

Three-Hopper Truck Fertilizer Spreaders— *An Economic Evaluation*



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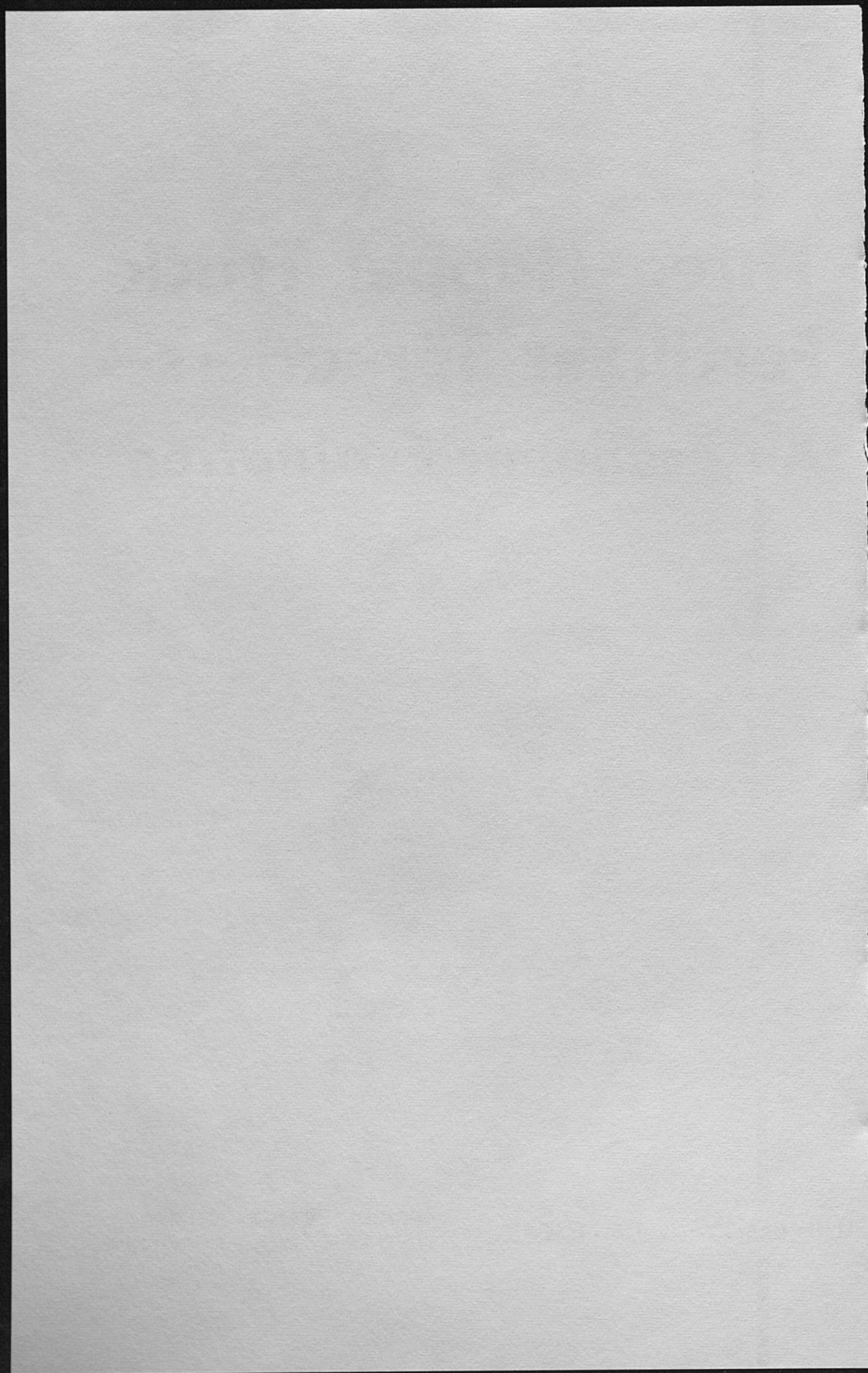
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SUMMARY

Custom service using a three-hopper truck fertilizer spreader generally provides a convenient method of fertilizer application; reduces the need for farm labor, machinery, and capital investment; and results in lower cost for fertilizer applications.

