



The Building Blocks of Life

Maximizing plant potential with amino acids

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What are amino acids?

Amino acids are essential building blocks for all life on earth. Without amino acids, life on earth would never have arisen and would no longer exist. Amino acids consist of hydrogen, oxygen, nitrogen, carbon and sulfur. These are elements that, in a healthy growing situation, are always available for plant growth.

There are about 500 amino acids, divided into several categories. In this whitepaper, we will focus on the 23 proteinogenic amino acids that most affect plant growth.

In plants, amino acids primarily contribute to the important growth and developmental processes such as osmotic regulation, pH buffering, coordination of carbon and nitrogen metabolism, energy supply and response to biotic and abiotic stress.

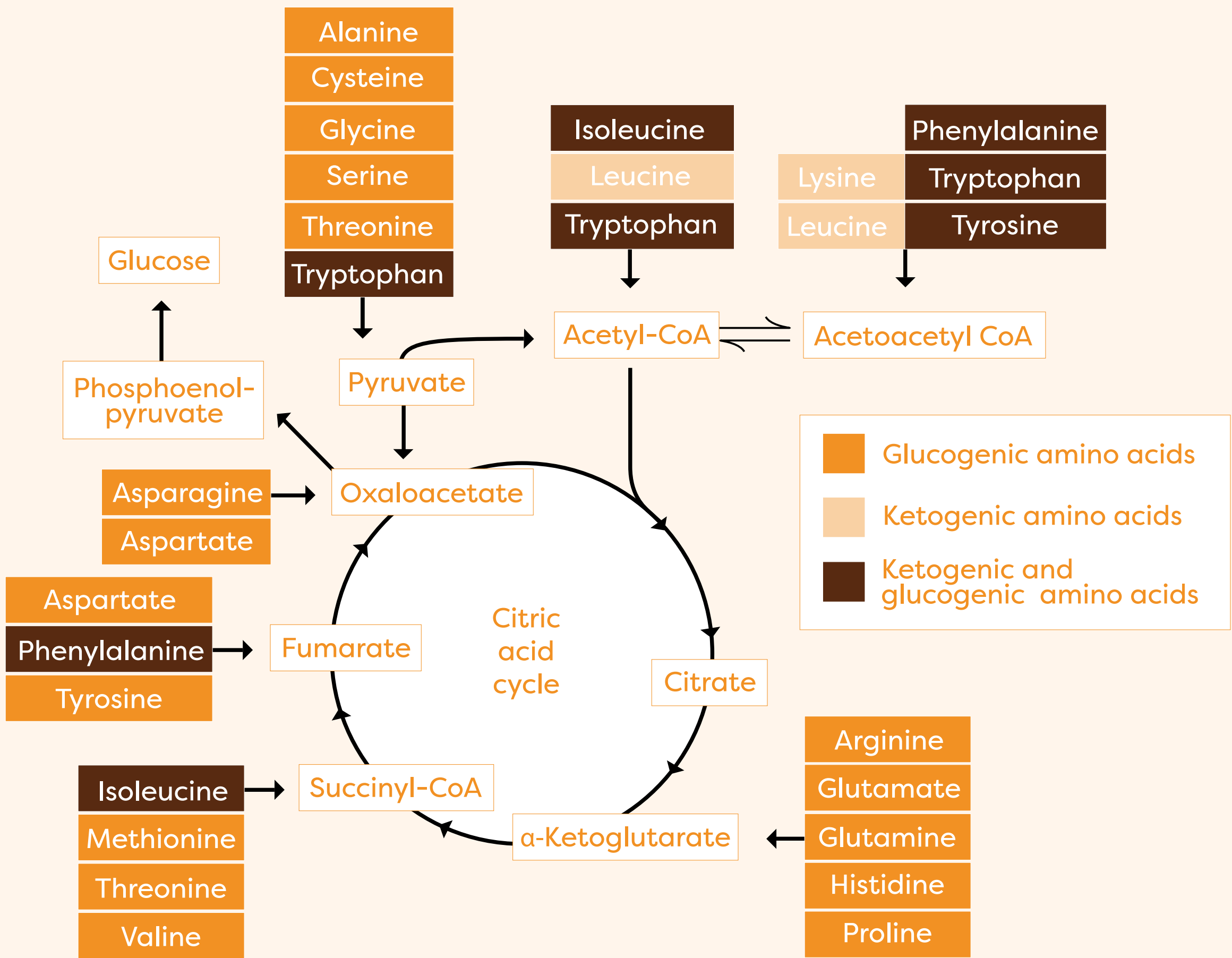
L-asparagine	L-phenylalanine
L-alanine	L-lysine
L-arginine	L-methionine
L-aspartic acid	L-proline
L-cysteine	*L-pyrrolysine
L-glutamic acid	*L-selenocysteine
L-glutamine	L-serine
Glycine (non-chiral, L- variant only)	L-threonine
L-histidine	L-tryptophan
L-isoleucine	L-tyrosine
L-leucine	L-valine

