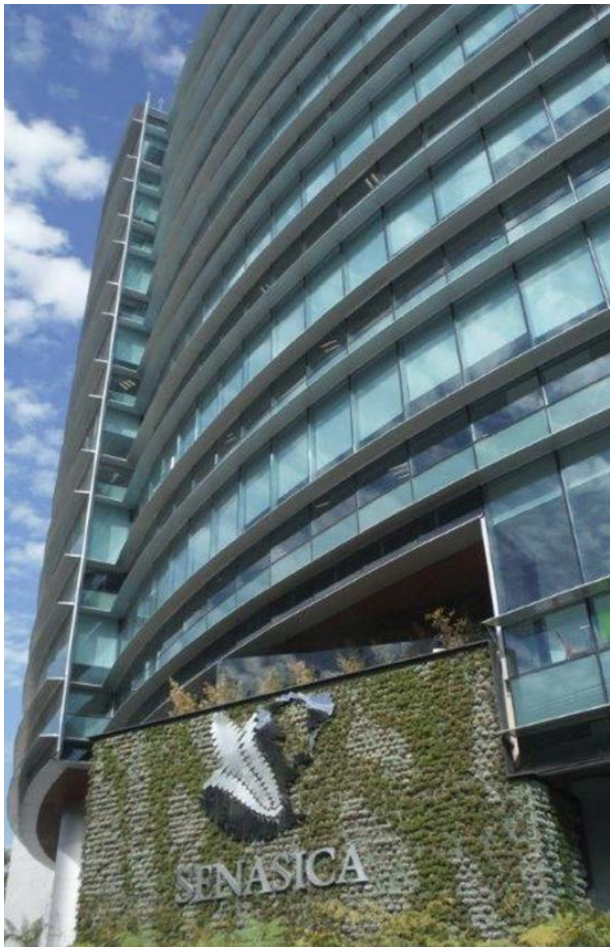
SAGARPA
SECRETARÍA DE AGRICULTURA, GANADERÍA, DESARROLLO RURAL, PESCA Y ALIMENTACIÓN

SENASICA
SERVICIO NACIONAL DE SANIDAD, INOCUIDAD Y CALIDAD AGROALIMENTARIA

Holistic Area-wide Approach for Successfully Managing Citrus Greening (Huanglongbing) in Mexico



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1. INTRODUCTION
   - HLB
   - CITRUS CROPS IN MEXICO
2. PHYTOSANITARY MEASURES ESTABLISHED BY MEXICO
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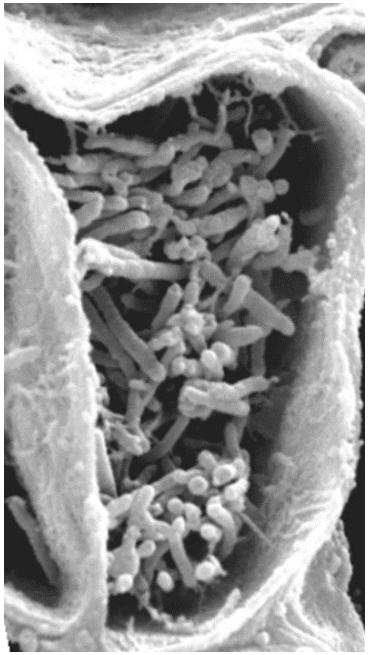
4. IMPACT ON CITRUS PRODUCTION FROM 2009 TO 2015
5. CURRENT SITUATION OF HLB IN MEXICO
6. CONCLUSIONS

1. INTRODUCTION

CITRUS GREENING OR HUANGLONGBING (HLB)

- The disease of HLB is caused by *Candidatus* Liberibacter spp.
- According to the literature is native to Africa[1].
- HLB was detected 100 years ago in Asia and Africa.
- More destructive disease on citrus crops.
- Was detected in America (Brazil), March 2004 .



HLB bacterium

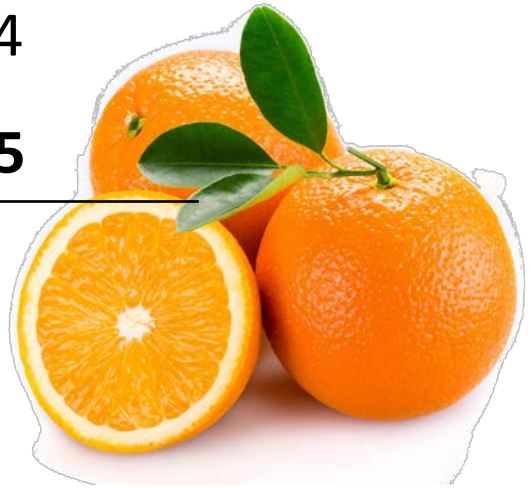
[1]da Graça JV. 2010. Etiology, history and world situation of citrus Huanglongbing. *In*: 2° Taller Internacional sobre el Huanglongbing y el Psilido Asiatico de los Cítricos. 19 al 23 de julio, 2010. Mérida, Yucatán.

- Four variants of this bacterium:
  - ✓ *Candidatus* L. asiaticus
  - ✓ *Ca*. L. africanus
  - ✓ *Ca*. L. americanus
  - ✓ *Ca*. L. caribbeanus
- HLB mainly attacks sweet orange and mandarins[1].
- The HLB is transmitted by *Trioza erytreae* and *Diaphorina citri.*
- Death of infected citrus tree in 3 to 8 years, according to literature.
- **Currently, does not exist any method of control for the disease**.

[1]da Graca and Korsten, 2004

PRODUCTION OF PRINCIPAL CITRUS CROPS IN MEXICO

Crop	Production (Tons)	Value US$ Million
Lime and lemon	2,187,257.2	**461,008,641.5**
Orange	**4,533,427.86**	344,998,666.7
Grapefruit	424,678.08	32,966,540.51
Mandarin	291,078.27	22,896,889.74
Total	**7,436,441.41**	**861,870,738.5**



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SURFACE PLANTED WITH CITRUS IN MEXICO

- States: **24**
- Principal state: **Veracruz**
- Total area in Mexico: 572,051 ha.

