4 Chapter

Secondary Research

Brief Description about the Secondary Data Collected

At the outset, information pertaining to total fruit production of the world as well as total mango production of the world, with a country wise break-up, over the past years was collected using various available sources like; FAO production year books, official website of FAO, etc., and tabulated in the desired order. Tables numbering I and II contain this particular information and the same have been publicized under appendix (Appendix I and II). This information is intended to help the researcher in analyzing the global trend related to fruit production in general and mango production in particular.

In the second phase of data collection, following information about India, the home country and Brazil, the benchmarking partner was collected:

1. Other important recent economic, agronomic, and demographic related parameters of both the countries (table 1).
2. Agrarian structure of both the countries.
3. Population distribution structure of both the countries based on their primary activity.
4. FAO indices on various production parameters of both the countries.
5. Imports configuration of major groups related to FPI (Fruit Processing Industry) of both the countries.
6. Exports configuration of major groups related to FPI (Fruit Processing Industry) of both the countries.
7. Major fruit production pattern of both the countries

Various available resources including; FAO commodity year book series, FAO production year book series, and FAO statistics year book series published by UN, the little green and red data book series of World Bank, International trade statistics from www. trademap.com [the official website of ITC (International Trade Center), the official websites of Governmental departments of both the countries, etc. have been explored to collect the required information and later tabulated in the desired order. Tables numbering 1 till 7 contain this information and the same have been publicized under appendix (Appendix III to VIII). This information is intended to enable the researcher to conduct a detailed in-depth comparison study between the two countries, i.e., India and Brazil.

In the third phase of data collection, information pertaining to imports and exports configuration of major fruits as well as major processed fruit products of India was collected through exploring various available sources, especially the official website of DGFT (Directorate General of Foreign Trade) under ministry of commerce and industry of India. The information so collected has been tabulated in the desired order. Tables numbering I1 to I8 contain this particular information and the same have been publicized in appendix (Appendix IX to XII). This information is intended to help the researcher in analyzing the Indian fruit processing industry in general, critically.

In the fourth phase of data collection attempt has been made to collect information pertaining to exports of mango and the various processed mango products from India over the past years using various available sources, especially the official website of DGFT (Directorate General of Foreign Trade) under ministry of commerce and industry of India. The information so collected has been tabulated in the desired order. Tables numbering i to xiii contain this particular information and the same have been publicized under appendix (Appendix XIII to XXV). This information is intended to help the researcher in analyzing the mango processing industry of India in particular, critically.

Method of Data Collection and Sources of Data

Desk top research method has been used to gather the secondary information. Following sources have been explored in great depth to gather the required information:

1. FAO production year book series published by UN.

2. FAO commodity book series published by UN.
3. FAO statistics year book series published by UN.
4. Other FAO periodicals published by UN.
5. The little green and red data book series of WB publications.
6. Other WB periodicals.
7. FAO portal.
8. WB portal.
9. Export Import data bank maintained by DGFT (Directorate General of Foreign Trade) under ministry of commerce and industry of India.
10. International trade statistics from www.trademap.com, the official website of ITC.
11. The official websites of Governmental departments of both the countries.
12. Various reliable websites and portals.

The data so collected has been tabulated systematically for further analysis.

Data Analysis Tools/Techniques Used

Following statistical tools and techniques were used to analyze the secondary data that was gathered;

1. Tabular Presentation Techniques

The data collected was being presented in tabular form to facilitate easy comparisons and simple calculations like;

(i) Average percentage contribution of each country/fruit/processed fruit product to total value of the parameter that is being analyzed

(ii) Average percentage increase or decrease in the value of the parameter that is being analyzed

These were later interpreted to obtain meaningful results.

2. Compound Growth Rate (CGR) Analysis

Growth rate of production of fruits and processed fruit products, processing of fruits, imports of fruits and processed fruit products, exports of fruits and processed fruit products, imports and exports of all

major groups involved in FPI (Fruit Processing Industry), etc., were computed using the past years data for both the countries, i.e., India and Brazil and also for the entire world, using this technique. Growth rate of key economic indicators like; FAO indices on various parameters related to FPI (Food processing Industry), etc., were also computed using the past years data, using this technique.

The linear, log-linear, exponential, and power functions are some of the important functional forms employed to study the growth rates. Different functional forms were tried in the past for working out the growth rates in area, yield, production, imports, exports, etc. by various researchers. Some of the important forms that were tried include;

(i) Linear growth model represented by mathematical function of the type:

$$Y = a + b\,t$$

(ii) Exponential function represented by $Y = ab^t$

(iii) Quadratic function represented by $Y = a - bt - ct^2$

However, it was found that exponential from of the growth function represented by $Y = ab^t$ is being used most frequently.

