

# Part 4. Section A

## Fertilizer and Lime

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# PART 4

## SECTION A. FERTILIZER AND LIME

### GENERAL INFORMATION

Information is presented in this section of part 4 on the tons of fertilizer and lime used and the acres on which they were used for class 1-5 farms. Similar data were not collected for farms with less than \$2,500 value of sales.

are shown in this chapter only when there were comparable data from the 1964 census. Other State and county data for crops fertilized in 1969 can be found in volume I. Where other data on fertilizer and lime can be found is shown below.

### Other Published Data

In addition to information for fertilizer and lime published in this chapter, data for 1969 have been published in volume I and in other chapters of volume II. State data for fertilizer by crops

### Source of Data

Data for acreage fertilized or limed and for tons of fertilizer or lime were obtained in the 1969 Census of Agriculture only for farms with sales of \$2,500 and over (class 1-5). Expenditures for commercial fertilizer and for lime were obtained for all farms; most data for expenditures are shown in part 3 of this chapter. A limited amount of data is shown in this part.

**Table 1. Other Published Data for Commercial Fertilizer**

Where found	Geographical area for which available	Period	Classification	Subject
<b>Volume I</b>				
<b>State tables</b>				
5.....	State.....	1969.....	<u>All Farms</u> Total farms.....	Farms, acres, fertilizer.
9.....	State.....	1969.....	Selected economic class group.....	Farms reporting the use of commercial fertilizer.
<u>Class 1-5 Farms</u>				
14.....	State.....	1969-1959.....	Total farms.....	Farms reporting the use of fertilizer.
21.....	State.....	1969-1959.....	Crops harvested.....	Farms reporting acres fertilized and tons used.
24.....	State.....	1969.....	Tenure of operator and type of organization.....	Farms reporting the use of fertilizer.
25.....	State.....	1969.....	Age of operator.....	Farms reporting the use of fertilizer.
26.....	State.....	1969.....	Farms by size.....	Farms reporting the use of fertilizer.
27.....	State.....	1969.....	Farms by economic class.....	Farms reporting the use of fertilizer.
28.....	State.....	1969.....	Farms by type.....	Farms reporting the use of fertilizer.
29.....	State.....	1969.....	Farms by type and economic class.....	Farms reporting the use of fertilizer.
30.....	State.....	1969.....	Large-scale farms by type.....	Farms reporting the use of fertilizer.
<b>County tables:</b>				
5.....	County and State.....	1969-1964.....	<u>All Farms</u> Total farms.....	Farms reporting the use of commercial fertilizer.
<u>Class 1-5 Farms</u>				
14.....	County and State.....	1969-1964.....	Production expenses.....	Farms reporting the use of fertilizer.
19.....	County and State.....	1969.....	Agricultural chemicals used.....	Farms reporting the use of fertilizer.
20.....	County and State.....	1969.....	Irrigation and commercial fertilizer used on pastureland and harvested crops.....	Farms reporting tons of fertilizer used. Farms reporting tons of fertilizer used.
22.....	County and State.....	1969-1964.....	Farms reporting small grains, soybeans, peanuts, potatoes, tobacco, and cotton.....	Farms reporting crops harvested and fertilizer used.
<b>County tables for miscellaneous items:</b>				
3.....	United States.....	1969.....	<u>Class 1-5 Farms</u> Farms reporting grain, soybeans, peas, and sweetpotatoes.....	Farms reporting crops harvested and fertilizer used.
<b>Volume II:</b>				
Chapter 2.....	United States.....	1969.....	Farms by size.....	Farms reporting fertilizer.
Chapter 3.....	United States.....	1969.....	Age of operator.....	Farms reporting fertilizer.
Chapter 3.....	United States.....	1969.....	Farms by tenure and type of organization.....	Farms reporting acres on which used and expenditures for commercial fertilizer.
Chapter 7.....	United States.....	1969.....	Farms by economic class.....	Farms reporting acres on which used and expenditures for commercial fertilizer.
Chapter 8.....	United States.....	1969.....	Farms by type.....	Farms reporting acres on which used and expenditures for commercial fertilizer.
Chapter 9.....	United States.....	1969.....	Irrigation and Drainage.....	Fertilizer used on irrigated and nonirrigated crops. Farms reporting acres fertilized and tons of fertilizer.

Facsimile of Section 10 (part), Form 69-A1

	Acres harvested	Quantity harvested	Acres irrigated	Acres fertilized	Commercial fertilizer used			
					Dry		Liquid or gas	
					Whole tons	Tenths	Whole tons	Tenths
1. Winter wheat . . . . .	113	1	4	5	6	7	10	10

Description of Report Form Items

For 1969, the report form used for class 1-5 farms contained inquiries regarding the use of commercial fertilizer on 42 specified crops or groupings of crops. The inquiries used were identical for all States other than Hawaii where the more commonly grown crops differed sufficiently to require modification. The farm operator was expected to answer only the fertilizer inquiries which applied to pasture or crop items applicable to his farm or ranch.

A facsimile of the format used to obtain fertilizer information for individually specified crops is shown above.

This format was used for 31 individually specified crops:

- |                               |                          |
|-------------------------------|--------------------------|
| Winter wheat                  | Dry field and seed beans |
| Spring wheat other than durum | Dry lima beans           |
| Durum wheat                   | Dry field and seed peas  |
| Oats for grain                | Cowpeas for dry peas     |
| Barley for grain              | Velvetbeans for beans    |
| Rye for grain                 | Mungbeans for beans      |
| Mixed grains                  | Cotton                   |
| Flaxseed                      | Sugar beets for sugar    |
| Buckwheat                     | Sugar beets for seed     |
| Proso millet                  | Popcorn                  |
| Emmer and spelt               | Broomcorn                |
| Rice                          | Mint for oil             |
| Safflower                     | Irish potatoes           |
| Mustard seed                  | Sweet potatoes           |
| Soybeans for beans            | Tobacco                  |
| Peanuts for nuts              |                          |

A separate format was used for groups of crops and applies to the total of all crops in the section:

	Acres fertilized	Fertilizer used			
		Dry		Liquid or gas	
		Whole tons	Tenths	Whole tons	Tenths
077	078		10	079	10
080	081		10	082	10

This format was used for seven crop groups as follows:

- Section 8—Corn for all purposes
- Section 9—Sorghums for all purposes
- Section 14—Hay or grass silage
- Section 15—Field seeds
- Section 20—Berries harvested for sale
- Section 21—Vegetables, sweet corn, or melons
- Section 23—All other crops

Slight variations of this format were used to obtain data for fertilizer used for cropland pasture, other pasture, land in bearing and nonbearing orchards and for nursery or greenhouse products.

