

SEED INDUSTRY IN BRAZIL

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SLIDE 1: Cover

SLIDE 2: World map

Brazil's territorial area consists of 8.5 million square kilometers (850 million ha), making it the fifth largest country in the world, surpassed only by Russia, Canada, China, and the United States.

SLIDE 3: Map of South America

Brazil covers 47% of South America and 57% of the land is on a plateau varying from 200 m to 900 m altitude.

SLIDE 4: Map of Brazil

The country is divided into 26 states and one Federal District located in the west central region; Brasilia is the national capital. In 2006, the population of Brazil was almost 190 million making it the sixth largest population size country in the world. Considerable variation can be found in population density, ranging from 2.6 people / km² in the Amazon region (north) to 27.5 people / km² in the northeast and 127 people / km² in São Paulo State.

SLIDE 5: Distribution of GDP and population

The racial composition of Brazil is quite varied. One expert on Brazil's population stated that "there are few places in the world in which the racial makeup of the population is more involved and complex than in Brazil. All the principal varieties of mankind into which the human race can be divided have contributed to the composition of the Brazilian population" (Baer, 2001).

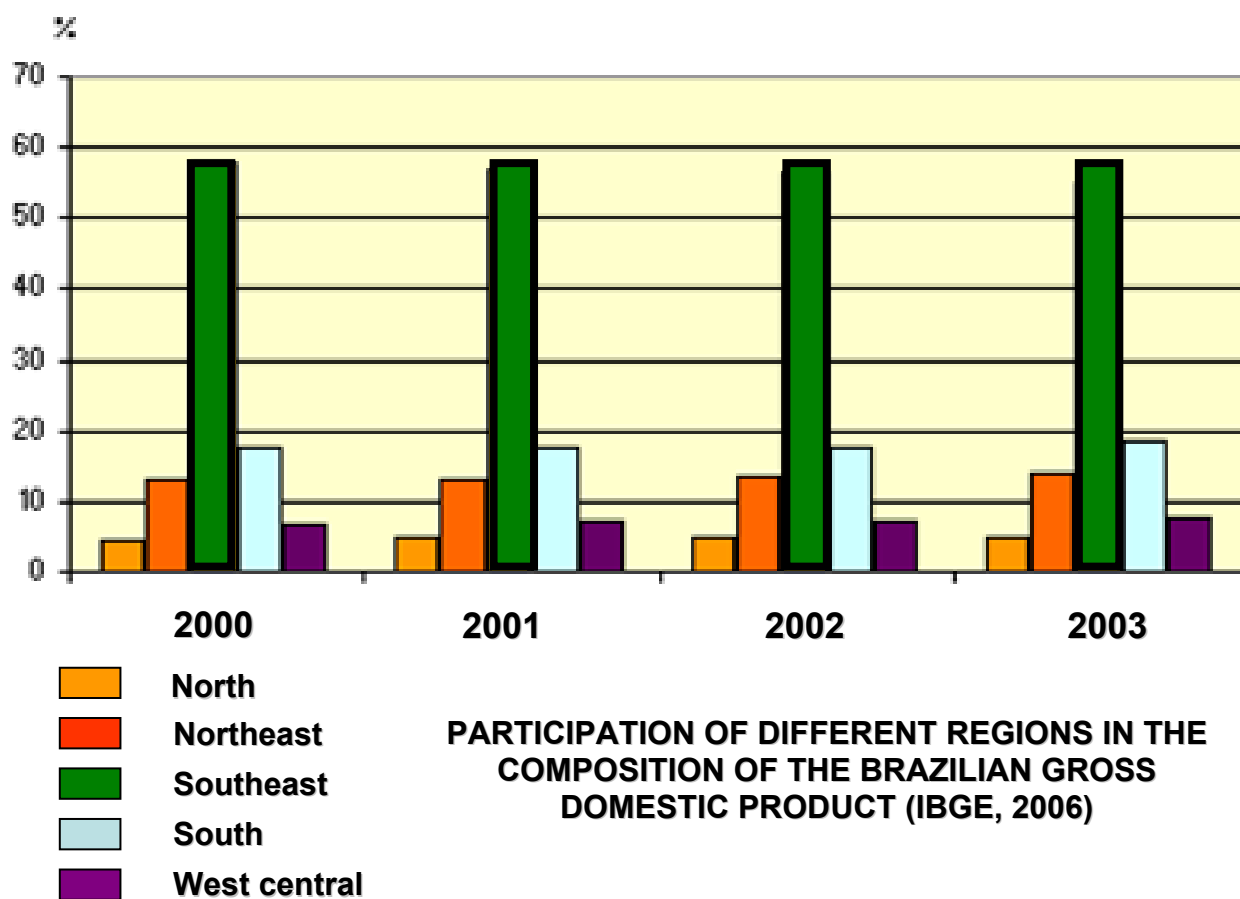
This table shows that the contribution of different regions to the gross domestic product (GDP) reflects the regional development of the country, i.e., the economic activity of the southeast followed by the southern states significantly surpasses those from other regions. This is also shown in the next figure.