State	Area (hectares)	%
Veracruz	246,750	43.13
Michoacán	50,276	8.79
Tamaulipas	44,432	7.77
San Luis Potosí	37,505	6.56
Puebla	32,067	5.61
Nuevo León	31,789	5.56
Oaxaca	25,469	4.45
Colima	19,748	3.45
Yucatán	18,189	3.18
Tabasco	15,532	2.72
Sonora	8,523	1.49
Guerrero	7,135	1.25
Jalisco	6,841	1.20
Hidalgo	5,680	0.99
Campeche	4,731	0.83
Chiapas	4,725	0.83
Quintana Roo	3,089	0.54
Baja California Sur	2,870	0.50
Sinaloa	2,729	0.48
Nayarit	2,469	0.43
Morelos	610	0.11
Baja California	383	0.07
Querétaro	253	0.04
Zacatecas	246	0.04
Total	572,051	100

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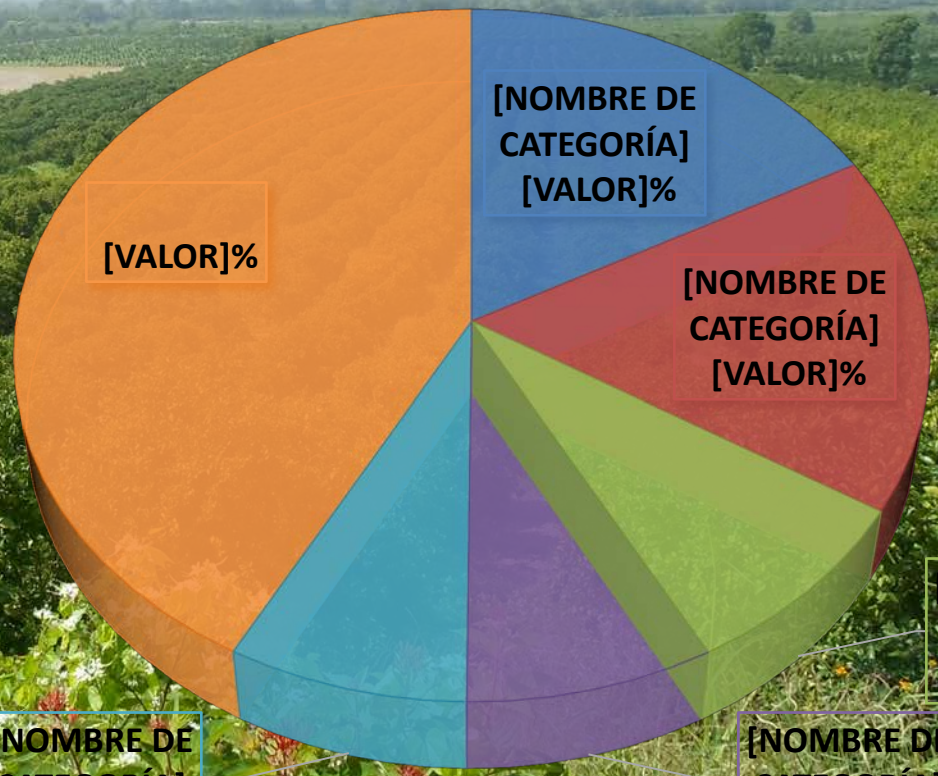
GLOBAL LIME PRODUCTION

EXPORT TO 23 COUNTRIES

FIRST EXPORTER OF PERSIAN LIME

FIRST PLACE IN LIME PRODUCTION IN THE WORLD



FAO, 2015

2. PHYTOSANITARY MEASURES ESTABLISHED BY MEXICO

National Plant Protection Organization of Mexico.

Some relevant plant protection programs of Mexico:

- Medfly Containement & Eradication Program
- **The Huanglongbing (HLB) - Asian Citrus Psyllid (ACP)**

- National Fruit Fly Control Program
- Phytosanitary Non-Native Pest Surveillance Program-ISPM 6.

STRATEGIC PHYTOSANITARY PROGRAMS FOR MEXICO

1° POLICY: prevent introduction and dispersion of importance regulated pest.

→ Pests under Surveillance, example: *Ceratitis capitata*.

2° POLICY: contain and prevent the dispersion of regulated pest (present in Mexico or regulated).

→ **HLB**,
Pink hibiscus mealybyg, *Trips palmi* , etc.

3° POLICY: Apply phytosanitary programs to improve competitiveness of the production systems, generate an added value to agricultural products……..

→ Fruit flies, avocado regulated pests, Pierce disease, etc.

3. THE HLB IN MEXICO IPM APPROACH

- *Diaphorina citri* was detected in Mexico in 2002.
- National priority program, was started in 2008 in 23 citrus states.
- Based on the "Protocol of action for the detection of HLB“, with the goal for early detecction of Psyllid and disease.
- First detection of *Candidatus* L. asiaticus in 2009.

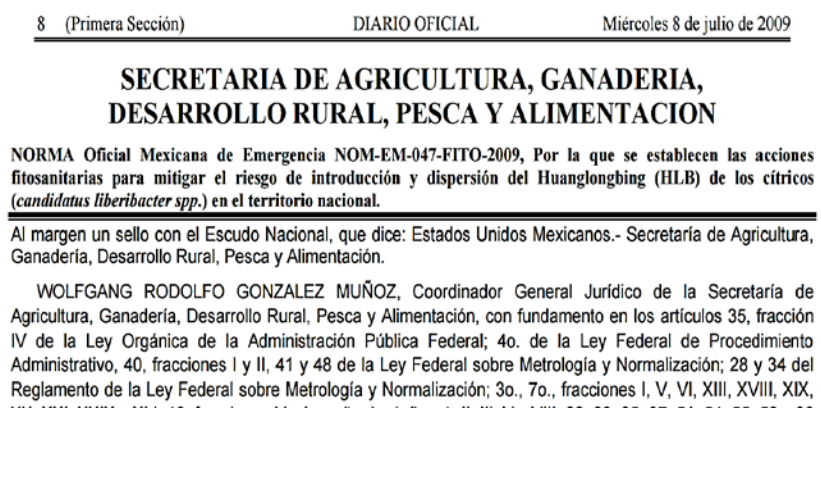
HLB DISTRIBUTION IN AMERICA

The Citrus Asian Psyillid present in Honduras, Puerto Rico and Argentina, but not the HLB.

CABI, 2016

- Government and scientific intitutions work jointly at strategies to achieve control.
- NPPO of Mexico has established:

Area-wide for vector management and disease through: detection, in commercial orchards and urban areas, chemical control of *D. citri* (commercial orchards), and biological control.



8 (Primera Sección) DIARIO OFICIAL Miércoles 8 de julio de 2009

SECRETARIA DE AGRICULTURA, GANADERIA, DESARROLLO RURAL, PESCA Y ALIMENTACION

NORMA Oficial Mexicana de Emergencia NOM-EM-047-FITO-2009, Por la que se establecen las acciones fitosanitarias para mitigar el riesgo de introducción y dispersión del Huanglongbing (HLB) de los cítricos (*candidatus liberibacter spp.*) en el territorio nacional.

Al margen un sello con el Escudo Nacional, que dice: Estados Unidos Mexicanos.- Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación.

WOLFGANG RODOLFO GONZALEZ MUÑOZ, Coordinador General Jurídico de la Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación, con fundamento en los artículos 35, fracción IV de la Ley Orgánica de la Administración Pública Federal; 4o. de la Ley Federal de Procedimiento Administrativo, 40, fracciones I y II, 41 y 48 de la Ley Federal sobre Metrología y Normalización; 28 y 34 del Reglamento de la Ley Federal sobre Metrología y Normalización; 3o., 7o., fracciones I, V, VI, XIII, XVIII, XIX,

MANAGEMENT OF *D. citri*- HLB, THROUGH AREA-WIDE

The government of Mexico is the sponsors the activities.

