EB-79

Brazil's Soybean Production and Impact

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JULY 2003

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Abstract

Soybean production in Brazil has grown rapidly in recent years. The objective of this publication is to evaluate the potential impact of Brazilian soybean production on North Dakota and other producers. Brazil, followed by Argentina, is the leading producer in South America. All South American soybean production surpassed the United States during 2002-03. In Brazil, production and yields have grown the fastest in Mato Grosso (Center-West) and other expansion states that have Cerrado land. Soybean costs of production for 2003 harvest are considerably lower in Mato Grosso than in North Dakota and Iowa even when freight costs to Rotterdam are considered, giving them a strong competitive position in the world market. Consequently, Mato Grosso soybean production is considerably more profitable. In the future, a 500 percent increase in Brazil cropland acres is possible. It would appear that world demand can accommodate the current pace of growth in Brazil at prices profitable to North Dakota producers.

Keywords: Brazil, soybeans, production, exports, expansion, cost of production, competitiveness

Introduction[1]

Background

Soybean production in Brazil has grown rapidly in recent years, and soybean exports have grown accordingly. Production grew from 18 million metric ton (mmt) in 1987-88 to 51 mmt in 2002-03 (USDA). During that same time period, exports grew from 2.7 mmt to 20.5 mmt.

The impact on U.S. producers has been pronounced. While world trade grew by 33.1 mmt during the 1987-2002 marketing years, Brazil exports grew by 17.8 mmt and U.S. exports grew by only 5.2 mmt.

Meanwhile, North Dakota soybean production accelerated (NASS). Planted acres increased from 520,000 acres in 1987 to 3 million in 2003. Acres planted to soybeans equaled 37 percent of those planted to all wheat in 2003. Relative to U.S. planted acres, North Dakota planted acres increased from 0.9 percent in 1987 to 4.1 percent in 2003.

The situation and outlook for soybeans have become important to North Dakota producers. How much soybean growth in Brazil is likely in the future? How competitive is the United States and North Dakota with Brazil? How much production can the world market absorb at prices profitable to North Dakota producers and others?

Objectives

The objective of this publication is to evaluate the potential impact of Brazilian soybean production on North Dakota and other producers. Specific objectives include:

- Examine the development and potential for soybean production in Brazil
- Review Brazil's production alternatives
- Compare Brazil and U.S. costs of production for soybeans
- Appraise world demand for soybeans

Organization

The evaluation is based on data from various publications and a study-visit in Brazil during February 2003. The geography of Brazil and its infrastructure are presented first. This is succeeded by a description of production and farms in Brazil and an analysis of production costs. Soybean use is examined, followed by an evaluation of potential soybean expansion in Brazil. In the final section, implications are derived for North Dakota producers.

This publication draws heavily from *Agriculture in Brazil and Argentina: Developments and Prospects for Major Field Crops* (Schnepf, Dohlman and Bolling). Go to this publication for a comprehensive analysis including historical perspective of Brazilian and Argentine agriculture.

Geography

Country

Brazil's temperate crop production that competes with U.S. production is concentrated in two main regions, the South and the Center-West (Schnepf, Dohlman and Bolling, pp. 7-8). Regions, states and ports are identified in Figure 1.

The South has been the historical center of Brazil's soybean production. It includes the states of Parana, Santa Catarina and Rio Grande do Sul. It has three major ports: Santos, Paranagua and Rio Grande.

Center-West includes the states of Mato Grosso, Mato Grosso do Sul, Goias and the Federal District surrounding Brazilia. Development of this area began in the 1960s and its production is comparable today with the South.

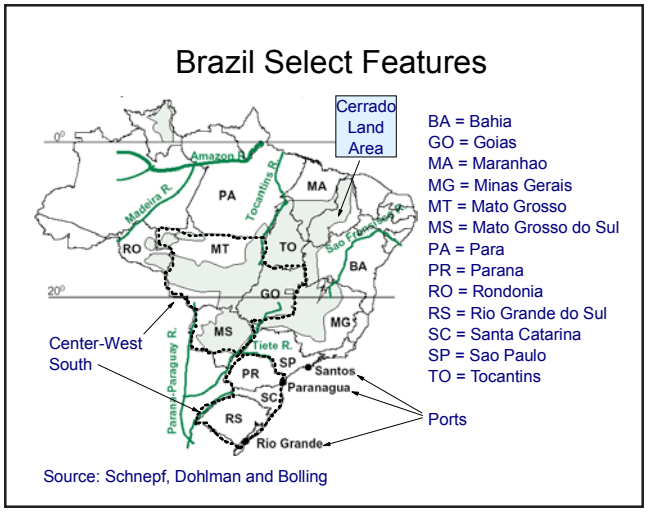


Figure 1

[1]*Comments on earlier versions of this publication were obtained from Mr. Dwight Aakre, Mr. Andrew Swenson, Mr. Tim Petry, Dr. William Wilson and Dr. Roger Johnson. The author is responsible for any errors and omissions.*

Brazil is about the size of the continental United States in land area. The South is a little over three times the size of North Dakota. The Center-West is about nine times the size of North Dakota. The terrain in the South is rolling while the Center-West is savanna-like flatland.

Soils in the South region are naturally productive (Huerta and Martin). In contrast, the fertility of the Cerrado land of the Center-West must be enhanced. Nitrogen, phosphorus and lime must be added to improve fertility. Fortunately, Brazil has large supplies of lime. The Cerrado land is also fragile. To minimize erosion, no-till production is practiced.

Climate

The South is semitropical and Center-West is tropical, whereas, the United States has a temperate climate (Schnepf, Dohlman and Bolling, pp. 9-10). Productive areas in Brazil lie between latitudes of 10 degrees and 30 degrees in the Southern Hemisphere. The United States lies mostly between northern latitudes of 30 degrees and 49 degrees. Crop production in Brazil is about six months later than in the United States.

Brazil is generally milder and wetter than the United States and temperatures vary little throughout the year. Monthly average temperatures range 63-75 degrees Fahrenheit (F) in Parana and 73-82 degrees F in Mato Grosso which is frost-free throughout the year. Monthly average growing-season precipitation ranges 4.5-7 inches in Parana and 5-8 inches in Mato Grosso. During June-August, precipitation is almost nonexistent in Mato Grosso.

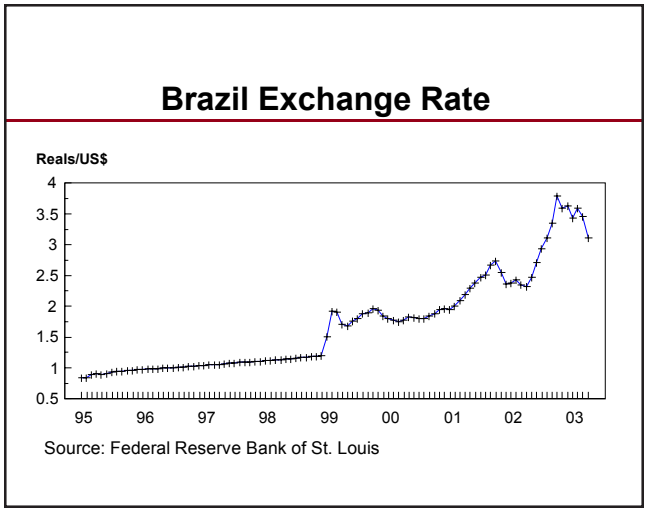


Figure 2

Infrastructure

Brazil transitioned from military rule to a democratic government during the 1980s (Schnepf, Dohlman and Bolling, pp. 35 and 42). A number of economic reforms were introduced by the government beginning in the early 1990s to minimize government interference in the marketplace. They have generally stabilized the economy and created a favorable climate for agricultural investment, production and exports.

