AP42 Section:	9.2.1
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TODAY'S RETAIL FERTILIZER INDUSTRY

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Today's Retail Fertilizer Industry[1]

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Introduction

The United States has more than 13,000 bulk blenders, fluid mixers, ammoniation-granulation plants, and retail stores. These outlets receive materials from basic producers of ammonia, phosphoric acid, diammonium phosphate, urea, triple superphosphate, and potash which they then mix, blend, suspend, or granulate, possibly adding micronutrients and pesticides. The final product, 43 million tons of fertilizer (worth 6.5 billion dollars), is sold to about 2.2 million farmers either directly or through other retail outlets or distributors. Figure 1 is a diagram of the U.S. fertilizer production and distribution flow.

This marketing pattern contrasts with the one 35 years ago when basic producers supplied material to regional wholesale mixing plants which manufactured relatively few grades for distribution to retail outlets which then sold to farmers. Today, hundreds of fertilizer mixtures are blended by bulk blenders and fluid mixers to meet individual farmer requests. Fewer than fifty ammoniation-granulation plants are operating.

TVA, cooperating with the Association of American Plant Food Control Officials (AAPFCO), periodically surveys the retail segment of the U.S. fertilizer market. Information from the survey is used in publishing the "Directory of Fertilizer Plants in the U.S." and in creating a profile of the retail market.

Survey of the Fertilizer Industry

Since 1973-74, AAPFCO and the National Fertilizer Development Center (NFDC) have conducted five surveys of the U.S. retail fertilizer distributors. Tables 1 and 2 summarize the number of Directory listings and the types of plants responding to the survey.

Results of the 1987-88 survey are based on 5,742 responses from bulk blenders, fluid mixers, granulation plants, retail stores, and a few basic producers. The responses included 4,758 plants with mixing capability and 984 retail or specialty outlets. Of the 4,758 plants, 84 percent had bulk blending

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1. Presented at the annual meeting of the Association of Southern Feed, Fertilizer, and Pesticide Control Officials, Lexington, Kentucky, June 19-22, 1988.

2. Agricultural Economists, Tennessee Valley Authority, Muscle Shoals, Alabama 35660.

facilities, 33 percent had liquid, 13 percent had suspension, and 36 percent had liquid and/or suspension.

The total number of fertilizer registrants and licensed dealers for all States was 13,044. This is a slight increase over four years ago which is due more to different reporting methodology by the regulatory officials than to an actual increase.

Sixty-three percent of the fertilizer plants responding are in the East North Central and West North Central States. Based on U.S. fertilizer use data compiled by TVA, these States accounted for 49 percent of all fertilizer distributed in fiscal year 1987 (ending June 30).

Distribution by class indicates that 46.6 percent of all fertilizers were dry bulk or bagged blends. Fluid fertilizers (including mixtures, anhydrous ammonia, nitrogen solutions, and other direct application materials) accounted for 36.1 percent. Granulation materials, accounted for only 4.4 percent, having dropped from 10.5 percent four years ago. The remaining 12.9 percent consisted of dry materials such as ammonium nitrate (34-0-0) and diammonium phosphate (18-46-0). Percentages of material distributed by all plants are shown in Table 3. Applying these percentages to the 43.2 million tons consumed in fiscal year 1987 indicates that 20.1 million tons of dry blends (both bulk and bagged), 1.9 million tons of granular NPK mixtures, and 5.1 million tons of fluid mixtures were used. Previous AAPFCO surveys indicated similar distribution patterns.

Bulk Blend Plants

Dry bulk blending is the largest system for manufacturing and distributing fertilizers. Bulk blending began its growth when diammonium phosphate was introduced during the middle 1950s. It grew rapidly because of ease of manufacture and because it offered distribution and economic advantage over traditional methods. Also, dealers were able to provide farmers with needed services such as custom mixing and spreading at attractive prices. This has been particularly true during the last four years because of low-cost imported nitrogen materials and ready availability of diammonium phosphate.

Bulk blending works best with well-granulated, closely sized, dry materials that don't deteriorate in storage. Bulk blending and granulating have complemented each other because blenders have motivated manufacturers of granular materials (i.e. diammonium phosphate) to provide more materials with improved physical properties. Materials most commonly used for bulk blending are diammonium phosphate, urea, triple superphosphate, potassium chloride, ammonium nitrate, and ammonium sulfate. Most plants report using urea more than any other material as a nitrogen source. Diammonium phosphate and triple superphosphate are the main sources of P_2O_5, and potassium chloride is the main source of K_2O (Table 4). Other materials used include: ammonium nitrate, ammonium sulfate, mono-ammonium phosphate, and other materials, such as potassium magnesium

sulfate (0-0-22) and ammonium phosphate sulfate (16-20-0).

Of the 4,758 plants in the survey, 2,975 were reported to be exclusively bulk blend facilities. The typical bulk blend plant has a total annual throughput of 4,648 tons of all materials. Of this total, 3,814 tons are dry bulk blend mixtures. The 10 leading grades reported are: 9-23-30, 19-19-19, 10-10-10, 6-24-24, 10-26-26, 15-15-15, 10-20-20, 17-17-17, 0-23-30, and 5-14-42. Average analysis of the 10 leading grades is 52.5 percent, which is considerably higher than grades produced in other types of fertilizer mix plants. The average bulk blend plant also distributes 1,506 tons of dry direct application materials, primarily ammonium nitrate and diammonium phosphate. A typical plant distributes 839 tons of anhydrous ammonia and 718 tons of nitrogen solutions. Because average tonnages are only for plants handling these products, they are not additive (Table 5).

Although the average annual throughput of a bulk blend plant is 4,648 tons, the greatest number of plants produce 1,000-2,000 tons. The mode--1,669--is the most common value. The median--2,153 tons--represents the middle value of all bulk blend plants considered for this study. Seventy percent of those respondents show distribution between 1,000 and 5,000 tons (Figure 2).

Storage capacity for raw materials and finished products averages 46.4 percent of the total annual distribution (Table 6). Storage at the retail level is important because it allows basic producers to maintain monthly production levels despite a highly seasonal market. A comparison with the previous survey shows that bulk blend plants have not increased their storage relative to total distribution.

The survey reveals that bulk blenders have continued to increase farmer services. In 1987, 42.8 percent of the fertilizer was custom applied and 33.5 percent was spread by the farmer with rental equipment (Table 7). In comparison, in 1974, 1976, 1980, and 1984, 30.0 percent, 25.0 percent, 44.3 percent, and 40.6 percent, respectively, of the fertilizer distributed by blender was custom applied. Data on custom application of bulk blends indicate that more material is being applied by farmers (57.2 percent) than is being custom applied by blenders. However, dealers often provide rental application equipment to farmers.

