Global Update on Slow-Release Fertilizers

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INTRODUCTION

In 2002, AgIndustries Research & Consulting, Inc. (AgIndustries) completed its latest multiclient study of CRF supply and demand trends in the U.S., Western European, and Japanese markets. This paper presents highlights from that study and also offers selected findings from our new *U.S. Controlled-Release Fertilizers Imports and Exports* monitoring service.

Slow-release fertilizers (SRFs) include both manufactured controlled-release fertilizers (CRFs) and processed natural organic materials, both of which provide the slow release of nitrogen (N) and are marketed in competition with lower cost conventional fertilizer products. This paper focuses on manufactured CRFs, but also includes summary information about U.S. consumption of processed natural organics.

Slowly soluble urea-aldehyde reaction products and coated fertilizers are the two major types of manufactured CRFs. Commercial urea-aldehyde reaction products include urea-formaldehyde (UF), isobutylidene diurea (IBDU), and crotonylidene diurea (CDU). Coated fertilizers mainly consist of sulfur-coated urea (SCU) and polymer- and sulfur-coated urea (P/SCU) and polymer-coated (including resin-coated) fertilizers (PCFs). Today, all SCU produced in North America is P/SCU. Relatively small amounts of other polymer and sulfur/coated fertilizer materials are also produced. PCFs include polymer-coated urea (PCU), polymer-coated NPK (PC-NPK), and polymer-coated potassium materials (PCK).

The market data and projections we present in this paper are AgIndustries' estimates, based on information we obtained through extensive interviews with CRF product manufacturers, agricultural and specialty fertilizer manufacturers and distributors, university specialists, and professional end users of CRF products in the United States, Western Europe, and Japan.

GLOBAL MARKET

Supply by Region

In the 1990-2001 period, the annual U.S. supply (production plus imports) of manufactured CRFs grew at an average annual rate of 4.7%. Domestic production grew at an average annual rate of 4.8%, with imports growing at an average rate of 3.6%. UF products continued to account for the largest share of U.S. production, but their share of the total CRFs supply declined from about 54% in 1990 to 45% in 2001 (see Table 1). The U.S. supply of coated fertilizers increased rapidly in the 1990s, with production of SCU and P/SCU rising by 150% between 1990 and 2001, and production of PCFs increasing by more than 130%. P/SCU and PCFs accounted for 34% and 12%, respectively, of total U.S. manufactured CRF production in 2001.

Other slowly soluble fertilizers manufactured in the United States include magnesium ammonium phosphate/magnesium potassium phosphate (MagAmp®), and spike, stake, and tablet formulations. This group of products accounted for about 2% of U.S. manufactured CRF production in 2001.

The total supply of manufactured CRFs in Western Europe increased by about 15% between 1996 and 2001. In 2001, CRF products manufactured within Western Europe accounted for about 70% of the total supply (down from about 80% in 1996), whereas imports accounted for nearly 30% (up from about 20% in 1996). Granular mixed SRFs based on urea reaction products accounted for more than 75% of Western European production, 60% of imports, and 72% of supply. PCFs

accounted for 21% of total production, 28% of total imports, and 23% of the total Western European manufactured CRFs supply. Western Europe had no significant production of SCU, and imports of unformulated sulfur-coated products were minor.

In Japan, the supply of manufactured CRFs increased by just 4% between 1996 and 2001. Domestic production made up 98% of the supply in 2001, with imports accounting for 2%. Coated fertilizers accounted for 74% of total CRF production in 2001, urea aldehyde condensation products for about 25%, and other synthetic organic compounds for less than 1%.

During the 1990-2001 period, Japan's annual production of coated fertilizers expanded rapidly—by more than 130% overall—with production of coated urea increasing more than threefold. Coated urea accounted for about 60% of the total coated fertilizer production in 2001 and coated complex fertilizers accounted for about 40%. Production of coated potassium is limited. Promotion and R&D activities for coated fertilizers have been actively pursued in Japan, driven by a strong need to reduce costs of agricultural crop production.

Table 1
MANUFACTURED CRF SUPPLY/DEMAND BY MAJOR REGION, 2001
(Thousands of Short Tons)

	United States	Western Europe[a]	Japan
Production	496	95	110
Imports[b]	51	40	2
Exports[b]	4	2	18
Apparent Consumption	543	133	94

[a] Data for production and imports include the product weight of granular mixed fertilizers based on urea reaction products. Thus they are not directly comparable with production and import data for the United States and Japan, which include only the unformulated urea reaction products.