Information on the use of lime was collected by single inquiry on the report form. A facsimile of the inquiry from section 33 of the A1 report form is shown below.

Facsimile of Section 33 (part), Form 69-A1

	Tons used	Acres on which used	Estimated cost (Do not include cost of applying) CENTS NOT REQUIRED	
			Dollars	Cents
			610	611
1. Lime (Do not include land plaster or gypsum or lime for sanitation.)			612	
			\$	

## Data From Prior Censuses

Some data for the cost or tonnage of fertilizer used has been obtained in most censuses since 1880. However, only limited comparable data are available from prior censuses. Data from prior censuses are shown in the report along with that from 1969 for essentially comparable items. Data from 1954, 1959, and 1964 were based on a sample of approximately 20 percent of the farms. A description of the types of fertilizer data collected in censuses since 1880 is shown in table 2.

**Table 2. Summary of Data Covering Fertilizer Obtained for 1969 and Prior Censuses**

	Kind of data obtained
1969.....	Commercial fertilizer used in 1969--Tons separately for dry and liquid fertilizer and acres fertilized for economic class 1-5 farms. There were separate inquiries for cropland used only for pasture, other pasture (not cropland or woodland pasture) and 34 individual crops.  In addition, there were separate inquiries for six crop groups. These crop groups were all hay or grass silage, all field seeds, all land in bearing and non-bearing orchards, all berries, all vegetables, all nursery or greenhouse products, and all other crops. There was a separate question in 1969 for commercial fertilizer purchased for all farms and economic class 1-5 farms.
1964.....	Commercial fertilizer and fertilizing materials in 1964--tons separately for dry and liquid materials and acres on which used. There were separate inquiries for hay and cropland pasture, other pasture (not cropland pasture), and three important crops (the crops varied by State) and for all other crops. There was a separate question in 1964 for expenditure for fertilizer and fertilizing materials.
1959.....	Commercial fertilizer and fertilizing materials in 1959--tons (separately for dry and liquid) and acres on which used. Inquiries were obtained separately for hay and cropland pasture, other pasture (not cropland), three important crops (which varied by States), and for all other crops.
1954 <sup>1</sup> .....	Commercial fertilizer and fertilizing materials in 1954--tons, acres on which used, and cost. Inquiries were obtained separately for hay and cropland pasture; other pasture; two important crops (which varied by States); fruits, vegetables, and potatoes; and for all other crops.
1945 <sup>1</sup> .....	Commercial fertilizer in 1944--cost only.
1940 <sup>1</sup> .....	Quantity and cost of commercial fertilizer bought in 1939.
1930 <sup>1</sup> .....	Quantity of commercial fertilizer bought in 1929. Amount expended was for commercial fertilizer, manure, marl, lime, and limestone. (No separate expenditure data were obtained for fertilizer alone.)
1925 <sup>1</sup> .....	Amount expended in 1924 for manure and fertilizer, including lime and ground limestone. (No separate data were obtained for fertilizer alone.)
1920.....	Amount expended in 1919 for manure and fertilizer.
1910.....	Amount expended in 1909 for manure and other fertilizer.
1900 <sup>1</sup> .....	Amount expended for fertilizer in 1899.
1890 <sup>1</sup> .....	Amount expended for fertilizer in 1889.
1880 <sup>1</sup> .....	Amount expended for fertilizer in 1879.

<sup>1</sup>Alaska and Hawaii not included.

In most censuses since 1925, some data have been collected either on the expenditure for or the use of lime and liming materials. Data from prior censuses are shown when comparable to 1969. Table 3 shows the type of data which have been collected in censuses since 1925.

## DEFINITIONS AND EXPLANATIONS

### Reporting Instructions and Problems

The farm operator was instructed to report for each crop or group of crops, the number of acres that were fertilized in 1969 and the total tons and 10ths of tons of commercial fertilizer

**Table 3. Summary of Data Covering Lime and Liming Materials for 1969 and Prior Censuses**

	Kind of data obtained
1969.....	Tons of lime and liming materials and acres limed for farms reporting 2,500 dollars or more of agriculture products sold and cost of liming materials for all farms. Ground limestone, hydrated and burnt lime, marl, oyster shells, etc. to be included. Lime used for sprays or sanitation to be omitted. Lime furnished under the Agriculture Conservation Programs to be included.
1964 and 1959.....	Tons of lime and liming materials and acres limed. Ground limestone, hydrated and burnt lime, marl, oyster shells, etc., to be included. Lime used for sprays or sanitation to be omitted. Lime furnished under the Agriculture Conservation Program to be included.
1954.....	Lime or liming materials purchased in 1954 (tons and cost) and acres limed. Ground limestone, hydrated and burnt lime, marl, oyster shells, etc., to be included. Lime used for sprays or sanitation to be omitted. Lime furnished under the Agriculture Conservation Program to be included.
1945.....	Cost of lime or liming materials purchased in 1944. Ground limestone, hydrated and burnt lime, marl, oyster shells, etc., to be included. Lime used for sprays or sanitation to be omitted. Lime furnished under the Agriculture Conservation Program to be included.
1940.....	Tons and cost of liming materials--lime, marl, gypsum, etc., bought in 1939.
1930.....	Amount expended in 1929 for commercial fertilizer, manure, marl, lime, and ground limestone. (No separate data for liming materials.)
1925.....	Amount expended in 1924 for manure and fertilizer, including lime and ground limestone. (No separate data for liming materials.)

used in all applications. If more than one application of fertilizer was made, the acreage covered was to be reported only once. Acreage fertilized and tonnage used were to be included on the report form for the farm operator who was operating the land. The fertilizer was to be reported regardless of whether it was purchased by the landlord, tenant, or both jointly.

