

# The road to a pesticide-free production

Experience our sustainable  
technology based on colloidal  
elements



# Our Company

B+H Solutions GmbH is a nanotechnology company located in Remshalden, Germany.

Since 2004, we have investigated the importance of supplying plants and crops with the necessary amount of trace elements.

We have discovered how to make plants obtain these compounds efficiently, taking advantage of the physical and chemical properties of the materials. The key: nanotechnology.





# Nanotechnology in agriculture

Here are some concepts to understand the nano-world applied to agriculture

## Nanoparticle

Small particle which has a dimension of less than 100 nm (1 nm = 1 billionth of a meter)

## Nanofertilizer

Modified form of a conventional fertilizer within the nano-range intended to improve soil fertility, quality and productivity of the agricultural goods

## Properties in nanofertilizers

- Higher surface area
- More penetration
- More bioavailability
- Very small amounts of fertilizer material to cover a large area

# Importance of surface area

## Bulk material



1 cm in side length

Total surface area =  $6 \text{ cm}^2$

## Nanoparticles



5 nm in side length

Total surface area =  $1200 \text{ m}^2$

The reduced size of the particles allows more opportunity of contact per unit area, which leads to more penetration into the plant and uptake of nutrients.

This technology allows the use of very small amounts of fertilizer material to cover a large area, which helps to save resources and have less environmental impact.

# Enhanced features of nanofertilizers

- Improved solubility and dispersion
- More bioavailable for the plants
- Reduced loss rate of nutrients into soil by leaching or leaking
- Efficient nutrient uptake by the plant due to the small size
- Saving fertilizer material resources
- Low impact on the ecological balance of the soil



# Mission and Vision

## Mission

To use innovation through new technologies in order to provide solutions to the problems faced by the agricultural sector today.



## Vision

Sustainable, pesticide-free growing of vegetable, fruit, cereals and ornamental plants in Germany, Europe and worldwide.



# Our technology

Our company develops metal-based nanofertilizers which possess trace elements, such as copper (Cu), silver (Ag), iron (Fe), boron (B), calcium (Ca) and magnesium (Mg) with nanotechnology.

The key is the higher surface area of the materials within our fertilizers that provides more reaction site among the molecules, which facilitates the metabolic reactions in the plant system.

We provide the plants with the necessary trace elements that make the plants healthy and strong.



# Importance of trace elements

Trace elements are essential for the good development of the plants, without which the crops are defenseless.

Symptoms such as chlorosis, lack of strength and brightness, necrotic spots, susceptibility to infection, etc. are caused by the lack of trace elements. Strong and healthy plants feel well, are not susceptible to disease and deliver the best possible harvest.

Our program consists of a mixture of trace elements that, due to its nature, are provided to the plant in the most efficient manner.



# New technologies in agriculture and friendly to the environment



 AgroArgentum® O-Mix

NK 9-6 EC fertilizer  
naturally reinforced  
with 0.1% Ag  
nanoparticles  
Packaging: 1L



 AgroArgentum® Forte

NK 9-6 EC fertilizer  
naturally reinforced  
with 1% Ag  
nanoparticles  
Packaging: 1L



 AgroArgentum® Endo

2% boron EC fertilizer  
suspension reinforced  
with 1% Ag  
nanoparticles  
Packaging: 100ml



 AgroArgentum® Bor

2% boron EC fertilizer  
suspension reinforced  
with 1% Ag  
nanoparticles  
Packaging: 100ml

# New technologies in agriculture and friendly to the environment



 **AgroCyprum®**

Copper EC fertilizer solution with 3% Cu nanoparticles  
Packaging: 100ml



 **AgroFerrum®**

Iron EC fertilizer solution with 15% Fe nanoparticles  
Packaging: 100ml



 **AgroCalcium®**

Calcium EC fertilizer solution with 20% Ca, 1,5% Mg and 1,5% Si made from microfine ground rock flour  
Packaging: 100ml



 **ESCALibur®**

2% boron, 0,3% copper EC fertilizer suspension reinforced with 1% Ag nanoparticles  
Packaging: 100ml

# Promotion from the German government

**The German Ministry for Economy and Technology sponsored the development of the following R&D - Projects:**

- Development of trace-element-fertilizers composed of nanometals
- Formulation and application method to control the grapevine-disease ESCA



Bundesministerium  
für Wirtschaft  
und Technologie

Gefördert durch: Bundesministerium für Wirtschaft und Energie  
aufgrund eines Beschlusses des deutschen Bundestages.