Hence the similar kind of growth function of the form (1) shown below is used; $Yt = ab^tUt$ ….(1)

Where-in;

Yt: Dependent variable for which growth rate was estimated like; production (quantity and value), imports (quantity and value), exports (quantity and value), etc., in year 't'.

a: Intercept

b: Regression coefficient

t: Year which takes value 1,2,……. n.

Ut: Error term or disturbance term in year 't'

Equation (1) was transformed in to log linear function as

$$Ln\,Y = Ln\,a + t\,Ln\,b + Ln\,Ut \quad \text{….(2)}$$

Equation (2) was estimated by using OLS (Ordinary Least Square) technique. $\hat{g}$ $(\hat{b}$ 1) 100

The compound growth rate (CGR) (g) was then estimated by using following equation.

Where-in;

$\hat{G}$ = estimated compound growth in percentage per annum

$\hat{b}$ Anti log of log b

3. t-Test for Independent Samples

The t-test is the most commonly used method to evaluate the differences in means between two groups. For example, the t-test can be used to test for a difference in test scores between a group of patients who were given a drug and a control group who received a placebo. Theoretically, the t-test can be used even if the sample sizes are very small (e.g., as small as 10; some researchers claim that even smaller n's are possible).

The p-level reported with a t-test represents the probability of error involved in accepting our research hypothesis about the existence of a difference. Technically speaking, this is the probability of error associated with rejecting the hypothesis of no difference between the two categories of observations (corresponding to the groups) in the population when, in fact, the hypothesis is true. Some researchers suggest that if the difference is in the predicted direction, you can consider only one half (one "tail") of the probability distribution and thus divide the standard p-level reported with a t-test (a "two-tailed" probability) by two. Others, however, suggest that one should always report the standard, two-tailed t-test probability.

$$t = \frac{\left|\bar{x} - \mu_0\right|}{S/\sqrt{n}}$$

Where,

$\bar{x}$ = sample mean

μ_o = population mean

n = sample size

S = standard deviation

This tool, i.e., independent t-test under equal variance, has been applied to various parameters like;

(i) Agronomic parameters including arable land, arable land under temporary crops, arable land under permanent crops, forest cover, etc., over past years for both the countries

(ii) Demographic parameters including; population distribution, population growth rates, growth in EAP (Economically Active Population), growth in EAPEIA (Economically Active Population Eng-aged. In Agriculture), etc., over past years for both the countries

(iii) Key Economic indicators including; exports, imports, growth imports and exports, net exports, etc., over past years for both the countries.

The outcome of such t-test will reveal the level of difference between India and Brazil at desired significance level. (Refer appendix XXVIII for detailed independent t-test application and results).

Presentation of Research Findings and Discussion

As discussed in the beginning of this chapter, secondary information was collected in four phases and the same was being presented systematically as described below;

1. Information about the Total fruit production of the world as well as total mango production of the world, with a country wise break-up, over the past years was presented vide tables numbered as I and II. (Appendix I and II)

2. Agronomic, demographic, economic and other relevant information like; imports configuration, export configuration, etc., related to India and Brazil, over the past years was presented vide tables numbered as 1 till 7. (Appendix III to VIII)

3. Information pertaining to imports and exports configuration of major fruits as well as major processed fruit products of India over the past years was presented vide tables numbered as I1 to I8. (Appendix IX to XII)

4. Information pertaining to exports of mango and the various processed mango products from India over the past years was presented vide tables numbered as i to xiii. (Appendix XII to XXV)

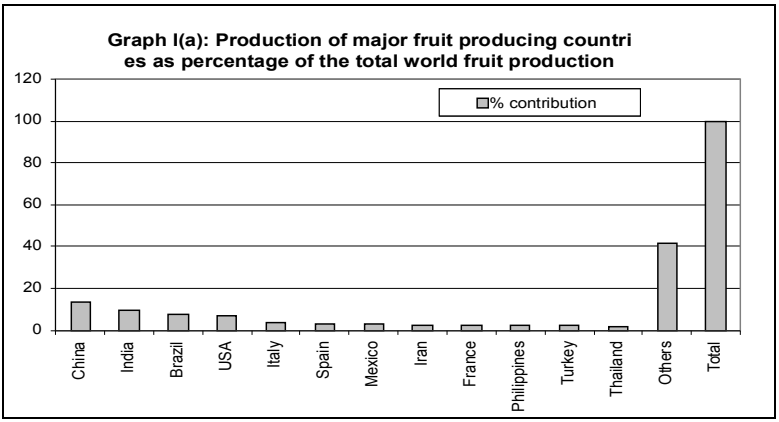
Each of the tables listed above were analyzed, critically, using various statistical, mathematical and computational tools and techniques and the final table together with a bar graph was displayed for every table

mentioned above. Each final table together with the graph is then discussed critically to reveal some of the hidden or implied aspects pertaining to fruit processing industry of India as well as Brazil.

