

# HALO<sup>®</sup>

PLANT BOOST

[www.halo-harpin.com](http://www.halo-harpin.com)



**HALO is the first product of an entirely new class of plant growth additives utilising the Harpin Alpha Beta protein, a powerful new plant technology.**

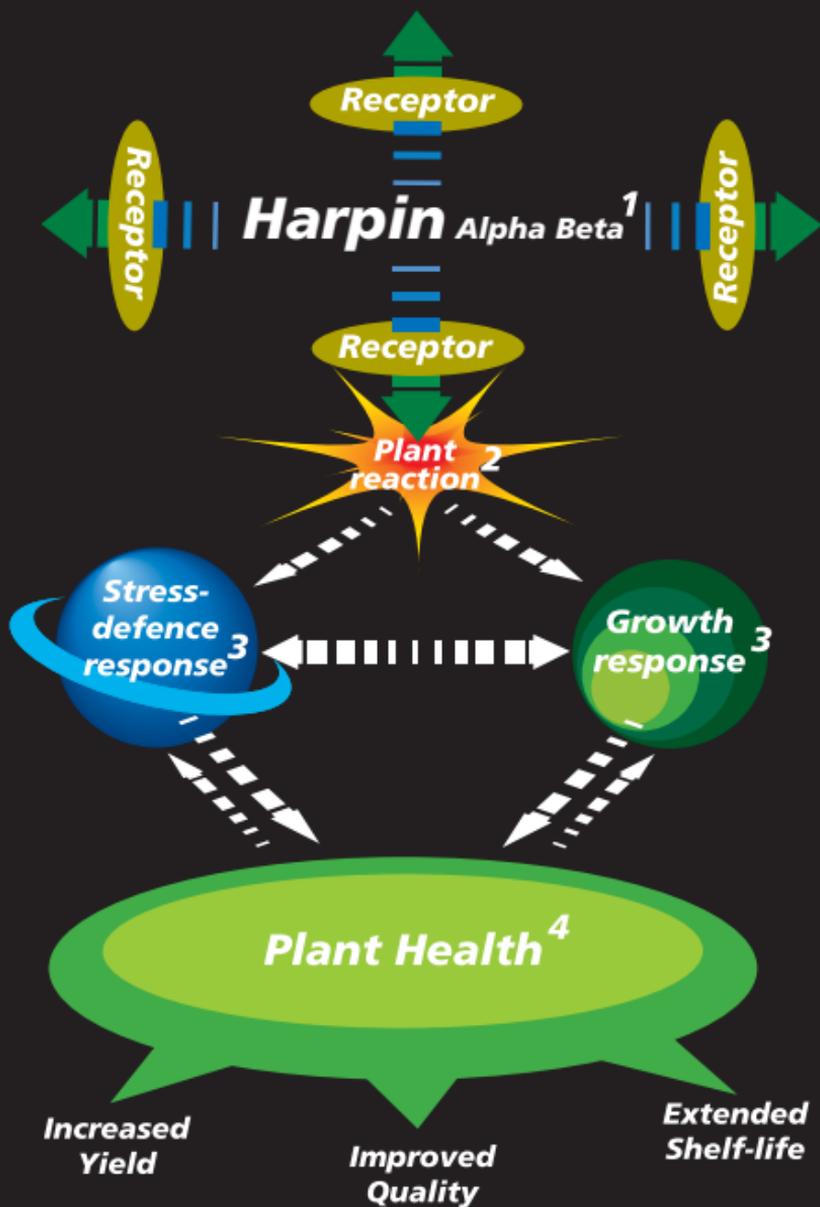
A HALO treated plant will have accelerated growth, early flowering and consequently an increased fruit set. All leading to an increase in yield and a shortened time to harvest.