1. Characteristics of the areas, based on criteria related to: weather, hosts, urban or commercial citrus crops, etc.

2. Monitoring psyllids vectors.

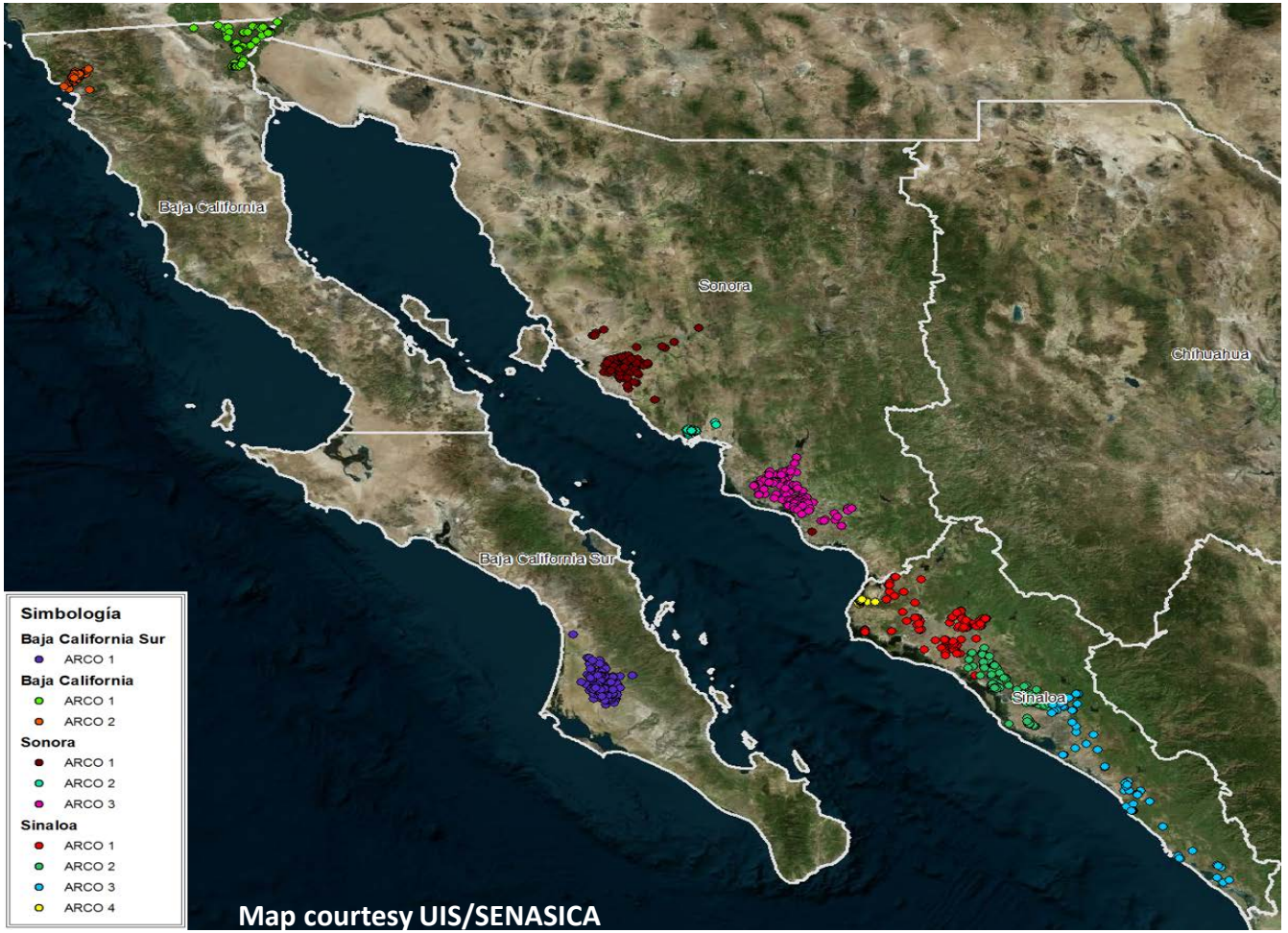
3. Elimination of trees infected and chemical control (insecticides, mineral oil, others).

4. Biological control (*Tamarixia radiata, Isaria fumosorosea*, others).

5. **Organization-Operation by the government and growers.**

AREA-WIDE FOR CONTROL OF *Diaphorina citri* IN THE NORTHWEST REGION

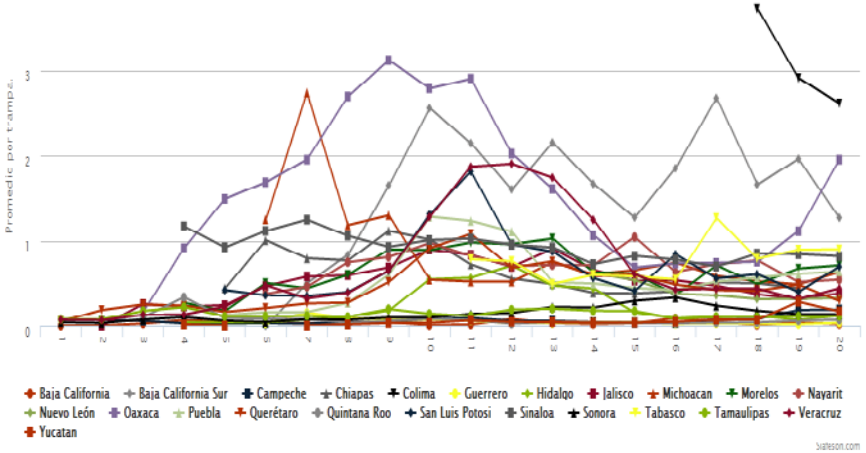
- Each area has at least 1000 hectares (10 km^2).
- 90 areas in 2017, 15.7% of the total citrus surface.



Map courtesy UIS/SENASICA

MONITORING PSYLLID POPULATIONS IN AREA-WIDE

- Every 14 days monitoring for detection of the Psyllid and assessment of the threshold for each area.