# ZIM Projects Details



Gefördert durch: Bundesministerium für Wirtschaft und Energie aufgrund eines Beschlusses des deutschen Bundestages.

Type of trace element	Goals	Goal achieved?	Product name
Iron	Works at every pH-value Environmentally friendly Every application type Saves resources (factor 10) Longer lasting effect Better assimilation by plants Cost reduction for farmers	Yes Yes Yes Yes Yes Yes Yes	 <b>AgroFerrum<sup>®</sup></b>

# ZIM Projects Details



Gefördert durch: Bundesministerium für Wirtschaft und Energie aufgrund eines Beschlusses des deutschen Bundestages.

Type of trace element	Goals	Goal achieved?	Product name
Copper	Environmentally friendly Reduction of copper emission by factor of 100 Longer lasting effect Better assimilation by plants Cost reduction for farmers	Yes  Yes Yes Yes Yes	 AgroCyprum®

# ZIM Projects Details



Gefördert durch: Bundesministerium für Wirtschaft und Energie aufgrund eines Beschlusses des deutschen Bundestages.

Type of trace element	Goals	Goal achieved?	Product name
Boron	Find the right formulation	Yes	The logo for ESCALibur features a stylized green figure holding a plant branch, followed by the text 'ESCALibur' in a green, sans-serif font.
Silver	Asses the best application method	Yes	
Copper	Reproducibility in different regions	Yes	
	Evidence of non-phytotoxic effect	Yes	
	Recovery of the grapevine-disease ESCA	Yes	
	Action through plant own defenses	Yes	
	Environmentally friendly	Yes	



# AgroArgentum® 0-Mix

- Optimized photosynthesis, which boosts the growth and development of the plant. More flowering and more harvest.
- Provides the necessary elements, thus, the plant itself becomes more strong and tolerant to stress.
- Less use of phytosanitary products. Production with less residues.



# AgroArgentum® Forte



# Advantages



- It provides the plant with the precise amount of boron, which is an important trace element necessary for the correct development of the plant.
- Optimized photosynthesis, which boosts the growth and development of the plant. More flowering and more harvest.
- Provides the necessary elements, thus, the plant itself becomes more strong and tolerant to stress.
- Less use of phytosanitary products. Production with less residues



**Advantages**

# Advantages



- Provides the plant with the precise amount of iron.
- Helps the plants with iron chlorosis, giving them a healthy green foliage.
- Little dosage needed, a good way to save money and the environment.
- In combination with other products of our catalog, the use of phytosanitary products can be reduced. Production with less residues.



- Provides the plant with the precise amount of copper.
- Helps the plants with copper chlorosis, giving them a healthy green foliage.
- Little dosage needed, a good way to save money and the environment.
- Keeps the plant strong and tolerant to stress.
- In combination with other products of our catalog, the use of phytosanitary products can be reduced. Production with less residues.





- Provides the plant with the precise amount of calcium.
- Helps the plants with calcium chlorosis, giving them a healthy green foliage.
- Little dosage needed, a good way to save money and the environment.
- In combination with other products of our catalog, the use of phytosanitary products can be reduced. Production with less residues.



- Product specially developed to help grapevines overcome ESCA disease.
- Optimized photosynthesis, which boosts the growth and development of the plant. More flowering and more harvest.
- Provides the necessary elements, thus, the plant itself becomes more strong and tolerant to stress.
- Less use of phytosanitary products. Production with less residues.



**Advantages**

# Synergism

All of our products have been developed in such a way that application can be done jointly.

The results and experiences that have been provided by both our customers, as well as from official trials performed by partner companies and in collaboration with research institutions, have shown the synergistic effect between all trace elements.

Each of our products works perfectly by itself but together, the effects are mutually improved.