[b] Data for imports and exports do not include CRF components of finished chemically mixed or blended fertilizer products.

Source: AgIndustries estimates.

Consumption by Region

The United States is the primary world market for CRFs, followed by Western Europe and Japan. In terms of product volume, the U.S. market is more than 4 times the size of the Western European market and more than 5.5 times the size of the Japanese market (see Table 2). The difference in market size for Japan needs to be viewed, however, in the context of that country's much smaller land area, far smaller total fertilizer consumption, and the relatively small proportion of CRFs consumed in nonagricultural markets than that in the United States or Europe.

Table 2
CONSUMPTION OF MANUFACTURED CRFs BY PRODUCT TYPE AND WORLD REGION, 2001
(Thousands of Short Tons)

CRF Product Type	United States	Western Europe	Japan
Urea Reaction Products[a]	234	89	27
Coated Fertilizers	272	29	63
Other Products	10	5	< 1
Total	516	123	91

[a] Data for urea reaction products are not directly comparable among regions because data for Western Europe represent the product weight of granular mixed fertilizers based on urea reaction products, whereas data for the United States and Japan include only the unformulated products.

Source: AgIndustries estimates.

In the United States, coated fertilizers accounted for about 53% of the total manufactured CRF consumption in 2001, and urea reaction products for 45%. In Western Europe, urea reaction products accounted for 72% of total consumption and coated fertilizers for just 23%, whereas in Japan, urea reaction products accounted for 30% of CRF consumption, with coated fertilizers accounting for 69%.

As total demand for fertilizers in Japan has declined steadily, Japanese manufacturers have shifted production and marketing efforts from conventional to coated fertilizers. Coated fertilizer consumption has increased mainly because of commercial promotion. Use of coated fertilizers is supported by Zen-Noh (which accounts for 60% of domestic fertilizer sales) and the Japanese Ministry of Agriculture, Forestry, and Fisheries (JMAFF), which together are working to rationalize Japanese agriculture.

The market distribution of manufactured CRFs differs substantially among the three regions (see Table 3). Professional (golf courses, other professional turf, ornamental horticulture, landscapers, others) and consumer markets predominate in the United States and Western Europe. However, in Japan 90% of CRF consumption is for agricultural crops, with rice the primary crop market. In 2001, 25% of Japanese rice farmers used CRFs, with the N contained in CRF products accounting for about 11% of the fertilizer N applied for that crop. Coated fertilizers, primarily polymer- and resin-coated urea products, are preferred to urea-aldehyde reaction products and other synthetic organic CRF products for rice production in Japan. In 2001, 19% of Japan's rice farmers applied coated fertilizers, and 6% applied urea-reaction products, mainly IBDU.

Table 3
CONSUMPTION OF MANUFACTURED CRFs
BY MARKET AND WORLD REGION, 2001
(Thousands of Short Tons)

	United States	Western Europe	Japan
Agricultural Crops	30	8	82
Consumers	135	37	NEG
Professional Markets	351	78	9
Total	516	123	91
Projected Average Annual Growth Rate, 2001-2006	2.5–3.5%	2.5–4.0%	0.0–2.0%

Source: AgIndustries estimates.

The total volume of manufactured CRFs consumed for agricultural crops in Japan in 2001 was 2.7 times larger than the total volume consumed for crops in the United States and 10 times larger than the volume consumed for crops in Western Europe.

For the 2001-2006 period, we expect similar overall market growth trends for the U.S. and Western European CRFs markets. For the same period, we expect Japanese consumption to range from the 2001 level to an average annual increase of up to 2%.

Agricultural consumption of CRFs in Western Europe is expected to grow slowly during the 2001-2006 period, at an average annual rate of 1.5-2.5%. Stronger growth, at an overall average annual rate of 3-4%, is projected for consumption in Western Europe's nonagricultural markets.

One of the main requirements for future growth of the overall Western European CRFs market will be the availability of more cost-effective coated products. Various manufacturers are conducting research into more economic production techniques.

