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Tropical Fruits of Brazil

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Fertilizing for High Yield and Quality Tropical Fruits of Brazil

Managing Editors:

Dr. Lindbergue Araújo Crisóstomo
Embrapa Agroindústria Tropical
Rua Dr. Sara Mesquita 2270, Caixa Postal 3761
Fortaleza – CE, CEP 60511-110, Brazil

and

Dr. Alexey Naumov
Faculty of Geography
Lomonosov Moscow State University
Leninskie Gory, 119992 Moscow, Russia

Edited by **A.E. Johnston**
Agriculture and the Environment Division
Rothamsted Research
Harpenden, Herts. AL5 2JQ, UK



International Potash Institute
P.O. Box 569
CH-8810 Horgen
Switzerland

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Baumgärtlistrasse 17
P.O. Box 569
CH-8810 Horgen, Switzerland
Tel.: +41 43 810 49 22
Fax: +41 43 810 49 25
E-mail: ipi@ipipotash.org
www.ipipotash.org

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Tropical Fruits of Brazil

Alexey Naumov¹

Introduction

This discusses the cultivation, mineral nutrition and fertilization of 11 widely grown tropical, perennial fruits. Many of the data are from Brazil, with cross-references to production systems in other tropical climates, so that the observations are applicable to other parts of the world.

The International Potash Institute (IPI) considers that this topic is very important because the vast range and variety of tropical fruits offer great potential for the diversification of human nutrition. Tropical fruits are rich in vitamins, and have high nutritive value and very special, individual flavors: characteristics that ensure an ever-increasing demand for them. The boom in banana production for the U.S. and European markets in the early 20th century was soon followed by increasing orange juice consumption, and increasing demand for these two commodities stimulated expansion of banana and citrus plantations in Central America and the Caribbean. Since then, fruits from the tropics have become part of the everyday diet for many of those living in the developed countries, however, as their value is ever more appreciated in the less-developed countries demand continues to increase.

From the beginning of tropical fruit production worldwide, Latin America has been one of the most important producers, and it is now becoming an important exporter as a result of the globalization of trade in food. For fresh fruits, rapid delivery “from the field to the table” relies on modern transportation systems, storage infrastructure, and processing technologies. Expansion of this segment of the food production chain presents consumers with diversity and choice, and often introduces them to fruits with which many are not familiar. The increasing number of people aware of the need for healthy eating should guarantee the further expansion and successful development of this market in the near future. The diversification of agriculture into fruit production will also have environmental benefits through sustaining biodiversity in the landscape.

¹ Alexey Naumov is Coordinator of the International Potash Institute for Latin America and Associate Professor of the Faculty of Geography of Moscow State University, Russia, E-mail: alnaumov@geogr.msu.ru.

The increasing worldwide demand for tropical fruits and their processed products requires the increased yields that can be achieved through improvements in cultivation and production techniques, and fruit processing and storage. In many cases, the widely adopted, traditional methods of production result in small yields, poor fruit quality and a very short shelf life. Better mineral nutrition of these tropical fruits is one of the principle keys to improving this situation, because most tropical soils on which these fruits are grown are deficient in nutrients, and perennials usually require larger amounts of nutrients than do annual crops. Another factor that boosts the need for larger amounts of fertilizer is the increasing use of irrigation as another means to improve yields.

Many of the data presented in this crop bulletin are from Brazil, for two reasons. First, Brazil is one of the world's major producers of tropical fruits. Historically, the production of many tropical fruits has spread or migrated from the region where they originated. Consequently, countries currently in the top rank of world production are often not those where the fruit was originally introduced into agriculture. Brazil is a case in point, as shown in Table 1.

