Aspe

MOL

IMPORTED FROM EU

YIELD AND QUALITY

MOL

MOL AMYN

MOL FULVIC

MOL SOLID

MOL COMBI

MOL

MOL | MOL AMYN | MOL FULVIC | MOL SOLID | MOL COMBI

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Aspe MOL

1 / INTRODUCTION

In recent years, scientists, technicians, professionals and farmers have witnessed a real confusion about the so-called humic substances, organic products of very diverse origin: leonardite, plant residues, animals, peat, lignite, etc.

The information available about these products is sometimes confusing and unsubstantiated, which can lead us to make an erroneous choice in the product that interests us, the doses to apply or the most appropriate time for its use, so that the results obtained in many occasions are not the most desired.

With this report, we intend to offer a clearer vision of this type of product so widely used in world agriculture.

We will place special emphasis on the definitions, compositions and effects, so that we can have useful and complete information that allows us to better understand humic substances.

YIELD AND QUALITY

2 / DEFINITIONS

Since the appearance of agriculture, approximately 12,000 years ago (Neolithic) in the lands of the Middle East, the interest in learning about the interaction of organic matter with plants and soil has remained throughout history. Before delving into the effects and properties of humic substances, it would be best to define precisely the terminology that we are going to use.

Soil Organic Matter is one of the most important natural resources, recognized since ancient times as a primary agent in its fertility. It is defined as the totality of organic substances present in the soil, including the remains of unaltered plant and animal tissues, their partial decomposition products, soil biomass, the organic fraction soluble in water and humus.

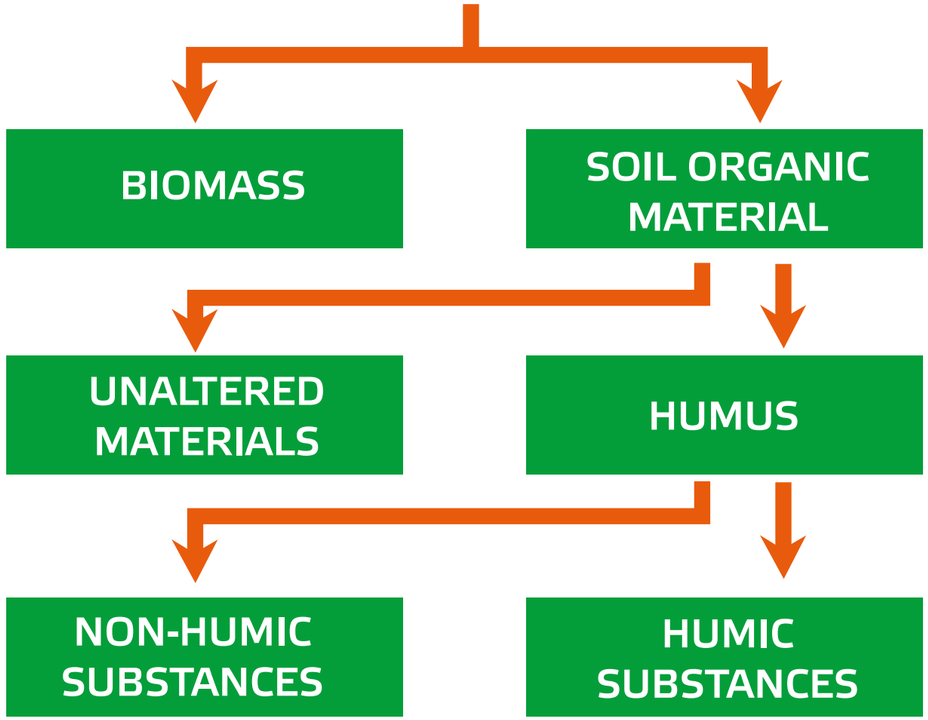
In the 19th century, De Saussure was the first to use the word **"humus"** (in Latin means "soil") to describe the dark-colored organic material present in soil. This author observed that the humus was richer in C and poorer in H and O than the original plant material.

