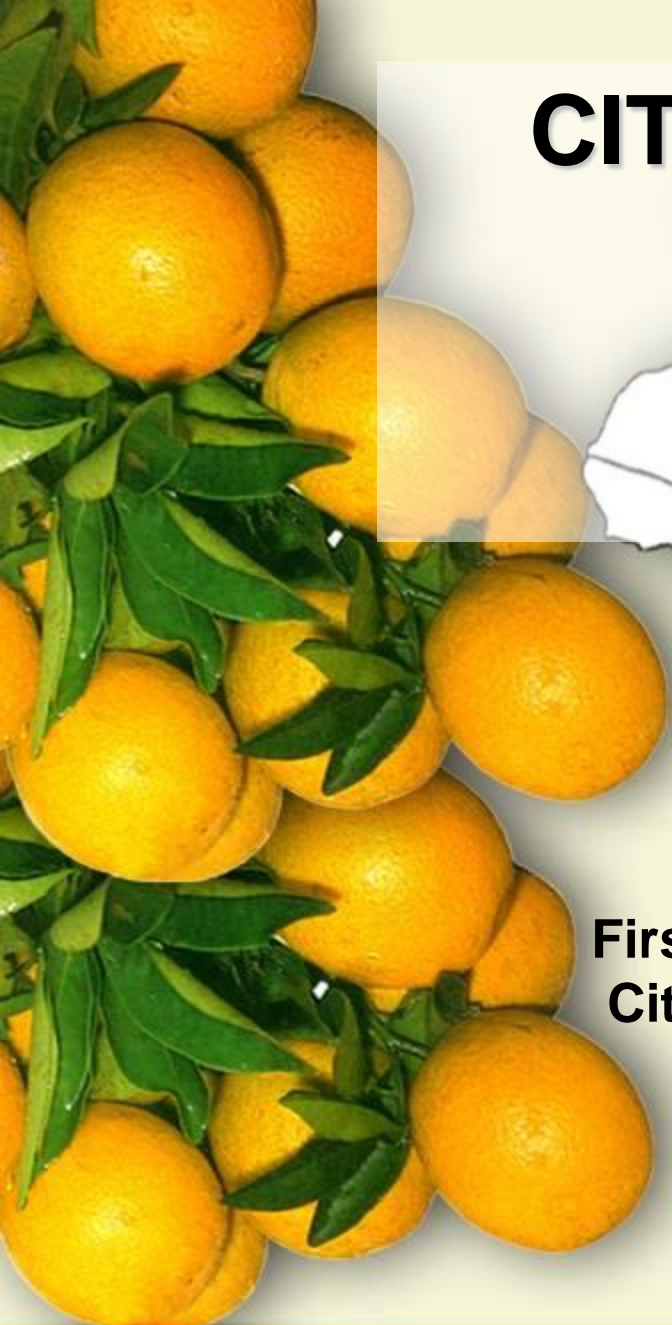




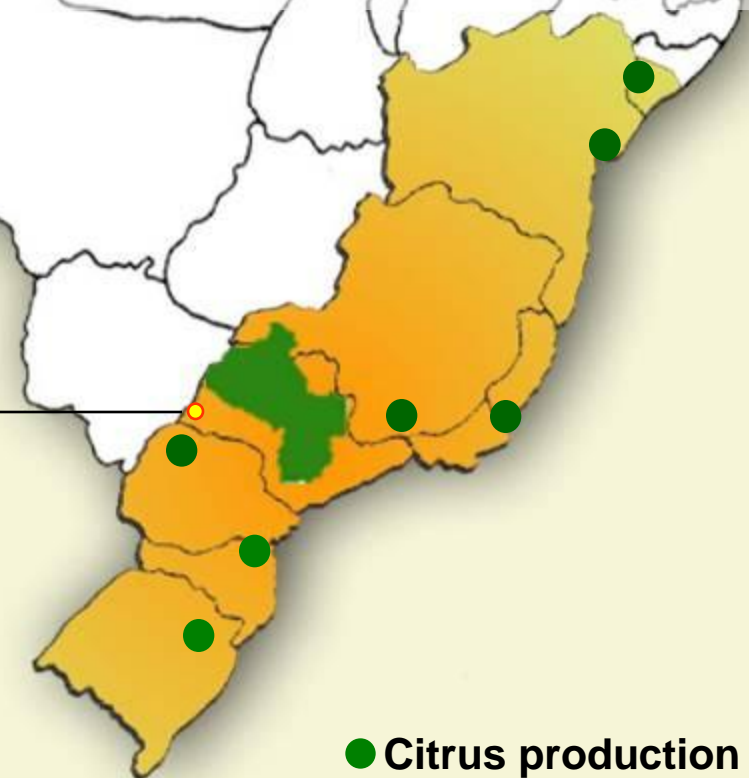
# **CURRENT SITUATION, MANAGEMENT AND ECONOMIC IMPACT OF CITRUS CANCKER IN SÃO PAULO AND MINAS GERAIS, BRAZIL**