Research Findings and Discussion

1. Table I(a): Average Percentage contribution of major fruit producing countries towards total fruit production of the world

Countries	*% contribution*
China	13.60
India	9.54
Brazil	7.75
USA	6.66
Italy	3.76
Spain	3.31
Mexico	2.89
Iran	2.54
France	2.38
Philippines	2.29
Turkey	2.28
Thailand	1.61
Others	41.39
Total	**100.00**

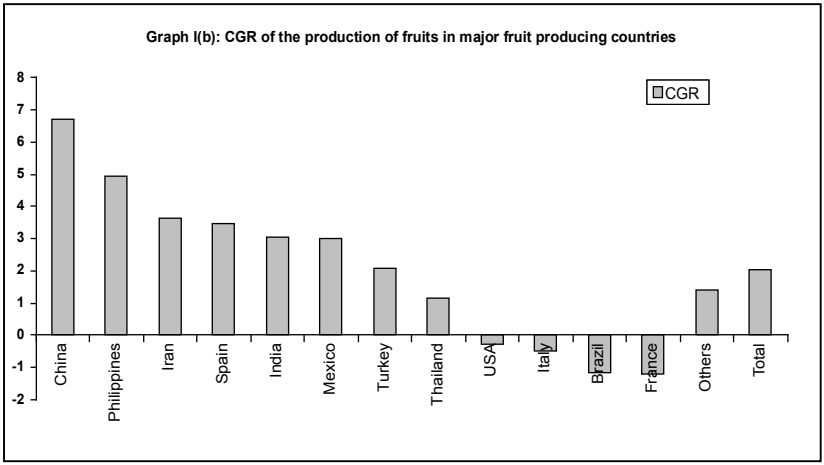


The table and graph shown above clearly rank China, India, Brazil and USA as the top four producers of fruits in the world. Percentage contribution of India and Brazil, towards total fruit production of the world, is comparable. Both India and Brazil enjoy the significant share of the total fruit production, which is next only to China.

But when it comes to fruit processing, India is lagging far behind Brazil. Brazil processes around 70 percent of the total fruit production, whereas India processes just around 5 percent. India has to strengthen its fruit processing industry with a strategic re-orientation and integrated approach, in order to exploit the huge potential.

2. Table I(b): CGR of the production of fruits in major fruit producing countries

Countries	*CGR*
China	6.70
Philippines	4.95
Iran	3.63
Spain	3.48
India	3.04
Mexico	3.00
Turkey	2.07
Thailand	1.16
USA	-0.29
Italy	-0.50
Brazil	-1.16
France	-1.18
Others	1.41
Net	**2.05**

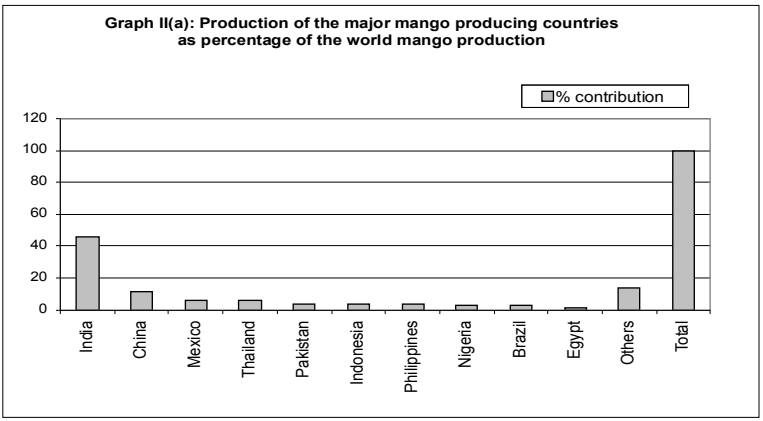


The table and graph displayed above reveal that China and Philippines are the countries which are growing significantly when it comes to total fruit production. This clearly indicates the fact that China has realized the tremendous potential that is being hidden in this sector and is trying to exploit the same before any other country does. CGRs of Iran, Spain, Mexico and India are more or less comparable.

Brazil, the benchmarking partner of India, has experienced a negative growth of -1.16 percent like that of many other countries. This is a cause of concern for Brazil, which should be addressed.

