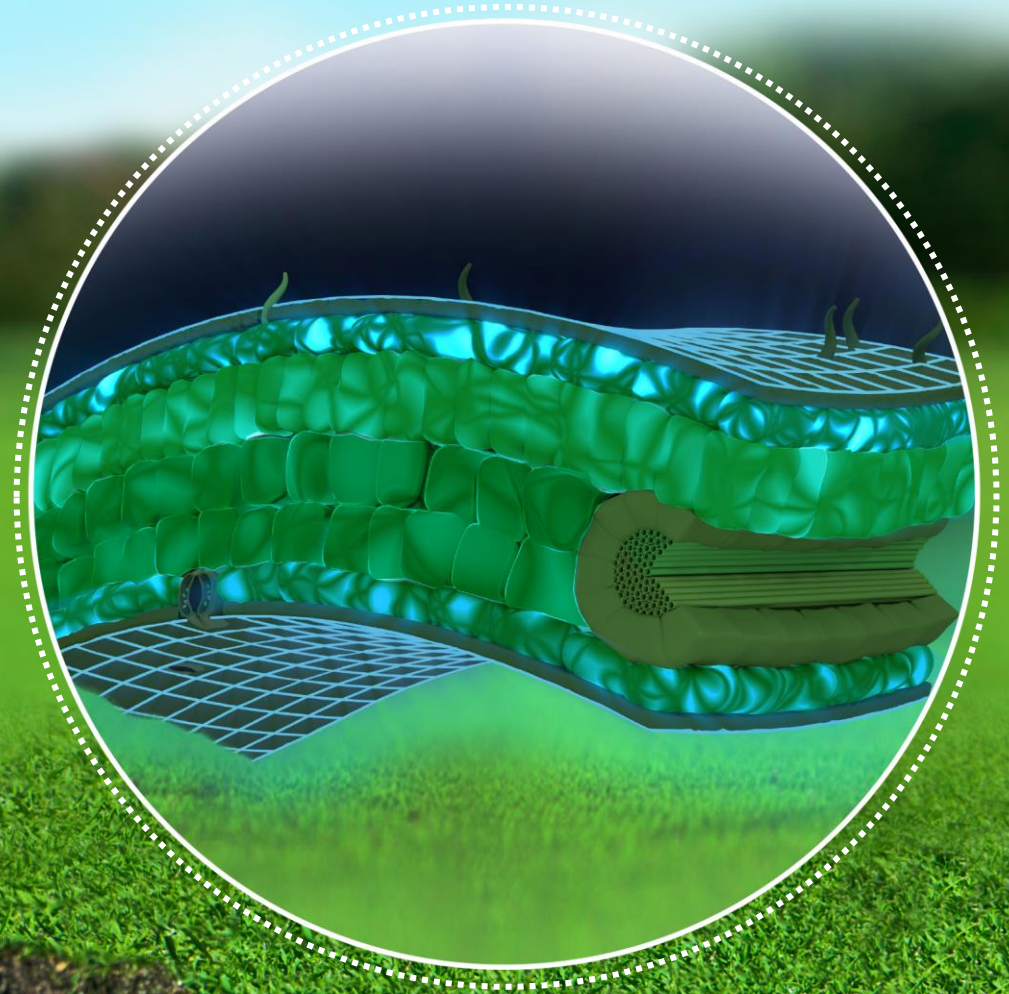
NEW

Hicure™

Turf Biostimulant

Unique 18 Amino Acid
Biostimulant formulation

1° TURF BIOSTIMULANT FROM SYNGENTA.



- Build
- Protect
- Recover

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Turf Biostimulant

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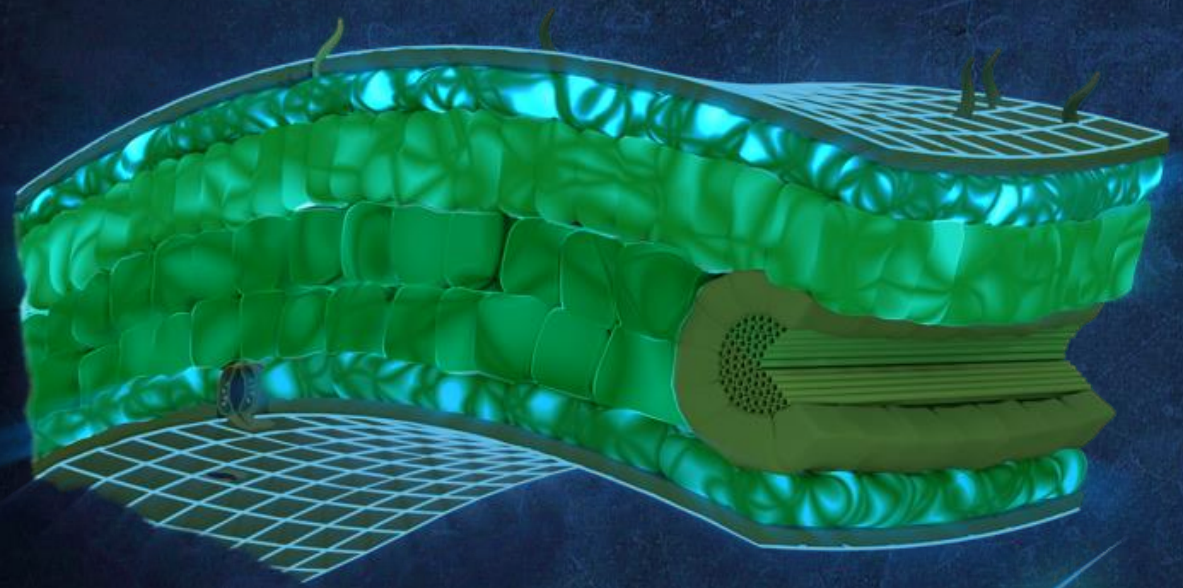
The challenge of delivering top turf quality

Spring	Over winter damage	Low energy reserves	Low pigment levels
Summer	Drought/drying winds	Light and heat	Shorter HOC decline in root mass and high wear
Autumn	Slowing but variable growth	Less photosynthesis	Lower nutritional inputs
Winter	Slow/no growth	Low photosynthesis/depleting energy	Frost damage

Wear, scarring, divots and disease pressure →

Hicure builds plant energy and fights stress

Hicure Turf Biostimulant is a unique formulation of 18 amino acids. Proven by science, Hicure can help sustain balanced growth, density and colour whatever stress or unforeseen challenge you face.



Builds plant energy to sustain growth

- Conserves plant energy lost through N assimilation and protein turnover
- Provides direct source of energy which can be immediately utilized by the plant
- Growth is balanced through supply of a nature and organic source of N

Protects and strengthens cells to fight stress

- Free aminos can rapidly enter the leaf and protect cells
- Hicure strengthens cell walls and delivers osmo protection to protect against osmotic stress

Recovers faster from turf damage

- Hicure aids recovery from damage and scars
- Improved playability and more consistent surfaces

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Hicure boosts plant energy and fights stress.

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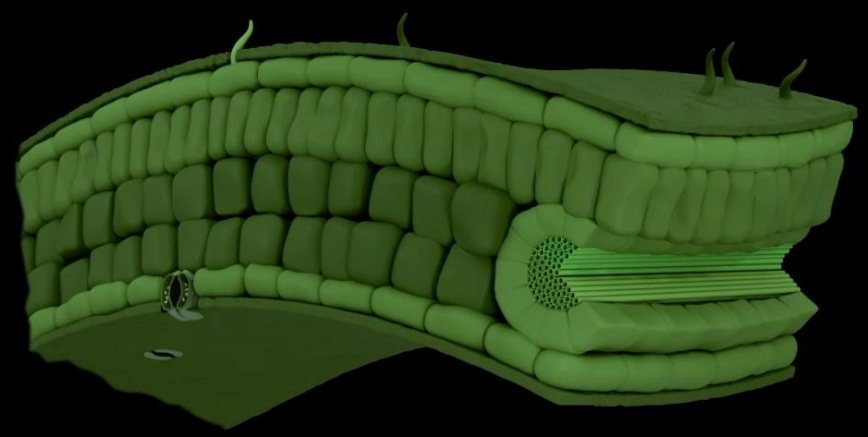

Boosts plant energy to sustain growth

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Recover faster from turf damage

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What is Hicure?

63% **amino acids** and peptides from natural origins

18 **different** amino acids

10% **free** amino acids

High **in** proline, glycine and glutamic acid

Contains **10%** **organic N**

11.5% total N

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Hicure is a unique formulation of amino acids & peptides

Free amino acids

18 different free amino acids immediately available to the turf to protect cells from stress. These also conserve plant energy by providing an organic N source, thus reducing the requirements for N uptake from soil which is energy demanding.

Short chain peptides

Absorbed more slowly and then as needed converted into amino acids or they form proteins as the plant needs over 7 to 10 days. Proteins have many important functions in the plant.

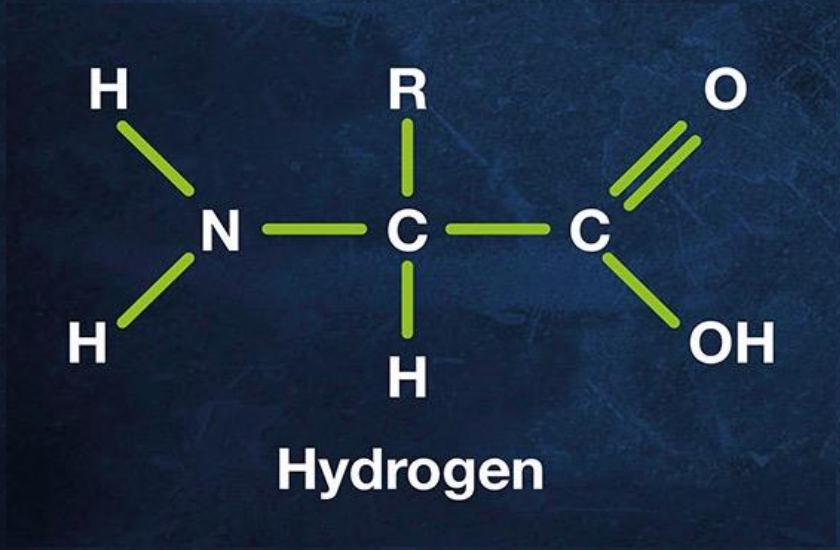
Long chain peptides

These can be considered as slow-release peptides, extending a positive residual effect on the soil and being absorbed into the plant over a period of weeks.

Amino acids

Amino acids provide the basis for formation of key N compounds basic to ***plant growth***

The amino acids are characterized by the AMINO GROUP (-NH2)



Amino acids are **organic compounds**, meaning that they contain carbon and hydrogen bonded to each other. In addition to those two elements, they include nitrogen, oxygen, and, in a few cases, sulphur

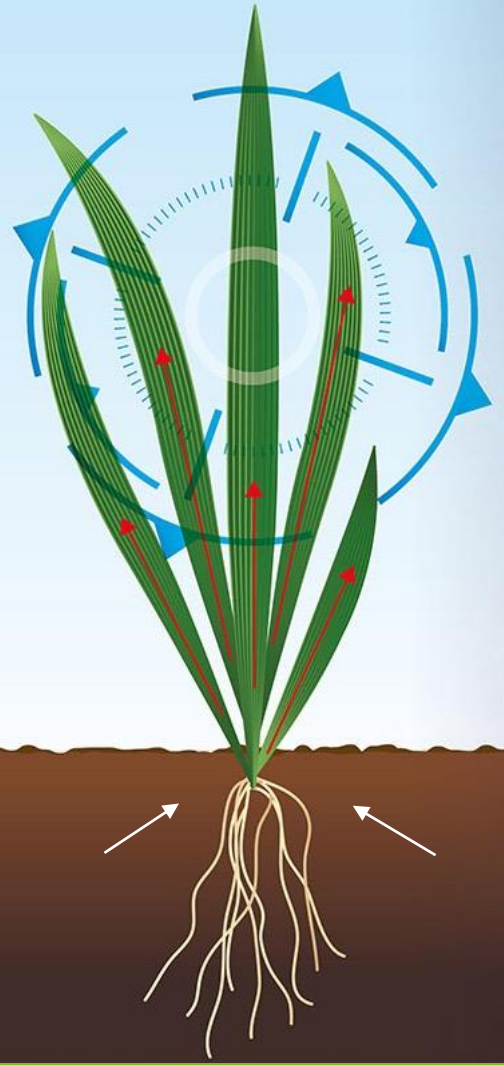
There are about 20 amino acids involved in plant growth and metabolism

Each amino acid plays a key part in turf performance

Hicure is a unique formulation of free amino acids and short and long chain peptides that balance our turfs immediate and long term needs.