**Renato B. Bassanezi  
José Belasque Júnior  
Cícero A. Massari**

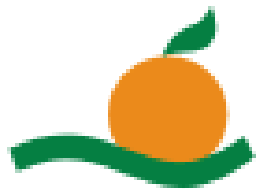
# CITRICULTURE IN BRAZIL VS CITRUS CANKER



1957  
First Report of  
Citrus Canker



● Citrus production areas



**FUNDECITRUS**  
FUND FOR CITRUS PLANT PROTECTION



**Built in 1977 to ensure the  
sanity of the citriculture,  
respecting the human  
being and the environment**

***fight against citrus canker***

# Citrus Canker Eradication Program

## Agreement Fundecitrus – Federal and SPS Governments

### Phytosanitary Support Centers

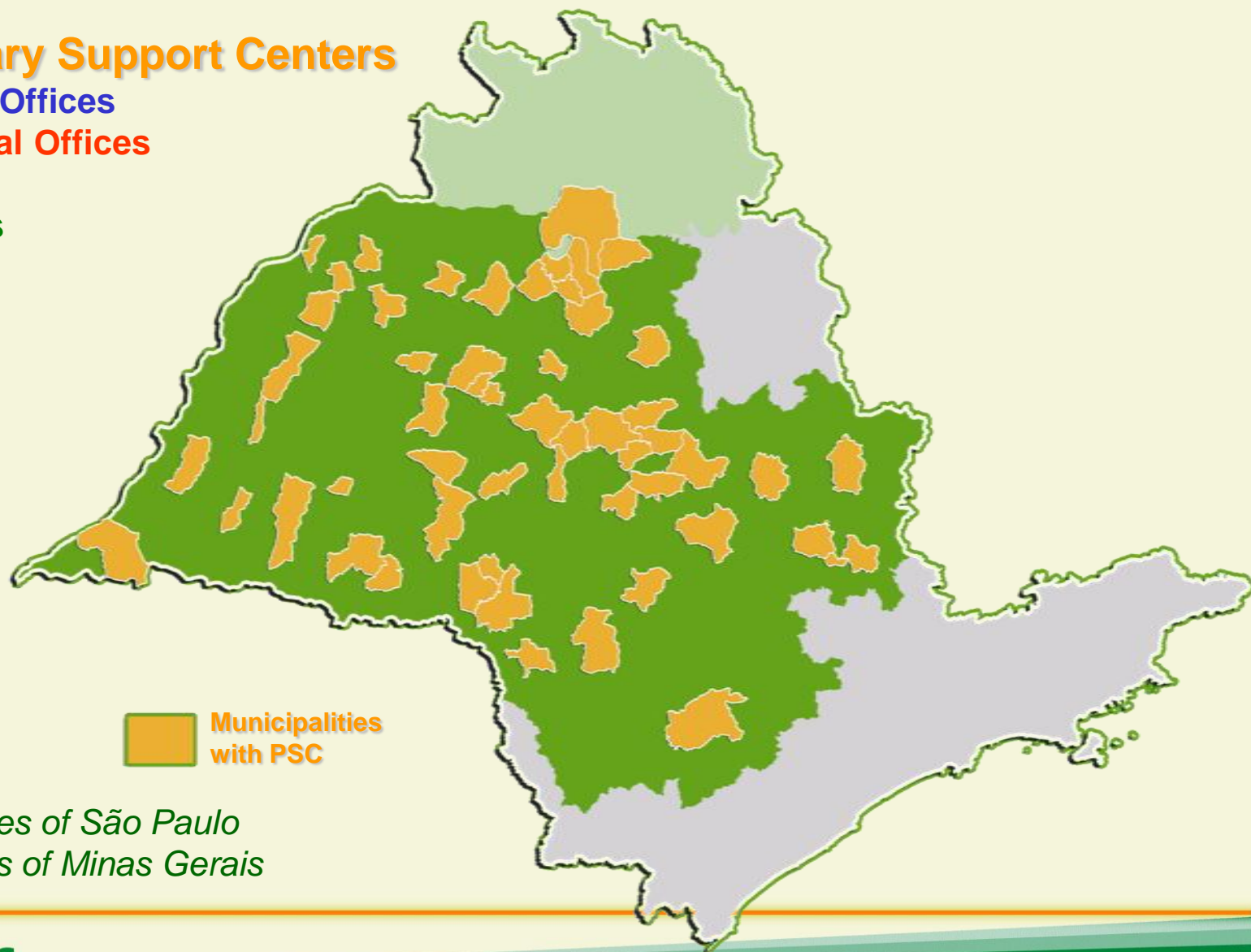
14 Fundecitrus Offices

42 Governmental Offices

1070 inspectors

54 technicians

18 agronomists



432 municipalities of São Paulo

17 municipalities of Minas Gerais

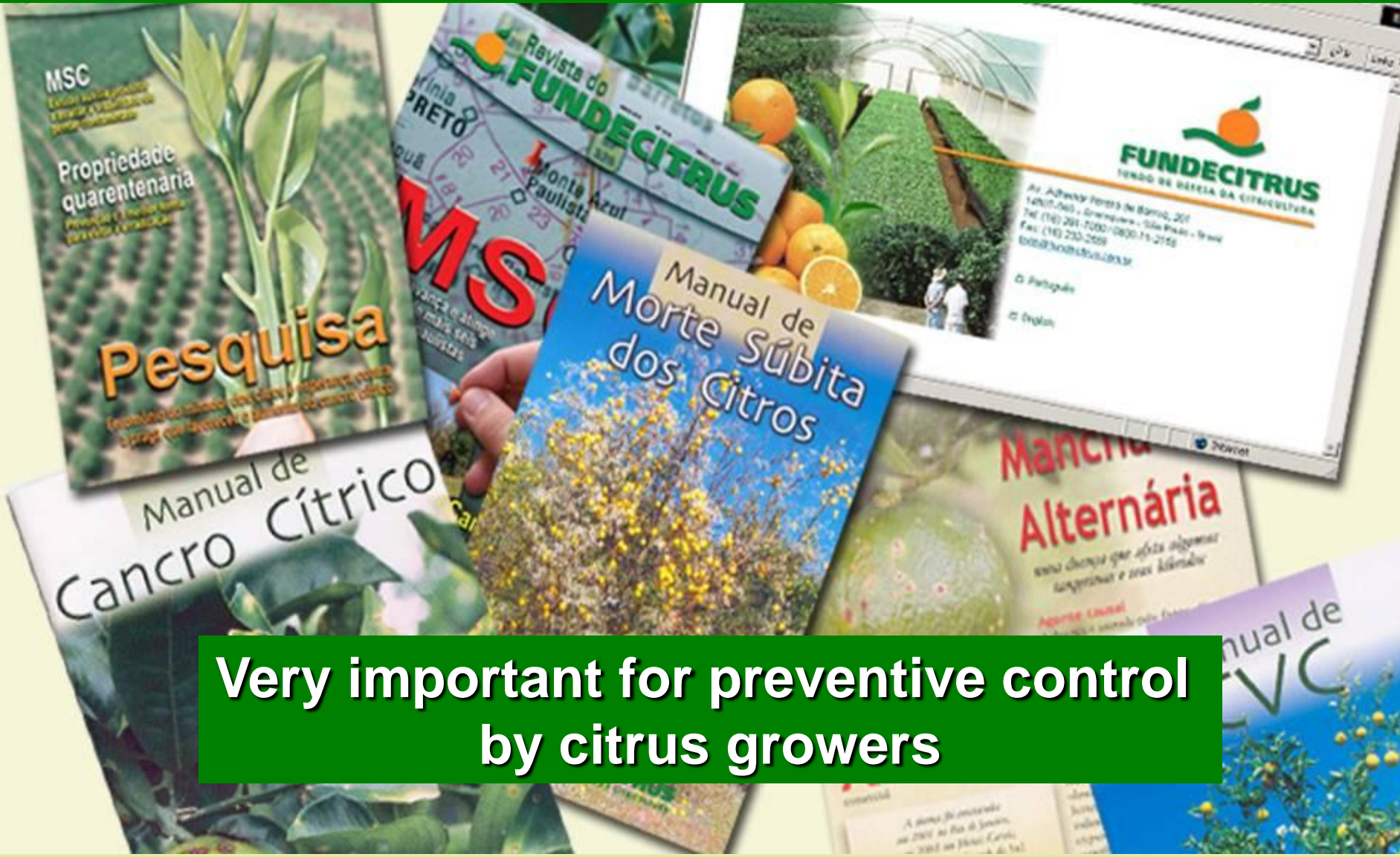
# Scientific Department - 1994



**08 researchers**  
**01 agronomist engineering**  
**01 lab technician**  
**04 research assistants**  
**04 lab assistants**  
**12 field assistants**  
**02 greenhouse workers**  
**12 students**



