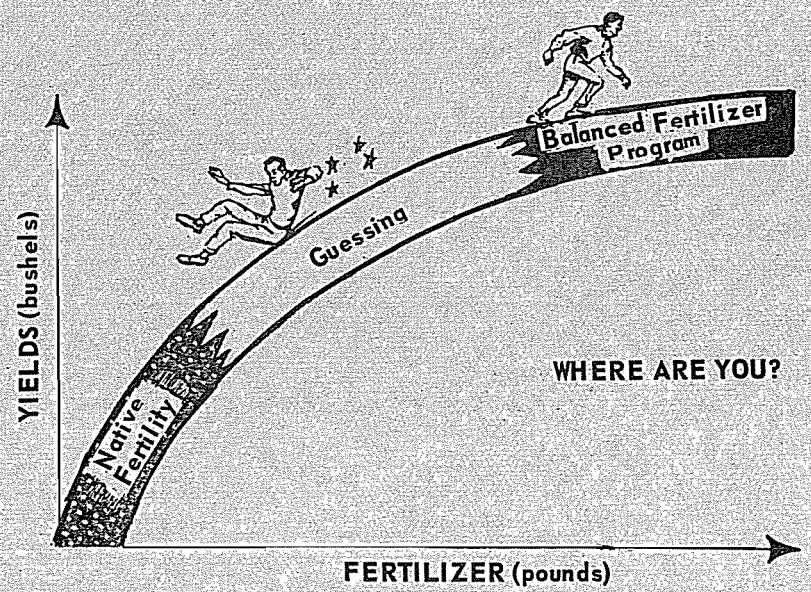
AGRICULTURAL ECONOMICS REPORT NO. 41 For Check Out Only! APRIL 1965

the 1964 REPORT

ON TEST-DEMONSTRATION FARMS IN NORTH DAKOTA



HERMAN W. DELVO
AND
VIRGIL L. WEISER

DEPARTMENT OF AGRICULTURAL ECONOMICS
AGRICULTURAL EXPERIMENT STATION
NORTH DAKOTA STATE UNIVERSITY
OF AGRICULTURE AND APPLIED SCIENCE
FARGO, NORTH DAKOTA

FOREWORD

This publication is the eighth annual report of fertilizer test-demonstration work in North Dakota. This work has been made possible by cooperation of the Tennessee Valley Authority. They provide a grant to the North Dakota Agricultural Experiment Station to help support this work and also to make experimental fertilizer materials available at a reduced price for educational and demonstrational work. Names and addresses of farm cooperators in this project during 1964 are shown below.

Cooperator	Address	Cooperator	Address
Anderson Brothers	Hillsboro	Joe Knight	Casselton
Daryl Anderson	Reeder	John Larson	Lemmon, S. D.
Howard Anderson	Willow City	J. P. Lorenzen	Mohall
Harold Bergman	Bottineau	Earl Nelson	Gascoyne
Harry Benshoof	Flaxton	C. L. O'Keefe	Lansford
Donald Brown	Scranton	George Ott	Reeder
Floyd Bryan, Jr.	Bowbells	Ralph Peterson	Harwood
Henry Busch	Portal	Jerald Radcliffe	Amenia
Morten Clausen	Norma	Randolph Brothers	Lansford
Gene Davison	Haynes	Lorry Rotvold	Halstad, Minn.
Alvin Dill	Regent	Marce Schaefer	Glenburn
Fred Ehlers	Hettinger	Henry Schlichtmann	Hillsboro
Arnold Funk	Bowbells	Delmar Schulz	Davenport
Art Grove	Hillsboro	Donald Schumacher	Scranton
Orlin Gunderson	Buxton	Walter Stzegura	Gascoyne
Harold Hanson	New England	Dave Witteman	Mohall
Bennie Hass	Bowbells	George Witteman Co.	Mohall
Ervin Haux	Kindred	Raymond Wothe	Reeder
Roy Kern	Scranton	Henry Zahn, Jr.	New England
Kermit Kjonaas	Maxbass		

ACKNOWLEDGMENTS

The authors acknowledge the assistance of farm cooperators and the county extension agents in Adams, Bottineau, Bowman, Burke, Cass, Hettinger, Renville, and Traill counties. Without their assistance the information contained in this publication could not have been obtained.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

THE 1964 REPORT ON THE FERTILIZER TEST-DEMONSTRATION PROGRAM IN NORTH DAKOTA

by
Herman W. Delvo[1] and Virgil Weiser[2]

Introduction

The Tennessee Valley Authority and the North Dakota State University of Agriculture and Applied Sciences cooperate in the conduct of a test-demonstration program in North Dakota. The broad objectives of this program are:

1. To introduce TVA experimental fertilizers in farm fertilizer programs in the state.
2. To determine farmers' acceptance of these fertilizer materials.
3. To demonstrate and test the effects of recommended fertilizer treatments on individual crop yields and overall farm income.
4. To promote agricultural developments in North Dakota through improved use of fertilizer in combination with other recommended farming practices.

The North Dakota Agricultural Experiment Station and the North Dakota Extension Service cooperate in conducting and demonstrating this program within the state. The Agricultural Economics Department conducts its share of the program under Station Project S-3-5 which has as its main objective an economic evaluation of a recommended and balanced fertilizer program as it applies to the overall farm. The responsibilities of various cooperating personnel are explained in the 1960 report (Agricultural Economics Report No. 18).

---

[1]Assistant in Agricultural Economics, North Dakota State University.

[2]Extension Soils Agent, North Dakota State University.

Three-Year Summary

Farmers in eight counties have participated in the test-demonstration program for the past three years, 1962 through 1964. Location of the counties and farms is shown in Figure 1.

The average annual percent profit for fertilizer use in this program within the state and each area is shown graphically in Figure 2. The average percent profit for the state during this period was about 69 percent. That is, for each dollar invested in fertilizer, an average return of $1.69 was realized. The average percent profit for the southwest area was considerably higher than the other areas in 1962 and 1963. This result was primarily due to the plentiful moisture supply and exceptional growing conditions. During these same two years the valley

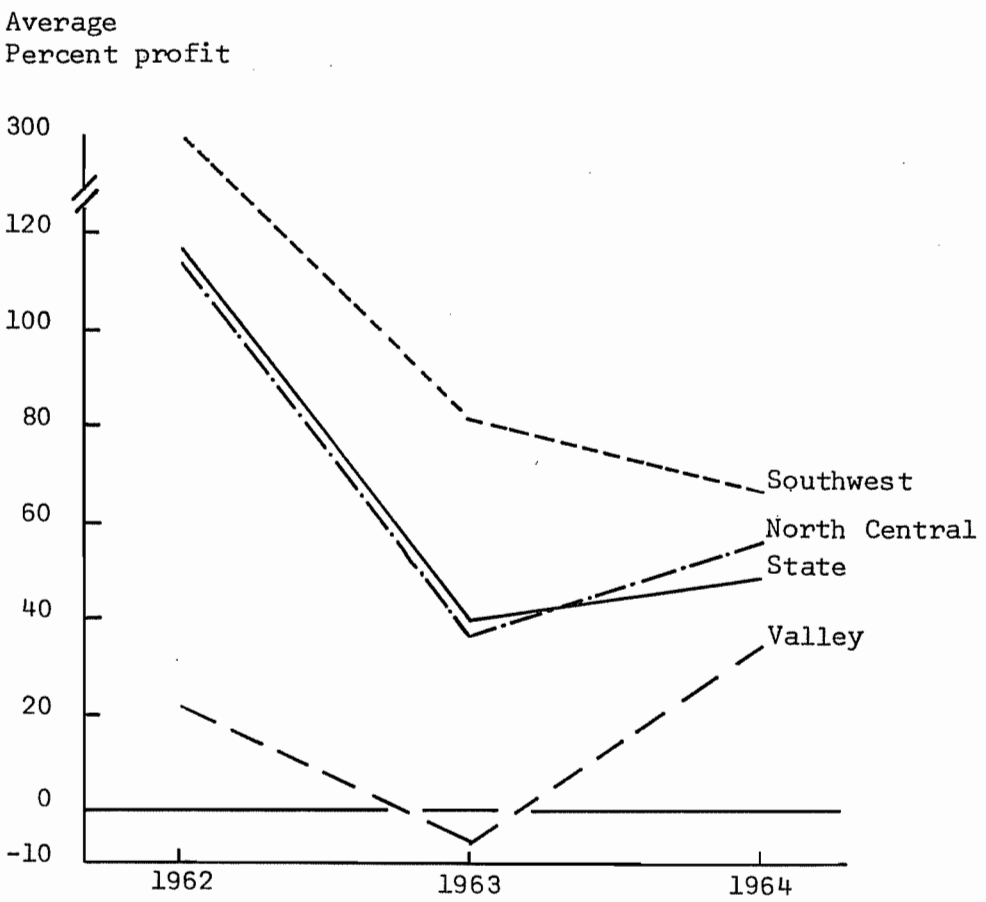


Figure 2. Average Annual Profitability of Fertilizer on Test-Demonstration Farms in North Dakota, by Areas and State, 1962-1964.

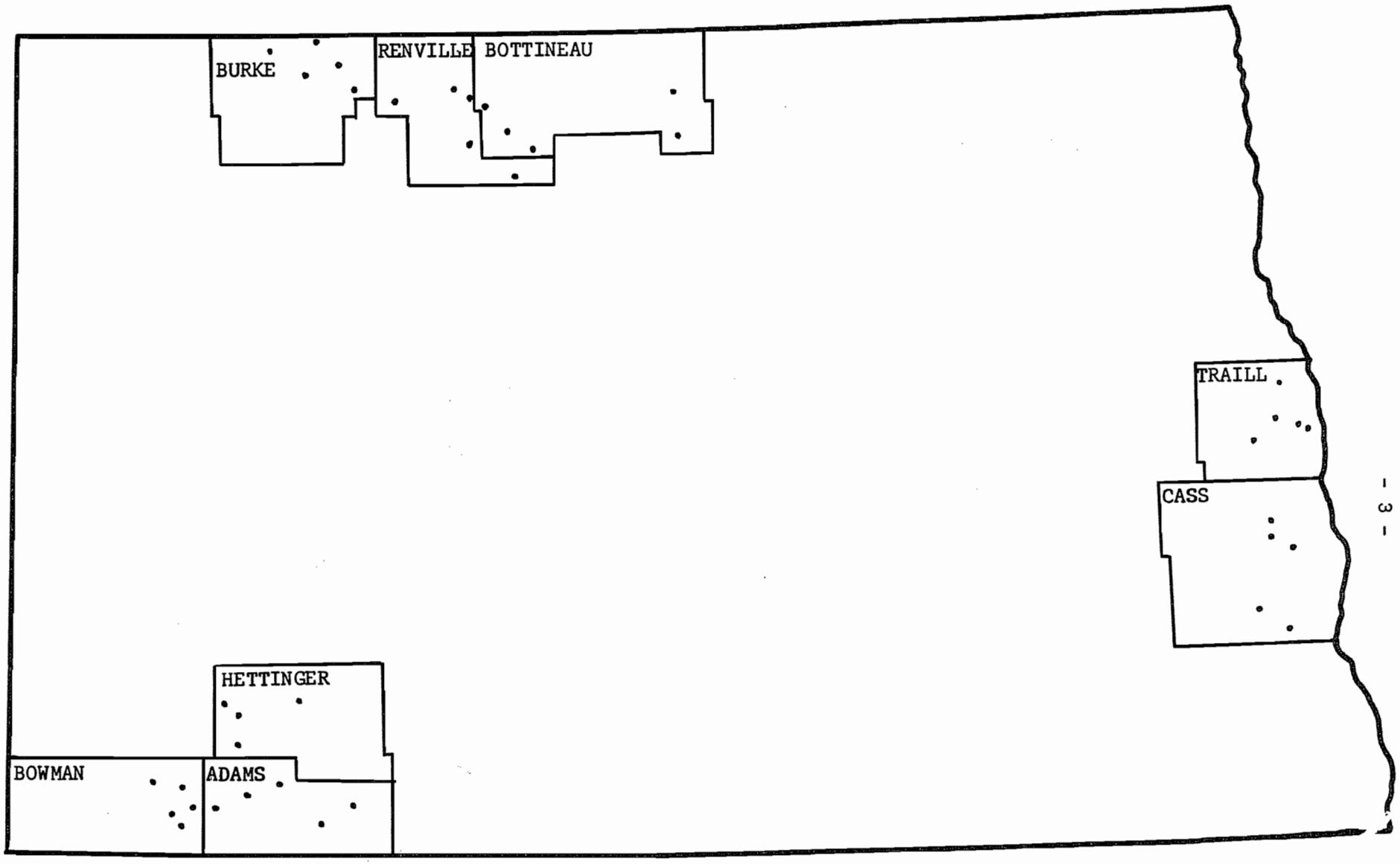


Figure 1. Location of Test-Demonstration Farms, by Counties, 1964.

farmers experienced very little response to fertilizer use because of excess moisture in 1962 and lack of precipitation during the latter part of the 1963 growing season. The profitability in the north central area has been about the same as the state average and midway between the extremes of the southwest and valley.

