SOLANACEOUS AND CUCURBITACEOUS

CROP SOLUTIONS SHEET

Biorizon biotech

Greenhouse cultivation cycle of solanaceous and cucurbitaceous crops

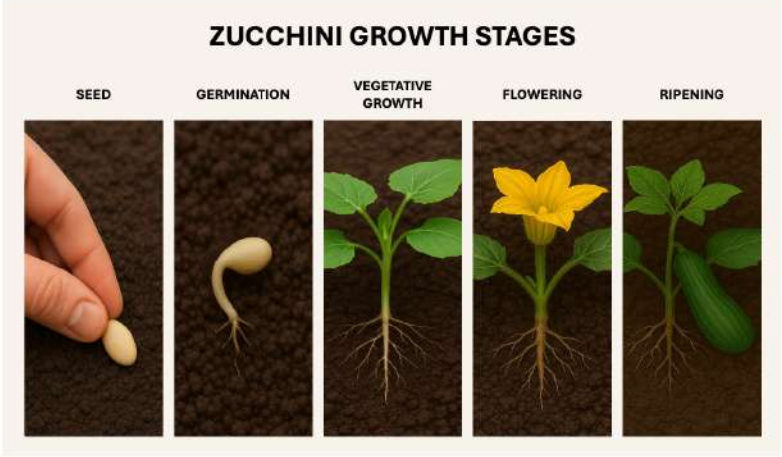
The greenhouse cultivation cycle of solanaceous and cucurbitaceous crops begins with the transplanting of seedlings previously developed in a nursery. Once in the greenhouse, the plant goes through a series of defined phenological stages: establishment and root development, vegetative growth with the formation of successive flower trusses or branches, flowering, fruit set, swelling, and finally, the staggered ripening of fruits for harvest. Greenhouse management allows for precise control of environmental conditions (temperature, humidity, CO_2) and nutrition (fertigation), which optimizes each of these stages and extends the productive period.

Crop characteristics

Solanaceous plants are a family of horticultural plants, cultivated for their edible fruit. Under greenhouse conditions, they are managed as indeterminate growth plants, staked to guide their vertical development. They require high luminosity, daytime temperatures of 20-25°C, and nighttime temperatures of 15-18°C. They are very demanding in nutrients, especially Potassium and Calcium, and sensitive to both water stress and waterlogging. Relative humidity control is key to avoiding pollination, fruit set, and disease problems. The root system, although initially taprooted, becomes fibrous and concentrates in the dripper zone, making proper fertigation management fundamental for crop success.

Main phenological stages

- Post-transplant Establishment: The seedling develops its root system and adapts to the new greenhouse conditions.
- Vegetative Growth Control of Dominance: Rapid development of stem, leaves, and formation of flower trusses.
- Flowering: Appearance and opening of flowers in each truss. Pollination is usually assisted (vibration or bumblebees).
- Fruit Set: Fertilization of the flower and initial development of the ovary to form the fruit.
- Fruit Swelling: Rapid growth and increase in fruit size through cell division and elongation.
- Veraison and Ripening: The fruit changes color, accumulating sugars, acids, and aromatic compounds.
- Harvest: Staggered harvesting of fruits as they reach their optimal point of commercial maturity.



Dark Green Zucchini

Light Green Zucchini

Pumpkin

Watermelon

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MAIN CROP PROBLEMS FOR SOLANACEOUS AND CUCURBITACEOUS CROPS

VEGETATIVE GROWTH AND VIGOR CONTROL

After transplanting, the development of a plant with good vegetative structure is crucial, allowing for good flowering and subsequent development of newly set fruit, thanks to the creation of a good structure and adequate foliage mass, which ensures the maximum photosynthetic rate. However, it must be considered that excessive vegetative vigor will imply less flowering and less efficient fruit set.

Main problems and causes influencing poor vegetative development

Unfavorable Environmental Conditions:

- Relative humidity too high (>85%) or too low (<50%) which compacts or desiccates pollen.
- Extreme temperatures (night <12°C or day >35°C) affecting pollen viability and pollen tube development.

