

RESEARCH BULLETIN 735

10
197
APRIL, 1960

UNIVERSITY OF MISSOURI COLLEGE OF AGRICULTURE
AGRICULTURAL EXPERIMENT STATION

J. H. LONGWELL, *Director*

Nature and Extent of Irrigation In Missouri

TED L. JONES AND FRANK MILLER



(Publication Authorized April 28, 1960)

COLUMBIA, MISSOURI

CONTENTS

Summary	3
Introduction	6
Location of Irrigation in Missouri	7
Year Irrigation Systems Were Installed	9
Characteristics of Missouri Irrigators	12
Crops Irrigated	15
Acres Irrigated	15
By Kind of Crop	15
By Type-of-farming Area and Type of Crop	18
By Tenure Groups	26
Soils	29
Sources of Water	29
Methods of Distributing Water	35
Investment in Irrigation Systems	39
Degree of Satisfaction with Irrigation	39
Legality of Water Use by Sources	42
Expectation of Increasing Acres Irrigated	42
Farmers Who Discontinued Irrigation	44
Farmers' Questions Concerning Irrigation	44

Missouri Agricultural Experiment Station and
Farm Economics Research Division,
Agricultural Research Service,
U. S. Department of Agriculture, Cooperating

SUMMARY

Irrigation has been common in the vegetable-producing areas of Missouri for many years. But for field crops irrigation is a recent innovation; most of the expansion has come since 1950. Compared with the total number of farmers, the number of irrigators is still small—approximately 800 among 200,000 farmers.

A mail survey was conducted in the fall and spring of 1958 and 1959 to determine the nature and extent of irrigation in the state. Questionnaires were sent to 644 farmers who were reported to have irrigated some of their crops within the last five years. Seventy percent, or 451 questionnaires were returned. Of this number, 366 were used in this report.

Irrigation of field crops is scattered over the entire state with the heaviest concentration in the Delta Cotton and Corn, and Northwest Meat Production areas. Irrigation of vegetables and other specialty crops is concentrated relatively near St. Louis, Kansas City, St. Joseph, and Springfield.

The number of irrigators reporting per county ranged from zero to 27. No irrigation was reported in 31 percent of the counties; one to three irrigators were reported in 38 percent of the counties; seven to 12 in 8 percent of the counties; and 16 to 27 in 5 percent of the counties.

The number of Missouri farmers with irrigation equipment increased each year between 1921 and 1954. Since 1954, the number of new installations per year has decreased rapidly. More and better distribution of rainfall has been a reason for the decrease in irrigation.

Of the 352 farmers who reported the year in which they obtained irrigation equipment, only 19 started before 1950 (1921 to 1949). Fifteen of these 19 irrigators were growing specialty crops. Of those who started irrigating after 1950, 51 irrigated specialty crops and 282 irrigated field crops. A greater number of Missouri farmers started irrigating in 1954 than in any other year.

The average age of the 366 irrigators was 47 years. Farms averaged 494 acres, with an average of 338 acres tillable. Sixty-six percent of the irrigators were full owners, 16 percent were part owners, and 18 percent were tenants. The irrigators were younger and operated larger farms than the average of all commercial farmers in Missouri. The percentage of irrigators who were full owners was greater, but the percentages who were part owners and tenants were less than among all commercial farmers.

The field crops irrigated were corn, cotton, pasture and hay, grain sorghum, and small grain. Of the specialty crops, vegetables, orchards, nursery stock, flowers, strawberries, and tobacco were irrigated. Corn was the major irrigated crop in terms of the total number of acres irrigated from 1954 to 1958. Pasture and hay crops were second in importance. Cotton was third and vegetable crops were fourth. Vegetables were the only crop for which the total number of acres irrigated increased each year during the five-year period.

For the five years from 1954 to 1958, the largest acreage was irrigated in 1956, when water was distributed on 18,591 acres by 244 farmers—an average of

70 acres per farm. Field crops occupied 15,827 acres; specialty crops occupied 2764 acres. The smallest acreage was irrigated in 1958, when 140 farmers irrigated 8061 acres—an average of 58 acres per farm. The irrigated acreage included 6097 acres of field crops and 1964 acres of specialty crops.

Water was used on a wide range of soil types. Twenty-eight percent of the farmers irrigated crops on silt loams; 28 percent on sandy loams; and 11 percent on clay and clay loam soils. The rest were irrigating crops on a combination of soil types.

Wells, natural streams or rivers, natural lakes or springs, constructed reservoirs, city water, and drainage ditches were sources of water for irrigation. Wells were the exclusive source for 40 percent of the irrigators, and wells in combination with another source for another 8 percent. Natural streams and rivers were the entire or partial source for 37 percent of the irrigators. Constructed ponds or reservoirs were the only source for 8 percent of the irrigators.

Water was applied by sprinklers and by surface methods. Seventy-eight percent, or 283 farmers, used portable pipe and sprinklers exclusively. Four different sprinkler systems were reported: (1) A system featuring several small sprinklers 60 to 90 feet apart on lateral lines, low pump pressure, and a relatively low rate of application; (2) giant sprinklers with rotating booms mounted on a trailer, high pump pressure, and a high rate of water application; and (3) two or three giant sprinklers per quarter of mile of lateral line, high pump pressure, and a high rate of application; and (4) self-propelled automatic sprinklers, which used a system of towers mounted on wheels to carry the pipe and small sprinklers in a circular pattern over the field. Water from portable gated pipe or ditches to furrows were the two methods of surface irrigation.

Sixty-five percent of the irrigators used internal combustion engines other than farm tractors for pumping water. Twenty percent used farm tractors; 7 percent used electric motors; and 6 percent used a combination of the three methods. Two percent used city water which did not require pumping.

The investment in irrigation equipment in 1954 ranged from \$1,596 per farm on which an average of 4.5 acres was irrigated to \$10,871 for an average of 266.8 acres irrigated. The average cost per acre irrigated ranged from \$351 per acre for the first group to \$41 for the second group. The difference in cost per acre was due to number of acres irrigated and to size and type of irrigation equipment.

Ninety-two percent of the farmers were satisfied in various degrees with their past experience with irrigation. Eight percent were dissatisfied. The degree of satisfaction was related to the type of crop irrigated. None of the specialty crop irrigators was dissatisfied. But 18, 9, and 8 percent of the cotton, corn, and pasture irrigators respectively were concerned about the costs and returns or the additional work required. The type-of-farming area and type of tenure showed no significant difference in the degree of satisfaction with irrigation.

The 29 farmers who were dissatisfied with irrigation gave the following reasons for their opinions: (1) Irrigation required too much labor, and it was difficult to hire workers to move pipe in tall crops; (2) extra yield did not cover the operating costs; (3) at times, rain immediately after irrigation had harmed the crops on poorly drained soils; (4) irrigation conflicted with other farm work; (5) the present irrigation system does not distribute the water fast enough; and (6) some of the farmers who had graded or "leveled" their land for surface irrigation reported a decrease in crop yields.

Only 5 percent of the 366 irrigators indicated that their right to use water from streams had been challenged.

Forty-four percent of the farmers expected to increase the number of acres irrigated within the next five years. The areas in the state where more than 50 percent of the irrigators expected to increase the number of acres irrigated were the Western Grain and Delta Cotton and Corn areas. Soybeans and grain sorghum were the only major crops for which 50 percent or more of the farmers who had irrigated within the last five years would increase the acreage irrigated.

Thirty farmers had stopped irrigating. Ten had sold their farms and retired; three had insufficient water; one had ground that was too rough for surface irrigation; and 16 said irrigation involved too much labor and extra costs that were not covered by increased returns.

Missouri farmers asked many questions concerning irrigation. The most common were: When should I irrigate? How can I reduce the amount of labor involved? How much water should be applied per setting? What is the recommended plant population and fertilizer application when irrigating? How can the fuel costs be reduced? What share of the irrigation costs should the landlord bear when the farm is operated by a tenant?

The total number of acres irrigated in Missouri has declined each year since 1956. It is expected that the irrigated acreage will vary over a period of years in the humid area, depending upon the amount of rainfall. Several farmers stated that they had purchased their irrigation system as insurance against total crop failure. This indicates that they did not expect to irrigate every year.

Nature and Extent of Irrigation In Missouri

TED L. JONES AND FRANK MILLER¹

INTRODUCTION

Irrigation of specialty crops has been a common practice in the vegetable-producing area of Missouri for many years. Irrigation of field crops began a noticeable expansion in the late 1940's. Interest in irrigation of many crops advanced rapidly in dry years during the early 1950's. The total number of farmers with distributing equipment increased each year between 1950 and 1958. Yet the total number of irrigators is small; there are approximately 800 irrigators among 200,000 farmers.²

Shortage of natural moisture in recent years has encouraged the use of supplemental irrigation. The desire to increase or at least to maintain a relatively high level of income in dry years led farmers who had supplies of water available to consider the feasibility of irrigation. Furthermore, the technological advances that had been made in crop varieties, fertilizers and irrigation equipment, seemed to indicate that supplemental irrigation could reduce the risk and uncertainty of crop production. No doubt there are other reasons, but apparently these were the major ones in the minds of farmers who bought equipment and applied water to their land.

Whether to irrigate land is a managerial question that must be answered for each farm. An objective decision depends upon several types of information that can be made available through research. The types needed include: (1) The quantity and quality of water available; (2) the cost of installing equipment and distributing water on the land; (3) the type of crop that can be irrigated and additional yield under irrigation; (4) frequency of need for supplemental water; and (5) additional returns in relation to additional costs. Little information is available concerning the extent and conditions under which irrigation is used on Missouri farms, the kinds of crops irrigated, the sources of the water supply, the methods of distributing water, the designs and types of irrigation systems, and the costs of and returns for the various crops grown on different soil types.

From the fall of 1958 to the spring of 1959, information was obtained from farmers concerning the extent of irrigation in different parts of the state. A two-page questionnaire was mailed to all known irrigators as reported by the State and County Extension personnel and irrigation equipment dealers. Six hundred forty-four questionnaires were mailed; 451, or 70 percent, were returned. The returned questionnaires were classified as follows:

¹*Agricultural Economist, Farm Economics Research Division, Agricultural Research Service, U.S. Department of Agriculture; and Professor of Agricultural Economics, University of Missouri, respectively.*

²*U. S. Census of Agriculture, 1954, Volume 3, Part 6. Irrigation in Humid Areas, 1956, p. 185.*

Classification	Number	Percentage of Total
Completed questionnaire	366	81
Irrigated, but on such a small scale that questions were not answered	11	3
Flooded rice only	6	1
Did not irrigate in 1958 and did not complete questionnaire	10	2
Duplicate names of tenant and landlord or of partners	1	*
Non irrigator	18	4
Discontinued irrigation	30	7
Interested in buying or planning to buy irrigation equipment	7	2
Missouri address, but irrigated land in Arkansas	2	*
Total	451	100

*Less than 0.5 percent.

LOCATION OF IRRIGATION IN MISSOURI

Field crop irrigation is scattered over the state, though sparsely in the Northeast Meat Production area (Figure 1). Vegetable and other specialty crop irrigation is concentrated near St. Louis, Kansas City, St. Joseph, and Springfield.

Fig. 1—Major crop irrigated from 1954 to 1958 in terms of total acreage, by counties.

