“Brazilian Orange Production Forecasts Under Endemic HLB”

Antonio Juliano Ayres
General Manager

SÃO PAULO STATE CITRICULTURE

The importance of the citriculture

Tree inventory and orange forecast

Orange productivity in the presence of HLB

HLB management

Final considerations

THE CITRICULTURE IN BRAZIL AND SÃO PAULO STATE

The main orange juice producer in the world

Fundecitrus
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

CITRUS: MAIN JOB GENERATOR

Citrus: 460,000 hectars / 11,500 properties in Sao Paulo

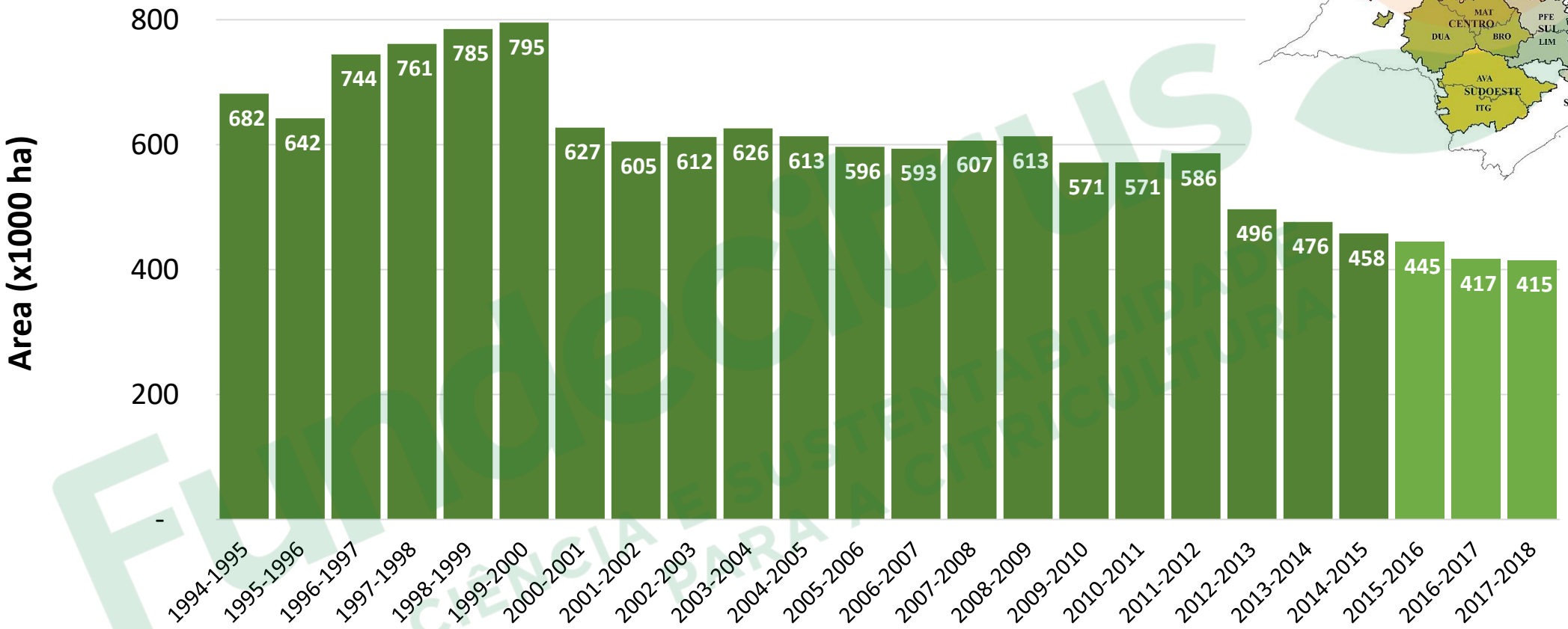
200,000 jobs (direct and indirect)

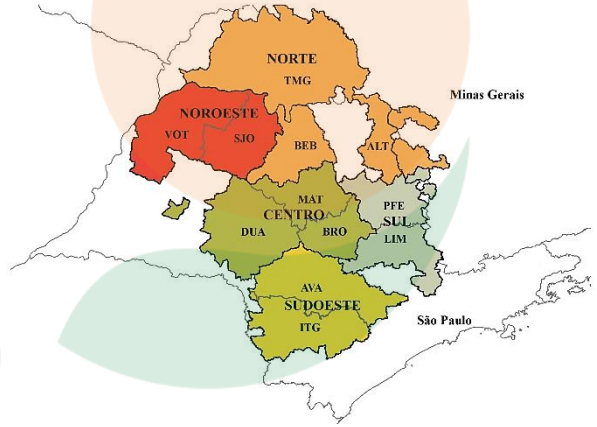
1 direct employee per 10 hectars

Sugarcane: 5,600,000 hectars

1 direct employee per 70 hectars

ORANGE GROVE AREA IN SÃO PAULO AND TRIÂNGULO MINEIRO





Source: CitrusBR (1998/89 to 2014/15) and Fundecitrus (2015/16 to 2017/18)

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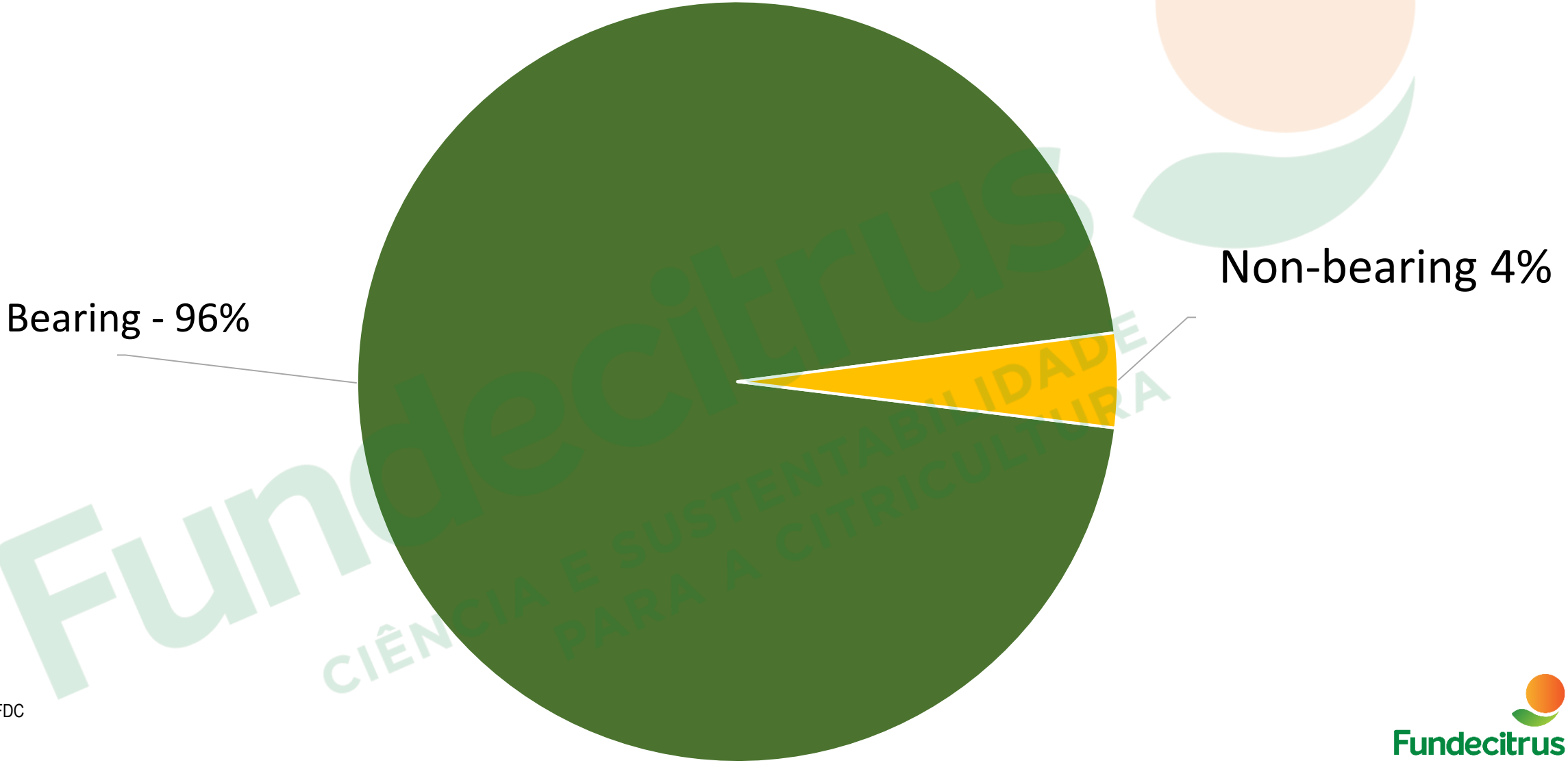
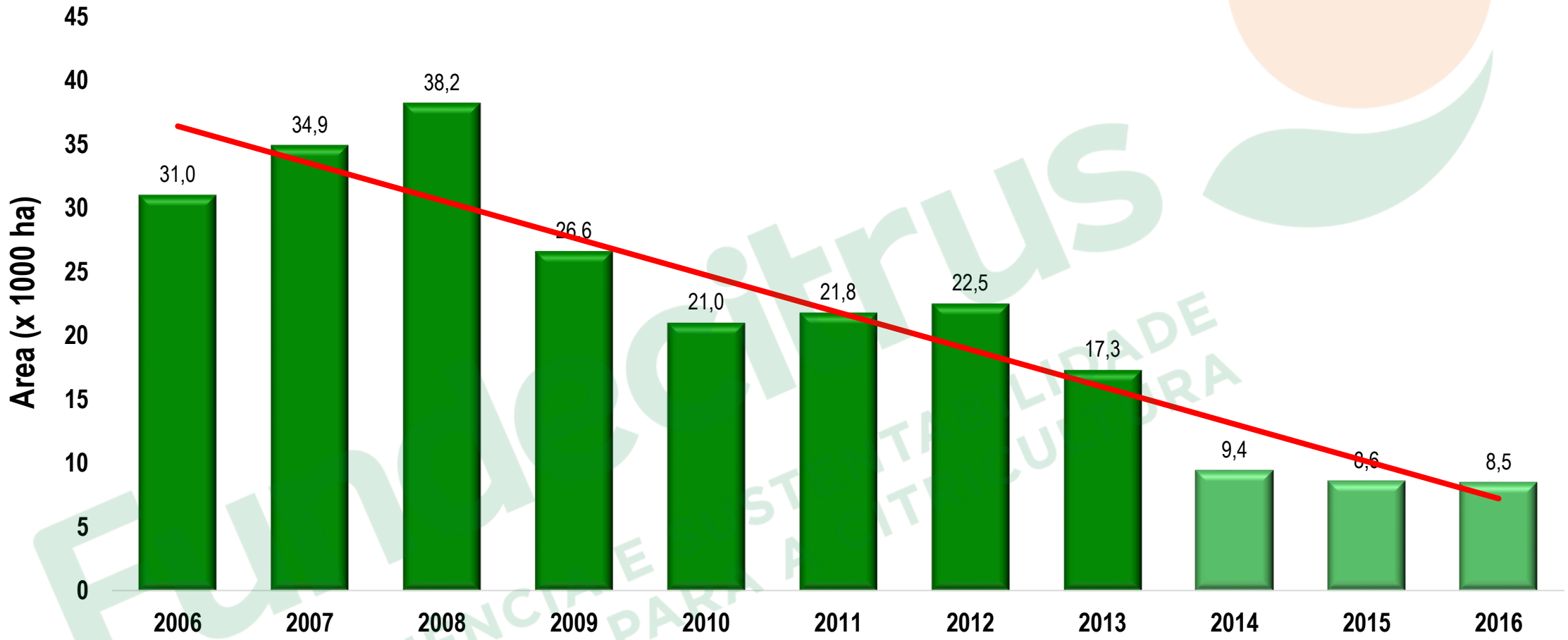
BEARING AND NON-BEARING GROVES (2017)



Source: FDC

NEW PLANTING AREA

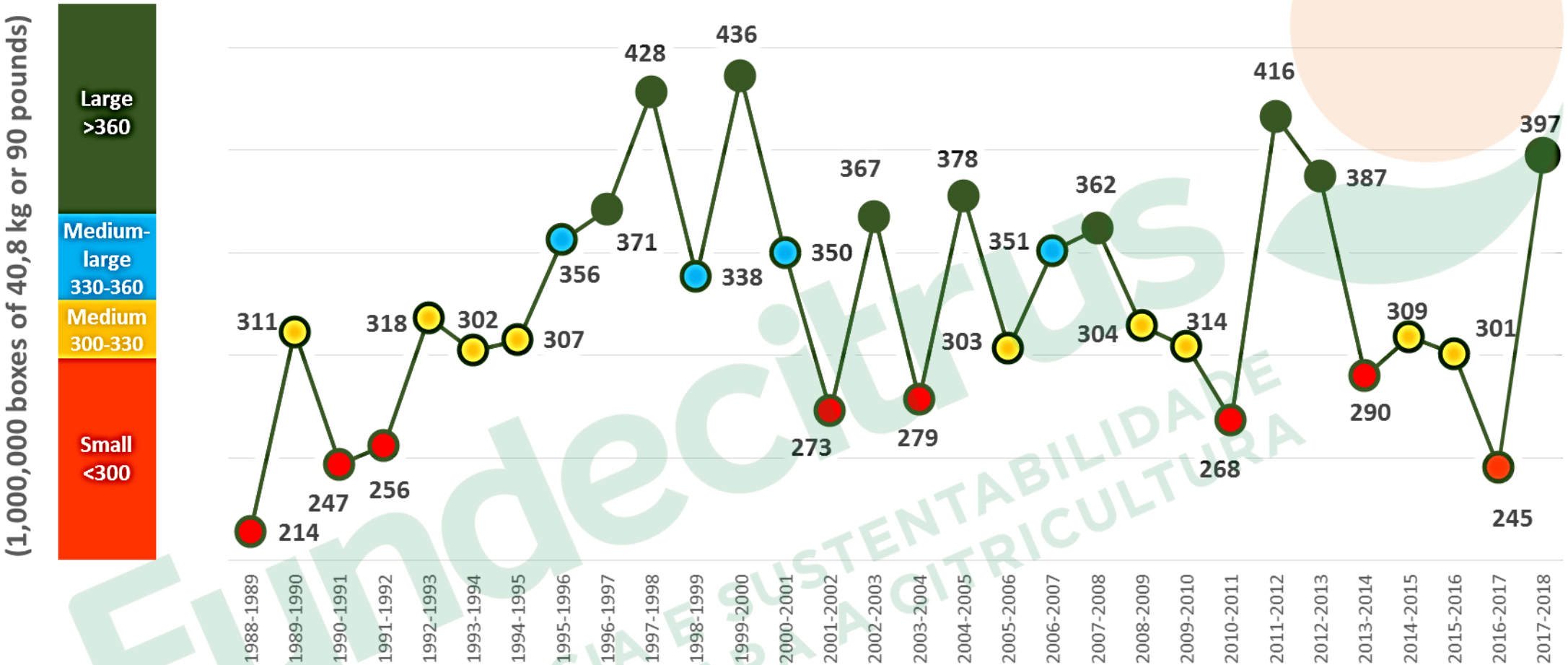


Source: **CDA** e FDC

ORANGE PROCUCTION FORECAST FOR THE 2017/18 SEASON

Group of varieties	Forecast Components				Final Estimation (February/2018)			Harvest (up to Jan 31th)
	Bearing trees (x1,000)	Fruit at striping (per tree)	Fruit forecasted (per box)	Fruit loss from droppage forecast (%)	Boxes/tree	Boxes/ha	Total boxes (x 1,000,000)	
Hamlin, Westin and Rubi	27,308	972	277	10.00	2.84	1,235	77.48	100%
Other Erliers [2]	7,949	714	251	11.30	2.27	1,008	18.02	100%
Pera Rio	60,234	666	253	17.00	1.97	945	118.47	99%
Valencia and Folha Murcha	61,182	729	227	21.50	2.27	1,010	138.77	95%
Natal	18,105	813	238	20.00	2.46	1,057	44.53	90%
Total 2017/2018	**174.779**	**753**	**247**	**17.20**	**2.27**	**1,030**	**397.27**	**97%**

ORANGE YIELD IN SÃO PAULO STATE



Source: CitrusBR (1998/89 to 2014/15) and Fundecitrus (2015/16 to 2017/18). 2017-2018 September Forecast.