# Communication



Very important for preventive control by citrus growers

# Citrus canker symptoms





# Citrus Canker Prevention

# Citrus Canker Prevention



# Citrus Canker Prevention



# Citrus Canker Prevention



# Citrus Canker Prevention



# Citrus Canker Prevention



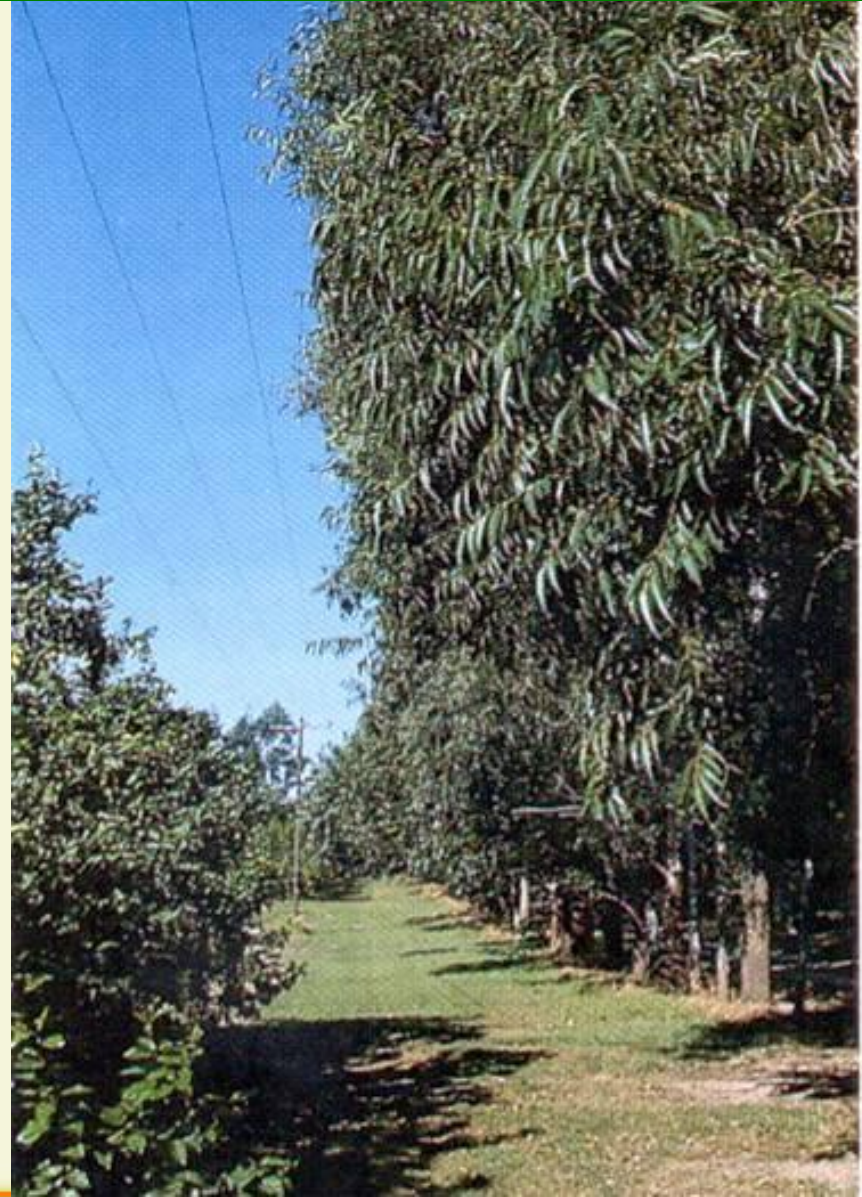
# Citrus Canker Prevention



# Citrus Canker Prevention



- *Casuarina*
- *Grevillea*
- *Leucaena*
- *Pinus*
- *Eucalyptus*



# Citrus Canker Prevention



# Citrus canker eradication in Brazil

## São Paulo State

- 1957 to 1961 – elimination of all citrus trees in 21 municipalities and planting prohibition (up to 1982)
- 1961 to 1979 – elimination of all trees from infested farm and trees in a radius of 1000 meters from infected tree
- 1987 to 1995 – radius of 50 meters from infected tree
- 1995 to 1999 – radius of 30 meters from infected tree



**Asian leafminer introduction**

- Leafminer injuries allow bacteria infection for longer time
- Leafminer infested trees show faster symptoms and in higher severity
- Leafminer injuries allow higher disease incidence
- Leafminer changed the spatial pattern of Canker in SPS (from high aggregated to less aggregated)



# Changing of methodology of eradication

An aerial photograph of an olive grove. The trees are arranged in a regular grid pattern. In the center of the grove, there is a large, roughly circular area where the vegetation is denser and greener than the surrounding trees, indicating a higher incidence of a disease.

$\leq 0.5\%$

- After September 1999

**Eradication based on disease incidence**

$> 0.5\%$

An aerial photograph of an olive grove, similar to the one above. This grove shows several distinct circular areas where the vegetation is significantly darker and denser than the surrounding trees, indicating a higher incidence of the disease. These areas are scattered throughout the grove.

# Citrus Canker Eradication Program in São Paulo State

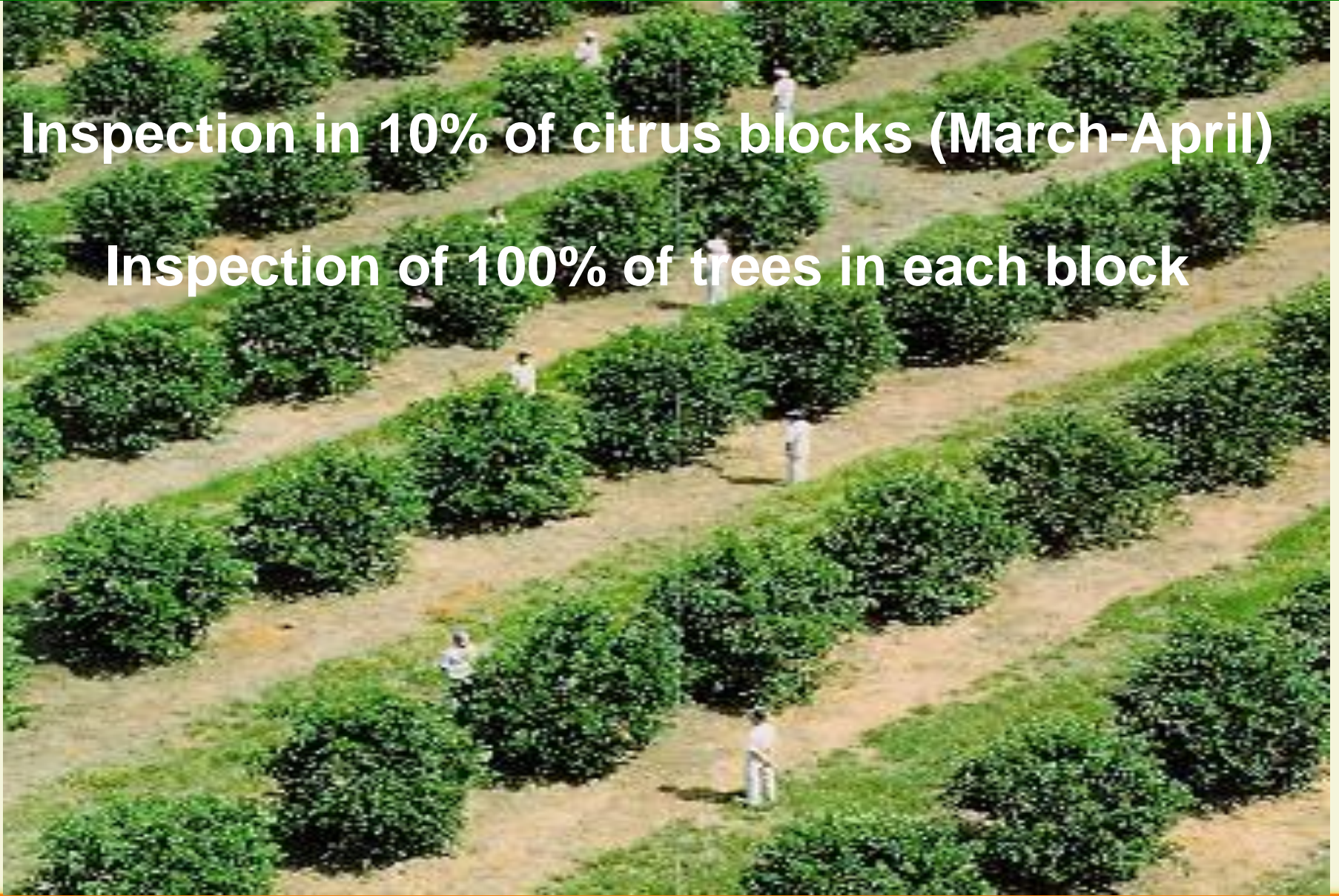
1. Sampling survey in all State
2. Total survey in suspected regions
3. Routine of inspection after focus detection
4. Inspection in non-commercial and urban areas
5. Inspection in nurseries



