AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

Agricultural Economics Report No. 338 December 1995

MARKET POTENTIAL FOR NORTHERN PLAINS FARM EQUIPMENT IN BRAZIL

Roger G. Johnson
Mark A. Krause

Department of Agricultural Economics • Agricultural Experiment Station
North Dakota State University • Fargo, ND 58105-5636

ACKNOWLEDGMENTS

The authors give special thanks to Eduardo Zaffaroni, Consultoria e Comercio Exterior Ltda., Pelotas, RS, José Honorato Santos de Moraes, Linck Equipamentos, Porto Alegre, RS, and Pedro Valentim Margues, Universidade de São Paulo, for making arrangements to visit technical experts in production areas, providing information sources and personal assistance to make our stay in south Brazil both productive and enjoyable. Recognition and thanks is given to Luis Henrique Caldasso for summarizing the census data presented in appendices A-E and helping with interviews in Paraná, and Rio Grande do Sul. Thanks also to Wilmar Luz for arranging visits in the Passo Fundo area and for his and Leone's hospitality. Finally acknowledgment is given to the many Brazilians who graciously gave of their expertise and time to provide information for this study.

TABLE OF CONTENTS

Page

List of Tables iii

List of Figures iv

Highlights v

Introduction 1
Brazil and Its Agriculture 1

Temperate Zone Crop Production in Brazil 2
Brazilian Agriculture 3
South and Center-West Agriculture 4
Homogeneous Agricultural Areas 10
Rio Grande do Sul 10
Paraná 11
Center-West States 12
Farm Production Systems 13
Irrigated Rice, Rio Grande do Sul 13
Soybean-Wheat, High Plains North, Rio Grande do Sul 17
Soybean-Wheat, West Paraná 22
Soybean, Center-West 25

Calculation of Potential Market Size by Area 27

The Farm Machinery Industry 29
Brazilian Manufactures 29
Technology 30
Dealers 31
Importance of Durability and Rapid Provision of Spare Parts 33
Importance of Financing for Farm Sales 33
Machinery Desires Expressed by Agronomists and Farmers 34
Other Remarks Concerning Equipment by Northern Plains Manufacturers 34
Market Potential for Northern Plains Farm Equipment in Brazil 35

Exporting Machinery to Brazil 36
The Process of Importing 36
Costs of Importing 36
Payment Terms for Export Sales 38
Availability of Assistance for Import/Export 39
Investing in Brazil and Possibilities for Joint Ventures 40
Evaluation of Options for Exports to Brazil 40
Importance of Timing 42

References 43

Persons Interviewed by Roger Johnson 47

Persons Interviewed by Mark Krause 50

Appendices

Appendix A Farm Census Summary, Rio Grande do Sul 53
Appendix B Farm Census Summary, Parana 58
Appendix C Farm Census Summary, Mato Grosso do Sul 63
Appendix D Farm Census Summary, Mato Grosso 68
Appendix E Farm Census Summary, Goias-Tocantins 73
Appendix F Visit to Granjas 4 Irmaos S.A. 78
Appendix G Brazilian Farm Equipment Prices 1994 79
Appendix H Brazilian Subsidiaries of U.S. Banks & Their Location 81

Endnotes 82

List of Tables

Table		Page
I	Acreage of Major Crops Harvested, Production and Yield of Temperate Zone Crops in Brazil, 1993	4
II	Planted Acres of Temperate Zone Crops by Geographic Areas and State of Brazil, 1994	5
III	Agricultural Characteristics of Five States in the South and Center-west of Brazil	6
IV	Farm Numbers, Acreage and Characteristics of Medium and Large Sized Farms in Five States of Brazil	7
V	Estimated 1994 Planted Acres of Major Crops on Medium and Large Farms by State of Brazil	8
VI	Average Acres of Specified Crop per Farm on Farms above 1,235 Total Acres, 1985	9
VII	Number of Tractors by Horsepower Class, Planting and Harvesting Machinery on Large Farms in Five States of Brazil, 1985	9
VIII	Location of Production of Selected Crops by Homogeneous Areas in Rio Grande do Sul	10
IX	Location of Production of Selected Crops by Homogeneous Areas in Paraná	11
X	Location of Production for Selected Crops by Homogeneous Areas in Mato Grosso do Sul, Mato Grosso and Goiás	13
XI	Number of Rice Producers by Size and Area, Rio Grande do Sul	14
XII	Irrigated Rice Production Field Operations - Rio Grande do Sul, Brazil	15
XIII	Labor Costs on Rice Farms in Rio Grande do Sul, Brazil, 1993	16
XIV	Summary of Crop Production on Large Farms, High Plains North, Rio Grande Do Sul	18
XV	Field Operations for Soybean, Corn and Wheat-Conventional and Direct Planting, High Plains North, Rio Grande do Sul	19
XVI	Farm Size, Soybean Acres, Machinery and Employees, Passo-Fundo Catazinho Area. Rio Grande do Sul, Brazil	20
XVII	Production Costs per Acre Conventional and Direct Planting Soybean, Corn and Wheat, High Plains North, Rio Grande do Sul	21
XVIII	Returns above Direct Costs per Acre for Soybean, Corn and Wheat - Direct Planting, High Plains North of Rio Grande do Sul	22
XIX	Summary of Crop Production on Large Farms, West Paraná, Brazil	23
XX	Farm Size, Cropping System, Machinery and Employees, Large Direct Plant Farms Paraná, Brazil	24
XXI	Estimated Market Potential of Air Seeders for Soybean in South and West-Central Brazil on Large and Medium Sized Farms.	28
XXII	Sales of Domestically Produced Tractors and Combines	32
XXIII	Characteristics of Three Farm Machinery Dealerships in South Brazil	37
XXIV	Estimated Cost of Importing Equipment into Brazil	38

List of Figures

Figure		Page
1	Map of Brazil With Regions and States	3
2	Homogeneous Areas of Rio Grande do Sul	10
3	Homogeneous Areas of Paraná	11
4	Homogeneous Regions of Center-West States	12

Market Potential for Northern Plains
Farm Equipment in Brazil

HIGHLIGHTS

Brazil, the size of continental United States, has 162 million people with per capita Gross Domestic Product of $3,000. The democratically elected government is pursuing economic reforms including trade liberalization, privatization and macro economic policies which are bringing persistent inflation under control. These measurers are making Brazil an increasingly attractive export market.

Northern plains farm equipment could be sold in southern and west-central Brazil where there are large acreages of soybean, corn, rice, dry edible beans and wheat. Over 18 million acres of these crops are produced on farms large enough to use medium to large scale machinery. About 10 million of these aces are devoted to mechanized soybean production. No-till planting is used on 15 to 25 percent of the mechanized production and is increasing.

Farms are located close together and a network of machinery dealers are available in southern Brazil. Large sized equipment in the south is limited by steeply sloped topography and a limited numbers of large farms.

In center-west Brazil soybeans farms have been established in the last 15 to 20 years. Farms are often scattered around undeveloped land and farm machinery dealers are few and often far apart. However, the potential sales for large sized machinery is better than the south as the land is more level and farms are larger.

Although farm machinery sales in Brazil were declining or stagnant from 1977 to 1992, the Brazilian market grew rapidly in 1993-94. A slowing of sales is occurring in 1995. Under current macroeconomic, trade, and agricultural policies, growth of this market is expected to continue. Indeed, with the implementation of the MERCOSUL customs union with Argentina, Paraguay, and Uruguay in January, 1995, the Brazilian/MERCOSUL market includes most of the large-scale grain farms in South America.

However, the market is highly sensitive to changes in policies. Farm incomes depend on agricultural product prices that are highly sensitive to the exchange rate and Brazilian macroeconomic policies. Agricultural product prices also are sensitive to import policies and government budgets for price-support operations. Machinery sales depend largely on the availability and cost of debt financing, which also fluctuates and continues to be a major constraint. For these reasons, investment in the Brazilian machinery market is risky, but potentially profitable.

New exporters of farm machinery to Brazil need to move quickly, partner with Brazilian companies, and provide unique and very durable technology. Brazil already has several well-established farm machinery manufacturers with good reputations for quality, including one firm that is partially owned by Deere and Company. It also has many smaller, entrepreneurial manufacturers that are filling new market niches with high-quality equipment.

Brazilian manufacturers have three major advantages over foreign firms: (1) they are favored by government-provided financing; (2) they can provide spare parts more quickly than foreign firms unless a large and expensive stock is maintained by dealers; and (3) they understand the intricacies of Brazilian economic policies and the Brazilian way of doing business. However, the level of technology still is below the best in the U.S. market, and Brazilians are interested in upgrading their technology provided that it is also durable.

Many firms are interested in potential joint-venture or distribution agreements with American manufacturers. American manufacturers should note, however, that many European and American firms are already developing new products and marketing networks in Brazil. New exporters to Brazil should develop dealer networks and brand-name recognition soon, before competitive high-technology products are firmly established in the Brazilian market.

INTRODUCTION

Farm machinery markets in the United States and other industrialized countries are highly developed, with many well-established, highly specialized manufacturers and extensive dealer networks. Therefore, the best opportunities to expand markets for Northern Plains farm machinery manufacturers may be in developing countries where competition may be less. This report evaluates the potential for Northern Plains farm machinery manufacturers to export to Brazil.

Brazil was chosen for this study because it has a large area of commercial, temperate crop production on medium to large-sized farms. Most of the machinery designed for the Northern Plains is not well-adapted to small farms. This report focuses on farming practices for Brazilian farms of at least 494 acres (200 hectares) of cultivated land.

At various times, Brazil has been an important export market for U.S. agricultural machinery, although U.S. exports to Brazil in most years have been limited by high import duties and unfavorable domestic agricultural policies. U.S. exports of farm machinery to Brazil reached a peak in the late 1960s and early 1970s before declining. Sales of tractors within Brazil also declined from 63,776 units in 1976 to 12,054 units in 1992 (ANFAVEA). Brazilian farm machinery sales and U.S. exports of agricultural machinery to Brazil increased rapidly in 1993 and 1994 (Globo Rural, Ferraz de Mesquita, International Trade Administration Brazil 5) before declining again in 1995 (Correa).

Many Northern Plains farm machinery manufacturers specialize in equipment for conservation tillage. Economies of size are not as important in manufacturing conservation tillage and planting equipment as for tractors and combines. In addition, technology for conservation tillage is still under development and needs to be adapted to regional conditions. These characteristics have allowed manufacturers in the Northern Plains to establish themselves in the conservation tillage equipment market. Conservation tillage also is an important trend in Brazil because much of the farmland for temperate crops is sloped and the soils are susceptible to compaction and erosion. Therefore, this report emphasizes the Brazilian market for conservation tillage equipment, although the information will also be useful to manufacturers of other types of farm machinery.

After a brief description of Brazil and its agriculture the remainder of the report is divided into four parts. First is a description of temperate zone crop production. Next is a discussion of how to calculate the potential machinery market size. A description of the Brazilian farm machinery industry follows. The final section details the process of exporting machinery to Brazil.

Brazil and its Agriculture

Brazil is a huge country, the largest in Latin America, with vast agricultural resources and a population of 162 million (International Trade Administration, Brazil, 1994). It has a highly developed industrial sector, and 74 percent of the population lives in urban areas (World Bank, 1994). The gross domestic product per capita in 1994 is estimated at $3,007 (International Trade Administration, 1995). Brazil produces most of its own cars, trucks, steel, household appliances, and industrial machinery. It also exports many of these industrial products to other Latin American countries, Europe, and the U.S.

Brazil also is a country of striking contrasts, with shanty towns of poor people within sight of busy shopping centers that cater to Brazil's middle and upper classes. Unemployment and crime are major

concerns, especially in the largest cities. However, Brazil also has the fifth largest shopping mall industry in the world, with the number of shopping malls increasing from 12 to 104 in the past two decades (International Trade Administration-Retail Trends). Satellite TV dishes and cable TV are common. American fast-food franchises are very popular in Brazil's large cities. In May 1994 Pizza Hut had 38 outlets in São Paulo alone, and São Paulo also offers McDonald's, Domino's Pizza, Arby's, Kentucky Fried Chicken (Brooke), and Dunkin' Doughnuts.

From 1980 until July of 1994, Brazil had one of the highest rates of inflation in the world, exceeding 1000 percent per year in 1989-90 and 1992-94 (Instituto Brasileiro de Economica). High rates of inflation greatly reduced incentives to invest and the purchasing power of the lower classes, with the result that Brazil's real gross domestic product declined in 1981, 1983, 1988, 1990, 1992, and 1993 (Instituto Brasileiro de Economica). Efforts to control inflation, government budget deficits, and external debt have been a preoccupation of the Brazilian government during the past several years. A three-phased fiscal and monetary reform program was announced by the Finance Minister, Fernando Henrique Cardoso, in December of 1993 and was fully implemented by July 1, 1994. Monthly inflation declined from 46.6 percent in June to 24.7 percent in July, 3.3 percent in August, and 1.5 percent in September (as measured by the IGP-DI price index). Inflation remained low for the rest of 1994 and first six months of 1995, totaling 15.2 percent from August 1994 to June 1995 (DESR/ESALQ/USP). Several months of low inflation and the election of Cardoso to president (his term began in January 1995) have given Brazilians hope that the many years of high inflation and economic stagnation have ended.

Besides macro economic reform Brazil began other economic reforms in the 1990s. Reforms included trade liberalization, deregulation and privatization. Brazil has no quantitative restrictions on imports and the average tariff came down from 32 percent in 1990 to 14 percent in 1993.

Brazil's agricultural production grew rapidly in the 1960s and early 1970s before stagnating and sometimes declining in per capita terms during the 1980s and 1990s. Major Brazilian crops include sugarcane, corn, soybean, manioc (cassava), oranges, rice, wheat, dry beans, coffee, cotton, cocoa, and tobacco. According to the persons interviewed in Brazil, the primary cause of both the increase and stagnation of agricultural production has been the level of investment by the Brazilian government and international organizations in credit for farmers and farm cooperatives, research, and subsidies for inputs.

Although agricultural production in general has been stagnant in recent years, production of corn increased 52%, production of soybean increased 26%, and production of rice increased 42% from 1990 to 1994 (Instituto Brasileiro de Economia). Area planted and crop yield both increased over this period for these three crops (area planted for soybean increased only slightly). Prices received for corn (in US dollars per bushel) have averaged $3.08 from January 1990 to June 1995, with a range of $2.16-4.28. Prices received for soybean have averaged $4.68 per bushel during this period, with a range of $3.60-5.68. Prices received for rice have averaged $5.52 per bushel during this period, with a range of $3.41-7.52.

TEMPERATE ZONE CROP PRODUCTION IN BRAZIL

This section begins with an aggregate analysis of statistical data on farm numbers, and crop acres planted by farm size for selected states and areas within states. The statistical information is followed by a description and analysis of farm production practices, machinery use and farm income in areas with a potential market for Northern Plains equipment.

Brazilian Agriculture

Brazil's most important temperate zone crops are soybean, corn, rice, dry edible beans, and wheat. These crops are produced in the temperate climate of the three southern states of Paraná, Santa Catarina, and Rio Grande do Sul. Although located north of the Tropic of Capricorn, the center-west states of Mato Grosso do Sul, Mato Grosso and Goiás are also important producers of some of these crops. Since 1991 farmers and investors from south Brazil have also been establishing large scale soybean farms (over 1,000 ha.) in the northeast states of Maranhão and Piauí.

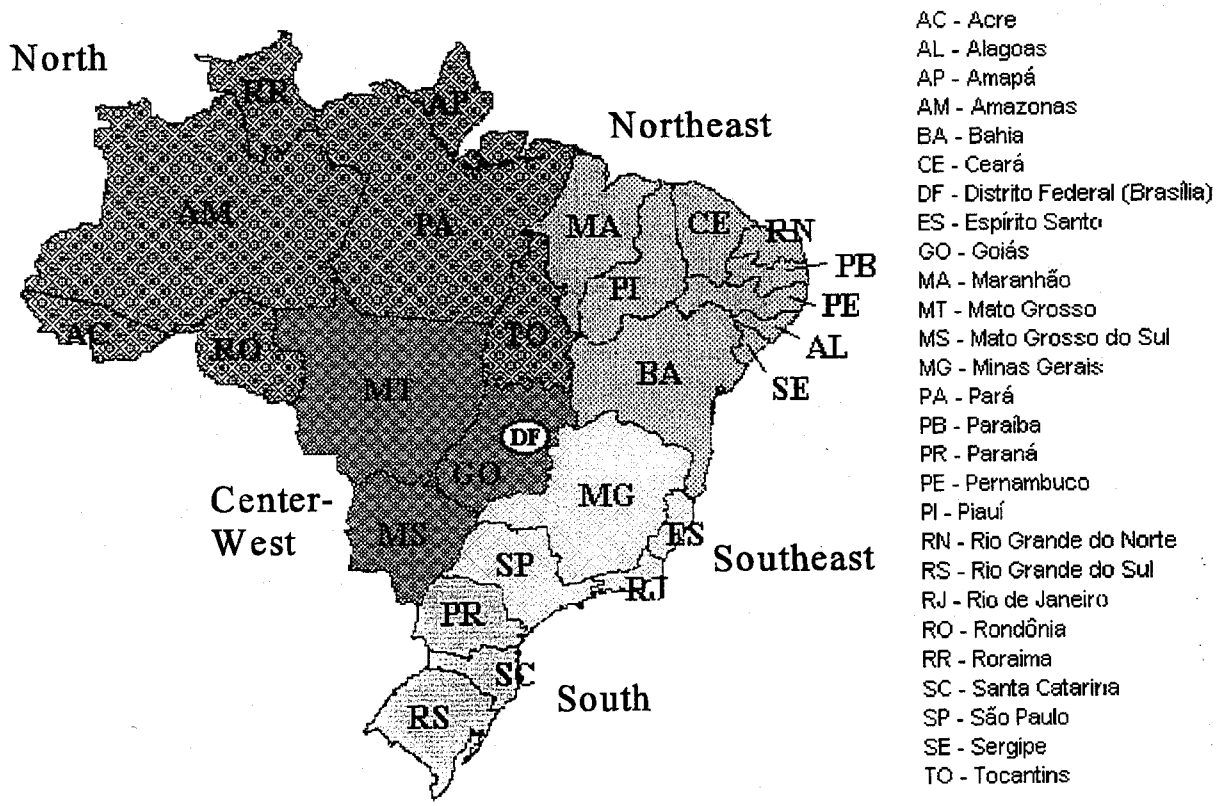

Figure 1. Map of Brazil With Regions and States

The data in Table I summarize the 1993 acreage of the major crops produced in Brazil and the production and yield of the most important temperate zone crops.

Corn, followed closely by soybean, occupies the most land in Brazil. The two crops account for nearly half the cropland of the country. Rice, dry edible beans and sugarcane are also major land using crops. The yield of soybean is similar to the United States while corn yields are much lower. The yield difference exists because soybean is grown as a cash crop by medium and large sized farms, while much of the corn is produced for food and feed on small subsistence farms with poor quality land and low technology. However, even on farms utilizing modern technology corn yields are lower relative to soybean than in the U.S. One reason is the shorter day length in Brazil compared to the corn areas of the U.S.

Table I - Acreage of Major Crops Harvested, Production and Yield of Temperate Zone Crops in Brazil, 1993.

Crop	Acres (Millions)	Production (Millions)	Yield (Units/Acre)
Corn	29.3	1,183.8 bushels	40.4 bushels
Soybean	26.2	832.1 bushels	31.7 bushels
Rice	10.9	223.7 cwt.	20.5 cwt.
Dry Edible Beans	9.6	54.6 cwt.	5.7 cwt.
Wheat	3.7	80.9 bushels	21.7 bushels
Sugarcane	9.5		
Coffee	5.6		
Cassava	4.5		
Other Crops	14.2		
Acres Harvested	113.6		

Source: Fundação Instituto Brasileiro de Geografia e Estatistica, Rio de Janeiro, 1994.

Total harvested acres are greater than the annual land devoted to crops because some land produces two crops a year. For example, nearly all the wheat is produced during the winter on land producing soybean or corn the previous summer. Dry edible beans are commonly produced as a second summer crop after corn or another crop.

South and Center-West Agriculture

As stated previously, most temperate zone crops are produced in either the south or the center-west areas of Brazil. Table II data show the location of production within geographical areas and states for soybean, corn, wheat, rice and dry edible beans.

Although nearly half the soybean acreage is in the southern states of Rio Grande do Sul and Paraná, the center-west is also a major soybean production area with nearly 40 percent of the planted acres. Corn acreage is more evenly distributed throughout Brazil, however, the major production concentration is in the south.

Wheat production is limited almost entirely to the states of Paraná and Rio Grande do Sul. Although rice acreage is found throughout the country, the most concentrated production area is in Rio Grande do Sul. Dry edible bean production is widely distributed throughout the country with no major area of concentration.