Results of the survey reported in this publication show that the cost per acre of owning and operating a three-hopper truck spreader decreased as more acres were fertilized annually. For example, when 1,000 acres were fertilized, the cost per acre was \$2.30; however, when 4,000 acres were fertilized, the cost per acre was reduced to \$0.96.

The most usual custom rate charged in 1960 for use of the three-hopper truck spreader was \$1.50 per acre. A dealer making that charge needed to fertilize about 1,800 acres annually to pay all costs.

Equivalent amounts of primary plant nutrients (nitrogen, phosphorus, and potassium) were usually purchased by farmers for less in straight materials than in mixtures in 1960. The savings ranged from \$7.20 to \$12.60 per ton for the three most popular grades used in Kentucky.

If the average-size farm of 132 acres in the 12-county study area had been fertilized at recommended rates in 1960, the 94.1 acres of cropland could have been fertilized with a three-hopper truck spreader using straight materials for \$167.25 less per year than with a farmer's spreader using mixed fertilizer—a saving of \$1.78 per acre.

“Lower cost of applying fertilizer,” “saves labor,” and “saves time” were advantages most frequently mentioned by farmers who had used the three-hopper truck spreader service. Disadvantages most frequently mentioned were “difficulty in spreading on wet ground,” “truck packs ground,” and “obtaining service at the desired time.” Thirty percent of the farmers saw, however, no disadvantage in using the service.

Three-Hopper Truck Fertilizer Spreaders—An Economic Evaluation

By JOE E. FUQUA and HAROLD G. WALKUP¹

New fertilizer materials, higher application rates, and the need for labor efficiency have encouraged the development of new methods of fertilizer application. The three-hopper truck fertilizer spreader is one of the new methods. These spreaders simultaneously apply up to three straight fertilizer materials in any combination of primary plant nutrient ratios.

A forerunner of the three-hopper truck spreader, a pull-type three-hopper spreader introduced in Kentucky in 1950, was used mainly by fertilizer dealers and custom operators and by some farmers with large acreages.²

Three-hopper truck spreaders were introduced in Kentucky in 1958. Cost and capacity usually limit ownership to fertilizer dealers for custom operation.

Economic evaluation of three-hopper truck fertilizer spreaders, the subject of this report, was begun in Kentucky in 1961. Objectives were to determine: (1) cost to dealers of owning and operating a three-hopper truck as a custom service, (2) cost to farmers of using the custom service in relation to other methods of spreading fertilizer, and (3) farmers' opinions of the three-hopper truck spreading service.³

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² Harold G. Walkup, "Three-Hopper Fertilizer Spreaders—Economic Considerations of Their Use," Tennessee Valley Authority Report T60-1 AE, 1959; Harold G. Walkup and Joe E. Fuqua, *Cost of Operating the Pull-Type Three-Hopper Fertilizer Spreader*, Ky. Coop. Ext. Service Circ. 564 (1959).

³ For a more detailed description and analysis of the study see: Joe E. Fuqua and Harold G. Walkup, *Bulk Fertilizer Spreading Practices in Kentucky—With Special Emphasis on Three-Hopper Truck Spreader Custom Services*, Ky. Agr. Exp. Sta. Bul. 683 (1963).

THREE-HOPPER TRUCK FERTILIZER SPREADERS

Description

Two types of spreaders were studied. One (the most widely used) has a tank for nitrogen solution and two hoppers for dry phosphate and potash. The dry materials are spread through auger booms, and the nitrogen solution is pumped through jets or "dribble hoses" attached to the booms. The other has three hoppers for dry nitrogen, phosphate, and potash materials which are spread with revolving fans. Some have a small additional hopper for minor element materials. Both types, referred to as three-hopper truck spreaders, have a capacity of 8 to 9 tons.

Performance

Width of spread, spreading speed, rate of application, loading time, and distance to job determine the number of acres that can be fertilized in a given amount of time. Spreading speed (maximum is generally 15 to 20 miles per hour) depends on soil firmness and moisture, slope, and field size and shape.

