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GENERAL REPORT 95  
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# Liquid Fertilizer Distribution by Local Cooperatives in the Pacific Northwest

by B.H. Pentecost



FARMER COOPERATIVE SERVICE  
U. S. DEPARTMENT OF AGRICULTURE  
WASHINGTON 25, D. C.

*Joseph G. Knapp, Administrator*

The Farmer Cooperative Service conducts research studies and service activities of assistance to farmers in connection with cooperatives engaged in marketing farm products, purchasing farm supplies, and supplying business services. The work of the Service relates to problems of management, organization, policies, merchandising, product quality, costs, efficiency, financing, and membership.

The Service publishes the results of such studies; confers and advises with officials of farmer cooperatives; and works with educational agencies, cooperatives, and others in the dissemination of information relating to cooperative principles and practices.

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## Summary

This is the second in a series of reports on studies dealing with liquid fertilizer distribution by farmer cooperatives. It covers operations of 17 local cooperatives located in Idaho, Oregon, and Washington. Pacific Supply Cooperative's (PSC) Fertilizer and Chemical Division personnel selected the cooperatives for study on the basis of the cooperatives' experience in liquid fertilizer distribution.

The objectives of the study were to determine: (1) The type, size, cost, and adequacy of facilities and equipment used; (2) operating practices and policies followed; (3) distribution problems; and (4) possibilities for improving distribution services to farmers. The associations selected for study were either owned by or affiliated with PSC.

The primary materials distributed were: (1) Aqua ammonia (20 percent nitrogen); (2) 32 percent nitrogen solution; and (3) liquid mixed (8-24-0) fertilizer. Some of the locals studied distributed other types but only to a limited extent at the time of this study.

Some type of liquid fertilizer was used on about every type of crop grown in the areas studied.

Of the 17 associations, 8 distributed at least 3 different types of liquid materials; 4 handled 4 types; and 5 associations handled only 1 type. Aqua ammonia had been distributed in the areas studied from 2 to 5 years, but only one association had distributed 32 percent nitrogen solution for more than 3 years.

Average liquid fertilizer sales volume for 11 reporting associations was \$76,167 — or

about 57 percent of total fertilizer volume. Gross margins on liquid sales averaged 22 percent compared to 7.4 percent on dry materials for those associations reporting.

## Facilities

Most of the facilities and equipment used by locals were acquired through PSC. They were designed to be used for more than one type of material, and could be changed from one type to another with a minimum of work or cash outlay.

All but one local association leased its bulk plant facilities from PSC. Most leases were for a 5-year period. PSC also furnished liquid material with the assurance of a specified margin under normal conditions. Local representatives expressed satisfaction with this arrangement.

Bulk tanks were constructed of steel and the 15,000-gallon capacity was the most common size. In addition to leasing large bulk tanks, some associations with wider distribution areas purchased smaller tanks (called satellite tanks) from 8,000- to 10,000-gallon capacity to place in outlying areas. The cost of these tanks ranged from \$800 to \$1,350, depending on whether or not a trailer was included.

Primarily nurse tanks — those used to move liquid fertilizer from bulk storage to the farm — were of three sizes, 1,500-, 1,300-, and 650-gallon capacities. The most popular size used was the 1,300-gallon tank. A total of 137, or 48 percent of the 286 tanks used, were of this size, followed by 60, or 21 percent of the 650-gallon size, and 43, or 15 percent

of the 1,500-gallon size. Forty-six, or 16 percent, were of other sizes and types including dual compartment tanks used for transporting incompatible liquids. The total investment in tanks by all associations ranged from \$630 to \$9,222 and averaged \$3,639 for each association.

The 17 associations owned a total of 251 applicators of sizes up to 60 feet. Most applicators could be used for the different types of liquids with a minimum amount of conversion and modification, and the cost ranged from \$350 to \$1,875. Side-dressing applicators cost from \$100 to \$350, depending on the size of tank and whether bought complete or rigged at the cooperative.

### Operations

All liquid materials distributed by the 17 associations were purchased either from or through PSC. Tank trucks, either PSC owned or common carrier, were the primary means used to transport materials.

Aqua ammonia cost patrons from 9.8 to 12.6 cents per pound of nitrogen, f.o.b. plant. The average cost was 11.1 cents. The price charged patrons for 32 percent nitrogen solution ranged from 13.0 to 15.0 cents per pound of nitrogen and averaged 14.2 cents. The liquid mixed material varied in price from 40 to 45 cents a gallon.

All but one association had some type of credit policy. Policies varied from all cash to credit on a crop-to-crop basis.

Thirteen associations had application equipment available to patrons on a rental basis and seven handling nitrogen solution offered an equipment rental service.

Charges for custom application of liquid nitrogen fertilizers ranged from \$1 to \$1.75

an acre for preplant or broadcast and up to \$2.25 for side dressing. Additional charges of 0.6 to 1 cent a pound of nitrogen were made if material was delivered. The charge for dual application which included both straight nitrogen and mixed material was \$2.25 for preplant applications and \$2.25 an acre for side dressing.

Other services offered included a soil sampling service, on the farm assistance, equipment overhaul and repair service, and a supply of parts for farmer-owned equipment.

Fertilizer sales were encouraged by regular advertising media such as radio, newspaper, and mail. In addition, 10 associations employed fertilizer fieldmen to work with patrons in planning and initiating their fertilization programs. Fertilizer meetings and field demonstrations were also used.

Patronage refunds were paid separately on liquid materials by only two associations. Most of the remaining association representatives agreed that they needed to examine the feasibility of handling higher margin items separately.

The most commonly distributed material in the areas studied was aqua ammonia. However, the general trend for all fertilizers was upward.

Ten association representatives said they could see no noticeable effect in their dry fertilizer sales in favor of liquids; five believed dry sales were not increasing in proportion to liquids, and two did not see any present effects but believed the future trend to be toward liquids.

Eleven association representatives reported soil tests to be the most important factor in determining the kind and amount of fertilizer farmers buy.

Representatives of the associations studied believed the outlook for liquid nitrogen fertilizers in the areas studied was good. According to those representatives, farmer acceptance, especially for other liquid materials distributed, depended first on the need and

second on how good a job was done in educating patrons in the comparative values and potential of the fertilizer. In view of the expected favorable outlook, future operations in relation to expansion and modification were planned accordingly.