Table II - Planted Acres of Temperate Zone Crops by Geographic Areas and State of Brazil, 1994

Location	Soybean	Corn	Wheat	Rice	Dry Beans
	----------Millions of Acres----------				
Brazil	28.4	35.7	3.6	11.1	14.0
South	13.8	13.9	3.4	3.1	2.9
Paraná	5.4	7.1	1.8	.3	1.4
Santa Catarina	.5	2.6	.2	.4	.9
Rio Grande do Sul	7.9	4.2	1.4	2.4	.5
Center-West	10.6	4.6	.2	2.2	.6
Mato Grosso do Sul	2.7	1.2	.2	.2	.1
Mato Grosso	5.0	1.1	---	1.2	.1
Goiás	2.7	2.2	---	.7	.4
Federal District	.1	.1	---	---	---
Rest of Brazil	4.0	17.2	.1	5.9	11.1

Source: Fundacão Instituto Brasileiro de Geografia e Estatistica, Rio de Janeiro, 1994

As the data in Table II indicate, the state of Santa Catarina and the Federal District are not major producers of temperate zone crops. Characteristics of farming in the five remaining south and center-west states are presented in Table III. For more detail by farm size and area within states see Tables 1 and 2 of Appendices A-E.

The southern states of Rio Grande do Sul and Paraná have more of their land under cultivation than the center-west states where most of the land is extensively grazed or unused. Nearly all land is managed by the owner rather than rented out. Because the land in the two southern states is more steeply undulating than the center-west the need for soil conservation practices is greater.

Agriculture in Brazil is dominated by very small farms. Most Northern Plains manufactured equipment would not be suited to farms averaging 30 to 110 cultivated acres. The study assumes that a farm would need a minimum of 500 planted acres to be a potential market for Northern Plains farm equipment. Farms with over 1,200 planted acres, termed large farms, would have the best market potential. A greater portion of the land in the center-west states is farmed by owners of medium and large farms. Mato Grosso and Mato Grosso do Sul have nearly half their land in the hands of large farm owners.

The number of farms and acres planted by medium and large farms and some characteristics of these farms by state are presented in Table IV. The information in Table IV is based on the 1985 agricultural census but has been updated to reflect 1994 planted acreage. The portion of planted acreage represented by each farm size group was assumed not to have changed from 1985. The number of medium

Table III - Agricultural Characteristics of Five States in the South and Center-West of Brazil

	South		Center-West		
	Rio Grande do Sul	Paraná	Mato Grosso do Sul	Mato Grosso	Goiás
Land in Crops (%)	41	51	9.5	23	18
Land Owned by Operator (%)	82	87	94	96	94
Conservation					
Practices (%) (a)	28	31	14	7	18
Average Farm Size (Acres)	34	30	110	72	62
Workers Per Farm	3.5	4.0	4.6	4.6	4.7
Land Distribution					
Medium Size Farms % (b)	14.6	10.2	22.0	17.1	18.2
Large Size Farms % (c)	11.1	7.2	44.7	48.7	24.4

(a) One or more soil conservation practices such as contours and terraces
(b) Percent of farmland occupied by farms with 494 to 1,235 cultivated acres
(c) Percent of farmland occupied by Farm with more than 1,235 cultivated acres

Source: Censo Agropecuário, IBGE. Rio de Janeiro, 1985

and large farms in Mato Grosso was increased in proportion to the increase in land farmed since 1985. No appreciable change in land farmed occurred since 1985 in the other states. The figures for Goiás have been adjusted to reflect the formation of Tocantins since the 1985 agriculture census. Census data for 1985 is presented for additional farm size groups in Appendices A-E.

Rio Grande do Sul has both the greatest number and the most planted acres in medium sized farms. The other states have similar representations of medium farms. Mato Grosso has the most farms and planted acres in large enterprises. Rio Grande do Sul followed by Mato Grosso do Sul have the next most farms and acres in large farms.

Acres planted double counts land planted twice a year, which is appropriate in evaluating machinery needs. Land in Rio Grande do Sul and Paraná produces a summer crop such as soybean or corn and often a second winter crop such as wheat or oats. The center-west states do not have sufficient winter moisture for a winter crop except for a small portion of irrigated land. However, a second summer dry bean or corn crop is sometimes produced in the center-west states and also in Paraná.

Conservation practices are used on most medium and large farms. More conservation measures are used in the south than the center-west because of more sloped topography.

Table IV - Farm Numbers, Acreage and Characteristics of Medium and Large Sized Farms in Five States of Brazil.

	Rio Grande do Sul	Paraná	Mato Grosso do Sul	Mato Grosso	Goiás
Medium Sized Farms (494 to 1,235 cultivated acres)					
Number	3,207	2,000	1,392	1,751	1,372
Acres Planted (1,000) (a)	2,613	1,780	1,031	1,312	1,164
Planted Acres/Farm	815	890	741	749	848
Workers/Farm	11.1	19.6	9.7	9.9	11.4
Conservation Practices (%) (b)	82	94	70	55	72
Large Sized Farms (Over 1,235 cultivated acres)					
Number	876	474	674	1,239	550
Acres Planted (1,000) (a)	2,267	1,256	2,095	3,738	1,560
Planted Acres/Farm	2,587	2,650	3,108	3,017	2,836
Workers/Farm	28.9	60.2	25.3	24.1	23.5
Conservation Practices (%) (b)	89	91	85	66	83

(a)Acres planted to annual crops 1994, including land cropped more than one time a year
(b)One or more conservation practices such as contours ,and terraces

Source: Censo Agropecuário, IBGE., Rio de Janeiro, 1985 and IBGE, 1994

The large number of workers per farm, including seasonal labor, reflects the low wages paid and the relatively small size of machinery used. Owners of large farms normally do not provide their own physical labor and often hire one or more managers, agronomists, mechanics and accountants in addition to tractor drivers and unskilled workers.

An estimate of the acreage of each crop produced on medium and large farms by state is presented in Table V. The land devoted to specific crops on medium and large farms for Rio Grande do Sul and Paraná is computed from the 1985 census distribution of crop production by farm size. Because large farms dominate land use in the center-west, the portion of total land (excluding horticultural crops), devoted to each crop in 1994 was used to estimate crop acreage on medium and large farms.

Soybean production dominates the cropping system on medium and large farms in all five states. Rice is a major land using crop in Rio Grande do Sul. Corn uses 70 to 80 percent as much land as soybean in Paraná and Goiás but is less dominant in the other states. Although wheat represents only 7 to 10 percent of land use in Paraná and Rio Grande do Sul, the two-state acreage is equivalent to 470 sections of wheat.

Table V - Estimated 1994 Planted Acres of Major Crops on Medium and Large Farms by State of Brazil.

Crop and Farm Size	Rio Grande do Sul	Paraná	Mato Grosso do Sul	Mato Grosso	Goiás
	----------	----------	1,000 Acres	----------	----------
Soybean					
Medium (a)	1,171	865	627	871	535
Large (b)	1,016	610	1,273	2,482	718
Wheat					
Medium (a)	193	188	----	----	----
Large (b)	168	133	----	----	----
Corn					
Medium (a)	178	627	283	190	434
Large (b)	154	442	576	542	582
Rice					
Medium (a)	956	----	58	211	145
Large (b)	830	----	117	602	195
Other Crops					
Medium (a)	112	100	63	39	49
Large (b)	97	70	128	112	65
All Crops					
Medium (a)	2,613	1,780	1,031	1,312	1,164
Large (b)	2,267	1,256	2,095	2,738	1,560
TOTALS	4,880	3,036	3,126	5,050	2,724

(a) Farms with 494 to 1,235 Cultivated Acres
(b) Farms with more than 1,235 Cultivated Acres

Source: Fundação Instituto Brasieiro de Geografia e Estatistica - Censos Econômicos Rio de Janeiro, 1985, 1994

The average acreage a farmer devotes to a given crop is also a consideration in evaluating farmer's machinery needs. The 1985 agriculture census provides this information by total acres farm size groups. **(See Table VI)**.

Table VI - Average Acres of Specified Crop Per Farm On Farms Above 1,235 Total Acres in Five States of Brazil, 1985.

States	Soybean	Wheat	Corn	Rice
	---------- Acres Per Farm ----------			
Rio Grande do Sul	826	446	44	389
Paraná	888	598	182	----
Mato Grosso do Sul	1,608	----	----	125
Mato Grosso	1,394	----	----	190
Goiás	976	----	84	102

Source: Censo Agropecuário, IBGE, Rio de Janeiro, 1985

It is evident from Table VI that soybean is the crop produced on the largest scale. Wheat is normally produced in the winter on land in soybean the previous summer. Wheat acreage is less because farmers normally do not plant all their soybean acreage to wheat. Some land is planted to a cover crop such as black oats or left idle over winter. Corn production tends to be on a smaller scale, even on large farms. In Rio Grande do Sul and Goiás many farmers grow corn only for feed for their livestock. Corn production for sale is more common in Paraná. Rice farmers in Rio Grande do Sul tend to specialize and produce few or no other crops.

Information on the number of tractors by horsepower class, planting and harvesting equipment on medium to large farms is summarized in Table VII. The data are available by total acres groups rather than cultivated acre groups. A medium to large farm was defined as one with more than 1,235 total acres. See Appendix Tables A3-E3 for further size groupings.

Table VII - Number of Tractors by Horsepower Class, Planting and Harvesting Machinery on Farms Above 1,235 Total Acres.

	Rio Grande do Sul	Paraná	Mato Grosso do Sul	Mato Grosso	Goiás
Number of Farms (a)	8,237	2,842	7,520	4,925	7,394
Number of Tractors					
50-100 hp.	13,741	6,883	10,217	6,045	9,261
over 100 hp.	5,015	2,156	6,117	4,858	3,891
Number of Implements					
Planting	11,316	4,588	6,747	5,179	8,045
Harvesting	6,522	2,337	2,313	3,114	2,562

(a) Farms over 1,235 total acres

Source: Censo Agropecuário, IBGE. Rio de Janeiro, 1985

The data in Table VII can be used to estimate the potential annual market for these pieces of machinery. For example assuming a 10 year replacement cycle Rio Grande do Sul farmers would need 501 replacement tractors over 100 horsepower a year.

Homogeneous Agricultural Areas

The five states studied encompass large land areas which are not necessarily homogeneous. The following sections describe the agriculture by regions in each state.

Rio Grande do Sul is diverse both in crops and livestock produced and the size of farms and ranches. The state is divided into four homogenous agricultural areas: high plains north, foothills, east and west **(See Figure 2)**. The distribution of crops among regions is shown in Table VIII.

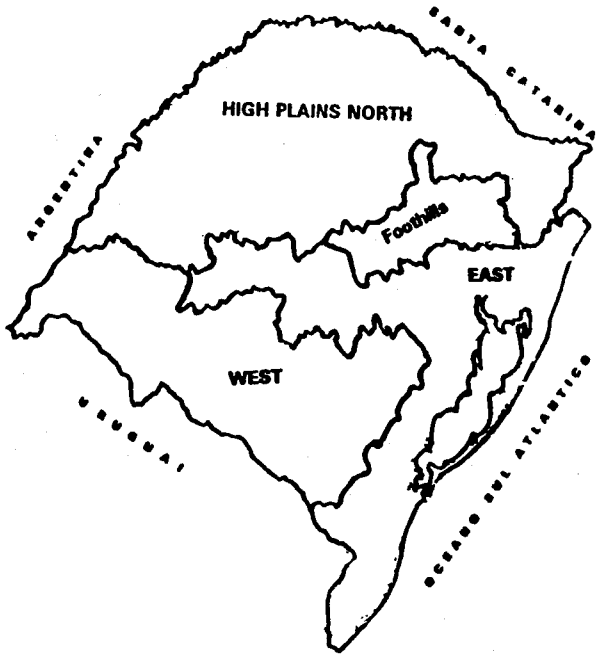

Figure 2 Homogeneous Areas of Rio Grande do Sul

Table VIII - Location of Production of Selected Crops by Homogeneous Areas in Rio Grande do Sul.

Crop	High Plains North	Foothills	East	West	Total Acres
	----------Percent----------				(1,000)
Wheat	87	1	3	10	2,339
Soybean	83	2	7	8	8,911
Corn	64	13	17	5	3,522
Rice	5	3	46	46	1,973

Source: Censo Agropecuário, IBGE, Rio de Janeiro, 1985

The high plains in the north is the major soybean and wheat producing region. The foothills region is mostly steeply sloped land largely devoted to forests, where farming is limited to small properties producing horticultural products and vineyards. The eastern area includes the central depression and is largely lowlands used mostly for cattle grazing and irrigated rice production. The west is mostly grassland devoted to large cattle ranches. In recent years some land in this area has been converted to soybean and wheat production. Irrigated rice is an important crop near the Argentine border.

Paraná: Topographically the state consists of a narrow coastal plain, a coastal mountain range, and three high plains to the west. The high plains are characterized by undulating land, much of which is steeply sloped. Most of the land was cleared of forests and brought into production since World War II. Cultivation has resulted in problems of soil erosion that are being controlled through soil conservation practices.

The state is divided into three homogeneous agricultural areas: east, west and north **(See Figure 3)**. The distribution of wheat, soybean and corn production by areas is shown in Table IX.

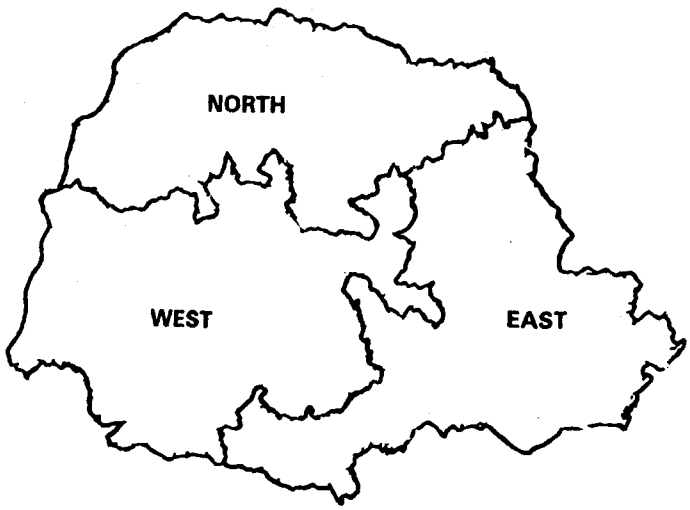

Figure 3 Homogeneous Areas of Paraná

Table IX - Location of Production of Selected Crop by Homogeneous Areas in Paraná

Crop	East	West	North	Total Acres
	----------Percent----------			(1,000)
Wheat	4	62	34	3,034
Soybean	10	65	25	5,138
Corn	23	57	20	4,793

Source: Censo Agropecuário, IBGE., Rio de Janeiro, 1985

The eastern area which contains the coastal plain and mountains is the least important agricultural area. The west has the most relatively level land and is the most important soybean, wheat and corn producing area. The northern area is more diversified, producing coffee, cotton and sugar cane as well as wheat, corn and soybean.

Center-West States: Most of the land in Mato Grosso do Sul, Mato Grosso and Goiás are in acid savannas, termed "cerrados" in Portuguese. Dominant vegetation in the region is wooded savanna with cover types ranging from native grasslands to a closed-tree canopy along permanent streams. The dry season of four to six months (April-September) constitutes an environment analogous to the winter of temperate regions. Use of irrigation systems during the dry season permits multiple cropping (Nasser, Resck and Charckar).

Development of the area for cultivated crops began in the 1970s and continued through the 1980s with the help of government subsidized loans. Subsidized loans have been reduced and development has slowed in the 1990s. Development involves clearing the land, applying lime and fertilizer, and tillage to incorporate the lime and fertilizer. The major crop is soybean. However, rice, corn, dry edible beans, wheat, and coffee are also grown.

A majority of the land in the region remains undeveloped and some developed land has been seeded with improved grasses for pasture. Livestock ranching is an important activity, utilizing both unimproved land and seeded pasture.

Development has been concentrated in certain parts of the central-west states. The agricultural census divides each state into homogeneous areas. **(See Figure 4)**. A summary of soybean and rice production by area within the three states is presented in Table X.

Figure 4 Homogeneous Regions of Central-West States

Table X - Location of Production for Selected Crops by Homogeneous Areas in Mato Grosso do Sul, Mato Grosso and Goiás.

	Soybean		Rice	
	Acres (1,000)	Percent	Acres (1,000)	Percent
Mato Grosso do Sul				
Pantanal	146.8	6.2	124.7	23.0
High Plains	1,529.5	64.6	195.2	36.0
High Plains East	619.4	29.2	222.3	41.0
TOTAL	2,295.7	100.0	542.2	100.0
Mato Grosso				
North	772.0	38.8	609.2	55.2
Cuiaba	278.4	13.7	101.5	9.2
Southeast	910.5	44.8	190.9	17.3
Southwest	71.1	3.5	202.0	18.3
TOTAL	2,032.0	100.0	1,103.6	100.0
Goiás				
East	165.8	11.2	171.2	10.0
South	1,267.6	85.6	640.3	37.4
Northern Areas	51.8	3.2	900.5	52.6
TOTAL	1,485.2	100.0	1,712.0	100.0

Source: Censo Agropecuário, IBGE, Rio de Janeiro, 1985

Very little agriculture exists in the Pantanal area of Mato Grosso do Sul and southwest Mato Grosso because much of the area is an alluvial plain, utilized for extensive grazing and a wildlife reserve. Soybean production is most concentrated in the high plains of Mato Grosso do Sul, south Goiás and southeast Mato Grosso.

Farm Production Systems

This section is based on interviews with agricultural engineers, production specialists, farmers and machinery dealers in four farming areas of Brazil. They were the rice growing area in eastern Rio Grande do Sul, the soybean and wheat growing area in the high plains north of Rio Grande do Sul, the soybean-wheat area of West Paraná and the savanna area of east Goiás.

Irrigated Rice, Rio Grande do Sul: Rio Grande do Sul has 12,000 irrigated rice growers planting 2,364,000 acres of rice for an average of 200 acres per grower. However, there are many small growers and a few extremely large operations. Rice production areas are along the east coast (40%), the southwest near the Uruguay River (33%) and the central depression (15%). The number and location of medium and large producers is shown in Table XI.

Table XI - Number of Medium and Large Farms of Rice Producers by Size and Location, Rio Grande do Sul.

Farm Size in Acres Irrigated	Area of Rio Grande do Sul			
	East Coast	Southwest	Other	TOTAL
	Number of Producers			
494 - 1,235	170	146	59	375
1,235 - 2,470	26	35	2	63
over 2,400	13	11	1	25

Source: Instituto Rio Grandense do Arroz, Porto Alegre, 1993

There are 25 producers with over 2,400 acres. The largest producers are corporations that produce, process and market the rice. The largest is the group Extrem do Sul, Erico Ribeiro owner, with 98,800 acres in Brazil and more in Uruguay. This farm is considered the largest rice farm in the world. The second largest is Granjas Quatro Irmãos with 74,000 acres in several locations.

Production Practices: Rio Grande do Sul has nearly five million acres structured to cultivate irrigated rice. The traditional production system normally utilizes less than half of this land for rice. When not devoted to rice the land is in grass for grazing beef cattle. Typically after one to two years of rice the land is allowed to be taken over by native grass or planted to improved grasses for two to five years. Reduced yields from infestation of the weed red rice is the main reason rice can not be grown more intensively (Rigatto and Stulp).

No-till planting is being utilized by the larger innovative producers as a means to control red rice and permit more intensive use of the rice land (Rigatto and Stulp). About 25 percent of the rice is currently planted no-till (Iribarrem).

In contrast to other types of farming in Brazil, 75 percent of the rice land is rented. Typically the landowner supplies the land and water for 30 percent of the crop. The renter supplies machinery, labor and the variable inputs are shared.

Machinery Use: Because irrigated rice is produced in association with cattle, the preparation of the soil is on land previously in grass. Also, the land must be leveled and diked for flooding. Land preparation and seeding occurs in October and November (spring in southern hemisphere) with harvest in March and April. Typical field operations and equipment size for conventional irrigated rice production are summarized in Table XII.

Irrigated rice production requires many field operations and uses much labor. Operations such as dike making use specialized equipment. However, the land preparation, seeding and harvesting operations use equipment similar to small grain equipment used in the U.S. Northern Plains.

The larger producers seed with a double disk opening small grain drill with fertilizer attachment. However, on many farms seed is broadcast on top of the soil and a harrow is used to cover the seed. A small (1%) but growing group of producers broadcast pregerminated seed by air into the flooded fields.

Table XII - Irrigated Rice Production Field Operations - Rio Grande do Sul, Brazil

Field Operation	Times Over	Speed Miles/hr.	Typical Machinery Width (ft)	E[a]	Hr/Acre [b]
Level Dikes	1	----	----	----	.23
Disk Plow	2	4.0	5.8	.7	1.02
Disk	5	5.6	13.1	.8	.70
Level	2	3.7	7.9	.7	.80
Ditch	(1.33 ft. of drains/acre)				.17
Seed & Fertilizer [c]	1	3.7	9.8	.6	.38
Dike Making	(1,527 ft. of dikes/acre)				.70
Spray [d]	2	3.1	56	.5	.19
Combine	1	2.0	13	.6	.53
Field Transport	----	----	----	----	.80
Maintain Canals	----	----	----	----	2.00
TOTAL	14	----	----	----	7.52

(a)Efficiency factor
(b)Hours/acre = [8.25/(mph)(w')(E)](times over)
(c)Seeded in rows 5-7 inches apart with fertilizer, additional nitrogen is usually applied by airplane
(d)Ground application, aerial application is more common

Source: Instituto Rio Grandense do Arroz, 1993

The newest technology is to direct seed rice into grass killed with glyphosate (Roundup) herbicide. Currently eight percent of the area is seeded in this manner, but the practice is increasing rapidly among the larger farms. Direct seeding is almost always done subsequent to summer soil preparation and planting of rye grass for winter pasture. Summer soil preparation removes the land from use for rice or summer pasture and is necessary to control red rice. No selective herbicide is available to control red rice. The cattle are removed 20 days prior to planting and vegetation-killing herbicide is applied 24 hours before planting.

