THE IMPORTANCE OF SÃO PAULO CITRICULTURE AND CHALLENGES

Antonio Juliano Ayres | *General Manager*

WORLD CITRUS PRODUCTION

There are 140 citrus producing countries

2017/2018
Orange: 47,754 millions Tons
Grapefruit: 6,630 millions Tons
Tangerine: 30,0188 millions Tons
Lemons and limes: 7,686 millions Tons
Total: 92,088 millions Tons

60% of the world's total citrus production is grown in China, Brazil and US

Source USDA

2017/18 JUICE YIELD IN THE MAIN REGIONS

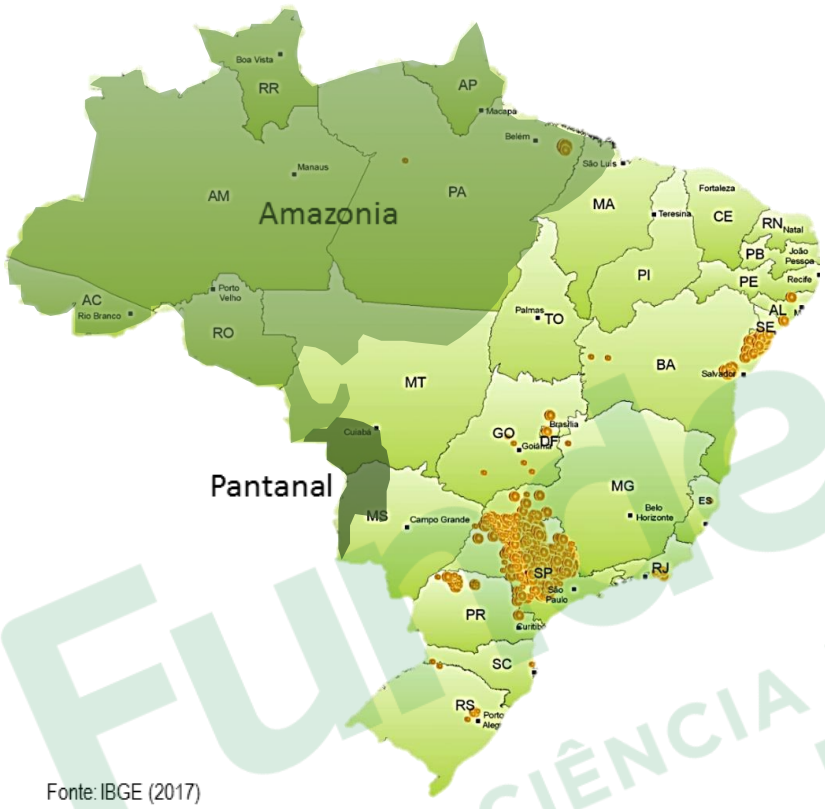
ORANGE GROWING REGIONS	TOTAL BEARING AREA	TOTAL ORANGE PRODUCTION		FARMING YIELD	JUICE YIELD ON FRUIT	JUICE YIELD PER HECTARE	
	Thousand Hectares (Above 3 Years Old)	Million Metric Tons	Million Boxes 40.8 kg	40.8 Kg Boxes Per Hectare	40.8 kg Boxes Per Metric Tons of FCOJ 66°Brix Equiv.	Metric Tons of FCOJ 66°Brix Equiv.	Liters Of Ready-To-Drink Orange Juice
São Paulo & M.Gerais Citrus Belt	385.5	16.3	398.4	1,033	282	3.67	19,622
South Africa	n.a.	1.5	36.0	900	330	2.73	14,597
Califórnia	62.7	2.0	48.3	770	350	2.20	11,775
European Union	n.a.	6.4	157.4	735	335	2.19	11,743
Florida (2016/17 Pre-Irma)	148,7	2,8	68,9	463	247	1,87	10.031
Argentina	n.a.	0.5	11.0	600	285	2.11	11,268
Australia	n.a.	0.5	11.8	750	360	2.08	11,151
Egypt	n.a.	3.2	77.9	600	330	1.82	9,732
Morocco	n.a.	1.0	25.1	600	330	1.82	9,732
All Other States of Brazil	192.6	4.3	105.0	545	315	1.73	9,263
Turkey	n.a.	1.9	46.7	650	380	1.71	9,155
Texas	3.0	0.1	1.4	457	300	1.52	8,162
Costa Rica	n.a.	0.3	8.0	400	285	1.40	7,512
Florida (2017/18 Post-Irma)	146,4	1,8	45,0	307	271	1,13	6.053
Mexico	n.a.	4.6	112.7	350	285	1.23	6,573
China	n.a.	7.3	178.9	250	300	0.83	4,460

n.a. = not available.

Source: Based on data from Fundecitrus, IBGE, CitrusBR, USDA and FCPA.

THE BRAZILIAN AND SÃO PAULO STATE CITRICULTURE

The main orange juice producer in the world



Fonte: IBGE (2017)

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CIÊNCIA E SUSTENTABILIDADE PARA A CITRICULTURA

SÃO PAULO COMPETITIVE ADVANTAGE

- Favorable soil and climate
- Adequate infrastructure (highway and port)
- Know-how of growers and industry
- Strong research network

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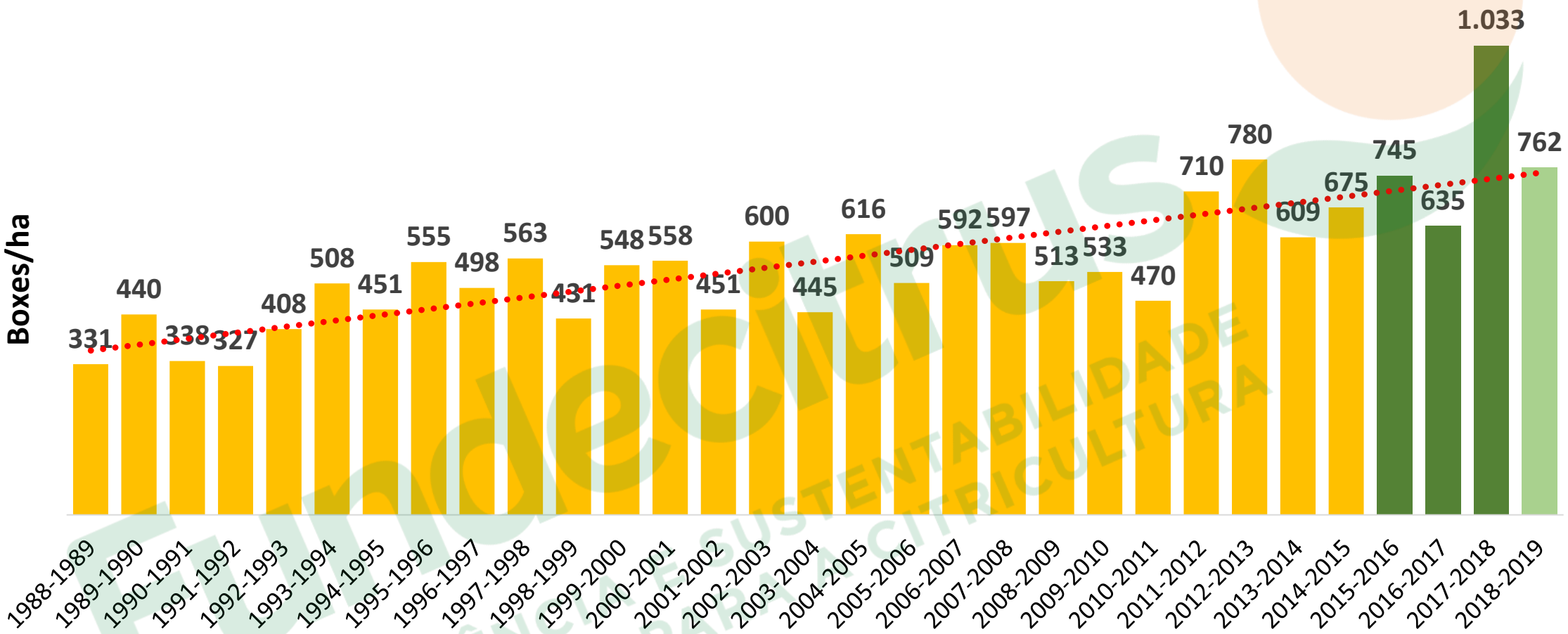
DIRECT JOBS IN SAO PAULO STATE

Citrus: 465,635 hectares
9,845 farms in Sao Paulo
200,000 jobs (direct and indirect)

1 direct employee per 10 hectares

PRODUCTIVITY



Source: CitrusBR e IBGE (1988-1989 a 2014-2015) Fundecitrus (2015, 2016, 2017) Forecast Fundecitrus (2018)

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WHY HAS THE PRODUCTIVITY INCREASED?

- Health young trees
- Varieties and rootstocks
- New planting systems
- Irrigation and Nutrition
- Higher planting density
- Disease management


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SCIENCE AND SUSTAINABILITY
IN CITRICULTURE

FUNDECITRUS

Intelligence center, worldwide benchmark for science and sustainability in citriculture.

Maintained by citrus growers and orange juice companies (Budget: US$ 9 million/year)

Pursuing effective and sustainable solutions to challenges in citrus plant health for 41 years.

