Shift in Bean-Disease Importance due to Changes in Cultural Practice and in Seed Preference in Brazil[1]

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Introduction.

Back in 1978/79 the major bean production area was concentrated in the southern part of Brazil, where Parana, Santa Catarina and Rio Grande do Sul produced about 38 % of the national bean production of 2.1 million ton/year. Beans were mainly planted in September and to a extent, in January as secondary season. Santa Catarina had the highest productivity which is around 900 kg/ha. In Central west region, the State Sao Paulo and Minas Gerais produced around 500 000 t/year and in the northeast, Bahia (with 210 000 t/year) was the largest producer. In 1990, beans production in Brazil shifted to more intensive agriculture and moved to the north, specially into regions where night temperature during the winter period does not go below 14^0 C. In these regions, irrigated bean production during the dry winter months produced almost 10 % of the National Bean Production, which is now around 2.8 million ton/year, and with only a fraction of acreage needed. Bean yield in irrigated area is 3 to 4 times higher than under rainfed production. Average yield of 2.5 t/ha is common under irrigation and disease and pest incidence is minimum. As a consequence of this third planting season and northward move, the biotic constraints change accordingly, since beans are in the field all year long.

In this period there were more than 9 grain types offered at the commodity market of São Paulo: Preto (Black), Roxão (Purple), Rosinha (Pink), Mulatinho (Cream), Chumbinho (Tan), Enxofre (Yellow medium seeded), Rajado or Carnaval (Cranberry type), Jalo (Yellow large seeded), Mantegão (Large seeded cream) and in the mid 90's the commodity market at São Paulo offers just 5 grain types: Carioca, Black, Jalinho, Jalo and

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Rajado. The Carioca grain type that became popular in the mid 80's, is now the leading grain type in Brazil and is available all year long in the market places. This is the easiest grain type to sell at the farm gate to the intermediaries. But within the Carioca grain type, the commodity market in São Paulo subdivided the Carioca grain type into several subclasses according to the freshness of the product. The most recently harvested commands the highest price and classified as luxo novo, and the subsequent classes are: extra I, extra 2, semi novo, and commercial.A new Carioca grain type class was created because of the newly released cultivars by several Research Institutions. These new cultivars are not exactly the same grain color and pattern as the Carioca, some of them are speckled, striped with slightly different background color. For example, the cultivar Aporé, which is now a class of its own, because it has the characteristics of the Carioca cultivar, but possesses an orange hilum. Aporé become a commercial class, because it is a very high yielding variety and therefore cultivated by many small and large famers. Because of this advantage it can compensate the price difference imposed by the intermediaries at the farm gate. Also some new commercial classes were created according to the Institution who released the material. In 1985 the first of this type is EMGOPA Ouro, which was in the beginning called Jalinho. When there are several new cultivars adopted by the farmers, slightly different from the commercial ones, and available in large quantity, the commodity market is flexible enough and opens new classes. The venerable Jalinho of EMGOPA become ENGOPA and in the beginning of the 90's, IAPAR has released several speckled Carioca types. These lines are now classified as IAPAR group. These many classifications of bean within and outside the Carioca grain type, unfortunately, do not reflect on the large genetic variation of the Phaseolus bean. These newly released cultivars have till to certain extent the traditional Carioca genetic composition. The seed color preference is changed not due to the consumer's preference, but the market force. The bean supply leads the consumer to adopt this change. Hence the market tends to narrow the genetic variability of the bean in Brazil. This shows the urgent need to release and distribute the recently bred Carioca advanced breeding lines with different backgrounds. On the other hand there is a small trend in diversification in seed color beyond the traditional boundary. In a few cases farmers plant some other cultivars for their own consumption. E.g., In the northeast, where Mulatinho grain type dominates the

region, some farmers do plant black beans for their own consumption and in Acre, where Carioca is the leading cultivar, some farmers grow Rosinha de moite and/or Gurgutuba cultivars. In the Zona da Mata of Minas Gerais, people commonly grow the black seeded bean, but in some areas farmers do plant red brilliant beans for a specific local market and their own consumption. The quantity of the product of these varieties is too small to go into the commodity market, hence it will remain in their traditional site. The tendency in the future is going toward planting uniform cultivar that dominate the market. This is not desirable from the point of view of genetic variability. Uniform genetic bases may be prone to great disaster when one disease can decimate the whole bean production of the region with more or less homogeneous genetic composition. Recently CIAT produced Carioca grain types from different parents as the traditional Carioca, and now they are available in Brazil and ready for distribution.