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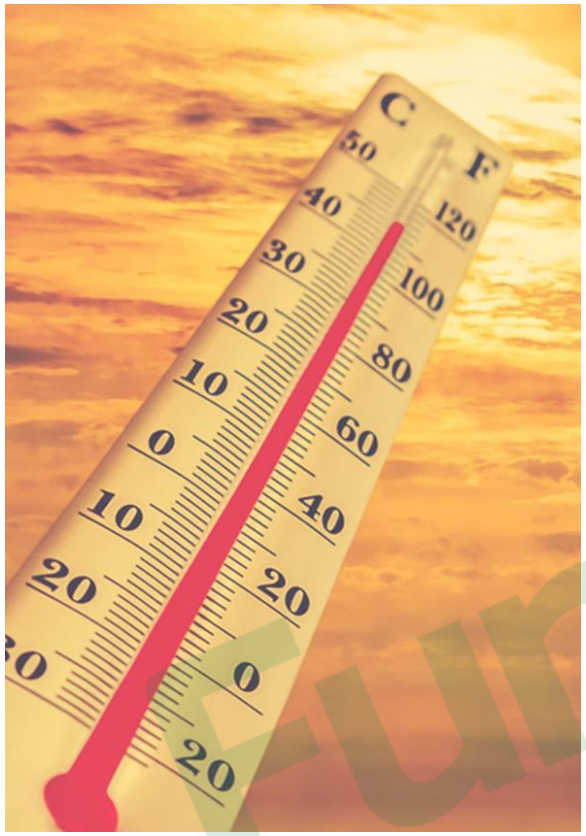
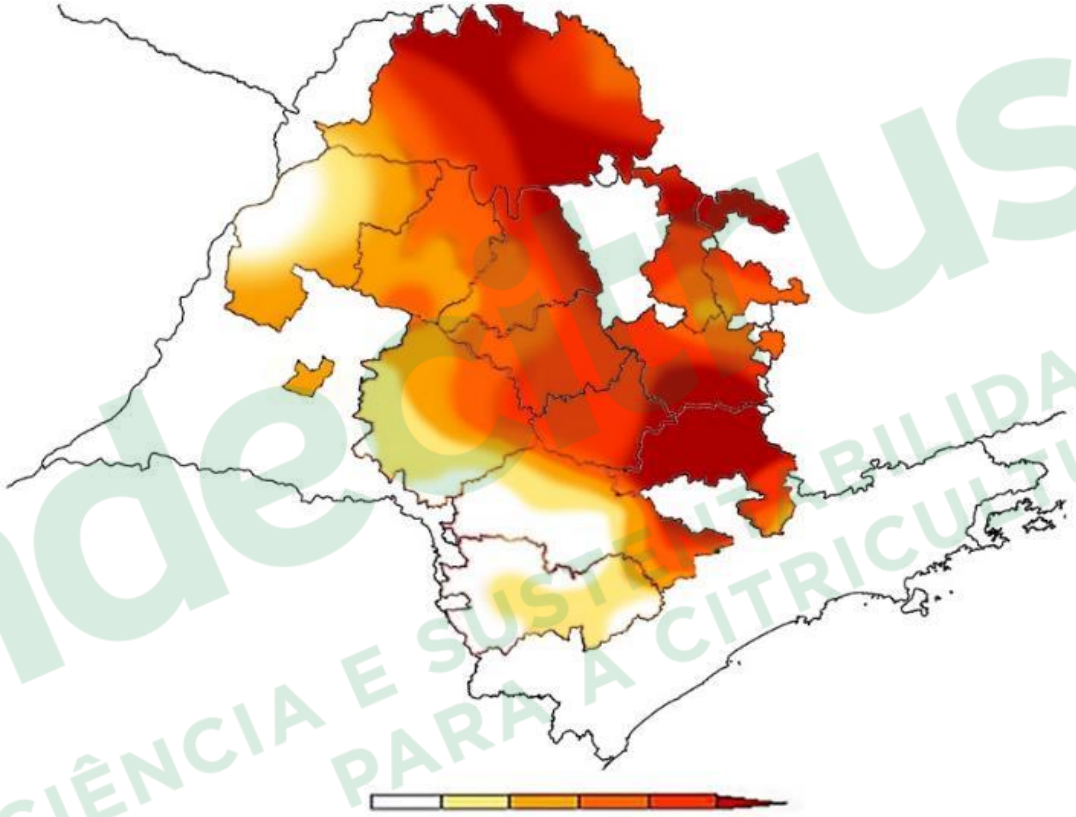
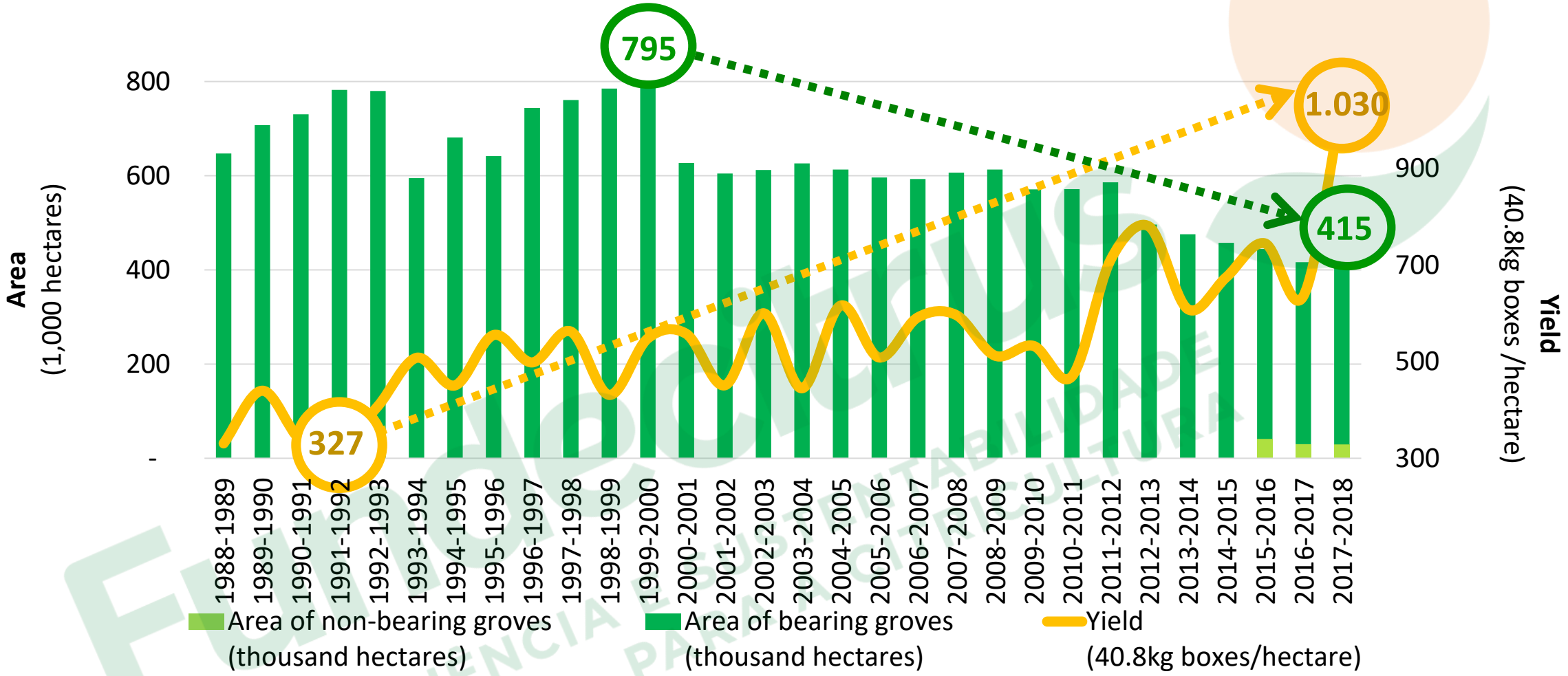
MAIN REASON FOR YIELD VARIATION DURING THE YEARS

Fruit drop during Spring is caused by high temperatures and dry period





PLANTED AREA VS. ORANGE YIELD



Source: CitrusBR, Fundecitrus, IBGE. Until 2014-2015 it is not possible to presente bearing and non-bearing area separately.

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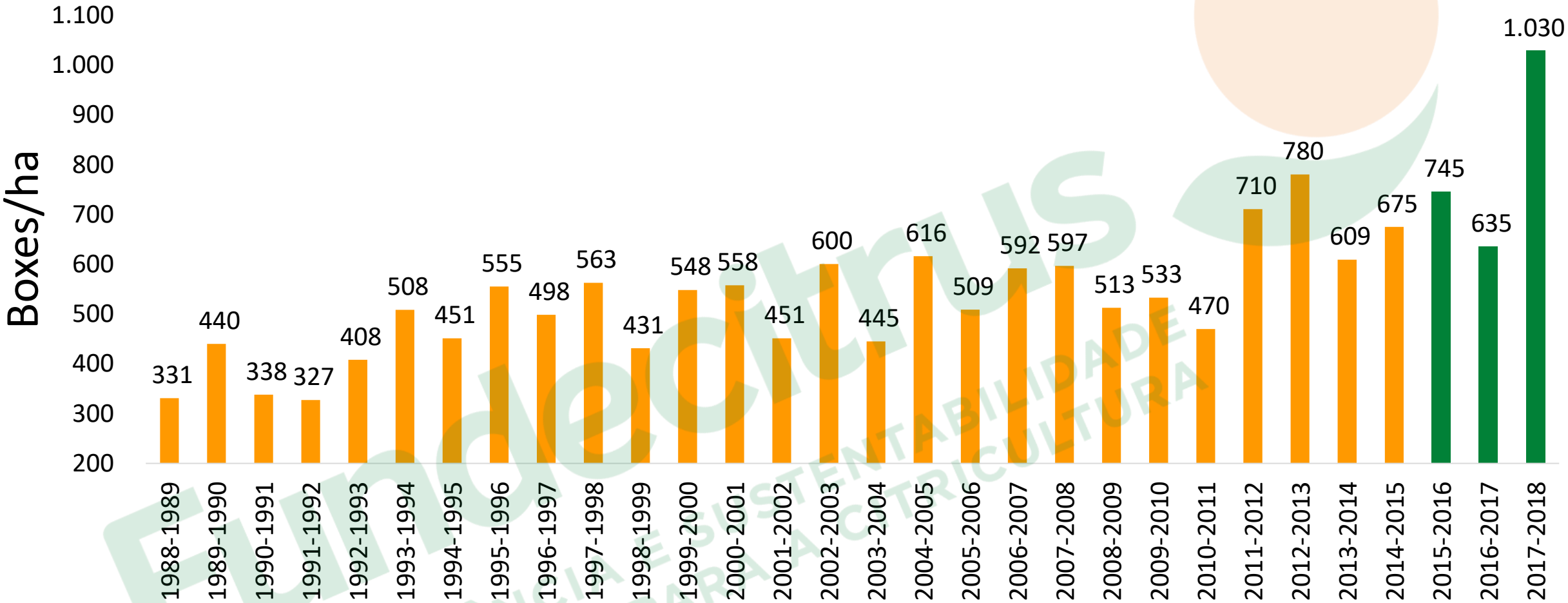
PRODUTIVITY DURING SEASONS



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

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REASONS FOR THE INCREASE IN PRODUCTIVITY

Use of healthy young trees

Disease management

Favorable climate

Increased planting density

Nutrition and Irrigation

Aggressive HLB management

HEALTHY YOUNG TREES

Before 2002

After 2003

200 million young trees
produced since 2003

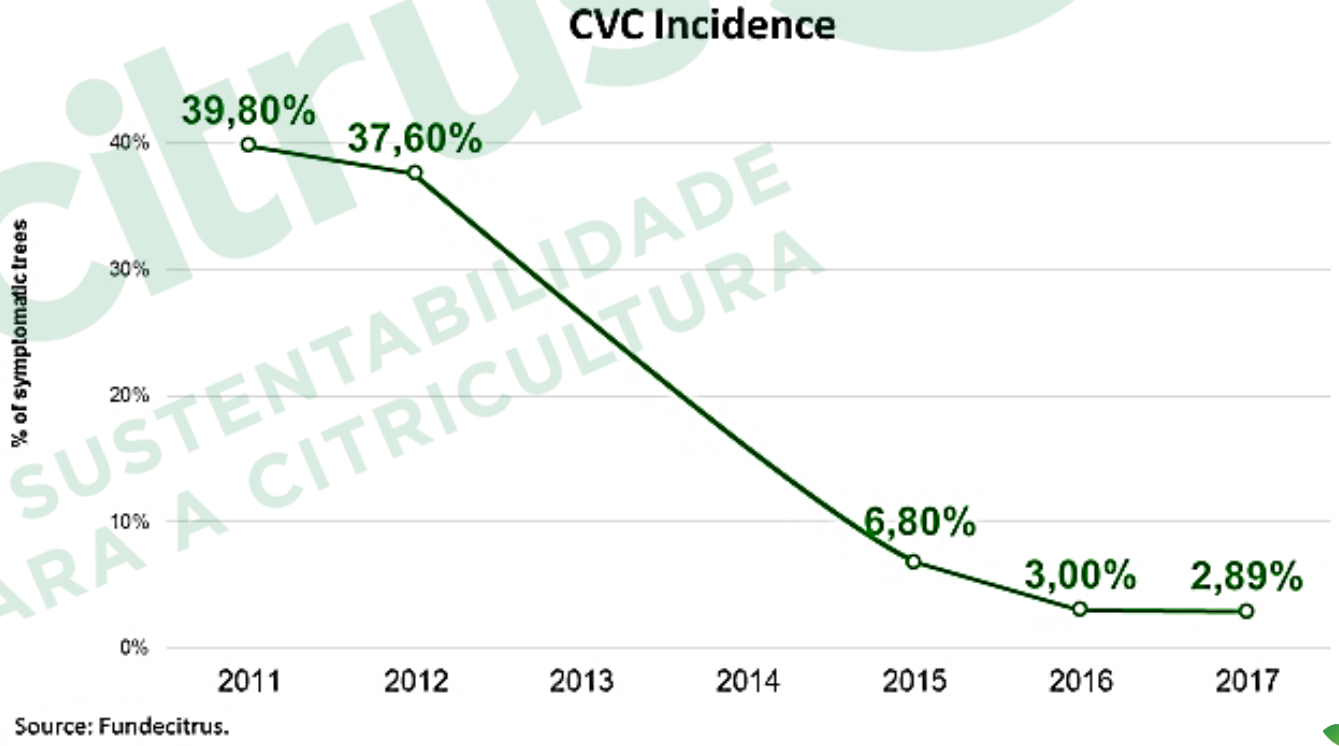
MAIN DISEASE MANAGEMENT

CITRUS VARIEGATED CHLOROSIS

Healthy young trees

Inspection and eradication of affected trees

Vector control



ROOTSTOCKS TOLERANT TO CITRUS SUDDEN DEATH

INARCHING

Valencia/Rangpur lime

Valencia/Cleopatra

CITRUS CANKER MITIGATION

- Grove inspections
- Leaf miner control

- Windbreak
- Tolerant varieties
- Copper spray

- Material disinfestation

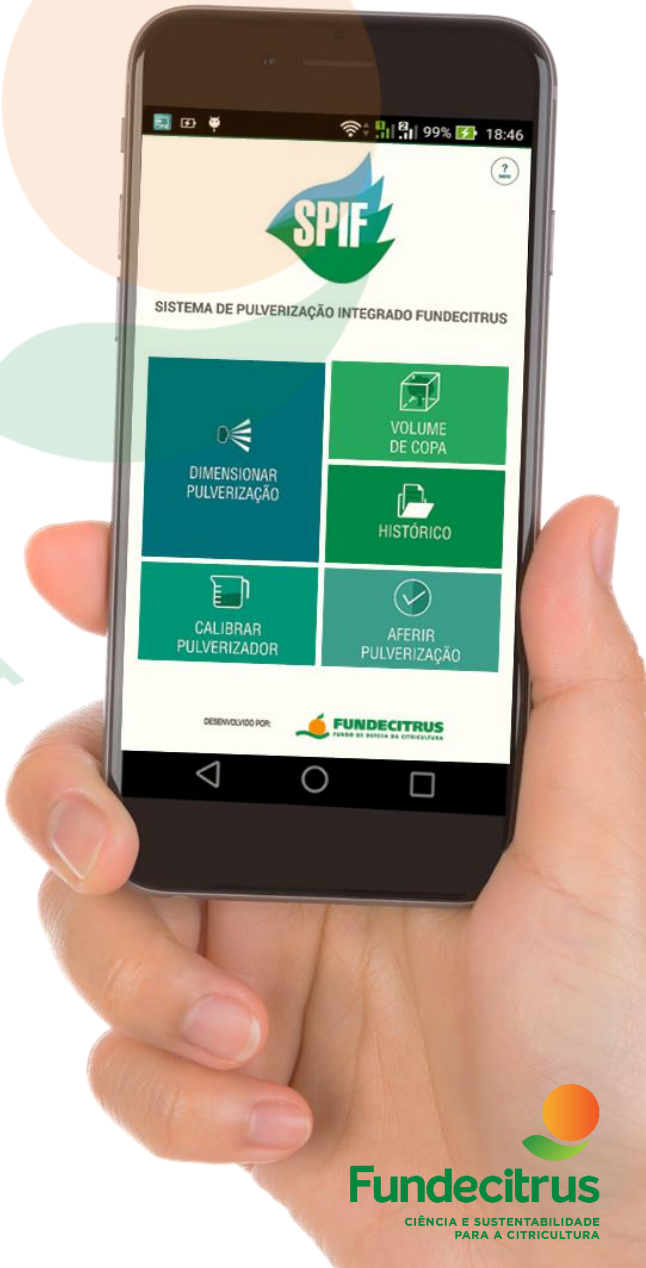
SPRAY VOLUME ADEQUACY

SAVINGS

- 30 – 70% water saving
- Up to 50% pesticide saving

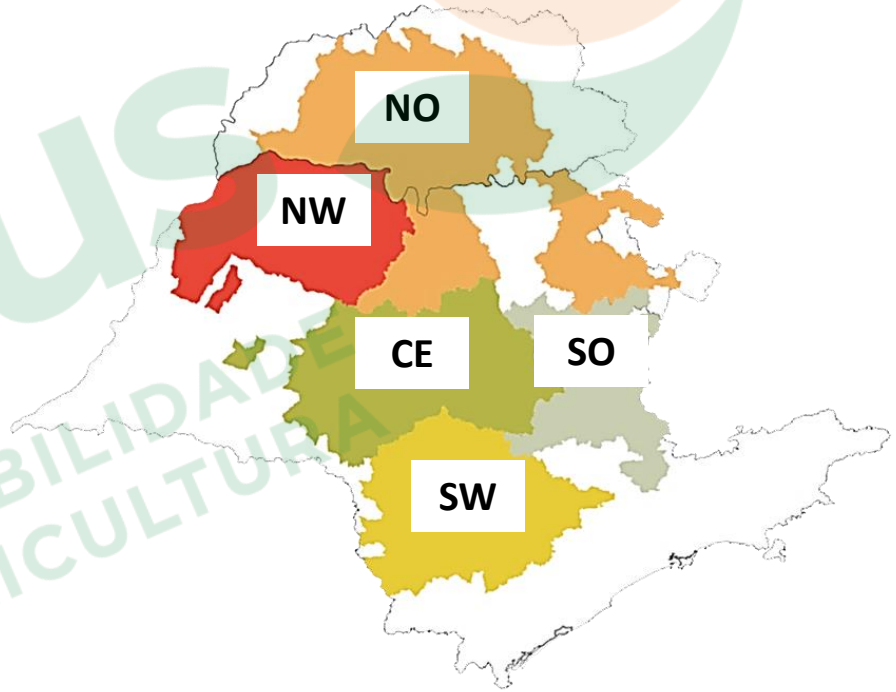
FUNDECITRUS INTEGRATED SPRAYING SYSTEM

- Versions - desktop, website and mobile
- Access - spif.fundecitrus.com.br

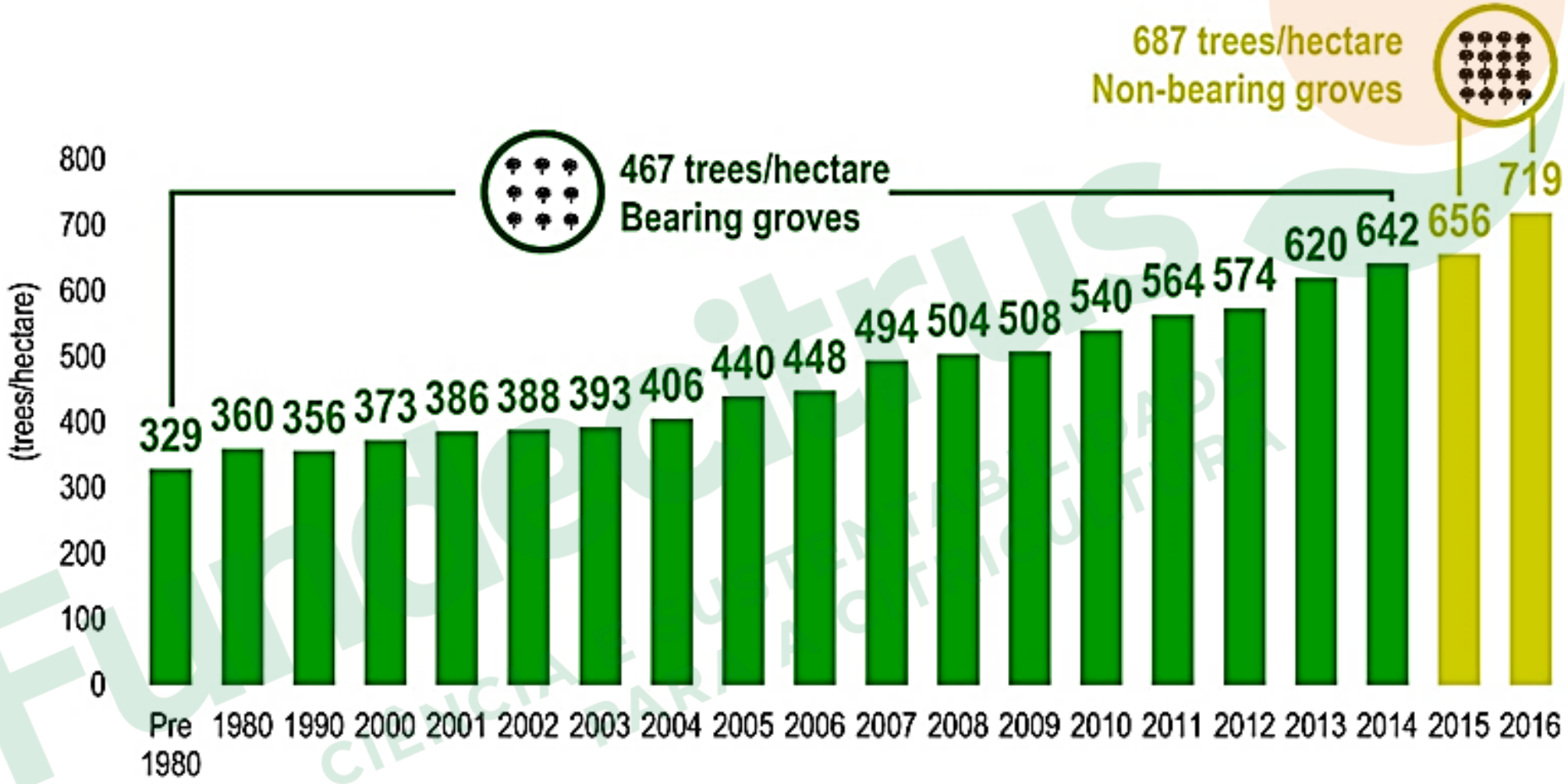


SECTOR AND PRODUCTIVITY (BOXES/HA)