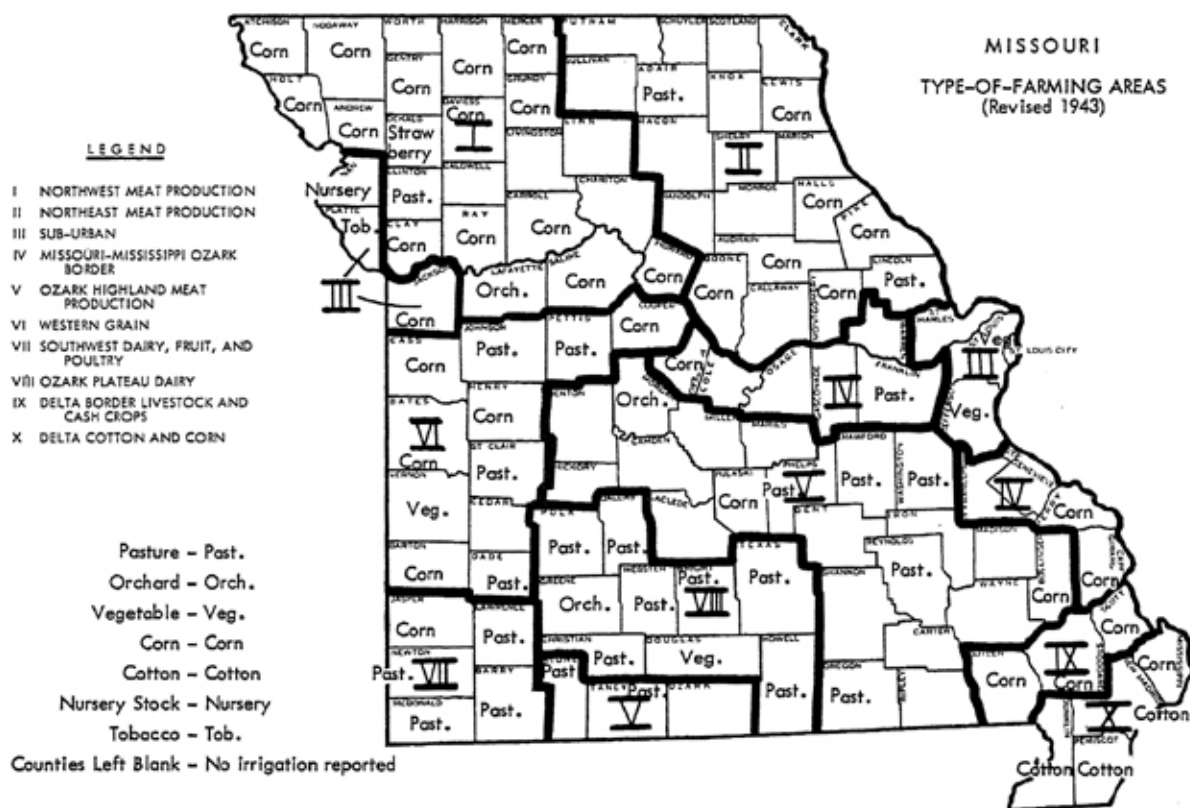
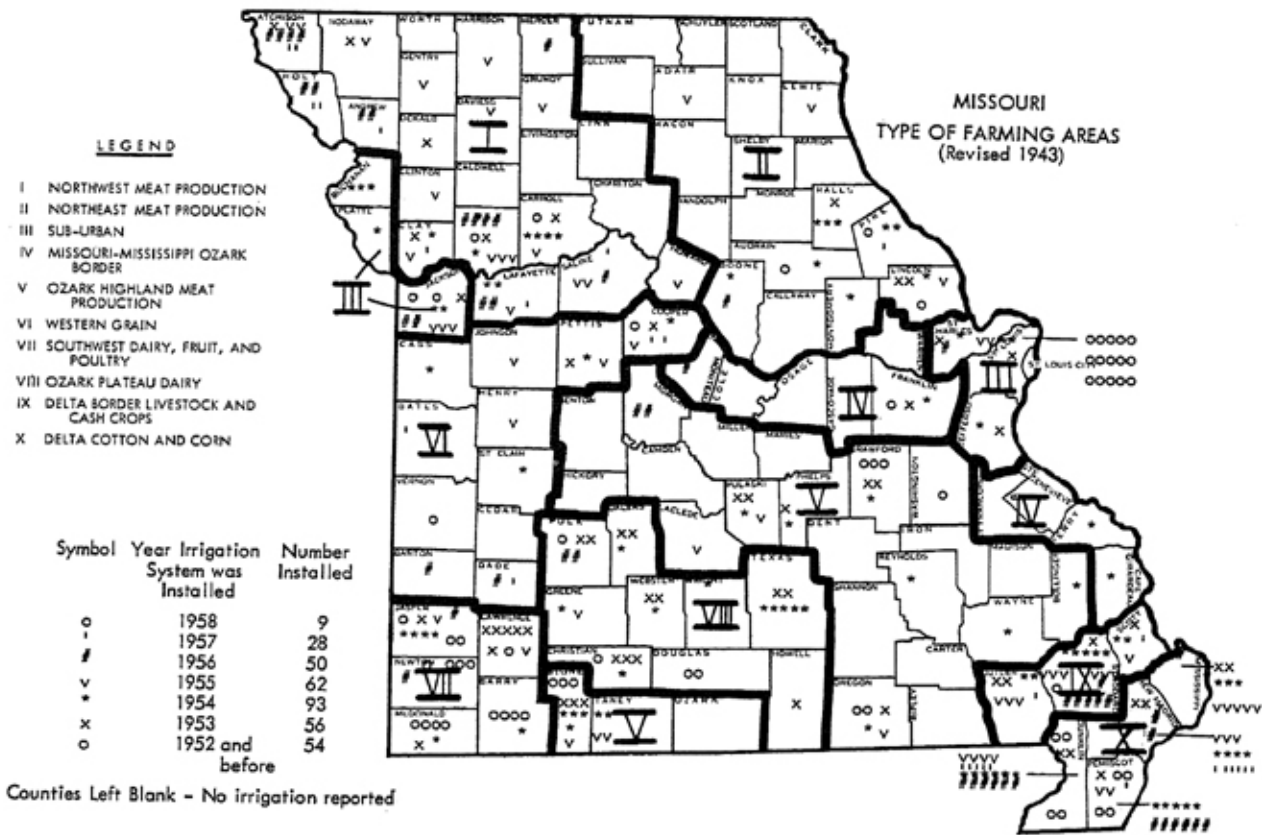


Fig. 2—Location by counties and type of farming areas, by year of first irrigation, 352 irrigators, 1958.



In 1958, the Delta Cotton and Corn area, with 74 irrigators, had the greatest concentration in the state. Cotton and corn were the two major crops irrigated (Figure 1). The Northwest Meat Production area had the second greatest concentration with 61. Corn was the major crop irrigated in all the northwestern counties except Lafayette, where orchards prevailed. Forty-one irrigators from the Ozark Highland Meat Production area reported pasture as the major crop irrigated. Specialty crops, mainly vegetables, received most of the water in the sub-urban area where 40 farmers were irrigating their crops. The Southwest Dairy, Fruit, and Poultry; Delta Border Livestock and Cash Crops; and the Ozark Plateau Dairy areas reported 37, 33, and 31 irrigators, respectively. Pasture was the major irrigated crop in the Southwest Dairy, Fruit, and Poultry; and the Ozark Plateau Dairy areas, while the Delta Border Livestock and Cash Crop irrigators reported corn as the major crop receiving water. The Western Grain; Northeast Meat Production; and Missouri-Mississippi Ozark Border areas reported the smallest number of irrigators with 22, 21, and 6, respectively. Corn and pasture were the major irrigated crops in these three areas.

The reported number of irrigators per county ranged from zero to 27 (Figure 2). Thirty-one percent of the counties reported no irrigators; 38 percent had 1 to 3; 18 percent 4 to 6; 8 percent 7 to 12, and 5 percent had 16 to 27 (Table 1).

The five counties in which from 16 to 27 irrigators were reported were Dunklin, 27; Stoddard, 19; Pemiscot, 19; St. Louis, 19 and New Madrid, 17. Except for St. Louis County, all are in the Delta area of southeastern Missouri (Figure 2).

YEAR IRRIGATION SYSTEMS WERE INSTALLED

The number of Missouri farmers with irrigation systems is increasing, but the number of new installations per year has decreased rapidly since 1954 (Figures 3 and 4). The number who reported obtaining irrigation systems in 1952, 1953, and 1954 were 22, 56, and 93, respectively. The number decreased to 62 in 1955; 50 in 1956; 28 in 1957, and 9 in 1958.

Fig. 3—Number of irrigators, by year irrigation was started, and kind of crop irrigated, 352 irrigators, Missouri, 1958.

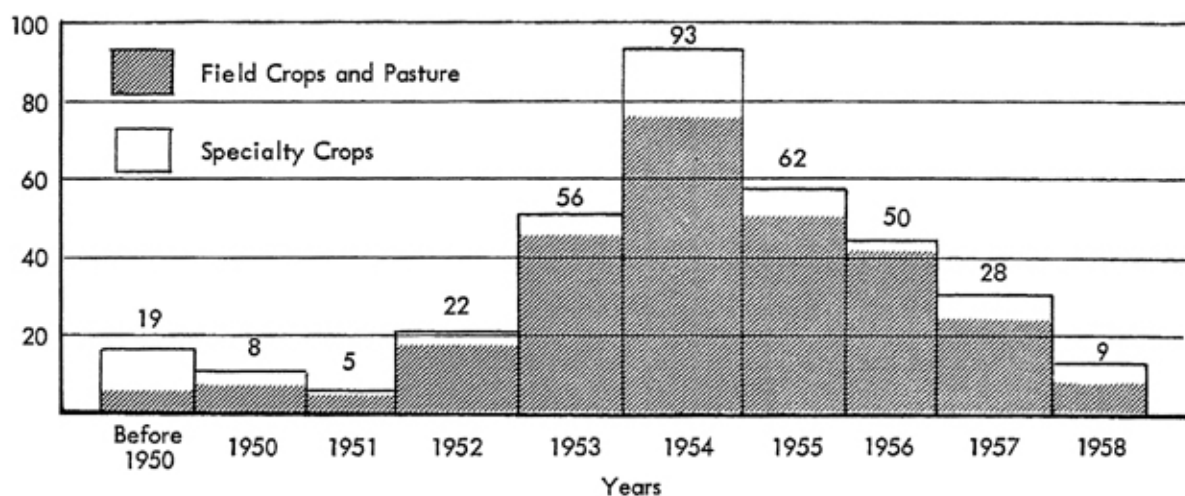


Fig. 4—Cumulative number of farms with irrigation systems, 352 irrigators, Missouri, 1958.

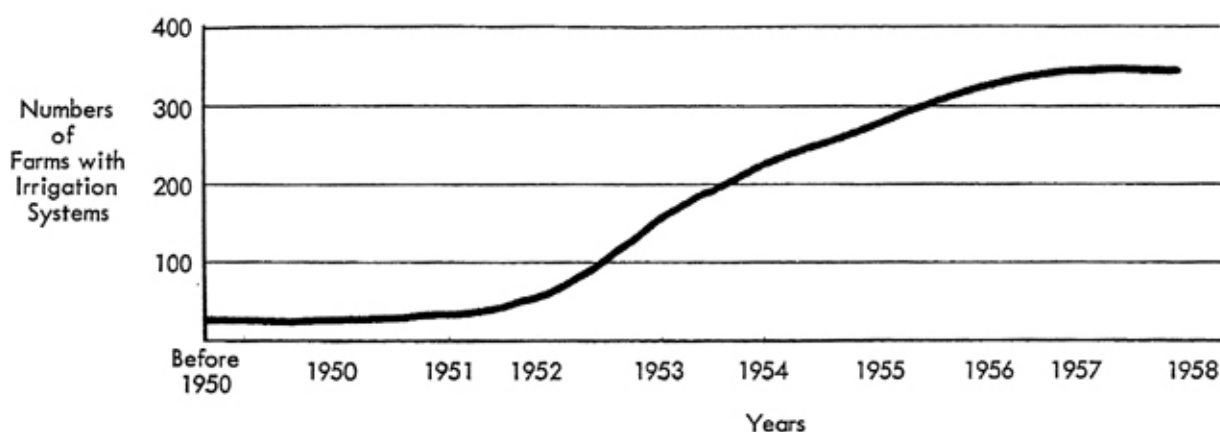


TABLE 1--DISTRIBUTION OF COUNTIES, BY NUMBER OF IRRIGATORS PER COUNTY, 366 IRRIGATORS, MISSOURI, 1958.

Irrigators in each county	Counties	Percentage
	Number	Percent
0 - - - - -	35	31
1 to 3 - - - - -	43	38
4 to 6 - - - - -	21	18
7 to 9 - - - - -	4	3
10 to 12- - - - -	6	5
13 to 15- - - - -	--	--
16 to 18- - - - -	1	1
19 to 21- - - - -	3	3
22 to 24- - - - -	--	--
25 to 27- - - - -	1	1
Total - - - - -	114	100

Of the 352 farmers who reported that they had irrigated in the 1954-58 period, only 19 said they started irrigating before 1950 (1921 to 1949). Fifteen of these 19 irrigators were specialty-crop producers. Among 333 farmers who started irrigating between 1950 and 1958, 51 were specialty crop producers and 282 were predominately field crop producers (Table 2).

TABLE 2

NUMBER OF IRRIGATORS, BY YEAR IRRIGATION FIRST STARTED AND MAJOR TYPE OF CROP IRRIGATED, 338 IRRIGATORS, 1950-58, MISSOURI

Crop irrigated <u>1/</u>	Year irrigation started <u>2/</u>									
	Before									
	1950	1950	1951	1952	1953	1954	1955	1956	1957	1958
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Field crop and pasture	4	5	2	17	48	70	51	44	24	7
Specialty crops <u>3/</u>	15	3	2	3	7	15	9	6	4	2
Total irrigators	19	8	4	20	55	85	60	50	28	9

1/ 11 field and specialty crop irrigators did not report year started.

2/ 14 irrigators reported year started, but not type of crop irrigated. 1-1951, 2-1952, 1-1953, 8-1954, 2-1955.

3/ Vegetable, orchard, flowers, tobacco, strawberries, and nursery stock.

A greater number of Missouri farmers started irrigating in 1954 than in any other year. However, this is not true for all farming areas (Table 3). In the Ozark Plateau Dairy area, the greatest number of farmers started irrigating in 1953. In the Northeast Meat Production; and Delta Border Livestock and Cash Crop areas, 1955 was the most important year. In the Western Grain area, an equal number of irrigators started in 1954, 1955, and 1957. For the rest of the state, the largest number of farmers started irrigating in 1954. These differences among areas probably can be explained by the variable rainfall over the state in these years.