Currency

The unit of currency is the Real. The exchange rate was 3.5 Reals to the U.S. dollar in February 2003 (Federal Reserve Bank of St. Louis). Exchange rates are presented in Figure 2.

The Real was linked to the U.S. dollar when it was introduced on July 1, 1994 (Schnepf, Dohlman and Bolling, pp. 43-44). This exchange rate policy and tight monetary policy dramatically lowered inflation in Brazil from the hyperinflation experienced earlier. The inflation rate has remained under 10 percent since January 1997 (Verdonk).

Linking the Real to the U.S. dollar worked until the later-1990s. Then the strengthening of the U.S. dollar resulted in overvaluation of the Real exchange rate (Schnepf, Dohlman and Bolling, p. 46). The Real was unlinked from the U.S. dollar in January 1999 and allowed to float. It immediately fell in value (more Reals required per dollar). The exchange rate was 1.21 Reals to the U.S. dollar during December 1998, on average (Federal Reserve Bank of St. Louis). Within two months, the Real depreciated 37 percent. The February 2003 rate of 3.5 reflects a depreciation of 65 percent.

Devaluation raised prices in Brazil and stimulated additional soybean planting despite declining world prices (Schnepf, Dohlman and Bolling, p. 46-47). The devaluation also increased the cost of dollar-denominated imported inputs such as fertilizer and herbicides.

Suppliers price most inputs in terms of “bags of soybeans” as a way of dealing with inflation, exchange rate changes and soybean price changes. For example, during January-October 2002 on average, it took 16.4 bags to purchase one metric ton of fertilizer.

Trade

Many trade barriers were reduced or eliminated in the 1990s. Since then, soybean production and exports have accelerated (Schnepf, Dohlman and Bolling, pp. 45-46). The reduction or elimination of import barriers increased the imports of agricultural inputs including fertilizer, pesticides and machinery.

An interstate movement tax (ICMS) causes some problems, especially for soybean crushers (Schnepf, Dohlman and Bolling, pp. 44-45). In 1996, raw materials and semi-manufactured products were exempted from the ICMS. In effect, the export taxes on soybeans, soymeal and soyoil were removed. However, the taxes are removed indirectly.

The ICMS is collected by state governments from crushers when they buy raw material across a state border but within Brazil. Although collected by the states, the ICMS is refunded by the national government when the final product is exported. The ICMS is an important source of funds to state governments so the national government has been unable to eliminate the ICMS.

The problem is mostly cash flow for crushers. The ICMS can also lead to abnormally higher prices in a state if that state has a large crushing capacity relative to supply. It has also encouraged some imports from nearby countries because the imports are exempt from the ICMS if re-exported.

Imports from within MERCOSUR are exempt from import tariffs (Verdonk). The MERCOSUR trade pact includes Brazil, Argentina, Paraguay and Uruguay. Bolivia and Chile are associate members.

Development

The government has effectively promoted soybean production with a number of policies (Schnepf, Dohlman and Bolling, pp. 37-39). The Center-West Region benefited the most, beginning with the 1960s policy of making free tracts of government land available in the Center-West.

Public funding of agricultural research and experiment stations began in the 1960s with the establishment of EMBRAPA (Brazilian Agency for Research on Agriculture and Animal Husbandry). It developed a tropical soybean which was critical to expansion of production in the Center-West. The development of improved corn varieties has received increased attention in recent years.

A National System of Rural Credit with subsidized interest rates supported the development of soybean production during the 1970s and 1980s. The costly and inflationary program was modified in the 1990s and is now restricted to mostly small farmers.

The government has a price support program in place for primary crops including soybeans but the support prices are relatively low. Farmers rarely benefit from the program.

Transportation and Ports

Transportation and ports are critical to the growth of Brazilian agriculture. Some commodities in some states must move in excess of 1,500 miles by truck to gain access to an export point (Verdonk). Also, the Cerrado land in Mato Grosso and other states needs essential inputs to be productive.

Production has traditionally been hauled by truck (Figure 3) to one of the three ports in the South, a distance of about 1,000 miles from Cuiaba, Mato Grosso. In recent years, increasing amounts have been trucked and barged to Itacoatiara, a floating port on the Amazon, a distance of about 1,200 miles from Cuiaba. Itacoatiara is about 600 miles from the Atlantic.

Roads vary in quality from freeways to dirt, according to Verdonk. Major roads in several states as well as railroads have been privatized and then improved. But, they have high tolls and truckers often avoid them. Most trucks are a double-trailer arrangement that can carry almost 50 percent more than single trailers. The major port of Paranagua becomes very congested with trucks during harvest.

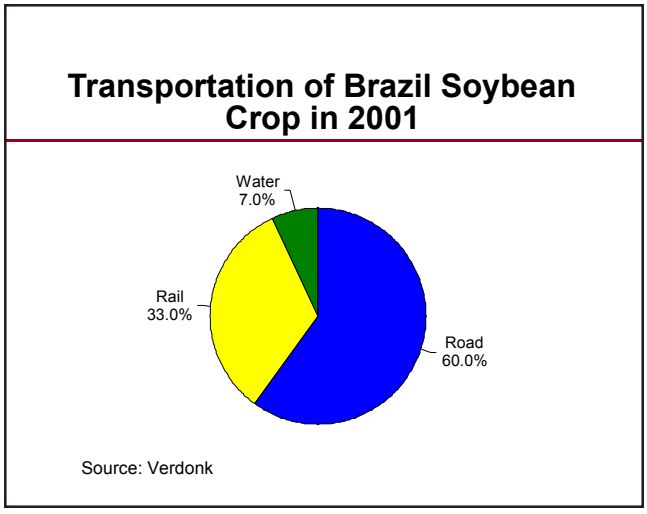


Figure 3

The ports of Paranagua, Santos and Rio Grande exported 74 percent of the soybeans during February 2002 to January 2003 (Figures 4-5). Itacoatiara is a floating port about 600 miles up the Amazon River from the Atlantic where the Madeira River joins the Amazon (Thompson). The Amazon is wide and deep enough up to this point to accommodate ocean-going ships; some need to be topped-off at an ocean port (Wilson, Koo, Dahl and Taylor).

Soybeans arrive at this port from Mato Grosso. Some are trucked about 500 miles to Porto Velho on the Madeira River where they are barged approximately 700 miles to Itacoatiara (Thompson).