# Liquid Fertilizer Distribution by Local Cooperatives in the Pacific Northwest

by

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The use of liquid fertilizer for direct application to soils has been increasing consistently for the last few years. Enough different kinds of liquids are on the market now to meet almost any specified job of fertilization desired by farmers.

This report is based on a study of cooperative liquid fertilizer distribution in three States — Idaho, Oregon, and Washington. Total amount of all fertilizers consumed in this area

in 1959 was 510,978 tons compared with 19,673,490 tons consumed in the United States (table 1). In Washington 33.6 percent of all fertilizers consumed was in liquid form. In Idaho and Oregon the percentage was 13.2 and 15.5 percent, respectively. Liquids amounted to 7.8 percent of the United States total. In Washington and Oregon more liquid than dry fertilizers were used on most small grains.

Aqua ammonia and "32 percent" nitrogen solution were the most commonly used materials distributed by cooperatives included in this study. A few also handled anhydrous ammonia. The trend for use of these materials in the United States is shown in table 2, page 2.

Table 1.—Fertilizers consumed by types of materials and liquid  
as a percent of total—Idaho, Oregon, and Washington, 1959

State	Types of materials		Total	Percent liquids were of total
	Liquid	Dry		
<u>Tons</u>				
Idaho	20,050	132,433	152,483	13.2
Oregon	61,350	121,456	182,806	33.6
Washington	27,223	148,466	175,689	15.5
Total	108,623	402,355	510,978	--
U. S. Total	1,535,395	18,138,095	19,673,490	7.8

Source: 1959 Census of Agriculture.

Note: The author expresses appreciation to the personnel of Pacific Supply Cooperative, Walla Walla, Wash.; to the managers and personnel of local affiliates who provided information for this study; and to J. Warren Mather, Chief, and Charlie B. Robbins, Farm Supplies Branch, Farmer Cooperative Service, for helpful suggestions and assistance during the preparation of the manuscript.

Table 2.—Liquid nitrogen fertilizers consumed as direct application materials in the United States, 1947 and 1953-60

Years ended June 30	Aqua ammonia	Nitrogen solutions	Anhydrous ammonia
<u>Tons</u>			
1947	572	7,049	25,061
1953	1/ 72,917	--	217,182
1954	1/ 191,592	--	350,477
1955	231,808	108,766	353,681
1956	309,948	108,895	418,454
1957	381,432	245,878	452,702
1958	365,062	324,546	583,434
1959	482,818	504,440	681,073
1960 <sup>2/</sup>	398,000	657,000	717,000

1/ Included both aqua ammonia and nitrogen solutions.

2/ Preliminary.

This descriptive report is the second in a series of studies dealing with liquid fertilizer distribution by local cooperatives. The initial study was reported in "Liquid Nitrogen Distribution by Local Cooperatives in Nebraska and Kansas," FCS General Report 82, 1960. This publication described liquid nitrogen distribution activities of 17 local cooperatives in Nebraska and Kansas.

The present report covers activities of 17 local cooperatives. These studies have grown out of the expressed interest of cooperative leaders in obtaining information on operating practices and policies, facilities and equipment, and types and trends in usage of liquid fertilizer.

No attempt has been made to determine which type of material is best for any par-

ticular area. The purposes of these area studies were to determine: (1) The type, size, cost, and adequacy of facilities and equipment used; (2) operating practices and policies followed; and (3) problems and possibilities for improving distribution services to farmers.

The 17 associations selected for study were either owned by, or affiliated with, Pacific Supply Cooperative (PSC), Walla Walla, Wash. They were selected for study on the basis of their experience in the field of liquid distribution by PSC Fertilizer and Chemical Division personnel. Five associations were located in Idaho, eight in Oregon, and four in Washington.

Data for the study were obtained by personal interviews with managers and key fertilizer personnel referred to as representatives of each association.

## Types and Uses of Liquid Fertilizers Distributed

This section discusses types and uses of liquid fertilizers distributed by the 17 associations studied.

### Types of Fertilizers Distributed

Primarily these associations distributed three different types of liquid fertilizers. They



Typical bulk storage facilities found in Pacific Supply area.

were aqua ammonia (20 percent nitrogen), 32 percent nitrogen solution, and liquid mixed materials (8-24-0). However, a nitrogen-sulphur solution (20 percent nitrogen, 45 percent sulphur) sold under the trade name Nitro-sul was becoming more popular. In areas deficient in potash, some associations were handling liquid potassium material.

#### Uses of Fertilizers Distributed

Aqua ammonia purchased through PSC was the most popular liquid fertilizer distributed by cooperatives in the areas studied. It is a solution of ammonia and water and can be applied in the soil or through irrigation water.

In the areas studied it was applied at a depth of 3 to 4 inches on row crops and small grains. Some, however, was applied through irrigation water.

The type of nitrogen solution handled by cooperatives studied was nonpressure 32 percent nitrogen. It was used largely on pasture and hay crops and small grains.

Liquid mixed materials (8-24-0) were applied to the above crops when materials in addition to nitrogen were desired. Also in areas where deficiencies were prevalent, potassium ( $K_2O$ ) in the liquid form was applied.

## Development and Current Volume

Of the 17 associations studied, 16 were distributing aqua ammonia. Fourteen also handled 32 percent nitrogen solution, 11 handled liquid mixed (8-24-0), and 8 sold Nitro-sul. Eight of the 17 handled at least 3 different liquid materials, and 4 handled 4 types.

The 17 cooperatives had distributed aqua ammonia from 2 to 5 years. Only five, however, had been distributing less than 4 years. Only 1 association had handled nitrogen solution more than 3 years; the remaining 13 associations that handled it had been in the business from less than 1 year up to 3 years. Two associations had handled liquid mixed materials more than 2 full operating years and the remaining nine that handled it had been distributing it from 1 to 2 years. Most of the associations handling Nitro-sul had distributed it for 2 years or less.

Cooperatives in the areas studied started liquid fertilizer distribution operations primarily because of encouragement on the part of PSC's Fertilizer Division, which recognized the

need for such services for cooperative patrons and initiated a program.