The biomass of the soil is the living organic matter included in the microbial tissues, while the humus would be the mixture of complex organic substances of high molecular weight, colloidal nature and acid properties; sometimes this term is also used as a synonym for organic matter.

Soil organic matter includes a broad spectrum of organic constituents, many of which are derived from biological tissues.

2 / DEFINITIONS

SOIL ORGANIC MATERIALS



We can distinguish two large groups, non-humic substances and humic substances. Non-humic substances include those organic compounds that belong to chemically recognizable species and not exclusive to the soil:

- Polysaccharides
- Simple carbohydrates
- Amino sugars
- Proteins
- Amino acids
- Fatty acids
- Waxes
- Lignin
- Resins
- Pigments
- Nucleic acids
- Hormones
- Organic acids

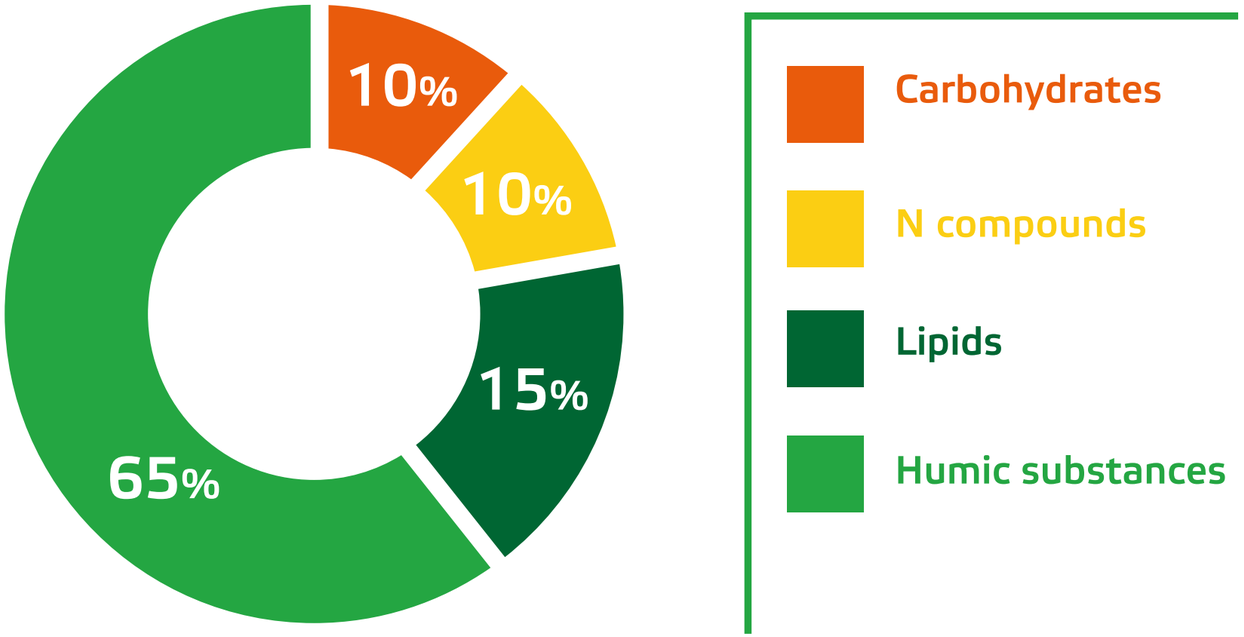
2 / DEFINITIONS

Most of these substances are easily degradable, can be used as a substrate by soil microorgaisms and have a transitory existence in the soil.

Humic substances can be defined as a category of yellow to black substances with high molecular weight and refractory properties, they also have a colloidal nature and resistance to microbial attack. This statement, however, is more a description of humic substances than a definition, and is a sign of the non-specificity that prevails in the study of these substances. These materials result from the degradation of animal and plant remains, and cannot be classified within the category of discrete compounds, as occurs with non-humic substances.

