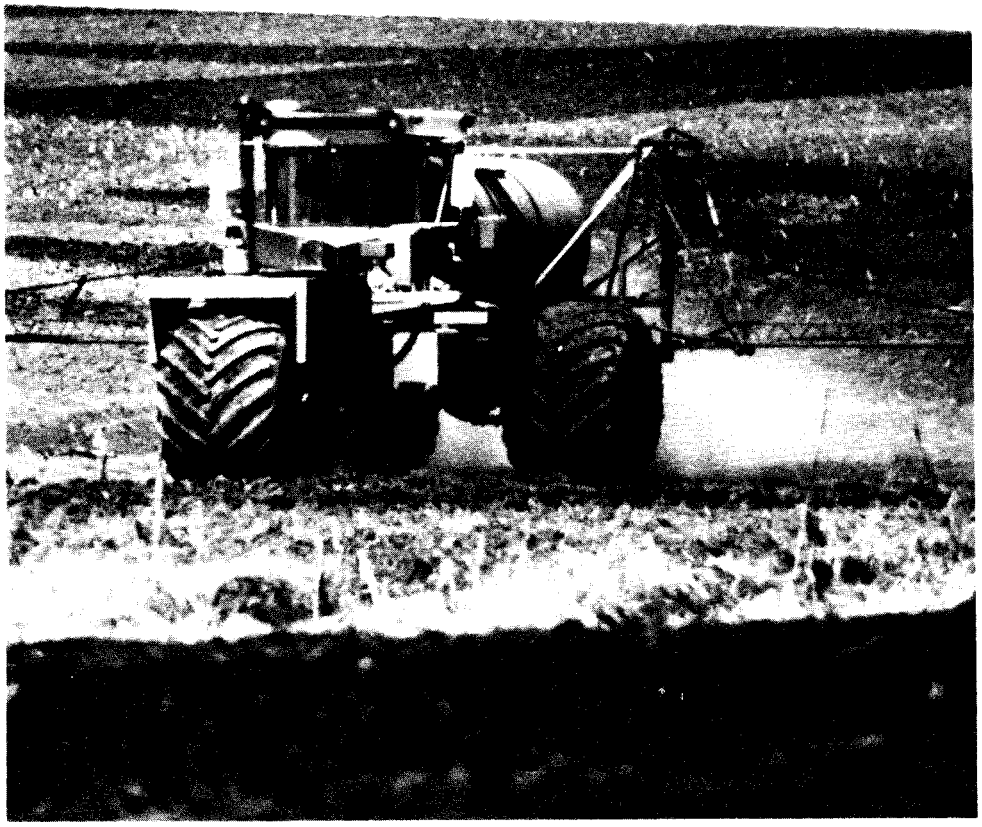
Cooperative Agrichemical and Seed Operations

FARMER COOPERATIVES IN THE UNITED STATES
COOPERATIVE INFORMATION REPORT 1
SECTION 22

U.S. DEPARTMENT OF AGRICULTURE
AGRICULTURAL COOPERATIVE SERVICE



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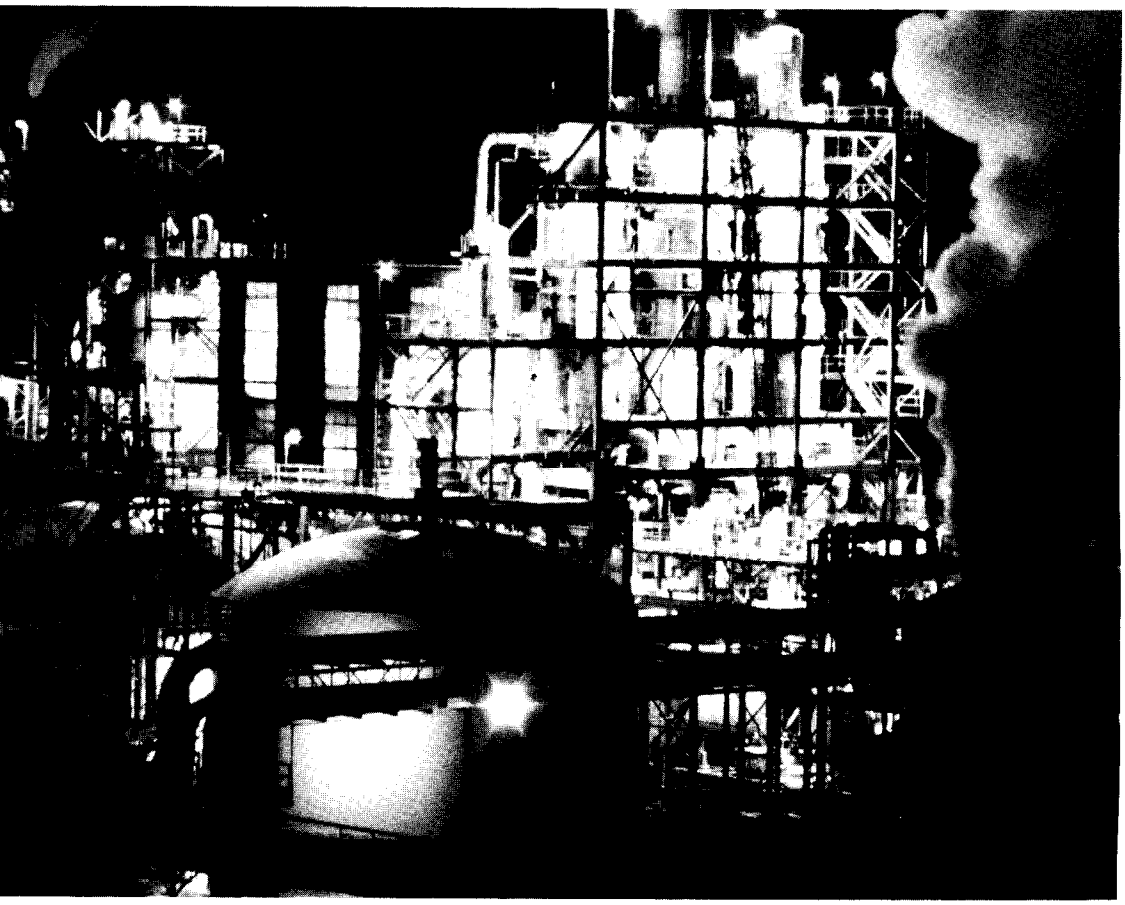
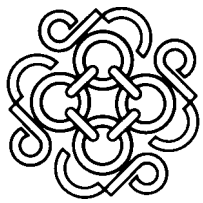
To provide themselves with agrichemicals, farmers have integrated operations through cooperatives backward from custom application with expensive equipment, such as on the cover, to manufacturing. Below is the Green Bay fertilizer complex near Bartow, FL, owned by Farmland Industries, Inc., Kansas City, MO.



Cooperative Agrichemical and Seed Operations



Through cooperatives, farmers control significant portions of the manufacturing and marketing of fertilizer, agrichemicals, and seed. Control began with small purchasing groups and grew through the organization of large wholesale and manufacturing cooperatives. Through their cooperatives, farmers have obtained a broad variety of products and services efficiently and economically and gained significant benefits.

FERTILIZER

Farmers' accomplishments can be understood better by showing the size of the cooperative fertilizer industry.

In 1987, farmers spent $5.4 billion for fertilizer and lime, nearly 5 percent of their total production costs. At $5.4 billion farmer expenditure on fertilizer and limestone was down 39 percent from an all-time high in 1980. During the mid-1980's. farmers experienced the worst depression since the 1930's. Their experience reverberated through the fertilizer industry. For example, 40 percent of the 90 ammonia plants operating in 1980 were either closed or idled and a third of the remainder changing ownership. Cooperatives experienced the trauma of this period as well as non-cooperatives.

With $5.4 billion, farmers bought 43,239,000 tons of fertilizers. Of these, 24,379,000 tons were primary materials, 17,270,000 tons were mixed products, and 1,590,000 tons contained minor elements. These fertilizers represented 19,214,000

tons of nutrients—10,349,000 tons of nitrogen, 4,852,000 tons of potassium, and 4,013,000 tons of phosphate.

The top 10 States in applying fertilizers (primary nutrients) were:

	1,000 tons
Illinois	1,833
Iowa	1,581
Indiana	1,183
Minnesota	1,124
Texas	1,066
Nebraska	937
Ohio	860
California	762
Wisconsin	742
Missouri	707

California, in eighth place and not among the top 10 in 1986, replaced Kansas which was tenth that year.

Retailing

Cooperative fertilizer activities began on a small scale at the local retail level and have expanded over the years to include a wide variety of supplies and services.

Early Cooperative Developments

In December 1863, farmers around Riverhead, NY, formed a club and incorporated in 1866 as the Riverhead Farm Agricultural Society. Their agent bought Peruvian guano and chartered a vessel to bring it from New York to the Jonestown wharf.

As the cooperative idea grew, farmers in the Northeast continued to form purchasing clubs, local and county exchanges, and Grange cooperative stores to purchase feed, fertilizer, containers, pesticides, and coal. Farmers often pooled orders through these organizations, with local representatives (farmers and later, local dealers) overseeing "car door" operations, notifying farmers when railcars arrived, and collecting payments for the fertilizer.

Two regional supply cooperatives eventually were formed. The Eastern States Farmers Exchange (Eastern States), West

Springfield, MA, was organized in 1918, and provided wholesale services to local cooperatives and local representatives. In 1926, it introduced double strength fertilizer on an open formula basis. By 1932, Eastern States had 374 local representatives and a fertilizer volume exceeding 14,000 tons. Soon the cooperative began operating area retail warehouses and became a centralized association serving farmers directly.

The Cooperative GLF Exchange (GLF), Ithaca, NY, formed in 1920, was the other regional supply cooperative that grew similarly. It soon began using a pooling plan with farmer representatives but also organized local cooperatives. To increase volume, GLF enlisted local supply dealers (called agent-buyers) to handle fertilizer and other supplies as franchise operations. By 1931, GLF had 74 cooperative service stores and more than 300 agent-buyers. In 1940, it reached a peak of 520 agent-buyers.

During this period, many farmers in the East believed they were paying exorbitant prices for fertilizer and other production supplies because of monopolistic practices by large corporations. Two large firms had achieved a high degree of control over the manufacture and distribution of fertilizer. In 1916, the Federal Trade Commission found that seven companies were selling 58 percent of the fertilizer used domestically; by 1921, their share had increased to 65 percent.

In Indiana, local farmer buying groups and grain marketing cooperatives began handling fertilizer and other supplies in bulk between 1915 and 1920. County farm bureaus sponsored car door purchasing groups and agents that handled fertilizer and other supplies. In the late 1920's and early 1930's, they began organizing countywide supply cooperatives.

In the South during World War I, county agricultural agents helped farmers pool orders for carloads of fertilizer from manufacturers. In 1920, representatives of Mississippi farmers visited E.I. duPont to negotiate lower prices and to purchase duPont's Chilean nitrate. As a result, Mississippi farmers pooled a 50,000-ton order, which they received through Gulfport, MS. Between 1919 and 1928, county farm bureaus took over this activity and by 1930, 63 had become incorporated purchasing associations.

The Virginia Seed Service, Richmond, VA, now Southern States Cooperative (SS), began handling fertilizer in 1926 through managed local service stores and independent dealer-agents. It employed the open formula principle of publishing the ingredients

of mixed fertilizers. Staple Cotton Growers Association, Greenwood, MS, ordered carloads of nitrate of soda for its members until supplies were curtailed in World War II. Cotton Producers Association (CPA), Atlanta, GA, now Gold Kist Inc., began distributing fertilizer in 1941.

Fertilizer use, especially nitrogen, increased in the Midwest during and after World War II. For example, Iowa consumption averaged 49,297 tons during 1940-44, then jumped to 520,130 tons during 1950-54. Local grain marketing and supply cooperatives began handling fertilizer, and their volume increased rapidly after Consumers Cooperative Association (CCA), Kansas City, MO, now Farmland Industries, Inc. (Farmland), began providing wholesale fertilizer services in 1946 and manufacturing in 1948.

Current Status

In 1987, 3,015 cooperatives reported net fertilizer sales of $2.7 billion (table 1). Probably representing little change, twenty-four regional and interregional cooperatives retailed nearly 20 percent of the cooperative total in 1986. Agway, MFA, and SS handled two-fifths of the 20 percent, retailing more fertilizer than they wholesaled. CF, Farmland, and MCC, basic fertilizer manufactures, retailed nearly a quarter of the 20 percent. Eight centralized regionals, principally Gold Kist, retailed most of the remainder, selling all of their fertilizer through branch stores.* Ten regionals, such as Countrymark and MFC, retailed less fertilizer than they wholesaled.

Fertilizer accounted for about a fifth of cooperatives' total supply volume, only slightly above feed and 65 percent of petroleum. This $2.7 billion was a hefty increase over 1950-51, the first year data were available, when 3,357 cooperatives had fertilizer sales of $156 million. Cooperatives' share of the farm market increased from 15 percent to 51 percent during this period.

The five States with the largest cooperative net sales in 1987 were: Iowa, $327 million; Illinois, $255 million; Minnesota, $236 million; Nebraska, $13 1 million; and Indiana, $13 1 million. Indiana nugged Kansas out of fifth place in 1985, Kansas dropping

*The. full names of cooperatives not identified earlier are: Agway (Agway Inc., Syracuse, NY), MFA (MFA, Inc.. Columbia. MO), CF (CF Industries, Inc., Long Grove. IL), MCC (Mississippi Chemical Corporation. Yazoo City, MS), and MFC (MFC Services, AAL, Madison, MS).

to seventh place in 1987. Among these States, statistics indicate a large cooperative share of market ranging from 95 percent to 40 percent, as shown below:

	*Percent**
Iowa	95
Minnesota	92
Illinois	55
Nebraska	52
Indiana	40

During the past quarter century, major changes have occurred in the cooperative distribution of fertilizer. One was the dramatic increase in the amount of nitrogen fertilizer sold, espe-

* Market shares for States with low percentages may suffer from statistical inconsistancy. For example, Nebraska's share was 68 percent in 1985. Shares are not reported for farm chemicals and seed.

Table l-Cooperatives handling fertilizer and lime and their net sales and share of the farm market in specified years.

Year 1/	Cooperatives selling fertilizer and lime	Cooperatives' net sales of fertilizer and lime 2/	Farmers' expenditures for fertilizer and lime 3/	Cooperatives' market share
	Number	..... *Million Dollars* --------		*Percent*
1950-51	3,357	156.2	1,019s	15
1955-56	4,018	261.4	1,175.5	22
1960-61	4,276	361.6	1.390.5	26
1965-66	4,363	561.7	2,106.5	27
1970-71	4,134	762.1	2,544.5	30
1975-76	3,949	2,284.0	6,564.0	35
1981	3,789	3,676.3	9,409.0	39
1983	3,442	2,837.2	7,066.0	40
1984	3,323	3,434.7	7,429.0	44
1985	3,237	3,341.6	7,258.0	46
1986	3,134	2,915.4	5,787.0	50
1987	3,015	2,731.8	5,610.0	43
1988 4/	2,899	2,976.8	6,400.0	40

1/ Business years ending June 30, except in 1981-88 when calendar years are used.
2/ Excludes business among cooperatives but includes sales not for farm use.
3/ Average of 2 calendar years for 1950-51 through 1975-76. See Economic Indicators, 1987, p. 31.
4/ Preliminary.

cially as anhydrous ammonia and nitrogen solutions. As a result, cooperatives own many ammonia and nitrogen solution stations, nurse tanks, and liquid applicator rigs.