Nutritional Imbalances:

Deficient nutritional balance (NPK), deficiencies in the supply of Zinc (Zn), Manganese (Mn), Molybdenum (Mo), Magnesium (Mg), or Calcium (Ca).

Inadequate soil structure, Water or Saline Stress:

- Electrical conductivity (EC) of irrigation water too high.
- Irregular irrigation causing plant stress.

Consequences

- Poor vegetative development
- Low photosynthetic activity
- Poor crop establishment and poor structural formation
- Low productive capacity

BIORIZON SOLUTION TO IMPROVE VEGETATIVE DEVELOPMENT

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 application 1-3 L/ha weekly, from transplanting to the end of the cycle, in order to generate optimal root development from the initial stages of cultivation, achieving not only an increase in root absorption capacity but also generating a strong root capable of producing the necessary cytokinins for balanced vegetative development.

ROOTBEST root application 5-7 L/ha weekly, from transplanting to the end of the cycle, in order to generate continuous root development from the initial stages of cultivation, achieving not only an increase in root absorption capacity (NUE/WUE) but also constantly renewing the root, 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 auxin movement in the plant.

ALGAFERT foliar application 2-3 L/ha, one or two applications from transplanting, 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.

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MAIN CROP PROBLEMS FOR SOLANACEAE AND CUCURBITACEAE

Main problems and causes influencing excessive vegetative vigor

Unfavorable Environmental Conditions

- Relative humidity too high (>85%)
- Non-extreme temperatures (18-28°C) and small day-night temperature gradient
- Low luminosity (cloudy days), which induces the production of gibberellins, to lengthen internodes in search of light

Nutritional Imbalances

Excessive fertilization (NPK) or in the supply of Zinc (Zn), Manganese (Mn), Excess Nitrogen (N - mainly in nitrate form), which causes the generation of gibberellins, leading to increased vegetative vigor.

Consequences

- Effect on the number of inflorescences
- Fewer clusters and fewer fruits per cluster, drastically reducing yield
- Direct economic loss due to unrealized production potential.

BIORIZON SOLUTION FOR CONTROLLING VEGETATIVE VIGOR

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. The key timing for this treatment, if applicable, will be prior to the introduction of pollinators.

BIORIZON foliar spray 3-5 L/ha, prior to inflorescence, in order to redirect photosynthate movement, preventing it from reaching the apical meristem and causing its accumulation in the flower buds.

BIOFAT foliar spray 2-3 L/ha, in order to stimulate this sugar movement, promote lateral vegetative development, and promote inflorescence development.

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MAIN CROP PROBLEMS FOR SOLANACEAE AND CUCURBITACEAE

POOR FRUIT SET AND/OR FLOWER DROP (ABSCISSION)

Poor fruit set is one of the main problems in greenhouse solanaceae and cucurbitaceae, causing a direct loss of production. Flowers or newly formed fruits dry out and fall off.

The main problems and causes influencing poor vegetative development.

Unfavorable Environmental Conditions:

- Very high (>85%) or very low (<50%) relative humidity that clumps or desiccates pollen.
- Extreme temperatures (night <12°C or day >35°C) that affect pollen viability and pollen tube development.
- Low light intensity (cloudy days) that reduces photosynthetic activity and available energy for the flower.

Nutritional Imbalances:

- Boron (B) and Molybdenum (Mo) deficiency, crucial for pollen germination.
- Lack of Calcium (Ca), which affects cell structure and flower stalk viability.
- Excess Nitrogen (N) that causes excessive vegetative vigor at the expense of the reproductive part (flowers).

Pollination Problems:

- Lack or low activity of pollinating insects (bumblebees).
- Insufficient manual vibration or performed at inappropriate times of the day.

Water or Saline Stress:

- Electrical conductivity (EC) of irrigation water too high.
- Irregular irrigation causing plant stress.

Consequences

- Fewer fruits per cluster, drastically reducing yield.
- "droopy" clusters with few fruits, making harvest planning difficult.
- Direct economic loss due to unrealized production potential.

BIORIZON SOLUTION TO IMPROVE 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. These treatments are applied after the introduction, if applicable, of pollinators.