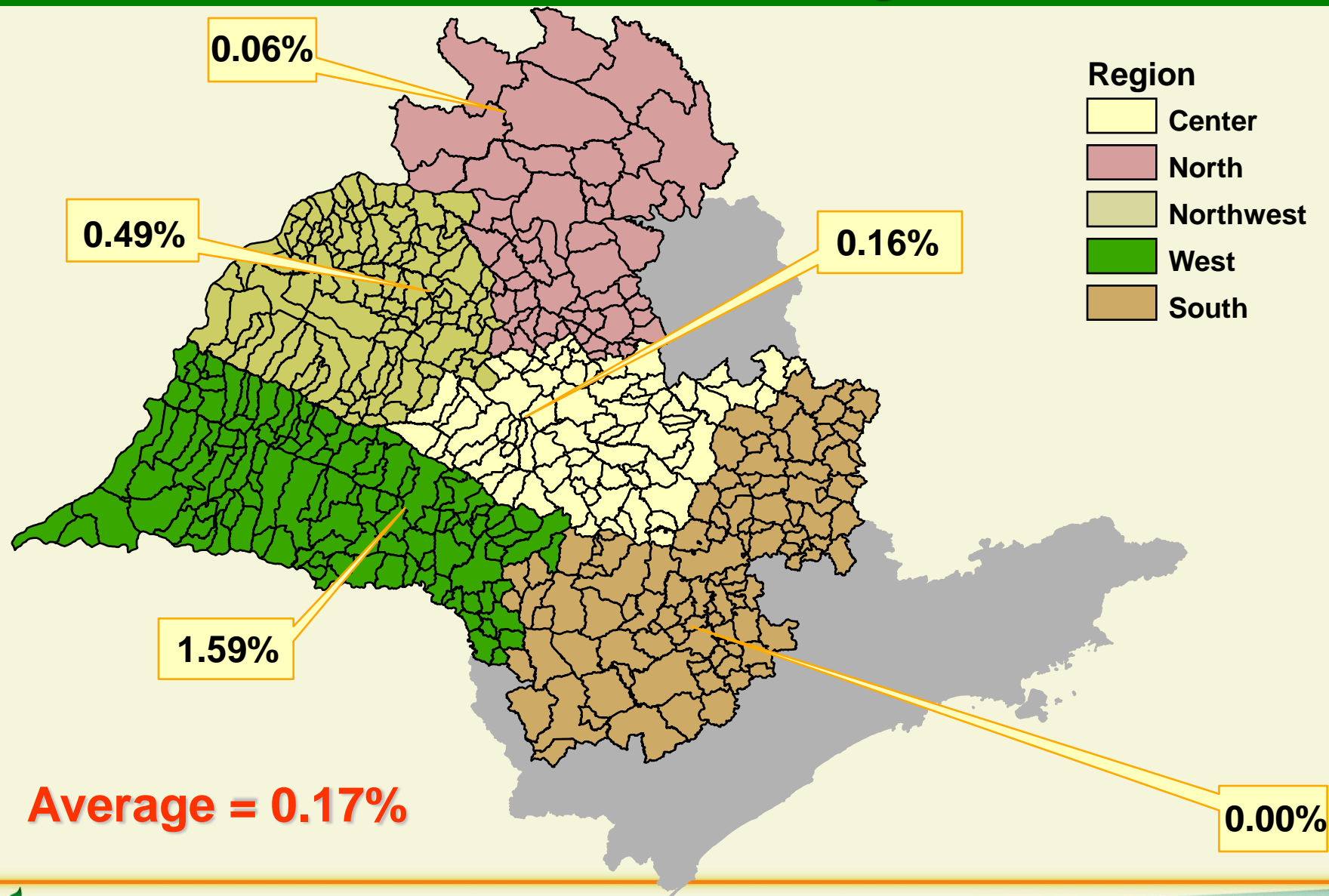
# 1. Sampling Survey in São Paulo State

Inspection in 10% of citrus blocks (March-April)