TABLE 1. Distributions of gross domestic product and population of Brazilian regions.

| Region | Percentage of Brazilian Gross Domestic Product (GDP) | Population (1,000 people) |
|-------------|--|---------------------------|
| North | 4.5 | 12,900,704 |
| Northeast | 13.0 | 47,741,711 |
| Westcentral | 6.9 | 11,636,728 |
| Southeast | 58.2 | 72,412,411 |
| South | 17.5 | 25,107,116 |
| Total | 100 | 169,799,170 |

Statistics and Geography Brazilian Institute (IBGE, 2000)

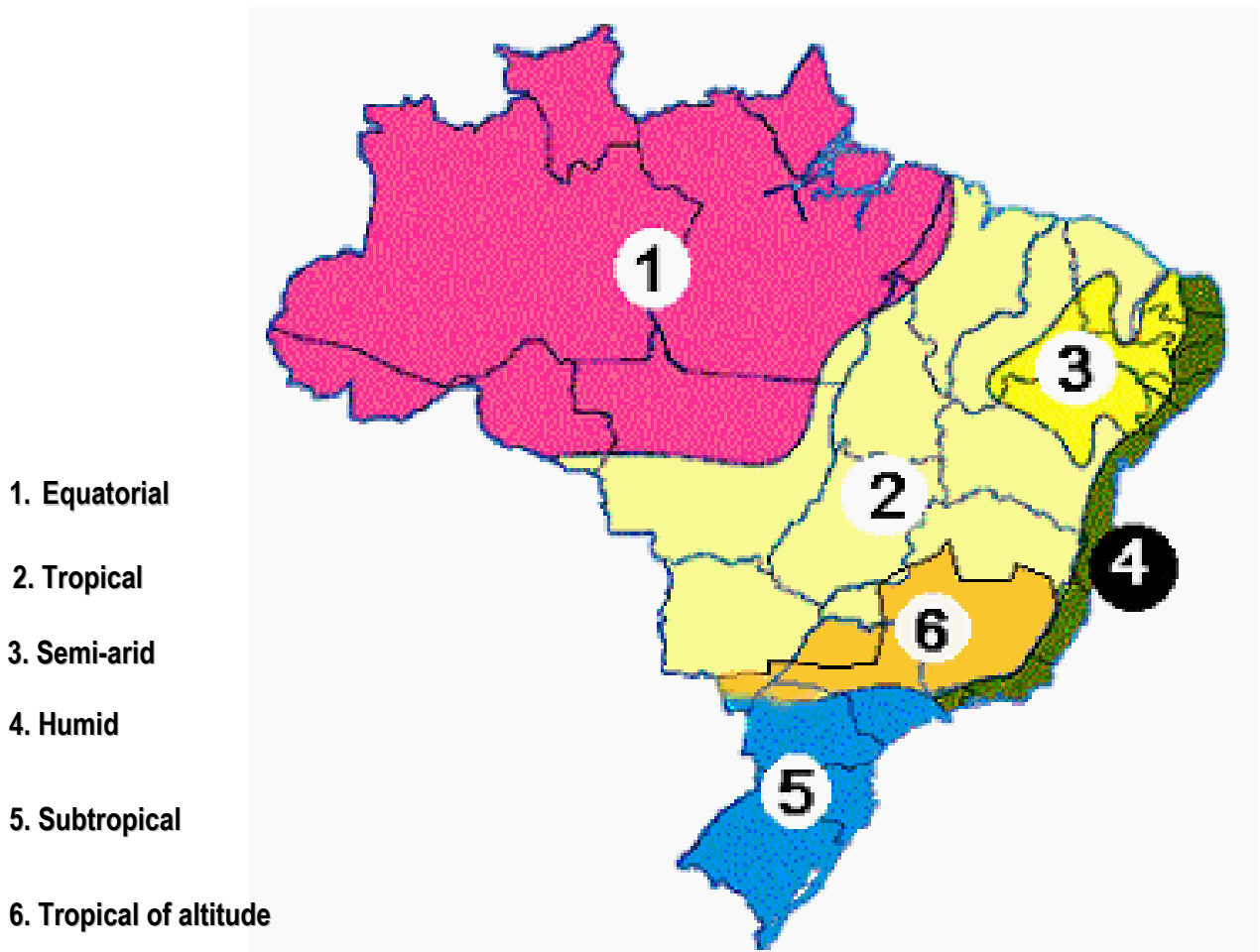
SLIDE 6: Participation of different country regions in the Brazilian GDP