If two or more crops were harvested from the same land or if one crop was harvested and the land then planted to another crop for harvest next year and both crops were fertilized, then the acreage fertilized and the tonnage used was to be reported for each crop. In the case of wheat and some other crops planted in the fall of 1969 and fertilized at the time of planting, the acreage fertilized may relate to the acreage harvested in 1970 and not to the acreage harvested in 1969.

The tons of fertilizer and lime used shown for class 1-5 farms do not account for the total tons used in the United States. Farms with sales of less than \$2,500, purchased \$102 million tons of fertilizer in 1969. The short form used for such farms did not provide for reporting on which crops the fertilizer was used.

Considerable quantities of fertilizer and lime are used by places such as golf courses, lawns and gardens of homes, places with insufficient agricultural operations to qualify them as census farms, and farms entirely in the soil-bank program. In some of the more urban States, the quantity of fertilizer and lime used by such places represents a significant portion of the total consumed by all users.

It appears that in some instances underreporting of gross tons occurred in the census when farm operators reported the tons of plant nutrients in place of the gross tons. This was most likely to occur in the reporting of liquid fertilizers. For census reports

where this type of error was obvious, a correction was made to the tonnage figures. In cases where the report appeared questionable but possible, telephone calls were made to verify the report or to determine the correct figures. However, in many instances reports which may have been incorrect would fall within the broad limits established for determining acceptability. Reporting errors of this type have resulted in an understatement of the tons of liquid fertilizer used in some areas of the country.

The tonnage of fertilizers shown by the census does not indicate the varying compositions of the fertilizer used and is not an accurate measure of the actual amount of plant nutrients used

for various crops or acres. Plant nutrients measured by the amount of nitrogen, phosphorous, and potassium vary significantly from one type of fertilizer to another. In general, liquid fertilizers have a higher plant nutrient content than most dry fertilizers.

#### Data Processing

Prior to the transfer of data from the A1 report form to computer tapes, a clerical review was made to locate and identify remarks or notations which could significantly affect the data. Often such notations indicated that the farm operator

Table 4. Computer Fertilized Crops

	Corn for all purposes	Rice	Cotton	Sugar beets for sugar	Sugar beets for seed	Popcorn	Mint for oil	Irish potatoes	Sweet potatoes	Tobacco	Land in orchards excluding land in nut trees	Vegeta- bles	Sugar- cane	Pine- apples
<b>New England:</b>														
Maine.....								X	X		X			
New Hampshire.....								X	X		X			
Vermont.....								X	X		X			
Massachusetts.....								X	X		X	X		
Rhode Island.....	X							X			X	X		
Connecticut.....								X		X	X	X		
<b>Middle Atlantic:</b>														
New York.....								X	X		X	X		
New Jersey.....								X	X		X	X		
Pennsylvania.....								X		X	X	X		
<b>East North Central:</b>														
Ohio.....				X	X	X		X	X	X	X			
Indiana.....							X	X	X	X	X	X		
Illinois.....			X	X		X		X	X	X	X			
Michigan.....				X			X	X	X		X			
Wisconsin.....				X			X	X		X	X			
<b>West North Central:</b>														
Minnesota.....				X	X			X	X		X			
Iowa.....				X				X	X		X			
Missouri.....		X	X					X	X	X	X		X	
North Dakota.....				X				X			X			
South Dakota.....				X				X			X			
Nebraska.....				X				X			X			
Kansas.....				X				X	X		X			
<b>South Atlantic:</b>														
Delaware.....								X	X		X			X
Maryland.....								X	X	X	X			X
Virginia.....			X					X	X	X	X			
West Virginia.....								X	X	X	X			X
North Carolina.....			X					X	X	X	X			
South Carolina.....								X	X	X	X			
Georgia.....			X					X	X	X	X			
Florida.....			X					X	X	X	X	X	X	
<b>East South Central:</b>														
Kentucky.....			X					X	X	X	X			
Tennessee.....			X					X	X	X	X			
Alabama.....			X					X	X	X	X			
Mississippi.....		X	X					X	X		X		X	
<b>West South Central:</b>														
Arkansas.....		X	X					X	X	X	X			
Louisiana.....		X	X					X	X	X	X		X	
Oklahoma.....								X	X	X	X			
Texas.....		X		X				X	X		X			
<b>Mountain:</b>														
Montana.....				X	X			X			X			
Idaho.....				X			X	X			X			
Wyoming.....				X			X	X			X			
Colorado.....				X				X			X			
New Mexico.....				X				X	X		X			
Arizona.....			X	X	X			X	X		X			
Utah.....				X	X			X	X		X			
Nevada.....			X	X	X			X	X		X			
<b>Pacific:</b>														
Washington.....				X	X		X	X	X		X			
Oregon.....				X	X		X	X			X			
California.....		X	X	X	X			X	X		X			
Alaska.....								X			X	X		
Hawaii.....								X	X		X		X	X

reported the amount of fertilizer in some unit other than tons and that a conversion was required.

A more precise check was made of the fertilizer and lime figures for each farm report as part of the computer edit. Detailed specifications for the computer provided for a comparison of figures for acres fertilized and tons of fertilizer used to insure that they were within acceptable limits and consistent with figures for other related items on the report form.

For cases in which rate of fertilizer or lime applied per acre were outside of reasonably wide acceptable limits or the tonnage report was missing, the computer specifications provided for deletion of the unacceptable figures and imputation for the missing data. Such imputations were based on an acceptable fertilizer report for the item from another farm.

A limited number of crops are not grown commercially without the use of fertilizer. In order to compensate for the failure of some operators to report use of fertilizer, provision was made in the computer edit to impute data for fertilizer usage if it was not reported for specified crops. In general these crops, shown in table 4 by State, had 95 percent or more of their harvested acreage reported as fertilized in the 1964 Census of Agriculture. Small noncommercial acreage of the crops were excluded from this imputation scheme.