Humic substances are ubiquitous, found in all soils, sediments, and waters. We can make an estimate of the average composition of organic matter in the soil (Figure 2), although we must consider that these percentages are highly influenced by environmental conditions.

AVERAGE COMPOSITION OF THE SOIL ORGANIC MATERIAL.



(Figure 2)

2 / DEFINITIONS

Within these heterogeneous substances, of a colloidal nature that we have called humic substances, **we find two groups of compounds known as humic acids and fulvic acids that we can define as:**

- **Humic acids:** Dark colored organic material that can be extracted from the soil by alkalis and other reagents and also it is insoluble in dilute acid.

- **Fulvic acids:** Fraction of soil organic matter that is soluble in both alkali and acid.

Although humic and fulvic acids largely share the effects on the soil and on the plant, their different structure and physicochemical properties make them more effective for certain functions **(Figure 3).**

Therefore, despite being considered globally as humic substances, humic acids and fulvic acids have many physical-chemical differences that make their behavior in the soil and their physiological actions on plants different depending on the fraction used.

From all the variety of functional groups that humic substances have, the most frequent in the structure of fulvic and humic acids are usually the **–COOH (carboxylic), -OH (phenolic and alcoholic), quinonic and ketonic groups.**

The concentration in which these functional groups are found in humic substances varies according to their origins. The total acidity, and therefore the groups that contribute the most to it **(-COOH and –OH)**, is higher in fulvic acids than in humic acids.

On the contrary, humic acids have a higher percentage of quinone groups.

FULVIC ACIDS	HUMIC ACIDS
− COLOR INTENSITY +	
− POLYMERIZATION LEVEL +	
− MOLECULAR WEIGHT +	
− CONCENTRATION OF C +	
− CONTENT OF N +	
− LIGNITE SIMILARITY +	
+ CONTENT OF O −	
+ ACIDITY AND EIC −	

(Figure 3).

3 / MOL PRODUCTS

COMPOSITION %w/w

Total Humic Extract	24,0
Total Humic Acids	12,0
Total Fulvic Acids	12,0
Potassium (K_2O)	12,0
Total Organic Matter	45,0
pH 5 – 6	

COMPOSITION %w/v

Total Fulvic Acid	22,0%
Free Amino Acids	16,5%
Total Polysaccharides	8,0%

Density: 1,27 g/cc
pH: 5-6

COMPOSITION %w/v

Total humic extract	41,5
Fulvic acid	38,5
Total Nitrogen (N)	3,5
Phosphorus (P_2O_5)	0,15
Potassium (K_2O)	5,0

Density: 1,28 g/cc
pH: 5,7

COMPOSITION %w/w

Total humic extract	85,0
Humic acids	74,0
Fulvic acids	11,0
Potassium (K_2O)	11,0

COMPOSITION %w/w

Organic matter	30,0
Fulvic acids	13,0
Calcium (CaO) (complexed by ligno)	3,5
Magnesium (Mg)	2,5
Boron (B)	0,7
Iron (Fe) (complexed by ligno)	5,0
Manganese (Mn) (complexed by ligno)	5,5
Zinc (Zn) (complexed by ligno)	5,5

4 / ACTIONS OF HUMIC SUBSTANCES

In the mid-19th century, Justus von Liebig established that the principle of plant nutrition was determined by chemical elements called nutrients (carbon, oxygen, nitrogen, potassium, etc.) that plants take in different forms: CO_2, NO_3^-, K^+, Mg^{2+}, and that once absorbed via the roots or air, they constitute the materials, the fundamental bricks from which the vegetal structure is built.

Therefore, humus is not essential "per se" for plants, but it does play an important role by controlling a series of nutrition factors, both in the soil and if we grow in hydroponic conditions.

