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Fertilizer

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Agricultural Situation

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Report Highlights:
The following report highlights the production, consumption, and functions of the most popular fertilizers in the China market. This includes nitrogenous, phosphate, potash, and the most common compound fertilizers, along with other alternative types of fertilizer. It also includes fertilizer import and export activity in China and draws conclusions why certain countries are key players. The issue of subsidies and domestic production protection by the government is also discussed.

Origin and function of Fertilizers:

Compound Fertilizers

Compound fertilizers are the by-product of combining two or more elements to create a fertilizing substance. The most common compound fertilizers are anhydrous ammonia, ammonium nitrate, ammonium sulfate, calcium nitrate, and potassium nitrate. The category is extremely broad and includes processed fertilizers. Most compound fertilizers can be used on a wide range of crops, depending on soil content . [1]

Phosphate

Phosphate fertilizers are derived from phosphate rock deposits and then treated with sulfuric acid to produce fertilizer; the most common are superphosphate or phosphoric acid. Other phosphate fertilizers include triple superphosphate, diammonium phosphate, monoammonium phosphate, and ground phosphate rock.[2] Phosphate is usually divided into two main categories: sodium phosphate (NaP) and monoammonium phosphate (MaP). Phosphate fertilizer is primarily used for wheat, barley, rapeseed, corn, and soybeans. However, all crops need some amount of phosphate, depending on soil content. Phosphate has been known to be more damaging to rice because it is highly water soluble.

Potash

Potash (K2O) originates from the element potassium (K). Small amounts of potassium are needed to support many of the crucial enzyme processes in plants and play a vital role in the transport of sugars and other products of photosynthesis from leaves to storage organs. An adequate quantity of potassium is essential for crops to achieve full potential yield. In times of environmental stress such as drought or frost, potash allows the plant to have a higher tolerance to these physiological conditions. Potash fertilizers include potash sulphate and potash magnesia sulphate. Potash is used for all crops, however mainly used in the assistance of growing fruits, vegetables, soybeans, alfalfa, cabbage, and corn.[3]

Nitrogen

Nitrogenous fertilizer consists of organic and inorganic products. Organic fertilizers mainly include biochar and manures which are addressed later in the report. In the inorganic category, nitrogenous fertilizers include nitrate (NO3-) and ammonium (NH4+). However, nearly one-third of nitrogen fertilizers are combined with other elements to be categorized as compound fertilizers. Nitrate fertilizers are readily absorbed by plants because NO3 ions rapidly dissociate and are released into the ground. Nitrate ions are highly reactive and are very susceptible to leaching. Ammonium fertilizers are soluble in water so are protected from leaching. The soil collects and absorbs the ammonium ions and transforms them to nitrate slowly. This allows the fertilizer to stay with the plant for a longer period. Other nitrogenous fertilizers include ammonium sulphate, calcium ammonium nitrate, and urea. Nitrogenous fertilizer can be used on corn, soybeans, rice, sugarcane, and wheat.[4]

Production:

Production of fertilizers is difficult to measure in China. However, local industry experts have revealed rough estimates of production in the last two years for each of the named fertilizer groups. Nitrogen fertilizer production was estimated at 50 million metric tons (MMT) in 2008 and is expected to reach 51-52 MMT in 2009. Phosphate fertilizer, estimated at 15 MMT in 2008, is expected to increase by 6.6 percent to 16-17 million tons in 2009. Even though potash and potassium based fertilizers are in high demand, local producers only supplied close to three million tons in 2009. This only accounts for 40 percent of the demand and explains China's high import volume. Compound fertilizers are expected to reach 38-40 MMT in 2009. This is an 8.5 percent increase from the 2008 level of over 35 million. Below is a chart illustrating these findings.