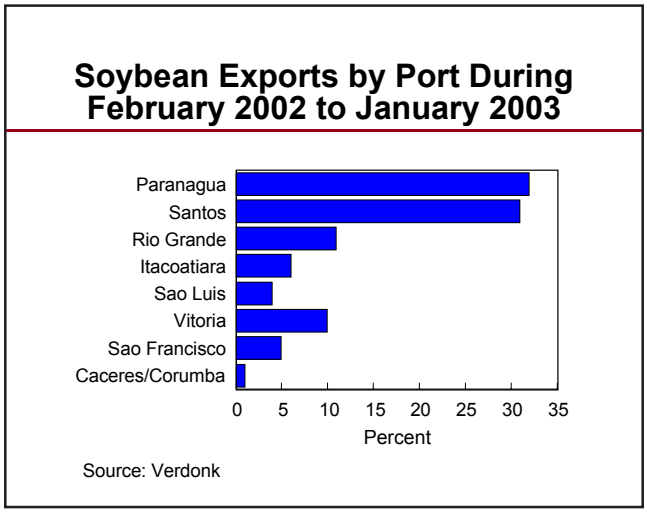


Figure 4

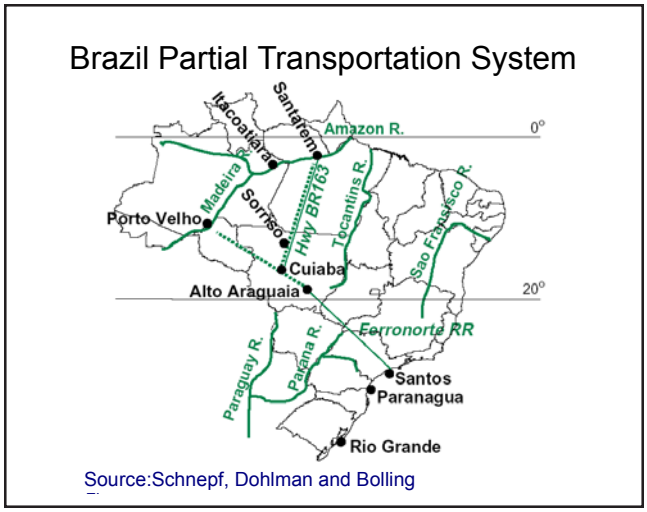


Figure 5

Cargill loaded its first ship during mid-April, 2003 at Santarem which is about 450 miles inland on the Amazon (Ray). Cargill anticipates that this port will encourage additional soybean plantings nearer to the port. Also, Highway BR163 connects the port to Cuiaba in Mato Grosso. The highway is paved through most of Mato Grosso but not the 625 miles through Para, which is a priority project (Verdonk).

The Ferronorte railroad connects the port of Santos in Sao Paulo to the southeast corner of Mato Grasso and is scheduled to connect to Rondonopolis in Mato Grosso (Verdonk). It will eventually be extended to Cuiaba and then to Porto Velho as well as Santarem.

The Novoeste railroad (not shown in Figure 5) connects Santos to Corumba in Mato Grosso do Sul (Verdonk). Southern Mato Grosso do Sul is also connected to the Atlantic by the Parana-Paraguay waterway and the Tiete-Parana waterway.

A number of projects are under way to improve the transportation system (Verdonk). Information on the transportation projects can be found on the Brazil Ministry of Transportation Web site.

Production

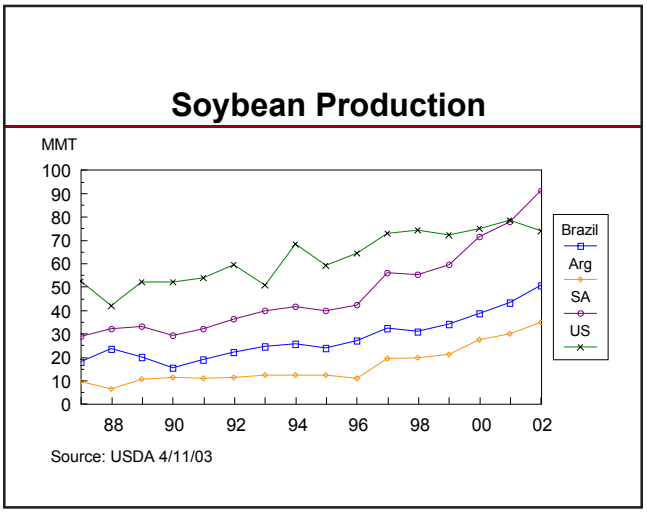
Soybeans

Brazil, followed by Argentina, is the leading producer of soybeans in South America. All South American production surpassed the United States during 2002-03 (Figure 6). Acres harvested in South America also surpassed acres in the United States during 2002-03 (Figure 7).

Soybean yields in Brazil exceeded those in the United States during four of the last 16 years (Figure 8). They have been similar in recent years.

Yields and harvested acres grew faster in Brazil than in the United States; yields grew the fastest. Comparing 1987-89 with 2001-03, harvested acres grew by 141 percent in Brazil and 125 percent in the United States, and yields grew by 153 percent in Brazil and 124 percent in the United States.

Production (Figure 9) and yields (Figure 10) grew the fastest in Mato Grosso (Center-West) and other expansion states that have Cerrado land (Schnepf, Dohlman and Bolling, pp. 40-42). In the traditional area of the South, production and yields have stagnated since



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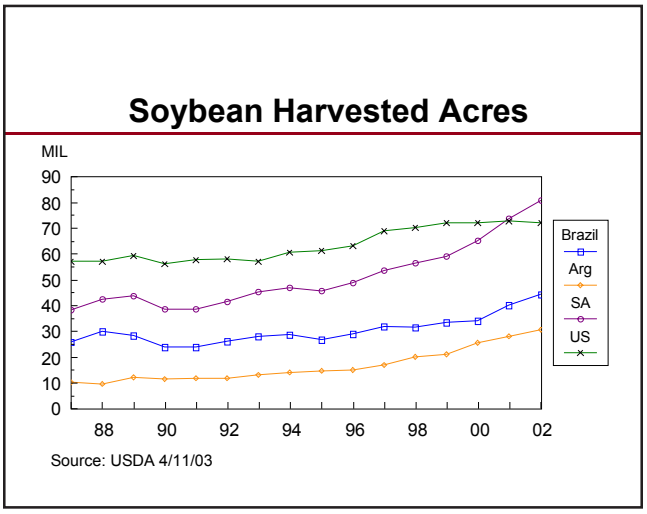

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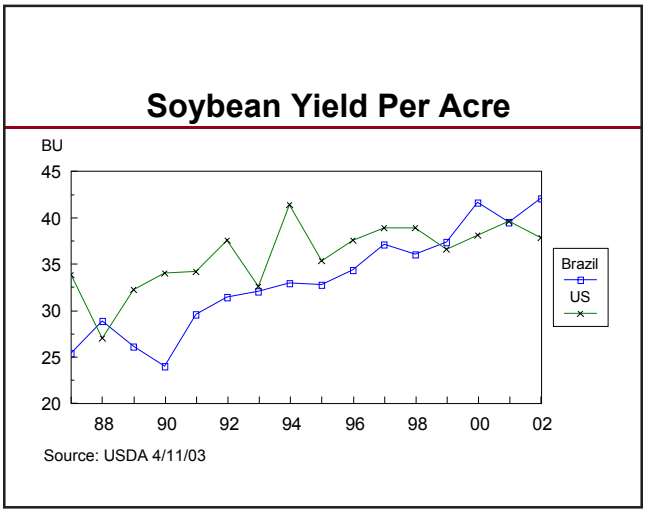


Figure 8

the mid-1970s. According to Verdonk, soybean area in 2002-03 was about equally divided between the South and the Center-West although production was greater in the Center-West (Figure 11).