**Some scientists also consider these to be standard amino acids.*

How do plants acquire amino acids?

Unlike humans and animals, plants possess the ability to produce the approximately 23 amino acids crucial for protein construction themselves. The quantity synthesized by the plant is based on various factors: its specific stage of growth, nutrient demand, stress, etc. However, making amino acids consumes a lot of energy. To efficiently fulfill their protein synthesis needs, plants must uptake either individual amino acids or small peptides through their leaves or from the soil. In most cases, the plant must manufacture the amino acid building blocks itself from absorbed nitrogen, water and carbon.

Plants are only able to use L-amino acids, which are suitable for uptake through their foliage or root network. L-amino acids play an important role in the citric acid cycle, also known as the Krebs cycle: a sequence of biochemical reactions by which the plant generates energy for maintenance, growth and production. Therefore, providing supplemental amino acids through the roots or leaves ensures that the plant has sufficient raw materials to produce the important proteins. The resulting proteins and enzymes contribute to the plant’s defense system.



In naturally fertile soils boasting a robust ecosystem, plants primarily derive amino acids from the breakdown of organic matter. However, in modern, high-yield agricultural settings, this process becomes challenging, often resulting in a shortage of naturally occurring amino acids. When plants must allocate energy toward synthesizing amino acids, it detracts from other vital functions.

On nutrient-deficient soils and under less favorable growing conditions, such as periods of stress, plants struggle to produce an adequate supply of amino acids on their own. Moreover, the plant’s own production of amino acids costs a lot of energy. Additionally, the energy-intensive nature of amino acid production by plants compromises other essential functions, including defense mechanisms against diseases and pests that exploit weakened plants. Insufficient amino acids render plants increasingly susceptible to diseases and hinder their growth.

Adding amino acids to plants only makes sense if they are offered in the form of “free” amino acids or small peptides, otherwise the molecules are too large for plant uptake. Large molecules cannot pass through the narrow openings in roots and leaves.

Free L-amino acids, such as those found in Aminocore’s solutions, offer the following advantages:

- Boost energy levels when extra energy is needed to combat the negative effects of abiotic or biotic stress
- Enhance the absorption of other nutritional elements with their chelating action
- Contribute to building an additional energy reserve, promoting better yields
- Help to supplement amino acid content of plants, thus optimizing the functioning of the plant

Why add amino acids to your plants?

Amino acids provide stability to a plant’s growth. In fact, problems arise mainly when a plant “stagnates”. Thus in order to secure your investment, it makes sense to add amino acids from Aminocore while growing your crops.

The functions of amino acids in plants are almost endless, and science is constantly discovering more. Listed below are some of the important effects. Amino acids:

- ☼ increase chlorophyll production;
- ☼ provide a rich source of organic nitrogen;
- ☼ stimulate the production of vitamins;
- ☼ influence several enzyme systems;
- ☼ stimulate flowering;
- ☼ enhance fruit set;
- ☼ increase nutritional value, size, taste and color of fruit;
- ☼ increase brix content (increase in quality);
- ☼ improve resistance to pathogens and pests.