SECTORS	2015	2016	2017
NORTHWEST	450	377	880
NORTH	792	495	1105
CENTER	613	616	981
SOUTH	779	664	986
SOUTHWEST	1052	950	1151



GROVE DENSITY




NUTRITION
AND
IRRIGATION

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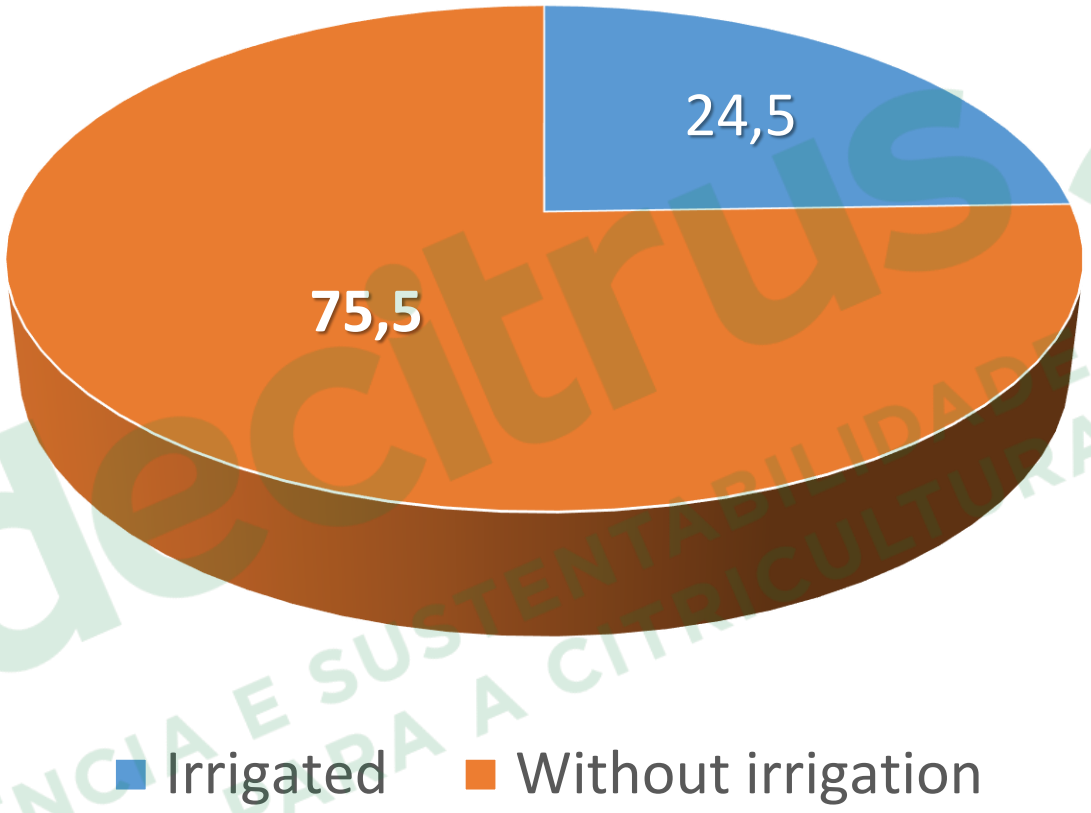
PARA A CITRICULTURA

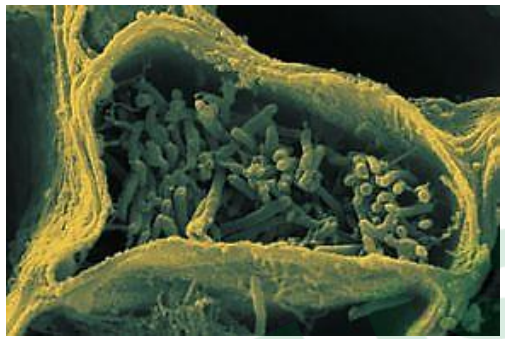
PERCENTAGE OF ORANGE GROVES WITH IRRIGATION (2017)

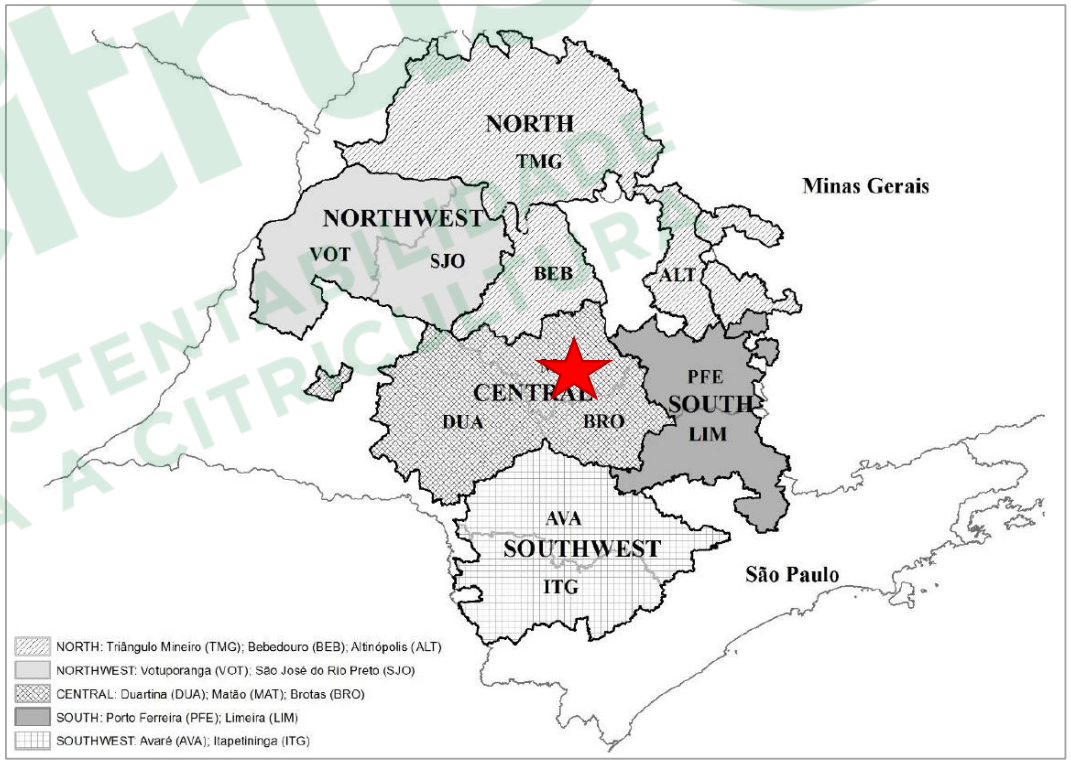


HLB CONTROL :
THE MAIN CHALLENGE

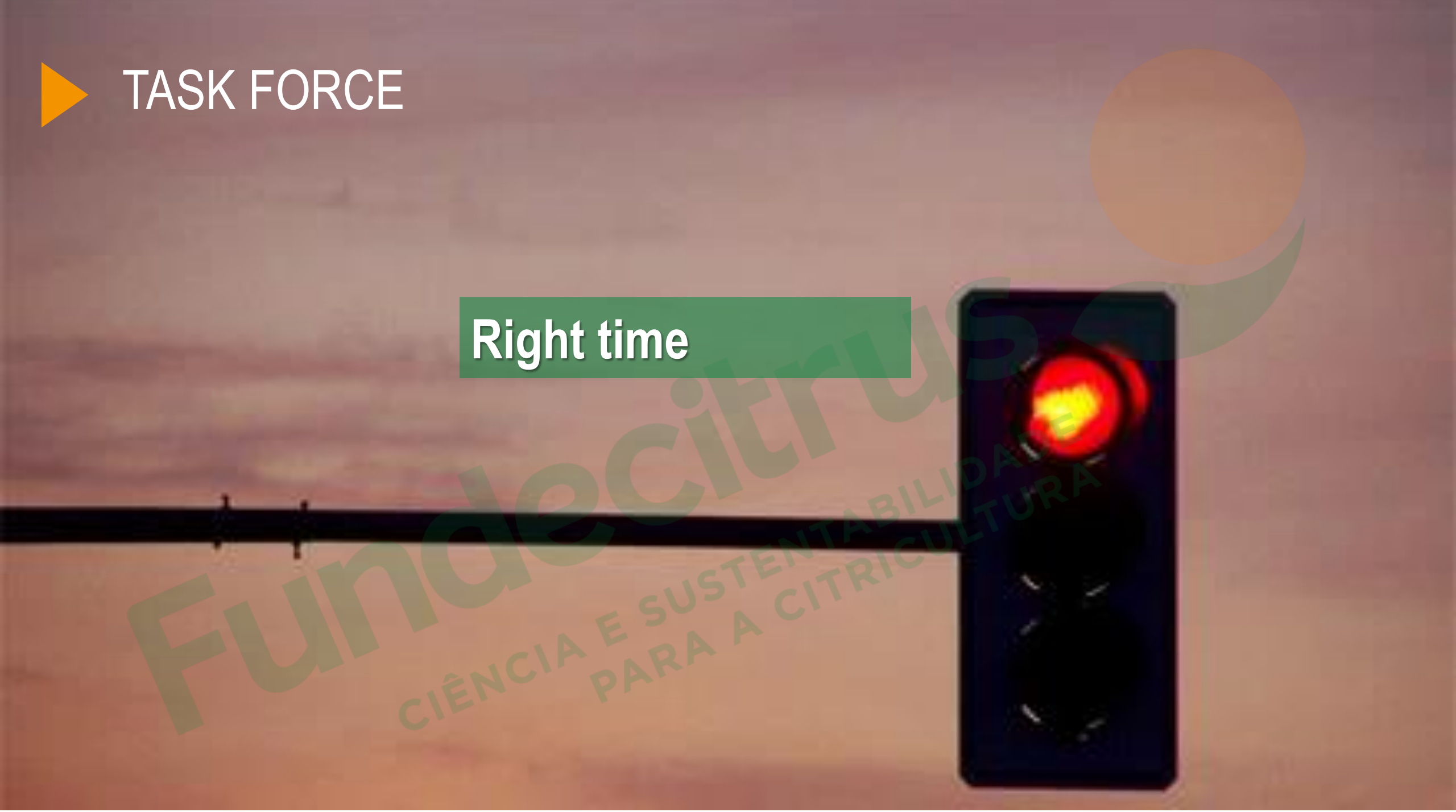
HLB IN SÃO PAULO STATE

Detection in 2004





TASK FORCE



FUNDECITRUS ACTIONS

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FUNDECITRUS ACTIONS

Ago/2004 - Campaign to call grower attention

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FUNDECITRUS ACTIONS

Nov/2004

International Seminar (Araraquara)

Os pesquisadores sul-africanos van Vuuren, Le Roux e Pietersen respondem às dúvidas da platéia, depois de contarem o histórico do greening na África do Sul e discutirem os perigos do greening americano

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Jul/2006

International Workshop (Ribeirão Preto)

CRUCIAL FACTORS THAT SUPPORT THE CONTROL OF HLB

Healthy young trees

Historical success in the control of Canker and CVC

Fundecitrus leadership with growers and government

Research institution network

FUNDECITRUS

Intelligence center

Maintained by growers and the industry

International research net work

CASE STUDY: MAIN FACTORS FOR CONTROL SUCCESS

Journal of Plant Pathology (2010), 92 (2), 285-302 Edizioni ETS Pisa, 2010

LETTER TO THE EDITOR

LESSONS FROM HUANGLONGBING MANAGEMENT IN SÃO PAULO STATE, BRAZIL

J. Belasque Jr.[1], R.B. Bassanezi[1], P.T. Yamamoto[1], A.J. Ayres[1], A. Tachibana[2], A.R. Violante[3], A. Tank Jr.[4], F. Di Giorgi[5], F.E.A. Tersi[6], G.M. Menezes[7], J. Dragone[8], R.H. Jank Jr.[9] and J.M. Bové[10]

Local actions

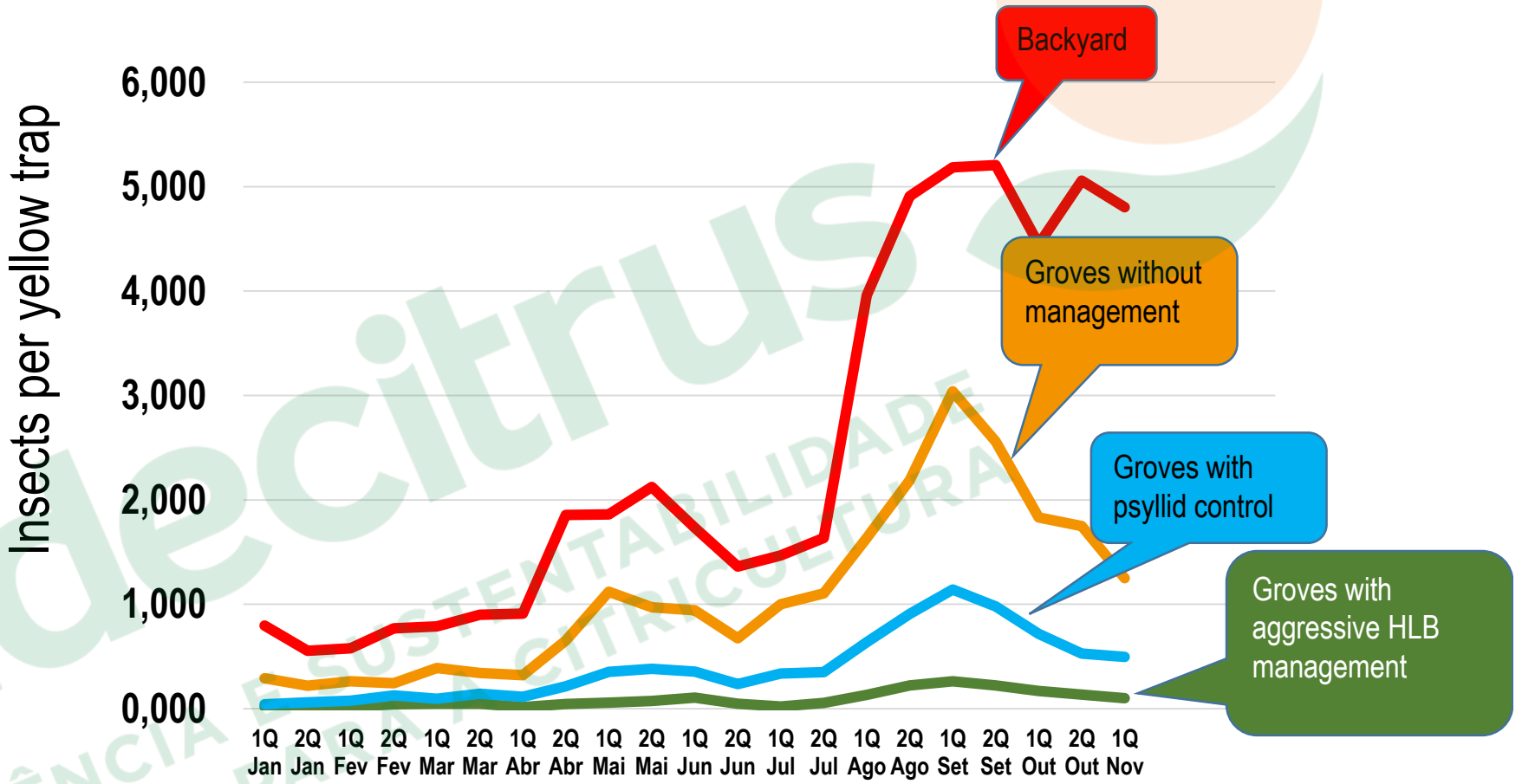
1. Moment that the control started
2. Time-period the control measures have been adopted
3. Total number of insecticide sprays per year
4. Total number of tree inspections and symptomatic tree removal per year
5. Age of the tree when the disease appears

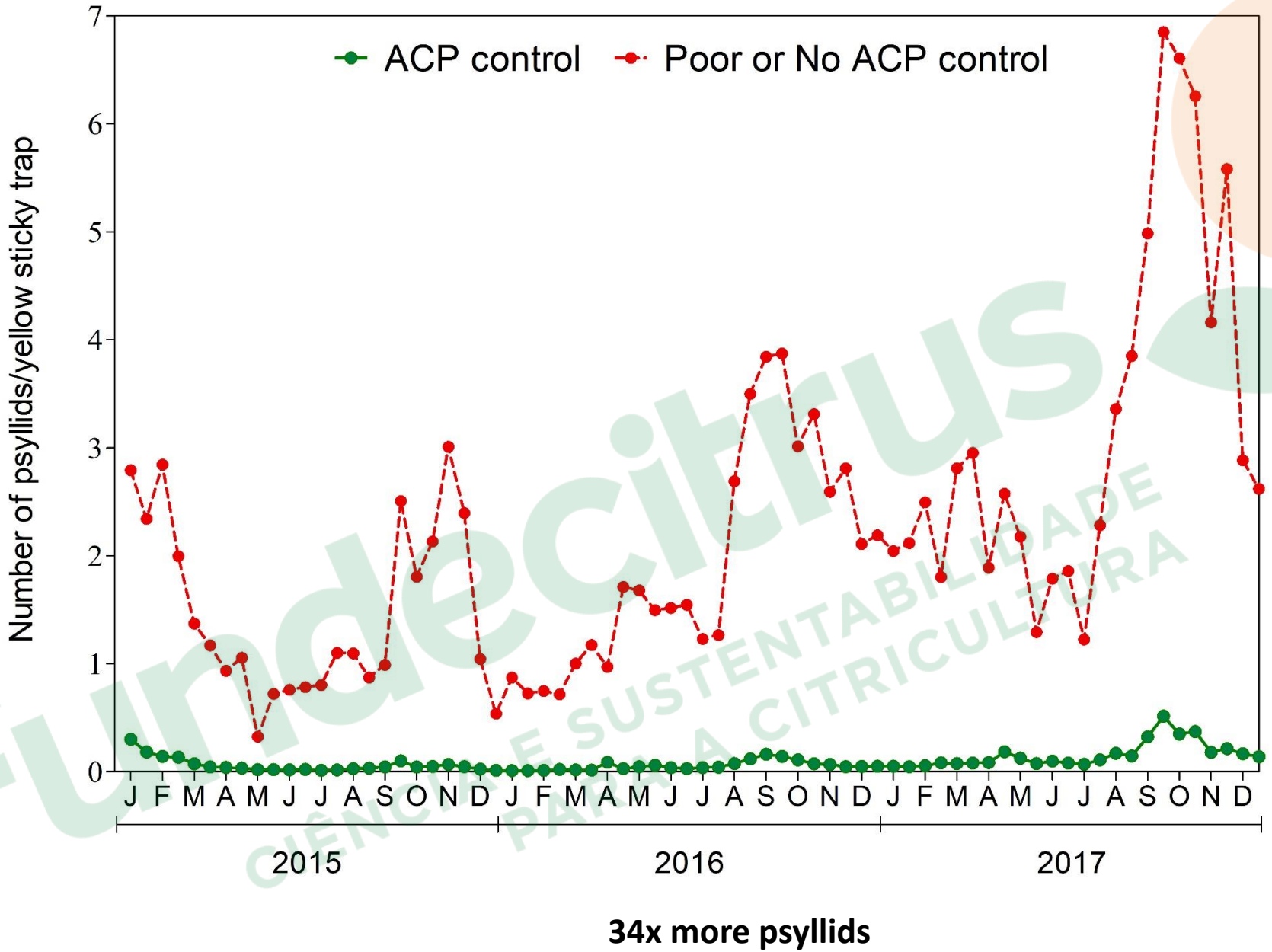
Regional actions

6. Distance from farm without control
7. HLB in the municipality the farm is located
8. Size of the farm

LOOKING OUTSIDE

ADULT PSYLLID POPULATION





34x more psyllids

MOST ADULT PSYLLIDS ENTER THE GROVES THROUGH THE EDGE

Psyllid distribution:

80% in the first 100 m

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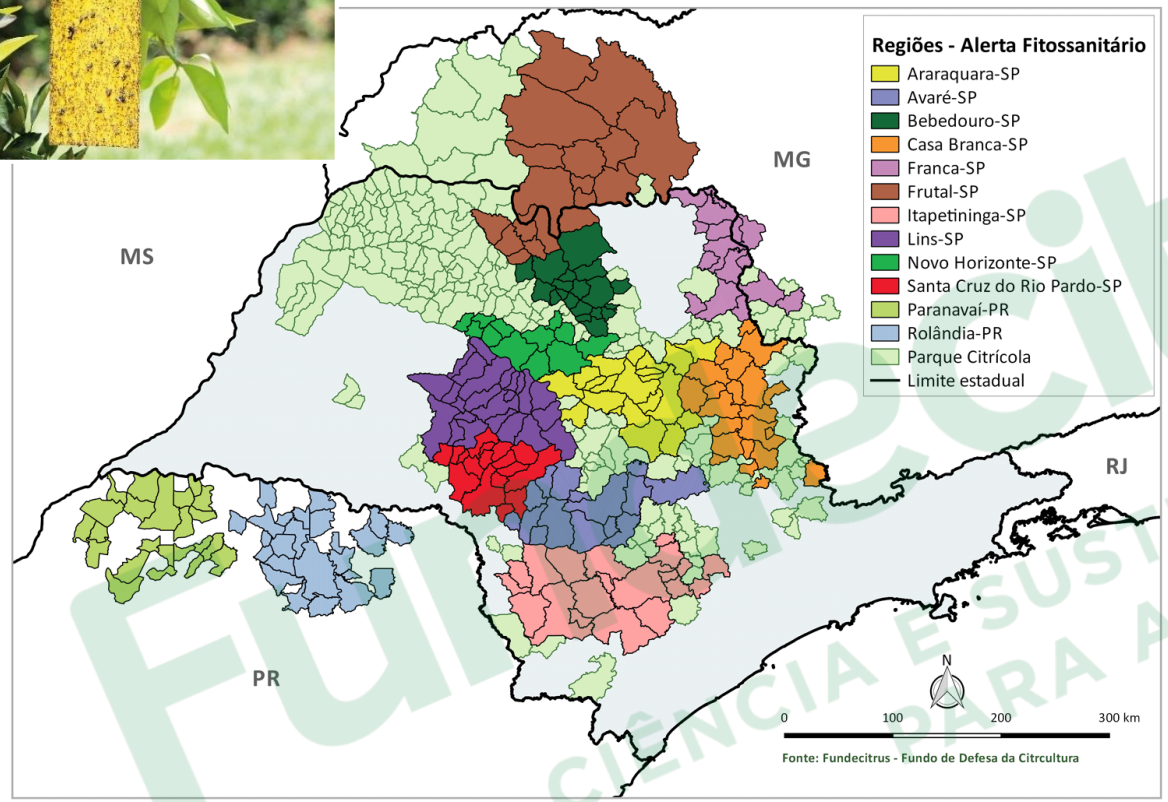
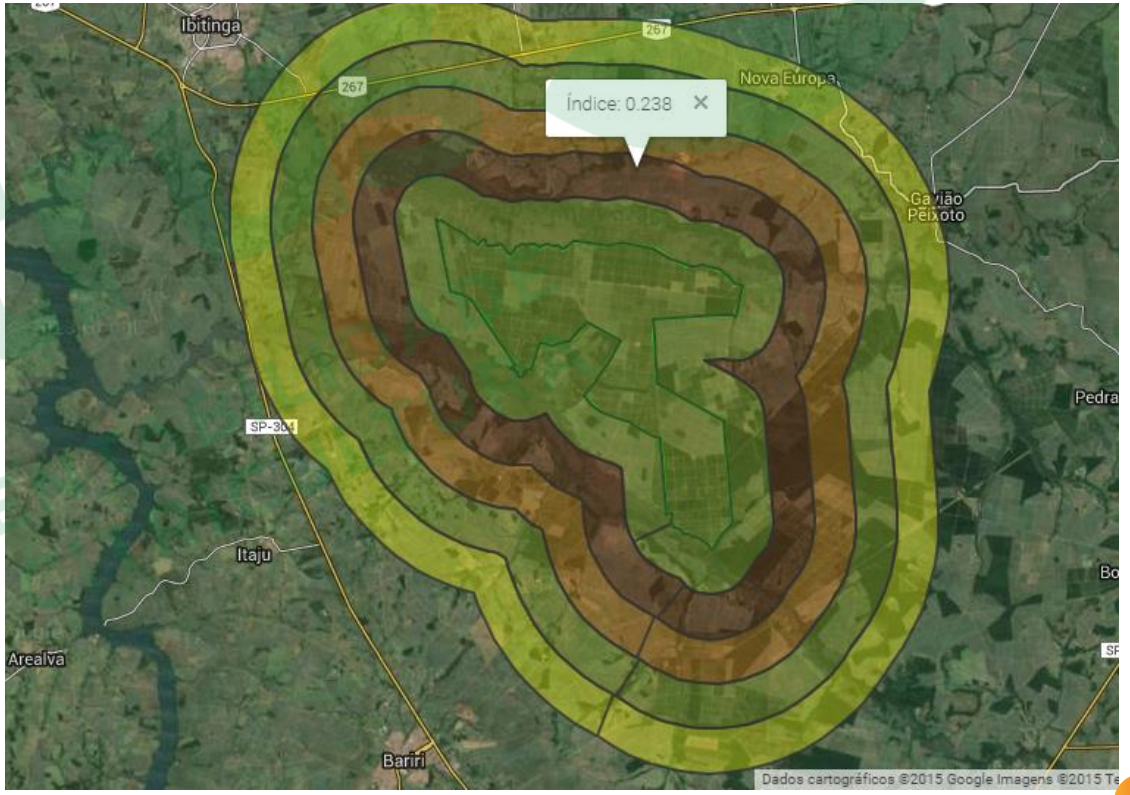
EXTERNAL ACTIONS AND REGIONAL MANAGEMENT

PSYLLID ALERT SYSTEM AND REGIONAL MANAGEMENT





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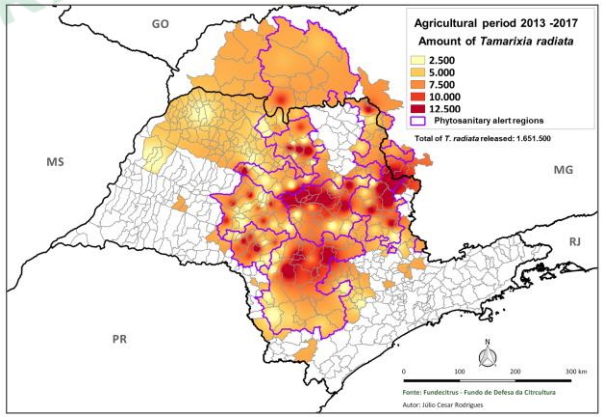
Fundecitrus and Growers

Region	Área (ha)	Number of trees	Yellow Trap	Farms	Cover Area
Araraquara	42.228	18.675.864	2.899	156	72,00%
Avaré	50.462	24.677.000	3.976	114	100,00%
Bebedouro	23.833	10.572.192	2.748	163	57,40%
Casa Branca	13.840	5.655.571	1.900	122	26,70%
Franca	8.608	4.796.000	777	98	100,00%
Frutal	42.955	19.063.684	4.606	153	89,00%
Itapetininga	14.127	6.172.730	2.157	33	57,70%
Limeira	10.256	4.987.412	1.280	24	24,10%
Lins	20.729	7.906.713	2.063	144	70,10%
Novo Horizonte	7.052	3.197.620	1.199	167	23,10%
Santa Cruz do Rio Pardo	23.963	11.638.149	2.887	109	71,40%
Total	**258.052**	**87.899.408**	**26.492**	**1.283**	**62,90%**

PSYLLID BIOCONTROL

Tamarixia radiata

100 thousand parasitoids released every month in non commercial groves



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A NEW CONCEPT FOR NEW PLANTINGS

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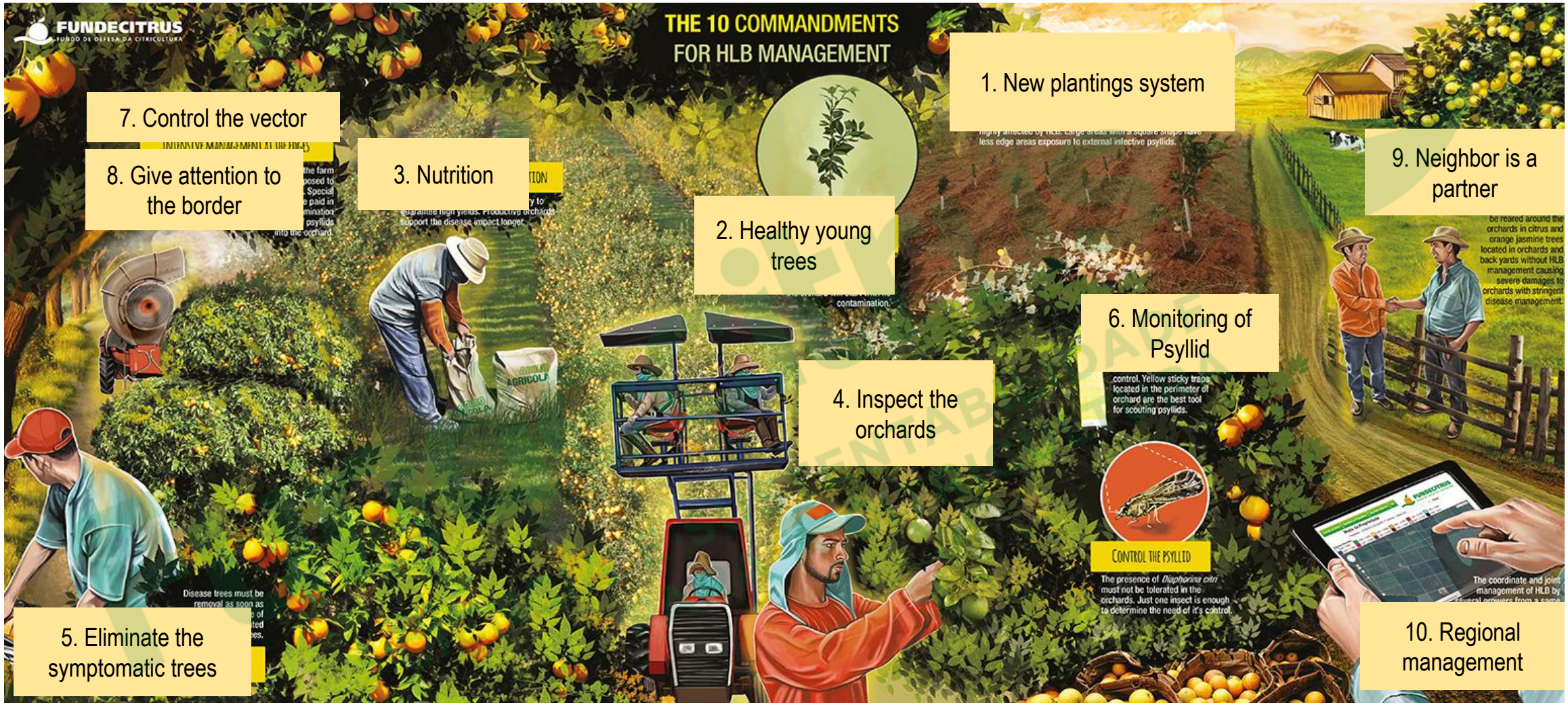
MORE EFICIENCY AND SUSTAINABILITY

THE 10 COMMANDMENTS AGAINST HLB



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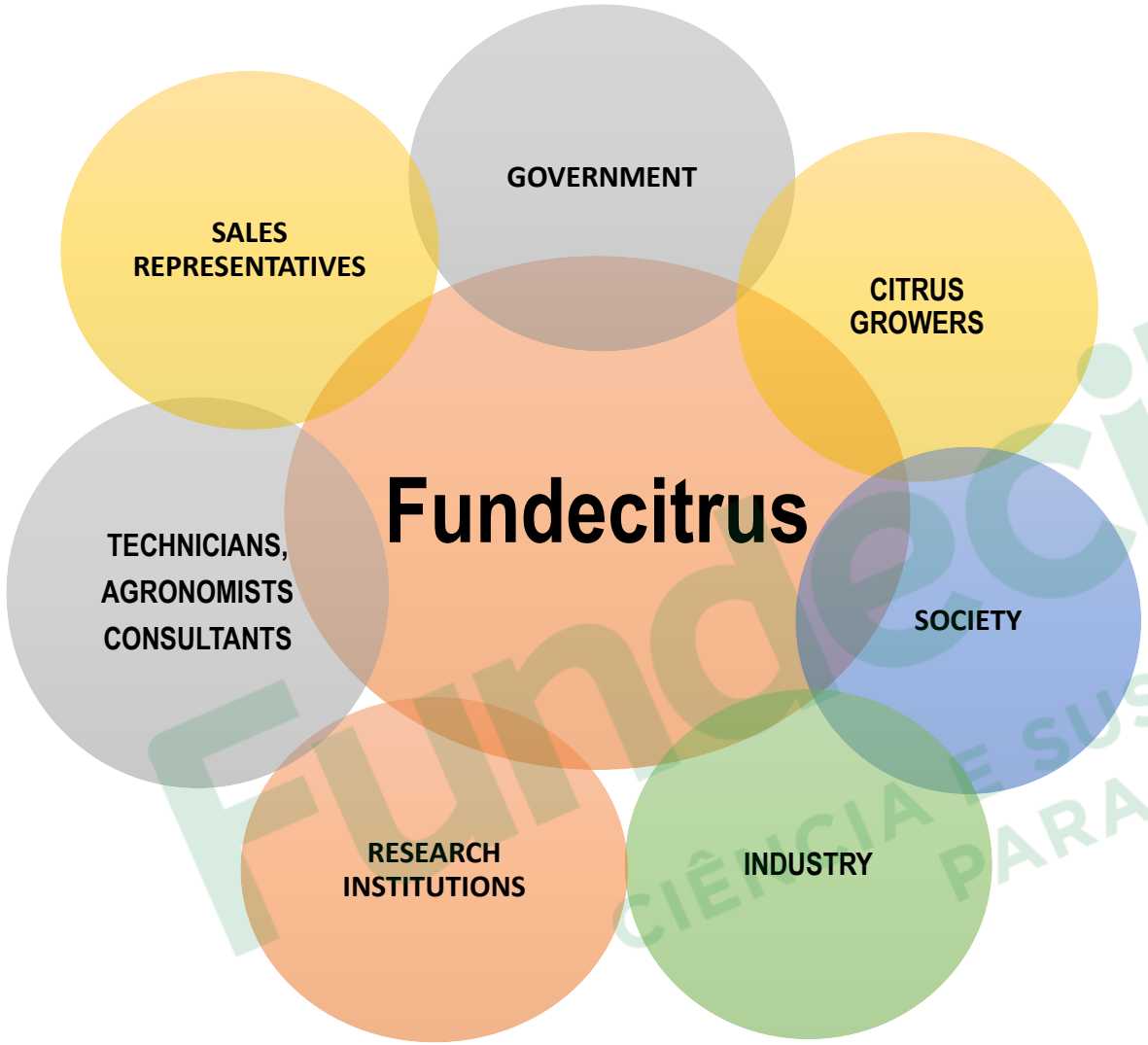
PARTNERSHIP

SUCCESS OF HLB CONTROL



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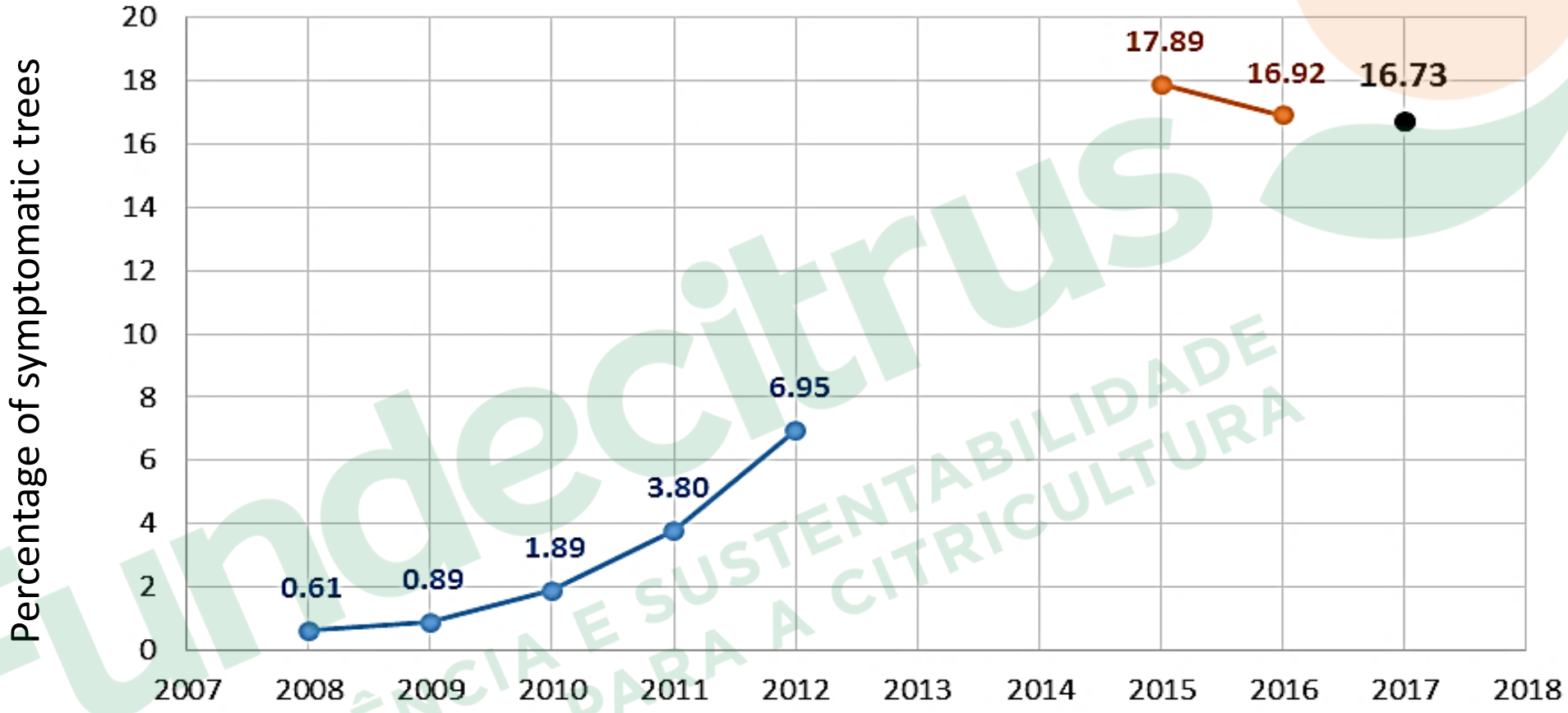
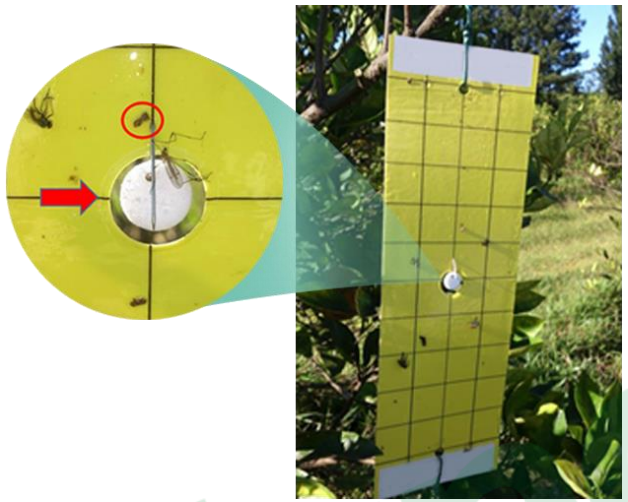
HLB PROGRESS IN SÃO PAULO STATE AND TRIÂNGULO MINEIRO

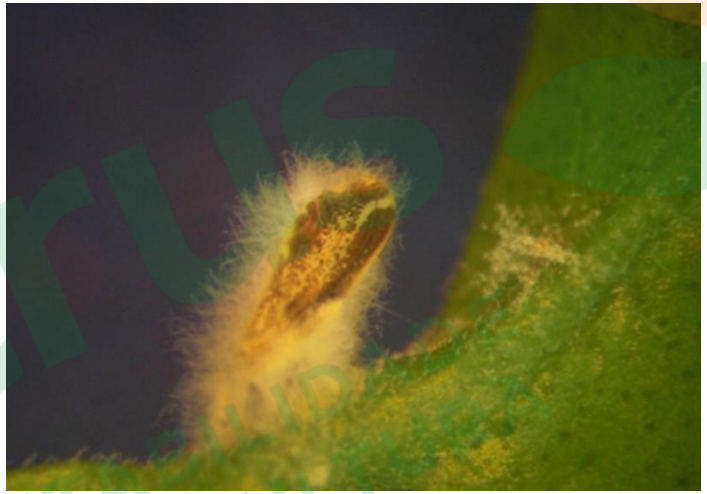


NEW APPROACHES IN HLB CONTROL

Psyllid pheromone



Bioinsecticide



Isaria fumosorosea

*"The **HLB-management system (TPS)** as described here is only a **short-term solution** to keep the citrus industry alive and to buy time for **long-term solutions**, probably based on **engineered citrus genotypes**, to come in, hopefully, within five to ten years. In the meantime, **research on psyllid control and identification of infected but still symptomless trees might improve the system."***

Dr. Joseph Marie Bové

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VAGAS LIMITADAS

II SIMPÓSIO INTERNACIONAL DE

GREENING

22 e 23 de maio de 2018

INSCREVA-SE

Participe e saiba tudo o que você precisa fazer para controlar o greening.