AMINO ACIDS	ROLE
Proline, hydroxyl proline	• *Acts a anti oxidant, and protects against damage from free radicals. A strong osmolyte protecting cells from osmotic stress*
Glycine	• *Forms glycine betaine, a potent osmolyte providing osmo protection* • *Precursor to chlorophyll*
Glutamic acid	• *Building block of all other amino acids* • *Precursor to chlorophyll* • *Key role in N assimilation*
Alanine	• *Alanine is precursor to plant hormones*

Hicure uptake into the plant



Main target is foliar absorption

Amino acids and short chain peptides are readily absorbed by the leaf

Larger peptides break down in the soil into smaller units

Amino acids and short peptides are then taken up by the roots

Target foliar application

Amino acids are the building blocks of proteins

Can be taken up by the plant

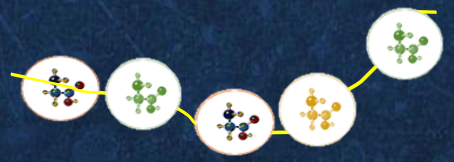
Proteins

Amino acids

(1 unit)

Peptides

(2-50 units)



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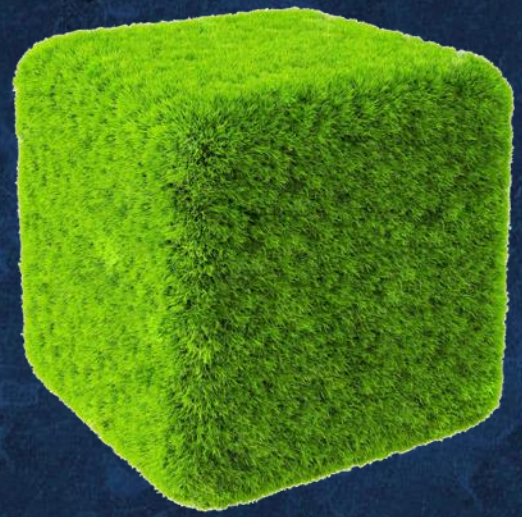
Proteins perform many key and diverse solution

Component of cell membranes

Key role in fungal defence – PR proteins

Anti-oxidants to counter free radicals



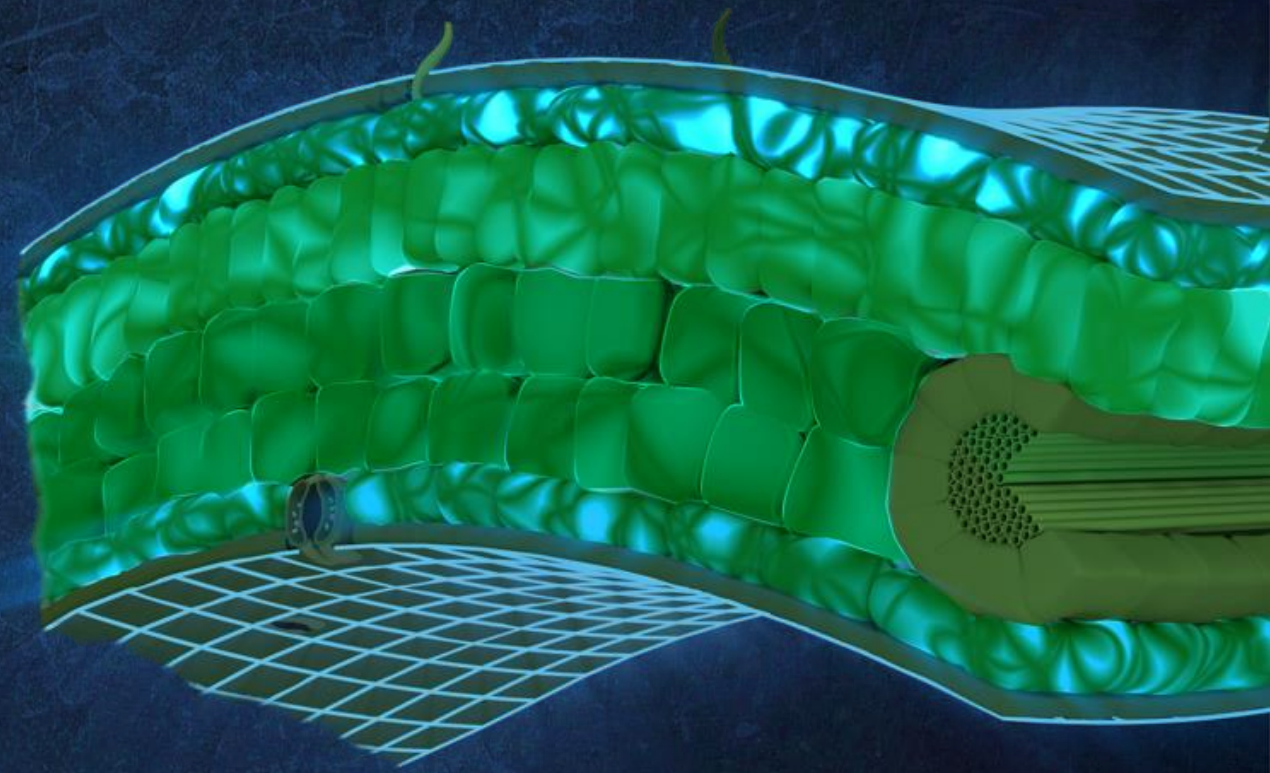
Regulate function of membranes

Provide protection against heat stress

Key role in biosynthesis of enzymes and hormones

Key component of chloroplasts and photosynthetic processes

Turf Stress



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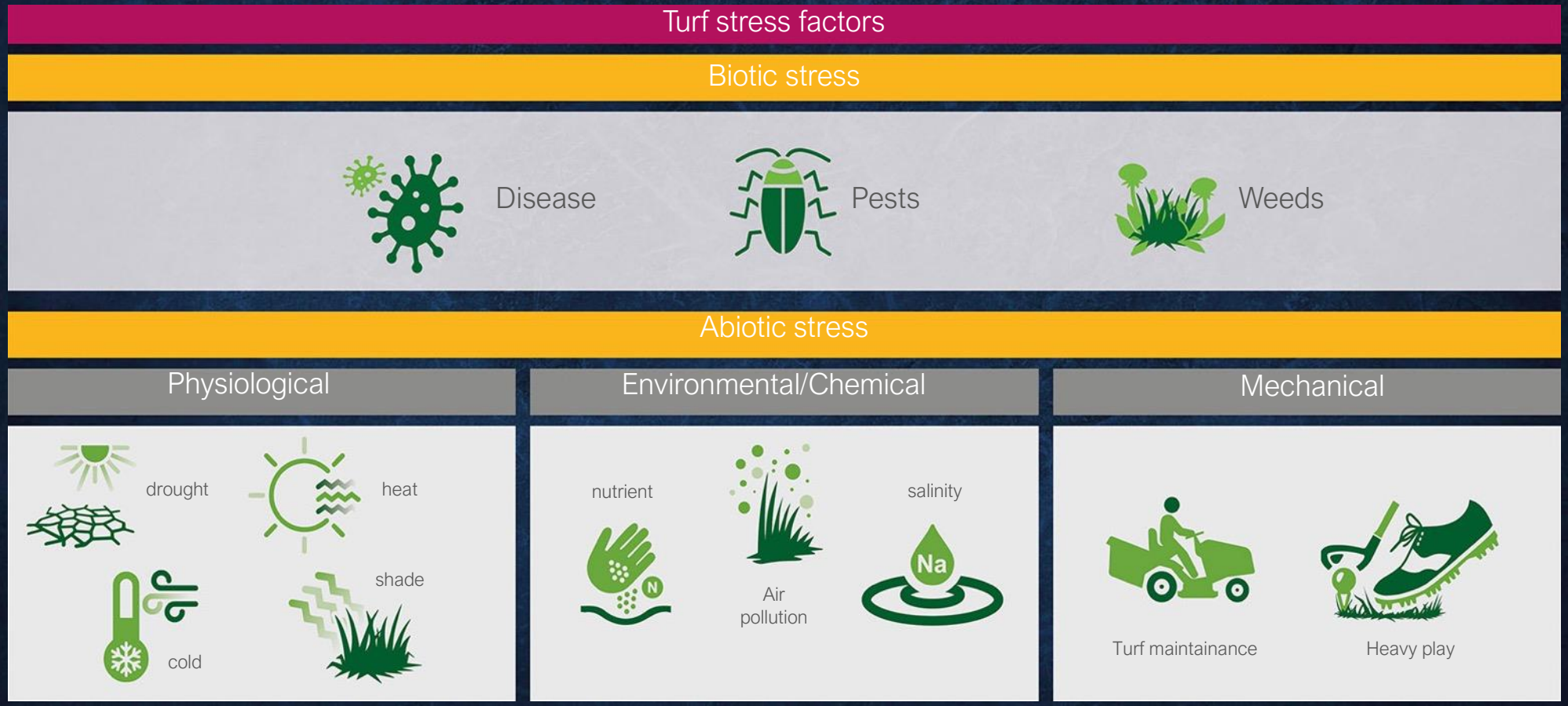
Turf is exposed to many stresses