Inspection of 100% of trees in each block



# Citrus Canker incidence in commercial groves in São Paulo State and South of Triângulo Mineiro in 2008



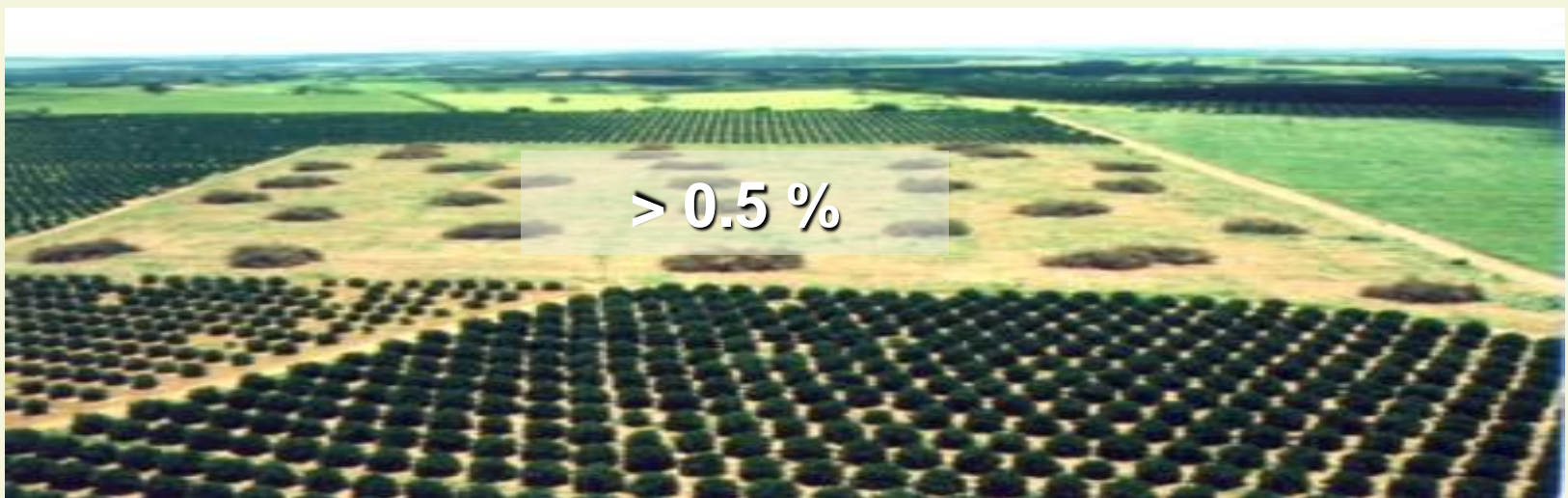
## 2. Total survey in suspected regions

**Inspection in 100% of citrus blocks in the suspected region**



**3 consecutive inspector teams to find all diseased trees in the block**

# Methodology of eradication





# 3. Routine of inspection after focus detection

## Blocks partially eradicated

- re-inspection 30 days after eradication (2 teams)
- one more re-inspection after 30 days (2 teams)
- one more re-inspection after 60 days (1 team)
- one more re-inspection after 60 days (1 team)
- one more re-inspection after 90 days (1 team) ... up to 2 years

### In the re-inspections:

- if  $> 0.5\%$  of diseased trees = elimination of block
- if  $< \text{or} = 0.5\%$  of diseased trees = elimination of diseased tree

- All block of contaminated farms and of neighbor farms are inspected



# Burning of “new focus” tree



# Burning of “new focus” tree



## 4. Inspection in non-commercial and urban areas



## 4. Inspection in non-commercial and urban areas



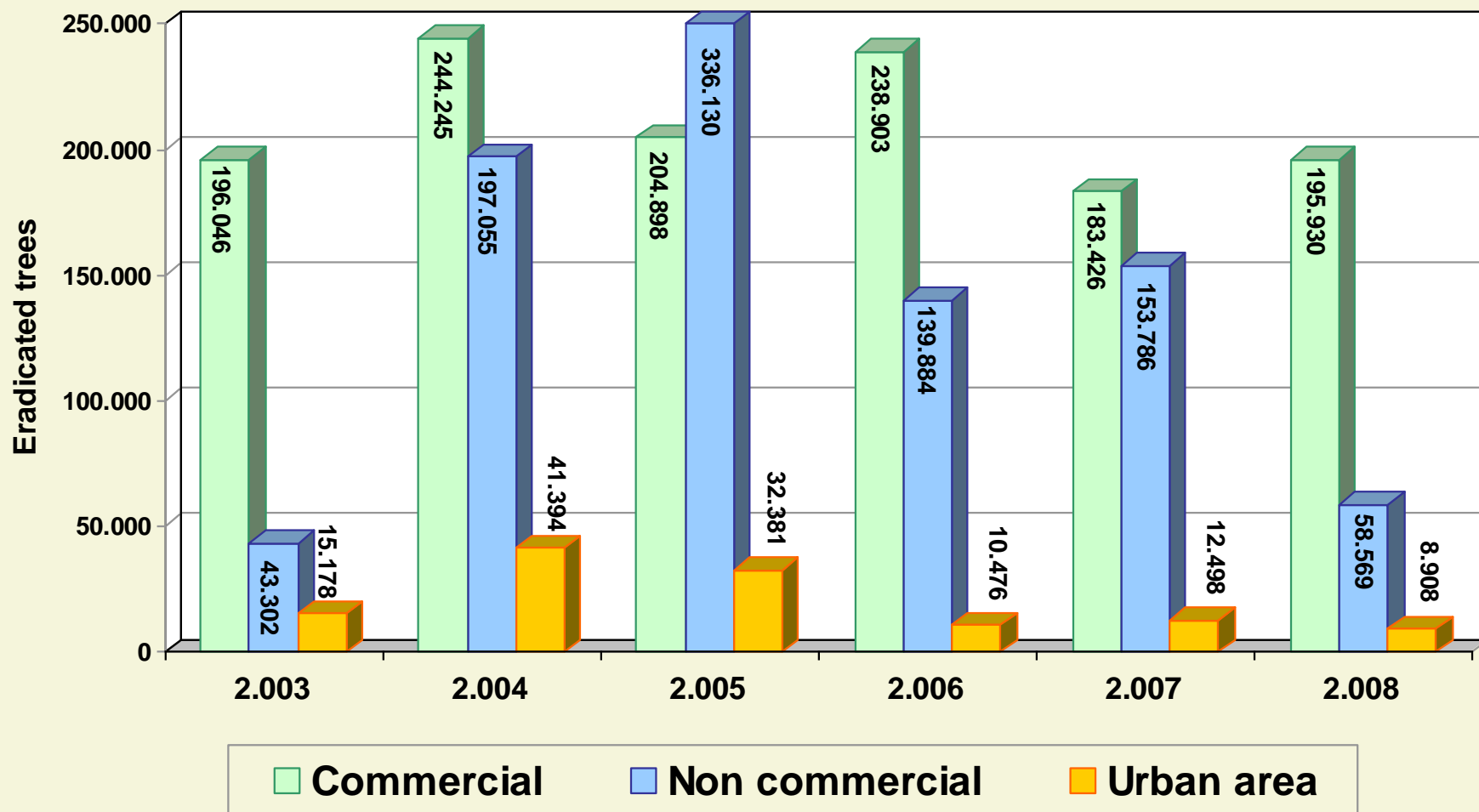
## 4. Inspection in non-commercial and urban areas



## 4. Inspection in non-commercial and urban areas



# Eradicated trees in São Paulo State and South of Triângulo Mineiro from 2.003 to June 2.008



# 5. Inspections in nurseries

- **Mandatory program since 2003**
- **530 nurseries protected**
- **Monthly Inspected by Fundecitrus**