TABLE 3--NUMBER OF IRRIGATORS, BY YEAR IRRIGATION FIRST STARTED AND BY TYPE-OF-FARMING AREA,
352 IRRIGATORS, MISSOURI, 1950-58.

Type-of-farming Area	Year Irrigation Started										Total No.
	Before 1950 No.	1950 No.	1951 No.	1952 No.	1953 No.	1954 No.	1955 No.	1956 No.	1957 No.	1958 No.	
Northwest Meat Production	1	--	--	1	6	8	17	16	8	--	57
Northeast Meat Production	--	--	2	1	3	9	3	1	1	--	20
Sub-urban	12	3	1	--	4	10	5	3	1	--	39
Missouri-Mississippi Ozark Border	--	--	--	1	1	3	--	1	--	--	6
Ozark Highland Meat Production	1	1	--	7	9	13	6	2	--	--	39
Western Grain	1	1	--	--	2	4	4	2	4	1	19
Southwest Dairy, Fruit, and Poultry	3	1	1	8	8	9	2	2	--	3	37
Ozark Plateau Dairy	1	--	1	2	12	10	1	2	--	--	29
Delta Border Livestock and Cash Crop	--	--	--	--	4	9	10	6	2	1	32
Delta Cotton Corn	--	2	--	2	7	18	14	15	12	4	74
Total Irrigators	19	8	5	22	56	93	62	50	28	9	352 ¹

¹Fourteen irrigators did not report year started.

CHARACTERISTICS OF MISSOURI IRRIGATORS

The average age of all commercial farmers in Missouri in 1955 was 51 years. The average size of farm was 211 acres with an average of 90 acres of cropland harvested. Fifty-five percent of the farmers were full owners, 24 percent were part owners, and 20 percent were tenants.³ The average size of farm operated by full owners, part owners, and tenants was 185, 286, and 195 acres, respectively. The average acreage of cropland harvested by full owners, part owners, and tenants was 90, 99, and 96, respectively.

The average age of the 366 farmers reporting use of irrigation water was 47 years. The average size of farm was 494 acres, with an average of 338 tillable acres (Table 4). Sixty-six percent were full owners, 16 percent were part owners, and 18 percent were tenants.

The average size farm operated by full owners, part owners, and tenants was 431, 707, and 540 acres, respectively (Table 5). The average number of tillable acres on owner-operated farms was 262. Part owners had 529 acres of tillable land and tenants 447 acres.

In comparison with all commercial farmers, the irrigators were younger and operated larger farms. The percentage of full owners was greater among the irrigators than among all Missouri commercial farmers, but the percentage of part owners and tenants was less.

The 366 irrigators operated a total of 180,947 acres, of which 68 percent, or 123,619 acres, were tillable. The largest number of acres controlled by the irrigators was in the Delta Cotton and Corn area with 33,961 acres. The Northwest Meat Production area was second with 32,524 acres. The same relationship held for the tillable acres (Table 4).

The owners, who made up 66 percent of the irrigators, controlled 57 percent of the land, a total of 103,128 acres. The part owners, 16 percent of the irrigators, controlled 23 percent of the land, 41,726 acres; and the tenants, 18 percent, controlled 20 percent, 35,693 acres. In regard to tillable acres, the owners controlled 51 percent, 62,544 acres; the part owners 25 percent, 31,241 acres, and the tenants 24 percent, 29,534 acres. Thus, the part owners and tenants, who made up 34 percent of the irrigators, controlled 49 percent of the tillable land.

When classified by type-of-farming area and tenure status, the highest percentage of full owners who were irrigating crops were in the Ozark Highland Meat Production area (90 percent). The Ozark Plateau Dairy area was second with 83.9 percent (Table 6). The Delta Cotton and Corn area had the lowest percentage with 44.6 percent of full owners among the irrigators. The lowest percent of all part owners, 33.3 percent, was in the Northeast Meat Production area. The Northwest Meat Production area was second with 24.6 percent, and the Ozark Highland Meat Production area lowest with only 5 percent part owners among the irrigators. More than one-third (36.5 percent) of the irrigators in the Delta Cotton and Corn area were tenants. In the Northwest Meat

³U. S. Census of Agriculture, 1954, Volume 1, Part 10, 1956.

TABLE 4--AGE OF OPERATORS, NUMBER OF ACRES FARMED, AND TOTAL TILLABLE ACREAGE,
BY TYPE-OF-FARMING AREA, 366 IRRIGATORS, MISSOURI, 1958.

Type-of-farming area	Operators reporting farms Number	Average age of operator Years	Acreage operated		Tillable acreage operated	
			Total Acres	Average Acres	Total Acres	Average Acres
Northwest Meat Production ¹	61	46	23,524	561	26,351	454
Northeast Meat Production	21	44	11,805	562	7,492	357
Sub-urban ²	40	47	13,305	333	10,235	269
Missouri-Mississippi Ozarks Border	6	52	1,630	272	1,185	198
Ozark Highland Meat Production ³	41	51	31,791	837	9,761	257
Western Grain ⁴	22	48	12,473	594	8,529	406
Southwest Dairy, Fruit, and Poultry ⁵	37	49	14,009	379	8,357	232
Ozark Plateau Dairy ⁶	31	49	15,391	496	7,184	248
Delta Border Livestock and Cash Crop ⁷	33	47	14,058	426	12,377	387
Delta Cotton and Corn ⁸	74	43	33,961	459	32,148	453
Total or average	366	47	180,947	494	123,619	338

¹Three operators did not report total number of acres operated or total number of tillable acres operated.

²Two operators did not report total number of tillable acres operated.

³Three operators did not report total number of acres operated or total number of tillable acres operated.

⁴One operator did not report total number of acres operated or total number of tillable acres operated.

⁵One operator did not report total number of tillable acres operated.

⁶Two operators did not report total number of tillable acres operated.

⁷One operator did not report total number of tillable acres operated.

⁸Three operators did not report total number of tillable acres operated.

TABLE 5--AGE OF OPERATOR, NUMBER OF ACRES FARMED, AND TOTAL TILLABLE ACREAGE, BY TENURE OF OPERATOR, 364 IRRIGATORS, MISSOURI, 1958.

Tenure of operator	Operators reporting Number	Average age of operator Years	Acreage operated		Tillable acreage operated	
			Total Acres	Average Acres	Total Acres	Average Acres
Owner	239	49	103,128	431	62,544	262
Part owner	59	44	41,726	707	31,241	530
Tenant.	66	41	35,693	541	29,534	447
Total or average ¹	366	47	² 180,947	494	³ 123,619	338

¹Includes two irrigators not reporting tenure.

²Includes 400 acres operated by two irrigators not reporting tenure.

³Includes 300 tillable acres operated by two irrigators not reporting tenure.

TABLE 6--NUMBER AND PERCENTAGE OF IRRIGATORS, BY TYPE-OF-FARMING AREA AND TENURE OF OPERATOR, 364 IRRIGATORS, MISSOURI, 1958.

Type-of-farming area	Owners		Part owners		Tenants		All groups	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Northwest Meat								
Production	32	52.5	15	24.6	14	22.9	61	100.0
Northeast Meat								
Production.	12	57.2	7	33.3	2	9.5	21	100.0
Suburban.	26	65.0	9	22.5	5	12.5	40	100.0
Missouri-Mississippi								
Ozark Border.	5	83.3	1	16.7	--	--	6	100.0
Ozark Highland Meat								
Production	36	90.0	2	5.0	2	5.0	40	100.0
Western Grain	18	81.8	3	13.6	1	4.6	22	100.0
Southwest Dairy, Fruit, and Poultry	26	72.2	3	8.3	7	19.5	36	100.0
Ozark Plateau Dairy	26	83.9	3	9.7	2	6.4	31	100.0
Delta Border Livestock and Cash Crop.	25	75.8	2	6.0	6	18.2	33	100.0
Delta Cotton and Corn	33	44.6	14	18.9	27	36.5	74	100.0
Total or average	239	65.7	59	16.2	66	18.1	264	100.0

Production area, 22.9 percent were tenants. The land in these two areas is the most productive in the state. No tenants were reported from the Missouri-Mississippi Ozark Border, and few tenants were using irrigation water in the Ozark Highland Meat Production and Western Grain areas.

CROPS IRRIGATED

In terms of total number of acres irrigated, corn was the major crop reported as irrigated by 127 farmers, from 1954 to 1958. Pasture and hay crops were second in importance, 88 farmers applied water to these crops. Cotton was third with 40 farmers applying water, and vegetables were fourth with 32 farmers applying water (Table 7).

ACRES IRRIGATED

By kind of crop

A total of 10,748 acres of field and specialty crops was irrigated by 165 farmers in 1954 (Table 8). Seventy-seven farmers irrigated 3608 acres of corn with an average of 47 acres per farm. This was 33 percent of the irrigated acres (Table 9). Twenty-nine percent of the total acreage (3075 acres) was in pasture and hay crops. Eighty-six farmers with an average of 36 acres per farm applied water to these crops. In terms of irrigated acres, the third major crop was cotton with 14 percent, or 1511 acres, irrigated by 30 farmers with an average of 50 acres per farm. The area irrigated by one farmer ranged from one to 400 acres.

In 1955, 210 farmers increased the total number of irrigated acres to 13,274, an average of 63 acres per farm (Table 8). The range of irrigated crops varied from one to 300 acres per farm. The acreage of all irrigated crops increased in 1955. That of corn increased by 1167 acres; this was the largest absolute gain.

The largest number of acres irrigated within the five years was in 1956. In that year, water was applied to 18,591 acres by 244 farmers, who irrigated an average of 76 acres per farm. The total area of all crops irrigated increased in 1956, but the average per farm decreased for pasture and hay and for soybeans, and other crops.⁴ One hundred twenty-one farmers irrigated 5773 acres of corn with an average of 48 acres per farm. Thirty-one percent of all irrigated acres was in corn. Of pasture and hay crops, 3871 acres (21 percent) were irrigated by 128 farmers with an average of 30 acres per farm. Fifty-eight farmers irrigated 3611 acres of cotton with an average of 62 acres per farm. This crop occupied 19 percent of the irrigated acres.

In 1957, the total number of acres irrigated was 14,929 compared with 18,591 in 1956, a decline of 3662, or 20 percent. One reason for the decrease was an extremely wet year in the Delta. The acreage decreased for each crop except grain sorghum, orchards, and vegetables. However, the average number of acres irrigated per farm decreased for only small grains and hay and pasture. Two

⁴Nursery stock, flowers, tobacco, and strawberries.

TABLE 7--NUMBER OF IRRIGATORS, BY MAJOR CROP IRRIGATED AND TYPE-OF-FARMING AREA, 347 IRRIGATORS, MISSOURI, 1954-58.

Major Crop irrigated ¹	Operators irrigating crops in										Total No.
	N.W. Meat	N.E. Meat	Sub-urban	Ozark Border	Ozark High-land Meat	Western Grain	S.W. Dairy Fruit and Poultry	Ozark Plateau Dairy	Delta Border Livestock Cash Crop	Delta Cotton & Corn	
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	
Milo	--	--	--	--	--	--	1	1	--	--	2
Corn	46	12	8	3	6	8	8	2	14	20	127
Cotton	--	--	--	--	--	--	--	--	8	32	40
Vegetables	--	1	21	--	3	2	1	1	1	2	32
Orchard	7	1	5	1	1	2	2	2	--	--	21
Pasture Hay	1	3	1	2	23	5	18	22	5	8	88
Strawberries	2	--	1	--	2	1	1	--	1	3	11
Soybeans	1	--	--	--	--	--	1	--	4	6	12
Small grain	1	1	--	--	1	1	1	--	--	--	5
Other ²	--	2	4	--	--	1	2	--	--	--	9
Total operators . .	58	20	40	6	36	20	35	28	33	71	³ 347

¹In terms of total number of acres irrigated within the last five years.

²Tobacco, nursery stock, flowers, etc.

³Nineteen survey irrigators did not report major crop irrigated.

TABLE 8--NUMBER OF IRRIGATORS AND ACREAGE IRRIGATED, BY SPECIFIED CROP AND YEAR, MISSOURI, 1954-58.

Item	Crop irrigated									Total or average Number
	Grain sorghum	Corn	Cotton	Vege- tables	Orchard	Pasture and hay	Soybeans	Small grain	Other ¹	
	Number	Number	Number	Number	Number	Number	Number	Number	Number	
Farmers reporting irrigation in ²										
1954.....	11	77	30	27	10	86	17	12	18	165
1955.....	17	108	40	32	16	106	23	15	21	210
1956.....	25	121	58	32	22	128	42	26	29	244
1957.....	36	91	27	37	23	77	17	17	28	213
1958.....	8	52	28	36	9	24	26	2	25	140
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Acreage irrigated total in										
1954 ³	191	3,608	1,511	281	724	3,075	603	273	412	10,748
1955 ⁴	241	4,775	1,653	355	1,025	3,459	725	396	605	13,274
1956 ⁵	480	5,773	3,611	433	1,575	3,871	1,255	777	756	18,591
1957 ⁶	836	5,627	2,112	539	1,820	2,153	616	412	744	14,929
1958.....	162	1,976	2,084	653	687	643	1,197	35	624	8,061
Average per farm in										
1954.....	17	46	50	10	72	36	35	23	23	65
1955.....	14	44	41	11	64	33	32	26	29	63
1956.....	19	48	62	14	72	30	30	30	26	76
1957.....	23	62	78	15	79	28	36	24	27	70
1958.....	20	38	74	18	76	27	46	18	25	58

¹Nursery stock, flowers, tobacco, and strawberries.