**NOTE: HALO is a foliar feed that is used in addition to normal nutrient feeding programmes. It is not a standalone nutrient source.**



Control

HALO



## What is HALO and how does it work?

1. The Harpin protein binds to the plant's receptors. Plants are naturally equipped with early warning receptors that detect Harpin proteins.
2. The receptors react to Harpin as if it were a pathogen – stimulating the plant to act. The plant responds by initiating a sequence of physiological and biochemical reactions within itself.
3. The plant reaction activates both growth and stress-defence pathways within the plant. The growth response is the most pronounced – increasing the plant's current processes. This response increases nutrient uptake, photosynthesis, vigour and reproductive activity of the plant. The stress-defence response improves plant stamina, increasing stress tolerance. Plant stress can be caused by environmental events, physiological shifts in plant growth and outside biological agents. The benefit of stress-defence response depends on the severity and duration of a particular stress condition.
4. Growth and stress-defence responses interact and contribute to overall plant health. Improved plant health can result in one or more of the following outcomes: increased yield, improved quality and extended shelf life.

## What's in HALO?

The main component of HALO is the active ingredient - Harpin Alpha Beta, a natural bacterial protein that activates the plant's natural defence system. When applied, the activated plant growth and stress-defence pathways trigger calcium release and an increase in chloroplast and photosynthesis. The result is a healthier, more productive crop.

The Harpin protein in HALO evolved from the original native Harpin EA protein initially isolated from *Erwinia Amylovora*, the bacterium that causes fire blight in apples and other rosaceous plants. Harpin is an acidic, heat-stable, glycine-rich, extracellular protein. The protein consists of 403 amino acids.

HALO's Harpin Alpha Beta is not to be confused with Harpin EA, which is used in a well-known product in the USA. Harpin EA is the first generation science with only a single receptor. HALO Harpin Alpha Beta is the latest generation of the Harpin protein with 4 active sites. The increase in both number and nature of these active sites upon the protein, enable lower dose rates and a wider efficacy with a more positive effect on the crop.

HALO also benefits the plant with a blend of micronutrients that are specially designed to slow release over a period of 3 to 10 days. It is this combination of slow release nutrients and the Harpin protein that ensures the amazing results growers achieve when using HALO.

## How does HALO work?

HALO is foliar-applied or used as a seed or tuber pre-treatment. HALO's unique natural protein leads the plant to believe it is under attack, this 'tricks' the plant and naturally forces the plant to 'defend itself', turning on stress-defence and growth systems and reproducing very rapidly. If a plant 'believes' it is under attack, it will grow and reproduce at rapid rates as a means of ensuring its survival. This results in a healthier and more productive plant with an increase in crop vigour, stamina, nutrient uptake and reproductive growth (depending on time of application).

Both laboratory and field studies have shown that HALO treated plants exhibit accelerated growth, earlier flowering and early/increased fruit sets. These observed effects on growth and development will lead to a stronger, healthier plant that is less susceptible to disease with increased yields and a shortened time to harvest.

**Increases in photosynthesis rates of 25% are not uncommon.**

## HALO benefits:

- A higher growth rate due to an increase in photosynthesis by up to 25% (this is particularly noticed when growing under lights). In addition, the nutrient uptake in plants is also increased. Ultimately, HALO provides value to growers by increasing yield and fruit quality.
- Activates growth mechanisms that result in improved plant vigour, increased plant stamina and an improved stress-defence response.
- Activates cell wall expansion, cell elongation, protein and sugar transport and promotes flower initiation, fruit set and size.
- Activates defence mechanisms increasing the plant's ability to defend itself against certain viral, bacterial and fungal plant diseases.
- Pre-harvest applications reduce the incidence of Botrytis (bud rot) and extends crop shelf-life.
- Increases fruit sugars - tests have demonstrated increases of over 35% in Gala apples, for example.
- Increased calcium uptake through the roots by more than 20%.
- An increase in vegetative growth when applied in the growth phase of a plant.
- Offers some frost protection on blossoming crops.

- In trials, it has been found that in seed treatments, HALO reduces the number of nematode eggs among plant roots by an average of 50% or more.