Second, the yields of tropical fruits in Brazil are mostly above the world average (see Fig. 1)². Brazilian government bodies and other research and development institutions in the agricultural sector recognize the importance of tropical fruit production. In the 1990s, the Ministry of Agriculture and Food Supply launched the special PROFRUTA program to support research and extension regarding tropical fruits, and this program became one of the strategic priorities in national agricultural development; its benefits are already perceptible. Tropical fruit production has become an important source of revenue for the national economy: in 2004, exports of fruit juices (including concentrates) generated US\$ 1.1 billion, and exports of fresh fruits and nuts brought in US\$ 592 million (including US\$ 115 million from exports of cashew nuts³). In Brazil, the revenue from fresh fruit exports has nearly doubled during the last 10 years, and there are positive prospects for further increases in the future.

Tropical fruits are planted throughout Brazil, wherever the climate is suitable (see Table 2 and Fig. 2), with some states specializing in specific crops. For example, São Paulo has 71% of the total national planted area of citrus, Ceará has 53% of the cashew trees, and Bahia has 43 and 27%, respectively, of the papaya and coconut areas. The federal and state governments' promotion of tropical fruit production has caused some changes in the areas planted in the

² Banana is an exception because banana production in Brazil is mostly for the domestic market, and the varieties differ from those grown for export in Ecuador, Costa Rica, etc.

³ Data published by the Secretaria da Política Agrícola at www.agricultura.gov.br.

various states. The main natural factor restricting production, especially in the regions near the equator (except Amazonia), is water deficiency, caused by insufficient rainfall and high evaporation. Consequently, recently planted areas are associated with irrigation projects. In the north-eastern states, more than 30 areas being developed for agricultural production are on irrigated land. The largest one, specializing in tropical fruits, is the Petrolina-Juazeiro region, near the Sobradinho hydroelectric power station and dam on the São Francisco river. Most of the mangoes and other fruits exported from Brazil originate from this region.

The production of tropical fruits in Brazil has benefited from cooperation between the IPI and the Brazilian Corporation of Agricultural Research (EMBRAPA). Among the activities fostered by this cooperation was a joint research program on the fertilization of tropical fruits, which was launched jointly by IPI and EMBRAPA in 2001. Some of the data presented here are based on the results of field experiments in the north-eastern region of Brazil during 2001–2005.

Each of the 11 chapters in this Crop Bulletin is devoted to one of the following fruits: Acerola, or West Indian cherry (*Malpighia emarginata*), Banana (*Musa spp.*), Cashew (*Anacardium occidentale*)⁴, Citrus⁵, Coconut (*Coco nucifera*)⁶, Guava (*Psidium guajava*), Mango (*Mangifera indica*), Papaya (*Carica papaya*), Passion-fruit (*Passiflora alata*), Pineapple (*Ananas comosus*) and Soursop (*Annona muricata*). Each chapter has a brief overview of the geography of the area where the fruit is grown, the characteristics of the climate and soil, and recommendations for soil preparation and amelioration, if required. In general, the soils where tropical fruits are grown in Brazil are red or yellow Latosols with tropical Podzols in the inner regions and sandy soils in the coastal zone. All these soils tend to be acidic, with aluminum and iron oxides, therefore, liming before planting is a common practice. To increase the base saturation of a Latosol and bring the soil pH up to 6.0–6.5, producers usually apply CaCO₃ at 5–6 mt/ha. The water requirement of each fruit type is discussed in its chapter, together with the amounts of nutrients removed in the harvested produce, the function of each nutrient, and a description of the visible symptoms caused by their deficiency. The authors emphasize fertilization practices for the various

⁴ Cashew trees in Brazil are grown mostly for their nuts, or fruit pistils, called “apple”. The “apple” itself is also used to produce juice and jam.

⁵ Mostly oranges. The climate in Sao Paulo state, the major producer of oranges in Brazil, is tropical.

⁶ Coconut in Brazil is produced mostly for its “milk”, and not for copra, as in Asian and Pacific countries.

phases of plant development from nursery to production, with attention to irrigation (including fertigation).