Roundup Ready soybeans and other biotech seeds continue to be illegal in Brazil. Verdonk estimated that 10-20 percent of Brazil's 2003 crop is biotech. The estimate of Roundup Ready soybean acres in Rio Grande do Sul was 70 percent. Buyers have assumed that soybeans and products exported from Santos in Sao Paulo and other northern ports are transgenic free. Ports south of Santos handle nearly 50 percent of the country's

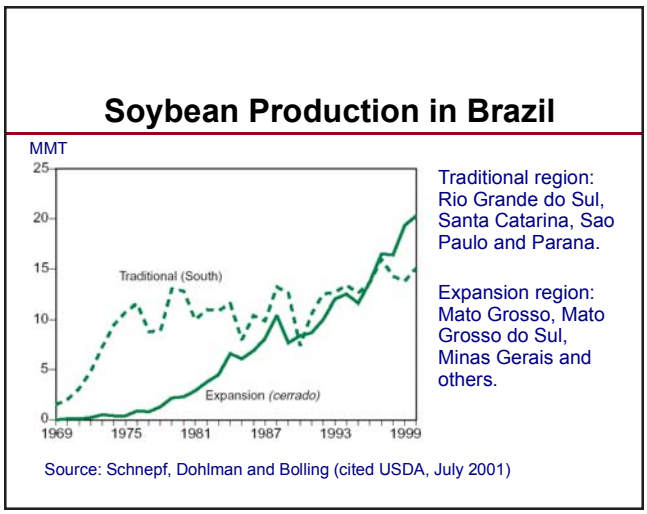
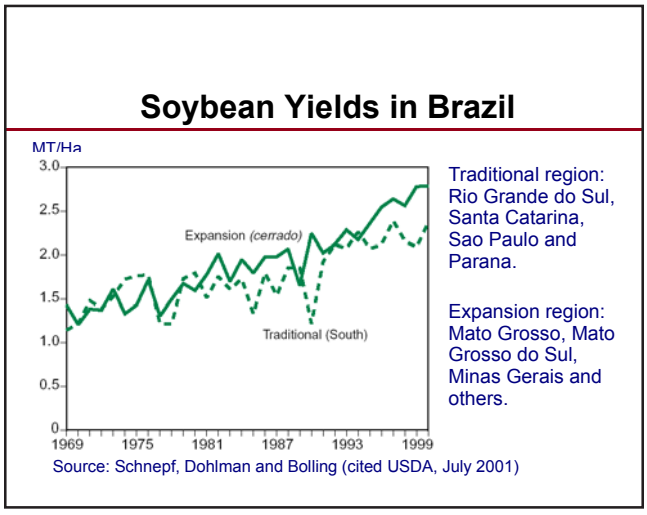


Figure 9



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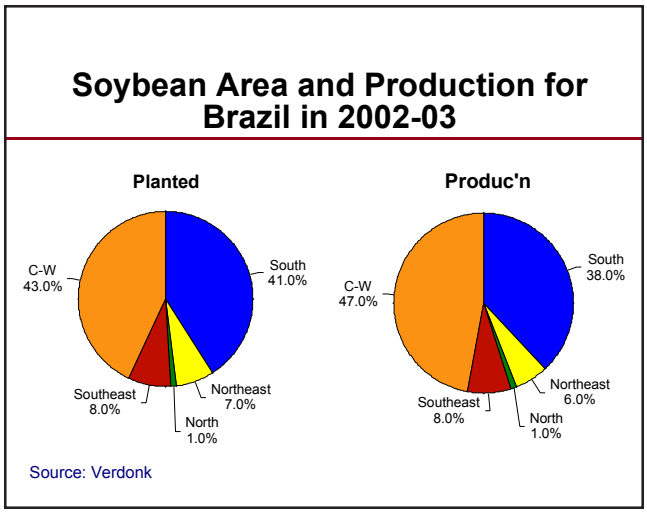

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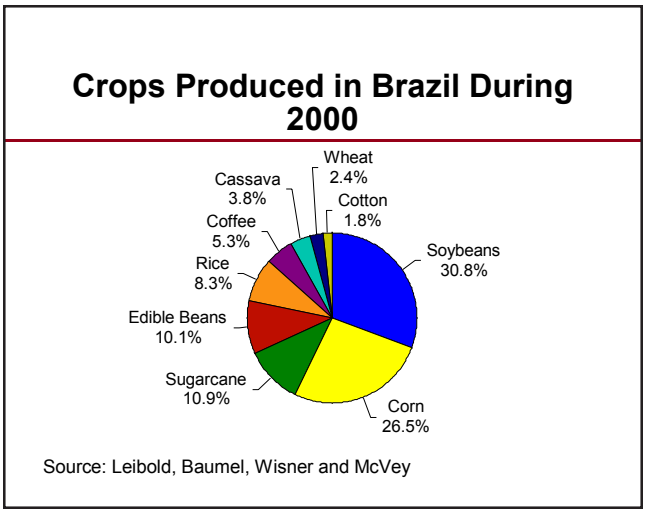


Figure 12

soybean exports, 65 percent of soymeal exports and 100 percent of soyoil exports.

Leaf rust has been found but is considered a limited threat since treatments are available (Verdonk). Left untreated, leaf rust results in premature leaf yellowing and shedding which reduce yield.

Other Enterprises

Brazil produces a number of other crops besides soybeans (Figure 12). In addition, Brazil has a substantial livestock industry.

Corn is a major crop in Brazil. It is profitable and has important rotational benefits (Schnepf, Dohlman and Bolling, pp. 49-50). Harvested acres of corn have been below those of soybeans in Brazil since 1997-98 (Figure 13) but production has climbed steadily (Figure 14).

Corn yields in Brazil are considerably below those in the United States but rising at about the same rate (Figure 15). Yields are low in part because much of the corn is produced on small subsistence farms with poor-quality land and low technology and because day length is relatively short compared to the U.S. (Johnson and Krause).

In 1997, double-cropped corn production was 14 percent of total production (Schnepf, Dohlman and Bolling, p. 50) although substantial acres were devoted to double-cropped corn after soybeans. As a second crop, corn acres are growing significantly.

Forty percent of the corn was grown in the South-Southeast during 1995-99 with the balance in the Center-West and North-Northeast, according to Schnepf, Dohlman and Bolling (p. 50). Yields are a little higher in

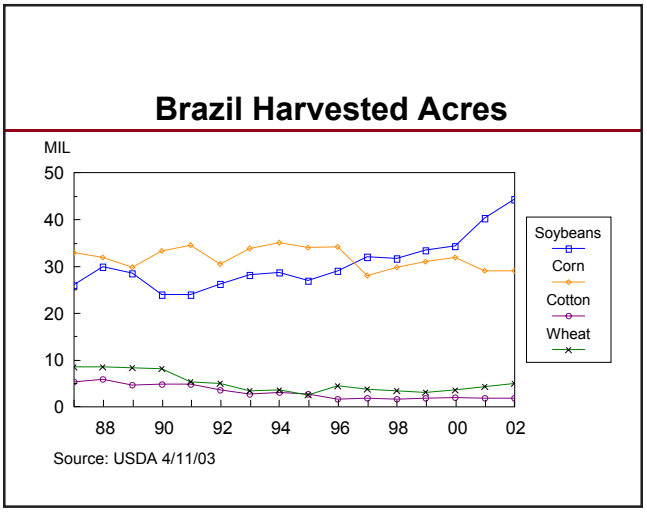
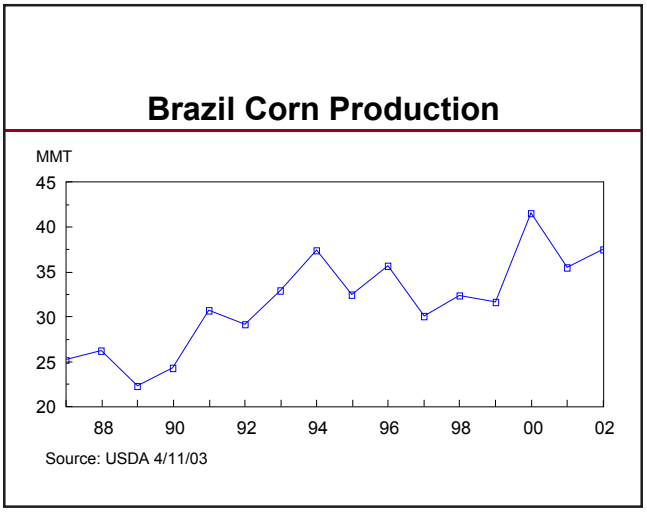