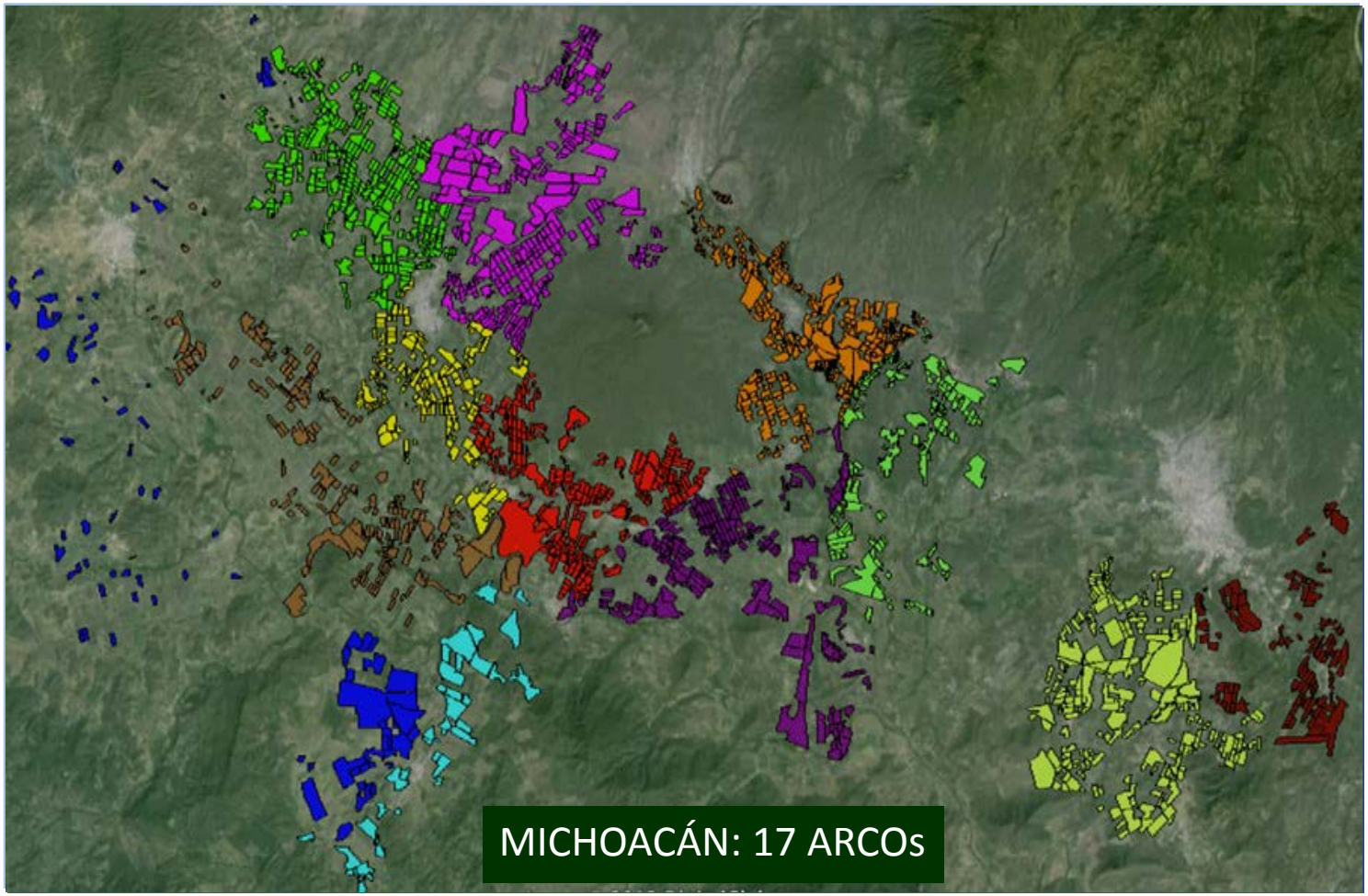
ELIMINATION OF INFECTED TREES

La Cuadrita, Mpio. de Guaymas
(25 abril 2017)

Garcia-Robles, 2017

APPLICATION OF CHEMICAL CONTROL IN 17 AREAS (DURING 15 DAYS)

17,000 hectares



BIOLOGICAL CONTROL IN AREA-WIDE

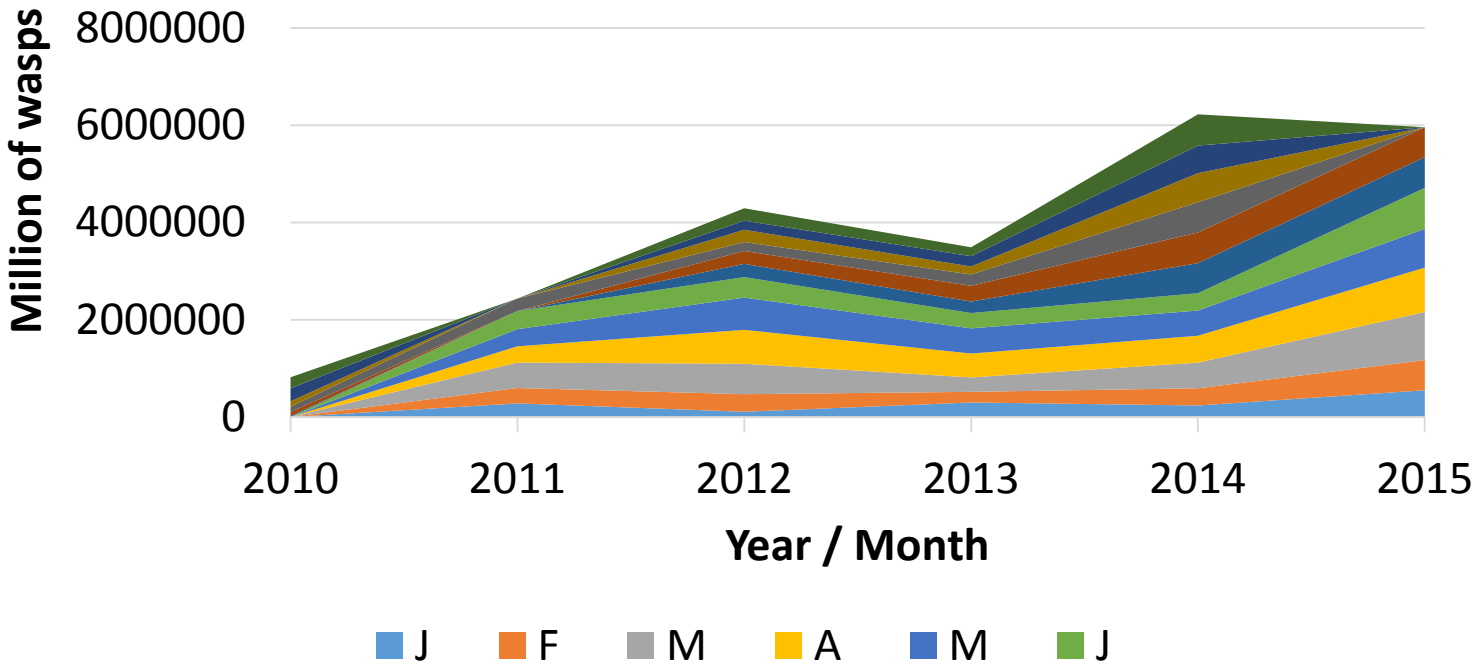
Tamarixia radiata (backyards, urbans and marginal areas)

Entomopathogens fungi (comercial groves)

