
FERTILIZER USE

Columbia Basin Wheat-Summerfallow Area

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Summary

Fertilizer practices vary greatly from farm to farm and experiences of farmers with fertilizer use also show great differences. This was brought out by the results of a mail inquiry sent to approximately half of all wheat producers in the wheat-summerfallow area. Replies received represent a cross section of major types and sizes of farm operations and existing natural conditions.

Three out of four farmers who had used fertilizers reported satisfactory results. The remainder either had insufficient experience for judging, questioned its merits, or decided to discontinue its use because of unsatisfactory results.

Six out of ten farmers replying to the mail inquiry were using fertilizers in 1956. First trials were made in western Umatilla and Wasco Counties on medium and small farms. At present, large-scale operators are the most numerous users.

Acreage fertilized in 1956 was slightly smaller than in 1955 when 55 per cent of all wheat in the wheat-summerfallow area received fertilizers.

Applications were made chiefly in the fall shortly before or at seeding time. Split applications in the fall and spring were more common in 1956 than in 1955 because of an increase in soil moisture during the winter months.

Gaseous fertilizers were more commonly used than dry materials or liquids, and the usual rate of application was 30-40 pounds of nitrogen per acre. Applications of less than 30 pounds were reported more frequently than those of 40 pounds or more.

Fertilizer use in wheat production in low rainfall areas is relatively new, and only limited knowledge is available to insure best results on individual farms.

¹/ Agricultural Economist, Farm Economics Research Division, Agricultural Research Service, U. S. Department of Agriculture. This report is part of a larger research project, dealing with production adjustments on wheat farms, carried on cooperatively by the Department of Agricultural Economics, Oregon State College and Agricultural Research Service, U. S. Department of Agriculture.

Farmer Experiences With Fertilizer Use

Varying conditions from farm to farm make it practically impossible to summarize farmers' experiences with fertilizers in such a way that conclusions generally helpful to others can be drawn. In addition to providing specific data on types, rates of application, etc., a large number of farmers related their experiences. Some indicate the major considerations in applying fertilizer.

Many farmers pointed out or implied that soil moisture is probably most important. Available moisture prior to seeding as well as that expected or received during the growing season is, according to their experiences, of the utmost importance in determining success or failure. Texture and depth of soil are almost as important. A combination of these is uppermost in the minds of farmers when they decide whether or not to fertilize, how much to apply, when to apply it, and what materials to use.

Those who have used fertilizers for some time realize that the mere application of fertilizers, even under favorable conditions, does not always insure a sufficient increase in yield to cover costs. They feel that fertilizer application should be geared to good production practices, and particularly to the method of handling summerfallow. Careful consideration should be given to fertilizer use in connection with the method of incorporating crop residue into the soil. Beneficial effects of storing moisture and helping to prevent soil erosion are considered by some to be of equal value to the increase in yield obtained.

Some experiences appeared to be contradictory. For example, some reported fertilized wheat yielded more grain with insufficient moisture. Others working under similar moisture conditions reported there was more straw on fertilized land, but the yield of grain was lower than on unfertilized ground which yielded plump kernels. Some reported earlier maturity of fertilized wheat, others said maturity was delayed. Experiences with nitrogen in relation to soil moisture, texture, depth of soil, and the method of handling summerfallow appear different for different farmers.

Yield increases for most farmers ranged from 6 to 15 bushels per acre. A few reported yield increases did not cover costs involved. There were also instances of a yield-depressing effect of fertilizer. About 3 out of 4 farmers (77 per cent) who used fertilizer and commented on their experiences had satisfactory results. However, 1 in 10 of these farmers would not apply fertilizer to shallow land. About 1 out of 8 farmers (12 per cent) were still experimenting. In 1956, they had either test plots or made the first large-scale attempt to use fertilizer. Thus, they were withholding judgment about its merits. About 1 out of 9 farmers (11 per cent) questioned the benefits of fertilizer on the basis of their experience (5 per cent), or had unsatisfactory results and decided to discontinue its use (6 per cent).