Pacific Supply Cooperative's Fertilizer Division personnel contacted managers and directors throughout their territories and pointed out possibilities for handling liquids from the standpoint of extending and improving services to patrons and expanding cooperative business. The better-informed managers and directors usually recognized a necessity for beginning this type of service if they were to serve members effectively.

In most cases, associations did not maintain separate records for the different types of liquids, but some did separate liquid and dry materials. The average sales volume for 11 associations handling liquids was \$76,167. Ten of these reported a total fertilizer volume of \$141,628 with liquids amounting to 57 percent of the total. The gross margin on sales of liquid materials averaged 22 percent for 11 associations, compared to 7.4 percent for dry materials for 7 associations (table 3).

Table 3. --Volume and margins of all fertilizers sold and percent liquid materials were of total sales, 11 local farm supply cooperatives--Idaho, Oregon, and Washington, 1960

Associa- tion code number	Total liquid sales	Cost of sales	Percentage gross margin on sales	Cost dry sales	Cost of sales	Percentage gross margin on sales	Total fertilizer sales	Liquid as percent of total ferti- lizer sales
			<u>Percent</u>			<u>Percent</u>		<u>Percent</u>
1	\$105,355	\$ 85,545	18.8	\$ 34,172	\$30,495	10.7	\$139,527	76
2	49,836	40,606	18.5	87,647	78,891	10.1	137,483	36
3	127,000	100,991	20.5	70,000	66,660	6.2	197,000	64
4	14,160	2,761	19.5	16,757	15,879	5.2	30,917	46
5	31,991	24,464	23.7	1/	1/	1/	1/	1/
6	31,000	25,017	19.3	121,000	1/	1/	152,000	20
9	123,953	1/	1/	37,000	1/	1/	160,953	77
10	201,598	157,484	21.9	210,227	200,374	4.7	411,825	49
11	46,365	38,104	17.8	7,000	1/	1/	53,365	87
14	30,200	23,738	21.4	14,000	12,978	7.3	44,200	68
16	76,022	57,836	23.9	12,986	7,566	7.1	89,008	85
Total	837,480	556,546	-	610,789	412,843	-	1,416,278	-
Average	76,167	2/55,655	22.0	61,079	3/58,978	7.4	2/141,628	57

1/ Data not available.

2/ Includes 10 associations.

3/ Includes 7 associations.

## Facilities and Equipment



Above, aqua ammonia is being pumped from a typical bulk storage tank into a nurse tank on a farmer's truck. Below, aerial view of same bulk plant with pull-type spray applicator in foreground.

Facilities and equipment used by locals were designed to handle more than one type of liquid. The design permitted changing liquids with a minimum amount of work and cash outlay. These were usually acquired through the regional association.

Equipment and facilities are discussed under single headings since they could be used interchangeably in handling different types of liquids.

### Plant Facilities

Generally PSC owned plant facilities, including bulk storage tanks, transfer pumps, and a hoist for loading and unloading nurse tanks. The regional leased these to local associations on a marginal basis; that is, PSC made no actual charges, but supplied liquids along with the assurance of a specified margin under normal conditions. Most leases ran for 5 years, with an option to buy at the expiration date. However, only one association had purchased the facilities upon expiration of its lease. Those remaining liked this arrangement and preferred to continue the lease arrangement.

Association managers expressed satisfaction with their bulk plant storage at the time of this study. The most common size tanks used were 15,000-gallon capacity, constructed of steel. Three associations indicated a need for additional storage for nitrogen solution and mixed materials during rush seasons. PSC owns four aqua ammonia converter plants strategically located, that help alleviate the need for added storage for this material.

The 17 local associations studied had wide distribution areas. In addition to large bulk plant storage, many used smaller (satellite) tanks of 8,000- to 10,000-gallon capacity, placed in heavy distribution areas. These installations saved farmer-patrons' time and expense and helped associations lower operating costs.

## Plant-to-Farm Equipment

Tanks used to move liquid fertilizer from bulk storage to the farm are generally referred to as nurse tanks or field tanks. Nurse tanks used by the associations studied were constructed of the same type steel as bulk storage tanks and were moved in farmer-owned trucks or flat-bed trailers. Depreciation rates on nurse tanks varied among associations, with some using the straight line method, some depreciating on an acreage basis, and others depreciating on a ton basis. A straight 20 percent annual depreciation, however, was most popular.

Specially made electric hoists and booms were used for loading and unloading nurse tanks. Materials were transferred from nurse tanks to applicator tanks by pumps or gravity.

The three most common sizes of nurse tanks used by the 17 associations studied were 650-, 1,300-, and 1,500-gallon capacities (table 4). Of these, the most popular size was the 1,300-gallon tank used by 16 associations. A total of 137, or 48 percent of the 286 tanks used by the 17 associations, were of this size, followed by 21 percent of the total in the 650-gallon size, and 15 percent in the 1,500-gallon size. Sixteen percent were of various

Table 4.--Number, size, and total investment in nurse tanks, 16 local farm supply cooperatives—Idaho, Oregon, and Washington, 1960

Association number	650-gal.	1,300-gal.	1,500-gal. <sup>1/</sup>	Other	Total number	Total investment in nurse tanks
	Number of tanks owned					
1	1	5	2	-	8	\$ 1,735
2	3	4	2	2	11	2,335
3	2	14	-	-	16	3,370
4	2	2	-	-	4	630
5	1	4	-	-	5	1,025
6	5	4	2	-	11	2,442
7	9	10	6	-	25	5,764
8	10	3	-	2	15	2,819
9	3	15	8	2	28	7,283
10	12	20	10	-	42	9,922
11	-	10	-	5	15	2/
12	2	6	6	-	14	3,420
13	2	26	-	20	48	2/
14	6	2	-	-	8	1,562
15	2	7	2	5	16	3,998
16	-	5	5	10	20	4,640
Total	60	137	43	46	286	50,945
Average	4.3	8.6	4.8	6.7	17.9	3,639

<sup>1/</sup>Includes dual-compartment tanks for transporting straight and liquid mixed materials.

<sup>2/</sup>Information not available.

sizes and types, including dual-compartment tanks used for transporting incompatible liquids.

The total investment in tanks by all associations ranged from \$630 to \$9,922 and averaged \$3,639 an association.

