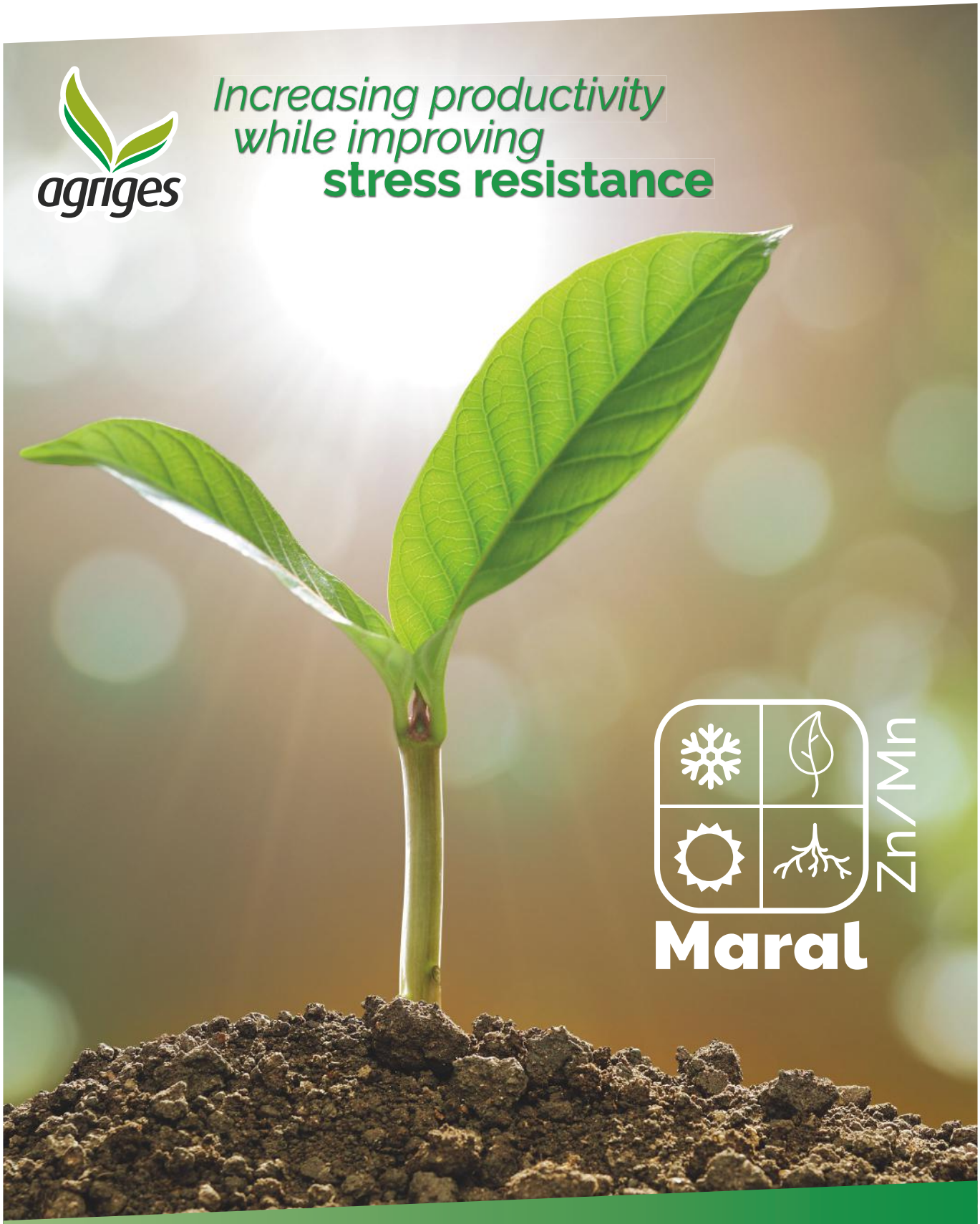
agriges

Increasing productivity while improving **stress resistance**



Zn/Mn

Maral

+ safety

+ production

+ quality

Green Path

Producing more and producing healthy food!

Agriges' answer to the new challenges of modern agriculture is the Green Path project. The projects focuses on the goal of developing safe and sustainable products that allow obtaining abundant, quality and healthy productions while reducing the use of potentially polluting chemicals.

To achieve this goal, the Green Path project involves Agriges' collaboration with research institutes, test centres, universities, cooperatives and farms for the research and development of new formulations.