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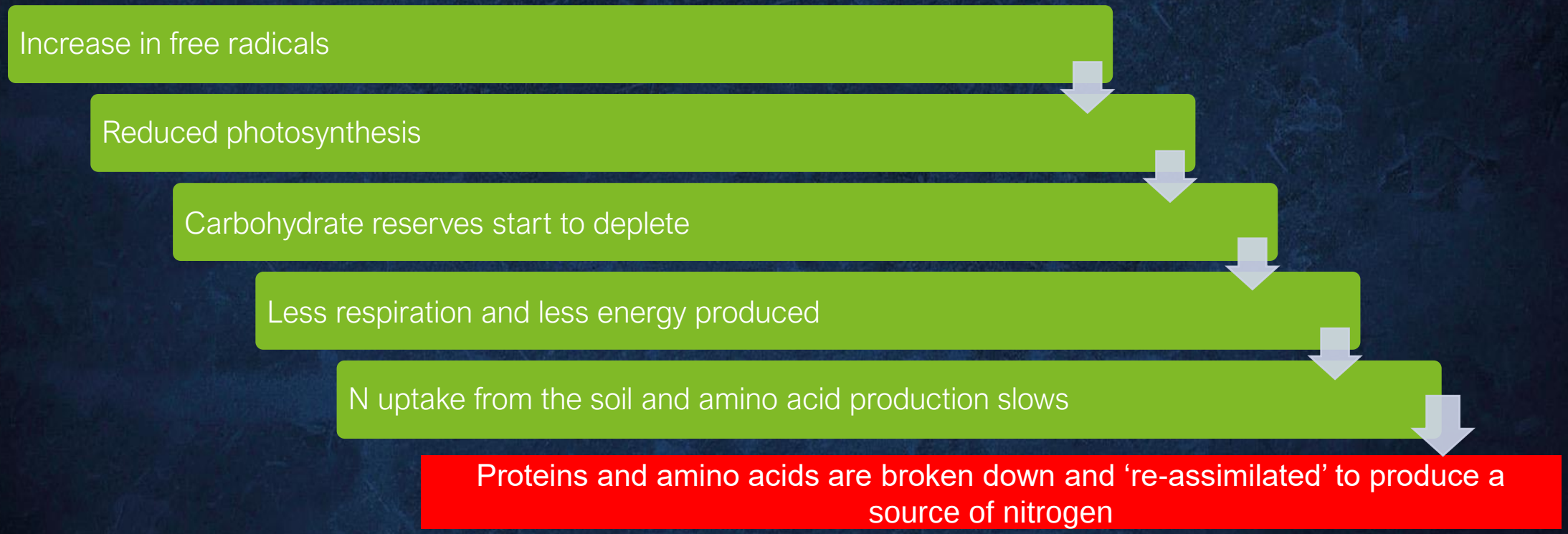
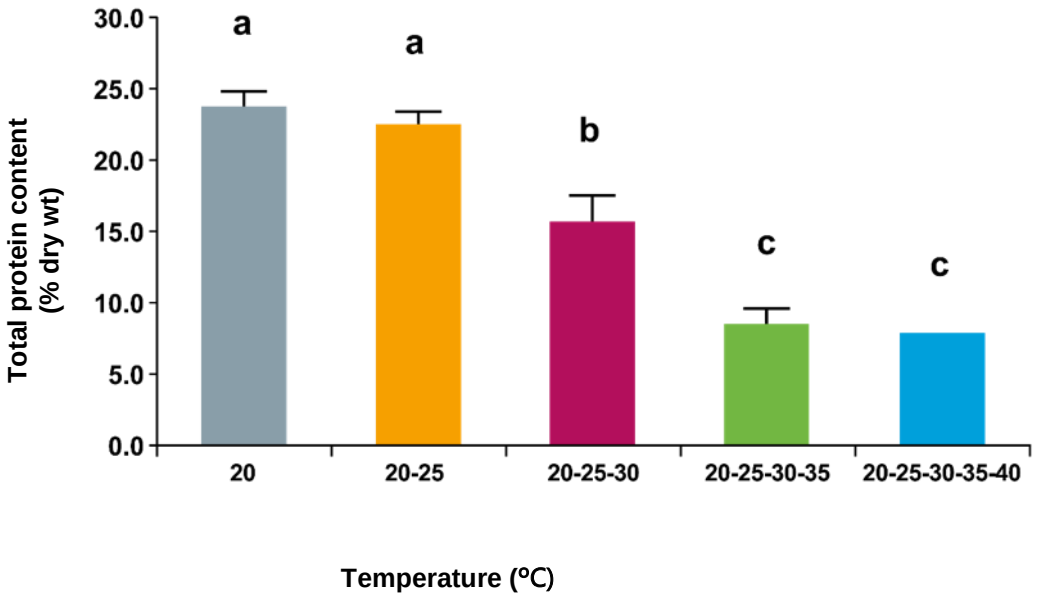
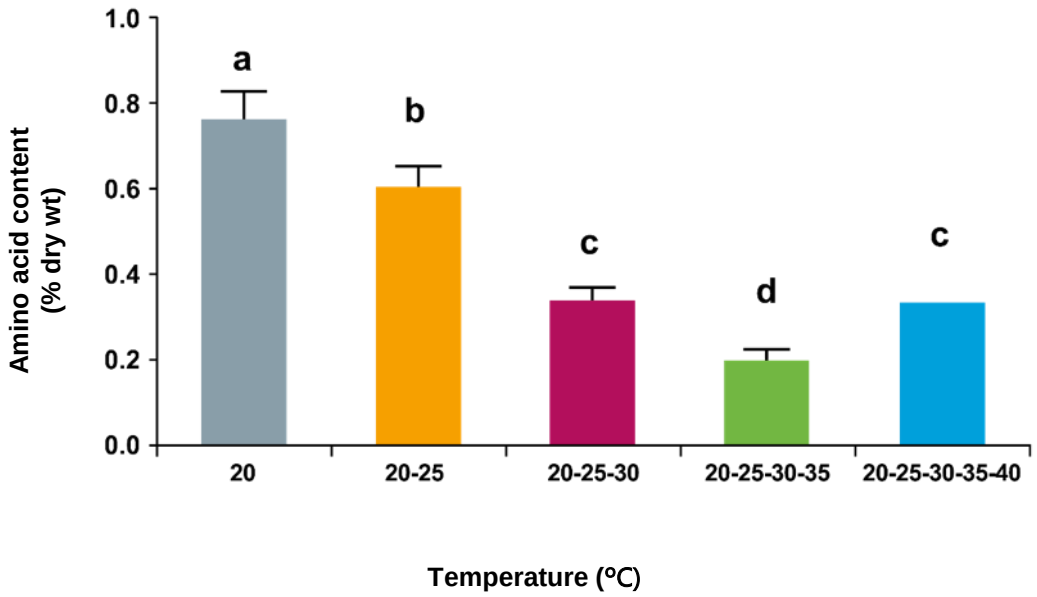
The stress curve /decline curve



Heat stress reduces protein and amino acids content

Creeping bent grass and gradual heat stress (GHS)





Yali He, X. Liu and Bingru Huang. Hort. Sci. 2005.

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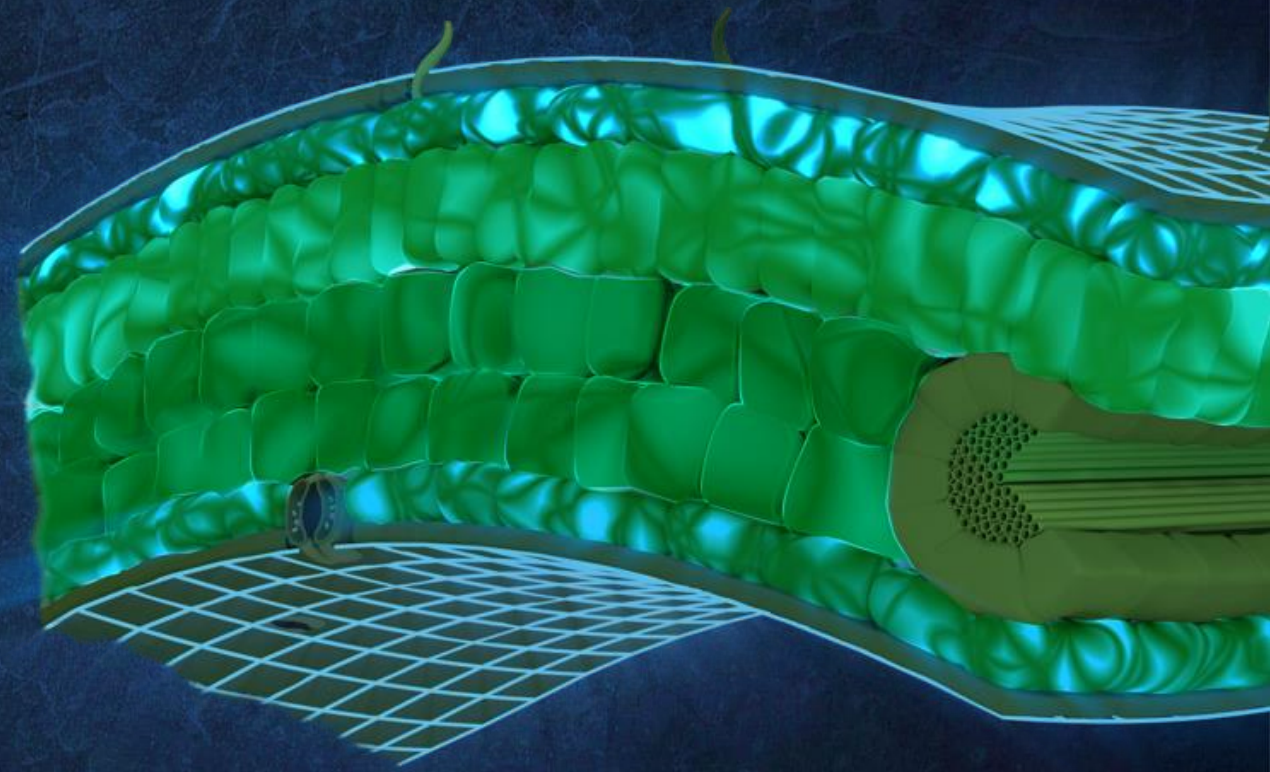
Building Turf Energy



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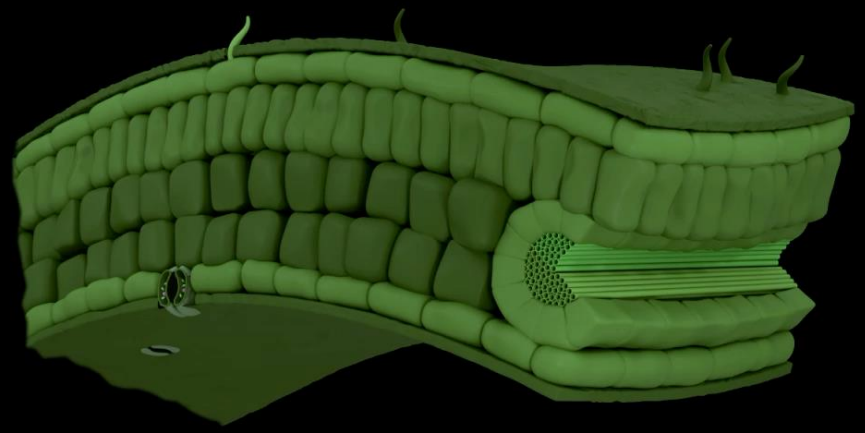
Hicure builds plant energy and fights stress.



Builds plant energy to sustain growth

• Conserves plant energy lost through N assimilation and protein turnover.

• Provides direct source of energy which can be immediately utilized by the plant.

• Growth is balanced through supply of a nature and organic source of N.