Direct seeding is accomplished with a single-cutting coulter followed by a double-disk opener and packing wheel. Speed of travel is generally about one-third slower than with conventional seeding. Several Brazilian companies manufacture direct plant or no-till seeders. The interviewed farmers indicated that these were satisfactory.

A recent study (Rigatto and Stulp) concluded that the most profitable rice farm plan would include half the rice direct (no-till) planted and half conventional. This result implies that seeders suitable for both types of planting need to be provided.

The optimal period for seeding rice is a 30 to 40- day period from mid-October to the end of November. However, during this period there are many days of rainfall and subsequent days when the fields are too wet. Most farmers have seeding capacity to complete the seeding in 10 to 15 days. The spring of 1994 provided an example of a year when less than 10 days were suitable for rice planting on many farms.

With the limited time for land preparation and seeding there would appear to be a place on large farms for high capacity no-till seeding equipment. Two large rice farms were visited, one with 24,700 acres of rice (See Appendix F) another with 2,400 rice acres. Both farms had articulated four-wheel drive tractors of over 20 horsepower manufactured by Miller. The majority of the other tractors on these farms were from 100 to 120 horsepower. Tillage equipment ran from 21 to 36 feet in width. Seeding equipment was 12.4 feet in width on the largest farm and 9.8 to 10.8 feet in width on the other farm. The largest seeder manufactured by Semeato, the major domestic manufacturer, is 12.4 feet wide. However, the company does manufacture a hitch to pull two drills side by side.

The most profitable size of equipment on rice farms is affected by (1) field size and (2) cost of labor. Field size is determined by the irrigation and drainage system. According to Luis DeLeon Valenti, irrigation and drainage specialist for EMATER (the extension service), a typical size of irrigated rice field is 22.5 acres (9 hectares). The time involved in turning to avoid irrigation canals diminishes the efficiency of very wide equipment.

The main economic advantage for large equipment units over many smaller units is the saving in labor. (The power and equipment cost per unit capacity tends to be nearly constant with size of machine.) Labor costs in Brazil are low by U.S. standards. As was shown earlier in this report (Table IV), owners of large farms have many employees, both permanent and seasonal. Because there seldom if ever seems to be a labor shortage, the price of labor rather than its marginal use value tends to represent its opportunity cost. Labor costs for 1993 on rice farms are summarized in Table XIII.

Table XIII - Labor Costs on Rice Farms in Rio Grande do Sul, Brazil 1993

Job	Basic Salary	Benefits	Total	Hours/Month	Cost Per Hour
	---$ Per Month---				
Common Labor	89.21	13.73	102.95	192	$.54
Tractor Driver	146.14	19.82	165.96	192	.86
Irrigator	120.44	17.07	137.52	180	.76

Source: Instituto Rio Grandense do Arroz, 1994

The costs presented in Table XIII are averages used in cost of production studies published by the rice growers association. The rice farmers visited indicated that temporary labor received $91 a month plus some food and permanent labor was paid $91 to $150 a month plus housing and some food. Food includes rice, beef, garden space and some other items produced on the farm. Employee housing is modest. For evaluating the value of labor saved through mechanization a value of $1.00 per hour would appear reasonable.

A simple example illustrates the effect of low labor costs on the economics of larger machinery. Assuming a 120 hour planting period, the substitution of one 24-foot seeder for two 12-foot drills would save $120 annually in labor cost. If the annual cost of the hitches needed for a 24-foot drill exceeded $120, it would not be economic. This assumes the 200 horsepower tractor needed to pull the wider seeder had a cost similar to two 100 horsepower tractors pulling 12 foot seeders and field efficiency did not decline for the wider unit.

Economic Conditions: The per-acre investment in rice production are as follows: (Iribarrem)

Land	$485
Machinery	364
Other Capital	283
TOTAL	$1,132

Total cost of production averages $430 per acre. Machinery depreciation is $48 per acre and machinery maintenance and repair $24 per acre. An average yield per acre is 40.5 (50 kilogram) sacks. The breakeven price is therefore $10.61 per sack. The average price in May 1995 was $8.23 a sack (Zero Hora), indicating that the average producer would lose money if he had to purchase assets at current prices for machinery and rice.

As with other agricultural products, rice is losing its protected status in Brazil. Rice can be imported from the U.S. at $10.80 a sack. The only alternative for the industry, if it is to be profitable in competition with imports, is to reduce its costs by becoming more efficient.

The area devoted to rice production is limited by economic conditions, rather than the availability of land or water for irrigation. The industry is adjusting to world market-oriented price levels, which means that cost- reducing and or yield-increasing practices have high priority. Under these conditions machinery investments will be under tight scrutiny by producers.

Soybean-Wheat, High Plains North , Rio Grande do Sul: The northern high plains area of Rio Grande do Sul (See Figure 2) can be subdivided north and south. Most of the large farms are found in the southern part where the land is less steeply sloped.

About 60 percent of the land is under cultivation in the areas dominated by large farms. Because of the steep slopes, most land is farmed on the contour and farmed hillsides usually have been terraced. The soil is acid and red due to large concentrations of iron oxide. The topsoil on average is extremely deep, up to 10 feet in places. When properly neutralized and fertilized, it is highly productive.

The area is well served with product markets (both independent and cooperative) and input supplies including a network of machinery dealers. Major market centers include Passo Fundo, Carazinho, Cruz Alta and Ijue.

Although most of the land is in small farms, there are more than 2,200 farms with over 494 cultivated acres (See Appendix A - Table A2).

Production Practices: Small farms are diversified both in crops and livestock, while the larger farms tend to specialize in soybean, wheat and corn. However, there is a long-standing livestock production tradition, so it is common for large soybean-wheat farms to also produce beef cattle.

Farmers tend to own the land they operate. Value of cropland runs about $1,000 per acre and normally has little or no debt against it. Only about 20 percent of land is rented. The common rental rate is six bags (60 kg or 132 lbs.) of soybean per hectare (2.47 acres). At prices prevailing in May 1995, this would be about $22.00 per acre (6 sacks @ $8.94/sack ÷ 2.47).

Farmers are able to produce two crops a year. Typical large farm operators devote 70 percent of their land to soybean and 30 percent to corn in the summer (September-April). (These will be referred to as summer crops even though the production season begins in the spring and may extend into fall.) Winter crops (June-November) are 20-30 percent wheat, 10-20 percent oats for grain, 40 percent cover crop and the remaining 10-20 percent in other crops such as barley or not planted. Planting, harvest periods and average yields are summarized in Table XIV.

Table XIV - Summary of Crop Production on Large Farms, High Plains North, Rio Grande do Sul.

Crops	Seeding Date	Harvest Date	Expected Yield [a]
Summer			
Soybean	October 1 - December 15	April	35 bu./acre
Corn	August 15 - September 30	February - March	60 bu./acre
Winter			
Wheat	June 10 - July 10	November	30 bu./acre
Oats	April	November	33 bu./acre

(a) Higher than average yield, used for planning purposes, does not discount for disease, insects and drought

Source: Diago Martainz, farm consultant, Carazinho, RS, 1994

Machinery Use: Direct planting (no-till) into previous crop residues is the emerging technology to reduce soil erosion, improve soil structure and control costs. Rainoldo Kochhann, soil scientist for EMBRAPA (Wheat research center), estimates that from 25 to 28 percent of the land on large farms is no-till planted and the percentage is growing.

The sequence of field operations under conventional and direct planting for soybean, corn and wheat production are summarized in Table XV.

Table XV - Field Operations for Soybean, Corn and Wheat - Conventional and Direct Planting, High Plains North, Rio Grande do Sul.

Conventional			Direct Plant		
Soybean	Corn	Wheat	Soybean	Corn	Wheat
Chisel Plow	Chisel Plow	Chisel Plow	(roll or shred previous crop) [a]		
Disk	Disk	Disk	Spray	Spray	Spray
Spray	Plant	Seed	Plant	Plant	Plant
Disk	Spray	Spray - (2 times)	Spray	Spray	Spray (2 times)
Plant	Apply Urea	Apply Nitrogen	Harvest	Apply Urea	Apply Nitrogen
Spray	Harvest	Harvest		Harvest	Harvest
Harvest				Shred [b]	

(a) If a cover crop such as black oats proceeds the summer crop
(b) If planted to a winter crop such as wheat or oats

Four large to medium-sized farms using direct planting were interviewed to obtain information on cropping systems, machinery use and employment practices. The data are summarized in Table XVI.

The land not in soybean during the summer is planted to corn. Land not seeded to wheat is often planted to cover crops, mainly black oats. Farmers interviewed have less tractor power than farmers using conventional tillage. The farmers have soybean planting capacity to complete planting in 80 to 170 hours or 8 to 15 ten-hour days.

The usual row spacing is 17 ½ inches for soybean and 35 inches for corn. The common practice is to lift or remove every other row to convert an eight-row soybean planter to a four-row corn planter. Most larger farms also have one or more small grain seeders for wheat, oats and other small grains. Row spacing on the seeders is usually 6 1/4 inches. Some farmers who do not produce corn use a small-grain drill to plant their soybean, using half the rows. Semeato has developed an all-purpose seeder suitable for small grains, soybean and corn.

The market for large capacity planting equipment is limited by (1) the sloping land farmed on the contour with terraces and (2) low labor costs. The data in Table XVI illustrate the abundance of available low cost labor.

Table XVI - Farm Size, Soybean Acres, Equipment and Employees, Passo-Fundo Carazinho Area. Rio Grande do Sul, Brazil.

Item	Unit	Farm #1		Farm #2		Farm #3		Farm #4	
Total Land	Acres	6,263		2,964		1,304		459	
Cultivated	Acres	4,446		2,149		1,037		370	
Soybean	Acres	2,840		1,531		692		296	
Wheat	Acres	741		618		304		149	
Direct Plant	Percent	100		65		100		100	
Cattle	Head	650[a]		85		12		None	
Tractors	Over 250 HP	1		----		----		----	
	100 - 140	5		2		2		1	
	Under 100	12		6		3		1	
Equipment		No.	Width	No.	Width	No.	Width	No.	Width
Soybean-Corn Planter		8	11.7'	4	9.8'	1	11.7'	1	9.8'
Sprayer		6	36.0'	4	33.0'	2	36.0'	1	33.0'
Combine		10	13.0'	5	12.0'	1	13.0'	1	10.5'
Employees									
Full-Time		43		9		4		3	
Part-Time		20		3		2.5		0	
Monthly Wage [b]		$140		$152		$137		$152	

(a) 150 of these are milk cows
(b) Fringe benefits include a house and part of their food

Efficiency gains from wider equipment are limited by the contour terraces, according to José Portella, agricultural engineer at EMBRAPA (national wheat research center) in Passo Fundo. The width between terraces is not uniform and often is as narrow as 50 to 65 feet. The wider the planter the more problems encountered in turning and planting the short rows to fill out the area where distance between terraces is wider. Portella's judgment is that 6-row corn or 12-row soybean (17 ½ ft.) planters are about as wide as is practical on most farms in this area. However, one farmer visited had removed the terraces when he converted to no-till planting.

Economic Conditions: Farm profitability is largely determined by the international soybean market. In the past wheat provided an additional good source of income, but removal of government support has made wheat a marginal income producer in recent years and wheat acreage has declined. Planting corn is viewed as diversification to better control weeds and diseases and to reduce risk. Brisk farm equipment sales in 1994 when wheat income was down indicate that soybean and corn income are the important determinants to equipment sales.

A comparison of direct planting (no-till) and conventional planting costs is presented in Table XVII. Cost savings per acre from direct planting are $11.20 for corn, $7.14 for wheat and $6.84 for soybean.

Table XVII - Production Costs Per Acre Conventional and Direct Planting Soybean, Corn and Wheat, High Plains North, Rio Grande do Sul

	Soybean		Corn		Wheat	
ITEM	Conv.	Direct	Conv.	Direct	Conv.	Direct
	---$ Per Acre---					
Seed	10.49	10.49	16.19	16.19	17.61	17.61
Fertilizer	23.14	23.14	39.09	39.09	34.85	34.85
Pesticides [a]	12.50	18.91	14.45	17.48	11.34	12.02
Fuel & Oil	11.56	6.58	11.00	6.45	9.14	5.99
Repairs	12.21	10.33	12.62	11.18	10.16	9.34
Labor	12.79.	12.71	11.75	11.02	10.97	11.90
Other [b]	3.34	3.34	3.54	3.54	3.67	3.67
Total Direct	86.03	85.50	108.64	104.95	97.74	95.28
Fixed Machinery [c]	29.35	23.04	31.81	24.48	25.57	20.89

(a) Herbicide, Insecticide and Fungicide
(b) Transport of inputs, drying
(c) Depreciation and interest on investment

Source: EMBRAPA (national center for wheat research) Passo Fundo, Rio Grande do Sul

Direct planting is likely to give better crop yields over time from better soil structure, water infiltration and reduced erosion. However, in the first few years direct plant yields are similar to the conventional system. Return above direct costs under direct planting soybean, corn and wheat are summarized in Table XVIII.

Table XVIII - Returns Above Direct Costs Per Acre for Soybean, Corn and Wheat - Direct Planting, High Plains North of Rio Grande do Sul

	Soybean	Corn	Wheat
Yield (bu./acre)	35.60	63.60	35.60
Price ($/bu.)	4.58	2.54	3.17
Gross Return	$163.09	$161.59	$112.93
Direct Cost	85.50	104.95	95.27
Return above D. Cost	$ 77.59	$ 56.64	$ 17.67

Source: EMBRAPA (national center for wheat research) Passo Fundo, Rio Grande do Sul

The reason soybean is the preferred crop is evident from the return shown in Table XVIII. Although the wheat enterprise yields a positive return over direct costs it does not cover fixed machinery costs. However, the alternatives for the winter period are not attractive either. One is to incur the cost of establishing a cover crop, such as black oats. A second is leaving the land idle, subjecting it to soil losses from erosion. Winter grazing of cattle has proven to be a profitable alternative for some producers.

Soybean-Wheat, West Paraná: Farm production systems in western Paraná are similar to the high plain north of Rio Grande do Sul. West Paraná is a relatively new agricultural area, having developed over the last 40 years. State agricultural development was first led by coffee in the north, but severe freezes in 1975 and 1994 have diminished the importance of the crop. Large land areas were converted from forest or grazing to soybean production in the 1960s and 1970s. After the 1975 freeze some coffee land was also converted to soybean and wheat production.

The area has well-developed input and production markets. Forty-two percent of farmers are associated with cooperatives, the highest percentage in Brazil. The co-ops are large and are engaged in product marketing and processing, input supply and technical assistance to producers. Major market centers include Ponta Grossa, Campo Mourão, Cascavel, and Guarapuava. Market centers in north Paraná include Londrina and Maringá.

The most level land tends to be in the hands of large farm owners. Even in these locales the land is farmed on the contour and many hillsides have been terraced or ridged. The ridges were constructed during the 1980s to help solve a serious soil erosion problem.

The soil is acid, with a pH of 4.0 to 4.5, and red due to high iron oxide content. Topsoil is typically very deep, but some areas of shallow soil are found near Ponta Grossa. Soil texture ranges from sands to clay, but high-percentage clay soils predominate.

Most of the land is occupied by small farms. There are, however, 1,140 farms in west and 845 in north Paraná with over 494 acres (Appendix B - Table B2).

Production Practices: Although the small farms are diversified, most large farms are organized around soybean and corn summer production and wheat in the winter. Most livestock are produced on small farms although large, specialized dairy, hog and poultry farms also exist.

Farmers own about 70 percent of the land they operate. Cropland values average $1,500 per acre. The common rental rate is 5 to 6 bags (60 kg or 132 lbs) of soybean per hectare (2.47 acres) or about $24 per acre (Los).

Farmers are able to produce two crops a year, a common rotation is as follows:

Year	Summer	Winter
1	Corn	Wheat for harvest
2	Soybean	Oat cover crop
3	Soybean	Oat cover crop

Staggering this rotation among fields results in two-thirds soybean and one-third corn in the summer and one-third wheat and two-thirds cover crop in the winter. A practice increasing in popularity is to plant a second corn crop after the first corn harvest in the fall as an alternative to wheat. Planting, harvest periods and average yields are summarized in Table XIX.

Table XIX - Summary of Crop Production on Large Farms, West Paraná, Brazil.

Crops	Seeding Date	Harvest Date	Average Yield/A	Potential Yield/A
Summer				
Corn	Sept 1 - Oct 20	February-March	64 bu	100 bu.
Soybean	Oct 10 - Nov 30	April-May 15	32.9 bu.	44.6 bu.
Dry Edible	Nov 20 - Dec 30	March	11.6 cwt.	22.3 cwt.
Winter				
Wheat	May 15 - June 15	Oct - Nov 15	30.3 bu.	37.1 bu.
Dry Beans (2nd Crop)	February	May	9.3 cwt.	17.8 cwt.

Source: Carleto Jacob Los, Technical Coordinator, ABC Fundacão Costro, Paraná

Machinery Use: Direct planting (no-till) in Brazil had its origins in Paraná, according to Manoel Pereira, president of the Brazilian Direct Plant Association. An estimated 2,500,000 acres or one-fifth of the cultivated land in Paraná is planted directly into previous crop residues. The percentage is higher among the larger farms. In certain areas direct planting is used almost exclusively. An area of 740,000 acres around Ponta Grossa served by the ABC Cooperative association is 95 percent direct planted (Los). An area of 1,950,000 acres around Campo Maurao served by the COAMO Cooperative has 65 percent of soybean, 40 percent of wheat and 20 percent of corn direct planted (Ostrowski).

The sequence of field operations is essentially the same as in the High Plains North of Rio Grande do Sul **(See Table XV)**. Tractor and equipment size are also similar to Rio Grande do Sul. The slope of the land and the use of ridges to control soil erosion limits the size of equipment. In areas where

direct planting dominates, the ridges either were never constructed or have been removed. Direct planting is done on the contour. Crop spraying is done up and down the slopes perpendicular to terraces.

Two large farms near Ponta Grossa using direct planting were interviewed to obtain information on cropping systems, machinery use and employment practices. The data are summarized in Table XX.

Table XX - Farm Size, Cropping System, Equipment and Employees, Large Direct Plant Farms, Paraná, Brazil

Item	Unit	Farm #1		Farm #2	
Total Land	Acres	4,900		5,680	
Cultivated	Acres	3,458		4,490	
Soybean	Acres	2,306		3,211	
Corn	Acres	1,152		1,729	
Wheat	Acres	1,152		1,087	
Oats & Rye	Acres	0		395	
Cattle		400		0	
Tractors	100 - 140 hp	4		4	
Equipment		No.	Width	No.	Width
Soybean-Corn Planter		3	11.7'	6	9.2'
Sprayer		3	36'	4	46' to 69' [a]
Comaine		4	12'	8	13'
Flail Shredder		1	8.2'	1	8.2'
Employees					
Full-Time		12		8	
Part-Time		2		3	
Monthly Wage [b]		$200		$190 - 227 [c]	

(a) One sprayer is a vortex (air stream to drive spray to the ground)
(b) For tractor drivers, supervisory personal receives higher wages
(c) No food or housing

Land not producing wheat, oats or rye during the winter is in cover crops. These farmers used a variety of cover crops including black oats, peas, triticale and rye. One farm applied lime and used a chisel plow to incorporate the lime every few years as needed. The other farmer just applied lime on the soil surface.

The farmers had soybean planting capacity to complete planting in 150 to 170 hours. Both farmers said they were not interested in wider equipment, due to the slope of the land. One said he had some social obligation to hire workers and therefore was not motivated to buy machinery solely to save labor.

Economic Conditions: Profitability of soybean farms is highly dependent on the international oilseed market. Wheat production has declined in the 1990s in Paraná as in Rio Grande do Sul. Because Paraná is located closer to the population centers of Saõ Paulo and Rio de Janeiro, wheat prices are higher there than in Rio Grande do Sul. For example, in October 1995 wheat was selling for $3.48 per bushel in western Paraná and only $3.21 per bushel in northern Rio Grande do Sul. The October 1994 price of soybean in northern Rio Grande do Sul and in western Paraná on the other hand were nearly identical at $4.33 per bu. and $4.36 per bu. respectively (Safras & Mercado).

Besides the two farms summarized in Table XX, visits were made to several other large farms. Although the managers did not describe their financial condition, the farms appeared prosperous. Their line of equipment ranged from some new purchases to items 8-10 years old. They had plans to replace older equipment and all machinery looked to be in good repair. Soybean farms in Brazil have always been dealing with the international market, so, unlike rice and wheat farmers, they are not facing a changing economic situation.