Preference in size of tanks depended largely on the size job to be done and size and type of delivery equipment available.

Only two of 14 associations that responded to the question reported a need for additional tanks.

### Application Equipment

Farmers in some areas studied owned application equipment while they did not in other

areas. The number of farmers owning application equipment influenced the number of applicators owned by cooperatives. Some managers indicated they could increase volume and provide a needed service by owning application equipment and making it available on a rental basis. This was particularly true in areas of relatively small farms.

The 17 associations studied reported they owned a total of 219 applicators, an average of 12.9 per association (table 5). Most types of applicators owned by locals had been purchased through their parent association and were designed and constructed to handle the different types of liquids distributed with a minimum of conversion or modification. For example, an applicator used to apply aqua

Table 5. --Number and size of applicators owned, 17 local farm supply cooperatives—Idaho, Oregon, and Washington, 1960

Association number	Number of applicators and approximate size				Total number owned
	16-ft.	24-ft.	48-ft.	Other 1/	
1	1	3	2	1	7
2	5	2	-	1	8
3	14	3	-	-	17
4	2	-	-	2	4
5	1	3	-	2	6
6	2	4	-	1	7
7	7	1	2	3	13
8	-	4	-	4	8
9	9	6	-	-	15
10	9	15	-	-	24
11	4	6	-	-	10
12	-	3	-	2/ 12	15
13	-	-	-	1	1
14	6	-	-	5	11
15	-	12	11	3/ 3	26
16	-	-	-	2/ 22	22
17	-	-	7	2/ 18	25
Total	60	62	22	75	219
Average	5.5	5.2	5.5	5.8	12.9

1/ Includes dual and straight materials applicators and side dressers of various sizes.

2/ Range in sizes from 12 to 40 feet, number of each unknown.

3/ Range in sizes from 37 to 60 feet, number of each unknown.



Satellite tanks in outlying areas can be mutually advantageous for both cooperatives and their patrons.

ammonia could also be used to apply the 32 percent nitrogen solution by replacing aqua injectors with spray booms. Most associations had machine shops that were equipped to build and modify equipment to suit their needs at a relatively low cost.

In some areas of PSC territory, a liquid spreader truck service was offered. Trucks equipped with tank, spray booms, and a hypro pump operated off the power-take-off were developed primarily for fertilizing pastures. They could be used for spraying both nitrogen solution and liquid mixed materials.

Cost of applicators ranged from \$350 for small sizes to \$1,875 for the larger ones that were used for dual application of liquid mixed and aqua ammonia in one operation.

Some local associations in row-crop farming areas owned applicators for side dressing. The cost ranged from \$100 to \$350 and depended on the size of tank and amount of construction performed in associations' shops. Most side dressers were tractor mounted, although some pull-type applicators were used for side dressing.

Of the 17 associations, 10 had patrons who owned applicating equipment or who rigged applicators on regular farm implements such as spring-tooth harrows and plow-down rigs. A few of the associations assembled or built and modified applicators in their machine shops to fit area needs for farmer patrons. About one-half of the managers or representatives said they encouraged patrons to own their equipment.



Nurse tanks are loaded and unloaded by electrically operated hoists.

## Operating Practices and Policies

This section discusses operating practices, and policies on procurement, pricing, credit, sales promotion, and services offered.

### Procurement

Fertilizer use, to a great extent, is seasonal and procurement problems during these seasons can be detrimental to a cooperative's business as well as irritating to patrons. However, none of the associations studied were having

any serious procurement problems. This was largely because all associations purchased their liquid fertilizer materials through their central wholesale agency, PSC. Although PSC did not produce all of the materials distributed, the lack of problems among locals indicated it had an effective procurement system for purchasing from outside sources. Pacific Supply did have aqua ammonia converter plants located strategically in its territory, which enabled them to effectively supply locals.



Here aqua ammonia is being used in a preplant application to wheat ground. Applicators up to 40 feet or more in width are used by cooperatives in the Pacific Northwest's small grain country.

With two exceptions all liquid materials were transported to local bulk storage tanks by truck. Two associations received some 32 percent nitrogen solution by rail. Only two associations reported transporting liquid materials with their own equipment, and this had not been a frequent practice. The remaining associations received materials transported by PSC-owned trucks or by common carrier hired by PSC.

PSC supplied the materials distributed by the locals studied, assuring a specified margin under normal conditions. The prices paid by local associations varied according to area prices and distance transported.

#### **Pricing Policies**

In general local associations charged prices for liquid fertilizers based on a suggested price from their supplier. The suggested price was

in line with, and depended largely on, area pricing practices. Both cooperative and other distributors in the areas studied attempted to offer reasonable prices according to services offered and expenses involved. Eight of the 17 associations studied offered quantity discounts.

#### Prices Patrons Paid for Aqua Ammonia

Aqua ammonia was priced on a pound-of-nitrogen basis by some associations and on a gallon-of-material basis by others. A few also priced on a ton basis, and some used a combination of the above methods. The f.o.b. plant price of aqua ammonia varied from 9.8 cents to 12.6 cents a pound of nitrogen and averaged 11.1 cents (table 6). Prices are also shown on a gallon and a ton basis.

The aqua ammonia distributed by local associations studied contained 400 pounds of

Table 6.--Prices paid by patrons for aqua ammonia, 16 local farm supply cooperatives--Idaho, Oregon, and Washington, June 1960

Number of associations reporting	Prices paid:		
	Per pound of nitrogen	Per gallon of material	Per ton of material
	Cents	Cents	Dollars
1	9.8	14.8	\$ 39.20
1	9.9	15.0	39.60
1	10.0	15.2	40.00
1	10.4	15.8	41.60
2	10.9	16.5	43.60
1	11.1	16.9	44.40
2	11.2	17.0	44.80
1	11.3	17.2	45.20
1	11.5	17.5	46.00
2	11.6	17.6	46.40
1	11.7	17.8	46.80
1	12.4	18.8	49.60
1	<u>12.6</u>	<u>19.2</u>	<u>50.40</u>
Average	11.1	16.9	44.40



This truck is rigged with folding 32-foot booms for spraying both straight nitrogen and liquid mixed materials. The booms can be folded back when not in use.