Figure 13



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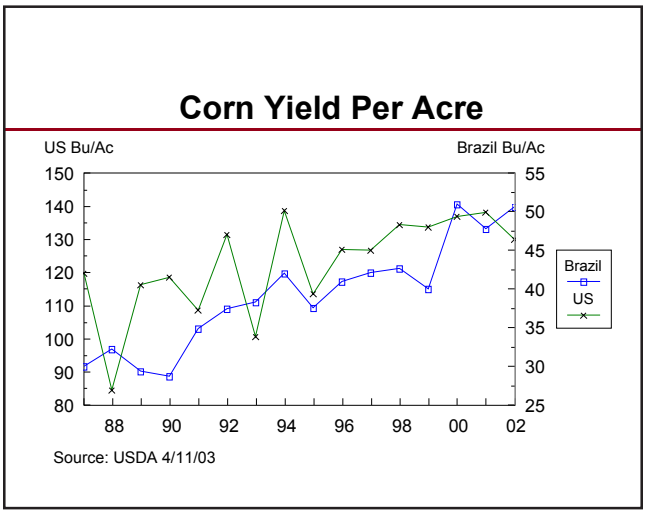


Figure 15

the Center-West than in the South-Southeast and substantially higher than in the North-Northeast. The Southeast includes the states of Sao Paulo, Rio de Janeiro, Espirito Santo and Minas Gerais. The North-Northeast includes those states north of Center-West and Southeast.

Corn production just barely kept pace with domestic demand by the livestock industry until recent years. Exports were small or nonexistent until 2000-01. For the three-year period since then, exports have averaged 3.4 mmt or 7.3 percent of U.S. corn exports.

Future production and export growth of corn in Brazil will depend primarily on the development of tropical corn varieties and infrastructure developments, according to Schnepf, Dohlman and Bolling (p. 50). They indicated that while corn yields are better in the Center-West, they are more variable which makes corn less appealing than soybeans and cotton as a production alternative. Corn will continue to be an important production alternative in the Center-West because of rotational benefits.

Sugarcane is the third largest crop in Brazil. It is used to make ethanol and to make sugar that is exported (Leibold, Baumel, Wisner and McVey). Edible beans are grown on about the same number of acres as sugarcane; they are grown widely throughout Brazil (Johnson and Krause).

Rice is widely grown crop in Brazil (Schnepf, Dohlman and Bolling, p. 52). It is generally important as a food and to rotations. It is grown primarily in Rio Grande do Sul. It is also an essential part of new land development. New land is typically used first for pasture. After roads have been developed, rice is grown for a year or two because it grows above stubble remains after initial clearing.

Cotton is a minor crop at this point (Figure 13) but has great potential in the Center-West where acreage is growing (Schnepf, Dohlman and Bolling, p. 51). Cotton provides an alternative to soybeans. The soils and climate of that region are conducive to cotton production. In addition, varietal improvements and increased mechanization have benefited cotton production in the Center-West.

Wheat acres declined after production supports were removed in 1990 (Schnepf, Dohlman and Bolling, pp. 50-51). Since then wheat imports have increased; Brazil is projected to import 6.7 mmt during 2002-03, making Brazil the number-one importer of wheat in the world (USDA). Minor amounts have been imported from the United States since the early 1980s. Most of the wheat is produced in the South during the winter on land that produced soybeans or corn the previous summer (Johnson and Krause).

Brazil is a major producer of coffee. Trees will produce for about 12 years. Coffee is harvested mechanically (Leibold, Baumel, Wisner and McVey).

Pastureland is estimated at 437 million acres or 21 percent of total land area (Shean). In contrast, only 5 percent of total land area (103 million acres) is cropped. By comparison, 19 percent of U.S. total land is cropped and 22 percent is pastured.

The cattle population is large and growing (Schnepf, Dohlman and Bolling, p. 52); about 82 percent is beef and the balance is dairy. The Brazilian cattle herd (163.6 million) is about 45 percent larger than the combined U.S. and Canadian dairy and beef herds (Hughes). The primary breed is Nelore which originated in India; it is white and has big ears and a small hump behind the neck. The cattle are grass fed. The hog population is significant and the poultry industry is growing rapidly, according to Schnepf, Dohlman and Bolling (p. 52).

Impact

Beginning in 1999-00, South American soybean production and exports clearly began to impact the relationship between the U.S. stocks/use ratio and price (Figure 16). The average 2002 October price of the Chicago Board of Trade (CBOT) November soybean futures contract was $5.47 when USDA's October stocks/use estimate was 6.5 percent. Stocks this tight in the past have warranted at least $6 in the futures.

Several more years of data are needed to develop a new, more accurate relationship between stock/use and price. For now, the graph in Figure 16 can only serve as an approximation to prices. A projected price may need to be discounted by $1-$1.50, depending on development of the South American crop.

The U.S. seasonal price pattern for soybeans may also be influenced by the increased export competition from South America (Figure 17). But, recent price patterns do not provide evidence of a change. Prices peaked during May 2000 and during July 2001 and 2002. Under favorable growing conditions in South America and the United States, however, a price peak by mid-March would be expected, about the time that South American exports begin to intensify.

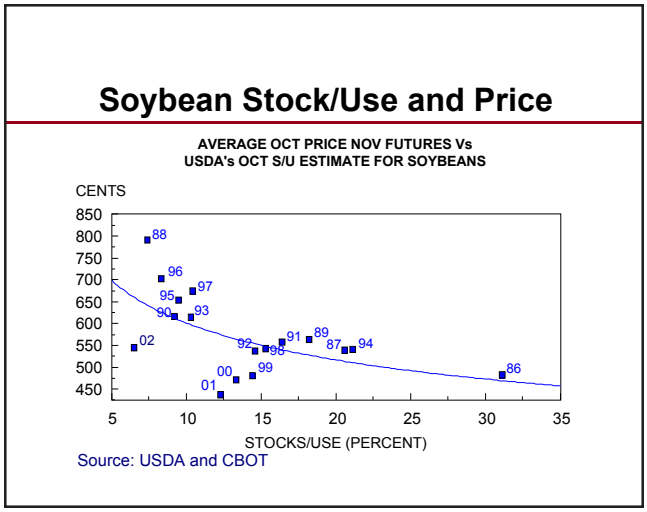


Figure 16

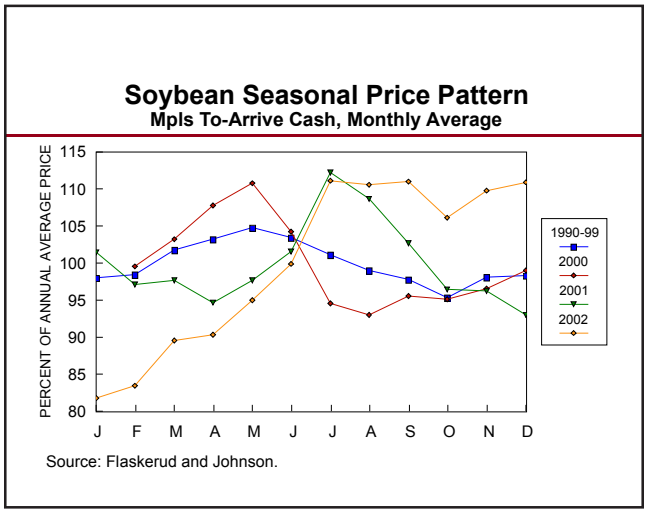


Figure 17

Farms

Farms in the Center-West Region are generally much larger than in the South. In the Cerrado land area which includes the Center-West, two-thirds of the farms are larger than 2,500 acres compared to an average size of 75 acres in Parana (Schnepf, Dohlman and Bolling, pp. 13 and 57). The South includes a large number of very small farms.