+ safety | + sustainable | + production | + quality | - chemistry | - pollution

GOAL:

to produce more by improving resistance to environmental stresses

As part of the Green Path project, Agriges has developed Maral Zn/Mn with the aim of increasing plant productivity by improving their resistance to environmental stress factors.

As reported by Raza A. et al. (2019), agriculture is the activity most threatened by climate change, as this is the main cause of biotic and abiotic stress. Although it is difficult to obtain accurate estimates of the effects of abiotic stress on plant production, more authors report that biotic and abiotic stress can reduce the average plant productivity by 65% up to 87%.

Environmental stress factors cause a greater vulnerability of plants and therefore, very often, abiotic stress is the first step for attacks by harmful organisms such as insects, fungi, bacteria and viruses.

Why Maral Zn/Mn?

Maral Zn/Mn is a highly effective and reliable bioactivator based on Zinc and Manganese complexed with RyZea, the exclusive Agriges production technology. Thanks to RyZea,

Maral Zn/Mn ensures plant vitality and productivity at every vegetative stage, in synergy with Zinc and Manganese, very important nutrients involved in a large number of metabolic processes as well as regulating the activity of essential enzymes.

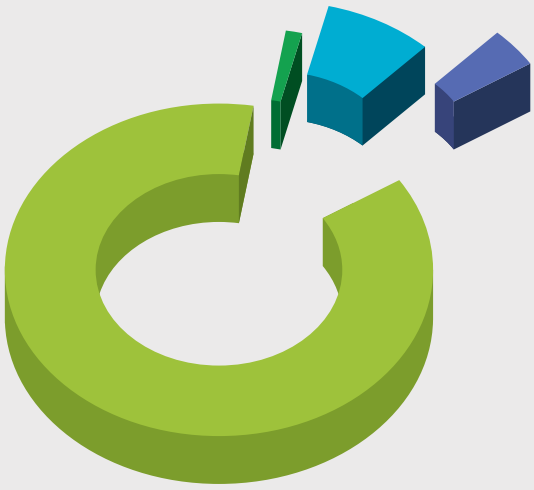
Seaweed extracts enhance the nutritional effect of the microelements and provide numerous molecules with a chelating, anti-stress and revitalising action. In the event of weeding-related stress, Maral Zn/Mn significantly reduces the related stress by stimulating a quick recovery of the plant.

RyZea

RyZea is the production technology that Agriges has developed for the extraction of phytostimulant compounds from three different types of algae, namely: Ascophyllum nodosum,

Fucus spp. and Laminaria spp. During the industrial production, the extraction process is carried out in an extremely "gentle" way, so as not to alter the stability of the phytostimulant algal molecules. I

n fact, no invasive extraction techniques are used, as these might alter the quality of the final product.



- Polysaccharides
- Natural phytohormones
- Nutritional compounds
- Amino acids

RYZEA	Activity	Source	Action	Effect on the plant
POLYSACCHARIDES	**ALGINATES**	Vera et al. 2011	Induce the "oxidative burst" and trigger the expression of the genes involved in defence responses.	**ANTI-STRESS**
	MANNITOL	Stoop et al. 1996 Bohnert and Jensen 1996 Prabhavathi and Rajam 2007	In addition to the nutritional reserve functions, regulates osmotic balance, elimination of free radicals in the cell and resistance to various pathogens.	
	FUCOIDAN	Lapshina et al. 2006 Hearst et al. 2013	A polysaccharide with a high sulphur content that improves the plant's well-being.	
NATURAL PLANT HORMONES	**AUXINS**	Guiry and Blunden 1991	Promote rooting and, consequently, the overcoming of stress factors on the root (root asphyxia, drought)	**STIMULATION OF GROWTH AND PHYSIOLOGICAL RESPONSES DURING STRESS**
	CYTOKININS	Stirk and van Staden 1997 Stirk et al. 2004	Promote chloroplast functionality and delay senescence.	
	GIBBERELLINS	Rayorath et al. 2008b	Induction of alpha-amylase activity and sprout lengthening.	
	ABSCISIC ACID	Sharp et al., 2004 Tuberosa et al., 2002b	Promotes the expression of protective genes, reduces stomatal conductance and increases the root-sprout ratio while maintaining root cell lengthening.	
AMINO ACIDS AND BETAINES	**BETAINES**	Blunden et al. 1996a	Cytoplasmic osmolytes that protect the cell against osmotic stress, drought, high temperatures and salinity.	**RESERVES OF NUTRIENTS, CHELATING AGENTS, PROTECTING OSMOLYTE**
	GLYCINE BETAINE	Park et al. 2006 Cuin and Shabala 2005	Improves the growth and survival of a wide variety of plants under stress conditions.	
	ARGININE	Lea et al. 2006	Accumulates and deposits Nitrogen reserves in the event of stress.	
	PROLINE	Shamsul Hayat el al. 2012	Protects plants from various stress factors and helps them recover more quickly from stress conditions.	
	GLUTAMIC ACID	Rai and Sharma 1991	Together with other amino acids, helps regulate the stomatal opening.	
	GLYCINE	Tamura et al. 2003	A protecting osmolyte during osmotic stress of cell turgor.	