AREAS OF WORK

RESEARCH AND INNOVATION

TRAINING OF PROFESSIONALS

TECHNOLOGY TRANSFER

CROP FORECAST SURVEY

FUNDECITRUS CONTRIBUTION TO THE CITRICULTURE COMPETITIVENESS

HEALTHY YOUNG TREES – PROTECTED NURSERIES

Past – Before 2002

200 millions of young trees produced since 2003

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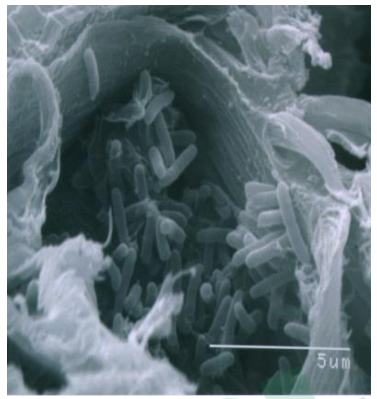
CITRUS VARIEGATED CHLOROSIS

Causal agent: *Xylella fastidiosa*

Vector: *sharpshooters*

Damages:

- Defoliation
- Fruit depreciation for fresh market
- Yield reduction
- Poor fruit quality
    - Smaller fruit
    - Higher Brix and acidity
    - Less TSS and Ratio
    - Less intense juice color

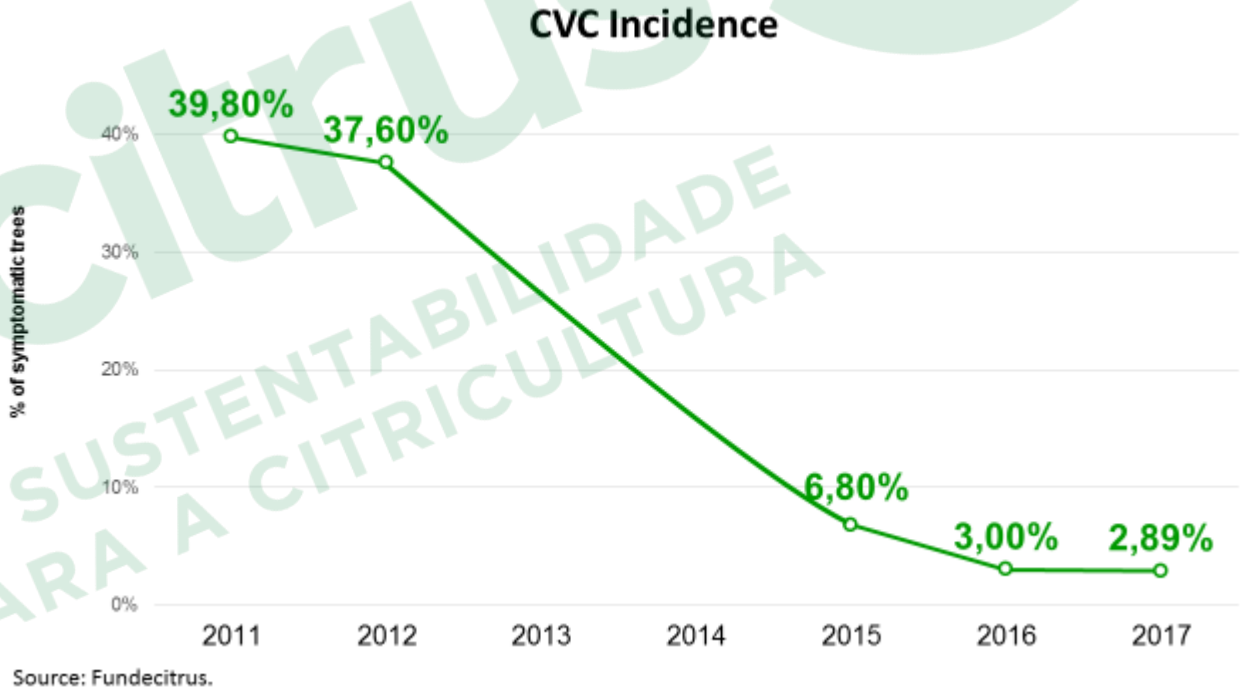


CITRUS VARIEGATED CHLOROSIS

SEQUENCING OF *XYLELLA FASTIDIOSA* GENOME

CVC MANAGEMENT

- Healthy young trees
- Inspection and eradication of affected trees
- Vector control



Source: Fundecitrus.

Healthy grove: 97,1% without CVC

ROOTSTOCKS TOLERANT TO CITRUS SUDDEN DEATH

INARCHING

Valencia/Rangpur lime

Valencia/Cleopatra

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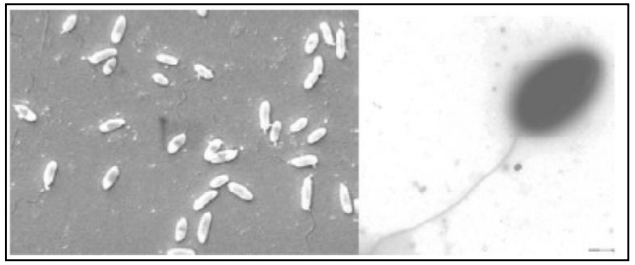
CITRUS CANKER

Causal agent: *Xanthomonas citri* pv. *citri*



Damages:
- Defoliation
- Fruit depreciation for fresh market
- Premature fruit drop

CITRUS CANKER MITIGATION

- Grove inspections
- Leaf miner biocontrol

- Windbreak
- Tolerant varieties
- Copper spray

- Material disinfestation

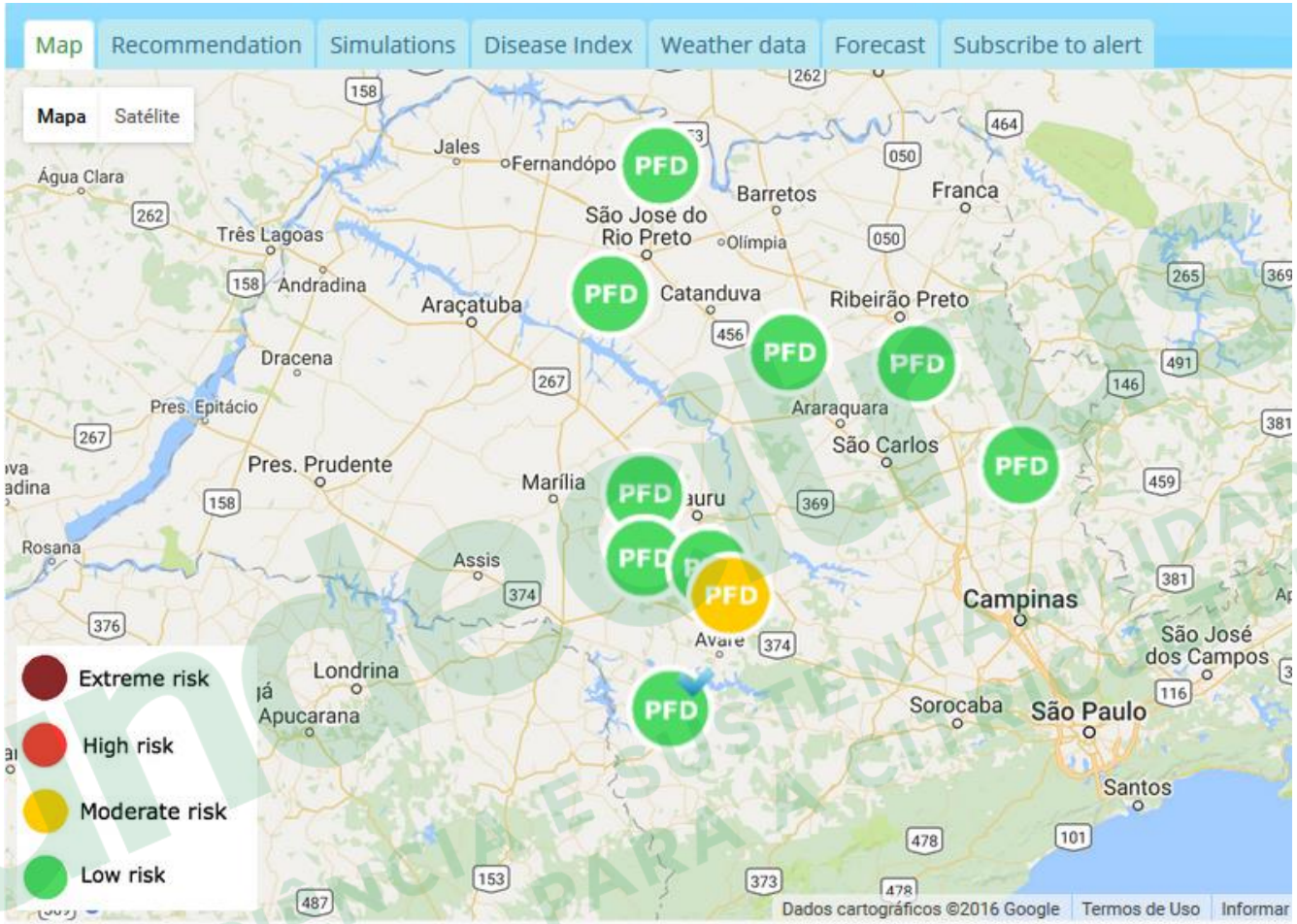
FRUIT BORER PHEROMONE

Bento et al. 2016

- Losses avoided in 10 years - U$ 1.2 billion dollars
- 50% less insecticides
- Natural enemy preservation