- ***Isaria javanica***
- ***Metarhizium anisopliae***

Considerations
- Season
- Fungi strains
- Dose
- Regional labs for prodcution

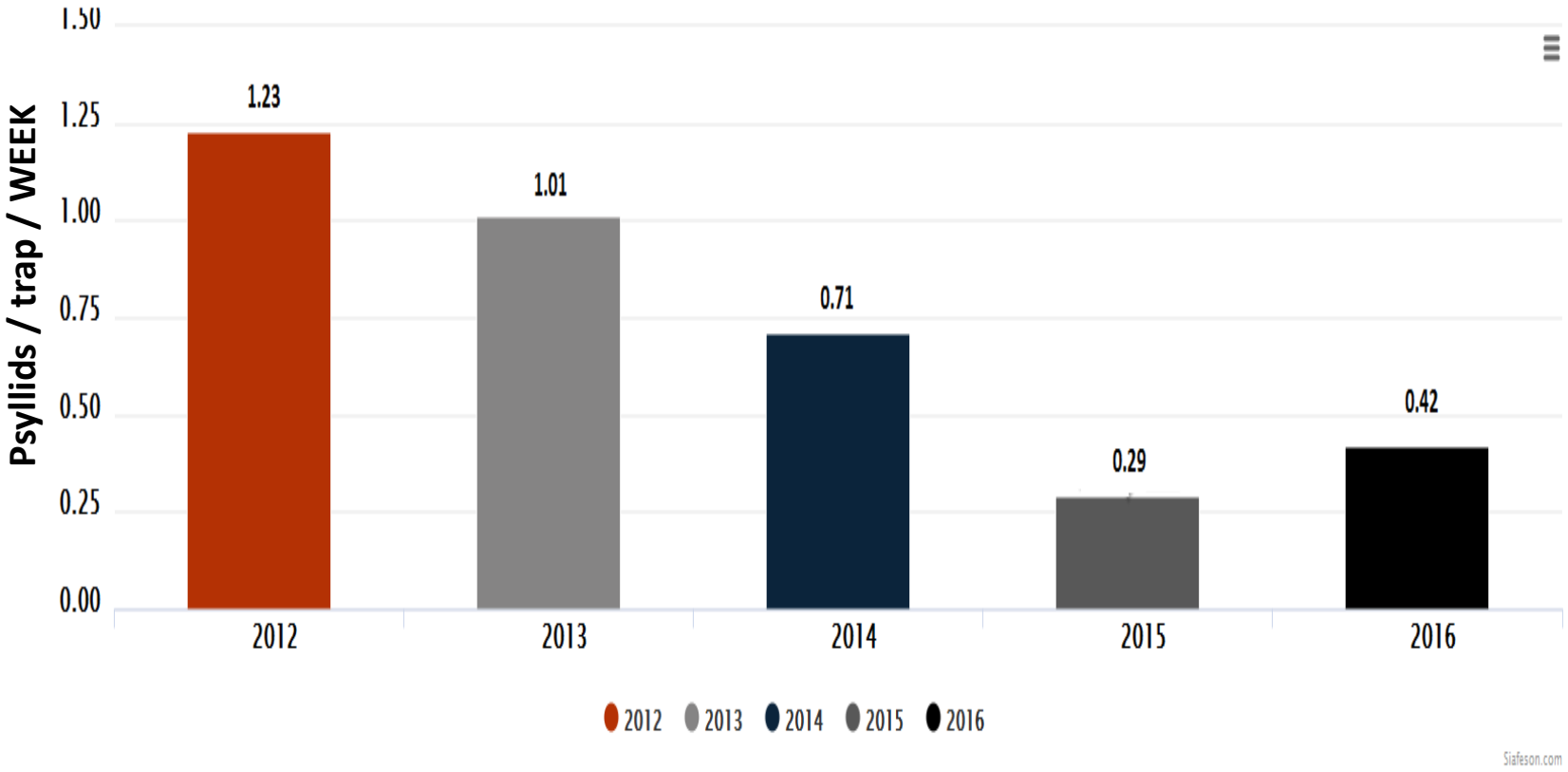
BIOLOGICAL CONTROL



More than 31 thousand million individual wasps parasitoids have been produced.

IN AREA-WIDE

Asian Citrus Psyllid Populations from 2012 to 2016

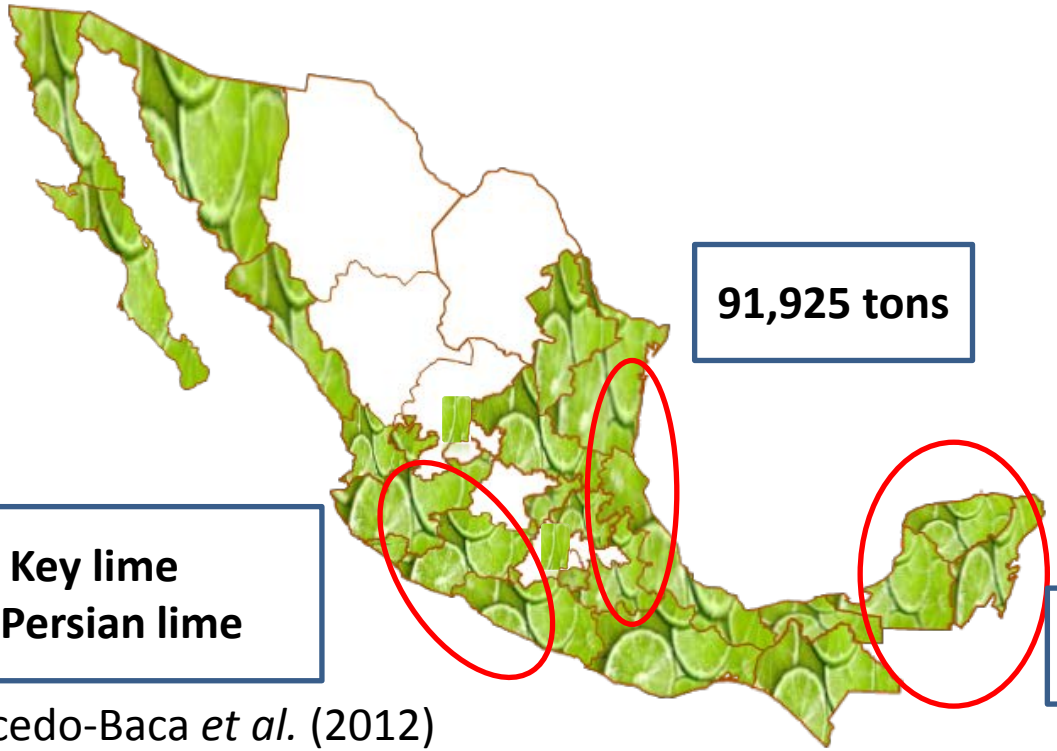


AREA-WIDE CONTROL OF *Diaphorina citri*

- The vector incidence was reduced by 90% and disease rate by 75% of HLB.
- Reduced insecticide use and shift to mineral oils.
- Reduced pest management costs.