Of the farmers who had not used fertilizer in the past, 90 per cent made no comment or gave no indication of future plans to use fertilizer. A few were opposed to increasing yields because of the wheat surplus. The remaining 10 per cent intended to use fertilizer in the future. Some of these would like more information before making a decision. In general, it appears that farmers who have not used fertilizers are located in areas where greater-than-normal risk is involved.

Extent of Fertilizer Use

About 6 out of 10 farmers (61 per cent) had used nitrogen fertilizers during the past 15 years (table 1). Only a few are not making this a regular practice now. Number of farmers using fertilizer was highest in Wasco County, followed by western Umatilla County. It was lowest in Morrow County, where apparently soils and climate are less favorable. Of farms having less than 720 acres of cropland (small wheat farms), 58 per cent used fertilizers. Of medium-sized farms (721 to 1,440 acres of cropland), 54 per cent reported fertilizer use. A large number of medium-large and large farms have used fertilizers in the past--77 and 74 per cent respectively.

TABLE 1. Date of First Fertilizer Trials

Item	Prior to 1946	1946 to 1949	1950 to 1953	1954 to 1956	All farms in sample using fertilizer	
	Per cent	Per cent	Per cent	Per cent	Number	Per cent
County						
Wasco.....	1.6	16.4	41.0	41.0	61	74.4
Sherman.....	--	3.2	54.9	41.9	31	54.4
Gilliam.....	--	3.8	46.2	50.0	26	60.5
Morrow.....	--	6.7	43.3	50.0	30	47.6
Western Umatilla	2.1	10.6	63.8	23.4	47	64.4
Size of Farm*						
Small farms (720 acres and under).....	1.4	8.1	55.4	35.1	74	57.8
Medium farms (721 to 1,440 acres)	1.7	12.3	47.4	38.6	57	53.8
Medium-Large farms (1,441 to 2,400 acres).....	--	4.9	43.9	51.2	41	77.4
Large farms (2,401 acres and over).....	--	17.4	47.8	34.8	23	74.2
Total all farms.....	1.0	9.7	49.8	39.5	195	61.3

* Basis of total cropland per farm.

The reason for this difference in the use of fertilizer by areas and size of farm may be found partly in the better financial ability of larger operators to incur the cost and risk involved. It is also the result of size distribution of farms within the area in relation to soil quality and climate. Farmers with insufficient rangeland to support a cattle enterprise in connection with their wheat production more often reported fertilizer use than those with necessary resources for a livestock enterprise.

Approximately half of all farmers who used fertilizer in the wheat-summerfallow area made their first trials from 1950 to 1953, the four years immediately preceding the acreage allotment program (table 1).

Prior to 1950 only a few farmers (11 per cent of the total) had used fertilizer. First trials were made in western Umatilla and Wasco Counties on farms of moderate size. Large farms soon followed in accepting this practice. From 1954 to 1956, the number of farmers using fertilizer for the first time continued to increase, particularly in Gilliam and Morrow Counties, on farms classified medium-large.

Even after initial trials, most farmers do not fertilize their entire wheat acreage. Application is usually limited to that portion of the wheat acreage where response is expected to be greatest and risk is lowest. Differences in soil and moisture conditions between fields, quantity of straw residue, and funds available are some of the reasons why less than the entire wheat acreage is fertilized on most farms. With change in summerfallow practices, particularly the handling of straw, the trend in recent years has apparently been toward fertilizing all summerfallow land for wheat and barley.

The proportion of wheat acreage fertilized on farms whose operators used fertilizer from 1952 to 1956 is shown in table 2 by counties. Note that data obtained do not indicate a consistent trend in individual counties or for the area as a whole. The only conclusion that may be drawn is that farmers in Wasco, Sherman, and western Umatilla Counties fertilize a large part of their wheat acreage more consistently than do those in Gilliam and Morrow Counties. The number of farmers who reported this information for the early years of the period 1952 to 1956 was small, and this raises some doubt as to the representativeness of the data for these years.