Complementary services continue to be a vital part of the bulk blender's fertilizer marketing program. Almost 79 percent of all bulk blend plants add micronutrients, 64.1 percent add herbicides, 35.9 percent add insecticides, 64.1 percent add seed to their dry bulk blend, and 14.7 percent have bagging facilities (Table 8).

Data relating to type of business reveal that 43.8 percent of bulk blend plants are privately owned, 51.7 percent are cooperatives, and 4.5 percent are corporations.

Fluid Fertilizer Plants

The number of plants mixing fluid (liquid and/or suspension) fertilizer has increased dramatically during the past 25 years. And, although there has been an overall decrease in fertilizer used in the United States during the last three years, the market share for fluids has actually increased slightly. As with dry blending, little investment is required for establishing a fluid mix fertilizer unit. Higher analysis grades are possible, at lower costs, with suspensions than with liquids. Both bulk blends and fluid mix fertilizer systems can economically combine intermediate fertilizer materials produced at widely dispersed production points. They also save on storage facilities in the market area and are points of contact between dealers and farmers.

Superphosphoric acid, when neutralized with ammonia, produces a liquid 11-37-0 or 10-34-0. Today, liquid ammonium polyphosphate 10-34-0 is the primary base material used in the fluid industry. High nitrogen, nonpressure urea-ammonium nitrate solutions are combined with soluble potash and 10-34-0 to produce fluid mixtures. Each of these components can also be used as a direct application material. Advantages of fluids include ease of mixing, ease of incorporating additives while achieving mixture homogeneity, convenience of mechanical handling, and high reliability of fluid application systems.

Suspension fertilizers are liquids in which salts are suspended by incorporating a suspending agent. Complete solubility of phosphate is not required in suspension. This allows a wider range of phosphate materials to be used. Mono-ammonium phosphate (MAP) has become a primary source of P_2O_5 for suspension manufacture (Table 4). Higher analysis grades can be formed with suspensions than are possible with conventional liquids. Consumption of all fluid mixtures (liquids and suspensions) for fertilizer year 1987 is estimated at 5.1 million tons. In 1987, seven States, California, Florida, Illinois, Indiana, Iowa, Nebraska, and Texas, accounted for 60 percent of all fluid mixtures used. Based on TVA estimates, suspensions comprised about 36 percent of all fluid mixtures compared with 40 percent in 1984. This was the first decrease in suspension market share.

The AAPFCO survey shows an average throughput of 3,671 tons for the 335 plants listing only liquid mix facilities. A typical liquid plant distributes 2,154 tons of liquid mixtures, 1,051 tons of anhydrous ammonia, 1,388 tons of nitrogen solutions, and 941 tons of liquid direct application materials, such as 10-34-0 and 8-24-0 (Table 5). The ten leading liquid grades reported are: 7-21-7, 4-10-10, 20-10-0, 2-6-12, 7-22-5, 6-18-6, 24-8-0, 10-10-10, 18-18-0, and 21-7-3. These grades have an average 30.2-percent nutrient content. Fluid plants also distribute significant tonnage of bulk and bagged mixtures and materials such as ammonium nitrate and diammonium phosphate.

Comparable data for suspension fertilizer plants show an average annual throughput of 2,799 tons, including 1,758 tons of suspension mixtures, 770 tons

of nitrogen solutions, 482 tons of anhydrous ammonia, and 392 tons of liquid direct application materials (Table 5). The ten leading suspension grades produced by these plants are: 3-10-30, 10-30-0, 4-12-24, 3-9-27, 6-18-18, 13-13-13, 7-21-7, 3-9-18, 12-12-12, and 8-24-0. Average analysis for these grades is 37.6 percent compared with 30.2 percent for liquids and 52.5 for bulk blends. Similar to the liquid plants, these suspension plants also distribute significant tonnage of dry direct application materials and dry, complete mixtures. A frequency distribution for fluid plants (liquids and/or suspensions only) indicates the greatest number of plants in the 1,000-ton range (Figure 3). Compared with bulk blend plants, the average annual throughput of fluid plants tends to be smaller. The mode for fluids is 1,000 tons and the mode for bulk blending is 1,669 tons, while the median for fluids is 2,018 tons, and the median for bulk blends is 2,153 tons.

Storage capacity for liquid fertilizer plants surveyed amounts to 31.3 percent of the total annual distribution. Suspension plants have a storage capacity of 26.6 percent of the total annual distribution. But plants with liquid and/or suspension capabilities show their storage capacity at 35.5 percent of their total annual distribution. Storage capacity by plant type and region is shown in Table 6.

A total of 36.3 percent of the liquid fertilizer tonnage is custom applied (Table 7), of which 31 percent of the tonnage is applied by the dealer and 5.3 percent by application contractors. Similar to the bulk blenders, farmer application of liquid fertilizer is far greater than custom application by the dealer, although dealers provide the rental equipment for farmers to apply 32.2 percent of the fertilizer. (The farmer applies 31.5 percent using his own equipment.)

The percentage of custom-applied suspension fertilizer is higher than that for both bulk blends and liquids. Seventy-one percent of suspension mixes is custom applied primarily by suspension dealers rather than by custom applicators. This percentage of dealer application is greater because suspensions generally require more sophisticated application equipment (Table 7).

As with bulk blenders, an increasing percentage of fluid plants offer complementary services. Of liquid plants, 71 percent add herbicides, 48.6 percent add insecticides, 79.8 percent add micronutrients, and 21.2 percent add seeds to mixtures. Of suspension plants, 95.8 report adding herbicides, 56.3 percent add insecticides, 89.6 percent add micronutrients, and 39.6 percent add seeds (Table 8).

Ownership data relating to all fluid fertilizer plants show that 80.1 percent are privately owned, 12.4 percent are cooperatives, and 7.5 percent are corporations.

National Market Patterns

Other Services - The survey also provides a composite description of the U.S. fertilizer market system. Of the 5,742 respondents, 4,758 have manufacturing facilities such as bulk blending, liquid mixing, suspension mixing, or granulation or are basic production units. Thirty-six percent offer anhydrous ammonia, 42.4 percent add insecticides, 70.1 percent add herbicides to their fertilizer mixtures, and 81.4 percent add micronutrients. Consulting is offered by 60.1 percent of the manufacturing plants. Soil testing is offered by 89.8 percent of the plants.

Non-farm use - Eleven percent of the total tonnage for all respondents is for non-farm use. Granulators sell 31.6 percent of their annual tonnage for non-farm use; bulk blenders, 7.4 percent; and fluid mixers, 5.9 percent.

Types of Plants - Eighty-four percent of all manufacturing plants have bulk blend facilities and 36.2 percent have fluid mix facilities. Sixty-three percent of the plants had bulk blending only facilities and 15 percent had fluid mix only (liquid and/or suspension only) facilities.

Ownership Patterns - Forty-two percent of all manufacturing plants indicate their form of business as cooperatives--a significant increase over the 1984 survey data. The remaining 58 percent consist of sole proprietorships and public and private corporations.