In 1964 the average profitability of all fertilizer use in the program was about 49 percent. The range was from about 67 percent in the southwest to 35 percent in the valley. Growing conditions were generally favorable throughout the state in 1964. This reduced the variation in the percent profit between areas as shown in Figure 2.

To help explain some of the variability in fertilizer profitability, selected data for three crops by cropping practice are shown in Table 1. The pounds of nutrients applied per acre, both N and P_2O_5, have varied more for crops grown on nonfallow land than on fallow land. Nitrogen rates on fallow land increased slightly in 1963 but decreased in 1964. Relatively high increases in yield in 1962 resulted in some experimentation in higher nitrogen rates. Generally speaking, the nitrogen level on fallow land is sufficient to promote good plant development. However, if a cover crop is planted or weeds are allowed to grow up in the fall, some nitrogen applied at planting time is beneficial. Phosphate rates were adapted to the soil test that the farmers had taken.

Fertilizer rates on nonfallow land varied considerably. Most soil tests for phosphate are taken on fallow land resulting in a one-year delay in applying this information. Secondly, at the present time there is no reliable and economical way of testing soil samples for nitrogen. Therefore, to determine a satisfactory application for nonfallow land more experiementation is necessary.

The average yield per acre and increase in yield per acre due to fertilizer use has remained fairly stable during the three-year period. An exception is durum on nonfallow land which has varied from 8.1 bushels to .8 bushels.

TABLE 1. SELECTED FERTILIZER DATA FOR NORTH DAKOTA,[1] BY CROPS AND CROPPING PRACTICES, 1962-1964[2]

		Year		
Crops on Fallow Land		1962	1963	1964
Durum	Ave Fertilizer Treatment	2+22+0	7+21+0	4+23+0
	Average Yield/Acre-bu	45	35	36
	Average Yld Inc/Acre-bu	4.4	2.7	3.1
	Percent Profit	292%	77%	45%
HRS Wheat	Ave Fertilizer Treatment	3+24+0	6+26+0	3+25+0
	Average Yield/Acre-bu	35	28	27
	Average Yld Inc/Acre-bu	3.1	3.3	3.1
	Percent Profit	142%	99%	56%
Barley	Ave Fertilizer Treatment	0+24+0	6+27+0	0+24+0
	Average Yield/Acre-bu	73	44	56
	Average Yld Inc/Acre-bu	2.7	3.3	2.9
	Percent Profit	-19%	-27%	1%
Crops on Nonfallow Land				
Durum	Ave Fertilizer Treatment	15+26+0	15+20+0	28+16+0
	Average Yield/Acre-bu	37	31	34
	Average Yld Inc/Acre-bu	8.1	.8	3.9
	Percent Profit	283%	-66%	-5%
HRS Wheat	Ave Fertilizer Treatment	19+24+0	23+28+0	18+19+0
	Average Yield/Acre-bu	32	21	23
	Average Yld Inc/Acre-bu	5.1	3.0	3.9
	Percent Profit	110%	-3%	30%
Barley	Ave Fertilizer Treatment	18+25+0	23+22+0	25+20+0
	Average Yield/Acre-bu	45	46	53
	Average Yld Inc/Acre-bu	5.5	6.0	9.3
	Percent Profit	-13%	-16%	40%

[1]Includes Adams, Bowman, Hettinger, Burke, Renville, Bottineau, Cass, and Traill counties.

[2]Price assumptions are those included in Table 2. Cost assumptions are 14 cents per pound for nitrogen and 10 cents per pound for P_2O_5.

Most durum grown on nonfallow land is in the valley which experienced unusual weather conditions in 1962 and 1963. The response of 3.9 bushels in 1964 could be considered about normal.

The percent profit for the various crops and years has varied considerably. Examination of Table 1 indicates that durum and HRS wheat on fallow consistently return a profit. Variation in profitability for crops grown on nonfallow is caused in part by the experimentation involved in determining the correct fertilizer rate and the more critical moisture situation, both amount and distribution.

However, the most important factor that affects profitability is the price received for the product. The mid-October prices that have been used for some crops in the analysis of fertilizer responses on the test-demonstration farms are contained in Table 2.

TABLE 2. STATE AVERAGE MID-OCTOBER CASH GRAIN PRICES FOR 1962, 1963, AND 1964

Crop	1962	1963	1964
Durum	2.23	2.09	1.36
HRS Wheat	2.10	2.03	1.45
Barley	.78	.77	.83

Source: Annual Summaries, USDA Statistical Reporting Service and Department of Agricultural Economics, North Dakota State University of Agriculture and Applied Science.

Since 1962 durum and HRS wheat prices have declined, while barley prices have remained fairly stable. Between 1963 and 1964 durum and HRS wheat fell by 35 and 29 percent, respectively. Even if the fertilizer treatment and average yield increase per acre had remained the same as in 1963, profits would have been reduced substantially due to these lower prices.

The three-year summary for the southwest, north central, and valley areas is shown in Tables 3, 4, and 5, respectively. Durum and HRS wheat show an acceptable response to fertilizer in the southwest and north central. In the southwest

the loss of one percent on durum in 1964 resulted in part both from the decline in price and from wind damage to swaths on the check fields.[3] No conclusions can be drawn from the responses of barley on fallow and crops on nonfallow because of the limited number of acres checked in the southwest and north central areas.

In the valley crop responses to fallow have been generally favorable except in 1964 when losses occurred as shown in Table 5. Fallow land was extremely wet in the spring resulting in delayed planting. The crops were damaged by heat and lodged severely.[4] Returns on nonfallow crops varied considerably, but for the three-year period show a profit. The losses incurred in 1963 are partly explained by a lack of moisture and the small increase in yield to additional nitrogen for HRS wheat. It is noted that, for barley, as the amount of nitrogen was increased and phosphate decreased, the average response to fertilizer increased from 5.5 bushels in 1962 to 9.3 bushels in 1964, resulting in a profit in the latter year. This seems to indicate that higher rates of nitrogen are profitable when phosphate is applied according to the soil test.

---

[3]Appendix Table A-2.

[4]Appendix Tables A-7 and A-8.

TABLE 3. SELECTED FERTILIZER DATA FOR THE SOUTHWEST AREA,[1] BY CROPS AND CROPPING PRACTICE, 1962-1964[2]

Crops on Fallow Land		Year 1962	1963	1964
Durum	Ave Fertilizer Treatment	7+21+0	8+20+0	6+23+0
	Average Yield/Acre-bu	33	32	27
	Average Yld Inc/Acre-bu	4.3	4.8	2.3
	Percent Profit	210%	220%	-1%
HRS Wheat	Ave Fertilizer Treatment	3+19+0	6+27+0	4+27+0
	Average Yield/Acre-bu	30	27	20
	Average Yld Inc/Acre-bu	4.7	4.6	3.5
	Percent Profit	329%	162%	55%
Barley	Ave Fertilizer Treatment	0+21+0[3]	5+22+0	0+32+0[4]
	Average Yield/Acre-bu	47	45	53
	Average Yld Inc/Acre-bu	6.7	3.2	17.5
	Percent Profit	149%	-12%	319%
Crops on Nonfallow Land				
Durum	Ave Fertilizer Treatment	8+21+0	None	None
	Average Yield/Acre-bu	27		
	Average Yld Inc/Acre-bu	5.7		
	Percent Profit	295%		
HRS Wheat	Ave Fertilizer Treatment	8+22+0	14+30+0	9+16+0
	Average Yield/Acre-bu	37	18	15
	Average Yld Inc/Acre-bu	7.3	2.5	2.3
	Percent Profit	366%	0%	15%
Barley	Ave Fertilizer Treatment	8+21+0	16+29+0	9+23+0
	Average Yield/Acre-bu	48	45	29
	Average Yld Inc/Acre-bu	12.3	8.2	4.4
	Percent Profit	205%	21%	5%

[1]Includes Adams, Bowman, and Hettinger counties.

[2]Price assumptions are those included in Table 2. Cost assumptions are 14 cents per pound for nitrogen and 10 cents per pound for P_2O_5.

[3]Only 10 acres checked.

[4]Only eight acres checked.

TABLE 4. SELECTED FERTILIZER DATA FOR THE NORTH CENTRAL AREA,[1] BY CROPS AND CROPPING PRACTICE, 1962-1964[2]

Crops on Fallow Land		Year 1962	1963	1964
Durum	Ave Fertilizer Treatment	1+21+0	6+21+0	3+22+0
	Average Yield/Acre-bu	45	35	40
	Average Yld Inc/Acre-bu	3.9	2.6	3.4
	Percent Profit	268%	85%	72%
HRS Wheat	Ave Fertilizer Treatment	2+25+0	3+21+0	2+22+0
	Average Yield/Acre-bu	39	29	35
	Average Yld Inc/Acre-bu	2.3	1.8	3.0
	Percent Profit	77%	51%	83%
Barley	Ave Fertilizer Treatment	2+23+0	4+25+0	0+20+0
	Average Yield/Acre-bu	76	43	59
	Average Yld Inc/Acre-bu	2.1	1.6	2.6
	Percent Profit	-37%	-59%	8%
Crops on Nonfallow Land				
Durum	Ave Fertilizer Treatment	None	13+12+0	11+11+0
	Average Yield/Acre-bu		28	35
	Average Yld Inc/Acre-bu		---	4.4
	Percent Profit		-100%	121%
HRS Wheat	Ave Fertilizer Treatment	0+26+0[3]	None	None
	Average Yield/Acre-bu	38		
	Average Yld Inc/Acre-bu	2.8		
	Percent Profit	126%		
Barley	Ave Fertilizer Treatment	9+22+0	13+16+0	10+21+0
	Average Yield/Acre-bu	53	43	47
	Average Yld Inc/Acre-bu	3.9	5.3	5.0
	Percent Profit	-9%	24%	15%

[1]Includes Burke, Renville, and Bottineau counties.

[2]Price assumptions are those included in Table 2. Cost assumptions are 14 cents per pound for nitrogen and 10 cents per pound for P_2O_5.

[3]Only one field checked.

TABLE 5. SELECTED FERTILIZER DATA FOR THE VALLEY AREA,[1] BY CROPS AND CROPPING PRACTICE, 1962-1964[2]

Crops on Fallow Land		Year 1962	1963	1964
Durum	Ave Fertilizer Treatment	4+26+0	9+23+0	9+31+0
	Average Yield/Acre-bu	35	37	35
	Average Yld Inc/Acre-bu	8.1	2.2	1.9
	Percent Profit	468%	26%	-41%
HRS Wheat	Ave Fertilizer Treatment	9+27+0	13+35+0	7+30+0
	Average Yield/Acre-bu	35	30	24
	Average Yld Inc/Acre-bu	3.5	4.4	2.3
	Percent Profit	86%	66%	-18%
Barley	Ave Fertilizer Treatment	None	22+41+0	0+28+0[3]
	Average Yield/Acre-bu		53	52
	Average Yld Inc/Acre-bu		15.6	.7
	Percent Profit		67%	-79%
Crops on Nonfallow Land				
Durum	Ave Fertilizer Treatment	18+28+0	15+21+0	36+19+0
	Average Yield/Acre-bu	41	31	33
	Average Yld Inc/Acre-bu	9.0	.9	3.7
	Percent Profit	281%	-62%	-28%
HRS Wheat	Ave Fertilizer Treatment	26+28+0	44+25+0	33+23+0
	Average Yield/Acre-bu	25	27	38
	Average Yld Inc/Acre-bu	3.5	4.0	6.8
	Percent Profit	16%	-6%	42%
Barley	Ave Fertilizer Treatment	26+27+0	27+23+0	31+20+0
	Average Yield/Acre-bu	38	48	57
	Average Yld Inc/Acre-bu	4.1	5.8	11.2
	Percent Profit	-47%	-28%	46%

[1]Includes Cass and Traill counties.

[2]Price assumptions are those included in Table 2. Cost assumptions are 14 cents per pound for nitrogen and 10 cents per pound for P_2O_5.

[3]Only one field checked.

Active Test-Demonstration Farms in North Dakota

The number of active test-demonstration cooperators in 1964 is shown, by counties, in Table 6. At the beginning of the year 38 cooperators were active in the program. One cooperator in Cass county dropped out because of lease arrangements. To replace this cooperator, one of the farms in the program was divided into two units with separate fertilizer programs. A cooperator was added in Burke county to replace one that dropped out in 1963.

TABLE 6. NUMBER OF ACTIVE TEST-DEMONSTRATION COOPERATORS, BY COUNTIES

County	Cooperators Active January 1, 1964	Number Dropped During Year	Number Added During Year	Cooperators Active At End of Year
Adams	5	-	-	5
Bottineau	5	-	-	5
Bowman	5	-	-	5
Burke	4	-	1	5
Cass	5	1	1	5
Hettinger	4	-	-	4
Renville	5	-	-	5
Traill	5	-	-	5
All Counties	38	1	2	39

Moisture Situation in 1964

The moisture situation was generally favorable throughout the state in 1964. Figure 3 shows the average precipitation received by crop reporting district. In the western part of the state precipitation was below the 1963 average but above normal. In the valley, which suffered from a lack of moisture in the latter part of the growing season in 1963, the moisture situation improved greatly. The average precipitation in the valley increased by 7.14 inches, from 14.26 in 1963 to 21.40 in 1964.