This farmer is side dressing sugar beets with aqua ammonia.

nitrogen in a ton and 1.52 pounds of nitrogen in a gallon of material. Prices were calculated accordingly when not specifically stated for each method. Sometimes when prices were quoted on a ton basis, they were rounded off and did not correspond exactly if calculated in this manner.

#### Prices Patrons Paid for Nitrogen Solution

Aqua ammonia was the most common liquid material sold by associations studied although some had been distributing nitrogen solution for 2 or more years. Perhaps this was due largely to its lower cost. The difference in cost existed mainly because of the greater transportation costs involved in distributing nitrogen solution. Some managers stated that more

32 percent solution was purchased by dry-land farmers than by irrigation farmers.

The prices paid f.o.b. for the nitrogen solution distributed by 12 associations varied from 13 cents to 15 cents a pound. The average price was 14.2 cents a pound (table 7). Expressed in terms of gallons of material, the average price was 50.2 cents. On a tonnage basis the average price paid by patrons was \$91.13 a ton of material. Some associations quoted prices to patrons on a pound-of-nitrogen or gallon-of-material basis, while others used all three methods or a combination of the three.

#### Prices Patrons Paid for Other Liquid Materials

The primary liquid mixed material distributed was 8-24-0. Most of the associations

Table 7. -- Prices paid by patrons for nitrogen solution, 12 local farm supply cooperatives--Idaho, Oregon, and Washington, June 1960

Number of associations reporting	Prices Paid		
	Per pound of nitrogen	Per gallon of material	Per ton of material
	Cents	Cents	Dollars
1	13.0	46.1	\$ 83.20
1	13.1	46.5	83.80
1	13.8	49.0	88.30
1	14.0	49.7	89.60
3	14.5	51.5	93.00
4	14.6	51.8	93.40
1	<u>15.0</u>	<u>53.2</u>	<u>96.00</u>
Average	14.2	50.5	91.13

included in the study handled it. Prices to patrons varied from approximately 40 cents to 45 cents a gallon of material.

A few associations were distributing a nitrogen-sulphur solution (20 percent nitrogen, 45 percent sulphur) under the trade name Nitro-sul. The prices varied from approximately 65 cents to 70 cents a gallon of material.

Pricing data for potassium materials distributed were not available.

#### Credit Policies

Credit policies of the 17 associations studied were as follows:

Credit policies	Number of associations
Cash on delivery	5
Crop to crop	1
30-day	8
15-day	1
10-day	1
No established policy	1
Total	17

The association without a formal credit policy gave 1 percent cash discount, but charged no penalty for extended nonpayment. Of the eight associations operating on a 30-day credit

policy, three gave cash discounts if paid within the 30 days and one made an additional charge of 1 percent a month if not paid within 45 days. Two of the other five charged 6 percent interest on the outstanding balance after 30 days. Two of the five operating on a cash basis, had not strictly adhered to this policy. The manager of one of these associations said "If we know a farmer well enough, we will carry him until his crop is harvested."

The two other associations operating on 15- and 10-day policies respectively, offered discounts if paid within these limits. Some of the associations, adhering more closely to their policies, would hold a note at a specified interest charge.

#### Transportation to Farms

Most nurse tanks used for transporting liquids were carried on trucks or flat-bed trailers owned by patrons. However, associations offering a custom application service transported materials in their own equipment. Only a few used permanently mounted tanks. Managers preferred the movable tanks because transportation equipment could be used for other jobs when not needed to move fertilizer.



Aqua ammonia is transported to the farmer's field in nurse tanks on trucks or trailers and transferred to field applicators.

### Safety Precautions

Safety precautions should be observed at all times when handling liquid fertilizer. Safety precautions are especially important to those handling ammonia or solutions containing ammonia because of its irritating action on skin and membranes of the eyes, nose, throat, and lungs.

Safety information was made available to local distributors through their wholesale association (PSC) and other sources. Most managers reported that employees generally followed safety precautions closely. Some, however, reported that employees were sometimes careless during rush periods.

Under normal circumstances the hazards involved in handling liquids can be largely eliminated by following a few recommended precautions. Some of the more important are:

1. Take necessary precautions to avoid breathing ammonia fumes. Approved masks should be worn when a possibility of breathing fumes exists.

2. Protect exposed skin surfaces at all times. Protect eyes with approved goggles.
3. Have clean water available in case of emergency. All exposed parts of the body should be immediately washed thoroughly.
4. Allow only reliable persons properly instructed to perform operations involving handling of liquid fertilizers.
5. Do not apply an open flame or attempt to weld tanks or equipment used for handling liquid materials before thoroughly cleaning them.

Although aqua ammonia and other non-pressure solutions are potentially not considered as hazardous as high pressure materials, all should be treated with respect at all times.

### Services Offered

The types of services offered are important to the success of any business. Farmers are naturally best satisfied when their needs are being met, and often in liquid fertilizer distribution it may be necessary to offer additional services to meet these needs. However, most managers interviewed for this study agreed

that offering additional services to meet patron needs resulted in greater patronage and increased volume.

#### Equipment Rental Service

One of the more important services offered patrons by associations in the areas studied was a rental service for nurse tanks and applicators. Many farmers preferred renting equipment to buying it. They considered this an important service because it made the equipment available to them without having to tie up capital needed elsewhere in their farm operations. Most managers believed it was necessary to either offer equipment on a rental basis or to offer a custom application service for patrons. Therefore, they generally preferred to provide rental equipment and let patrons make their own applications.

A total of 13 associations offered aqua ammonia rental equipment services for patrons. They reported relatively uniform charges for rental equipment. Both nurse tanks and applicators were included in one stated rental charge. Rental charges and number of associations reporting each charge for aqua ammonia application were as follows:

<u>Rental charge</u>	<u>Number of associations</u>
50 cents per acre plus \$10 a day	1
50 cents per acre <sup>1/</sup>	11
No charge	1
Total	13

<sup>1/</sup> Two associations charged only 35 cents an acre for jobs over 100 acres, and one made a minimum charge of \$10 a day.

At the time of this study seven associations were offering a rental service for 32 percent nitrogen solution. Others stated they had adapt-

able equipment and would start the service if the demand became great enough.