It is hoped that this recent survey on diseases will help to plan the breeding program.

Materials and Method:

In order to actualize the information on diseases in the bean production area all over Brazil without traveling extensively, simple questionnaires were elaborated and sent to the collaborators, who are working in the National Bean Evaluation Network, in the Cooperative and Private Company to evaluate the disease and pest development in their region.
The simple questionnaire has 3 columns of questions to be filled in: 1. the importance (how frequently it occurs) of the disease in the region), 2. the severity (how severe is the damage in each planting) and 3. the planting season, in which the disease normally occurred. Collaborator was asked to fill these columns by giving their scoring (1= very important to 5= non The questionnaire is not designed to separate what is chronic and what is sporadic disease, although scientists tend to answer the sporadic disease as less important. The list of 18 diseases and 25 pests were given and if there is any other important disease in the region not included in the list, they were asked to add. Fifty questionnaires were distributed and thirty-one returned within 2 months and some doubts were clarified by phone calls. Their great effort to fill the questionnaire merits to be mentioned here.

The questionnaires were evaluated by counting the frequency

(in percentage of the number of the respondents) of each disease. Very important (1) and important (2) scores are bulk to gether and become important and score 3 and lower is classified as not important. The severity column is also evaluated in the same manner. The class of importance are those diseases that more than 50% of the collaborators scores as 1 or 2. Frequency lower than 50 % of the respondents will be classified as not important disease.

Result:

To produce advanced breeding lines with multiple disease resistance in combination with high yielding potential is still a long process and time consuming. In addition breeding program needs to know what is the demand in the future. In the past, bean scientists had the chance to visit the important bean growing regions in Brazil every year and the progress of the breeding could be evaluated directly during the visit in the field and at the same time discussed with the local scientists. With limited time to travel and increasing velocity of development in bean production area, it is difficult to keep abreast with the changes. To aleviate these problems questionnaires were sent to all collaborators in the Bean Evaluation Network in Brazil and asked their judgement of diseses prevalent in their region. Sixty percent responded and the result is as followed.

The questionnaires reveal, that 87% of the respondents mentioned the Angular Leaf Spot as the most important disease in bean production in Brazil, followed by 70% for Anthracnose, 63% for CBB, and 60% for Fusarium oxysporum. Only 56% of the respondents think that Rust and BGMV is important in Brazil. The secondary diseases (less than 50% of the respondents) are Fusarium solani, Sclerotium, Rhizoctonia and BCMV (Table 1). These soil born diseases are rather new developments and become more and more important in the irrigated production areas. When bean production is divided in 3 regions as recommended by the Bean Technical Commission, the rank order of importance changed somewhat, but the diseases stay in the same class of importance. In the South, the highest priorities were given to Anthracnose and ALS; in the Northeast, Fusarium oxysporum and ALS; and in Central west ALS and Fusarium oxysporum. Furthermore White mold and Rhizoctonia are frequently observed. In the past these soil born diseases were limited to areas with special climatic conditions for the development of these diseases. In the

majority of the areas the soil dries up for more than 5 months. Now irrigation keeps the soil humidity high all the time, favorable for disease development. In short, these are man made diseases.

Web blight was limited in the warm region only, but recently it occasionally became rampant in the Cerrado area, when favorable climatical conditions occurred. Bean Golden mosaic virus problem in beans is the result of the expansion of soybean production. Beans are planted next to soybean and agriculture zonification is difficult to implement. In the safrinha when the soybean is ready for harvest, the white fly in the soybean migrates to the recently planted bean, causing severe damage.

BGMV, for still unknown reason, is still limited to the traditional region where it was, in the northern part of Parana, São Paulo, Mato Grosso do Sul, Goias, part of Minas Gerais and Tocantins. These small grain type preferences of Meso american race, determined by the supply side, narrow the genetic viariability of bean in the field though reducing the production of the medium to large grain type from the field. These large to medium size grain types are Andean races germplasm that have normally some tolerant to ALS, but susceptible to mildew (Oidium = Erysiphe polygoni DC. Ex Merat). Example Jalo EEP 558 normally cultivated in several region due to its earliness and have its class of its own in commodity market:. Jalo. For many year Jalo EEP 558 is the best source for resistance to ALS in breeding program. Up to this date no total resistance has been detected for ALS disease. In the last 15 years there was not a single large or medium size bean has been released in Brazil. The argument of not woorking in this type of grain is the limited demand. But in the remote area such as in the Forest Margins of the Amazon medium to large seeded beans are commonly grown by small farmers for own consumption.

