# CITRUS
## CROP SOLUTIONS SHEET

Biorizon biotech

### Citrus Crop Cycle

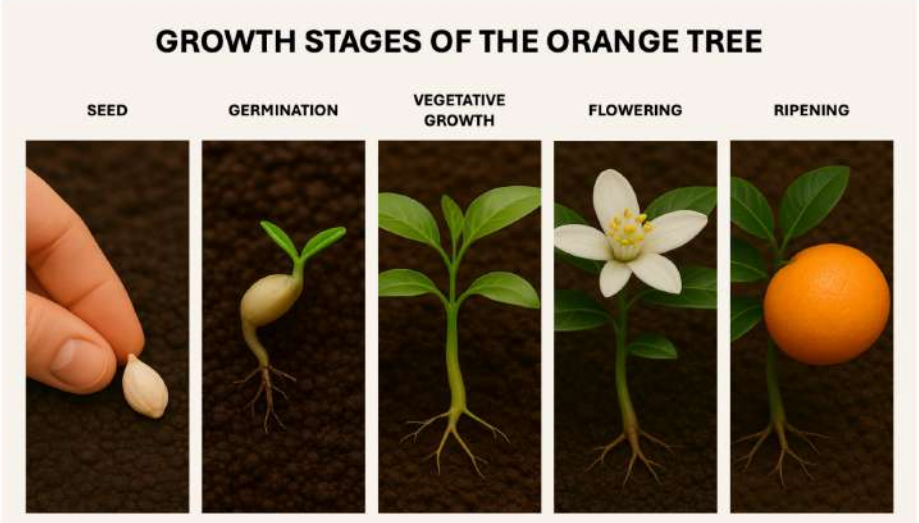
The citrus crop cycle is perennial and characterized by several annual flushes, with the spring flush being the most important for production. After the relative dormancy of winter, activity resumes with the sprouting of wood and flower buds. Flowering (orange blossom) gives way to fruit set, a critical process where harvest potential is defined. This is followed by a phase of rapid fruit growth (sizing) during summer and autumn. Finally, the fruit enters the veraison phase, where its color changes and it accumulates sugars and acids, until it reaches maturity for harvesting, which can extend for several months depending on the variety.

### Crop Characteristics

Citrus (genus Citrus) are perennial trees or shrubs of the Rutaceae family. They prefer subtropical climates, without hard frosts that can damage both wood and fruit. They require deep, well-drained soils with a slightly acidic to neutral pH. They are very sensitive to salinity and root asphyxiation due to waterlogging. Their root system is shallow, making them dependent on proper irrigation and nutrition management. Fruit quality (size, juice, color, peel thickness) is strongly influenced by nutrition, irrigation, and climatic conditions, especially temperature fluctuations during ripening.

### Main Phenological Stages

- **Winter Dormancy: Low activity. The tree accumulates reserves. Essential for floral induction.**
- **Spring Flush: Development of new shoots and flower buds. This is the main flush.**
- **Flowering: Opening of flowers (orange blossom). Pollination is predominantly entomophilous.**
- **Fruit Set: Fertilization and physiological drop of flowers and small fruits ("clareta").**
- **Fruit Sizing: Stage of rapid fruit growth through cell division and elongation (Phase II).**
- **Veraison and Ripening: The fruit stops growing, changes color, and undergoes organoleptic changes (sugar accumulation, acidity decrease).**
- **Harvest: Collection of fruits at their optimal point of commercial maturity.**




Navel Orange

Valencian Orange

Blood Orange

Salustiana Orange

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## MAIN CROP PROBLEMS FOR CITRUS GROWERS

### POOR FRUIT SET AND EXCESSIVE FRUIT DROP ("CLARETA")

One of the biggest concerns in citrus cultivation is the massive drop of newly set fruits, which occurs mainly in June-July. This drastically reduces the final harvest.

**The main problems and causes include:**

**Physiological Competition:**

Strong competition for carbohydrates and nutrients between developing fruits and the new summer flush.

Hormonal imbalance (low levels of cytokinins and gibberellins, high levels of abscisic acid).