## Effect of Nanosilver on Seed Germination and Seedling Growth in *Pennisetum glaucum*

Asra Parveen · Srinath Rao

Received: 4 October 2013  
© Springer Science+Business Media New York 2014

determine the shape of the nanoparticles. The seeds treated with synthesized AgNPs showed better germination but the seedling growth of tested specie was affected by exposure to concentrations of AgNPs. Silver nanoparticles may hold significant applications in agriculture and gardening by selectively inhibiting harmful fungi and bacteria presents on seeds and could provide as an alternative source of fertilizer that may improve sustainable agriculture. Thus, nano treated seeds can be used to lower the environmental impacts of chemical fungicides and reduce the cost of agricultural production.



Full Length Research Paper

## Effects of silver nanoparticles in some crop plants, Common bean (*Phaseolus vulgaris* L.) and corn (*Zea mays* L.)

Hediat M. H. Salama

Botany and Microbiology Department, Science Collage, King Saud University, Riyadh, Saudi Arabia.  
E-mail: hoda.salama@hotmail.com

Accepted December 13, 2012



was carried out for 12 days during plant growth. The results showed that small concentrations of silver nanoparticles had a stimulating effect on the growth of the plantlets, while the enhanced concentrations induced an inhibitory effect. However, increasing concentration of silver nanoparticles from 20 to 60 ppm has led to an increase in shoot and root lengths, leaf surface area, chlorophyll, carbohydrate and protein contents of the two tested crop plants. Additionally, the lowest amount of these parameters was found with control plants, but the enhancing level of silver nanoparticles resulting in the reduction of these compounds.

RESEARCH PAPERS - 10TH SPECIAL ISSUE ON GRAPEVINE TRUNK DISEASES

## Endotherapy of infected grapevine cuttings for the control of *Phaeomoniella chlamydospora* and *Phaeoacremonium minimum*

GIOVANNI DEL FRARI, JOÃO COSTA, HELENA OLIVEIRA and RICARDO BOAVIDA FERREIRA

Linking Landscape, Environment, Agriculture and Food (LEAF), Instituto Superior de Agronomia, Universidade de Lisboa Tapada da Ajuda, 1349-017 Lisboa, Portugal



# Academic Publications

Active Ingredient	Trade Name	Manufacturer	Formulation	In vitro conc. max – min (g a.i. L <sup>-1</sup> )	MIC (g a.i. L <sup>-1</sup> )	
					Pch	Pmin
Blad-containing oligomer (BCO)	Fracture®	CEV/ CONVERDE	20% (v/v) BCO	1.00 – 1.69×10 <sup>-5</sup>	0.037	0.111
Elemental silver	BioBac®	M.H.I Compania de Ingenerie	1000 ppm Elemental silver	0.012 – 2.00×10 <sup>-7</sup>	0.004	0.012
Fosetyl-Al	Aliette Flash®	Bayer	74.6% (w/w) Fosetyl-Al	0.667 – 1.13×10 <sup>-5</sup>	0.222	0.222

tion frequency. These results indicate that endotherapy of young grapevines during early stages of infection may be an effective control strategy, especially against the wood pathogen *Pa. chlamydospora*.

MATEC Web of Conferences 290, 03006 (2019)  
MSE 2019

<https://doi.org/10.1051/mateconf/201929003006>

## Current Experience with Application of Metal-based Nanofertilizers

Martin Heinisch<sup>1</sup>, José Jácome<sup>2\*</sup>, and Dan Miricescu<sup>3</sup>

<sup>1</sup>MHI Ingenieurgesellschaft mbH, B+H Solutions GmbH in 73630 Remshalden, Germany; also visiting professor Engineering Faculty, “Lucian Blaga” University of Sibiu, Romania

<sup>2</sup>B+H Solutions GmbH in 73630 Remshalden, Germany

<sup>3</sup>Engineering Faculty, “Lucian Blaga” University of Sibiu, Romania

bioactivity. This paper presents the results derived from the application of metal-based nanofertilizers in different crops of economic relevance, displaying their importance in sustainable agriculture. The trials showed that the metabolic reactions in the plants are enhanced by providing them with the optimum amount of trace elements, which also improves the rate of photosynthesis, increases productivity, and prevents biotic and abiotic stress.

# FFA

## **Our concept for sustainable agriculture caught the attention of the Forum for the Future of Agriculture**

FFA's goal is to stimulate open discussions on the future of European and world agriculture and assess what should be achieved according to two challenges: food security and environmental security.