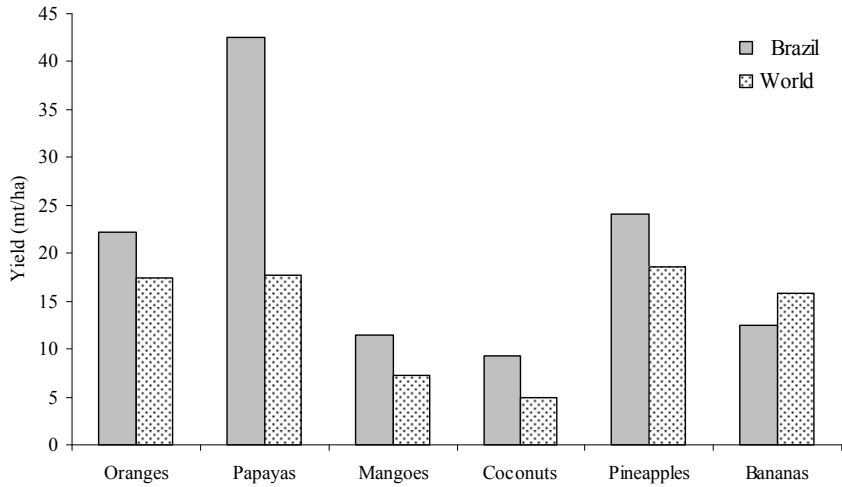


Fig. 1. Average 2000-2005 yield of some tropical perennial fruits in Brazil and the world, mt/ha (Source: FAOSTAT, 2004; www.fao.org).

Table 1. Countries of origin of some tropical fruits, and the major producing countries.

| Plant | Botanical name | Origin | Major producing countries ⁽¹⁾ | Brazil's rank | Harvested Area, 2004 (1,000 ha) | | Production, 2004 (1,000 mt) | |
|-----------------------|-------------------------------|---|--|---------------|---------------------------------|--------|-----------------------------|--------|
| | | | | | World | Brazil | World | Brazil |
| Avocado | <i>Persea gratissima</i> | Central America | Mexico, Indonesia, United States, Brazil, Colombia | 4 | 417 | 13 | 3,078 | 173 |
| Banana ⁽²⁾ | <i>Musa spp.</i> | South-east Asia, Pacific Ocean islands | India, Brazil, China, Ecuador, Philippines | 2 | 4,446 | 485 | 71,343 | 6,603 |
| Cashew | <i>Anacardium occidentale</i> | South America (Brazil) | Nuts Viet Nam, India, Nigeria, Brazil, Indonesia | 4 | 3,078 | 682 | 2,292 | 212 |
| | | | “Apples” Brazil, Guyana, Madagascar | 1 | 626 | 600 | 1,678 | 1610 |
| Oranges | <i>Citrus</i> ⁽³⁾ | South-east and East Asia | Brazil, USA, Mexico, India, Spain | 1 | 3,601 | 820 | 62,814 | 18,257 |
| Coconut | <i>Coco nucifera</i> | South-east Asia or South America | Indonesia, Philippines, India, Brazil, Sri Lanka | 4 | | 275 | 54,737 | 2974 |
| Lime ⁽⁴⁾ | <i>Citrus aurantifolia</i> | South-east Asia | Mexico, India, Argentina, Iran, Brazil | 5 | 802 | 52 | 12,339 | 1,000 |
| Mango | <i>Mangifera indica</i> | South and South-east Asia | India, China, Thailand, Mexico, Pakistan, Indonesia, Philippines, Brazil | 8 | 3,690 | 68 | 26,574 | 850 |
| Papaya | <i>Carica papaya</i> | Central and South America | Brazil, Mexico, Nigeria, India, Indonesia | 1 | 375 | 37 | 6,709 | 1,650 |
| Pineapple | <i>Ananas comosus</i> | South America (Brazil, Bolivia, Paraguay) | Thailand, Philippines, Brazil, China, India | 3 | 843 | 55 | 15,288 | 1,435 |

⁽¹⁾Five major producers in order of gross production volume (except mangoes).

⁽²⁾Dessert varieties only.

⁽³⁾Genus.

⁽⁴⁾Also known as Key Lime. Statistical data for lemons and limes, the last predominant in Brazil.