EMBRAPA has done this exercise in 1975-1979 and published in 1981 as The National Program for Bean Research. Basically there are few changes, but important ones. ALS was not classified as the most important disease in most region of Brazil except in Espirito Santo, Minas Gerais and Rio de Janeiro at that time, whereas now ALS is the most important disease in all bean regions of Brazil. Fusarium and white mold are now very important and in the early days it was lumped together as root rot complex. BGMV seems not to develop beyond the boundary known.

These are the biotic constraints classified as important by the respondents. Abiotic constraints such low soil fertility, high Al and Mn toxicity, soil degradation and erosion will be accessed next opportunity, which is expected to be as important as the biotic constraints.

No.	DISEASE	SCIENTIFIC NAME	PERCENTAGE OF RESPONDENTS
1	Angular Leaf Spot	Isariopsis griseola Sacc.	87%
2	Anthracnose	Colletotrichum lindemuthianum (Sacc. & Mag.) Scrib.	70%
3	Common Bacterial Blight	Xanthomonas campestris pv. Phaseoli (Smith) Dye	63%
4	Fusarium Yellows	Fusarium oxysporum Schlecht.f.sp. Phaseoli Kendrick& Snyder	60%
5	Rust	Uromyces phaseoli var. typica arth.	56%
6	Bean Golden Mosaic Virus	Virus	56%
7	Fusarium solani	Fusarium solani (Mart.)Sacc.f.sp.pisi (Jones)Snyd.& Hans.	43%
8	Southern Blight	Sclerotium rolfsii Curzi	41%
9	Rhizoctonia solani	Rhizoctonia solani Kühn	40%
10	White Mold	Sclerotinia sclerotiorum (Lib.) de Barry	38%
11	Bean Common Mosaic Virus	Virus	33%
12	Ashy Stem Blight	Macrophomina phaseolina (Tassi) Goidanich	26%
13	Powdery Mildew	Erysiphe polygoni DC. ex Merat	18%
14	Web Blight	Thanatephorus cucumeris (Frank) Donk	15%
15	Ascochyta Leaf Spot	Ascochyta spp	14%
16	Nematode	Meloidogyne incognata (Kofoid & White) Chitwood	11%
17	Phytium Wilt	Phytium spp	8%
18	Alternaria	Alternaria spp	---

Table 1 : Percentage of respondents indicating the **importance** of bean disease in all Brazil, number of respondents = 30 .

No.	DISEASE	SCIENTIFIC NAME	PERCENTAGE OF RESPONDENTS
1	Angular Leaf Spot	Isariopsis griseola Sacc.	85%
2	Fusarium Yellows	Fusarium oxysporum Schlecht.f.sp. Phaseoli Kendrick& Snyder	77%
3	Bean Golden Mosaic Virus	Virus	72%
4	Fusarium solani	Fusarium solani (Mart.)Sacc.f.sp.pisi (Jones)Snyd.& Hans.	67%
5	Rust	Uromyces phaseoli var. typica arth.	62%
6	Common Bacterial Blight	Xanthomonas campestris pv. Phaseoli (Smith) Dye	61%
7	White Mold	Sclerotinia sclerotiorum (Lib.) de Barry	61%
8	Bean Common Mosaic Virus	Virus	54%
9	Anthracnose	Colletotrichum lindemuthianum (Sacc. & Mag.) Scrib.	54%
10	Rhizoctonia solani	Rhizoctonia solani Kühn	54%
11	Ashy Stem Blight	Macrophomina phaseolina (Tassi) Goidanich	45%
12	Southern Blight	Sclerotium rolfsii Curzi	42%
13	Web Blight	Thanatephorus cucumeris (Frank) Donk	30%
14	Alternaria	Alternaria spp	27%
15	Powdery Mildew	Erysiphe polygoni DC. ex Merat	25%
16	Phytium	Phytium spp	9%
17	Nematode	Meloidogyne incognata (Kofoid & White) Chitwood	9%
18	Ascochyta Leaf Spot	Ascochyta spp	---

Table 2 : Percentage of respondents indicating the **importance** of bean diseases in the Central West of Brazil (Goias, Mato Grosso do Sul, Mato Grosso, Minas Gerais, São Paulo, Rio de Janeiro, Espirito Santo) , number of respondents = 13.