²Several farmers reported more than 1 crop irrigated.

³Includes 70 acres - kind of crop not reported.

⁴Includes 40 acres - kind of crop not reported.

⁵Includes 60 acres - kind of crop not reported.

⁶Includes 70 acres - kind of crop not reported.

TABLE 9--PERCENTAGE DISTRIBUTION OF IRRIGATED ACREAGE, BY YEAR AND KIND OF CROP IRRIGATED, MISSOURI, 1954-58.

Crop	1954	1955	1956	1957	1958	Average
	Percent	Percent	Percent	Percent	Percent	1954-58 Percent
Grain sorghum	2	2	3	6	2	3
Corn	33	36	31	38	24	33
Cotton	14	12	19	14	26	17
Vegetables	3	3	2	4	8	3
Orchard	7	8	9	12	9	9
Pasture and hay	29	26	21	14	8	20
Soybeans	6	5	7	4	15	7
Small grain	2	3	4	3	--	3
Other ¹	4	5	4	5	8	5
Total	100	100	100	100	100	100

¹Nursery stock, flowers, tobacco, and strawberries.

hundred thirteen farmers irrigated 14,929 acres in 1957 with an average of 70 acres per farm.

A total of 8061 acres was irrigated by 140 farmers in 1958 with an average of 58 acres per farm. This was the smallest number of acres irrigated from 1954 to 1958. Soybeans and vegetables were the only crop to have a greater number of acres irrigated in 1958 than in 1957. An additional 114 acres of vegetables crops were irrigated, a 21 percent increase from 1957. Soybeans increased by 581 acres, or 94 percent, from 1957. Twenty-eight farmers irrigated 2084 acres of cotton with an average of 74 acres per farm. This crop occupied 26 percent of all irrigated acres. Fifty-two farmers irrigated 1976 acres of corn with an average of 38 acres per farm.

From 1954 to 1958, 1956 was the big irrigation year in Missouri, as reported by 366 irrigators. The largest number of acres irrigated for each crop except grain sorghum, orchards, and vegetables was in 1956. The largest acreage of grain sorghum and orchards was irrigated in 1957, and of vegetables in 1958. A uniform moisture supply is essential to good yields and quality of these crops. Under Missouri conditions, a commercial grower cannot stay in business without irrigating.

Corn occupied the highest percentage of irrigated land each year except for 1958, when cotton led (Tables 8 and 9).

Irrigation by Type-of-farming Area and Type of Crop

In 1954, 165 farmers irrigated a total of 10,748 acres with an average of 65 acres per farm. Further examination of the data shows that 125 farmers irrigated 9331 acres of field crops and pasture with an average of 75 acres per farm. Forty-five farmers irrigated 1417 acres of specialty crops with an average of 31 acres per farm (Table 10). The greatest concentration of irrigation was in the Delta Cotton and Corn area with 2531 acres, or 24 percent of all land irrigated. All of

TABLE 10

NUMBER OF IRRIGATORS, ACREAGE IRRIGATED, AND AVERAGE ACREAGE IRRIGATED PER FARM,
BY TYPE-OF-FARMING AREA, AND KIND OF CROP IRRIGATED, MISSOURI 1954-58

Item	Type-of-farming area and kind of crop											
	Northwest Meat			Northeast Meat			Sub-urban			Ozark Border		
	Field crops	Specialty crops	All crops	Field crops	Specialty crops	All crops	Field crops	Specialty crops	All crops	Field crops	Specialty crops	All crops
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Farmers reporting irrigation in												
1954 1/	11	4	15	10	3	13	3	22	25	1	4	5
1955 2/	24	7	30	9	3	12	6	23	29	4	1	5
1956 3/	33	8	40	8	3	11	4	25	29	3	1	4
1957 4/	39	8	46	8	3	11	3	28	31	3	1	4
1958 5/	5	3	7	1	3	4	2	25	27	...	...	...
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Acreage irrigated												
Total in												
1954	1,123	134	1,257	997	71	1,068	140	605	745	299	50	349
1955	2,127	271	2,398	713	170	883	369	828	1,197	200	50	250
1956	3,882	421	4,303	512	201	713	175	958	1,133	132	50	182
1957	5,015	618	5,633	476	204	680	62	1,112	1,174	116	50	166
1958	318	202	520	30	123	153	155	968	1,123	...	...	...
Average per farm in												
1954	102	34	84	100	24	82	47	28	30	299	12	70
1955	89	39	80	79	57	74	62	36	41	50	50	50
1956	118	53	108	64	67	65	44	38	39	44	50	46
1957	129	77	122	60	68	62	21	40	38	39	50	42
1958	64	67	74	30	41	38	77	39	42	...	...	...

TABLE 10-CONTINUED

Item	Type-of-farming area and kind of crop											
	Ozark Highland Meat			Western Grain			S.W. Dairy, Fruit & Poultry			Ozark Plateau Dairy		
	Field crops	Specialty crops	All crops	Field crops	Specialty crops	All crops	Field crops	Specialty crops	All crops	Field crops	Specialty crops	All crops
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Farmers reporting irrigation in												
1954 1/	20	4	24	6	2	8	17	6	19	20	2	22
1955 2/	25	7	29	7	5	11	19	5	21	21	1	22
1956 3/	22	7	28	10	5	14	20	6	23	22	2	23
1957 4/	17	6	21	11	6	16	15	7	20	17	1	18
1958 5/	4	4	7	4	4	8	6	5	11	5	1	6
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Acreage irrigated												
Total in												
1954	1,198	25	1,223	309	209	518	768	230	998	1,146	91	1,237
1955	1,300	47	1,347	427	249	676	802	236	1,038	1,196	85	1,281
1956	1,017	316	1,333	785	248	1,033	834	348	1,182	1,276	89	1,365
1957	645	310	955	692	255	947	572	329	901	743	65	808
1958	119	38	157	77	28	105	242	283	525	216	21	237
Average per farm in												
1954	60	6	51	52	105	65	45	38	53	57	46	56
1955	52	7	46	61	50	61	42	47	49	57	85	58
1956	46	45	48	79	50	74	42	58	51	58	46	59
1957	38	52	45	63	43	59	38	47	45	44	65	45
1958	30	10	22	19	7	13	40	57	48	43	21	40

TABLE 10 CONTINUED

Item	Type-of-farming area and kind of crop								
	Delta Border			Delta Cotton & Corn			Total		
	Field	Specialty	All	Field	Specialty	All	Field	Specialty	All
	crops	crops	crops	crops	crops	crops	crops	crops	crops
No.	No.	No.	No.	No.	No.	No.	No.	No.	
Farmers reporting irrigation in									
1954 ¹ / ₁	9	1	9	25	...	25	125	45 ¹ / ₁	165
1955 ² / ₂	18	1	18	32	4	33	165	57 ² / ₂	210
1956 ³ / ₃	22	...	22	48	9	51	192	66 ³ / ₃	244
1957 ⁴ / ₄	13	1	13	27	12	33	153	73 ⁴ / ₄	213
1958 ⁵ / ₅	15	1	16	48	14	54	90	60 ⁵ / ₅	140
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Acreage irrigated									
Total in									
1954	820	2	822	2,531	...	2,531	9,331	1,417	10,748
1955	1,442	6	1,448	2,713	43	2,756	11,289	1,985	13,274
1956	2,804	...	2,804	4,410	133	4,543	15,827	2,764	18,591
1957	1,940	14	1,954	1,559	152	1,711	11,820	3,109	14,929
1958	1,694	5	1,699	3,246	296	3,542	6,097	1,964	8,061
Average per farm in									
1954	91	2	91	101	...	101	75	31	65
1955	80	6	80	85	11	84	68	35	63
1956	127	...	127	92	15	89	82	42	76
1957	149	14	150	58	13	52	77	43	70
1958	113	5	106	68	21	66	68	33	58

¹ Five farmers irrigated both field and specialty crops; one in the Delta Border Livestock and Cash Crop and four in the Southeast Dairy, Fruit, and Poultry areas.

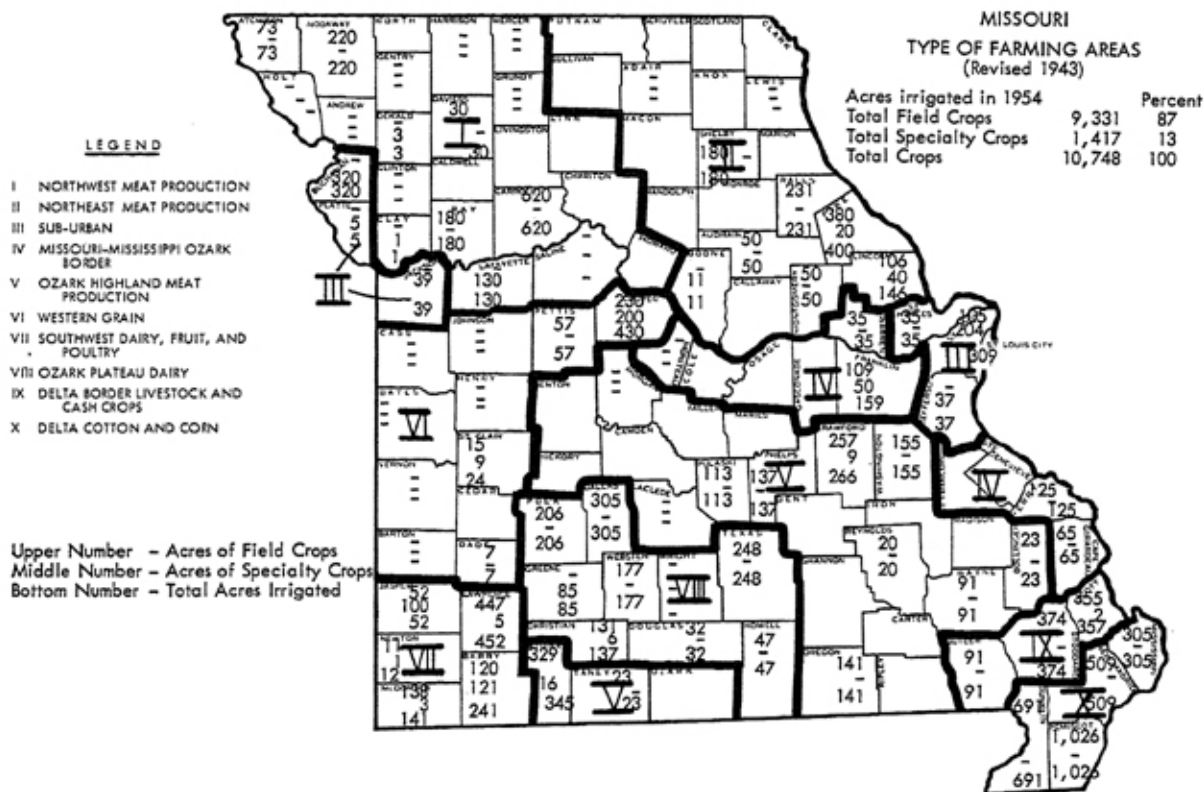
² Twelve farmers irrigated both field and specialty crops; one in the Northwest Meat Production area, three in the Ozark Highland Meat Production area, one in the Western Grain area, three in the Southwest Dairy, Fruit, and Poultry area, one in the Delta Border Livestock and Cash Crop area, and three in the Delta Cotton and Corn area.

³ Fourteen farmers irrigated both field and specialty crops; one in the Northwest Meat Production area, two in the Ozark Highland Meat Production area, one in the Western Grain area, three in the Southwest Dairy, Fruit, and Poultry area, six in the Delta Cotton and Corn area, and one in the Ozark Plateau Dairy area.

⁴ Thirteen farmers irrigated both field and specialty crops; one in the Northwest Meat Production area, two in the Ozark Highland Meat Production area, one in the Western Grain area, two in the Southwest Dairy, Fruit, and Poultry area, one in the Delta Border Livestock and Cash Crop area, and six in the Delta Cotton and Corn area.

⁵ Ten farmers irrigated both field and specialty crops; one in the Northwest Meat Production area, one in the Ozark Highland Meat Production area, and eight in the Delta Cotton and Corn area.

Fig. 5—Acreage of field crops, specialty crops, and total number of acres irrigated, by counties, 165 irrigators, 1954.



the 2531 acres was in field crops or pasture. The Northwest Meat Production area had the second largest number of irrigated acres, with 1257, or 12 percent. Forty-three percent of the 1417 acres of specialty crops was in the Sub-urban area (Table 11). The largest number of acres irrigated per county was in Pemis-scot with 1026 acres (Figure 5).