U.S. MARKET

Leading Suppliers

The five leading North American suppliers of manufactured CRFs are The Scotts Company, Nu-Gro Corporation, LESCO, Inc., Pursell Technologies, and Lebanon Seaboard (see Table 4). Nu-Gro, headquartered in Canada, produces CRF products in Canada and in the United States through two subsidiary companies. Together, the five leading producers accounted for an estimated 92% of the total volume of manufactured CRF products consumed in the U.S. market in 2001.

Table 4
LEADING NORTH AMERICAN SUPPLIERS OF MANUFACTURED CRFS

	Estimated Rank as Supplier to the U.S. Market Based on Product Volume, 2001				
	UF Products	IBDU	SCU or P/SCU	PCFs	Overall
Scotts	1	--	2	1 (tie)	1
Nu-Gro	3	1	3	--	2
LESCO	--	--	1	--	3
Pursell Technologies	--	--	4	1 (tie)	4
Lebanon Seaboard	2	--	--	--	5

Source: AgIndustries estimates.

The overall ranking of the top five suppliers has not changed since 1998. However, between 1998 and 2001, Nu-Gro, Pursell Technologies, and Lebanon Seaboard each increased their market shares modestly, while Scotts' and LESCO's shares remained about the same. Scotts has historically been the leading U.S. manufacturer and marketer of CRF products, with a domestic market share of about 40% in both 1998 and 2001.

Market Value

U.S. manufacturers' and primary distributors' sales of manufactured CRFs and processed natural organic fertilizer materials totaled an estimated $362 million in 2001 (see Table 5). Agricultural crop markets accounted for 11% of the total market value, and nonagricultural markets accounted for 89%. The three largest nonfarm markets, in terms of wholesale value, are the consumers market, golf courses, and nurseries and greenhouses. Manufactured CRF products accounted for 87% of the total market value in 2001.

Table 5
WHOLESALE VALUE OF THE U.S. MARKET FOR CRFs, 2001
(Millions of Dollars)

	Manufactured Products	Processed Natural Organics	Total[a]
Agricultural Crop Markets	20	20	40
Nonagricultural Markets	297	25	322
Total, All Markets[a]	317	45	362

Source: AgIndustries estimates.

Consumption by Market

Manufactured CRFs accounted for about 1% of the total gross tonnage of commercial fertilizers applied in the United States in 2001 and for 1.6% of the contained N. An estimated 516,000 short tons of manufactured CRFs were applied, of which nonagricultural markets accounted for about 94% and agricultural crop markets accounted for about 6% (see Table 7). The overall N analysis of the applied manufactured CRF was about 36%. By 2006, we expect U.S. consumption of manufactured CRFs to increase to 586,000–620,000 short tons.

Table 7
U.S. CONSUMPTION OF MANUFACTURED CRFs BY MARKET, 2001-2006
(Thousands of Short Tons, Product)

	2001	2006	Average Annual Growth Rate, 2001-2006[a] (Percent)
Agricultural Crop Markets, Total	30	35-38	3.5–5.0
Nonagricultural Markets			
Consumers	135	155–165	2.5–4.0
Professional Lawn Care and Landscape Maintenance	101	115–120	2.5–3.5
Golf Courses	111	120–125	1.5–2.5
Other Professional Turf	56	65–68	3.0–4.0
Nurseries and Greenhouses	63	74–79	3.0–4.5
Landscapers, Others	20	22–25	2.0–4.0
Total	486	551–582	2.5–3.5
Total, All Markets	516	586–620	2.5–3.5

[a] Growth rates are rounded to the nearest 0.5%.

Source: AgIndustries estimates.

In addition to manufactured CRFs, an estimated 700,000 short tons of processed natural organic fertilizer materials were consumed in U.S. agricultural crop and nonagricultural markets in 2001. The average N content of the natural organic materials was 4.2%. Nonagricultural markets accounted for 56% of the total natural organic fertilizer consumption and agricultural crop markets accounted for 44%. Annual consumption of processed natural organics more than doubled between 1990 and 2001 as supplies of heat-dried sewage sludge increased, prompted by new environmental laws.

Between 2001 and 2006, we expect overall U.S. consumption of processed natural organics to increase at an average annual rate of 2–4% as a result of:

- Continuing emphasis on recycling organic wastes because of restrictions on landfill
- Increasing production of heat-dried sewage sludge products via new processes designed to produce less dusty pelletized sludge products for blending with other fertilizer materials

- Availability of new technologies for the conversion of poultry and animal manures to commercially acceptable pelletized or granular organic fertilizers, and development of distribution and marketing systems for these products.