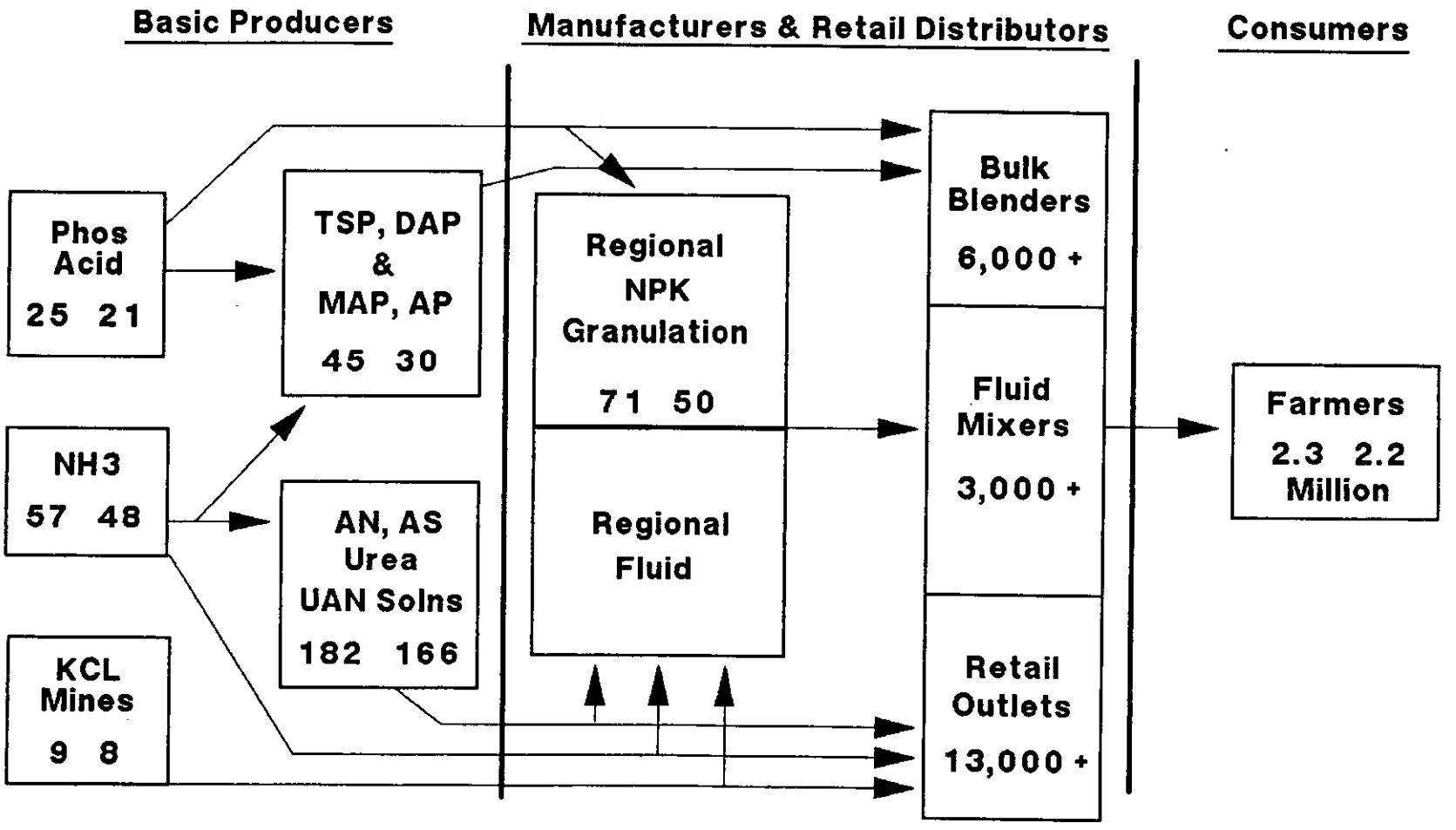
Directory Of Fertilizer Manufacturers

The 1988 edition of "Directory of Fertilizer Plants in the U.S.," based on respondents to the AAPFCO survey, is available through the Association of American Plant Food Control Officials (AAPFCO). Directory entries list plant location, plant owner's or manager's name, telephone number, storage capacity, plant type, and related services offered. Orders, including prepayment of $20.00 per copy, should be directed to:

Mr. Penn Zentmeyer
Virginia Department of Agriculture
and Consumer Services
P.O. Box 1163
Richmond, Virginia 23209

