1. COMPOSITION (% p/p)

Free amino acids	45,0%
Total Nitrogen	17,0%
Organic Nitrogen	7,0%
Ammonium Nitrogen	9,5%

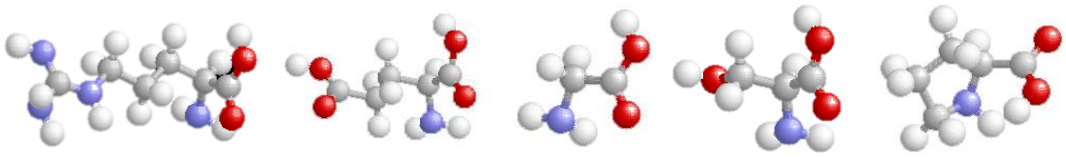
L-Proline concentrated

pH (solution 1%) 4,5

STANDARD AMINOGRAM	
Aspartic acid	**Valine**
Glutamic acid	**Methionine**
Histidine	**Phenilalanine**
Serine	**Isoleucine**
Glycine	**Leucine**
Threonine	**Lysine**
Arginine	**Hydroxyproline**
Alanine	**Proline**
Tyrosine	

2. DESCRIPTION

BOTAMISOL® is an organic fertilizer mainly based on amino acids from double enzymatic hydrolysis (from plant proteins). By this process, peptide bounds are broken, thus releasing biologically active L-α-amino acids. Since amino acid structure remain intact, nitrogen bases (purine and pyrimidine) are still able to exert hormonal related activities (as precursors).



Arginine Glutamic acid Glycine Serine Proline

Main molecules found in Botamisol®

3. MODE OF ACTION

Treating plants with BOTAMISOL® stimulates their own metabolism, particularly when applied during growth and after suffering an environmental stress.

Amino acids are biostimulants with beneficial effects upon plant growth, crop yield and in minimizing damage caused by adverse growing conditions. Since amino acids are nitrogen containing compounds, they take part in plant growth. In addition, given that amino acids are the building blocks for protein synthesis, exogenous supply

results in an energy saving for treated plants, that won't need to synthetize them from nitrogen. As a result, crop yield will be improved.

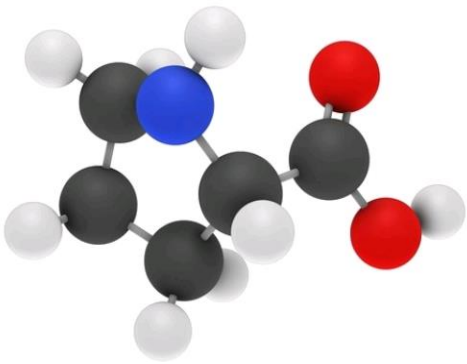
Their role in stress recovery, free amino acids from BOTAMISOL® might take part in such phase in several levels (as osmolytes, regulators of stomata opening, ionic transport, heavy metal detoxification, etc.). In this way, L-Proline found in high amounts in BOTAMISOL® plays a key role in plant stress recovery.

PROLINE FUNCTIONS IN PLANTS:

Hyperosmotic stress is caused by an unbalance in osmotic equilibrium. When plants suffer drought conditions (water stress) or when soils have high amounts of salt (salt stress), plant cells try to alleviate such unbalance between their cytosols and the environment, which lead to a loss of cell volume due to water leakage. Amino acids do play a fundamental role in such situations given their ability of acting as osmoregulators.

Since many stressed plants show a cytosolic increase of Proline (Pro) contents, it might become particularly important in stress recovery. Such overaccumulation of Pro should be due to an increase of its own biosynthesis, to a decrease of its degradation or both causes, suggesting that increased Pro levels might be result of a regulated process. Furthermore, genetically modified plants show an additional role of Pro in plant development and its involvement in stress responses, becoming an important component in tolerance to adverse growing conditions.