After entering the field, the three-hopper spreader with 20-foot auger booms, in this study, could fertilize about 10 acres per hour on pasture, small grains, or unplowed corn land and 7 to 8 acres on plowed ground. The hourly spreading rate on tobacco land was reduced to 3 to 4 acres because of heavier fertilizer applications. When loading time and traveling time from the store to the farm were included, an overall average of about 5 acres per hour was fertilized by spreaders operated by the dealers studied. Spreaders equipped with the fan distributor (covering a 24-foot wide swath) could fertilize about 20 percent more per hour than a truck with auger booms.

COSTS AND RETURNS OF OWNING AND OPERATING A THREE-HOPPER TRUCK SPREADER

Purchase Prices

Prices paid by 12 dealers in the study averaged \$3,879 for spreaders and \$3,328 for trucks—for a total of \$7,207.

Overhead Costs

Costs that occur regardless of use, such as depreciation, interest on investment, insurance, taxes, and license, are overhead costs (Table 1). Depreciation was based on the purchase price of the equipment, less 10 percent for a salvage value, over an estimated life of 5 years. Interest on investment was estimated as 5 percent of one half the purchase price of the equipment.

Operating Costs

Costs, such as labor, gas, oil, lubrication, and repairs, occur when the machine is being used and are called operating costs (Table 1).

Table 1.— Annual Overhead Costs and Per-Acre Operating Costs for a Three-Hopper Truck Fertilizer Spreader^a

Overhead Costs		Operating Costs	
Depreciation	\$1,297.19	Labor	\$0.22
Interest	180.16	Gas, Oil, Lubrication	0.18
Insurance	217.33	Repairs	0.11
Taxes	51.17		
License	41.16	Total (per acre)	\$0.51
Total (annual)		\$1,787.01	

^a All costs except depreciation and interest are an average obtained from the 12 dealers in the study.

Cost Per Acre

Cost per acre decreases as the acres fertilized increase (Table 2). Cost per acre can be calculated for any amount of use by dividing overhead costs by the number of acres fertilized annually and adding operating cost per acre. For example, if 1,800 acres were fertilized during a year, total costs would be \$1.50 per acre, determined as follows: \$1,787.01 (annual overhead) ÷ 1,800 (acres) = \$0.99; then \$0.99 (overhead cost per acre) + \$0.51 (operating cost per acre) = \$1.50.

Table 2.— Cost Per Acre of Owning and Operating a Three-Hopper Fertilizer Spreader at Various Levels of Annual Use

Acres Fertilized	Overhead Cost	Operating Cost	Total Cost
500	\$3.57	\$0.51	\$4.08
1,000	1.79	0.51	2.30
1,500	1.19	0.51	1.70
1,800	0.99	0.51	1.50
2,000	0.89	0.51	1.40
3,000	0.60	0.51	1.11
4,000	0.45	0.51	0.96
5,000	0.36	0.51	0.87
6,000	0.30	0.51	0.81

Custom Charges

The most usual custom rate charged for use of the three-hopper truck spreader was \$1.50 per acre. Variations in custom rates by some dealers included \$5 per acre on tobacco land, \$2 on plowed ground (other than tobacco land), and \$1 per acre on solid ground

for large acreages or when only nitrogen materials were applied. One dealer charged \$1.25 per acre for all crops and land conditions. A minimum fee per job of \$5 to \$12.50 was charged by 7 of the 12 dealers.

Break-even Points for Dealers

A dealer charging \$1.50 per acre would need to spread fertilizer on about 1,800 acres annually to pay truck spreader and labor costs, while a rate of \$1.80 per acre would require only 1,385 acres to pay the costs.

COSTS OF FERTILIZING WITH THE THREE-HOPPER TRUCK SPREADER AND THE FARMER'S SPREADER COMPARED

The most usual farmer-owned equipment for spreading fertilizer is a pull-type single-hopper spreader. Mixed goods usually are used in these spreaders as contrasted with two or more straight materials being applied simultaneously by the three-hopper truck spreaders.