Figure 1

U.S. FERTILIZER PRODUCTION & DISTRIBUTION



Figures indicate number of operating plant locations - FY 1984, 1988

Total retail outlets: 13,000 - 15,000

AAPFCO Survey - 1984, 1988

Figure 2

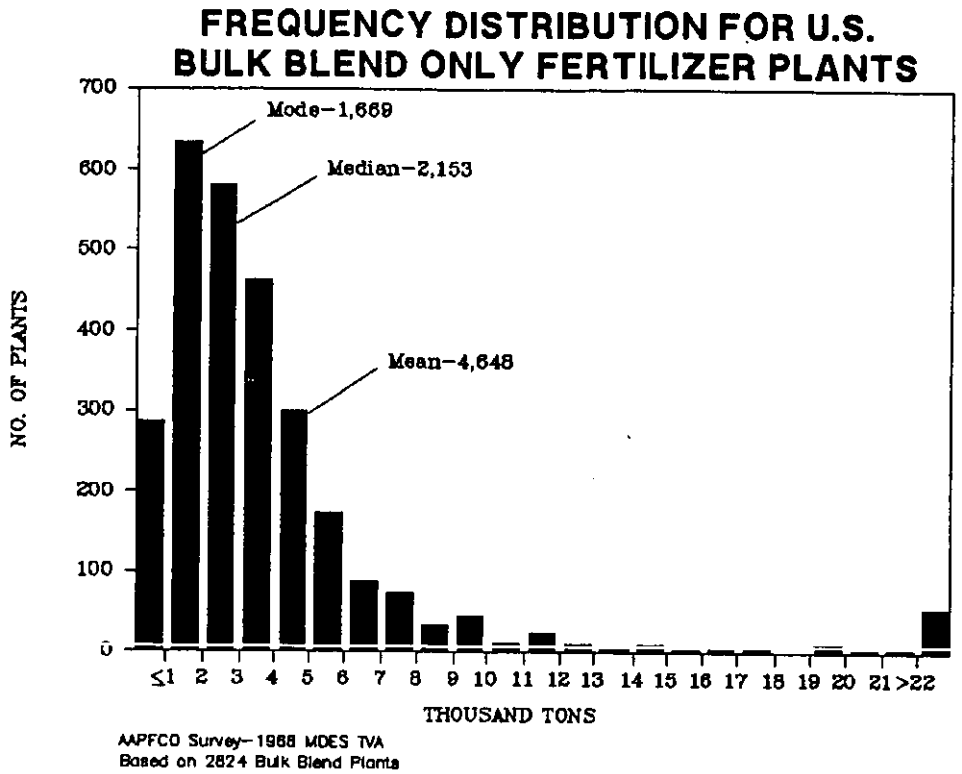


Figure 3

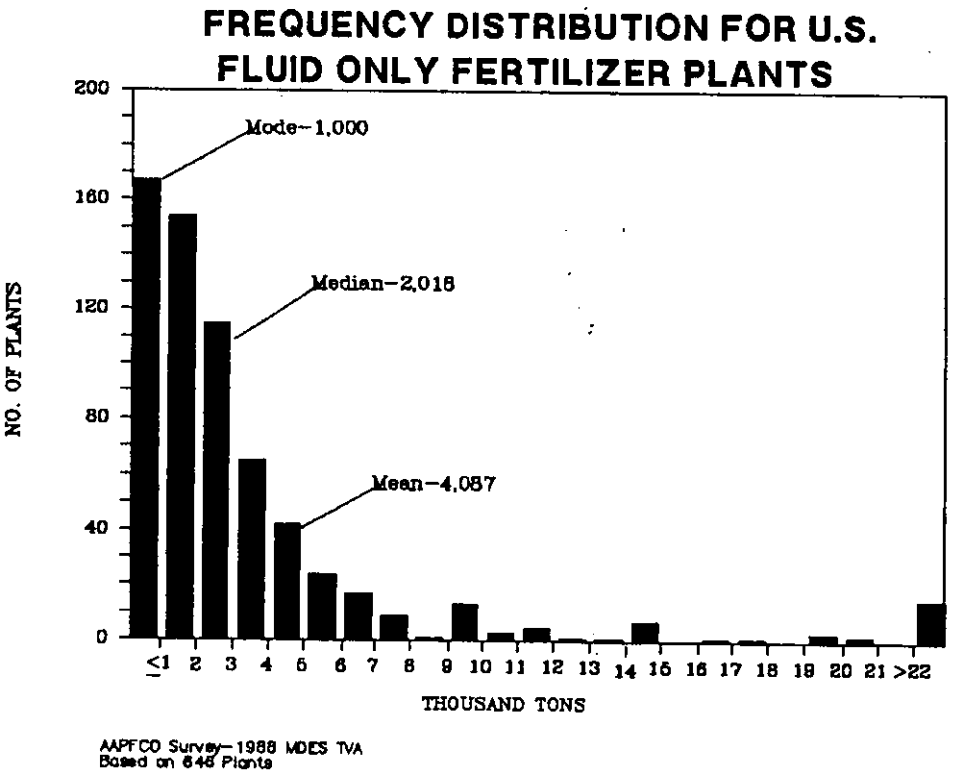


TABLE 1
SUMMARY OF DIRECTORY LISTINGS--1988[a]

REGION	Total Listings[b] 1984	1988	Total Questionnaires 1984	% Listings	1988	% Listings
New England	56	61	37	66.1	31	50.8
Middle Atlantic	419	402	222	53.0	217	54.0
South Atlantic	847	837	555	65.5	502	60.0
East North Central	2,934	2,807	1,549	52.8	1,219	43.4
West North Central	4,890	5,023	2,014	41.2	2,189	43.6
East South Central	507	763	363	71.6	427	56.0
West South Central	1,420	1,383	1,165	82.0	607	43.9
Mountain	613	685	319	52.0	280	40.9
Pacific	1,144	1,076	144	12.6	263	24.4
Alaska/Hawaii/PR	1	7	1	100.0	7	100.0
U.S. Total	12,831	13,044	6,369	49.6	5,742	44.0

REGION	Total Plants 1984	1988
New England	32	24
Middle Atlantic	179	178
South Atlantic	495	386
East North Central	1,365	1,092
West North Central	1,735	1,903
East South Central	340	392
West South Central	714	453
Mountain	204	206
Pacific	95	121
Alaska/Hawaii/PR	1	3
U.S. Total	5,160	4,758

[a]AAPFCO Fertilizer Plant Survey--1988
[b]Includes questionnaires and list of registrants

TABLE 2
TYPES OF PLANTS[a]

REGION	Bulk Blends All 1984	Bulk Blends All 1988	Bulk Blends Only 1984	Bulk Blends Only 1988	Granulation All 1984	Granulation All 1988
New England	26	22	20	17	1	1
Middle Atlantic	136	152	110	125	9	2
South Atlantic	358	302	314	248	19	16
East North Central	1,162	999	995	786	18	6
West North Central	1,368	1,619	1,050	1,103	9	4
East South Central	286	358	263	333	10	5
West South Central	441	290	366	229	5	4
Mountain	161	171	104	95	--	1
Pacific	59	70	38	37	--	1
Alaska/Hawaii/PR	1	3	1	2	--	1
U.S. Total	3,998	3,986	3,261	2,975	71	41

REGION	Fluid All 1984	Fluid All 1988	All Liquid 1984	All Liquid 1988	Liquid Only 1984	Liquid Only 1988	All Suspension 1984	All Suspension 1988	Suspension Only 1984	Suspension Only 1988	Liq. Susp. Only 1984	Liq. Susp. Only 1988
England	11	6	9	5	4	1	7	4	1	1	--	--
Middle Atlantic	57	49	49	44	11	9	32	29	4	1	17	11
South Atlantic	163	117	138	99	52	35	93	59	19	9	50	23
East North Central	334	302	308	269	55	28	185	157	11	8	103	51
West North Central	668	789	602	729	140	103	338	289	36	21	155	139
East South Central	60	53	29	37	8	10	45	38	19	9	12	13
West South Central	343	220	329	213	228	127	51	36	11	4	28	23
Mountain	97	106	96	104	34	22	16	11	1	--	4	3
Pacific	50	79	47	78	23	34	5	14	3	1	2	7
Alaska/Hawaii/PR	--	--	--	--	--	--	--	--	--	--	--	--
U. S. Total	1,783	1,721	1,607	1,578	555	369	772	637	105	54	371	270