Cooperatives encouraged the use of high-analysis fertilizers, furnished custom bulk spreading to save time and labor for farmers, provided bulk blending of materials based on soil tests of individual fields, offered other services such as agronomic advice and recordkeeping, and supplied fertilizer through farm service centers to share overhead costs with other supplies and products marketed.

Cooperatives gradually integrated operations through dry-mixing and ammoniating services, initiated joint purchasing, acquired storage and transportation facilities, and began manufacturing basic materials to ensure seasonal supplies and provide additional savings for farmer-members.

Another change was the shift from dry mixtures to straight materials applied in bulk. This led to bulk blending of materials for direct application by farmers or custom operators. Consequently, local cooperatives own numerous bulk blending plants, some owned jointly with regionals, while regionals own some plants themselves. Cooperatives outlets also operate many dry spreaders and dry feeder tenders.

Operating Practices

Cooperatives have much the same facilities and equipment for distributing fertilizer to farmers as other firms. These include warehouses, storage tanks, bulk trucks, spreader trucks, pull-spreaders, nurse tanks, liquid applicators, and the like. Application equipment is usually available for loan, rent, and custom application, a service that has grown in popularity.

Likewise, many cooperative operating practices resemble those of other firms. For example, cooperatives sell fertilizer on credit with terms varying from 30 days to a seasonal basis extending over several months. Some offer cash discounts, some charge for accounts receivable that run for more than 30 days, and some do both. But cooperatives have also done some things differently from other firms, such as stressing higher analysis fertilizers, direct application (DA) materials, and the economics of bulk blends in combination with anhydrous ammonia.

However, cooperatives historically lagged in supplying liquid mixtures and nitrogen solutions. These fertilizers often appeal

to farmers because of their safety, labor savings, and convenience (they can be combined with pesticide applications).

Cooperatives historically have had at least three operational advantages. Many have tended to be more diversified and larger and, at the same time, serve more highly concentrated fertilizer markets than noncooperatives. Greater diversification and size attract farmers, while larger businesses and more concentrated markets can increase operational efficiencies. [1*] In Nebraska, for example, cooperatives' major advantages over other types of fertilizer firms have been:

1. Diversification (proportion of total annual sales per outlet from nonfertilizer sources). Cooperatives averaged 84 percent, noncooperatives, 57 percent. [2]

2. Size. Cooperatives averaged 3,746 tons annually, noncooperatives 2,497 tons. [3]

3. Density. Cooperatives sold $26,824 per 10 square miles of territory, noncooperatives, $11,366. [4]

In addition, many local cooperatives have their ability to market fertilizers enhanced by their activities in grain marketing.

Like noncooperatives, most cooperatives take fertilizer orders in the fall and offer early-order discounts that decrease as spring approaches. They also offer quantity and annual volume discounts. But cooperatives historically have often avoided price leadership and priced "at the market."

This practice seems less prevalent today, however. For example, nationwide cooperative fertilizer prices averaged 8 percent below competition in 1975. Later studies found that cooperative outlets priced ammonia, 28-o-0, TSP, and potash lower than noncooperatives in Iowa and Nebraska during 1979, where a $4.45 per ton advantage on ammonia was registered. [5]

Wholesaling

Having succeeded in retailing fertilizer, local buying groups and co-ops turned their attention to wholesale operations.

Early Cooperative Developments

The first known wholesale supply purchasing cooperative, Fruit Growers Supply Co., Los Angeles, added fertilizer to its con-

* Footnotes are grouped at the end of the text.

tainer business around 1911. It obtained orders from citrus marketing exchanges for 166,000 tons, reducing dealers' gross margins from $6 to $3 per ton. It also introduced the practice of selling fertilizer on the basis of plant food units to help members make more intelligent and economical use of this supply.

Eastern States was the first eastern regional cooperative to provide wholesale fertilizer service to local farmer organizations. Eastern States sold 1,699 tons on a brokerage basis in 1919, and in the 1930's, became the foremost advocate of using high analysis fertilizers based on individual soil samples that could be tested in its own laboratory.

About the same time, statewide farm bureaus helped begin cooperative purchasing of fertilizer and other supplies in the. central part of the country. For example, in 1920 the Indiana Farm Bureau joined with the Indiana Grain Dealers Association and the Indiana State Grange to form the Federated Marketing Service, a brokerage agency for local buying groups and cooperative elevators that assembled orders for bulk supplies.

In 1923, the Indiana Farm Bureau established its own purchasing department, but it was soon boycotted by the established fertilizer manufacturers. Fortunately, the Tennessee Copper and Chemical Corp., had a supply of sulfuric acid that could best be used in manufacturing fertilizer, so it contracted with the Farm Bureau to take the output of a future fertilizer plant. In 1927, the Farm Bureau purchasing department was reorganized as the The Indiana Farm Bureau Cooperative Association (IFBCA), Indianapolis, IN, designed to serve county farm bureau cooperatives that were to be organized in the next 5 years. In 1938, the State association began its own manufacturing.

In 1926, Virginia Seed Service initiated contracts with companies in the Norfolk area to manufacture mixed fertilizers. Its contracts called for specified ingredients manufactured according to an "open formula" recommended by the State Agricultural College in Virginia. In 1928, it began buying some fertilizer from GLF.

In 1930, the Mississippi Farm Bureau Federation (AAL) was formed to purchase fertilizer and other supplies for members' countywide associations. This function passed to MFC in 1935. The State Farm Bureau of Mississippi began buying nitrate of soda and acid phosphate for members of county units in 1922.

The Alabama Farmers Cooperative (AFC), Decatur, AL; the Tennessee Farmers Cooperative (TFC), La Vergne, TN; and

CPA began wholesale fertilizer services in the late 1930's or early 1940's.

As local cooperatives in the Midwest began to handle fertilizer on a larger scale after World War II, their regional wholesale cooperatives began to acquire supplies for them. CCA started handling fertilizer on a commission basis in 1946. The Illinois Farm Supply Co., (later named GROWMARK) and MFA had begun providing fertilizer a few years earlier. Land O'Lakes (LOL), Minneapolis; Farmers Union Central Exchange (Cenex), St. Paul; and Midland Cooperatives, Minneapolis, were other regionals expanding their wholesale services.

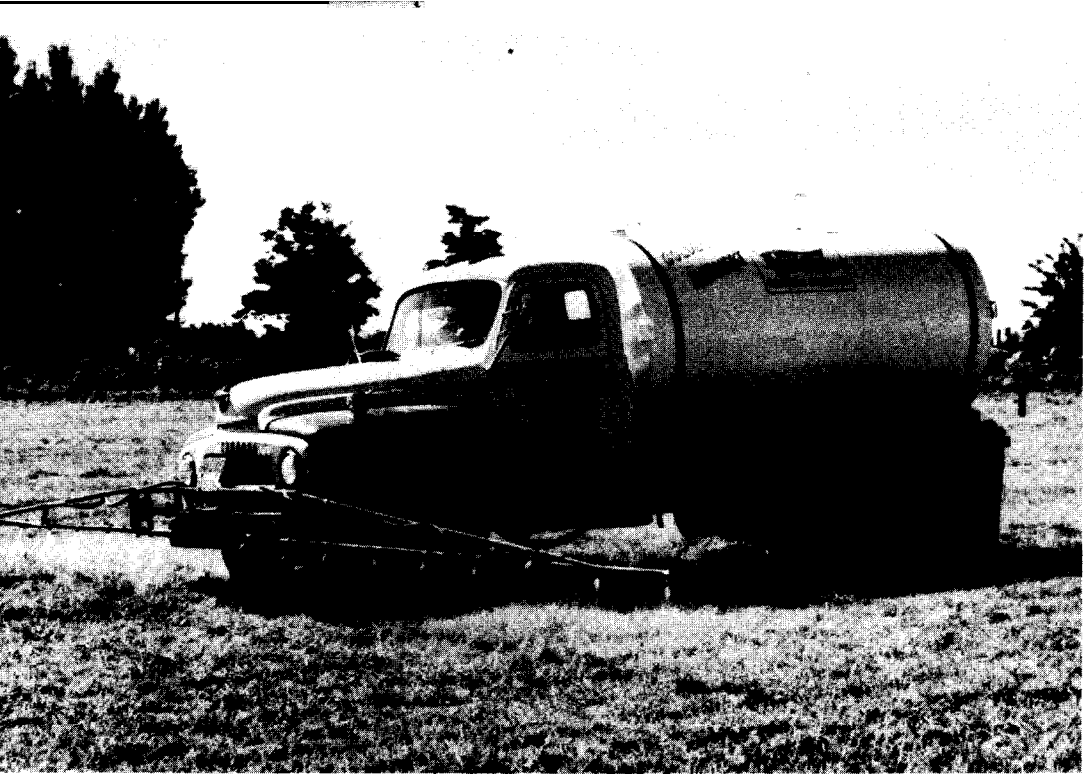
Current Status

Cooperatives probably provided wholesale services for little more than 75 percent of the fertilizer retailed by all cooperatives. These services come mainly from 32 regionals interregionals having over $1 million worth of business. Similar services on the remaining twenty-five percent of the fertilizer purchased by retail cooperative come from noncooperatives.

The 32 regionals did $1.8 billion of wholesale business 1986, with two-thirds of this total generated by 18 regionals which conducted most of their fertilizer business at the wholesale level. Details are as follows:

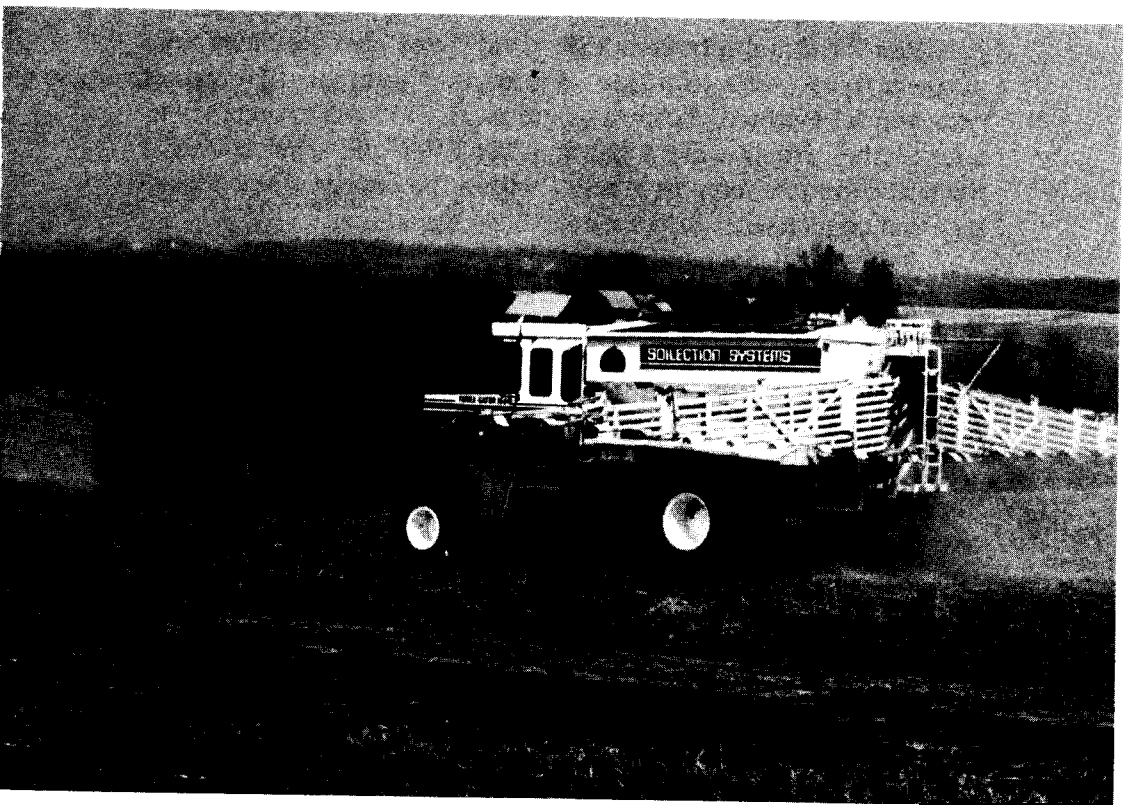
Type of cooperative	Number of cooperatives	Wholesale volume
		Million dollars
Wholesaling regionals [a]		
Entirely wholesale	8	486
Both wholesale & retail	10	762
Total	18	1,248
Retailing regionals [b]		
Both retail & wholesale	3	325
Entirely retail	8	118
Total	11	443
Manufacturing cooperatives	3	115
Grand Total	32	1,806

[a] More than 50 percent of each cooperative's sales generated at wholesale level.
[b] Mom than 50 percent of sales generated at retail level.



Fertilizer application equipment has progressed from add-on and pull-type applicators to . . .

... massive customized machinery employing computers to analyze soil deficiencies and prescribe corrective fertilizer materials.



In 1987, the number of regionals that were strictly wholesalers of fertilizer declined by one. Cenex and LOL embarked on a unique joint venture entitled Cenex/Land O'Lakes Ag Services (Cenex/LOL) to produce and/or market fertilizer, petroleum products, feed, and agricultural chemicals.

Operating Practices

Four operating practices have exemplified cooperative wholesalers in the fertilizer market: fair prices, timely deliveries, technical support, and interregional cooperation.

To date, cooperative wholesalers generally have followed the leadership of noncooperatives and priced at the market, continuing a traditional cooperative practice. But practices may be changing, for during the fertilizer shortage of 1973/1975, cooperative manufacturers and regional members slowed the rise in their prices and priced below competition. This action probably showed up in some relatively lower prices charged by cooperative outlets, noted earlier. Specific examples of this action were MCC's pricing ammonia at under $200 per ton compared to more than $300 per ton by competitors, and more dramatically, FS Services (now GROWMARK) losing $14 million on some of its fertilizer purchases because it sold them for lower prices than it paid.

Regionals showed some price leadership again in 1978 and 1979, but whether it continued from 1974/75 or reappeared is unknown. Regardless, in Nebraska and Iowa, local cooperatives paid less for liquid nitrogen, TSP, potash, and ammonia than noncooperatives. For example, one of the greatest differences occurred for ammonia in Iowa where average cooperative and noncooperative prices were $128 and $146 per ton, respectively. [6] Such occurrences support a belief within the cooperative community that cooperatives help keep fertilizer costs low.

Regional cooperatives have always stressed timeliness in delivering fertilizers. They must be positioned properly (on intransit railroad cars, if nowhere else) when spring demand surges. Therefore, cooperatives have set up well-developed and efficient distribution systems. For example, during the early 1980's, Farmland constructed new storage facilities at Enid, OK; Fort Dodge, IA; and Hutchinson, KS, all capable of rapidly loading huge amounts of fertilizer. During 1984, on the other hand, economic adversity caused FCX to begin closing some of its 95 outlets. FCX was liquidated in 1986.

Regional cooperatives support fertilizer sales, pricing, and distribution efforts with hundreds of technical service people. They advise on all phases of fertilizer handling and application and are often employed as crop management specialists. These specialists are discussed more fully under farm chemicals.

Many cooperative technical service representatives are authorities on fertilization practices from their own experience and study. Most are supported by field trials and research by regionals' staffs. For example, Agway staffs its Farm Research Center at Tully, NY, while LOL does similarly at its "Answer Farm" at Ft. Dodge, IA. Technical service people operate under programs such as: "Integrated Crop Management," at Agway; "Croplan," at Cenex/LOL; "Total Crop Planning," at Countrymark; "Crop Management Service," at Farmland; and "Grow Master Crop Service," at SS.