SLIDE 7: Brazilian Climate

Brazil is a tropical country and its climate exhibits few extremes. Rainfall is generally adequate throughout the year with water deficits limited only to part of the Northeast where some areas receive less than 200 mm per year and the principal problem is rainfall irregularity.

Six well defined climatic regions are identified in the country:



1. Equatorial

2. Tropical

3. Semi-arid

4. Humid

5. Subtropical

6. Tropical of altitude

1. Equatorial: is characteristic of the Amazon region. Temperatures are high during the entire year and the mean of the highest and lowest temperature months are around 27°C and 25°C, respectively. Rainfall usually exceeds 2,000 mm per year.

2. Tropical: is found in a large area of the West Central region and also includes part of the Southeast (west of São Paulo and Minas Gerais states) and North. There are alternate periods of rainfall during the spring and summer followed by dry seasons in the fall and winter.

3. Semi-arid: the tropical semi-arid climate is identified by an irregular rainfall season, usually lower than 800 mm/year. Mean temperatures are around 27°C.

4. Humid: this climate occurs in a wide extension of the Brazilian coast from the Northeast to the Southeast. Temperatures are usually high mainly in the Northeast. The rainfall season occurs during March to July in the Northeast and from October to February in the Southeast.

5. Subtropical: is characteristic of the Southern region. Mean temperatures are around 18°C, but higher in the summer. The occurrence of frosts is relatively common and occasionally snow is found in higher altitude locations. Rainfall is regular throughout the year.

6. Tropical of altitude: is typical of some places in the Southeast. Temperatures are lower than those of the tropical region and rainfall occurs during the entire year although slightly higher in the summer.

SLIDE 8: Landscape of a Brazilian farm

The diversity of climate in different regions of the country allows excellent environmental conditions for the production of grain, vegetable, fruits, forages, woody plants, i.e., from tropical to temperate crops. This means that farmers usually can find specific locations to establish successful agricultural programs.

One of the most significant examples is the possibility of soybean production in the Northern region under latitudes near zero. This is a result of an excellent and efficient plant breeding program in the development of soybean varieties that reduce the influence of photoperiod on plant growth and flower induction.

The same conclusion is applied to seed production where the climate does not represent an obstacle to seed production of different species; there are exceptions, such as beet and radish seeds. The lack of socio-economic resources is the primary restriction for seed production of some species.