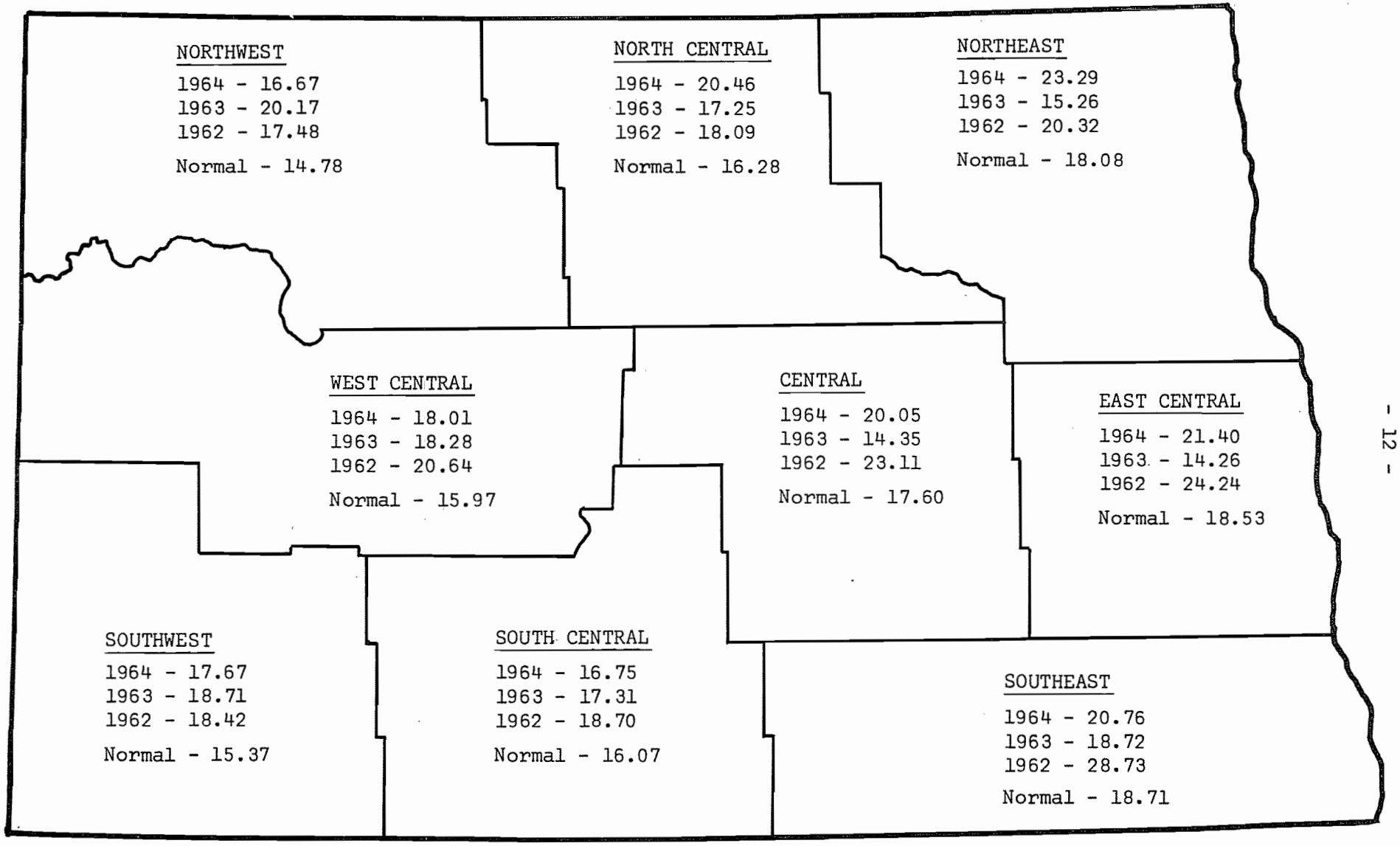


Figure 3. Average Annual Precipitation in North Dakota, by Crop Reporting Districts for 1962, 1963, 1964, and 1931-1960 Average.

Source: USDA Statistical Reporting Service, Agricultural Statistician, Fargo, North Dakota.

Several cooperators kept precipitation records during the 1964 growing season. The inches of precipitation and length of period for which the record was kept are shown in Figure 4. In the southwest a major proportion of the precipitation was received in thunderstorms during the first week of June. Runoff was heavy with little moisture being absorbed by the soil. The north central area received a limited amount of rain during the growing season. In the valley the amount received and distribution were generally adequate.

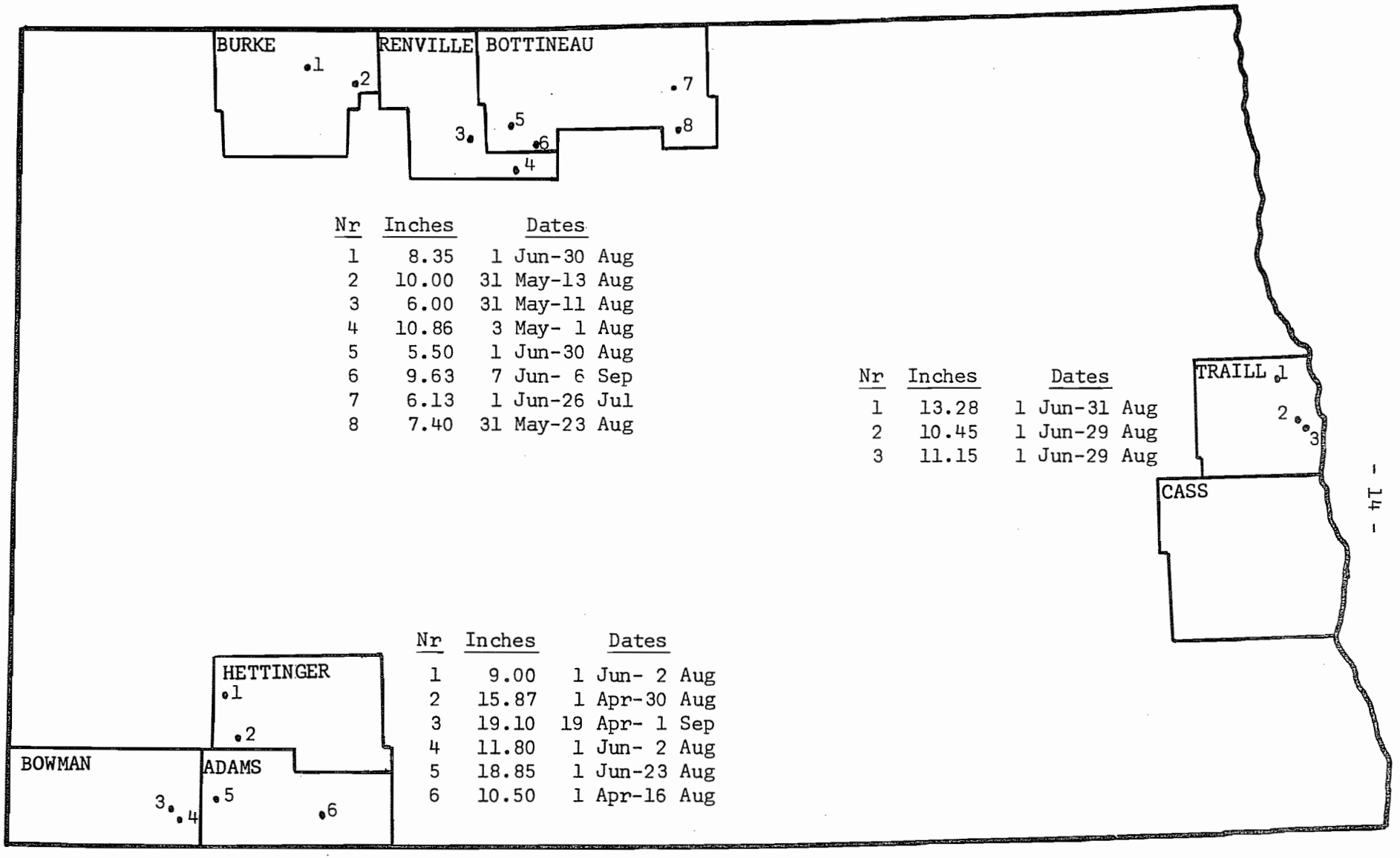
Examination of the data in Figure 4 indicates that precipitation varied considerably within small areas. The amount of precipitation in conjunction with its distribution and temperatures during the growing season affects yield responses to fertilizer.

Crops Fertilized

Test-demonstration farms fertilized 18,006 acres in 1964. Table 7 shows the acreage fertilized by crops and areas for the last three years. The number of acres of wheat fertilized increased by 15 percent over 1963; barley acreage decreased by about 1,000 acres. This decrease resulted primarily from two factors: (1) price discounts for barley in 1963 because of high protein and (2) poorer responses to fertilizer in the southwest and north central areas.

The acreage fertilized in 1964 for each crop, by area, is shown in Table 8. Durum and HRS wheat accounted for about 72 percent of the acreage fertilized. About 80 percent of the wheat fertilized was on fallow, while about 79 percent of the barley was planted on nonfallow. Several specialty crops were fertilized, but no yield responses were obtained.

Table 9 contains the fertilized acreage checked for yield responses. The number of acres checked was less than total acres fertilized because several cooperatives suffered hail losses and wind damage while the grain was in the swath. About 37 percent of the total acreage fertilized was checked at harvest time, 6,715 acres out of 18,006 acres.



Nr	Inches	Dates
1	8.35	1 Jun-30 Aug
2	10.00	31 May-13 Aug
3	6.00	31 May-11 Aug
4	10.86	3 May- 1 Aug
5	5.50	1 Jun-30 Aug
6	9.63	7 Jun- 6 Sep
7	6.13	1 Jun-26 Jul
8	7.40	31 May-23 Aug

Nr	Inches	Dates
1	13.28	1 Jun-31 Aug
2	10.45	1 Jun-29 Aug
3	11.15	1 Jun-29 Aug

Nr	Inches	Dates
1	9.00	1 Jun- 2 Aug
2	15.87	1 Apr-30 Aug
3	19.10	19 Apr- 1 Sep
4	11.80	1 Jun- 2 Aug
5	18.85	1 Jun-23 Aug
6	10.50	1 Apr-16 Aug

Figure 4. Precipitation Recorded on Test-Demonstration Farms in North Dakota, 1964.

TABLE 7. ACREAGE FERTILIZED IN 1962, 1963, AND 1964 ON TEST-DEMONSTRATION FARMS, BY COUNTIES

Crop	Year	Counties			
		Cass and Traill	Adams, Bowman, & Hettinger	Bottineau, Burke, & Renville	All Counties
		acres			
Wheat	1962	1,180	3,782	4,442	9,404
	1963	1,756	5,539	4,050	11,345
	1964	1,665	6,316	5,051	13,032
Barley	1962	1,102	493	986	2,581
	1963	1,636	578	1,762	3,976
	1964	1,535	359	946	2,840
Oats	1962	147	186	150	483
	1963	356	275	314	945
	1964	216	322	284	822
Rye	1962	-	-	-	-
	1963	-	-	99	99
	1964	-	11	145	156
Flax	1962	-	-	-	-
	1963	95	-	30	125
	1964	25	-	203	228
Corn	1962	306	116	-	422
	1963	417	190	-	607
	1964	321	32	60	413
Specialty Crops[1]	1962	237	-	-	237
	1963	454	-	-	454
	1964	462	-	-	462
Hay and Pasture[2]	1962	-	-	10	10
	1963	70	-	30	100
	1964	10	-	43	53
All Crops	1962	2,972	4,577	5,588	13,137
	1963	4,784	6,582	6,285	17,651
	1964	4,234	7,040	6,732	18,006

[1]Includes sugar beets, soybeans, sunflowers, peas, and canary grass.

[2]Includes alfalfa, millet, brome and clover hay, and pastures.

TABLE 8. ACREAGE FERTILIZED IN 1964, BY CROPS AND COUNTIES

Crop	Counties			
	Cass and Traill	Adams, Bowman, & Hettinger	Bottineau, Burke, & Renville	All Counties
	acres			
Wheat on Fallow	711	4,955	4,775	10,441
Wheat on Nonfallow	954	1,361	276	2,591
All Wheat	1,665	6,316	5,051	13,032
Barley on Fallow	205	107	289	601
Barley on Nonfallow	1,330	252	657	2,239
All Barley	1,535	359	946	2,840
Oats	216	322	284	822
Flax	25	-	203	228
Rye	-	11	145	156
Corn	321	32	60	413
Sunflowers	76	-	-	76
Soybeans	77	-	-	77
Peas	41	-	-	41
Beets	268	-	-	268
Pasture	-	-	43	43
Alfalfa	10	-	-	10
All Crops	4,234	7,040	6,732	18,006

TABLE 9. FERTILIZED ACREAGE CHECKED AT HARVEST TIME, BY CROPS AND COUNTIES

Crop	Counties			
	Cass and Traill	Adams, Bowman, & Hettinger	Bottineau, Burke, & Renville	All Counties
	acres			
Wheat on Fallow	283	1,358	1,923	3,564
Wheat on Nonfallow	494	380	135	1,009
All Wheat	777	1,738	2,058	4,573
Barley on Fallow	45	8	66	119
Barley on Nonfallow	885	50	317	1,252
All Barley	930	58	383	1,371
Oats on Nonfallow	158	163	110	431
Rye on Fallow	-	11	154	165
Flax on Nonfallow	-	-	95	95
Corn on Nonfallow	80	-	-	80
All Crops	1,945	1,970	2,800	6,715

Amount of Fertilizer Material Used

As compared to 1963, fertilizer use decreased by about seven percent on the test-demonstration farms in 1964. About 562 tons of fertilizer were used for the 1964 crop. The decline in the amount of fertilizer used was primarily caused by the following factors: (1) poorer responses in 1963 compared to 1962, (2) a general feeling that high rates of fertilizer caused high protein in barley, and (3) anticipation of lower product prices in 1964 because of changes in government price support programs.