Table 1.1 Production Levels of Fertilizers

Amount in (1000 tons)			
Type	**2008**	**2009**	**% Change**

Compound	35000	38000	8.5
Phosphate	12590	16000	6.6
Potash	2770	4000	44.4
Nitrogen	43310	51000	2.0

**Source: NDRC website*

Consumption:

Consumption of fertilizer in China has steadily increased in the last decade. Total fertilizer consumption in 2008 was 51-52 MMT, according to sources at China's Academy of Agricultural Science (CAAS). This is an increase of 26.4 percent for overall fertilizer consumption. From 2000 to 2007, compound fertilizer consumption increased from 9.1 MMT to over 15 MMT. Phosphate fertilizer consumption has also increased from 6.9 MMT in 2000 to 7.7 MMT in 2007. Nearly 80 percent of phosphate fertilizer consumed is in the form of compound fertilizer, most commonly NaP and MaP. Potash fertilizer consumption increased by 43.2 percent from 3.7 MMT to 5.3 MMT. Close to 90 percent of potash consumed in China is in the form of a compound fertilizer. Nitrogenous fertilizers account for the largest share of fertilizer used in China, and use also increased from 21 MMT to over 22 MMT, with minor declines in consumption in 2000-2003. Nitrogen fertilizer represents 60.7 percent of the total 51-52 MMT consumed. Nearly 10 MMT of nitrogenous fertilizer is converted into compound fertilizer. The remaining 21 MMT is used as pure nitrogen fertilizer. Below are tables illustrating the increase in fertilizer use in China.

Table 2.1 Compound Fertilizer

Year	Amount (1000 tons)	% Change
2007	15030	8.45
2006	13859	6.35
2005	13032	8.24
2004	12040	8.49
2003	11098	6.67
2002	10404	5.76
2001	9837	7.17
2000	9179	4.31

Table 2.2 Phosphate Fertilizer

Year	Amount (1000 tons)	% Change
2007	7730	0.45
2006	7695	3.46
2005	7438	1.07
2004	7359.6	3.09
2003	7139	0.24
2002	7122	0.92
2001	7057	2.20
2000	6905	-1.05

Table 2.3 Potash Fertilizer

Year	Amount (1000 tons)	% Change
2007	5336	4.69%
2006	5097	4.13
2005	4895	4.75
2004	4672.9	6.69
2003	4380	3.69
2002	4224	5.71
2001	3996	6.14
2000	3765	2.98

Table 2.4 Nitrogenous Fertilizer

Year	Amount (1000 tons)	% Change
2007	22972	1.53
2006	22625	1.49
2005	22293	.33
2004	22218.9	3.35
2003	21499	-0.34
2002	21573	-0.31
2001	21641	0.12
2000	21616	-0.88

Table 2.5 Total Fertilizer Consumption

Year	Amount (1000 tons)	% Change
2007	51078	3.65
2006	49277	3.39
2005	47662	2.79
2004	46366	5.09
2003	44118	1.67
2002	43394	2.01
2001	42538	2.59
2000	41464	0.54

***Source: USDA/ERS.*

Application

In recent decades, the Government of China has encouraged the use of nitrogen fertilizers to increase production rates. This movement is due to China's ever increasing concern with food security. However, overuse of nitrogen could result in air pollution, ocean dead zones, and less fertile soil in the long term. Persuading farmers to limit fertilizer inputs is difficult because many still hold to traditional opinions that higher crop yields will be obtained with the use of additional fertilizers. Researchers have found that, on average, farmers in China use 525 pounds of excess nitrogen fertilizer per acre annually.[5] Statistics show that from 2003-2005, annual corn yields in parts of the Midwestern United States and north China were almost the same, even though Chinese farmers used six times more nitrogenous fertilizer than their American counterparts.[6] Over fertilization can be linked to the lack of education in better farming techniques available to Chinese farmers.

The problem of nitrogenous fertilizer over-use also includes the imbalance of fertilizers being applied in comparison with other types of nutrients, such as phosphate and potash.[6] The government does recognize the need for increased use of other nutrients to balance nitrogenous use. However, this is not a high priority for the government because of the relatively low impact the industry has economically compared to the country's overall GDP.

