POTATO

CROP SOLUTIONS SHEET

Biorizon biotech

Potato Crop Cycle

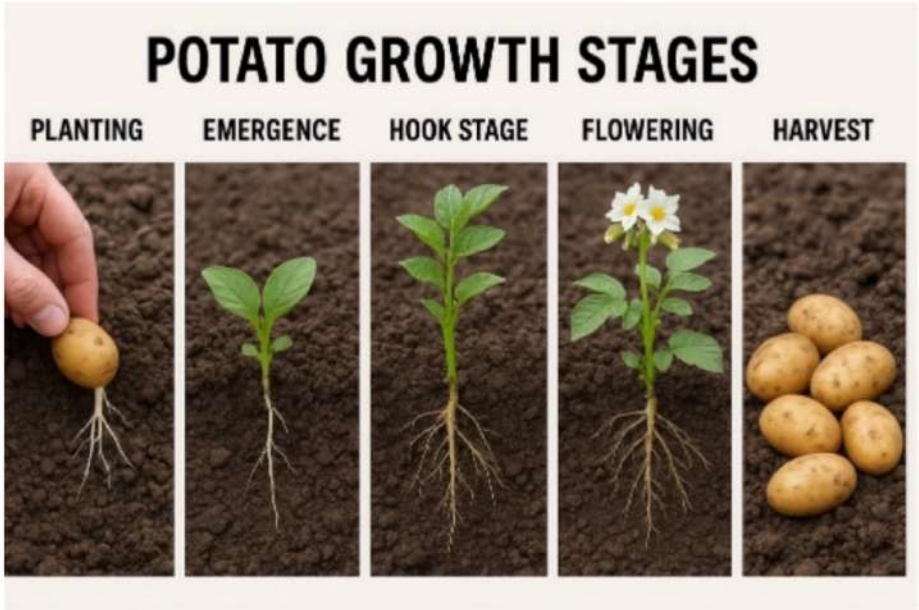
The potato crop cycle begins with the planting of seed tubers in well-prepared soil. These tubers germinate and develop plants with stems and leaves. As the plant grows, it goes through several phenological stages, including germination, vegetative growth, tuber initiation, tuber bulking, and maturity. The duration of each stage can vary depending on the potato variety and growing conditions.

Crop Characteristics

The potato is a versatile crop that thrives in temperate climates. It requires fertile, well-drained soils and regular irrigation. Potato plants have a relatively shallow root system, and their development is highly dependent on soil temperature and moisture levels. They produce flowers whose color varies by variety and develop abundant green foliage.

Main Phenological Stages

- Germination: The tuber/seed sprouts and the first shoots emerge from the soil.
- Vegetative Growth: The plant develops leaves and stems, forming a canopy that captures sunlight for photosynthesis.
- Tuber Initiation: The formation of tubers underground begins, generally when the plant has already developed a full canopy.
- Tuber Bulking: Tubers increase in size as the plant continues to photosynthesize and transport nutrients to them.
- Maturity: The foliage turns yellowish and begins to dry, signaling that the tubers have reached their optimal size and are ready for harvest.



Monalisa

Russet

Peruvian Purple

Red Bliss

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MAJOR CROP PROBLEMS FOR POTATO PRODUCERS

DELAYED OR ABSENT POTATO GERMINATION

Delayed or absent potato germination can significantly affect crop development, uniformity, and final yield. The main causes and factors involved include:

Poor Tuber Quality

Physiological age: Tubers that are too young (dormant) or too old (with depleted reserves) exhibit poor sprouting.

Mechanical damage: Cuts or bruises during harvest or handling can affect the sprouting points (eyes).

Diseases: Infections such as soft rot or Fusarium can destroy the tuber or delay emergence.

Unbroken Dormancy

Potato tubers naturally go through a dormancy period after harvest. If stored under inadequate conditions, this dormancy can be prolonged:
Low temperatures (<4–5 °C): Prolong dormancy.
Lack of light or poor pre-sprouting conditions: Do not stimulate growth.
Insufficient use of dormancy-breaking agents: In some cases, gibberellic acid or other biostimulants may be required.

Unfavorable Soil Conditions

Cold soil (<8–10 °C): Slows down metabolism and sprouting.
Waterlogged or excessively dry soil: Can damage the tuber or impede root development.
Soil compaction: Limits oxygen availability, hindering emergence.