Cost of Fertilizer Materials Compared

Cost of fertilizer is the principal difference in cost of applying primary plant nutrients with the truck spreader custom service and with the farmer's pull-type single-hopper spreader. In Kentucky in 1960 the primary plant nutrients in the following fertilizers could have been bought by farmers cheaper in straight materials than in mixed goods by these amounts: 10-10-10 for \$7.35 to \$12.60 less per ton; 5-10-15 (tobacco fertilizer, including potassium sulfate) for \$7.20 to \$10.87 less; and 4-12-8 for \$8.32 to \$12.14 less. The difference in cost between straight materials and mixed goods varied, depending on the straight materials used.

Costs of a Farmer-owned Spreader

An 8-foot pull-type single-hopper spreader was used as the farmer-owned spreader for comparative purposes. Overhead costs included: depreciation (based on 16 years estimated life), interest on investment (5 percent of one half the purchase price), insurance, and taxes (Table 3). Operating costs included: labor, lubrication, motive power, and repairs.

To calculate the cost per acre for owning and operating a single-hopper spreader, the total overhead costs were divided by the acres fertilized annually and the result was added to the operating cost per acre. For example, if a farmer fertilized 25 acres a year, his cost per acre for the spreader would be $(\$28 \div 25) + \$0.66 = \$1.78$ per

Table 3.— Annual Overhead Costs and Per-Acre Operating Costs Incurred in Owning and Operating a Pull-Type Single-Hopper Fertilizer Spreader

Overhead Costs		Operating Costs	
Depreciation	\$16.56	Labor	\$0.20
Interest	6.62	Lubrication	0.005
Insurance	4.50	Motive Power	0.35
Taxes	0.32	Repairs	0.10
<hr/>		<hr/>	
Total (annual)	\$28.00	Total (per acre)	\$0.655

acre. If he fertilized 50 acres per year, his cost would be $(\$28 \div 50) + \$0.66 = \$1.22$ per acre.

Comparison of Total Costs

The cost per acre of using a single-hopper spreader and mixed fertilizer was higher than the custom charge for the three-hopper truck spreader and equivalent quantities of primary plant nutrients in straight materials for all acreages considered in fertilizing corn, pasture, or tobacco (Table 4).⁴ Custom rates per acre used in the comparison were \$1.50 for corn and pasture, \$5.00 for tobacco, and a \$9.00 minimum per job.

Total cost per acre of spreading fertilizer with a single-hopper spreader decreased as more acres were fertilized. The total cost per acre of the three-hopper truck custom service remained constant to farmer customers if the acreage fertilized was large enough to exceed any minimum charge per job. Consequently, farmers with small acreages to fertilize usually could obtain greater savings per acre by using the three-hopper truck custom service than those with larger acreages.

ECONOMICS OF USING THE THREE-HOPPER TRUCK SPREADER ON THE WHOLE FARM

Since most farmers fertilize several crops each year, a cost comparison of the three-hopper truck spreader versus a pull-type single-

⁴ Assumed annual rates of application of primary plant nutrients used in the comparison for various crops and for the whole farm analysis that follows are based on general per-acre recommendations by the University of Kentucky in 1960: corn, 400 pounds of 10-10-10 or equivalent; pasture, 120 pounds of 5-20-20 and 240 pounds of 0-20-20 or equivalent (calculated from the recommendation of 600 pounds of 5-20-20 to establish pasture and 4 annual top dressings of 300 pounds of 0-20-20 for a pasture stand lasting 5 years); tobacco, 1,500 pounds of 5-10-15 (sulfate) or equivalent; and small grains and seed crops, 800 pounds of 4-12-8 or equivalent.