POSTBLOOM FORECAST SYSTEM

- Depend on the climate condition during the blossom period



Low Risk

Moderate Risk

High Risk

Extreme Risk

- Access - www.fundecitrus.com.br/tecnologiasfundecitrus

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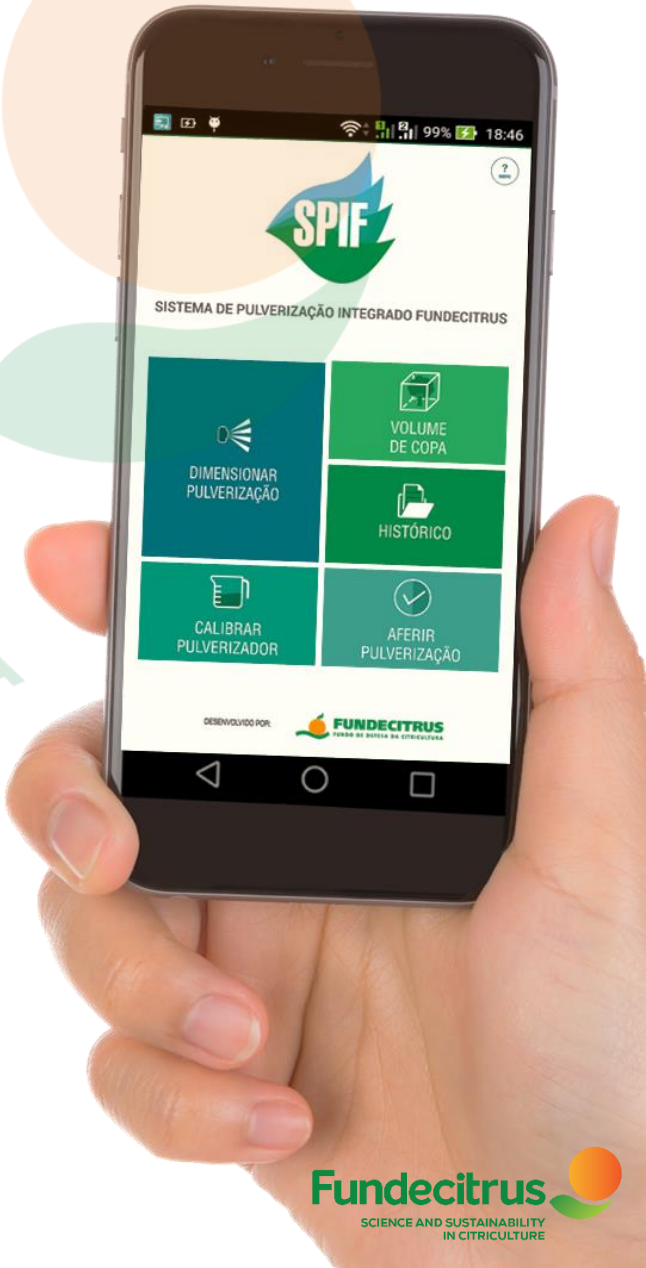
SPRAY VOLUME ADEQUACY

SAVINGS

- 30 – 70% water saving
- Up to 50% pesticide saving
- Less environmental impact
- Increasing operational time

FUNDECITRUS INTEGRATED SPRAYING SYSTEM

- Versions - desktop, website and mobile
- Access - spif.fundecitrus.com.br
- > 1,000 users



Comparative of insecticides used in São Paulo and Florida for *D. citri* control

1) Rates (ml or g a.i. / L): **66% lower in SP**

(17 – 87%)

2) Volume application: **48% lower in SP**

Grove of 6 y-old: FL = 950 L/ha – SP = 500L/ha

Reduction: **65% a.i. / ha /season**

3) More frequent spray just on the edges blocks

FUNDECITRUS CONTRIBUTION TO HLB CONTROL

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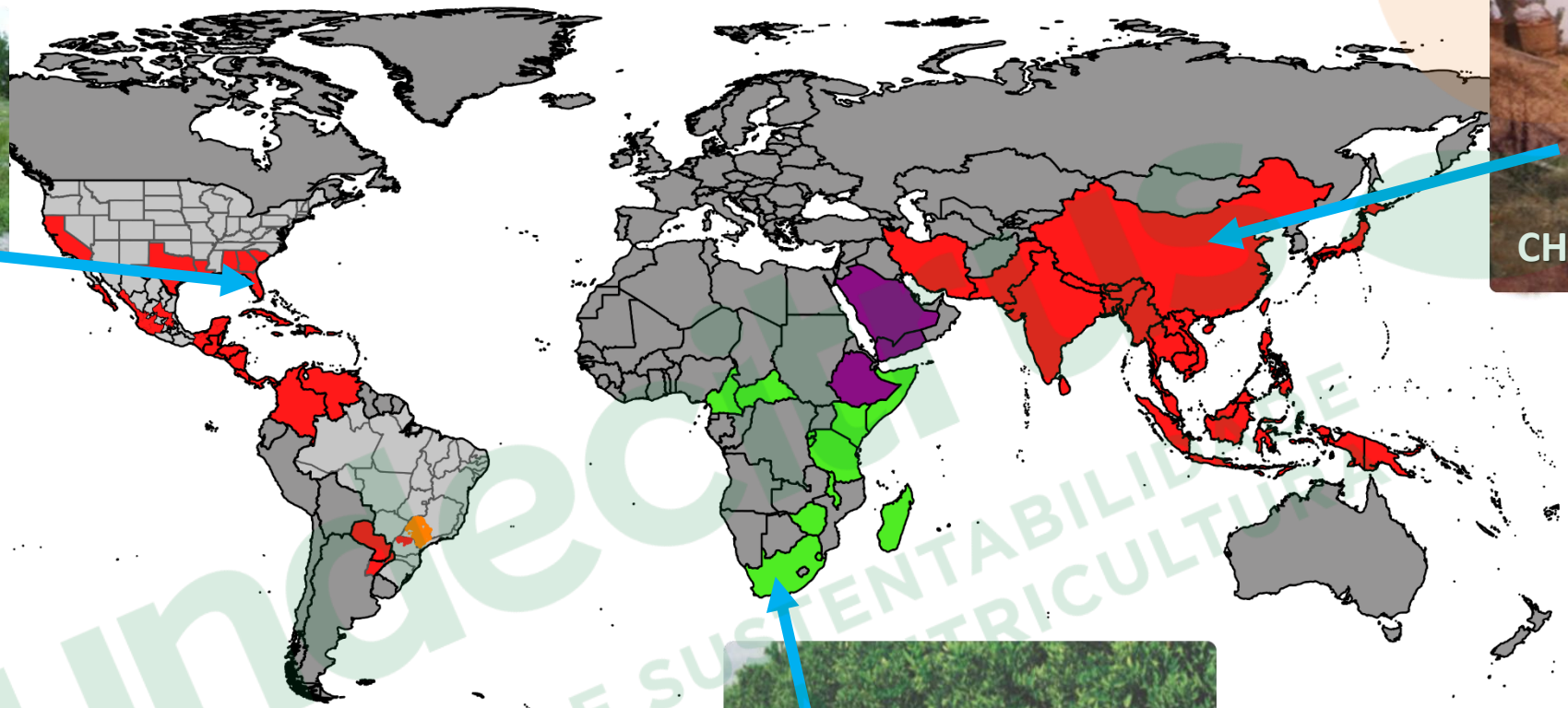
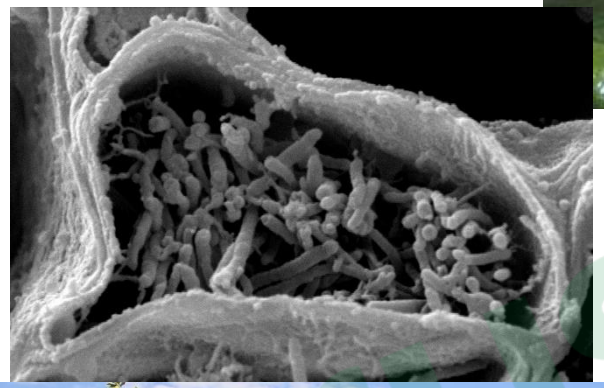
GREENING IN THE WORLD



- *Candidatus Liberibacter asiaticus*
- *Candidatus Liberibacter africanus*
- *Candidatus Liberibacter americanus x asiaticus*
- *Candidatus Liberibacter africanus x asiaticus*