Then, what are the effects derived from humic substances that makes them practically essential in current agriculture? These effects have been explained by different theories, however, the most accepted by the scientific community is the hypothesis that assigns humic substances direct effects on the plant, having an almost hormonal behavior, and indirect effects acting on the metabolism of soil microorganisms and the dynamics of nutrients in it.

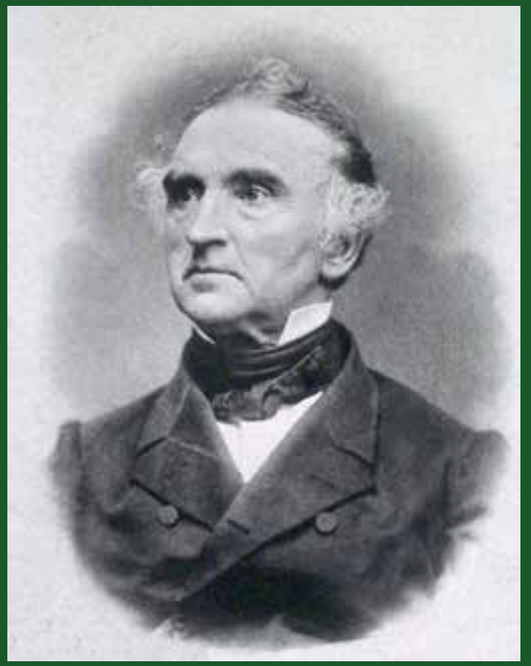


Figure 4. Justus von Liebig

5 / RESPONSES TO HUMIC SUBSTANCES

FRUIT

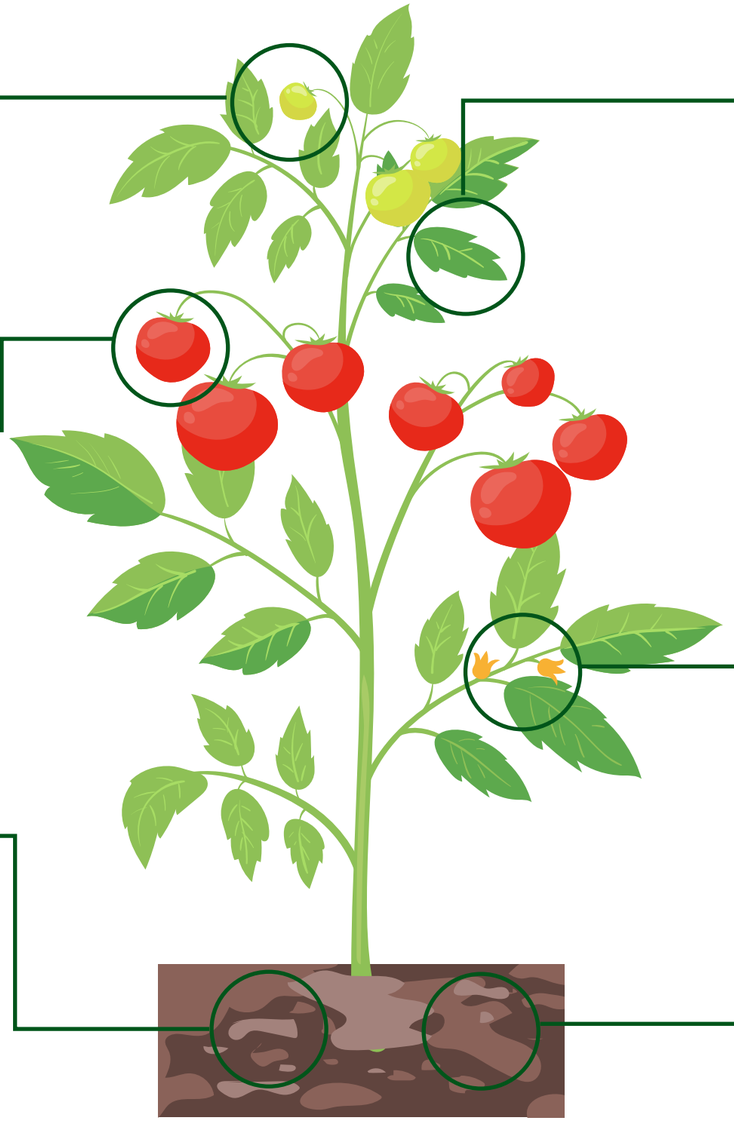
- Setting processes
- Fruit size and weight
- Quality