An important part of HALO is a blend of essential micronutrients: Iron, Manganese, Zinc and Copper. These micronutrients are specially chelated to be slow-released over a period of 3 to 10 days. HALO utilises a patented process for chelating the trace elements with polysaccharides, which maintains the availability of the nutrients both on the leaf and within the soil, maximising the effects of the Harpin protein.

**Below - Examples of plants showing tomato resistance to bacterial wilt against untreated plants.**



## Timing of application

Since the plant needs to convert the eliciting effects from HALO into biochemical processes, the best effects are obtained when the product is applied to physiologically active plants. Treatments are recommended around critical crop physiological growth stages, such as flower induction, fruit set, fruit enlargement and pre-harvest. In some perennial crops, the treatment of HALO in the previous season can affect the plant in the following growth cycle or spring. This can also benefit cuttings/clones taken from the treated plant. This can result in earlier bud formation and hence, greater flowering potential.

Always apply foliar feeds when the sun is down or when the lights are off to avoid scorching your plant.

Trials are also showing great benefits as a seed soak in some crops and this research is continuing. See field trial data on following pages.

**Top Tip: If you need to keep your plants small, do not apply in the vegetative stage of their development.**



## Application rates

### Foliar applications

Mix HALO in water at a dilution rate of 10ml per litre of tap water and apply to the plant with a sprayer.

A HALO 5ml soluble sachet will give maximum benefit when mixed with 500ml of water. Mixed in 1L of water it will be less concentrated, but still offer great results.

In general, apply every 2 weeks in flowering and once during the last week.

A scoop is provided in the tubs – marked 5ml and 15ml.

The use of ESSENTIALS Wetter is beneficial for maximising the benefits of HALO. When applied, this wetting agent breaks down the surface tension of water and the waxy layer on some leaves, allowing HALO to penetrate and not simply drip off the plant. HALO works best in temperatures above 20°C.

### Seed soak

Soak your seeds or tubers in a concentrated solution, 1 part HALO to 10 parts water. For a sachet, add 1 x 5ml sachet to 50ml of water.

Allow to dissolve into solution for at least 30 minutes and shake to aid dissolving, then soak your seeds or tubers for 10 minutes prior to sowing.

**Top Tip: Commercial growers are dosing with HALO in week 2 then 4, 6, 8 and so on until harvest. They are also dosing with an anti-fungal product, such as, Bud Rot Stop in week 3, 5, 7 etc. and achieving Class A crops that are sold under the 'pesticide-free' banner.**

## CROP CASE STUDIES

HALO has been extensively tested in greenhouses and commercial trials with many different crops and in major growing areas throughout the world. The Harpin Protein response among plants is so prevalent and extensive that the resulting beneficial activity has been documented across a broad spectrum of crops, including:

**Vegetables, Field Crops, Tree Fruit and Vines, Speciality Crops and Turf and Ornamentals.**

Shown here are 4 case studies of those field trials:

# CASE STUDY 1

## **Experiments into increased photosynthesis**

In a variety of experiments, researchers at NASA, Cornell University and other research groups in the US, as well as at IVIA (Instituto Valenciano de Investigaciones Agrarias) and the University of Cordoba in Spain have demonstrated the unique abilities of Harpin Alpha Beta to enhance photosynthesis.