3. Table II(a): Average Percentage contribution of major countries producing mango towards total mango production of the world

Country	*% Contribution*
India	45.47
China	11.34
Mexico	6.21
Thailand	5.75
Pakistan	3.97
Indonesia	3.63
Philippines	3.52
Nigeria	2.87
Brazil	2.63
Egypt	1.16
Others	13.45
Total	**100.00**



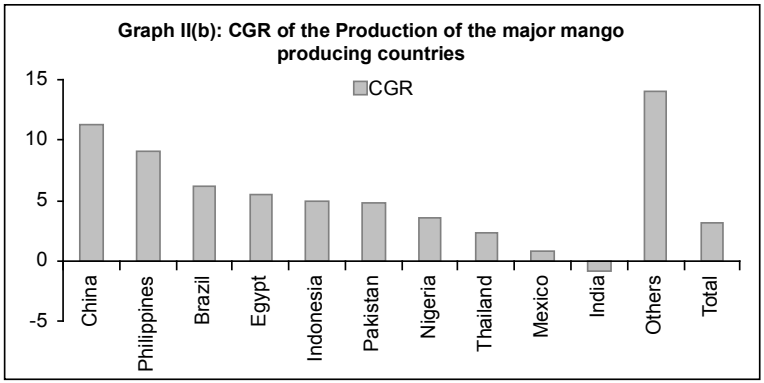
The table and graph shown above, undisputedly, rank India as the top most producer of mango in the world, contributing to nearly 46

percent of the total world production. China, Mexico, Thailand and Pakistan together account for nearly 28 percent of the total world production. Brazil stands at ninth position with a contribution of 2.63 percent.

India has an edge over other countries when it comes to mango production. India has the right soil, climatic condition and other required resources to produce mango. In fact the Indian 'Alphonso' is the most sought after fruit in the world – known popularly as the 'king of all fruits'. There is a great demand for Indian mangoes and also the processed mango products, especially the mango pulp, pickles, chutneys, juices, jams, slices in brine, etc., in the international markets. This should be seen as a great opportunity to be exploited by Indian mango processors.

4. Table II(b): CGR of the production of mango in major mango producing countries

Country	*CGR*
China	11.3
Philippines	9.08
Brazil	6.18
Egypt	5.54
Indonesia	4.88
Pakistan	4.85
Nigeria	3.55
Thailand	2.32
Mexico	0.85
India	-0.86
Others	14.05
Net	**3.16**

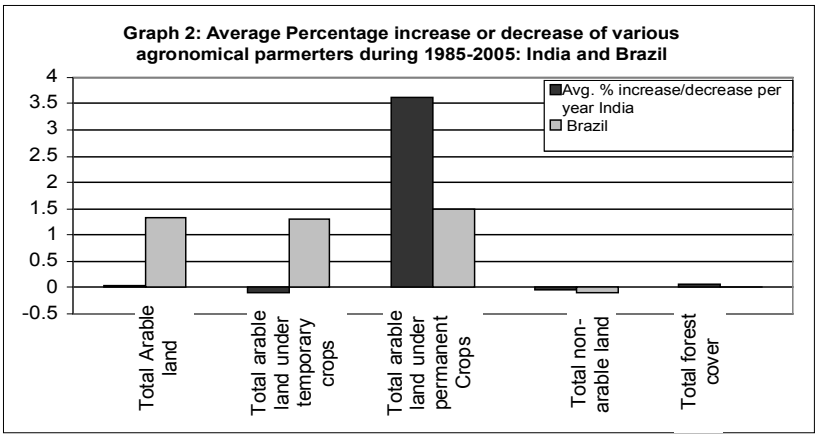


The table and graph depicted above reveals that China and Philippines have experienced highest growth rate, even in the mango production also. This clearly indicates the fact that China has realized the tremendous potential that is being hidden in this specialized sector, i.e., mango processing industry, and is trying to exploit the same before any other country does. Brazil, Egypt, Indonesia, Pakistan and Nigeria are the countries that are experiencing significant growth between 4 and 6 percent.

India, unfortunately, is the only country that has experienced a negative growth of -0.86 percent, in spite of her being the topmost producer of mango. This indeed is a matter of grave concern for India, which needs to be addressed.

5. Table 2: Average Percentage increase/decrease of important agronomical parameters

Agronomical parameters	*Average % increase/ decrease per year*	
	India	***Brazil***
Total Arable land	0.04	1.33
Total arable land under temporary crops	-0.09	1.31
Total arable land under permanent Crops	3.62	1.48
Total non-arable land	-0.05	-0.09
Total forest cover	0.06	0.01



Total arable land in India has increased marginally when compared with Brazil. This indicates that much of the non arable land is being transformed in to arable land through human efforts in Brazil. India

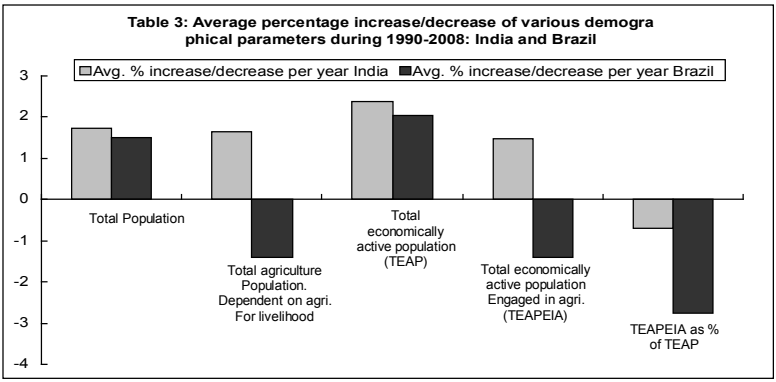
should make serious attempts to transform huge tracts of non arable land available in to arable one, like Brazil.