Similarly there are a number of crops which, if irrigated, are expected to be fertilized. The computer provided for imputation of fertilizer usage if there was no report. A list of these crops is shown in table 5 by State.

Table 5. Computer Fertilized Crops if Irrigated

	Corn for all purposes	Sorghums	Winter wheat	Spring wheat	Durum wheat	Barley	Dry field and seed beans	Cotton	Popcorn	Irish potatoes	Sweet potatoes	Hops	Berries	Vegeta- bles	Sweet- corn
<b>New England:</b>															
Maine.....	X														
New Hampshire.....	X													X	
Vermont.....														X	
Massachusetts.....														X	
Rhode Island.....													X		
Connecticut.....	X														
<b>Middle Atlantic:</b>															
New York.....	X						X								
New Jersey.....	X		X	X	X										
Pennsylvania.....	X								X				X		
<b>East North Central:</b>															
Ohio.....	X		X	X	X	X									
Indiana.....	X														
Illinois.....	X								X						
Michigan.....	X													X	
Wisconsin.....	X												X	X	
<b>West North Central:</b>															
Minnesota.....	X														
Iowa.....	X														X
Missouri.....															
North Dakota.....	X													X	
South Dakota.....	X													X	
Nebraska.....	X	X												X	
Kansas.....	X													X	
<b>South Atlantic:</b>															
Delaware.....	X														
Maryland.....	X														
Virginia.....	X														
West Virginia.....	X													X	
North Carolina.....	X														
South Carolina.....														X	
Georgia.....	X													X	
Florida.....	X												X	X	
<b>East South Central:</b>															
Kentucky.....	X														
Tennessee.....	X												X	X	
Alabama.....														X	
Mississippi.....	X													X	
<b>West South Central:</b>															
Arkansas.....	X														
Louisiana.....	X													X	
Oklahoma.....	X	X						X					X	X	
Texas.....								X						X	
<b>Mountain:</b>															
Montana.....										X	X				
Idaho.....	X													X	
Wyoming.....												X		X	
Colorado.....	X	X							X						
New Mexico.....															
Arizona.....	X													X	
Utah.....														X	
Nevada.....	X														
<b>Pacific:</b>															
Washington.....	X		X	X	X										
Oregon.....	X											X		X	
California.....												X	X	X	
Alaska.....													X		
Hawaii.....	X														

## Inconsistency of Published Data

A sizable number of farm operators who failed to report the use of fertilizers did report an expenditure for fertilizer. Reports with an expenditure for fertilizer of \$1,000 and over and with no use of fertilizer reported were reviewed and the necessary corrections were made. For similar cases with an expenditure of less than \$1,000, corrections were not made during the processing. This probably resulted in an understatement of the acreage of crops fertilized and the tons applied.

There are 104 thousand more class 1-5 farms in the United States reporting expenditures for fertilizer than farms reporting acres fertilized and tons applied. These reports accounted for 29.6 million dollars in fertilizer expenditures. Figures for the United States and for each State are shown in table 26.

Based on the average expenditure per ton and the average application rate per acre from those farms reporting tons used and an expenditure, it is estimated that about 270 thousand more tons of fertilizer and about 2.2 million more acres fertilized should have been reported for class 1-5 farms in the census.

## Revisions to Volume I Data

Revisions were required for the data on acreage harvested and production of Irish potatoes and sweetpotatoes, as a result of a processing error which was not found until after the publication of State data in volume I. These revisions resulted in changes being required for the fertilizer data for these crops. Additional information on the acreage and production changes are found in chapter 6 of this volume.

The figures for fertilizer used for Irish potatoes shown in this chapter represent a decrease of 23,923 acres, or 2.0 percent, and 16,418 tons of fertilizer, or 2.4 percent, from the figures shown in volume I. Figures for sweetpotatoes have been decreased by 5,654 acres, or 6.0 percent, and 3,984 tons of fertilizer or 9.0 percent.

An additional revision was required in the total acreage fertilized in 1969. Due to an error in the summation of the individual pasture and crop items which were fertilized, the volume I published total of 156.5 million acres fertilized for the United States has been revised down by 1.3 million acres, a change of 0.8 percent.

## USE OF FERTILIZER

### Summary of Findings

The use of fertilizer was reported by 1.3 million class 1-5 farms in 1969, or about 73 percent of all class 1-5 farms. Pasture and crops totaling 155.2 million acres were reported fertilized on

these farms. On this acreage, 26.2 million tons of fertilizer were applied, or an average of 338 pounds per acre. Of the total tons applied, 79 percent were dry materials and 21 percent were liquid materials.

The 12 States in the North Central Region accounted for one-half of the class 1-5 farms reporting fertilizer use, more than one-half of the acreage fertilized, and 42 percent of tons applied. States in the South having about one-third of the farms with fertilizer and one-third of the acreage fertilized accounted for 40 percent of the tons used.

More than 55 percent of the liquid fertilizer used was reported in the North Central Region. Illinois, Texas, and Iowa, which were the three leading States in the use of liquid fertilizer, accounted for 32 percent of the total.

Table 6 provides the summary of fertilizer used by crop for the United States. Similar data for individual States are shown for all crops in the volume I reports for each State.

Information for the United States from table 6 shows that corn accounted for 31 percent of the total acreage fertilized in 1969 and 36 percent of the tons used. Wheat accounted for almost 16 percent of the acreage fertilized, but only 7 percent of the tons used. Together cropland and improved pasture fertilized represented almost 11 percent of the total acreage fertilized. These proportions differ greatly depending on the region or State.

The proportion of the actual pasture or crop acreage which was fertilized in 1969 shows substantial difference by crop or item. Of the individual crops for which separate fertilizer data are available, the proportion ranges from a high of 99.9 percent for sugar beets to a low of 12 percent for flaxseed. More than 80 percent of the acres of corn, rice, peanuts, sugar beets, Irish potatoes, tobacco, vegetables, and orchards were fertilized.

