YELLOW DRAGON (HLB)
&
AGRUMES

THE SOLUTION
BARBARY PLANTE
Evolution
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Agriculture du Maghreb

AGRIMAG
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THE ORANGES OF SEVILLE THREATENED BY YELLOW DRAGON DISEASE

According to an article on Fresh Plaza, producers in the Seville region must take preventive measures to protect their 48,000 orange trees from the deadly bacteria that have already devastated citrus crops in Asia, Latin America and the US.

The European campaign “Life for Citrus”, which involves Spain, Portugal, France and Italy develop strategies to stem the spread of Huanglongbing (HLB). Caused by the bacterium Candidatus liberibacter, it is spread by certain insects and can completely destroy a citrus fruit in five years.

The infestation has already reached epidemic levels in 48 countries

Asian and 53 African states, as well as Brazil and the U.S. It was detected in China in 1943. in Africa in 1947 and, by 2005, it had begun to devastate the orange groves of Florida. It has not yet arrived in Europe, but the vector insect has already landed.

Greening / HLB (*Candidatus* Liberibacter)

Last modified: 12/09/2023
Author: M Negri (CIRAD)

Greening, HLB (Huanglongbing)

Candidatus Liberibacter asiaticus, *Ca.* L. africanus et *Ca.* L. americanus

Sensitive crops: Citrus

General

Greening or HLB is due to three species of intracellular bacteria Gram of the genus Candidatus Liberibacter that colonize the phloem of plants. It is a non-cultivable bacterium on semi-synthetic, and therefore not fully characterizable, which is why its name is preceded by the term Candidatus.

It is widespread worldwide and the most important threat to citrus fruits. The bacterium is transmitted by two species of psyllium and during grafting. African psyllium (Trioza erytreae) Transmits Ca. Liberibacter africanus in Africa, Mauritius and Reunion and is found preferentially in altitude in cool and wet areas. On the other hand, Asian psyla (Diaphorina citri) transmits Ca. Liberibacter asiaticus in its origin area (South-East Asia) and its introduction areas (America, Reunion, Mauritius), it is adapted to the warmer and drier areas of the coast. It does not seem there is no strict vector preference.

Affected production areas:

Guadeloupe	Martinique
Polynésie-française	La Réunion
Madagascar	Comores
Maurice	

Organs affected

Feuilles	Fruits

LEMON TREE CONTAMINATED WITH YELLOW DRAGON DISEASE IN PUERTO RICO

HUANGLONGBING (HLB) OR YELLOW DRAGON)

Huanglongbing (HLB), also known as Yellow Dragon Disease, is a serious bacterial disease that affects citrus fruits such as orange trees, lemon trees, and other members of the Rutaceae family.

It is caused by bacteria of the genus Candidatus Liberibacter, mainly Candidatus Liberibacter asiaticus, africanus, and americanus.

FRUIT DEFORMATION

SYMPTOMS AND IMPACT

Asymmetrical yellowing of the leaves
The leaves have a partial or total yellowing that is not uniform.

Premature leaf drop
Affected leaves drop prematurely.

Fruit deformation
Fruits produced by infected trees are often small, deformed, and may have irregular ripening with green and ripe parts simultaneously.

Bitter taste of fruit
Affected fruits may have a bitter taste, making them unsafe to eat.

Death of the tree
Over time, the tree may decline and die if the disease is not controlled.

INSECT VECTORS OF YELLOW DRAGON HUANGLONGBING (HLB) CONTAMINATION

MODE OF CONTAMINATION

Contamination by Huanglongbing (HLB) or YELLOW DRAGON occurs in two main ways

By insect vectors

- Asian citrus psyllid (Diaphorina citri)
- The African citrus psyllid (Trioza erytreae)
- The African citrus psyllid (Candidatus Liberibacter americanus)

These insects feed on plant sap by biting leaves and young shoots, thus transmitting bacteria from infected plants to healthy plants.

By grafting infected plant material

Using cuttings or scions from infected plants can introduce the disease to new areas.