Our novel fertilization strategy and its benefits got the attention of the FFA and will be presented at the 2020 annual conference in Brussels.



**FORUM FOR THE FUTURE OF AGRICULTURE**



25.03.2019 – 12:37

## **Pflanzenanbau ohne Fungizide / Schwaben entwickeln nachhaltiges Konzept für gesünderes Obst und Gemüse**

*Stuttgart (ots) -*  
und Picotechnol  
Technologie ihre  
und Gemüse oh  
anzubauen und  
bringen. Elmar E  
und Prof. Dr.-Ing

14.05.2019 – 10:44

## **Nachhaltige Landwirtschaft: Konzept durch Europäisches Patent geschützt**

st aus München kam am  
das Europäische  
ide in Remshalden bei  
n die beiden  
esellschafter, Elmar

27.06.2019 – 16:47

## **Pestizid-freie öffentliche Grünanlagen und Privatgärten sind machbar**

*Stuttgart (ots) -*  
aktuelle deutsch  
(PflSchG) in Kra  
gesetzlich gere  
Parks und Gärten  
Golfplätzen - Fr  
Grünanlagen in  
Gebäuden(Inne  
Freizeitplätzen,

12.08.2019 – 16:32

## **Gift und Pestizide sind passé / Urban Farming - ein Weg zu unbelastetem Essen**

*Stuttgart (ots) -*  
eine Millionen S  
Deutschland. La  
Magazins "STE  
Hobbygärtner a  
6.200 Tonnen P  
dafür über 60 M  
auch anders: "I  
es ums Essen .

20.01.2020 – 10:44

## **Schwäbische Tüftler erfinden Eisendünger neu**

*Stuttgart (ots) -* Eisendünger - ein ganz heißes  
Thema bei Landwirten und Hobbygärtnern.  
Grund: Viele Kulturpflanzen, Stauden, Blumen  
und Rasen benötigen ausreichend das  
Spurenelement Eisen. Bestehende Produkte  
haben Nachteile, kein Produkt ist richtig gut.  
Eisensulfat-Dünger, z.B. ist hochgiftig. Beim  
Ausbringen sollte Schutzkleidung getragen  
werden, da Eisensulfat-Dünger den Wirkstoff  
Eisen-II-Sulfat enthält. ...

# Press releases

- Cultivation without fungicides / Swabians develop sustainable concept for healthier fruits and vegetables.
- Sustainable agriculture: concept protected by European patent
- Pesticide-free public and private gardens are feasible
- Poison and pesticides are a thing of the past. Urban farming - a path to unencumbered food
- Swabian inventors reinvent iron fertilizers

# Crops

All the trace element fertilizers are suitable for any cormophyte, that is, any plant differentiated into roots, shoots and leaves, and among this classification, all crops of economic importance can be found.