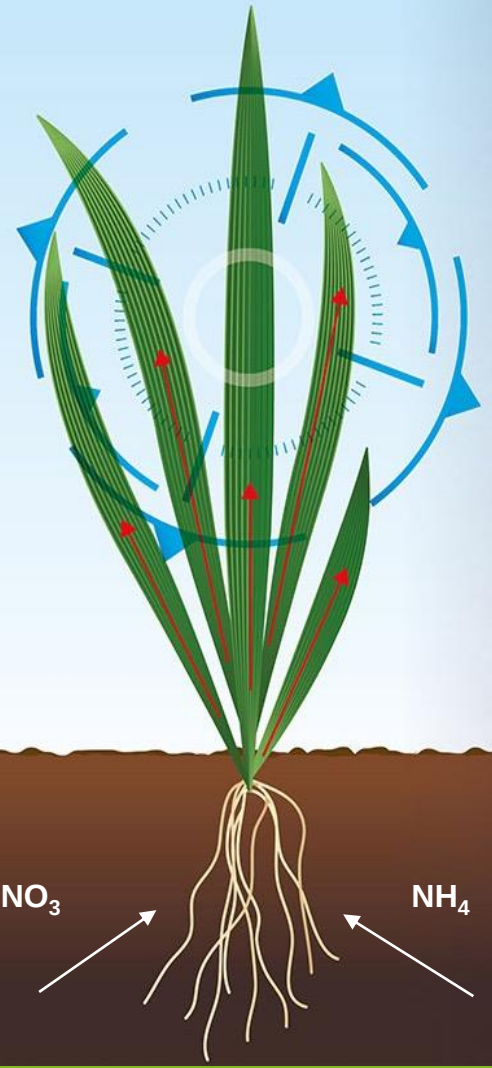
Protein creation and turnover

Plants are constantly adapting to the amino acids and proteins they need

Proteins are broken down and re-synthesis = **Protein turnover**

Protein turnover is an energy - intensive process

High energy demanding plant processes



When adapting to harsh conditions
Protein, peptide and amino turnover

Protein turnover

Energy demanding process

Formulation of amino acids

Energy demanding process

Nitrate or ammonium uptake

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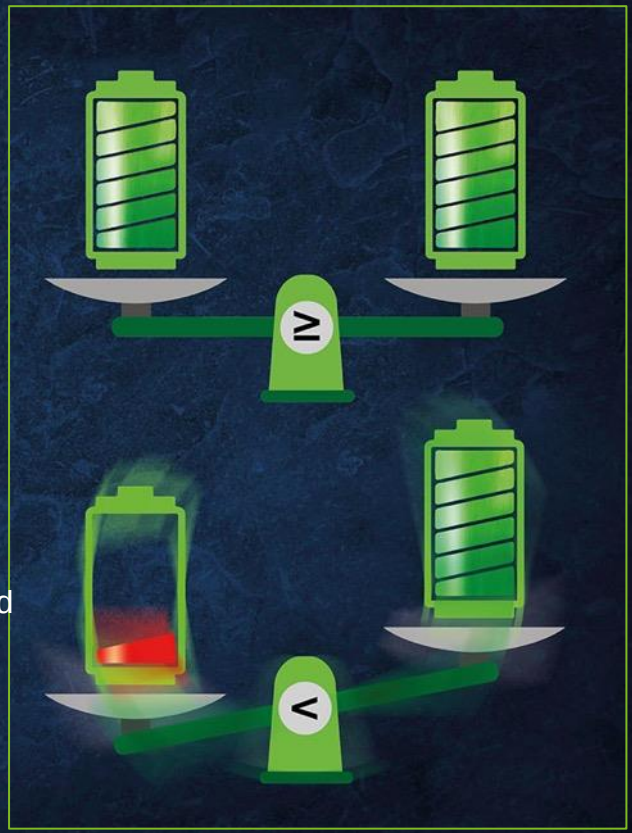
Under stress energy used is not replenished

Growing conditions	Synthesis of amino acids	Energy Balance
Normal growing conditions	Synthesis of amino acids through thousands of chemical reactions	Energy produced equals or exceeds energy required **IN BALANCE**
Stress/sub-optimal growing conditions	Reduced synthesis of amino acids and break down of proteins to obtain the required amount or types of amino acids and re-allocation of nitrogen	Energy requirements exceed energy available **OUT OF BALANCE**



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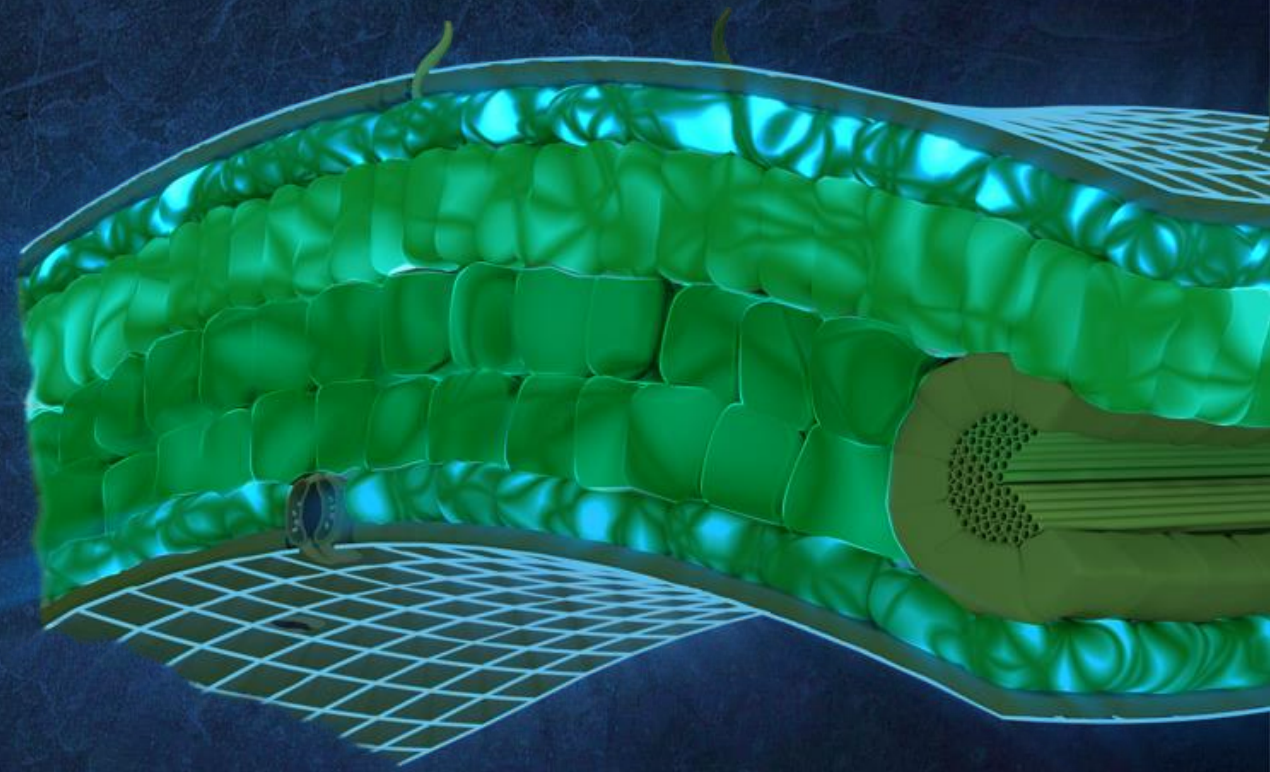
Osmo - protection



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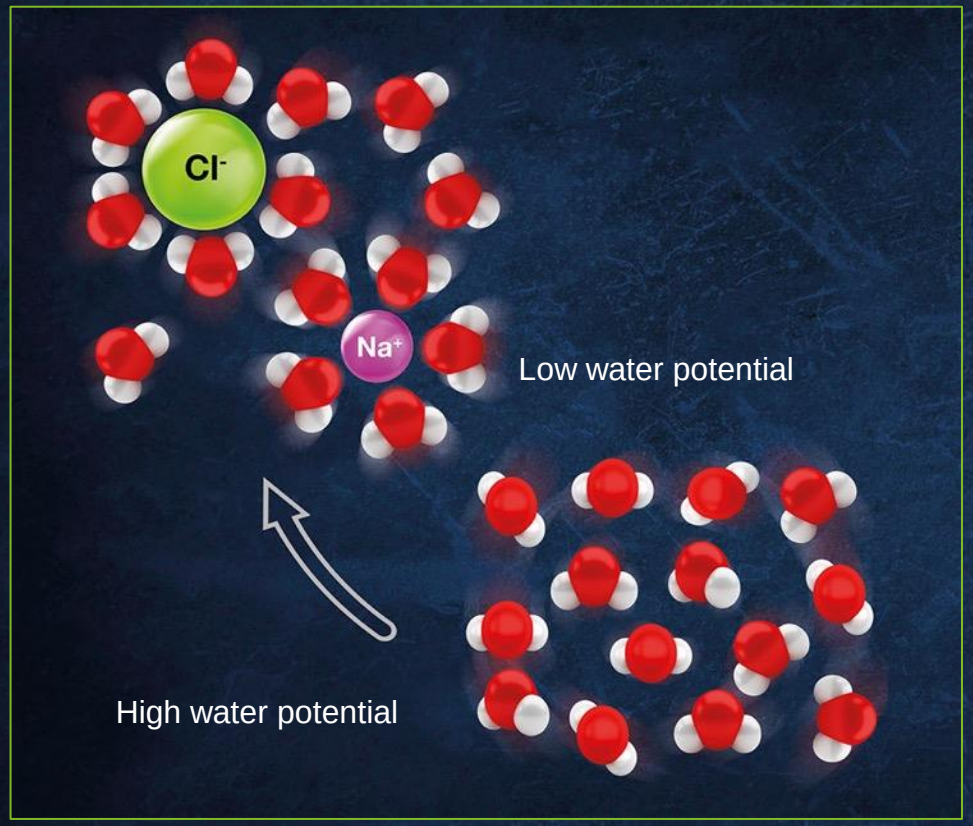
Water potential

- **Water potential** = the amount energy in a volume of water compared to pure water
- Water will move from an area of a **high water potential** to an area of **low water potential**
- What can change water potential?
    1. Dissolved salts and metabolites (amino acids, sugars, NaCl, and other salts)
    2. Pressure
- The greater the amount of dissolved salts, the lower the water potential
- The greater the pressure, the higher the water potential

Water moves from high water potential to low water potential

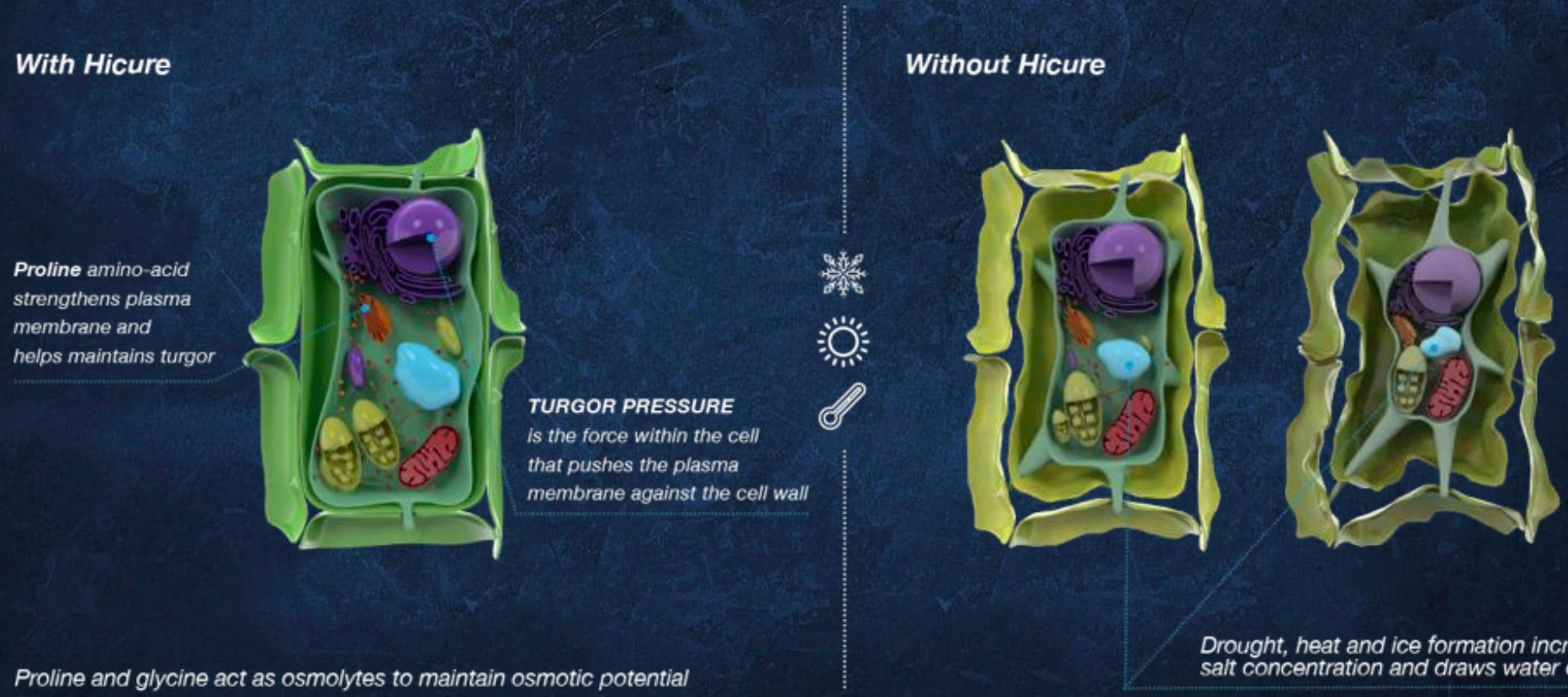


Two important aspects for osmo - protection

Water potential is a function of osmotic pressure and turgor pressure acting on water within the cell

Hicure provides turf Osmo-protection

Hicure contains high strength proline & glycine to strengthen cells and protect against osmotic stress caused by heat, drought and ice formation.