BIORIZON COMPLEX foliar spray 2-3 L/ha, when floral clusters begin to differentiate and open to improve homogeneous flowering with high-quality flowers and pollen.

BIOFIX foliar spray 2-3 L/ha, one or two applications from the beginning of flowering to ensure high levels of Calcium and Boron in plant tissues.

BIOFAT foliar spray 2-3 L/ha, during full bloom, to induce the appropriate signaling for cell division. The greater the cell division we achieve during flowering and fruit set, the greater the potential for size, filling, and firmness in our fruits.

ALGAFERT foliar spray 2-3 L/ha, one or two applications after effective pollination, to hormonally balance the plant, managing stress situations during this phase, thus avoiding fruit abscission.

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MAIN CROP PROBLEMS FOR SOLANACEAE AND CUCURBITACEAE

FRUIT QUALITY PROBLEMS: CRACKING AND BLOSSOM END ROT (PESETA)

The external and internal quality of the fruit is crucial for its commercial value. Cracking and blossom end rot (peseta or black bottom) are two of the most common and damaging physiopathies.

The main causes include

Cracking:

Causes: Sudden changes in turgor pressure within the fruit during its development (sawtooth growth).

Factors: Irregular and abundant irrigation after a dry period; drastic variations in ambient humidity and temperature (day/night); nutritional imbalances (excess N, deficiency of K and Ca); varietal susceptibility.

Blossom End Rot:

Direct cause: Localized Calcium (Ca) deficiency in the distal part of the fruit during its rapid growth.

Factors inducing Ca deficiency:

Low Calcium levels in the nutrient solution.

Water stress or high salinity (high EC) that hinder Calcium absorption and translocation, which moves with xylem flow, along with the generation of oxalic acid, which will block this calcium in the vacuoles, in the form of oxalic acid.

Very high relative humidity that reduces transpiration and, therefore, Calcium transport to the fruits.

Excessive vegetative growth that competes with the fruits for available Calcium.

Antagonism with other cations such as Ammonium (NH_4^+), Potassium (K^+), or Magnesium (Mg^{++}).

Consequences

- Total loss of commercial value of affected fruits.
- Increased labor costs due to the need to select and discard fruit.
- Entry point for secondary pathogens that can affect healthy fruits.

BIORIZON SOLUTION TO IMPROVE PRE/POST HARVEST FRUIT 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.

This strategy ensures a strong and flexible cell wall, reducing the incidence of "cracking" and eliminating the occurrence of BER.

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, thus promoting adequate auxinic levels and the formation of high commercial quality fruit.

ROOTBEST root 5-7 L/ha weekly, from transplanting to the end of the cycle, in order to generate 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 proper auxinic movement in the plant.

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

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MAIN CROP PROBLEMS FOR SOLANACEAE AND CUCURBITACEAE

FRUIT FILLING

After fruit set, adequate fruit development with a high and constant filling rate is essential to avoid malformations and lack of commercial quality.

Control of stress situations is essential, as they can compromise the correct development and formation of xylem vessels or calcium blockages.

Likewise, we must ensure constant root activity, which will ensure not only the absorption of water and nutrients but also the generation of the necessary cytokinins to ensure continuous vegetative development and movement of photosynthates. Furthermore, this constant root activity will prevent fruit development pauses, which would compromise its correct formation.

BIORIZON SOLUTION TO ENSURE GOOD FRUIT DEVELOPMENT AND FILLING

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 transplanting to the end of the cycle, in order to generate 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 transplanting to the end of the cycle, in order to generate 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 proper auxinic movement in the plant.

ALGAFERT foliar 2-3 L/ha, one or two applications from transplanting, 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.

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MAIN CROP PROBLEMS FOR SOLANACEAE AND CUCURBITACEAE

LACK OF VIGOR, YELLOWING, AND PREMATURE PLANT AGING

Maintaining a healthy, vigorous plant with good photosynthetic capacity throughout the cycle is key to sustaining prolonged, quality production.

The main causes include

Plant Exhaustion:
High fruit load demanding a large amount of photoassimilates and nutrients, depleting plant reserves.