Públicos-alvo: **citricultores e profissionais que atuam no setor.**

#UNIDOSCONTRAOGREENING


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THANK YOU

“HLB INFECTION RATES IN BRAZIL”

Juliano Ayres
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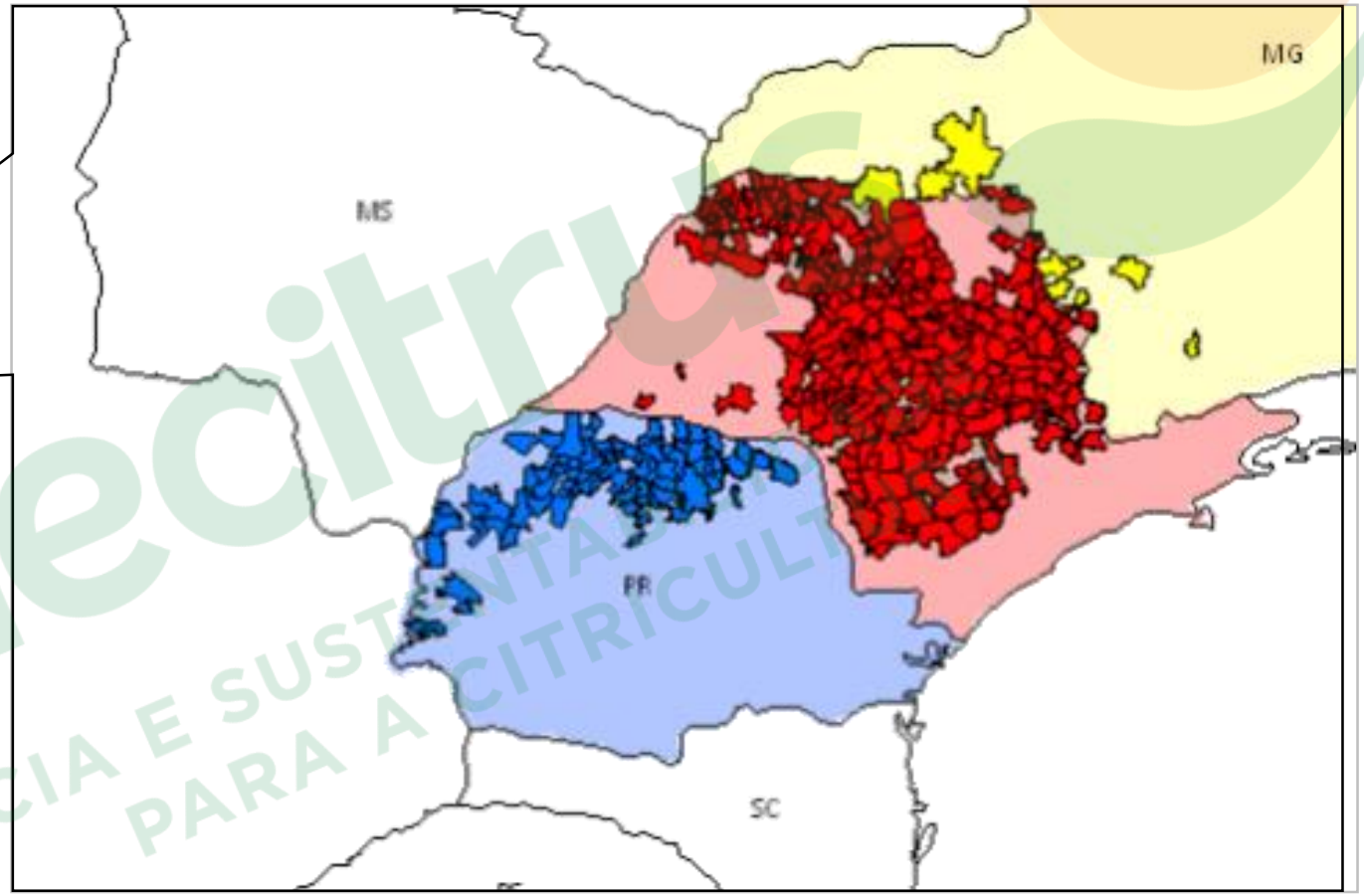
Renato Beozzo Bassanezi
renato.bassanezi@fundecitrus.com.br