Technical service representatives are on the forefront of new technology in helping their patrons. For example, GROWMARK claims that in 1981 it was the first farm supplies cooperative to use a simplified computer technology to help farmers make sound decisions about crop production. In 1986, GROWMARK helped several of its member companies extend this service from their stores to their patrons using portable computers. About the same time, Cenex and LOL were providing similar service.

These regionals were going further than GROWMARK, however. They were laying a basis for their AgriSource program. Introduced by Cenex/LOL, in late 1987, this program is an agronomic management and information system. It uses telecommunications and computers to help member locals speedily provide their patrons with soil-test results, precisely-blended fertilizers, pesticide recommendations, and valuable up-to-date informtion. AgriSource is an expanding, multisource system that may grow to include information from suppliers and government agencies. Later, it may include catalogs from which farmers can order supplies from their farm offices.

About the same time, Cenex/LOL was helping a partially owned subsidaiary develop the SOILECTION system. Using digital maps, radar and an on-board computer and fertilizer blender, a SOILECTION spreader adjusts plant food and chemical rates of application in accordance to soil need as it passes over fields. Introduced in 1985, 20 Cenex/LOL locals reportedly had invested in these spreaders by early 1989.

Interregional cooperation came about as regional cooperatives learned to increase their effectiveness much like individual farmers once learned to use cooperatives to maximize their buying power. This action was stimulated by World War II and by the Tennessee Valley Authority (TVA). In 1941, Fertilizer Cooperatives of North America was organized to coordinate increased fertilizer production for the war effort. After the war, the Tennessee Valley Authority (TVA) encouraged interregionals by using them to market TVA's fertilizers, and between 1943 and 1946, three were organized. They were Associated Cooperatives, Northwest Fertilizer Cooperatives, and Central Farmers, now CF Industries.

CF remained a wholesaler for only a decade or so, then it entered into manufacturing fertilizers where the most important interregional activities developed.

Mixing and Manufacturing

Early Cooperative Developments

Cooperatives wholesaling fertilizer soon found it advisable to undertake their own mixing operations, then to manufacture superphosphate, and finally to produce basic materials to assure a dependable supply and realize additional savings. The first known cooperative mixing plant was built at Caribou, ME, in 1920.

In 1924, GLF acquired a minority interest in a company that manufactured acid phosphate and mixed fertilizers. In 1927, GLF bought a mixing plant at Phelps, NY, and two more by 1930. Fertilizer sales more than doubled from fiscal year 1927 to 1930. In the late 1930's, GLF and the Farm Bureau Cooperative Association, Columbus, OH, jointly acquired a fertilizer plant in Baltimore, MD. In 1931, Eastern States acquired a mixing plant in Boston, then a second in Wilmington, DE.

In 1938, MFC began mixing fertilizer with a concrete mixer at Laurel, MS. In 1942, it acquired a small mixing plant at Canton, MS, and in 1943, it installed modem mixing machinery in a plant at Corinth, MS. In 1948, MFC helped organize the Coastal Chemical Corp., to manufacture mixed fertilizers and in 1950 it began manufacturing superphosphate at a new acidulating plant at Canton.

Two cooperatives in Alabama and one in Virginia were formed in the 1930's to dry mix fertilizers. In 1941, CPA acquired

A major transition in fertilizer use was from pre-determined and bagged mixtures of nitrogen, phosphorus, and potash to dry bulk-blended mixtures tailored to soil test recommendations.

a plant and began mixing fertilizer at Carrollton, GA. Soon fertilizer operations followed at Savannah, Cordele, and Sylvester, GA. Super-phosphate was later manufactured at two plants.

In 1934, SSC leased a mixing plant at Norfolk, VA, because its supplier's prices were high, and in December 1936, it acquired a large plant in Baltimore. The following year, SSC made arrangements to supply the statewide cooperative in Pennsylvania from this plant and the Farmers Cooperative Exchange, Raleigh, NC, from a new plant in Norfolk.

In 1939, IFBCA, after buying fertilizer from a noncooperative company for 8 years, constructed two plants of its own; a third was built in 1940. IFBCA needed to decentralize the program to reduce trucking costs, and manufacture cheaper fertilizer.

Fourteen cooperative mixing plants were built from 1940 to 1948, six with acidulating equipment. Besides mixtures, they also produced normal superphosphate.

In the early 1950's, cooperatives began to add equipment to produce granules rather than powdered products that often caked or became lumpy. This process aided the increase in bulk spreading by farmers.

As already mentioned, increased food production during World War II led to the development of a new and integrated cooperative fertilizer industry using basic products and their derivatives-nitrogen and phosphate fertilizers in the 1950's and potash in the late 1960's. Specifically, the reasons for these undertakings were:

1. Cooperatives had experienced difficulty in obtaining materials to meet their members' highly seasonal fertilizer needs. This was especially true during a shortage of nitrogen fertilizer after World War II. Suppliers took care of their own needs first.

2. Cooperatives found their own basic production and primary distribution helped support their marketing operations logistically and economically. Making products available to members as needed was of paramount importance.

3. Cooperatives soon discovered their wholesale margins were limited and they usually could return substantially greater savings to members by producing basic materials.

4. Cooperatives found they could develop new products, control quality, and effect new methods of application and other services by controlling a substantial amount of basic production.

The first cooperative anhydrous ammonia plant was built by MCC in 1951 at Yazoo City, MS. It came into being as a result of curtailed imports from Chile of nitrate of soda, a principal fertilizer used by Delta cotton farmers. Encouraged by the State Farm Bureau, MFC, AFC, MFA, other regionals, and local cooperatives, 10,000 farmers bought $4.25 million of capital stock, cooperatives bought $250,000, and a county industrial revenue bond issue raised $750,000 to build a $7.5 million nitrogen plant. It could produce anhydrous ammonia, ammonium nitrate, and nitric acid. It was highly successful and was expanded in later years. CCA built its first mixing plant at Eagle Grove, IA, in 1948. In the following year, it acquired a mixing and acidulation plant at St. Joseph, MO, and built a similar plant at Muskogee, OK.

From 1951 to 1954, CCA helped finance and build a $14 million nitrogen plant at Lawrence, KS. It was operated by a subsidiary-cooperative Farm Chemicals Association (CFCA); CCA owned 75 percent and Central Farmers Fertilizer Co. (now CF) owned 25 percent. This plant opened in 1955 and has since expanded. CF later sold its share to MFA who sold it to Farmland in 1985.

CCA/Farmland later expanded and integrated operations making it competitive with CF as the largest cooperative fertilizer manufacturer and distributor of some fertilizers. In 1959, CCA enlarged the Lawrence plant and acquired a 75-percent interest in an ammonium phosphate plant in Joplin, MO; in 1962, it opened an ammonia plant at Hastings, NE, and completed a third nitrogen plant at Fort Dodge, IA, both under contract to CFCA. In 1966, CCA completed a phosphate plant at Bartow, FL, purchased undeveloped phosphate land nearby, raised its investment in fertilizer facilities to $106 million, and increased its capacity to 1.4 million tons. In 1968, CCA built its third nitrogen plant at Dodge City, KS.

Expansions begun by CCA continued under the Farmland name. Farmland put one ammonia line on-stream in Enid, OK in 1974, followed by a second in 1977. These additions raised farmland's capacity to 1.1 million tons.

In 1959, Valley Nitrogen Producers, Inc. (VNP) of Helms, CA, began operating its first nitrogen plant. Agway built its first and only nitrogen plant at Olean, NY, in 1966.

Interregional Cooperation

Cooperation among regional cooperatives manufacturing fertilizer began on a small scale in the 1930's when GLF and FB Co-op formed the Fertilizer Manufacturing Cooperative and became joint owners of a plant in Baltimore. In 1939-40, the Farm Bureau cooperatives in Indiana and Ohio built a plant at Cincinnati.

CF first became an interregional manufacturer of basic fertilizers with the opening of CFCA's nitrogen plant at Lawrence in 1955, then steadily broadened its base. In 1967, it leased a nitrogen plant built during 1965, in Fremont, NE, by Fel-Tex, Inc., another cooperative. In 1971, CF purchased this plant. Then, it opened a plant at Terre Haute, IN, under a joint venture called Central Nitrogen, Inc. CF later acquired this plant and continued to add and to improve other facilities.

CF's last two investments in nitrogen production were the largest. As a major partner in Canadian Fertilizer, Ltd. (CFL), Calgary, Canada, CF began operating a world-scale plant in 1976. Finally, it completed another world-scale ammonia plant at Donaldsonville, LA, in 1977.

During the last decade of this period, CF used its experience to manage nitrogen plants at Olean, NY, owned by Agway, and at Tyner, TN, and Ahoskie, NC, owned by the Farmers Chemical Association (FCA) of Tyner, TN. CF began managing FCA's plants in 1973 under a lease-purchase agreement and purchased the Ahoskie plant in 1982.

In 1959, CF began to mine and process phosphate rock near Montpelier, ID. It operated this mine through 1963, when the mine closed because of adverse economics. In 1965, CF took its second major step toward basic phosphate production by buying a wet rock plant at Plant City, FL. In 1969, it took its third step by acquiring a plant at Bonnie from International Minerals and Chemical Corp.

These facilities were expanded and modernized. But in 1974-75 CF took its fourth major step by agreeing to purchase phosphate reserves of about 100 million tons of recoverable rock in Hardee County, FL. In 1978, CF started to process this rock; in 1984, it expected to put its second mine into operation and raise total annual rock output to 3 million tons. By 1984, CF's phosphate operations and a similar undertaking by Farmland were jeop-

ardized by adverse business conditions. In 1988, both CF and Farmland still retained their phosphate reserves , but CF found it economical to purchase much of its rock from a noncooperative source.

CF's first attempt at basic potash production was to buy a 49-percent interest in the Central Canada Potash Co. (CCPC) in 1969. Noranda Mines of Toronto owned the remaining share and operated the mine at Coloney, Saskatchewan, while CF marketed most of its output. Ten years later, at least partially because of regulations by the Province of Saskatchewan, CF divested itself of CCPC. Immediately, it entered into a long-term contract with its former partner for much of its own future potash requirements. Farmland later withdrew from CF and soon stopped procuring its potash from CF.

Mississippi Chemical Corp. developed into an interregional when MFC, AFC, MFA, and others became members at the time Mississippi Chemical obtained its first plants in 1948. Later, it acquired the mixing plants of regionals serving Mississippi and Arkansas and continued to manufacture mixed goods for them. As noted earlier, MCC built a nitrogen complex followed by the world's first l,OOO-ton ammonia plant being brought on stream in 1966. In 1970, MCC helped set up a nitrogen complex at Donaldsonville, LA. This was through Triad, a company owned equally with First Mississippi.

Other interregional manufacturing cooperatives formed over the years include the Farmers Chemical Company (Joplin, MO) owned by CCA and MFA; Central Nitrogen, Inc., (Terre Haute, IN) owned by Central Farmers, and statewide cooperatives in Indiana, Illinois, and Ohio (its plant was originally built for CFCA in 1963); and FCA owned by Tennessee Farmers, Gold Kist, FCX, and SSC.

Current Status

In 1984, Farmland and two interregional cooperatives manufactured fertilizers with an estimated value of just under $2 billion. Farmland probably manufactured about third of the total, MCC about a fifth, and CF the balance. Altogether these three cooperatives supplied about three-quarters of fertilizer purchased by cooperative wholesalers and up to 60 percent of the total retailed by all cooperatives.

By 1984, CF's primary products were nitrogen and phosphates. It had an interest in three anhydrous ammonia complexes, including one in Canada, with annual capacity totaling 2,450,000 tons. It also owned two phosphoric acid plants with an annual capacity of 1,340,000 tons.

During 1979-87, CF sold from 6.8 to 9.7 million tons of fertilizer a year, the high being in 1979; net sales varied from $766 million to $1.2 billion a year; and income before patronage refunds and income taxes ranged from a minus $98.5 million to $215.5 million.

By the end of 1987, CF had $856 million in assets and $477 million of stockholder equity, while CF's number or employees was still down several hundred from the all-time high. CF was smaller and more streamlined, having survived a severe industry-wide recession. It was owned by 13 regional cooperatives, including two in Canada.

In 1987, MCC was owned by about 20,000 farmers, about 90 locals, and several regional cooperatives. It still operated at least one mixed fertilizer facility and ammonia complexes in Pascagoula and Yazoo City. It had an annual production capacity of well over 500,000 tons of ammonia, including half of Triad's capacity. Also, MCC still had the capacity to produce 240,000 tons of K_2O annually and held huge potash rock reserves at Carlsbad, NM.

MCC's revenues ranged from $171 million to $395 million per year between 1979 and 1987. MCC's net margins ranged from a minus $26.1 million to $61.0 million a year, with 1987 the year of greatest loss. At the end of 1987, MCC had assets of $230.3 million, down 35 percent from 1984. Net investment in plant and equipment was $154.3 million in 1987, while members' equity was $121.4 million. MCC's number of employees was 640, down 1,035 from 1982.

In 1988, MCC sold its Pascaqoula plant and reopened its Carlsbad mine. Meanwhile, Farmland purchased a nitrogen facility at Beatrice, NE. In 1988, MCC sold about 1.6 million tons of fertilizer, compared to Farmland's 4.9 million and CF's 7.3 million. Like Farmland and CF, MCC had weathered the agricultural recession.

Operating Practices

Five operating practices have been particularly important in helping cooperative fertilizer manufacturers achieve success. They are fair prices, economical plants, maximized savings, basic manufacturing, and extensive distribution systems.

Cooperative manufacturers have priced fertilizer fairly by following the market; they have tended to follow the prices established by noncooperatives.

Cooperative fertilizer manufacturers have historically supported their ability to price competitively by operating economical plants. For example, CF has claimed exceptionally long between-maintenance runs on its nitrogen plants. Similar actions enabled cooperatives to operate their ammonia plants 10 to 20 percent more efficiently than noncooperatives between 1972 and 1977. However, most cooperative ammonia plants were also newer and larger. [7]

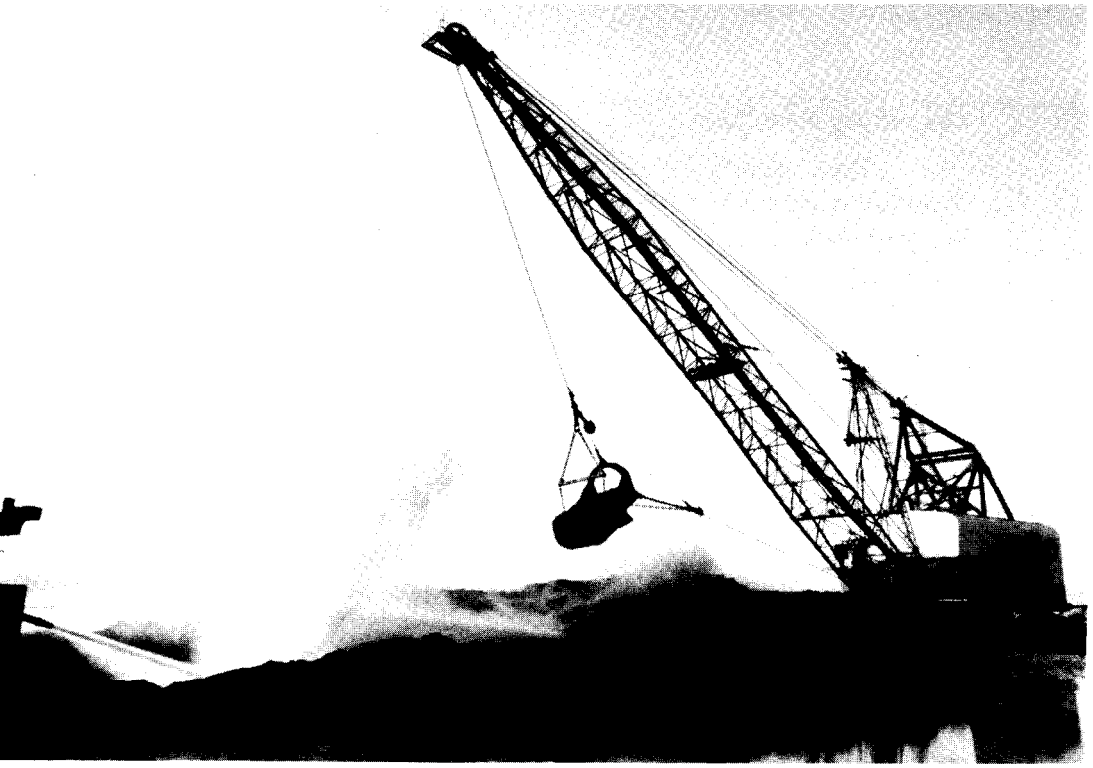
Cooperative fertilizer manufacturers seek maximum savings, recognizing their importance to the economic well-being of member regionals and locals. Unfortunately, savings, as measured by patronage refunds, varies greatly over time.