The rate of application of fertilizer was also significantly different for the various items or crops. The average rate per acre for fertilized acres was 338 pounds. The average rate per acre for the major crops varied from 1,957 pounds for tobacco to a low of 94 pounds for flaxseed. Corn and wheat received applications of 402 and 157 pounds per acre, respectively.

The gross weight measures of fertilizer are not a good measure of the amount of actual plant nutrients applied. Even though two crops have received approximately the same gross-weight application, the plant nutrient content of the fertilizer involved may be significantly different.

The use of liquid fertilizer has been increasing at a rapid rate in recent years. However, this use of liquid fertilizer has not been uniform for all crops. Liquid fertilizer used on corn accounted for more than one-half of the total liquid tons applied in 1969. The proportion of liquid fertilizers used ranged from less than 10 percent of the total tonnage for a number of crops to more than half for sorghums. Table 7 shows the proportion of dry



Class 1-5 Farms

Table 6. Distribution of Fertilizer Use by Crop for the United States: 1969

	Farms reporting use of fertilizer			Acres fertilized		Tons used			Percent distribution of—		
	Total	Percent of class 1-5 farms	Percent of farms using fertilizer	Total	Average per farm reporting	Percent of acreage of crop harvested	Total	Average per farm reporting	Pounds used per acre	Tons used	Ac fertili.
United States, total.....	1,268,840	73.2	100.0	155,219,036	122.4	41.2	26,209,051	20.7	338	100.0	100
Cropland used only for pasture.....	207,752	12.0	16.4	10,197,872	49.1	14.8	1,734,660	8.3	340	6.6	6
Improved pasture.....	76,683	4.4	6.0	6,344,080	82.7	14.5	983,421	12.8	310	3.7	4
Field corn for all purposes.....	680,437	39.2	53.6	47,541,038	69.9	81.4	9,558,347	14.0	402	36.4	30.
Sorghum for all purposes except silup..	108,318	6.2	8.5	9,711,256	89.7	64.1	1,061,702	9.8	219	4.0	6
Wheat.....	337,751	19.5	26.6	24,182,158	71.6	54.9	1,893,562	5.6	157	7.2	15
Oats.....	217,385	12.5	17.1	7,567,859	34.8	46.3	675,198	3.1	178	2.6	4
Barley.....	76,699	4.4	6.0	5,666,279	73.9	63.5	456,576	6.0	161	1.7	3.
Rye.....	13,249	0.8	1.0	415,124	31.3	37.2	47,691	3.6	230	0.2	0.
Rice.....	9,185	0.5	0.7	2,121,724	231.0	99.6	418,696	45.6	395	1.6	1
Mixed grain.....	4,670	0.3	0.4	138,121	29.6	53.2	17,763	3.8	257	0.1	0
Flaxseed.....	4,160	0.2	0.3	299,653	72.0	12.0	14,152	3.4	94	0.1	0
Buckwheat.....	826	(Z)	0.1	15,628	18.9	40.7	1,426	1.7	182	(Z)	(Z)
Proso millet.....	907	0.1	0.1	48,739	53.7	15.4	3,223	3.6	132	(Z)	(Z)
Emmer and smelt.....	3,263	0.2	0.3	36,546	11.2	67.7	4,741	1.5	259	(Z)	(Z)
Peanuts for nuts.....	26,494	1.5	2.1	1,126,033	42.5	81.8	260,073	9.8	462	1.0	0
Safflower.....	615	(Z)	(Z)	200,693	326.3	89.0	26,731	43.5	266	0.1	0
Mustard seed.....	43	(Z)	(Z)	3,589	83.5	46.2	394	9.2	220	(Z)	(Z)
Soybeans for beans.....	136,406	7.9	10.8	9,875,613	72.4	26.5	1,103,718	8.1	224	4.2	6.
Dry field and seed beans.....	12,206	0.7	1.0	808,609	66.2	62.2	101,763	8.3	252	0.4	0.
Dry lima beans.....	261	(Z)	(Z)	26,467	101.4	33.9	3,819	14.6	289	(Z)	(Z)
Dry field and seed peas.....	1,861	0.1	0.1	140,646	75.6	36.1	13,178	7.1	187	0.1	0
Cowpeas for dry peas.....	386	(Z)	(Z)	9,264	24.0	29.7	1,123	2.9	242	(Z)	(Z)
Velvetbeans for beans.....	33	(Z)	(Z)	1,519	46.0	75.5	217	6.6	286	(Z)	(Z)
Mungbeans for beans.....	67	(Z)	(Z)	2,319	34.6	10.0	162	2.4	140	(Z)	(Z)
Cotton.....	108,461	6.3	8.5	8,587,534	79.2	77.6	1,551,627	14.3	361	5.9	5
Sugar beets for sugar.....	17,868	1.0	1.4	1,462,459	81.8	99.9	365,925	20.5	500	1.4	0.
Sugar beets for seed.....	225	(Z)	(Z)	8,249	36.7	99.9	3,207	14.3	778	(Z)	(Z)
Popcorn.....	3,222	0.1	0.3	133,841	41.5	85.2	24,576	7.6	367	0.1	0
Broomcorn.....	224	(Z)	(Z)	22,874	102.1	21.3	1,429	6.4	125	(Z)	(Z)
Mint for Oil.....	970	0.1	0.1	108,163	111.5	99.8	36,120	37.2	668	0.1	0.
Irish potatoes.....	28,270	1.6	2.2	1,245,194	44.0	98.8	675,685	23.9	1,085	2.6	0
Sweet potatoes.....	8,014	0.5	0.6	95,464	11.9	95.5	41,695	5.2	874	0.2	0
Tobacco.....	163,181	9.4	12.9	781,853	4.8	99.1	765,221	4.7	1,957	2.9	0
Hay or grass silage.....	186,429	10.8	14.7	7,917,453	42.5	16.4	1,184,781	6.4	299	4.5	5.
Field seeds.....	9,610	0.6	0.8	720,041	74.9	36.2	134,876	14.0	375	0.5	0
Vegetables, sweet corn, or melons for sale.....	57,103	3.3	4.5	2,918,141	51.1	89.5	1,223,266	21.4	838	4.7	1
Berries for sale.....	7,691	0.4	0.6	94,640	12.3	74.3	33,224	4.3	702	0.1	0.
Land in orchards.....	62,639	3.6	4.9	3,509,298	56.0	87.5	1,357,681	21.7	774	5.2	2
Nursery and greenhouse products.....	11,015	0.6	0.9	208,434	18.9	73.2	102,369	9.3	982	0.4	0
Ginger root <sup>1</sup> .....	31	(Z)	(Z)	38	1.2	86.4	26	0.8	1,368	(Z)	(Z)
Lotus root <sup>1</sup> .....	4	(Z)	(Z)	15	3.8	93.8	10	2.5	1,333	(Z)	(Z)
Wetland taro.....	43	(Z)	(Z)	194	4.5	72.4	172	4.0	1,773	(Z)	(Z)
Dryland taro <sup>1</sup> .....	10	(Z)	(Z)	33	3.3	97.1	39	3.9	2,364	(Z)	(Z)
Pineapples <sup>2</sup> .....	42	(Z)	(Z)	51,237	1,219.9	80.7	20,173	480.3	787	0.1	(
Sugarcane <sup>2</sup> .....	517	(Z)	(Z)	180,221	348.6	75.3	179,123	346.5	1,988	0.7	(
All other crops.....	(NA)	(NA)	(NA)	692,831	(NA)	(NA)	125,490	(NA)	362	0.4	0