Soybean, Center-West: The center-west soybean area covers a large region including Mato Grosso, Mato Grosso do Sul and Goiás. The area, in spite of its size, is homogeneous in topography, climate, native vegetation, farming history, structure and practice. The area is a flat, acid savanna with a four to six-month dry season. Native vegetation ranges from pure grasslands to shrub vegetation, to a closed tree canopy along streams. Farming, led by soybean, has been introduced in most of the region in the last 15 to 20 years and is dominated by units with over 2,000 acres. Not all the area suitable for development has been exploited. Farms are often separated by large areas of undeveloped land. Land clearing has slowed because subsidized credit for this purpose has been withdrawn (Veloso).

The cultivated soils are mostly latosols, which account for 46% of the region. These soils have slopes ranging from 0-8%, and have high porosity with high water infiltration rates. The soils are chemically poor, being acid with high aluminum saturation down the profile. Organic matter averages 2.5 to 3.0% and phosphate levels are extremely low (Nasser, Resck and Charchar).

The authors obtained farm level information from a visit to EMBRAPA/CPAC (Brazilian Corporation for Agriculture Research/ Savannas Agricultural Research Center) at Planaltina, District Federal and a farm visit in the area (Veloso).

The relatively level land and predominance of large farms makes this area most suited for large capacity machinery manufactured in the Northern Plains. Although labor is still inexpensive, there is less competent labor available because of the sparse population density.

Cities are farther apart, so implement dealers, input and product markets are not uniformly available to farmers in this area. Some farms are as much as 125 miles from a city.

Land costs consist of land acquisition and land development. Cost of unimproved land is very low, averaging $40 to $80 per acre. The cost of clearing, liming, fertilizing and incorporation of lime and fertilizer costs $600 to $800 per acre. Normally it takes 2 to 3 years to get the soil into a highly productive

condition. The cost includes installation of an irrigation system to produce dry season crops (usually dry edible beans) on a portion (commonly 20%) of the land.

Development of the land in many cases has been with government- furnished financing of up to 70 percent. Many farms have too much debt to weather the fluctuations in the soybean market.

Clearing land with trees sometimes can be financed by selling the charcoal made from the trees. Other land has been acquired at a low cost by purchasing already cleared land at a fraction of the original cost of purchase and clearing. A significant portion of the land is owned by wealthy farmers and investors from Rio Grande do Sul and Panará. These owners often have access to additional debt financing. In summary, although the financial situation on some savannna farms is precarious, others are in a strong financial situation.

Only a small part of the land is rented. Rental rates depend on distance from market and land quality, but are normally 3-4 130 lb. sacks of soybean per hectare, or about $14 per acre.

Production Practices: Soybean is the crop that opened the savanna to large scale production. Many farmers produce only soybean. However, diversification with corn on a third to a fourth of land has become common. Dryland rice followed by improved pasture using andropogon, an african grass, is another farming system that has been profitable when beef prices are high, as they currently are in Brazil.

The sequence of field operations and equipment for soybean conventional tillage are as follows:

Operation	Times	Typical Implement Width
Disk Plow	1	4'
Disk Harrow	1-3	10-13'
Leveler Harrow	1-2	----
Plant	1	9.8' - 13.1'
Spray	2-3	33' - 53'
Harvest	1	13'

Sometimes a chisel plow is used to break up a hard pan condition. The same operations are involved for corn production, except an application of nitrogen fertilizer is added after the corn has emerged. Some farmers are adopting no-till technology. About 15 percent of the crops are direct planted in the area around Brazilia (Veloss). The practice is being adopted in other west-central areas also but no firm estimate of percentage was obtained.

Machinery Use: Some larger equipment is found in this region, including imported Caterpillar Challengers and air seeders. Some large farms use hitches behind a large tractor to pull up to three 9.8 to 13.1 foot planters.

A large commercial farm was visited for an example of the farming practices and machinery used (Peg). The farm was purchased in 1984 from a party that had already cleared the land to graze horses. Nearly three metric tons of lime was applied to bring the pH up from 4.6-4.8 to 5.8-6.2. The lime cost was $20/ton applied. Also, 80 pounds of phosphate and 80 pounds of potash per acre were applied. Soybean yield the first year averaged 32 bu./acre. Yields declined to an average of 28.5 bu./acre for the next two years before stabilizing at a higher level. Average yield over the last ten years has been 37.7 bu./acre. From 0 to 2 applications of herbicides are used and 60 % of the fields are treated with insecticide.

In 1989 corn production was started. The average yield the first year was 71 bu./acre. In 1994 the average corn yield was 95 bu./acre. To achieve this yield, 356 lbs of 5-20-20 fertilizer plus 175 lbs. of urea per acre are applied 26 days after emergence.

The farm has 5,829 acres under cultivation. Besides soybean and corn on dryland, two center pivots are used to irrigate 514 acres of dry edible beans and wheat in the winter. Irrigated dry beans yield 42 cwt./acre and irrigated wheat yields 83 bu./acre. Much of the production is cleaned and bagged to be sold as seed.

The farm has gone entirely to direct planting. The machinery complement consisted of three 148 horsepower tractors, two 86 horsepower tractors and three trucks. Other equipment included two 85 foot sprayers, seven combines, seven 9.8 foot soybean planters and 4 - 9.8 to 16.4 foot corn planters.

The soybean planters are able to plant the crop in approximately 145 hours. All mechanical repairs are done in the farm shop. Technical personnel are hired for some jobs.

The farm employs 13 people plus some seasonal labor. The 13 people have responsibilities as follows: two managers (one is a part-time consultant), one secretary, one mechanic and nine tractor drivers. Tractor drives are paid $300 per month.

Economic Conditions: Because of distance from markets, average prices realized on the farm are lower in west central Brazil than in the southern states. Input costs are also higher. However, this is reflected in the lower land values. The key to profitability is land acquired and improved at a low cost. Soybean yields on land that has been properly prepared are as good as in Rio Grande do Sul and Paraná. The opportunity to lower production costs by farming on a large scale exists and is being exploited. With a stable economy and more open markets there appears to be an opportunity for sales of high technology, high capacity farm machinery in this region.

CALCULATION OF POTENTIAL MARKET SIZE BY AREA

The data in the previous sections can be used by farm equipment manufactures to estimate the potential size of the market for the Brazilian farming areas described. The procedure would be similar among machine types. Air seeders for soybean are used to illustrate. Market potential evaluation involves the following steps:

1. Specification of the acres to be seeded by equipment of various sizes. The data in Table V gives acres planted to soybean on medium and large farms by state in Brazil.

2. Determination of the average size and field capacity of machines to be sold to farms in each area and farm size category. Because of their experience with large size machinery, Northern Plains manufacturers would want to sell the largest machinery practical in an area. Because of topographical considerations 17.5 feet (12 rows of 17.5 inches) is judged to be the practical size limit in south Brazil (see discussion on page 23). It is assumed that 23 feet (16 rows of 17.5 inches) would be the average sales to large farmers in the center-west area. Smaller sized units are assumed for sale to medium sized farms in each area (See Table XXI).

Field capacity, acres per hour, is calculated with the following formula:

acres/hour = (Speed in mph)(width in ft.)(field efficiency)/8.25

The field capacities presented in Table XXI assume a travel speed of 6.5 miles per hour and a field efficiency of .8.

3. Determination of the acres planted per machine. The number of hours available for planting soybean times the field capacity of the machine gives the acres planted by a machine in a season.

   The best guide to the field time available is the time needed by farmers using their present planting equipment. The six farmers interviewed in Rio Grande do Sul and Paraná had equipment to plant their soybean in 80 to 170 hours. The midpoint in this range, 125 hours, is assumed. Because of less days lost due to wet fields, 145 hours of planting is assumed in the central-west area.

4. Dividing the soybean acres to be planted in an area by the acres planted per machine gives the total number of units needed for the farm size group in the area.

5. The annual sales potential is determined by multiplying the number of machines needed by the replacement rate. The rate used is 12.5 percent or once in eight years. Assuming a wear out life of 1,200 hours and 145 hours use per year gives an eight-year life.

6. Estimate sales at various levels of market penetration. A 10 to 20 percent market penetration rate is used for illustrative purposes.

The estimated market potential of air seeders for soybean in south and west-central Brazil on large and medium sized farms is summarized in Table XXI.

Table XXI. Estimated Market Potential of Air seeders for Soybean in South and West-Central Brazil on Large and Medium Sized Farms.

		Rio Grande do Sul		Paraná		Center-West	
	Unit	Large (a)	Medium (b)	Large (a)	Medium (b)	Large (a)	Medium(b)
Planted Acres	(1,000)	1,016	1,171	610	865	4,473	2,033
Machine Width	ft	17.5	11.7	17.5	11.7	23.3	17.5
Field Capacity	acres/hr	11	7.4	11	7.4	14.7	11
Planting Period	hrs./yr	125	125	125	125	145	145
Machine Capacity	acres/yr	1,375	925	1,375	925	2,131	1,595
Units Needed	number	738	1,266	444	935	2,099	1,275
Replacement Rate	%	12.5	12.5	12.5	12.5	12.5	12.5
Annual Sale Potential	number	92	158	55	117	262	159
10% Penetration	number	9	16	6	12	26	16
20% Penetration	number	18	32	11	23	52	32

a) Farms with more than 1,235 cultivated acres
b) Farms with 494 to 1,235 cultivated acres

The market potential analysis as illustrated in Table XXI is a necessary starting point in deciding to pursue sales to a foreign country. The domestic competition and costs of exporting are other factors discussed in the subsequent section of this report.

THE FARM MACHINERY INDUSTRY

Brazilian Manufacturers

It is safe to estimate that well over 100 Brazilian firms are involved with the production of agricultural machinery. The magazine *Tratores e Maquinas Agricolas* listed 345 firms in Brazil in 1992, although many of these appear to only produce steel parts used in farm machinery. The association of farm machinery manufacturers in Rio Grande do Sul (SIMERS) currently has 78 member firms (Penteado). At least seven Brazilian companies currently produce wheel tractors (Anfavea, Table XXII). At least three Brazilian firms are producing self-propelled harvesters (Table XXII). Another 18 manufacturers of planters, tillage equipment, sprayers, and augers were identified in interviews or by National Association of Automobile Manufacturers (ANFAVEA). Sixty-five percent of the manufacturing plants are located in Rio Grande do Sul (Penteado). Most of the other manufacturing plants are in the state of São Paulo, although several are located in Paraná.

Table XXII - Sales of Domestically Produced Tractors and Combines

Tractors Manufacturer	Units Sold[a]	Market Share[a]
Iochpe-Maxion	9,669	45.2%
Valmet	5,494	25.7%
Ford	3,674	17.2%
Agrale	1,717	8.0%
CBT	419	2.0%
Yanmar	324	1.5%
Muller	101	0.5%
Combine Manufacturer	Units Sold[b]	Market Share[b]
SLC[c]	967	39.6%
Iochpe-Maxion	885	36.2%
New Holland	593	24.3%

a Tractor data for 1993
b Combine data for 1992
c SLC is affiliated with Deere & Co.

Brazilian tractor and harvester manufacturers include a few names that are well known in the United States, although these manufacturers only dominate the harvester market. In 1993 Ford/New Holland produced 17 percent of the tractors and 37 percent of the combines sold in Brazil (Ferraz de Mesquita,

Tejon Megido). The Massey Ferguson name appears on many of the tractors and combines produced by IOCHPE-MAXION, which purchased Brazil's Massey Ferguson subsidiary in 1984, but now is completely independent. In 1993 IOCHPE-MAXION produced 45% of the tractors and 29% of the combines sold in Brazil (Ferraz de Mesquita, Tejon Megido). J.I. Case sold a total of 1,273 tractors in Brazil from 1978 to 1986 (Ferraz de Mesquita) but has a negligible presence today (Case's construction equipment subsidiary is much stronger). The John Deere trademark generally does not appear in Brazil, but Deere and Co. own 20% of the Brazilian company SLC, which sells machinery with the same green and yellow paint as John Deere, and sells in other South American countries under the John Deere trademark. In 1993 SLC produced 34% of the combines sold in Brazil (Tejon Megido). The other important tractor manufacturers in Brazil are Valmet (26% of 1993 sales), and Agrale (8% of 1993 sales), according to Ferraz de Mesquita.

With the exception of SLC, none of the tractor and harvester manufacturers appear to be active in the market for planters, tillage equipment, sprayers, and augers. A few of the Brazilian manufacturers have dominant positions in one of these markets. Semeato leads the planter market. Other planter manufacturers include SLC, Marchesan, Baldan, Lavrale, Imasa, Frankauser, Jumil, Menegaz, and Maschietto. Jacto and Berthoud dominate the sprayer market. No company clearly dominates the national market for tillage equipment, although Marchesan (Tatu), Baldan, and Jan equipment are common.

Production facilities for Maxion, Semeato, Busa, and Moraes were viewed by either Roger Johnson or Mark Krause during their travels. Maxion a very large and technically advanced production facility, and employs 6,767 workers. In 1993, Maxion sold 9,669 tractors and 949 combines (Iochpe-Maxion Fiscal Year 1993 Annual Report). In the first nine months of 1994, Maxion sold 13,599 tractors (Ferraz de Mesquita). Busa and Moraes have small production facilities, appearing to employ about 60 and 20 workers, respectively. Semeato employs 2,100 workers at its primary facility in Passo Fundo. In 1993, Semeato sold 9,000 planters, although 20% of these were on a waiting list. Between 5 and 15 percent of machine components in Semeato equipment are imported, including tires, chains, bearings, and hydraulic parts. Semeato's component suppliers are mostly in Germany, Italy, China, and Czechoslovakia (Montagner).

Brazilian manufacturers export farm machinery all over the world. Exports of tractors, combines, and motorized tillers have exceeded imports of these items in every year since 1979 (ANFAVEA). [1] The primary destinations for Brazilian farm machinery exports are other South and Central American countries, especially Argentina, Uruguay, Mexico, and Chile. In 1993, the US imported about $28 million of farm machinery from Brazil while exporting $24.3 million of farm machinery to Brazil.

Active Brazilian farm machinery exporters to the United States include Baldan (São Paulo), which manufactures harrows, plows, and planters; Machinas Agricolas Jacto (São Paulo), which manufactures agricultural sprayers (Wiening, Sept 15., 1994), and Iochpe-Maxion, which sells small garden tractors in the U.S. (Tejon Megido).

Technology

During the 1970s and 1980s Brazil greatly restricted imports of farm machinery, except in years when demand greatly exceeded domestic supply. According to Ayrton Haynal, former president of the SINDIMAQ association of machinery manufacturers, the import restrictions encouraged Brazilian manufacturers to ignore technological developments in farm machinery elsewhere. However, several manufacturers have recently introduced new technological innovations that they have been developing for many years. For example, JUMIL recently introduced an air-seeder planter that they have been developing in collaboration with Professor Balastreire at the University of São Paulo in Piracicaba during the past 10 years (Balastreire). Semeato also is developing an air-seeder planter together with the German company Becker (Montagner).

Industry contacts Martin Jayo and Luiz Ferraz de Mesquita, characterize technological innovation as being actively pursued by a few firms (e.g. Maxion, Valmet, SLC, Semeato) and largely ignored by the majority. However, Krause observed the small Moraes operation using Danish S-tines on cultivators that look just like American versions, and self-lubricating metal sleeves for oscillating joints (both parts imported from Argentina). This seems to indicate that a number of smaller manufacturers are also incorporating technological innovations in their products.

Much of the machinery found on farms appears to be quite old. Jayo showed a report indicating that the average age of tractors in Brazil is 12 years. However, Iochpe-Maxion estimates that the average age of small tractors (up to 65 HP) is 15-18 years (Tejon Megido). The amount of agricultural machinery in use is also low by U.S. standards. Statistics published by ANFAVEA for 1990 indicate that there are about 516,000 tractors operating in Brazil for 48 million cultivated hectares, or 92.4 cultivated hectares per tractor. In contrast, the U.S. had 4,749,000 tractors operating for 188 million hectares, or 39.6 cultivated hectares per tractor. Less mechanization in Brazil than the U.S. is due to the large proportion of land farmed by small farms still using animal power and hand labor.

There were conflicting reports as to whether Brazilian farmers appreciate and are willing to pay for new technology. Haynal stated that Brazilian farmers do not understand their equipment to nearly the same degree as American farmers, partly because Brazilian farmers typically do not operate their equipment. Ferraz de Mesquita disagreed, citing the example of SLC, which has the highest market share for combines despite having the most expensive equipment. Similarly, Semeato dominates the planter market despite having the highest prices (Montager). Ferraz de Mesquita argues that high-technology machinery can be sold to Brazilian farmers provided that it is well marketed.

Dealers

Farmers are served by a network of competing machinery dealers similar to the United States. In southern Brazil, there often are several dealers in each farming community, and average distances to service locations are about 10 miles. In center-west Brazil, farms are much more widely scattered, and distances from a machinery service location may be more than 125 miles. Dealers normally handle only one brand of tractor and combine, but usually sell several brands of other equipment. Semeato has 1,100 dealers in Brazil. Ford/New Holland advertises more than 200 dealers in Brazil. Iochpe-Maxion has 140 dealers. Many of the dealers sell in more than one location. For example, the 140 Iochpe-Maxion dealers sell tractors in about 300 locations (Tejon Megido).

The large cooperatives also sell farm equipment, but normally do not sell tractors or combines. A dealer visited in Campo Morão, Paraná did not handle tillage and spray equipment because he could not compete with the local COAMO cooperative.

Machinery dealers in Carazinho and Pelotas, Rio Grande do Sul, Ponta Grossa, Parana, and Uberaba, Minas Gerais were interviewed. All but one of the dealers in Uberaba were major dealers in their cities and handled a long line of equipment, including tractors, planters, tillage equipment, and sprayers. Two also sold combines. Characteristics of three dealers are presented in Table XXIII.

Table XXIII - Characteristics of Three Farm Machinery Dealerships in South Brazil

Item	Unit	Dealer #1	Dealer #2	Dealer #3
Headquarters		Carazinho, RS	Pelotas, RS	Ponta Grossa, PA
Store Locations	No.	5	1	4
Tractor Brand		Massey-Ferguson	Agrale	Valmet
Combine Brand		Massey-Ferguson	None	SLC (a)
Annual Sales	$1,000	20,000	1,500	10,000
Tractors	No.	140	29	200
Combines	No.	36	(b)	25
Planters	No.	200	120	95
Tillage Equipment	No.	400	280	NR
Employment				
Sales	No.	30	9	17
Repair-Assembly	No.	70	21	100
Service Administration	No.	80	12	53
Customers	No.	5,000	NR(c)	3,000
Radius of Service	Miles	60	NR(c)	60-75
Competitors	No.	4	8	4

(a) SLC is 20% owned by John-Deere and sells combines and planters incorporating John-Deere technology
(b) Does not sell combines
(c) No response

Two of the interviewed dealers had multiple locations and between $10 and $20 million of annual sales. All the dealers in southern Brazil were optimistic about sales, which had increased up to 30% in 1994 and were expected to increase as much again in 1995. Recent sales data show the 1995 increase has not occurred (Correa). The dealers employed a labor force ranging from 42 to 180.

All of the interviewed dealers sell parts, provide repairs, and provide technical training on machine use and maintenance. Two of the dealers in Uberaba indicated that technical training was responsible for a major portion of staff and operating costs. Both new and used machinery are handled, but used equipment makes up a small portion of dealer business. None of the dealers reported renting any equipment. Dealers keep a large inventory of parts. One indicated having in excess of $2 million of parts inventory. Dealers said that they could obtain parts from factories in the same state within 24-48 hours, although a normal order would take eight to ten days. The dealers in Uberaba estimated that three to five days are required to get parts from factories in Rio Grande do Sul.

According to Montager at Semeato, only 10 percent of dealers carry a stock of machines. Dealers purchase machinery directly from the factory and transport it by truck. Semeato estimates that transportation costs average 3% of price in southern Brazil and 10-12% in west-central Brazil. Price lists for two of the dealers are presented in Appendix G. Sales tax is about 10-11% and is included in the list price. The dealer mark-up ranges between 15% and 25%. Most of the dealers said they generally discount from the list price. One dealer said that discounts from list price average 10%. Another said that discounts average 8-9%. However, dealers in Uberaba indicated that they normally sell near the list price.

All of the dealers in southern Brazil indicated that financing by the government agency, FINAME, was critical to sales volume. One dealer indicated that 70% of his sales had FINAME financing. Another dealer said all sales of large items had FINAME financing. However, one of the Uberaba dealers stated that credit was not a major constraint. He suggested that 60-70% of the farmers in west-central Brazil have sufficient retained earnings to finance machinery purchases.

Importance of Durability and Rapid Provision of Spare Parts

With the exception of some rickety old planters, all of the machinery appeared to be constructed with similar weights of steel to those found on the most durable of American farm equipment. This is consistent with the emphasis placed on machinery durability by nearly all the persons interviewed. The interviewees identified three primary factors that motivate farmers to choose machinery with a reputation for durability: (1) the frequently long distances and poor transportation networks between farmers or machinery dealers and the manufacturers, (2) operation of equipment by poorly trained hired workers, and (3) poor reliability of Eastern European and some U.S. equipment imported during the 1960s.