Much cooperative effort has gone into securing the most economical sources of basic fertilizers. Such was the driving force behind cooperative investments in potash mines, phosphate resources and facilities, and world-scale ammonia plants.

Cooperatives have exercised prudence and flexibility, however, as political and economic conditions have changed. For example, CF shut down phosphate production in Idaho and sold its interest in its Canadian potash mine. Meanwhile, in 1983, MCC and others began importing potash from Israel, even though MCC still had a closed mine and potash reserves in New Mexico.

Furthermore, during 1982 and early 1983, CF permanently closed nitrogen complexes at Ahoskie, NC, and Fremont, NE. It also temporarily shut down two ammonia lines at Donaldsonville, LA, its nitrogen complex at Tunis, TN, and its phosphate complex at Bartow, FL. Similarly, Agway halved its ammoniated fertilizer plants from 11 to 6. These drastic actions followed drastic changes in demand, international supplies, and production costs.

To have the needed quantities of fertilizer positioned properly for the fertilizer season, cooperative manufacturers have built extensive distribution systems. Through 1983, CF steadily



Farmers have united through local and regional cooperatives to own the interregional cooperative, CF Industries, known as the world's largest fertilizer manufacturer. Above, a dragline scoops up phosphate rock destined for CF's Plant City complex, below, in Florida.

expanded distribution storage until it peaked at 2.3 million tons and its requirements began to decline.

In 1988, CF provided 2.1 million tons of storage capacity in its distribution system. It owned 21 liquid terminals and 7 dry storage warehouses. It leased 26 liquid terminals and 7 dry storage warehouses. Thirteen of the terminals were in Illinois and Indiana. CF also had a fleet of railroad cars, access to pipelines, and a one-third share in a barge line.

CF negotiated its first contract to pipe anhydrous ammonia from the Gulf Coast to its midwestern terminals in 1969. In 1974, CF and several grain marketing cooperatives organized the barge line, Agri-Trans Corporation, St. Louis, MO. CF paid Agri-Trans $9.3 million in shipping charges in 1984, down from $17.5 million in 1982. CF operated Agri-Trans until 1986.

Limestone Distribution and Quarrying

U.S. farmers spent about $300 million for limestone in 1987, down from an all-time high of $442 million in 1981. Two earlier periods when expenditures were relatively high were 1963 to 1966, when they ranged from $112 million to $121 million, and 1945 to 1952, when they were between $97 million and $115 million.

Fine agricultural limestone is a byproduct of crushing stone for other purposes. Only a few local cooperatives ever owned or operated limestone quarries. An example was a quarry at Frederick, MD.

Few regional cooperatives have sold or spread limestone, except centralized organizations along the East Coast. In 1919, the Grange Exchange, one of Agway's and GLF's predecessors, quoted prices for ground limestone recommended by Cornell University in bulk and in paper sacks, but farmers preferred burned and hydrated lime produced by a firm in Ohio.

By 1929-30, GLF's lime volume was only 10,260 tons. Margins were low, but several long-term sources of supply were obtained, and by 1935-36, volume was 60,700 tons. Then volume expanded greatly as a result of several factors: the Agricultural Adjustment Administration's program of giving away lime or paying farmers cash to use it, the development of custom lime spreading, the increased practice of soil testing, and the large expansion of alfalfa acreage. By 1959-60, GLF's limestone volume reached

603,344 tons. Thirty-one suppliers were operating at 40 locations in 6 States.

As far back as 1933, GLF began searching for lime-spreading equipment to pull behind wagons and trucks. Later it spent a great deal of time and money developing lime-spreading trucks. Some 175 trucks with GLF equipment were operating by 1960—some owned by GLF stores, agent-buyers, and contract operators.

Today, Agway, Gold Kist, and SS are the principal cooperative regionals that handle limestone. Agway, for example, has long-term contracts with lime production firms in its area to ensure a stable source of supply, and some of its outlets have a number of spreader truck drivers, while others arrange with local individuals for custom lime-spreading services. Agway's limestone sales have been as high as a million tons per year, but totaled only 631,000 tons in 1988, down at least some from farming's economic adversity. During the same year, Gold Kist handled 306,000 tons.

In addition to large tonnage of agricultural limestone, SS also sold a sizable tonnage of pelleted limestone to nonfarm users. Pelleted limestone was made at two of SS's plants where it also acidulates mixed fertilizers.

Vertical Integration

Farmer cooperatives have made significant progress in integrating fertilizer operations, especially during the past 30 years. This has helped in the following ways:

- Local cooperatives deliver a large volume in their own bulk trucks and custom spread a considerable tonnage
- Wholesale cooperatives handle about 75 percent of the total cooperative retail volume.
- National or area manufacturing/purchasing cooperatives originate up to 60 percent of the net cooperative tonnage.
- Cooperatives mix or produce 90 to 95 percent of their mixtures and nearly all of the dry bulk blends they sell.
- They manufacture about 80 percent of the nitrogen fertilizers and 70 percent of the phosphate distributed by cooperative wholesalers. They could also mine about 10 percent of their potash needs.

Cooperatives manufacture a significant portion of the basic ingredients used in manufacturing fertilizer derivatives. These

include most of the nitric acid used in manufacturing solid nitrogen fertilizers and most of the phosphoric acid used in manufacturing phosphate fertilizer. In addition, cooperatives have several byproduct plants to recover uranium, hydrofluosilicic acid, fluorine, carbon dioxide, and argon gas.

Cooperatives have integrated their operations to a limited extent to produce basic ingredients, defined here as the mining of potash and phosphate rock, the drilling and production of natural gas, and the exploration and acquisition of land containing reserves of these ingredients. Only one cooperative now has a potash mine, one mines phosphate in Florida, and three have phosphate reserves in Florida.

Finally, cooperatives own extensive storage facilities at each major level of integrated operation. They have more than 100 liquid storage terminals and many dry warehouses at primary distribution points, plus dry and liquid storage facilities at chemical mixing and bulk blending plants, plus thousands of ammonia tanks and warehouses operated by local cooperatives, branch stores, warehouses, and dealer-agents.

The wholesaling/manufacturing cooperatives have some rail tank cars, highway transports for fertilizers, and numerous barges jointly owned with and by their interregional cooperative. Data are not available on the proportion of cooperatives' total fertilizer tonnage stored and transported in their own facilities and equipment.

Benefits

Cooperatives manufacturing, purchasing, and distributing fertilizer and lime operate to maximize member benefits. Although patron benefits originate throughout the cooperative system, the following discussion focuses mainly on benefits that cooperative fertilizer outlets finally transmit to their patrons. These are the only benefits meaningful to most farmers and they have been significant in savings and services.

Savings

Net savings generated by cooperative systems have substantially reduced the cost of fertilizer to farmer-patrons. In early days, savings were often 10 percent or more. In 1966, MCC refunded 40 percent of patrons' original investment and began to

operate the world's first l,OOO-ton-a-day centrifugal ammonia plant, itself a tremendous first for cooperatives.

Savings on cooperative fertilizers fluctuate periodically. For example, cash patronage refunds by cooperative fertilizer outlets across Nebraska and Iowa during 1979 ranged from 0.5 to 4.5 percent of the average prices quoted on six principal fertilizers. More specifically, cash refunds averaged 1.5 percent or $4.45 per ton of anhydrous ammonia across Nebraska and Iowa, while total refunds averaged 4.0 percent of the quoted price or $6.92 per ton.

Besides variations in the savings generated by cooperative manufacturers and wholesalers, the savings locals distribute to patrons vary by fertilizer, location, competitor pricing policies, the locals' financial strength, and their refund policies. For example, refund policies affect the proportion paid in cash, the basis used (tons or dollar purchases), and whether they are fertilizer-specific or uniform across all farm supplies.

Patron refunds on fertilizers simply magnify price savings that sometimes occur because of cooperative pricing practices or a cooperative presence in a market. For example, in 1957 potential competitors dropped the price of anhydrous ammonia 25 percent when Valley Nitrogen Producers, Helm, CA, announced its plan to build an ammonia plant. Valley Nitrogen met this price for the next 3 years and all farmers and cooperative patrons benefited.

Nationwide, fertilizer prices, as measured by index figures, have risen slower than prices of petroleum products and farm machinery. The cooperatives' market share of nonfertilizer products has been lower than for fertilizer. That all farmers benefit from this is also reflected in data maintained by IFBCA. Figures show that between 1931 to 1940 the prices of all fertilizer in Indiana averaged from 3 to 15 percent (or from $1 to $5 a ton on fertilizers selling for $30 to $35 a ton) lower than in Kentucky and Illinois, where few cooperatives were handling fertilizer. Similarly, in 1940, prices of 2-12-6 fertilizers in Michigan and Ohio, where cooperatives existed, averaged from 12 to 18 percent lower than in Kentucky and Illinois. On 0-20-O fertilizers, the difference ranged from 2 to 14 percent less. Nationwide, a quarter of the decline in the real price of fertilizer between 1930 and 1960 came from increased competition among cooperatives and other manufacturers. [8]

Perhaps the best measure of the cooperative influence was taken in 1975-76. It showed that in States where the cooperative

share of the fertilizer market was 10 percentage points higher than the national average (37 percent), fertilizer prices paid by farmers were $6.40 per ton lower than the national average price ($120 per ton). [9]

Services

Earlier sections on cooperative manufacturing and distribution alluded to cooperative efforts to provide patrons with adequate quantities of fertilizer. As important as these aspects of cooperative service are, none exemplifies the cooperative drive to benefit farmers more than their handling of fertilizer exports.

Exports-Although they have received more emphasis lately, fertilizer exports historically have been only a secondary business for a few cooperative manufacturers; most have not exported. Exporting was usually a way to dispose of surplus product. Because demand for most fertilizers has exceeded cooperative capacity, until recently, cooperative exports have been small-in 1969/70, only 455,000 tons, and probably considerably less than 750,000 tons in 1984.

Even during the period of high world prices and fertilizer shortages of 1973-75, cooperatives exported little and did not contribute to the U.S. fertilizer shortage. In fact, cooperatives decreased their exports to probably no more than 125,000 tons annually. Only Valley Nitrogen and Mississippi Chemical exported during these years, with some of the latter's exports going to members in Hawaii, El Salvador, and Mexico.

Nutrient Content-Cooperatives stress the quality of fertilizers. Early in their history, major cooperatives emphasized higher analysis products and substituted limestone for sand as fillers in mixed goods. Eastern States (now Agway) is a case in point. In 1929, it sold mixed fertilizers averaging 26 percent plant food, a very high percent for that time. But Eastern States was not satisfied and raised its average to 34 percent by 1939. Agway continued this tradition by raising its all-fertilizer average to 50 percent in 1974; this average was influenced by high-analysis fertilizers like anhydrous ammonia. Other cooperatives followed the Eastern States/Agway example while MFC's 1948 plant was built specifically for high-analysis mixtures.

Bulk Blends-The cooperative emphasis on high analysis fertilizers led naturally to their marketing bulk blends and anhy-

drous ammonia in combination. Cooperatives were already encouraging direct application of basic fertilizer with high plant food levels such as anhydrous ammonia (82 percent), potash (60 percent), and triple superphosphate (45 percent).

Cooperatives based their bulk-blending activities on soil tests, prescription applications, and adequate inventories of equipment to deliver and apply these fertilizers. These they loaned, rented, or used for custom applications. Cooperatives continued to support strongly these activities and services through the 1980's—so strongly, in fact, that some overlooked opportunities with liquid mixtures.

Other Product-Oriented Benefits-Of less, yet meaningful, importance are benefits from other product-oriented innovations begun by cooperatives. Early in their history, cooperatives advocated using "open formula" fertilizers based on recommendations of State experiment stations. They also advocated mixtures with fewer formulas as a means of saving money for patrons. Indiana cooperatives working with Purdue University reduced the number of formulas to about a dozen, far less than the number they previously manufactured and sold.

In 1934, one cooperative became the first company in the fertilizer industry to abandon problem-ladened burlap for paper to bag fertilizers. Its switch to paper was 95 percent complete by 1940. But it had no comer on cooperative innovations, which continued into the 1980's. In 1980, Agway introduced dry blends impregnated with pesticides and a year later expanded this service to 30 locations. In 1982, MCC developed a suspension grade potash. In about 1985 and in 1987, as previously noted, Cenex/LOL introduced SOILECTION and AgriSource.

Business Development-Business development, as practiced by CENEX and other regionals, is a service that benefits farmers not served by cooperatives. CENEX and others identify localities not served by cooperatives and proceed to build fertilizer outlets managed by the regionals' personnel.

At this stage, such outlets are operated much the same as outlets of any company. But the difference comes when a sufficient number of farmers become patrons of these outlets. At this point, patrons of federated cooperatives are given the opportunity to buy these outlets and the regionals recover their investments.

Challenges Ahead

Cooperative managers responsible for fertilizers will face many challenges during the next decade. Changes in economic conditions, the volatility of natural gas prices, shifts in demand, and the threat of foreign competition will be common to cooperatives and noncooperatives alike. Meeting patron needs, hiring and retaining effective personnel, and handling nonfarm business will be shared by several divisions within cooperatives.

Developing Size Advantages

Many local cooperatives handle more fertilizer and have greater total sales than noncooperatives. They must achieve the economics and generate the per-unit savings associated with large volume, increase the number and the quality of fertilizer-related services, and hire the quality of management befitting their size. Smaller locals are urged to generate more sales and services either by internal growth or consolidation. Cenex/LOL has demonstrated the economics of consolidation by regionals. Through AgriSource, it is also demonstrating how a pooling of resources can multiply and enhance services.

Expanding Service

Cooperative locals handling only farm supplies should realize that many farmers buy fertilizer from a company that also markets grain or other farm produce. Consequently, many farm supply locals should consider adding marketing functions to their operations. Thus, consolidations of locals may well include a grain elevator as well as two or more farm supply outlets.

Selling Competitively

Cooperative fertilizer outlets should be able to supply their patrons at less cost than noncooperatives. To meet this challenge, cooperative outlets should (1) take steps to reduce operating costs, (2) adjust their margins, (3) modify their refund policies, particularly those related to the level of cash refunds, (4) modify price adjustments in relation to service charges and discounts, and (5) pay less for their fertilizers.

