fact, the rates for fresh meats and other packinghouse products from St. Paul to the north West Coast are actually lower than those from Minot, despite the fact that St. Paul is over 500 miles farther.

On eastbound shipments, it is more favorable at present for interior North Dakota points to ship livestock eastward than it is to ship meat products in that direction. However, the establishment of a meat packing plant (other than those serving local areas within the State) would make it possible to secure lower commodity rates on meat products from the city where such a plant were located, if the volume would warrant it.

We conclude: the present freight rate structure

(1) does not favor Minot as a shipping center of fresh meats and processed products to western markets over competing points farther east which pay the same or lower rates;

(2) puts Minot in a most unfavorable position regarding eastward shipments of fresh meats and packing house products as compared to Fargo;

(3) makes it cheaper to ship livestock to the north West Coast than fresh meats, while the opposite holds true for eastern shipments from West Fargo and St. Paul;

(4) gives Minot a slight locational advantage over eastern points in shipping livestock to the north West Coast.

VEGETABLE AND BERRY PRODUCTION FOR

FRESH CONSUMPTION

In many older irrigation areas, vegetables and fruits provide high per-acre value crops which help farmers meet the higher land investment and operating costs characteristic of irrigation farming. What are the marketing prospects for an expanded production of such crops in the Minot Area?

Production of vegetables and berries on farms in the Area has been largely for home use. Census data show only very few instances where vegetables were harvested for sale. In these cases only the acreage has been reported (Table 21). The census data also give a few clues as to what vegetables and berries might be adapted to the Area. In view of the fact that the growing season is limited to about four months, the largest number of vegetables and berries that could be grown locally is about 15. The list includes: snap beans, beets, cabbage, carrots, cauliflower, celery, cucumbers, lettuce, onions, peas, potatoes, spinach, sweet corn, tomatoes, and strawberries.

Table 21. Vegetable (and berry) Production and Sales of Local Products in the Area (Bottineau, McHenry, Renville, and Ward Counties).

	Acres Harvested			Farms Reporting		
	1939	1944	1949	1939	1944	1949
Potatoes	5,145	4,125	1,637	4,689	4,282	2,791
Otehr Vegetables for Sale:						
Fresh Beans	2	--	--	10	6	--
Cabbage	22	12	4	29	19	4
Sweet corn	29	18	--	34	18	--
Tomatoes	20	5	4	48	17	6
Green Peas	3	--	--	8	3	--
Other Veg. & melons	60	37	22	--	33	--
Strawberries	5	12	5	15	69	20
Raspberries	6	3	--	20	26	--

Source: U. S. Census

But such vegetables and berries would be marketed at a time when they would also be generally available in local gardens. This would seriously cut down on the local demand for them. The shortness of the growing season and the fact that established commercial producing areas have managed to secure rather favorable adjustments in freight rates would make it very difficult for the Area to compete with other established vegetable and berry producing areas for markets farther away. There is therefore considerable doubt that anything more than a very limited acreage would be devoted to vegetable and berry production under irrigation.

SUMMARY AND CONCLUSIONS

To study the marketing prospects for several farm products whose output is expected to increase under irrigation, a four-county area with Minot as trade center was chosen. This Area includes Ward, Renville, Bottineau, and McHenry counties.

Farm products selected for study are dairy and poultry products, meats; and truck crops adapted to the physical conditions of the Area. These products were selected because of their relatively strong position in the long-time future demand prospects for agricultural commodities.

Major emphasis is placed upon possibilities of expanded market outlets in the local Area. The Minot Area, as other proposed irrigable areas in North Dakota, has no outstanding locational advantages over competing irrigation areas elsewhere, with respect to transportation costs in serving distant consumption centers. Hence, the possibilities of expanding local market outlets assume considerable importance in appraising the marketing prospects for expanded production under irrigation in the Area.

The capacity of the Area for absorbing increased production depends upon (1) future local population trends, (2) trends in per capita consumption, and (3) present surplus or deficit position of the Area regarding the respective products.