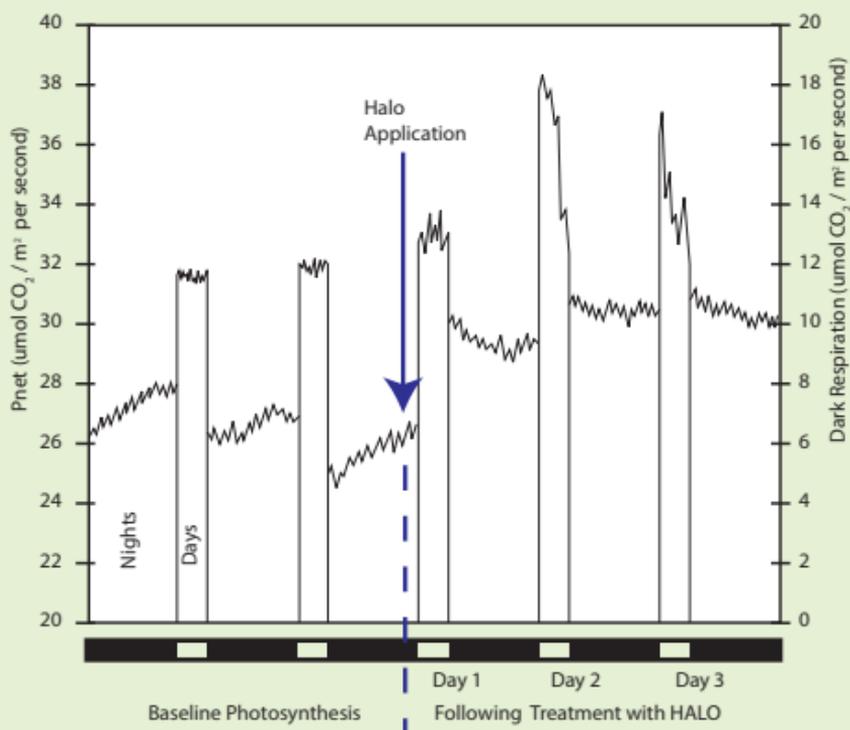
The aim was to measure HALO Harpin Protein's effect on photosynthetic activity in a closed system growth chamber. This was equipped for simultaneous measurements of multiple physiological parameters. After treatment with HALO, there were significant increases in net photosynthetic rates that persisted for a number of days.

The finding that net photosynthetic activity is elevated in response to Harpin and provides an important insight into how HALO produces enhanced growth and yield. Measurements made in tomato, grape, asparagus and strawberries have all shown increased photosynthetic activity in response to HALO application.

## Result of test:

### *HALO treatment increases daytime photosynthesis and night-time respiration in wheat plants.*

Wheat plants were grown through the anthesis (anthesis is the period during which a flower is fully open and functional) phase in a closed system growth chamber (NASA Ames Centre), permitting continuous measurement of photosynthetic activity. Photosynthetic rates were monitored both before and after treatment with HALO. Baseline measurements were made to establish the pre-treatment level of photosynthetic activity. Leaves were sprayed with HALO solution (20 ppm), 30 minutes prior to the beginning of the daily photo period. Days 1, 2 and 3 represent the days following HALO application. (See the peaks in increased light usage).