[a]AAPFCO Fertilizer Plant Survey--1988

TABLE 3
DISTRIBUTION OF FERTILIZER MATERIALS IN THE U.S. BY CLASS

CLASS	Percent of Total Fertilizer[a]					Total Material[b]				
	1974	1976	1979	1984	1988	1974	1976	1979	1984	1987
	----------%----------					------Million Tons----------				
Dry Bulk Blends	33.3	33.7	35.8	39.0	40.1	15.7	16.5	18.3	19.5	17.3
Dry Bagged Blends	9.2	6.4	5.7	5.5	6.5	4.3	3.1	2.9	2.8	2.8
Bulk Granulation	4.9	9.9	9.9	8.0	2.8	2.3	4.9	5.1	4.0	1.2
Bagged Granulation	6.2	9.0	6.3	2.5	1.6	2.9	4.4	3.2	1.3	0.7
Fluid Mixtures (Liq & Sus)	9.7	9.6	10.1	11.4	11.8	4.6	4.7	5.2	5.7	5.1
Anhydrous Ammonia	7.2	9.5	9.2	9.6	9.9	3.4	4.7	4.7	4.8	4.3
Nitrogen Solutions	7.1	9.4	10.8	13.1	11.6	3.3	4.6	5.5	6.6	5.0
Dry Direct Application Mat.	19.7	9.5	10.4	9.1	12.9	9.3	4.7	5.3	4.6	5.6
Liq. Direct Application Mat.	2.7	3.0	1.8	1.8	2.8	0.7	1.5	0.9	0.9	1.2
Total	100.0	100.0	100.0	100.0	100.0	47.1	49.1	51.1	50.2	43.2

[a]AAPFCO-TVA fertilizer plant surveys
[b]Projection based on survey, USDA, and TVA data

TABLE 4
TYPES OF MATERIALS USED IN BULK BLEND
AND FLUID MIX PLANTS--1984 AND 1988[a]

MATERIALS	Bulk Blend Only		Liquid Only		Suspension Only	
	1984	1988	1984	1988	1984	1988
	----------% of Plants Reporting----------					
Ammonium Nitrate	30.3	29.9	--	--	--	--
Ammonium Sulfate	26.6	37.9	--	--	8.0	10.2
Urea	79.4	82.4	15.3	16.9	23.0	4.1
DAP (18-46-0)	94.6	94.4	--	--	7.0	2.0
MAP (11-52-0, etc.)	15.4	18.2	--	--	33.0	44.9
Normal Superphosphate	3.2	6.6	--	--	--	--
Triple Superphosphate	73.1	70.9	--	--	--	--
Nitrogen Solutions	54.1	50.4	82.8	88.8	76.0	91.8
Anhydrous Ammonia	50.5	37.2	8.6	16.0	21.0	28.6
Ammonium Thiosulfate	--	--	19.0	44.1	1.0	14.3
10-34-0	--	--	80.3	84.8	54.0	44.9
Phosphoric Acid	--	--	7.7	11.2	3.0	2.0
Superphosphoric Acid	--	--	4.8	3.4	--	--
Dry Clay	--	--	--	--	41.0	49.0
Fluid Clay	--	--	--	--	17.0	24.5
Potassium Chloride (Std)	94.6	85.1	8.3	15.5	12.0	--
Potassium Chloride (Sol)	--	--	39.5	39.5	54.0	63.3
Potassium Nitrate	1.1	2.9	--	--	--	--
Potassium Sulfate	4.5	12.7	--	--	--	--
Sul-po-mag (0-0-22)	9.3	14.5	--	--	--	--
Other	25.0	8.0	24.0	33.5	46.0	79.6
Number of Plants Reporting:	3,187	2,954	517	349	100	49

[a]AAPFCO Fertilizer Plant Surveys

TABLE 5
AVERAGE THROUGHPUT FOR BULK BLEND,
AND FLUID MIX PLANTS--1988[a]

MATERIALS	Bulk Blend Only		Liquid Only		Suspension Only		Liquid & Suspension Only	
	Plants	Tons	Plants	Tons	Plants	Tons	Plants	Tons
Dry Bulk Blend Mixtures	2,696	2,640	57	533	8	260	33	333
Dry Bagged Blend Mixtures	1,152	1,174	34	163	3	150	26	167
Granulation Bulk Mixtures	282	734	18	861	7	458	21	578
Granulation Bagged Mixtures	368	317	20	291	7	352	27	380
Liquid Mixtures	352	423	284	2,154	5	650	198	1,199
Suspension Mixtures	36	525	27	739	47	1,758	232	1,476
Anhydrous Ammonia	1,066	839	92	1,051	21	482	61	780
Nitrogen Solutions	1,452	718	206	1,388	39	770	190	1,293
Direct Application, Dry	1,323	1,506	49	746	6	384	43	1,202
Direct Application, Fluid	426	299	116	941	16	392	75	457
Total Plants Reporting	2,824		335		51		257	
Average Throughput		4,648		3,671		2,799		3,908

[a]AAPFCO Fertilizer Plant Survey--1988

TABLE 6
STORAGE CAPACITY OF BULK BLEND AND FLUID PLANTS[a]
PERCENT OF TOTAL FERTILIZERS DISTRIBUTED

REGION	Bulk Blend Only		Liquid Only		Suspension Only	
	1984	1988	1984	1988	1984	1988
New England	69.3	67.8	14.1	6.3	--	9.5
Middle Atlantic	44.9	45.2	47.6	16.1	25.1	32.2
South Atlantic	34.6	32.9	28.1	19.8	26.4	16.6
East North Central	51.4	45.2	31.8	51.9	34.2	17.8
West North Central	53.9	53.0	35.5	32.8	31.1	30.1
East South Central	52.1	48.5	25.0	36.7	37.9	38.0
West South Central	42.8	41.6	31.0	32.9	21.9	32.2
Mountain	45.9	53.2	25.2	69.5	--	--
Pacific	33.5	40.6	10.6	9.8	26.9	--
Alaska/Hawaii/PR	40.0	80.2	--	--	--	--
U.S. Total	47.5	46.4	30.3	30.5	31.2	26.6
Number of Plants	2,710	2,392	456	264	94	39

REGION	Fluid Only		All Plants Reporting	
	1984	1988	1984	1988
New England	14.2	7.9	62.6	76.2
Middle Atlantic	65.1	45.7	47.3	42.2
South Atlantic	26.0	24.0	39.9	33.5
East North Central	45.3	46.7	51.4	45.5
West North Central	38.4	39.5	48.6	50.4
East South Central	38.3	37.4	38.5	48.3
West South Central	33.4	33.1	35.9	20.1
Mountain	26.9	60.4	40.8	46.2
Pacific	13.9	16.9	40.9	28.5
Alaska/Hawaii/PR	--	--	40.0	71.7
U.S. Total	35.3	35.5	44.5	39.0
Number of Plants	877	504	4,262	3,605

[a]AAPFCO Fertilizer Plant Surveys

TABLE 7
FERTILIZER APPLICATION--1984 and 1988
% OF TONNAGE FROM PLANTS REPORTING
Less Resale

	Bulk Blend Only		Liquid Only		Suspension Only		Fluid Only	
SERVICE	1984	1988	1984	1988	1984	1988	1984	1988
By Dealer	33.7	36.2	36.9	31.0	74.3	66.8	42.8	35.4
By Others	6.9	6.6	5.6	5.3	4.4	4.6	5.4	5.3
By Farmer (Own Equipment)	21.6	23.7	27.1	31.5	9.1	17.4	24.3	29.7
By Farmer (Rental)	32.8	33.5	26.3	32.2	10.4	11.2	23.8	29.6