Source: FAOSTAT, 2004.

Table 2. Planted areas of the main tropical fruits in Brazil by state, 2003 (1,000 ha and % of the total national area).⁽¹⁾

| State | Avocado | | Banana | | Cashew | | Coconut | | Guava | | Mango | | Orange | | Papaya | | Passion fruit | | Pineapple | |
|--------------------------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|----------|------|---------------|------|-----------|------|
| | 1,000 ha | % | 1,000 ha | % | 1,000 ha | % | 1,000 ha | % | 1,000 ha | % | 1,000 ha | % | 1,000 ha | % | 1,000 ha | % | 1,000 ha | % | 1,000 ha | % |
| North (Amazonia) | | | | | | | | | | | | | | | | | | | | |
| Amazonas (AM) | 0.5 | 4.5 | 35.0 | 6.8 | 0.0 | 0.0 | 0.6 | 0.2 | 0.1 | 0.4 | 0.4 | 0.6 | 2.8 | 0.3 | 1.2 | 3.2 | 0.5 | 1.5 | 3.1 | 5.3 |
| Roraima (RR) | - | - | 4.6 | 0.9 | 0.0 | 0.0 | - | - | - | - | - | - | 0.3 | 0.0 | 0.6 | 1.6 | - | - | 0.2 | 0.3 |
| Pará (PA) | 0.1 | 0.5 | 54.5 | 10.6 | 2.1 | 0.3 | 22.4 | 8.0 | 0.1 | 0.6 | - | - | 12.4 | 1.5 | 1.1 | 2.9 | 3.5 | 9.9 | 9.7 | 16.7 |
| Tocantins (TO) | 0.0 | 0.1 | 5.3 | 1.0 | 0.2 | 0.0 | 0.7 | 0.2 | 0.0 | 0.0 | 0.4 | 0.6 | 0.2 | 0.0 | 0.0 | 0.0 | 0.1 | 0.4 | 1.9 | 3.3 |
| North-east | | | | | | | | | | | | | | | | | | | | |
| Maranhão (MA) | 0.0 | 0.0 | 11.8 | 2.3 | 13.4 | 2.0 | 1.7 | 0.6 | - | - | 0.9 | 1.4 | 1.4 | 0.2 | 0.1 | 0.4 | 0.0 | 0.1 | 1.9 | 3.2 |
| Piauí (PI) | 0.0 | 0.3 | 2.5 | 0.5 | 154.7 | 22.7 | 1.5 | 0.5 | 0.1 | 0.3 | 1.8 | 2.6 | 0.6 | 0.1 | 0.0 | 0.1 | 0.0 | 0.1 | 0.0 | 0.1 |
| Ceará (CE) | 0.4 | 3.9 | 42.1 | 8.2 | 364.6 | 53.4 | 39.5 | 14.0 | 0.5 | 2.6 | 4.5 | 6.6 | 1.6 | 0.2 | 1.6 | 4.5 | 2.5 | 7.0 | 0.0 | 0.1 |
| Rio Grande do Norte (RN) | 0.1 | 1.4 | 6.3 | 1.2 | 113.8 | 16.7 | 33.5 | 11.9 | 0.4 | 2.2 | 3.1 | 4.5 | 0.4 | 0.0 | 0.8 | 2.3 | 0.3 | 0.7 | 3.7 | 6.3 |
| Paraíba (PB) | 0.1 | 1.1 | 16.3 | 3.2 | 7.6 | 1.1 | 11.9 | 4.2 | 0.6 | 3.2 | 2.5 | 3.6 | 0.8 | 0.1 | 1.2 | 3.3 | 0.7 | 2.1 | 9.1 | 15.6 |
| Pernambuco (PE) | 0.2 | 1.9 | 39.6 | 7.7 | 5.5 | 0.8 | 15.0 | 5.3 | 4.7 | 26.7 | 7.2 | 10.6 | 0.9 | 0.1 | 0.6 | 1.6 | 0.7 | 2.0 | 0.9 | 1.5 |