Some of known functions of Pro:



PROLINE CHEMICAL STRUCTURE

1. Protein synthesis
2. Environmental stress responses
3. Involvement in oxidative stress: ROS-antioxidant balance; stabilization of redox equilibrium; involvement in hypersensitive response and programmed cell death
4. Stabilization of subcellular structures
5. Chaperone activity
6. Photosynthetic apparatus protection
7. Cell signalling: possible roles in plant development, pollination and flowering
8. Mitochondrial respiration stabilizer
9. Gibberellin synthesis (plant hormones)

In addition, BOTAMISOL® might also contribute to minimize plant pathogen incidence through its contents in **Hydroxyproline**, which has been shown to increase plant resistance to pathogenic attacks due to its involvement in some structural proteins of plant cell walls (extensins)

MAIN ROLES OF OTHER AMINO ACIDS FROM BOTAMISOL®:

Amino acids are generally considered as cationic mineral chelating molecules able to binging and mobilizing soil elements, thus improving nutritional status of treated plants. However, most of them also play specific roles in plant physiology such as

shoot or root development, hormone biosynthesis (precursors) or being involved in plant resistance systems.

Some of those specific functions for amino acids found in BOTAMISOL® are listed here:

Glycine (gly) is the smallest amino acid, with the lowest molecular weight, and thus the main chelating agent. It also improves shoot and leaf development, takes part in resistance systems (as for **lysine**, lys) and, together with **alanine** (ala), they promote pyrrole group synthesis (key components in chlorophyll molecules).
On the other hand, **arginine** (arg) promotes root growth, stimulates polyamine biosynthesis (precursor), which are important in several plant growth and development (e. g. in cell division, normal morphology of plants), and is also involved in phloematic transport and improvement of both nutrient solubility and assimilation (chelating and transporter functions).

Gly and cysteine (cys) are both synthetized from **serine** (ser), which is also involved in several important physiological processes such as phospholipid, nucleotide and plant hormone biosynthesis. Moreover, it has been suggested a key role for ser in roots since it has been shown that some of the total amount synthetized in leaves is further directed to roots.

Glutamic acid (glu) becomes important given its role as a precursor for other amino acid biosynthesis but also because it stimulates plant growth and its involvement in plant resistance systems. Besides, glu increases pollen germination and promotes pollen tube elongation, both related to a greater chance for pollination and therefore for new fruit generation.

4. USE RECOMMENDATIONS

BOTAMISOL® can be applied with normal pulverizing machinery or either with irrigating water. Recommended doses for different crops can be found in the supporting documentation given with the product. When applied to seedlings, it is recommended to use a diluted solution (0.1-0.3%) of 1Kg/Ha, ensuring enough water to cover all plants. In order to favour rooting it is recommended to apply BOTAMISOL® twice (15 days between treatments), directly to the substrate.

5. BENEFFITS OF APPLICATIONS

BOTAMISOL® promotes seed germination, flowering, improves fruit setting, size, colour and sugar and vitamin contents and also hastens its ripening.

Component	Action	Effect on crops
Glutamic acid (amino acid)	▪ Stimulates meristematic growth ▪ Nitrogen source ▪ Glutamate dehydrogenase cofactor ▪ Nitrate reductase coenzyme ▪ Part of chlorophyll ring: increased photosynthetic rate ▪ Involved in plant resistance systems ▪ Increased pollen germination and pollen tube elongation ▪ Precursor for other amino acids such as Pro	▪ Stimulates root leaf and floral growth; direct effect on crop yield.
Proline (amino acid)	▪ Osmotic equilibrium ▪ Favours stomata opening ▪ Synergism with gibberellins (plant hormones) ▪ Involvement in reproductive development ▪ Protection of subcellular structures from oxidative stress caused by hyperosmotic stress (salt)	▪ Increased abiotic stress tolerance (extreme temperatures, drought); osmoprotectant function ▪ Improves pollen resistance to extreme temperatures. ▪ Increased attractive of flowers to pollinators (higher fecundation rates)
Glycine (amino acid)	▪ Nutrient chelation ▪ Part of chlorophyll ring: increased photosynthetic rate	▪ Stimulates root, leaf and floral growth; direct effect on crop yield
	▪ Heavy metal chelation	▪ Decreased phytotoxicity by heavy metals
Nitrogen	▪ Main cell components biosynthesis (amino acids, nucleotides, enzymes, hormones, chlorophyll, etc.) ▪ Lengthening of crop cycle phases ▪ Promotes cell multiplication ▪ Involvement in metabolic processes of synthesis and transfer of energy	▪ Stimulation of plant growth and development ▪ Maintaining of photosynthetic activity ▪ Promotion of fruit and seed development ▪ Increased crop yield