Table 4.— A Comparison of Total Costs Per Acre of Applying Mixed Fertilizer With a Pull-Type Single-Hopper Spreader Versus and Equivalent Quantity of Primary Plant Nutrients Using Straight Fertilizer Materials With the Custom Three-Hopper Truck Spreading Service

Number of Acres of Crops Fertilized Annually	Corn		Pasture		Tobacco	
	Single-Hopper Spreader	Truck Custom Service	Single-Hopper Spreader	Truck Custom Service	Single-Hopper Spreader	Truck Custom Service
1	\$	\$	\$	\$	\$70.15	\$44.56
2	26.25	14.20	26.01	13.72	56.56	40.56
4	19.25	11.95	19.01	11.47	49.56	40.56
6	16.92	11.20	16.68	10.72	47.88	40.56
8	15.75	11.20	15.51	10.72	46.72	40.56
10	15.05	11.20	14.81	10.72	46.02	40.56
15	14.12	11.20	13.88	10.72	45.08	40.56
20	13.65	11.20	13.41	10.72	44.62	40.56
25	13.37	11.20	13.14	10.72	44.34	40.56
30	13.18	11.20	12.94	10.72	44.15	40.56
40	12.95	11.20	12.71	10.72
50	12.81	11.20	12.57	10.72
100	12.53	11.20	12.29	10.72
200	12.39	11.20	12.15	10.72

hopper spreader used on the whole farm should help in decision making.

Average-size Farm

In 1959, farms in the study area averaged 132 acres, with 94.1 acres of cropland to be fertilized annually. The averages of the various crop acreages were: corn, 17.6; tobacco, 1.8; small grains, 5.1; pasture and hay crops, 66.0; and seed crops, 3.6.

Fertilizer Materials Required

To fertilize the average-size farm with a farmer's single-hopper spreader at recommended rates would have required 20.23 tons of mixed fertilizer annually. Grade and tonnage for the various crops would have been: corn, 3.52 tons of 10-10-10; tobacco, 1.35 tons of 5-10-15; pasture and hay crops, 3.96 tons of 5-20-20 and 7.92 tons of 0-20-20; and small grain and seed crops, 3.48 tons of 4-12-8.

To fertilize the crops with three-hopper truck spreaders using the same rate of primary plant nutrients per acre would have required 13.23 tons of straight materials. The amounts of each straight material would have been 2.52 tons (465 gallons) of 30 percent nitrogen solution, 5.29 tons of calcium metaphosphate, 5.01 tons of muriate of potash, and 0.41 ton of sulfate of potash.

Comparison of Costs

The annual cost of applying recommended applications of primary plant nutrients on the average-size farm would have been

\$167.25 less when using the three-hopper truck spreader and straight materials, or a saving of \$1.78 per acre.

Annual cost with the three-hopper truck spreader would have been \$1,110.93 (\$963.48 for straight fertilizer materials, plus \$147.45 for custom charges). With a single-hopper spreader, the annual cost would have been \$1,278.18 (\$1,188.54 for mixed fertilizer and \$89.64 for the spreader).

An additional saving in using the three-hopper truck spreader is the transportation cost of fertilizers from store to farm. When straight fertilizer materials are applied with the three-hopper spreader, no additional charge is made for delivery. However, when mixed goods are purchased, either the farmer hauls the fertilizer with his truck and labor or pays the dealer to deliver it. Dealers in the study charged from \$1.00 to \$2.00 per ton for delivery, which would add from \$0.21 to \$0.43 per-acre savings in addition to the \$1.78 per acre by the three-hopper truck spreader shown in the example given above.

FARMERS' OPINIONS OF THE THREE-HOPPER TRUCK SPREADING SERVICE

Sixty farmers who had used the three-hopper truck spreading service provided by the dealers were asked about advantages and disadvantages of the three-hopper truck spreading service.