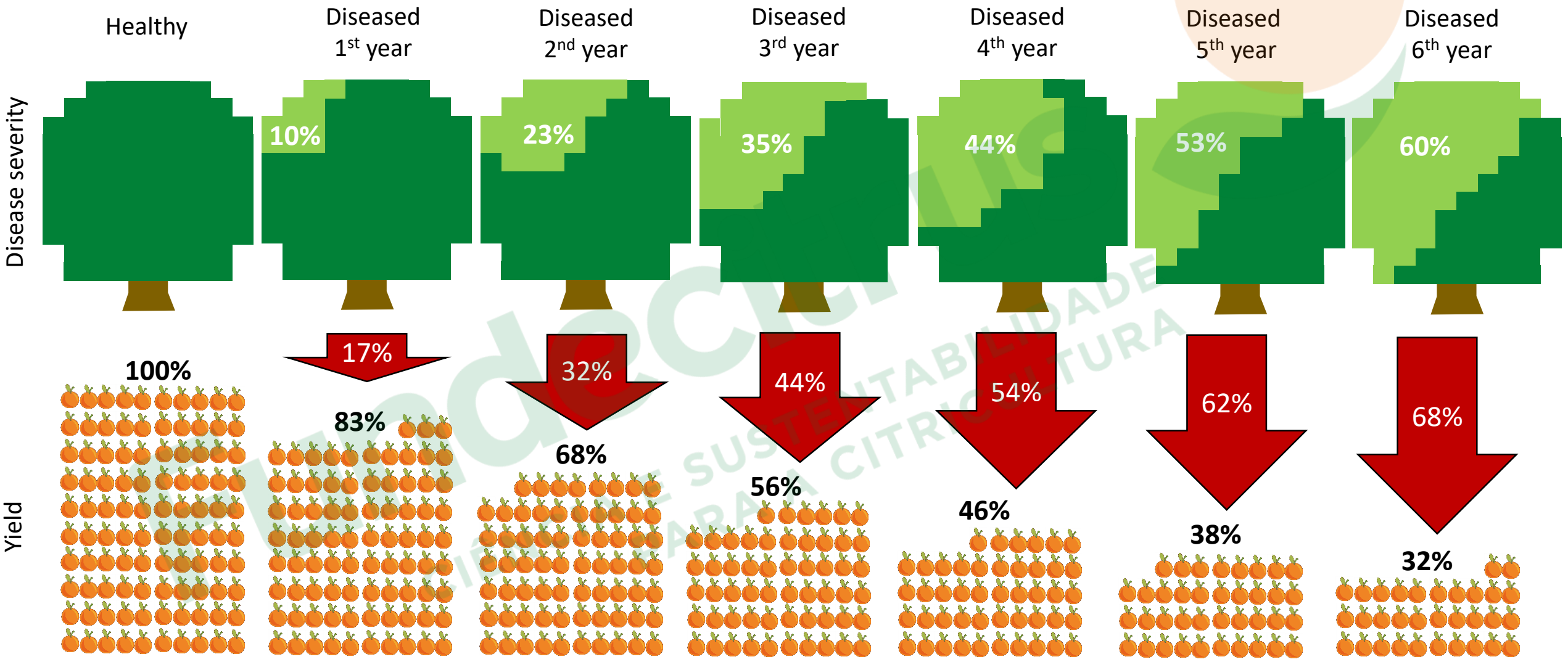
HLB CONTROL: CHALLENGE

CURRENT DISTRIBUTION IN BRAZIL

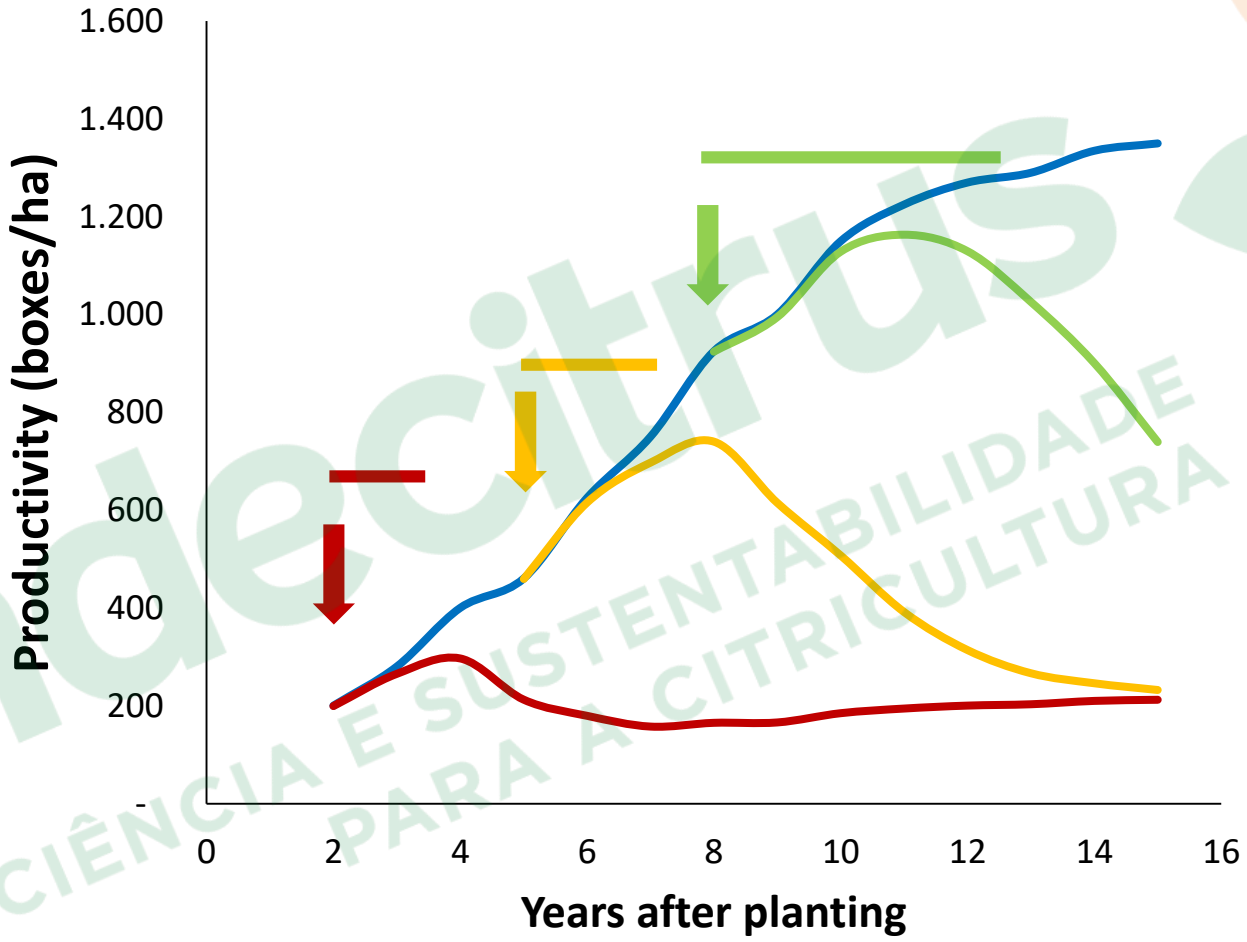


- ✓ Over 400 municipalities
- ✓ Most in São Paulo State

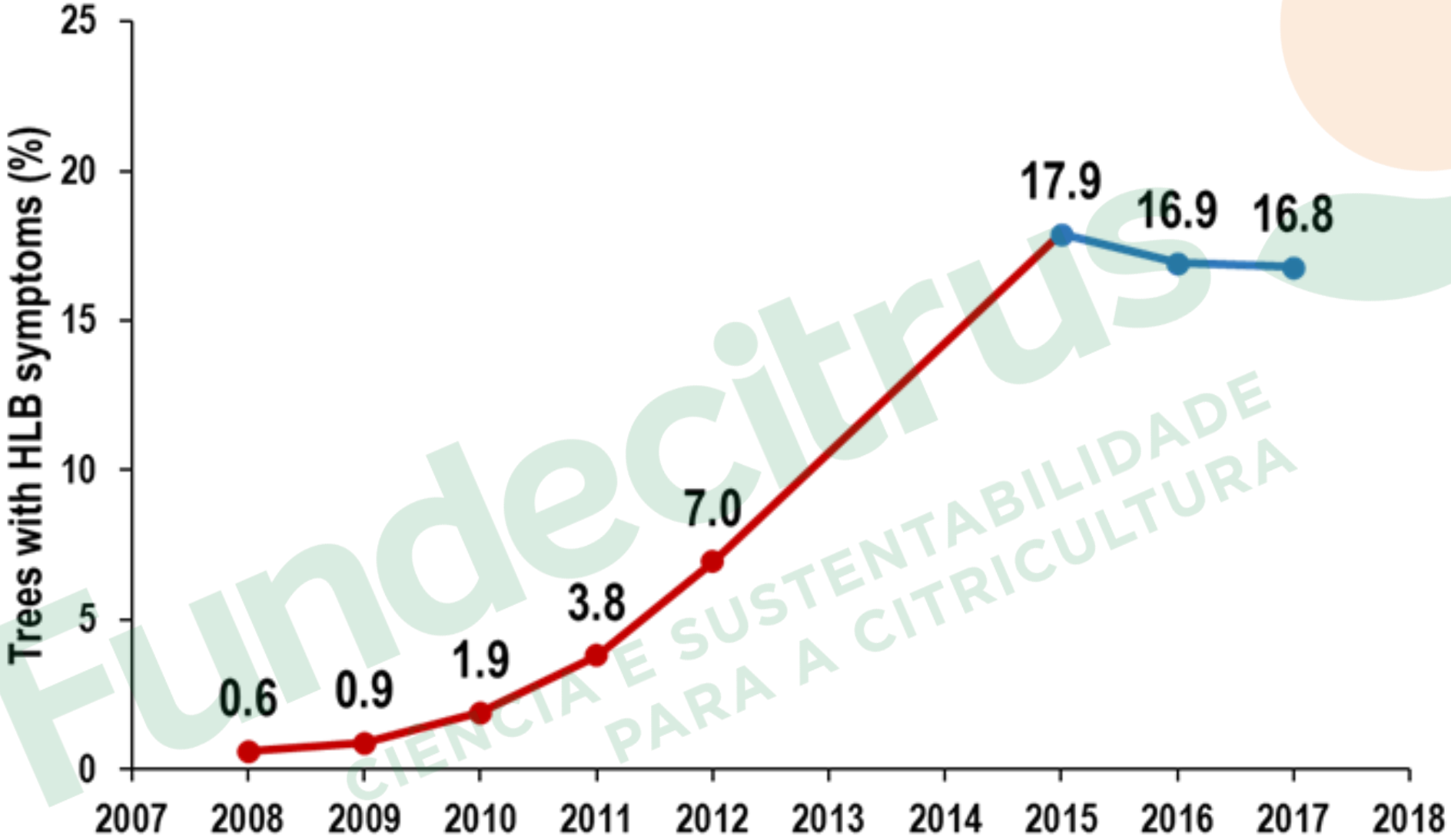
HLB SEVERITY PROGRESS IN ADULT ORANGE TREES



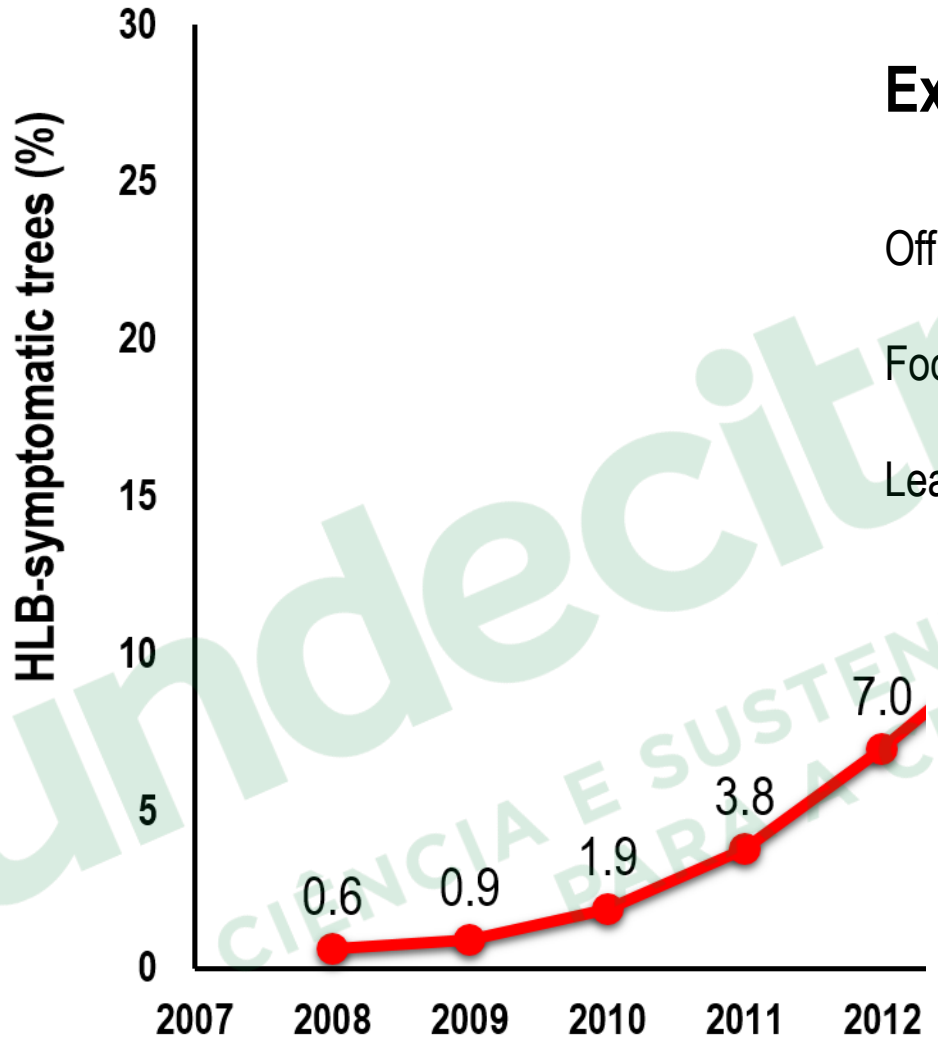
HLB SEVERITY PROGRESS AND YIELD DAMAGE ARE HIGHER IN YOUNGER GROVES



HLB PROGRESS IN SPS AND TRIÂNGULO MINEIRO



HLB PROGRESS IN SPS AND TRIÂNGULO MINEIRO



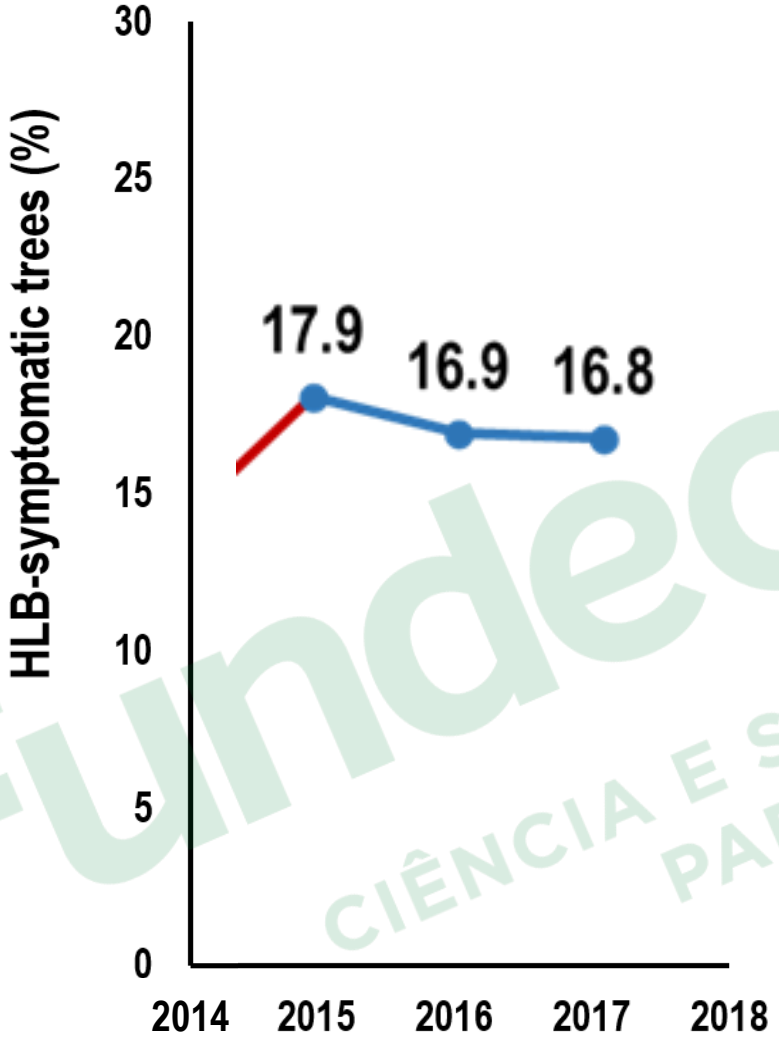
Exponential Disease Growth

Official disease suppression program up to 2009

Focus internal HLB management

Learning curve about HLB

HLB PROGRESS IN SPS AND TRIÂNGULO MINEIRO



Stabilized Disease Growth

Elimination of highly affected groves

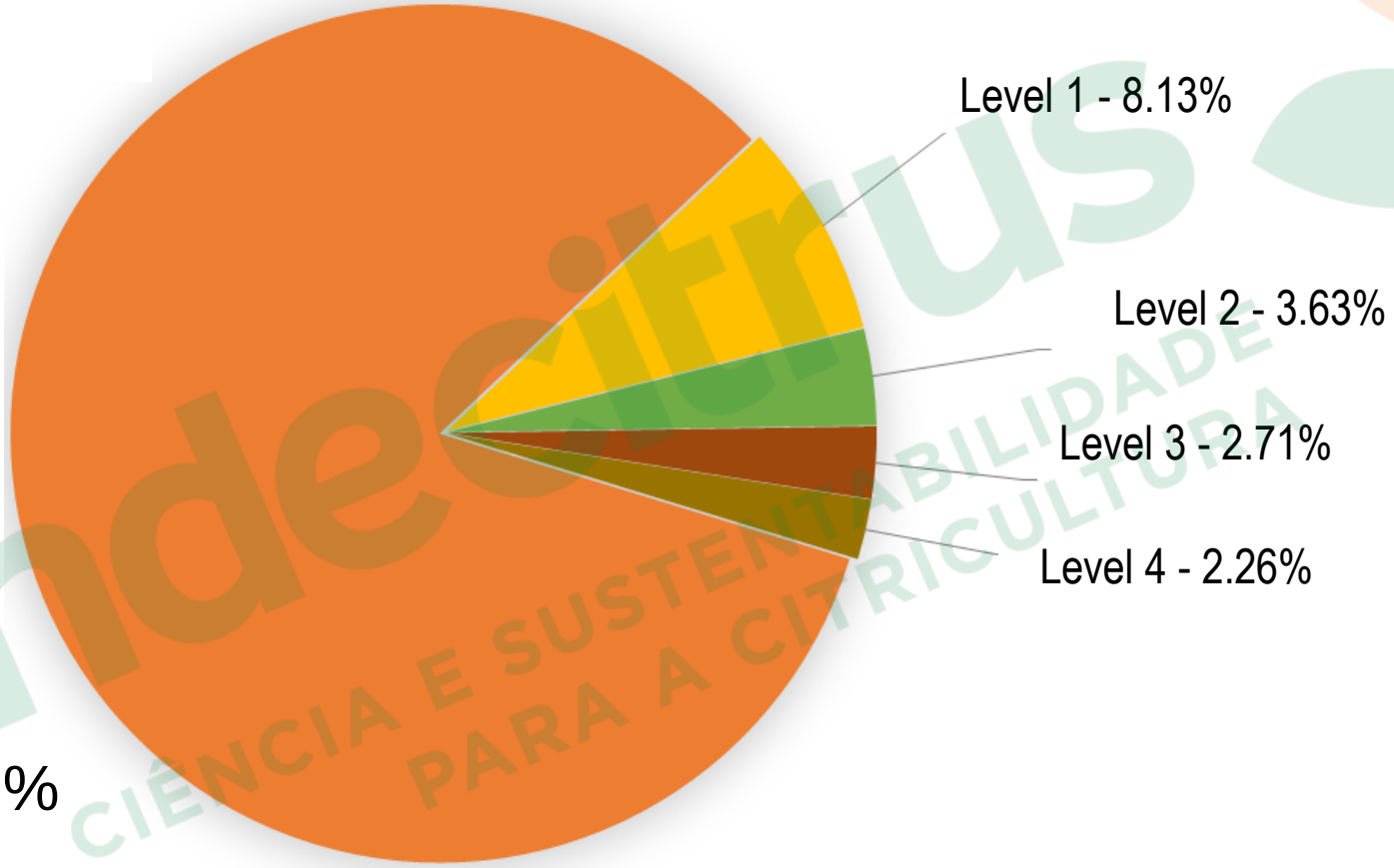
New large and solid citrus blocks

More knowledge about HLB

Focus on internal control and regional management

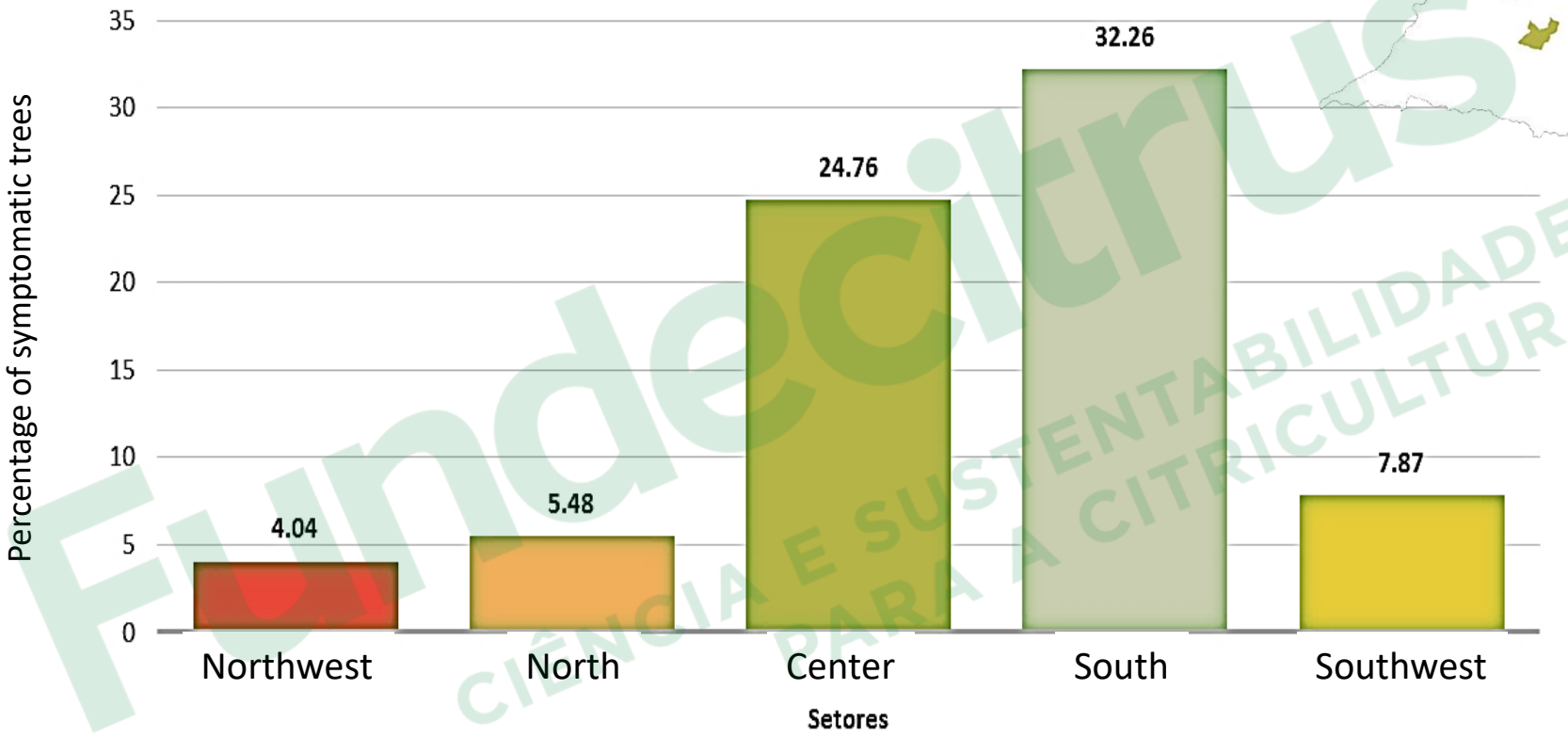