Agricultural Crop Markets

Approximately 30,000 short tons of manufactured CRFs were applied to U.S. agricultural cropland in 2001. In the agricultural crops sector, manufactured CRFs are used mainly for high-cash-value crops for which their cost is justified. Strawberries and vegetable and melon crops are the two largest agricultural markets for manufactured CRFs.

P/SCU is the most widely used CRN source for agricultural crops, primarily because it is the lowest cost source. On a product volume basis, P/SCU accounted for 47% of the agricultural use of manufactured CRFs in 2001, followed by polymer-coated products (24%), UF products (20%), and IBDU (7%).

Agricultural consumption of manufactured CRFs increased at an average annual rate of less than 2% between 1990 and 2001 on a product volume basis. Given the following current and expected trends, we project an overall average annual growth at a rate of 3.5–5.0% for the 2001-2006 period:

- Increasing market development and promotion of existing and new manufactured CRF products for higher value fruit and vegetable crops
- Development of new lower cost CRF manufacturing processes and lower cost coating technologies, and introduction of new CRF products based on these lower cost technologies
- Continuing environmental concerns about N pollution of groundwater in many U.S. crop-growing regions
- One regional grocery chains' recent decision not to buy produce that has been grown on land to which any sewage sludge product has been applied, and the potential that similar positions by other companies in the retail trade may result in increased demand for manufactured CRFs
- Possible legislation to require reduced N application rates in nitrate-sensitive areas (e.g., the Delmarva Peninsula on the east coast of the United States, which comprises portions of Delaware, Maryland, and Virginia).

The relatively low prices of conventional N fertilizers and low prices for agricultural commodities make CRFs unaffordable for major field crops. A field crop grower's decision to use a CRN fertilizer instead of a conventional N fertilizer will continue to be based on economics unless there should be mandated use of CRN sources because of environmental issues.

Nonagricultural Markets

In terms of product volume, the three largest U.S. nonagricultural markets for manufactured CRFs in 2001 were the consumers, golf courses, and the professional lawn care and landscape maintenance markets. Nurseries and greenhouses, other professional turf, and landscapers were smaller markets in terms of product volume.

Consumption by Product Type

Table 8 summarizes U.S. CRF consumption in 2001 by product type and shows the average annual growth trends we project for each product type for the 2001-2006 period.

Table 8
U.S. CONSUMPTION OF MANUFACTURED CRFs BY PRODUCT TYPE, 2001-2006
(Thousands of Short Tons)

Product Type	2001	2006	Average Annual Growth Rate, 2001-2006[a] (Percent)
Urea Reaction Products			
UF Products	223	245–258	2.0–3.0
IBDU	11	12–13	1.5–3.5
Subtotal	234	257–271	2.0–3.0
Coated Fertilizers			
P/SCU	197	227–238	3.0–4.0
PCFs	75	91–99	4.0-5.5
Subtotal	272	318–337	3.0–4.5
Other Slowly Soluble Products	10	11–12	1.5-3.0
Total	516	586–620	2.5–3.5

[a] Growth rates are rounded to the nearest 0.5%.

Source: AgIndustries estimates.

Urea Reaction Products

Solid and liquid UF products and IBDU are the urea reaction products used as SRFs in the United States. Urea reaction products accounted for 45% of the estimated total volume and for about 47% of the total N content of all manufactured CRFs consumed in U.S. markets in 2001. Nonagricultural markets account for most (97%) of the consumption of urea reaction products. Golf courses and the consumers market are the two most important markets for this group of products, with each at about 31% of total consumption.

UF products' share of key markets has declined since 1990 with the increasing availability and acceptance of less expensive sulfur-coated and polymer-coated products. However, we expect overall demand for urea reaction products to increase at an average annual rate of 2–3% in the 2001-2006 period as a result of:

- Continuing advances in UF technology and introduction and aggressive marketing and promotion of new UF products with N-release characteristics more closely matched to the N-uptake requirements of turfgrasses, ornamental crops, and high-value vegetable crops

- Increasing interest in using UF-based CRFs for ornamental nursery crops, vegetables, and other agricultural crops as growers face increasing pressure from regulatory authorities to avoid nitrate contamination of groundwater and/or runoff of N fertilizer
- Increasing consumption of liquid UF fertilizers for soil or foliar applications for vegetables, strawberries, tree and vine crops, cotton, and other field crops
- Promotion and marketing of blended and chemically mixed IBDU-based and IBDU plus UF-based SRFs for turf, landscape applications, and ornamentals.