Advantages

All farmers interviewed stated at least one advantage for the three-hopper truck spreaders over other methods available to them. The following is a list of advantages, with the percentage of farmers mentioning each in parentheses (percentages total more than 100 because some farmers mentioned more than one advantage):

1. Lower cost (52 percent);
2. Labor saving (35);
3. Time saving (30);
4. Spreads fertilizer more evenly or accurately (20);
5. More convenient (18);
6. Eliminates handling fertilizer (13);
7. Releases farm workers and machines for other work (12);
8. Mixes fertilizer better than the farmer can (10);
9. Can apply a specific analysis or recommendation (7);
10. Saves farmer from buying a spreader (7); and
11. Other advantages (13);

One of the advantages, "can apply a specific analysis or recommendation," was mentioned by only four farmers. However, 70 percent of all farmers in the study had previously obtained a soil test report for the land on which fertilizer was applied with the truck spreader. Of the 29,535 acres fertilized by the dealers with the three-hopper truck spreader in 1960, 20,490 acres (69.4 percent) had been tested. Therefore, it appears most farmers believed that fertilizer recommendations based on soil test results were more important than was indicated by their responses. Dealers believed that applying a specific analysis to meet a soil test recommendation was one of the biggest advantages offered by their truck spreading service.

Disadvantages

Eighteen (30 percent) of the 60 farmers included in the study replied that three-hopper truck spreading service had no disadvantages. Following are the disadvantages the remaining 42 farmers gave (some mentioned more than one), with the percentage of these farmers mentioning each in parentheses:

1. Difficulty of fertilizing wet fields (22 percent);
2. Truck packs ground or makes tracks (15);
3. Difficulty in obtaining service at desired time (13);
4. Uneven or inaccurate spreading (10);
5. More costly or costs too much (5);
6. Must schedule work ahead of time (5); and
7. Other disadvantages (15).

Additional Information Related to Farmers' Acceptance

The farmers interviewed used the three-hopper truck spreading service on 53 percent of the acreage they fertilized in 1960. They estimated a saving of one-half hour of labor per acre by using the service. Twelve farmers used the service to apply all their fertilizer. Only two of the farmers said they would not use the service in the future.

The 48 farmers who fertilized part of their crops by means other than the three-hopper truck gave a large assortment of reasons, as follows: (1) preferred fertilizer on corn to be placed in row; (2) truck service was not available at desired time for some of their crops; (3) thought they could fertilize a particular crop cheaper with own spreader; (4) wanted to try the three-hopper truck on only part of their crops to check results; (5) job was too small; (6) wanted to

side-dress a crop; and (7) fertilizer application rate did not warrant using the service.

OPPORTUNITIES FOR FUTURE USE OF THE THREE-HOPPER TRUCK SPREADER AS A CUSTOM SERVICE

Market Potential

In 1960, five dealers had used the spreaders only one full season; six had used theirs two years; and one had three years' experience. Consequently, the service had not been in operation long enough to realize its ultimate growth potential. Only about 5 percent of the total acreage fertilized was accomplished by three-hopper truck spreaders in 1960 and this on only 6 percent of farms in the 12-county area.

The dealers, surveyed predicted increases in the acreage to be fertilized with the three-hopper truck spreaders. However, the best indicator that the three-hopper truck spreading services will continue to grow probably is the favorable opinions given by farmers.

Effect On Mixed Fertilizer Sales and Other Business

Only two dealers thought that offering the three-hopper truck spreading service reduced their mixed fertilizer sales. The range of estimated reduction was 2 to 20 percent. Four dealers stated they gained additional business (other than straight fertilizer sales) by offering the spreading service. They believed that providing custom service with the three-hopper truck spreader more completely filled the fertilizer needs of their farmer customers and that the service was complementary to their mixed goods business.