**Vegetables**



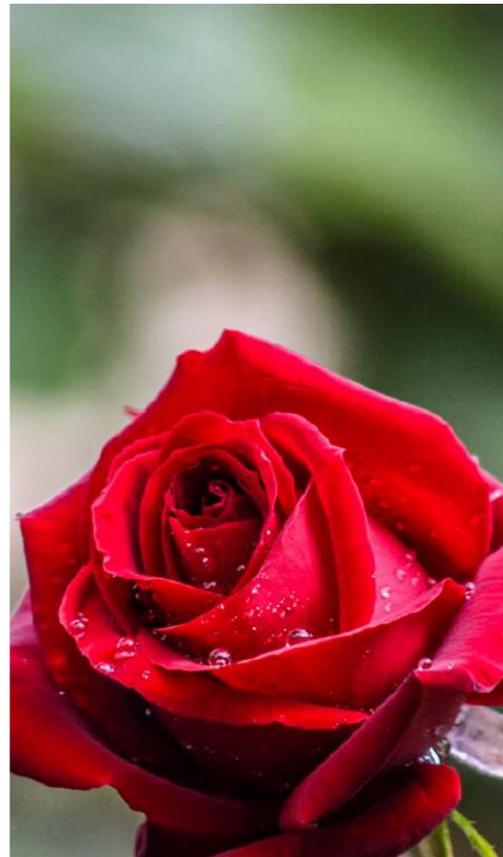
**Fruits**



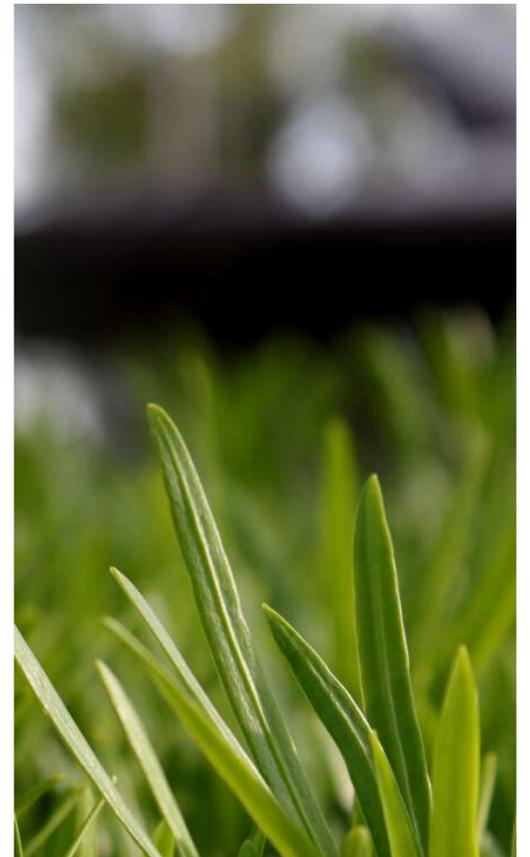
**Cereals**



**Berries**



**Flowers &  
Ornamentals**



**Turf**

# Application

The nature of the products makes them very easy to adapt to the farmer needs, situation and infrastructure.



**Irrigation System**



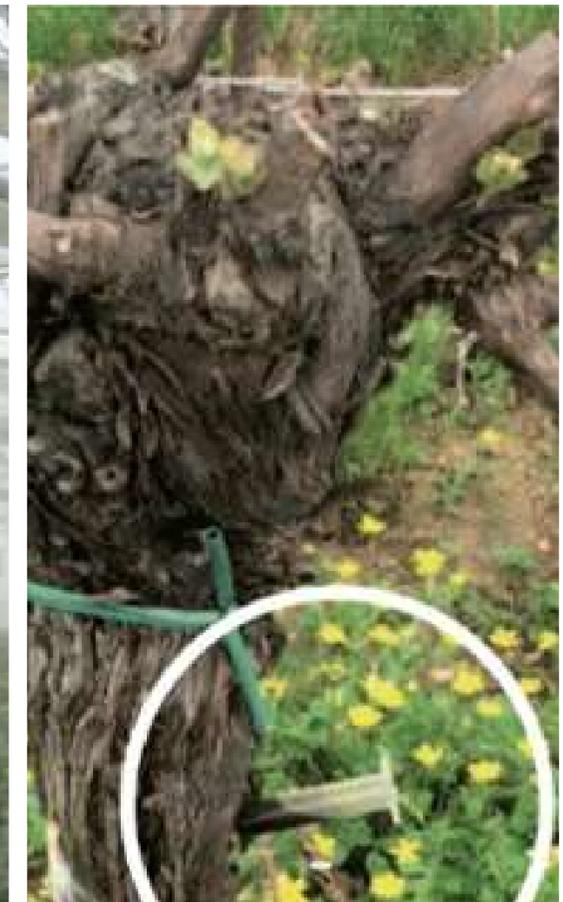
**Drip Irrigation**



**Field Sprayer**



**Cold fogging**



**Endotherapy**



# Protocols

Crop	Application type	In relation to	AgroArgentum® Bor	AgroCyprum®	AgroFerrum®	AgroCalcium®
Cabbage, lettuce, cauliflower, broccoli, bok choy, carrots, radish, beet, etc.	1 foliar treatment after transplant. 2nd foliar treatment 2 weeks later. Repeat every 4 weeks until harvest	1 hectare	100 ml	30 ml	40 ml	1 L
Tomato, zucchini, cucumber, eggplant, sweet pepper, green beans, etc.	1 foliar treatment  1 with every irrigation cycle	1 hectare	monthly: 150 ml  weekly: 100ml	monthly: 20 ml  weekly: 35ml	separate injection/dosatron or via drench weekly: 100ml	-  weekly: 1.5 L
Roses, orchids, geraniums, chrysanthemums, gypsophila, etc.	1 foliar treatment or per irrigation weekly	1 hectare	150 ml	20 ml	50 ml	Irrigation only: 1.5 L