Root Problems:
Suffocation due to over-irrigation or poor substrate drainage.
Damage by soil pathogens (Pythium, Fusarium) or nematodes.
Salt accumulation in the wet bulb (high EC).

Nutritional Deficiencies:
Deficiencies of Nitrogen (N) and Magnesium (Mg), causing chlorosis in older leaves.
Deficiency of Iron (Fe) and other microelements, causing yellowing in young leaves.

Continuous Abiotic Stress:
Prolonged suboptimal temperature or light conditions.

Presence of Viruses:
Viruses such as ToBRFV, TSWV, or TYLCV weaken the plant, cause yellowing, deformities, and reduce production.

Consequences

- Smaller size and lower quality of fruits on upper clusters.
- Reduction in the number of viable flowers and poor fruit set on new clusters.
- Shortening of the productive cycle and premature senescence.
- Increased susceptibility to pests and diseases.

BIORIZON SOLUTION TO BIOSTIMULATE AND REVITALIZE THE CROP

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 transplanting to the end of the cycle, in order to generate 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 transplanting to the end of the cycle, in order to generate 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 proper auxinic movement in the plant.

ALGAFERT foliar 2-3 L/ha, one or two applications from transplanting, 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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MAIN CROP PROBLEMS FOR SOLANACEAE AND CUCURBITACEAE

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 such as tomatoes or peppers will be of great interest, in order to advance the first harvests or reduce the total percentage of non-commercial fruits.

Likewise, the possibility of extending harvest windows, in order to facilitate its management, to adapt it to market requirements or available labor resources, allows for control of a fundamental part of the production process.

BIORIZON SOLUTION FOR HARVEST MANAGEMENT

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.

It will be critical to maintain root activity to ensure fruit quality.

BIOPOWER root 1-3 L/ha weekly, from transplant to end of cycle, in order to generate optimal root development, from the initial stages of the crop, 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 transplant to end of cycle, in order to generate continuous root development from the initial stages of the crop, achieving not only an increase in root absorption capacity (NUE/WUE) but also constantly renewing the root, ensuring the capacity to produce the necessary cytokinins for balanced vegetative development. It also represents an efficient source of translocable calcium, which will positively influence the creation of quality fruit and the correct auxin movement in the plant.

BIORIZON CONTROL foliar 3-5 L/ha, 30-20 and 15-7 days before harvest, in order 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 boron (B) and molybdenum (Mo) content will activate metabolic pathways related to anthocyanin production, 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 reduce ethylene production and maintain plant hormone levels, thus extending the harvest window without compromising commercial quality. Furthermore, the cobalt (Co) and molybdenum (Mo) content will activate metabolic pathways related to anthocyanin production, which will lead to greater homogenization of color change processes.

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MAIN CROP PROBLEMS FOR SOLANACEAE AND CUCURBITACEAE

IMPROVE PLANT HEALTH AND IMMUNE SYSTEM

Solanaceae and cucurbits, under greenhouse or open field conditions, 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 for farmers to combat all these diseases, and consumers require safe and healthy fruits.

For plants to be able to defend themselves against pathogen attacks, two factors must be taken into consideration: reducing stress in plants, as ethylene can hinder the immune system's response, and activating all their metabolic defense pathways; and activating these pathways to develop physical barriers and produce defense biomolecules.

Solanaceae and cucurbits 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 growing cycle and require a strategy that combines agrochemicals, bioprotectants, and biologicals.

BIORIZON SOLUTION FOR IMPROVING 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 metabolic defense 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, every 15 days, will help reduce the intensity of pathogen attack and increase the plant's recovery capacity from said attack, making any subsequent phytosanitary treatment more effective.

CROP PROTECT 4-5 kg/ha foliar, every 15 days, will help reduce the intensity of pathogen attack due to its drying and mycelium degradation capacity, and increase the plant's recovery capacity from said attack, making any subsequent phytosanitary treatment more effective.

CUPRACTIVE 3-5 kg/ha foliar or root, every 15 days in synergy with CROP PROTECT or ALGADEFENSE or in alternation, will help reduce the intensity and frequency of pathogen attack due to its fungicidal capacity, and increase the plant's recovery capacity from said attack, making any subsequent phytosanitary treatment more effective.