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Hicure provides Turf Osmo-protection.

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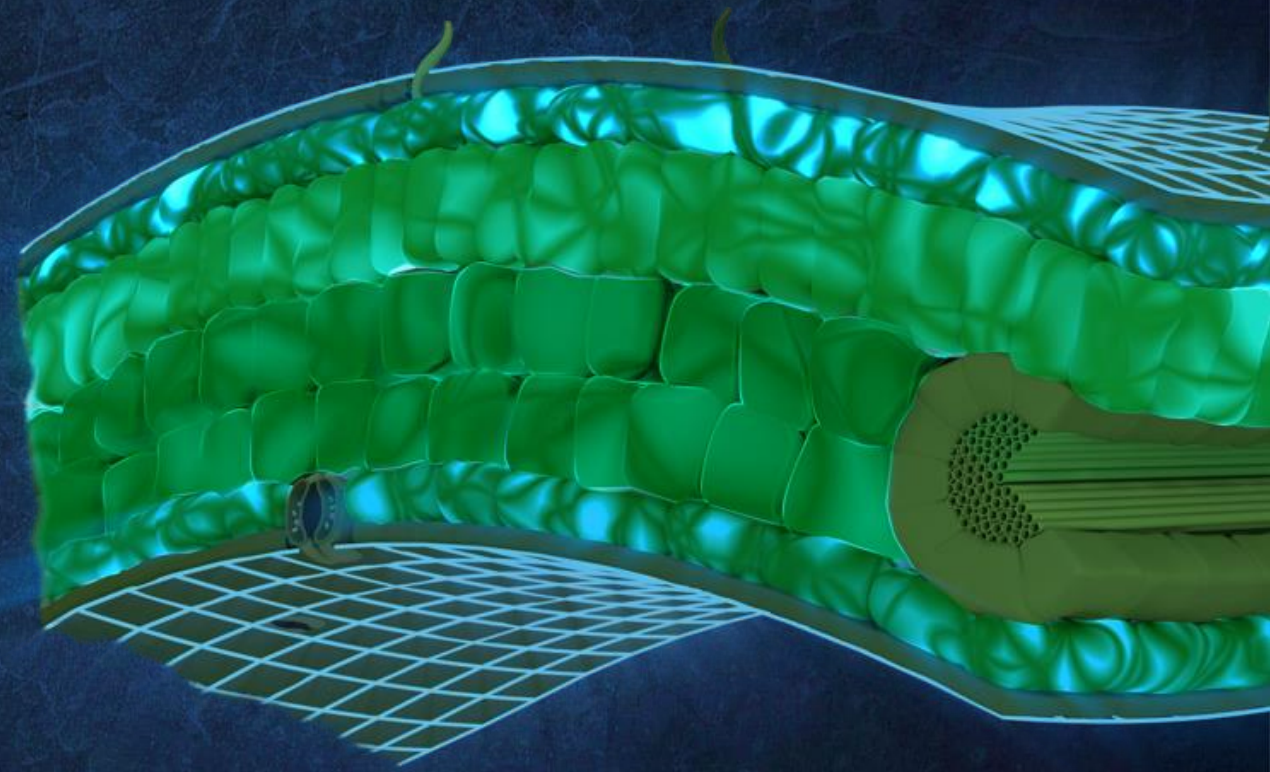
The science behind Hicure



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Proven performance with Hicure

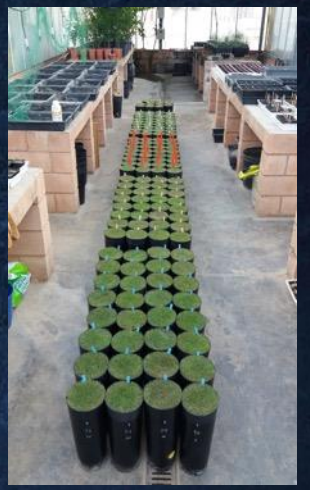
Glasshouse and field testing
3 years of studies
Rates from 2.5 – 100 l/ha tested

6 turf species: *Agrostis stolonifera, Poa annua, Lolium perenne, Festuca arundinacea,* fine fescues *(F. rubra), Poa pratensis*

40 trials to date assessing

- **Heat stress**
- **Drought stress**
- **Diseases stress**
- **Herbicide damage**

Laboratory



Greenhouse

Golf Course

Experimental Area

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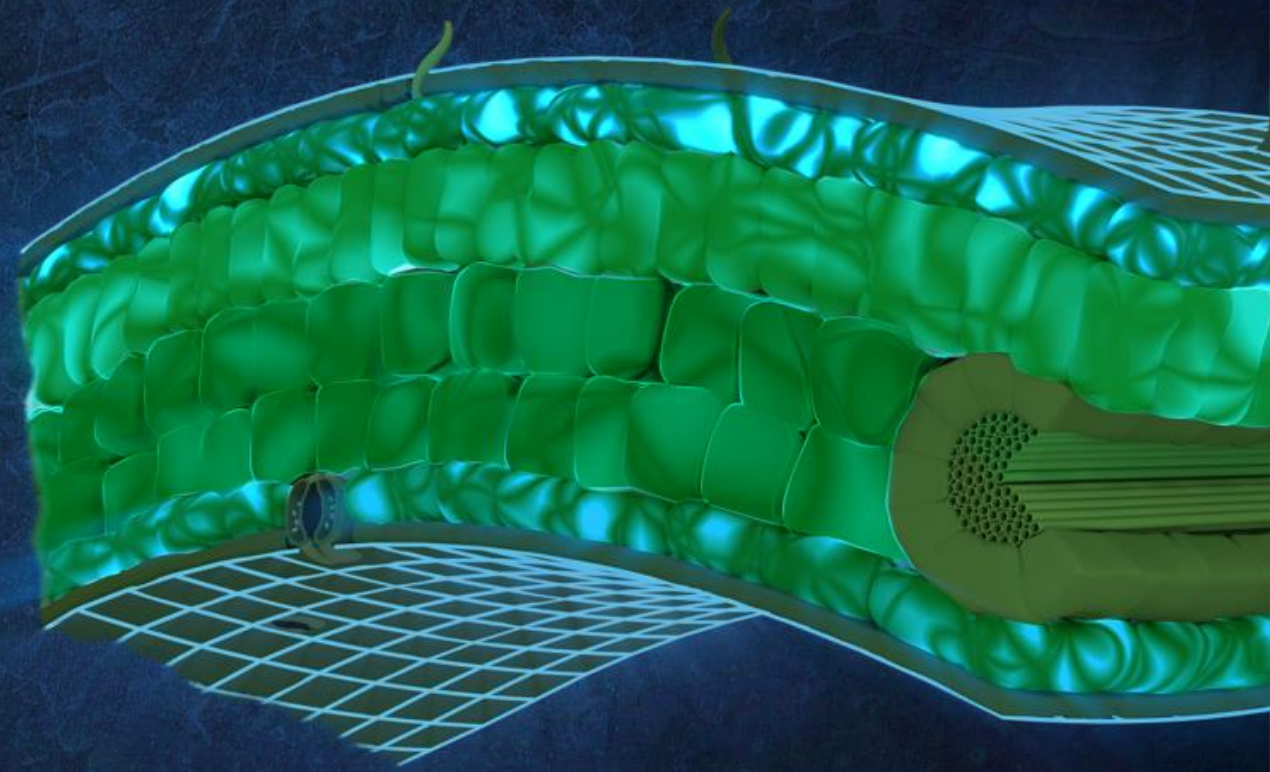
Heat



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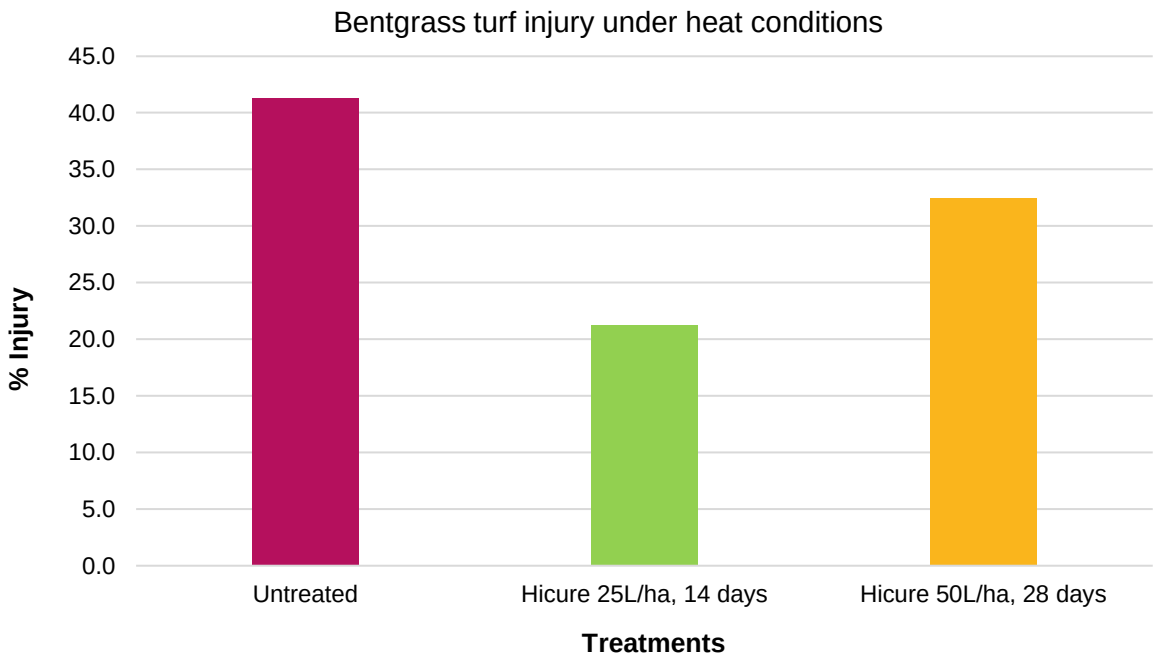
Superior turf quality under heat stress