The total arable land under temporary crops has experienced negative growth in India. But the total arable land under permanent crops, which is area of interest for this research, has increased by 3.62 percent during 1985-2005 in India compared to 1.48 percent for Brazil. The total non arable land and the total forest cover have shown no major changes for both the countries.

In spite of Brazil being nearly 2.6 times bigger than India w.r.t. total area, total arable area of Brazil remains very small compared to India (nearly 40 percent of that of India). The total area under permanent crops of Brazil also remains small compared to India (nearly 77 percent of that of India). This is primarily due to huge forest cover (56.5 percent of total land area), surrounding Amazon in Brazil compared to India (22.8 percent of total land area). As confirmed by t-test, there is no significant difference between the two countries when we compare the per capita arable land (refer appendix-XXIX).

6. Table 3: Average Percentage increase/decrease of important demographical parameters during 1990-2008: India and Brazil

Demographic Parameters	***Average % increase/decrease per year***	
	India	***Brazil***
Total Population	1.73	1.50
Total agriculture Population. Dependent on agri. for livelihood	1.65	-1.41
Total economically active population (TEAP)	2.37	2.03
Total economically active population Engaged in agri. (TEAPEIA)	1.48	-1.40
TEAPEIA as % of TEAP	-0.69	-2.76

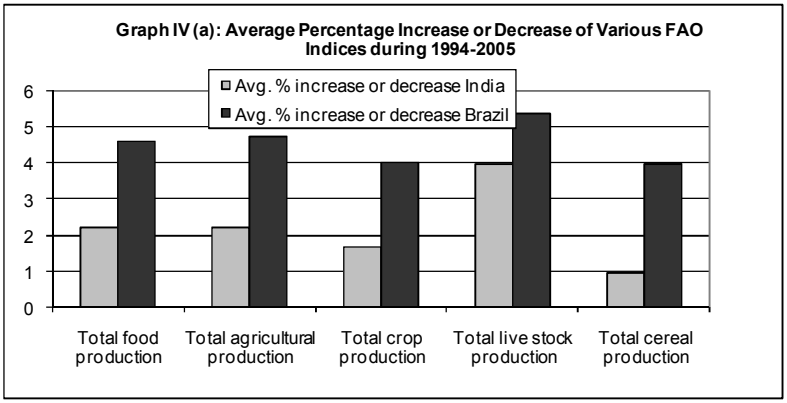


As revealed from the above table and graph the population of India was increasing at the rate of 1.73 percent compared to 1.50 percent in Brazil. But when we compare the total agricultural population dependent on agriculture for their livelihood, India has experienced growth of 1.65 percent where as Brazil has shown decline by 1.41 percent. This coupled with the fact that nearly 72 percent of the total Indian population is dependent on agriculture for their livelihood compared to just 18 percent in Brazil, reveals that Indian economy to a great extent is dependent on agriculture than Brazil. Thus India is expected to be much aggressive, superior and advanced in the agriculture sector than Brazil, but it is not. The above argument remains valid when we compare the percentage of total economically active population engaged in agriculture (which is 58.70 percent for India and just 15.60 percent for Brazil).

The study becomes more relevant and important for India than Brazil as much larger chunk of the total population of India is dependent on agriculture.

7. Table 4(a): Average Percentage increase or decrease of various FAO indices during 1994-2005

Various FAO indices	*Average % increase or decrease*	
	India	***Brazil***
Total food production	2.22	4.58
Total agricultural production	2.2	4.74
Total crop production	1.67	4.02
Total live stock production	3.96	5.36
Total cereal production	0.95	3.98

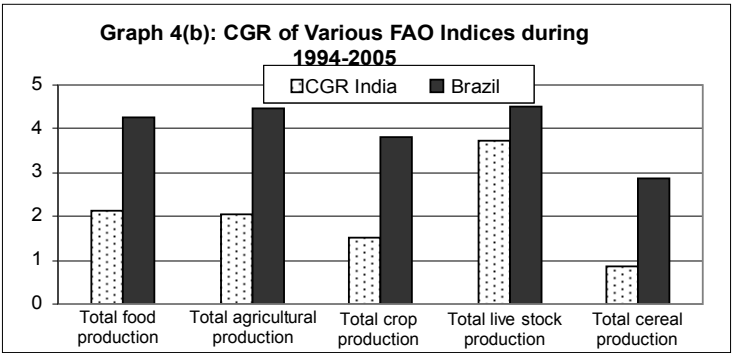


It becomes evident from the above table and graph that Brazil has fared better in all the areas mentioned above compared to India. Average percentage increase in total food production and total agricultural production of Brazil is more than 2.0 times that of India. Average percentage increase for Brazil is nearly 2.4 times that of India for total crop production and 4.2 times that of India for total cereal production. The average percentage increase in total live stock production of Brazil stands at 1.35 times that of India.