The role of amino acids in abiotic stress

Abiotic stress refers to suboptimal growing conditions, such as extreme temperatures, drought, flooding, pests, diseases or harmful effects of chemical pesticides. Such stressors have a harmful effect on a plant’s metabolism, resulting in a slowdown of its natural production of amino acids due to the high energy demands of this process.

In response, the plant resorts to breakin down existing proteins to make the required amino acids (catabolism). This process requires less energy compared to making its own amino acids (metabolism). However, this self-cannibalization ultimately leads to negative consequences for the plant.

To counteract these effects, it is recommended to apply Aminocore amino acids before, during and after stress-inducing conditions. This proactive approach gives plants the building blocks that prevent and repair the stress effects.

Additional amino acids as a vitamin boost

Furthermore, strategically integrating Aminocore into the cropping schedule is beneficial for stimulating additional growth and promoting a healthy soil environment. Amino acids serve as a nourishing food source for soil microorganisms and leaf-dwelling microbes. Therefore, incorporating Aminocore fosters the development of a more robust ecosystem, ultimately enhancing plant health and vitality.

Higher nutrient uptake through chelation

Arguably, one of the most important functions for amino acids is to enhance the availability of nutrients. Certain nutrients could not be absorbed by the plant due to their molecular structure, ionic charge, etc. Amino acids envelop and bind (chelate) these unavailable minerals so that the plant can still absorb and transport them, as shown in the figure below.

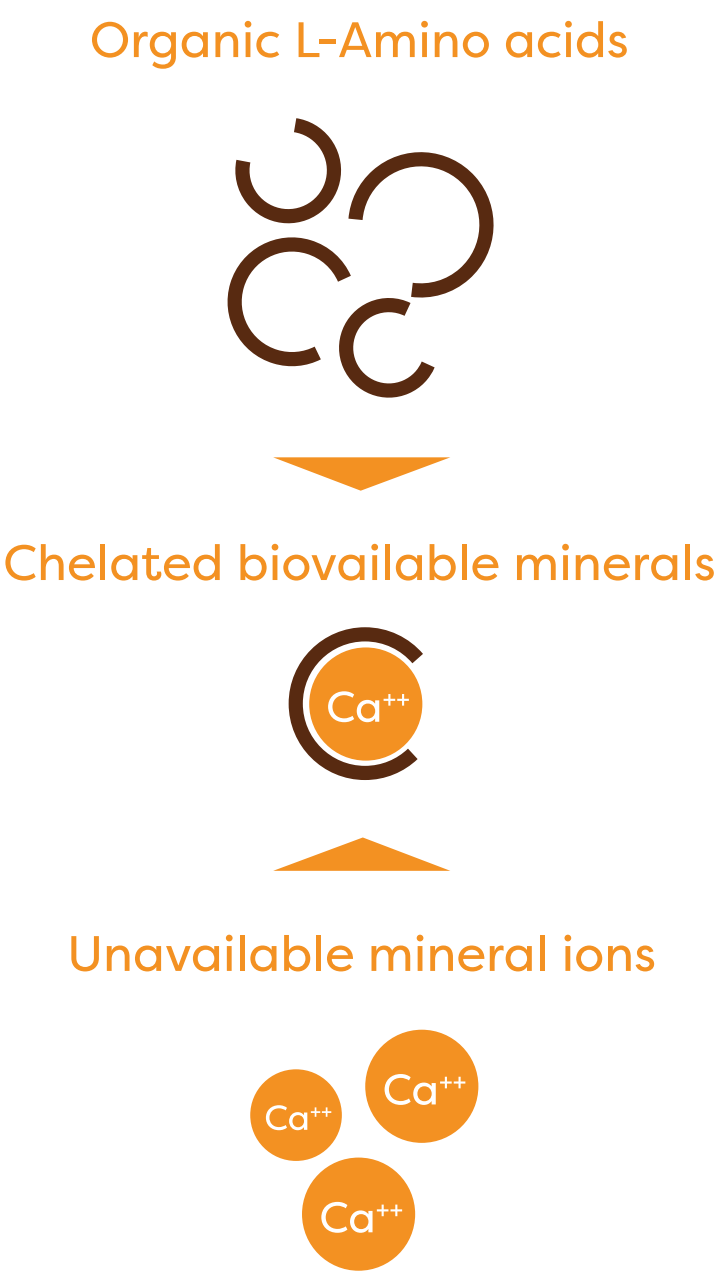
This chelation process facilitated by amino acids renders minerals available for uptake and transport by plants. Amino acids are thus particularly effective in feeding the leaves by transporting minerals through the “pores” of the leaves (stomata).

