Email: info@heavitech.com
Website: www.heavitech.com
Phone: 0027789015019 or 0027659517769

1.1.NITRO-GRO

Product Name: Nitro-Gro

Product Description: An organic fertilizer that comprises of nutrients (NPK), free amino acids, peptides, and polysaccharides, which, exerts physiological and morphological responses through bio-stimulatory mechanisms. Nitro-Gro stimulates the synthesis of endogenous phytohormones (auxins, cytokinine, and gibberellins), improves root architecture, augments nutrient uptake, modulates nitrogen metabolism and increase total photosynthetic capacity. The resultant is a high-performance plant with higher productivity, higher shoot: stem ratio, total biomass, improves tolerance to abiotic factors and increases yield and quality. Nitro-Gro is a novel fertilizer based on scientific innovation designed to engineer photosynthesis that maximizes plant output and limits the input.

Product Constituents:

Compound	Concentration (g.kg)	Compound	Concentration (g.kg)
Nitrogen	65.1	Lysine	27.06
Phosphorus	46.4	Threonine	14.50
Potassium	71.2	Methionine	3.60
Iron	7.30	Cystine	3.61
Sodium	1.30	Tryptophan	4.63
Copper	0.40	Valine	26.63
Cobalt	0.10	Tryosine	9.40
Zinc	1.80	-	-

Molybdenum	0.07	-	-
Manganese	0.20	-	-
Magnesium	0.20	-	-

PHOTOSYNTHESIS:
1.2. PLANT-PRODUCT INTERRACTIONS

Plant growth and production reflects photosynthesis integrated over the plant's life cycle. Photosynthesis is the conversion of solar energy into chemical energy through a complex system of proteins that consumes appreciable amounts of nitrogen to construct the photosynthetic systems. Nitrogen and photosynthesis are intimately interrelated and fluctuations within nitrogen content, limits plants productions. Nitrogen within the thylakoid is split into the pools of light capture and bioenergetics. The first pool of light capture involves photosynthetic systems II (PSII) and photosynthetic system I (PSI). Light harvesting chlorophylls (LHC) (chlorophyll a and b) facilitates the absorption and comprises of 56% of chlorophyll molecules. PSI comprises of 156 chlorophyll molecules are comprises of 30% of chlorophyll molecules.

The constituents of PSII include the antenna protein CP26 & CP29 which, binds to 63 chlorophyll molecules are accounts for 14% of chlorophylls within the leaf. Chlorophyll molecules contain a ring of porphyrin that has a magnesium atom at the center. Chlorophyll molecules in PSII absorb solar energy and transfer it inwards to the reaction center boosting an electron to a high energy level. The electron is transferred to the cytochrome b6f complex by plastoquinone, then transferred to plastocyanin and finally to PSI through the linear electron flow. The electron passes through ferrexodin reductase which, reduces $NADP^+$to form NADPH. To replace the electron in the chlorophyll molecule, an enzyme complex called oxygen evolving complex splits water in a process term photolysis to release electrons, protons, and oxygen. H^+ions create a proton motive force between the stroma and thylakoid, this passes through the enzyme Adenosine triphosphate (ATP) synthase. Through the process of chemiosmosis, ATP synthase catalyzes the synthesis of ATP. NADPH & ATP are energy molecules required for the assimilation of

carbon in the Calvin Benson Cycle. Capturing of solar energy is the initial step of photosynthesis and requires 37.2 mol. N^{-1}. Plant productivity is subjective to nitrogen content.