The overall performance of Brazil in the agriculture sector including livestock production is much superior to India. India has to learn a lot from Brazil, especially in this sector.

8. Table 4(b): CGR of various FAO indices during 1994-2005: India and Brazil

Various FAO indices	*CGR*	
	India	*Brazil*
Total food production	2.12	4.28
Total agricultural production	2.06	4.48
Total crop production	1.51	3.81
Total live stock production	3.73	4.51
Total cereal production	0.88	2.85



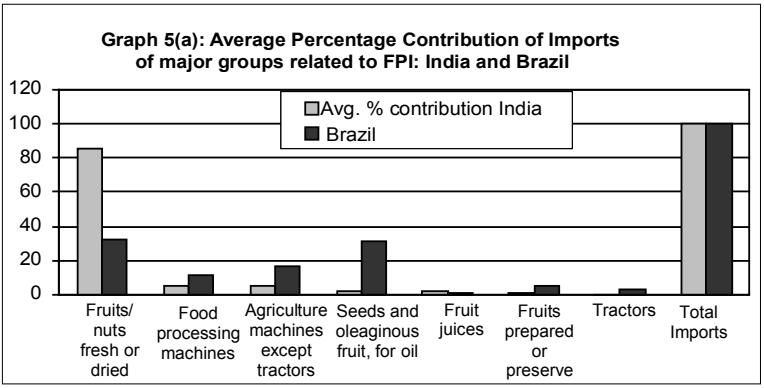
The above table and graph reveal some important findings pertaining to CGR of; total food production, total agricultural production, total crop production, total live stock production and also the total cereal production of both countries.

Brazil has fared better in all the areas mentioned above, compared to India. CGR of total food production and total agricultural production of Brazil is nearly 2.0 times that of India. CGR of Brazil is nearly 2.4 times that of India for total crop production and 3.2 times that of India for total cereal production. Total live stock production of Brazil is growing at CGR of 4.51, which is nearly 1.2 times that of India. CGR of cereal production of Brazil is much higher than that of India.

Thus it can be concluded that Brazil, in the agriculture sector as a whole, is growing much faster than India. India has to benchmark the best practices followed by Brazil in this sector and try to adopt the same with tailor made modifications and fine tunings.

9. Table 5(a): Average Percentage contribution of imports of major groups related to FPI to total imports

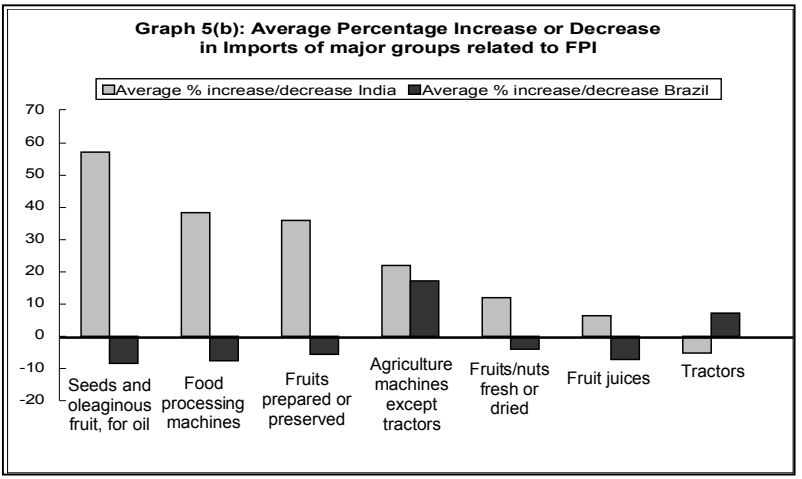
Imports of major groups related to FPI	*Average % contribution*	
	India	***Brazil***
Fruits/nuts fresh or dried	85.87	32.45
Food processing machines	5.23	11.15
Agriculture machines except tractors	4.75	16.48
Seeds and oleaginous fruit, for oil	1.83	31.65
Fruit juices	1.67	1.02
Fruits prepared or preserved	0.36	4.60
Tractors	0.28	2.65
Total Imports	**100.00**	**100.00**



The table and graph shown above explains the composition of total imports, related to FPI (Fruit Processing Industry), of both the countries. India is importing mainly (86%) the fruits/nuts (fresh or dried) and to some extent (around 5% each) the food processing machines and agricultural machines except tractors. Whereas Brazil is importing food processing machines and agricultural machines and tractors, which collectively account for around 30 percent of total imports. This clearly indicates the fact that Brazil is keen on upgrading technology on continuous basis and hence it is importing capital technological goods from the advanced countries. The domestic demand for imported fruits/nuts (fresh or dried) is quiet significant and is increasing. This is primarily due to sharp rise in the income levels of middle class population and also due to steep increase in the middle-class population itself.