In 1955, 210 farmers irrigated 13,274 acres, an average of 63 acres per farm. The data show further that 165 farmers irrigated 11,289 acres of field crops and pasture, an average of 68 acres per farm. Fifty-seven farmers averaged 35 acres of specialty crops per farm with a total of 1980 acres. The Delta Cotton and Corn area had the greatest concentration of irrigators in 1955, with 2756 acres, or 21 percent of the total acreage to which water was applied. Stoddard County, which had 902 acres irrigated, had the largest number of irrigated acres in this year (Figure 6).

The largest number of acres irrigated in Missouri from 1954 to 1958, was in 1956. In this year, 244 farmers irrigated 18,591 acres with an average of 76 acres per farm. Eighty-five percent, or 15,827 acres, of field crops and pasture were irrigated by 192 farmers with an average of 82 acres per farm. Of the 18,591 acres, 2764 acres of specialty crops—15 percent of the total—were irrigated by 66 farmers with an average of 42 acres per farm. The Delta Cotton and Corn area had 4543 acres, or 25 percent, the largest percentage of the total (Table 11). Stoddard County with 2327 acres had the largest number of irrigated acres of any county (Figure 7).

Fig. 6—Acreage of field, specialty crops, and total number of acres irrigated, by counties, 210 irrigators, 1955.

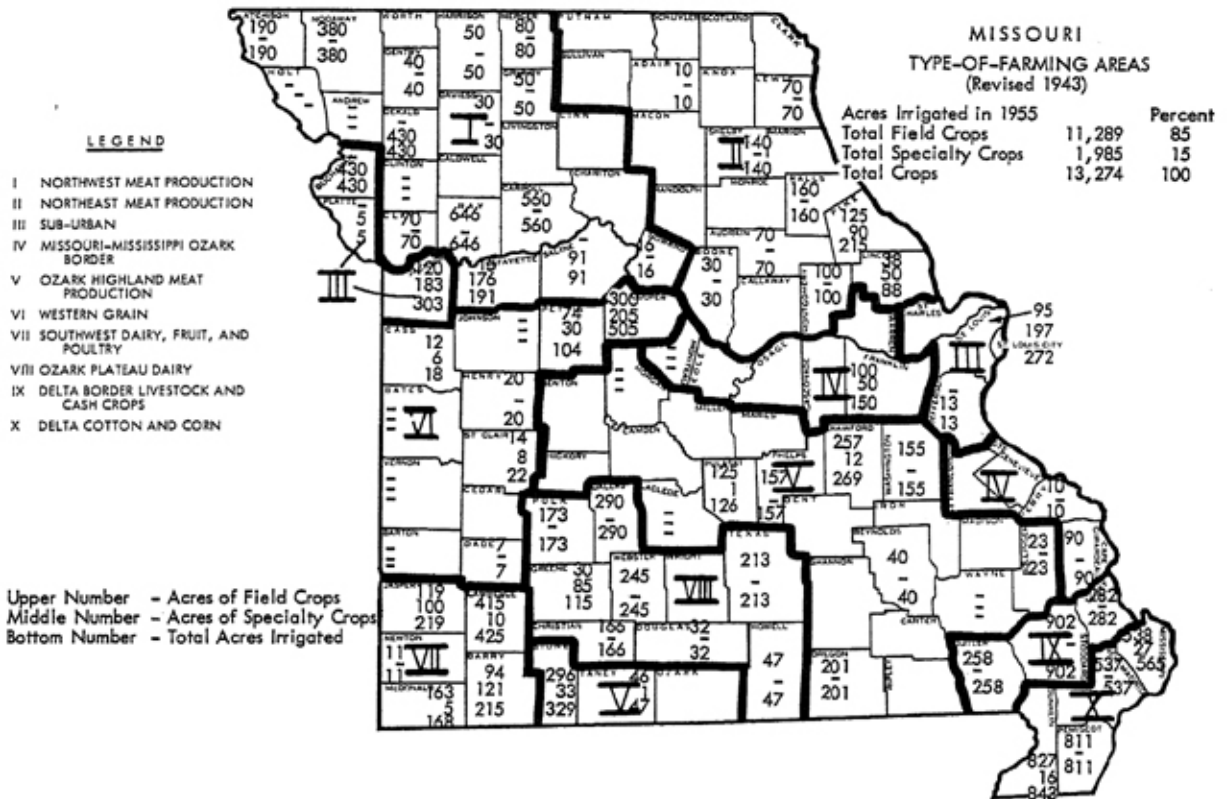


Fig. 7—Acreage of field crops, specialty crops, and total number of acres irrigated, by counties, 244 irrigators, 1956.

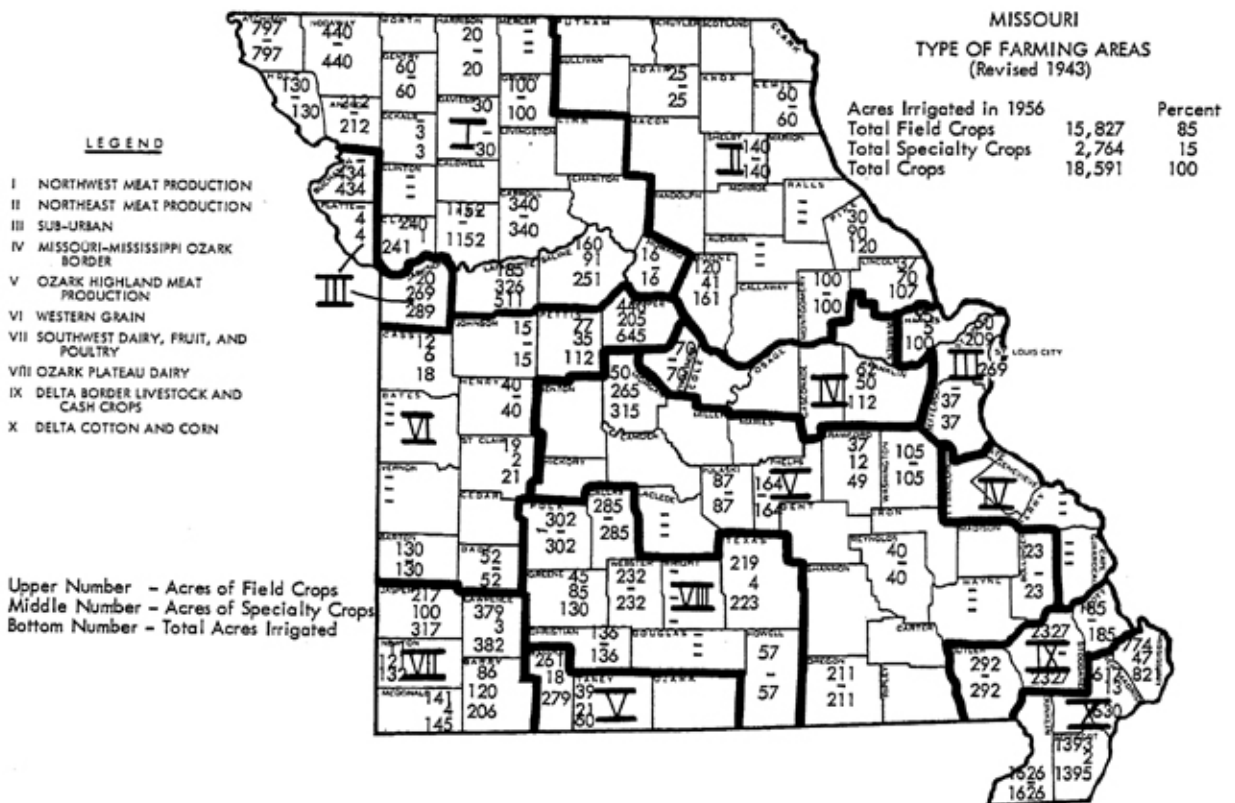


TABLE 11--PERCENTAGE OF TOTAL ACREAGE IRRIGATED, BY TYPE OF CROP AND TYPE-OF-FARMING AREA, MISSOURI, 1954-58.

Item	1954 Percent	1955 Percent	1956 Percent	1957 Percent	1958 Percent	Average 1954-58 Percent
Northwest Meat Production						
Field crops and pasture	12	19	25	42	5	23
Specialty crops	9	14	15	20	11	15
All crops	12	18	23	38	6	21
Northeast Meat Production						
Field crops and pasture	11	6	3	4	--	5
Specialty crops	5	9	7	7	6	7
All crops	10	7	4	5	2	5
Suburban						
Field crops and pasture	2	3	1	1	3	2
Specialty crops	43	42	35	36	49	39
All crops	7	9	6	8	14	8
Missouri-Mississippi Ozark Border						
Field crops and pasture	3	2	1	1	--	1
Specialty crops	3	3	2	2	--	2
All crops	3	2	1	1	--	2
Ozark Highland Meat Production						
Field crops and pasture	13	11	6	6	2	8
Specialty crops	2	2	11	10	2	7
All crops	11	10	7	6	2	8
Western Grain						
Field crops and pasture	3	4	5	6	1	4
Specialty crops	15	12	9	8	1	9
All crops	5	5	6	6	1	5
Southwest Dairy, Fruit, and Poultry						
Field crops and pasture	8	7	5	5	4	6
Specialty crops	16	12	13	10	15	13
All crops	9	8	6	6	7	7

TABLE 11 CONTINUED

Item	1954 Percent	1955 Percent	1956 Percent	1957 Percent	1958 Percent	Average 1954-58 Percent
Ozark Plateau Dairy						
Field crops and pasture	12	11	8	6	4	8
Specialty crops	7	4	3	2	1	3
All crops	11	9	7	5	3	8
Delta Border Livestock and Cash Crop						
Field crops and pasture	9	13	18	16	28	16
Specialty crops	--	--	--	--	--	--
All crops	8	11	15	13	21	13
Delta Cotton and Corn						
Field crops and pasture	27	24	28	13	53	27
Specialty crops	--	2	5	5	15	5
All crops	24	21	25	12	44	23
Total						
Field crops and pasture	100	100	100	100	100	100
Specialty crops	100	100	100	100	100	100
All crops	100	100	100	100	100	100

The total number of acres irrigated decreased from 18,591 in 1956 to 14,929 and the number of irrigators from 244 in 1956 to 213 in 1957, a decrease of 20 percent in acreage and 12.7 percent in the number of farmers. The acreage of field crops and pasture decreased by 4007 acres, or 25 percent from 1956. Seventy-nine percent of the total number of acres irrigated was in field crops and pasture, and 21 percent was in specialty crops. One hundred fifty-three farmers irrigated 11,820 acres of field crops and pasture with an average of 77 acres per farm. Seventy-three farmers irrigated 3109 acres of specialty crops. The Northwest Meat Production area had the largest percentage of irrigated acres with 5633 acres, or 38 percent, of total (Tables 10 and 11). Stoddard, Ray, and Atchison counties had 1681, 1200, and 1189 irrigated acres respectively for the largest numbers per county (Figure 8).

From 1954 to 1958, the smallest number of acres irrigated occurred in 1958 when 140 farmers applied water to 8061 acres. They irrigated an average of 58 acres of field crops and pasture, which was 76 percent of the total. Sixty farmers irrigated 1964 acres of specialty crops, or 24 percent. Forty-four percent or 3542 acres were irrigated in the Delta Cotton and Corn area. Stoddard and Pemiscot counties had 1480 and 1208 acres, respectively, for the largest number of irrigated acres per county (Figure 9).

Irrigation by Tenure Groups

In the five-year period 1954-58, full owners made up 68 percent of all irrigators. They applied water to 40,538 acres, or 62 percent of the total. Of the acreage irrigated by full owners, 81 percent was in field crops and pasture, and 19 percent was in specialty crops (Table 12).

Part owners made up 16 percent of the irrigators. They applied water to 19 percent of the irrigated acreage, or 12,385 acres, for the five years. Of the acres irrigated by part owners, 86 percent was in field crops and pasture, and 14 percent was in specialty crops (Table 12).

Tenants, who made up 16 percent of the irrigators, applied water to 12,570 acres over the five-year period. This was 19 percent of the total acreage irrigated. Of the acreage irrigated by tenants, 86 percent was in field crops and pasture, and 14 percent was in specialty crops (Table 12).

Full owners irrigated the largest number of acres in each of the five years. However, the average number of acres irrigated per farm was the smallest. Tenants had the highest average number of acres irrigated in each year except 1957, when part owners averaged 102 acres per farm (Table 12).

Fig. 8—Acreage of field crops, specialty crops, and total number of acres irrigated, by counties, 213 irrigators, 1957.