About 60% of Brazil's farm machinery is produced in the southernmost state of Rio Grande do Sul, which means that many farmers in the center-west or cerrado region are at least a couple of days' travel away from the manufacturers of their equipment. Unlike the U.S., the operators of farm equipment typically are not the owners, but hired workers who are less careful with equipment. Two other reasons to buy durable equipment are apparent: (4) the typical heavy clay soils in many regions, and (5) the uncertain availability of retained earnings or borrowed capital with which to replace broken or worn-out equipment.

Paz stated that getting spare parts from American manufacturers would take too long. During planting or harvesting, farmers need spare parts within a day. Honorato Santos de Moraes was present at this interview and stated that Linck can get spare parts from the U.S. within 48 hours. However, Oliveira and Tubben doubted that this was possible in most cases. They thought this could only happen through an air courier service, which is restricted to less than $500 in value and has to be for a person, not a company. Getting air freight in São Paulo takes no less than three days if everything is perfect. Normally it takes about 10 days to get spare parts through air freight, and the service is getting worse because the airports are not prepared for the large volumes of air freight that are currently arriving in Brazil. In addition, there always is the possibility of strikes. In September 1994 there was a airport strike, and one company claimed a 13 percent loss of air freight that was held up by the strike (lost or stolen). In contrast, Paz said his Rio Grande do Sul farmers could get parts from most Brazilian manufacturers within eight hours.

Importance of Financing for Farm Sales

The availability of debt financing for machinery purchases was cited by most of the persons interviewed as being one of the most important factors determining levels of farm machinery sales. Oliveira claimed to have 30 farmers waiting for the financing to buy cotton harvesters that he is importing from CASE-IH. Several of the interviewees explained the high level of machinery sales in the states of Matto Grosso and Goiás relative to other states by the availability of government (FINAME) financing for up to 90 percent of the cost in the frontier regions, versus a maximum of 70 percent financing in São Paulo state. Private bank financing for agricultural machinery purchases appears to be both unavailable and too expensive. The director for the Porto Alegre branch of Bank of Boston stated that 80 percent of their

commercial loans are for manufacturing, and retailing is their second biggest target. The Bank of Boston only recently started loans for agricultural businesses, and these are primarily processing and input suppliers. Agriculture generally is viewed by the Bank of Boston as being too risky, although they now consider agricultural loans if the applicant's financial statements are strong (Filho).

Brazilian private banks have more of a presence in the interior of Brazil than the American banks, and a few of them are more agriculturally oriented than others. Oliveira mentioned Itamarati and Bamerindus as banks that are owned by farmers and which are more willing to make agricultural loans. He also said that Banco do Brasil is interested but not well informed about machinery imports. However, even if credit is available, Paz indicated that the private banks' annual interest rate for agricultural loans is the taxa referencial de juros (TR) index plus 11 percent, which currently (based on the TR for August 1994) is about 13 percent, but as recently as June 1994 was 58 percent (Conjunctura Economia). According to Lopes, the most common agricultural interest rate in the 1994-95 agricultural season is the TR plus 22 percent. In contrast, annual interest rates for most agricultural loans from FINAME were 12% in Rio Grande do Sul in October, 1994 (Giacobo).

Machinery Desires Expressed by Agronomists and Farmers

Production experts and farmers were asked what equipment needs they had. They expressed a need for the following items:

(1) A pick-up device for dry edible beans. Attachments to the combine exist but do not work satisfactorily. Hand labor is usually required to pull the beans and put them into the combine header.

(2) Improved crop spraying equipment. Excessive chemicals are lost before reaching the intended plant. When going up and down terraces, the sprayer booms bounce up and down too much, allowing the wind to blow some of the chemical away. The trade-off between speed of travel and precision of application needs to be reduced.

(3) More rapid seeding equipment. Air seeders would allow more rapid travel than the gravity systems that are now used. In southern Brazil, implement widths are limited by terrain, so increased travel speed is the best way to increase field capacity.

(4) Equipment to cut and distribute crop residues, especially corn stocks under direct planting technology. Only one brand of flail-type chopper is available. Although farmers said that it performs satisfactorily, there may be room for competition.

Other Remarks Concerning Equipment by Northern Plains Manufacturers

The interviewed agronomists all expressed interest in air seeding technology, particularly if it is well adapted to soybean. Brazilian air seeder planters are either still under development or are not aggressively marketed. However, most of the same persons were concerned about the width of the equipment on the Concord air seeder sales brochures and weight of the tractors. Widths are a problem with irregularly shaped terraces at frequent intervals. Interviewed agronomists in Rio Grande do Sul also were concerned that the weight of tractors required to pull wide planters would lead to soil compaction. They stated that the trend in Brazil is toward lighter equipment, not toward larger, heavier equipment. However, this may be less of a concern in west-central Brazil.

The agricultural sprayers manufactured by AgChem likewise were viewed as being too large for all but a few Brazilian producers. Ayrton Haynal in São Paulo has been working with AgChem. He thinks that AgChem does have potential customers among the owners of sugar mills, who own 40% of the

sugarcane fields, and the largest of the soybean farms. He suggested that these potential customers be flown to the United States to view the AgChem equipment in operation.

The interviewed agronomists and agricultural engineers generally indicated that Brazil has equivalent technology for the tillage equipment and augers that we showed them in sales brochures. However, import-export consultant Ayrton Haynal indicated that two of the leading Brazilian manufacturers of tillage equipment, Baldan and Marchesan, were not much interested in technology. The authors' impression is that engineers from local manufacturers would have to visually inspect and disassemble Brazilian farm machinery in order to determine whether local manufacturers have a technological advantage.

Market Potential for Northern Plains Farm Equipment in Brazil

In general, the interviewed agronomists, agricultural engineers, and machinery dealers are very interested in machinery manufactured in the United States. There appears to be a general perception, largely based on experience with John Deere technology sold by SLC, that U.S. farm machinery has high quality and is reliable. Although many of the interviewed persons praised Brazilian farm equipment technology, the general perception is that American farm equipment probably has more advanced technology.

The primary deficiencies mentioned for machinery manufactured in the United States are:

1) government restrictions on FINAME financing of imported equipment,
2) parts and service availability for imported equipment,
3) adaptation to Brazilian conditions.

There are two approaches to overcoming the first deficiency. The first approach would be for the exporter to provide innovative financing in collaboration with banks operating in Brazil. The farm machinery manufacturers of the Northern Plains states probably are not large enough to absorb the risks of providing credit by themselves, but there probably are a few, financially sound Brazilian banks and several subsidiaries of U.S. banks that would be interested in working with American firms to provide credit to Brazilian farmers. SLC and Ford/New Holland were praised for their financing programs. Importer-exporter Evandro Oliveira stated that the Brazilian-owned banks Itamarati and Bamerindus are the most interested in and knowledgeable about agricultural loans. The Bank of Boston also works with John Deere and Melroe imports into Brazil. FINAME interest rates have usually been government-subsidized, but FINAME financing also has been uncertain and bureaucratic, so there are opportunities to win sales by providing financing.

The second approach to overcoming the FINAME financing restriction is to produce in Brazil in joint-venture partnerships. If approximately 50% of the machine's value comes from local production (the percentage is negotiable), then FINAME will provide the same level of financing as it would provide for a 100% Brazilian manufactured product.

The second deficiency of parts and service availability probably can only be overcome in partnership with Brazilian firms. Some of the machinery dealers and cooperatives may be willing to stock a large parts inventory if the rewards are high enough. Parts inventories also could be provided on credit. The largest cooperatives are considered to be excellent credit risks (Oliveira) and many of the machinery dealers are well-diversified businessmen who may also be excellent credit risks. As long as American manufacturers are willing to provide extensive technical training to Brazilian service technicians, service availability can be achieved for machinery produced in the U.S. or in Brazil with U.S. technology.

Likewise, the adaptation to Brazilian conditions can be achieved in partnership with Brazilian agronomists and agricultural engineers. American farm machinery manufacturers just have to invest the time to listen, experiment, and make changes if necessary.

EXPORTING MACHINERY TO BRAZIL

The Process of Importing

Although Brazil has taken major steps since 1990 to liberalize its import policy, the required procedure for importing into Brazil remains complex. Failure to comply with the regulations may result in fines and costly delays. Any firm that imports goods into Brazil must be registered with the Industry Commerce and Tourism Secretariat (SECEX) of the Ministry of Foreign Trade. It is usually advisable for importers to retain an expediter (*despachante*) who handles the paperwork with SECEX and Brazilian customs, in order to speed the process of obtaining import permits and customs clearance. Both the U.S. Department of Commerce and Linck recommend using an expediter.

The typical import procedure is as follows:

1. Before anything is shipped to Brazil, the importer files an application for an import permit for a specific transaction, together with the foreign supplier's *pro forma* invoice for the product(s) to be imported. The *pro forma* invoice for machinery will include detailed product specifications (Franco). The import license is usually granted within five days. There are plans to grant import licenses automatically via modem, starting in 1995. The importer also arranges for all risks insurance and bank documentary credit (e.g. letter of credit) at this time. The all risks insurance must be purchased from a Brazilian company.

2. Once the import permit has been improved by SECEX, the importer notifies the supplier to ship the product(s) and send all shipping documents and invoices. Shipping documents for machinery include the original and three copies of the bill of lading or airway bill, plus the original and three copies of the packing list. The original and five copies of the invoice must be sent. The exporter also must send a statement, certified by a chamber of commerce or Brazilian consulate, that the prices quoted are those prevailing for goods for export. If the machinery will have any exemption from Brazilian taxes, the shipment must be by Brazilian flag vessel or air transportation.

3. The importer arranges for a Brazilian government-licensed customs broker to clear the goods and pay customs duties and other taxes. Documentation required at this stage includes the receipt of freight payment, receipt of import taxes payment, and the import declaration form.

4. A copy of the import license and the paid customs declaration are then sent to the importer's exchange broker, typically a bank, for closing the foreign exchange transaction and paying the supplier.

Additional information concerning required documents and other import restrictions is provided in the Foreign Commercial Service publication *Marketing in Brazil* (Farris), and updates in the National Trade Data Bank.

Costs of Importing

Agricultural machinery in Brazil generally appear to be somewhat more expensive than equivalent machinery in the United States (See Appendix G). However, freight, import duties, fees, taxes, and dealer margins will more than double the cost of farm machinery produced in the Northern Plains of the U.S. by the time it is delivered to the customer in Brazil. Estimates of the costs of importing provided by Everton Franco of Linck, Karla Terra of the *Jornal do Brasil*, and the U.S. Dept. of Commerce are very consistent. A hypothetical budget based on information provided by these three sources is presented in Table XXIV.

Table XXIV - Estimated Cost of Importing Equipment Into Brazil

Item	Estimated	Cost Range
Price at factory	$10,000	$10,000
Inland freight, packing, and forwarders	100	100
Ocean freight	1,000	900-1,100
All risk insurance	250	100-278
C.I.F. (cost, insurance, freight)	11,350	11,100-11,478
Import duty (20% of c.i.f.)	2,270	2,220-2,296
Merchant marine tax (25% of ocean freight)	250	225-275
Port costs, including warehousing	172	56-285
Sindicate (expediter) fee (2.2% of c.i.f)	250	244-253
Import license and other documentation fees	38	38
Letter of credit fees and interest charges	1,338	833-2,092
IPI (Manufactured Products Tax - 10% on c.i.f. plus import	1,362	1,332-1,377
ICM (value-added tax - 17%-18% on c.i.f. plus duty plus	2,547	2,491-2,777
Transportation within Brazil	587	185-2,087
Delivered cost to dealer	20,164	18,724-22,958
Estimated sale price with 20% dealer margin	24,197	22,469-27,550
Additional ICM tax on dealer margin	1,566	1,329-1,906
Final price to customer	25,763	23,797-29,456

* Everton Franco did not include the IPI tax in his illustration, so it may not apply to agricultural or industrial machinery imports. Without the IPI, the estimated cost to the dealer would be $18,523, with a range of $17,150 to $21,115, and the estimated final price to the customer would be $23,690, with a range of $21,814 to $27,420.

The estimated costs in Table XXIV are for ocean freight to Paranagua, the port in Paraná state that Linck uses. Estimated interest charges are based on 60 days at 4% interest per month. Paranagua has a reputation for being a relatively fast port for receiving shipments. Linck also trucks its equipment only a short distance within Brazil. Everton Franco says that, in principle, Linck can complete the whole process within 30 days. However, delays are common, especially at the largest port of Santos, in São Paulo state. The Department of Commerce bases its estimated interest charges on a 90 day process. The upper range of interest charges in Table XXIV is based on 90 days. The estimated transportation costs within Brazil are 3% of value, with a range of 1% to 10%.

Sea freight costs will vary according to how well the exported product(s) will fit into a standard 40-foot shipping container. Sea freight is sold by volume, not value of contents or weight. Wedgcor

Buildings recently sent a 40-foot container from Jamestown, North Dakota to Santos for $8,700. Northern Plains machinery manufacturers would have a strong incentive to minimize the shipment of high-volume, low-value products, and maximize the shipment of low-volume, high-value products. This also is a reason for exporting machinery components rather than finished machinery. A small step in this direction is to export machinery without wheels or tires unless they fit into remaining small spaces within the shipping container. Wheels and tires could easily be purchased from Brazilian manufacturers and mounted by dealers in Brazil.

Payment Terms for Export Sales

Payment terms are an important issue for U.S. exporters, due to delays between receiving an order and delivering machinery to the customer, exchange rate fluctuations, and risks of non-payment. The most profitable and least risky payment policy for U.S. exporters is cash in advance. However, a cash in advance policy transfers interest costs and risks to Brazilian customers who may prefer to buy from a competing company that offers more favorable payment terms.

A more common payment policy is to require that the customer obtain a letter of credit from a local bank. The letter of credit is an agreement by the bank to pay the exporter a stated sum of money in a specified currency when specified documents are received or at some other specified date.

The specified documents usually include the commercial invoice, bill of lading (proof of delivery), and packing list. Letters of credit may be revocable or irrevocable, and confirmed or unconfirmed. Most export transactions require an irrevocable letter of credit, which means that the bank may not cancel its agreement, whereas a revocable letter of credit may be canceled by the bank.

A confirmed letter of credit requires that the local Brazilian bank obtain a promise by a U.S. (or other exporting country) bank to pay the exporter if the issuing (local) bank is unable to pay. An unconfirmed letter of credit is an agreement solely between the local bank and the customer (with terms specified by the exporter).

Discussions with Brazilian importers and their agents revealed that payment terms are a sensitive issue for Brazilian machinery buyers and dealers. The management of Linck (Melroe's dealer in southern Brazil) expressed frustration with the Melroe Company's policy of requiring confirmed letters of credit from subsidiaries of U.S. banks. The Linck management also objected to Melroe's practice of making another Brazilian bank, Banco Amerindus do Brasil, the consignee (recipient of goods), rather than Linck. The objections were primarily based on the additional cost, paperwork, and delays imposed on them by these requirements.

Linck's management also were frustrated by the fact that their perfect payment record over more than a decade with Melroe and Melroe's parent company, Clark Equipment[2], has not earned them more lenient payment terms. Import/export agent, Evandro Oliveira claimed that Case-IH ruined its chances of successfully competing in the Brazilian cotton harvester market by initially requiring cash in advance.

Letters of credit are a significant source of cost for Brazilian importers. Franco characterized the range of costs for obtaining a letter of credit to be 2-5% of the c.i.f. value, depending on risk fluctuations and whether confirmation is required. Interest costs also are high for export sales to Brazil. The manager of the Bank of Boston branch in Porto Alegre stated that annual interest rates are usually calculated at LIBOR (London Inter-Bank Offer Rate) plus 3%. However, he said that much of this is due to country risk. When exports are guaranteed by the U.S. Overseas Private Investment Corporation (OPIC) or U.S. Export-Import Bank (EXIMBANK), the interest rates can be lowered to LIBOR plus 0.5-1.0%.

Since both U.S. officials and Brazilian businessmen stated that innovative financing plans have helped companies such as SLC and Ford/New Holland gain market share, conservative payment policies

probably reduce the market share of U.S. exporters in Brazil. Oliveira stated that this clearly has been the case for Case-IH. In the case of Melroe, Linck does not appear inclined to sell any alternative skid-steer loader, but since Linck sells 15 other lines of construction machinery (mostly manufactured in Brazil), it may not be allocating as much sales staff and promotion budget to Melroe's equipment as it would if Melroe had a less costly payment policy.

According to the manager of the Bank of Boston branch in Porto Alegre, the analysis of applications for letters of credit follows standard practice for all loan applications. Applications are evaluated according to:

(1) personal reputation and management skill of the applicant,
(2) capitalization of the applicant, as measured by the balance sheet,
(3) profitability and sales volume, as measured by the income statement,
(4) cash flow, as indicated in the cash flow statement, and
(5) collateral.

The Bank of Boston is enthusiastic about granting letters of credit to well-established firms in the larger cities, such as Porto Alegre, Curitiba, and Sáo Paulo. The Bank of Boston generally considers businesses in the interior of Brazil to be weakly capitalized, poorly managed, and poor credit risks. However, the manager of the Porto Alegre branch describes the Bank of Boston as a relatively conservative bank. Approximately 80% of the Porto Alegre branch's loans are to manufacturing firms. Loans to retailing firms are second and loans to agribusiness (primarily food processing) are third. However, the Bank of Boston recently began working with agricultural cooperatives in Parana state. A list of other Brazilian subsidiaries of U.S. banks is presented in Appendix H.

Availability of Assistance for Import/Export

Although the importing process described above is complex and costly, many Brazilian businessmen are anxious to provide assistance. Although it may seem to U.S. firms that too many middlemen want to be involved in the process, each receiving a percentage of the final price, the alternative of trying to avoid middlemen could result in extremely costly delays. Some of the interviewed persons hinted that some port and customs officials may require bribes in order to expedite clearing imports through the port and customs. Several of the interviewed persons also suggested that there is a "Brazilian way" of doing business which minimizes the impact of bureaucratic red tape and government taxes. Brazilian agents also are accustomed to working with extremely high inflation rates, exchange rate risks, and Brazil's unique financial institutions.

The Foreign Commercial Service (FCS) of the U.S. Dept. of Commerce is prepared to find and introduce possible agents for American exporters for a fee. The FCS has offices in São Paulo and Brasilia. The larger office is in São Paulo, but the most knowledgeable person for farm machinery is Marilia Conter, an assistant commercial officer at the American Embassy in Brasilia. Among the services that the U.S. embassy and consulates in Brazil are willing to provide are hotel reservations at preferential rates and translators. However, most Brazilian import agents already speak excellent English and are familiar with American business practices. Marilia Conter also arranges to take American businessmen to Brazilian agricultural and industrial shows or Brazilian businessmen to similar shows in the United States.

The Foreign Commercial Service does not have a lot of information about the farm machinery industry in Brazil other than names of contacts. Providing contacts, arranging trade shows, and writing reports appear to keep its officers very busy. The Foreign Agricultural Service of the U.S. Department of Agriculture can also provide information about Brazilian agriculture and agricultural policies, but has no responsibility for monitoring agricultural machinery. However, many Brazilian import/export agents are very familiar with the farm machinery industry, including Ayrton Haynal in São Paulo and Evandro Oliveira in Riberão Preto.

Investing in Brazil and Possibilities for Joint Ventures

According to the U.S. Department of Commerce, establishment of joint ventures is a common practice in Brazil. Brazilian procurement policies for government agencies and parastatal companies heavily favor local firms, so many joint ventures have been established in order to sell U.S. technology to the Brazilian public sector. Government credit policies (e.g., FINAME) mostly restrict credit to purchases of Brazilian manufactured products. The availability of most manufactured component parts in Brazil and the high cost of importing finished machinery are other incentives for establishing a joint venture in Brazil to manufacture machinery.

Brazil restricts foreign investments in some economic sectors, including petroleum, telecommunications, mining, health care services, and financial services, but not in agricultural machinery. All foreign investment must be registered with the Central Bank Foreign Capital Registration and Supervision office (FIRCE). Failure to register investment can cause difficulties in repatriating earnings from the investments. Profit and dividend remittances are subject to a 15% witholding tax.

Many restrictions on foreign investment have been relaxed since 1991. For example, payment of royalties from a Brazilian subsidiary to a parent company for use of patents and trademarks is now much easier. However, such payments from a branch of a foreign firm and the parent company still are greatly restricted.

In recent years, Brazil has made an effort to bring its intellectual property rights laws in line with international standards, although enforcement of these laws still is lax.

Evaluation of Options for Exports to Brazil

Several options for exporting farm machinery to Brazil have been identified in the discussion above. The primary options include:

(1) export of finished machinery directly to customers in Brazil,
(2) export of finished machinery directly to dealers in Brazil,
(3) export of machinery to a Brazilian partner with minor assembly in Brazil,
(4) export of machinery components to a Brazilian partner, with major assembly in Brazil, and
(5) investment in a production facility in Brazil, export of machinery components to that production facility, and major assembly in Brazil.