Of the total fertilizer used, about 444 tons were acquired through the Tennessee Valley Authority test-demonstration program. Table 10 indicates the grade and amount of fertilizer used in each county cooperating in the program. Concentrated superphosphate (0-54-0) and diammonium phosphate (21-53-0) were the materials in greatest demand by farmers. Ammonium phosphate-nitrate (25-25-0), a new material, was used for the first time in 1964 on nonfallow land.

TABLE 10. GRADES AND AMOUNTS OF FERTILIZER PURCHASED FROM TVA IN 1964, BY COUNTIES

County	Fertilizer Grade				
	0-54-0	21-53-0	30-10-0	25-25-0	All Grades
	tons				
Adams	42.6	30.9	1.5	2.5	77.5
Bottineau	18.4	18.8	7.8	9.5	54.5
Bowman	21.4	25.7	-	4.8	51.9
Burke	40.7	1.5	2.6	2.5	47.3
Cass	1.3	16.3	20.5	29.5	67.6
Hettinger	18.0	23.7	-	-	41.7
Renville	21.8	5.5	1.2	5.8	34.3
Traill	18.2	13.8	24.8	12.7	69.5
All Counties	182.4	136.2	58.4	67.3	444.3

Additional fertilizer was purchased from local dealers to supplement the TVA materials. Of the 118 tons purchased locally, as shown in Table 11, ammonium nitrate accounted for about one third. However, this was a decline of about 40 percent from the amount used in 1963. Most of the ammonium nitrate is bulk spread on nonfallow fields in Cass and Traill counties.

Handling, Storing, and Spreading Characteristics of Test-Demonstration Fertilizer Materials

In general, the physical qualities and spreading characteristics of the TVA fertilizer materials were satisfactory. The fertilizer was stored on the test-demonstration farms for about six to eight weeks before being used. No unusual problems were encountered. The materials generally were placed on wooden floors or on wooden slats over concrete floors.

Some difficulties were encountered in applying a uniform and desired rate of fertilizer to the entire field. The particle size was uneven, ranging from fine dust to large lumps, causing the material to flow too freely or to build up and plug the attachment. Also, ammonium phosphate-nitrate (25-25-0) absorbed moisture readily.

The cooperators generally liked the 50-pound bags. However, the bags were loosely filled allowing them to shift in the boxcar during shipment. When the bags were handled, they broke quite easily. Some cooperators suggested using plastic bags to prevent moisture absorption.

Educational Uses Made of Test-Demonstration Farm Results

The primary objective of the test-demonstration program in North Dakota is to determine the economic effects of a recommended fertilizer program. The cooperating farmers take soil samples which are analyzed for phosphate content by the Soil Testing Laboratory, Soils Department, North Dakota State University. Soils

TABLE 11. COMMERCIAL FERTILIZER PURCHASED FOR 1964 BY TVA COOPERATORS, BY GRADE AND COUNTIES

Grade of Fertilizer	Counties								
	Cass	Traill	Adams	Bowman	Hettinger	Bottineau	Burke	Renville	All Counties
	tons								
0-45-0					1.0				1.0
0-46-0	2.1						8.0		10.1
11-48-0	7.2		.3		1.0			1.2	9.7
16-48-0	4.0		2.0						6.0
33- 0-0	4.0	37.2				.6			41.8
16-20-0						.4			.4
24-20-0	22.9								22.9
27-14-0	8.5	.4							8.9
23-23-0	3.2	1.2							4.4
10-30-0	1.0								1.0
8-32-8		10.8							10.8
0- 0-60	1.0								1.0
All Grades	53.9	49.6	2.3		2.0	1.0	8.0	1.2	118.0

testing very low in phosphate require between 30-35 pounds of phosphate per acre; low testing soils, about 25 pounds; medium testing soils, about 15 pounds; and high testing soils generally required no additional phosphate. The nitrogen rate is determined by the cropping history and amount of soil moisture at planting time. Generally, crops grown on fallow require no additional nitrogen. For non-fallow land examination of the soil profile is made at planting time to determine the amount of stored moisture available for use by the plant. A guide for making this estimation of available moisture is contained in Table 12.

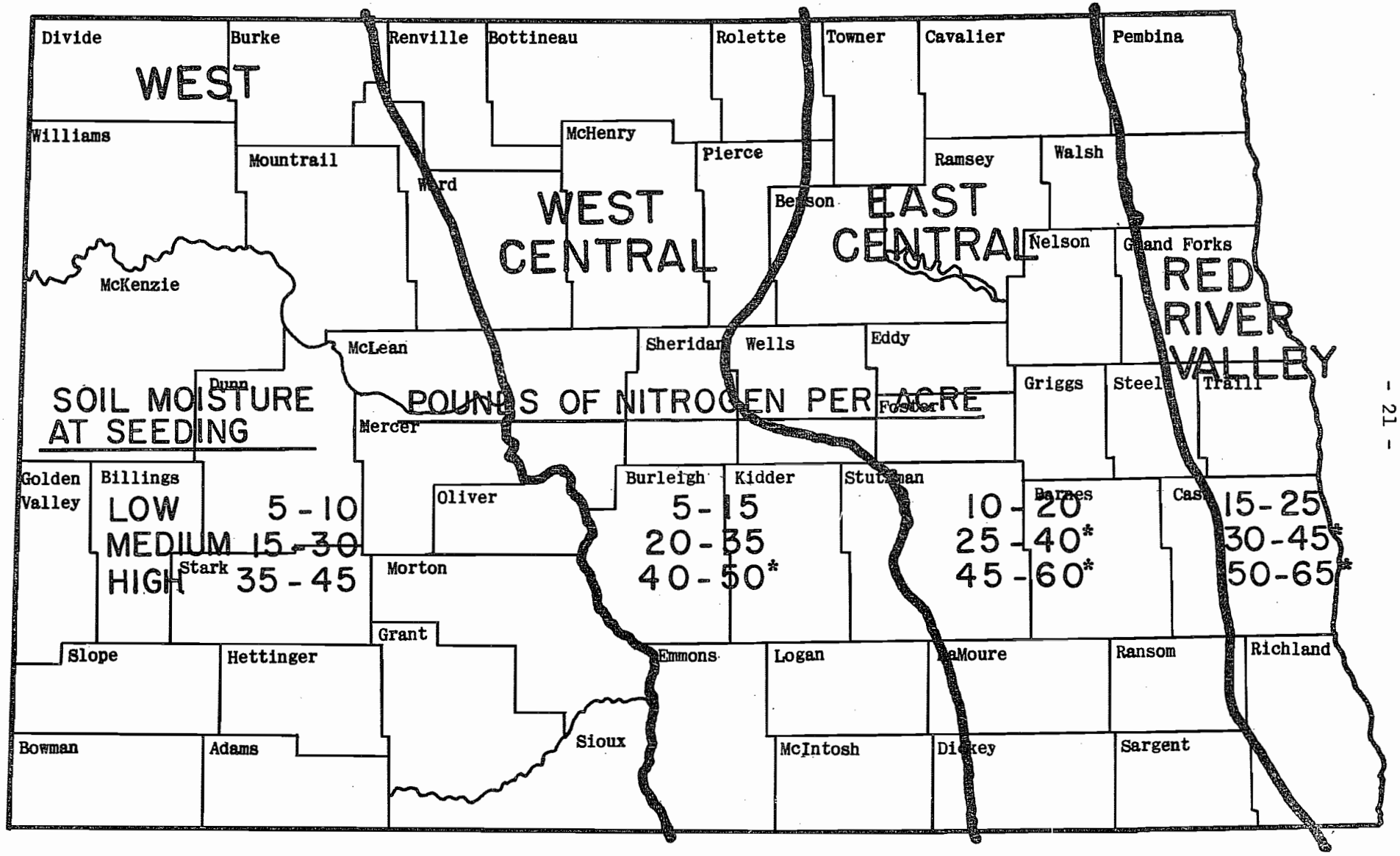
TABLE 12. GUIDE FOR ESTIMATING AVAILABLE SOIL MOISTURE

Available Moisture (inches)	Soil moisture at seeding	Wetted depth of soil by textures			
		Clay, silty clay, clay loams	Silt, silt loam, loam v.fine sandy loam	Fine sandy, loam, sandy loam	Loamy Sand
		inches			
0-2	Low	0-12	0-15	0-20	0-36
2-4	Medium	12-22	15-28	20-36	36-68
over 4	High	over 22	over 28	over 36	over 68

Source: North Dakota Fertilizer Guide, Circular A-350, Extension Service, North Dakota State University of Agriculture and Applied Science, April 1963.

Nitrogen recommendations for small grains on nonfallow to be used in conjunction with the available soil moisture estimation are shown in Figure 5.

Of the 18,006 acres fertilized on test-demonstration farms in 1964, yield comparisons were made on 200 fields representing 6,715 acres. Table 13 contains the number of fields checked in each county, by crop.



*For malting barley reduce higher nitrogen rates by 10 pounds per acre.

Figure 5. Nitrogen Recommendations for Small Grain Grown on Nonfallow.

Source: Circular A-350, North Dakota Fertilizer Guide, Extension Service, North Dakota State University of Agriculture and Applied Science, April 1963.

TABLE 13. NUMBER OF FIELDS CHECKED FOR FERTILIZER RESPONSES AT HARVEST, BY CROPS AND COUNTIES

County	Crops				
	Wheat	Barley	Oats	Other	All Crops
	number of fields				
Adams	35	2	2	-	39
Bowman	24	1	2	1	28
Hettinger	13	1	3	-	17
Bottineau	14	6	1	4	25
Burke	13	2	1	-	16
Renville	23	1	-	1	25
Cass	5	5	3	1	14
Traill	17	18	1	-	36
All Counties	144	36	13	7	200

The crop yield comparisons on the fertilized and unfertilized portions of the fields are used to demonstrate the physical and economic effects of recommended fertilizer treatments on individual fields and crops. County extension personnel use the test-demonstration farms and the results obtained from the check strips in their educational program. Generally, they are included as a part of other extension programs rather than as separate programs. The educational uses made of the test-demonstration program by the county agents are shown in Table 14.

In addition, the results are used by state extension service personnel, vocational agriculture teachers, researchers, and other agencies to promote the profitable use of fertilizer in North Dakota.

TABLE 14. EDUCATIONAL USES MADE OF TEST-DEMONSTRATION FARMS IN 1964

Number of people who visited fertilizer demonstrations (including tour groups and individual visits).	491
Number of tour groups who saw fertilizer demonstrations.	12
Number of news articles mentioning one or more of these demonstrations and/or results of these demonstrations.	40
Number of radio and television programs in which reference was made to these demonstrations and results obtained.	16
Number of people attending meetings where results of these demonstrations were discussed.	1,677

To determine the overall effect of the fertilizer program, the cooperators keep farm records which are analyzed in conjunction with the North Dakota Extension Farm Account Route. Records were completed by 30 cooperators. In addition, 21 other farmers not participating in the test-demonstration program completed farm records. This will allow a comparative analysis of records for farms that did and did not participate in the program.

Fertilizer Responses in 1964

State

As shown in Table 15, the average percent profit due to fertilizer in 1964 was about 49 percent, an increase of nine percent over 1963. Even though wheat prices declined considerably, they were offset by a slight reduction in fertilizer cost per acre[5] and a rise in the average yield increase per acre.

Durum and HRS wheat prices declined from $2.09 and $2.03 in 1963 to $1.36 and $1.45 in 1964, respectively. Yield responses on fallow land were about the same as 1963; however, on nonfallow land durum and barley showed significant increase. The average yield increase per acre rose from .8 to 3.9 bushels per

[5]Pounds of nutrients per acre were reduced, not the price of the materials.