SEED / SEEDLINGS

- Germination
- “Starter effect”
- Overcoming transplant stress
- Priming effect
- Seed quality

ROOTS

- Root development
- Young root development
- Rooting of cuttings



PLANT

- Plant growth / yield physiological modulation
- Water / nutrient uptake
- Stress response

FLOWERS

- Flowering and sprouting induction

SOIL

- Physico-chemical properties
- Development of beneficial soil microorganisms
- Water / nutrient retention
- Overcoming salinity stress

5 / RESPONSES TO HUMIC SUBSTANCES

Germination % comparation with Control

One of the generally assumed effects of humic substances is their influence on seed germination. Our investigations have shown how MOL and MOL Solid improve the germination percentage of tomato seeds, even under saline conditions (Figure 4).

Figure 4: (Germination % of Daniela tomato variety compared with control)

Rooting Development

The application both to the soil and to the leaves of MOL and MOL Solid improve root growth, influencing the elongation and formation of the first root hairs. The latest investigations consider that humic substances contain compounds that serve the plant as precursors or substrates for the synthesis of hormone-like substances, which would explain the effect that humic substances have on the root and functional development of plants.

Without MOL

With MOL

5 / RESPONSES TO HUMIC SUBSTANCES

Salinity

The results of our investigations have shown how the application of MOL and MOL SOLID reduces the serious effects of salinity, reflected in a decrease in foliar sodium in crops such as table grapes, tomatoes or peppers. (Figure 5)

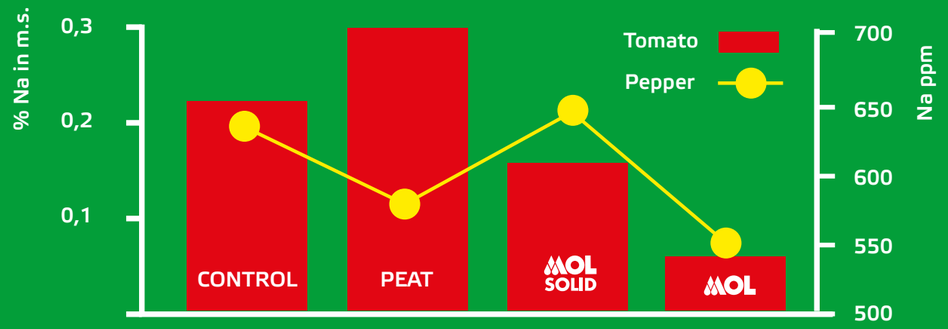


Figure 5. Influence of the humic substances in the Na content on pepper and tomato crop

Iron Chlorosis

In limestone soils, with an alkaline pH, the concentration of micronutrients in the soil solution may be insufficient for the needs of the plants. In this case, the stimulation of plant growth, by the application of humic substances, can normally be attributed to the maintenance of Cu, Zn, Mn and especially Fe in solution, at levels that prevent the appearance of microdeficiencies. The application of MOL and MOL Solid under iron deficiency conditions prevented the appearance of iron deficiency symptoms, such as interveinal yellowing of young leaves and less vegetative development.

LEMON	COPPER (ppm)	MANGENESE (ppm)
CONTROL	6,4 a	40 a
MOL SOLID	9,3 b	52 b
MOL	9,1 b	54 b
LEVEL	***	***

TABLE GRAPE	ZINC (ppm)	MANGENESE (ppm)
CONTROL	29 a	240 a
MOL SOLID	35 b	268 b
MOL	35 b	254 b
LEVEL	***	***

TOMATO	ZINC (ppm)	MANGENESE (ppm)
CONTROL	46 a	42 a
MOL SOLID	58 b	51 b
MOL	58 b	50 b
LEVEL	***	***

Letters a and b indicate statistics differences.