Options 1 and 2, the export of finished machinery directly to customers or directly to dealers in Brazil have already been used by Northern Plains farm machinery manufacturers. Concord Manufacturing has sold at least one air seeder to the Topp family, which has a farm in Goias, Brazil as well as near Grace City, North Dakota. Concord Manufacturing also has sold several soil testing units to individuals in Brazil. Haybuster Manufacturing has sold a total of 11 hay and feed grinders to a Brazilian dealer.

The export of finished machinery directly to Brazilian customers appears to have very limited market potential. Only a very few customers are willing to purchase farm machinery that has no technical support or spare parts inventory in Brazil, and it would be very expensive for U.S. companies to provide technical support or spare parts inventories in Brazil without assistance from Brazilian dealers. It also would be difficult for U.S. companies to advertise and promote their products in Brazil without help from Brazilian dealers.

A few Brazilian customers have been attending farm machinery shows in the U.S. U.S. manufacturers could display their machinery at Brazilian farm machinery shows at an estimated annual cost of $20,000-$35,000. [3] Language, knowledge of regional differences in soils and cultural practices, and knowledge of Brazilian laws and regulations all would be constraints. Furthermore, an understanding

of foreign exchange risk, inflation risk, and the many financial instruments available in Brazil to control these risks appears to be both necessary and difficult for foreigners.

The second option of exporting finished machinery to Brazilian dealers would provide a potential market of no more than 100 units per year for each exporter (Krause's estimate). The most important constraints would be the lack of FINAME financing, relatively high cost of completely imported machinery, and the difficulty of stocking spare parts. Another constraint would be the current practice of most Brazilian farm machinery dealers of not keeping an inventory of new machinery. This practice would force the U.S. manufacturer either to maintain a warehoused inventory in Brazil, or else lose sales to farmers who are unwilling or unable to wait 30-90 days for a new shipment from the U.S.

Sales through dealers probably would be restricted to a few niche markets in which farmers are attracted to unique features of the imported machinery and are able to finance most of their purchases using equity capital. However, many Brazilian machinery dealers would be enthusiastic about carrying American farm machinery if it is sufficiently different from Brazilian machinery, durable, and not too difficult to use. The cost of the required inventory of spare parts would be an issue with machinery dealers. Another issue would be the quickness of response to orders for new machines and spare parts. Finally, dealers would expect the manufacturer to actively promote the product with brochures, magazine advertisements, and participation in farm shows, in addition to providing technical training for the dealers' sales and service staff. Promotion and technical training would either require frequent visits by U.S. staff or hiring a permanent staff in Brazil to work with dealers. Annual expenses for the manufacturer would be higher for option two than for option one, but costs per unit sold would probably be much less.

The third option of exporting to a Brazilian partner for minor assembly could result in many more sales than option two if the shipping cost is much lower, if local content is sufficient to obtain FINAME financing (this is doubtful for minor assembly), or if the Brazilian partner is more effective in promotion and technical training than the U.S. manufacturer. Since ocean shipping is sold by volume and duties and taxes are assessed on shipping as well as price in the U.S., it is much cheaper to buy bulky components in Brazil than ship them from the U.S. The associated reduction in cost could make the imported machinery much more competitive in Brazil. Active participation by the Brazilian partner in product promotion, dealer relations, and technical training could have much more impact on sales volume than reductions in cost. Obviously, a dedicated, reliable partner would have to be found for this strategy to work. However, the businessmen interviewed for this study were very professional, resourceful, and resilient. U.S. manufacturers should recognize the challenges that Brazilian businessmen have routinely overcome in purchasing, manufacturing, marketing, and financing in an environment characterized by rapid inflation and frequent, dramatic changes in government policies. Costs and the level of sales under this third option would depend on the success of the partnership.

A combination of the fourth and fifth options of exporting to a Brazilian partner for major assembly and investment in Brazilian manufacturing facilities is the primary strategy that Deere and Co. and Ford/New Holland have pursued in Brazil. Their leadership positions in the Brazilian market for selected farm equipment indicates that this is potentially the most profitable strategy. The primary advantages of working with a Brazilian partner as opposed to investing in one's own facility are the lower cost and securing the Brazilian knowledge of their market.

It appears that there are many high-precision manufacturing facilities already in Brazil, so the quality of the product would not be an issue if a good partner is found. With over 100 farm machinery manufacturers operating in Brazil, there are many potential partners to choose from.

Major advantages for the fourth and fifth options over the third option of minor assembly in Brazil are the greater reduction in shipping cost, more rapid response to orders for new machines and spare parts, and certain availability of FINAME financing. In addition, one may be able to find a manufacturing partner in Brazil that has a well-established dealer network.

Based on discussions with Brazilian farmers, agronomists, and businessmen, it appears that the most profitable options will depend on the uniqueness and superiority of the technology in Northern Plains manufactured machinery. If the U.S. machinery is sufficiently unique that there is a large potential market, then either the third or fourth options would appear to be the most profitable. If the U.S. machinery is not much superior or unique and potential niche markets are small, then the second option would appear to be the most profitable. The choice between options three and four would depend on opportunities for partnership and whether minor assembly in Brazil would qualify for FINAME financing. It appears that the Brazilian market already has too much competition for the option of investing in new production facilities for major assembly to be very profitable. Also, the option of selling directly to customers appears to have little profit potential.

Importance of Timing

One important warning to potential new entrants is that the Brazilian market is very dynamic. Since Brazil's international trade policies began to be liberalized in 1991 and since Brazil's inflation problem began to be controlled in 1994, U.S. and European firms have been aggressively investing and promoting their products in Brazil. An article in the *New York Times* in May 1994 (Brooke) stated that an estimated 300 U.S. businessmen visit São Paulo, Brazil's commercial center, every day. The article also stated that the number of U.S. businessmen using services of the United States Trade Center (U.S. Dept. of Commerce) in São Paulo is four times higher in 1994 than in 1993. Brazilian entrepreneurs also are actively investing and seeking new market niches. The best Brazilian technology is rapidly catching up to technology in the United States. Office and home electronics technology in major Brazilian cities is fully comparable to what we expect to see in the U.S. Therefore, opportunities for new entrants in Brazil's farm machinery market may rapidly diminish due to competition from firms that are already established.

Brazilian businessmen emphasized that successful marketing in Brazil requires a major investment of time to show and demonstrate products, talk to dealers, establish distribution channels, develop brand name recognition, and learn the Brazilian way of doing business. Import agents Oliveira and Haynal described it as a multi-year process. Therefore, if U.S. farm machinery manufacturers are interested in the Brazilian market they need to start showing their product and making contacts now.

The dynamics of the Brazilian market have accelerated in recent months with the completion of the Cardoso anti-inflation plan in July 1994, the inauguration of Fernando Henrique Cardoso as President in January 1995, and the implementation of the MERCOSUL trade union in January 1995. Consumer and business spending have increased rapidly, prompting additional anti-inflation measures by the government. Imports also accelerated, which has taxed the capacity of the ports and airports to handle the additional freight volume. The implementation of MERCOSUL and a policy of supporting the new Brazilian currency, the real, at artificially high levels resulted in a surge of imports from Argentina (Moffet). The sudden devaluation of the Mexican peso in December, 1994 caused some reduction of American investment in Brazil due to apprehension that Brazil may suffer similar financial troubles. However, the Brazilian financial markets have adjusted to all of these events with surprising calm.

There are reasons for U.S. companies to be cautious about investing too much in Brazil. Many of Brazil's largest banks are owned by state governments and have large portfolios of very shaky loans. The new president has faced a lot of resistance from the Brazilian legislature in trying to reform Brazil's constitution and curtail government spending. However, Brazilian businessmen have successfully adapted to severe economic problems before, and appear ready to do it again if necessary. Virtually all the Brazilians interviewed were optimistic about their economic future.

In summary, manufacturing firms that are interested in exporting farm machinery to Brazil need to begin researching the market and establishing a presence in Brazil quickly. Future payoffs will require a substantial investment of time in Brazil to learn about the market and make contacts with possible partners and dealers.

REFERENCES

ANFAVEA (Associacão Nacional dos Fabricantes de Veiculos Automotores). *Anuario Estatistico, 1957/1992.* São Paulo, Brazil: ANFAVEA, 1993.

Balastreire, Dr. Luiz Antonio. 1994. Professor, Departamento de Engenharia Rural, Universidade de São Paulo. Personal Conversation. Piracicaba, São Paulo

Brooke, James. "U.S. Businesses Flocking to Brazilian Ventures." *New York Times*, May 9, 1994, pp. D1,D4.

Bruce, James. "Deere has Room to Run in Growing Brazilian Mart." *Journal of Commerce and Commercial*, Vol 391, No. 27663, February 12, 1992, p. 5A.

Conter, Marilia. 1994. Assistant Commercial Officer, U.S. Embassy. Personal Conversation. Brasilia, Distrito Federal.

Correa, Jorge. "Uma Reviravolta na Venda de Maquinas." *Zero Hora* (Porto Alegre), Campo & Lavoura, May 12, 1995, p. 3.

DESR/ESALQ/USP Departamento de Economia e Sociologia Rural da Escola Superior de Agricultura "Luiz de Queiroz", Universidade de São Paulo. *Preços Agricolas*, No. 103, May 1995.

EMBRAPA/CNPT. 1994. Cost of Production Budgets for Wheat, Soybean, and Corn. Passo Fundo, RS.

Farris, Larry. *Marketing in Brazil.* Washington, D.C.: U.S. Dept. of Commerce, July, 1992.

Ferraz de Mesquita, Luiz. 1994. Regional Marketing Manager. Valmet do Brasil S.A. Personal Conversation. São Paulo, São Paulo.

Filho, Paulo Geraldo de Oliveira. 1994. Director, Bank of Boston, Porto Alegre. Personal Conversation. Porto Alegre, Rio Grande do Sul.

Franco, Everton. 1994. Director of Import and Export Sales, Linck. Personal Conversation. Porto Alegre, Rio Grande do Sul.

Fundacão Instituto Brasileiro de Geografia E Estatística, 1994 Lavantamento Sistematico Da Producão Agricola, Rio de Janeiro.

Giacobo, Luiz Angelo. 1994. Agricultural Engineer, Banco Regional do Extremo Sul (BRDS). Personal Conversation. Porto Alegre, Rio Grande do Sul.

Globo Rural (writer not credited). "Maquinas: Potencia nas Vendas." *Globo Rural*, Vol. 10, No. 109, November, 1994. pp. 91-96.

Haynal, Ayrton. 1994. Director (Owner), ARMTEC (import/export firm), and past President of SINDIMAC (Syndicato das Maquinas). Personal Conversation. São Paulo, São Paulo.

Instituto Brasileiro de Economica. *Conjunctura Economica*, Vol. 48, No. 10, October 1994.

Instituto Brasileiro de Geografica E Estatistica, 1985 Censo Agropecuário, Rio de Janeiro.

Instituto Rio Grandense do Arroz. 1993. Lavoura Arrozeira Gaúcha-Perfil de Systema Productivo. Relatorio Estatistico do Convenue IRGA/UFRGS-IEPE. Porto Alegre, RS.

Instituto Rio Grandense do Arroz. 1994. Cost of Rice Production. Porto, Alegre, Rio Grande do Sul.

International Trade Administration (U.S. Dept. of Commerce). "Brazil: Commercial Overview." Item ID: IT CCG BRAZIL01, National Trade Data Bank. February 1, 1995.

International Trade Administration (U.S. Dept. of Commerce). "Brazil: Marketing U.S. Products and Services." Item ID: IT CCG BRAZIL05, National Trade Data Bank. February 1, 1995.

International Trade Administration (U.S. Dept. of Commerce). "Brazil: Trade and Project Financing." Item ID: IT CCG BRAZIL08, National Trade Data Bank. February 1, 1995.

International Trade Administration (U.S. Dept. of Commerce). "Brazil-Retail Trends." Item ID: IT MAR KET 111089269, National Trade Data Bank. February 1, 1995.

Iribarrem, Ciloter. Oct. 26, 1994. Consultant and Accountant, Personal Conversation. Pelotas, Rio Grande do Sul.

Jayo, Martin. 1994. Graduate Student, Faculdade de Economia e Administracao, Universidade de São Paulo. Personal Conversation. São Paulo, São Paulo.

Kochhann, Rainoldo. Oct. 10, 1994. Soil Scientist, EMBRAPA. Personal Conversation. Passo Fundo, RS.

Lopes, Mauro de Rezende. "TR: O Maior, mas não o Unico Problema." *Agroanalysis*, Vol. 15, No. 6, June 15, 1995, pp. 9-12.

Los, Carleto Jacob. Nov. 21, 1994. Technical Coordinator, Fundacao ABC. Personal Conversation. Castro, Paraná.

Martainz, Diago. Oct. 20, 1994. Consultant and Farmer, Personal Conversation. Carazinho, Rio Grande do Sul.

Moffett, Matt. "Brazil to Allow Real to Slip 12% Against Dollar." *Wall Street Journal*, March 7, 1995. p. A16.

Montagner, Paulo. October 17, 1994. Director Research and Development, Semeato, Personal Conversation. Passo Fundo, Rio Grande do Sul.

Nasser L.C.B., D.V.S. Resck, and M.J.D. Avila Charchar. 1990. "Soil Management, Crop Sequences, and Plant Diseases in the Cerrado Region of Brazil." Proceedings of International Workshop on Conservation Tillage Systems. EMBRAPA/CNPT. Passo Fundo, RS.

Oliveira, Evandro A. L. 1994. Director (Owner), Assimpex Riberao Preto Importacão e Exportacão Ltda. Personal Conversation. Riberao Preto, São Paulo.

Ostrowski, Antoneo Carlos. Nov. 23, 1994. Agronomist for COAMO Cooperative. Personal Conversation. Campo Maurão, Paraná.

Paz, Hugo Eduardo Giudice. 1994. President, Federacao da Agricultura do Estado do Rio Grande do Sul. Personal Conversation. Porto Alegre, Rio Grande do Sul.

Pereira, Manoel. Nov. 18, 1994. President of Brazilian Direct Planting Association. Personal Conversation. Ponta Grossa, Paraná.

Peg, Joel André. Oct. 9, 1994. Consulting Agronomist. Personal Conversation. Planaltina, District Federal.

Penteado, Roberto. October 25, 1994. President of State Farm Equipment Syndicate. Personal Conversation. Pelotas, Rio Grande do Sul.

Portella, José. Oct. 17, 1994. Agricultural engineer. EMBRAPA. Personal Conversation. Passo Fundo, Rio Grande do Sul.

Rigatto, Paulo and Valter Stulp. 1994. Viability Economica de Sistemas de Producão Para Regiões de Várzeas. IEPE/UFRGS. Porto Alegre, Rio Grande do Sul.

Safras & Mercado-Soja. Oct. 17, 1994. 822-XVIII. Safras Ltda. Porto Alegre, RS.

Santos de Moraes, Jose Honorato. 1994. Director General, Linck Equipamentos Rodiaviarios e Industriais. Personal Conversation. Porto Alegre, Rio Grande de Sul.

Tejon Megido, Jose Luiz. "Estudo de Caso: Iochpe-Maxion." Unpublished paper presented at the 4th Annual Seminar of PENSA (Programa de Estudos dos Negocios do Sistema Agroindustrial), Coordinated by Prof. Decio Zylberzstajn. Departamento de Administracao, Universidade de São Paulo.

Terra, Karla. "Simulando a Importacao." *Jornal do Brazil.* November 6, 1994. p. 5. Valenti, De Leon Luis. Nov. 11, 1994.

Tubben, Hans. 1994. Engineer, Industria e Comercio de Maquinas Agricolos Ltda. Personal Conversation, Guara, São Paulo.

Valenti, Luis DeLeon. Nov. 11, 1994. Irrigation and Drainage Specialist. EMATER. Personal Conversation. Porto Alegre, Rio Grande do Sul.

Veloso, Rui. Oct. 8, 1994. Farm Management Economist. Personal Conversation. EMBRAPA Centro de Pesquisa Agropecuária dos Cerrados Planaltina, DF.

Weining, Mary. Industry Desk Officer, International Trade Administration (U.S. Department of Commerce). Personal Communication. September 15, 1994.

World Bank. World Development Report 1994. New York: Oxford University Presss, 1994.

Zero Hora. May 15, 1995. Campo & Lavoura, "Preços ao Productor". Porto Alegre, Rio Grande do Sul.

PERSONS INTERVIEWED BY ROGER JOHNSON

Name	Date	Job Description	Organization& Location
Eduardo Zaffaroni	10-04-94	Agronomy Professor	Universidade Federal de Pelotas Pelotas, Rio Grande do Sul
Paulo Rigatto	10-06-94	Rural Economics Professor	Universidade Federal de Pelotas Pelotas, Rio Grande do Sul
Valter Stulp	10-10-94	Rural Economics Professor	Instituto de Estudos e Pesquisas Economica Porto Alegre, Rio Grande do Sul
Atos Grawunder	10-10-94	Rural Economics Professor	Instituto de Estudos e Pesquisas Economica Porto Alegre, Rio Grande do Sul
Marcus da Rosa Coll	10-11-94	Production Manager	Granjas 4 Irmaos (rice farm) Taim, Rio Grande do Sul
Wagner Quillfeldt	10-13-94	Product Planning Engineer	Iochpe-Maxion (Massey -Fergerson) Canoas, Rio Grande do Sul
Jose A. Portella	10-17-94	Agricultural Engineer	EMBRAPA (national wheat research ctr.) Passo Fundo, Rio Grande do Sul
Paulo Montagner	10-17-94	Director Research, Dev.	Semeato (farm equipment manufacturer) Passo Fundo, Rio Grande do Sul
Rainoldo Kochhann	10-18-94	Soil Scientist	EMBRAPA (national wheat research ctr.) Passo Fundo, Rio Grande do Sul
Rogue Tomasini	10-19-94	Rural Economist	EMBRAPA (national wheat research ctr.) Passo Fundo, Rio Grande do Sul
Ivo Ambrosi	10-19-94	Rural Economist	EMBRAPA (national wheat research ctr.) Passo Fundo, Rio Grande do Sul
Henrique Stedils	10-19-94	Seed Dept. Manager	Santa Ezardo (corporate soybean farm) Passo Fundo, Rio Grande do Sul
Einer Duckeer	10-20-94	Farm Owner-Operator	Soybean and wheat farm Passo Fundo, Rio Grande do Sul
Marves Matiotti	10-20-94	Farm Owner-Operator	Soybean and wheat farm Carazinho, Rio Grande do Sul

Diago G. Martinez	10-20-94	Farm Consultant & Farmer	Private consulting firm Carazinho, Rio Grand do Sul
Valter M. Cruz	10-20-94	Manager Mach. Dealership	Augustin (Massy-Fergerson dealership) Carazinho, Rio Grande do Sul
Jorge Tossmann	10-25-94	Manager of Dealership	Bettin Agricola (machinery dealer) Pelotas, Rio Grande do Sul
Roberto Penteado	10-25-94	President	SIMERS (state farm equipment syndicate) Pelotas & Porto Alegre
Paulo R. Hadler	10-25-94	Rice Farm Owner-Operator	Rice farm and seed processing Pelotas, (rural) Rio Grande do Sul Ciloter
Ciloter Iribarrem	10-26-94	Consultant & Accountant	Safras e Cifras Pelotas, Rio Grande do Sul
Paulo Rodrigeous	10-31-94	Statistician	EMATAR (extension service) Porto Alegre, Rio Grande do Sul
Karl Hampton	11-07-94	Agricultural Counselor	American Embassy Brazilia, Federal District
Marilia Conter	11-07-94	Commercial Council	American Embassy Brazilia, Federal District
Shackford Pitcher	11-07-94	Agricultural Attache	American Embassy Brazilia, District Federal
Rui Veloso	11-08-94	Farm Management Economist	EMBRAPA (agricultural research - savannas) Planaitina, Federal District
Claudie Franz	11-08-94	Agricultural Engineer	EMBRAPA (agricultural research - savannas) Brazilia, Federal District
Joel Andre Peg	11-09-94	Consulting Agronomist	Fazenda Riede (corporate farm) Planaltina, District Federal
Luis Valente	11-11-94	Rice Irrigation Specialist	EMATAR (extension service) Porto Alegre, Rio Grande do Sul
Gastao Pinheiro	11-18-94	Research Economist	OCEPAR (organization of coops in Parana) Curitiba, Parana

Manoel Pereira	11-18-94	Farmer & President	Associacão Brassileira de Plantio Direct Ponta Grossa, Parana
Pedro Gort	11-19-94	Farm Owner-Operator	Independent farmer Ponta Grossa, Parana
Francisco Medeiros	11-21-94	Manager	Comarive (John Deere affiliated dealer) Ponta Grossa, Parana
Jamil Samara	11-21-94	Mach.Dealership Investor	Comarive (John Deere affiliated dealer) Ponta Grossa, Parana
Carlito Jacob Los	11-21-94	Technical Coordinator	Fundacao ABC (technical data center) Castro, Parana
Moacyr Doretto	11-22-94	Economist	IAPAR (agronomic research institute) Londrina, Parana
Augusto De Araiso	11-22-94	Agricultural Engineer	IAPAR (agronomic research institute) Londrina, Parana
Luis Cesar	11-22-94	Economist	EMBRAPA (center for soybean research) Londrina, Parana
Lineu Domit	11-22-94	Agricultural Engineer	EMBRAPA (center for soybean research) Londrina, Parana
Paulo Galerani	11-22-94	Extension Educator	EMBRAPA (center for soybean research) Londrina, Parana
Antonio Ostrowski	11-23-94	Agronomist	COAMO (largest coop in Brazil) Campo Mourao, Parana
Carlita Paulo	11-23-94	Agronomist	COAMO (largest coop in Brazil) Campo Mourao, Parana
Jacquim Montanz	11-23-94	Farmer & Cooperative Dir.	Soybean and wheat farm Campo Mourao, Parana

PERSONS INTERVIEWED BY MARK KRAUSE

Porto Alegre, Estado do Rio Grande do Sul:

Jose Honorato Santos de Moraes	Director General, Linck Equipamentos Rodiaviarios e Industriais
Everton Franco	Director of Import and Export Sales, Linck
Jaco Alles	Sales Coordinator, Linck
Leandro Wengrover	Promotion and Advertising Coordinator, Linck
Hugo Eduardo Giudice Paz	President, Federacao da Agricultura do Estado do Rio Grande do Sul
Pedro Chaves Barcellos Filho	Director-Secretary, Federacao das Associacoes dos Arrozeiros do RGS (FEDERARROZ)
Luiz Antonio de Leon Valente	Agricultural Engineer, Assist. Technia de Irrigacao/Drenagem e Arroz, EMATER-RS, Governo do Estado do Rio Grande do Sul
Aurelino Dutra de Farias	Agricultural Engineer, EMATER-RS, Governo do Estado do Rio Grande do Sul
Luiz Angelo Giacobo	Agricultural Engineer, Banco Regional do Extremo Sul (BRDS)
Paulo Geraldo de Oliveira Filho	Director, Bank of Boston, Porto Alegre

Piracicaba, Estado do São Paulo:

Dr. Pedro Valentim Marques	Professor, Departmento de Economia e Sociologia Rural, Univ. de São Paulo
Dr. Geraldo Sant'Ana de C. Barros	Professor and Head, Departmento de Economia e Sociologia Rural, Univ. de São Paulo
Dr. Marcos Vinicius Folegatti	Professor, Departamento de Engenharia Rural, Univ. de São Paulo
Dr. Luiz Antonio Balastreire	Professor, Departamento de Engenharia Rural, Univ. de São Paulo
Luiz Claudio and Beatris Cafagni	Graduate Students, Departmento de Economia e Sociologia Rural, Univ. de São Paulo, and orange farmers near Piracununga, SP
Eduardo Luis Leao de Sousa Paulo,	Graduate Student, Departmento de Economiae Sociologia Rural, Univ. de São and part owner of a commodity storage business in Uberaba, MG

Riberao Preto, Estado do São Paulo:

Evandro A. L. Oliveira	Director (Owner), Assimpex Riberao Preto Importacao e Exportacao Ltda.