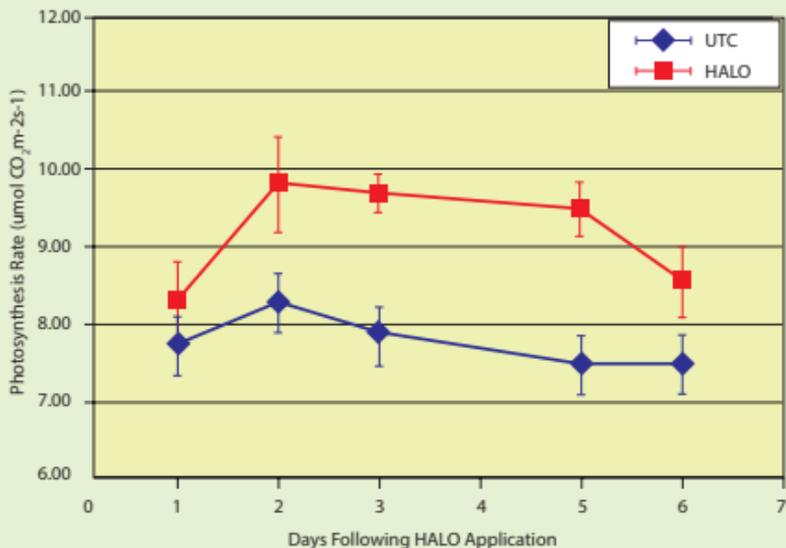
# CASE STUDY 2

## HALO treatment of tomato plants results in increased photosynthesis, leading to increased growth rates.

Three week old Marglobe tomato plants were sprayed to run off with 40 ppm HALO. Untreated controls (UTC) were kept separate during the application. The photosynthetic rate was measured with the Li-Cor LI 6400 over a period of 6 days after application. All measurements were made each day between 10:00 am and noon. Photosynthetic rates increased to 19.8% after 1 day and 25.4% after 4 days.

### Increased Photosynthesis in HALO-treated tomato plants

1. Tomato plants sprayed with HALO at 40 ppm.
2. Photosynthesis measured with a Li-Cor LI 6400.
3. Up to 25% increase in activity compared to untreated controls.



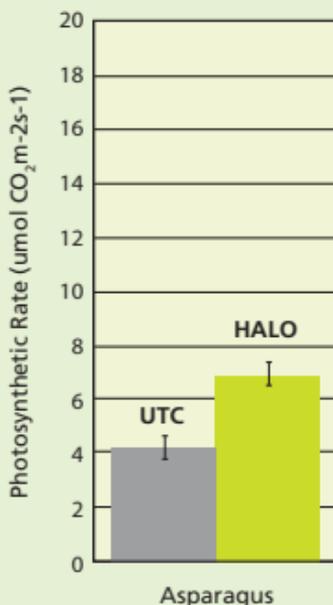
## Conclusions:

*HALO treatments elicit increased photosynthetic rates in diverse plant species. All plant species tested have exhibited an increase in photosynthetic activity upon HALO treatment as compared to untreated controls.*

- HALO treatment results in increased net CO<sub>2</sub> uptake and therefore, increased photosynthetic rate for a wide range of plant species tested thus far. These include wheat, tomato, asparagus, grapes and strawberry.
- Elevated photosynthetic rates were demonstrated using two independent methods of measurement in controlled laboratory conditions and in field conditions.
- Photosynthetic rates remain elevated above basal levels for at least four days following a single HALO treatment.

## Photosynthetic Activity in HALO Treated Asparagus

**62% increase in photosynthetic activity**



# CASE STUDY 3

**Experiments to demonstrate how HALO affects basic growth mechanisms in the plant leading to significant positive effects on plant development, resulting in higher yields.**

HALO increases growth in a wide range of crop plants.

The following examples show increased growth in a variety of crop species after treatment with HALO:



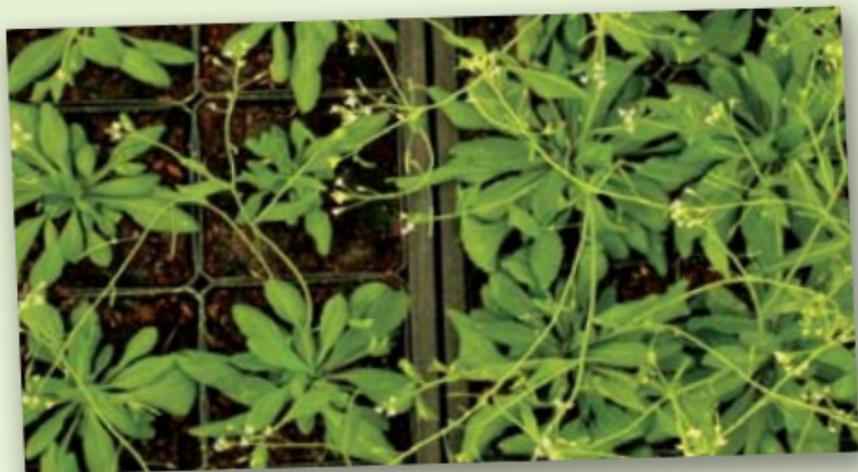
Tobacco following seed treatment and one foliar application of HALO.