Results after 4 weeks of heat stress
Hicure applied for 4 weeks prior to stress

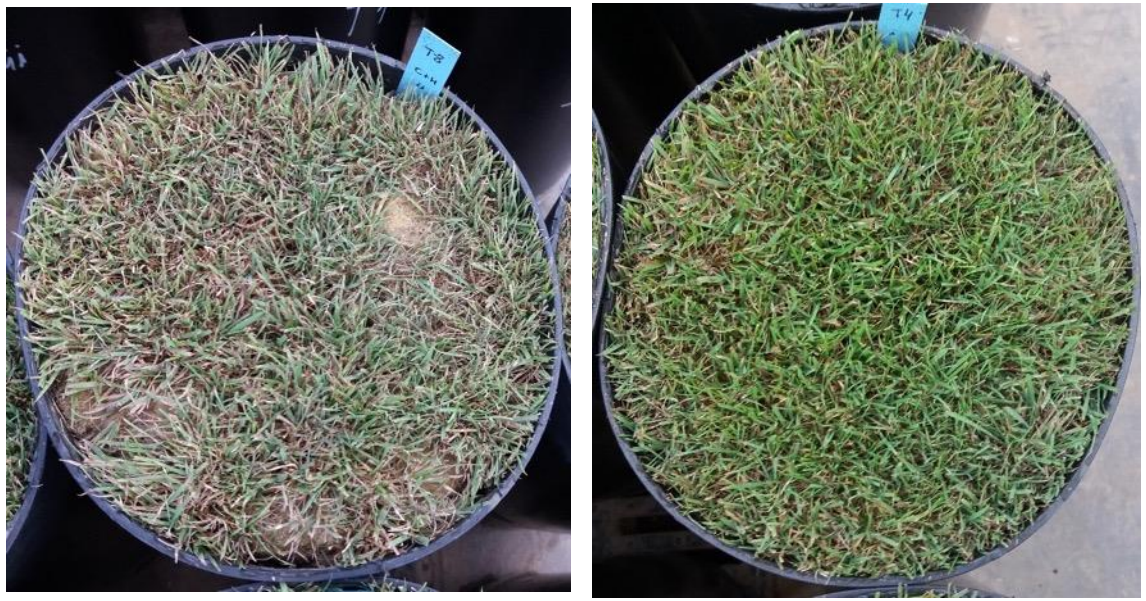


Hicure applications 14-day: 8
Hicure applications 28-day: 4

T max: 27.07ºC
T min: 21.14ºC

2016MM35. Hicure preventative applications. UPV, Spain. Date: 6/6/2017

Effect on turf injury 06 June 2017



Untreated

Hicure
(25 L/ha, 14 days)

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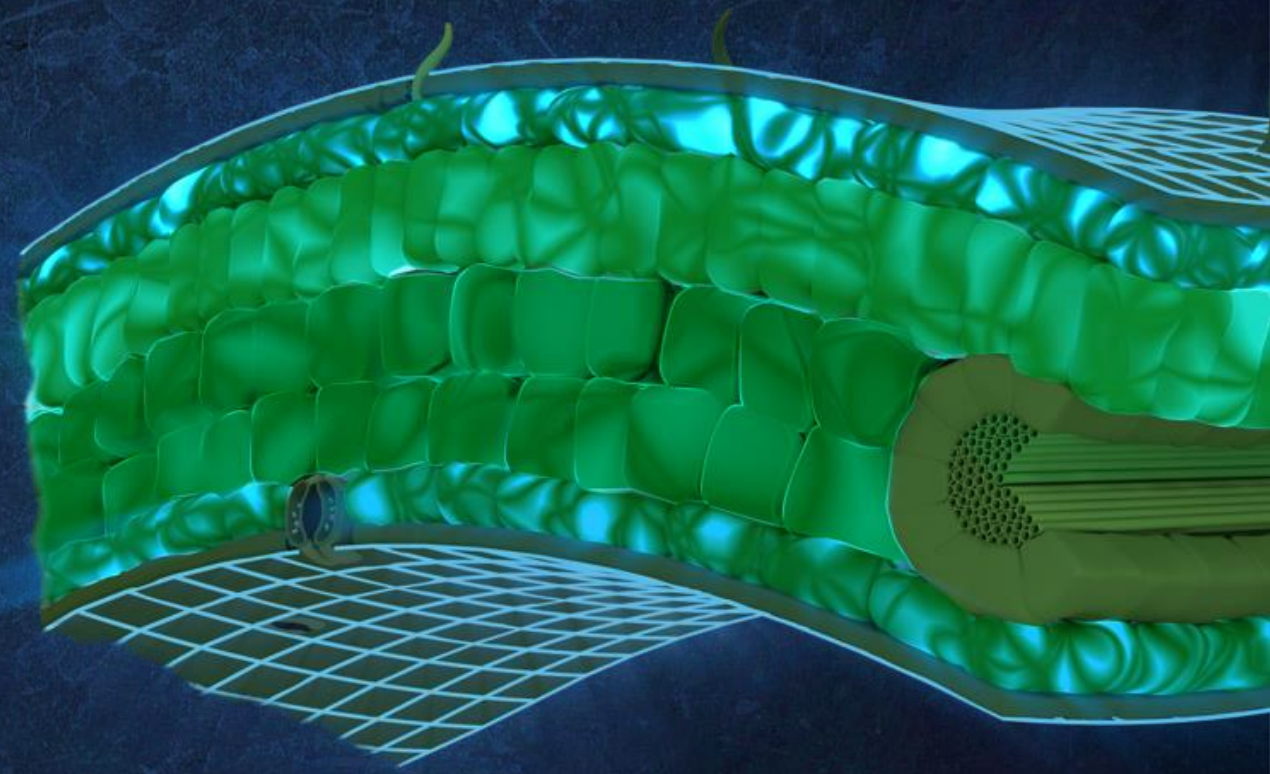
Drought



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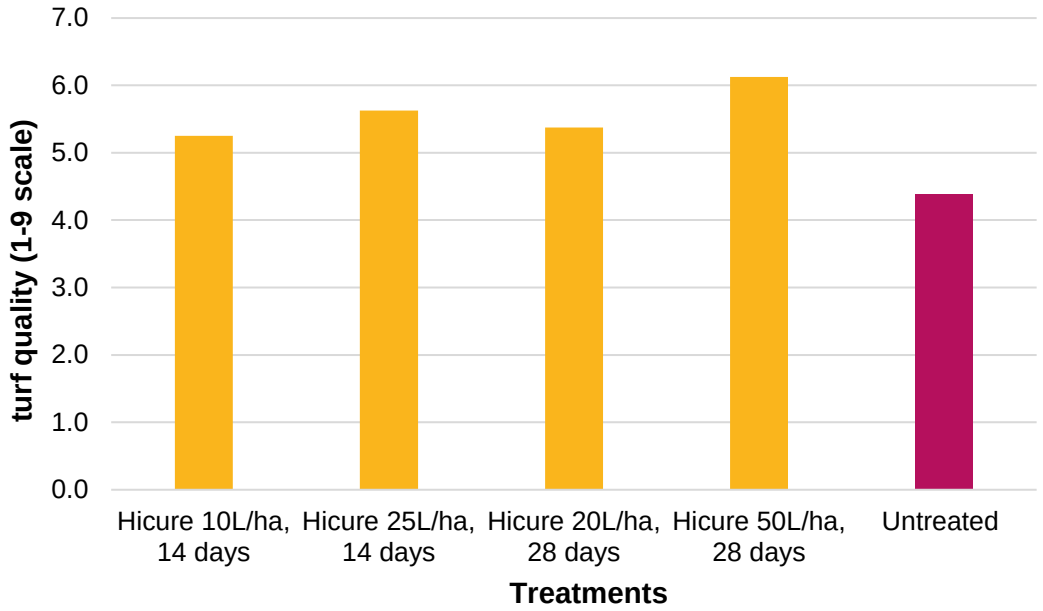
Enhanced drought tolerance with Hicure

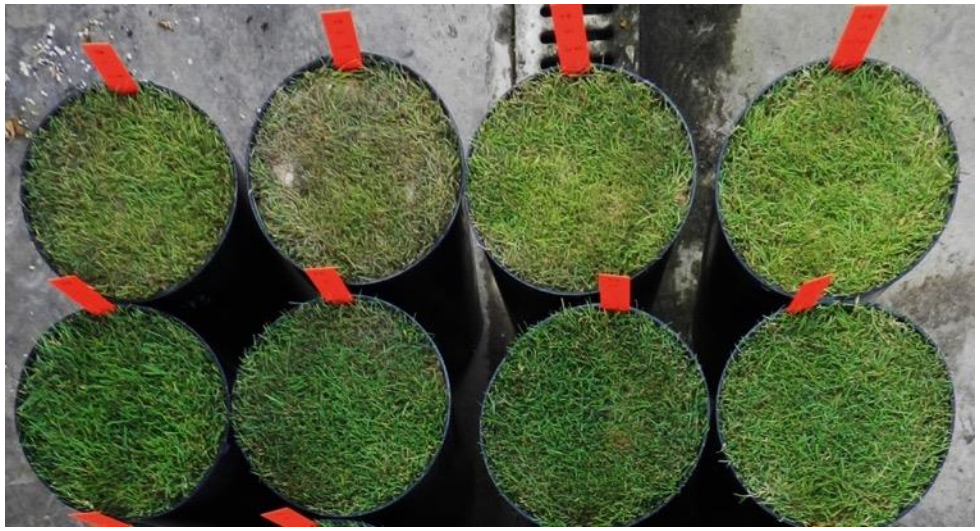
Results after 4 weeks of heat stress
Hicure applied for 4 weeks prior to stress



Stress: half of the normal irrigation (13.6 L/m^2 and week)
Total Hicure applic.: 14-d: 5. 28-day: 2)

2016MM35. Hicure preventative applications and drought stress. UPV, Spain. Date:

Untreated



Hicure
(50 L/ha, 28 days)

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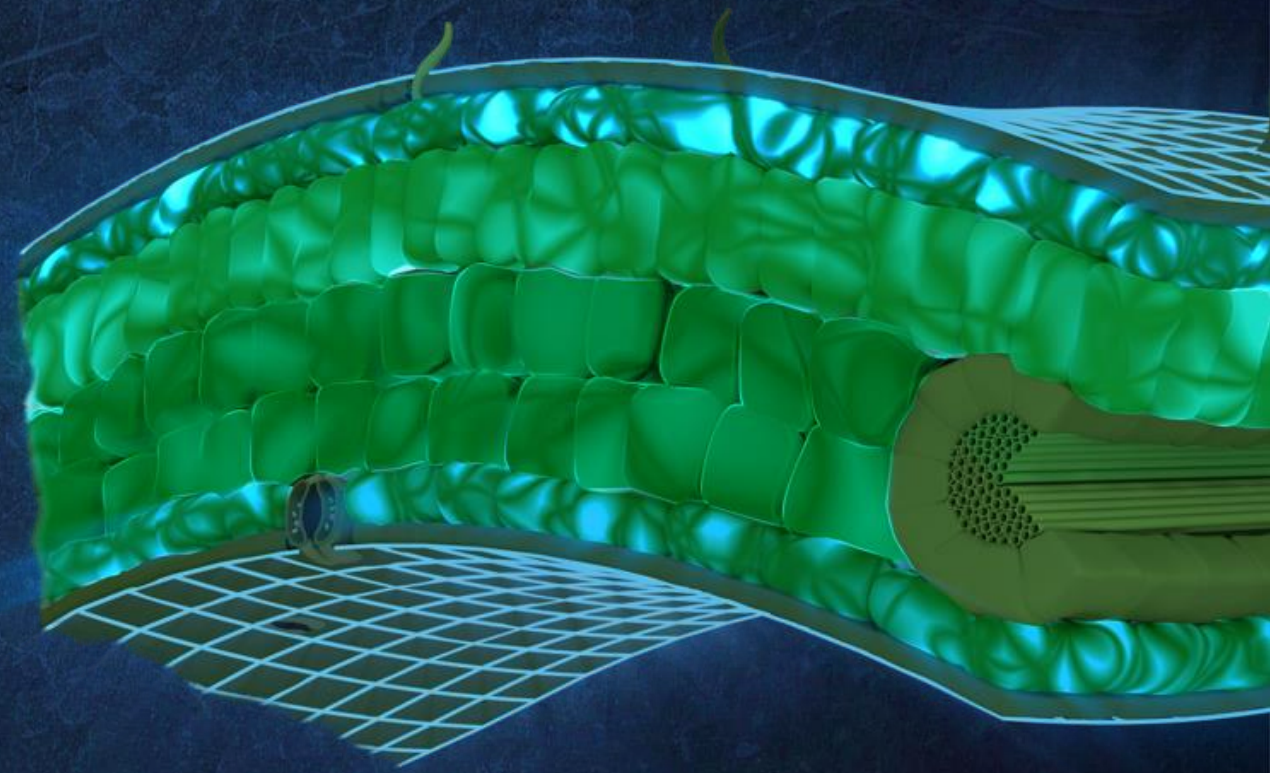
Recovery