Probability levels:
*p < 0.05
**p <0.01
***p <0.001

Normal values (ppm)	Copper	Manganese	Zinc
LEMON	5 - 15	19 - 100	19 - 100
TABLE GRAPE		31 - 270	31 - 50
TOMATO		50 - 350	20 - 79

Field trials made with MOL and MOL SOLID in fertigation have shown better foliar levels of Cu, Mn and Zn in tomato, citrus and table grape crops.

Figure 6. Field trials made with MOL and MOL SOLID in fertigation have shown better foliar levels of Cu, Mn and Zn in tomato, citrus and table grape crops.

6 / PRODUCTS

COMPOSITION %w/w

Total Humic Extract	24,0
Total Humic Acids	12,0
Total Fulvic Acids	12,0
Potassium (K_2O)	12,0
Total Organic Matter	45,0
pH 5 – 6	

CHARACTERISTICS

MOL is a liquid humic acid corrector made from vegetable matter. **MOL** is a completely soluble microfiltered product.

The application of **MOL** is safe and easy throughout all stages of plant growth, from planting to harvesting.

MOL

PACKING:

- Enhance efficiency of nutrient use
- Increase stress tolerance
- Decrease disease incidence
- Improves sprouting and root system

APPLICATION

FOLIAR APPLICATION

Crops	Applications	Annual dosage
Lawn	5-6 app.	5L / 1.000 m
Ornamental	5-6 app.	100 cc / 20 Lts
Vegetable	3-4 app.	1-2 L / 200 Lts

General dosage 1-3 Lts MOL /200 Lts

SOIL APPLICATION

Crops	Season	Annual dosage
Citrus Fruits	From budding to mid-cycle	100-130 cc/tree
Fruit Trees	From budding to mid-cycle	100-150 cc/tree
Strawberries	Throughout the whole cycle	100 L/Ha
Cut Flowers	Throughout the whole cycle	100-120 L/Ha
Open-air Horticultural Crops	Throughout the whole cycle	80-100 L/Ha
Greenhouse Horticultural Crops	Throughout the whole cycle	100-120 L/Ha
Maize	In the first irrigations	50-80 L/Ha
Olive Trees	Throughout the whole cycle	100-150 cc/tree
Peer Trees	From budding to mid-cycle	150-200 cc/tree
Wine Grapes	From budding to mid-cycle	30-50 L/Ha
Table Grapes	From budding to mid-cycle	70-100 L/Ha

6 / PRODUCTS

COMPOSITION %w/v

Total Fulvic Acid	22,0
Free Amino Acids	16,5
Total Polysaccharides	8,0

Density: 1,27 g/cc
pH: 5-6

CHARACTERISTICS

MOL AMYN is an extremely bioactive growth promoting and soil improving agent in liquid form with a high concentration of natural fulvic acids and amino acids.

MOL AMYN

PACKING:

- OPTIMUM VIGOUR CROP
- INCREASES STRESS TOLERANCE
- PROMOTES ROOT GROWTH
- IMPROVE THE NUTRIENTS UPTAKE AND TRANSPORT
- INCREASES THE MICROBIAL ACTIVITY IN THE SOIL
- YIELD AND QUALITY

APPLICATION

Foliar: 200-300 mls/100 water
Fertirrigation: Drip: 5-10 L/ha

CROPS	Season and annual dosage
Blueberries and Cranberries	10L/ha Apply 3 times; budding, fruit setting and fruit sizing.
Cereals	Minimum dose: 4L/ha once. Can be applied mixed with herbicides. In summer cereals, apply at 35-40 days after seeding.
Fruiting vegetables and cut flowers	4-6 applications from the beginning of the crop, depending on stress and development.
Greenhouse vegetable	Apply through the cycle of the crop of the crop every 7-14 days; foliar or fertigate.
Orchards, Citrus, Subtropical and Olives	Apply and bud break, pre-bloom and once the fruit setting is complete. Use when crops stressed.
Vegetable (melon, watermelon, lettuce,etc)	Leafy crops: Apply regularly in early stage of growth.
Vines	Apply during vegetative growth; repeat 2 to 3 times from post berry set until the beginning of ripening.