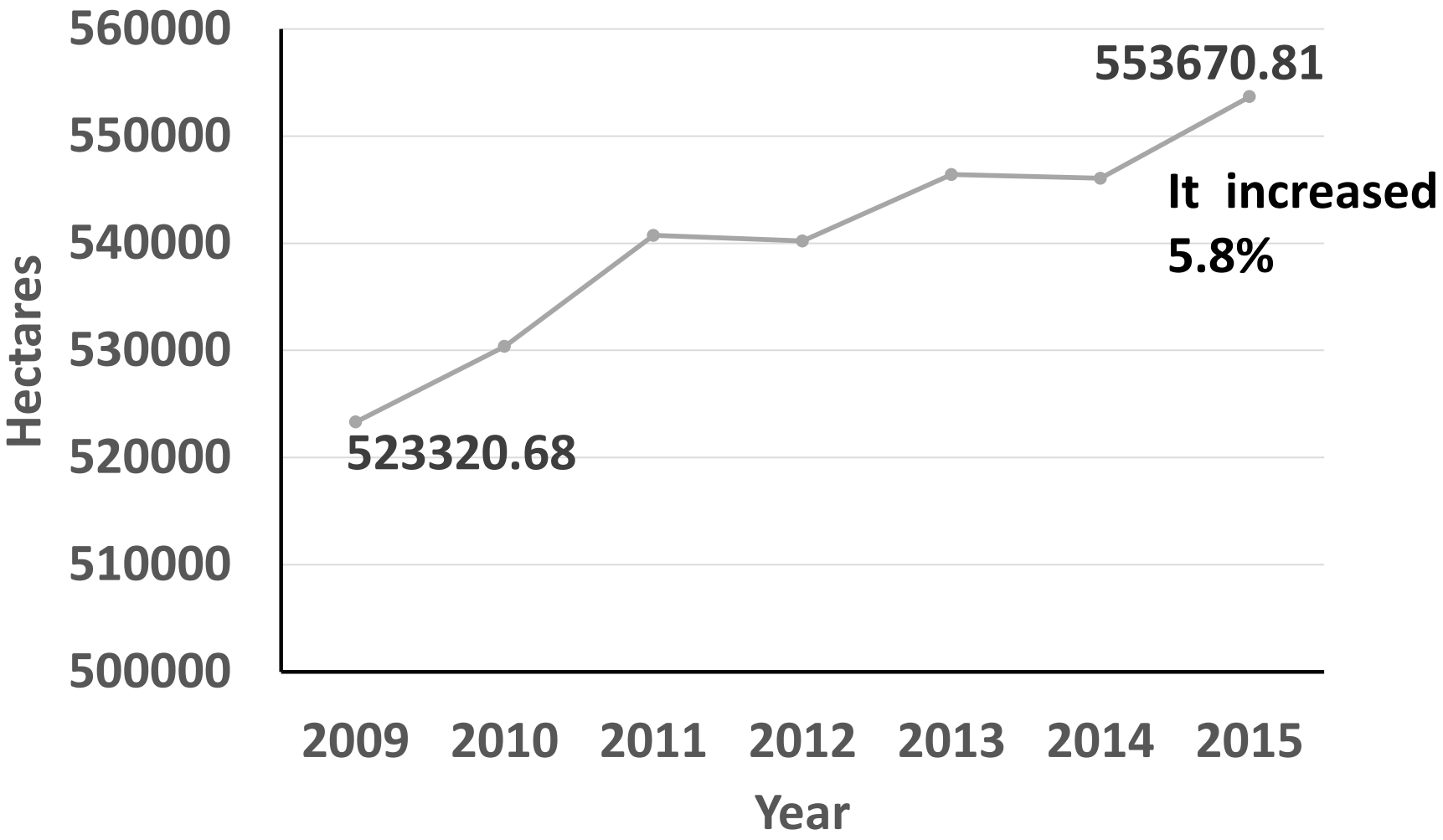
4. IMPACT ON CITRUS PRODUCTION (2009-2015)

- Prospective studies indicated that, the citrus production would be reduced by 2.7 million tons (39.6%) in 5 years.
- In 2012 another economic impact evaluation indicated that production would be reduced:



Salcedo-Baca *et al.* (2010); Salcedo-Baca *et al.* (2012)

TOTAL SURFACE OF CITRUS FROM 2009 TO 2015



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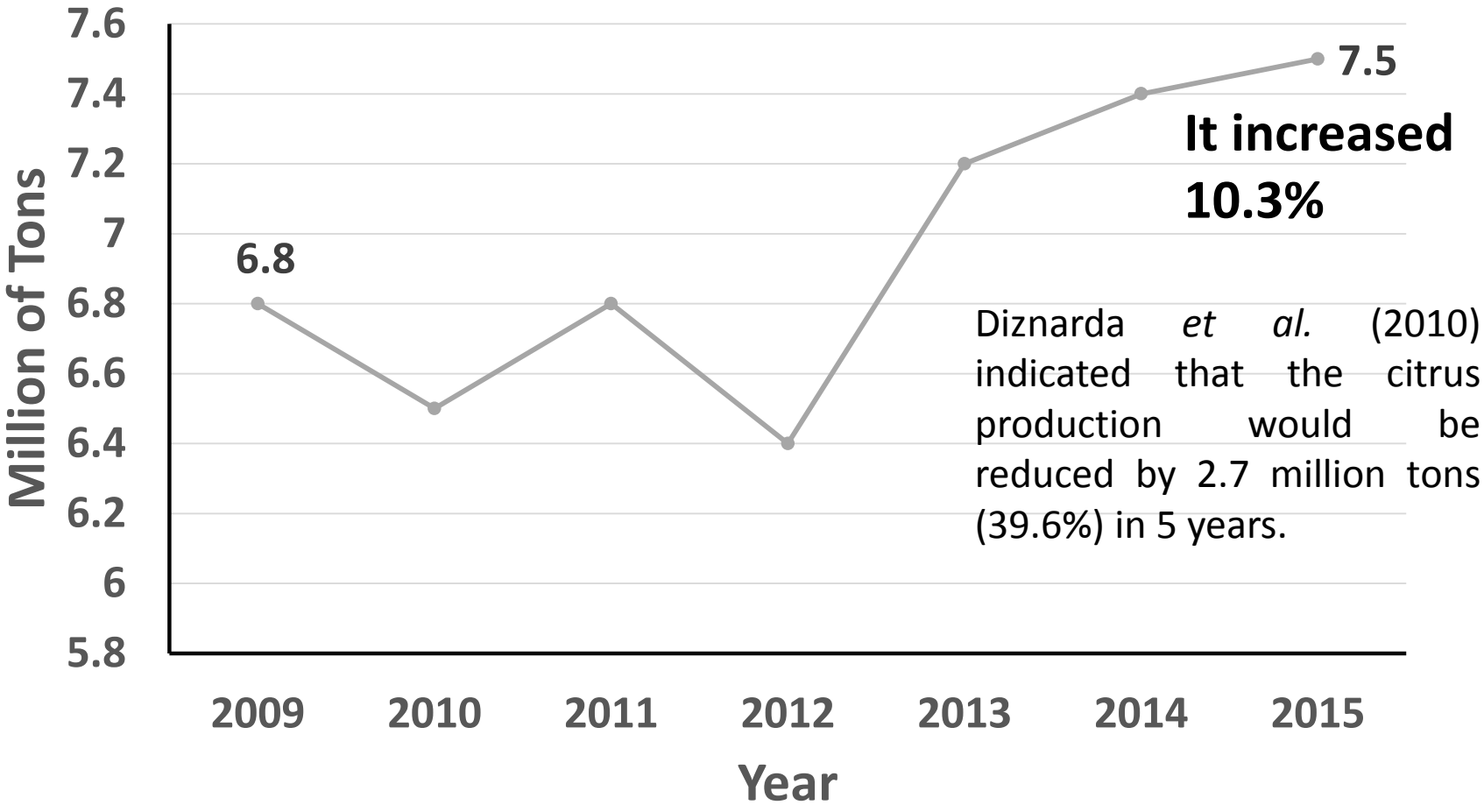
CITRUS PRODUCTION FROM 2009 TO 2015