	Granulation Only		All Plants		Retail Outlets	
SERVICE	1984	1988	1984	1988	1984	1988
By Dealer	0.2	0.0	35.0	40.2	26.3	23.6
By Others	1.6	18.3	8.0	6.4	4.2	7.9
By Farmer (Own Equipment)	88.6	81.7	25.6	24.1	33.5	46.2
By Farmer (Rental)	1.4	0.0	25.6	29.3	33.1	21.5

TABLE 8
OTHER SERVICES OFFERED--1984 and 1988

SERVICE	Bulk Blend Only		Liquid Only		Suspension Only	
	1984	1988	1984	1988	1984	1988
	% of Plants Reporting					
Adding Herbicide to Mixtures	58.3	64.1	67.2	71.0	94.8	95.8
Adding Insecticides to Mixtures	34.9	35.9	42.4	48.6	53.6	56.3
Adding Micronutrients to Mixtures	78.3	78.4	76.5	79.8	90.7	89.6
Adding Seeds to Mixtures	57.9	64.1	19.1	21.2	35.1	39.6
Bagging Equipment	17.5	14.7	--	--	--	--
Soil Testing	88.4	90.0	79.7	78.5	87.6	85.4
Agricultural Limestone	38.0	45.5	15.0	15.3	34.0	33.3
Consultation Service	72.5	60.5	65.7	50.5	62.9	50.0
Number of Plants	3,057	2,834	472	321	97	48

SERVICE	Fluid Only		Granulation Only		All Plants	
	1984	1988	1984	1988	1984	1988
	% of Plants Reporting					
Adding Herbicide to Mixtures	81.2	82.6	7.7	--	65.5	70.1
Adding Insecticides to Mixtures	51.5	55.2	7.7	--	40.8	42.4
Adding Micronutrients to Mixtures	84.4	85.3	92.3	57.1	81.3	81.4
Adding Seeds to Mixtures	30.6	34.1	--	--	51.9	59.0
Bagging Equipment	--	--	84.6	85.7	14.9	12.7
Soil Testing	85.9	85.9	34.6	57.1	87.8	89.8
Agricultural Limestone	25.4	27.1	7.7	42.9	35.2	42.4
Consultation Service	66.6	52.8	57.7	57.1	71.7	60.1
Number of Plants	932	631	26	7	4,750	4,315

[a]AAPFCO Fertilizer Plant Surveys

APPENDIX TABLE A

REGIONAL SUMMARY OF BULK BLEND PLANTS -- AAPFCO FERTILIZER PLANT SURVEY -- 1988

	REGION									
	NEW ENGLAND	MIDDLE ATLANTIC	SOUTH ATLANTIC	EAST N. CENTRAL	WEST N. CENTRAL	EAST S. CENTRAL	WEST S. CENTRAL	MOUNTAIN	PACIFIC	TOTAL
BULK BLEND ONLY										
Number	17	125	248	786	1,103	333	229	95	37	2,975
Avg. size plant (tons) (2,824)*	5,896	5,107	6,359	5,064	3,206	5,778	6,155	3,249	7,435	4,648
Storage capacity dist. (%) (2,392)*	67.8	45.2	32.9	45.2	53.0	48.5	41.6	53.2	40.6	46.4
Fert., custom applied (%) (2,756)*	19.9	34.7	42.1	44.5	41.6	42.9	57.2	37.7	25.4	42.8
By dealer	13.5	28.4	28.6	42.5	38.8	36.4	32.6	32.1	6.6	36.2
By others	6.4	6.3	13.6	2.0	2.8	6.6	24.5	5.6	18.7	6.6
By farmer (own equip)	61.6	30.2	46.8	17.7	19.8	18.4	10.2	32.1	54.2	23.7
By farmer (rental)	18.5	35.0	11.0	37.8	38.6	38.7	32.7	30.3	20.5	33.5
Plants offering: (%) (2,834)*										
Herbicide addition	56.3	63.3	41.4	67.7	71.6	70.0	43.9	46.1	36.4	64.1
Insecticide addition	18.8	48.6	28.9	50.6	27.0	46.7	24.9	11.2	24.2	35.9
Micronutrient addition	93.8	85.3	87.9	81.9	74.7	84.8	62.0	69.7	75.8	78.4
Seed addition	43.8	56.9	59.8	72.9	54.5	87.9	69.8	42.7	21.2	64.1
Soil testing	81.3	89.9	88.3	94.7	93.1	80.5	77.6	91.0	75.8	90.0
Consultation services	68.8	70.6	56.5	66.0	61.3	51.7	47.3	58.4	75.8	60.5
Plants w/bassins equip. (%)	50.0	25.7	22.2	15.2	11.2	8.7	15.6	21.3	48.5	14.7
ALL BULK BLEND PLANTS										
Number	22	152	302	999	1,619	358	290	171	70	3,986
Avg. size plant (tons) (3,600)*	7,161	5,959	8,538	5,360	3,850	5,997	8,299	4,388	8,760	5,396
Storage capacity dist. (%) (3,051)*	76.7	43.1	32.2	45.6	52.1	49.3	35.7	46.7	34.2	44.9
Fert., custom applied (%) (3,506)*	35.8	39.3	42.1	47.4	46.4	45.2	55.4	46.5	34.7	45.8
By dealer	29.9	33.6	29.0	45.3	44.3	36.3	31.5	35.8	20.7	39.1
By others	5.9	5.6	13.1	2.1	2.2	8.9	24.0	10.8	14.0	6.7
By farmer (own equip.)	48.7	31.4	48.9	17.3	19.5	17.8	12.3	24.2	45.4	23.9
By farmer (rental)	15.6	29.3	9.1	35.3	34.0	36.9	32.2	29.3	19.8	30.4
Plants offering: (%) (3,644)*										
Herbicide addition	61.9	66.4	47.4	72.2	75.3	70.9	48.7	60.6	41.5	68.2
Insecticide addition	33.3	54.5	33.4	55.4	33.5	47.6	28.1	17.6	32.3	40.3
Micronutrient addition	95.2	87.3	88.7	84.5	76.8	85.6	69.2	77.6	81.5	80.7
Seed addition	52.4	60.4	57.0	74.9	55.0	86.7	68.1	46.1	23.1	63.6
Soil testing	81.0	91.0	87.0	95.0	93.7	81.3	77.6	94.5	78.5	90.7
Consultation services	61.9	71.6	57.7	66.8	61.4	51.0	50.2	60.0	81.5	61.4
Plants w/bagging equip. (%)	47.6	26.9	25.9	14.4	10.3	8.6	14.4	18.2	49.2	14.7
Plants offering limestone (%)	76.2	79.9	82.9	54.5	31.4	48.1	43.0	9.1	38.5	45.2
Plant ownership: (3,986)*										
Privately owned	59.1	46.7	62.3	50.9	28.6	54.7	59.7	49.1	72.9	43.9
Corporation	9.1	4.6	6.0	7.9	13.1	4.2	4.1	4.1	4.3	8.9
Cooperative	31.8	48.7	32.1	41.2	58.3	41.1	36.2	46.8	22.9	47.2
Dist. of fert. by class: (%) (3,560)*										
Dry bulk blend	39.1	53.7	56.1	48.6	49.1	59.4	50.9	44.2	38.6	50.3
Dry bagged blend	35.4	14.2	18.0	4.1	2.6	17.2	2.9	3.0	14.2	7.8
Bulk granulation	3.4	0.6	3.2	1.6	1.6	3.4	1.2	2.4	6.5	2.1
Bagged granulation	1.2	0.7	3.7	0.7	0.4	2.3	1.1	0.7	3.8	1.4
Suspension mixtures	3.9	4.8	2.1	2.7	2.9	1.4	1.4	1.0	1.1	2.4
Liquid mixtures	11.3	3.6	2.4	3.8	4.4	0.2	6.5	10.1	6.0	4.0
Anhydrous ammonia	0.0	0.6	0.2	9.4	15.2	1.5	5.6	12.7	2.6	8.4
Nitrogen solutions	2.3	14.1	7.9	13.3	9.1	2.9	7.7	7.2	9.3	9.4
Dry DA materials	3.5	6.4	4.5	13.6	12.0	11.6	21.9	15.2	16.2	12.2
Liquid DA materials	0.0	1.3	1.9	2.1	2.7	0.2	0.8	3.6	1.8	2.0