EARLY SIGNS OF THE DISEASE

PREVENTION AND CONTROL

The management of Huanglongbing is based on several strategies

Surveillance and early detection

- Regular inspection of orchards for early signs of the disease.
- Use of diagnostic tests to confirm the presence of bacteria.

Vector management

- Control of psyllid populations through the use of insecticides.
- Introduction of natural enemies of psyllids for biological control.

Healthy plant material

- Use of certified disease-free plants.
- Avoid grafts with potentially infected materials.

Eradication of Infected Plants

- Pulling up and destroying infected trees to prevent the spread of the disease.

IN SUMMARY

PLANTING LEMON TREES CONTAMINATED WITH YELLOW DRAGON DISEASE IN PUERTO RICO

Huanglongbing (HLB) or Yellow Dragon is a serious threat to citrus plantations around the world and the fight against this disease requires an integrated approach combining surveillance, vector management, use of healthy plant material, and continuous research to find new solutions.

RESEARCH AND INNOVATIONS

The
Fertilizers Hydro-Retentive
BARBARY PLANTE Evolution
represent a major innovation for the regeneration of citrus fruits affected by Yellow Dragon Disease.

These fertilizers have demonstrated their effectiveness through numerous contaminated plantations, allowing the trees to return to their normal production cycle.

RESEARCH AND INNOVATIONS

Successful trials have been carried out on orange and lemon trees in Florida, California, Brazil and Puerto Rico.

Innovation

A water-retaining fertilizer technology that promotes the regeneration of diseased trees.

Efficiency

Allows you to restore the citrus production cycle.

Test areas

Successfully tested in Florida, California, Brazil and Puerto Rico.

RESEARCH AND INNOVATION

Patent filed in 1987
after 6 years of research by Dr. Salah Barbary, Mineral Technology Engineer
Gold medal
at the International Exhibition of Inventions and New Techniques in Geneva in 1987
Approved
by the World Intellectual Property Organization

Hydro-retentive Fertilizer
BARBARY PLANTE Evolution

Find out how they can transform the fight against Yellow Dragon Disease and revitalize your citrus groves.

WHAT IS A FERTILIZER HYDRO-RETENTIVE?

The " **Hydro-Retentive Fertilizer BARBARY PLANTE Evolution** " combine two concepts: that of Fertilizer and that of Hydro-Retentive.

Fertilizer

A fertilizer is a substance added to the soil or directly to plants in order to provide them with nutrients essential for their growth and health.

The **Hydro-Retentive Fertilizer BARBARY PLANTE Evolution** are special products that combine conventional fertilizers such as Nitrogen (N), Phosphorus (P) and Potassium (K) in powder form, with trace elements.

These nutrients are encapsulated in a biodegradable super-absorbent water retainer.

This ensures optimal nutrient uptake by the plants, thus promoting their growth and protection.

Hydro Retentive

A water retentive is a substance that has the ability to absorb and retain water.
These substances are often used in agriculture and gardening to help retain moisture in the soil, allowing plants to have access to water for longer periods between waterings.