No.	DISEASE	SCIENTIFIC NAME	PERCENTAGE OF RESPONDENTS
1	Fusarium Yellows	Fusarium oxysporum Schlecht.f.sp. Phaseoli Kendrick& Snyder	60%
2	Angular Leaf Spot	Isariopsis griseola Sacc.	50%
3	Southern Blight	Sclerotium rolfsii Curzi	50%
4	Rust	Uromyces phaseoli var. typica arth..	40%
5	Anthracnose	Colletotrichum lindemuthianum (Sacc. & Mag.) Scrib.	40%
6	Ashy Stem Blight	Macrophomina phaseolina (Tassi) Goidanich	40%
7	Rhizoctonia solani	Rhizoctonia solani Kühn	40%
8	Nematode	Meloidogyne incognata (Kofoid & White) Chitwood	40%
9	Web Blight	Thanatephorus cucumeris (Frank) Donk	40%
10	Bean Common Mosaic Virus	Virus	20%
11	Powdery Mildew	Erysiphe polygoni DC. ex Merat	20%

Table 3 : Percentage of respondents indicating the **importance** of bean diseases in Northeast of Brazil (Pernambuco, and Bahia) number of respondents = 5 .

No.	DISEASE	SCIENTIFIC NAME	PERCENTAGE OF RESPONDENTS
1	Anthracnose	Colletotrichum lindemuthianum (Sacc. & Mag.) Scrib.	100%
2	Angular Leaf Spot	Isariopsis griseola Sacc.	100%
3	Common Bacterial Blight	Xanthomonas campestris pv. Phaseoli (Smith) Dye	83%
4	Bean Golden Mosaic Virus	Virus	64% * restricted to Parana only
5	Rust	Uromyces phaseoli var. typica arth.	58%
6	Fusarium Yellows	Fusarium oxysporum Schlecht.f.sp. Phaseoli Kendrick& Snyder	42%
7	Southern Blight	Sclerotium rolfsii Curzi Sclerotinia sclerotiorum (Lib.) de Barry	36%
8	Fusarium solani	Fusarium solani (Mart.)Sacc.f.sp.pisi (Jones)Snyd.& Hans. Virus	33%
9	Rhizoctonia solani	Rhizoctonia solani	25%
10	White Mold	Sclerotinia sclerotiorum (Lib.) de Barry	25%
11	Bean Common Mosaic Virus	Virus	18%
12	Powdery Mildew	Erysiphe polygoni DC. ex Merat	9%
13	Alternaria	Alternaria spp	8%

Table 4 : Percentage of respondents indicating the **importance** of bean diseases in the South of Brazil (Parana, Santa Catarina and Rio Grande do Sul) , number of respondents = 12 .

No.	DISEASE	SCIENTIFIC NAME	PERCENTAGE OF RESPONDENTS
1.	Angular Leaf Spot	Isariopsis griseola Sacc.	93%
2.	Antracnose	Colletotrichum lindemuthianum (Sacc. & Mag.) Scrib.	78%
3.	Fusarium Yellows	Fusarium oxysporum Schlecht.f.sp. Phaseoli Kendrick& Snyder	68%
4.	Common Bacterial Blight	Xanthomonas campestris pv. Phaseoli (Smith) Dye	63%
5.	White Mold	Sclerotinia sclerotiorum (Lib.) de Barry	56%
6.	Fusarium solani	Fusarium solani (Mart.)Sacc.f.sp.pisi (Jones)Snyd.& Hans.	54%
7.	Bean Golden Mosaic Virus	Virus	54%
8.	Rizoctonia solani	Rhizoctonia solani Kühn	54%
9.	Rust	Uromyces phaseoli var. typica arth.	46%
10.	Bean Common Mosaic Virus	Virus	40%
11.	Ashy Stem Blight	Macrophomina phaseolina (Tassi) Goidanich	36%
12.	Southern Blight	Sclerotium rolfsii Curzi	31%
13.	Web Blight	Thanatephorus cucumeris (Frank) Donk	29%
14.	Nematode	Meloidogyne incognata (Kofoid & White) Chitwood	28%
15.	Powdery Mildew	Erysiphe polygoni DC. ex Merat	15%
16.	Alternaria	Alternaria spp	8%
17.	Phytium Wilt	Phytium spp	4%
18.	Ascochyta Leaf Spot	Ascochyta spp	---