Foliar application enhance the effect of insecticides and fungicides.
For crop specific programs contact our technical support.

6 / PRODUCTS

COMPOSITION %w/v

Total humic extract	41,5
Fulvic acid	38,5
Total Nitrogen (N)	3,5
Phosphorus (P_2O_5)	0,15
Potassium (K_2O)	5,0

Density: 1,28 g/cc
pH: 5,7

CHARACTERISTICS

MOL FULVIC is an organic amendment residue from plants, wich added to soil, stimulates the roots growth and microorganisms, and unlocks the nutrients that are not assimilated by the plant (nitrogen, phosphorus, potassium, iron, manganese, copper, zinc ...).

A proper use of **MOL FULVIC** will allow a saving in the dose of fertilizer, thus improving their uptake by the plant, facilitating their transport to the places where nutrients are necessary for the perfect plant development.

MOL FULVIC

PACKING:

MOL FULVIC IS A STRONG METABOLIC ACTIVATOR BECAUSE OF THE HIGH FULVIC ACIDS CONTENT.

- HIGH CONTENT OF FULVIC ACIDS
- INCREASES PLANT GROWTH, YIELD AND NUTRIENT UPTAKE
- INCREASES GERMINATION OF SEEDS
- PREVENTS THE ABIOTIC STRESS

SOIL FOLIAR SEED

APPLICATION

SOIL APPLICATION

CULTURE	STAGE OF APPLICATION	ANUAL DOSE
CITRUS	Spring-half cycle	100-140 cc/tree
FRUIT TREES	Spring-half cycle	100-160 cc/tree
STRAWBERRY	Whole cycle	120 L/Ha
CUT FLOWER	Whole cycle	100-120 L/Ha
OPEN HORTICULTURE	Whole cycle	80-120 L/Ha
GREEN HOUSE	Whole cycle	100-120 L/Ha
CORN	During the first irrigation	50-80 L/Ha
OLIVE TREE	Whole cycle	110-120 cc/tree
PEAR TREE	Spring-half cycle	30-50 L/Ha
GRAPE WINE	Spring-half cycle	30-60 L/Ha
GRAPE FRUIT	Spring-half cycle	70-100 L/Ha

FOLIAR APPLICATION

ENERAL DOSE 1-3 L MOL / 200 L

GRAYGRASS	5 L/1000 m^2	5-6 applications
ORNAMENTAL	100 CC / 20 L	5-6 applications
HORTICULTURES	1-2 L/200 L	3-4 applications

SEED APPLICATION

Submersion of seeds in a 0.05% solution (5ml/10L water), for approximately 5 hours, then dry.

6 / PRODUCTS

COMPOSITION %w/w

Total humic extract	85,0
Humic acids	74,0
Fulvic acids	11,0
Potassium (K_2O)	11,0

CHARACTERISTICS

MOL SOLID is a highly concentrated potassium humate. It is a plant stimulant of the highest quality and improves soil conditions.