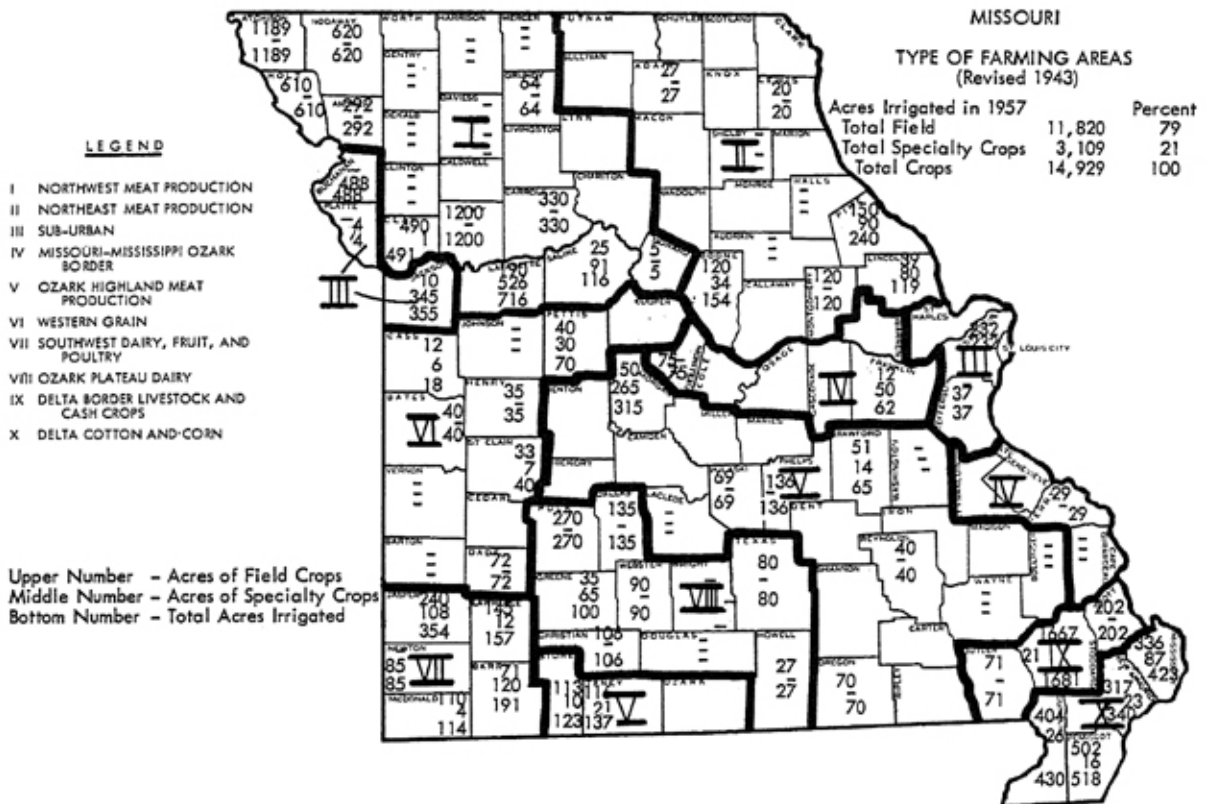


Fig. 9—Acres of field crops, specialty crops, and total number of acres irrigated, by counties, 140 irrigators, 1958.

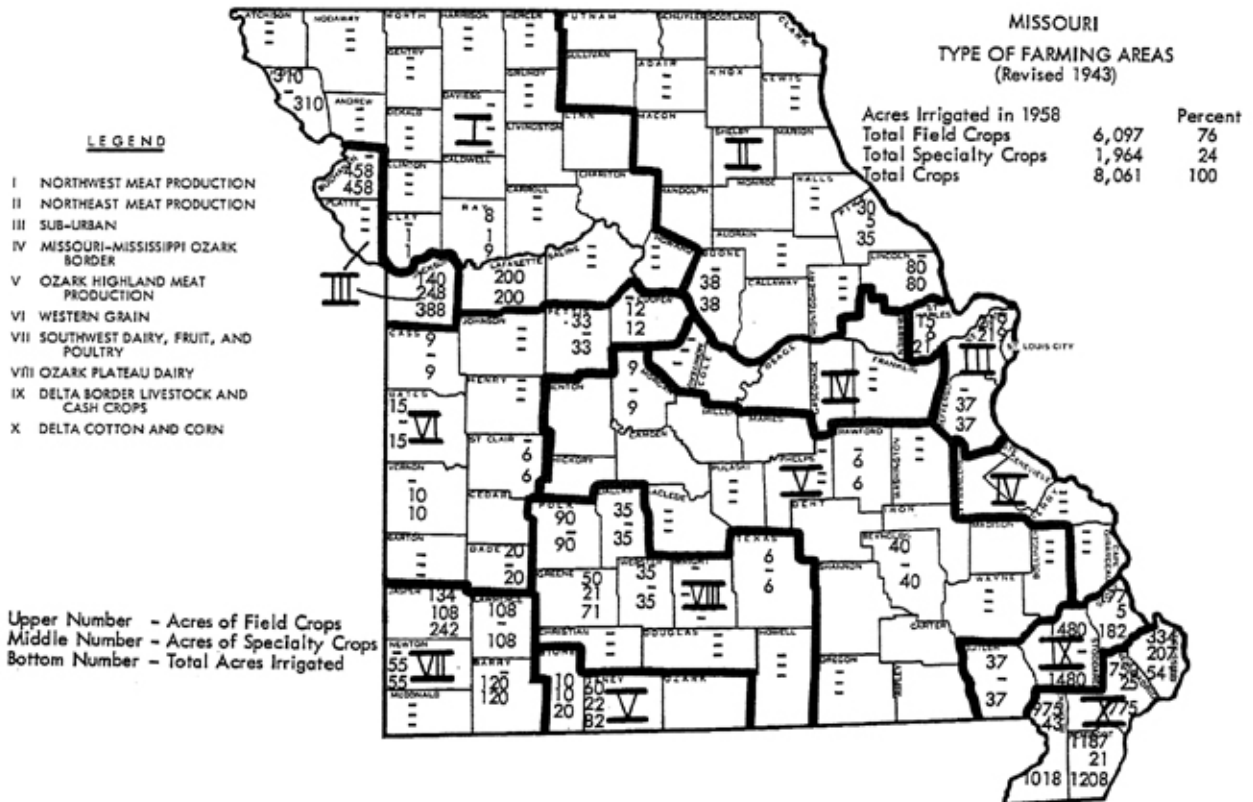


TABLE 12
NUMBER OF IRRIGATORS, AND TOTAL AND AVERAGE IRRIGATED ACREAGE, BY TENURE OF OPERATOR AND
KIND OF CROP, MISSOURI 1954-58

Item	Tenure and kind of crop											
	Owner			Part Owner			Tenant			Total		
	Field crops	Specialty crops	All crops	Field crops	Specialty crops	All crops	Field crops	Specialty crops	All crops	Field crops	Specialty crops	All crops
No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Farmers reporting irrigation in												
1954	89	34 <u>1/</u>	119	22	8	30	13	3 <u>2/</u>	15	125	45	165
1955	118	40 <u>3/</u>	151	27	10 <u>4/</u>	36	19	7 <u>5/</u>	23	165	57	210
1956	126	45 <u>6/</u>	162	31	13 <u>7/</u>	41	34	8 <u>8/</u>	40	192	66	244
1957	104	48 <u>9/</u>	142	19	14 <u>10/</u>	31	29	10	39	153	73	213
1958	49	44 <u>11/</u>	88	9	9 <u>12/</u>	16	32	7 <u>13/</u>	36	90	60	140
	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres	Acres
Acreage irrigated												
Total in												
1954	5,536	1,128	6,664	2,122	162	2,284	1,643	127	1,770 <u>14/</u>	9,331	1,417	10,748
1955	7,350	1,364	8,714	2,331	425	2,756	1,578	196	1,774 <u>15/</u>	11,289	1,985	13,274
1956	9,620	1,869	11,489	3,087	461	3,548	3,085	434	3,519 <u>16/</u>	15,827	2,764	18,591
1957	6,988	1,991	8,979	2,693	483	3,176	2,124	635	2,759 <u>17/</u>	11,820	3,109	14,929
1958	3,228	1,464	4,692	454	167	621	2,415	333	2,748	6,097	1,964	8,061
Average per farm in												
1954	62	33	56	96	20	76	126	42	118	75	31	65
1955	62	34	58	86	43	77	83	28	77	68	35	63
1956	76	42	71	100	35	87	91	54	88	82	42	76
1957	67	41	65	142	34	102	73	63	71	77	43	70
1958	66	33	53	50	19	39	75	48	76	68	33	58
<u>1/</u>	Four irrigators irrigated both field and specialty crops.					<u>10/</u>	Two irrigators irrigated both field and specialty crops.					
<u>2/</u>	One irrigator irrigated both field and specialty crops.					<u>11/</u>	Five irrigators irrigated both field and specialty crops.					
<u>3/</u>	Eight irrigators irrigated both field and specialty crops.					<u>12/</u>	Two irrigators irrigated both field and specialty crops.					
<u>4/</u>	One irrigator irrigated both field and specialty crops.					<u>13/</u>	Three irrigators irrigated both field and specialty crops.					
<u>5/</u>	Three irrigators irrigated both field and specialty crops.					<u>14/</u>	Includes 30 acres by irrigator not reporting tenure.					
<u>6/</u>	Eight irrigators irrigated both field and specialty crops.					<u>15/</u>	Includes 30 acres by irrigator not reporting tenure.					
<u>7/</u>	Three irrigators irrigated both field and specialty crops.					<u>16/</u>	Includes 35 acres by irrigator not reporting tenure.					
<u>8/</u>	Two irrigators irrigated both field and specialty crops.					<u>17/</u>	Includes 15 acres by irrigator not reporting tenure.					
<u>9/</u>	Ten irrigators irrigated both field and specialty crops.											

SOILS

Water has been applied to a wide range of Missouri soils. Twenty-eight percent, or 99 farmers, reported their irrigated land to be silt loam. Twenty-eight percent, or 99 farmers, irrigated sandy loam soils. Clay and clay loams were reported by 11 percent, or 40 farmers. Thirty-three percent, or 115 farmers, reported a combination of soil types (Table 13).

SOURCES OF WATER

Availability of an adequate, dependable, economical supply of water is a basic requirement, if irrigation is to be a practical and profitable farm practice.

Irrigation water may come from wells, natural streams, lakes, springs, constructed reservoirs, city water, or drainage ditches (Table 14). Forty percent of the farmers (147) used wells as their only source of water. Twenty-eight additional farmers had wells in combination with other sources of water. Therefore, wells were the entire or partial source of water for 48 percent of the irrigators. The only source for 28 percent, or 102 farmers, was natural streams or rivers. An additional 9 percent of the farmers obtained part of their irrigation water from streams. Constructed ponds or reservoirs were the only source for another 8 percent of the irrigators. The remaining 7 percent obtained their water from other sources.

TABLE 13--NUMBER OF IRRIGATORS BY TEXTURE OF SOILS USED FOR IRRIGATION AND TYPE-OF-FARMING AREA, 353 IRRIGATORS, MISSOURI, 1958.

Type-of-farming Area	Operators using							Total
	Clay & Clay Loam	Silt Loam	Sandy Loam	Silt & Sandy Loam	Clay & Silt Loam	Clay & Sandy Loam	Clay, Silt, and Sandy Loam	
Northwest Meat Production	3	13	11	9	8	4	9	57
Northeast Meat Production	3	8	2	4	3	-	1	21
Sub-urban	10	13	4	4	7	-	2	40
Missouri-Mississippi Ozark Border	1	1	1	1	1	-	-	5
Ozark Highland Meat Production	3	10	12	7	3	1	3	39
Western Grain	1	13	4	-	1	1	1	21
Southwest Dairy, Fruit, and Poultry	4	16	2	5	5	2	2	36
Ozark Plateau Dairy	1	8	13	5	-	-	2	29
Delta Border Livestock and Cash Crop	4	11	11	2	1	1	2	32
Delta Cotton and Corn	10	6	39	3	2	10	3	73
Total	40	99	99	40	31	19	25	¹ 353

¹Thirteen irrigators did not report texture of soil.