Planting Problems

Inadequate depth: If planted too deep, emergence is delayed; if too shallow, the tuber is exposed.
Poorly healed cut tubers: Increase the risk of infection and reduce viability.
Low vigor or too small seed tubers: Insufficient reserves to initiate sprouting.

Pest or Pathogen Pressure

Wireworms, nematodes, and soil fungi (such as Rhizoctonia): Can damage the eyes or developing sprouts, causing premature death.

Consequences

- **Non-uniform emergence → uneven plants and competition between individuals.**
- **Lower number and size of tubers → penalty in yield and quality.**
- **Increased pressure from diseases and weeds in areas with emergence failures.**

BIORIZON SOLUTION FOR DELAYED OR ABSENT GERMINATION

To promote the germination of planted tubers, it is essential to ensure adequate hormonal stimulation that promotes both the emission of the first sprouts and root development.

During germination, soil temperature plays a key role in accelerating potato metabolism, but also in stimulating nutrient availability and the activity of soil microorganisms, which are responsible for multiple benefits for young plants.

Therefore, Biorizon Biotech recommends, if direct applications can be made to the seed or in the planting furrow, to use ALGASEED as a source of natural plant hormones related to germination, such as gibberellins and auxins, in addition to polysaccharides that will nourish both the incipient roots and the surrounding microorganisms. This product also provides beneficial natural vitamins and polyphenols that support the initial plant metabolism. Finally, its high quality in the combination of amino acids will facilitate the germination process and the growth of the first tissues, providing immediate energy and reducing the time the plant needs to synthesize them internally.

ALGASEED should be applied in 1 or 2 treatments (if applied to seed and in furrow) at a dose of between 0.5 and 2 L/ha, depending on the application method.

Non-uniform emergence → plants of different sizes and competition between them. Lower number and size of tubers → penalty in yield and quality. Increased pressure from diseases and weeds in uncovered areas.

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MAIN CROP PROBLEMS FOR POTATO PRODUCERS

LACK OF VEGETATIVE GROWTH

Lack of vegetative growth in potato crops, when plants fail to develop strong stems, leaves, or adequate foliage, can be due to several factors, which often overlap.
The most common causes are detailed below:

Poor or incomplete germination

Even if sprouting occurs, weak or heterogeneous emergence can limit initial vegetative growth. Causes include:
Low-quality tubers/seed (e.g., virus-infected, aged, or small-sized).
Dormancy not fully broken before planting.
Planting in cold or excessively wet soils that delay shoot emergence.

Nutritional deficiencies

Nitrogen (N) deficiency is the most common, directly affecting foliage development.
Phosphorus (P) deficiency can slow root development, limiting nutrient uptake.
Micronutrient imbalances (especially zinc or manganese) can affect enzyme activity and photosynthesis.

Water stress

Drought reduces leaf expansion and shoot elongation.
Waterlogging suffocates roots, decreasing nutrient uptake and causing stunting.
Irrigation errors (excess or deficit) are especially detrimental in the initial stages.

Soil problems

Compacted soils restrict root penetration and gas exchange.
Poor drainage or low organic matter content limits root functionality and microbial activity.
Low soil temperatures slow growth, even if tubers have emerged.

Pests and diseases

Rhizoctonia solani (black scurf) attacks roots and stems, affecting development.
Aphids, beetles, or mites feeding on young plants can cause early stress.
The use of virus-infected seed can reduce vigor, even if emergence appears normal.

Environmental stress

Frost damage to emerging shoots.
High temperatures at the start of development (above 30 °C) can inhibit vegetative growth.
Hail or wind can cause physical damage to young plants.

Herbicide damage or chemical residues

Residual herbicides in the soil from previous crops can slow initial development.
Drift from treatments in neighboring fields or improper application can cause phytotoxicity.

Genetic or physiological factors

Varietal differences: some varieties exhibit naturally slower vegetative growth.
Physiological age of the tuber: very young or aged tubers can hinder foliage formation.