The Calvin Benson cycle utilizes high energy molecules (ATP & NADPH) to fix atmosphere carbon into organic carbon mediated by the protein Rubisco (Ribulose 1-5 Bisphosphate Carboxylase/Oxygenase). Carbon dioxide (CO_2) enters the chloroplast through the stomata and diffuses into the stroma. The carbon molecule is bound to Ribulose-1,5 bisphosphate (RuBP), a five-carbon acceptor. These forms an unstable an unstable 6 carbon intermediate that is split into two 3 carbon molecules called phosphoglycerate. The phosphoglycerate is phosphorylated by ATP to form 1,5 bisphosphoglycerate. The 1,5

bisphosphoglycerate is reduced by NADPH into glyceraldehyde-3-phosphate (G3P) which is converted into glucose, amino acids, and lipids to form macromolecules within the plant. Nitro-Gro further enhances the carbon and nitrogen metabolism by stimulating the enzymes involves in the tricarboxylic acid cycle. Increasing the concentration of citrate synthase, isocitric, dehydrogenase and malate dehydrogenase. The stimulation and uptake of nitrogen facilitated by an increased rooting system, increases the CO_2 assimilation, and enhances the translocation of photosynthates via the phloem. The nitrogen is then integrated into the synthesis of proteins involved in photosynthetic systems and synthesis of chlorophyll.

A higher level of Rubulose-1,5 Bisphosphate enables for a higher photosynthetic rate, thus increasing the plant growth, productivity, yield, and product quality.

ROOT ARCHITECTURE:

Root architecture refers to the arrangements of the roots in a soil space. This encompasses primary (lateral & adventitious), root hairs and clusters/nodules. The development of a root system is paramount to fulfil the plants nutrient requirements for optimal physiological processes. To maximize absorption of nutrients, roots hairs increase the surface area of the roots. Root hairs are epidermal extensions that amplify the effective surface area of the root-soil interface. Nutrients uptake via the roots occurs through passive or active transport across a membrane and travel from the soil solution through diffusion or mass flow. Nutrient uptake occurs through root interception, mass flow, and root diffusion.

1) Root Interception: The root surface area encounters the nutrient ions in the soil. This accounts for 1% of nutrient uptake in a plant.
2) Mass Flow: Soluble nutrients present in the soil fraction flow to the root. Nitrate is the ion that is

predominantly absorbed via this mechanism.

3) Root Diffusion: Phosphorus and potassium are absorbed through this mechanism. Nutrients within proximity to the roots becomes depleted. This creates a zone of low nutrient concentration. Nutrients from a zone of high concentration flow to the root zone through the concentration gradient created.

As plants transpire and water levels deplete within the plant, a “water suction” is created, and water diffuses into the roots. Through mass flow and root diffusion nutrients passively enter the rooting system. However, the plasma membrane of the endoderm may block the movement of ions. ATP is phosphorylated to provide energy to actively move ions against the gradient and facilitate entry into the plant.

Nutrient uptake by the rooting system may be constrained by a poorly developed rooting system or the lack of accessible nutrients. Nitro-Gro contains soluble nutrients that is easily accessible for plant uptake. When applied to the soil, the nutrients form aggregates around the rooting system to contain a region of high nutrient content. It further increases the humic matter and carbon content to sustain higher levels of microbial activity. This fulfils the plants nutritional requirements and augments soil productivity. Amino acids within Nitro-Grow stimulate the activation of glutamate receptors (GLRs), which is responsible for root architecture. The GLRs signal and improves root development, resulting a higher nutrient uptake. It further inhibits primary root formation and shifts to lateral root formation to increase root density and nutrient uptake capacity. The amino acids also stimulate transcription genes involved in the transport of nitrate, ammonium, phosphate, magnesium, and iron. Nitrogen assimilation within the plant increases as the activity of nitrate reductase increases. Nitrate reductase synthesis is dependent on energy from photosynthesis (NADPH) therefore, the higher photosynthetic capacity of the plant supports the higher enzyme activity. The amino acid L-Tryptophan serves as the precursor for auxin within the plant. Higher levels of auxin within the plant stimulates the formation of root hairs with higher degrees of elongation. This increases the surface area and absorption capacity of the root. Auxin also increases cell division within the apical meristem, which promotes root elongation. This enables the root to growth into the water table and reduce water stress during unfavorable conditions. Nitro-Gro contains high levels of NPK nutrients in a plant accessible form that augments soil fertility and nutrient status of the plant. Bioactive peptide and free amino acids within Nitro-Gro exert physiological and morphological responses in the plant through molecular stimulation to promote a vigorous rooting system. The amino

acids of glutamate, glycine and cysteine enhances the root morphology by increasing the root length, length & number of secondary roots, increases the number of root hairs and enhances root nodulation to allow for greater nutrient uptake. It further signals root hair to increase the absorption of nutrients. The improved root architecture is obtained through the complexation of nutrients, peptides, and amino acids within Nitro Gro that stimulates root formation and enhances microbial activity.

