

April 30, 2008

THE FOOD CHAIN

# Shortages Threaten Farmers' Key Tool: Fertilizer

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XUAN CANH, Vietnam — Truong Thi Nha stands just four and a half feet tall. Her three grown children tower over her, just as many young people in this village outside Hanoi dwarf their parents.

The biggest reason the children are so robust: fertilizer.

Ms. Nha, her face weathered beyond its 51 years, said her growth was stunted by a childhood of hunger and malnutrition. Just a few decades ago, crop yields here were far lower and diets much worse.

Then the widespread use of inexpensive chemical fertilizer, coupled with market reforms, helped power an agricultural explosion here that had already occurred in other parts of the world. Yields of rice and corn rose, and diets grew richer.

Now those gains are threatened in many countries by spot shortages and soaring prices for fertilizer, the most essential ingredient of modern agriculture.

Some kinds of fertilizer have nearly tripled in price in the last year, keeping farmers from buying all they need. That is one of many factors contributing to a rise in [food prices](#) that, according to the [United Nations' World Food Program](#), threatens to push tens of millions of poor people into malnutrition.

Protests over high food prices have erupted across the developing world, and the stability of governments from Senegal to the Philippines is threatened.

In the United States, farmers in Iowa eager to replenish nutrients in the soil have increased the age-old practice of spreading hog manure on fields. In India, the cost of subsidizing fertilizer for farmers has soared, leading to political dispute. And in Africa, plans to stave off hunger by increasing crop yields are suddenly in jeopardy.

The squeeze on the supply of fertilizer has been building for roughly five years. Rising demand for food and biofuels prompted farmers everywhere to plant more crops. As demand grew, the fertilizer mines and factories of the world proved unable to keep up.

Some dealers in the Midwest ran out of fertilizer last fall, and they continue to restrict sales this spring because of a limited supply.

“If you want 10,000 tons, they’ll sell you 5,000 today, maybe 3,000,” said W. Scott Tinsman Jr., a fertilizer dealer in Davenport, Iowa. “The rubber band is stretched really far.”

Fertilizer companies are confident the shortage will be solved eventually, noting that they plan to build scores of new factories. But that will probably create fresh problems in the long run as the world grows more dependent on fossil fuels to produce chemical fertilizers. Intensified use of such fertilizers is certain to mean greater pollution of waterways, too.

Agriculture and development experts say the world has few alternatives to its growing dependence on fertilizer. As population increases and a rising global middle class demands more food, fertilizer is among the most effective strategies to increase crop yields.

“Putting fertilizer on the ground on a one-acre plot can, in typical cases, raise an extra ton of output,” said [Jeffrey D. Sachs](#), the [Columbia University](#) economist who has focused on eradicating poverty. “That’s the difference between life and death.”

The demand for fertilizer has been driven by a confluence of events, including population growth, shrinking world grain stocks and the

appetite for corn and palm oil to make biofuel. But experts say the biggest factor has been the growing demand for food, especially meat, in the developing world.

Recently, Ms. Nha, the tiny Vietnamese woman, stood in a field outside her village, her weather-beaten face shielded from the drizzle by a big straw hat. She took a break from wielding her wood-handled hoe and described the meager diets of her youth.

Her family, including six brothers and sisters, struggled to survive on rations from the commune where they lived, eating little protein. The occasional pigs they raised on rice stalks and mush “fattened very slowly,” Ms. Nha recalled.

But with market reforms, better seeds and increased fertilizer use, Vietnam’s rice yields per acre have doubled and corn yields have tripled, allowing farmers to fatten a growing herd of livestock.

Several times a season, Ms. Nha and her neighbors walk down their rows of corn with battered metal buckets full of chemical fertilizer, which looks like coarse gray sand, sprinkling a bit at the base of each plant. Ms. Nha’s husband, Le Van Son, remembers villagers’ amazement in the 1990s when they learned that a pound of chemical fertilizer contained more of the major nutrients than 100 pounds of manure.

Overall global consumption of fertilizer increased by an estimated 31 percent from 1996 to 2008, driven by a 56 percent increase in developing countries, according to the International Fertilizer Industry Association.

“Markets are asking farmers to step on the accelerator,” said Michael R. Rahm, vice president for market analysis and strategic planning at Mosaic, a fertilizer producer in Plymouth, Minn. “They’ve pressed on it, but the market has told them to step on it harder.”