Both regional and local managements must address the question of pricing to high-volume users. They must devise plans

and member education programs to treat both high- and low-volume users on an equitable basis.

Sources of Fertilizer

Cooperative manufacturers will continue to be challenged to maintain whatever economic advantage they have in supplying fertilizers. The challenge will possibly be felt mostly in the production of anhydrous ammonia. Cooperative manufacturers experienced cost increases when they renegotiated natural gas prices during the last half of the 1980's. Meanwhile, at least some pricing pressure will continue from foreign producers.

Cooperatives must meet these challenges by running their most economic and most efficient facilities to the maximum; procuring inputs from the most economical sources; securing more of their own resources either in or outside the United States; trading phosphate for other foreign fertilizers; possibly producing fertilizers overseas; purchasing offshore fertilizers, if economical; and examining methods for intercooperative pooling of raw material reserves. Also, wholesale and manufacturing cooperatives should continue to devise means of obtaining a larger share of the fertilizer purchased by cooperative retailers and wholesalers.

Price Leadership

Regional and interregional suppliers of fertilizer have sometimes acted as price leaders, but their strength in the market may now indicate that they should take this role more consistently.

In general, cooperative suppliers should more often lead rather than follow the competition, modulate price fluctuation more than in the past, and determine when farmer patrons are best served by raising and lowering fertilizer prices. They should pursue such price leadership after carefully considering margin objectives, shortrun and longrun competitiveness of their members, actions of their competitors, their own business objectives, their longrun need to lead in fertilizer improvements, and their need to improve both fertilizer distribution and services.

Distribution Systems

Cooperatives must maintain and improve their distribution systems. While they can ensure the timely and economic delivery of fertilizers, these systems must remain economical by elimina-

tion of duplication and underutilization. Full utilization can be achieved by increasing volume both from the owner-cooperative and competing cooperatives and from providing facilities and services to noncooperatives. Recent consolidations of cooperatives has helped.

Developing New Markets

Regional cooperatives can strengthen their position in the fertilizer market by organizing locals in undeveloped areas, both within and on the periphery of their territories. By so doing, they can spread their overhead costs, increase their volume advantages, and bring added financial benefits to old and new patrons.

Regionals such as Cenex and Farmland, which already have programs for developing additional markets, should continue to use and improve their programs. Regionals that do not have such programs may wish to emulate the CENEX and Farmland approaches. Such programs directed at other cooperatives are discouraged.

FARM CHEMICALS

Farm chemicals, sometimes called agrichemicals, include insecticides, fungicides, herbicides, rodenticides, and repellents-in both dry and liquid forms. They also may include fumigants, defoliants, seed innoculants, soil treatments, and wood preservatives.

Farmers spent about $4.6 billion for agricultural chemicals in 1987 compared with about $1 billion in 1970-71 (table 2). The $4.6 billion subdivided into the following approximate percentages:

Pesticide	*Percent*
Herbicides	62
Insecticides	22
Fungicides	10
Other	6
Total	100

Table 2-Cooperatives handling farm chemicals (pesticides) and their net sales and share of the farm market in specified years. 1/

Year	Cooperatives selling farm chemicals	Cooperatives' net sales of farm chemicals 2/	Farmers expenditures for farm chemicals 3/	Cooperatives' market share
	Number	*Million dollars*		*Percent*
1950-51	1,111	24.7	192.5	13
1955-56	2,145	35.6	234.5	15
1960-61	3,014	56.4	310.0	18
1965-66	3,330	89.1	518.0	17
1970-7 1	3,556	199.7	1,051.5	19
1975-76	3,597	627.8	1,945.5	32
1981	3,684	1,275.0	4,201 .0	30
1983	3,407	1,250.2	4,154.0	30
1984	3,289	1,460.3	4,767.0	29
1985	3,204	1,450.8	4,994.0	29
1986	3,102	1.358.3	4,484.0	31
1987	3.005	1,291.2	4.588.0	28
1988 4/	2,907	1,339.2	4,716.0	28

1/ Business years ending June 30, except in 1981-88 when calendar years are used.
2/ Excludes business among cooperatives but includes sales not for farm use.
3/ Average of 2 calendar years for 1950-51 through 1975-76.
4/ Preliminary.

Retailing

Early Developments

Among the earliest cooperative efforts was the handling of fumigants by local citrus marketing cooperatives in California around 1910-l 1. They supplied members with potassium cyanide and later sodium cyanide to fumigate their orchards.

Local Grange cooperative stores and farmer buying groups in the Northeast began handling farm chemicals along with feed, seed, and fertilizer from 1915 to 1920. Stores and dealer agents affiliated with Eastern States Farmers Exchange (Springfield, MA) and Cooperative GLF Exchange (Ithaca, NY) began to offer the same service in the early 1920's. Most handled only a few items such as copper sulfate and calcium arsenate for potatoes; lead arsenate, nicotine sulfate, and lime sulfur solution for apples; and Bordeaux mixtures made from copper sulfate and hydrated lime.

In the South, many cotton gins and marketing and supply cooperatives began selling pesticides for cotton. Dairy cooperatives throughout the country handled flysprays and cleansing powders or disinfectants, and livestock marketing and farm supply cooperatives in the central areas began selling livestock sprays and disinfectants and grain fumigants.

The farm chemical business increased in the 1950's because of a growing interest in insect and disease control and the development of chemical weed sprays and other new materials. By that time, cooperatives were handling a wide variety of complex pesticides-often as many as 100 to 200, a trend that has continued.

Cooperative exchanges in the South first distributed liquid chemicals for treating crops in the mid-1960's.

Current Status

In 1987, 3,005 cooperatives reported net sales of farm chemicals totaling $1.3 billion (table 2). This compares with 3,556 associations that sold only $200 million in 1970-71. An undetermined amount of cooperative sales falls under "general farm supply sales." Leading States in net sales of farm chemicals by cooperatives in 1987 were Iowa with $172 million; Illinois, $133 million; Minnesota, $113 million; Nebraska, $66 million; and Indiana with $65 million.

Two of these States were among the five Combelt States where farmers use herbicides heavily and purchased 40 percent of their pesticides through cooperatives in 1985, compared with a 25-percent share in the remaining States. In the United States as a whole, the cooperative share of pesticide sales rested at 30 percent in 1983, up from 19 percent in 1971. It stabilized at 28 percent to 3 1 percent through 1987.

Operating Practices

Cooperatives retail farm chemicals much the same as other firms, storing them in warehouses and selling them from displays. On the other hand, since the mid-1970's, a growing proportion of the pesticides have been handled in bulk. Tanker trucks deliver liquids to local storage; from there, they are delivered directly to the farm. By 1976, local cooperatives, like those buying through Land O'Lakes (LOL), had begun to handle bulk chemicals. The following year, Southern States (SS) outlets were handling bulk chemicals.

Most cooperatives' bulk chemicals are custom applied in combination with liquid fertilizers. Custom application preceded bulk handling and so in 1976, more than 200 Land O'Lakes locals provided this service. In 1982, Landmark (now Countrymark) locals custom applied an estimated 1 million acres of crops. By 1988, about 900 Cenex/LOL locals engaged in this activity.

Some 200 Cenex/LOL locals also rely on AgriSource for chemical recommendations, while some of them, plus many other cooperatives apply chemicals with flotation sprayers. At the same time, some locals, including about 50 Cenex/LOL locals, retain aerial applicators. About a half dozen Cenex/LOL locals even lease and operate planes. Despite this sophistication of application, most locals still rely on ground rigs, with some locals owning a couple dozen. Many fruit and vegetable marketing cooperatives also provide custom application.

Cooperatives usually price chemicals at the going market levels and offer volume discounts. From net savings, patronage refunds are declared annually with at least 20 percent paid in cash. The remainder may be retained and evidenced by book credits or revolving capital certificates. Total refunds, which may be up to 10 percent of sales, vary widely among cooperatives. Some declare separate rates on total farm chemicals, but many use the same rate on all farm supply sales.

Integrated Pest Management Service

As with other agricultural businesses, cooperatives did little with integrated pest management (IPM) until the 1960's, a decade with several key developments. During the early 1960's, even before IPM became a popular concept, Farmers' Supply Cooperative, Greenwood, MS, began to hire young people to scout its members' cotton fields. In 1968, the Safford Valley Cotton Growers Cooperative, a ginning operation in Safford, AZ, initiated a full IPM program. [10]

During the 1970's, Extension Service programs encouraged several California cotton gins to sponsor IPM, and soon other local cooperatives either began IPM programs or organized to deliver the service. These included Agro-Serv, Inc., Imperial, NE; Farmers Pest Management Services Cooperatives, Inc., Edenton, NC; Gold Kist locals at Camilla, GA; Courtland, AL; and Little Rock, SC; Lake Shore Crop Management Cooperative, North East, PA; Northern Growmark, a branch of GROWMARK, Hampshire, IL; Rainbow Industries, Inc., Buckeye, AZ; and Trimont Cooperative Association, Trimont, MN.

In 1988, farmer-owned cooperatives delivered IPM services to well over 2.5 million acres of U.S. cropland. Servi-Tech, Inc., of Dodge City, KS, a regional, and CENTROL, a series of federations supported by Cenex/LOL, dominated cooperative IPM activities. The IPM programs of other regionals' were small or non-existant, including Farmland's Crop Management Service and Agway's Integrated Crop Management sales program. For example, some of Agway's Crop specialist scout fields regularly, but only those of the cooperative's very best customers.

Servi-Tech—The managers of three local cooperatives organized Servi-Tech in 1975 with no official help from a regional cooperative and without geographic constraints. Servi-Tech was intended to go beyond IPM and provide a full set of crop management services for a fee.

In 1988, 120 local cooperatives and about 6,000 farmers used Servi-Tech's crop management services, covering nearly 1.3 million acres across at least portions of Colorado, Kansas, Nebraska, New Mexico, Oklahoma, and Texas, and Wyoming. Other related services included about 30,000 soil, and water analyses. By 1988, Servi-Tech had built two soil- and tissue-testing laboratories, launched a livestock management service, organized a

research program that included two research farms, and inaugrated a farm management service.

CENTROL—CENTROL started 4 years after Servi-Tech as a 22,000-acre pilot program in Morris, MN. Cenex locals owned this newly organized regional cooperative. Cenex encouraged the federation and committed financial and technical resources to help it and later CENTROL units succeed. As with Servi-Tech, services are supplied for a fee.

While the first CENTROL unit was confined to the trade territories of its 12 locals, the CENTROL concept had few geographic limitations. By 1988, it had expanded into 13 units serving 140 local cooperatives across Iowa, Minnesota, Montana, Nebraska, North Dakota, South Dakota, and Wisconsin. CENTROL units contracted to supply their services to 1.2 million acres.

Like Servi-Tech, Cenex/LOL considers CENTROL a full crop management service that focuses on IPM, but goes beyond it. Cenex/LOL continues to support one CENTROL unit that provides a package of farm management services. It provides soil analyses through a laboratory owned jointly with a noncooperative firm. CENTROL also conducts seminars to help farms increase profits through improved marketing.

Crop Management Service (CMS)—This Farmland service has two parts: that done by a crop management specialist (CMS) and that by a crop management retailer specialist (CMRS). Under each, Farmland trains participants for positions in sales and management, but CMS's are employed by Farmland while CMRS's are employed by Farmland locals. Farmland subsidizes the cost of both groups, neither of which charge for their services. While most of CMS's and CMRS's use elements of IPM in their services, Farmland's CMS program is included because a few CMS's supervise employees to scout fileds.

Employing 20 CMS's in 1979, its first full year, the Farmland system fielded 56 CMS's for 59 locals in 1988. The number of CMRS's peaked at 61 in 1983 and declined to about one-third this number in 1988.

Other Cooperative Developments-California cooperatives first used nonchemical elements of the IPM system. Fruit growers organized the Fillmore Citrus Protective District, (Fillmore) in 1922, the Associates Insectory, (Santa Paula) in 1928, and the

Oxnard Pest Control Association (Oxnard) in 1938. They still emphase the rearing and distributing of predator insects and mites to control citrus pests.

Wholesaling

Early Developments

The Fruit Growers Supply Co., Los Angeles, began supplying fumigants in addition to containers to its local citrus marketing exchanges around 1911. Following an attempt to reduce the 28.5 cents a pound price of potassium cyanide, it boycotted American producers and contracted for a supply of sodium cyanide from an English firm. The following year, domestic companies agreed to supply this product at 23 cents a pound, a direct savings of $50,000 a year on members' requirements of 1 million pounds.

In the Northeast, Eastern States began handling farm chemicals for its affiliated retail cooperatives and buying clubs in 1918. GLF began supplying its outlets in 1920. Soon other wholesale supply cooperatives in the East and South undertook this service. Midwest cooperatives began handling large volumes of farm chemicals after World War II.

Some wholesale cooperative distributors had difficulty getting old line companies to supply them because they were cooperatives. Others had to agree to sell chemicals to retailers at prices set by the suppliers.

United Cooperatives, Alliance, OH, an interregional association, established a farm chemical department in 1938. Meanwhile, GLF, which had merged into Agway, joined the Agricultural Insecticide and Fungicide Association, greatly reducing the long-time friction between pesticide manufacturers and farmer cooperatives.

Current Status

In 1986, 27 regional cooperatives provided wholesale services for $1,056 million worth of farm chemicals. Nineteen federated regionals wholesaled $838 million of product to local cooperatives while retailing $163 million of product through their own outlets. Eight centalized regionals provided wholesaling functions on $55 million of farm chemicals entirely retailed through their outlets.

Cenex/LOL, Farmland, and GROWMARK, sold the largest volumes of farm chemicals. In 1988, Cenex/LOL wholesaled well over $250 million of chemicals, with Farmland probably a close second and GROWMARK selling well over $100 million.

Operating Practices

Some regional cooperatives such as Agway, IFBCA and MFC separate their lawn and garden chemical sales from their agricultural chemical sales. In 1979, Agway began handling a new group of insecticides called synthetic pyrethroids and impregnating herbicides on dry fertilizer to eliminate separate herbicide applications. By 1988, most regionals had adopted the latter practice.

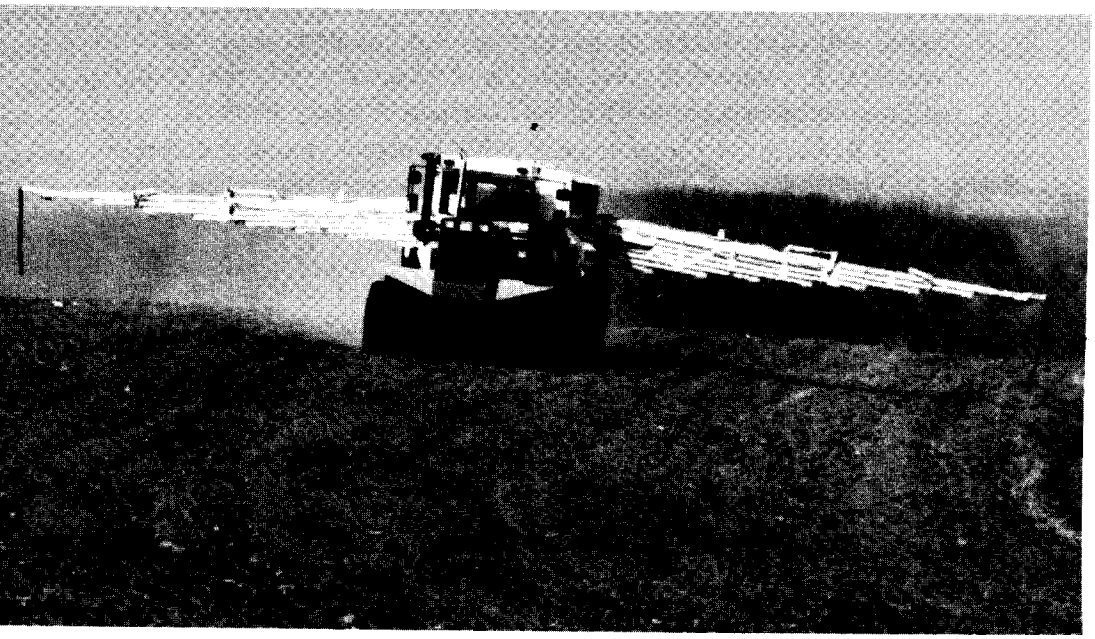
A continuous flow of new products tends to cause an inventory management problem for regional cooperatives. For example, Tennessee Farmers (TFC) recently found that four products accounted for nearly 40 percent of its pesticide sales and eight for 50 percent.