Consequences

- **Poor foliage → less photosynthesis → reduced yield and tuber size.**
- **Increased plant vulnerability to heat stress, weed competition, and diseases.**

BIORIZON SOLUTION FOR LACK OF VEGETATIVE GROWTH

To help and support vegetative growth, we need to understand what is essential during this period. Plants will require an adequate hormonal balance to show their full genetic potential, but they will also need appropriate climatic conditions, adequate soil fertility (nutrient availability and microbial activity), water availability, and protection against pests and diseases. Based on this information, Biorizon Biotech recommends working in parallel with two strategies:

Root development to improve nutrient and water use efficiency:

When irrigation is available, we suggest ROOT BEST applications every 15 days (5-10 L/ha), and in the first two applications, we recommend a possible combination with BIOPOWER 0.5 L/ha, as there is strong synergy between both products. When irrigation is not available, we suggest 2 foliar applications of BIOPOWER at 1 L/ha.

Vegetative growth and development to increase photosynthesis:

Foliar application of ALGAFERT at 1 L/ha to balance the plant's hormonal system and provide high-value biostimulant molecules such as polyphenols, vitamins, amino acids, and polysaccharides. This application can be enhanced by adding 2 L/ha of MICROMIX BASIC, thus ensuring that no essential microelement for normal crop growth is lacking.

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MAJOR CROP PROBLEMS FOR POTATO PRODUCERS

INCREASING THE NUMBER OF TUBERS

Most of the time, the number of tubers is directly related to yield; the higher the number of tubers per plant, the greater the productive potential. It is equally relevant not only to increase the quantity but also to ensure homogeneous growth with the desired commercial size.
The number of tubers can be determined by internal hormonal signaling in the plant during the "hook" phase, which would be related to the auxin/cytokinin ratio within the root tissues. It is important to remember that auxins are mainly produced in young growing tissues (new leaves and flowers) and apical meristems, while cytokinins are synthesized in the root tips during their active growth.
After years of research and trials, it has been identified that foliar applications of cytokinins during the "hook" phase can induce greater cell division in the aerial part of the plant and increase chloroplast activity. This additional active tissue is capable of producing a greater amount of carbohydrates, which descend to the roots and induce the formation of a larger number of tubers.

INCREASING TUBER SIZE AND WEIGHT

The filling of young tubers represents a major challenge for farmers. It is essential to achieve homogeneous growth and reach the optimal commercial size. The more efficient this process, the greater the benefits obtained by producers. From a nutritional standpoint, it is imperative to ensure an adequate supply of Calcium, Boron, and Potassium. Furthermore, it is essential to maintain active photosynthesis during the tuberization period, as it is the source of carbohydrates necessary for tuber filling.
Biorizon Biotech has developed a solution based on all this nutritional and physiological knowledge, providing plants with both the essential nutrients and the natural hormonal signaling and biostimulation necessary for this purpose.

BIORIZON SOLUTION FOR INCREASING THE NUMBER OF TUBERS

For this reason, the Biorizon Solution for this challenge, need, or problem of increasing the number of tubers consists of applying BIOFAT 600 foliar at a dose of 2 L/ha. The application of BIOFAT 600 is relevant from the beginning of the "Hook" phase until the "Flowering" phase. This solution provides plants with key factors directly related to the increased formation of the "hook" at the root tips and, therefore, to the increase in the number of tubers. These key factors are cytokinins, carbohydrates, and jasmonates.

BIORIZON SOLUTION TO INCREASE TUBER SIZE AND WEIGHT

Foliar application:
BIOFIX 2–3 L/ha, one or two applications starting from the "flowering stage" to ensure high levels of calcium and boron in plant tissues.
BIORIZON FINAL 2 L/ha to induce proper signaling that favors the transport of sugars from the leaves to the tubers. This product should be applied mid-way through the "tuber bulking stage".
KOLOR (NEUTRAL, BASIC,...) as a source of potassium, the element responsible for increased carbohydrate production. This product is applied at 2 to 5 L/ha throughout the entire "tuber bulking stage". It can be mixed with BIORIZON FINAL.
PHOTOPOWER 1 L/ha from the start of the "tuber bulking stage". This product improves the rate of photosynthesis and, therefore, carbohydrate production in the leaves.

Drip irrigation
(when possible or available)
PLENTY 5 L/ha every 15 days from the start of the "tuber bulking stage". This product supplies potassium without nitrates and feeds the roots to maintain their growth activity. This will favor healthy aerial activity.

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MAJOR CROP PROBLEMS FOR POTATO PRODUCERS

IMPROVE PLANT HEALTH AND ITS IMMUNE SYSTEM

Potatoes 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 and fewer active ingredients available to farmers to combat all these diseases, and consumers are demanding a safer and healthier source of vegetables.