Trade:

Imports

Currently, China imports the majority of its fertilizers from Russia, followed by Belarus and Germany purchasing $613.174 million, $328.580 million, and $184.683 million in 2009 respectively. From Russia, potassic mineral or chemical fertilizer, also known as potash, is the main import and accounts for over 38 percent of total fertilizer imports to China. Potash is imported from Belarus and Germany, with potash accounting for 98 percent of Germany's total fertilizer import activity. Canada comes in a close fourth, selling $165.316 million, with 99 percent of fertilizer supplied being potash.

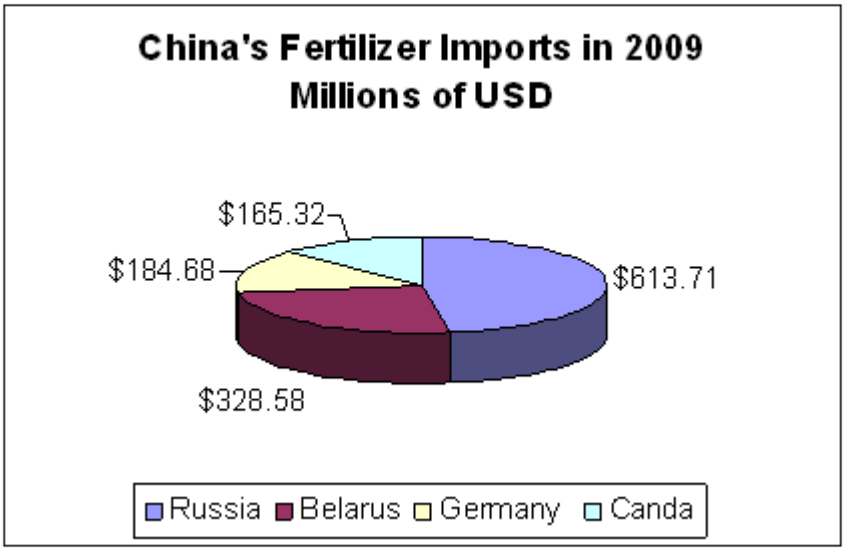

Table 3.1 Fertilizer Imports

In millions of USD				
Country	**2007 (Jan-Dec)**	**2008 (Jan-Dec)**	**2009 (Jan-Oct YTD)**	**% Change**
Russia	1,134.2	3,481.8	613.2	-82.4
Belarus	384.1	323.1	328.6	1.7
Germany	82.9	84.9	184.7	117.3
Canada	653.1	806.5	165.3	-79.5

Source: World Trade Atlas

The drop in Russian exports of potash to China in 2009 stems from a deal that Russian producer OAO Silvinit, Russia's largest potash producer, made with India to supply 850,000 MT of potash by March of 2010.[7] Chinese

farmers also delayed purchasing potash to seek discounts to help maximize profits during the world economic crisis, which resulted in lower commodity prices throughout China.

Germany has greatly increased its exports of fertilizer to China resulting from the influence of K+S Aktiengesellschaft and the company's contracts with the China National Agricultural Means of Production Corporation, the China National Chemical Construction Company (CNCCC), and Sinochem, all Chinese state-owned fertilizer companies.[8]

Exports

China has taken advantage of the growing demand for fertilizer abroad in other developing countries, such as India and Brazil. China's top export markets are India, Vietnam, Bangladesh, and Australia selling $288 million, $255 million, $100 million, and $96 million, respectively in 2009. China exports mostly compound fertilizers to these countries however, exports have drastically decreased in the last year with all exports seeing double digits declines. This is no doubt the result of the subsidy program enacted last year. (See Policy).