Regional wholesalers strive for high-quality pesticides, using rigorous quality controls to ensure top performance from products bearing their labels. They also strive to have pesticides readily available for their outlets and believe this is an important key to their sales record. For example, in 1988, Cenex used 27 strategically situated depots at permanent locations. In addition, it leased another dozen or so to supplement heavy in-season demands. On the other hand, GROWMARK uses only one distribution point, relying heavily on its excellent delivery service.

Besides their warehouses, MFC consigns major chemicals to local member cooperatives under an inventory protection plan. Other regionals also encourage substantial preseason ordering and stocking under various plans.

Regional cooperatives distribute farm chemicals for very low gross margins; therefore, they have welcomed the direct shipment of bulk products. Sometimes manufacturers ship chemicals to strategically located distribution points and sometimes directly to the cooperative's local outlets. In 1988, for example, Cenex/LOL shipped an estimated one-third of its pesticide sales directly to its locals, while GROWMARK and Agway did similarly with at least half of their sales.

In foregoing ways, regionals seek to maintain their role as indispensable participants in the marketing chain for farm chemi-



As the pictures at left illustrate, farm chemical application has changed over time. Both economic and environmental concerns have led to increasingly scientific approaches. An example is the Soilection unit, lower left, used by Farmers Union Oil Company at Montevideo, MN, equipped with a computer microprocessor to apply fertilizer impregnated with a liquid herbicide.

A computer crop management service is offered by Cenex/Land O'Lakes Ag Services called AgriSource. The system contains chemical label information from major chemical companies. Seconds after crop and pest information is entered, every product that controls the problem can be evaluated for best solution. Other reference data is available on fertilizer recommendations and blending based on soil tests, a catalog of safety data sheets, and overnight communication of technical information.

cals. Other ways include AgriSource by Cenex/LOL (see references in fertilizer section). In addition to its other services, AgriSource provides standardized pesticide recommendations of principal manufacturers, instantaneously available on computer screens. Being tied into manufacture information systems, AgriSource provides farmers with the most up-to-date advice available anywhere.

Formulating

Early Developments

As with fertilizer, wholesale cooperatives concluded that it was advantageous for them to formulate the dry chemicals bought in large volumes. GLF began formulating four mixtures of dusts at Batavia, NY, in 1929, grinding rotenone powder or dust at South Keamey, NJ, in 1939, and formulating a 25-percent DDT emulsifiable dust there in 1946. Eastern States began making dusts in the 1920's and 1930's, and Magee Cooperative Gin, Magee, MS, began manufacturing chemicals for cotton about 1953.

Two interregional cooperatives began formulating farm chemicals on a small scale: National Cooperatives at Chicago, IL, in 1943, and United Cooperatives at Alliance, OH, in 1949. Later, United Cooperatives acquired two more plants. These interregionals were founded in the 1930's to combine the purchasing of several regional cooperatives.

Cooperatives began making liquid insecticides a little later, mostly in the South. In 1955, the Valley Chemical Company, Greenville, MS, was organized specifically to formulate liquid pesticides. In 1962, the Valley Cooperative Oil Mill, Harlingen, TX, began making liquids for spraying cotton and some vegetables. And in 1965, CPA (now Gold Kist) built a plant to make chemicals for cotton, tobacco, and peanuts. Its capacity was 3,500 gallons of liquid and 20 tons of dust per 8-hour shift.

By the mid-1950's 25 cooperatives owned 32 dust-blending plants. Nearly all purchased basic materials from the country's major suppliers.

During the 1960's, two significant developments occurred in the cooperative sector of the agrichemical industry. In 1960, the Iowa Farm Bureau purchased Imperial, Inc., Shenandoah, IA, from investors. Shortly thereafter, FS Services (now GROWMARK)

assumed ownership until 1966, when it sold Imperial to Felco (now LOL) and MFA Oil Co. By this time, Farmland began to emphasize serving the production needs of commercial farmers. For several years, it had purchased large quantities of chemicals from a company in St. Joseph, MO, from which it bought a formulation plant in 1969.

Later Developments

At least four recent developments have occurred. In 1972, National Cooperatives and United Cooperatives merged to become Universal Cooperatives, Inc., which eventually located in Minneapolis, MN. In 1988, Universal procured and formulated farm chemicals for 38 regional cooperatives including four Canadian operations.

In 1974, Imperial purchased a second plant at Albert Lea, MN, and Farmland moved toward becoming the first cooperative to produce basic pesticides. For an additional $1.5 million, it became the full owner of the St. Joseph facilities where more than 200 Farmland products were being formulated. It then began building a plant to manufacture atrazine and other pesticides of the triazine family. About 10 million pounds of annual capacity by late 1976 helped increase Farmland's sales of farm chemicals from $37 million in 1971 to $196 million in 1981. Then, declining prices made the plant unprofitable, and Farmland converted it to other uses in 1983.

In 1977, MFC purchased a variety of facilities from the Riverside Chemical Co., at Clarksdale, including three chemical formulating plants at Clarksdale, Belden, and Canton, MS. In 1979, this company became the Red Panther Chemical Co., of Clarksdale, formed by MFC (majority owner), Alabama Farmers Association, and TFC to produce and wholesale farm chemicals. In 1987, the creation of Cenex/LOL made Cenex a partner in Imperial.

Current Status

Data are not available on the number, type, and capacities of cooperative farm chemical plants but they have almost certainly declined in number and increased in size. For example, Gold Kist closed its last formulating plant in 1984, while Agway continued to consolidate its production to Spring Garden, PA, opened in

1974. Agway ceased to formulate farm chemicals here in 1988, where it once had the capacity to produce at least 15 million pounds of dusts and granules, plus at least 1 million gallons of liquid pesticides. Farmland's only plant at St. Joseph, MO, is reportedly one of the best in the U.S. and probably cooperatives' largest pesticide plant.

In 1988, three chemical formulators operated like interregional cooperatives, being owned by and formulating for two or more regional cooperatives. Universal was the only true interregional, however, because Imperial and Red Panther each had at least one dominant stockholder. Universal had the largest volume of chemical business in 1986 with $169 million in sales, including sales of animal health products. Universal also had close working relationships with Red Panther and Farmland, using their plants to formulate much of its needs.

Vertical Integration

A number of local cooperatives and branch outlets provide their farmer-members custom application services and some offer advisory services on the proper use of farm chemicals. Local cooperatives obtain a high percent of their farm chemicals from their regional wholesale cooperatives. On the other hand, the regionals obtain only a small percent of their chemicals (perhaps 25 percent) from interregional cooperatives. Regional and interregional wholesaling cooperatives formulate a substantial portion of their sales volume in their own plants. None presently manufactures any basic materials or ingredients used in its formulating operations.

Benefits

Farmer-members' benefits from cooperative procurement of farm chemicals have been similar to those from buying other production supplies. Cooperatives are dependable sources for a wide variety of high-quality pesticides and other chemicals. They try to inventory the proper amounts of product in a timely manner at strategic locations. Cooperatives offer high quality, because cooperative specialists study and screen the best chemicals for their patrons. Moreover, cooperatives exercise rigid quality control in their formulating operations.

In addition, farmers receive all the services associated with agricultural chemicals. Many cooperatives make custom application service available and supply technically sound crop management services, broadening them into complete farm management services. Cooperatives also provide information about pesticide safety and regulations through meetings, correspondence, and field tours.

Cooperative members profit from possibly the strongest distribution systems in the farm chemical industry. The fact that cooperatives hold a 30-percent share of the market says something about both the performance and the potential of that system.

Cooperative members realized substantial savings from retailing, wholesaling, and formulating farm chemicals. Where cooperatives have had large volumes and efficient operations, their costs per unit have sometimes been low and net margins high. Some cooperatives declare separate patronage refund rates on farm chemicals, but many pay the same rate on them as on all farm production supplies. Two of the earliest cooperatives to formulate and distribute liquid pesticides realized 6 to 18 percent of their sales on the combined operations.

The competitive effect of cooperatives on market prices also has benefited members and nonmembers. But their impact is less visible after the first year or two of their entry into the market.

Challenges Ahead

Cooperative managers responsible for farm chemicals will face many challenges during the next decade, but only those relating directly to chemicals will be discussed.

Increasing Patron Savings

Cooperative regional distributors must enlarge their share of the gross margin on patented pesticides-the margin between farmer price and manufacturer cost. The opportunity exists because the margins on many patented chemicals have transferred large amounts of income from the farm to nonfarm businesses, a transfer that cooperatives have had little success in tapping.

Possibly adding value to the distributor function is the most practical and promising means of enlarging the cooperative share of the gross margin on patented pesticides. For example,

some farmers may be willing to pay for exceptional services, and some manufacturers may be willing to pay for exceptional salesmanship. It may also be possible to reduce manufacturer prices, which introduces a second challenge to cooperatives in agricultural chemicals.

Pooling Market Power

Cooperative distributors across the Nation need to pool and concentrate the full weight of their market power on the prices they pay for farm chemicals, especially for patented pesticides. Regional and local cooperatives must decide to pool orders and bargain with chemical suppliers.

Universal, with 36 member cooperatives, represents one beginning-but one that has yet to bring much of the cooperatives' total power to the bargaining table, a power represented by a 30-percent share of the market. Operations like Universal's need to find ways of capturing more of their members' farm chemical business.

Manufacturing Basic Chemicals

Pooling market power leads naturally to pooling other resources and to considering the manufacture of patented pesticides. This challenge stimulates the imagination because of the great and positive potential impact on cooperative gross margins and patron savings. Considering their recent financial reverses and limited successes in coordinating activities, however, it is unlikely that regional cooperatives will arise to this challenge before the next century. Nevertheless, they ought to be ready to take advantage of a favorable acquisition or other opportunity.

Cooperative managers need little reminder that any venture in patented chemicals must proceed with caution. Such projects mean an intensive research and development effort, require a huge capital outlay, face competitors with advantages from being in industrial chemicals, incur considerable financial risk, and will frequently yield products with short market lives. Over the next few years, however, this challenge should further stimulate cooperative managers as noncooperatives assume the risk, bring increasingly expensive chemicals to market, and, profit from their efforts.

If cooperatives cannot produce patented chemicals, they may be able to become basic through chemicals with expired

patents. While Farmland's success with atrazine may have fallen somewhat short of anticipations, the venture is a prototype for future endeavors. To be successful, they need to be undertaken as close to patent expiration as possible, while a strong demand still exists, and respectable margins are attainable. Success is further assured if payback periods are minimized, future competition is carefully assessed, and the market strategies of the prime producer, which has an inherent advantage with its depreciated facilities and production expertise, are correctly anticipated.

Achieving and Maintaining Adequate Volume

Maintenance of adequate volume is vital for any regional or group of regionals involved in manufacturing basic chemicals, but the volume will depend on the type of activity. If a cooperative is to manufacture products with recent patent expirations, at least one and perhaps more regionals already have sufficient volumes. If it is to manufacture products with new patents, volume must be much larger. Therefore, the venture may require a pooling of markets.

Maintaining an adequate volume of sales is a challenge for some federated regionals, because some of their locals have sufficient purchasing power to buy chemicals directly from manufacturers. Unfortunately, most regional cooperatives cannot lower their prices and have great difficulty replacing such sales losses. They have to stress loyalty, buttressed with an emphasis on quality chemical services and reasonable costs for other products and services.

Providing Narrower Lines of Chemicals

Providing narrower lines of necessary farm chemicals presents a fifth challenge to cooperatives. Cooperatives can often increase patron savings by minimizing their lines while handling the high-demand and most effective products.

This challenge is more important to farm chemicals than other farm supplies because chemical distributors face a continuing flow of new products. These include traditional chemicals as well as nontraditional products, such as photosynthesis enhancers and sprays to increase plant resistance to pests. Even now, nontraditional items based on genetic engineering are beginning to be marketed.

Continuing High-Quality Services

Finally, cooperatives are challenged to continue offering exceptionally high-quality services. This challenge is best seen in consulting services. These will increase with the number and complexity of agricultural chemicals and other products, as governmental regulations become stricter, and farmers realize how consulting services can save time, prevent problems, and enhance income.

Even the most reluctant regionals will be forcefully challenged by the movement from crop management services to complete farm advisories, the need to draw information and recommendations from multistate and multisource telecommunication networks, and the management of huge and ever-expanding data bases containing increasingly sophisticated information.

Over the next few years, regionals will no longer have to decide whether to provide advisory services; this decision has already been made. Very likely most regional suppliers of farm chemicals soon will offer their patrons all-farm advisory services.

The question is how regional cooperatives will provide these services. Some will retain an independent organization (not necessarily a cooperative) to provide them, while others will create their own services. If they decide to create their own, regionals must then choose between doing it internally, in a traditional manner like Farmland or going through an independent cooperative patterned after Servi-Tech or CENTROL. Bases for advisory services are already well established in such cooperative programs as SS's Grow Master Crop Service, Landmark's Total Crop Planning Program, and Agway's Integrated Crop Management approach. With its AgriSource program, Cenex/LOL seems to have been the first regional to begin building multisource telecommunication network.


SEED

SEED

Procuring seed for sale to farmers involves several stages of operation by agribusinesses: research or plant breeding; contract or in-house production of breeder, foundation, registered, and certified seed; processing; storing and wholesaling; and retailing. These forward vertical integration components starting with plant breeding and ending with the sale of seed to farmers have been traditional for cooperatives.

Over the years, however, cooperatives have begun seed operations in the reverse order. They have integrated backward from retailing to becoming basic in research and plant breeding. Their seed operations, therefore, are discussed in this order.

Farmers' Expenditures for Seed

Farmers spent $3.0 billion on seed in 1987. Most of this expenditure is believed to have gone for seed of field crops and small grains, about twice the amount spent on the seed of legume, grass, and forage crops. Seed expenditures represent about 4.5 percent of farm supply expenses and other intermediate expenses, and 2.5 percent of farmers' total production expenses. Expenditures rested at the lowest point in seven years, still almost triple their level in 1972. Much of the increase was attributable to rising prices.

Some of the increase in seed prices may be explained by the 1970 Plant Variety Protection Act that permits seed research and development companies to receive 18-year patents. Under this protection, the trend is generally away from public varieties to higher cost proprietary ones. Hybrid varieties of corn and sorghum have long been proprietary and self-fertilizing varieties such as soybeans, wheat, cotton, barley, oats, and grasses are now also following this trend.