TABLE 2. Wheat Acreage Fertilized on Farms Using Fertilizers

County	Year				
	1952	1953	1954	1955	1956
	<u>Per cent</u>	<u>Per cent</u>	<u>Per cent</u>	<u>Per cent</u>	<u>Per cent</u>
Wasco.....	46.4	80.5	89.8	96.2	92.6
Sherman.....	49.3	76.2	71.3	84.6	80.0
Gilliam.....	87.1	55.8	54.5	52.1	82.3
Morrow.....	39.9	50.8	49.9	41.8	35.9
Western Umatilla.	74.2	75.6	83.5	82.4	79.8
All farms.....	63.1	69.0	71.1	69.8	73.3

More reliable information was obtained for the wheat crops of 1955 and 1956. Because of the larger number of farmers who gave detailed information for these two years, the sample is considered sufficiently reliable to permit conclusions about the total wheat acreage fertilized. The 1955 and 1956 wheat acreage in the wheat-summerfallow area that received nitrogen fertilizer has been estimated by counties in table 3. These estimates indicate that a slightly larger total acreage of the 1955 crop was fertilized than of the 1956 crop. In any case, more than half the acreage seeded to wheat in the area is fertilized at present. The proportion varies from about 20 per cent in Morrow County to about 80 per cent in western Umatilla County.

TABLE 3. Estimated Acreage of 1955 and 1956 Wheat Crops Fertilized

County or area	Sample		County or area	
	Total wheat acreage	Proportion of acreage fertilized	Total wheat acreage*	Fertilized**
	<u>Acres</u>	<u>Per cent</u>	<u>Acres</u>	<u>Acres</u>
<u>1955 Crop</u>				
Wasco.....	14,416	68.65	64,000	43,900
Sherman.....	14,246	58.47	94,000	55,000
Gilliam.....	13,716	44.47	91,000	40,500
Morrow.....	17,260	20.91	114,000	23,800
Western Umatilla..	17,077	84.49	127,000***	107,300
Total area.....	76,715	55.11	490,000	270,500
<u>1956 Crop</u>				
Wasco.....	14,273	65.15	62,000	40,400
Sherman.....	13,465	68.04	91,000	61,900
Gilliam.....	16,628	47.73	87,000	41,500
Morrow.....	17,815	20.85	116,600	24,300
Western Umatilla..	17,399	77.77	126,400***	98,300
Total area	79,580	54.84	483,000	266,400

* Latest estimates of total wheat acreage compiled by the Crop Reporting Service, U. S. Department of Agriculture and Oregon State Extension Service, except for western Umatilla County.

** Percentage of acreage fertilized as shown for the sample applied to wheat acreage in the county. Area total is addition of county figures.

*** Estimated from county allotment for communities included in the wheat-summerfallow area.

Normally fertilizer is applied during the fallow year, only a few farmers use it in the spring. Three farmers applied fertilizer when the land was reseeded to spring wheat. The relative importance of the various seasons in fertilizer application is given in table 4 for the 1955 and 1956 wheat crops. Split applications were unimportant in 1955, but were reported more often in 1956. The reason for this is that ample precipitation during the winter of 1955-56 changed the moisture situation from deficiency to abundance, and made additional applications in spring 1956 advisable on many farms. Most farmers made a single application at the time of seeding or shortly before. No doubt many factors influence the time of application. Type of material applied and the desire to combine application with other field operations are important in this connection. No information was available to indicate the reasons for choosing certain seasons in which to apply fertilizer.

TABLE 4. Number of Farmers Reporting Specified Seasons of Fertilizer Application

Item	1955 Crop		1956 Crop	
	Number	Per cent	Number	Per cent
<u>Single Application</u>				
Fallow year:				
Spring.....	40	26.7	41	25.0
Summer.....	17	11.3	22	13.4
Fall.....	87	58.0	76	46.4
Crop year:				
Spring.....	3	2.0	5	3.1
<u>Split application</u>				
First application, Fallow year:*				
Spring.....	--	--	3	1.8
Summer.....	--	--	4	2.4
Fall.....	3	2.0	13	7.9
Total number of farmers reporting....	150	100.0	164	100.0

* For split applications, only the time of first application is of significance. The second application is always made in the spring of the crop year.