TABLE 15. AVERAGE COSTS AND RETURNS TO FERTILIZER USE BY CROP ON ALL TEST-DEMONSTRATION FARMS, 1964[1]

Crop	Acres Checked	Ave Fert Treat/A	Ave Yld/ Acre	Ave Yld Inc Per A	Ave Fert Cost/A[2]	Ave Net Return Per A[3]	Percent Profit
		Crops Grown on Fallow Land					
			bushels				
Durum	1,398	4+23+0	36.5	3.1	$2.93	$1.32	
HRS Wheat	1,964	3+25+0	26.8	3.1	2.97	1.67	
HRW Wheat	202	3+26+0	29.2	8.5	2.99	9.53	
Barley	119	0+24+0	56.0	2.9	2.39	.02	
Rye	165	7+21+0	43.3	3.6	3.15	.56	
All Small Grains	3,848	3+24+0	----	---	2.95	1.85	63
		Crops Grown on Nonfallow Land					
Durum	415	28+16+0	33.5	3.9	5.64	- .32	
HRS Wheat	594	18+19+0	23.4	3.9	4.38	1.33	
Barley	1,252	25+20+0	53.2	9.3	5.47	2.20	
Oats	431	13+13+0	66.4	12.0	3.06	3.58	
Flax	95	5+ 6+0	16.1	- 1.3	1.32	-4.84	
Corn	80	19+58+0	50.3	20.1	8.46	9.24	
All Small Grains	2,867	21+19+0	----	----	4.85	1.88	39
Total	6,715	11+22+0	----	----	$3.76	$1.84	49

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Net returns from fertilizer based on 1964 mid-October cash grain prices.

Durum	= $1.36	Oats	= $ .50
HRS Wheat	= 1.45	Rye	= .92
HRW Wheat	= 1.45	Flax	= 2.82
Barley	= .83	Corn	= .98

acre for durum and from 6.0 to 9.3 bushels per acre for barley. This increase is the major reason for the percent profit on nonfallow land increasing from a -14 percent in 1963 to 39 percent in 1964.

The average nitrogen and phosphate treatments per acre declined by two and one pounds, respectively. This decline resulted in a decrease in fertilizer cost per acre of about $0.38, $4.12 per acre in 1963 compared to $3.76 per acre in 1964.

Southwest

The southwest experienced an extremely dry spring in 1964. The amount of precipitation received was generally good, but distribution was poor. Two cooperators in the eastern part of Adams county experienced droughty conditions for the second consecutive year.

Yield responses per acre were generally below previous years. The percent profit as indicated in Table 16 was about 67 percent, a decline from the 82 percent received in 1963. However, for crops grown on nonfallow the percent profit from fertilizer use increased by 22 percent, from five percent in 1963 to 27 percent in 1964. Because of the dry spring the average fertilizer treatment was decreased. Nitrogen use declined by five pounds and phosphate by 11 pounds per acre. The reduction in fertilizer cost per acre more than offset the decline in yield responses and prices.

The average profitability for all crops during the past three years has been about 150 percent.

North Central

The growing season in this area was abnormal. The crop was damaged by frost the last week in May and again about the middle of August. Precipitation was short during most of the growing season as indicated previously in Figure 4. During harvest time several cooperators were unable to make yield comparisons because of extremely rainy weather and many swaths were scattered by wind.

TABLE 16. AVERAGE COSTS AND RETURNS TO FERTILIZER USE BY CROP IN ADAMS, BOWMAN, AND HETTINGER COUNTIES, 1964[1]

Crop	Acres Checked	Ave Fert Treat/A	Ave Yld/ Acre	Ave Yld Inc Per A	Ave Fert Cost/A[2]	Ave Net Return Per A[3]	Percent Profit
		Crops Grown on Fallow Land					
			bushels				
Durum	258	6+23+0	27.4	2.3	$3.16	$- .04	
HRS Wheat	898	4+27+0	19.8	3.5	3.28	1.82	
HRW Wheat	202	3+26+0	29.2	8.5	2.99	9.53	
Barley	8	0+32+0	53.3	17.5	3.20	11.32	
Rye	11	8+22+0	21.5	8.1	3.32	4.13	
All Small Grains	1,377	4+26+0	----	----	3.22	2.67	83
		Crops Grown on Nonfallow Land					
HRS Wheat	380	9+16+0	15.1	2.3	2.92	.43	
Barley	50	9+23+0	28.6	4.4	3.54	.16	
Oats	163	8+16+0	49.6	9.1	2.75	1.81	
All Small Grains	593	9+17+0	----	---	2.93	.78	27
Total	1,970	6+23+0	----	---	$3.13	$2.10	67

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Net returns from fertilizer based on 1964 mid-October cash grain prices.

Durum	= $1.36	Barley	= $ .83
HRS Wheat	= 1.45	Oats	= .50
HRW Wheat	= 1.45	Rye	= .92

The average yield increases per acre as shown in Table 17 were generally above those recorded in 1963, while the fertilizer treatment remained about the same. Profitability of crops grown on nonfallow decreased about 16 percent because of the yield loss suffered on flax. Generally, flax doesn't give a profitable response and shouldn't be fertilized. The average net return of 57 percent for 1964 compares favorably with the three-year average for this area of 69 percent.

Valley

The general growing conditions in the Red River Valley were the best since the test-demonstration program was initiated in Cass and Traill counties in 1962. The average net return per acre rose from a minus six percent in 1963 to 35 percent in 1964 as shown in Table 18.

However, difficulties were still encountered. Losses were experienced for crops grown on fallow. Excess moisture delayed planting. The stand was heavy and damaged by heat in July. Several of the fields lodged severely making yield comparisons impossible.

Crops grown on nonfallow showed a profit, except durum which incurred a loss of about $2.00 per acre. Part of this loss can be attributed to the decrease in yield responses from fall application of nitrogen experienced on some fields.[6] Nitrogen was applied to these fields in July of 1963. A heavy regrowth occurred and wasn't worked down. This tied up a considerable amount of the nitrogen in plant tissues making it unavailable for the 1964 crop. On those fields where nitrogen was applied later in the fall or the regrowth was controlled, the yield responses were favorable. So in addition to applying the correct rate, other management factors affected the profitability of fertilizer use.

---

[6]Appendix Table A-8.

TABLE 17. AVERAGE COSTS AND RETURNS TO FERTILIZER USE BY CROP IN BOTTINEAU, BURKE, AND RENVILLE COUNTIES, 1964[1]

Crop	Acres Checked	Ave Fert Treat/A	Ave Yld/ Acre	Ave Yld Inc Per A	Ave Fert Cost/A[2]	Ave Net Return Per A[3]	Percent Profit
		Crops Grown on Fallow Land					
			bushels				
Durum	1,039	3+22+0	38.9	3.4	$2.73	$1.97	
HRS Wheat	884	2+22+0	34.5	3.0	2.43	2.02	
Barley	66	0+20+0	59.0	2.6	2.02	.17	
Rye	154	7+21+0	44.9	3.3	3.14	.31	
All Small Grains	2,143	3+22+0	----	---	2.62	1.81	69
		Crops Grown on Nonfallow Land					
Durum	135	11+11+0	35.0	4.4	2.70	3.26	
Barley	317	10+21+0	46.8	5.0	3.51	.53	
Oats	110	14+ 7+0	78.3	10.7	2.69	2.66	
Flax	95	5+ 6+0	16.1	-1.3	1.32	-4.84	
All Small Grains	657	10+14+0	----	----	2.89	.67	23
Total	2,800	5+20+0	----	----	$2.68	$1.54	57

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Net returns from fertilizer based on 1964 mid-October cash grain prices.

Durum	= $1.36	Oats	= $ .50
HRS Wheat	= 1.45	Flax	= 2.82
Barley	= .83	Rye	= .92

TABLE 18. AVERAGE COSTS AND RETURNS TO FERTILIZER USE BY CROP IN CASS AND TRAILL COUNTIES, 1964[1]

Crop	Acres Checked	Ave Fert Treat/A	Ave Yld/ Acre	Ave Yld Inc Per A	Ave Fert Cost/A[2]	Ave Net Return Per A[3]	Percent Profit
		Crops Grown on Fallow Land					
			bushels				
Durum	101	9+31+0	35.1	1.9	$4.36	$-1.80	
HRS Wheat	182	7+30+0	24.4	2.3	4.02	- .74	
Barley	45	0+28+0	52.0	.7	2.80	-2.22	
All Small Grains	328	7+30+0	----	---	3.96	-1.27	-32
		Crops Grown on Nonfallow Land					
Durum	280	36+19+0	32.8	3.7	7.06	-2.01	
HRS Wheat	214	33+23+0	38.1	6.8	6.97	2.94	
Barley	885	31+20+0	56.9	11.2	6.28	2.91	
Oats	158	17+13+0	75.5	15.9	3.64	6.05	
Corn	80	19+58+0	50.3	20.1	8.46	11.24	
All Small Grains	1,617	30+21+0	----	----	6.36	2.77	42
Total	1,945	26+23+0	----	----	$5.95	$2.10	35

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Net returns from fertilizer based on 1964 mid-October cash grain prices.

Durum	= $1.36	Oats	= $ .50
HRS Wheat	= 1.45	Corn	= .98
Barley	= .83		

Individual

Appendix A contains the crop yield responses to fertilizer treatment for each cooperator. Appendix B contains the average costs and returns to fertilizer for each cooperator.

APPENDIX A

CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN NORTH DAKOTA, 1964

APPENDIX TABLE A-1. CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN ADAMS COUNTY, 1964

Cooperator	Field No.	1963 Crop	1964 Crop	Nutrient Per Acre	Yield-Bushels/Acre		
					Fert.	Check	Diff.
Daryl Anderson	NE-12	Fallow	HRS Wheat	0+27+0	29.5	27.3	2.2
	S-10[1]	Fallow	HRS Wheat	0+22+0	20.4	19.6	.8
	S 1/2-7	Corn	HRS Wheat	10+26+0	22.3	16.5	5.8
	SE-18	Corn	Barley	9+24+0	45.7	42.0	3.7
Gene Davison[2]	B-3	Fallow	HRS Wheat	0+38+0	11.2	9.6	1.6
	C-1	Barley	HRS Wheat	13+32+0	10.7	9.6	1.1
	E-4	Fallow	HRS Wheat	0+38+0	7.2	4.8	2.4
	E-11	Grain	HRS Wheat	13+32+0	10.6	5.4	5.2
	D-7	Corn	HRS Wheat	13+32+0	11.7	9.4	2.3
	N-13	Fallow	HRS Wheat	0+38+0	13.0	9.6	3.4
	N-12	Grain	HRS Wheat	13+32+0	8.0	7.0	1.0
	T-1	Corn	HRS Wheat	18+ 6+0	21.1	22.1	-1.0
	U-4	Corn	HRS Wheat	13+32+0	22.2	21.9	.3
Fred Ehlers	26-L	Fallow	HRW Wheat	0+32+0	18.0	16.0	2.0
	25-N	Fallow	HRS Wheat	0+32+0	16.7	12.0	4.7
	26-D	Fallow	HRS Wheat	0+32+0	14.7	12.0	2.7
	3-P	Fallow	HRS Wheat	0+32+0	28.7	25.3	3.4
	3-V	Fallow	HRS Wheat	0+32+0	26.0	24.0	2.0
	14-O	Corn	HRS Wheat	15+ 5+0	24.0	22.0	2.0
	26-V	Corn	HRS Wheat	14+36+0	15.3	14.7	.6
	3-F	Fallow	Barley	0+32+0	53.3	35.8	17.5
John Larson[3]	1-2	Fallow	HRS Wheat	6+19+0	23.4	19.6	3.8
	11-5	Corn	HRS Wheat	8+21+0	13.4	18.6	-5.2
	9	Fallow	HRS Wheat	8+21+0	22.6	21.2	1.4
	12-1	Corn	HRS Wheat	8+21+0	16.9	17.2	- .3
	16-13	Fallow	HRS Wheat	0+22+0	15.5	16.3	- .8
	2-A	Wheat	HRS Wheat	8+21+0	24.4	23.7	.7
Raymond Wothe	8-P	Fallow	HRS Wheat	0+32+0	30.7	25.3	5.4
	8-R[4]	Fallow	HRS Wheat	0+32+0	26.7	8.0	18.7
	8-J	Fallow	HRS Wheat	0+32+0	18.7	18.7	-
	3-L	Fallow	HRS Wheat	0+32+0	24.0	13.6	10.4
	3-N	Fallow	HRS Wheat	0+32+0	26.7	17.3	9.4
	1-A	Fallow	HRS Wheat	0+32+0	16.0	10.7	5.3
	2-B	Fallow	HRS Wheat	0+32+0	8.0	5.3	2.7
	5-G[5]	Corn	HRS Wheat	10+26+0	10.7	12.0	-1.3
	5-D[5]	Corn	HRS Wheat	10+26+0	13.3	12.0	1.3
	6-M[5]	Corn	HRS Wheat	10+26+0	14.7	13.3	1.4
	1-F	Grain	Oats	10+26+0	70.0	60.0	10.0
	1-H	Grain	Oats	10+26+0	82.5	67.5	15.0

(continued)

APPENDIX TABLE A-1. CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN ADAMS COUNTY, 1964 (continued)

Cooperator	Field No.	1963 Crop	1964 Crop	Nutrient Per Acre	Yield-Bushels/Acre		
					Fert.	Check	Diff.
Adams County	Ave.	Fallow	HRS Wheat	1+30+0	20.4	16.0	4.4
		Fallow	HRW Wheat	0+32+0	18.0	16.0	2.0
		Nonfallow	HRS Wheat	12+23+0	17.4	16.1	1.3
		Fallow	Barley	0+32+0	53.3	35.8	17.5
		Nonfallow	Barley	9+24+0	45.7	42.0	3.7
		Nonfallow	Oats	10+26+0	76.2	63.8	12.4

[1]Check strips were heavily infested with weeds.