Retailing

Early Cooperative Development

Seed was one of the first production supplies that cooperatives began to handle. It was a basic item in farm supply cooperatives in the Eastern, Central, and Southern States, in grain marketing cooperatives in the Midwest, and in cotton marketing cooperatives in the South.

In the East, two factors caused farmers to look to their cooperatives for planting seed. Seed available from other sources often had low germination and purity and was not adapted to their climatic conditions. Much of the legume seed available from the trade came from France, Italy, Africa, and Argentina.

The need for better seed was one of the reasons for organizing two of the most successful cooperatives in the Northeast and Central Atlantic. These were GLF, now Agway, and VSS, now Southern States (SS). Before these cooperatives were organized, county and State Extension agronomists in New York and Virginia helped farmers obtain better seed through pooling activities. These State agronomists also helped organize the cooperatives and some became their general managers.

Another event leading to the organization of GLF was the assistance of county Farm Bureau associations in New York in helping farmers pool orders for better quality seed. These activities soon resulted in complaints from commercial seed firms and the formation in 1918 of the State Grange Exchange as a statewide purchasing agency for local cooperatives. "Seeds That Grow" was one of its slogans.

In 1920, the State Grange Exchange and two other regional cooperatives combined their farm supply purchasing operations to form GLF. [11] GLF soon developed a reputation for selling seed of high quality and used these slogans: "Known-Origin Seed" and "Know What You Sow." Early in its history, GLF posted a $25,000 bond with the New York State Grange to back up its guarantees on alfalfa and clover seed. In 1925, it began working on corn and feed grain seed, and by 1926 some 35,000 farmers were using GLF seeds.

In 1927, GLF made a special effort to switch distribution of its seed from farmers and other seed poolers to its local retail service cooperatives and private buyer-agents. By 1930 its seed sales exceeded $1 million.

SS, starting in 1923, developed and produced superior strains of seed adapted to Virginia conditions and certified as to origin. These factors were not recognized by the seed trade at that time, forcing the producers to organize their own marketing activity. Farmers wanted to know the origin and adaptability of seed, but could not tell from its appearance. So they formed their own cooperative to ensure that the seed they bought would flourish on their Virginia farms.

Southern States Cooperative, Inc., Richmond, VA, began in 1923 as Virginia Seed Service, and continues to be a major distributor of seeds. The regional shares ownership with eight other cooperatives in the seed research interregional, FFR Cooperative.

This need was supported by the Virginia Experiment Station, which had shown that farmers had difficulty establishing and maintaining good stands of clover and alfalfa because seeds imported from other regions were not adapted to Virginia conditions and were susceptible to diseases.

Carefully selected seed sold at premium prices. It took time to convince farmers that they could get dependable seed through their cooperative and that the seed would more than repay the premium price.

An early practice that helped make VSS successful was its pooling system. More than 300 farmer-poolers assembled orders from their neighbors and then delivered the seed to them when it arrived.

Early in the century, in the South, one-variety cotton improvement associations emphasized the use of pure seed. Thus, cotton ginning and marketing associations began to sell cotton planting seed. Later, many farm supply cooperatives were formed with seed as one of their major supplies. In Illinois, 14 seed corn improvement associations existed by 1911. In other Central States, many local farm supply cooperatives organized in the 1920's and early 1930's handled seed, but very few specialized seed purchasing associations were organized.

By 1950-51, about 3,600 cooperatives were selling seed to farmers. Their net sales of seed totaled about $530 million.

Current Position

In 1987, nearly 3,000 cooperatives reported $577 million of net sales of seed to farmers and other patrons (table 3). This volume represents about 19 percent of all farmers' seed expenditures, a share that is comparable to that of the early 1960's and above a low of 15 percent in 1985.

The five States with largest cooperative net sales of seed in 1987 were: Minnesota, $34.3 million; Iowa, $34.0 million; Illinois, $32.8 million; Ohio, $27.3 million; and Texas, $21.8 million.

Farm supply or purchasing cooperatives employ the usual industry practices in selling, pricing, and merchandising seed at the retail level with one exception. Except for a few local supply cooperatives, they usually do not employ farmer dealers to sell hybrid seed corn. On the other hand, a few seed marketing cooperatives use such dealers.

Such farmer-dealers are the major source of retail sales for noncooperative firms in the Midwest and have apparently hindered the growth of cooperative seed corn sales. Exceptions to the rule include NC+ Hybrids, Lincoln, NE, Gold Kist, Cenex/LOL, and Agway. NC+ markets seed directly through about 1,200 farmer-dealers. Gold Kist and Cenex/LOL use significant numbers of such dealers indirectly through subsidiaries. Agway depends on upward to 500 farmer-dealers, using two-thirds of them directly as Dekalb-Pfizer dealers and fielding the rest through Feedway, Inc., one of Agway's wholly-owned subsidaries. Cenex/LOL fields a few farmer/dealers to fill voids in their market coverage, while some of their locals also commission such dealers. GROWMARK uses farmer-dealers similarly, but is encouraging more of its locals to use their own salespersons.

Retailing seed is one of the more difficult aspects of seed distribution. The cooperative first must market superior seed varieties, but it must also inform the farmer of their attributes. Demand for seed is seasonal, with sales often tied to those of fer-

Table 3—Cooperatives handling seed and their net sales and share of farm market in specified years 1/

Year	Cooperatives selling seed	Cooperative net sales of seed 2/	Farmer expenditures for seed	Cooperatives' market share
	Nwnber	------*Million dollars* -------		*Percent*
1950-51	3,638	90.5	534.5	17
1955-56	3,686	97.3	542.5	18
1960-61	3,912	100.3	532.0	19
1965-66	3,942	119.2	740.0	16
1970-71	3.871	158.3	1,000.0	16
1975-76	3,526	358.3	2.252.0	16
1981	3,607	574.8	3,428.0	17
1983	3,318	483.1	2,993.0	16
1984	3.203	586.9	3,448.0	17
1985	3,120	510.3	3,350.0	15
1986	3,020	513.9	2,984.0	17
1987	2,964	576.6	3,009.0	19
1988 4/	2,907	540.0	3,138.0	17

1/ Business years ending June 30. except in 1981-88 when calendar years are used.
2/ Excludes business among cooperatives but includes sales not for farm use.
3/ Average of 2 calendar years for 19.50-S through 1975-76.
4/ Preliminary.

tilizer and chemicals. Most varieties must be sold within the first year after production. This creates significant inventory risks when sales projections differ from actual volume.

Seed, especially hybrid varieties, generally competes on a nonprice basis. The performance of the variety is often stressed in terms of yield, disease and drought resistance, and standability.

With performance stressed, advertising is necessary to promote and differentiate new and existing varieties. Cooperatives use their own publications for this purpose and can also use national farm magazines that have regional editions. Strip tests or plots are often used where a competitor's variety is planted beside several of the cooperative's varieties to compare performance.

Many of the local retailing cooperatives operate simple seed cleaning plants and a few of the larger ones operate more complete seed conditioning plants.

Wholesale Procurement and Distribution

These phases of the business involve purchasing seed and contracting with growers to produce seed, operating conditioning or processing plants, warehousing, transportation, and selling.

Early Developments

Local cooperatives soon began to look to their federated farm supply cooperatives for quality seed, even as some farmers looked to their centralized regionals. Regional cooperatives began procuring, wholesaling, and retailing all kinds of seed, from corn to potato. Fruit Growers Supply, Los Angeles, undertook this function along with fertilizer selling in 19 11; GLF, in 19 18; Farm Bureau Service, in 1919; Eastern States and MFC in 1922; and LOL in the early 1930's. In 1933, Eastern States became the sales agent for 15 Maine producers of seed potatoes.

In 1945, two more rgionals began to handle seed, Pacific Supply Cooperative, Portland, OR and Washington Co-operative Farmers Association, Seattle, WA. The last regional became the Western Farmers Association in 1960 and a part of Cenex in 1982, as did Pacific Supply in 1977.

About the same time as farm supply cooperatives were organizing seed activities, a few cooperatives were organizing solely to produce and market seed. In 1937, Illinois farmers organized Producers Seed in Ford County, encouraged by the Farm

Bureau. Producers Seed was followed by two California cooperatives, Caladina, in 1938, and Calapproved, in 1947. In 1958, 50 to 60 certified seed growers organized NC+ with the help of a leader in the Nebraska Crop Improvement Association.

Fruit Growers Supply began its seed operation by importing vetch seed from Germany. Volume was 300 to 500 tons the first 2 years, bought at prices far below the prevailing local rate.

Seed cooperatives were formed in a few States to handle foundation seed stocks. For example, Pennsylvania Foundation Seed Cooperative, Jersey Shore, received all new varieties of hybrid corn and small grains produced by a university research program. This association operated a modem seed cleaning and storage plant, as well as a nursery for multiplying lines and crosses for certified hybrid seed corn. It contracted with farmers to produce foundation seed stock and distributed it to growers' seed houses and cooperatives to produce registered and certified planting seed.

Initially, GLF attempted to procure good field-grown seed under contract with reliable growers in the Northeast, but found that growing conditions there were not favorable. So it took seed stocks to Illinois for contract production.

GLF soon found that most of the ideal seed-producing areas for legume and grass seed were in the far Northwest. It therefore contracted with farmers there to produce seed that was shipped rough to its seed cleaning plant in Buffalo, NY. In 1950, GLF pulled its western seed operations together under Allied Seed Cooperative, Inc., a wholly-owned subsidiary, now of Nampa, ID. About this time, Allied built a seed cleaning plant and warehouse at Caldwell, ID, and in 1954 established a seed warehouse in the San Joaquin Valley of California.

By 1945, at least 26 regional cooperative associations were procuring seed for farmer members. During that year, at least 27 regionals were marketing farmer produced seed, with four also acting as seed procuring agents. During the same year, cooperatives attained a 15-percent share of the seed corn business in Northeast and Middle Atlantic States but less then 2 percent in the North Central States.

In 1946-47, GLF sold its seed plant in Fort Wayne, IN, to Select Seeds, Inc., an interregional cooperative originally owned by it and six other regionals. GLF continued to manage it and the contract operations for producing legume seed.

In 1960, GLF, SS, and the Pennsylvania Farm Bureau Cooperative Association, Harrisburg, began to jointly procure hybrid seed corn in Illinois. Agway later began contracting for vegetable seed in Pennsylvania.

During the mid-1960's, GROWMARK acquired Producers Seed, at the same time acquiring its farmer/dealers and its research capabilities. In 1969, Cal/West Seeds of Woodland, CA, was formed through the consolidation of Caladino and Calapproved. Cal/West wholesaled at least $30 million worth of seed in 1988, mostly alfalfa. Most of this cooperative's seed was produced by more than 650 member farmers. About a third of it was exported.

In 1973, approximately 1,300 farmers in Minnesota and North Dakota gained control over a sugarbeet seed development and marketing operation. They did so by reorganizing the American Crystal Sugar Company of Moorhead, MN, into a cooperative.

In 1976, the cooperative moved its seed development program to a new 211-acre research center at Moorhead. American Crystal had come a long way, from 1936, when it employed the first commercial sugarbeet plant breeder in te United States, and from the mid-1960's, when its research freed sugarbeets in the Red River Valley from Cercospora leafspot.

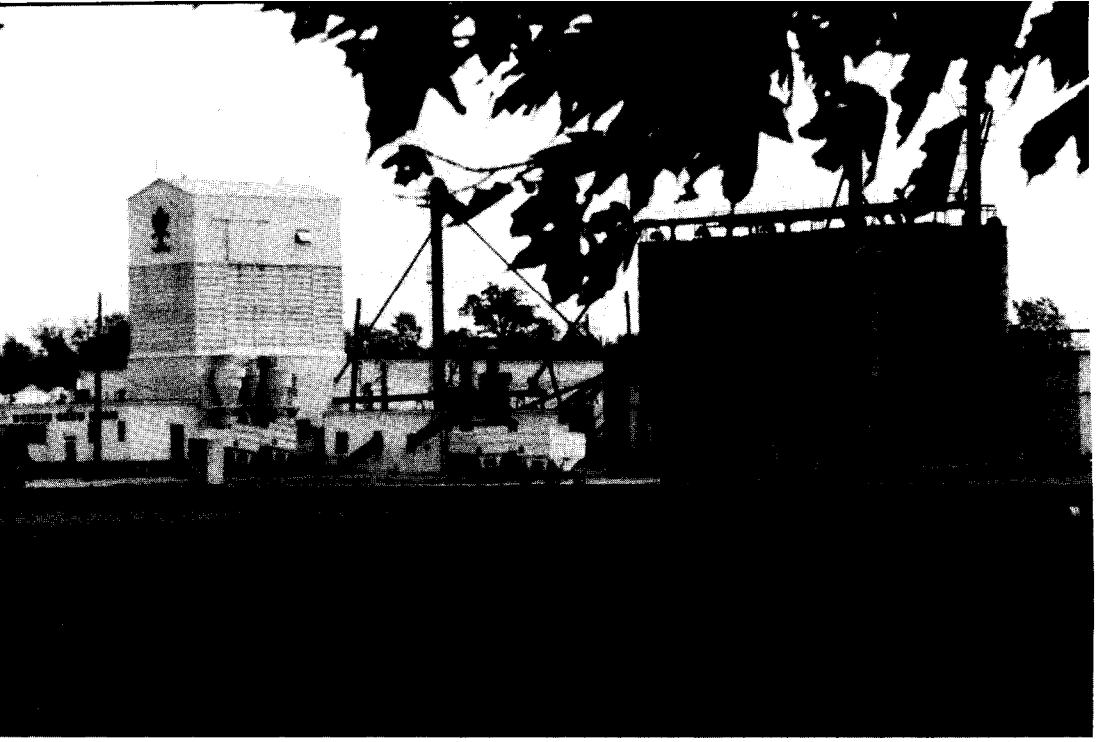
During the mid-1980's, Agway, GLF's successor cooperative, and Landmark, Agway's only surviving partner, closed the Fort Wayne operation, completing Agway's shift away from eastem legume seeds, one started by GLF 30 years previously.