VEGETATIVE GROWTH:

Nitrogen, phosphorus, and potassium constitute macromolecules that is required in large concentrations for elevated plant growth and productivity. Nitrogen is fundamental for the synthesis of amino acids, enzymes, and proteins, which catalyze biological reactions required for plant growth. Nitrogen levels of a plant controls the plants height, stem diameter, number of leaves, leaf area, and leaf thickness. Phosphorus is paramount to the plant and incorporated in the plant's energy reaction. Phosphorus is transmuted into the form of adenosine diphosphate (ADP) and adenosine triphosphate (ATP), which provides high energy molecules for photosynthesis, nutrient uptake, nutrient translocation, and new plant growth. Phosphorus is also involved in the regulation of vascular tissue formation (phloem and xylem). Potassium is associated with the movement of water, nutrients, and carbohydrates within the plant. It also regulates the rate of photosynthesis by controlling stomata aperture. Potassium further influences the uptake of nitrogen. The levels of NPK indirectly regulate physiological processes within the plant, and deficiencies in these ions has nocuous effects on the plant. In addition, plants convert 2-4% of photosynthetically derived energy into the new plant growth. Up-regulating the energy source to 10% results in a 50% enhancement in the absolute growth during the vegetative growth. The resultant is increasesin the number of leaves, surface area of leaves, stem length and width respectively. The specific nutrient formation within Nitro-Gro provides an immediate boost of nutrients to the plant. The higher levels of nitrogen with the organic fertilizer increases leaf growth as it stimulates the synthesis of proteins that are involved in cell growth, cell division, cell wall and cell exoskeleton synthesis. This correlates to an increase in the size, biomass thickness and photosynthetic surface area of the leave. The resultant is taller plants, with a large foliage. The phosphorus content in Nitro-Gro facilitates for higher energy molecules to up-regulate the photosynthetic capacity. Higher levels of ATP and nitrogen within the plant, increases the rate of fixed carbon and plant energy, which can be shifted into plant growth. In addition, amino acids within Nitro-Gro serve as endogenous phytohormones to bolster plant growth. L-Tryptophan is converted into auxins (indole acetic acid), which promotes elongation of the stem,

roots, and buds. Auxin causes the cells to growth larger and increases productivity. Amino acids in Nitro-Gro further stimulate the synthesis of cytokinin and gibberellins, involved in cell division and elongation. The wholistic effect of Nitro-Gro increases the nutrient status of the plant, augments metabolic functions and elevates productivity. This allows the plant to translocate higher of nutrients to improve yield quantity and quality.

1.3. APPLICATION MODES

SOIL DRENCH

• Dilute 50ml of concentrated Nitro-Gro into 1L of tap water •

Apply over the plant until leaves are wet.

• Apply in 30day intervals

• Apply first application over entire soil area.

• Apply second application as a side dressing or at base of plant.

FOLIAR APPLICATION

• Diluter 20ml of Nitro-Gro into 1L of water

• Apply directly to leaves.

• Repeat this process every 2 weeks.

• Do not spray crops two weeks from harvest.