**NOTE: HALO treated plants on the right in all panels, untreated control plants on the left.**

Similar effects are observed in other species, including both monocots and dicots suggesting that this is a general response among crop species. Increased growth can be obtained from either foliar spray application or seed treatment.



Bell pepper seedlings. Seedling drench treatment.



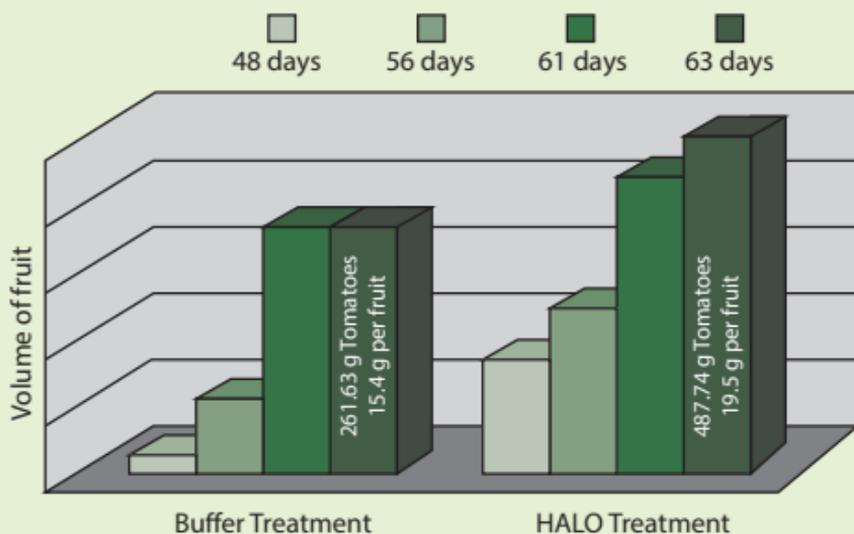
Arabidopsis after 33 days

# CASE STUDY 4

## Increased fruit yield in HALO treated tomatoes.

Fruit development in HALO treated Marglobe tomatoes is accelerated relative to untreated control plants.

(A) The number of fruits observed on 12 control and HALO treated (20 ppm) tomato plants at 48, 56, 61 and 63 days after germination are shown. Fruit was harvested and weighed on the 63rd day. Total fruit weights and average weights of individual fruits are inset in the dark bars. Total fruit weight from HALO treated plants was 86.42% greater than for untreated control plants.



- (B) Photographs of fruit harvested. Untreated control (left) and HALO treated (right). HALO treatment resulted in an increased number of fruit and more full size fruit.



**Fruit from 9 week old  
Tomato Plant (Marglobe)  
Buffer Treatment**



**Fruit from 9 week old  
Tomato Plant (Marglobe)  
HALO Treatment**

### **Early fruit maturation in raspberry plants in response to HALO treatment.**

Pictures show HALO treated raspberry plants. They exhibit mature raspberries well in advance of untreated control plants. Plants were treated with 127.5 grams/acre of HALO.



## Conclusions:

- HALO increases plant growth and accelerates plant development, in addition to promoting disease resistance.
- Effects of HALO on growth include increased plant size and root mass.
- Effects of HALO on plant development include early flowering, early fruit set and maturation, and increased fruit number.

### **HALO is available in:**

HALO Sachet Pack (5 x 2.5g sachets)

HALO 100g tub

Pump-Up Compression Sprayer 2 Litre (ideal for use with the bulk tub for treating larger growing areas).



# HALO Application Diary

**APPLICATION**

**DATE**

Seed Soak

Week 2

Week 4

Week 6

Week 8

Week 10

Week 12

Then every 2  
weeks  
depending on  
your crop



# HALO<sup>®</sup>



For further information visit  
[www.halo-harpin.com](http://www.halo-harpin.com)



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