| Alagoas (AL) | - | - | 4.1 | 0.8 | 0.2 | 0.0 | 14.1 | 5.0 | 0.0 | 0.1 | 1.0 | 1.5 | 3.8 | 0.5 | 0.1 | 0.2 | 0.9 | 2.7 | 0.7 | 1.2 |
| Sergipe (SE) | - | - | 4.6 | 0.9 | - | - | 40.0 | 14.2 | 0.2 | 1.0 | 1.4 | 2.0 | 51.1 | 6.1 | 0.4 | 1.1 | 4.1 | 11.6 | 0.5 | 0.8 |
| Bahia (BA) | 0.0 | 0.3 | 53.7 | 10.4 | 19.5 | 2.9 | 76.4 | 27.1 | 2.7 | 15.3 | 18.1 | 26.5 | 48.3 | 5.8 | 16.0 | 43.8 | 8.1 | 23.0 | 4.7 | 8.0 |
| South-east | | | | | | | | | | | | | | | | | | | | |
| Minas Gerais (MG) | 0.9 | 8.5 | 39.1 | 7.6 | - | - | 2.3 | 0.8 | 0.6 | 3.5 | 5.0 | 7.3 | 40.8 | 4.9 | 0.8 | 2.2 | 2.6 | 7.4 | 9.1 | 15.6 |
| Espírito Santo (ES) | 0.8 | 7.4 | 19.5 | 3.8 | - | - | 10.5 | 3.7 | 0.4 | 2.0 | 0.5 | 0.7 | 2.5 | 0.3 | 10.5 | 28.6 | 2.9 | 8.3 | 1.9 | 3.3 |
| Rio de Janeiro (RJ) | 0.0 | 0.4 | 25.6 | 5.0 | - | - | 4.1 | 1.5 | 0.6 | 3.5 | 0.3 | 0.4 | 7.1 | 0.8 | 0.1 | 0.3 | 2.1 | 6.0 | 2.4 | 4.2 |
| São Paulo (SP) | 4.6 | 45.2 | 57.2 | 11.1 | - | - | 2.6 | 0.9 | 4.9 | 27.5 | 19.4 | 28.4 | 600.1 | 71.7 | 0.2 | 0.5 | 2.8 | 7.9 | 3.5 | 6.1 |
| South | | | | | | | | | | | | | | | | | | | | |
| Paraná (PR) | 1.5 | 14.8 | 9.8 | 1.9 | - | - | 0.1 | 0.0 | 0.3 | 1.6 | 0.6 | 0.8 | 14.9 | 1.8 | 0.1 | 0.2 | 0.6 | 1.7 | 0.4 | 0.6 |
| Santa Catarina (SC) | - | - | 29.7 | 5.8 | - | - | - | - | 0.0 | 0.0 | - | - | 9.6 | 1.2 | 0.0 | 0.0 | 0.6 | 1.8 | 0.1 | 0.1 |
| Rio Grande do Sul (RS) | 0.7 | 6.6 | 10.8 | 2.1 | - | - | - | - | 0.7 | 4.2 | 0.1 | 0.2 | 27.1 | 3.2 | 0.3 | 0.9 | - | - | 0.3 | 0.5 |
| Center West | | | | | | | | | | | | | | | | | | | | |
| Mato Grosso (MT) | - | - | 11.7 | 2.3 | 0.9 | 0.1 | 2.3 | 0.8 | - | - | 0.3 | 0.4 | 1.0 | 0.1 | 0.1 | 0.2 | 0.3 | 0.9 | 1.0 | 1.8 |
| Goiás (GO) | 0.1 | 0.5 | 13.1 | 2.5 | - | - | 0.9 | 0.3 | 0.6 | 3.5 | 0.3 | 0.4 | 6.1 | 0.7 | 0.2 | 0.5 | 1.0 | 2.9 | 2.0 | 3.4 |
| Brazil | 10.1 | 100 | 514.5 | 100 | 682.5 | 100 | 281.6 | 100 | 17.8 | 100 | 68.5 | 100 | 836.7 | 100 | 36.6 | 100 | 35.1 | 100 | 58.2 | 100 |

⁽¹⁾Only states with 1% and more of national planted area of each of 10 selected fruits.