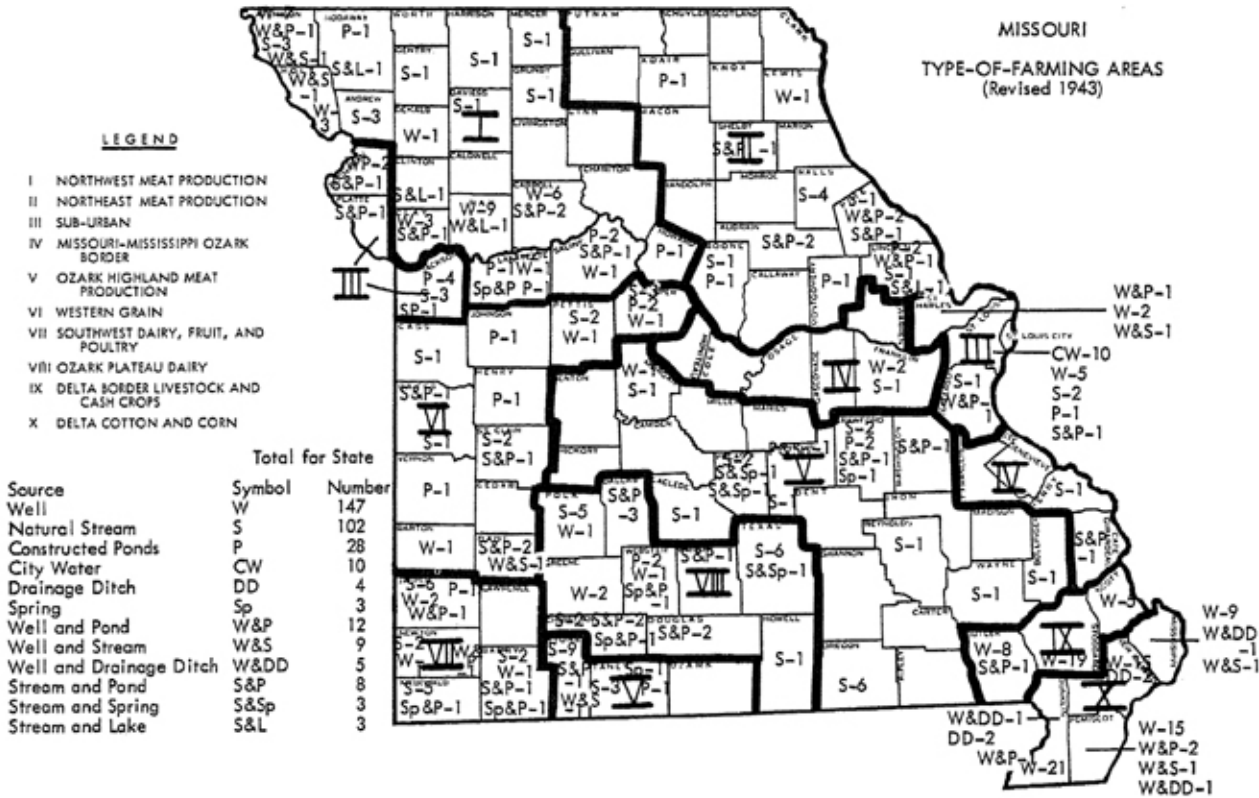
TABLE 14
NUMBER OF IRRIGATORS BY SPECIFIED SOURCE OF WATER FOR IRRIGATION AND
BY TYPE-OF-FARMING AREA, MISSOURI, 1958

Type-of farming area	Well	Stream	Spring	City	Con-structed ponds	Drain age ditch	Well and stream	Well and drainage pond	Well and drainage ditch	Stream and spring	Stream and lake	Stream and pond	Spring and pond	Other	Total
Northwest Meat Production	31	13	...	...	5	...	4	1	...	...	2	1	2	<u>1/2</u>	61
Northeast Meat Production	1	7	...	...	5	...	...	3	...	...	1	4	...	...	21
Sub-urban Mo. - Miss. Ozark Border	9	6	1	10	5	...	1	3	...	...	...	4	1	...	40
Ozark Highland Meat Production	2	2	...	...	1	...	...	...	...	...	...	1	...	...	6
Western Grain	1	28	2	...	3	...	1	...	...	1	...	3	1	<u>2/1</u>	41
Southwest Dairy, Fruit, and Poultry	3	9	...	...	5	...	1	...	...	...	...	4	...	...	22
Ozark Plateau Dairy	4	23	...	...	2	...	...	2	...	1	...	3	2	...	37
Delta Border Livestock and Cash Crop	4	14	...	...	2	...	...	...	...	1	...	8	2	...	31
Delta Cotton and Corn	32	...	...	...	...	...	...	...	...	...	...	1	...	...	33
Total	60	...	...	...	...	4	2	3	5	...	...	...	...	...	74
	147	102	3	10	28	4	9	12	5	3	3	29	8	3	366

1/ One irrigator - well and spring, one irrigator - well and natural lake.

2/ Combination - spring and natural lake.

Fig. 10—Sources of water for irrigation, 366 irrigators, Missouri, 1958.



Sources of Water by Type-of-farming Area

Wells were the major source for the Delta Cotton and Corn, the Delta Border and Cash Crop, and the Northwest Meat Production areas (Table 14 and Figure 10). Natural streams or rivers were the major sources in the Ozark Highland Meat Production; Southwest Dairy, Fruit, and Poultry; the Ozark Plateau Dairy; the Northeast Meat Production; and the Western Grain areas. City water was the major source in the Sub-urban areas.

Sources of Water Used to Irrigate the Major Crop Within the Last Five Years

Wells were the major source of water used to irrigate corn, cotton, orchards, strawberries, and soybeans (Table 15). Natural streams or rivers were the major source for pasture and hay, grain sorghum, and small grains. The major source for vegetables was city water.

Depth and Diameter of Irrigation Wells

Irrigation wells varied from 2 to 30 inches in diameter, and from 20 to 1,500 feet in depth (Table 16). One hundred seventy-five farmers had 265 wells. More than half—52 percent, or 138 wells—were either 6 or 12 inches in dia-

TABLE 15
 NUMBER OF IRRIGATORS USING SPECIFIED SOURCES OF WATER, BY MAJOR CROP IRRIGATED,
 366 IRRIGATORS, AVERAGE 1954-58 MISSOURI

Crop irrigated	Well and														Total
	Well	River or stream	Spring	City	Construc- ted ponds	drain- age ditch	Well and stream	Well and pond	drain- age ditch	Stream and spring	Stream and lake	Stream and pond	Spring and pond	Other	
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Grain															
Sorghum	...	2	...	...	...	...	...	...	...	...	...	...	...	...	2
Corn	64	32	1	...	6	...	5	4	...	1	1	11	...	1/ 2	127
Cotton	31	...	...	...	...	3	1	2	3	...	...	...	...	...	40
Orchard	7	4	...	...	4	...	...	3	...	...	...	2	1	...	21
Vegetables	9	6	...	10	4	...	1	...	...	...	...	2	...	...	32
Pasture and hay	15	44	2	...	8	...	2	...	1	2	1	8	4	2/ 1	88
Strawberries	6	...	...	...	4	...	...	...	...	...	...	...	1	...	11
Soybeans	10	...	...	...	...	1	...	1	...	...	...	...	...	...	12
Small Grain	1	2	...	...	...	...	...	...	...	...	1	1	...	...	5
Other 3/	1	1	...	...	2	...	...	1	...	...	...	3	1	...	9
Crop not reported	3	11	...	...	...	...	...	1	1	...	...	2	1	...	19
Total	147	102	3	10	28	4	9	12	5	3	3	29	8	3	366

1/ One irrigator - combination well and spring; one irrigator - combination well and natural lake.

2/ One irrigator - combination spring and natural lake.

3/ Tobacco, nursery stock, flowers, etc.

TABLE 16--NUMBER OF IRRIGATION WELLS, BY DEPTH AND DIAMETER OF WELL, 265 IRRIGATION WELLS, MISSOURI, 1958.

Depth of Well (feet)	Diameter of well in inches										Total No.	
	2 No.	4 No.	6 No.	8 No.	10 No.	12 No.	14 No.	16 No.	18 No.	20+ No.		
20 to 39	4	-	--	-	-	1	-	-	-	-	-	5
40 to 59	1	3	13	2	-	2	-	-	1	-	-	22
60 to 79	-	7	22	4	3	13	1	-	7	-	-	57
80 to 99	-	5	17	16	3	23	-	2	11	1	-	78
100 to 119	-	5	16	7	5	17	1	2	5	2	-	60
120 to 139	-	-	--	1	5	3	2	-	1	-	-	12
140 to 159	-	-	--	-	2	3	1	-	-	-	-	6
160 to 179	-	-	--	-	-	--	-	-	-	-	-	--
180 /	2	-	7	10	2	1	-	-	-	-	-	1 22
Total	7	20	75	² 41	20	63	5	4	25	³ 3	⁴ 3	265

¹The depth of the 22 wells over 180 feet is: 200 to 299 feet; six wells; three wells-500 to 699 feet; six wells - 700 to 999 feet; four wells - 1,000 to 1,299 feet, and three wells - 1,300 to 1,499 feet.

²Includes one 8-inch well with depth not reported.

³The diameter of the three wells is 20, 24, and 30 inches.

⁴Includes two wells with depth and diameter not reported.

meter. Only three wells were above 20 inches in diameter. Eighty-four percent, or 222, wells were less than 119 feet in depth.

The 22 wells over 180 feet deep were located as follows: 1—Northwest Meat Production area, 3—Northeast Meat Production area, 2—Sub-urban, 1—Missouri-Mississippi Ozark Border, 1—Ozark Highland Meat Production area, 3—Western Grain, 7—Southwest Dairy, Fruit, and Poultry, and 4—Ozark Plateau Dairy areas. The depth of these 22 wells were as follows: 6—200 to 499 feet, 3—500 to 699 feet, 6—700 to 999 feet, 4—1000 to 1299 feet, and 3—1300 to 1499 feet.

METHODS OF DISTRIBUTING WATER

Sprinkler and surface irrigation are used in applying water to field and specialty crops in Missouri. Four types of portable pipe and sprinkler systems were used. The most common was the conventional sprinkler system, which has several small sprinklers 60 to 90 feet apart on lateral lines, low pump pressure, and a relatively low rate of water application. Ordinarily, this system is called the 60 X 60 or 90 X 90 system, meaning that the sprinklers are 60 to 90 feet apart on the lateral lines and that the entire line is moved 60 or 90 feet after the completion of irrigation from each set. The second type of portable pipe and sprinkler system used has a giant sprinkler on a rotating boom mounted on a trailer. The system is operated under high pump pressure. The third type used has two or three giant sprinklers per quarter mile of lateral line, high pump pressure, and a high rate of application. The fourth type had self-propelled automatic sprinklers, which used a system of towers mounted on wheels to carry the pipe. Small sprinklers apply the water in a circular pattern over the field.

Surface irrigation was done in two ways: (1) Light portable gated pipes with gates 38 or 40 inches apart were used to carry water to the rows where it was to be applied. (2) Ditches and furrows were to guide the water to the rows. Siphon tubes transferred the water to furrows between the rows for distribution.

Seventy-eight percent, or 283 farmers, used the portable pipe and sprinkler method exclusively. Eight farmers used fixed overhead pipe exclusively. This is another type of sprinkler irrigation. Twelve percent, or 43 farmers, used only surface irrigation. Eight percent, or 31 farmers, used combinations of portable pipe and sprinkler system and portable gated pipe, fixed overhead pipe, or ditches and furrows (Table 17).

Methods of Water Distribution by Type-of-farming Areas

Portable pipe used with sprinklers was the primary method of applying water in all areas of the state (Table 17). Surface irrigation was practiced chiefly on the relatively flat bottomland in the Northwest Meat Production area, the Delta Cotton and Corn area, and the Delta Border Livestock and Cash Crop area. Only three farmers used surface irrigation in other parts of the state. Twenty-

TABLE 17--NUMBER OF IRRIGATORS BY SPECIFIED METHOD OF APPLYING WATER AND BY TYPE-OF-FARMING AREA, MISSOURI, 1958.

Type-of-farming area	Method of Applying Water							Total Number
	Portable pipe and sprinkler only Number	Portable pipe and sprinkler in combination with			Portable gated pipe only Number	Ditches and furrows only Number	Fixed overhead pipe only Number	
		Portable gated pipe Number	Fixed overhead pipe Number	Ditches and furrows Number				
N.W. Meat Production . .	37	2	--	5	11	6	--	61
N.E. Meat Production . .	20	--	--	--	--	1	--	21
Sub-urban	31	2	1	--	--	--	6	40
Missouri-Mississippi								
Ozark Border	6	--	--	--	--	--	--	6
Ozark Highland								
Meat Production	39	--	--	--	1	--	1	41
Western Grain	19	1	--	1	--	--	--	21 ¹
S.W. Dairy, Fruit, and Poultry	33	--	1	1	1	--	1	37
Ozark Plateau Dairy . . .	30	--	--	1	--	--	--	31
Delta Border Livestock and Cash Crop	19	--	--	4	2	8	--	33
Delta Cotton and Corn	49	7	--	5	7	6	--	74
Total	283	12	2	17	22	21	8	365

¹One irrigator did not report method of applying water.

three of the 29 irrigators who used combinations of portable pipe and sprinklers with portable gated pipe or ditches and furrows were in the above three areas.

Methods of Distributing Water on Different Crops

The portable pipe and sprinkler system was the principal method of applying water to all crops (Table 18). Cotton and corn were the two major crops to receive water from surface irrigation. Water was applied by means of surface irrigation to a limited acreage of vegetables, pasture and hay, strawberries, and soybeans.

Irrigation Pumps

The 354 farmers who used pumps had 466 machines with an average rated capacity of 900 gallons per minute. Nine irrigators who used city water did not have irrigation pumps. Two hundred eighty-one irrigators had one pump; 54 had two; 10, three; five, four; two, five; one, six, and one irrigator, 11. Ten percent of the pumps had capacities of less than 300 gallons per minute (gpm), while 24 percent ranged from 300 to 599 gpm. The 600 to 899 gpm range included 29 percent of the pumps; 13 percent had capacities of 900 to 1999 gpm; and 24 percent had capacities of 1200 gpm and above.

Power Used for Pumping Water

The farmers used several types of power to operate their irrigating equipment. Important among them were internal combustion engines and electric motors, or combinations of the two. The internal combustion engines were of three types—gasoline, diesel, and LP gas.

Twenty percent of the irrigators used farm tractors to drive their pumps. Sixty-five percent used internal combustion engines other than tractors. Only 7 percent used electric motors. Six percent used a combination of the three power types, and 3 percent did not require pumps as they used city water.