Guara, Estado do São Paulo:

Hans Tubben	Engineer, Busa - Industria e Comercio de Maquinas Agricolas Ltda.

Batatais, Estado do São Paulo:

Jose Mario Dias de Moraes	Director (Owner), Moraes Equipamentos Agicolas Ltda.

São Paulo, Estado do São Paulo:

Martin Jayo	Graduate Student, Faculdade de Economia e Administracao, Universidade de São Paulo
Dr. Decio Zylbersztajn	Professor, Departamento de Administracao, Universidade de São Paulo
Alan Hrapsky	Assistant Agricultural Counselor, Foreign Agricultural Service, USDA
Fernando L. Pimentel	Manager of Development, CPF Comercio e Participcoes Ltda., Grupo Copas Fertilizantes
Ayrton Haynal	Director (Owner), ARMTEC (import/export firm), and past President of SINDIMAC (Syndicato das Maquinas)
Luiz Ferraz de Mesquita	Regional Marketing Manager, Valmet do Brasil S.A.

Uberaba, Estado do Minas Gerais:

Luismael Leal Costa	Manager, Solomaq Ltda. (Machinery Dealer)
Senhor Ary	Manager, Terra Pecas Ltda. (Machinery Dealer)
Heleno Braga	Manager, ABC Maquinas e Implementos Agricolas S/A (Machinery Dealer)

Brasilia, Distrito Federal:

Shackford Pitcher	Agricultural Counselor, U.S. Embassy
Karl Hampton	Agricultural Attache, U.S. Embassy
Marilia Conter	Assistant Commercial Officer, U.S. Embassy

Dr. Maria Alice Santos Oliveira	Technical Head, Centro de Pesquisa Agropecuaria dos Cerrados (CPAC), Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA)
Dr. Rui Veloso	Research Economist, CPAC/EMBRAPA
Dr. Claudio Alberto Bento Franz	Research Agricultural Engineer, CPAC/EMBRAPA

Formosa, Distrito Federal:

Joel Andre Peg	Agricultural Engineer and Part-Owner, Charrua Comercial Agricola Ltda.
Dr. Maria Alice Santos Oliveira	Technical Head, Centro de Pesquisa Agropecuaria dos Cerrados (CPAC), Empresa Brasileira de Pesquisa Agropecuaria (EMBRAPA)
Dr. Rui Veloso	Research Economist, CPAC/EMBRAPA
Dr. Claudio Alberto Bento Franz	Research Agricultural Engineer, CPAC/EMBRAPA

Formosa, Distrito Federal:

Joel Andre Peg	Agricultural Engineer and Part-Owner, Charrua Comercial Agricola Ltda.

dra\WP60DOC\Brazman.R

APPENDIX A

Farm Census Summary, Rio Grande do Sul

Table A1 - Land Use and Land Ownership - Rio Grande Do Sul

Item	Percent of Farms	Percent of Land
Land Use		
Crop Production	61.6	40.9
Livestock	31.8	53.3
Crop & Livestock	3.5	3.0
Other Uses (1)	3.1	2.8
Land Ownership		
Owned	75.1	82.2
Rented	6.6	10.6
Squatted	9.5	3.7
Part owner	8.7	3.5
Rented & Squatted	16.1	14.3

(1) Horticulture, forestry, poultry and miscellaneous

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos Censo Agropecuário 1985 Número 24 - RS

Table A2- Farm Numbers and Area in Annual Crops by Crop Acre Groups - Rio Grande do Sul

Cultivated Acreage	State of Rio Grande do Sul			High Plain North	
Groups	Farms	Crop acres (1)	Acres/farm	Farms	Crop acres (2)
Less than 247	458,217	10,040,827	21.9	244,895	5,363,200
247 to 494	5,157	1,714,242	332.4	2,773	921,745
494 to 1,235	3,207	2,311,762	720.8	1,773	1,277,978
1,235 to 2,470	697	1,118,493	1,604.7	392	629,042
More than 2,470	179	643,176	3,593.2	92	330,574
Total	467,459	15,828,500	33.9	249,885	8,522,539

(1) Acres in annual Crops
(2) Estimated assuming average within size group is the same as for the state of R.S.

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos Censo Agropecuário 1985 Número 24 - Rio Grande do Sul

Table A3- Tractors and Implements on Farms by Total Farm Size Groups - Rio Grande do Sul

Total Acres Groups	Number of farms	Tractors by horsepower under 50	50-100	over 100	Number of Implements planting	harvesting
Less than 494	476,588	30,208	66,287	4,834	65,277	23,844
494 to 1,235	11,754	1,613	11,793	3,150	9,660	5,401
1,235 to 2,470	4,908	920	6,790	2,147	5,547	3,149
2,470 to 4,940	2,357	459	3,968	1,516	3,494	1,931
4,940 to 12,350	862	295	2,280	948	1,838	1,073
12,350 to 24,700	94	42	543	251	292	248
More than 24,700	16	3	160	153	145	121
Totals	496,579	33,540	91,821	12,999	86,253	35,767

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 24 - Rio Grande do Sul

Table A4 - Tractors and Implements on Farms by Homogeneous Areas in Rio Grande do Sul

State Area	Tractors by Horsepower Under 50	50-100	Over 100	Number of Implements planting	harvesting
High Plain North (1)	10,356	53,552	5,790	56,569	21,555
Foothills (2)	13,268	4,327	259	4,635	1,772
East (3)	7,463	18,920	3,279	13,388	6,954
West (4)	2,453	15,202	3,671	11,662	5,486
Totals	33,540	92,001	12,999	86,254	35,767

(1) Planalto Meridional do RS e Triticultora de Cruz Alta
(2) Encosta do Planalto Meridional e Caxias do Sul
(3) Porto Alegre e Leste Rio-Grandense
(4) Oeste Gaucho menos Triticultora de Cruz Alta

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 24 - Rio Grande do Sul

Table A5- Acreage and Number of Producers of Principle Crops and All Annual Crops by Total Farm Size Groups - Rio Grande do Sul

Total Acres Groups	Rice No.	Rice acres (1,000)	Soybean No.	Soybean acres (1,000)	Wheat No.	Wheat acres (1,000)	Corn No.	Corn acres (1,000)	All Annual Crops No.	All Annual Crops acres (1,000)
Less than 494	129,378	661.0	243,690	5,964.9	80,311	1,566.2	375,642	3,216.3	441,810	10,527.8
494 to 1,235	2,760	399.8	3,432	1,404.2	1,850	383.6	5,998	131.6	8,748	2,172.2
1,235 to 2,470	1,282	327.4	1,202	848.0	609	221.5	2,452	89.3	3,595	1,464.6
2,470 to 4,940	668	250.5	490	480.3	213	114.4	1,090	53.5	1,658	950.9
4,940 to 12,350	332	223.8	154	180.6	50	52.8	359	28.0	625	556.0
12,350 to 24,700	49	81.9	16	30.3	2	1.0	26	2.3	68	127.3
More than 24,700	7	27.5	5	2.8	-	-	3	0.2	10	29.6
Total	134,476	1,971.9	248,989	8,911.1	83,035	2,339.5	385,570	3,521.2	456,514	15,828.4

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 24 - Rio Grande do Sul

Table A6 - Location of Production of Selected Crops by Homogenous Areas in Rio Grande do Sul

Product	High Plain North (1)	Foothills (2)	East (3)	West (4)	Total Acres
	Percent				
Wheat	86.5	1.2	2.7	10.0	2,339.4
Soybean	82.5	2.5	7.3	7.7	8,911.1
Corn	64.4	12.7	17.4	5.4	3,522.0
Rice	4.8	3.4	45.8	45.9	1,972.8
Four Crops					16,745.3

(1) Planalto Meridional do Rio G. Do Sul e Triticultora de Cruse Alta
(2) Encosta do Planalto Meridiional e Caxias do Sul
(3) Porto Alegre e Leste Rio-Grandense
(4) Oeste Gaúcho menos Triticultora de Cruz Alta

Source: Fundação Instituto Brasileiro de Geografia e Estatístic - Censos Econômicos Censo Agropecuário 1985 Número 24 - Rio Grande do Sul

Table A7 - Use of Soil Conservation Practices by Crop Acreage Groups - Rio Grande do Sul

Cultivated Acreage Groups	Percent of Farms Using Soil Conservation			
	Total (1)	Contour farming	Terraced	Others
Less than 247	36.3	23.7	14.4	5.1
247 to 494	81.7	55.9	49.6	6.8
494 to 1,235	85.6	59.1	55.7	8.0
1,235 to 2,470	89.4	62.7	61.8	12.0
More than 2,470	87.7	67.0	54.7	20.7

(1) Including farms using more than one practice

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 24 - Rio Grande do Sul

Table A8 - Use of Soil Conservation Practices by Homogeneous Areas in Rio Grande do Sul

State Area	Percent of Farms Using Soil Conservation			
	Total (1)	Contour Farming	Terrace	Others
High Plain North	48.0	30.1	24.1	5.6
Foothills	27.2	17.6	4.4	7.8
East	15.8	12.5	2.5	1.9
West	23.2	18.9	6.1	1.0

(1) Including farm using more than one practices

Source: Fundação Institutot Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agripecuário 1985 Número 24 - Rio Grande do Sul

Table A9 - Number of Workers by Farm Size Group - Rio Grande do Sul

Cultivated Acres Groups	Establishments	Workers Total	Workers Per Farm
Less than 247	487,932	1,649,058	3.4
247 - 494	5,157	37,833	7.3
494 - 1,235	3,207	35,732	11.1
1,235 - 2,470	697	14,728	21.1
More than 2,470	179	10,612	59.3
Totals	497,172	1,747,963	3.5

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos - Censo Agropecuário 1985 Número 24 - Rio Grande do Sul

APPENDIX B

Farm Census Summary, Paraná

Table B1 - Land Use and Land Ownership - Paraná

Item	Percent of farms	Percent of land
Land Use		
Crop Production	75.5	51.0
Livestock	19.2	36.3
Crop & Livestock	2.1	2.2
Other Uses (1)	3.2	10.4
Land Ownership		
Owned	63.1	86.7
Rented	10.8	5.6
Squatted	15.8	4.7
Part owner	10.4	3.0
Rented & Squatted	26.6	10.3

(1) Horticulture, forestry, poultry and miscellaneous

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos Censo Agropecuário 1985 Número 22 - Paraná

Table B2 - Farm Numbers and Area in Annual Crops by Crop Acre Groups - Paraná

Cultivated Acreage Groups	State of Paraná			East	West	North
	Farms	Acres	Acres/Farm	Farms	Farms	Farms
Less than 247	436,359	9,738,560	22.3	102,140	212,023	122,196
247 to 494	4,259	1,355,761	318.3	587	2,084	1,588
494 to 1,235	2,000	1,362,684	681.3	365	940	695
1,235 to 2,470	371	588,460	1,586.1	86	165	120
More than 2,470	103	377,707	3,667.1	38	35	30
Totals	443,092	13,423,172	30.3	103,216	215,247	124,629

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 22 - Paraná

Table B3 - Tractors and Implements on Farms by Total Farm Size Groups - Paraná

Total Acres Groups	Number of Farms	Tractors by Horsepower			Number of Implements	
		Under 50	50-100	Over 100	planting	harvesting
Less than 494	60,890	18,370	56,156	4,687	64,349	15,524
494 to 1,235	4,926	1,737	8,280	1,836	6,646	3,162
1,235 to 2,470	1,679	644	3,398	948	2,503	1,247
2,470 to 4,940	792	423	1,985	575	1,342	624
4,940 to 12,350	309	156	1,018	414	607	381
12,350 to 24,700	40	10	157	108	60	36
More than 24,700	22	6	325	111	76	49
Totals	68,658	21,346	71,319	8,679	75,583	21,023

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos
Censo Agropecuário 1985 Número 22 - Paraná

Table B4 - Tractors and Implements on Farms by Homogeneous Areas in Paraná

State Area	Tractors by Horsepower			Number of Implements	
	Under 50	50-100	Over 100	Planting	Harvesting
East (1)	4,839	9,909	1,618	10,368	3,254
West	7,470	33,386	3,531	38,162	11,837
North	9,037	28,026	3,530	27,054	5,932
Totals	21,346	71,321	8,679	75,584	21,023

(1) East and Curitiba

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos
Censo Agropecuário 1985 Número 22 - Paraná

Table B5 - Acreage and Number of Producers of Principle Crops and All Annual Crops by Total Farm Size Groups
Paraná

Total Acres Groups	Soybean		Wheat		Corn		Rice		All Annual Crops	
	No.	acres (1,000)	No.	acres (1,000)	No.	acres (1,000)	No.	acres (1,000)	No.	acres (1,000)
Less than 494	82,619	3,515.2	44,181	2,259.4	319,976	4,032.1	144,542	351.4	397,248	10,213.3
494 to 1,235	2,154	866.9	1,475	484.9	4,530	374.0	1,629	29.3	6,029	1,587.8
1,235 to 2,470	562	401.4	338	181.9	1,306	181.6	423	13.8	1,698	775.3
2,470 to 4,940	199	189.1	108	67.6	578	123.3	182	7.7	716	446.9
4,940 to 12,350	81	138.6	37	38.3	220	59.2	65	3.2	272	291.1
12,350 to 24,700	6	7.9	1	0.1	17	10.5	6	1.2	25	55.4
More than 24,700	3	18.7	2	2.9	10	12.6	5	5.2	11	54.5
Totals	85,624	5,137.8	46,142	3,035.1	326,637	4,793.3	146,952	411.8	405,999	13,423.3

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 22 - Paraná

Table B6 - Location of Production of Selected Crops by Homogeneous Areas in Paraná

Product	East (1)	West	North	Total acres
	Percent			(1,000)
Wheat	3.9	62.0	34.0	3,034.4
Soybean	9.5	65.4	25.1	5,137.5
Corn	22.6	57.5	19.9	4,793.4
Rice	29.9	40.3	29.8	411.9
Four Crops				13,377.2

(1) East and Curitiba

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 22 - Paraná

Table B7 - Use of Soil Conservation Practices by Crop Acreage Groups - Paraná

Cultivated Acreage Groups	Percent of Farms Using Soil Conservation			
	Total (1)	Contour farming	Terraced	Others
Less than 247	32.2	25.5	9.7	2.0
247 to 494	90.1	76.0	42.6	10.0
494 to 1,235	93.6	80.7	50.3	12.8
1,235 to 2,470	95.4	86.2	54.7	14.6
More than 2,470	85.4	80.6	58.2	13.6

(1) Including farms using more than one practice

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 22 - Paraná

Table B8 - Use of Soil Conservation Practices by Homogeneous Areas in Paraná

State Area	Percent of Farms Using Soil Conservation			
	Total (1)	Contour farming	Terrace	Others
North	45.3	37.2	11.1	3.0
East	12.7	10.4	1.9	1.9
West	33.6	25.7	13.0	1.7

(1) Including farm using more than one practices

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agripecuário 1985 Número 22 - Paraná

Table B9 - Number of Workers by Farm Size Group - Paraná

Cultivated Acres Groups	Establishments	Workers Total	Workers Per Farm
Less than 247	459,644	1,738,185	3.8
247 - 494	4,259	49,065	11.5
494 - 1,235	2,000	39,274	19.6
1,235 - 2,470	371	16,799	45.3
More than 2,470	103	11,747	114.0
Totals	466,397	1,855,070	4.8

Source: Fimdação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos - Censo Agropecuário 1985 Número 24 - Rio Grande do Sul

APPENDIX C
Farm Census Summary, Mato Grosso do Sul

Table C1 - Land Use and Land Ownership - Mato Grosso do Sul

Item	Percent of farms	Percent of land
Land Use		
Crop Production	38.9	9.5
Livestock	56.0	85.8
Crop & Livestock	2.4	2.2
Other Uses (1)	2.7	2.5
Land Ownership		
Owned	69.8	94.0
Rented	12.2	4.1
Squatted	5.1	0.4
Part owner	12.9	1.5
Rented & Squatted	17.3	4.5

(1) Horticulture, forestry, poultry and miscellaneous

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos -Censo Agropecuário 1985 Número 25 - MS

Table C2 - Farm Numbers and Area in Annual Crops by Crop Acre Groups - Mato Grosso do Sul

Cultivated Acreage Groups	State of Mato Grosso do Sul			Pantanal (1)	High Plains	High Plains East
	Farms	Crop acres (1)	Acres/farm	Farms	Farms	Farms
Less than 247	38,426	1,027,883	26.7	9,143	18,989	10,294
247 to 494	1,562	515,047	330.0	312	831	419
494 to 1,235	1,392	1,016,652	730.4	217	777	398
1,235 to 2,470	451	740,518	1,641.9	59	252	140
More than 2,470	223	1,329,468	5,961.7	15	112	96
Totals	42,054	4,629,928	110.1	9,746	21,961	11,347

(1) Pantanal and Campo Grande

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos Censo Agropecuário 1985 Número 25 - Mato Grosso do Sul

Table C3- Tractors and Implements on Farms by Total Farm Size Groups - Mato Grosso do Sul

Total Acres Group	Number of farms	Tractors by horsepower under 50	50-100	over 100	Number of Implements planting	harvesting
Less than 494	5,797	1,471	4,957	927	5,179	1,053
494 to 1,235	3,266	642	3,382	1,315	2,475	1,059
1,235 to 2,470	2,629	598	2,790	1,378	1,967	794
2,470 to 4,940	2,158	504	2,635	1,415	1,721	595
4,940 to 12,350	1,778	540	2,630	1,731	1,800	661
12,350 to 24,700	564	246	996	734	606	224
More than 24,700	391	159	1,166	859	653	39
	16,583	4,160	18,556	8,359	14,401	4,777

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos Censo Agropecuário 1985 Número 25 - Mato Grosso do Sul

Table C4 - Tractors and Implements on Farms by Homogeneous Areas in Mato Grosso do Sul

State Area	Tractors by Horsepower Under 50	50-100	Over 100	Number of Implements planting	harvesting
Pantanal (1)	1,212	3,780	1,617	2,088	512
High Plains	1,252	8,630	3,008	8,297	2,873
High Plains East	1,696	6,147	3,734	4,016	1,392
Totals	4,160	18,557	8,359	14,401	4,777

(1) Pantanal and Campo Grande

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 25 - Mato Grosso do Sul

Table C5 - Acreage and Number of Producers of Principle Crops by Total Farm Size Groups Mato Grosso do Sul