Source: IBGE, Produção Agrícola Municipal, 2005.

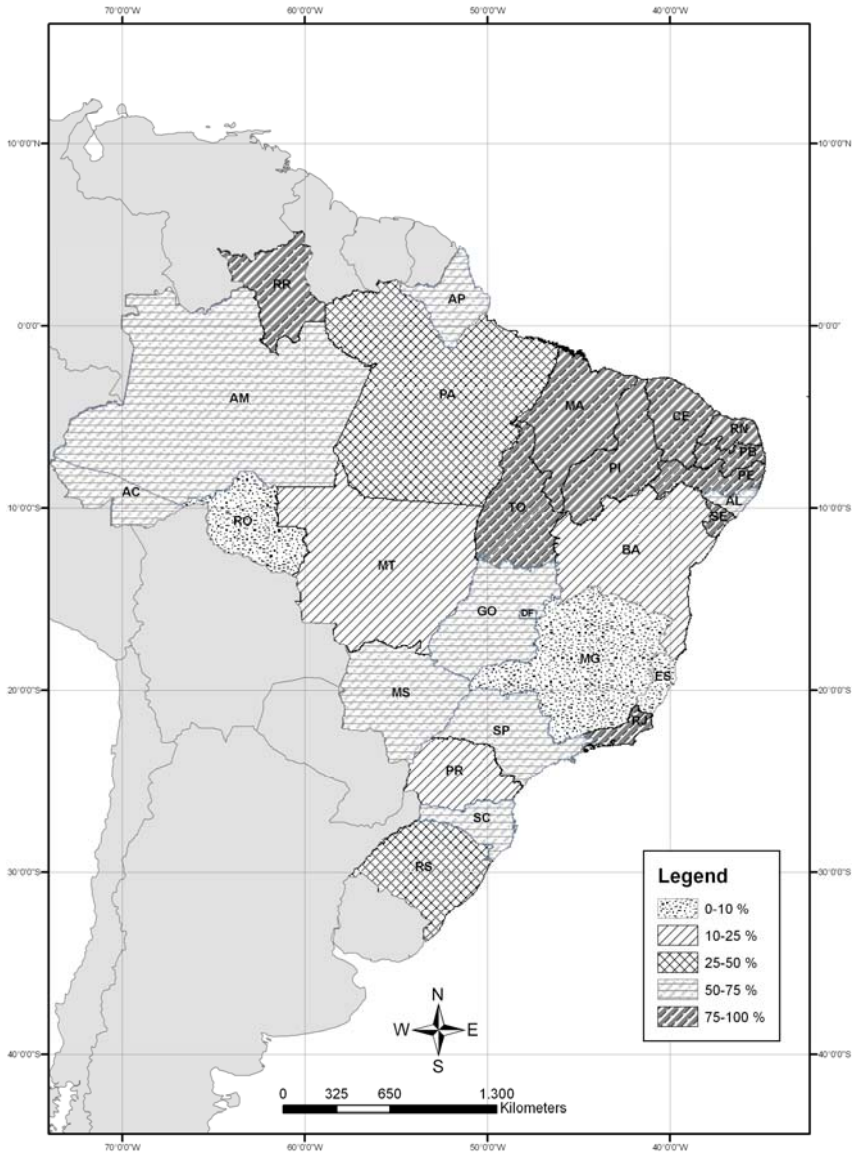


Fig 2. Share of tropical fruits: avocado, banana, cashew, citrus (oranges and others), coconut, guava, mango, papaya, passion fruit in the total planted area of permanent crops by states of Brazil, 2003 (*Source:* IBGE, Produção Agrícola Municipal, 2005; www.ibge.gov. Map design by Dr. R.B. Prado, Embrapa National Soils Research Center).