Rental charges for use of nitrogen solution equipment and the number of associations reporting were as follows:

<u>Rental charge</u>	<u>Number of associations</u>
35 cents per acre	2
25 cents per acre	4
No charge	1
Total	7

Information on equipment rental was not obtained for the other liquid materials.

#### Custom Application Service

In areas where patrons had insufficient acreage to justify owning application equipment, local cooperatives provided an application service or arranged it through custom applicators.<sup>1/</sup> In some areas farmers used liquid fertilizers on large acreages and preferred to have their cooperative do the job for them. This was true primarily because cooperatives had experienced personnel employed in their fertilizer operations and therefore farmers could expect a better job at a reasonable charge. Some associations preferred to arrange this service through custom applicators and use their capital and employees in other areas of their farm supply operations.

Charges for custom application of liquid nitrogen fertilizers ranged from \$1.00 to \$1.75 an acre for preplant applications and up to \$2.25 for side dressing applications. An additional charge of 0.6 cents to 1 cent a pound of nitrogen was made if material was delivered.

<sup>1/</sup> Individuals who apply liquid fertilizer with their own equipment for a specified charge and for someone other than themselves are referred to as custom applicators.

A few associations owned dual applicators for applying both straight nitrogen and mixed materials. The charge for this service was \$2.25 an acre for preplant applications and \$2.75 an acre for side dressing.

#### Soil Sampling Service

Farmers everywhere are becoming more aware of the value of soil testing in planning their fertilization programs. In many areas cooperatives have played a big role in getting their patrons to take advantage of soil-testing facilities available to them.

Managers answered four questions relating to soil testing. Their response was as follows:

<u>Question</u>	<u>Number responding</u>	
	<u>Yes</u>	<u>No</u>
Do you have a soil-sampling service?	6	11
Do you take, or assist in taking, samples?	6	0
Do you pay for samples tested?	3	3
Do you own soil-testing facilities?	0	6

Although none of the six providing a soil-sampling service owned laboratory facilities to perform these tests, two planned to acquire them in the future. Other managers said they would assist patrons in taking samples and send them to laboratories for testing if patrons expressed a desire for the service.

Some of the six sent their soil samples to a PSC local affiliate, Pendleton Grain Growers, Inc., which owned a complete laboratory used for various testing and analytical work, including soil testing. Other associations in the area either sent patrons' samples there or to their State college or university for testing.

#### Other Services

Many of the associations studied also offered other services relating to liquid fertilizer operations. Questions regarding these services were asked managers. Their response was as follows:

<u>Question</u>	<u>Number responding</u>	
	<u>Yes</u>	<u>No</u>
Do you overhaul farmer-owned fertilizer equipment?	7	10
Do you have personnel who can assist farmers with liquid fertilizer application problems?	6	11
Do you keep an inventory of used parts?	14	3

Some associations owned a machine shop for maintaining equipment used in their farm supply operations. Seven associations indicated they had overhauled and repaired some farmer-owned fertilizer equipment, but most of their work was on their own equipment. In general, not enough farmers owned liquid equipment to warrant a cooperatively owned repair service, but cooperatives needed these shops to maintain their own equipment. This also applied to assistance on application problems. Most associations had enough equipment in operation to justify having their own servicemen to keep it operating. Inventories of parts were kept largely for use on cooperatively owned equipment, but the parts were available to patrons who needed them.

#### **Information Programs**

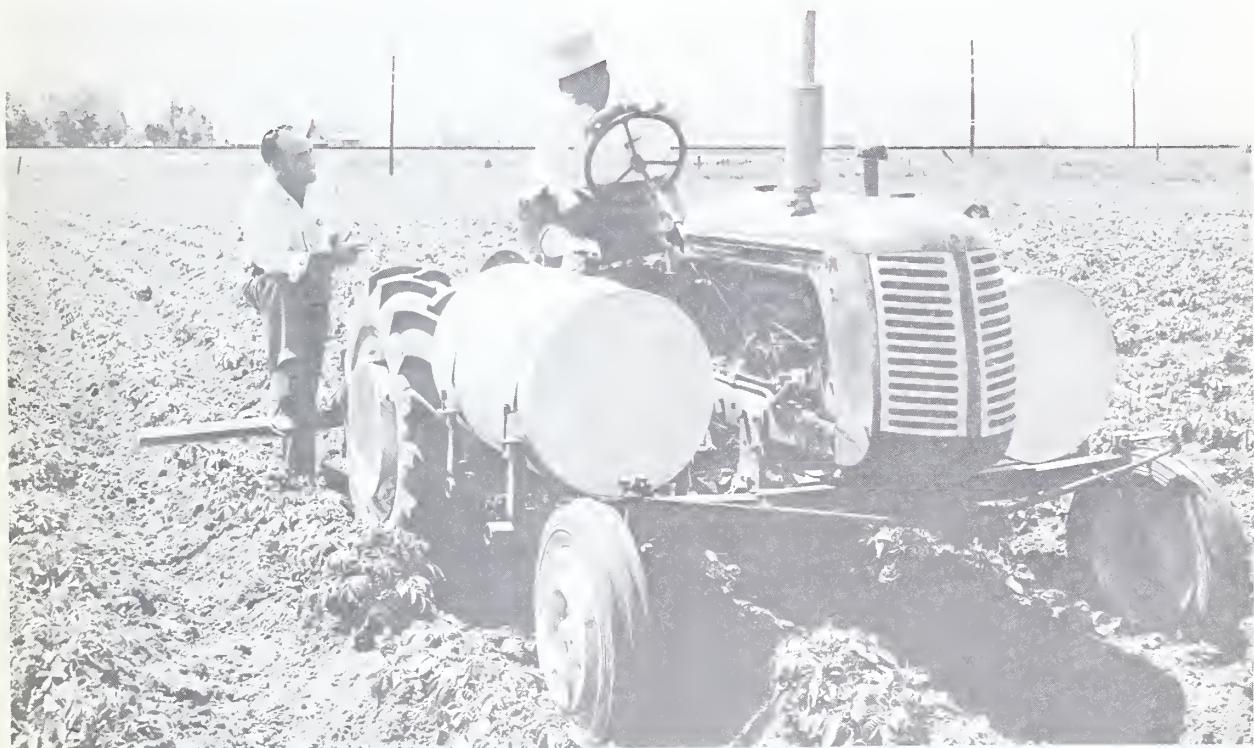
Fertilizer consumption reports indicate that farmers are becoming more aware of their increased fertilizer needs and are using more each year. When compared to use recommendations based on experimentation, however,

many farmers still are not completely aware of the profitability of adequate fertilization. The objective of farmer cooperatives should be to meet the needs of patrons. To do this, many of the cooperatives studied believed that farmers needed further education in the economics of fertilization and information programs should be planned to fill that need.