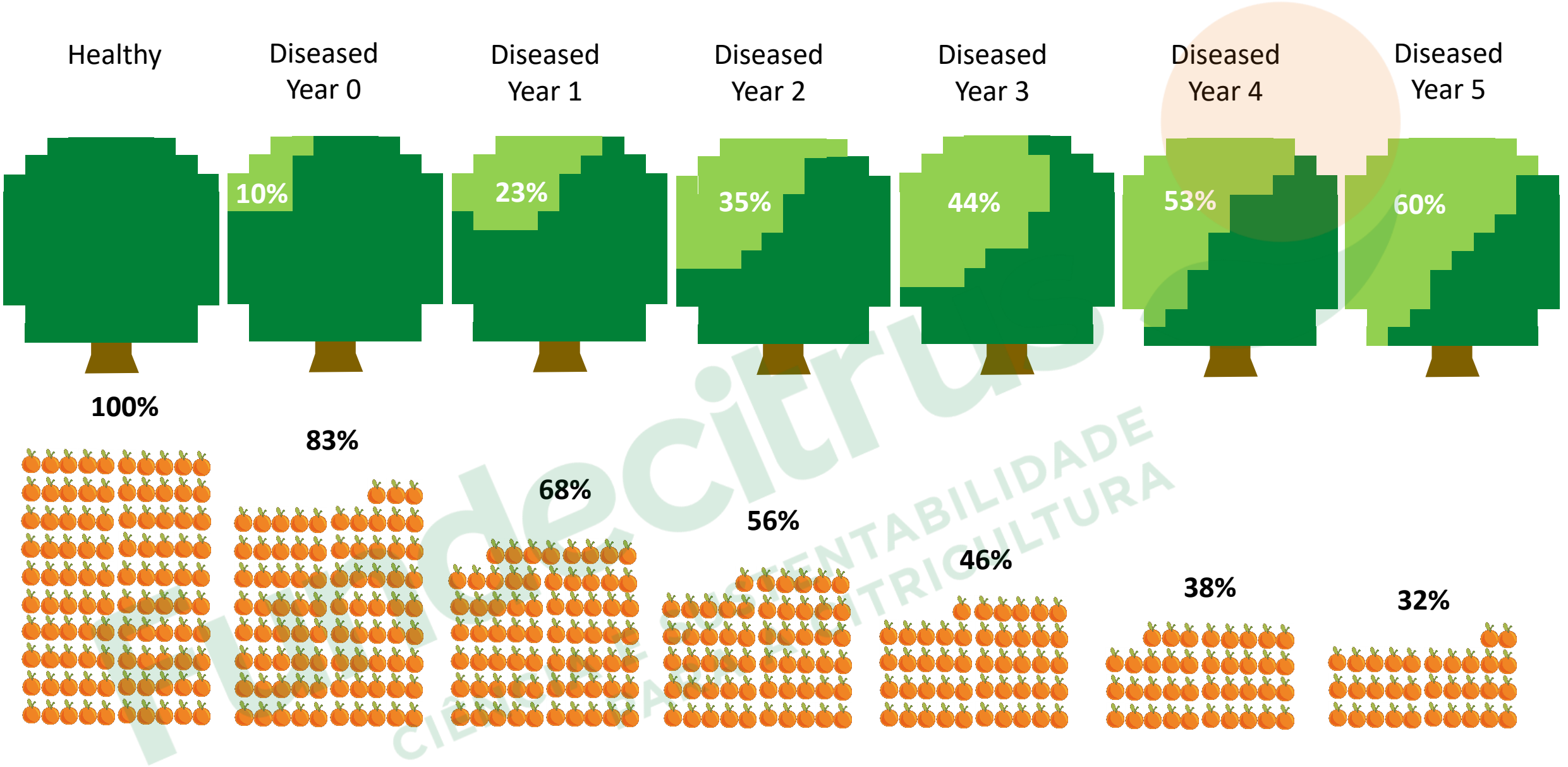
GREENING CHALLENGE



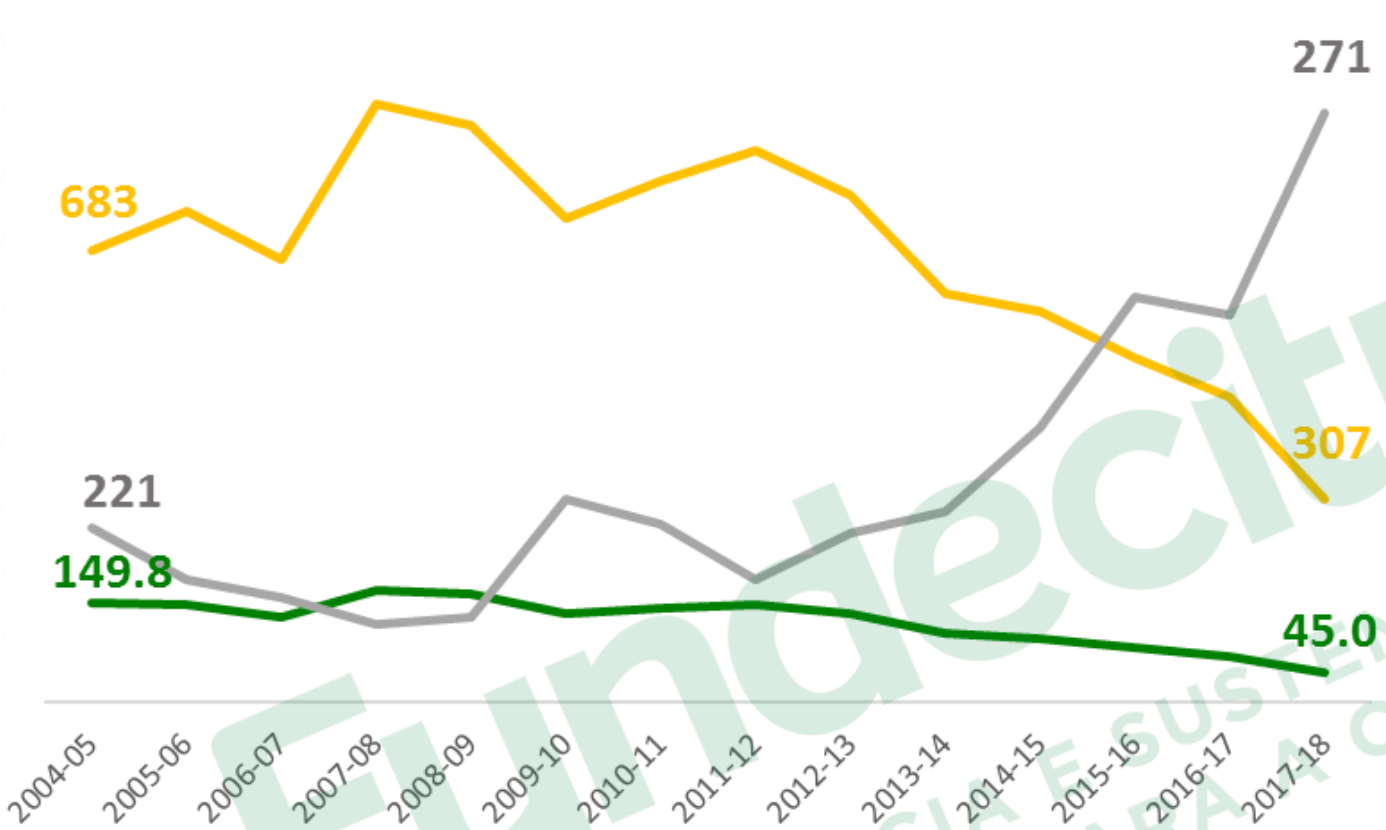
Causal agent: *Candidatus* Liberibacter asiaticus

Vector: *Diaphorina citri*

Damages:
- Defoliation
- Tree decline
- Yield reduction
- Premature fruit drop
- Poor fruit quality
    - -Smaller fruit
    - Less TSS, Brix and ratio
    - Higher acidity and bitterness
    - Less intense juice color


Healthy
Diseased Year 0
Diseased Year 1
Diseased Year 2
Diseased Year 3
Diseased Year 4
Diseased Year 5
10%
23%
35%
44%
53%
60%
100%
83%
68%
56%
46%
38%
32%

IMPACT OF GREENING IN FLORIDA



271 **JUICE YIELD ON FRUIT –23%**

(40.8 kg Boxes Per Metric Tons of FCOJ 66ºBrix Equiv.)

307 **FARMING YIELD –55%**

(40.8 Kg Boxes Per Hectare)

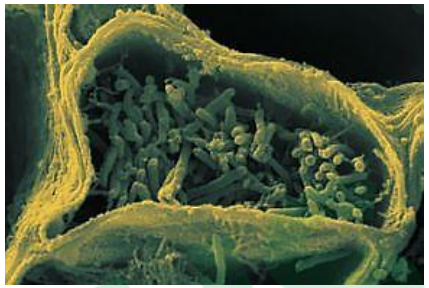
45.0 **TOTAL ORANGE PRODUCTION –70%**

(Million Boxes 40.8 kg)

Source: USDA

GREENING IN SÃO PAULO STATE

Detection in 2004



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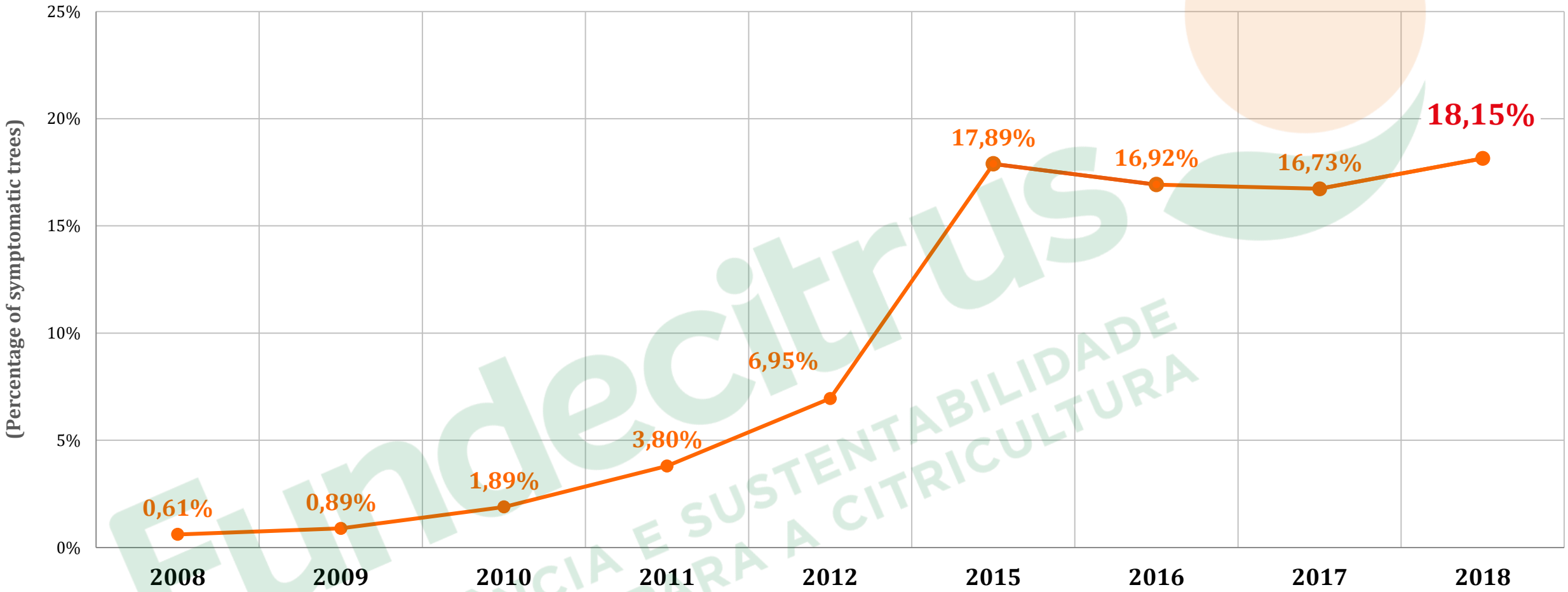
GREENING PROGRESS IN SPS AND TRIÂNGULO MINEIRO