COMPONENTS					
Total Zinc (Zn)	**5.0 %** (w/w)	**7.1 %** (w/v)	**Total Manganese (Mn)**	**5.0 %** (w/w)	**7.1 %** (w/v)

MICROELEMENTS	**ZINC**	Aravind e Prasad 2003	Has stabilising and protective effects against oxidative, peroxidative damage, loss of integrity and alteration of membrane permeability.	**PROTECTOR AGAINST OXIDATIVE STRESSES**
	MANGANESE	Ducic and Polle 2005	Is a cofactor of superoxide dismutase (SOD) and therefore participates in plant defence from oxidative stress, produced by high levels of reactive oxygen species (ROS) and free radicals.	
		Gherardi e Rengel 2003 Millaleo et al. 2010	Manganese deficiency also weakens structural resistance against pathogens and reduces tolerance to drought and heat-related stress.	**STRUCTURAL FORTIFIER**

Field results

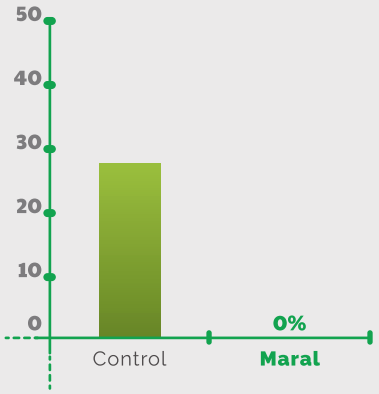
The FTS (Agriges Field Technical Service) team has conducted numerous field trials, testing Maral Zn/Mn around the world.

The product was also tested in the framework of the European BIOFECTOR research project, in which Agriges was the only Italian SME partner. The tests were conducted on different crops of agricultural interest in alternative fertilisation strategies, including those with low environmental impact and biological ones, in numerous experimental areas with the twofold purpose of increasing endogenous plant resistance to stress (biotic and abiotic) and improving the plant productive capacity.

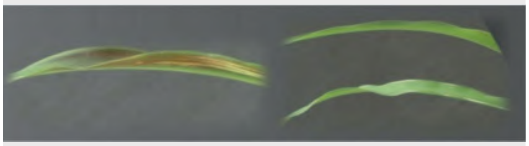
The beneficial effects of Maral Zn/Mn as a protector against cold-related stress, evaluated during the Biofector project, showed the following results:

0% leaf necrosis

While the other samples subjected to cold-related stress showed delays in plant development, leaf chlorosis that became leaf necrosis, with 30-40% damage, Maral Zn/Mn reduced the incidence of leaf necrosis by 0-15%.



Furthermore, the application of Maral Zn/Mn maintained an optimal foliar Zn concentration, such as to completely reduce leaf damage, as shown in the comparison photos below:



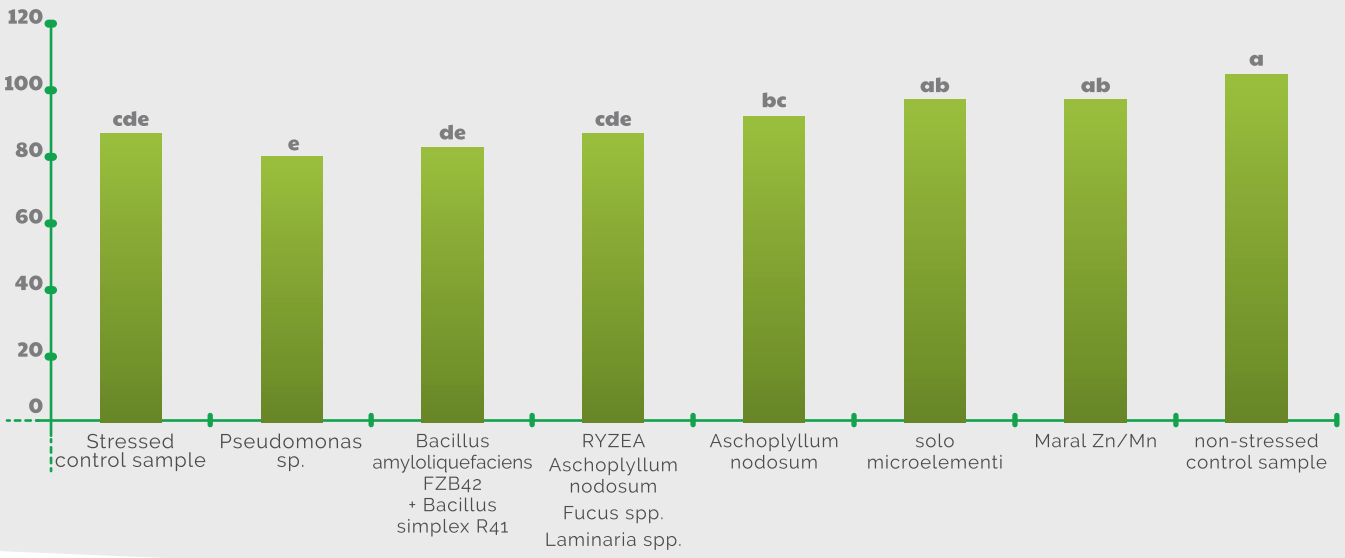
Necrotic leaves
Zn 7.3 - Cu 3.2

Maral Zn/Mn
Zn 23.0 - Cu 24.4

Sprouting and root growth equal to the non-stressed control sample

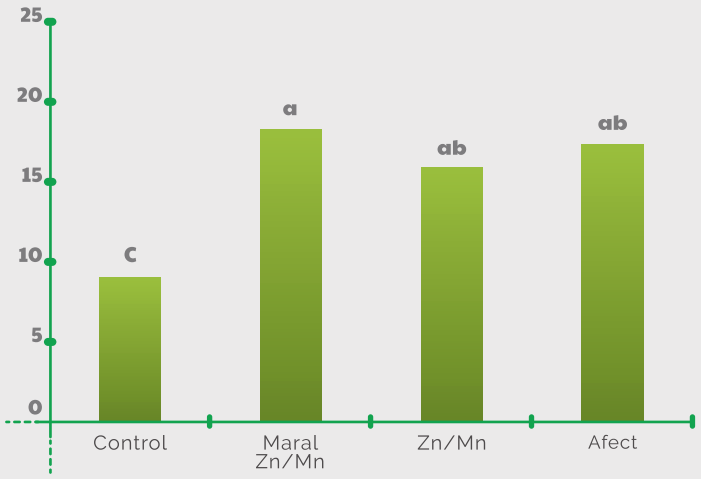
Maral Zn/ Mn improved the sprouting and growth of maize roots subjected to low temperature of the root zone (RZT - Root Zone Temperatures) to levels similar to those of plants that had not undergone stress.

Stressed control sample **Maral Zn/Mn** **Zn/Mn** **non-stressed control sample**



+ 100 %
root length density

The beneficial effects of fertigation with Zn and Mn as such, Algafect (only seaweed extracts/RyZea) and Maral Zn/Mn on leaf necrosis induced by cold-related stress and sprout growth inhibition were associated with a doubling of the root length density (Fig. 3), showing strong effects on root lengthening and on the production of fine roots, which play an exceptionally important role for the acquisition of nutrients.



Development cycle of the untreated plant, which shows stress symptoms such as: yellowing, leaf necrosis, and poor productivity.

Development cycle of a plant in well-being conditions.

(Fig. 3)

Crops	Foliar Application	Dose ml/hl
TREE CROPS	From vegetative resumption, 1-2 applications	100-200
HORTICULTURAL, INDUSTRIAL CROPS	Starting from early development stages	100-200
ORNAMENTAL CROPS	Apply after transplanting every 5 - 7 dd	100-200
Crops	**Application in Fertigation**	**Dose l/ha**
ALL CROPS	Curative applications and/or to raise production level	2-4

WARNINGS

In case of mixture with other products, carry out preliminary miscibility tests. Avoid mixing with cupric products. To avoid unwanted phenomena of product crystallisation, store it at a temperature not lower than 8-10° C.

Formulation
Soluble liquid

Packages
1 L - 5 L - 10 L - 20 L

Density (t=20°c)
approx. 1400 kg/m^3
pH (sol. 6%)
approx. 6.5

Conductivity (only 10%)
approx. 20.0 dS/m

Exclusive Agriges production technology

Foliar application

Fertigation

Allowed in Organic Farming

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