Table 5 : Percentage of respondents indicating the **severity** of bean disease in all Brazil , number of respondents = 30.

No.	DISEASE	SCIENTIFIC NAME	PERCENTAGE OF RESPONDENTS
1	Angular Leaf Spot	Isariopsis griseola Sacc.	100%
2	Fusarium Yellows	Fusarium oxysporum Schlecht.f.sp. Phaseoli Kendrick& Snyder	82%
3	Antracnose	Colletotrichum lindemuthianum (Sacc. & Mag.) Scrib.	70%
4	Bean Golden Mosaic Virus	Virus	60%
5	Fusarium solani	Fusarium solani (Mart.)Sacc.f.sp.pisi (Jones)Snyd.& Hans.	60%
6	Bean Common Mosaic Virus	Xanthomonas campestris pv. Phaseoli (Smith) Dye	58%
7	Rhizoctonia solani	Rhizoctonia solani Kühn	58%
8	White Mold	Sclerotinia sclerotiorum (Lib.) de Barry	58%
9.	Bean Common Mosaic Virus	Virus	50%
10.	Web Blight	Thanatephorus cucumeris (Frank) Donk	44%
11.	Rust	Uromyces phaseoli var. Typica Arth.	36%
12.	Ashy Stem Blight	Macrophomina phaseolina (Tassi) Goidanich	36%
13.	Nematode	Meloidogyne incognata (Kofoid & White) Chitwood	27%
14.	Alternaria	Alternaria spp	20%
15.	Powdery Mildew	Erysiphe polygoni DC. ex Merat	18%
16.	Southern Blight	Sclerotium rolfsii Curzi	17%
17.	Ascochyta Leaf Spot	Ascochyta spp	---
18.	Phytium wilt	Phytium spp	---

Table 6 : Percentage of respondents indicating the **severity** of bean diseases in the Central West of Brazil (Goias, Mato Grosso do Sul, Mato Grosso, Minas Gerais, São Paulo, Rio de Janeiro, Espirito Santo) , number of respondents =13.

No.	DISEASE	SCIENTIFIC NAME	PERCENTAGE OF RESPONDENTS
1	Angular Leaf Spot	Isariopsis griseola Sacc.	75%
2	Rust	Uromyces phaseoli var. typica arth..	60%
3	Antracnose	Colletotrichum lindemuthianum (Sacc. & Mag.) Scrib.	60%
4	Fusarium Yellows	Fusarium oxysporum Schlecht.f.sp. Phaseoli Kendrick& Snyder	40%
5	Bean Common Mosaic Virus	Virus	40%
6	Common Bacterial Blight	Xanthomonas campestris pv. Phaseoli (Smith) Dye	40%
7	Rhizoctonia solani	Rhizoctonia solani Kühn	40%
8	Web Blight	Thanatephorus cucumeris (Frank) Donk	33%
9	Ashy Stem Blight	Macrophomina phaseolina (Tassi) Goidanich	25%
10	Southern Blight	Sclerotium rolfsii Curzi	25%
11	Bean Golden Mosaic Virus	Virus	20%
12	Alternaria	Alternaria spp	---
13	Ascochyta Leaf Spot	Ascochyta spp	---
14	Powdery Mildew	Erysiphe polygoni DC. ex Merat	---
15	Fusarium solani	Fusarium solani (Mart.)Sacc.f.sp.pisi (Jones)Snyd.& Hans.	---
16	Nematode	Meloidogyne incognata (Kofoid & White) Chitwood	---
17	Phytium Wilt	Phytium spp	---
18	White Mold	Sclerotinia sclerotiorum (Lib.) de Barry	---

Table 7 : Percentage of respondents indicating the **severity** of bean diseases in Northeast of Brazil (Pernambuco, and Bahia) number of respondents = 5.