SLIDE 9: Agriculture in Brazil

The strategic importance of the agricultural sector as an engine of economic growth in Brazil has been demonstrated over time. The contribution of the whole chain of agribusiness to the Brazilian GDP is about 26% (it was 32% in 2003). The country is the world's largest sugar producer and orange juice exporter and the second largest exporter of soybeans. The contribution of industry to the GDP is 34% and over 60% of the Brazilian exports consist of manufactured products.

Brazil's available area for agriculture is around 338.5 million ha, representing 39.8% of the country's area. This land is covered by annual crops (36%), permanent crops (12%), natural pasture (15%), forage crops

(13%), natural forests and woodland (15%), and cultivated forests (15%). This means that there remains 6% of potential, but still not used agricultural land.

SLIDE 10: Important crops

Soybean, sugarcane, maize, coffee, rice, cassava, field bean, cotton, citrus fruits and tomatoes are the 10 most important crops in Brazil. The country is one of the largest producers of these crops and, with the exception of cotton and rice (sixth and tenth, respectively), holds one of the first three positions among major world producers.

SLIDE 11: World and Brazil total production of some crops

This Table shows the world and Brazilian production of important crops and that Brazil produces a significant percentage of the world's total production of coffee, soybean and field bean. The country annually produces more than 100 million tons of grain crops.

| Crop | Production (1000 t) | | Percentage Brazil/World |
|--------------|---------------------|----------------|-------------------------|
| | World | Brazil | |
| Cotton | 71,981 | 3,621 | 5.0 |
| Rice | 605,758 | 10,490 | 2.2 |
| Coffee | 7,761 | 2,475 | 31.9 |
| Field bean | 18,438 | 2,998 | 16.2 |
| Maize | 721,379 | 41,683 | 5.8 |
| Soybean | 204,266 | 49,205 | 24.0 |
| Sorghum | 58,884 | 2,138 | 3.6 |
| Wheat | 627,130 | 5,962 | 1.0 |
| Total | 2,015,597 | 121,333 | 6.0 |

World and Brazilian total production of selected grains crops in year 2004 (FAO, 2006)

SLIDE 12: Crop productivity

This same is not true when productivity is considered. This is explained by the expansion of cultivated areas and the wide differences in technology levels adopted in various regions of the country. Even so, the average productivity of these major crops is similar to or higher than the world average. In addition, productivity levels in the southeast and the south regions are comparable to those of countries exhibiting higher productivity.

| Crop | Total Production (2004) | Mean World Productivity (kg/ha) | Brazilian Productivity (kg/ha) | Best Brazilian State Productivity (kg/ha) |
|-------------------|------------------------------------|--|---|--|
| Cotton | <u>5th</u> | 2,062 | 3,138 (8th) | 4,011 (MT) |
| Rice | <u>9th</u> | 4,003 | 3,552 (47th) | 6,705 (SC) |
| Field bean | <u>1st</u> | 697 | 746 (76th) | 2,009 (GO) |
| Maize | <u>4th</u> | 4,906 | 3,373 (59th) | 5,059 (GO) |
| Soybean | <u>2nd</u> | 2,233 | 2,291 (15th) | 2,888 (RO) |
| Coffee | <u>1st</u> | 760 | 1,038 (10th) | 1,914 (MS) |

SLIDE 13, 14, 15, 16 and 17: Crop productivity

It is possible to improve agricultural production if Brazil adopts two different approaches: first, through the increase of cultivated areas since 6% of non-used agricultural land remains available, but this is a limited and short-term solution. Second, the best long-term approach is to increase agricultural research for the improvement of crop productivity.