Current Position

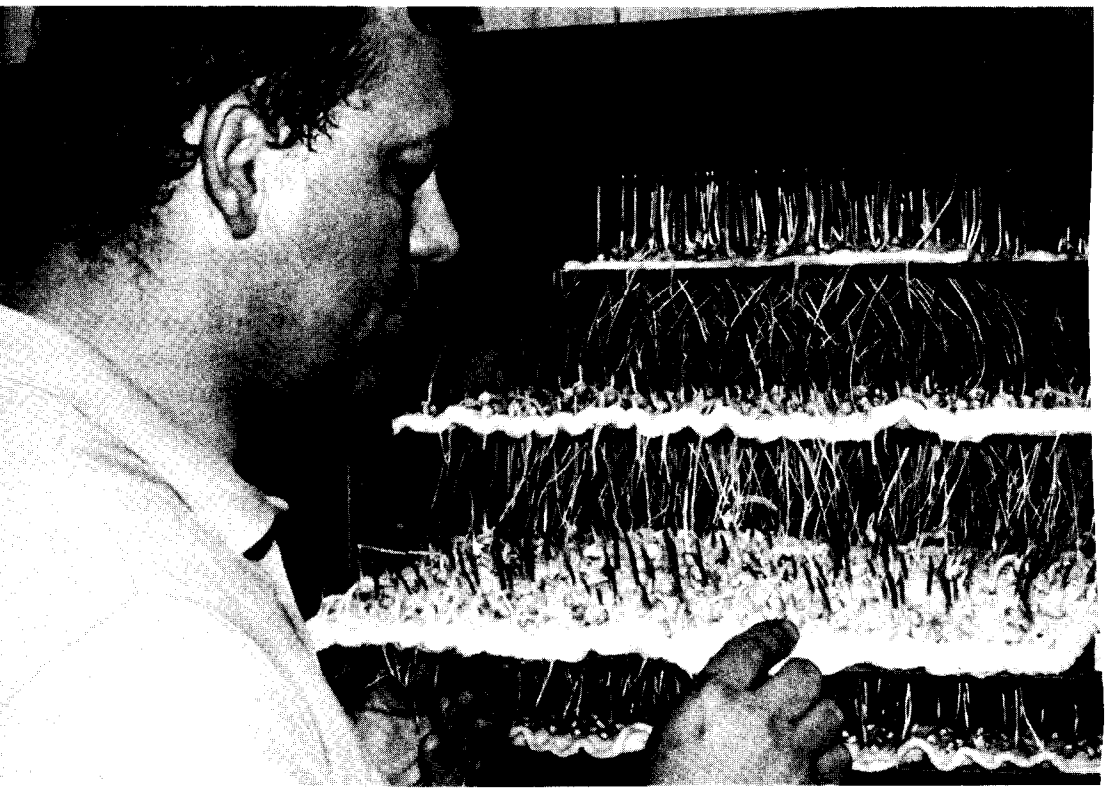
Most local retail cooperatives now are members of regional wholesale cooperatives and obtain some of their seed from them. A major exception is Farmland, one of largest farm supply regionals. Never having achieved a volume comparable to other leading regionals, Farmland quit wholesaling seed in 1980.

In 1986, cooperatives generated about $189 million of intercooperative or wholesale seed sales. Wholesale cooperatives, primarily regionals, may pay royalties to the firms (cooperative or noncooperative) that developed the seed.

Locals have recently wholesaled a small part of their seed sales to an increasing number of large farms whose seed purchases are of significant volumes. These farmers have approached both regional and local cooperatives for wholesale prices.



Countrymark's South Charleston Seed plant annually conditions more than 105,000 bushels of seed corn of 11 different hybrids plus 300,000 bushels of soybeans and 60,000 bushels of seed wheat. Below, quality supervisor Tom Rutshcilling inspects results of germination tests.



Since 1987, Cenex and LOL have marketed seed through their joint venture, Cenex/LOL. It sold at least $50 million of farm seeds in 1988, more than any other regional and twice that of Agway. Both Cenex/LOL and Agway supplement foregoing sales with large volumes of turf seeds. Both compete for the forage seed business of other regionals. Both market seeds through subsidiaries. Cenex/LOL uses marketing associates to distribute seeds outside its traditional marketing territory. Agway uses Seedway within its traditional marketing territory.

Gold Kist also wholesales seed corn outside its traditional territory, marketing in the Midwest out of an Indiana plant. All of Gold Kist's proprietary seed is marketed by AgraTech Seeds, Inc., a wholly-owned subsidiary organized in 1982.

Except as noted, cooperative regionals generally merchandise and distribute seeds about the same as other seed companies.

Several cooperatives operate seed processing or conditioning plants that dry, sort to size or quality, clean, bag, warehouse, and ship the seed. In 1988, Cenex/LOL operated 7 seed processing plants, one being owned jointly with Cal/West, since 1989, through Proprietary Seeds. Agway used 6 facilities, down from 10 in 1983. Meanwhile, Gold Kist operated two seed mills, having acquired its Indiana plant in 1986. Cal/West processed upwards to 90 percent of its seed through its own 5 plants.

SS, TFC and Countrymark own Cooperative Seeds, Inc., Lebanon, IN, an interregional formed in 1979. It has a seed corn processing plant and contracts for corn acreage each year. Cooperative Seeds operates at cost, with members sharing costs according to their portions of equity and use.

In 1988, American Crystal marketed enough seed to establish at least 275,000 acres of sugarbeets, with about a third of this total planted by growers other than those affiliated with American Crystal. All of this seed is produced in Oregon by the West Coast Beet Seed Company, a subsidiary jointly owned by American Crystal and other beet sugar refiners. During 1988, Agway continued to serve decendents of many of the original 15 seed potato producers who originally worked with Eastern States. Agway marketed enough seed to plant about 35,000 acres of potatoes. It also managed a newly-modernized facility for storing seed potatoes.

Several regional cooperatives operate seed testing laboratories; others arrange for testing by State or other laboratories.

NC+ Hybrids

Organized to give its seed-growing members the advantage of larger-scale marketing, NC+ Hybrids reportedly is one of the 15 largest seed businesses in the U.S. It focuses on the production and marketing of hybrid seed corn, with most of its members using their own drying facilities. Seed is delivered to NC+ facilities to be graded, packaged, labeled, and marketed by the cooperative's staff. NC+ contracts with another dozen farmers, or so, for seed corn and with other seed companies, such as with Cal/West for alfalfa seeds.

NC+ has 18 farmer members and markets hybrid corn, sorghum, soybean, and alfalfa seed to farmers in many States, but mostly to those in the Plains and Western Combelt. Farmer-dealers sell for NC+ within this area, while distributors market elsewhere. NC+ ranks with Agway and GROWMARK in the sales of farm seeds. NC+ carries on plant breeding research at two locations, one at Hastings, NE, the location of its principal seed processing plant, and a second at Colwich, KS. In addition to Hastings, the cooperative processes seed at Grand Junction, IA and Lincoln, NE.

Research or Plant Breeding

For many years, cooperatives relied on State and Federal experiment stations and major seed companies to conduct plant breeding to improve seed. But as the trend to proprietary brands developed, a few of the larger regionals undertook seed research, mostly in corn. And several organized interregionals to do plant breeding in alfalfa and other forages, corn, and soybeans.

Cal/West claims it was one of the first U.S. agricultural seed companies to invest in private research, but several regionals followed later. They include Agway, Gold Kist, GROWMARK, LOL, and NC+. Agway has backed off, however, and now relies on other seed companies such as Dekalb-Pfizer, for the development of farm seeds. Growers Seed Association, Lubbock, TX, was quite involved in seed research before it went out of business in 1982.

Most regional cooperative research efforts on field seeds involve a single plant breeder. In 1988, however, Gold Kist and GROWMARK employed at least two plant breeders with Ph.D

degrees. Since 1988, Vista, owned by Cal/West, Cenex/LOL, and Research Seeds, one of Cenex/LOL's associate companies, has employed six plant breeders at four locations.

In 1989, American Crystal employed three plant breeders having just opened a plant breeding station in Idaho. Thus, American Crystal employed about 15 percent of the nation's plant breeders working with sugarbeets. Since 1910, plant breeders with American Crystal have been developing propietary varities amounting to about 25 to 30 percent of the seed currently marketed by this cooperative. It also tests sugarbeets for the State of Minnesota.

Agway has never employed plant breeders to work with potatoes. They once tested potato varieties but recently relinquished this responsibility to the State of Maine.

Significant requirements bar entry into plant varietal development. A cooperative needs to invest in research and test facilities, employ one or more plant breeders, contract with seed growers, and have processing facilities.

Seed developed by this type of operation and submitted to a certifying agency (usually State controlled) is one of four types: breeder, foundation, registered, and certified. Certified seed is the end product of seed research and what farmers purchase. This seed is analyzed by a certifying agency for germination rates and contamination levels of both weed and other seeds.

A cooperative can enter at this stage with a smaller outlay by not entirely developing its own seed lines. With smaller amounts of research, seed lines developed by State experiment stations and universities can be combined with seed lines from the cooperative to develop new varieties. A significant percent of both self-fertilizing and hybrid varieties introduced by cooperatives and noncooperatives contain some public lineage.

Where ever the initial developmental work is undertaken, plant varietal development is a slow procedure. It often requires 10 years' work before a new variety can be marketed; this is a significant barrier to entry.

A few regionals test seeds. Agway has for years operated an extensive test farm to find the actual value-in-use of various varieties and strains under conditions existing in its territory. It advises members as to weak and strong points of recommended varieties and refuses to sell those not worthy of recommendation.

Research by an Interreglonal Cooperative

Farmers Forage Research Cooperative was organized in 1961 by nine cooperatives feeling the need to be involved in seed research. Initially involved in breeding alfalfa, the cooperative quickly moved into breeding of other forages, corn, and soybeans. In 1976, the name was changed to the present FFR Cooperative to reflect its broader research effort.

FFR is governed by a board of directors consisting of one representative from each of its members. In 1988, FFR had five member cooperatives, including four diversified U.S. regional cooperatives, and one Canadian cooperative. Funding for FFR research is generated through royalty payments on FFR-developed varieties, membership fees, and assessments.

The mission of FFR is to provide seed of improved crop varieties for member cooperatives. FFR has breeding programs to develop varieties of hybrid field corn, soybeans, alfalfa, red clover, orchard grass, tall fescue, timothy, sorghum x sudan, and sudan-grass. FFR has breeding stations at its headquarters near Lafayette, IN; Salem, OR; Jackson, TN; and Providence Forge, VA. Besides developing seed at the four stations, FFR does extensive testing and evaluation at other locations across several States. FFR employs more than 30 full-time people, including six with Ph.D.s in plant breeding.

The varieties and hybrids coming from FFR's testing program are sold through one of the following means: (1) member cooperatives produce the variety and market it, either under their own or the FFR name; (2) nonmember seed cooperatives or other companies may obtain a license to produce and market a variety under their own or the FFR name; or (3) nonmember organization may be granted right to produce and market a variety, again under their own or the FFR name. The wholesale value of FFR-based seed sales by FFR member cooperatives probably approximates the sales of NC+.

Highlights of FFR's breeding program include:

Forage Program-Extensive screening programs are in place to select high-yielding alfalfa varieties with resistance to a wide range of diseases and insect pests. Red clover varieties are selected for both seed and forage yield, longevity of stand, and pest resistance. Cool-season grasses, orchardgrass, tall fescue, and timothy are selected for forage and seed yield, leafiness, vigor,

persistence, pest resistance, and ability to grow in pure or mixed variety stands. The sorghum x sudan hybrids are selected for forage yield and broad adaptability. FFR's forage program has over the years produced many outstanding products, some of which serve as industry standards for comparison.

Soybean Program-FFR's soybean research program has developed a broad range of commercial varieties and continues to provide improved new soybean varieties. FFR breeds soybeans for a range of maturity groups, breeding and testing them in different States to better meet the requirements for varieties used in differing farming areas. Soybean varieties are selected on the basis of yield, lodging resistance, seed quality, and pest resistance.

Corn *Program*-FFR began its corn research program in 1970, in a consolidation of the programs of two members, Landmark and Southern States, with the program of the Agricultural Alumni Seed Improvement Association. The program, led by two world renowned corn breeders, quickly established itself as a leader in breeding superior corn hybrids. The FFR corn breeding effort rests heavily on selection for yield and pest resistance, though other important factors include standability, moisture at harvest, seedling vigor, and test weight. The corn program has been especially strong in the eastern and southern Corn Belt, and provides hybrids to meet most growing conditions.

Benefits

For many years, cooperatives procuring and distributing planting seed have provided substantial benefits to farmers. While seed sales were only 3 percent of total supply sales of cooperatives in 1986, their benefits have been much greater. Seed has been one of the cornerstones in the success of several regional cooperatives, their local outlets, and member cooperatives.

One of the major benefits has been their improvement of seed quality. They have supplied better adapted seed and seed with higher germination and purity. Their objective has been to handle seed that will give better yields to farmers rather than better income to the cooperative.

A third benefit has been the development of better varieties through the cooperatives' research or plant breeding programs, especially in alfalfa, orchard grass, and sorghum-sudan seed. Millions of pounds of cooperative alfalfa varieties are now market-

ed annually. FFR's Hallmark, Able, and Rancho varieties account for a significant portion of the orchard grass market in the United States.

FFR's corn program has enabled several members to distribute corn under their own label for the first time and strengthened their offerings with long-term breeding programs. The use of its new inbred lines form the base of more than half of some members' offerings. These genetically different hybrids protect farmers' production.

Challenges Ahead

Seed is one of the basic farm production supplies that greatly affects farmers' annual yields and income. Cooperatives face the challenge of continuing to be effective seed procurement agencies for their members; they also face the problem of raising their standards of performance.

Since 1960, cooperatives' share of the farm planting seed market has declined from the 17-to 19-percent range to a 15-to 17-percent range. Regional cooperatives, both purchasing and marketing, must sponsor studies to determine reasons for this decline and steps that can be taken to reverse the trend. At the retail and wholesale levels, the following problems, among others, should be analyzed:

1. There is a trend to fewer and larger farms. Larger farms are demanding quantity discounts. For some large farms, additional services may have to be provided or cooperatives may risk losing their business. Others, however, may want few services and prefer to buy directly from wholesale cooperatives. These farms are also quicker to accept innovations and varieties and will pay more for seed that returns more. Cooperatives must stay at the forefront of developments in seed and inform their local cooperatives and farmers to ensure their continued business.

2. Sales methods have not significantly changed over the past decade but cooperatives have not always matched the competition. The most common method of seed sales in the Northern Plains, Lake States, and Corn Belt is farmer dealers, yet few cooperatives use farmer dealers enough. Attracting the volume of different groups of patrons requires a variety of sales strategies. Cooperatives must examine all available strategies to determine the best mix of sales tools to compete in their markets.

3. A few cooperatives are now providing special services in seed sales by using crop specialists. Usually knowledgeable in chemicals, fertilizers, and seed, crop specialists' sales efforts in several products are combined. There may be a charge for the crop specialist's service unless the farmer purchases a specific amount of supplies from the cooperative. The crop specialist may also monitor the crop's progress throughout the growing season.

4. There has been considerable work to develop hybrid varieties of both wheat and soybeans the past two decades. Genetic engineering has received considerable attention. Some of the items under research are recombinant DNA, nitrogen fixation, photosynthesis improvement, and hydroponics. New seed products are also on the horizon.

5. The developing role of public seed research also raises concerns. These include: (a) Difficulty of State experiment stations in maintaining their plant breeding programs and the trend to more private varieties, and (b) the experiment stations' use of exclusive distribution contracts with individual firms for university-developed varieties.

These situations and trends question how cooperatives can best develop effective seed research programs and how many resources they should channel into research. And because marketing cooperatives have a stake in the volume and type of products that will be grown and marketed, they may also have a stake in assisting supply cooperatives in conducting research or plant breeding. This may help explain the joint ventures between Cal/West and Cenex/LOL.

6. The seed industry has become more complex in recent years, especially with the inception of genetic engineering. Several multinational companies have entered this field through mergers and acquisitions. This has led to some concern over the direction of both seed research and seed marketing. There is a special concern over whether or not research is leading toward sales systems which tie seed and chemicals together more firmly than cooperatives have hitherto done. Multinational firms now involved in seed research will have more overall market power than their predecessors.

These observations lead to at least three questions. Will cooperatives be forced out of the seed business, or will they only distribute seed for powerful seed companies? What effect could this have on cooperatives' efforts to keep some plant breeding

under the ownership and decisionmaking of farmers who use the seed? Is Agway's partnership with Dekalb-Pfizer Genetics a harbinger of the future?

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Agricultural Cooperative Service (ACS) provides research, management, and educational assistance to cooperatives to strengthen the economic position of farmers and other rural residents. It works directly with cooperative leaders and Federal and State agencies to improve organization, leadership, and operation of cooperatives and to give guidance to further development.

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