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CRUCIAL FACTORS THAT SUPPORT THE CONTROL OF GREENING

Healthy young trees

Historical success in the control of Canker and CVC

Fundecitrus leadership with growers and government

Research institution network

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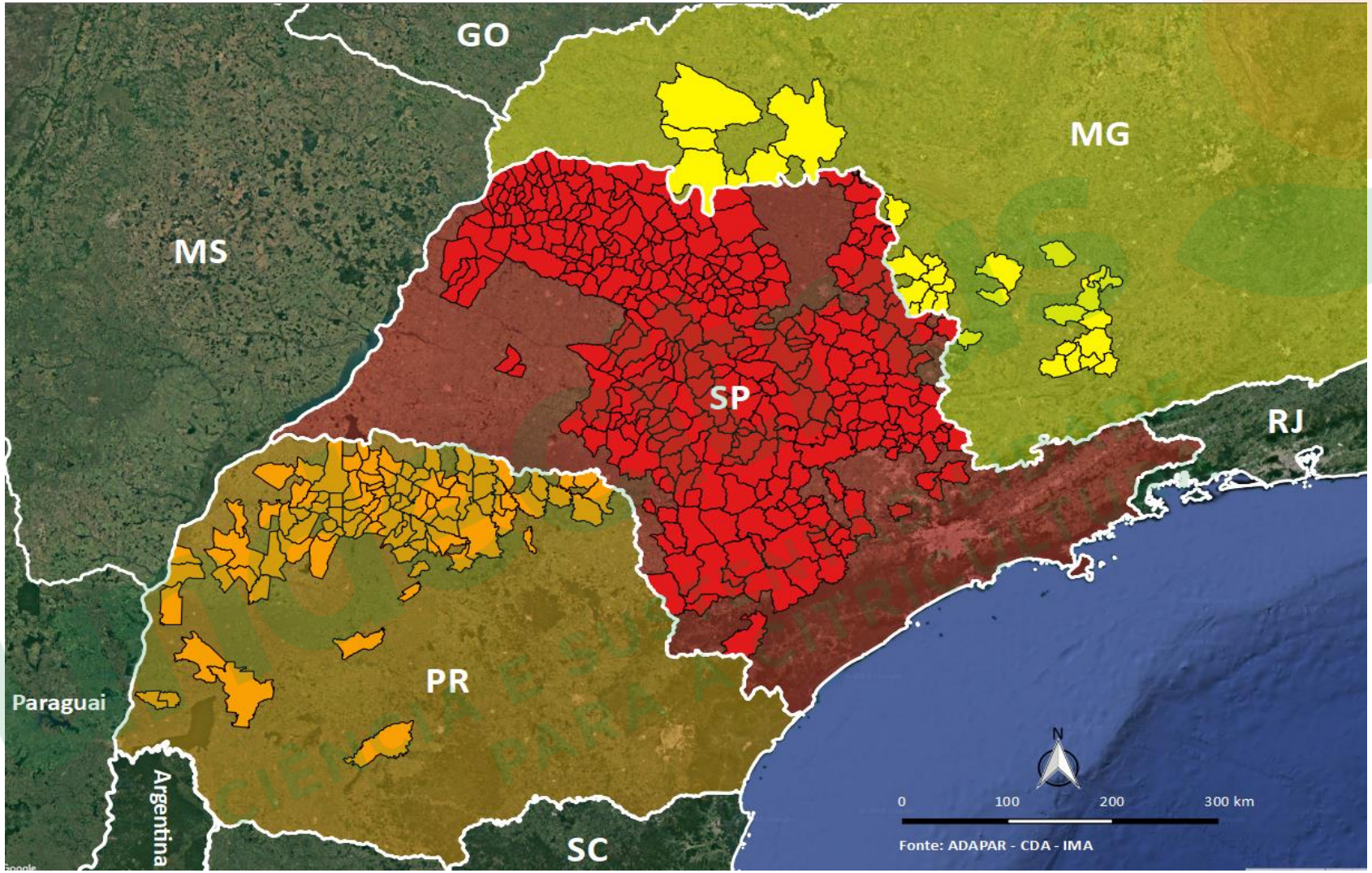
BRASIL GREENING DISTRIBUTION



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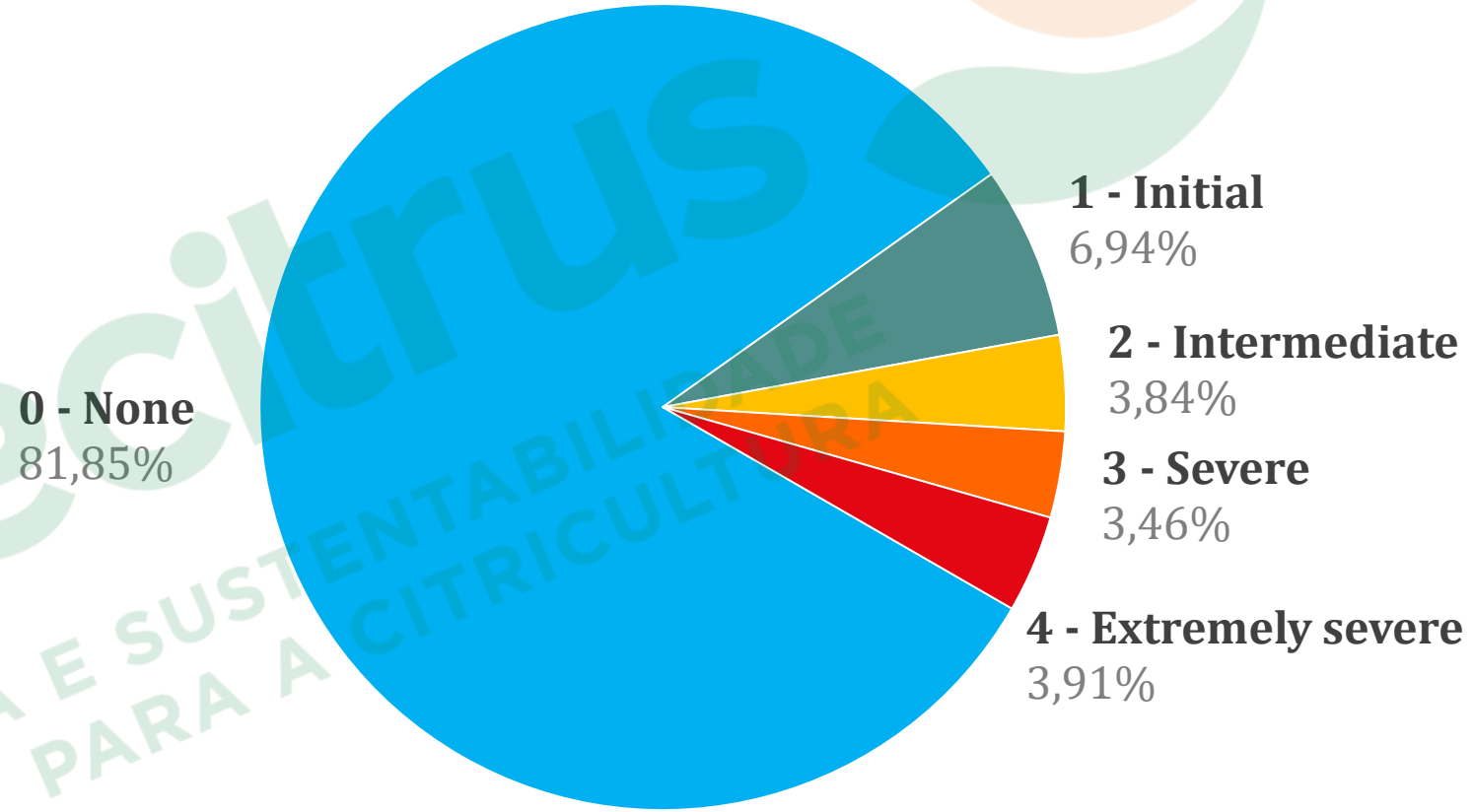
GREENING INCIDENCE BY LEVEL OF SYMPTOM SEVERITY ON THE CANOPY - 2018

Disease trees

18.15%

Fruit Drop in 2017:

19,5 milions of orange boxes (4,06% total)