Table 3.2 Fertilizer Exports

In millions of USD				
Country	**2007 (Jan-Dec)**	**2008 (Jan-Dec)**	**2009 (Jan-Oct YTD)**	**% Change**
India	746.9	1,031.4	391.2	-62.1
Vietnam	393.9	385.8	360.9	-6.4
Bangladesh	207.9	346.1	200.9	-41.9
Australia	109.8	187.2	105.1	-43.9

***Source: World Trade Atlas*

Trade with the United States

Currently, the United States has a negative trade balance with China in fertilizer trade, exporting an average of $139.9 million over the last three years. In January- August 2009, the United States only exported a total of $38.465 million, but imported near double the amount, $81.496 million. Nevertheless, the dramatic drop in

Chinese fertilizer exports, down by 69.29 percent, demonstrates that China is expected to keep domestically produced fertilizers in-country to build state reserves.

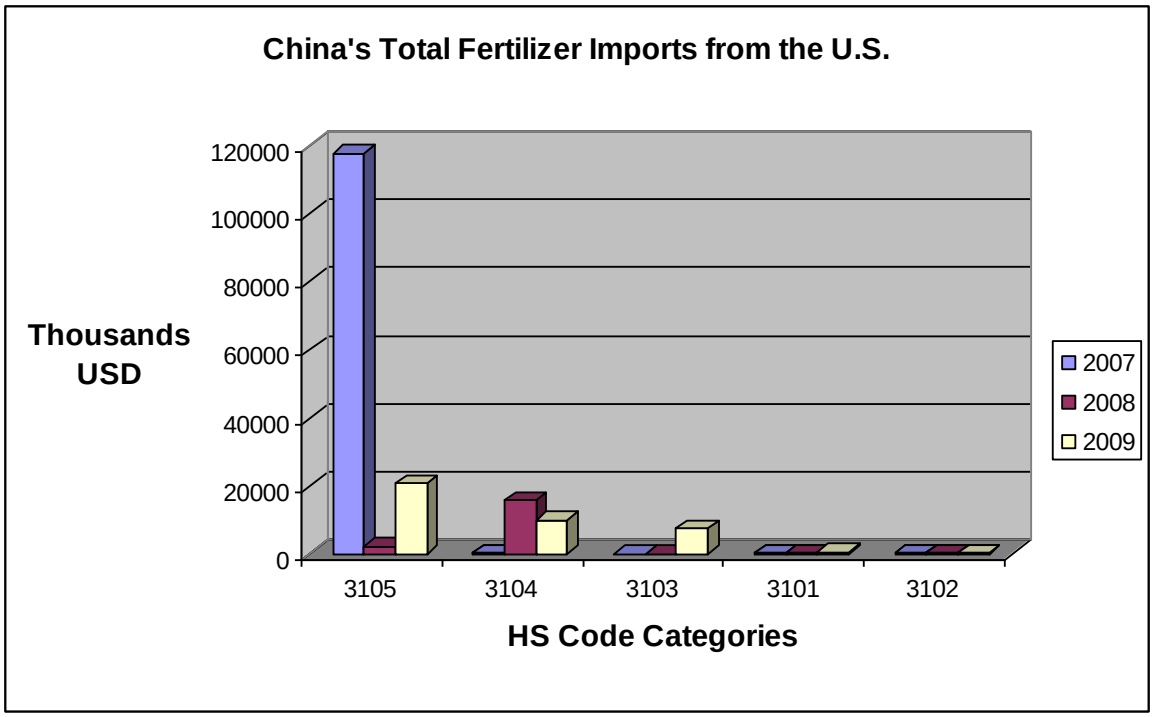

Table 4.1 China's Total Fertilizer Imports from the U.S.