Besides improving nutrient availability, amino acids also aid in detoxifying plants and soils by binding with excessive metals. This mechanism helps to regulate the levels of various elements and nutrients within the plant.

In our product line, Aminocore offers several amino acid products enriched with nutrients to optimize the plant growth by correcting deficiencies using this chelating effect. Examples include Aminofer (iron), Aminocal (calcium) and Aminobor (boron).

Soil improvement

Furthermore, amino acids in soil provide a rich source of organic matter, which helps improve soil structure and fertility. Amino acids advance the soil’s ability to retain water as well.

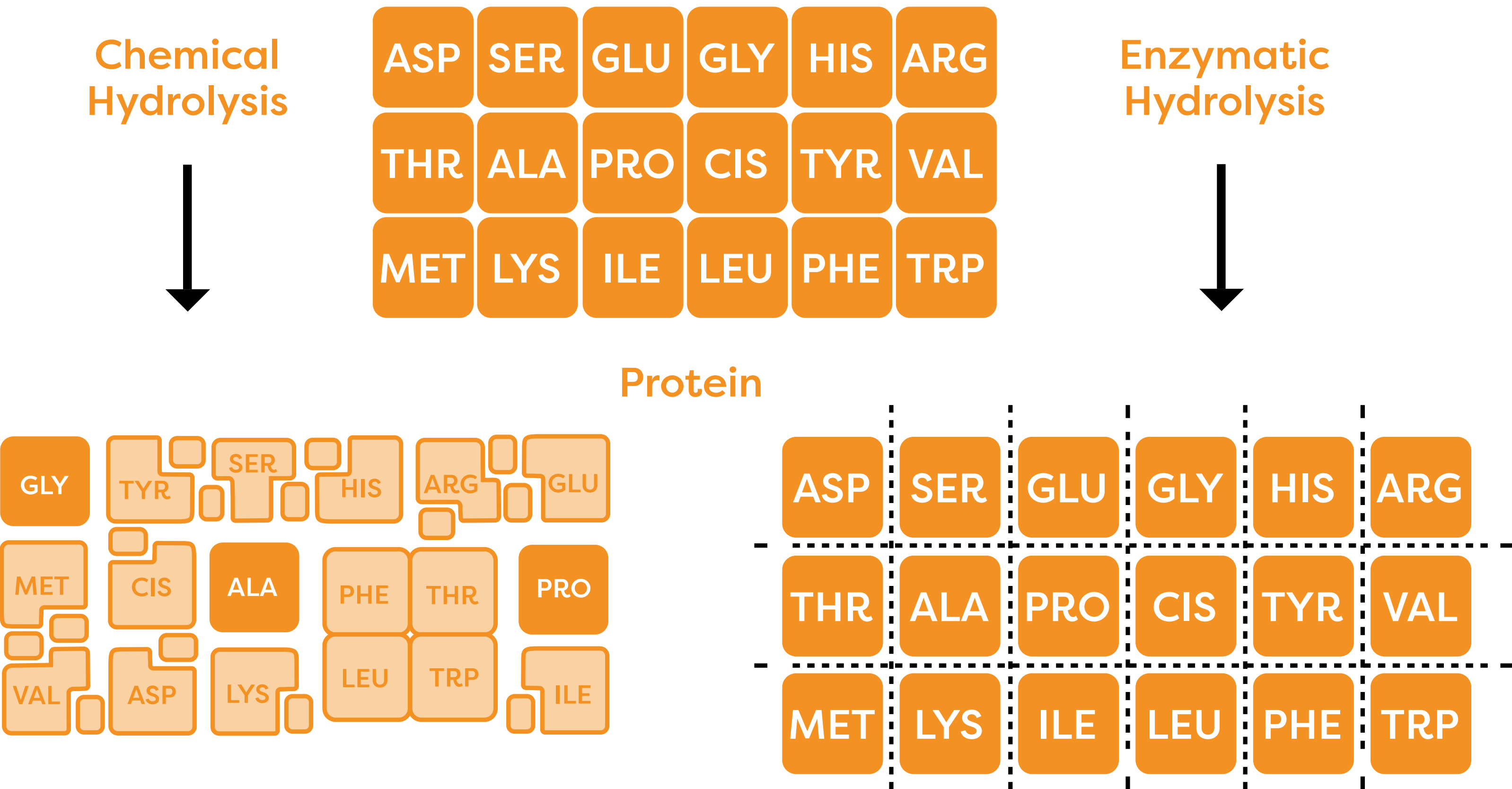


Chemically vs. enzymatically hydrolyzed amino acids

At Aminocore we use pharmaceutical grade raw protein material which is enzymatically treated. Our amino acids are harvested from a natural, protein-rich substrate by using an ion exchange resin filtration and enzymatic hydrolysis. These are mild processing methods that guarantee that our amino acid material contains most of all the N-containing amino acids that a plant requires.

Enzymatic hydrolysis is the process in which enzymes convert organic material, releasing heat. The organic material is broken down into basic components (L-amino acids). While this process is expensive and requires specialized equipment, it guarantees the production of pure, organism-friendly L-amino acids.

Chemically hydrolyzed amino acids	Aminocore, an enzymatically hydrolyzed amino acid
During chemical or alkaline hydrolysis, all proteins are broken down into smaller fragments, but due to the aggressive environment, many amino acids are destroyed or converted to non-plant absorbable D-amino acids.	The mild conditions during enzymatic hydrolysis cause most of the amino acids to assume the plant-absorbable L form. Little to no amino acids are broken down.