DISEASED TREE INCIDENCE BY LEVEL OF SYMPTOM SEVERITY ON THE CANOPY - 2017

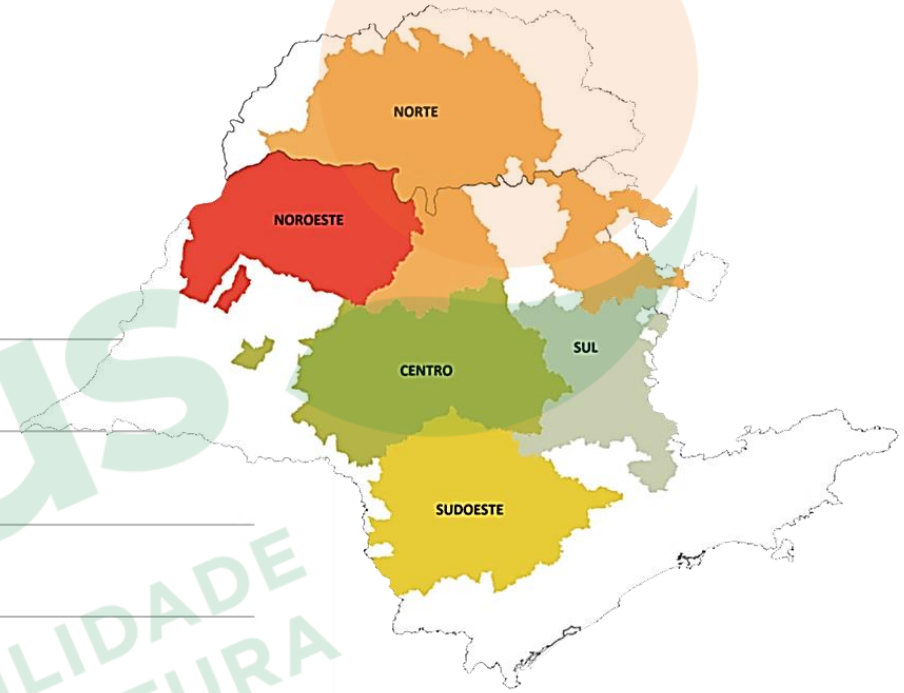
Diseased trees – 16.7%



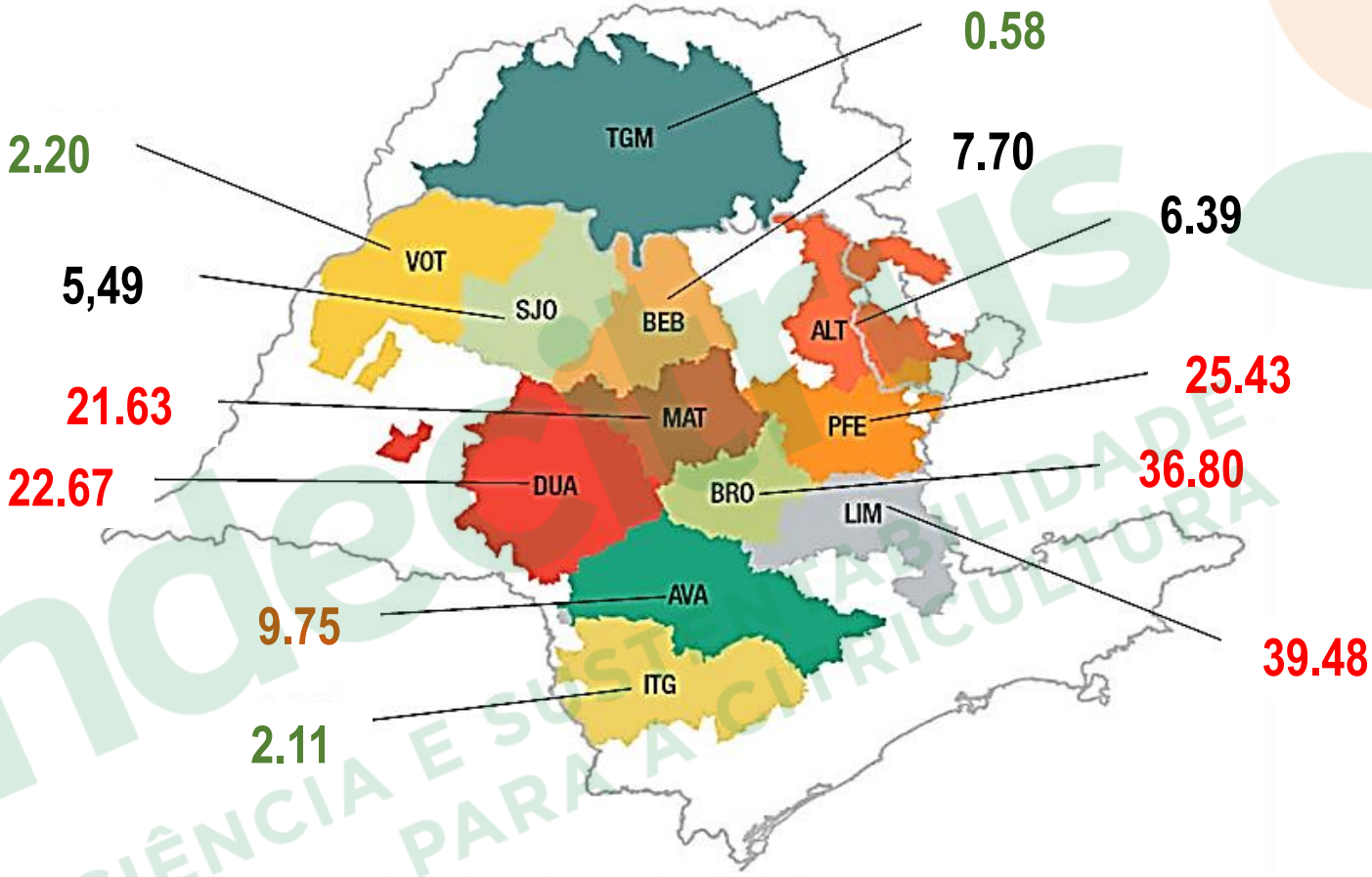
Healthy trees – 83.3%

HLB INCIDENCE BY GEOGRAPHIC SECTOR IN 2017



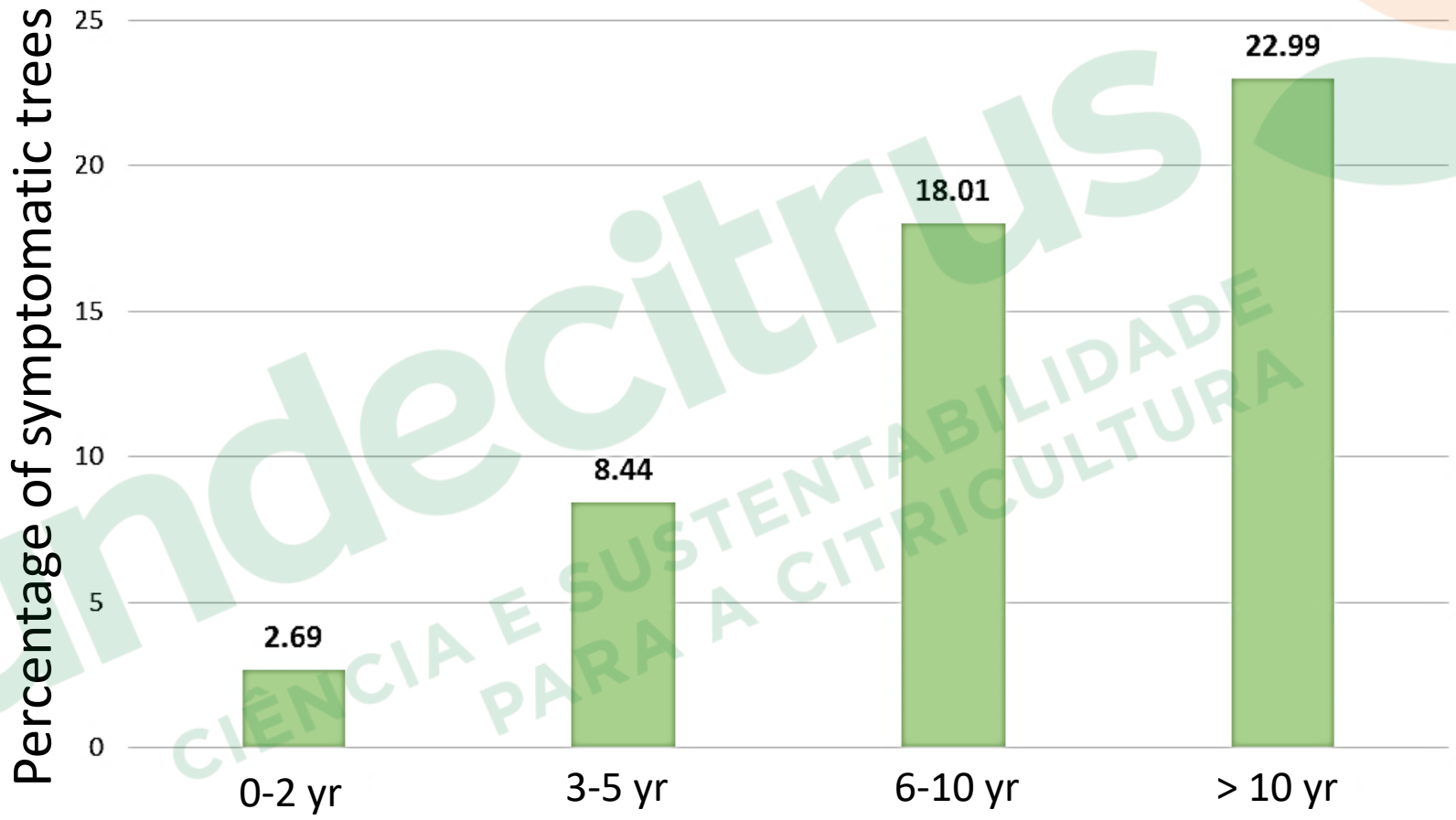


HLB INCIDENCE BY GEOGRAPHIC REGION IN 2017

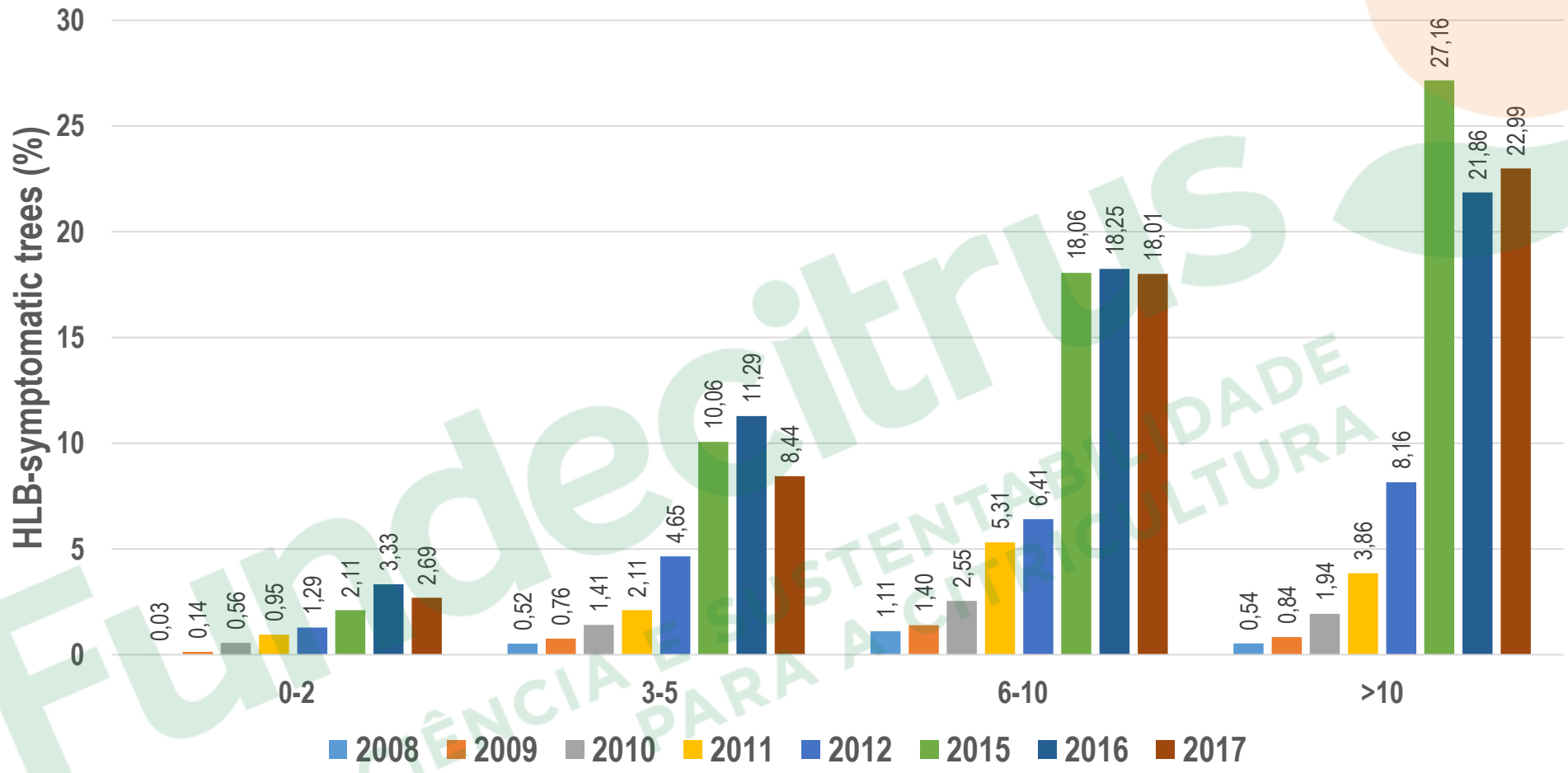


TGM - Triângulo Mineiro I VOT - Votuporanga I SJO - S. J. do Rio Preto I DUA - Duartina I BEB - Bebedouro I ALT - Altinópolis I MAT - Matão I BRO - Brotas I PFE - Porto Ferreira I LIM - Limeira I AVA - Avaré I ITG - Itapetininga

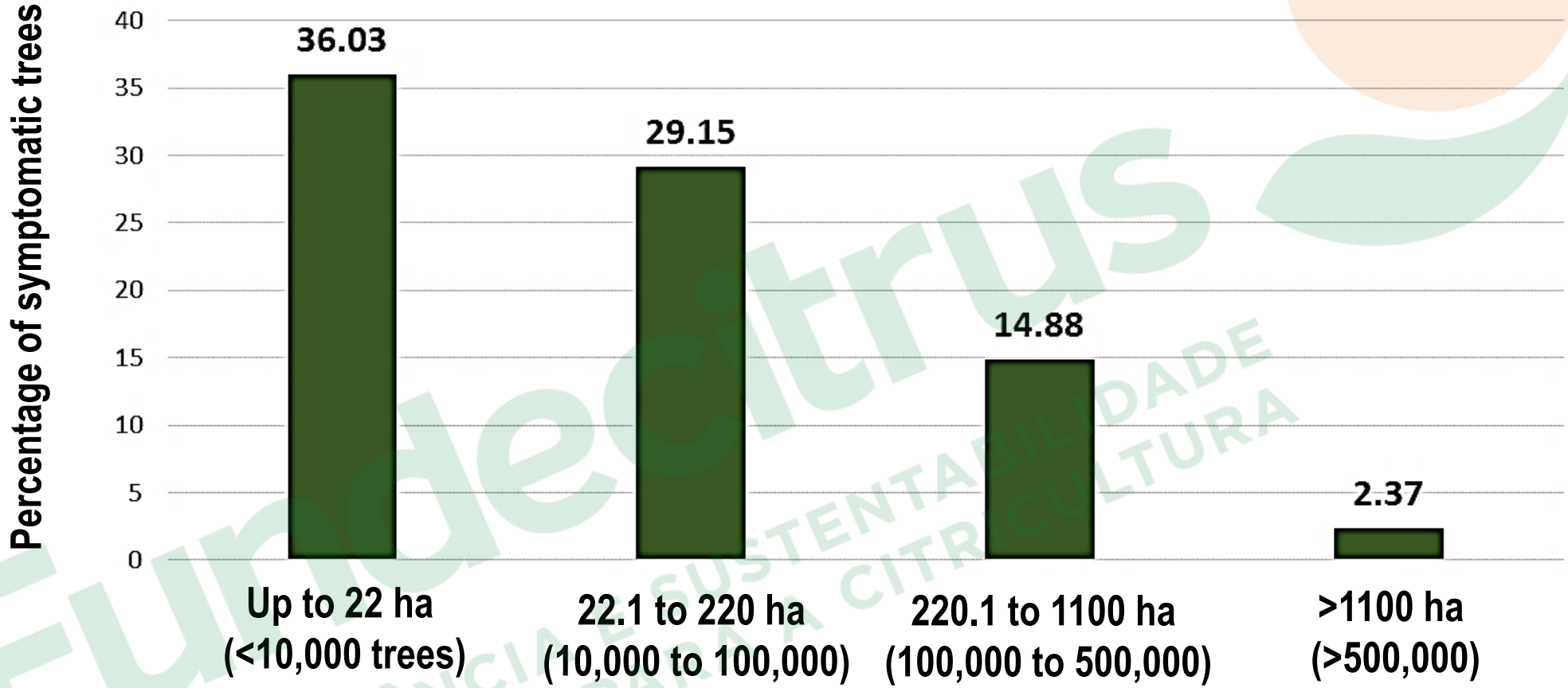
HLB INCIDENCE BY AGE OF THE TREE - 2017



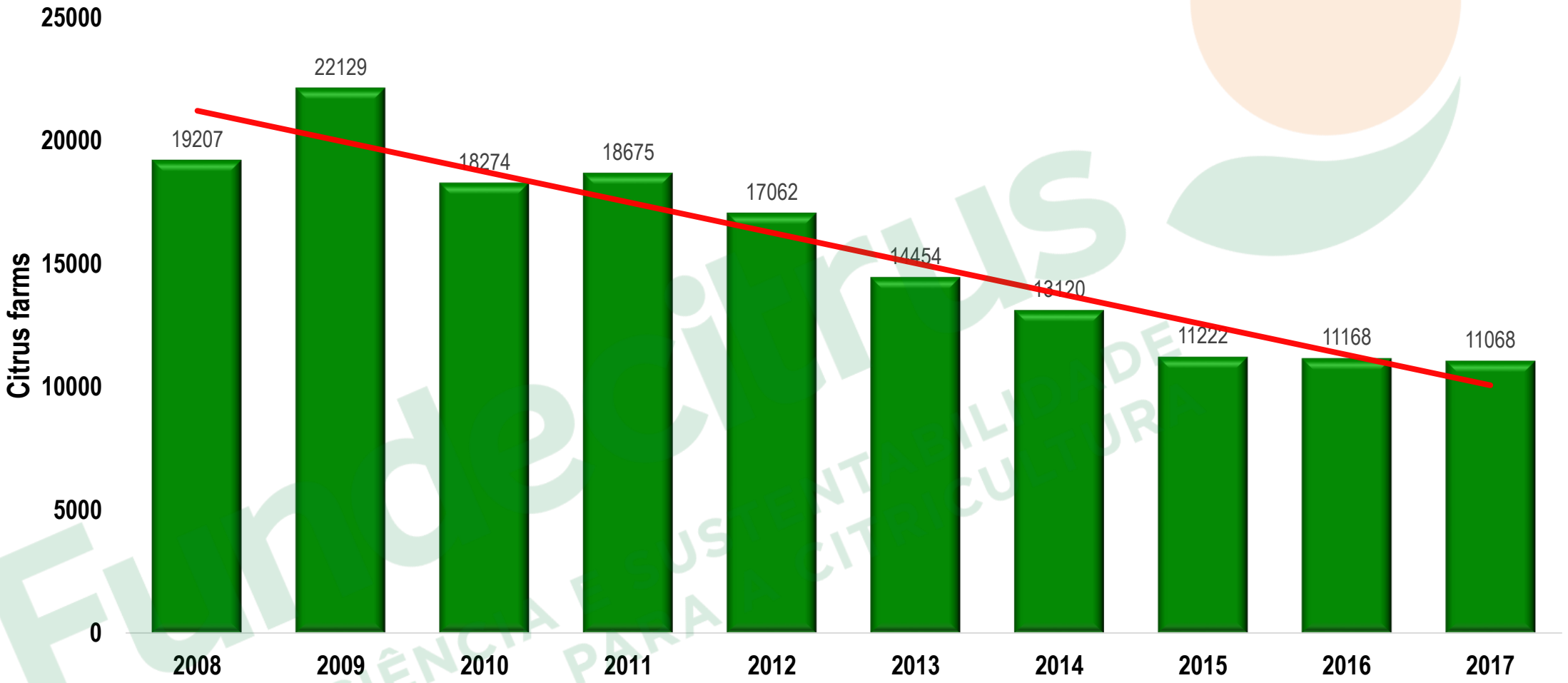
HLB INCIDENCE BY THE TREE AGE



HLB INCIDENCE BY FARM SIZE - 2017



TOTAL CITRUS FARMS



Source: CDA SP

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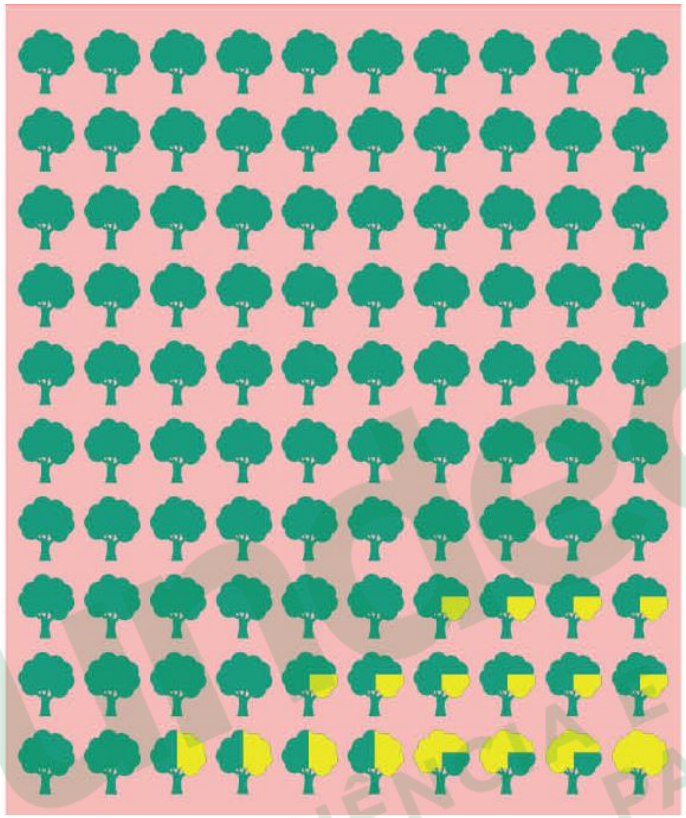
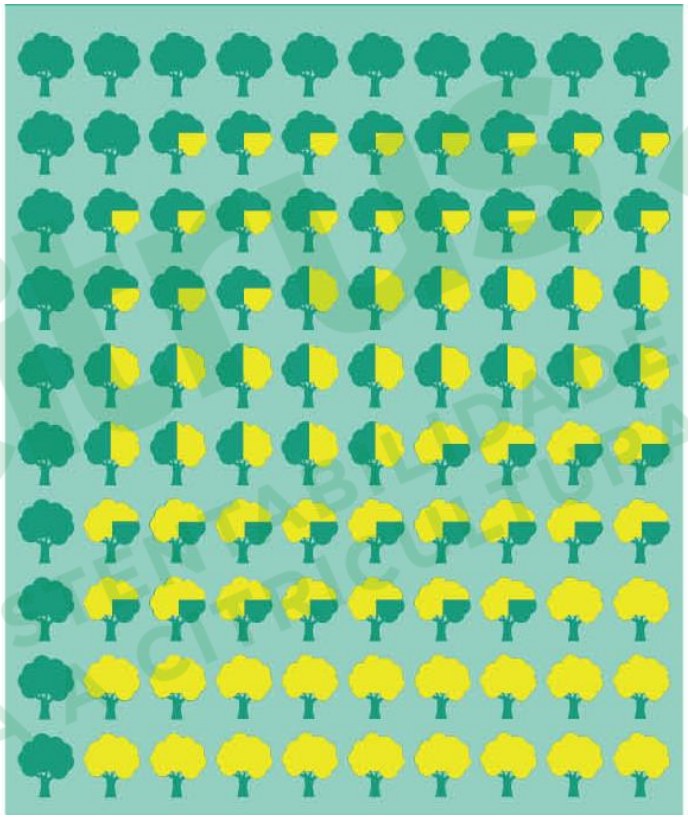
HLB INCIDENCE IN SÃO PAULO AND FLORIDA