<sup>1</sup>Data for Hawaii crops only.

<sup>2</sup>Data for Hawaii crops only; and includes both acres harvested and acres not harvested.

and liquid fertilizers used for some of the major crops on class 1-5 farms.

Of the 1.2 million class 1-5 farms reporting the use of dry fertilizer, 1.1 million or 94 percent used less than 50 tons in 1969. In comparison for liquid fertilizer, 287 thousand of the 426 thousand farms reporting or 67 percent used less than 50

Table 7. Tons of Dry and Liquid Fertilizer Used for Selected Crops: 1969

	Tons of fertilizer			Percent distribution	
	Total	Dry	Liquid	Dry	Liquid
Total.....	22,018,416	16,886,104	5,132,312	76.7	23.3
Cropland pasture.....	1,734,660	1,601,059	133,601	92.3	7.7
Improved pasture.....	983,421	919,154	64,267	93.5	6.5
Corn for all purposes.....	9,558,348	6,573,523	2,984,825	68.8	31.2
Sorghums for all purposes.....	1,061,694	524,592	537,102	49.4	50.6
Wheat.....	1,893,560	1,453,273	440,287	76.8	23.3
Oats.....	675,185	629,313	45,872	93.2	6.8
Barley.....	456,567	356,762	99,805	78.1	21.9
Rice.....	418,696	392,377	26,319	93.7	6.3
Soybeans for beans.....	1,103,715	1,014,552	89,163	91.9	8.1
Cotton.....	1,551,625	1,096,838	454,787	70.7	29.3
Vegetables.....	1,223,264	1,049,525	173,739	85.8	14.2
Land in orchards.....	1,257,681	1,275,136	82,545	93.9	6.1

tons. Table 8 shows the distribution of farms reporting dry and liquid fertilizer on class 1-5 farms.

Table 8. Farms Reporting Use of Dry and Liquid Fertilizer by Amount Used: 1969

	Farms reporting		Percent distribution	
	Dry fertilizer	Liquid fertilizer	Dry	Liquid
Total.....	1,209,250	425,709	100.0	100.0
1 to 49 tons.....	1,134,815	286,893	93.8	67.4
50 to 99 tons.....	50,619	119,971	4.2	28.2
100 to 199 tons.....	16,948	13,040	1.4	3.1
200 to 499 tons.....	5,612	4,333	.5	1.0
500 to 999 tons.....	812	1,228	.1	.3
1,000 tons and over.....	444	244	( <sup>1</sup> )	.1

<sup>1</sup>Less than .05 percent.

Data by class of farm show that the larger and more productive farms fertilize a higher proportion of the crops harvested than less productive farms. The more productive farms also applied a higher rate of fertilizer per acre than did the farms with less sales. A similar pattern can be found in the average yield per acre for most crops among the various classes of farms. (See table 9.)

**Table 9. Proportion of Harvested Acres Fertilized for Selected Crops by Class: 1969**

	Total	Proportion of harvested acres fertilized				
		Class 1	Class 2	Class 3	Class 4	Class 5
Corn for all purposes.....	81.4	90.1	83.0	74.8	66.5	63.5
Sorghums for all purposes.....	64.1	73.2	65.7	59.0	51.6	44.4
Wheat.....	54.9	62.8	59.2	51.4	43.2	39.0
Oats.....	46.3	56.2	50.0	42.0	36.6	35.4
Barley.....	63.5	72.0	63.8	56.8	50.2	44.1
Soybeans.....	26.5	28.1	25.3	25.2	26.7	27.7
Peanuts.....	81.8	87.2	84.3	80.8	70.2	60.9
Cotton.....	77.6	99.1	77.5	68.1	62.7	57.0
Irish potatoes.....	98.9	99.3	98.6	97.6	94.1	90.1
Tobacco.....	99.1	99.0	99.1	99.1	99.2	98.9
Hay crops.....	16.4	22.9	16.4	12.3	12.3	13.7
Vegetables.....	89.5	91.9	87.1	83.6	80.0	79.6
Land in orchards.....	87.5	91.7	87.5	82.8	79.5	76.5

**Changes From Prior Censuses**

Increased fertilizer use probably has contributed greatly to the phenomenal gains in yields for many crops. Information on extent and level of fertilizer use provides important measures of changes in farm technology as well as a basis for projecting changes in crop yields and crop production.

According to data shown in table 10, the number of farms reporting fertilizer has decreased in each of the last three censuses; however, the percent of all farms has increased. Much of this decrease is accounted for by the decrease in total farms.