Amino acids not intact and in L-form.	All amino acids in the source material intact and in their L-form. L-Free amino acids are considered biologically active.
Chemical hydrolysis instead destroys part of the amino acids in the original material and produces not only an end product with a limited number of different Free amino acids, but the Free amino acids that are produced are partly in the D-form and partly in the L-form. D-amino acids can be phytotoxic and are less desired in an end product.	After the enzymatic process our amino acid solution is filtered and desalted to obtain an end product with a L-Free amino acid content that is among the highest in the market and with a salt content that is among the lowest among competing products.





How to use Aminocore’s amino acids?

Amino acids from Aminocore are suitable for a wide variety of crops. It provides the flexibility to target different segments, fulfill various functions, and capitalize on numerous value propositions. This broad applicability makes Aminocore unique.

Our amino acid products predominantly comprise liquids, except for Aminocore PRO SOIL, which comes in pellet form. Liquid applications are typically conducted via fertigation or drip hose systems. Aminocore prides itself on being a sustainable and circular amino acid solution manufactured through a natural process that requires minimal energy, free from synthetic minerals or additives. A comforting thought when spraying it on to valuable crops!

Moreover, the scent of Aminocore’s amino acids is notably more neutral compared to other amino acids on the market. Thus, it also offers more comfort during application.

However, any product that is organic can contribute to the formation of biofilm, the plaque of agriculture and horticulture. Therefore, it’s needed to monitor this closely and always incorporate (organic) products with a hygiene plan.