Fertilizer is plant food, a combination of nutrients added to soil to help plants grow. The three most important are nitrogen, phosphorus and

potassium. The latter two have long been available. But nitrogen in a form that plants can absorb is scarce, and the lack of it led to low crop yields for centuries.

That limitation ended in the early 20th century with the invention of a procedure, now primarily fueled by natural gas, that draws chemically inert nitrogen from the air and converts it into a usable form.

As the use of such fertilizer spread, it was accompanied by improved plant varieties and greater mechanization. From 1900 to 2000, worldwide food production jumped by 600 percent. Scientists said that increase was the fundamental reason world population was able to rise to about 6.7 billion today from 1.7 billion in 1900.

Vaclav Smil, a professor at the University of Manitoba, calculates that without nitrogen fertilizer, there would be insufficient food for 40 percent of the world's population, at least based on today's diets.

Initially, much of the increased production of fertilizer went to grains like wheat and rice that served as the foundation of a basic diet. But recently, with world economic growth at a brisk 5 percent a year, hundreds of millions of people began earning enough money to buy more meat from animals fattened with grains. That occurred at the same time that rising production of biofuels, like ethanol, put new pressure on grain supplies.

These factors translated into rising fertilizer demand. Prices at a terminal in Tampa, Fla., for one fertilizer, diammonium phosphate, jumped to \$1,102 a ton from \$393 a ton in the last year, according to [JPMorgan](#) Securities, which tracks the prices. Urea, a type of granular nitrogen fertilizer, jumped to \$505 a ton from \$273 a ton in the last year.

Manufacturers are scrambling to increase supply. At least 50 plants to make nitrogen fertilizer are under construction, many in the Middle East where natural gas is abundant, and phosphorous and potassium

mines are being expanded. But these projects are expensive and time-consuming, and supplies are expected to remain tight for years.

Fertilizer is vitally important in Iowa, whose farmers grow more corn than in any other state and depend on fertilizer to increase yields.

But the combination of high prices and spot shortages has forced some farmers to revert to older methods of fertilization, making hog manure a hot commodity. Farmers are cutting deals to have hog barns built on the edges of their corn and soybean fields.

On a tour of his rolling farm in Oxford Junction in eastern Iowa, Jayson Willimack pointed to the future sites of two buildings that will hold 2,400 hogs. Their manure will eventually replace commercial fertilizer on 400 acres, about 10 percent of his farm, and save him perhaps \$50,000 annually. "Every little bit helps," he said.

Such a strategy has severe limits — manure contains so little nitrogen that tons are required on each acre. That means farmers in Iowa and abroad have little choice but to pay the higher prices for commercial fertilizer.

In many countries, those cost increases have so far been offset by record high prices for crops. But fertilizer inflation has created a crisis in countries that subsidize fertilizer use for farmers. In India, for instance, the government's subsidy bill could be as high as \$22 billion in the coming year, up from \$4 billion in 2004-5.

Once new supplies become available, the rising use of fertilizer will still pose difficulties.

Environmental groups fear increased use, particularly of nitrogen fertilizer made using fossil fuels. Because plants do not absorb all the nitrogen, much of it leaches into streams and groundwater. That runoff has long been recognized as a major pollution problem, and it is growing.

A barometer of the pollution is the rising number of dead zones where rivers meet the sea. In the Gulf of Mexico, for instance, nitrogen runoff from fields in the Corn Belt washes downstream and feeds plant life in the gulf. The algae blooms suck oxygen from the water, killing other marine life.

More than 400 dead zones have been identified, from the coasts of China to the Chesapeake Bay, and the primary reason is agricultural runoff, said Robert J. Diaz, a professor at the Virginia Institute of Marine Science.

“Nitrogen is nitrogen,” Professor Diaz said. “If it’s on land, it produces corn. If it gets in the water, it produces algae.”

This month, a United Nations panel called for changes in agricultural practices to make them less damaging. The panel recommended techniques that offer some of the same benefits as chemical fertilizer, like increased crop rotation with legumes that naturally add some nitrogen to the soil.

But others say those approaches, while helpful, will be not be enough to meet the world’s rapidly rising demand for food and biofuel.

“This is a basic problem, to feed 6.6 billion people,” said Norman Borlaug, an American scientist who was awarded a Nobel Peace Prize in 1970 for his role in spreading intensive agricultural practices to poor countries. “Without chemical fertilizer, forget it. The game is over.”

*Keith Bradsher reported from Vietnam and did additional reporting from Hong Kong. Andrew Martin reported from New York and Iowa.*