January-August					
Thousands of USD					
HS Code	Type	2007	2008	2009	% Change
3105	Compound mineral or chemical	117888	2212	20689	835.4
3104	Potash; potassium	50	15671	9887	-36.9
3103	Phosphate	0	0	7343	0
3101	Animal or veg. (Guano)	149	178	505	183.4
3102	Nitrogenous	138	121	41	-65.8

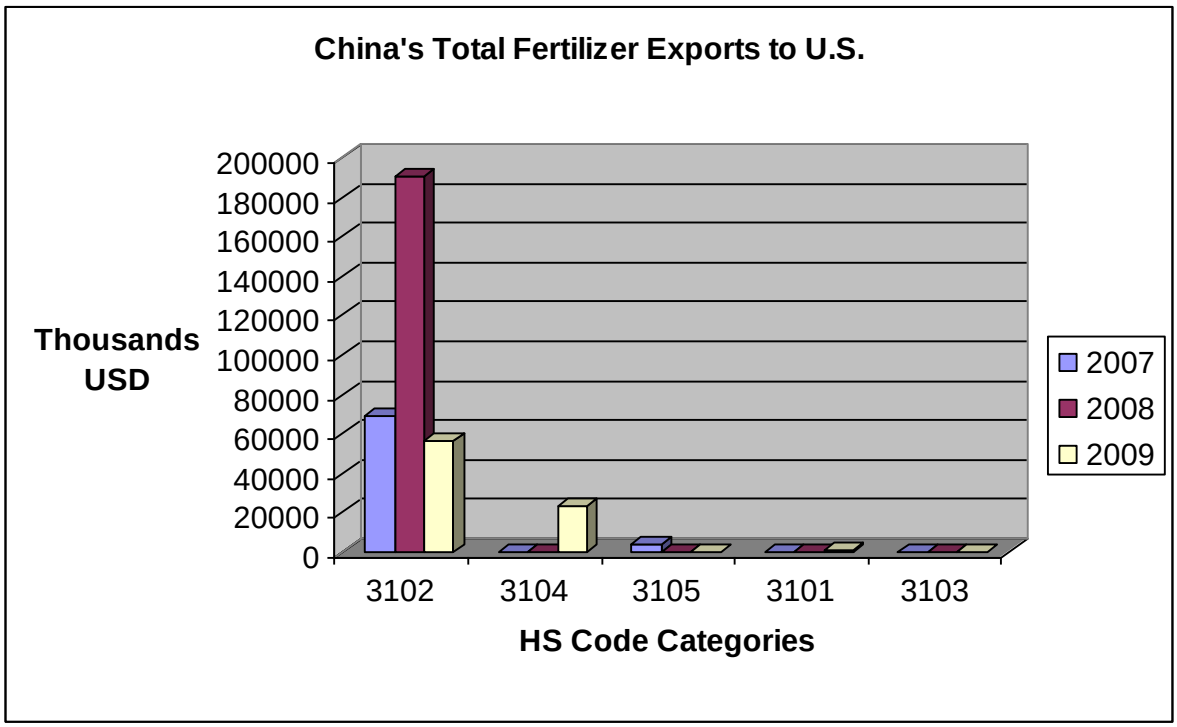

Table 4.2 China's Total Fertilizer Exports to the U.S.

January-August					
Millions of USD					
HS Code	Type	2007	2008	2009	% Change
3102	Nitrogenous	68847	190512	55968	-70.6
3104	Potash; potassium	78	7	23114	n/a
3105	Compound mineral or chemical	3903	74810	2266	-96.9
3101	Animal or veg. (Guano)	58	62	148	137.5
3103	Phosphate	3	0	0	0

**Source: World Trade Atlas*

The following charts illustrate the specific fertilizer trade between the United States and China as of April, 2009.