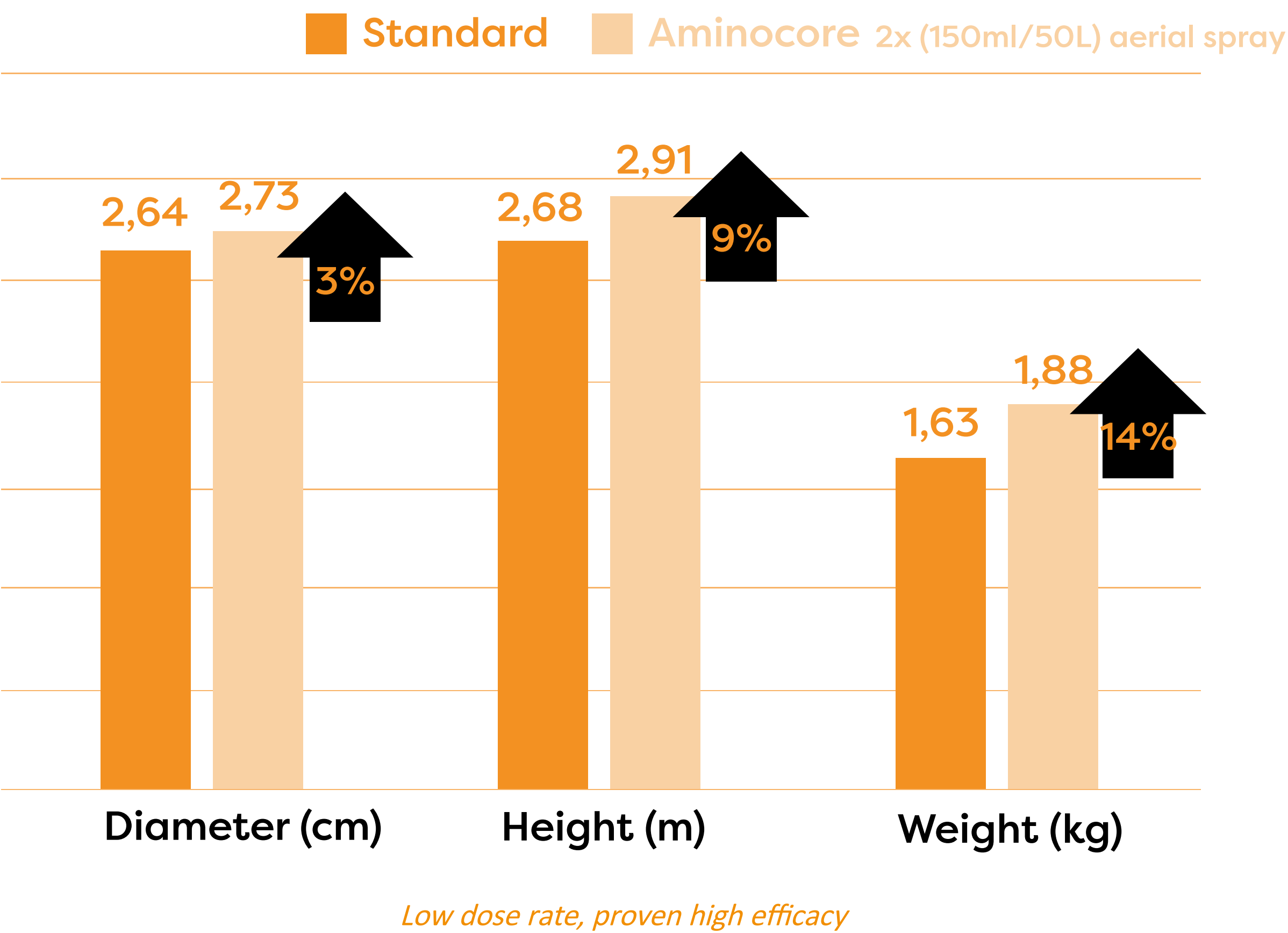
What are the effects of amino acids?

Amino acids are used extensively during metabolic peaks. Pollination and fruiting are two of the most important times for plants that increase metabolic activity. Among the effects brought about by Aminocore are the following:

- L-histidine aids in fruit ripening.
- L-proline increases pollen fertility.
- L-lysine, L-methionine, and L-glutamic acid increase pollen germination and pollen tube length.
- L-alanine, L-valine, and L-leucine improve fruit quality.