Examples

Several farms were visited during February 2003 in the rapidly-growing soybean producing states of Mato Grosso and Mato Grosso do Sul. Farms visited were near the major cities of Cuiaba, capital of Mato Grosso and Campo Grande, capital of Mato Grosso do Sul. Additional depictions of farms in Brazil can be found in articles by Cummins; Dappert; Lamp; White.

The farms were well-managed and applied the latest technology. Most were very large with many employees who received $200-$500 per month plus benefits. Housing and a cafeteria were generally provided.

Labor was typically substituted for capital. Farm equipment was relatively small considering the size of farms. A 165-horsepower tractor without a cab and a combine with 20-25-foot header were common. This size equipment was possible because of low labor costs and also because of extended planting and harvesting seasons. Equipment was maintained on the farm.

Farm 1 was near Campo Verde, northeast of Cuiaba. It had 50,000 total acres. It included 15,250 acres of soybeans, 18,250 acres of cotton and 7,500 acres of corn. The average field size was 500 acres. The number of employees totaled 195 and they were paid an average of $285 per month. The farm had its own cotton gin which cost $2 million. Land was valued at $910 per acre. Land could be rented for five bags/hectare (4.45 bushels/acre) Capital was provided by retained earnings and suppliers which was typical of farms in the area, according to the owner.

Farm/ranch 2 was near Rondonopolis, southeast of Cuiaba. It had 7,500 total acres, mostly pasture. It had 3,800 head of Nalore purebred cattle. One of their bulls was champion of its breed in Brazil this past year. The owner/operator was a veterinarian who did his own embryo transfers.

Farm 3 was also near Rondonopolis. It had 50,750 cropland acres which included 40,000 acres of soybeans, 10,000 acres of cotton and 750 acres of coffee. A seed cleaning plant and two spray planes on the farm took care of its own needs as well as those in the area. The farm had 220 employees. The total cash cost of producing soybeans was $3.40 per bushel. Emus were observed in the fields of this farm and others, usually in groups of three or four. Their purpose, we were told, was to eat snakes.

Farm/ranch 4 was near Campo Grande. It had 10,000 total acres which was mostly pasture for 4,000 head of cattle. They specialized in producing veal for restaurants. They are working on developing bulls for semen sale.

Farm/ranch 5 was near Sidrolandia, south of Campo Grande. Cattle were the main enterprise. They also produced fish (Pintado Specie) and soybeans. The fish are taken to Sao Paulo for processing and then shipped to a buyer in Holland. The buyer requires uncontaminated water in the fish ponds and checks them periodically for purity. Land was valued at $400-$800 per acre depending on development.

Management

The primary growing season in Brazil is September-March (Schnepf, Dohlman and Bolling, pp. 9-10). Soybeans are planted during October-December for harvest during February-May. The date ranges are wide since they reflect all of Brazil.

Corn is planted as a second crop on soybeans harvested before early March, according to farm managers visited. Second-crop corn is planted by early March for harvest during August-September. Limited fertilizer is applied due to lack of moisture during the growing season. As a single crop, corn is planted during October-December for harvest during April-June (Schnepf, Dohlman and Bolling, pp. 9-10).

No-till is the common management practice in Brazil. It is done to reduce the loss of organic matter that can be substantial due to heat and high rainfall.

A limited amount of government credit is currently available to producers. Restrictions limit credit program use to relatively small producers. Most credit to larger farms for soybeans and cotton is provided by input suppliers and the companies who buy the crop (Verdonk). Corn production receives little support from either suppliers or buyers.

Farmers can store only about 5 percent of the crop on-farm (Verdonk). However, bigger farms are investing in storage facilities on-farm. Cooperatives, crushers and exporters handle most of the storage.

The grain trade and farmers rely on the CBOT for their price information (Leibold, Baumel, Wisner and McVey). While Reals are the medium of exchange, the price is determined by CBOT prices and U.S. currency exchange rates.

Cost of Production

Soybean costs of production for 2003 harvest are considerably lower in Mato Grosso than in North Dakota and Iowa even when freight costs to Rotterdam are considered, giving Brazil a strong competitive position in the world market. Consequently, Mato Grosso soybean production appears to be considerably more profitable.

Economic rather than cash costs are presented. Economic costs reflect full opportunity costs for land and machinery investment. Costs and returns should be regarded with caution since methods used to calculate costs may vary by source. In addition, exchange rate changes can have a significant impact.

Cost of production estimates for North Dakota (Swenson and Haugen), Iowa (Duffy and Smith) and Mato Grosso (Richetti and Augusto) are presented for soybeans harvested in 2003. The Mato Grosso budget was translated by Roger Johnson (Professor Emeritus, personal communications, May 2003).

Some direct costs were combined to accommodate the Mato Grosso budget format. Machinery operations include fuel, lubrication, repairs, custom operations, machinery rent, transportation of harvest to a nearby facility and labor ($8.10 in North Dakota and $20.25 in Iowa). Labor does not include management. Fixed costs reflect machinery depreciation and interest on investment and land rent as specified in the state budgets.

Freight costs to Rotterdam reflect differences between local prices and Rotterdam prices (Oil World) during 2002, on average. The Rotterdam price is for delivery there and is net of all costs, insurance and freight (c.i.f.).

The soybean price for Mato Grosso was the Rondonopolis, Mato Grosso, average March 2003 price (ABIOVE). Prices for North Dakota and Iowa are estimates for the 2003 harvest based on the April 7,

2003, November futures price ($5.55) adjusted for the 2002 harvest basis of -$.46 in North Dakota and -$.27 in Iowa. The harvest bases were derived from October 2002 cash prices (NASS) and November 2002 soybean futures prices during October 2002.

Direct costs per acre (Table 1) for North Dakota were 43 percent lower than for Mato Grosso. The costs of chemicals and fertilizer were much lower for North Dakota. Direct costs in Iowa were only 5 percent lower than for Mato Grosso.

Indirect costs per acre (Table 2) for North Dakota were 260 percent of those for Mato Grosso due to higher machinery and land costs (rent). Land rent was particularly high in Iowa.

Total costs per acre (Table 3) were the lowest in North Dakota, a little higher in Mato Grosso and the highest in Iowa. Per bushel, total costs were the lowest in Mato Grosso ($3.24) followed by North Dakota ($4.59) and Iowa ($6.28). Total costs per bushel remained the lowest in Mato Grosso even when freight costs to Rotterdam are considered.

Soybean production in 2003 was projected to be over three times more profitable per acre for Mato Grosso than projected for North Dakota (Table 4). For Iowa, soybeans show a potential substantial loss for this budget that reflects all economic costs of production.

Alternatively, an analysis could be conducted excluding land rent, in effect, the return to land. Since

Soybean Direct Costs of Production for 2003 Harvest, US$/Ac

	North Dakota	Iowa	Mato Grosso
Seed	29.16	31.25	8.45
Herbicides	9.75	18.68	25.33
Fungicides			5.29
Insecticides			6.54
Fertilizer	1.25	23.15	49.13
Crop Insurance	3.20	3.15	
Machinery Operation	27.98	34.16	24.41
Miscellaneous		7.00	3.23
Operating Interest	1.98	3.91	5.36
Total	73.32	121.30	127.75

Sources: Swenson and Haugen; Duffy and Smith; Richetti and Augusto.