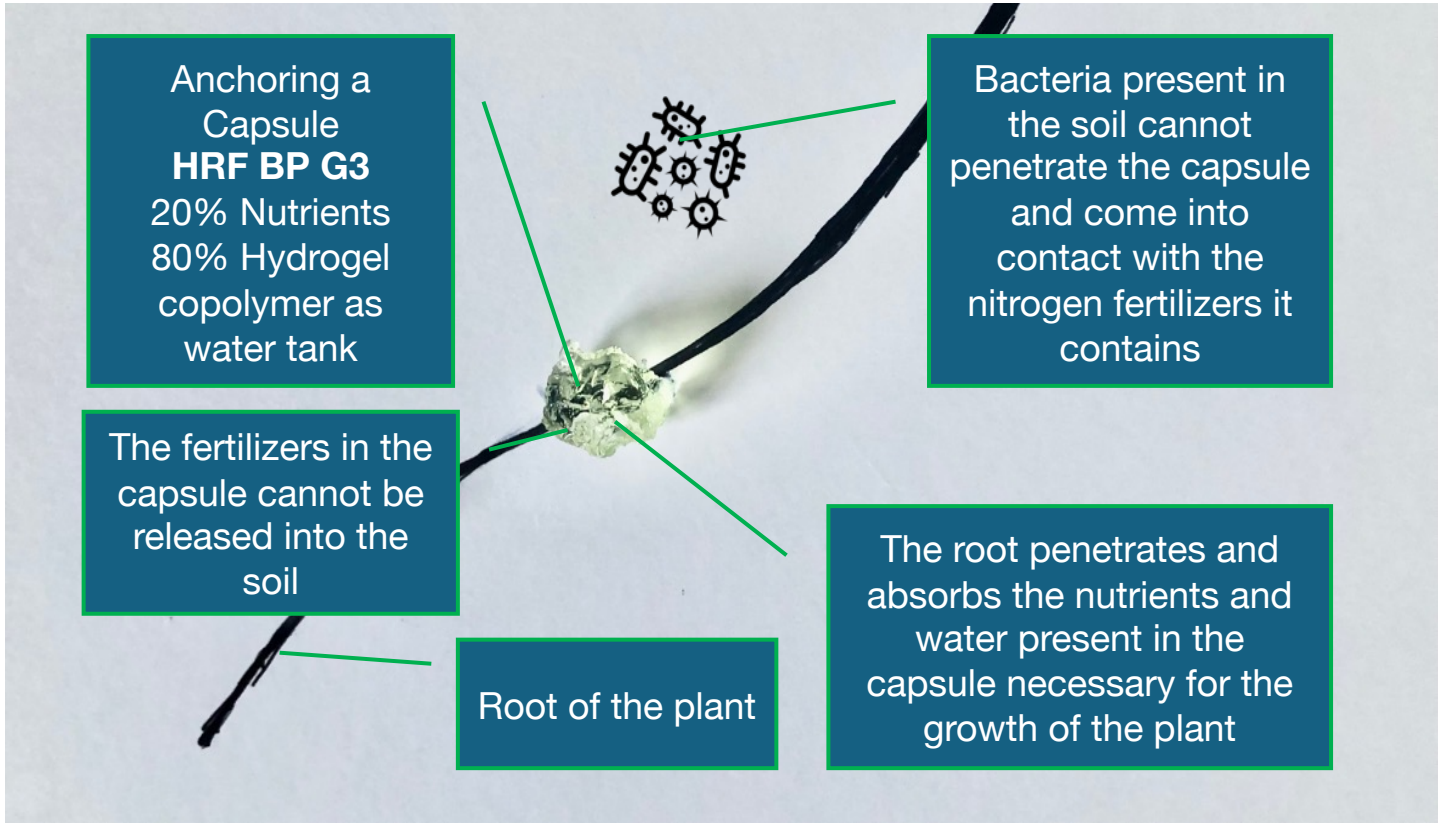
The **Hydro-Retentive Fertilizer BARBARY PLANTE Evolution** use the latest generation of biodegradable agricultural superabsorbent copolymers developed specifically by Barbary Plante to optimize water management and soil quality.

HYDRO RETENTIVE FERTILIZER Barbary Plante EVOLUTION

HOW DOES THE FERTILIZER HYDRO-RETENTIVE?

The live seed germinates and creates roots in order to actively search for water and nutrients, attracted they graft into the **BARBARY PLANTE** capsules present in the soil.

During its growth process, the young plant will continuously draw nutrients and water from **BARBARY PLANTE**'s capsules to nourish its development and establish a robust root system that will maximize its growth.



The principle of anchoring Hydro-Retentive Fertilizer BARBARY PLANTE Evolution on the roots of a plant

Capsules
Hydro-Retentive Fertilizer
BARBARY PLANTE G3

WHAT ARE THE BENEFITS?

THE BENEFITS ARE MULTIPLE OF USING Hydro-retentive Fertilizer BARBARY PLANTE Evolution

- **Optimization of irrigation**
  Their high capacity to hold water in the soil allows for a more efficient use of water resources.

- **Improved plant health**
  By providing plants with more consistent access to water and nutrients, they promote their growth and development. Plants are healthier, more vigorous and less sensitive to water stress.