In every trial and in every practice Aminocore significantly outperforms conventional amino acids by showing superior effectivity and a better return on investment. Aminocore’s commercial proposition is anchored in its remarkable efficiency and low dosage rates, offering substantial benefits to partners and growers. With an application rate as low as 150 mL per hectare, Aminocore significantly outperforms competitors. At the meantime it is providing distributors and growers with cost-effective solutions and higher margins.

The success of Aminocore’s low dosage has been proven in field research all over the world. One of the experiments took place in Brazil, where over 150,000 hectares of various crops have been tested, on 25 locations spread all over the country. This research yielded impressive results, even in challenging climatic conditions. On that grounds, Aminocore is in collaboration with their local partners now leader for the sugar cane market in Brazil.



Aminocore Sugar Cane results in Brazil

Trial Areas involved	➔	>100,000 ha
Average production of sugar cane (TCH)	➔	85 Mt/ha
Average gain in TCH with 2x150 ml/ha Aminocore	➔	5.5% = 4.7Mt/ha

The impact of Aminocore’s products goes beyond economic prosperity, empowering farmers to adopt more sustainable and environmentally friendly practices. Farmers using Aminocore can achieve significantly higher yields with lower chemical inputs. This translates to substantial cost savings and higher profits. A mere investment of 2-3 euros per hectare can yield an 8% increase in crop yield, amounting to hundreds of euros in additional revenue. The application costs per hectare is how Aminocore outshines its competitors. That’s why Aminocore products meet today’s need for high quality and environmental friendly solutions.

Aminocore in practice

Aminocore has achieved positive results worldwide. Take, for example, the Eastern European Yagodka Farm. This farm has been dedicated to producing planting material for berry crops for over 20 years. Over this extensive period, they have amassed considerable experience and knowledge, which are effectively applied on our farm. The primary objective of the nursery is to produce only the highest quality products. State-of-the-art methods are employed in the technology used for growing seedlings.

Yagodka Farm yields over 500,000 highbush blueberry plants annually, along with blue honeysuckle, cranberries, chokeberries, and other crops. Rigorous standards are applied to the substrate, water, and mineral fertilizers during the rooting and growth of seedlings. Various growth stimulants and foliar feedings are utilized at different cultivation stages.

The nursery consistently conducts scientific research to enhance existing technologies. Upon BIROMARS’ recommendation of Aminocore to Yagodka Farm, they eagerly embraced its application. Yagodka utilized the Aminocore Complex product on 2-year-old highbush blueberry seedlings over two growing seasons (2022 and 2023). In 2022, two treatments were administered in late July and early August, spaced 10 days apart. In 2023, they conducted two treatments in late May and early June, also with a 10-day interval.



Yulia Botyanovskaya, the Chief Agronomist of Yagodka Farm, further elaborates on the effects: “After a short period of time, we saw good, powerful growth on all treated plants. In appearance, the plants looked greener, healthier, stronger. The product helps to obtain healthy, high-quality planting material.”



Is there a risk in overdosing?

First and foremost: the likelihood of overdosing with Aminocore is zero.

Normally, excess of one aspect is a problem with plants. Too much fertilizer can poison the soil and subsequently harm plants, an abundance of pesticides can lead to adverse effects on humans, habitats, and plants alike, while excessive exposure to sunlight may result in burning and dehydration.

However, Aminocore's L-amino acids are not aggressive like fertilizers or pesticides. Therefore, the risk of overdosing and causing damage is eliminated. At Aminocore, we implement additional measures to minimize the salt content in our final products, making it possible to dose weekly.

Furthermore, overdosing is absolutely unnecessary. Even small quantities of Aminocore yield significant effects! Unlike conventional amino acids, which require at least 1 to 2 liters per hectare, Aminocore is proven to be effective at 150 ml per hectare.

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Ready to revolutionize farming practices?

Join the countless growers worldwide who trust Aminocore to deliver exceptional results, higher yields and a brighter future for agriculture. Take the first step towards success with Aminocore today and contact us to discuss the potential!



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