**Table 10. All Farms Reporting Fertilizer Used or Purchased: 1909 to 1969**

	Total	Increase or decrease (-) over preceding censuses		Percent of all farms
		Farms	Percent	
1969.....	1,953,510	-270,207	-12.2	63.9
1964.....	2,223,717	-154,737	- 6.5	60.0
1959.....	2,378,454	-537,952	-18.4	49.7
1954.....	2,916,406	336,135	13.0	54.1
1944.....	2,580,271	243,240	10.4	44.0
1939.....	2,337,031	12,941	0.6	38.3
1929.....	2,324,090	140,034	6.4	36.9
1924.....	2,184,056	- 87,123	- 3.8	34.3
1919.....	2,271,179	448,147	24.6	35.2
1909.....	1,823,032	-	-	28.6

The tonnage of fertilizer used on class 1-5 farms increased over 20 percent from 1964 to 1969. The quantity of fertilizer used in 1969 was almost one and three-quarters times the amount used 15 years earlier, and 50 percent more than the amount used 10 years earlier. In addition, sources other than the census data indicate that the primary plant nutrient content of commercial fertilizer has been increasing at a rapid rate during this time period. Census data show that much of the additional tonnage of fertilizer is being applied to crops in areas which in the past have not used extensive amounts of fertilizer. For

**Class 1-5 Farms Table 11. Tons of Fertilizer Used: 1954 to 1969**

	Total	Increase or decrease (-) over preceding census	
		Tons	Percent
1969.....	26,229,465	4,806,770	22.4
1964.....	21,422,695	4,040,410	23.2
1959.....	17,382,285	2,480,868	16.6
1954.....	14,901,417	-	-

example, there were large increases in the acreages fertilized for sorghums and soybeans between 1964 and 1969. Table 11 shows changes in total tons of fertilizer used on class 1-5 farms since 1954.

There has been a significant increase in the use of liquid fertilizing materials in recent years. Liquid fertilizing material used on class 1-5 farms in 1969 totaled 5.6 million tons, compared with 3.0 million tons used in 1964. The data show an increase in the tonnage of liquid materials in each of the 50 States between 1964 and 1969. Table 12 presents the changes in tonnage used for class 1-5 farms since 1959.

Three-fifths of the total increase of 2.6 million tons of liquid fertilizer between 1964 and 1969 were applied to corn. Other crops such as wheat and sorghums for which comparable data are available also showed substantial increases in the use of liquid fertilizers.

**Table 12. Tons of Dry and Liquid Fertilizer Used: 1959 to 1969**

	Tons of fertilizer		Increase or decrease	
	Dry	Liquid	Dry tons	Liquid tons
1969.....	20,647,890	5,561,161	2,194,253	2,592,103
1964.....	18,453,637	2,969,058	2,628,107	1,412,202
1959.....	15,825,530	1,596,755	-	-

**Use on Selected Crops**

There are four items on usages of fertilizer for which comparable data are available for class 1-5 farms for the past four censuses. These items, together with the pertinent data, are shown in table 13.

**Class 1-5 Farms Table 13. Crops Fertilizer Data Collected on Entire Acreage: 1954 to 1969**

	Hay and cropland pasture	Improved pasture	Corn	Cotton	All crops
<b>Farms using fertilizer</b>					
(1,000).....1969..	(NA)	77	680	108	1,269
.....1964..	396	117	939	182	1,438
.....1959..	339	103	1,020	200	1,489
.....1954..	342	95	1,033	190	1,465
<b>Acres fertilized</b>					
(1,000).....1969..	18,115	6,344	47,541	8,588	155,249
.....1964..	14,625	5,331	47,287	9,765	140,934
.....1959..	11,528	3,770	45,457	7,237	120,001
.....1954..	10,314	3,225	36,586	6,602	99,209
<b>Tons fertilizer used</b>					
(1,000).....1969..	2,919	983	9,558	1,552	26,229
.....1964..	2,255	819	7,205	1,872	21,423
.....1959..	1,852	619	5,879	1,328	17,382
.....1954..	1,559	488	4,622	1,164	14,901
<b>Average pounds used per acre.....</b>					
.....1969..	322	310	402	361	338
.....1964..	308	307	305	383	304
.....1959..	321	328	259	367	290
.....1954..	302	303	253	353	300

These four crops accounted for 52 percent of the total acreage fertilized in 1969, compared to 55 percent in 1964, 57 percent in 1959, and 57 percent in 1954. The fertilizer used on these crops represented 57 percent of all the fertilizer used in 1969, 58 percent in 1964, 57 percent in 1959, and 53 percent in 1954. The increase in the tons of fertilizer used on these crops accounted for 2.7 million tons of the 4.8 million tons increase

in fertilizer used from 1964 to 1969, 2.6 million tons of the 4 million ton increase in the tons of fertilizer used from 1959 to 1964, and 7.2 million tons of the 11.3 million ton increase in the tons of fertilizer used from 1954 to 1969.

The decrease in the acres fertilized and tons of fertilizer used on cotton was a result of the decrease in acres of cotton harvested, while the increase in the tons of fertilizer used on hay and cropland pasture and other pasture was largely due to the increases in acres fertilized. The acreage of corn fertilized has increased slightly from 1964 to 1969, but the tonnage increased by almost one-third. The largest increase in acres fertilized and tons of fertilizer used on crops from 1964 to 1969 has been on wheat, sorghums for all purposes, soybeans, and barley.

For 1964 to 1969, the average number of pounds per acre applied to all crops increased 10 percent. The rate for corn increased by about one-third. Increases in the plant nutrient content of the fertilizers may be a more important factor in the increased productivity in crop production than changes in gross tonnage applied.

For crops in States for which comparable data are available from prior censuses, the most significant increases in the use of fertilizer occurred for sorghums and soybeans. The comparable data for five selected crops are shown in table 14.

Table 14. Acres Fertilized for Selected Crops: 1959 to 1969

	Acres fertilized <sup>1</sup> (1,000)			Tons (1,000)		
	1969	1964	1959	1969	1964	1959
Wheat.....	21,218	21,860	16,520	1,547	1,591	1,287
Sorghums.....	8,542	6,306	2,303	865	485	151
Soybeans for beans.....	7,663	4,507	2,543	831	469	257
Tobacco.....	586	669	647	583	612	521
Irish potatoes.....	1,001	957	857	525	487	443

<sup>1</sup>Represents totals for States for which comparable data are available for the three censuses.