- **Reduced fertilizer losses**
  The encapsulation of fertilizers and trace elements in the hydrogel makes it possible to limit losses due to leaching. Nutrients are released gradually as the plant needs it, reducing waste and maximizing fertilizer effectiveness.

- **Environmental sustainability**
  They meet the objectives of sustainable and responsible agriculture by minimizing the environmental impact.

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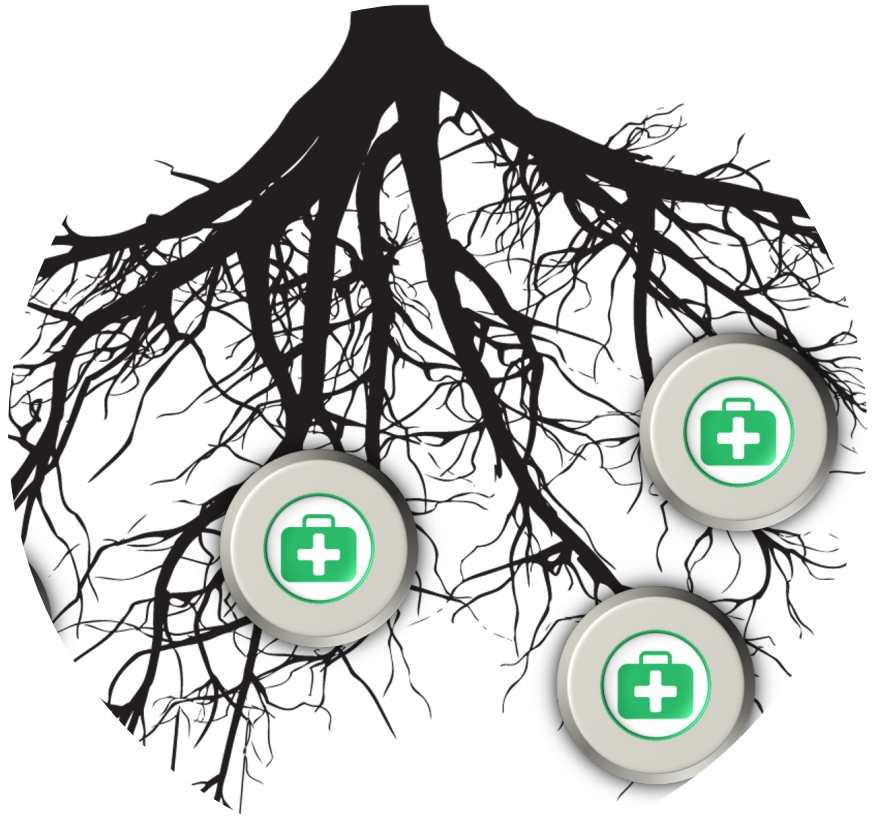
HYDRO RETENTIVE FERTILIZER Barbary Plante EVOLUTION

PREVENTIVE & CURATIVE IMMUNIZER



The

Hydro-Retentive Fertilizer

BARBARY PLANTE Evolution

act as a vaccine and increases the immune system of plants

METHODOLOGY

CURATIVE TREATMENT

The objective of this method is to regenerate diseased fruit trees.

To do this, we use Fertilizers Hydro-Retentive BARBARY PLANTE Evolution.

These are applied in a perimeter extended to the circumference of the tree's foliage and to a certain depth, thus allowing the roots to be grafted onto it.

Cette approche vise à enrichir le sol autour des arbres fruitiers, facilitant ainsi la régénération des arbres affectés par des maladies.

Regeneration of date palms in Burkina Faso

METHODOLOGY

PREVENTIVE TREATMENT

The objective of this method is to protect the fruit tree shoots in nurseries against the risk of disease.

To do this, we use **Hydro-Retentive Fertilizers BARBARY PLANTE Evolution**.

These are mixed in the substrate and then bagged or trayed for nursery cultivation.

This approach aims to enrich the soil around the sprouts of future fruit trees, thus facilitating their growth and strengthening their resistance to diseases.