Coated Fertilizers

Coated fertilizers accounted for 53% of the total volume of manufactured CRFs consumed in the United States in 2001 and for about 52% of total manufactured product CRN. Nonagricultural markets collectively represented about 92% of coated fertilizer consumption, with agricultural crop markets at almost 8%. Professional lawn care and landscape maintenance is the largest market for coated fertilizers, followed by the consumers market and nurseries and greenhouses.

Total consumption of coated fertilizers grew at an average annual rate of about 7% between 1990 and 2001. Consumption of P/SCU grew at an average rate of 7% per year, and consumption of polymer-coated products grew at an average rate of 8.4%.

We project continued but slower growth—at an overall average annual rate of 3–4.5%—for U.S. demand for coated fertilizers in the 2001-2006 period. We expect growth in consumption of P/SCU to grow at an average annual rate of 3–4%. Demand for PCFs is expected to grow at an average annual rate of 4.0–5.5% as a result of:

- Availability and aggressive marketing of a lower cost PCU product based on new coating technology from the Canadian fertilizer producer, Agrium
- Continuing environmental concerns and/or legislation to require ornamental growers to reduce or prevent runoff of N fertilizer from their properties, resulting in increasing use of polymer-coated CRF products
- Development of new coating technologies that permit production of new lower cost polymer-coated products affordable for a wider range of agricultural crops
- Increasing popularity of blended turf and ornamental SRFs containing PCF materials.

U.S. IMPORTS AND EXPORTS

AgIndustries tracks U.S. shipborne imports and exports of manufactured CRFs and specialty fertilizers known to contain CRF ingredients through subscription to the *Journal of Commerce's* online Port Import Export Reporting Service (PIERS). We provide monthly analyses of the raw PIERS data to subscribers of our *U.S. Controlled-Release Fertilizer Imports and Exports Monitoring Service*. Some highlights from the *Monitoring Service* reports follow.

Imports

In 2002, approximately 14,000 short tons of manufactured CRFs were imported to the United States from offshore countries (see Table 9). PCFs accounted 90% of the imported products and UF products for 10%. PC-NPK products, primarily Nutricote® from Japan, made up more than 90% of the imported PCFs. There were also imports of Scotts' Osmocote® products from the Netherlands and of Aglukon's Plantacote® Pluss from Germany. PCU was imported from Japan. Imported UF products included a ureaform product from Italy (Sirflor®), an MU product from Italy (Sazolene®), and UF-based products from Scotts UK.

Table 9
U.S. SHIPBORNE IMPORTS OF MANUFACTURED CRFS BY PRODUCT TYPE, 2002

Product Type	Short Tons
UF Products	1,393
PCFs	
PCU	953
PC-NPK	11,932
Subtotal	12,885
Total	14,278

Source: AgIndustries estimates, based on data reported by PIERS.

Japan was the primary source of U.S. shipborne imports of manufactured CRFs in 2002, accounting for nearly 80% of the total (see Table 10). Italy and the Netherlands each accounted for about 7% of the total ship borne imports.

Table 10
U.S. SHIPBORNE IMPORTS OF MANUFACTURED CRFS BY COUNTRY OF ORIGIN, 2002

Country	Short Tons
Japan	11,360
Italy	1,056
Netherlands	1,011
United Kingdom	336
Germany	316
Israel	197
Total	14,278

Source: AgIndustries estimates based on data reported by PIERS.

In addition to the offshore sources, the U.S. market is also supplied with PCU from Agrium in Canada and with substantial volumes of SCU from Nu-Gro in Canada.

Exports

U.S. shipborne exports of manufactured CRFs and blended fertilizers containing CRF components totaled nearly 25,000 short tons in 2002 (see Table 11). The Scotts Company's UF- based and/or P/SCU-based products were exported in the largest volume, accounting for about 22% of the total ship borne exports. IBDU accounted for 14% of the shipborne exports, whereas polymer-coated fertilizers and J.R. Simplot's blended products each accounted for slightly less than 14%. LESCO's P/SCU and/or UF-based products represented about 11% of the total exports. And Lebanon Seaboard's UF-based products made up 8.5%.