*Number of plants on which calculation is based.

APPENDIX TABLE B

REGIONAL SUMMARY OF FLUID PLANTS -- AAPFCO FERTILIZER PLANT SURVEY -- 1988

	REGION									
	NEW ENGLAND	MIDDLE ATLANTIC	SOUTH ATLANTIC	EAST N. CENTRAL	WEST N. CENTRAL	EAST S. CENTRAL	WEST S. CENTRAL	MOUNTAIN	PACIFIC	TOTAL
LIQUID MIX ONLY										
Number	NA	9	35	28	103	10	127	22	34	369
Avg. size plant (tons) (335)*	NA	4,170	4,122	3,169	2,808	9,726	4,055	2,062	4,624	3,671
Storage capacity dist. (%) (264)*	NA	16.1	19.8	51.9	32.8	36.7	32.9	69.5	9.8	30.5
Fert., custom applied (%) (311)*	NA	32.0	27.4	70.8	44.2	34.7	35.3	29.7	21.3	36.3
By dealer	NA	31.2	25.4	70.8	42.8	8.6	30.6	21.7	10.5	31.0
By others	NA	0.8	2.0	0.0	1.4	26.1	4.6	8.0	10.8	5.3
By farmer (own equip.)	NA	68.0	36.0	13.3	29.5	55.0	29.0	22.4	26.5	31.5
By farmer (rental)	NA	0.0	36.6	15.9	26.3	10.2	35.8	47.9	52.2	32.2
Plants offering: (%) (321)*	NA									
Herbicide addition	NA	57.1	58.1	80.0	85.1	57.1	73.0	61.9	29.2	71.0
Insecticide addition	NA	57.1	41.9	60.0	51.1	28.6	56.8	23.8	20.8	48.6
Micronutrient addition	NA	100.0	90.3	84.0	79.8	71.4	79.3	76.2	62.5	79.8
Seed addition	NA	28.6	16.1	48.0	22.3	14.3	17.1	23.8	8.3	21.2
Soil testing	NA	71.4	67.7	88.0	89.4	57.1	71.2	90.5	70.8	78.5
Consulation services	NA	57.1	54.8	44.0	54.3	42.9	42.3	52.4	70.8	50.5
SUSPENSION MIX ONLY										
Number	NA	NA	9	8	21	9	4	NA	NA	54
Avg. size plant (tons) (51)*	NA	NA	4,136	2,964	2,490	2,411	3,250	NA	NA	2,799
Storage capacity dist. (%) (39)*	NA	NA	16.6	17.8	30.1	38.0	32.3	NA	NA	26.6
Fert., custom applied (%) (50)*	NA	NA	62.9	70.3	77.1	81.2	57.7	NA	NA	71.4
By dealer	NA	NA	57.7	69.9	76.2	56.3	57.7	NA	NA	66.8
By others	NA	NA	5.2	0.4	0.9	24.8	0.0	NA	NA	4.6
By farmer (own equip.)	NA	NA	29.0	24.2	6.0	18.0	22.3	NA	NA	17.4
By farmer (rental)	NA	NA	8.1	5.5	16.9	0.8	20.0	NA	NA	11.2
Plants offering: (%) (48)*										
Herbicide addition	100.0	100.0	87.5	100.0	100.0	100.0	66.7	NA	NA	95.8
Insecticide addition	100.0	100.0	25.0	85.7	47.6	71.4	66.7	NA	NA	56.3
Micronutrient addition	100.0	100.0	100.0	85.7	85.7	100.0	66.7	NA	NA	89.6
Seed addition	0.0	100.0	0.0	57.1	57.1	14.3	33.3	NA	NA	39.6
Soil testing	100.0	100.0	75.0	85.7	100.0	57.1	66.7	NA	NA	85.4
Consultation services	100.0	100.0	50.0	14.3	66.7	28.6	33.3	NA	NA	50.0
ALL FLUID MIX PLANTS										
Number	6	49	117	302	789	53	220	106	79	1,721
Avg. size plant (tons) (1,431)*	7,803	6,910	9,641	5,692	4,889	4,750	7,842	5,337	8,440	6,084
Storage capacity dist. (%) (1,169)	58.9	43.1	24.6	47.4	48.0	41.4	30.1	42.5	23.2	39.3
Fert., custom applied (%) (1,366)*	61.6	57.8	49.3	59.1	57.2	54.8	46.4	51.8	36.5	53.7
By dealer	61.5	54.8	41.4	57.1	55.6	39.8	33.3	37.8	25.6	48.1
By others	0.1	3.0	7.9	2.0	1.6	15.0	13.1	13.9	10.9	5.6
By farmer (own equip.)	23.0	33.9	37.2	16.2	19.5	24.3	21.8	18.6	34.7	22.9
By farmer (rental)	15.4	8.3	13.5	24.7	23.2	20.9	31.8	29.6	28.8	23.4
Plants offering: (1,443)*										
Herbicide addition	100.0	84.1	76.4	90.7	88.8	85.1	73.3	74.5	41.8	82.7
Insecticide addition	100.0	84.1	54.5	75.1	54.5	48.9	49.2	24.5	31.3	55.5
Micronutrient addition	100.0	97.7	95.5	91.8	84.6	87.2	86.2	85.3	80.6	87.5
Seed addition	83.3	68.2	37.3	75.1	49.7	44.7	31.3	44.1	19.4	50.0
Soil testing	100.0	95.5	81.8	95.0	95.1	70.2	75.9	96.1	79.1	90.0
Consultation services	66.7	75.0	62.7	64.1	59.1	42.6	47.7	59.8	76.1	59.6
Plants w/bagging equip. (%)	16.7	15.9	11.8	7.8	4.6	2.1	4.1	10.8	26.9	7.5

*Number of plants on which calculation is based.