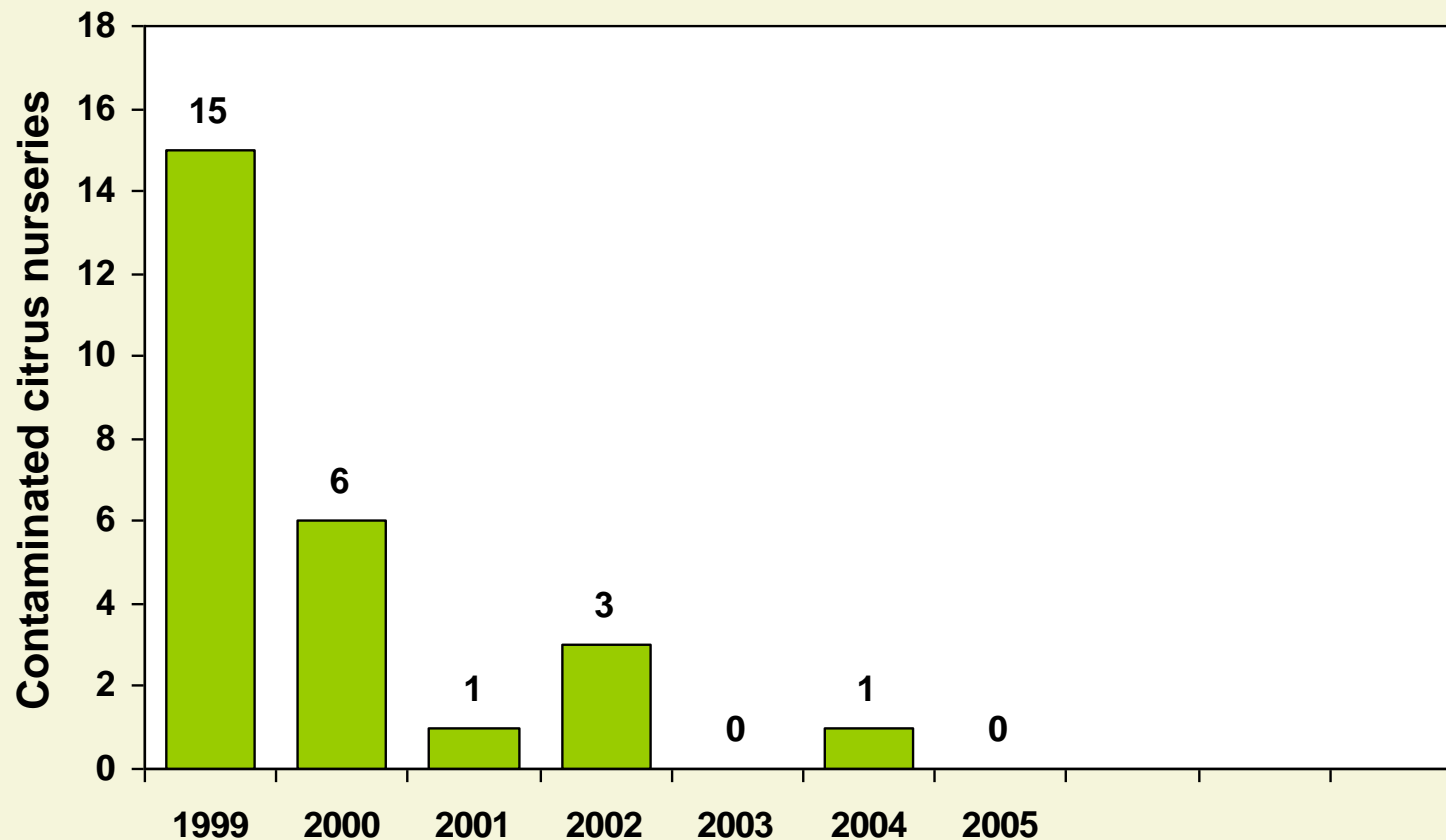


# 5. Inspections in nurseries

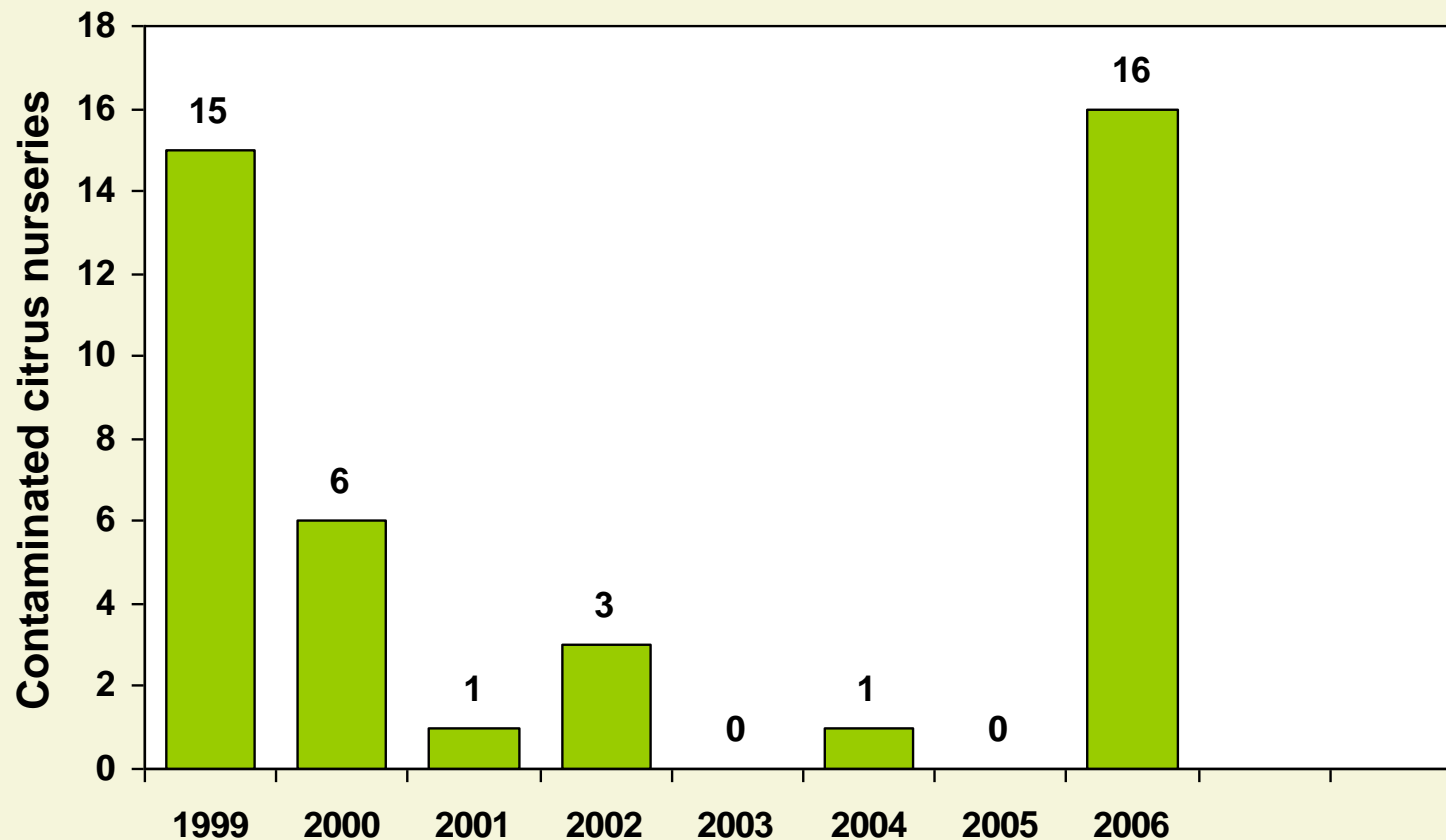
- **Prevention, Certification, and Inspection**