No.	DISEASE	SCIENTIFIC NAME	PERCENTAGE OF RESPONDENTS
1	Angular Leaf Spot	Isariopsis griseola Sacc.	92%
2	Antracnose	Colletotrichum lindemuthianum (Sacc. & Mag.) Scrib.	92%
3	Common Bacterial Blight	Xanthomonas campestris pv. Phaseoli (Smith) Dye	77%
4	White Mold	Sclerotinia sclerotiorum (Lib.) de Barry	70%
5	Fusarium Yellows	Fusarium oxysporum Schlecht.f.sp. Phaseoli Kendrick& Snyder	67%
6	Bean Golden Mosaico Virus	Virus	67%
7	Fusarium solani	Fusarium solani (Mart.)Sacc.f.sp.pisi (Jones)Snyd.& Hans.	64%
8	Rhizoctonia	Rhizoctonia solani Kühn	55%
9	Rust	Uromyces phaseoli var. typica arth.	50%
10	Southern Blight	Sclerotium rolfsii Curzi	50%
11	Nematode	Meloidogyne incognata (Kofoid & White) Chitwood	44%
12	Ashy Stem Blight	Macrophomina phaseolina (Tassi) Goidanich	40%
13	Bean Common Mosaic Virus	Virus	30%
14	Powdery Mildew	Erysiphe polygoni DC. ex Merat	18%
15	Phytium Wilt	Phytium spp	11%
16	Alternaria	Alternaria spp	---
17	Ascochyta Leaf Spot	Ascochyta spp	---
18	Web Blight	Thanatephorus cucumeris (Frank) Donk	---

Table 8 : Percentage of respondents indicating the **severity** of bean diseases in the South of Brazil (Parana, Santa Catarina and Rio Grande do Sul) , number of respondents = 12.

No.	DISEASE	SCIENTIFIC NAME	FIRST SEASON - PLANTING: SEPTEMBER - OCTOBER			
			CENTRAL WEST	NORTHEAST	SOUTH	BRAZIL
1	Angular Leaf Spot	Isariopsis griseola Sacc	40%	50%	71%	56%
2	Anthracnose	Colletotrichum lindemuthianum (Sacc. & Mag.) Scrib.	46%	25%	55%	49%
3	Web Blight	Thanatephorus cucumeris (Frank) Donk	44%	67%	0%	43%
4	Common Bacterial Blight	Xanthomonas campestris pv. phaseoli (Smith)	33%	33%	53%	42%
5	Rhizoctonia solani	Rhizoctonia solani Kühn	30%	33%	53%	40%
6	Fusarium solani	Fusarium solani (Mart.) Sacc.f. sp. pisi (Jones) Snyd. & Hans.	24%	50%	48%	37%
7	Phytium Wilt	Phytium spp	25%	25%	50%	37%
8	Alternaria	Alternaria spp	27%	29%	50%	37%
9	Southern Blight	Sclerotium rolfsii Curzi	29%	29%	47%	36%
10	Nematode	Meloidogyne incognata (Kofoid & White) Chitwood	33%	14%	44%	34%
11	Fusarium Yellows	Fusarium oxysporum Schlecht. f.sp.phaseoli Kendrick & Snyder.	24%	17%	48%	34%
12	White Mold	Sclerotinia sclerotiorum (Lib.) de Barry	7%	33%	53%	31%
13	Bean Common Mosaic Virus	Virus	22%	17%	43%	31%
14	Ashy Stem Blight	Macrophomina phaseolina (Tassi) Goidanich	9%	29%	44%	29%
15	Powdery Mildew	Erysiphe polygoni DC. ex Merat	21%	0%	40%	28%
16	Ascochyta Leaf Spot	Ascochyta spp	23%	40%	29%	27%
17	Rust	Uromyces phaseoli var.typica Arth.	16%	33%	10%	17%
18	Bean Golden Mosaic Virus	Virus	15%	20%	0%	11%

Table 9. The number of responses given by the collaborators indicating the incidence of disease in the bean crop planted in September - October.