# Protocols

Crop	Application type	In relation to	AgroArgentum® Bor	AgroCyprum®	AgroFerrum®	AgroCalcium®
Pome fruits, stone fruits, citrus, avocado, mango, etc	1 foliar treatment at the beginning of flowering 2nd foliar t. 2 weeks later 3rd foliar t. 1 month later	500 L water	100 ml	30 ml	40 ml	-
Vines	5 foliar treatments per year Last treatment before winter: duplicate dose	200 L water	100 ml	20 ml	50 ml	1 L
golf/football lawns	1 foliar treatments once per week Last treatment before winter: triplicate dose	250-400 L water	100 ml	30 ml	50 ml	1 L

**Contact us to receive a specific protocol for your needs**

# Experiences with our program



Control



In this endive field, B+H Solutions' program allowed for a 10-days-earlier harvest and less failure.

# Experiences with our program



Production average in Gemüse-Bösiger Niederbipp, Switzerland in 2017 was 51 kg per square meter.

Production average of 2018 (with our system) was 62 kg per square meter, 21.6% more harvest.

# Experiences with our program



B+H Solutions'  
Program in bell  
pepper (Spain, 2019)

No infected plants  
and record harvest

# Experiences with our program



Control area (left) vs. treated area (right) in the same rose variety in Cotopaxi, Ecuador (March 2019).

B+H Solutions' area had longer stems, larger shiny dark-green leaves and larger buds.

# Experiences with our program



Application started



2 months later



3 months later

Grapevines healthy, green and with excellent fruit set after the treatment with the trace element mix (Italy). No fungicide treatments.

# Experiences with our program



Massive flowering formation and fruit set with the B+H Solutions' program in cucumber (Spain, 2019).

# Experiences with our program



Used from the very beginning, our concept allows a healthy start and a massive root formation. This Spanish grower is very happy to transplant seedlings after 17 days in perfect condition.

# Experiences with our program



This Chrysanthemums greenhouse in Austria has high quality production with no signs of stress from beginning to end.