The cooperatives studied employed several methods of providing information on fertilizer use. One important method was use of fertilizer fieldmen to make personal calls on patrons for the purpose of selling fertilizers. This method was mutually advantageous to cooperatives and their patrons. It helped increase the coopera-

tives' volume, and at the same time patrons received valuable assistance in planning their fertilization programs as well as assistance when problems emerged.

Another way to provide information to members was through holding fertilizer meetings during the year. These meetings gave farmers an opportunity to learn more about fertilizer use and how they could benefit by increased use. A third method employed, which was particularly useful for new materials or those that were not well established, was the use of demonstration plots or check strips. Patrons believe quickly when they are shown visual results.



Most farmers agree that a few minutes of conversation with their co-op fertilizer fieldman is time well spent.

Specific questions on fertilizer information programs were asked managers. The response was as follows:

<u>Question</u>	<u>Number responding</u>	
	<u>Yes</u>	<u>No</u>
Do you have personnel who make farm visits?	10	7
If you have personnel, are they full-time fieldmen?	9	1
Have you held any fertilizer meetings in the past year?	10	7
Did you get yield comparisons last year from demonstration plots or check strips?	8	9

Ten associations held from 1 to 3 general fertilizer meetings. In addition some associations held as many as 10 small group area meetings each year. These were usually informal meetings held at night in patrons' homes with a fertilizer fieldman or cooperative representative present to discuss problems and answer questions. The number of meetings varied with size of trade territory and number and location of patrons. Many patrons preferred these small local meetings, and there was a better overall turnout because they did not have to travel as far to attend. Also, the informality of small group meetings afforded patrons a chance to discuss their own problems according to their specific area needs.

Those associations not having demonstration plots or check strips for comparative purposes encouraged patrons to increase or decrease application in strips to get comparisons. PSC had various types of demon-

stration plots throughout its territory that afforded patrons an opportunity to see the results of good fertilization practices. The primary advantage of demonstration plots is that visual results of what fertilizers will do is not likely to be questioned.

In addition to meetings and demonstration plots, the cooperatives employed other regular advertising media. The types used by 17 associations were as follows:

<u>Media used</u>	<u>Number reporting</u>
Radio and newspaper	5
Newspaper and regular mail (pamphlets, publications, and cards)	2
All of the above	3
No formal advertising other than what was done by parent organization	7
Total	17

Three associations used all regular advertising media, and one published a monthly publication in which fertilizer was advertised. Those associations using no formal advertising relied on personal contact with patrons and PSC's overall fertilizer advertising program.

#### **Handling Patronage Refunds**

In general, higher margins are realized on liquid fertilizers than on other fertilizers and supplies. However, most of the associations studied were still combining patronage refunds for their entire operation including fertilizer. Cooperative representatives interviewed were asked, "How are patronage refunds handled for fertilizer?" The response was as shown in the accompanying tabulation.

<u>Response to question</u>	<u>Number responding</u>
Refunds paid on entire operation	7
Refunds paid on selected group of supply items	2
Refunds paid on all fertilizers grouped together	1
Refunds paid on liquid fertilizers separately	2
No refunds paid	3
No specific answer to question	2
<b>Total</b>	<b>17</b>

## **Trends in Use and Farmer Preferences and Attitudes**

The information reported in this section is based on managers' observations and opinions.

### **Trends in Use**

At the time of this study aqua ammonia was the liquid most commonly handled by the 17 associations. In many areas, the 32 percent nitrogen solution had not been distributed long enough for adequate comparison to be made with other liquids. However, in wheat and dry-land farming areas, the trend appeared to be toward nitrogen solution. Representatives of two associations stated that the trend had been toward the 32 percent solution. In two other areas, however, this material had not been accepted although it had been distributed for 2 or more years. One manager stated, "It is too windy during the fertilizer season to spray, but we do not have suitable equipment for using fertilizer in irrigation water."

The trend in use of aqua ammonia had been consistently upward for all associations except one, since they began handling it from 2 to 5 years ago. According to the manager, the one association's sales were down in 1959 because of adverse weather conditions.

All but two of the associations that had handled 32 percent nitrogen solutions for over 1 year reported the trend in use as upward.

The use of liquid mixed fertilizer had been increasing more slowly than other liquids. Most of the associations, however, had been distributing it for a relatively short time, and generally managers believed that in time its use would increase more consistently.

Managers or representatives of each association were asked if they believed the use of liquid fertilizers had affected their sales of

dry fertilizers. The response to this question was as follows:

<u>Response</u>	<u>Number responding</u>
No noticeable effect	10
Believe dry sales have been affected	5
Not affected as yet, but expect trend to be toward liquids	2
Total	17

Seven of the 10 respondents who saw no noticeable effect generally believed that the potential sales of fertilizer were great enough that both dry and liquid types would continue to move forward together. The others said they had started handling both types at about the same time and had been pleased with the sales of both.

Only one of the five associations reporting a noticeable effect in dry sales mentioned a large decrease. The remaining four reported the effects as slight but expected sharper effects as more fertilizer was used. Sales appeared to be affected to a considerable extent by the promotion of liquids over dry materials or vice versa.

#### **Farmers' Preferences and Attitudes**

As previously stated, aqua ammonia was the most popular liquid material used at the time of this study, due in part to this material having been distributed longer in most areas.

Since most of the associations had been distributing nitrogen solution for a relatively short period, a comparative evaluation of farmer's preferences was not attempted. However, it was the general feeling among most association representatives interviewed that the 32 percent nitrogen solution was finding its place in their distribution program and that no one type would be sufficient to meet future needs and demands of patrons.

A separate attempt was not made at the time of this study to evaluate or determine farmers' preferences and attitudes for other types of liquids.