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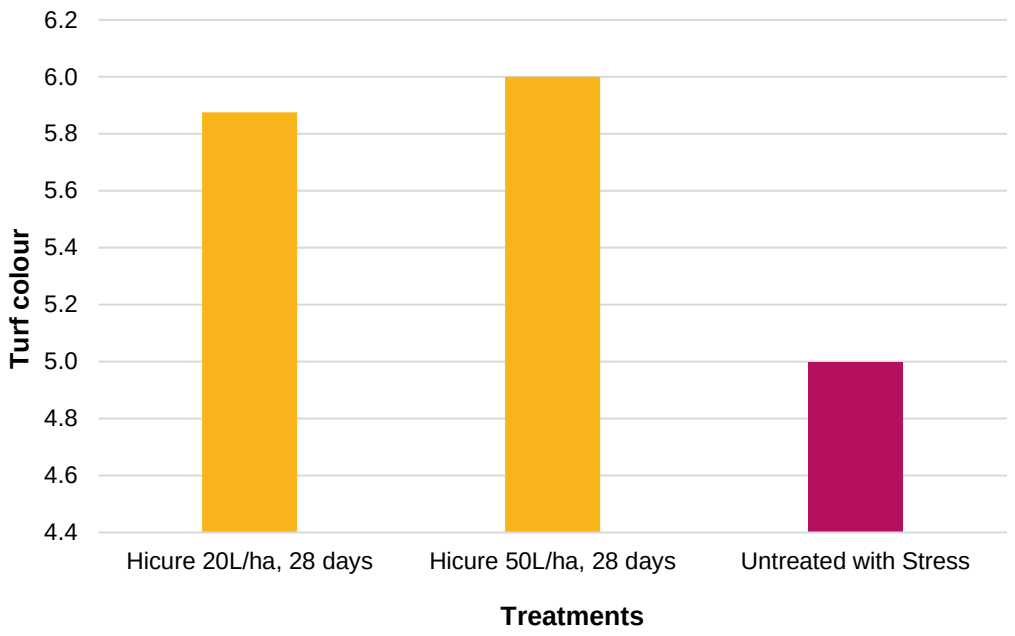
Faster recovery from turf damage/stress

Results 2 weeks after damage



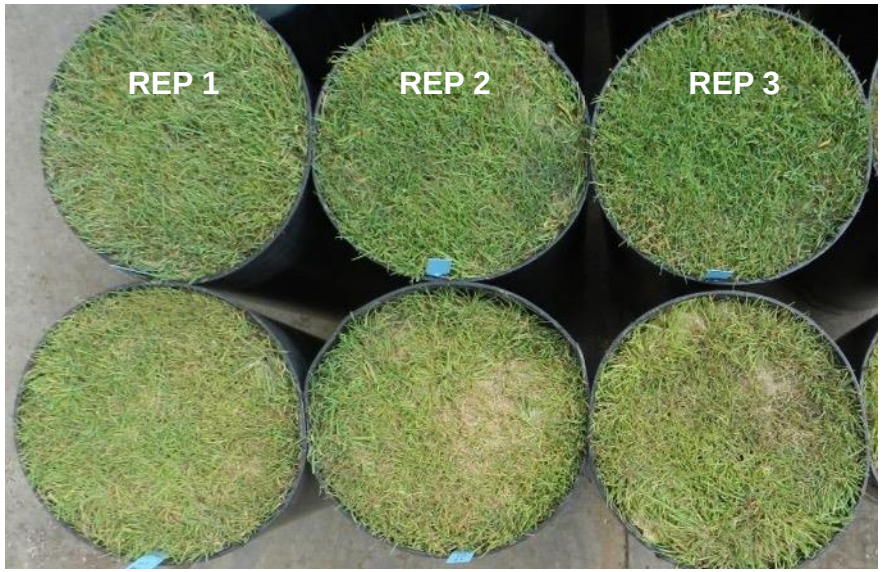
Herbicide: bispiribac-sodium
Hicure applications before stress: 2

2016MM35 (1-17). Hicure preventative applications and Herbicide stress. Date: 2/5/17

POLYTECHNIC UNIVERSITY OF VALENCIA

Effect on turf colour - 2 May 2017

Hicure
(20 L/ha, 28 days)



Untreated with stress

Herbicide stress preventative applications. 5 may 2017:
3 weeks after stress application

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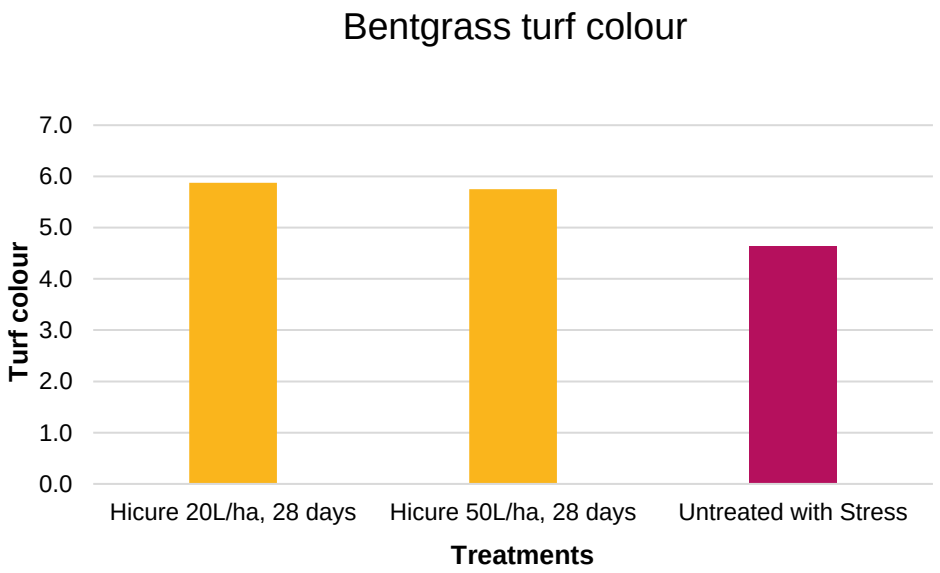
Faster recovery from turf damage/stress

Results 4 weeks after damage



Herbicide: bispiribac-sodium
Hicure applications before stress: 2

2016MM35 (1-17). Hicure preventative applications and Herbicide stress. Date: 16/5/17

POLYTECHNIC UNIVERSITY OF VALENCIA

Effect on turf colour 16 May 2017

Hicure
(20 L/ha, 28 days)

Untreated with stress

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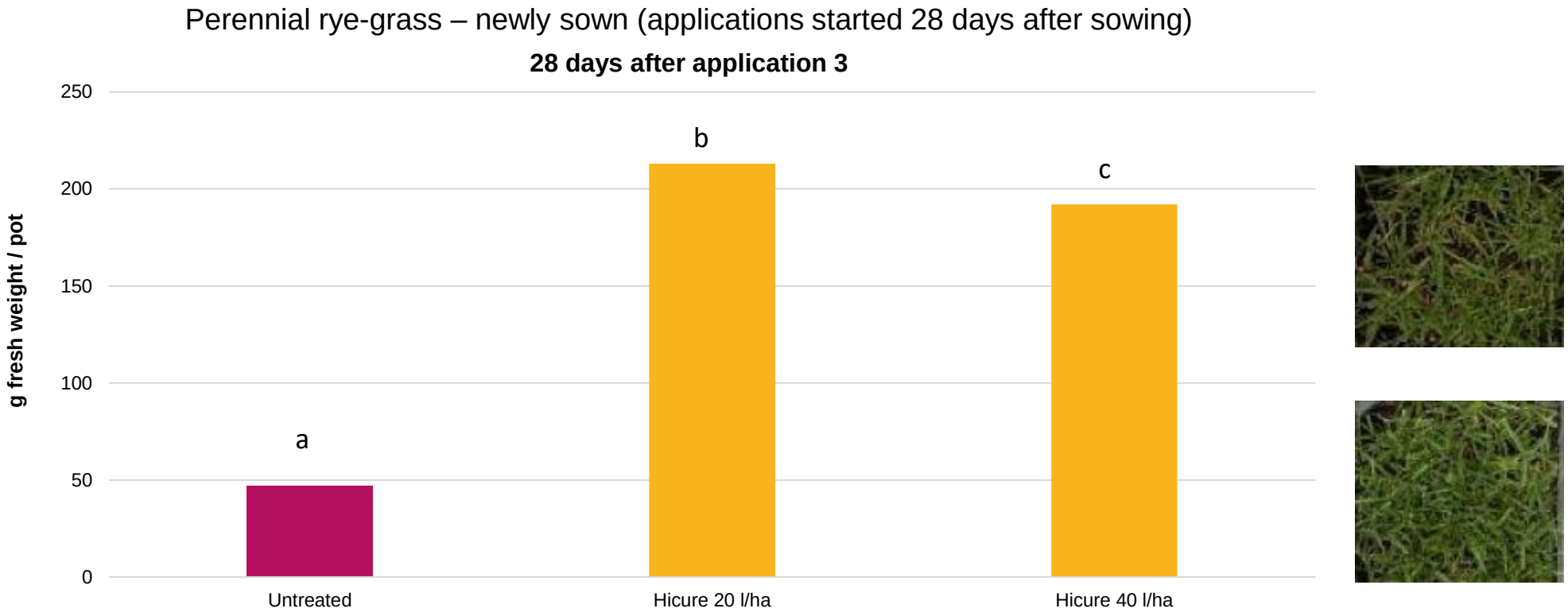
Hicure boosts early seedling development



STRI 2018 – glasshouse study. Applications every 14 days.

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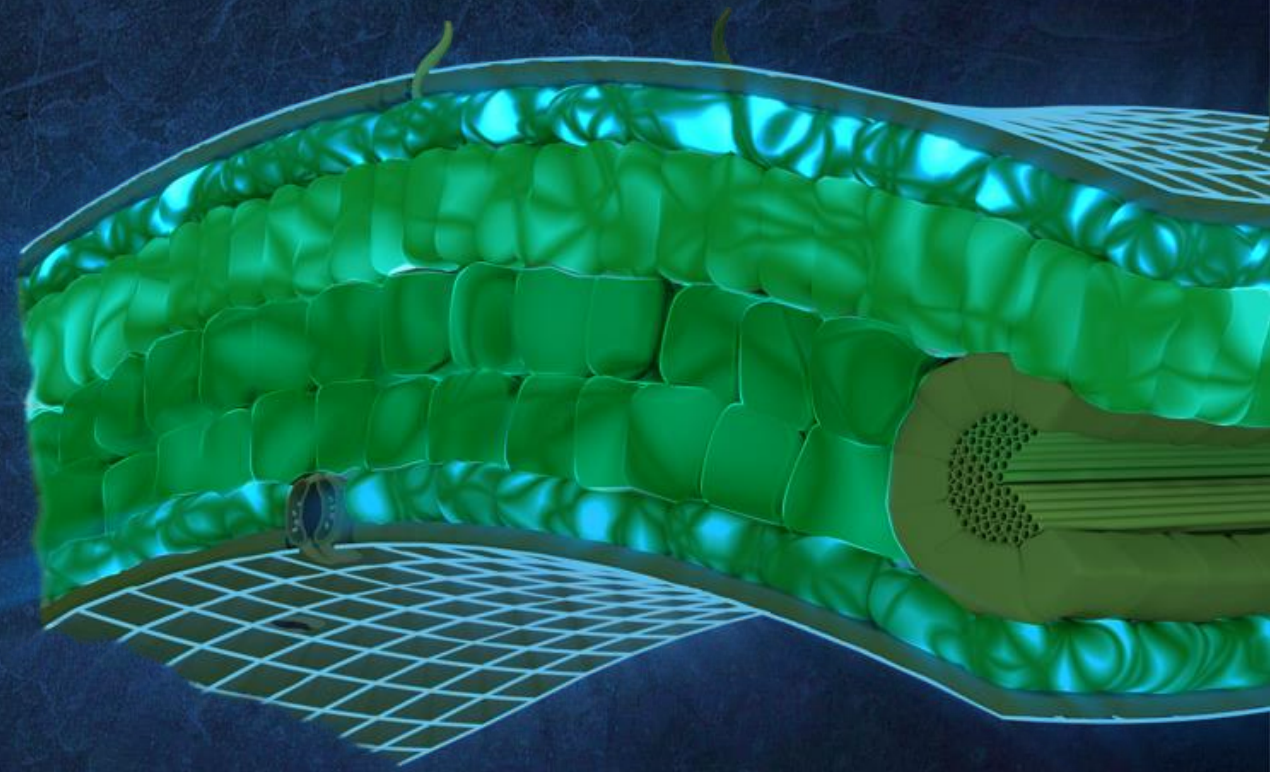
Building Disease Tolerance