Table 1

Soybean Total Costs of Production for 2003 Harvest, US$

	North Dakota	Iowa	Mato Grosso
Direct Costs/Ac	73.32	121.30	127.75
Indirect Costs/Ac	73.59	161.27	28.16
Total Costs/Ac	146.91	282.57	155.91
Total Costs/Bu	4.59	6.28	3.24
Freight/Bu to Rotterdam	1.17	0.93	1.33
TC/Bu @ Rotterdam	5.76	7.21	4.57

Sources: Swenson and Haugen; Duffy and Smith; Richetti and Augusto; Oil World.

Table 3

Soybean Indirect Costs of Production for 2003 Harvest, US$/Ac

	North Dakota	Iowa	Mato Grosso
Machinery	24.59	26.27	7.91
Land	44.89	135.00	20.24
Miscellaneous	4.11		
Total	73.59	161.27	28.16

Sources: Swenson and Haugen; Duffy and Smith; Richetti and Augusto.

Table 2

Soybean Return to Management for 2003 Harvest, US$

	North Dakota	Iowa	Mato Grosso
Income/Ac	162.88	237.60	207.88
Yield/Ac	32	45	48
Price/Bu	5.09	5.28	4.32
Total Costs/Ac	146.91	282.57	155.91
Return to Mngt/Ac	15.97	-44.97	51.97

Sources: Swenson and Haugen; Duffy and Smith; Richetti and Augusto.

Table 4

the return to land is determined by profitability, it could be argued that the real competitive position of different production areas would be measured by removing the land rent charge.

Under this scenario, the three areas analyzed are competitive; cost differences would be insignificant. Total costs per bushel would be $2.82 in Mato Grosso, $3.19 in North Dakota and $3.28 in Iowa. After considering freight costs to Rotterdam, total costs per bushel would be $4.15 in Mato Grosso, $4.36 in North Dakota and $4.21 in Iowa.

It may not be necessary to equalize land rents. A competitive equilibrium in soybean production among competing countries may be realized even with differentiated land values through a combination of world market forces and domestic policies.

Soybean Use

Crush

The amount of soybeans crushed in Brazil continues to increase (Figure 18). The amount crushed in South America surpassed U.S. crush in 2002-03.

Crush capacity is the greatest in Parana and Rio Grande do Sul (Figure 19). Sixty percent of the crush capacity is located in the southern states of Parana, Rio Grande do Sul, Sao Paulo and Santa Catarina while they produced 43 percent of the soybeans in 2003 (Verdonk). Crushing capacity is gradually shifting to the Center-West Region, according to Verdonk.

Exports

Soybean exports are growing at a rapid pace in Brazil (Figure 20). South American exports surpassed U.S. exports during 2002-03. During the same year, South America captured a larger percentage of the world soybean market than did the United States (Figure 21). Brazil's share of the world soybean export market has increased sharply since 1987 while market share has declined in the United States.

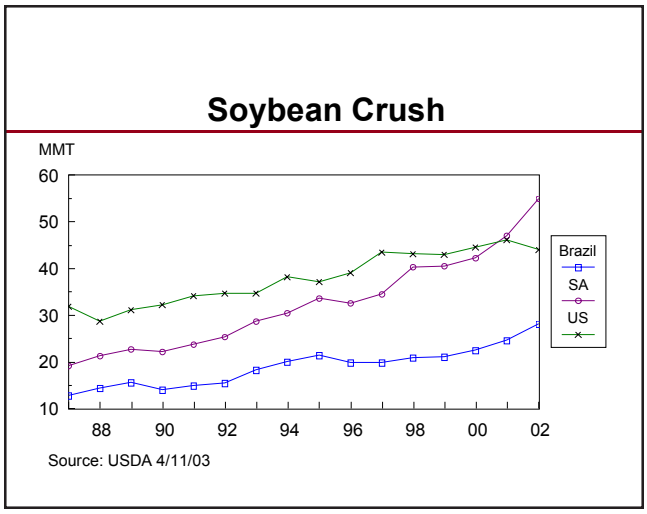
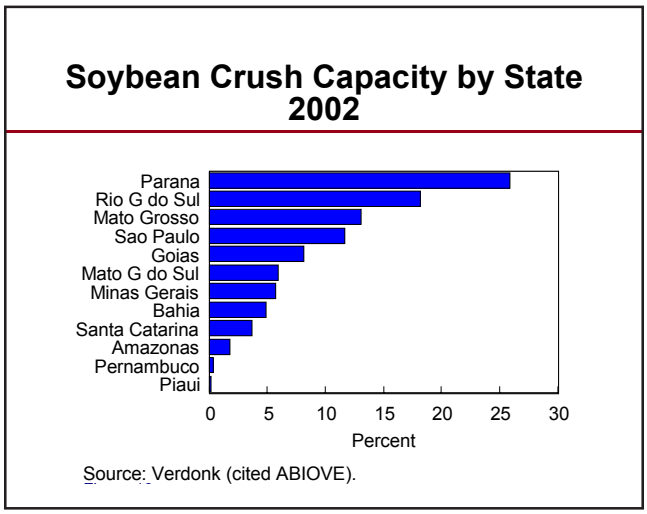


Figure 18



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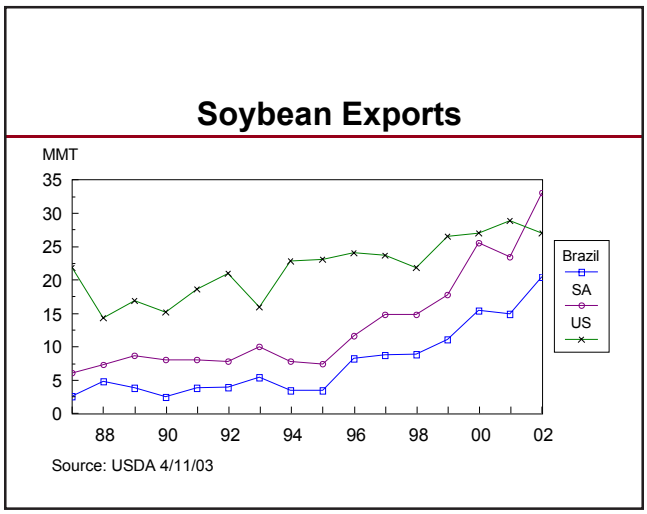

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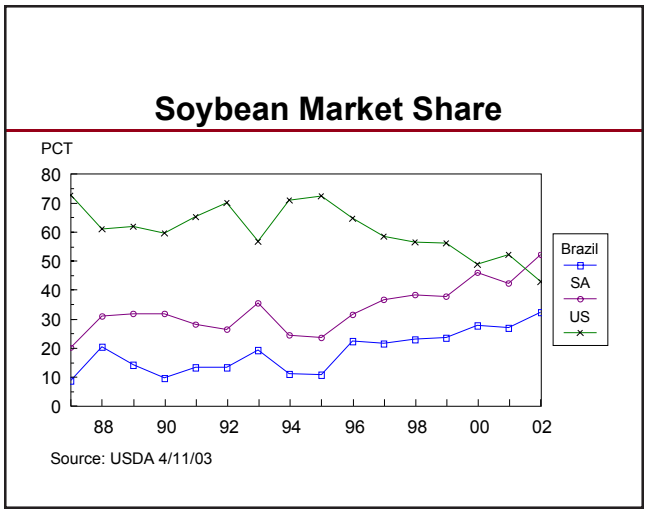