Response to the question, "How do farmers in your area determine the kind and amount of fertilizer to buy?" was as follows:

<u>Response</u>	<u>Number responding</u>
Soil tests	11
By what area distributors advertise and recommend	3
Price	2
Depends largely on equipment	1
Total	17

Soil tests were reported as first in importance in determining the kind of fertilizer farmers buy by 11 associations. Many managers, however, listed other things such as distributor demonstrations and results seen on neighbors' farms as important.

## **Outlook**

Past observations have shown that the most successful cooperative managers are those who are best informed on agricultural conditions and all situations in all areas related to their business operations. The need for keeping well informed

exists particularly for fertilizer distributors if they plan to give patrons the best possible service on an efficient basis. A good manager should anticipate not only present, but also future needs of patrons and plan operations accordingly.

### Future Use by Farmers

All but one representative of the 16 associations handling aqua ammonia stated that area farmers' attitudes toward it were favorable. They expected their volume to increase consistently under normal weather conditions.

Associations that had been handling 32 percent nitrogen solution more than 1 year reported favorable farmer attitudes. Most of those who had been handling it for only a short while expected it to be accepted by farmers as they became better acquainted with it.

Farmers' attitudes toward liquid mixed and other liquid materials were reported to be favorable in most areas where these materials were handled; in some areas they were quite good. Again managers believed acceptance of these materials depended first on the need and second on patrons' education in their comparative values and potential.

In general, all managers or representatives interviewed believed the future of nonpressure liquid fertilizers to be quite good in their areas. In most of the areas studied the type of agriculture practiced was suited to the use of liquid nitrogen. From all general indications the other liquids studied would be used more as farmers gained more experience with them.

### Future Plans of Cooperatives

As stated previously, the general belief among cooperative managers or representatives interviewed was that the potential for all types of fertilizers was good. In light of the expected increase in use, many association managers or representatives also anticipated an increase in competition and were planning accordingly.

Specific information for each type of liquid material was not obtained. However, a more general question, "What are your future plans in regard to liquid fertilizer distribution?" was asked. The response was as follows:

Response	Number responding
Add application equipment, all types	4
Expand overall operations	3
No immediate changes planned	8
Modify equipment and add more as needed	1
Add side dressers to equipment line	1
Total	17

### Observations and Suggestions

Cooperatives in the Pacific Northwest were among the first in their area to enter the liquid fertilizer distribution business approximately 6 years ago. Most have improved their operations consistently since that time. The associations selected for study were among the more successful in handling liquid fertilizers and in most cases had done a good job in working out their problems.

Following, however, are a few observations and suggestions for further improvement of cooperative fertilizer operations and services:

1. Keep Separate Records on Liquid Operations.—Generally higher margins are realized on liquid fertilizers than on dry materials. Separate records for liquids, therefore, would provide management with information on operating results and a more accurate basis for determining patronage refunds. Sales in dollars and quantities, cost of sales, gross margins, expenses, and net margins should be kept separately on liquid materials. Direct expenses could be kept daily but general overhead expenses would have to be allocated each month. Such records would indicate whether

a separate patronage refund on liquids would result in a more equitable distribution of net margins.

2. Provide Application Service.—An applicator and nurse tank rental service, a custom application service, or both would be important in areas where farmers generally cannot economically justify owning equipment. Farmers may prefer renting equipment or custom service because it makes the equipment available to them without their having to tie up capital needed elsewhere in their farm operations.

Most of the associations studied were offering this type of service to some extent. Others should study the economic feasibility of providing such a service. However, in areas where farm operations are predominantly large and farmer-owned equipment is economically justifiable, cooperatives may find it advantageous to encourage individual ownership. For the same reason small farm operators prefer an application service rather than having to tie up their capital in expensive equipment.

3. Emphasize Stronger Information Programs.—Although the cooperatives studied were generally doing a good job in helping inform patrons on the economics of fertilization, continual encouragement is needed. Adequate information programs in the area of fertilization are mutually advantageous to both patrons

and their associations. Increased knowledge helps patrons to plan better fertilizer programs resulting in greater yields and at the same time increasing the associations' volumes and patronage refunds.

4. Offer a Soil Sampling Service.—By helping farmers to take soil samples, cooperatives encourage farmers to take advantage of soil testing facilities available to them. Farmers in general are becoming more aware of the values that come from having their soils tested. However, many still need encouragement. Both farmers and their associations are mutually benefited by this service. Farmers benefit from increased yields and greater profits as a result of planned fertilization programs and their associations are able to return them greater savings as a result of increased volume. This service need not overlap or infringe on sampling services already available but rather supplement them. The six associations already offering such a service endorsed it wholeheartedly.

5. Adhere to Safety Precautions.—Some employees handling liquid materials did not always closely observe recommended safety precautions. This occurred more often during rush seasons. Therefore, management should continue to stress the need for following proper safety measures at all times.





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## Other Publications Available

Liquid Nitrogen Distribution by Local Cooperatives in Nebraska and Kansas, General Report 82. B. H. Pentecost.

Methods of Financing Farmer Cooperatives, General Report 32. H. H. Hulbert, Nelda Griffin, and K. B. Gardner.

Farmers Buy Supplies Cooperatively, Bulletin Reprint 3. J. Warren Mather.

Controlling Open Account Credit in Feed Cooperatives, FCS Circular 24. Charlie B. Robbins and Lacey F. Rickey.

Credit Control in Selected Retail Farm Supply Co-ops, General Report 57. T. R. Eichers.

Inventory Management by Selected Retail Farm Supply Co-ops, General Report 70. J. M. Bailey.

Bulk Distribution of Fertilizer and Lime in the Northeast, General Report 24. Warren K. Trotter.

Bulk Distribution of Lime by Selected Cooperatives in Three Southern States, Service Report 49. B. H. Pentecost.

Manufacture of Fertilizer by Cooperatives in the South, FCS Bulletin 13. Warren K. Trotter.

Fertilizer Distribution: Methods and Costs, Service Report 19. M. A. Abrahamsen.

Distribution of Fertilizer by Cooperatives in the South, FCS Bulletin 11. Warren K. Trotter.

A copy of these publications may be obtained upon request while a supply is available from—

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