### Use on Irrigated and Nonirrigated Farms

There was a total of 32.1 million acres of crops fertilized on class 1-5 irrigated farms in 1969. This acreage accounted for over 20 percent of the total acres fertilized in the United States. Also, there was a total of 6.6 million tons of fertilizer used on class 1-5 irrigated farms in the United States. This was over 25 percent of the total tons of fertilizer applied in 1969. Data for fertilizer use on irrigated and nonirrigated farms are shown in the following table.

Table 15. Use of Fertilizer on Irrigated and Nonirrigated Farms: 1969

	Acres harvested	Acres irrigated	Acres fertilized	Tons of fertilizer applied	
				Dry	Liquid
Irrigated farms					
United States...	50,385,527	33,059,581	32,101,023	4,920,321	1,717,978
The Northeast.....	426,544	175,891	377,085	198,107	7,531
The North Central..	10,252,965	4,853,616	6,347,683	442,227	451,601
The South.....	17,336,632	9,719,848	12,354,918	2,285,868	533,835
The West.....	22,369,395	18,310,229	13,021,340	1,994,119	725,010
Nonirrigated farms					
United States...	2,139,326,770	(X)	106,600,294	13,231,962	3,645,924
The Northeast.....	8,152,544	(X)	4,157,490	956,168	50,821
The North Central..	143,636,265	(X)	70,642,548	7,105,258	2,575,786
The South.....	47,444,424	(X)	25,984,763	4,865,111	881,023
The West.....	14,699,727	(X)	5,815,500	305,426	138,292

Over 63 percent of the crops harvested on irrigated farms are fertilized as compared to less than 50 percent of the crops harvested on nonirrigated farms. Also, there were 413 pounds per acre of fertilizer applied to crops on irrigated farms as compared to 316 pounds per acre of fertilizer applied to nonirrigated farms in 1969. There is a substantial difference in the fertilizer application rate per acre between regions for crops on both irrigated and nonirrigated class 1-5 farms. (See table 16.) For additional information see chapter 9.

Table 16. Fertilizer Usage on Crops Harvested on Irrigated and Nonirrigated Farms: 1969

	Irrigated farms			Nonirrigated farms	
	Percent of crops irrigated	Percent of crops fertilized	Pounds of fertilizer applied per acre	Percent of crops fertilized	Pounds of fertilizer applied per acre
United States.....	65.6	63.7	413.6	49.8	316.7
The Northeast.....	41.2	88.4	1,090.7	51.0	484.4
The North Central.....	47.3	61.9	282.0	49.2	274.1
The South.....	56.1	71.3	456.5	54.8	442.3
The West.....	81.9	58.2	417.6	39.6	152.6

### USE OF LIME AND LIMING MATERIALS

In 1969, about one out of 10 class 1-5 farms reported the use of lime and liming materials. Both the number of class 1-5 farms and the proportion of farms reporting the use of lime have decreased since 1964. The proportion of farms using lime has decreased from 19.8 to 15.0 percent. In 1969, 262 thousand class 1-5 farms reported 10.1 million acres limed and 18.7 million tons of lime used.

States in the North Central Region accounted for 42.6 percent of the acreage limed on class 1-5 farms, but because of a heavier rate of application per acre, these States account for 56.9 percent of the total tons used. The three leading States in tons of lime used were Illinois, Missouri, and Iowa. They accounted for 37.8 percent of the total tons on class 1-5 farms.

Of the 262 thousand class 1-5 farms reporting the use of lime, over one-half used less than 50 tons in 1969. About 10 percent of the farms used 500 tons or more. As shown in table 17, the distribution of farms by the tonnage of lime used varied by region.

Table 17. Percent Distribution of Farms Reporting by Tons of Lime Used: 1969

	United States	Northeast	North Central	South	West
Total.....	100.0	100.0	100.0	100.0	100.0
1 to 49 tons.....	56.5	72.5	43.4	65.8	73.0
50 to 99 tons.....	22.5	17.8	27.9	18.3	13.1
100 to 199 tons.....	13.8	7.5	18.7	10.3	8.0
200 to 499 tons.....	6.1	2.0	8.6	4.6	4.3
500 to 999 tons.....	0.8	0.2	1.1	0.7	1.1
1,000 tons and over.....	0.2	( <sup>1</sup> )	0.2	0.3	0.5

<sup>1</sup>Less than 0.05 percent.

The tons of lime and liming materials used on class 1-5 farms in 1969 were 12.9 percent less than in 1964 while the acreage limed decreased 5.5 percent. The decrease from 1964 to 1969 in tons of lime and liming materials used was largely the result of

decreases in the following seven States: Illinois, Indiana, Michigan, New York, Ohio, Pennsylvania, and Wisconsin. (See table 18.)

It should be noted that class 1-5 farms do not account for all of the lime used for farm purposes. About 94,000 farms with sales of farm products of less than \$2,500 in 1969 reported the purchase of \$9.6 million of lime and liming materials. Using the average price paid for lime on class 1-5 farms, it is estimated that these farms with sales of less than \$2,500 probably used about 1.9 million tons of lime in 1969.

Data for expenditures for all farms in 1969 indicated that 356 thousand farms purchased lime or liming materials. Adding the

tons of lime reported on class 1-5 farms and the estimated tons as calculated from expenditures for lime reported on the remaining farms, it is estimated that 20.6 million tons of lime were used on farms in 1969.

**Table 18. Lime and Liming Materials Used: 1954 to 1969**

Class 1-5 Farms	Farms reporting		Tons of lime and liming materials	
	Number	Percent increase or decrease (-) over preceding census	Total	Percent increase or decrease (-) over preceding census
1969 .....	262,122	-27.0	18,650,044	-12.9
1964 .....	359,193	6.9	21,402,874	28.2
1959 .....	336,017	-5.7	16,697,436	16.1
1954 .....	356,152	-	14,382,368	-