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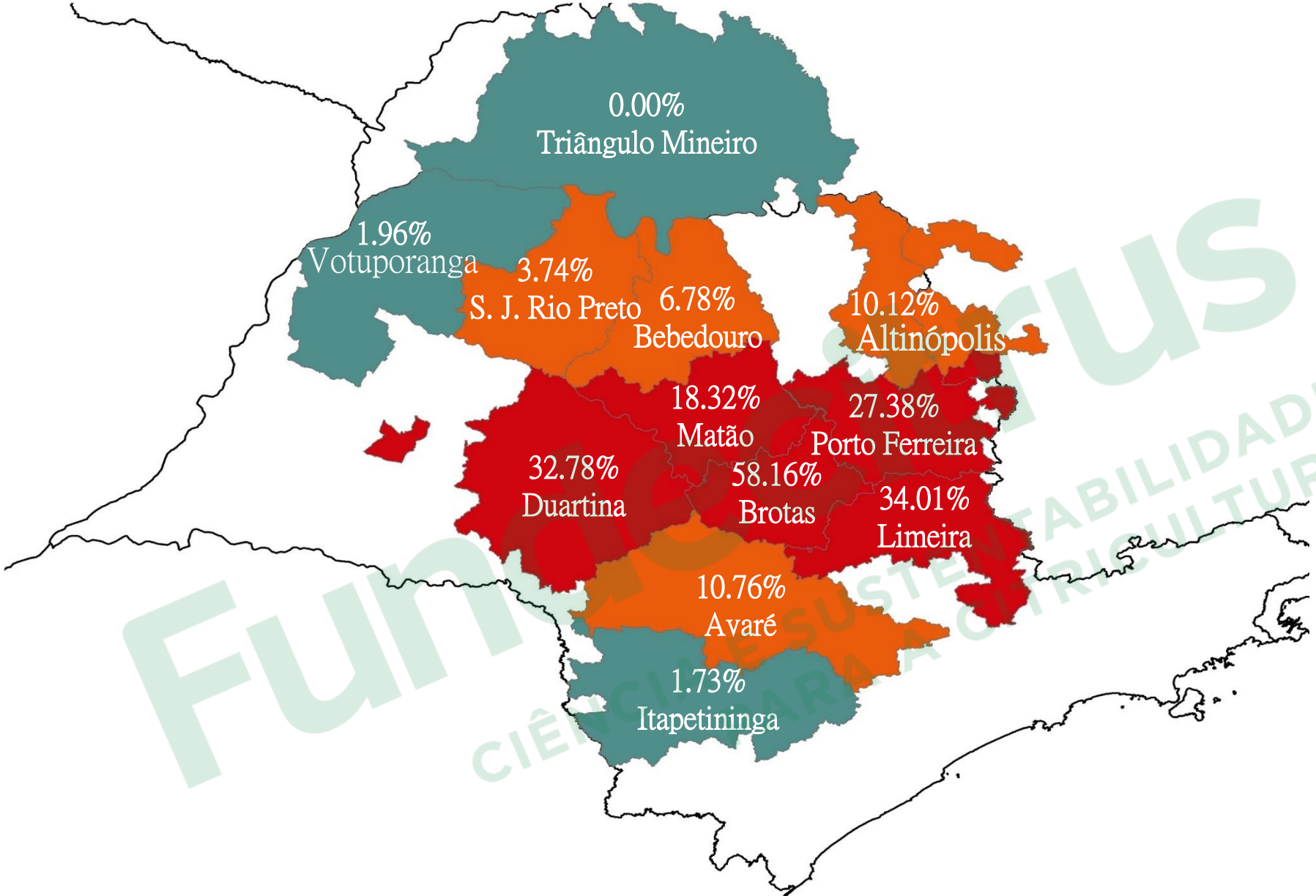
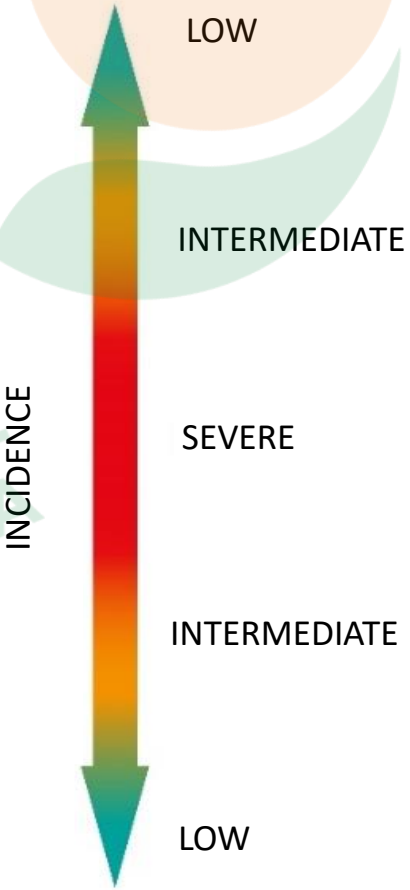
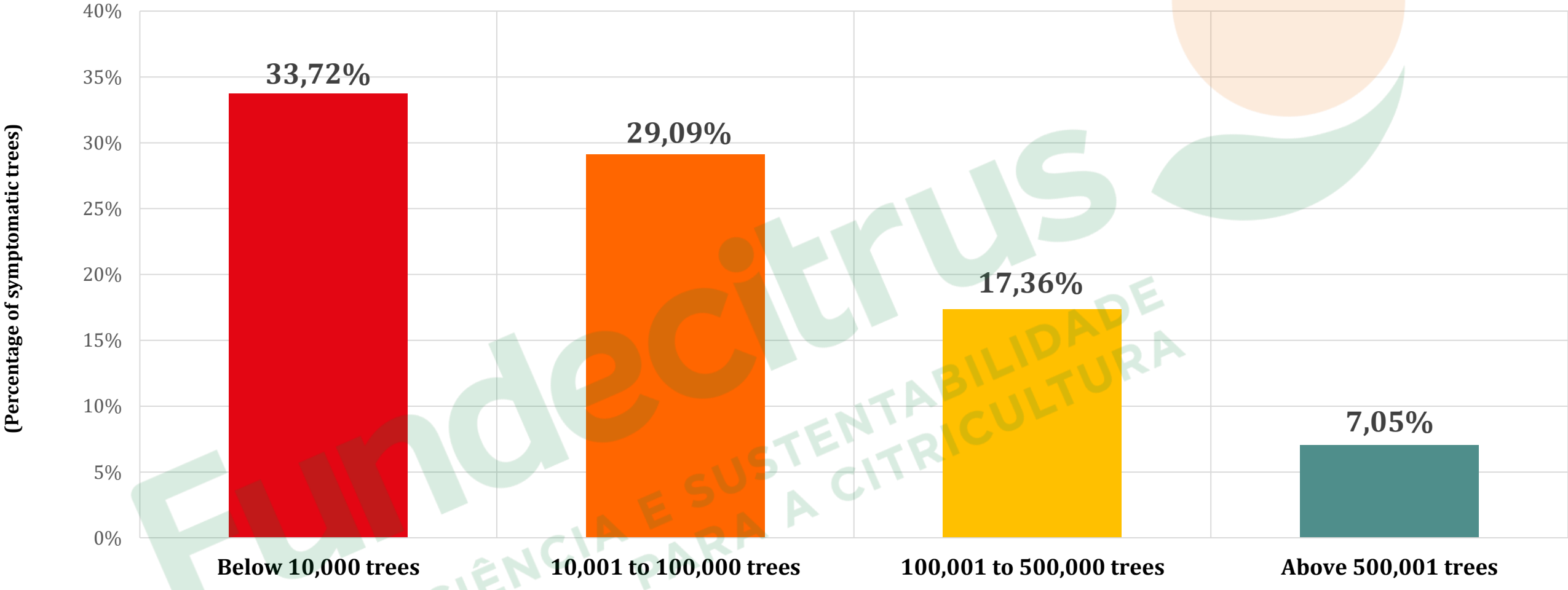
GREENING INCIDENCE BY REGION IN 2018





GREENING INCIDENCE BY FARM SIZE - 2018



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EDGE EFFECT OF GREENING

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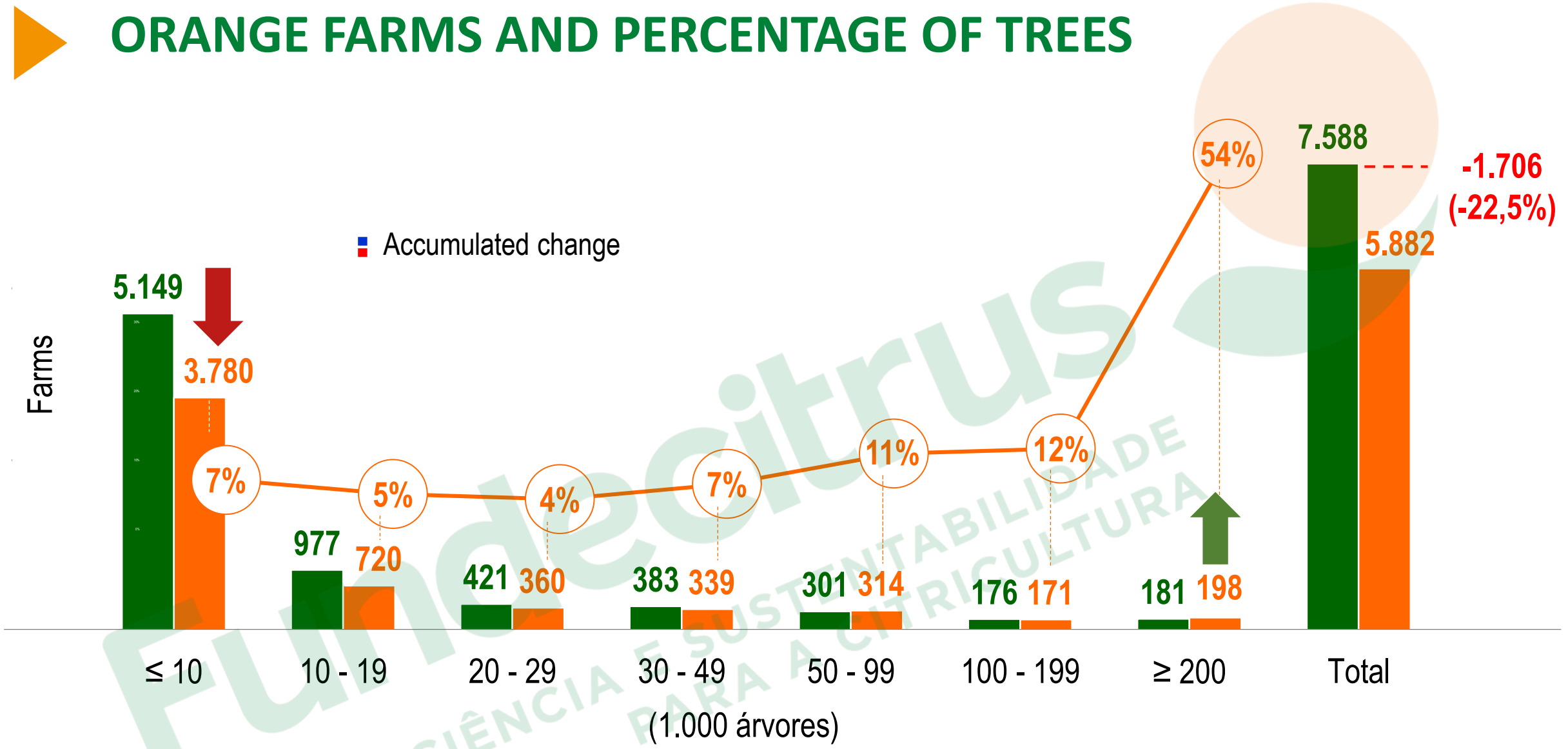
ORANGE FARMS AND PERCENTAGE OF TREES