Table 11
U.S. SHIPBORNE EXPORTS OF MANUFACTURED CRFs AND SPECIALTY FERTILIZERS CONTAINING CRFs BY PRODUCT OR PRODUCT TYPE, 2002[a]

Product or Product Type	Short Tons
Scotts UF- and/or P/SCU-Based Products	5,411
IBDU	3,536
PCFs	3,365
J.R. Simplot Blended Products	3,357
LESCO P/SCU- and/or UF-Based Products	2,672
Lebanon Seaboard UF-Based Products	2,104
Other Blends Containing CRFs	1,375
Other Slowly Soluble Products	920
P/SCU	915
Liquid UF Products[b]	695
Solid UF Products	279
Total	24,629

[a] Exports by truck or rail are not included.

[b] Volume shown for liquid UF Products may include other liquid fertilizers and thus may be overstated.

Source: AgIndustries estimates based on data reported by PIERS.

Japan, Germany, and Australia were the three leading destinations of U.S. manufacturers' shipborne exports of manufactured CRFs and specialty mixed fertilizers containing CRF products, together accounting for about 64% of the total exported product volume (see Table 12). The next most important export markets were other Asian countries, other European countries, Caribbean countries, and the Netherlands. For the first half of 2003, Japan and Germany continued to rank as the two largest export markets, but Belgium displaced Australia as the third largest market.

Table 12
PRINCIPAL DESTINATIONS OF RECENT U.S. SHIPBORNE EXPORTS OF MANUFACTURED CRFs AND SPECIALTY FERTILIZERS CONTAINING CRFs[a]
(Short Tons, Product)

Destination	January-December 2002	January-June 2,003
Japan	7,266	5,256
Germany	5,018	1,789
Australia	3,368	1,266
Other Asian Countries	1,798	1,384
Other European Countries	1,330	653
Caribbean	1,228	489
Netherlands	1,026	609
Singapore	811	437
United Kingdom	714	923
Belgium	669	1,542

[a] Exports by truck or rail are not included.

Source: AgIndustries estimates based on data reported by PIERS.

Conclusions

During 2001-2006, based on our analysis of recent supply and demand trends in the three principal world regional markets for manufactured CRFs, we project the following trends for the global CRFs market during the 2001-2006 period:

- The global market for SRFs based on urea-aldehyde reaction products will grow at an average annual rate of 1.5-2.5%. Total consumption of products in the three principal world regional markets—the United States, Western Europe, and Japan—will amount to 377,000-396,000 by 2006.
- Global consumption of coated fertilizers will grow at an average annual rate of 3-4.5% during 2001-2006. Total consumption of coated fertilizers in the United States, Western Europe, and Japan is expected to reach 423,000-452,000 short tons by 2006.
  - — Consumption of P/SCU, mainly in the United States, will increase at an average rate of 3-4% per year.
  - — Demand for PCFs will increase at an average rate of 3-5% per year.

Continuing advances in UF technology are leading to new solid and liquid UF products with N-release characteristics more closely matched to the N uptake requirements of turfgrasses, ornamental crops, and high-value vegetable crops.

Opportunities exist to supply lower cost CRF products. There is a need for lower cost coating technologies and lower cost manufacturing processes for PCFs. Currently, numerous companies

worldwide are developing and patenting new polymer coating technologies and/or are working to improve or enhance their present PCF products.

On the basis of our continuing monitoring and analysis of U.S. CRF imports and exports, we conclude that:

- Japan is both the principal source of U.S. shipborne imports of CRFs and the largest export market for CRF products manufactured in the United States.
- The volume of PCFs imported from Japan in 2002 was equivalent to about 14% of Japan's total production of coated fertilizers in 2001.
- Imports of UF products, mainly from Italy, are growing; the volume imported in 2002 was twice the volume imported in 2001.
- Each of the five leading North American CRF manufacturers has export markets for its products:
  - Scotts' exports include UF-and/or P/SCU-based products and PCFs
  - Nu-Gro exports IBDU and solid UF products
  - LESCO exports turf fertilizers containing P/SCU and/or UF components as well as some straight P/SCU
  - Pursell Technologies exports straight P/SCU and PCFs
  - Lebanon Seaboard exports UF-based fertilizer product
  - J.R. Simplot Company exports blended mixed turf and ornamental fertilizers containing Pursell Technologies' P/SCU and/or PCFs.