10. Table 5(b): Average Percentage increase or decrease in imports of major groups related to FPI

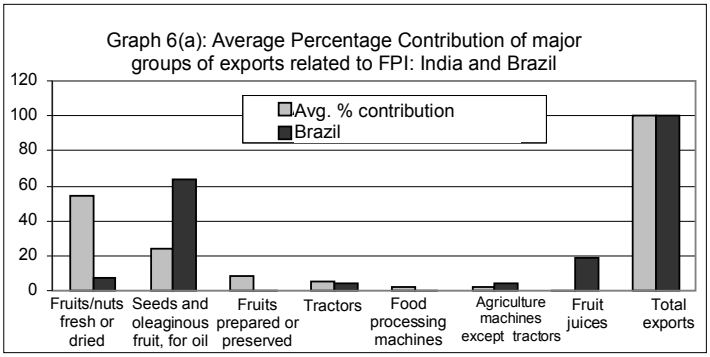
Imports of major groups related to FPI	*Average % increase/decrease*	
	India	***Brazil***
Seeds and oleaginous fruit, for oil	57.14	-8.46
Food processing machines	38.46	-7.43
Fruits prepared or preserved	36.05	-5.56
Agriculture machines except tractors	21.78	17.17
Fruits/nuts fresh or dried	11.85	-4.08
Fruit juices	6.43	-7.10
Tractors	-5.32	7.30
Total Imports	**13.56**	**-2.86**



The table and graph shown above reveal that except Agri. Machines and tractors, Brazil has experienced decrease in the imports of all the major groups pertaining to FPI, whereas India has experienced significant increase (ranging from 6 to 57%) in the imports of all the major groups related to FPI (Fruit Processing Industry) except tractors. The total imports of all the major groups related to FPI stands at 74 million US$ for India, which is much higher compared to Brazilian imports worth 47 million US$. The average percentage increase in total imports related to FPI stands at 13.56 percent for India whereas the same is -2.86 percent for Brazil. This clearly means India is more dependent on imports than Brazil and is steadily increasing. Brazilian imports over the past years had shown a small fluctuation (from 47 to 54 million US$), whereas Indian imports revealed a wide fluctuation (from 30 to 74 million US$).

11. Table 6(a): Average Percentage contribution of major groups of exports related to FPI: India and Brazil

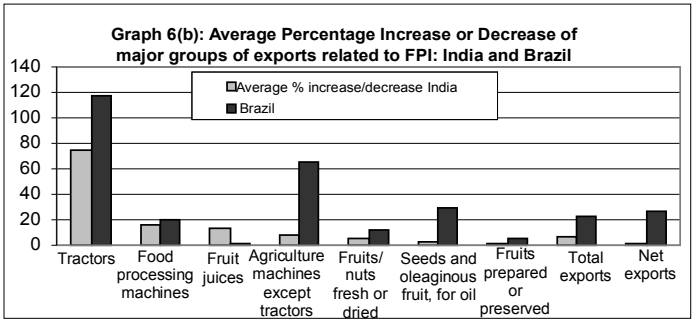
Exports of major groups related to FPI	***Average % contribution***	
	India	***Brazil***
Fruits/nuts fresh or dried	54.86	7.7
Seeds and oleaginous fruit, for oil	24.56	63.36
Fruits prepared or preserved	8.81	0.57
Tractors	6.07	4.13
Food processing machines	2.88	0.51
Agriculture machines except tractors	2.29	4.18
Fruit juices	0.53	19.54
Total exports	**100**	**100**



The table and graph shown above reveal the composition of total exports of major groups related to FPI (Fruit Processing Industry), of both the countries. Indian exports constitute of; the fruits/nuts (fresh or dried) (55%), seeds and oleaginous fruit for oil (25%) and the preserved and prepared fruits (9%). Whereas Brazilian exports constitute of; the seeds and oleaginous fruit (63%), fruit juices (20%) and the fruits/nuts (fresh and dried) (8%). This clearly gives the signal that Brazil is keen on exporting value added processed fruit products like fruit juices than simply the fresh fruits/nuts, which India is doing. Moreover the byproducts of fruits like seeds have been put to waste in India, whereas Brazil is earning significant FOREX through exporting the same. So India has to shift her attention from exporting basic fruits to exporting the value added processed fruit products, which in turn will strengthen the BoP (Balance of Payments) position of India and generate more employment. Moreover the byproducts of fruits like seeds shouldn't be wasted.