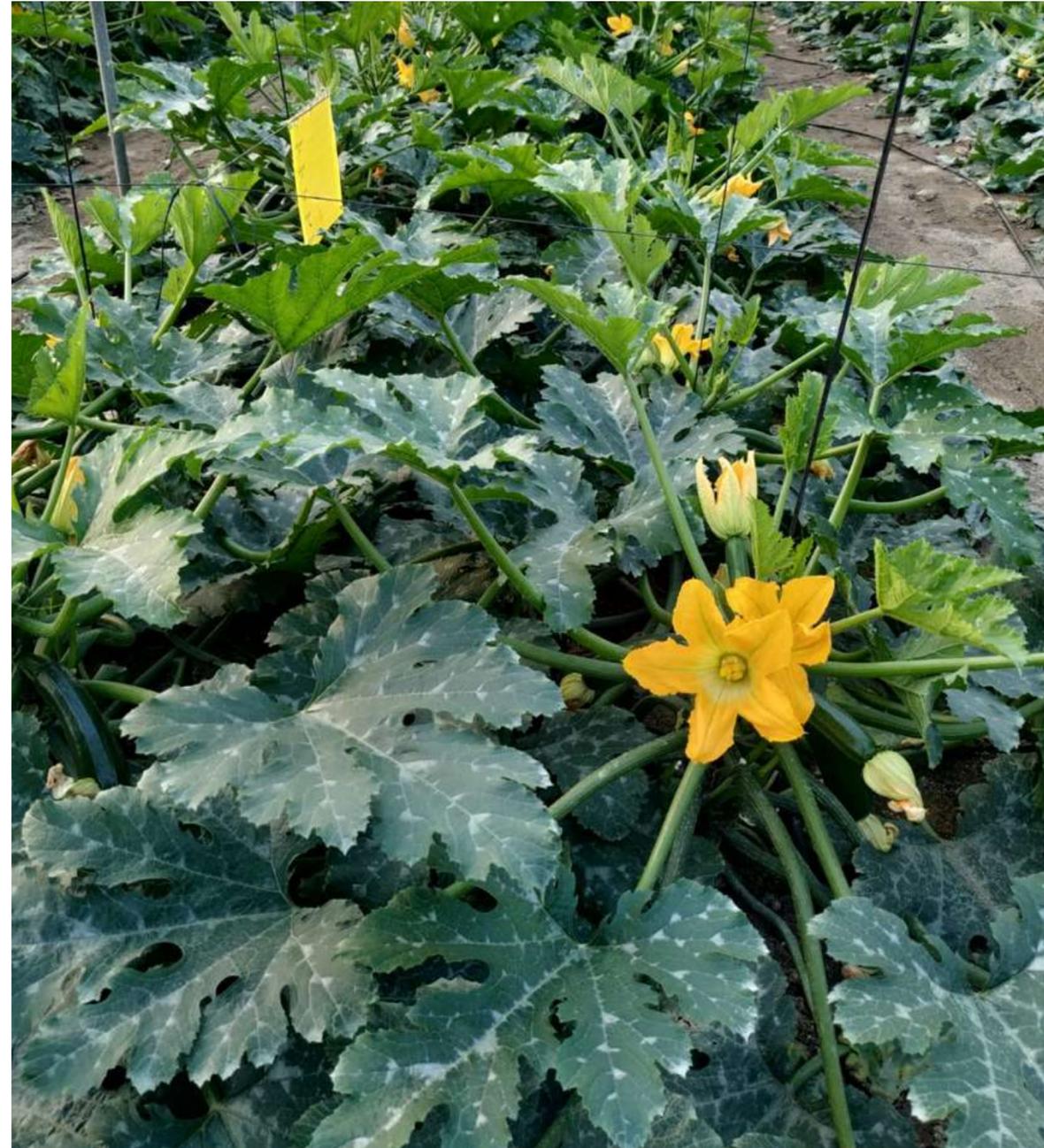
# Experiences with our program



Before B+H Solutions' program (left) and after (right) in vine.

The mixture of colloidal metals could help the plant to recover from the ESCA disease in more than 90% of the treated vines.