MOL SOLID

PACKING:

- ORGANIC SOIL AMENDMENT
- ROOT DEVELOPMENT
- NUTRIENT UPTAKE
- THE GERMINATION OF SEED

APPLICATION

Foliar application

Growth stimulant, and increases foliar fertilizer penetration. **Application:** 150-300 g/1000L water every two weeks during the season

Seed treatment

Stimulation of seed germination and root growth. **Application:** 1kg/100kg seeds

APPLICATION

CROP	OBJECTIVE	RECOMENDED APPLICATION
Soil application		
Cereals, potatoes, legumes (Spinklers and pivot system)	Soil conditioning, root growth stimulation, increasing of soil fertility and fertilizer utilisation	6-8 kg/ha divided into several doses (1-2 kg/ha) during the season and at the time of fertilzer application
Fruit trees (Apple, citrus)	Soil conditioning, root growth, increasing of soil fertility and fertilizer utilisation	8-10 kg/ha divided into several doses (1-2 kg/ha)
In all crops	Soil conditioning, increasing of soil fertility and fertilizer utilisation	6-8 kg/ha divided into several doses (1-2 kg/ha) during the season
Open field vegetable	Soil conditioning, root growth, increasing of soil fertility and fertilizer utilisation	6-8 kg/ha divided into several doses (1-2 kg/ha)
Ornamental plants and tree nursery, turf grass, landscaping (in general)	Soil conditioning, root growth, stimulation, increasing of soil fertility and fertilizer utilisation	8-10 kg/ha divided into several doses (1-2 kg/ha) or 1kg/m^3 during the preparation of substrates
vegetables in greenhouses	Growth stimulant, and increases foliar fertilizer utilisation	150-300g/100Lwater every two weeks during the season

6 / PRODUCTS

COMPOSITION %w/w

Organic matter	30,0
Fulvic acids	13,0
Calcium (CaO) (complexed by ligno)	3,5
Magnesium (Mg)	2,5
Boron (B)	0,7
Iron (Fe) (complexed by ligno)	5,0
Manganese (Mn) (complexed by ligno)	5,5
Zinc (Zn) (complexed by ligno)	5,5

CHARACTERISTICS

MOL COMBI is a product developed by Aspe which includes in its composition Macro and Micronutrients complexes with Fulvic Acids.

FULVIC ACIDS BIOSTIMULANTS FOR IMPROVED NUTRIENT UPTAKE, BALANCED GROWTH AND TO PROMOTE BENEFICIAL BIOLOGY

MOL COMBI

PACKING:

ACTIONS

- IMPROVES THE AVAILABILITY AND TAKE UP OF SOIL NUTRIENTS
- ARE EXCELLENT IN TRANSPORTING NUTRIENTS FROM THE ROOT TO THE PLANT
- ENHANCES FLOWERING AND FRUCTIFICATION
- INCREASES ROOT FORMATION

APPLICATION

1 Enrichment of substrates
Mix 10-20 g. MOL COMBI per m^3 of substrate.

2 Strawberries
Foliar: 30-60 g/100L; 2-6 treatments (total dose per crop: 100 - 200 g/1000 m^2). Do not spray at flowering.
Soil: 50-100 g/1000 m^2 and application, repeat the treatment every 3-5 weeks (total dose per crop: 300 - 500 g/1000 m^2).

3 Vegetables
Foliar: : 20-50 g/L; 2-4 treatments (total dose per crop: 100 - 200 g/1000 m^2). In radishes. Do not exceed concentrations of 10 g/100 L).
Soil: 50-100 g/1000 m^2 and application, repeat the treatment every 2-4 weeks (total dose per crop: 200 - 600 g/1000 m^2). Higher doses will be used on crops of high yield (tomato and cucumber in greenhouse, etc.).

4 Nurseries
Nurseries: applications in spraying concentration 20-40g/ 100L.
Containers: prepare a 0,05% solution (0,5 g/l) and apply at the rate of 200 g per liter of substrate.
Perennials: irrigate with a solution 0,1% (1 g/L) at a rate of 100 - 150 g / 100 m^2.

5 Fruit trees
Foliar: 50-150 g/100L; 2-6 treatments (total dose per year: 3-8 Kg/Ha).
Soil: 0,5-1,5 Kg/Ha and application, repeat the treatment every 2-5 weeks (total dose per year: 4-7 Kg/Ha).

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