No.	DISEASE	SCIENTIFIC NAME	FREQUENCY			
			SECOND SEASON - PLANTING: JANUARY - MARCH			
			CENTRAL WEST	NORTHEAST	SOUTH	BRAZIL
1	Bean Golden Mosaic Virus	Virus	62%	40%	100%	70%
2	Angular Leaf Spot	Isariopsis griseola Sacc.	45%	40%	71%	54%
3	Ashy Stem Blight	Macrophomina phaseolina (Tassi) Goidanich	73%	29%	44%	50%
4	Web Blight	Thanatephorus cucumeris (Frank) Donk	44%	33%	100%	50%
5	Bean Common Mosaic Virus	Virus	44%	50%	43%	45%
6	Alternaria	Alternaria spp	36%	43%	50%	43%
7	Rust	Uromyces phaseoli var.typica Arth.	37%	33%	60%	43%
8	Common Bacterial Blight	Xanthomonas campestris pv. phaseoli (Smith)	39%	33%	47%	42%
9	Southern Blight	Sclerotium rolfsii Curzi	35%	43%	40%	38%
10	Powdery Mildew	Erysiphe polygoni DC. ex Merat	21%	33%	53%	38%
11	Fusarium Yellows	Fusarium oxysporum Schlecht. f.sp.phaseoli Kendrick & Snyder.	33%	33%	39%	36%
12	Rhizoctonia solani	Rhizoctonia solani Kühn	35%	33%	35%	35%
13	Fusarium solani	Fusarium solani (Mart.) Sacc.f. sp. pisi (Jones) Snyd. & Hans.	33%	25%	38%	35%
14	Nematode	Meloidogyne incognata (Kofoid & White) Chitwood	25%	43%	38%	34%
15	Phytium Wilt	Phytium spp	13%	38%	36%	30%
16	White Mold	Sclerotinia sclerotiorum (Lib.) de Barry	21%	33%	27%	26%
17	Ascochyta Leaf Spot	Ascochyta spp	20%	25%	29%	25%
18	Anthracnose	Colletotrichum lindemuthianum (Sacc. & Mag.) Scrib.	15%	25%	30%	24%

Table 10: The number of responses given by the collaborators indicating the incidence of disease in the bean crop planted in January - March.

No.	DISEASE	SCIENTIFIC NAME	FREQUENCY			
			THIRD SEASON - PLANTING: JUNE - JULY			
			CENTRAL WEST	NORTHEAST	SOUTH	BRAZIL
1	White Mold	Sclerotinia sclerotiorum (Lib.) de Barry	71%	33%	20%	43%
2	Rust	Uromyces phaseoli var.typica Arth.	47%	33%	30%	40%
3	Powdery Mildew	Erysiphe polygoni DC. ex Merat	57%	67%	7%	34%
4	Phytium Wilt	Phytium spp	63%	38%	14%	33%
5	Nematode	Meloidogyne incognata (Kofoid & White) Chitwood	42%	43%	19%	31%
6	Fusarium Yellows	Fusarium oxysporum Schlecht. f.sp.phaseoli Kendrick & Snyder.	43%	50%	13%	30%
7	Fusarium solani	Fusarium solani (Mart.) Sacc.f. sp. pisi (Jones) Snyd. & Hans.	43%	25%	14%	28%
8	Anthracnose	Colletotrichum lindemuthianum (Sacc. & Mag.) Scrib.	38%	50%	15%	27%
9	Southern Blight	Sclerotium rolfsii Curzi	35%	29%	13%	26%
10	Rhizoctonia solani	Rhizoctonia solani Kühn	35%	33%	12%	26%
11	Bean Common Mosaic Virus	Virus	33%	33%	14%	24%
12	Ashy Stem Blight	Macrophomina phaseolina (Tassi) Goidanich	18%	43%	13%	21%
13	Alternaria	Alternaria spp	36%	29%	0%	20%
14	Angular Leaf Spot	Isariopsis griseola Sacc.	32%	20%	0%	20%
15	Ascochyta Leaf Spot	Ascochyta spp	40%	25%	0%	19%
16	Bean Golden Mosaic Virus	Virus	23%	40%	0%	19%
17	Common Bacterial Blight	Xanthomonas campestris pv. phaseoli (Smith)	28%	33%	0%	16%
18	Web Blight	Thanatephorus cucumeris (Frank) Donk	11%	0%	0%	7%

Table 11: The number of responses given by the collaborators indicating the incidence of disease in the bean crop planted in June - July.