4.3 Chinese Fertilizer Imports by Quantity and Commodity, 2008

Commodity	Material Quantity (in short tons)
Anhydrous Ammonia	261
Aqua Amonia	29
Ammonium Sulfate	429
Phos. Acid, Wet Proc.	549
Phos. Acid, Sup	42
Monammonium Phosphate	36,939
Potassium Muriate	53,468

Potassium Nitrate	44
Chemical Mixtures	1,680
Other Nitrogen Fert.	1
Phosphate Rock	47,444
Total	*140,886*

4.4 Chinese Fertilizer Exports by Quantity and Commodity, 2008

Commodity	**Material Quantity (in short tons)**
Anhydrous Ammonia	80
Ammonium Nitrate Solid	2,750
Ammonium Sulfate	43
Urea (Solid)	788,383
Phos. Acid, Sup	6,076
Normal Super	163
Concentrated Super	7,885
Diammonium Phosphate	3,921
Monammonium Phosphate	99,422
Potassium Muriate	2
Potassium Sulfate	18
Potassium Nitrate	67
Sodium Nitrate	5,739
Chemical Mixtures	1,092
Calcium Nitrate	157
Potassium-Sodium Nitrate	1
Other Nitrogen Fert.	17
Sulfer	13,276
Phosphate Rock	119
Total	*929,210*

***Source: USDA/ERS*

Price and Costs:

The price of fertilizer in China has greatly fluctuated over the last decade. This is mainly attributed to uneven production levels in fertilizers and the government's desire to maintain adequate production to meet domestic market needs. Rapid increases in international fertilizer prices also contributed to higher domestic prices. The market price for nitrogen fertilizer rose from $280 to $405/MT in 2007 and reached a high of $452 in April 2008.[9] Experts have speculated there are many reasons contributing to such a spike in fertilizer prices, all stemming from the imbalance between low supply and rising demand on the world market. The tariff restrictions imposed on Chinese fertilizer producers and the demand for fertilizers to produce biofuels in the United States, Brazil, and Europe also helped contribute to the rise in price. The price for fertilizer dropped dramatically to $247 at the end of 2008.[9] Local sources indicated Chinese farmers were unwilling to pay two or three times the prices of early 2007 so demand was weak. The global recession also contributed to the price drop.

Policy:

Subsidies

In 2007, the comprehensive subsidy on fuel and fertilizer for grain farmers totaled $3.6 billion (RMB 27.6 billion), up 120 percent from the previous year. The program was started in 2006 and was intended to partially compensate farmers for price increases in fuel, fertilizer, and other agricultural inputs. According to the Ministry of Finance (MOF), the comprehensive subsidy averaged about U.S. $14.5 per farm household in 2007. In 2009, fuel and fertilizer subsidies are estimated to reach RMB 72.01 billion. For more on the comprehensive subsidy policy see CH9028.

In December 2003, the government issued an electricity subsidy for small and large nitrogen fertilizer producers that has totaled RMB6.3 billion every year since. Transportation for fertilizer has been subsidized by RMB5.0 billion every year since 2003. Since 2004, the Chinese government has given a bank loan subsidy to qualified fertilizer distributors who store fertilizer during the winter season. This, on average, amounts to $43.9 million to $73.3 million (RMB300 million to RMB500 million) every year. [10]

Tariffs

On April 17, 2008, MOF announced the State Council Tariff Committee had imposed a 100 percent special export duty on fertilizer and related material exports between April 20 and September 30, 2008. This affected 32 tariff lines including phosphoric acid, ammonia, nitrogen, phosphate, potash, and compound fertilizer. MOF stated runaway exports were the result of domestic supply strain that lead to price increases as demand began to soar with respect to spring planting. The tariff increase was intended to help restrain rising prices and guarantee an abundant grain harvest for the year. Over the last 10 years China has transitioned from being a net importer of phosphate fertilizer to being a net exporter. The United States has been the hardest hit by this shift, since it previously supplied 95 percent of China's phosphate imports. For more on this export duty, see CH8025.

On January 24, 2009, the National Development and Reform Commission (NDRC), and MOF jointly announced "the Notification of Fertilizer Price Formation Mechanism Reform." The main purpose of this notification was to remove the current tariff restriction on domestic fertilizer prices. Other main points included (1) the removal of fertilizer price restrictions (2) implementation of preferential policies for fertilizer production (3) applying comprehensive measures to maintain the fertilizer market through import and export regulation, reserve control and transportation parameters (4) improve agricultural subsidies for the industry (5) increase monitoring, supervision, and inspection on market pricing and (6) to make efforts on program organization and implementation .[11]

The World Trade Organization (WTO) trade policy report also notes this tariff policy. [12] Chemical fertilizers are still subject to the state trading system, which remains in place to ensure the stable supply and price of specific products.