PRICING:

5 litres : R645,89 (makes 100 litres of high-intensity solution or 200 litres of foliage application)

25 litres : R2310,49 (makes 500 litres of high-intensity solution or 1000 litres of foliage application)

*Please note: for larger orders please contact us. Higher volumes always results in lowered prices. Price does not include shipping

2.1. K^+ BOOSTER

Product Name: K^+ Booster

Product Description: It is an organic plant bio-stimulant which has been scientifically developed on a nano- particle technology. It augments seed germination, nutrient efficiency, tolerance to abiotic factors and fruiting/flowering development through molecular interactions

that activates and increases amino acids, stomatal aperture, photosynthesis capacity, adenosine triphosphate and auxin synthesis

Product Constituents:

Compound	Concentration (g.L)	Compound	Concentration (g.L)
Nitrogen	0.03	Proteins	28.0
Phosphorus	0.12	Tryptophan	0.60
Potassium	52.0	Total Phenolic	0.09
Calcium	0.09	Total Flavonoids	0.09
Magnesium	0.15	Total Tannins	0.01
Sodium	0.11	-	-

2.2. PLANT-PRODUCT INTERRACTION

Photosynthesis:

The high concentration of potassium (K_+) within the K_+ Booster indirectly controls photosynthesis by influencing chlorophyll fluorescence and activation of enzymes such as RuBisCo and ATP synthase. Higher levels of RuBisCo enable the plant to fix higher levels of carbon, thus increasing the plants net productivity. ATP or adenosine triphosphate is the primary energy source of the plant during photosynthesis. During photosynthesis, the movement of protons (derived from the splitting of H2O) from the luminal creates an electrochemical gradient which is referred to as the proton motive force (PMF). Chloroplastic F1-F0 ATP synthase catalyze the synthesis of ATP from the PMF. The introduction of the K^+ Booster increases the rate of ATP synthase, thus enabling for high levels of energy within the plant, this is channeled into photosynthesis. This works in tandem with RuBisCo to produce plants of higher productivity. The K^+ Booster stimulates stomatal conductance by serving as an osmolyte. The stomatal

opening is dependent on bidirectional movement of potassium between the plasma and tonoplast membrane. By applying the K+ Booster at the instructed time of day, H^+ ATPase activity is maximised and results in hyperpolarization of the plasma membrane. This induces the influx of K^+into the K^+channel to stimulate guard cells to open the stomata. This allows for maximum entry of carbon dioxide for photosynthesis.

GERMINATION:

When applied as a pre-treatment to seeds, increases the sucrose metabolism. Sucrose forms a substratum for the synthesis of bio-molecules and respiration. It further increases the enzyme activity of the seeds, thus enhancing germination rates and reducing germination times. Phyto-hormones within the K^+ Booster aid in the seed's acclimation to the environment. It contains a myriad of amino acids (Tryptophan) that serves as the precursor to auxins. A higher level of IAA (auxin) accelerates the sucrose metabolism in plant and increases the plants physiological growth character and vigor.

RESISTANCE TO THERMAL STRESS:

Plants are vulnerable to nocuous effects associated with climate change. Thermal shock to plants results in the formation of reactive oxygen species (ROS) in the form of single oxygen (1O2), superoxide (O2-), hydrogen peroxide (H2O2) and hydroxyl radicle (HO•). Thermal shock perturbs the plants' ability to detoxify ROS. The imbalance created results in a net increase in ROS and leads to photo-oxidative stress that destroys DNA and macromolecules. Anti-oxidants (flavonoids, flavone & phenylpropanoids) within the K^+ Booster function as redox buffers and influence gene expression to mitigate the negative effects of abiotic factors. In conditions of heat stress, the K^+ Booster increases soluble levels of phenols in the plant; this stimulates the bio-synthesis of phenols by upregulating the conversion of L-phenylalanine to trans cinnamic acid. This serves as an ROS scavenger to mitigate the effects of ROS. The phenolic compounds within the K-Booster form complexes with metal ions to catalyze oxygenation, but also serve as electron donors to stabilize unpaired electrons thereby reducing the synthesis of ROS. In addition, the phenolic compounds aid in the accumulation of IAA in the plants levels to ensure photosynthesis and plant growth under unfavorable environmental conditions.

MECHANISM OF ABSORPTION:

The K^+ Booster is a plant bio-stimulant that is to be applied to the plant via foliar spraying. This product is at an optimum pH that facilitates absorption through the stomata of the leaves. By this method, a higher concentration of the bio-stimulant is absorbed and can directly interact with the plant's metabolism. It can also be used as a soil drench to increase soil fertility and microcosm activity to aid in the absorption of other essential nutrients.