Type of Fertilizers Used and Rate of Application

Experiments conducted in the wheat-summerfallow area over a number of years^{1/} have demonstrated that of the major fertilizer materials, nitrogen is the element which under generally favorable conditions will give an appreciable increase in yield. On a few farms, sulfur and other elements may be needed. Furthermore, numerous experiments have indicated that nitrogen from all common sources has similar effects on yield, if each source is applied in accordance with its peculiar properties. Response varies primarily with the amount of nitrogen in the fertilizer material.

In view of these findings, the types of fertilizers reported used by farmers have been summarized (table 5) into dry materials, liquids, and gases. These main groupings influence the method of application, and to some extent the time of application.

^{1/} Wheat Fertilization Experiments in the Columbia Basin. Progress Report 1953-55.
A. S. Hunter, C. J. Gerard, H. M. Waddoups, W. E. Hall, H. E. Cushman, L. A. Alban.
Oregon Agricultural Experiment Station Circular of Information 570, March 1957. Also unpublished data, same authors, 1955-56 crop season.

TABLE 5. Types of Fertilizer Used and Rates of Application

Type or material	Farms reporting	Acreage fertilized		Pounds of actual nitrogen		Average rate of nitrogen per acre
		Total	Per cent of total	Total	Per cent of total	
	Number	Acres	Per cent	Pounds	Per cent	Pounds
1955 Wheat Crop						
Dry materials	62	13,655	28.9	483,563	33.0	35
Liquids	13	3,329	7.0	96,115	6.5	29
Gases	80	30,315	64.1	887,494	60.5	29
All types	155	47,299	100.0	1,467,172	100.0	31
1956 Wheat Crop						
Dry materials	57	11,344	24.8	286,020	23.5	25
Liquids	31	6,995	15.3	202,911	16.6	29
Gases	76	27,420	59.9	729,651	59.9	27
All types	164	45,759	100.0	1,218,582	100.0	27

Changes in acreages fertilized by different materials or in total amount of nitrogen used in the area may not indicate definite trends from one type of material to another when 1955 is compared with 1956. Availability of different materials in local areas, prices, and conditions on individual farms may cause great yearly variations.

Rate of application also shows some differences from one year to the next. This may be explained partly by moisture available at the time of applying fertilizers. Most farmers reported applications of 30 to 40 pounds of nitrogen per acre. Very few applied more than 40 pounds while a considerable number applied less than 30 pounds. Practically all farmers vary the rate from year to year. They decide on the basis of quality and depth of soil, amount of crop residue, available resources, price of fertilizer materials, and cost of application. When financial resources restrict the use of fertilizers, most farmers are inclined to apply a lower rate on a larger acreage than a higher rate on a limited acreage. This procedure, generally speaking, has considerable merit from the viewpoint of crop response to different rates of application (the shape of the response curve) as shown by experimental results^{1/}. It is also advisable because of the higher risk involved in heavy applications in view of the uncertainty as to moisture conditions during the growing season.

Should Farmers Fertilize Wheat?

Fertilizer application is one of many technological improvements which wheat farmers in the Columbia Basin have adopted during the past two or three decades. Others are modern equipment, better varieties, improved practices, and various other innovations, which also have helped to lower costs per unit of production. All these have contributed greatly to the maintenance of net farm income despite acreage reductions in recent years.

^{1/} Data prepared by W. G. Brown, Department of Agricultural Economics. This study will be printed soon as an Experiment Station Bulletin.

There is no doubt that many of these improvements have also aggravated our wheat surplus situation. For this reason, farmers as well as the general public, often believe there is a conflict between the interest of the individual farmer and the wheat industry as a whole in its efforts to alleviate the surplus problem.

In their effort to maintain a level of living comparable to other occupations, individual farmers cannot afford to neglect technological improvements that will lower the cost per unit of output. This is particularly true in times of acreage restrictions and increasing severity of the so-called cost-price squeeze. The result of the adoption of improved practices on individual farms, however, is increased wheat production at a time when this crop is in surplus supply.