**Adverse Environmental Conditions:**

High temperatures and low relative humidity (heat stress) causing acute water stress.

Warm and dry winds that increase transpiration.

**Nutritional Imbalances:**

Lack of key nutrients at times of maximum demand such as Phosphorus (P), Zinc (Zn), and Manganese (Mn).

Excess Nitrogen (N) that promotes lush vegetative growth at the expense of fruits.

**Inadequate Irrigation Management:**

Water deficit causing stress and fruit drop as a defense mechanism.

Excess irrigation causing root asphyxiation and limiting nutrient absorption.

**Consequences:**

Drastic reduction in the number of fruits per tree.

Severe decrease in final production.

Irregular harvests and lower economic profitability.

## SOLUTION TO IMPROVE FRUIT SET AND RETENTION


Flowering is a very demanding stage, it is the reproductive stage of the plant, and it will require both: adequate hormonal signaling and available nutrients. Whenever either of these two key factors is not adequate, the reproductive stage (flowering and fruit set) will be negatively affected, and we will lose production potential.

There are many different causes for unbalancing the plant's hormonal system when the reproductive stage should begin. Excess nitrogen in the soil, warm temperatures with lack of sunlight, excess or lack of irrigation water, and many other negative factors. All these factors will move hormonal balance away from cytokinin dominance, and the lack of this signal will hinder any differentiation of reproductive buds.

On the other hand, the lack or insufficient levels of Calcium, Boron, Zinc, Phosphorus,... will end up decreasing the quantity and quality of flowers and pollen. When the levels of these nutrients are really low, then a deficiency may appear, and you may end up losing flowers and fruits after fruit set.

BIORIZON has developed a solution based on all this nutritional and physiological knowledge, providing plants with essential nutrients, natural hormonal signaling, and the necessary biostimulation for this purpose.

**BIORIZON COMPLEX foliar 2-3 L/ha when buds begin to swell and open to improve homogeneous flowering with high-quality flowers and pollen.**

**BIOFIX foliar 2-3 L/ha, one or two applications from the "Flowering Stage" to ensure high levels of Calcium and Boron in plant tissues.**

**BIOFAT foliar 2 L/ha during flowering, to induce the appropriate signaling for cell division. The greater the cell division we achieve during flowering and fruit set, the greater the potential size we will have for our berries.**

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### SMALL CALIBER FRUITS AND THICK PEEL

Obtaining optimal commercial caliber and a thin, high-quality peel is essential for the fresh market. Small fruits or those with excessively thick peel suffer significant depreciation.

### The main causes include:

**Nutritional Factors:**
Potassium (K) Deficiency: Essential for sugar transport, water accumulation in the fruit, and therefore for sizing.
Low levels of Phosphorus (P) and Magnesium (Mg): Involved in the energy metabolism necessary for fruit growth.
Excess Nitrogen (N) in final stages: Promotes bark development (albedo) at the expense of size and juice quality.

**Irrigation Management:**
Deficit irrigation during the sizing phase (summer) is the most common cause of lack of caliber.

**Plant Factors:**
Excessive fruit load on the tree (lack of thinning), leading to high competition.
Trees with a weak or damaged root system.
Poor or damaged foliage that reduces photosynthetic capacity.

**Rootstock or Scion:**
Some rootstocks induce smaller caliber or thicker skin.

### Consequences:

- Reduction in the commercial value of the harvest.
- Lower yield in weight per hectare.
- Fruits with a lower percentage of juice and inferior organoleptic quality.

# BIORIZON SOLUTION TO INCREASE FRUIT CALIBER AND QUALITY


BIORIZON has developed a solution based on all this nutritional and physiological knowledge, providing plants with essential nutrients, natural hormonal signaling, and the necessary biostimulation for this purpose. These treatments are applied not only at critical moments during the development of newly set fruit but throughout the entire cycle, as they are indispensable for avoiding deficiencies caused by the previously mentioned factors.