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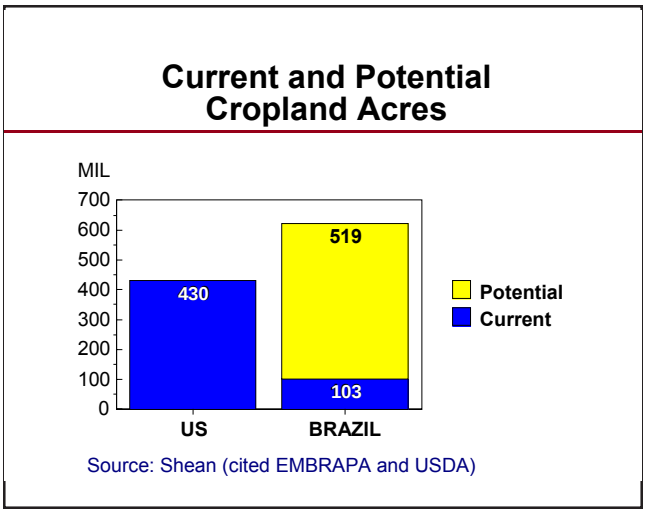

Figure 22

Expansion

A 500 percent increase in Brazil cropland acres is possible, according to Shean (Figure 22). The current cropland base of 103 million acres could be expanded to 519 million acres. Cropland in the United States totals 430 million acres.

The additional land could be developed by clearing new land and by converting pastureland, according to Shean (Table 5). An estimated 161 million acres could be developed by clearing new land and 173-222 million acres could be developed by converting pastureland.

An estimated 124-247 million acres of additional soybeans could be grown on the additional cropland. An estimated 44.5 million acres were harvested in 2002-03. In effect, soybean acres in Brazil could at least triple.

Most of the 4.1 million increase in 2002-03 harvested acres came from new land and pastureland (Verdonk). According to Verdonk, this kind of growth is possible for a number of years.

Brazil increased its production of soybeans in 2002-03 by 7.5 mmt (USDA). World production grew 4.1 percent as a result of the Brazil increase.

Additional Land Available for Soybean Production

	Million Acres
Virgin Cerrado	161
Pasture Conversion	173 - 222
Amazonia	25
Total Additional Land	358 - 420
Additional Soybeans	124 - 247

Source: Shean (cited EMBRAPA and USDA)

Table 5

Implications

U.S. soybean production and exports have been surpassed by South America and it is unlikely that the United States will be able to maintain market share. For U.S. producers, an expanding world demand is of the utmost importance.

World demand has been able, so far, to absorb ever-increasing production of soybeans at prices that are still profitable to North Dakota producers. Commodity prices at early-2003 levels will encourage additional soybean production.

World consumption of soybeans has grown at an annual rate of 4.8 percent, on average, since 1970 (Figure 23). During the last 10 years (1993-02), consumption has grown annually at 5.4 percent, on average.

Evidence suggests that production growth of about 5 percent is needed. It would appear that demand can accommodate the current pace of growth in Brazil at prices profitable to North Dakota producers. Many of the large producers in Brazil will likely prosper. Too rapid a pace of growth would be detrimental to all producers.

Summary and Conclusions

Soybean production in Brazil has grown rapidly in recent years, and soybean exports have grown accordingly. The impact on U.S. markets has been pronounced. During this time, North Dakota soybean production accelerated. The situation and outlook for soybeans has become important to North Dakota producers. The objective of this publication was to evaluate the potential impact of Brazilian soybean production on North Dakota and other producers.

Brazil's temperate crop production is concentrated in two main regions. The South has been the historical center of Brazil's soybean production. Development of the Center-West began in the 1960s and its production is comparable today with the South. Soils in the South are naturally productive while the fertility of the Center-West soils must be enhanced.

The unit of currency is the Real. Introduced in 1994, it was linked to the U.S. dollar until January 1999. Since then it has undergone considerable devaluation. The exchange rate was 3.5 Reals to the U.S. dollar in February 2003.

The government has effectively promoted soybean production with a number of policies. The Center-West Region benefited tremendously, beginning with the 1960s policy of making free tracts of government land available in the Center-West.

Many trade barriers were reduced or eliminated in the 1990s. Since then, soybean production and exports have accelerated. In 1996, the export taxes on soybeans, soymeal and soyoil were removed.

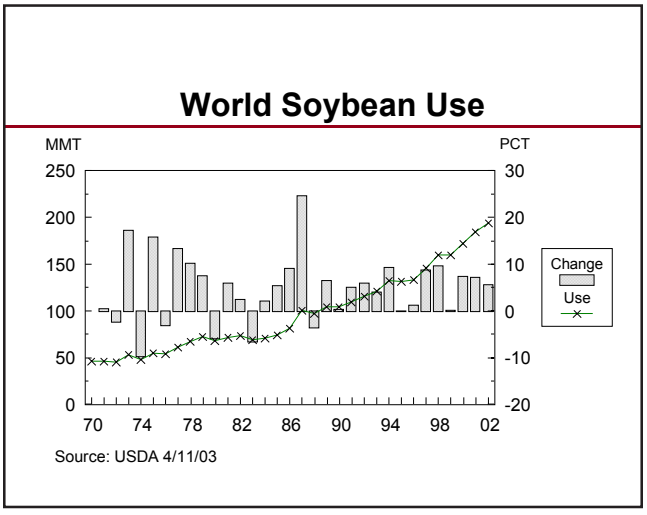

Figure 23

Transportation and ports are critical to the growth of Brazilian agriculture. Some commodities in some states must move in excess of 1,500 miles by truck to gain access to an export point. Production has traditionally been hauled by truck to one of three ports in the South. In recent years, increasing amounts have been trucked and barged to a floating port on the Amazon. A number of projects are under way to improve the transportation system.

Brazil, followed by Argentina, is the leading producer of soybeans in South America. All South America soybean production surpassed the United States during 2002-03. Production and yields have grown the fastest in Mato Grosso (Center-West) and other expansion states that have Cerrado land. Roundup Ready soybeans and other biotech seeds continue to be illegal in Brazil but are widely grown in some areas.

Brazil produces a number of other crops besides soybeans. Corn is a major crop and cotton is becoming more important. In addition, Brazil has a substantial livestock industry.

Beginning in 1999-00, South American soybean production and exports clearly began to impact the relationship between the U.S. stocks/use ratio and price. The U.S. seasonal price pattern for soybeans may also be impacted, but recent price patterns do not provide evidence of a change. Under favorable growing conditions in South America and the United States, however, a price peak by mid-March would be expected.

Farms in the Center-West Region are generally much larger than in the South and are well-managed. No-till is the common management practice in both areas. Most credit to larger farms for soybeans and cotton is provided by input suppliers and the companies who buy the crop. Farmers can store only about 5 percent of the crop on-farm but are expanding capacity. The grain trade and farmers rely on the CBOT for their price information.

Soybean costs of production for 2003 harvest are considerably lower in Mato Grosso than in North Dakota and Iowa even when freight costs to Rotterdam are considered, giving them a strong competitive position in the world market. Consequently, Mato Grosso soybean production appears to be considerably more profitable.

Soybean crush and exports are growing at a rapid pace in Brazil. For both, South America surpassed the U.S. during 2002-03. During the same year, South

America captured a larger percentage of the world soybean market than did the United States.

In the future, a 500 percent increase in Brazil cropland acres is possible. The additional land could be developed by clearing new land and by converting pastureland. Soybean acres in Brazil could at least triple.

The United States will likely continue to lose market share. For U.S. producers, an expanding world demand is of the utmost importance. It would appear that world demand can accommodate the current pace of growth in Brazil at prices profitable to North Dakota producers. Many of the large producers in Brazil will likely prosper. Too rapid a pace of growth would be detrimental to all producers.

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