Crop productivity in Brazil has increased overtime for important Brazilian crops and this has been a consequence of increasing investments in transportation infrastructure, transfer of human capital to frontier regions (especially to the West Center), the plant cultivar protection law passed in 1997, and finally the enhancement of modern inputs to include high quality seeds at lower prices.

| Crop | Year | | |
|------------|------|------|------|
| | 1986 | 1990 | 1998 |
| Cotton | 100 | 116 | 152 |
| Field Bean | 100 | 122 | 158 |
| Maize | 100 | 100 | 131 |
| Soybeans | 100 | 112 | 124 |

Productivity indices of four major crops in Brazil, 1986/1998. (IBGE, 2000)

| Crop | Mean (kg/ha) | | |
|------------|--------------|--------------|---------------|
| | 1991 to 1993 | 2002 to 2004 | Variation (%) |
| Cotton | 987.7 | 2,933.3 | 197.0 |
| Rice | 2,269.8 | 3,371.3 | 48.5 |
| Field bean | 524.3 | 714.0 | 36.2 |
| Maize | 2,111.3 | 3,246.7 | 53.8 |
| Soybean | 1,919.0 | 2,575.3 | 34.2 |
| Sorghum | 1,706.2 | 2,063.7 | 21.0 |
| Wheat | 1,351.7 | 2,007.3 | 48.5 |

Variation of selected crops productivity in Brazil, within the periods 1991/93 and 2002/2004 (Peske and Levien, 2005)

SLIDE 18: Seed Industry in Brazil

Brazilian seed production includes grain, vegetable, forage and forestry crops. Flower seed production has not been an important activity in the country. The seed industry is well developed and until the middle 1990s there were both national and international companies active and competitive with each other. Recently, most of the important Brazilian seed companies have been incorporated into international companies such as Monsanto, Dow, Pioneer, Novartis, Sakata, Syngenta, etc. Even in this situation, the Brazilian Association of Seed Producers has 554 members each representing a seed company (Abrasem, 2006).

SLIDE 19: Seed Industry in Brazil - Brazilian Seed Market

Seed production in Brazil is primarily directed to the national market. Export is promoted by some tropical forage seed companies.

The Brazilian seed market is substantial at a value of US\$ 1.9 billion and represents 7.6% of the world seed market. Soybean and maize seeds are responsible for 75% of the national market value.

Vegetable seeds are also important and represent 4% of the vegetable world seed market. Tomato (30% of the national vegetable seed market), melon, sweet corn, carrot, bell pepper, other cucurbits such as pumpkin, watermelon, cucumber and brassicas are the most important species. Besides the favorable climate to produce seeds in Brazil, part of the vegetable seed market, mainly hybrids, is imported such as tomato and carrot seeds among others.

SLIDE 20: Seed Industry in Brazil - Brazilian Seed Market / Tropical forages

The Brazilian tropical forage seed market comprises 70 to 85 million kg of seeds. This corresponds to a value of US\$ 110 million.

Brachiaria and *Panicum* are the most important species. Seeds are exported to North (southern USA), Central and South America, Africa (Madagascar, Angola), Asia (Laos Rep., Cambodja, Okinawa). China is a potential emerging market.

The preference of importers is for *Brachiaria brizantha* cv. Marandu (75%) and *Panicum maximum* cv. Mombaça (20-25%).

SLIDE 21: Seed Industry in Brazil - Seed Production

The certification system is only recognized by the Brazilian seed legislation. In this figure, there is an example of the distribution of seed production proportions among important crop species in 2000/2001.

SLIDE 22: Seed Industry in Brazil

The infrastructure of the Brazilian seed industry is composed of 300 processing plants with a capacity to produce 50,000 tons of seed per day. In addition, 980 storage units hold up to 4 million tons of seeds; there are 300 seed testing laboratories in the country and 53 seed laboratories qualified to conduct GMO analysis; more than 35,000 farmers produce seeds of different crops by contract.