Total Acres Groups	Rice No.	Rice Acres (1,000)	Soybean No.	Soybean Acres (1,000)
Less than 494	10,901	114.5	4,772	383.0
494 to 1,235	1,735	79.0	1,014	504.6
1,235 to 2,470	1,147	78.2	428	421.3
2,470 to 4,940	787	67.9	241	323.9
4,940 to 12,350	622	96.5	187	379.5
12,350 to 24,700	162	45.6	39	106.4
More than 24,700	66	60.2	25	249.1
Totals	15,420	541.9	6,706	2,367.8

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 25 - Mato Grosso do Sul

Table C6 - Location of Production of Selected Crops by Homogeneous Areas in Mato Grosso do Sul

Product	Pantanal (1)	High Plains	High Plains East	Total Acres
	Percent			(1,000)
Soybean	6.2	64.6	29.2	2,367.7
Rice	23.0	36.0	41.0	542.2
Two Crops				2,909.9

(1) Pantanal and Campo Grande

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 25 - Mato Grosso do Sul

Table C7 - Use of Soil Conservation Practices by Crop Acreage Groups - Mato Grosso do Sul

Cultivated acreage Groups	Percent of Farms Using Soil Conservation			
	Total (1)	Contour farming	Terraced	Others
Less than 247	12.3	10.2	2.9	0.6
247 to 494	56.8	48.8	21.7	2.2
494 to 1,235	70.4	61.1	31.8	2.0
1,235 to 2,470	80.7	67.8	44.3	4.4
More than 2,470	91.0	78.9	58.3	4.9

(1) Including farms using more than one practice

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 25 - Mato Grosso do Sul

Table C8 - Use of Soil Conservation Practices by Homogeneous Areas in Mato Grosso do Sul

State Area	Percent of Farms Using Soil Conservation			
	Total (2)	Contour farming	Terrace	Others
Pantanal (1)	9.7	7.6	2.4	0.9
High Plains	18.3	15.6	5.6	0.7
High Plains East	14.2	11.6	4.8	0.8

(1) Pantanal and Campo Grande
(2) Including farm using more than one practices

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agripecuário 1985 Número 25 - Mato Grosso do Sul

Table C9 - Number of Workers by Farm Size Group - Mato Grosso do Sul

Cultivated Acres Groups	Establishments Establishments	Workers Total	Workers Per Farm
Less than 247	51,003	211,254	4.1
247 - 494	1,562	12,116	7.7
494 - 1,235	1,392	13,567	9.7
1,235 - 2,470	451	6,871	15.2
More than 2,470	223	10,191	45.7
Totals	54,631	253,999	4.6

Source: Fundação Instituto Brasileiro de Geografia e Estatistica Censos Econômicos - Censo Agropecuário 1985 Número 25 - Mato Grosso do Sul

APPENDIX D

Farm Census Summary, Mato Grosso

Table D1 - Land Use and Land Ownership - Mato Grosso

Item	Percent of farms	Percent of land
Land Use		
Crop Production	55.8	23.0
Livestock	39.2	73.8
Crop & Livestock	1.4	1.0
Other Uses (1)	3.6	2.2
Land Ownership		
Owned	62.1	96.3
Rented	13.5	1.1
Squatted	6.5	0.4
Part owner	17.9	2.2
Rented & Squatted	20.0	1.5

(1) Horticulture, forestry, poultry and miscellaneous

Source: Fundação Instituto Brasileiro de Geografia e Estatistica Censos Econômicos Censo Agropecuário 1985 Número 26 Mato Grosso

Table D2 - Farm Numbers and Area in Annual Crops by Crop Acre Groups - Mato Grosso

Cultivated Acreage Groups	State of Mato Grosso			North	Cuiabá	Southeast
	Farms	Crop Acres	Acres/Farm	Farms	Farms	Farms
Less than 247	65,145	1,254,614	19.3	30,056	9,221	7,181
247 to 494	1,364	427,441	313.4	706	121	331
494 to 1,235	1,200	842,421	702.0	571	115	396
1,235 to 2,470	509	809,113	1,589.6	205	74	188
More than 2,470	340	1,588,714	4,672.7	145	51	124
Totals	68,558	4,922,302	71.8	31,683	9,582	8,220

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos Censo Agropecuário 1985 Número 26 - Mato Grosso

Table D3 - Tractors and Implements on Farms by Total Farm Size Groups - Mato Grosso

Total acres group	Number of farms	Tractors by Horsepower under 50	50-100	over 100	Number of Implements planting	harvesting
Less than 494	2,401	874	1,465	427	1,038	621
494 to 1,235	2,270	765	1,815	714	1,674	860
1,235 to 2,470	1,336	454	1,233	732	1,068	578
2,470 to 4,940	1,266	514	1,491	959	1,263	747
4,940 to 12,350	1,273	643	1,264	1,273	1,362	884
12,350 to 24,700	540	271	887	836	690	456
More than 24,700	510	329	1,170	1,058	796	449
Total	9,596	3,850	9,685	5,999	7,921	4,595

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos Censo Agropecuário 1985 Número 26 - Mato Grosso

Table D4 - Tractors and Implements on Farms by Homogeneous Areas in Mato Grosso

State Area	Tractors by Horsepower Under 50	50-100	Over 100	Number of Implements Planting	Harvesting
North	1,915	4,210	2,556	3,739	2,381
Cuiabá	353	1,130	597	848	554
Southeast	764	2,612	1,773	2,325	1,309
Totals	3,032	7,952	4,296	6,912	4,244

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 26 - Mato Grosso

Table D5 - Acreage and Number of Producers of Principle Crops by Total Farm Size Groups - Mato Grosso

Total Acres Groups	Rice No.	Rice Acres (1,000)	Soybean No.	Soybean Acres (1,000)
Less than 494	38,860	376.7	854	87.1
494 to 1,235	2,985	136.3	1,008	302.0
1,235 to 2,470	1,185	92.1	396	256.0
2,470 to 4,940	833	124.5	334	388.5
4,940 to 12,350	667	164.3	293	474.1
12,350 to 24,700	234	102.7	93	275.4
More than 24,700	193	107.1	62	249.2
Totals	44,957	1,103.7	3,040	2,032.3

Source: Fundação Instituto Brasileiro de Geografia e Estatística- Censos Econômicos Censo Agropecuário 1985 Número 26 - MATO GROSSO

Table D6 - Location of Production of Selected Crops by Homogeneous Areas in Mato Grosso

Product Acres	North	Cuiabá	Southeast	Southwest	Total
	Percent				(1,000)
Rice	55.2	9.2	17.3	18.3	1,103.7
Soybean	38.0	13.7	44.8	3.5	2,032.4
Two Crops					3,136.1

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 26 - Mato Grosso

Table D7 - Use of Soil Conservation Practices by Crop Acreage Groups - Mato Grosso

Cultivated Acreage Groups	Percent of Farms Using Soil Conservation			
	Total (1)	Contour farming	Terraced	Others
Less than 247	2.6	1.9	0.6	0.1
247 to 494	42.4	30.6	18.3	1.6
494 to 1,235	54.9	44.8	26.8	1.7
1,235 to 2,470	59.5	48.3	32.8	1.4
More than 2,470	73.5	62.1	48.2	2.9

(1) Including farms using more than one practice

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 26 - Mato Grosso

Table D8 - Use of Soil Conservation Practices by Homogeneous Areas in Mato Grosso

State Area	Percent of Farms Using Soil Conservation			
	Total (1)	Contour farming	Terrace	Others
North	3.9	2.7	1.7	0.2
Cuiabá	3.3	1.9	1.2	0.6
Southeast	12.9	10.5	5.6	0.7

(1) Including farm using more than one practices

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agripecuário 1985 Número 26 - Mato Grosso

Table D9 - Number of Workers by Farm Size Group - Mato Grosso

Cultivated Acres Groups	Establishments	Workers Total	Workers Per Farm
Less than 247	74,708	316,200	4.2
247 - 494	1,364	10,688	7.8
494 - 1,235	1,200	11,864	9.9
1,235 - 2,470	509	8,255	16.2
More than 2,470	340	12,222	35.9
Totals	77,921	359,229	4.6

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos - Censo Agropecuário 1985 Número 26 - Mato Grosso

APPRENDIX E

Farm Census Summary, Goiás-Tocantins

Table E1 - Land Use and Land Ownership - Goiás - Tocantins

Item	Percent of farms	Percent of land
Land Use		
Crop Production	34.2	17.9
Livestock	60.0	77.5
Crop & Livestock	3.6	3.0
Other Uses (1)	2.2	1.6
Land Ownership		
Owned	78.4	94.3
Rented	7.6	2.7
Squatted	6.3	0.6
Part owner	7.7	2.4
Rented & Squatted	13.9	3.3

(1) Horticulture, forestry, poultry and miscellaneous

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos - Censo Agropecuário 1985 Número 27 - Goiás (including Tocantins)

Table E2 - Farm Numbers and Area in Annual Crops by Crop Acre Groups - Goiás - Tocantins

Cultivated Acreage Groups	State of Goiás			East Goiano	South Goiano
	Farms	Crop acres (1)	Acres/farm	Farms	Farms
Less than 247	106,306	3,126,504	29.4	15,864	30,108
247 to 494	2,685	937,567	349.2	221	1,655
494 to 1,235	1,700	1,285,114	755.9	159	1,151
1,235 to 2,470	474	806,080	1,700.6	49	337
More than 2,470	208	921,836	4,431.9	28	154
Totals	113,373	7,077,101	62.4	16,321	33,405

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Econômicos Censo Agropecuário 1985 Número 27 - Goiás

Table E3 - Tractors and Implements on Farms by Total Farm Size Groups - Goiás - Tocantins

Total Acres Groups	Number of Farms	Tractors by Horsepower Under 50	50-100	over 100	Number of Implements Planting	Harvesting
Less than 494	7,659	3,195	5,045	730	5,346	944
494 to 1,235	5,673	2,108	4,828	1,027	4,570	1,168
1,235 to 2,470	3,476	1,365	3,480	1,082	3,233	952
2,470 to 4,940	2,255	1,046	2,841	1,100	2,474	815
4,940 to 12,350	1,308	750	2,004	1,119	1,653	530
12,350 to 24,700	271	236	519	345	420	148
More than 24,700	84	64	417	237	265	117
Totals	20,726	8,764	19,134	5,648	17,961	4,674

Source: Fundação Instituto Brasileiro de Geografia e Estatistica - Censos Enconômicos Censo Agropecuário 1985 Número 27 - Goiás

Table E4 - Tractors and Implements on Farms by Homogeneous Areas in Goiás-Tocantins

State Area	Tractors by Horsepower Under 50	50-100	Over 100	Number of Implements planting	harvesting
East Goiano	1,059	1,535	749	1,488	496
South Goiano	3,766	12,276	2,848	11,191	3,153
Totals	4,825	13,811	3,597	12,679	3,649

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 27 - Goiás

Table E5 - Acreage and Number of Producers of Principle Crops by Total farm Size Groups - Goiás - Tocantins

Total Acres Groups	Rice No.	Rice acres (1,000)	Corn No.	Corn acres (1,000)	Soybean No.	Soybean acres (1,000)
Less than 494	63,164	705.5	64,079	927.9	1,614	205.2
494 to 1,235	9,449	336.5	9,450	385.7	867	320.1
1,235 to 2,470	3,569	244.2	3,460	229.1	498	321.9
2,470 to 4,940	1,867	200.7	1,730	158.3	307	335.4
4,940 to 12,350	930	152.5	833	101.4	129	191.4
12,350 to 24,700	177	49.6	142	21.2	27	58.3
More than 24,700	49	22.9	44	8.7	18	48.6
Totals	79,205	1,711.9	79,738	1,832.3	3,460	1,480.9

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 27 - Goiás

Table E6 - Location of Production of Selected Crops by Homogeneous Areas in Goiás-Tocantins

Product	East Goiano	South Goiano	Rest of State	Total acres
	Percent			(1,000)
Soybean	11.2	85.6	3.2	1,480.9
Rice	10.0	37.4	52.6	1,712.0
Corn	8.7	46.6	44.7	1,832.3
Three Crops				5,025.2

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 27 - Goiás

Table E7 - Use of Soil Conservation Practices by Crop Acreage Groups - Goiás-Tocantins

Cultivated Acreage Groups	Percent of Farms Using Soil Conservation			
	Total (1)	Contour farming	Terraced	Others
Less than 247	15.4	13.8	1.5	1.5
247 to 494	61.3	57.6	12.7	1.2
494 to 1,235	72.3	67.6	18.4	1.3
1,235 to 2,470	80.2	74.3	30.2	1.3
More than 2,470	85.1	82.7	39.4	1.4

(1) Including farms using more than one practice

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 27 - Goiás

Table E8 - Use of Soil Conservation Practices by Homogeneous Areas in Goiás-Tocantins

State Area	Percent of Farms Using Soil Conservation			
	Total (1)	Contour Farming	Terrace	Others
East Goiano	6.2	5.6	1.5	0.2
South Goiano	28.9	26.9	2.8	0.5

(1) Including farm using more than one practice

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos Censo Agropecuário 1985 Número 27 - Goiás

Table E9 - Number of Workers by Farm Size Group - Goiás-Tocantins

Cultivated Acres Groups	Establisments	Workers Total	Workers Per Farm
Less than 247	126,298	555,937	4.4
247 - 494	2,685	24,941	9.3
494 - 1,235	1,700	19,421	11.4
1,235 - 2,470	474	7,187	15.2
More than 2,470	208	8,853	42.6
Totals	131,365	616,339	4.7

Source: Fundação Instituto Brasileiro de Geografia e Estatística - Censos Econômicos - Censo Agropecuário 1985 Número 27 - Goiás

APPENDIX F
Visit to Granjas 4 Irmãos S. A. (4 brothers farm inc.)
October 11, 1994

The farm is located about 50 miles south of Pelotas near Taim. This is the second largest rice farm in Rio Grande do Sul. The closely held corporation has six divisions. Besides the farm at Taim, there are three other farms , one in Argentina, and a seed development and cattle division. The following information was obtained from the Taim operation manager, Marcus Vinicius da Rosa Coll.

The Tain farm consists of 26,000 hectares [60,000 aces] of which 14,000 hectares. is in rice production. Cattle are grazed on the rest of the land. There are about 7,000 head of cattle on the farm. Ten thousand hectares of rice are farmed directly, and 4,000 hectares. are rented out on a 50-50 share basis .

The farm employees 180 people full time and another 50 seasonal employees during planting and harvest. This is a major reduction from a few years ago to reduce costs. Housing is provided as well as a store and a school is also located on the property. There is a complete farm shop which has recently been contracted out to a firm to do the machinery upkeep and repair for the farm.

Half the rice is seeded directly into rye grass planted the previous fall and killed with Roundup herbicide. Most of the rest is seeded into land that has been prepared using a tillage system reduced from the area standard. About 15 percent is seeded Pregerminated into the flooded fields by airplane. This is contracted done. Yields on the direct seeding are about 5% less than on tilled land.

The farm has 20 large articulated 4-wheel-drive tractors of 310 hp. used for tillage and 50 110 hp. tractors that are used to pull planters as well as other jobs. The direct seeding is done with a no-till disk opening drill similar to the Haybuster drill. The seeders have 24 seed and fertilizer openers for a width of about 12.5 feet. The farm has 19 of these.

Seeding is done during daylight hours only, about 12 hours, during which 13 to 15 hectors (2-37 acres) are seeded. Speed of travel is only 3-4 mph. in order to get good penetration in the hard ground. The optimum seeding time is from October 10 to November 20. The field operations for tilled seeding are: 2 passes with a disk plow followed by one pass with a disk harrow. Finally one pass is made with a lever type harrow. The same drills are used to seed the tilled fields as is used for the direct seeding. On tilled land 20 to 25 hectares (49-61 acres) are seeded in a 12 hour day.

Interestingly the seed and fertilizer are handled in bags and put into the planter using hand labor. The farm manager was interested in bulk handling and is trying it on some land. The farm manager indicated production costs of $800 per ha., down from $1350 before the present direct seeding plan was implemented.

There appears to be potential for larger capacity planters to reduce the number of tractors and workers needed to seed the rice. Minimum disturbance of the soil is necessary to not get sprouting of red rice their problem weed. Disk openers they now use seem to be satisfactory for them. The manager would be interested in alternative equipment if he was convinced it would reduce cost per unit produced. He is concerned about competing with Uruguay and Argentine rice with free trade among these countries under the Mercosul agreement.

APPENDIX G
Brazilian Farm Equipment Prices, 1994

Farm machinery price lists were secured from dealerships in Carazinho, Rio Grande do Sul on October, 1994 and Ponta Grossa, Paraná in November, 1994. Prices in Brazilian reais was converted to U.S. dollars using an exchange rate of .90 real equal one U.S. dollar. Only a sample of farm equipment available are listed. The items described are presented to help evaluate the market competition. More detailed specifications or an examination of the equipment would be needed to accurately determine price competitiveness with U.S. built machines.

	Price in U.S.$[1]
I. Planting Equipment	
1. Semeato 24 row small grain drill TD400-11 6.2 inches between rows, 12.4 feet width 14 inch double disk opener with cutting disk weight 7,062, requires 100 hp tractor	17,732
2. Semeato - 8 row soybean planter PSE6-09 17.5 inches between rows, 11.6 feet width remote hydraulic control 15 inch off set disk opener and knife for fertilizer weight 4,514 lbs	11,597
3. Semeato - 10 row soybean planter PSM102-25 15.7 inches between rows, 13.0 feet width capacity: fertilizer 2,640 lbs, seed 660 lbs. remote hydraulic control 15 inch offset disk opener weight: 5,478 lbs. requires 80 hp tractor	13,168
4. Semeato - 12 row soybean planter PSM122-25 15.7 inches between rows- 15.7 feet width (same futures as 10 row above)	17,753
5. Semeato - 9 row soybean-corn planter PAR 3600/95-19 17.5 inches between soybean rows 35 inches between corn rows (5 rows) Width - 11.8 feet Capacity: fertilizer - 2,640 lbs seed 990 lbs Weight: 7,920 lbs..... requires 110 hp tractor Remote hydraulic control Off-set disk seed opener and knife for fertilizer	22,827

[1]Price quotes in Brazilian reais were converted to U.S. $ using a conversion rate of .9 R$ per U.S. $.

6.	SLC - 8 row soybean planter 203500 Ver. 708 17 inches between rows, 11.2 ft width Capacity: fertilizer - 2,640 lbs seed 739 lbs	14,868
	7. SLC - 12 row soybean planters 203800 Version 712	27,738
	8. SLC - 16 rows soybean planter 203900 Version 716	37,413
II.	Flail Chopper Tritten 2300 cc width - 17.3 feet	3,805
III.	Sprayers - by Jacto	
	1. Sprayer - Columbia 150 Width - 59 feet Capacity : 150 liters/minute Tank: 526 gallons, fiber with agitator Hydraulic Control of farm	12,720
	2. Sprayer - Columbia Vortex Width - 59 feet Capacity: 100 liters/minute Assisted by air down draft Tank 2000 526 gallons	23,052
IV.	Tractors	
	1. Valmont 1780 4 x 4 turbo 6 cylinder diesel 167 hp 16 speed transmission	93,382

APPENDIX H

Brazilian Subsidiaries of U.S. Banks and Their Location

American Express do Brazil, São Paulo, Rio de Janeiro (branch)

BankCal, São Paulo

Banco Chase Manhattan S.A., São Paulo

Banco de Boston, São Paulo, Brasilia (branch), Porto Alegre (branch)

Bank of America International, São Paulo

Bankers Trust Company, Rio de Janeiro, São Paulo (branch)

Chemical Bank (Noroeste-Chemical S.A. Leasing), São Paulo

Citicorp Investment Bank, São Paulo, Brasilia (branch)

The Citizens & Southern National Bank, Rio de Janeiro

Continental Bank International, São Paulo

Crocker National Bank, São Paulo

The First National Bank of Chicago, São Paulo

First Interstate Bank of California, Rio de Janeiro

Manufacturers Hanover Trust Company, São Paulo

Morgan Guaranty Trust Company of New York, São Paulo

NorChem (Banco Noroeste Chemical de Investimento S.A.), São Paulo

The Philadelphia National Bank Ltda., São Paulo

Pittsburg National Corporation, São Paulo

Salomon Brothers, Inc., São Paulo

T. Henry Schroder Bank & Trust Company, Rio de Janeiro, São Paulo (branch)

Security Pacific International Bank, São Paulo

Standard Chartered Bank, São Paulo

Texas Commerce Bank N.A., São Paulo

ENDNOTES

1. Production, domestic sales, imports, and exports of these items are tracked by ANFAVEA. Similar aggregate data are not available for planters, tillage equipment, and sprayers.

2. Recently purchased by the Ingersoll-Rand Corp.

3. This assumes freight and insurance of $10,000, warehousing and in-country transportation of $1,000 - $4,000, promotional materials in Portuguese for $2,000 - $3,000, travel and lodging for a company representative of $3,000 - $6,000, hiring of Brazilian help for $2,000 - $5,000, show participation fees of $1,000 - $3,000 and interest on the machinery of $1,000 - $4000. This also assumes that the exhibited machinery is eventually sold at a price that covers original cost, import duty, and all applicable taxes, but not shipping cost.