São Paulo



17% incidence

Florida

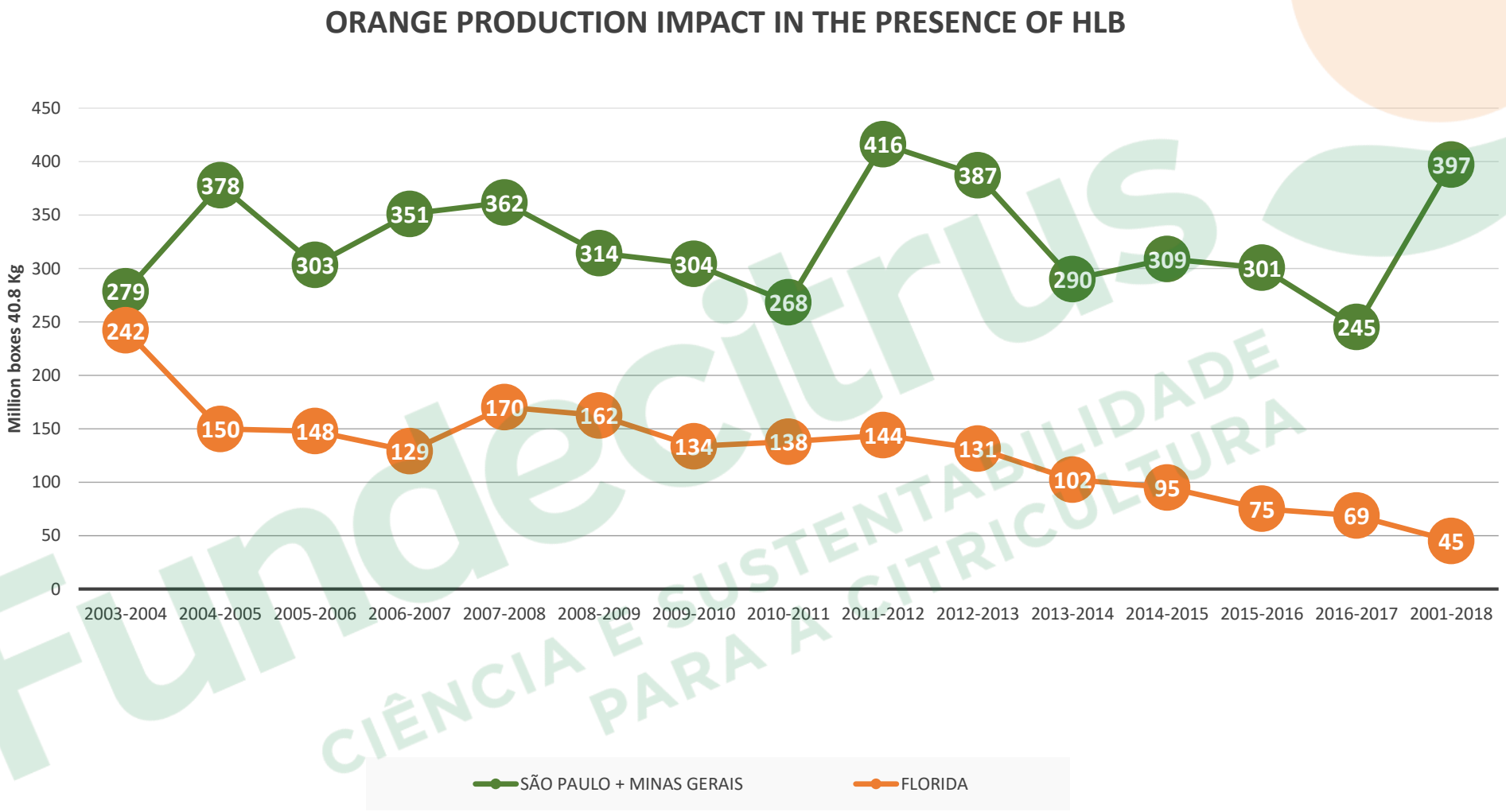


>90% incidence

Healthy tree

Diseased tree

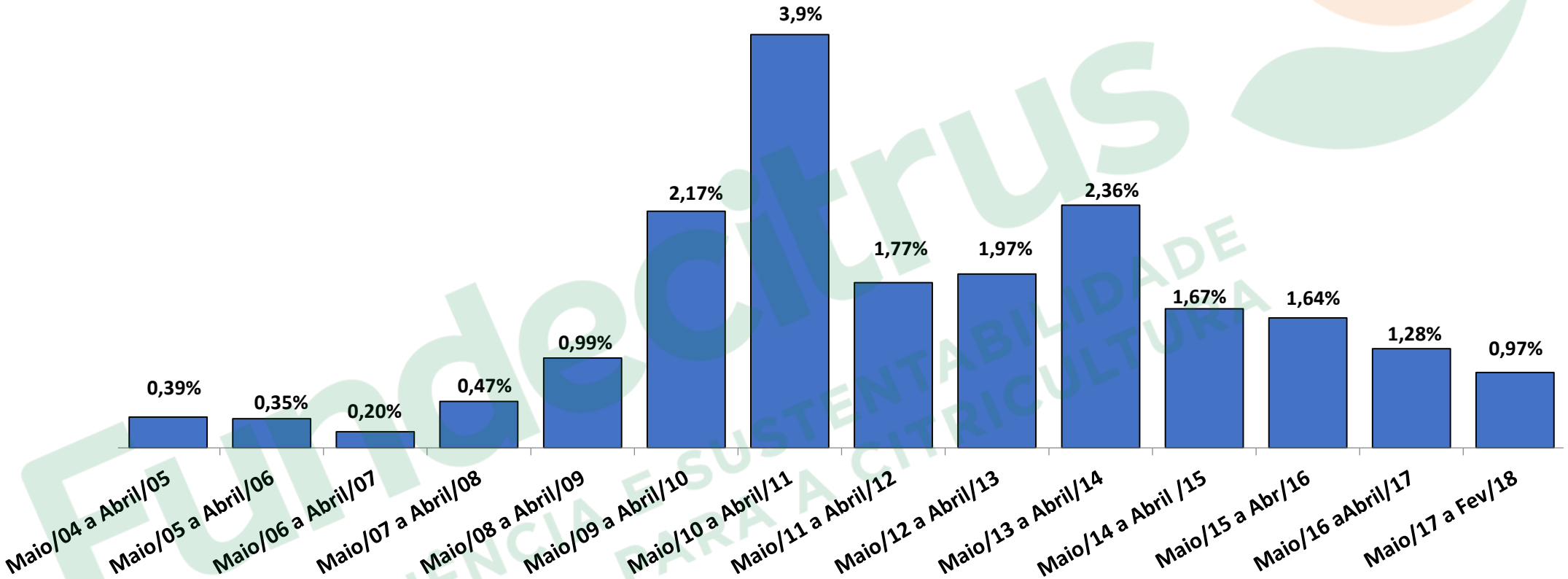
ORANGE PRODUCTION IN SÃO PAULO AND FLORIDA



Source: FL - NASS/USDA - SP - IBGE e FDC

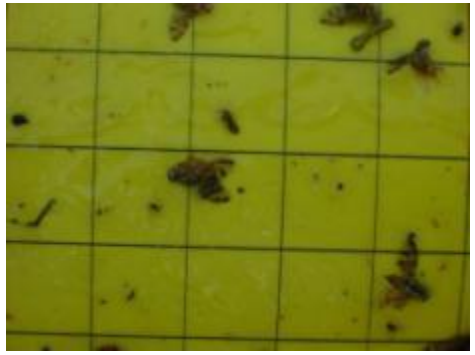
A CASE OF SUCCESS IN THE CONTROL OF HLB

Percentage of erradicated trees



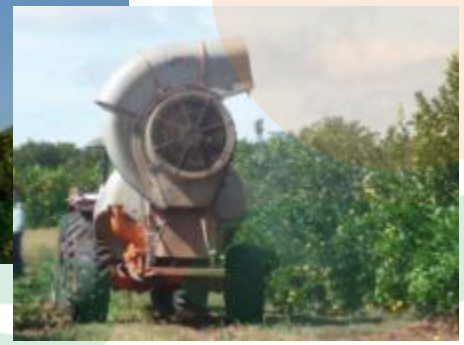
HLB MANAGEMENT

Nurserys



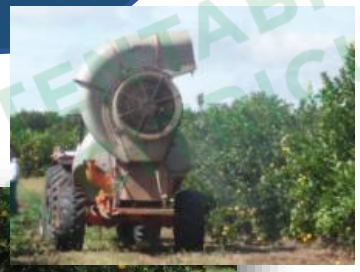
Vector Monitoring

HLB Management



Vector Control

Eradication



Vector Monitoring and control - NEIGHBORS

Scouting

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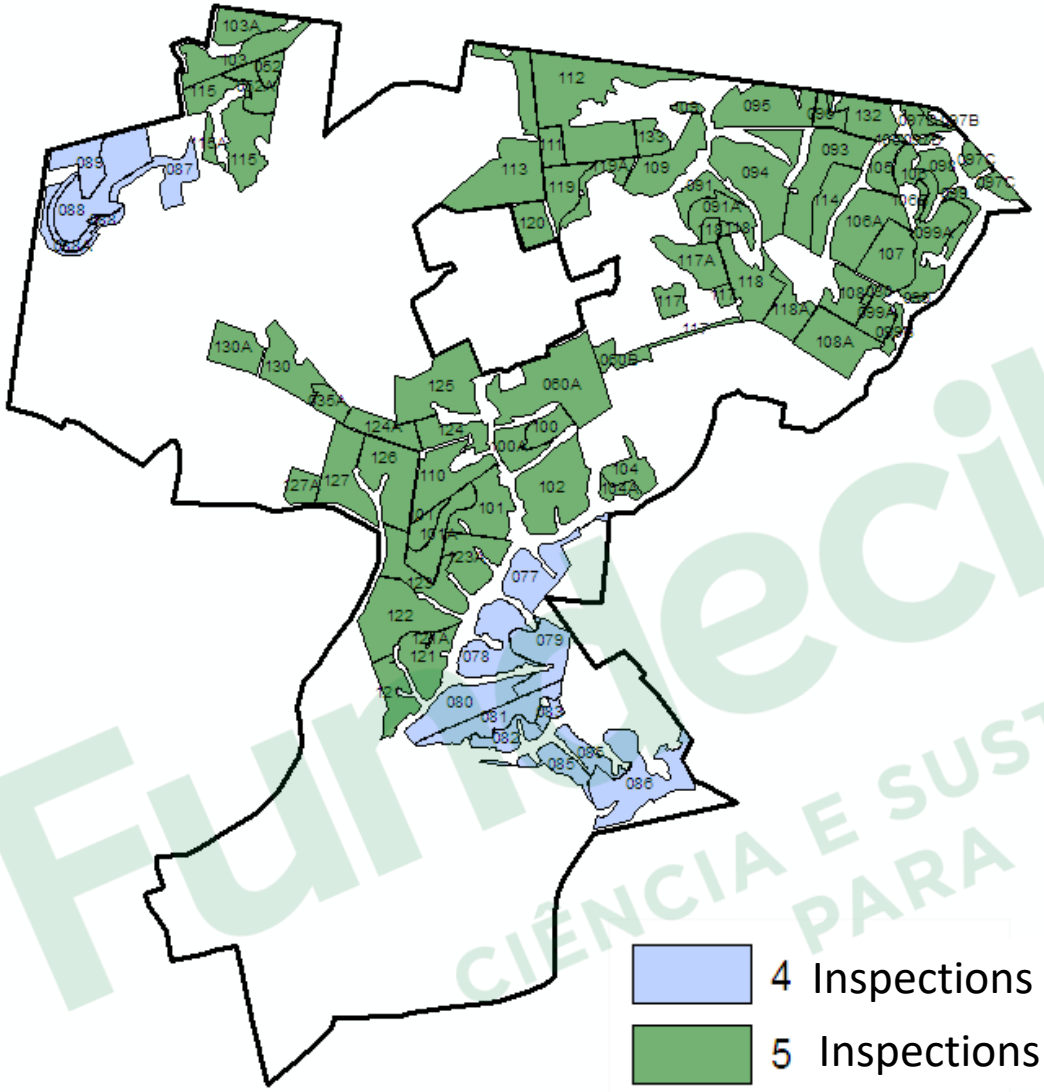
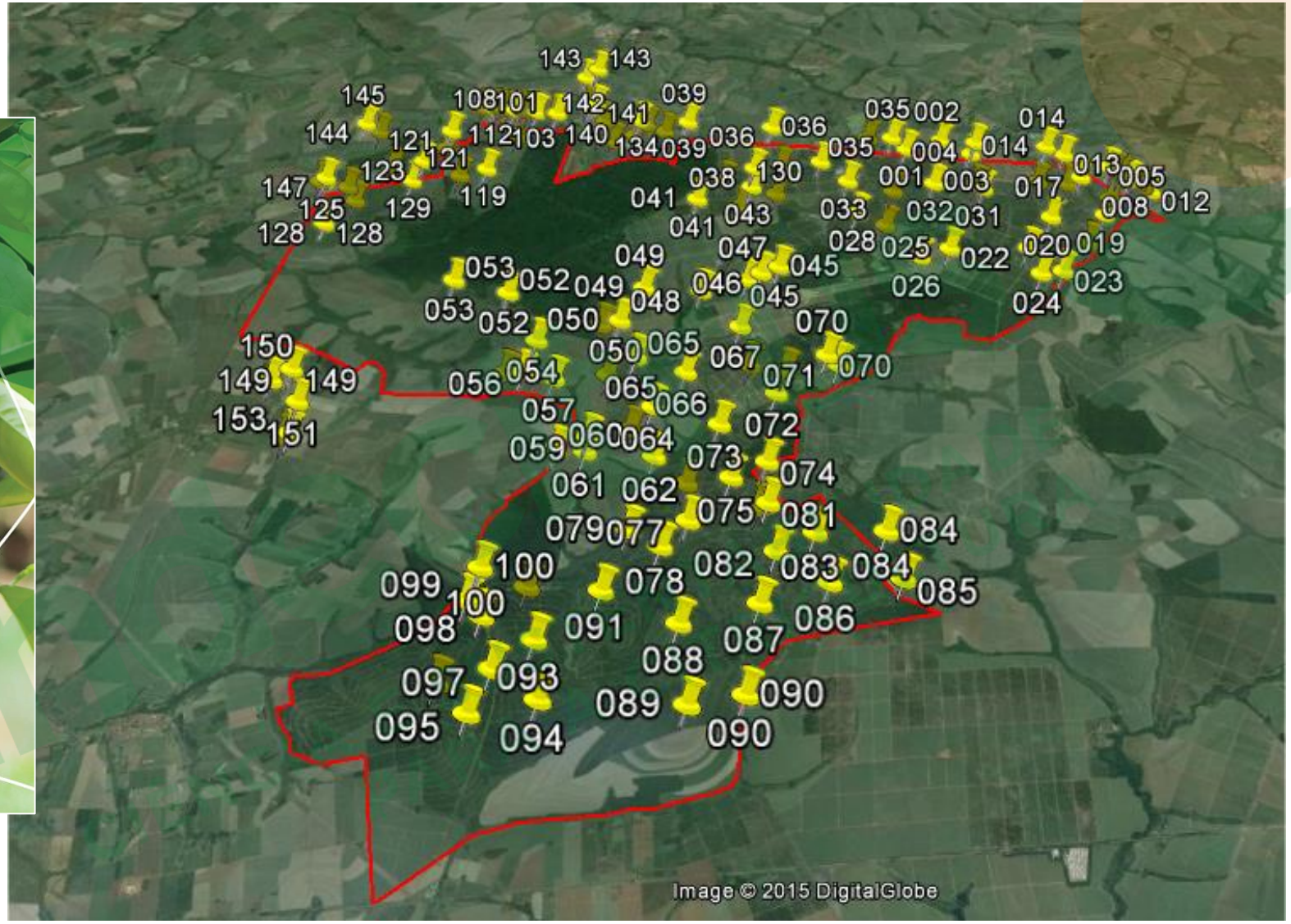
GROVE INSPECTION



PSYLLID MONITORING WITH YELLOW TRAPS



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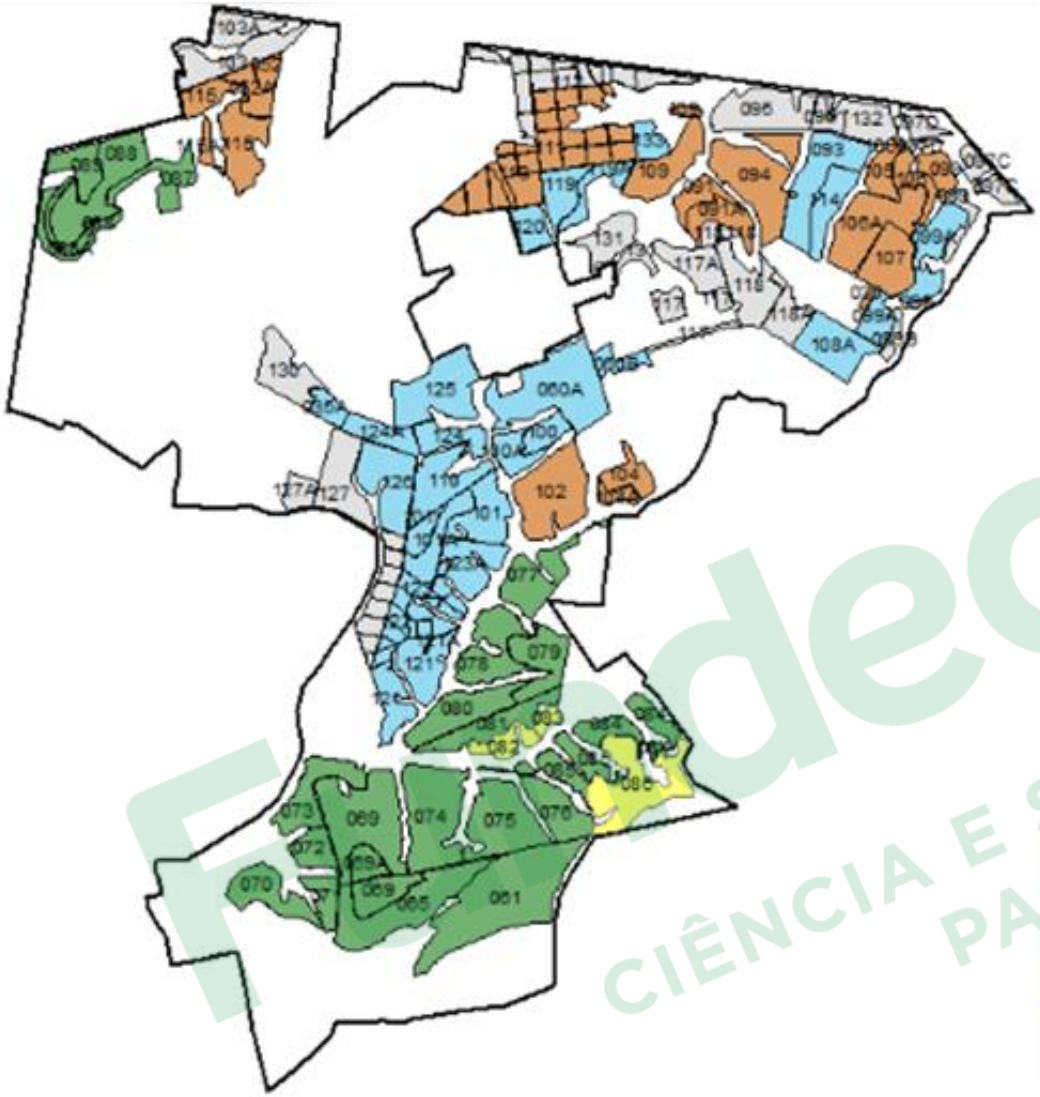
NUMBER OF SPRAY BASED ON THE RISK OF HLB INFECTION



EDGE EFFECT

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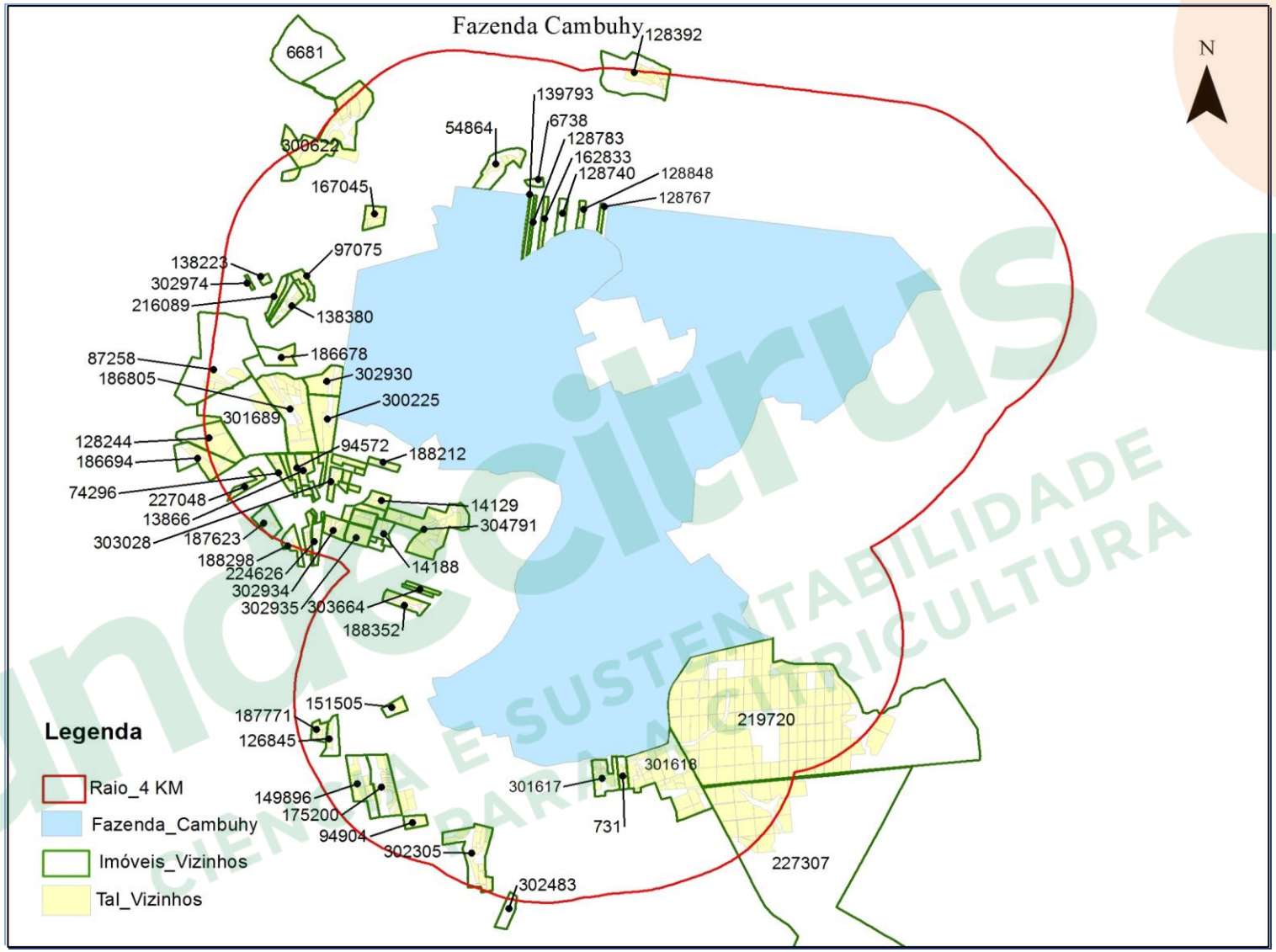
EXTERNAL ACTIONS



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NEIGHBOR PARTNERSHIP

Meetings

Spraying

Tamarixia releasing

Removal of diseased trees

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THANK YOU

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