| | 1998 | 2002 | 2004 |
|------------------------------------|--------------------|--------------------|---------------|
| Members (Seed Companies) | 612 | 512 | 554 |
| Seed Producers by Contract | 41,200 | 36,350 | 38,000 |
| Seed Processing Plants | 1,045 | 692 | 300 |
| Storage Facilities | 1,215 | 982 | --- |
| StorageCapacity | 5,072,000 t | 3,900,000 t | --- |
| Seed Testing Laboratories | 208 | 231 | 300 |
| GMO Laboratories | --- | --- | 53 |
| Agronomists and Technicians | 2016 | 2650 | 4,000 |

Structure of the Brazilian Seed System (Abrasem, 2005)

SLIDE 23: Seed Production (Table)

This table shows seed production data, seed demand, area covered by those crops, real demand and the index of use of high quality seeds. This information does not consider Brazilian regions and it is well known that farmers from the southeast, south and westcentral regions are those that consistently adopt high technology and use high quality seeds; the higher percentages of this use are verified for wheat, soybean, maize and cotton.

Brazilian seed production of selected grain crops, planted area, seed demand and index of use of high quality seeds, in 2004/2005.

| Crop | Seed Production (1,000 t) | Area (1,000 ha) | Real Demand (1,000 t) | Use of Seeds (%) |
|--------------|------------------------------|--------------------|--------------------------|---------------------|
| Cotton | 14,8 | 1,166 | 6,252 | 49 |
| Field bean | 16,5 | 3,718 | 11,789 | 13 |
| Maize | 241,3 | 12,148 | 213,748 | 85 |
| Rice | 114,3 | 3,856 | 162,158 | 43 |
| Soybean | 820,0 | 23,103 | 666,387 | 50 |
| Wheat | 288,0 | 2,756 | 201,225 | 71 |
| Total | 1,494 | 46,747 | 1261,759 | |

Brazilian Association of Seed Producers (ABRASEM, 2000)

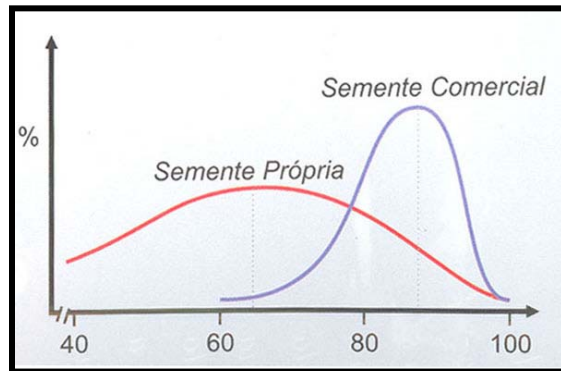
SLIDE 24: Use of High Quality Seeds

The use of high quality seeds by Brazilian farmers is related to: 1) technology level of crop production; 2) seed and crop product market prices; 3) relationship between seed prices and crop production costs; 4) prevailing climate conditions; 5) national and international demand for the crop product; 6) convenience of annual acquisition of high quality seeds, and 7) degree of success obtained by using high quality seeds.

At the same time, according to Brazilian seed legislation, farmers are allowed to use "farmer-saved" seeds. This policy has recently been adopted primarily for self-pollinated species and contributes to a reduced demand and use of high quality commercial seeds.

SLIDE 25: Commercial Compared to Farmer-saved Seeds

This figure shows the performance of commercial seeds in comparison to “farmer-saved” seeds collected in a drill box survey. Results of germination, tetrazolium and seedling emergence tests clearly demonstrated the advantages of seeds produced using efficient quality control programs.



SLIDE 26: Concluding Remarks

The use of high quality seeds is a permanent challenge to agriculture in Brazil. This situation will not change in the future, requiring constant attention and steadfast, devoted efforts from professionals dedicated to Seed Technology and Agriculture Sciences.

This mission has been accomplished in Brazil. It must be remembered that the country faces difficulties caused by wide-spread differences among regions which are caused by the reduced agricultural technology level and results in decreased crop production. The quality of the Brazilian seed industry with respect to the competence of seed technologists in the country creates a scenario in which great optimism exists for a successful future. Without doubt, the most efficient way to transfer improvements in plant breeding programs to farmers is by the production and use of high quality seeds.