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SUCCESS IN GREENING CONTROL

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GREENING CONTROL INSIDE THE FARM

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A NEW CONCEPT FOR THE PLANTINGS – MORE EFICIENCY AND SUSTAINABILITY

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LOOKING OUTSIDE

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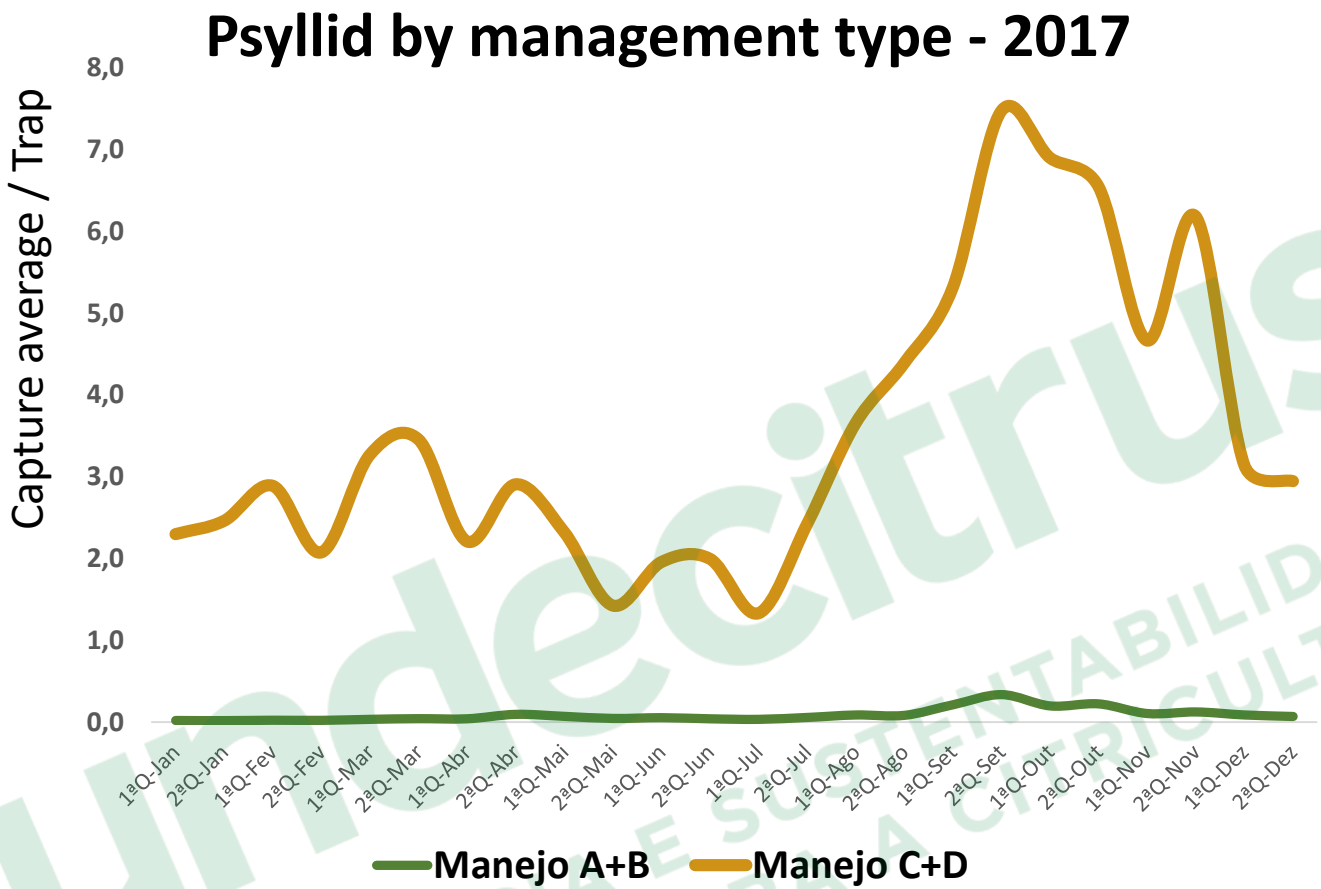
TRAPPED PSYLLIDS IN MONITORED AREAS



40-200x

A - Psyllid control and trees eradication
B - Good psyllid control
C - Commercial with no management
D - Backyard with no management

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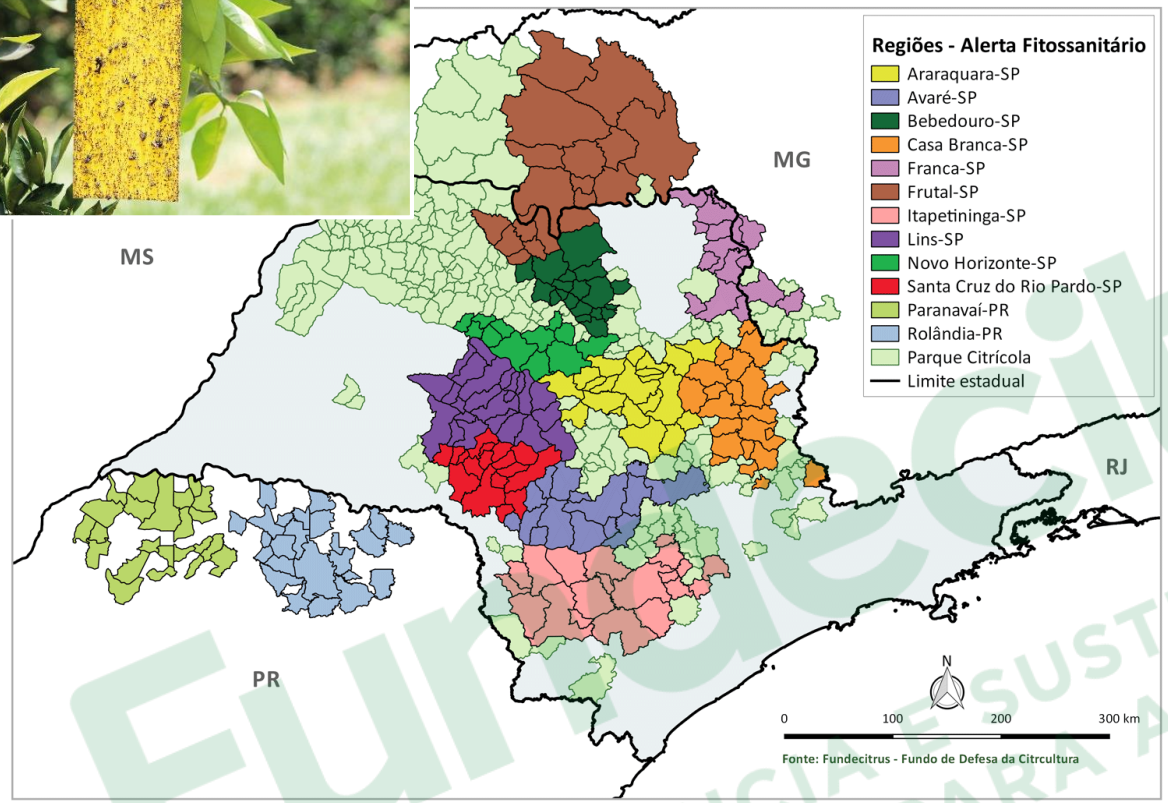
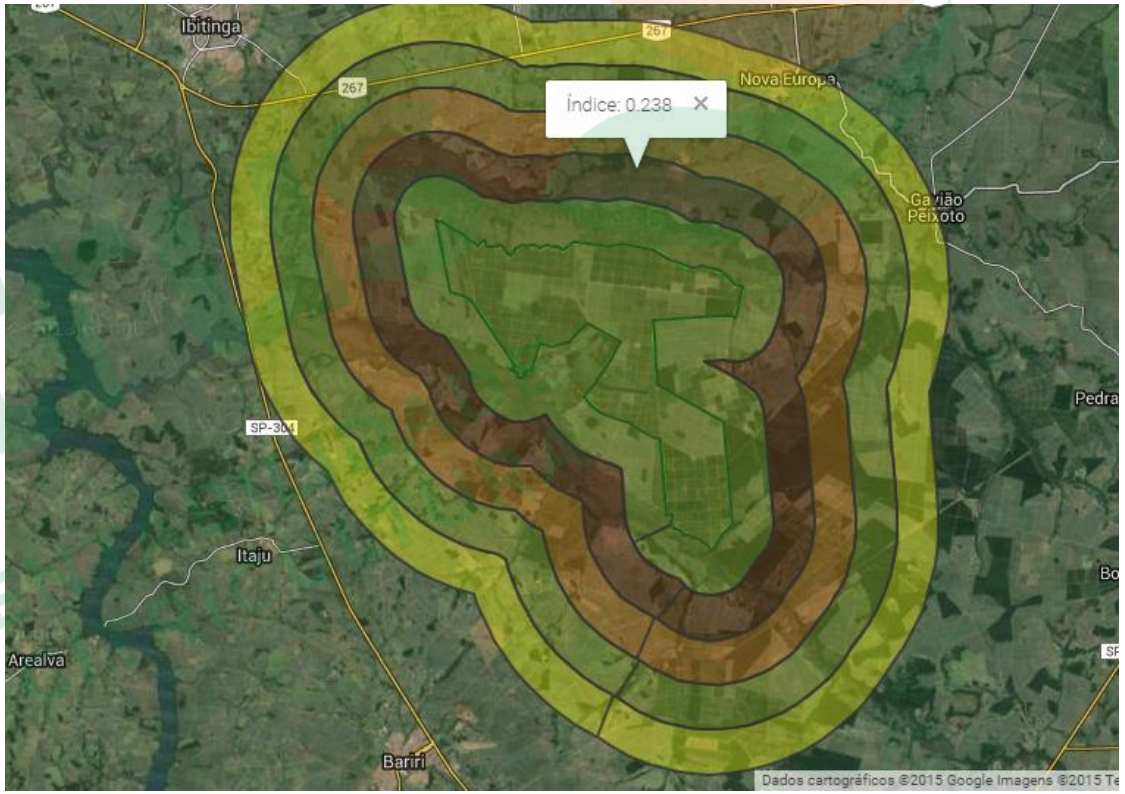
PSYLLID ALERT SYSTEM AND REGIONAL MANAGEMENT