APPENDIX TABLE 8 (continued)

REGIONAL SUMMARY OF FLUID PLANTS -- AAPFCO FERTILIZER PLANT SURVEY -- 1988

	REGION									
	NEW ENGLAND	MIDDLE ATLANTIC	SOUTH ATLANTIC	EAST N. CENTRAL	WEST N. CENTRAL	EAST S. CENTRAL	WEST S. CENTRAL	MOUNTAIN	PACIFIC	TOTAL
Plants offering limestone (%)	83.3	75.0	70.0	53.0	32.7	34.0	12.3	5.9	31.3	36.3
Plant ownership: (%) (1,721)*										
Privately owned	83.3	85.7	82.1	62.6	44.5	67.9	75.9	67.0	75.9	59.1
Corporation	16.7	2.0	4.3	11.9	26.2	11.3	4.5	6.6	5.1	16.1
Cooperative	0.0	12.2	13.7	25.5	29.3	20.8	19.5	26.4	19.0	24.8
Dist. of fert. by class: (%) (1,414)*										
Dry bulk blend	20.6	22.7	22.8	28.7	21.4	16.9	18.5	32.5	27.0	23.6
Dry bagged blend	21.0	5.9	7.1	3.3	0.9	2.1	1.0	1.7	5.0	2.8
Bulk granulation	0.7	0.7	7.1	1.7	1.0	3.0	0.7	1.6	5.0	2.2
Bagged granulation	0.7	0.7	1.9	1.0	0.3	1.9	0.2	0.2	0.4	0.7
Suspension mixtures	12.6	18.3	14.6	15.3	12.9	26.2	6.4	2.7	3.6	12.3
Liquid mixtures	38.0	29.7	27.7	12.7	14.6	11.1	38.2	17.4	16.9	19.4
Anhydrous ammonia	0.0	0.5	0.3	7.3	15.4	0.6	5.4	14.9	3.6	8.9
Nitrogen solutions	5.5	12.1	12.9	18.7	14.7	31.2	16.6	9.8	13.4	15.5
Dry DA materials	0.9	7.2	2.3	8.1	13.0	5.2	9.4	12.5	12.5	9.7
Liquid DA materials	0.0	2.1	3.1	3.2	5.7	1.8	3.6	6.5	12.5	4.8

*Number of plants on which calculation is based.

APPENDIX TABLE C

REGIONAL SUMMARY OF ALL PLANTS -- AAPFCO FERTILIZER PLANT SURVEY -- 1988

	REGION									
	NEW ENGLAND	MIDDLE ATLANTIC	SOUTH ATLANTIC	EAST N. CENTRAL	WEST N. CENTRAL	EAST S. CENTRAL	WEST S. CENTRAL	MOUNTAIN	PACIFIC	TOTAL
ALL PLANTS										
Number	24	178	386	1,092	1,903	392	453	206	121	4,758
Avg. size plant (tons) (4,301)*	6,598	6,392	8,803	5,380	3,834	6,074	13,758	4,353	7,945	6,041
Storage capacity dist. (%) (3,605)*	76.2	42.2	33.5	45.5	50.4	48.3	20.1	46.2	28.5	39.0
Fert., custom applied (%) (4,148)*	36.0	42.0	42.9	48.8	48.2	45.5	52.2	46.0	32.9	46.6
By dealer	30.1	37.0	31.5	46.8	46.0	35.7	33.2	35.5	19.3	40.2
By others	5.9	5.0	11.4	2.0	2.2	9.8	19.0	10.5	13.6	6.4
By farmer (own equip.)	48.5	32.8	45.9	17.5	19.6	19.5	15.7	24.1	41.0	24.1
By farmer (rental)	15.5	25.2	11.2	33.7	32.2	35.0	32.2	29.9	26.1	29.3
Plants offering: (%) (4,315)*										
Herbicide addition	65.2	67.9	50.8	73.7	77.8	71.7	58.0	60.9	40.0	70.1
Insecticide addition	39.1	57.7	36.0	57.1	36.9	47.2	36.6	18.2	29.0	42.4
Micronutrient addition	95.7	89.1	89.6	84.5	78.3	85.3	73.6	78.1	79.0	81.4
Seed addition	52.2	59.0	51.1	73.3	52.8	81.3	51.0	43.2	20.0	59.0
Soil testing	82.6	91.0	84.6	94.6	93.8	79.5	76.9	93.8	78.0	89.8
Consultation services	65.2	71.8	58.8	65.3	60.5	50.1	47.5	59.4	76.0	60.1
Plants w/bagging equip. (%)	43.5	24.4	22.0	13.4	8.8	8.3	10.0	15.6	34.0	12.7
Plants offering limestone (%)	78.3	76.9	78.6	53.1	30.7	45.9	29.9	7.8	32.0	42.4
Plant ownership: (%) (4,758)*										
Privately owned	58.3	53.9	67.4	53.6	35.5	56.9	66.9	54.9	75.2	49.7
Corporation	12.5	4.5	5.7	8.1	12.7	4.6	4.9	5.3	5.0	8.8
Cooperative	29.2	41.6	27.2	38.4	51.9	38.5	28.3	39.8	19.8	41.6
Dist. of fert. by class: (%) (4,247)*										
Dry bulk blend	38.8	44.3	46.1	45.3	43.1	54.5	39.2	40.6	28.7	43.9
Dry bagged blend	35.2	11.9	14.8	3.8	2.3	15.8	2.4	2.7	10.6	6.9
Bulk granulation	3.4	4.3	5.0	1.6	1.5	3.8	1.0	2.7	5.4	2.5
Bagged granulation	1.2	3.6	3.7	1.1	0.5	2.3	0.9	0.6	2.9	1.6
Suspension mixtures	3.9	6.0	5.2	4.8	5.8	3.3	3.0	1.6	2.5	4.7
Liquid mixtures	11.8	9.9	10.0	5.1	7.2	1.5	18.7	10.7	12.5	8.0
Anhydrous ammonia	0.0	0.6	0.2	9.0	15.0	1.4	5.3	12.8	3.4	8.1
Nitrogen solutions	2.3	12.5	9.3	14.2	10.7	6.2	10.7	7.8	10.5	10.8
Dry DA materials	3.4	5.7	3.8	12.8	10.8	11.0	17.1	15.1	15.0	11.0
Liquid DA materials	0.0	1.2	1.9	2.3	3.1	0.4	1.7	5.3	8.3	2.5

*Number of plants on which calculation is based.