# Citrus canker in nurseries in São Paulo State and South of Triângulo Mineiro



# Citrus canker in nurseries in São Paulo State and South of Triângulo Mineiro



# Citrus canker in nurseries in São Paulo State and South of Triângulo Mineiro



# Citrus canker in nurseries in São Paulo State and South of Triângulo Mineiro



# Citrus canker in nurseries in São Paulo State and South of Triângulo Mineiro



# Citrus canker in nurseries in São Paulo State and South of Triângulo Mineiro



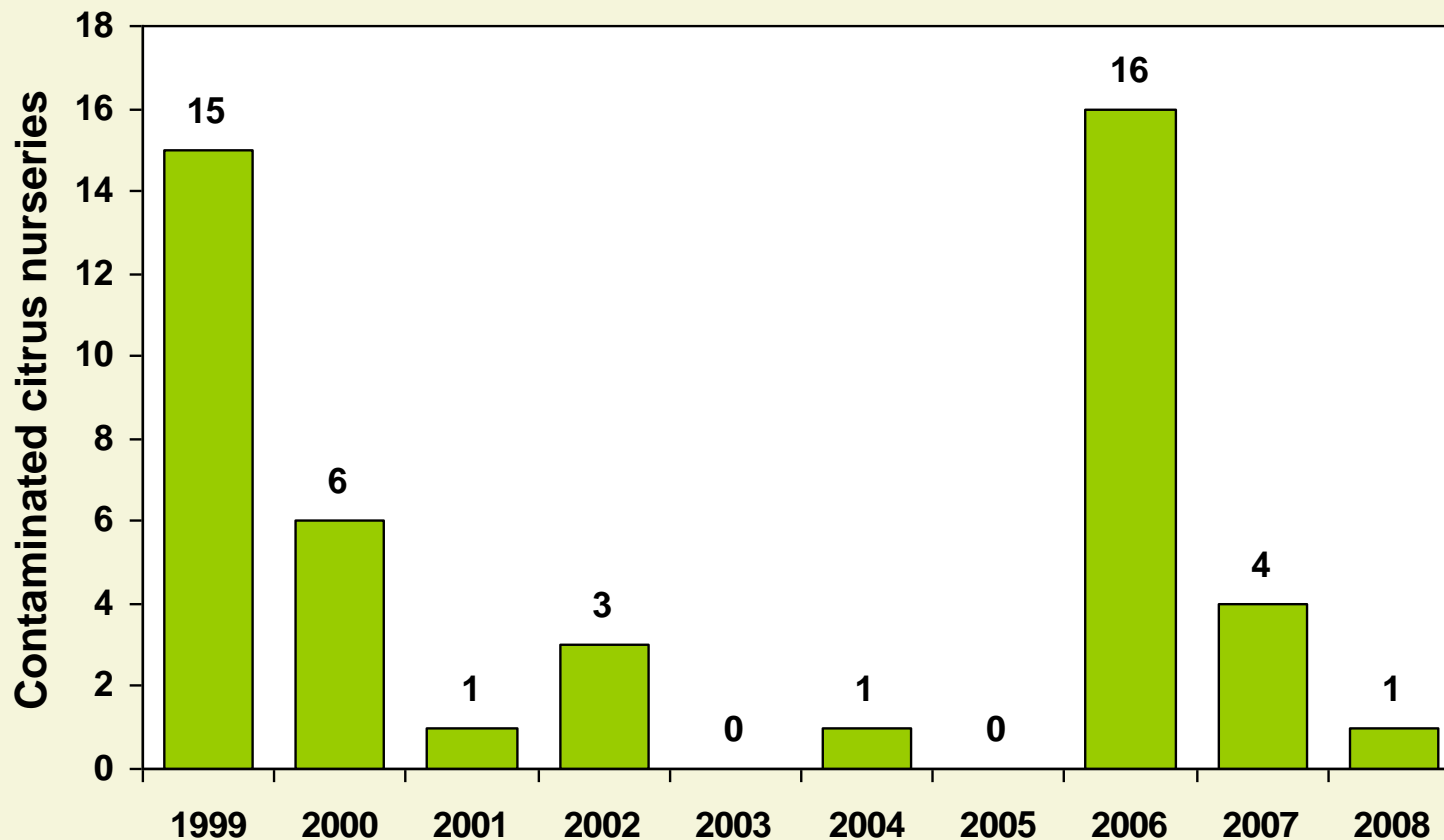
# Citrus canker in nurseries in São Paulo State and South of Triângulo Mineiro