Plants can defend themselves against pathogens, and there are two factors that must be improved to facilitate their defense: reducing stress in plants, as ethylene can hinder the response and activation of the immune system, and strengthening all defensive metabolisms within the plants.

Potatoes are vulnerable to a wide range of diseases caused by fungi, bacteria, viruses, and nematodes. These can affect the plant at various stages, impacting both yield and tuber quality.

Here are the main potato diseases grouped by pathogen type:

Fungal Diseases

Late blight (Phytophthora infestans)

- Most devastating potato disease worldwide.

Early blight (Alternaria solani)

- Dark concentric spots on leaves ("target spots")

Black scurf (Rhizoctonia solani)

- Causes stem cankers, stunted growth, and black sclerotia on tubers.

Fusarium dry rot (Fusarium spp.)

- Post-harvest disease.

Bacterial Diseases

Common scab (Streptomyces scabies)

- Corky, scabby lesions on the tuber surface.

Soft rot / Blackleg (Pectobacterium spp. Dickeya spp.)

- Soft rot with a foul odor in tubers or stems.

Viral Diseases

Potato Virus Y (PVY)

- Causes mosaic, leaf drop, and yield loss.

Potato Leafroll Virus (PLRV)

- Rolled leaves, stunted growth.

Potato Virus X (PVX)

- Usually mild or asymptomatic.
- Can cause mosaic when combined with other viruses.

BIORIZON SOLUTION TO IMPROVE PLANT HEALTH AND ITS IMMUNE SYSTEM

Biorizon Biotech has developed a solution for this need over the years, and thanks to the properties of one of our microalgae hydrolysates, which contains significant amounts of defensive phytohormones such as salicylic acid, jasmonates, and natural defensive peptides, we can recommend strengthening the potato plant's immune system by applying ALGADEFENSE at a rate of 1.5 L/ha every 2 weeks, either via foliar spray or drip irrigation.

These treatments will help farmers reduce the presence of diseases in crops and, therefore, decrease the need for chemical phytosanitary treatments.

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MAIN CROP PROBLEMS FOR POTATO PRODUCERS

NEED TO IMPROVE SKIN FORMATION AND CROP DRYING FOR HARVEST

Skin formation in potatoes, also known as periderm development, is a vital physiological and protective process that occurs mainly after tuber initiation and continues during its maturation. It replaces the epidermis and acts as the outer skin of the tuber.

Skin Formation Mechanism (Periderm Development)

Skin formation involves the development of three layers in the periderm:

1. Phellogen (cork cambium): meristematic layer that produces new cork cells.
2. Phelloderm (internal parenchyma cells) with some metabolic activity.
3. Phellem (outer cork cells): suberized cells that form the definitive skin.

The process occurs in three key phases:

- Initiation phase.
- Immature periderm phase.
- Skin maturation or hardening.
- Occurs at the end of the tuber thickening phase.
- The phellogen becomes inactive.
- The periderm becomes completely suberized, forming a hard and protective barrier.

Importance of Skin Formation

- Physical protection
- Barrier against pathogens
- Reduction of water loss
- Commercial quality
- Suberin, a complex polyester, is the key component of cork cells.
- Its biosynthesis is regulated by environmental factors, hormones (such as abscisic acid, ABA), and stress situations.

ABA and ethylene are the two most relevant natural hormones in potato skin formation. It is necessary to increase the levels of both within the plant to complete this process and allow for harvest.

This is considered the last step before harvest, but it can be prolonged for weeks. It is not only a process where the potato skin forms correctly, but also a key moment for the last stored carbohydrates in the leaves to be mobilized towards the tubers.

BIORIZON SOLUTION TO IMPROVE SKIN FORMATION AND CROP DRYING FOR HARVEST

For this reason, Biorizon Biotech has designed a solution focused on solving these two problems: rescuing the last carbohydrates present in the leaves and transferring them to the tubers, as well as promoting the formation of healthy skin, which will be a key factor in final commercial quality.

Biorizon Biotech's proposal is to apply BIORIZON FINAL at a dose of 3 to 10 L/ha, depending on whether a gradual cycle closure or a more drastic drying effect on the crop is sought.

These solutions will stimulate the mobilization of sugars from the leaves to the tubers, in addition to activating skin formation.

Application should be carried out between one and two weeks before the planned harvest date; the drier and sunnier the climate, the more efficient and rapid the effect will be.

This solution may present synergy with herbicide applications, if performed.