85% surveyed area



25,000 yellow traps monitored each 14 days

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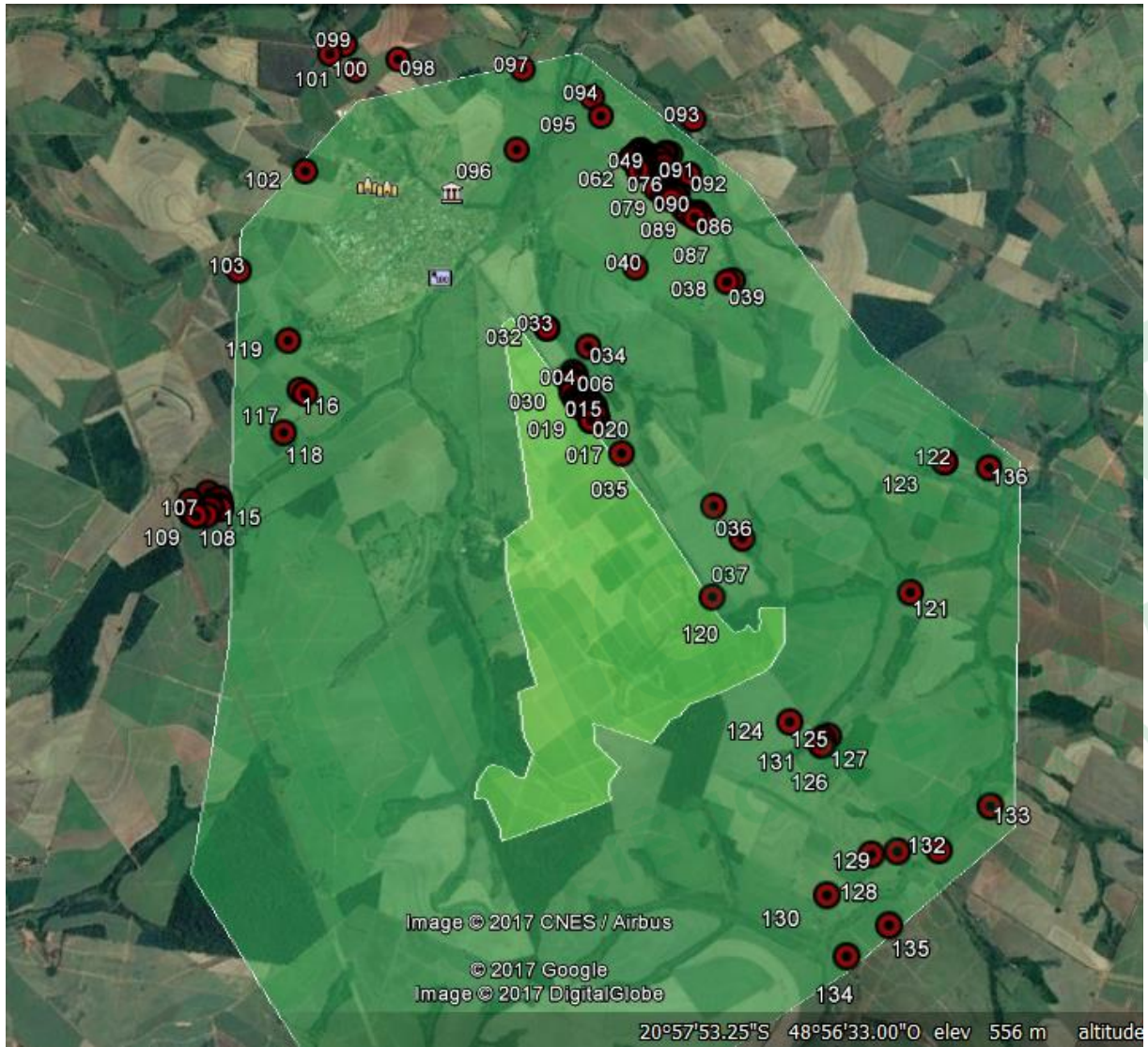
EXTERNAL CONTROL



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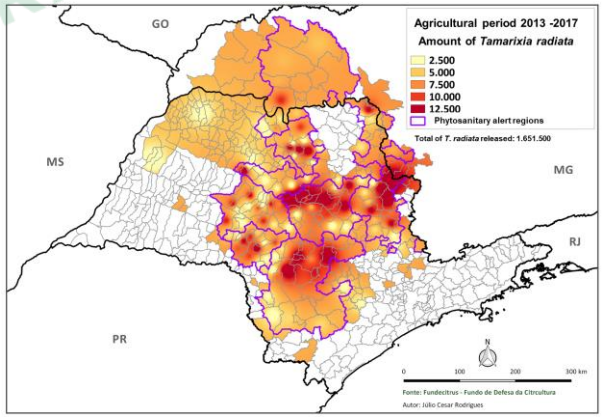
PSYLLID BIOCONTROL

Tamarixia radiata

100 thousand parasitoids released every month in non commercial groves



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NEW ALTERNATIVES FOR SUSTAINABLE MANAGEMENT OF GREENING

Bioinsecticide

(Isaria fumosorosea)

BENEFITS

- Psyllid control
- No residue on fruit
- No interval of carency
- Preserve natural enemies and polinization agents
- Compatibility with other products

NEW ALTERNATIVES FOR SUSTAINABLE MANAGEMENT OF GREENING

BENEFITS

- Psyllid repellency

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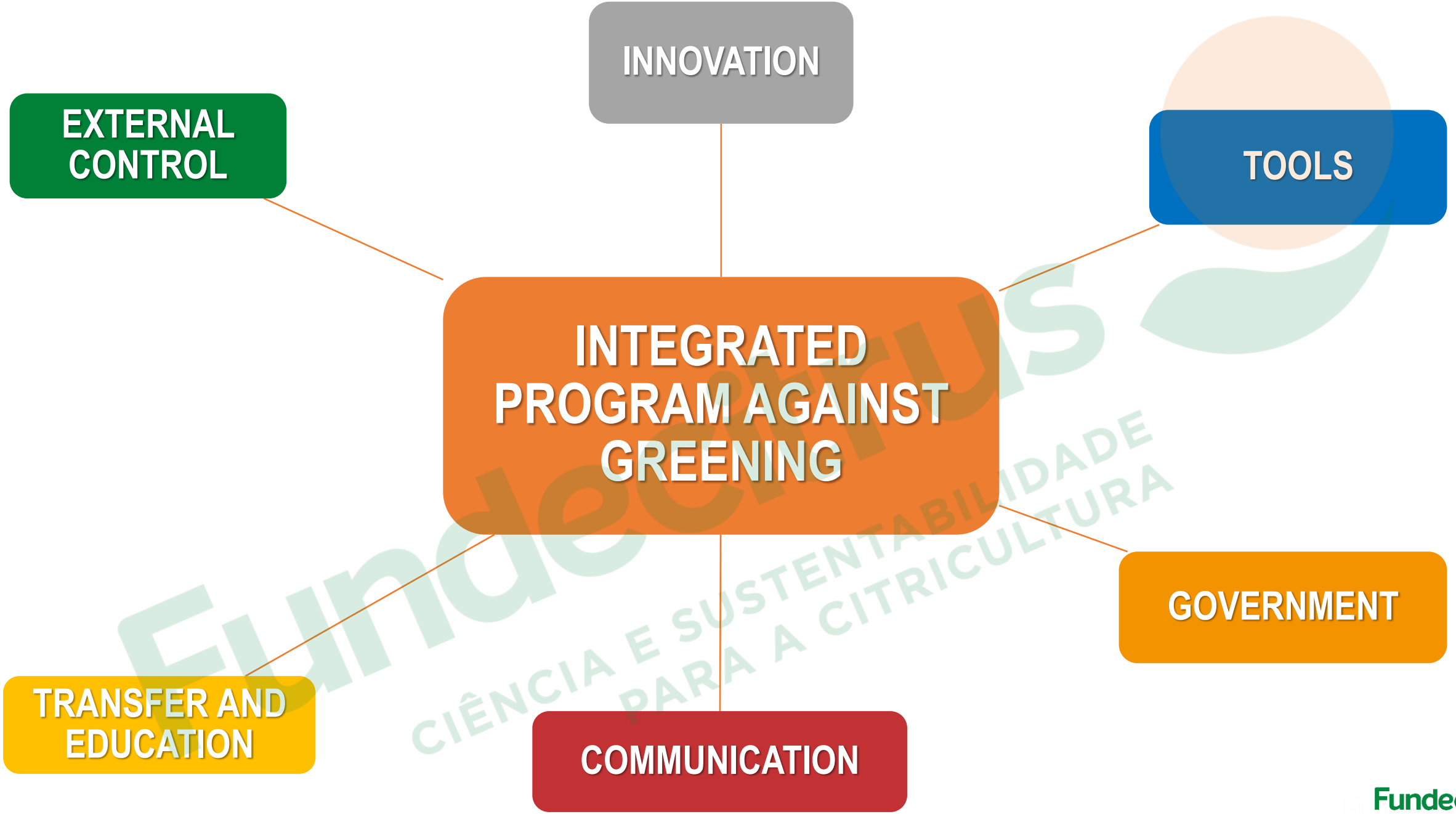

#UNITED against GREENING

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THANK YOU


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GREENING:
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