[2]An extremely dry spring was observed. (About 7.5 inches of precipitation were received during the growing season, with about 5 inches being received during thunderstorms on June 7 and 8.)

[3]A dry spring with little precipitation during the growing season was observed.

[4]Unfertilized check strip was infested with weeds.

[5]About 50 percent hail damage was reported.

APPENDIX TABLE A-2. CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN BOWMAN COUNTY, 1964

Cooperator	Field No.	1963 Crop	1964 Crop	Nutrient Per Acre	Yield-Bushels/Acre Fert.	Check	Diff.
Donald Brown	1-A	Fallow	HRW Wheat	0+22+0	20.4	11.8	8.6
	1-B	Fallow	HRW Wheat	13+32+0	33.4	19.6	13.8
	1-C	Fallow	HRW Wheat	8+22+0	24.6	11.3	13.3
	2-A	Fallow	HRS Wheat	6+16+0	20.8	13.3	7.5
	2-B[1]	Fallow	HRS Wheat	8+22+0	12.1	11.7	.4
	2-C	Fallow	HRS Wheat	0+26+0	25.3	22.1	3.2
	3-A	Fallow	Rye	8+22+0	21.5	13.4	8.1
Roy Kern	1	Fallow	HRS Wheat	10+25+0	32.4	26.2	6.2
	2	Fallow	HRW Wheat	0+27+0	33.2	26.5	6.7
Earl Nelson	S-4-0	Fallow	HRS Wheat	8+21+0	17.3	11.5	5.8
	S-4-0	Grain	HRS Wheat	8+ 8+0	11.5	8.6	2.9
	S-4-N	Oats	HRS Wheat	8+ 8+0	12.2	8.9	3.3
	S-34-M[2]	Wheat	HRS Wheat	8+ 8+0	10.1	7.2	2.9
	E & F[2]	Corn	HRS Wheat	8+ 8+0	10.8	6.5	4.3
	S-4-0	Grain	Barley	8+21+0	17.1	14.4	2.7
	S-34-H[2]	Corn	Oats	8+ 8+0	25.7	21.6	4.1
	S-34-L[2]	Grain	Oats	8+ 8+0	25.7	22.1	3.6
Donald Schumacher		Fallow	HRS Wheat	10+26+0	14.7	9.3	5.4
		Fallow	HRS Wheat	10+26+0	13.3	10.7	2.6
		Fallow	HRS Wheat	0+32+0	14.7	13.3	1.4
		Fallow	HRS Wheat	0+32+0	14.7	13.3	1.4
		Fallow	HRS Wheat	0+32+0	16.0	13.3	2.7
		Fallow	HRS Wheat	10+26+0	16.0	12.0	4.0
Walter Stzegura	10 R	Fallow	HRS Wheat	10+26+0	20.4	18.9	1.5
	S-26	Fallow	HRS Wheat	11+29+0	20.5	17.9	2.6
	S-26	Fallow	HRS Wheat	11+29+0	25.1	19.9	5.2
	S-31, E 1/2[1]	Fallow	Durum	9+23+0	27.5	24.8	2.7
	S-30, SE 1/4[1]	Fallow	Durum	9+23+0	27.9	25.5	2.4
	S-30, SW 1/4[1]	Fallow	Durum	0+22+0	26.9	25.3	1.6
Bowman County	Ave.	Fallow	Durum	6+23+0	27.4	25.1	2.3
		Fallow	HRS Wheat	6+27+0	18.5	15.5	3.0
		Fallow	HRW Wheat	3+26+0	29.8	20.9	8.9
		Nonfallow	HRS Wheat	8+ 8+0	11.4	8.0	3.4
		Nonfallow	Barley	8+21+0	17.1	14.4	2.7
		Nonfallow	Oats	8+ 8+0	25.7	22.0	3.7
		Fallow	Rye	8+22+0	21.5	13.4	8.1

[1]Swaths were scattered by the wind.

[2]Between 80 and 100 percent hail damage was received on June 17.

APPENDIX TABLE A-3. CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN HETTINGER COUNTY, 1964

Cooperator	Field No.	1963 Crop	1964 Crop	Nutrient Per Acre	Yield-Bushels/Acre		
					Fert.	Check	Diff.
Alvin Dill	G	Fallow	HRS Wheat	0+22+0	23.9	20.3	3.6
	O	Fallow	HRS Wheat	0+22+0	23.7	20.1	3.6
	F	Fallow	HRS Wheat	0+22+0	21.5	18.4	3.1
	H	Fallow	HRS Wheat	0+22+0	22.9	18.5	4.4
	A	Corn	HRS Wheat	0+22+0	22.3	19.5	2.8
	C	Corn	HRS Wheat	0+22+0	21.2	18.1	3.1
	G	Grain	Oats	8+21+0	61.0	47.0	14.0
	E	Grain	Oats	8+21+0	70.0	57.0	13.0
	B	Grain	Oats	8+21+0	65.5	52.8	12.7
George Ott	15[1]	Fallow	HRS Wheat	10+26+0	20.2	17.4	2.8
	15	Fallow	HRS Wheat	10+26+0	20.7	14.0	6.7
	15	Fallow	HRS Wheat	10+26+0	21.2	14.8	6.4
	8[1]	Fallow	HRS Wheat	10+26+0	22.9	21.2	1.7
	8	Fallow	HRS Wheat	10+26+0	21.6	16.1	5.5
	8	Fallow	HRS Wheat	10+26+0	17.4	16.1	1.3
	21[2]	Corn	HRS Wheat	10+26+0	16.9	16.9	-
	2	Corn	Barley	10+26+0	36.5	28.6	7.9
Hettinger County	Ave.	Fallow	HRS Wheat	3+23+0	22.3	18.4	3.9
		Nonfallow	HRS Wheat	3+23+0	20.4	18.3	2.1
		Nonfallow	Barley	10+26+0	36.5	28.6	7.9
		Nonfallow	Oats	8+21+0	65.5	52.2	13.3

[1]Field numbers are duplicated when more than one check was made in the same field.

[2]Lack of moisture resulted in an unsatisfactory seedbed preparation.

APPENDIX TABLE A-4. CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN BOTTINEAU COUNTY, 1964

Cooperator	Field No.	1963 Crop	1964 Crop	Nutrient Per Acre	Yield-Bushels/Acre Fert.	Check	Diff.
Howard Anderson	2-T	Fallow	HRS Wheat	9+23+0	34.3	31.3	3.0
	7-A	Fallow	HRS Wheat	14+ 5+0	27.5	25.7	1.8
	2-J	Fallow	Durum	7+17+0	37.1	32.0	5.1
	3-S	Fallow	Durum	8+21+0	28.7	27.3	1.4
	2-M	HRS Wheat	Barley	21+ 7+0	34.2	31.5	2.7
	D-L-K[1]	Grain	Barley	21+14+0	55.6	55.8	- .2
Harold Bergman	16-I	Fallow	Durum	9+23+0	41.4	39.0	2.4
	15-C	Fallow	Durum	10+26+0	37.2	34.5	2.7
	22-L	Barley	Barley	0+32+0	51.1	39.1	12.0
	15-A	Fallow	Barley	0+22+0	70.0	64.7	5.3
	16-G	Grain	Barley	10+26+0	51.9	43.3	8.6
Kermit Kjonaas	8-A	Fallow	HRS Wheat	0+22+0	37.3	33.3	4.0
	33-C	Fallow	HRS Wheat	8+21+0	33.3	29.3	4.0
	3-F & G	Fallow	Durum	0+22+0	42.0	40.0	2.0
		Fallow	Durum	8+21+0	38.7	34.7	4.0
	33-B[2]	Durum	Barley	8+21+0	35.3	38.3	-3.0
C. L. O'Keefe	F[2]	Fallow	HRS Wheat	0+28+0	49.7	46.8	2.9
	SE-23-C[2]	Fallow	Durum	0+27+0	42.1	43.1	-1.0
George Witteman	5	Fallow	Durum	10+26+0	45.7	40.1	5.6
	9	Fallow	Durum	10+26+0	40.7	36.1	4.6
	15[3]	Fallow	Rye	4+19+0	37.9	30.6	7.3
	19[3]	Fallow	Rye	9+21+0	49.6	47.9	1.7
	8	Barley	Oats	12+12+0	109.5	97.5	12.0
	18-A[4]	Durum	Flax	7+ 7+0	15.6	19.6	4.0
	18-A			7+ 7+0	20.0	20.0	-
	S-2[4]	Durum	Flax	4+ 5+0	13.3	15.9	2.6
	S-2			4+ 5+0	13.6	14.9	1.3
	S-2			4+ 5+0	17.7	15.9	1.8

(continued)

APPENDIX TABLE A-4. CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN BOTTINEAU COUNTY, 1964 (continued)

Cooperator	Field No.	1963 Crop	1964 Crop	Nutrient Per Acre	Yield-Bushels/Acre		
					Fert.	Check	Diff.
Bottineau County	Ave.	Fallow	Durum	7+24+0	39.6	36.6	3.0
		Fallow	HRS Wheat	5+21+0	37.9	34.8	3.1
		Fallow	Barley	0+22+0	70.0	64.7	5.3
		Nonfallow	Barley	11+22+0	49.3	44.3	5.0
		Fallow	Rye	8+20+0	46.2	42.8	3.4
		Nonfallow	Oats	12+12+0	109.5	97.5	12.0
		Nonfallow	Flax	5+ 6+0	16.1	17.4	-1.3

[1]Heavy application of commercial fertilizer and manure caused a heavy stand. (The crop lodged badly.)

[2]Swaths were scattered by the wind.

[3]Response is to fall application only. (Fields were top dressed with 50 pounds of 30-10-0 in the spring, no checks were left.)

[4]Field numbers are duplicated when more than one check was made in the same field.

APPENDIX TABLE A-5. CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN BURKE COUNTY, 1964

Cooperator	Field No.	1963 Crop	1964 Crop	Nutrient Per Acre	Yield-Bushels/Acre Fert.	Check	Diff.
Harry Benshoof	III-D	Fallow	HRS Wheat	0+35+0	20.5	18.5	2.0
Floyd Bryan	I-C	Fallow	HRS Wheat	0+22+0	41.4	38.7	2.7
	III-E	Fallow	HRS Wheat	0+22+0	48.0	44.0	4.0
	III-H	Fallow	HRS Wheat	0+22+0	46.7	42.7	4.0
	I-A[1]	Grain	Durum	8+ 8+0	33.4	32.0	1.4
	I-D[1]	Grain	Durum	8+ 8+0	33.4	32.0	1.4
Henry Busch	D	Fallow	HRS Wheat	0+21+0	32.3	26.9	5.4
	E	Fallow	HRS Wheat	0+21+0	33.6	28.9	4.7
	F	Fallow	HRS Wheat	0+21+0	31.6	26.2	5.4
	32	Grain	Barley	10+10+0	30.2	26.9	3.3
	32	Fallow	Barley	0+21+0	40.3	34.5	5.8
Arnold Funk	S-28-A	Fallow	Durum	10+26+0	46.5	37.8	8.7
	S-27-E	Fallow	Durum	0+30+0	39.9	36.6	3.3
	S-28-B	Grain	Oats	15+ 5+0	63.7	53.6	10.1
Bennie Hass	1	Fallow	Durum	0+16+0	30.9	21.3	9.6
	2	Fallow	Durum	0+16+0	40.4	35.4	5.0
Burke County	Ave.	Fallow	Durum	3+20+0	38.7	31.2	7.5
		Fallow	HRS Wheat	0+23+0	34.4	29.8	4.6
		Nonfallow	Durum	8+ 8+0	33.4	32.0	1.4
		Nonfallow	Barley	5+15+0	34.9	30.4	4.5
		Nonfallow	Oats	15+ 5+0	63.7	53.6	10.1

[1]Stubble plowed in the spring.