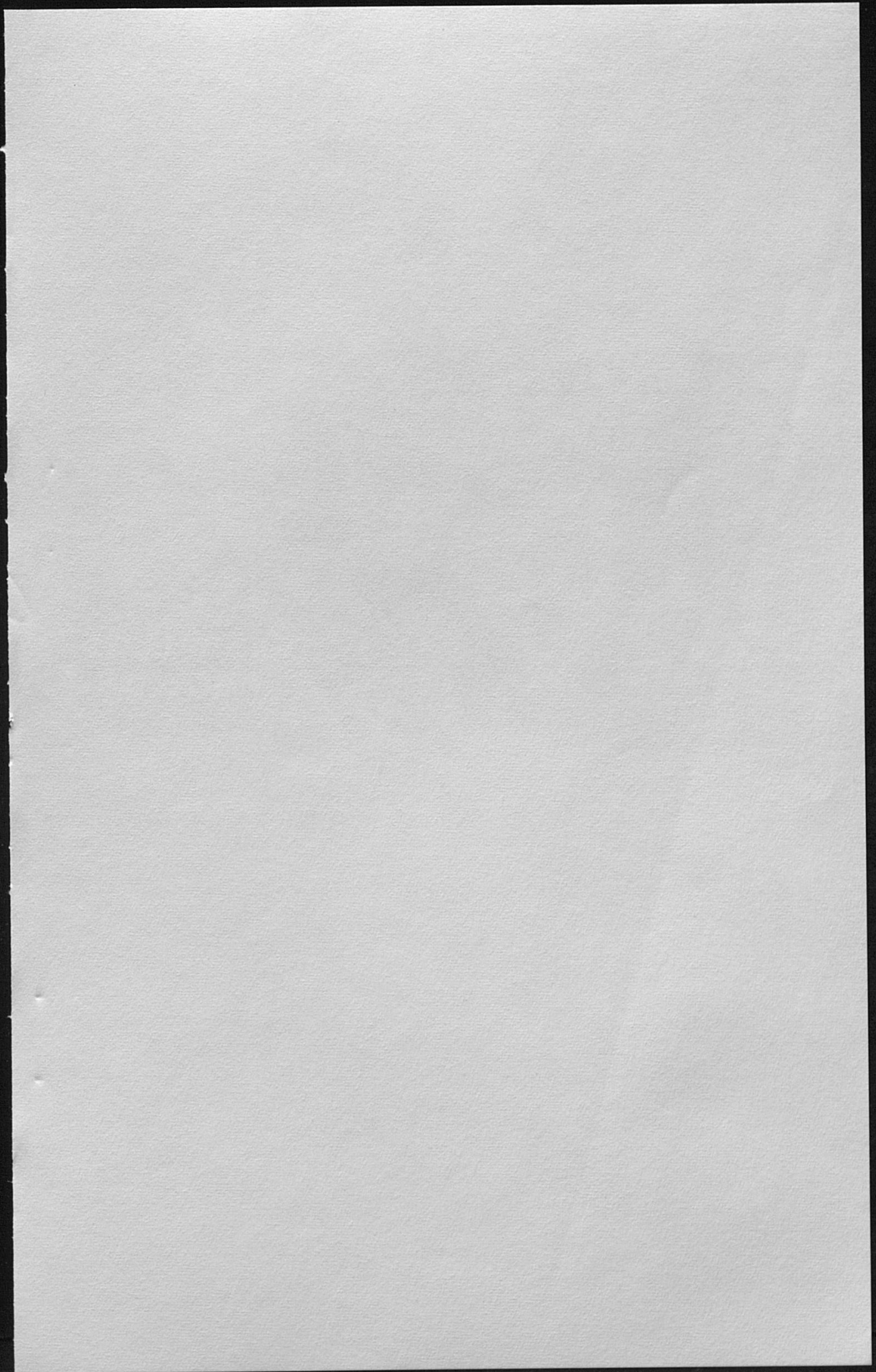
Truck Operator—The Key To Success

The success or failure of a three-hopper truck spreading service depends greatly on the truck operator. He needs to know how to operate and care for an expensive and relatively complicated machine. The operator should have the ability to calculate amounts of plant nutrients and explain to the farmer what is being applied. Just as important is the need for him to be a good public relations man for the dealer—to win the confidence of farmers by convincing them that he does a good job of spreading with regard to application rate and uniform distribution.

Educational Program

Fertilizer dealers offering the three-hopper truck spreading service or other custom application services have a great opportunity to do

an educational program with their customers. Such a program could accomplish some or all the following: (1) increase farmer's understanding of the principal values in fertilizing—addition of nitrogen, phosphorus, and potassium to soils; (2) encourage farmers to use the needed plant nutrients; (3) increase understanding of the costs incurred in buying and handling carrier and filler ingredients; and (4) improve farmer's knowledge of plant nutrient content of fertilizers.



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