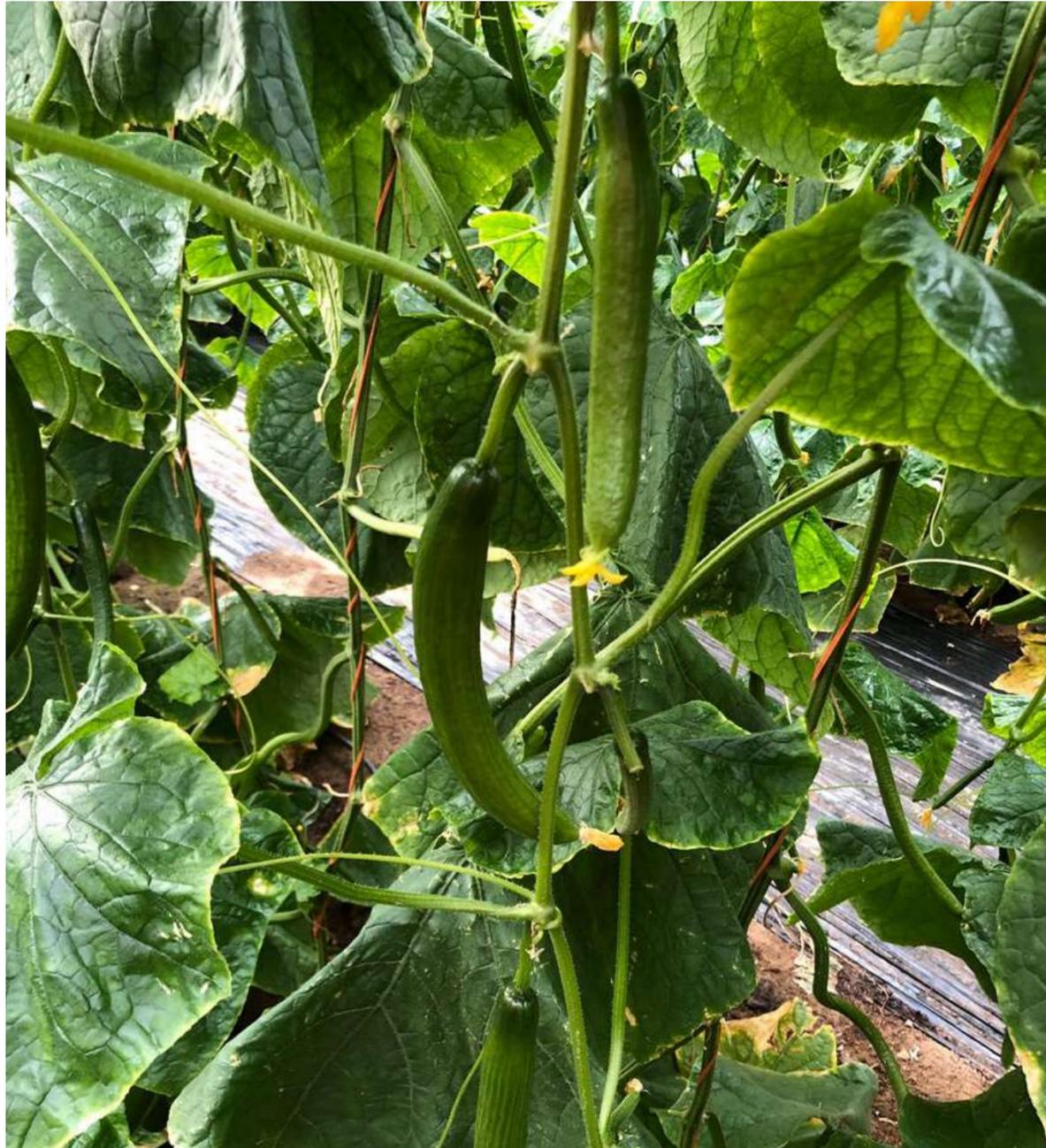
# Experiences with our program



This producer makes 1400 kg of zucchini every day per hectare with our program.

Average zucchini Brix in the production is 4.0 (normally this value is between 1.9 and 2.2).

# Experiences with our program



The structure of the greenhouse of this customer in Almeria Spain cracked because of the weight of his cucumber production.

They produce 15,000 kg per week in an area of 13,000 square meters.

# Experiences with our program



11 months after the start of the campaign, this egg plant crop in El Ejido, Spain was very stressed (left). After 20 days with our program, plants became vital, strong and healthy, and were not interesting to pathogens anymore (center and right).

# Experiences with our program



This lawn in southern Germany in May 2018 was highly affected by pathogens.

After application of the mixture of colloidal metals, by mid-June 2018 the turf grass was in optimal condition.

# Catalog



 AgroArgentum® 0-Mix  
Package: 1L



 AgroArgentum® Endo  
Package: 100ml



 AgroArgentum® Forte  
Package: 1L



 AgroCyprum®  
Package: 100ml



 AgroArgentum® Bor  
Package: 100ml



 AgroFerrum®  
Package: 100ml



 AgroCalcium®  
Package: 5L



 ESCAlibur  
Package: 100 ml

Contact us for pricing and purchasing options in your region

# Cost effectiveness

- With your high-quality production, your crop will be of high value.
- Harvest yield is much higher.
- Your crop will make less waste.
- There is a significant reduction on the use of phytosanitary products. Customers have reduced and eliminated these completely from their inputs.
- The nature of our fertilizers allows the use of small amounts of material. In comparison, you will need much less material to cover the same area than with conventional fertilizers.



# Conclusions

- B+H Solutions GmbH is a company committed to finding solutions to the problems faced by the agricultural sector today, using the most advanced and innovative technologies.
- Our products are a result of the joint efforts of our highly professional team and have been demonstrated to be very effective and environmentally friendly. Thanks to their improved properties, our solutions provide perfect tools for sustainable agriculture.



**To sum up**

# Conclusions

- We have demonstrated repeatedly that residue-free production is possible with our concept, in greater quantity and with the best quality.
- The company will continue with its efforts in research and development of new technologies applied to agriculture. As always, we will focus on the creation of ecological products that will bring the maximum level of economic success to the farmers.



**To sum up**

# Get in Touch



**B+H** Solutions GmbH

**Schnaiter Straße 11-13  
D-73630 Remshalden  
info@bh-solutions.eu  
www.bh-solutions.eu**