APPENDIX TABLE A-6. CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN RENVILLE COUNTY, 1964

Cooperator	Field No.	1963 Crop	1964 Crop	Nutrient Per Acre	Yield-Bushels/Acre Fert.	Check	Diff.
Morten	9-H[1]	Fallow	Durum	0+22+0	42.7	41.3	1.4
Clausen	34-E	Fallow	Durum	0+22+0	37.3	33.3	4.0
	34-C	Fallow	Durum	0+22+0	38.7	32.0	6.7
	2-A	Fallow	HRS Wheat	0+22+0	26.7	24.0	2.7
	2-D	Fallow	HRS Wheat	0+22+0	29.3	24.0	5.3
	9-G[1]	Fallow	HRS Wheat	0+22+0	25.3	24.0	1.3
J. P.	35-A-B[2]	Fallow	Durum	0+21+0	32.0	32.3	- .3
Lorenzen	34-I[2]	Fallow	Durum	0+22+0	48.4	46.1	2.3
	14-Y	Grain	Durum	12+12+0	38.1	28.1	10.0
	27-R[2]	Fallow	HRS Wheat	8+21+0	32.4	31.9	.5
Randolph	22-B	Corn	Durum	15+15+0	33.1	32.0	1.1
Brothers	21-C	Alf/SF	Durum	0+32+0	21.4	27.5	-6.1
	21-R	Fallow	Durum	9+ 3+0	37.4	33.1	4.3
	17-C	Alf/SF	HRS Wheat	0+32+0	29.4	28.8	.6
	21-E	Alf/SF	HRS Wheat	0+22+0	31.4	38.6	-7.2
	21-N	Fallow	HRS Wheat	9+ 3+0	37.5	35.2	2.3
	21-P	Fallow	HRS Wheat	9+ 3+0	33.8	33.4	.4
Marce	G-29	Fallow	Durum	0+19+0	43.1	38.6	4.5
Schaefer	F-31	Fallow	Durum	0+19+0	39.7	39.0	.7
	Y-36	Fallow	HRS Wheat	7+18+0	44.7	42.0	2.7
	P-32	Fallow	HRS Wheat	0+32+0	44.2	43.1	1.1
	E-29	Fallow	Barley	0+19+0	51.9	51.0	.9
David	12-F	Fallow	Durum	0+22+0	41.1	39.6	1.5
Witteman	13-I	Fallow	Durum	0+22+0	38.0	37.2	.8
	17-C	Fallow	Rye	6+24+0	41.7	38.7	3.0
Renville	Ave.	Fallow	Durum	0+21+0	38.3	37.0	1.3
County		Fallow	HRS Wheat	3+21+0	32.7	31.5	1.2
		Fallow	Barley	0+19+0	51.9	51.0	.9
		Fallow	Rye	6+24+0	41.7	38.7	3.0
		Nonfallow	Durum	13+13+0	36.0	29.7	6.3

[1]Crop received hail twice, once while standing and once in the swath. Damage was about 40 percent.

[2]Crop was damaged by hail resulting in lodging. Swaths were subsequently scattered by the wind.

APPENDIX TABLE A-7. CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN CASS COUNTY, 1964

Cooperator	Field No.	1963 Crop	1964 Crop	Nutrient Per Acre	Yield-Bushels/Acre Fert.	Check	Diff.
Joe Knight	1[1]	Corn	Durum	47+43+0	24.3	18.9	5.4
	2	Corn	Oats	16+16+0	92.2	59.2	33.0
Ralph Peterson	S-33-5[2]	Fallow	Durum	0+28+0	28.7	27.9	.8
	S-12-8[2]	Fallow	HRS Wheat	0+28+0	18.2	17.8	.4
	S-33-5[2]	Fallow	Barley	0+28+0	52.0	51.3	.7
	S-15-6	Beans	Durum	38+12+0	28.0	20.7	7.3
	S-15-8	Durum	Barley	38+12+0	65.0	48.2	16.8
	S-33-1	Corn	Barley	38+12+0	47.1	26.9	20.2
	S-33	Durum	Corn	19+58+0	50.3	30.2	20.1
	S-15-8	Durum	Oats	26+ 8+0	62.9	45.3	17.6
Jerald Radcliffe	1[3]	Beans	Durum	49+42+0	34.0	19.0	15.0
	2	Barley	Oats	14+14+0	81.5	69.8	11.7
Delmer Schulz	6[4]	Beans	Barley	40+40+0	46.3	34.8	11.5
	6			40+40+0	56.3	36.7	19.6
	9	Flax	Barley	43+22+0	39.3	21.0	18.3
Cass County	Ave.	Fallow	Durum	0+28+0	28.7	27.9	.8
		Fallow	HRS Wheat	0+28+0	18.2	17.8	.4
		Fallow	Barley	0+28+0	52.0	51.3	.7
		Nonfallow	Durum	44+32+0	28.4	19.6	8.8
		Nonfallow	Barley	40+20+0	48.2	29.8	18.4
		Nonfallow	Oats	18+13+0	78.6	61.3	17.3
		Nonfallow	Corn	19+58+0	50.3	30.2	20.1

[1]Thirty pounds of nitrogen applied in fall of 1963; response is to both spring and fall application.

[2]Excess moisture delayed planting, stand was heavy and damaged by heat in July. Crops lodged severely.

[3]Thirty-three pounds of nitrogen applied in fall of 1963; response is to both spring and fall application.

[4]Field numbers are duplicated when more than one check was made in the same field.

APPENDIX TABLE A-8. CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN TRAILL COUNTY, 1964

Cooperator	Field No.	1963 Crop	1964 Crop	Nutrient Per Acre	Yield-Bushels/Acre Fert.	Check	Diff.
Anderson Brothers	A-4-E[1]	Grain	Durum	40+ 0+0	28.4	33.1	-4.7
				10+26+0	35.1	33.1	2.0
				50+26+0	32.7	33.1	- .4
	A-12[1]	Durum	Durum	40+ 0+0	31.1	31.1	-
				12+12+0	32.1	31.1	1.0
				52+12+0	27.7	31.1	-3.4
	O-3	Beans	Durum	38+12+0	42.0	40.0	2.0
	S-2-E[2]	Barley	Durum	15+ 5+0	32.0	33.1	-1.1
	S1 & 3E	Beets	Barley	39+13+0	66.0	46.8	19.2
	S-8	Beets	Barley	36+12+0	69.5	55.8	13.7
	J-1-Wa[3]	Barley	Barley	40+ 0+0	68.3	62.7	5.6
				52+12+0	67.8	62.7	5.1
	J-1-Wb			15+37+0	70.5	62.7	7.8
	A-4-W[2,4]	Grain	Barley	10+26+0	56.2	57.8	-1.6
	A-9[2,4]	Barley	Barley	10+26+0	61.0	61.7	- .7
	A-11[4]	Grain	Barley	10+26+0	62.8	65.5	-3.8
	A-13[4]	Durum	Barley	40+ 0+0	56.0	52.0	4.0
Art Grove	B[5]	Beets	HRS Wheat	48+ 5+0	30.0	26.7	3.3
	Q	Beets/SF	HRS Wheat	14+36+0	31.3	26.7	4.6
	D	Alf/SF	HRS Wheat	15+ 5+0	33.3	26.7	6.6
	G & I	HRS Wheat	Barley	21+ 7+0	60.0	50.0	10.0
	E	HRS Wheat	Barley	21+ 7+0	50.0	33.3	16.7
Orlin Gunderson	C	Fallow	Durum	13+32+0	46.9	43.3	3.6
	E	Fallow	Durum	13+32+0	33.9	30.1	3.8
	K[6]	Fallow	Durum	13+32+0	34.0	33.3	.7
	F[7]	Flax	Barley	22+22+0	56.5	52.8	3.7
	I	Durum	Barley	20+15+0	54.0	41.3	12.7
Lorry Rotvold	I[8]	Beets	HRS Wheat	52+31+0	43.3	35.7	7.6
	D[8]	Beets	HRS Wheat	52+31+0	44.8	36.1	8.7
	F	Alf/SF	HRS Wheat	15+39+0	48.9	37.7	11.2
	J[8]	Grain	Barley	40+32+0	60.0	49.5	10.5
	I[8]	Beets	Barley	40+32+0	59.0	53.5	5.5
	E	HRS Wheat	Barley	15+30+0	54.5	43.3	11.2
Henry Schlichtmann	J[6]	Fallow	HRS Wheat	13+28+0	27.3	26.0	1.3
	C[6]	Alf/SF	HRS Wheat	13+34+0	30.0	29.3	.7
	S-16-11	CC/SF	HRS Wheat	13+34+0	30.7	22.7	8.0
	S-16-9&8	Grain	Barley	16+16+0	60.0	45.8	14.2
	I[6]	Barley	Barley	44+19+0	54.2	50.0	4.2
	H[6]	Alf/SF	Barley	12+31+0	51.7	48.7	3.0
	G	HRS Wheat	Barley	45+19+0	63.8	53.7	10.1
	B	Grain	Oats	13+13+0	59.8	51.2	8.6

(continued)

APPENDIX TABLE A-8. CROP YIELD RESULTS ON TVA TEST-DEMONSTRATION FARMS IN TRAILL COUNTY, 1964 (continued)

Cooperator	Field No.	1963 Crop	1964 Crop	Nutrient Per Acre	Yield-Bushels/Acre Fert.	Check	Diff.
Traill County	Ave.	Fallow	Durum	13+32+0	37.8	35.4	2.4
		Fallow	HRS Wheat	13+32+0	29.2	25.5	3.7
		Nonfallow	Durum	31+11+0	35.7	35.5	.2
		Nonfallow	Barley	28+20+0	59.9	51.3	8.6
		Nonfallow	HRS Wheat	33+23+0	38.1	31.3	6.8
		Nonfallow	Oats	13+13+0	59.8	51.2	8.6

[1]Three rates of fertilizer were checked. The first is for nitrogen applied in mid-July, 1963. The second is for spring application and the third a combination of spring and fall application. A heavy regrowth occurred in the fall of 1963 and wasn't worked down.

[2]Response is to spring application. Forty pounds of nitrogen was applied in the fall of 1963, no checks were left.

[3]First check is for fall application of nitrogen. Second check is for a combination of fall and spring application.

[4]Only the check strip was fertilized, not the whole field.

[5]Response is to fall and spring application. Thirty-three pounds of nitrogen was applied in the fall of 1963.

[6]Crops were lodged.

[7]Field has been cropped continuously for 10 years.

[8]Response is to fall and spring application. Forty pounds of nitrogen was applied in fall of 1963.

APPENDIX B

AVERAGE COST AND RETURNS TO FERTILIZER ON TEST-DEMONSTRATION FARMS IN NORTH DAKOTA, 1964

APPENDIX TABLE B-1. AVERAGE COST AND RETURNS TO FERTILIZER, ADAMS COUNTY, 1964[1]

Cooperator	Crop	Acres Checked	Ave Fert Cost/A[2]	Ave Added Return Per Acre[3]	Ave Net Return/ Acre	Percent Profit
Daryl Anderson	HRS Wheat on Fallow	16	$2.39	$ 1.92	$- .47	
	HRS Wheat on Nonfallow	25	4.00	8.41	4.41	
	Barley on Nonfallow	10	3.66	3.07	- .59	
	All Small Grains	51	3.43	5.33	1.90	55
Gene Davison[4]	HRS Wheat on Fallow	27	3.80	3.67	- .13	
	HRS Wheat on Nonfallow	60	4.67	1.81	-2.86	
	All Small Grains	87	4.40	2.39	-2.01	-46
Fred Ehlers	HRW Wheat on Fallow	10	3.20	2.90	- .30	
	HRS Wheat on Fallow	42	3.20	4.66	1.46	
	HRS Wheat on Nonfallow	30	3.22	2.49	- .73	
	Barley on Fallow	8	3.20	14.52	11.32	
	All Small Grains	90	3.21	4.62	1.41	44
John Larson[4]	HRS Wheat on Fallow	32	2.79	2.85	.06	
	HRS Wheat on Nonfallow	33	3.22	-2.15	-5.37	
	All Small Grains	65	3.01	.31	-2.70	-90
Raymond Wothe	HRS Wheat on Fallow	75	3.20	10.82	7.62	
	HRS Wheat on Nonfallow	23	4.00	.30	-3.70	
	Oats on Nonfallow	18	4.00	6.25	2.25	
	All Small Grains	116	3.48	8.02	4.54	130
Adams County	HRS Wheat on Fallow	192	3.15	6.40	3.25	
	HRW Wheat on Fallow	10	3.20	2.90	- .30	
	HRS Wheat on Nonfallow	171	3.95	1.93	-2.02	
	Barley on Fallow	8	3.20	14.52	11.32	
	Barley on Nonfallow	10	3.66	3.07	- .59	
	Oats on Nonfallow	18	4.00	6.25	2.25	
	All Small Grains	409	3.53	4.51	.98	28

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Based on mid-October 1964 prices of grain.

HRS Wheat = $1.45 Barley = $ .83
HRW Wheat = 1.45 Oats = .50

[4]Droughty conditions were experienced for the second consecutive year.

APPENDIX TABLE B-2. AVERAGE COST AND RETURNS TO FERTILIZER, BOWMAN COUNTY, 1964[1]

Cooperator	Crop	Acres Checked	Ave Fert Cost/A[2]	Ave Added Return Per Acre[3]	Ave Net Return/ Acre	Percent Profit
Donald Brown	HRW Wheat on Fallow	82	$3.37	$17.45	$14.08	
	HRS Wheat on Fallow	97	2.71	5.97	3.26	
	Rye on Fallow	11	3.32	7.45	4.13	
	All Small Grains	190	3.03	11.01	7.98	263
Roy Kern	HRS Wheat on Fallow	10	4.00	8.99	4.99	
	HRW Wheat on Fallow	110	2.70	9.72	7.02	
	All Small Grains	120	2.81	9.66	6.85	244
Earl Nelson	HRS Wheat on Fallow	12	3.22	8.41	5.19	
	HRS Wheat on Nonfallow	167	1.92	4.87	2.95	
	Barley on Nonfallow	25	3.22	2.24	- .98	
	Oats on Nonfallow	70	1.92	1.86	- .06	
	All Small Grains	274	2.10	4.02	1.92	91
Donald Schumacher	HRS Wheat on Fallow	230	3.51	4.00	.49	14
Walter Stzegura[4]	HRS Wheat on Fallow	150	4.13	3.22	- .92	
	Durum on Fallow	258	3.16	3.12	- .04	
	All Small Grains	408	3.52	3.16	- .36	-10
Bowman County	Durum on Fallow	258	3.16	3.12	- .04	
	HRS Wheat on Fallow	499	3.54	4.35	.81	
	HRW Wheat on Fallow	192	2.98	13.02	10.04	
	HRS Wheat on Nonfallow	167	1.92	4.87	2.95	
	Barley on Nonfallow	25	3.22	2.24	- .98	
	Oats on Nonfallow	70	1.92	1.86	- .06	
	Rye on Fallow	11	3.32	7.45	4.13	
	All Small Grains	1,222	3.05	5.37	2.32	76

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Based on mid-October 1964 prices of grain.