Between 1940 and 1950, the Area's population remained about the same. A 21% decline of the open-country population was offset by a 22% increase in city and village population. Minot alone increased 33% in population. No estimates of future population changes in the Area have been made. Without irrigation, a continued shift of farm population to villages and towns appears likely. Irrigation development may stop this trend. To the extent that this will occur, increases in town population will result in a net increase of the Area's population. The extent of such total population increase probably will be determined by the increase in general business, trade, and processing activities which will, at least in part, be stimulated by irrigation and oil development. The rate and scope of such resource developments are as yet too uncertain to warrant specific estimates of future population changes in the Area.

Dairy products as a whole are at present produced in excess of local consumption, despite the fact that during the last 10 years the number of milk cows declined 20% and total milk production about 25%.

Fluid milk, however, is in a seasonal deficit position during several months in late fall and winter. Increase in nonfarm population and rising incomes caused increases in the demand for fluid milk. Farmers responded by selling a larger proportion of their milk for fluid consumption. Although total milk output since 1940 fell by 25%, total sales of whole milk by farmers increased 78% between 1939 and 1949. Most of this increase took place since 1944, which suggests that, apart from nonfarm population increase, higher family incomes contributed substantially to the expanded demand for fluid milk.

Probably over 75% of all whole milk sold by farmers came from about 5% of the farms in the Area that have herds of 15 or more cows. Irrigation development might favor further concentration of milk production for fluid consumption on irrigated farms, because of a feed base more stable and more appropriate for milk production than under dryland farming.

Estimates of per capita consumption of fluid milk in the Area for 1949 were about 296 pounds per year in cities and villages, compared to a U. S. average of 266, and 496 pounds in the open country compared to 471 for the U. S. In view of the fact that per capita income in the Area was substantially above the national average in 1949, these estimates of consumption rates in the Area appear to be reasonably well in line with the country's general level of consumption. Rising incomes could further increase local consumption rates. Moreover, more efficient dairy enterprises could reduce production costs and hence prices to the consumer, which would further raise per capita consumption rates.

If future irrigation and other economic development should become associated with a 10% reduction in milk prices (relative to other consumer prices), a 20% increase in per capita income, and a 10% increase in population of the Area, the total commercial demand for fluid milk and cream would probably be about 25% greater than it was in 1949.

Butterfat sales (cream for buttermaking) by farmers in the Area declined by over 40% between 1939 and 1949. Still, the Area exports 78% of its butter production, mostly to eastern and western markets. Local per capita butter consumption is estimated at 18 pounds per year, as compared to 10 pounds for the U. S. average.

Dairy processing facilities now in the Area would be adequate for handling around 25% more fluid milk and for processing about twice as much butter during the flush season. Therefore, lack of plant capacity would not create a bottleneck to dairy expansion.

Production of chickens and eggs in the Area, as elsewhere in North Dakota, is largely from farm flocks. There is a more pronounced seasonal variation in the production of chickens and eggs in the Area than in the West North Central region as a whole.

In recent years, the Area has apparently shifted from a surplus to a deficit position with respect to chicken meat and eggs. Only about 50% of the capacity for processing chickens New York dressed style is presently utilized.

A large part of the fresh and processed meat in the Area is currently supplied from the outside by two national packers and one regional packer. Hence, the Area is in a deficit position.

There are some two dozen frozen food locker plants in the Area. Most of these are storage plants. The few that perform slaughtering and meat processing functions make it possible for local townspeople to purchase more of their meat from local producers. This market outlet might be expanded if more livestock for slaughter were produced in the Area.

The present freight rate structure does not favor Minot as a shipping point of fresh meats and other packing plant products to western markets, and is distinctly unfavorable to eastern shipments, compared with competing shipping centers in eastern North Dakota and Minnesota. Freight rate structures are often quite important in the location of packing plants.

For westward livestock shipments, the Minot Area has a slight transportation advantage over eastern areas.

A strong expansion of slaughter livestock in the Area, however, may result in a change in freight rates which might encourage the development of meat processing establishments.

Production of vegetables and berries on farms in the Area has been largely for home use. It is likely to continue so even if irrigation is introduced, because the major competitive areas elsewhere have established a very effective and far-flung distribution system under favorable freight rate structures serving metropolitan consumption centers.