Diznarda *et al.* (2010) indicated that the citrus production would be reduced by 2.7 million tons (39.6%) in 5 years.

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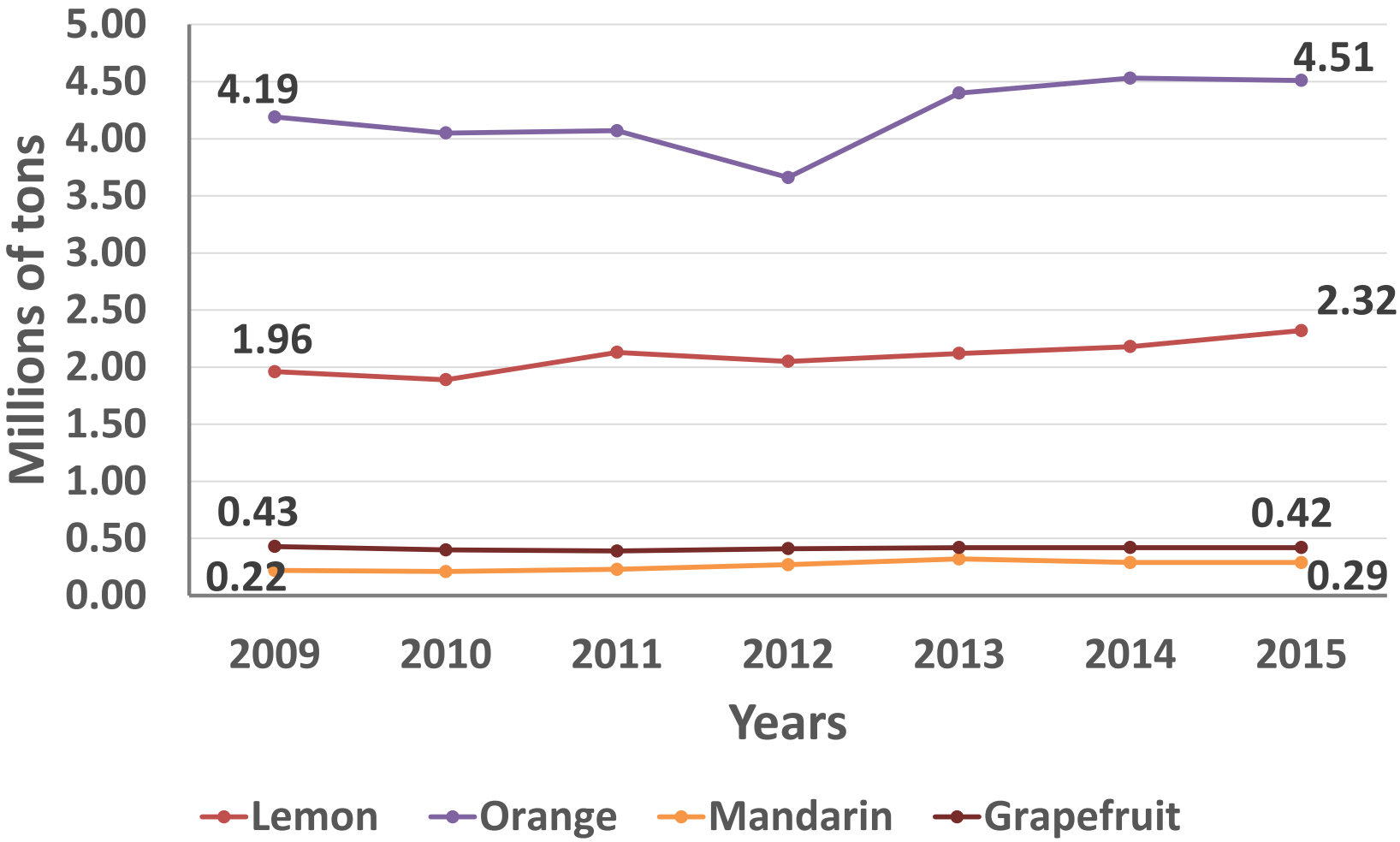
NATIONAL PRODUCTION FROM 2009 TO 2015.