National Reverse System

NDRC is currently working on a plan to establish a national fertilizer reserve for China. The reserve, which is currently at five million tons, would be expanded to hold 10 million tons of fertilizers. The goal of this petrochemical plan is to improve the off-season fertilizer storage system in order to improve agricultural support capabilities. It will also help fertilizer producers by providing stable prices throughout the year with the government mainly purchasing reserves during the off-season. If fertilizer prices greatly increase in the future, the government would take some of the reserves and release it to the market to drive down the price. According

to a State Securities' analyst, there is a risk with the current commercial off-season reserve system. In 2007, the off-season storage goal was 800 MMT, and the 2008 target was 12 MMT. However, Chinese storage enterprises could not meet these levels due to rapid price increases and the incentive to sell. Many manufacturers do not want to take the risk of storing fertilizers and receiving mediocre prices when they could be benefiting from the high prices during the peak season. FAS/Beijing will continue to monitor the full impact of a national fertilizer reserve system.

Training and Soil Testing Programs

There are many forms of technical support available to farmers in China that encourage good fertilizer and farming practices. Farmers typically receive education through three different channels that include (1) the Ministry of Agriculture sending technical experts to the farmers (2) training classes offered at central county locations (3) advertisement TV ads, CDs, and free services from the local government. The most effective method is to send technical experts to teach farmers. These technical experts include researchers, trainers from the Technical Promotion Centers of the Ministry of Agriculture, or professors from Agricultural Institutions. The most common are trainers from the Technical Promotion Centers. Post contacts also indicate private companies also provide training in fertilizer application to farmers.

An important aspect of the training is soil testing. Every three to four years, MOA sends representatives to test the soil for nutrient composition. This information is then used by the technical official to relay the necessary input back to the farmers. The farmers use this information to make better informed decisions in applying fertilizers for their rotating crops.

Alternative Fertilizers:

Biochar

Biochar is a fine-grained, highly porous charcoal that helps soils retain nutrients and water.[13] It is the decomposition of organic material under limited supply of oxygen at relatively low temperature of less than 700°C. It is found in soils around the world as a result of vegetation fires and historic soil management practices. Biochar is important because it can be used to increase sustainable food production in areas with severely depleted soils, scarce organic resources, and inadequate water and chemical fertilizer supplies. The carbon in biochar resists degradation and can sequester carbon in soils for hundreds to thousands of years, an excellent alternative for farmers having difficulty affording high priced fertilizers. It also reduces nitrogen leaching, soil acidity, and need for some chemical fertilizers, and can help combat global climate change by displacing fossil fuels and carbon admissions. Biochar was included in the 2008 U.S. Farm Bill with established grants for research, extension, and integrated activities related to the study of biochar production and use. Biochar could be an excellent alternative for Chinese farmers that desire to maximize profits because it is relatively inexpensive compared to conventional fertilizers.

Manure

Manure is also an excellent source of many nutrients including nitrogen, phosphorus, potassium and many others. The most common sources of fresh and dry manure come from chicken, dairy cow, goat, horse, pig, pigeon, rabbit, sheep, and steer. However, despite being an alternative source to chemical fertilizers, manure still posses some dangers to the environment. Most notably, nitrate-nitrogen can leach into groundwater and both nitrogen and phosphorus can erode or run off into streams, contributing to water pollution. This is why manure applications should be based strictly on the nutrient requirement of the crop and the soil content. The soil should be tested periodically in order to determine this need. Chinese farmers, many who operate conventional small farms of two acres or less, can easily access manure from natural sources.

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