TABLE 18--NUMBER OF IRRIGATORS BY SPECIFIED METHODS OF APPLYING WATER AND THE MAJOR CROP IRRIGATED, FIVE-YEAR AVERAGE, 1954-58, MISSOURI.

Type-of-farming area	Method of Applying Water							Total Number
	Portable pipe and sprinkler only	Portable pipe and sprinkler in combination with			Portable gated pipe only	Ditches and furrows only	Fixed overhead pipe only	
		Portable gated pipe	Fixed overhead pipe	Ditches and furrows				
Number	Number	Number	Number	Number	Number	Number	Number	
Grain Sorghum	2	--	--	--	--	--	--	2
Corn	89	6	--	9	14	9	--	127
Cotton	24	5	--	3	1	7	--	40
Vegetables	22	1	2	--	--	--	7	32
Orchard	21	--	--	--	--	--	--	21
Pasture and hay	83	--	--	2	2	1	--	88
Strawberries	7	--	1	--	1	1	1	11
Soybeans	6	--	--	1	1	1	4	12
Small Grain	5	--	--	--	--	--	--	5
Other ¹	9	--	--	--	--	--	--	9
Total	268	12	3	15	19	22	8	2 347

¹Tobacco, nursery stock, and flowers.

²Nineteen irrigators did not report crops irrigated.

INVESTMENT IN IRRIGATION SYSTEMS

The investment in irrigation equipment ranged from \$1596 per farm with an average of 4.5 acres irrigated to \$10,871 per farm with an average of 266.8 acres irrigated. The average investment per acre in the two groups was \$351 for the first group and \$41 for the second. The average cost of equipment for the 271 irrigators was \$3976 per farm, or \$71 per acre irrigated (Table 19).

The difference in per acre investment probably was due to both size and type of irrigation equipment. The farmers with high investments per acre were growing specialty crops, such as small fruits and vegetables, while the low-cost operators with larger acreages were growing field crops, such as corn, cotton, and soybeans.

DEGREE OF SATISFACTION WITH IRRIGATION

The type of crop irrigated significantly affected the degree of satisfaction with irrigation. None of the specialty crop irrigators were dissatisfied with their irrigation systems (Table 20). Among the field-crop growers, 18, 9, and 8 percent of the cotton, corn, and pasture irrigators respectively were not satisfied with the practice on their farms (Table 20). Type-of-farming area and type of tenure made no significant difference in the degree of satisfaction. However, the highest percentage of unsatisfied irrigators was in the Missouri-Mississippi Ozark Border; Southwest Dairy, Fruit, and Poultry; and Delta Cotton and Corn areas (Table 21).

Several things may influence a farmer's attitude toward irrigation. Basically, the problems of irrigating a crop differ for each farm. In some instances, the water supply is convenient and abundant. Some farmers have plenty of labor; the soils on their farms are light and there are no major water-distribution problems. Other farms present the opposite of these conditions.

The most common reason given by the 29 farmers who were dissatisfied with irrigation dealt with labor problems. In most areas of the state, it is difficult to hire day workers who will do a competent job of moving irrigation pipe in tall crops, particularly in corn, cotton, and soybeans. If the farmer does not have an adequate family labor supply or enough farm workers hired for the year to move the pipe, experience with sprinkler irrigation is likely to be unsatisfactory.

Several farmers reported that yield response from corn, cotton, pasture, and other field crops was not sufficient to cover operating costs. Once the investment in equipment has been made, a farmer is concerned only with variable or operating costs. The fixed costs (taxes, insurance, depreciation, etc.) are the same whether or not irrigation is carried out. Several farmers did not believe that in some of the past years their average yields had been enough higher than their neighbor's, who did not irrigate, to justify irrigation. Often, a rain occurs im-

TABLE 19--RELATIONSHIPS BETWEEN ACRES IRRIGATED AND INVESTMENT IN IRRIGATION EQUIPMENT, BY NUMBER OF ACRES IRRIGATED, MISSOURI, 1954.¹

Land irrigated	Acres irrigated			Cost of irrigation equipment ²		Total cost ³	
	Farmers reporting Number	Average Acres	Total Acres	Per farm Dollars	Per acre irrigated Dollars	Per farm Dollars	Per acre irrigated Dollars
1 to 9 acres	46	4.5	209	1,596	351	1,850	407
10 to 19 acres	38	12.8	486	2,744	209	3,386	265
20 to 29 acres	37	22.9	846	2,729	119	3,286	144
30 to 49 acres	46	37.1	1,706	3,456	93	4,326	117
50 to 99 acres	54	65.5	3,535	4,375	67	5,153	79
100 to 199 acres	35	135.5	4,744	7,043	52	7,971	59
200 to 499 acres	15	266.8	4,002	10,871	41	13,179	49
Not reported	9	---	---	3,081	---	3,264	--
Total	280	57.3	15,528	3,976	71	4,710	85

¹U.S. Census of Agriculture, 1954, Volume 3, Part 6, Irrigation in Humid Areas, 1956.

²Includes pumps, motors, and distribution equipment.

³Includes cost of irrigation equipment, leveling and ditching, and constructing reservoirs, for storing water and drilling wells.

TABLE 20--NUMBER OF IRRIGATORS EXPRESSING DEGREE OF SATISFACTION WITH IRRIGATION, BY MAJOR CROP IRRIGATED, 363 IRRIGATORS, MISSOURI, FIVE-YEAR AVERAGE, 1954-58.

Major Crop Irrigated	Irrigators reporting degree of satisfaction with irrigation							
	Very Satisfied		Satisfied		Not Satisfied		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Grain Sorghum	1	50	1	50	--	--	2	100
Corn	43	34	72	57	11	9	126	100
Cotton	11	28	21	54	7	18	39	100
Vegetables	21	66	11	34	--	--	32	100
Orchard	10	48	11	52	--	--	21	100
Pasture and hay	34	39	47	53	7	8	88	100
Strawberries	5	45	6	55	--	--	11	100
Soybeans	3	25	9	75	--	--	12	100
Small Grain	2	40	2	40	1	20	5	100
Other ¹	7	78	2	22	--	--	9	100
Major crop not reported	4	22	10	56	4	22	18	100
All	141	39	192	53	30	8	363	100

¹Tobacco, nursery stock, flowers, etc.

TABLE 21--NUMBER OF IRRIGATORS EXPRESSING DEGREE OF SATISFACTION WITH IRRIGATION, BY TYPE-OF-FARMING AREA, 363 IRRIGATORS, MISSOURI, 1958.

Type-of-farming Area	Irrigators reporting degree of satisfaction with irrigation							
	Very Satisfied		Satisfied		Not Satisfied		Total	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Northwest Meat Production . . .	18	30	38	62	5	8	61	100
Northeast Meat Production . . .	7	33	14	67	--	--	21	100
Sub-urban	19	47	19	48	2	5	40	100
Missouri-Mississippi								
Ozark Border	4	66	1	17	1	17	6	100
Ozark Highland Meat								
Production	15	37	23	56	3	7	41	100
Western Grain	11	50	9	41	2	9	22	100
Southwest Dairy, Fruit								
and Poultry	17	46	14	38	6	16	37	100
Ozark Plateau Dairy	16	53	13	44	1	3	30	100
Delta Border Livestock and								
Cash Crop	10	30	20	61	3	9	33	100
Delta Cotton and Corn	24	33	41	57	7	10	72	100
All	141	39	192	53	30	8	363	100

mediately after the crop is irrigated or before the irrigation is completed. On soils that have good drainage, rain immediately after irrigation will not harm the crop, but the variable costs of the irrigation are lost. On heavy, poorly drained soils, however, the additional water from the rain may injure the crop, so the yield may be less than that on non-irrigated fields.

The conflict of irrigation with other farm work is also a reason for dissatisfaction on individual farms. Ordinarily, Missouri crops need water in June, July, and August. This is the busy time of the year for crop cultivation, haying, and other farm work. Consequently, on many farms, the labor supply is inadequate to handle all jobs efficiently.

On some farms, the irrigation system distributes the water too slowly to do a satisfactory job on enough acres. In the event of a severe dry period, the crop cannot be irrigated completely in a short enough period to prevent deterioration. This usually occurs when the farmer tries to cover more acreage than the system was designed to irrigate or when the water is inadequate.

Some of the farmers who have graded or "leveled" their land for surface irrigation, have reported a decrease in crop yields for two or three years following the grading. Apparently, this is a combined fertility and soil structure problem.

It should be kept in mind that only 8 percent of the 363 men reporting were dissatisfied with irrigation. Ninety-two percent were satisfied with their irrigation experience (Table 20).

LEGALITY OF WATER USE BY SOURCES

Approximately 5 percent of the 366 irrigators indicated that their right to use irrigation water from a stream had been challenged. One suit had been filed but it was dropped before entering court. About half of the questions came from farmers who feared a water shortage downstream from the irrigation. Most of the farmers who irrigated from streams did not know their rights concerning the use of irrigation water.

EXPECTATION OF INCREASING ACRES IRRIGATED

Forty-four percent, or 156 irrigators, expected to increase the number of acres irrigated within the next five years; 51 percent were not planning to increase their irrigated acreages; and five percent were undecided (Table 22). The only sections of the state in which more than 50 percent of the irrigators expected to increase the number of acres irrigated were the Western Grain, and Delta Cotton and Corn areas (Table 22).

The only major irrigated crop of which 50 percent or more indicated they would increase their irrigated acreage, were soybeans, "other," orchard, and grain sorghum (Table 23).

TABLE 22--NUMBER OF IRRIGATORS EXPRESSING ATTITUDE TOWARD INCREASING THE ACREAGE IRRIGATED WITHIN THE NEXT FIVE YEARS, BY TYPE-OF-FARMING AREA, 366 IRRIGATORS, MISSOURI, 1958.

Attitude	N.W.	N.E.	Sub-urban	Mo. -	Ozark	West- ern Grain	S.W.	Ozark	Delta	Delta	Total
	Meat Prod.	Meat Prod.		Miss. Ozark Border	High- land Meat Prod.		Dairy, Fruit & Poultry	Plat- eau Dairy	Border Live- stock & Cash Crop	Cotton & Corn	
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
Expect to increase	25	10	12	2	15	14	15	13	13	38	157
Do not expect to increase	31	7	27	4	25	8	21	16	18	26	183
Undecided.	3	4	1	--	--	--	1	1	1	7	18
Total	59	21	40	6	40	22	37	30	32	71	1 358

¹Eight irrigators not reporting expectations as follows: Two - N.W. Meat Production; One - Ozark Highland Meat Production; One - Ozark Plateau Dairy; One - Delta Border Livestock and Cash Crop; and Three - Delta Cotton and Corn areas.

TABLE 23--NUMBER OF IRRIGATORS EXPRESSING ATTITUDE TOWARD INCREASING THE IRRIGATED ACREAGE OF SPECIFIED CROPS WITHIN THE NEXT FIVE YEARS, 342 IRRIGATORS, MISSOURI, 1958.

Expectation of increasing irrigation	Grain	Corn	Cotton	Veg- tables	Orchard	Pas- ture	Straw- berries	Soy- beans	Small Grain	Other ¹	Total
	Sor- ghum										
Yes ²	1	59	19	9	10	38	4	8	1	5	154
No ³	1	55	16	22	9	46	6	4	4	4	170
Undecided ⁴ . . .	-	11	4	1	1	--	1	-	-	-	18
Total ⁵	2	125	39	32	20	87	11	12	5	9	6 342

¹Nursery stock, tobacco, and flowers.

²Two irrigators expecting to increase the acreage, but did not report the specified crop.

³Eleven irrigators not expecting to increase acreage, but not reporting the crop now irrigated.

⁴Three irrigators undecided, but not reporting crop now irrigating.

⁵Three irrigators not reporting expectations or the crops irrigated.

⁶One cotton, one orchard, one pasture, and two irrigators of corn not reporting expectations.

It should be kept in mind that the irrigators were asked these questions in the fall of 1958 and the early spring of 1959. Judging by past experience, there is a tendency to base future expectations largely upon present conditions and with irrigation to discount heavily past experience. In the Delta Border Livestock and Cash Crop, and Delta Cotton and Corn areas, where 29 percent of the irrigators are located, 1957 had been an extremely wet year and 1958, a generally favorable year for crop production without irrigation. For these reasons, the opinions expressed may have a downward bias.

FARMERS WHO DISCONTINUED IRRIGATION

Thirty farmers had stopped irrigating their crops. Ten of them had sold their farms and retired. Three had stopped irrigating because of an insufficient water supply; one, because the ground was not level enough for surface irrigation; and 16, because irrigation involved too much labor and the added yields did not cover the additional costs.

FARMERS' QUESTIONS CONCERNING IRRIGATION

The questions asked by many farmers who were irrigating their crops reflected no previous experience with this farming practice. The following inquiries were common: When should I irrigate? How much water should be applied per setting? How can I reduce the labor involved? What is the recommended plant population and fertilizer application when irrigating? How can fuel costs be reduced? What share of the irrigation costs should the landlord bear, when the farm is operated by a tenant? The questions indicate a general lack of available technical information concerning irrigation in Missouri.