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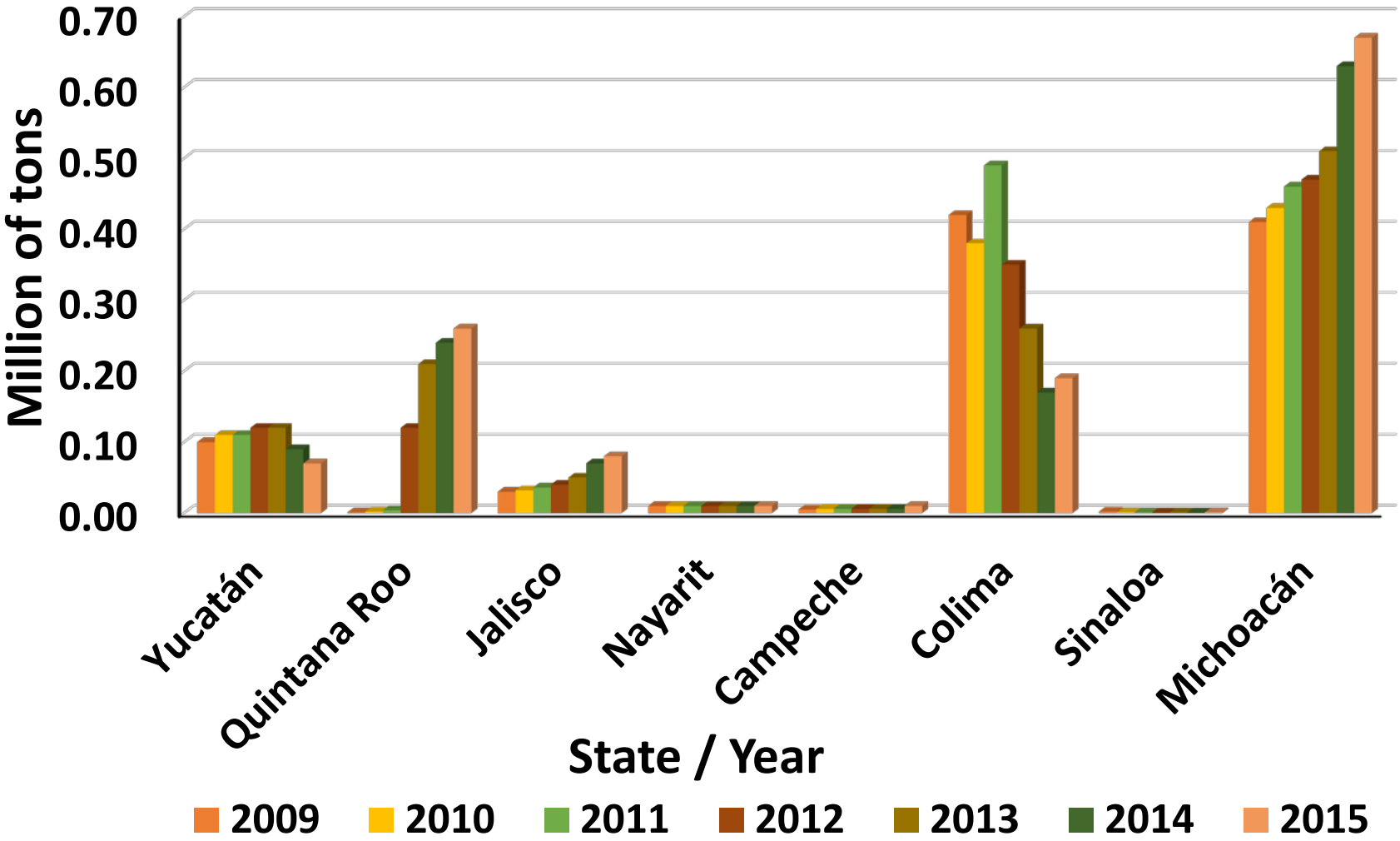
CITRUS PRODUCTION IN STATES WITH MORE THAN 5 YEARS WITH HLB



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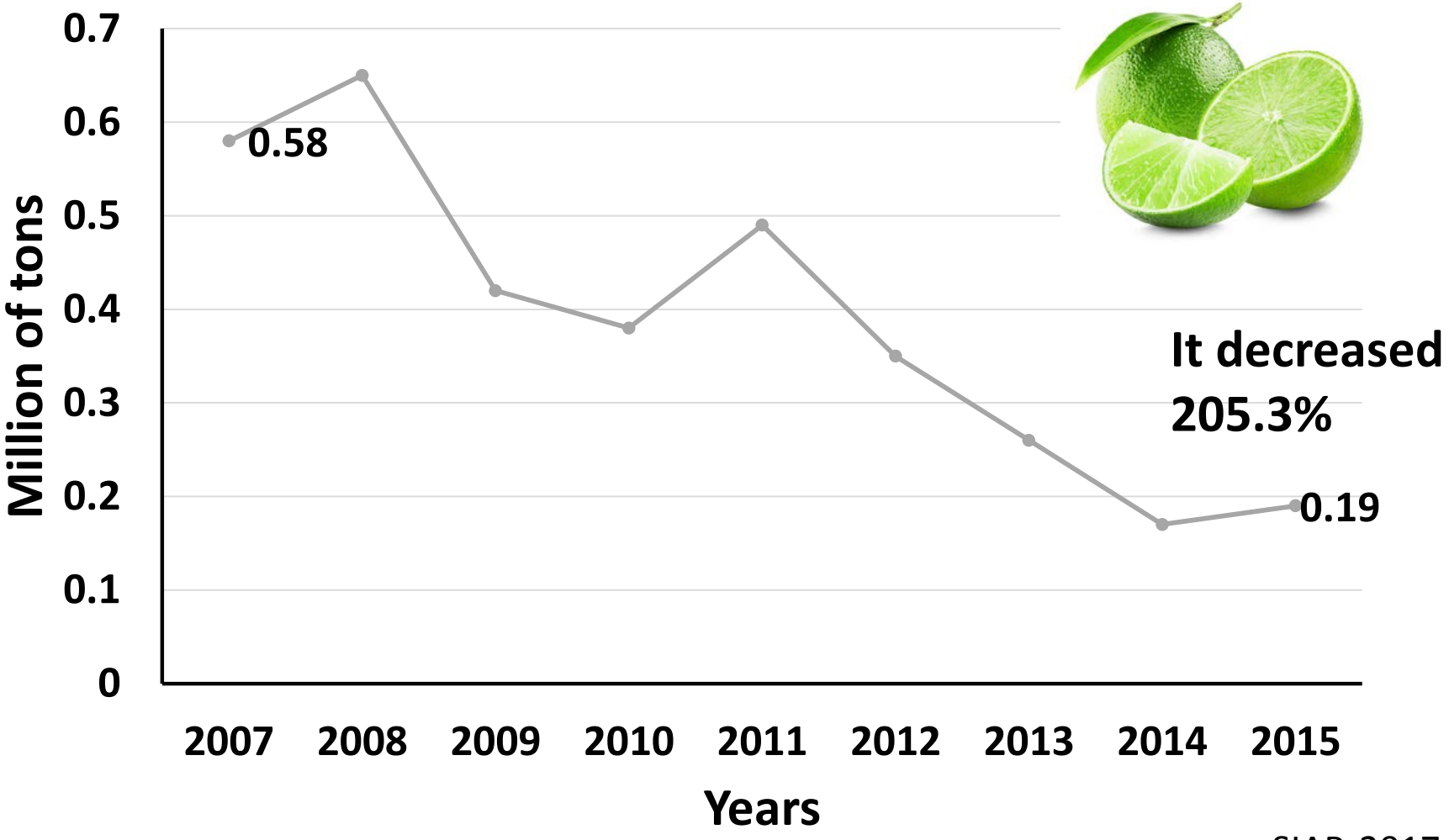
LIME CITRUS PRODUCTION IN COLIMA, MEXICO



SIAP, 2017.

5. CURRENT SITUATION OF HLB IN MEXICO

- March 2017, the HLB is present in 432 municipalities of 24 states.

- National surface of citrus increased from 523,320 hectares in 2009 to 572,051 hectares in 2017.

- Commercial citrus area with HLB: 15 % (86,425 hectares).

6. CONCLUSIONS

- With these actions, Mexico has prevented the rapid spread of the disease to new areas and impacted populations of the vector ACP.
- As result of the successful HLB Program, since 2009 the disease has been contained, over 85 % of citrus areas are still free.
- Is necessary to respond the questions on what the impact of each strategy has been.

THANKS

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