12. Table 6(b): Average Percentage increase or decrease of major groups of exports related to FPI

Exports of major groups related to FPI	***Average % increase/decrease***	
	India	***Brazil***
Tractors	75.43	117.12
Food processing machines	16.28	20.02
Fruit juices	14.01	0.94
Agriculture machines except tractors	8.63	65.91
Fruits/nuts fresh or dried	5.63	12.07
Seeds and oleaginous fruit, for oil	3.5	29.63
Fruits prepared or preserved	2.11	5.15
Total exports	6.84	22.35
Net exports	1.04	26.46

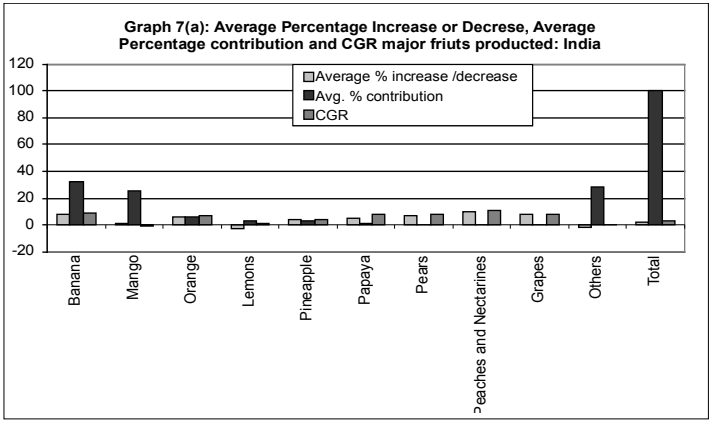


As revealed by the above table and graph shown above, exports of tractors and food processing machines have shown a tremendous growth, collectively, for both India and Brazil. India has experienced significant increase as far as exports of fruit juice is considered. Whereas in all the other groups including; fruits/nuts (fresh or dried), agricultural machines except tractors, and seeds and oleaginous fruits, Brazil has experienced significant increase in their exports than India. Brazil has experienced significant growth compared to India, when we consider the total exports of major groups related to FPI and also the net exports (because total Brazilian imports of major groups related to FPI has shown decline). It can be concluded that there lies tremendous scope for exports in this sector.

As the independent t-test reveals, there is a significant difference (t-critical = 2.306; t-stat = -5.55) between India and Brazil, when we consider total exports and net exports of each nation. Mean value of Brazilian exports is US$ 508 million, whereas mean value of Indian exports is US$ 55 million (Refer t-test table from Appendix XXIX). Value of Brazilian exports is nearly ten fold as that of India.

13. Table 7(a): Important parameters pertaining to major fruits produced in India

Major fruits produced	*Average % increase /decrease*	*Avg. % contribution*	*CGR*
Banana	8.2	32.33	8.45
Mango	0.63	25.4	-0.86
Orange	6.13	6.05	7.31
Lemons	-2.43	3.02	1.12
Pineapple	4.27	2.51	3.86
Papaya	5.36	1.37	7.37
Pears	6.73	0.39	7.68
Peaches and Nectarines	9.56	0.27	10.5
Grapes	8.04	0.26	8.11
Others	-1.45	28.4	0.17
Total/Net	**2.14**	**100**	**3.04**



It can be noticed from the above table and graph that Mango accounts for nearly 25 percent of the total fruit production in India, next only to Banana which accounts for nearly 33 percent of total fruit production. Orange, lemon, pineapple and papaya occupy the next slots, accounting, collectively, for around 13 percent of total fruit production.

It can be further noticed that banana, orange, papaya, pears, peaches and nectarines, and grapes have all experienced a healthy growth trend (CGR of 7-9 percent). Surprisingly, mango has shown marginal negative growth. This is in fact a cause for concern for mango processing industry of India and needs to be addressed. When we compare the growth rate of the total fruit production, India is well placed with a CGR of 3.04 percent compared to -1.16 percent of Brazil.

14. Table 7(b): Important parameters pertaining to major fruits produced in Brazil

Major fruits produced	*Average % increase/decrease*	*Average % contribution*	*CGR*
Orange	-2.79	56.15	-4.29
Banana	3.29	16.5	3.68
Papaya	-3.99	4.7	-3.93
Pineapple	4.2	4.08	0.38
Lemons	11.49	1.93	13.27
Mango	11.78	1.8	9.08
Peaches and Nectarines	7.41	0.49	8.97
Grapes	1.01	0.18	1.19
Pears	0.66	0.05	3.01
Others	3.12	14.11	3.14
Total/Net	**-0.65**	**100**	**-1.16**