**BIOFIX foliar 2-3 L/ha foliar, applied from fruit set and throughout fruit development, to ensure adequate levels of Calcium and Boron, which will strengthen cell walls and promote adequate auxinic levels and their movement in the system.**

**BIOFAT foliar 2-3 L/ha foliar, during flowering and fruit set, to ensure adequate levels of Calcium and cytokinins, which will increase cell division and strengthen cell walls, thereby promoting adequate auxinic levels and the formation of high commercial quality fruit.**

**ROOTBEST root 5-7 L/ha weekly, from bud break to the end of the cycle, to promote continuous root development from the initial stages of cultivation, achieving not only an increase in root absorption capacity (NUE/WUE) but also constant root renewal, ensuring the capacity to generate the necessary cytokinins for balanced vegetative development. It also provides an efficient source of translocable calcium, which will positively influence the creation of quality fruit and the correct auxinic movement in the plant.**

**ALGAFERT foliar 2-3 L/ha, throughout the cycle, to hormonally balance the plant, thereby managing stress situations and preventing calcium blockages in vacuoles in the form of calcium oxalate.**

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## IRON CHLOROSIS AND OTHER MICRONUTRIENT DEFICIENCIES

Leaf yellowing is a very common problem in citrus, especially in calcareous soils. It limits photosynthetic capacity and weakens the tree.

### The main causes include:

**Iron Chlorosis (Iron - Fe deficiency):**
Cause: High soil pH (calcareous soils) that immobilizes Iron, making it unavailable to the root, even if present.
Symptoms: Young leaves are yellowish-white with green veins.

**Zinc (Zn) and Manganese (Mn) Deficiency:**
Causes: Also induced by high pH, sandy soils, or excess Phosphorus.
Symptoms: Interveinal mottling on young leaves (Zn) or more diffuse yellowing (Mn).

**Factors Aggravating the Problem:**
Root asphyxiation due to over-irrigation, which damages roots and reduces their absorption capacity.
Low soil temperatures in winter/spring.
High bicarbonate concentration in irrigation water.

### Consequences:

- Drastic reduction in photosynthesis, limiting growth and production.
- General weakening of the tree, making it more vulnerable to pests and diseases.
- Smaller caliber and lower quality of fruits.
- In severe cases, it can cause defoliation and branch death.

## BIORIZON SOLUTION TO CORRECT CHLOROSIS AND MULTIPLE DEFICIENCIES


BIORIZON has developed a solution based on all this nutritional and physiological knowledge, providing plants with essential nutrients, natural hormonal signaling, and the necessary biostimulation for this purpose.

**BIOPOWER root 1-3 L/ha weekly, from bud break to the end of the cycle, to promote optimal root development from the initial stages of cultivation, achieving not only an increase in root absorption capacity but also generating a strong root with the capacity to produce the necessary cytokinins for balanced vegetative development.**

**ROOTBEST root 5-7 L/ha weekly, from bud break to the end of the cycle, to promote continuous root development from the initial stages of cultivation, achieving not only an increase in root absorption capacity (NUE/WUE) but also constant root renewal, ensuring the capacity to generate the necessary cytokinins for balanced vegetative development. It also provides an efficient source of translocable calcium, which will positively influence the creation of quality fruit and the correct auxinic movement in the plant.**

**ALGAFERT foliar 2-3 L/ha, one or two applications from bud break, to hormonally balance the plant, achieving correct and balanced vegetative development. It will also help manage stress situations during this phase, preventing unbalanced growth or blockages.**

**PHOTOPOWER foliar 1-2 L/ha, to increase photosynthetic potential.**

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### HARVEST MANAGEMENT

Depending on the conditions under which the crop develops, managing the commercial quality of the fruit is relevant.

Increasing sugar content and homogenizing color change in fruits will be of great interest, in order to advance early harvests or reduce the total percentage of non-commercial fruits.

Likewise, the possibility of extending harvest windows, to facilitate its management, to adapt it to market requirements or available labor resources, offers the possibility of controlling a fundamental part of the production process.