CURATIVE & PREVENTIVE TREATMENT IN PUERTO RICO

HATCH – 477

"Effects of cover crops and precision agriculture management on large lime (Citrus aurantifolia) grown on contrasting soil types"

PI : Dre Rebecca Tirado Corbalá
Co-PI : Jonathan Muñuz Barreto, Dr Elite Valencia-Chin et Dr Elvin Román Paoli

HATCH - 477

"HATCH" is an agricultural research funding program in the United States, known as the "Hatch Act". This program supports agricultural research conducted by agricultural experimental stations.

477 : indicates the number of the specific funded project that focuses on the effects of cover crops and precision agriculture management on the cultivation of large limes, particularly on different soil types.

CURATIVE TREATMENT OF YELLOW DRAGON DISEASE ON LEMON TREE

Identification
contaminated trees
by the disease of the
Yellow Dragon
About the plantation

CURATIVE TREATMENT OF YELLOW DRAGON DISEASE ON LEMON TREE

Trench preparation
all around the tree contaminated with Yellow Dragon disease.

The diameter of this trench corresponds to the span of the foliage.

The depth depends on the size of the tree, between 10 and 30 cm, right down to the roots.

CURATIVE TREATMENT OF YELLOW DRAGON DISEASE ON LEMON TREE

The
Hydro-Retentive Fertilizer
NPK BARBARY PLANTE G3
is ready to use.

In this application, it is used on average from 10 to 20 kg per contaminated or uncontaminated tree.

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CURATIVE TREATMENT OF YELLOW DRAGON DISEASE ON LEMON TREE

The
Hydro-Retentive Fertilizer
NPK Barbary Plante G3
is placed at the foot of the trees.

CURATIVE TREATMENT OF YELLOW DRAGON DISEASE ON LEMON TREE

The trench was closed in order to cover the
Hydro-Retentive Fertilizer
NPK Barbary Plante G3
at the foot of the trees.

CURATIVE TREATMENT OF YELLOW DRAGON DISEASE ON LEMON TREE

Treated trees are monitored to evaluate and validate their treatment.

CURATIVE TREATMENT OF YELLOW DRAGON DISEASE ON LEMON TREE

The treatment of the lemon trees took place in 2019 on this plot.

Several lime trees were treated during this curative treatment campaign for Yellow Dragon disease.

The photo shows one of the treated lemon trees blooming a few weeks after the curative treatment
BARBARY PLANTE

After a few months, the results showed that the treated lime trees returned to normal lime production.

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PREVENTIVE TREATMENT OF YELLOW DRAGON DISEASE OF THE LEMON TREE

The scientific team prepares the lime seed trays.

The substrate was mixed with the **Hydro-Retentive Fertilizer NPK BARBARY PLANTE G3** (visible in the shovel) then distributed among the trays containing the seeds (Blue Bag).

PREVENTIVE TREATMENT OF YELLOW DRAGON DISEASE OF THE LEMON TREE

The tray presents some of the lime seeds **without** the
Hydro-Retentive Fertilizer
NPK BARBARY PLANTE G3
(Left)
and some of the lime seeds **with** the
Hydro-Retentive Fertilizer
NPK BARBARY PLANTE G3
(right).

This demonstrates the impact on growth and development.

HYDRO RETENTIVE FERTILIZER Barbary Plante EVOLUTION

PREVENTIVE TREATMENT OF YELLOW DRAGON DISEASE OF THE LEMON TREE

The difference in size between the two sheets of this tray illustrates the benefits of the

Hydro-Retentive Fertilizer

NPK BARBARY PLANTE G3

on the growth of lime seeds.

This fertilizer, rich in organic nutrients and trace elements, strengthens plant health and makes them immune to diseases such as the yellow dragon.

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HYDRO RETENTIVE FERTILIZER Barbary Plante EVOLUTION

CURATIVE & PREVENTIVE TREATMENT OF YELLOW DRAGON DISEASE

Several citrus groves, including orange and lemon trees, have benefited from this innovative technology to reduce the impact of Yellow Dragon disease:

In CALIFORNIA
In FLORIDA
In BRAZIL
And
In DOMINICAN REPUBLIC

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