2.3. APPLICATION MODES

Foliar Application:

• Dilute 20ml of concentrated K+ Booster into 1L of tap water

• Apply over the plant until leaves are wet.

• Apply 2 to 3 times a week.

• Apply at Dawn or Dusk during high Stomatal Conductance of plants.

Soil Drench:

• Dilute 100ml of K+ Booster into 1L of water

• Apply at the base of the roots

• Repeat this process every 2 weeks.

Application on seeds

• Spray onto seed with diluted mix when inserted into the ground before covering. •

Apply mix every 3rd day until germination.

• Ensure that environment around seed is moist with K+ Booster.

PRICING:

5 litres : R512,85 (makes 50 litres of soil drench application or 100 litres of foliage application)

25 litres : R1501,18 (makes 250 litres of soil-drench application or 500 litres of foliage application)

*Please note: for larger orders please contact us. Higher volumes always results in lowered prices. Price does not include shipping.

3.1. WEED-KILLER

Product Name: Weed-Killer

Product Description: Developed on osmotic drying technology, the BioAge Weed-Killer is a contact organic weed control solution that is safe for utilization amongst children, pets and between vegetables and flowering plants. A ready to spray solution that works through the mechanisms of penetrating the leaf cuticle to inhibit photosynthesis through the disruption of chlorophyll membrane destruction and vascular tissue desiccation. The Weed-Killer has a fast-acting mode and kills all weeds within 24 hours of application.

3.2. PLANT-PRODUCT INTERRACTION

PRIMARY DERMAL LAYER:

The dermal layer in plants is a protective layer that protects underlying tissues of the plant from excessive water loss and pathogenic infection. The plant cuticle forms a protective film over the dermal layer. These composite structures comprise of covalently linked macromolecular scaffolds of cutins and a myriad of lipids and hydrocarbon polymers that are collectively termed the waxy epicuticle. Plant exposure to UV A and UV-B has detrimental effects on DNA synthesis, photosynthetic apparatus, and membrane lipids. The waxy epicuticle reflects a certain concentration of ultra violet light to protects the plants internal organs and maintain homeostatic functionality. The epicuticular wax layer is a hydrophobic and therefore controls the permeability of water into the leaf. This serves as a primary barrier to water loss and thus maintain hydrostatic pressure in the leaf. The BioAge Weed-Killer comprises desiccating agents and alcoholic compounds that degrades the waxy epicuticle and the cuticle of the leaf. The desiccating agent creates a hypertonic pressure that disrupts the internal water balance. This induces the process of plasmolysis (deformation of structure due to dehydration) in the dermal layer of cells. The removal of the waxy epicuticle exposes the dermal layer of cells to abiotic factors (temperature and light) which reduces functionality.

PROGRAM CELL DEATH:

The decrease in hydrostatic pressure associated with a breakage in the waxy cuticle imposes a pressure on epidermal cells. This external stimuli on the cell wall and membrane induces a process called programed cell death. The lysosome within the cell contains hydrolytic enzymes such as proteases, lipase, nuclease, and glycosidase. Under optimal cell functionality, these enzymes recycle macromolecules within the cell. However, when a dehydration pressure is induced on the vacuolar membrane, the lysosome releases the hydrolytic enzymes into the cytoplasm. These cells degrade cytoplasmic components, resulting in rapid and direct cell death. Plant dehydration and cell death reduces the ability of vascular tissue to transport water, solutes, and gases through the plant. Exposure of the cell to ultra violet light destroys photosynthetic apparatus and results in plant death within 24 hours of application.

3.3. APPLICATION MODE

FOLIAR APPLICATION

- Spray directly onto the weeds in garden, patio, gravel, and paths.
- Spray during daylight hours (8am-4pm)
- Apply no more than 100ml/m2

PRICING:

5 litres : R341,90 (direct application)

25 litres : R1168,26 (direct application)

*Please note: for larger orders please contact us. Higher volumes always results in lowered prices. Price does not include shipping.

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