# Citrus canker in nurseries in São Paulo State and South of Triângulo Mineiro

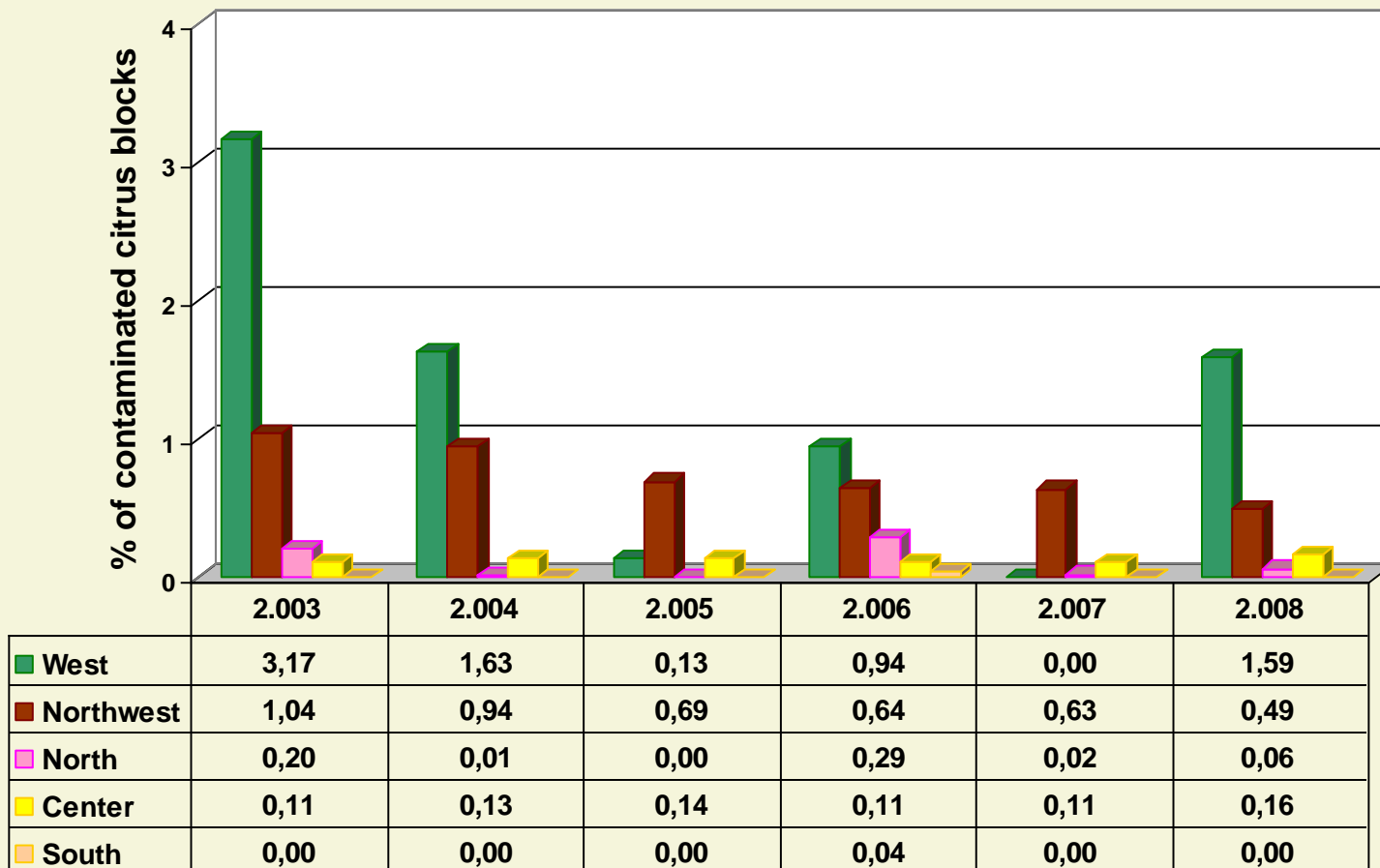


# Citrus canker in nurseries in São Paulo State and South of Triângulo Mineiro

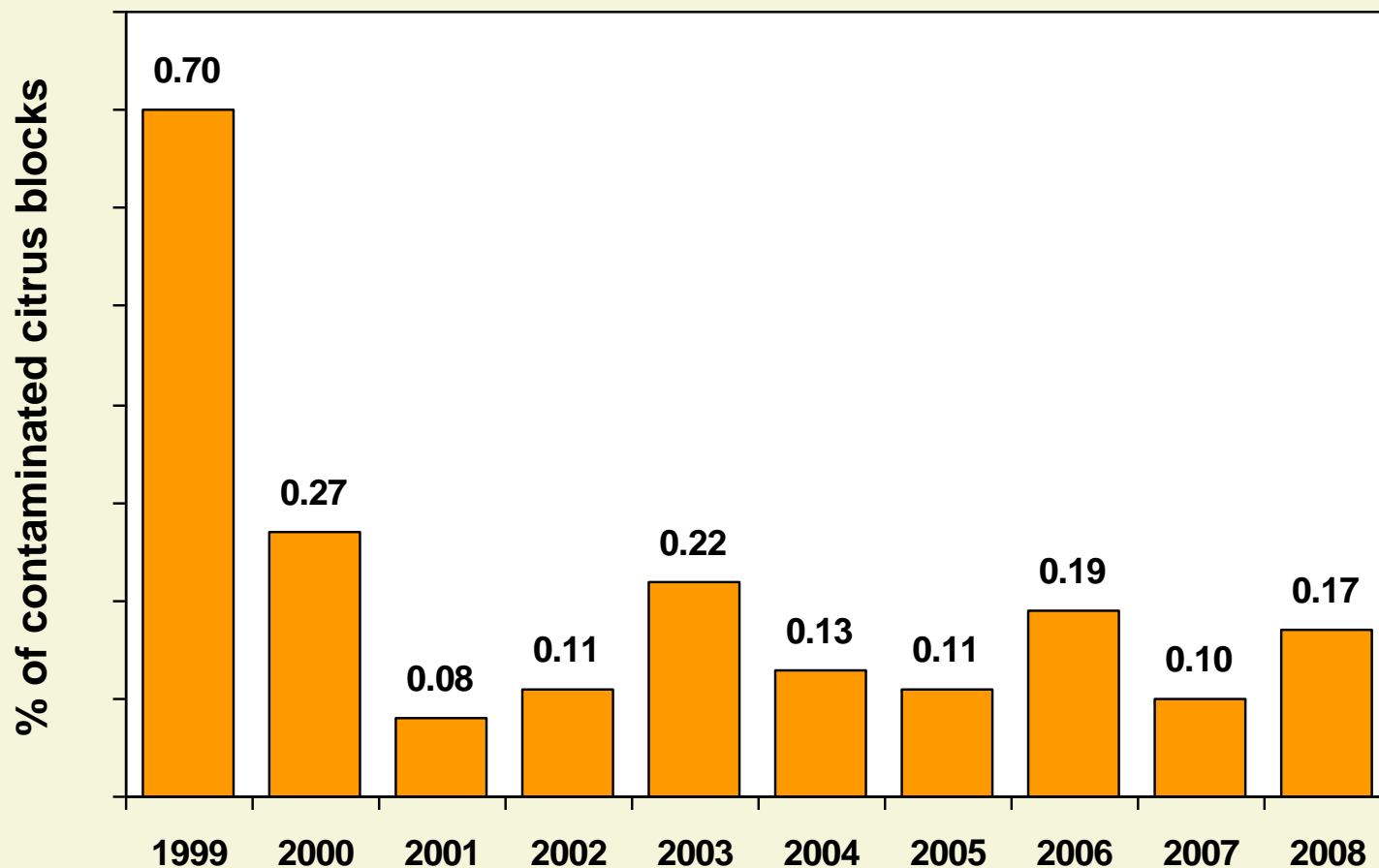


**2,327,772 eradicated nursery trees from 1999 to 2008**

# Citrus Canker incidence in São Paulo State and South of Triângulo Mineiro



# Citrus Canker incidence in commercial groves in São Paulo State and south of Triângulo Mineiro determined through sampling surveys



# **Characteristics of Citrus Canker pathosystem that allow the official eradication program**

- **low survival capacity out of host**
- **dissemination at relatively short distance and absent of vector**
- **low range of hosts**
- **high susceptibility of host**

# **Characteristics of Citrus Canker pathosystem that allow the official eradication program**

- **no high efficiency of other control strategies (low cost of eradication)**
- **high economic level of host (important business)**
- **relatively restricted and localized distribution (low incidence)**
- **eradication is economically feasible and desirable by government, growers and citrus industry**

# Economic Impact of Citrus Canker

**From Jan/99 to Dec/08**

## **Citrus trees losses:**

- Commercial citrus trees: 4,393,230 trees ~ US\$ 88.0 million
- Non commercial citrus trees: 1,178,518 trees ~ US\$ 23.5 million
- Nursery plants: 2,327,772 plants ~ US\$ 4.5 million

**Sub-total ~ US\$ 116 million in the last 10 years**

# Economic Impact of Citrus Canker

**From Jan/99 to Dec/08**

**Citrus eradication program:**

- Fundecitrus: US\$ 20 million / year
- Growers own prevention/inspection: US\$ 20 million / year

**Sub-total ~ US\$ 360 million in 10 years**

# Economic Impact of Citrus Canker

**In the last 10 years:**

**Citrus trees losses:** US\$ 116 million

**Citrus eradication program:** US\$ 360 million

**Total ~ US\$ 476 million in 10 years**

**or ~ US\$ 48 million per year**

## Why São Paulo State continues the eradication program?

- very low incidence (>99.8% of CC free blocks)
- low costs of the eradication program: **US\$ 48 millions/year**

## If São Paulo stops the eradication?

- spread of citrus canker through all the state (endemic situation)
- necessity to change varieties (very susceptible Hamlin)
- necessity to use wind-breaks (loss in cultivated area)
- necessity of protective copper sprays (4-6/year)  
cost of 1 copper spray = US\$ 80,00/ha  
in 650,000 ha (SP): **US\$ 260 million/year**



**Thank you!**