## BIORIZON SOLUTION, FOR MANAGING THE HARVEST PROCESS


BIORIZON has developed two solutions, depending on the harvest management requirement, based on all this nutritional and physiological knowledge, providing plants with essential nutrients, natural hormonal signaling, and the necessary biostimulation for this purpose.

Maintaining root activity will be critical to ensure fruit quality.

**BIOPOWER root 1-3 L/ha weekly, from bud break to the end of the cycle, to promote optimal root development from the initial stages of cultivation, achieving not only an increase in root absorption capacity but also generating a strong root with the capacity to produce the necessary cytokinins for balanced vegetative development.**

**ROOTBEST root 5-7 L/ha weekly, from bud break to the end of the cycle, to promote continuous root development from the initial stages of cultivation, achieving not only an increase in root absorption capacity (NUE/WUE) but also constant root renewal, ensuring the capacity to generate the necessary cytokinins for balanced vegetative development. It also provides an efficient source of translocable calcium, which will positively influence the creation of quality fruit and the correct auxinic movement in the plant.**

**BIORIZON CONTROL foliar 3-5 L/ha, 30-20 and 15-7 days prior to harvest, to redirect photosynthate movement, preventing their destination from being the apical meristem and causing their accumulation in the fruits in the form of sugars. Furthermore, the content of boron (B) and molybdenum (Mo) will activate metabolic pathways related to anthocyanin creation, which will lead to greater homogenization of color change processes.**

**FORTIFY foliar 2-3 L/ha foliar, 20-15 and 10-7 days before harvest, in order to decrease ethylene generation and maintain plant hormone levels, thus extending the harvest window without compromising commercial quality. Likewise, the cobalt (Co) and molybdenum (Mo) content will activate metabolic pathways related to anthocyanin creation, which will lead to greater homogenization of ripening processes.**

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### IMPROVE PLANT HEALTH AND ITS IMMUNE SYSTEM

Fruit trees in general, and citrus in particular, face a significant number of threats in terms of diseases, and the first barrier to protect them is their own immune system. Every day there are fewer active ingredients available to farmers to combat all these diseases, and consumers demand safe and healthy fruits.

For plants to be able to defend themselves against pathogen attacks, two factors must be taken into consideration: the reduction of stress in plants, since ethylene can hinder the immune system's response and the activation of all its defense metabolic pathways; and the activation of said pathways to develop physical barriers and produce defense biomolecules.

Citrus are vulnerable to a wide range of diseases caused by fungi, bacteria, viruses, and nematodes. These can affect the plant at various stages, conditioning both its yield and the commercial quality of the fruits. Powdery mildew, downy mildew, Botrytis, Alternaria, various bacterial diseases, and viruses are common throughout the crop cycle and require a strategy that combines agrochemicals, bioprotectants, and biologicals.

## BIORIZON SOLUTION TO IMPROVE PLANT DEFENSE SYSTEMS


BIORIZON has been developing a solution for years thanks to the properties of one of our microalgae hydrolysates, which contain significant amounts of plant hormones related to the activation of defense metabolic pathways, such as salicylic acid, jasmonic acid, and defense peptides.

To the extent that these pathways can be activated, the plant will act as the first barrier against pathogen attacks, showing greater resistance and, therefore, increasing the efficacy of phytosanitary treatments.

**ALGADEFENSE 1.5-2 L/ha foliar or root application, every 15 days, will help decrease the intensity of pathogen attack and increase the plant's recovery capacity from said attack, resulting in greater efficacy of any subsequent phytosanitary treatment.**

**CROP PROTECT 4-5 Kg/ha foliar application, every 15 days, will help decrease the intensity of pathogen attack, due to its capacity to dry and degrade mycelia, and increase the plant's recovery capacity from said attack, resulting in greater efficacy of any subsequent phytosanitary treatment.**

**CUPPRACIVE 3-5 Kg/ha foliar or root application, every 15 days in synergy with CROP PROTECT or ALGADEFENSE or in alternation, will help decrease the intensity and frequency of pathogen attack, due to its fungicidal capacity, and increase the plant's recovery capacity from said attack, resulting in greater efficacy of any subsequent phytosanitary treatment.**