Durum	= $1.36	Barley	= $ .83
HRS Wheat	= 1.45	Oats	= .50
HRW Wheat	= 1.45	Rye	= .92

[4]Swaths were scattered by the wind.

APPENDIX TABLE B-3. AVERAGE COST AND RETURNS TO FERTILIZER, HETTINGER COUNTY, 1964[1]

Cooperator	Crop	Acres Checked	Ave Fert Cost/A[2]	Ave Added Return Per Acre[3]	Ave Net Return/ Acre	Percent Profit
Alvin Dill	HRW Wheat on Fallow	140	$2.20	$5.33	$3.13	
	HRS Wheat on Fallow	30	2.20	4.28	2.08	
	Oats on Nonfallow	75	3.22	6.67	3.45	
	All Small Grains	245	2.51	5.61	3.10	124
George Ott	HRS Wheat on Fallow	67	4.00	6.39	2.39	
	HRS Wheat on Nonfallow	12	4.00	-	-4.00	
	Barley on Nonfallow	15	4.00	6.56	2.56	
	All Small Grains	94	4.00	5.60	1.60	40
Hettinger County	HRS Wheat on Fallow	207	2.78	5.67	2.89	
	HRS Wheat on Nonfallow	42	2.71	3.06	.35	
	Barley on Nonfallow	15	4.00	6.56	2.56	
	Oats on Nonfallow	75	3.22	6.67	3.45	
	All Small Grains	339	2.92	5.61	2.69	92

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Based on mid-October 1964 prices of grain.

HRS Wheat = $1.45
Barley = .83
Oats = .50

APPENDIX TABLE B-4. AVERAGE COST AND RETURNS TO FERTILIZER, BOTTINEAU COUNTY, 1964[1]

Cooperator	Crop	Acres Checked	Ave Fert Cost/A[2]	Ave Added Return Per Acre[3]	Ave Net Return/ Acre	Percent Profit
Howard Anderson	HRS Wheat on Fallow	63	$2.93	$3.36	$ .43	
	Durum on Fallow	54	2.88	5.07	2.19	
	Barley on Nonfallow	98	4.25	.29	-3.96	
	All Small Grains	215	3.52	2.39	-1.13	-32
Harold Bergman	Durum on Fallow	154	3.82	3.50	- .32	
	Barley on Fallow	26	2.20	4.40	2.20	
	Barley on Nonfallow	130	3.57	8.66	5.09	
	All Small Grains	310	3.58	5.74	2.16	60
Kermit Kjonaas	HRS Wheat on Fallow	71	2.53	5.80	3.27	
	Durum on Fallow	100	2.61	3.81	1.20	
	Barley on Nonfallow	33	3.22	-2.49	-5.71	
	All Small Grains	204	2.68	3.48	.80	30
C. L. O'Keefe	Durum on Fallow	23	2.70	-1.36	-4.06	
	HRS Wheat on Fallow	52	2.80	4.20	1.40	
	All Small Grains	75	2.77	2.49	- .28	-10
George Witteman	Durum on Fallow	71	4.00	6.95	2.95	
	Rye on Fallow	109	3.10	3.07	- .03	
	Oats on Nonfallow	35	2.88	6.00	3.12	
	Flax on Nonfallow	95	1.32	-3.52	-4.84	
	All Small Grains	310	2.73	2.27	- .46	-17
Bottineau County	Durum on Fallow	402	3.36	4.12	.76	
	HRS Wheat on Fallow	186	2.74	4.52	1.78	
	Barley on Fallow	26	2.20	4.40	2.20	
	Barley on Nonfallow	261	3.78	4.11	.33	
	Rye on Fallow	109	3.10	3.07	- .03	
	Oats on Nonfallow	35	2.88	6.00	3.12	
	Flax on Nonfallow	95	1.32	-3.52	-4.84	
	All Small Grains	1,114	3.11	3.50	.39	13

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Based on mid-October 1964 prices of grain.

Durum	= $1.36	Rye	= $ .92
HRS Wheat	= 1.45	Oats	= .50
Barley	= .83	Flax	= 2.82

APPENDIX TABLE B-5. AVERAGE COST AND RETURNS TO FERTILIZER, BURKE COUNTY, 1964[1]

Cooperator	Crop	Acres Checked	Ave Fert Cost/A[2]	Ave Added Return Per Acre[3]	Ave Net Return/ Acre	Percent Profit
Harry Benshoof	HRS Wheat on Fallow	40	$3.50	$ 2.90	$- .60	-17
Floyd Bryan	HRS Wheat on Fallow	95	2.20	5.31	3.11	
	Durum on Nonfallow	52	1.92	1.90	- .02	
	All Small Grains	147	2.10	4.10	2.00	95
Henry Busch	HRS Wheat on Fallow	250	2.10	7.63	5.53	
	Barley on Nonfallow	56	2.26	3.70	1.44	
	All Small Grains	306	2.13	6.91	4.78	224
Arnold Funk	Durum on Fallow	117	3.62	9.01	5.39	
	Oats on Nonfallow	75	2.60	5.05	2.45	
	All Small Grains	192	3.22	7.46	4.24	132
Bennie Hass	Durum on Fallow	128	1.60	11.10	9.50	594
Burke County	Durum on Fallow	245	2.56	10.10	7.54	
	HRS Wheat on Fallow	385	2.27	6.56	4.29	
	Durum on Nonfallow	52	1.92	1.90	- .02	
	Barley on Nonfallow	56	2.26	3.70	1.44	
	Oats on Nonfallow	75	2.60	5.05	2.45	
	All Small Grains	813	2.37	6.99	4.62	195

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Based on mid-October 1964 prices of grain.

Durum	= $1.36	Barley	= $ .83
HRS Wheat	= 1.45	Oats	= .50

APPENDIX TABLE B-6. AVERAGE COST AND RETURNS TO FERTILIZER, RENVILLE COUNTY, 1964[1]

Cooperator	Crop	Acres Checked	Ave Fert Cost/A[2]	Ave Added Return Per Acre[3]	Ave Net Return/ Acre	Percent Profit
Morten Clausen	Durum on Fallow	63	$2.20	$ 5.14	$ 2.94	
	HRS Wheat on Fallow	117	2.20	4.65	2.45	
	All Small Grains	180	2.20	4.82	2.62	119
J. P. Lorenzen	Durum on Fallow	69	2.15	1.94	- .21	
	Durum on Nonfallow	48	2.88	13.60	10.72	
	HRS Wheat on Fallow	60	2.80	.72	-2.08	
	All Small Grains	177	2.57	4.69	2.12	82
Randolph Brothers[4]	Durum on Nonfallow	35	3.60	1.50	-2.10	
	Durum on Alf/Fallow	53	2.61	-3.23	-5.84	
	HRS Wheat on Alf/Fallow	81	2.13	-1.97	-4.10	
	All Small Grain	169	2.59	-1.65	-4.24	-164
Marce Schaefer	Durum on Fallow	70	1.90	3.90	2.00	
	HRS Wheat on Fallow	55	3.05	2.44	- .61	
	Barley on Fallow	40	1.90	.75	-1.15	
	All Small Grains	165	2.28	2.65	.37	16
David Witteman	Durum on Fallow	137	2.20	1.40	- .80	
	Rye on Fallow	45	3.24	4.35	1.11	
	All Small Grains	182	2.46	2.13	- .33	-13
Renville County	Durum on Fallow	392	2.19	1.92	- .27	
	HRS Wheat on Fallow	313	2.45	1.79	- .66	
	Barley on Fallow	40	1.90	.75	-1.15	
	Rye on Fallow	45	3.24	4.35	1.11	
	Durum on Nonfallow	83	3.18	8.50	5.32	
	All Small Grains	873	2.42	2.57	.15	6

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Based on mid-October 1964 prices of grain.

Durum	= $1.36	Barley	= $ .83
HRS Wheat	= 1.45	Rye	= .92

[4]Little precipitation was received during the growing season.

APPENDIX TABLE B-7. AVERAGE COST AND RETURNS TO FERTILIZER, CASS COUNTY, 1964[1]

Cooperator	Crop	Acres Checked	Ave Fert Cost/A[2]	Ave Added Return Per Acre[3]	Ave Net Return/ Acre	Percent Profit
Joe Knight	Durum on Nonfallow	41	$10.88	$ 7.34	$-3.54	
	Oats on Nonfallow	25	3.84	16.50	12.66	
	All Small Grains	66	8.21	10.81	2.60	32
Ralph Peterson	Durum on Fallow	30	2.80	1.09	-1.71	
	HRS Wheat on Fallow	80	2.80	.58	-2.22	
	Barley on Fallow	45	2.80	.58	-2.22	
	Durum on Nonfallow	40	6.52	9.93	3.41	
	Barley on Nonfallow	115	6.52	15.91	9.39	
	Corn on Nonfallow	80	8.46	17.70	9.24	
	Oats on Nonfallow	35	4.44	8.80	4.36	
	All Small Grains	425	5.36	9.54	4.18	78
Jerald Radcliffe	Durum on Nonfallow	32	11.06	20.40	9.34	
	Oats on Nonfallow	72	3.36	9.71	6.35	
	All Small Grains	104	5.73	13.00	7.27	127
Delmer Schulz	Barley on Nonfallow	115	8.56	14.40	5.84	68
Cass County	Durum on Fallow	30	2.80	1.09	-1.71	
	HRS Wheat on Fallow	80	2.80	.58	-2.22	
	Barley on Fallow	45	2.80	.58	-2.22	
	Durum on Nonfallow	113	9.39	11.96	2.57	
	Barley on Nonfallow	230	7.54	15.15	7.61	
	Oats on Nonfallow	132	3.74	10.75	7.01	
	Corn on Nonfallow	80	8.46	17.70	9.24	
	All Small Grains	710	6.20	10.95	4.75	77

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Based on mid-October 1964 prices of grain.

Durum	= $1.36	Oats	= $ .50
HRS Wheat	= 1.45	Barley	= .83
Corn	= .98		

APPENDIX TABLE B-8. AVERAGE COST AND RETURNS TO FERTILIZER, TRAILL COUNTY, 1964[1]

Cooperator	Crop	Acres Checked	Ave Fert Cost/A[2]	Ave Added Return Per Acre[3]	Ave Net Return/ Acre	Percent Profit
Anderson Brothers	Durum on Nonfallow	167	$5.48	$ .32	$-5.16	
	Barley on Nonfallow	248	5.46	4.81	- .65	
	All Small Grains	415	5.47	3.01	-2.46	-45
Art Grove	HRS Wheat on Nonfallow	114	5.13	7.01	1.88	
	Barley on Nonfallow	88	3.64	10.38	6.74	
	All Small Grains	202	4.48	8.48	4.00	89
Orlin Gunderson	Durum on Fallow	71	5.02	3.19	-1.83	
	Barley on Nonfallow	37	4.62	8.12	3.50	
	All Small Grains	108	4.88	4.88	-	0
Lorry Rotvold	HRS Wheat on Nonfallow	100	9.07	13.23	4.16	
	Barley on Nonfallow	140	8.30	8.38	.08	
	All Small Grains	240	8.62	10.40	1.78	21
Henry Schlichtmann	HRS Wheat on Fallow	102	4.98	5.40	.42	
	Barley on Nonfallow	142	5.76	7.53	1.77	
	Oats on Nonfallow	26	3.12	4.30	1.18	
	All Small Grains	270	5.21	6.41	1.20	23
Traill County	Durum on Fallow	71	5.02	3.19	-1.83	
	HRS Wheat on Fallow	102	4.98	5.40	.42	
	Durum on Nonfallow	167	5.48	.32	-5.16	
	Barley on Nonfallow	655	5.84	7.10	1.26	
	HRS Wheat on Nonfallow	214	6.97	9.91	2.94	
	Oats on Nonfallow	26	3.12	4.30	1.18	
	All Small Grains	1,235	5.81	6.25	.44	8

[1]Weighted averages based on number of acres checked at harvest.

[2]Cost of fertilizer = 14 cents per pound of nitrogen and 10 cents per pound of P_2O_5.

[3]Based on mid-October 1964 prices of grain.

Durum	= $1.36	Barley	= $ .83
HRS Wheat	= 1.45	Oats	= .50