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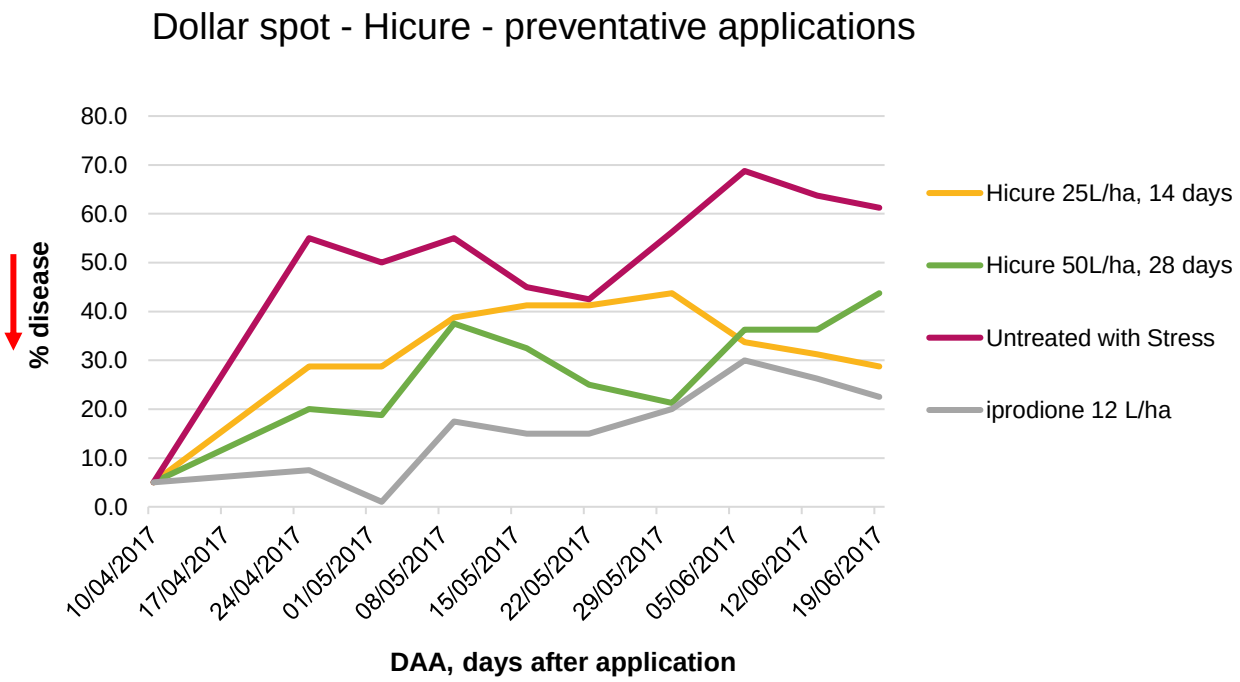
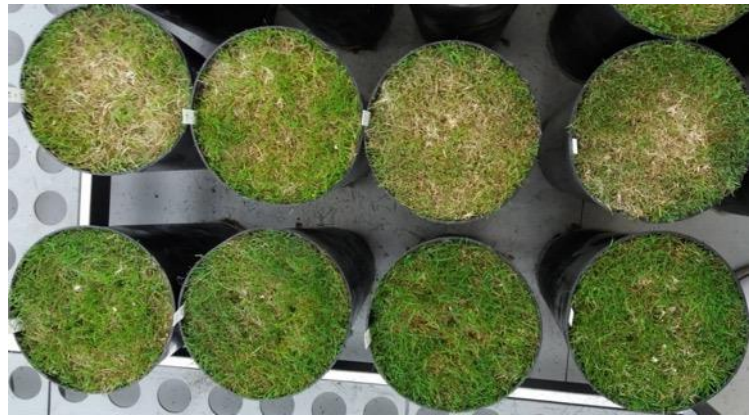
Greater tolerance to dollar spot with Hicure

Hicure applied for 8 weeks prior to inoculation



GREENHOUSE STUDY .
POLYTECHNIC UNIVERSITY OF VALENCIA 2016

Untreated and inoculated



Hicure
(50 L/ha, 28 days)

Hicure Turf Biostimulant

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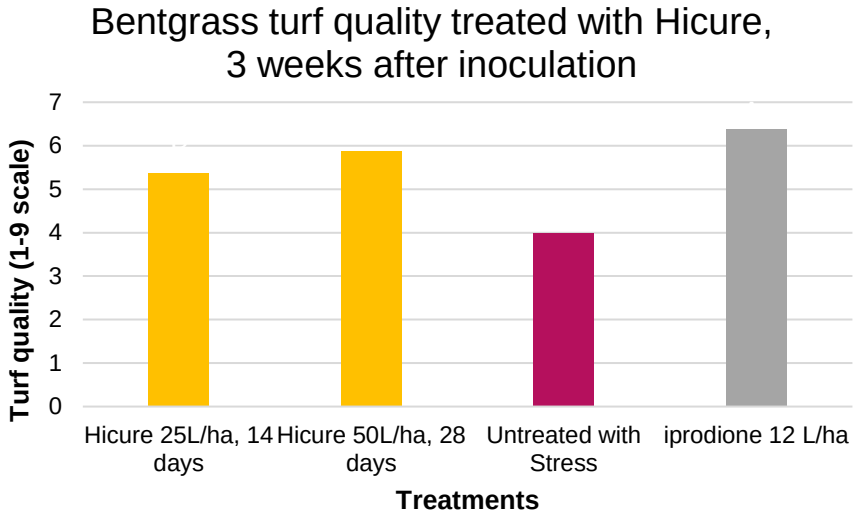
Superior turf quality under Dollar Spot pressure

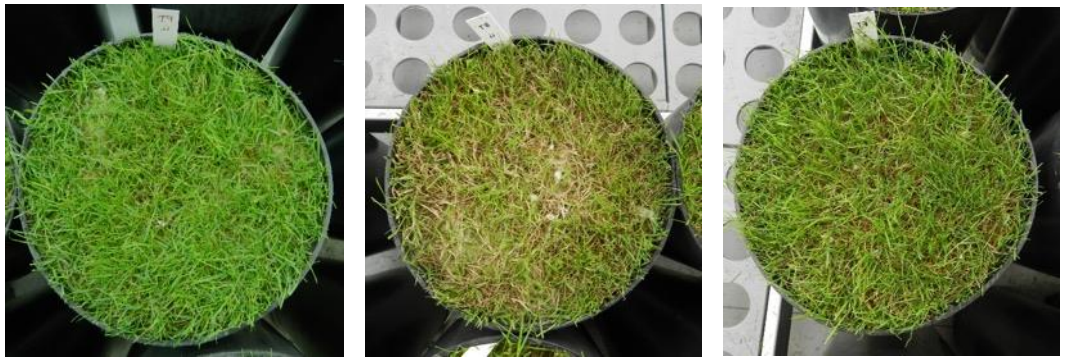


Stress: Dollar spot inoculation, 4 g/pot Total Hicure applic.: 14-d: 5. 28-d: 2.

2016MM35. Hicure preventative applic. and Disease stress. Date: 2 May 2017

GREENHOUSE STUDY .
POLYTECHNIC UNIVERSITY OF VALENCIA 2016

iprodine (12 L/ha)	Untreated and inoculated	**Hicure** (50 L/ha, 28 days)



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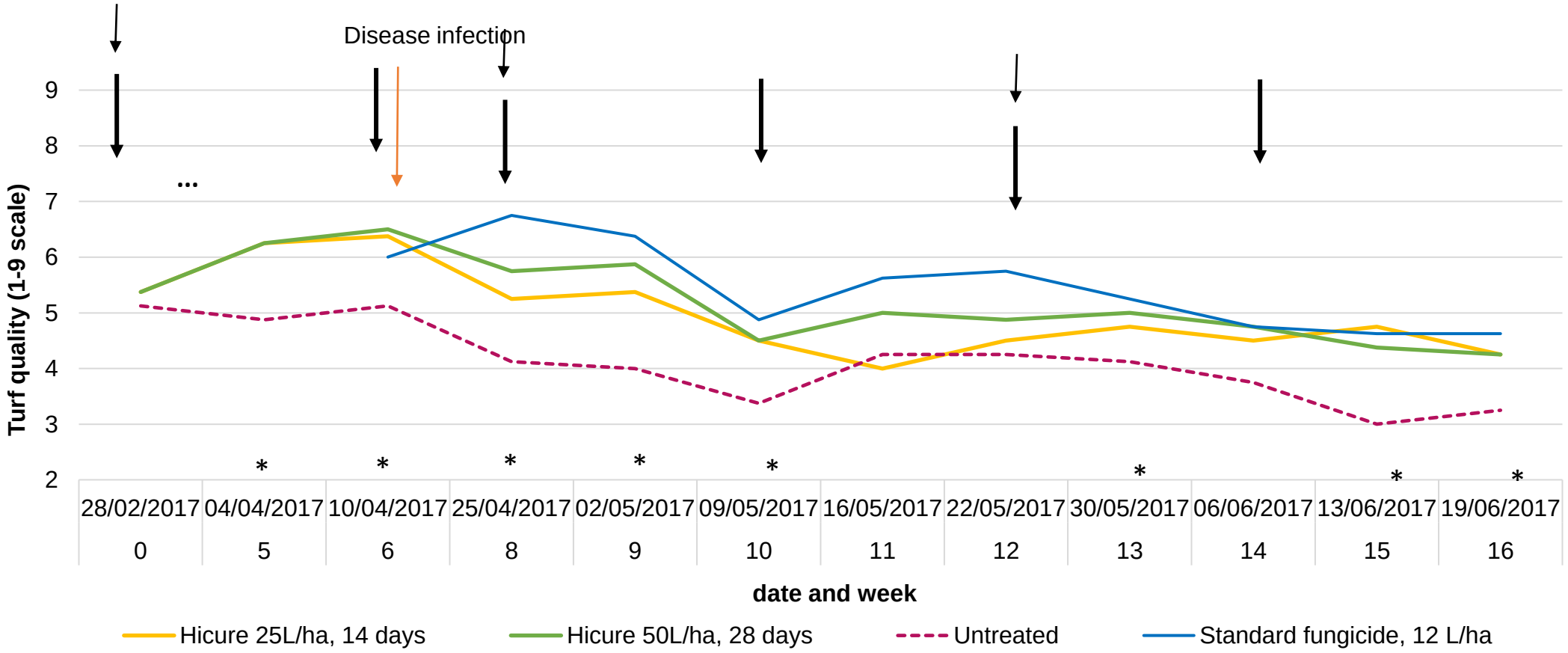
Superior turf quality under dollar spot infection



2016MM35. (5-18). UPV. Spain. 2017, Glasshouse study

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Effect of Hicure on reducing dollar spot

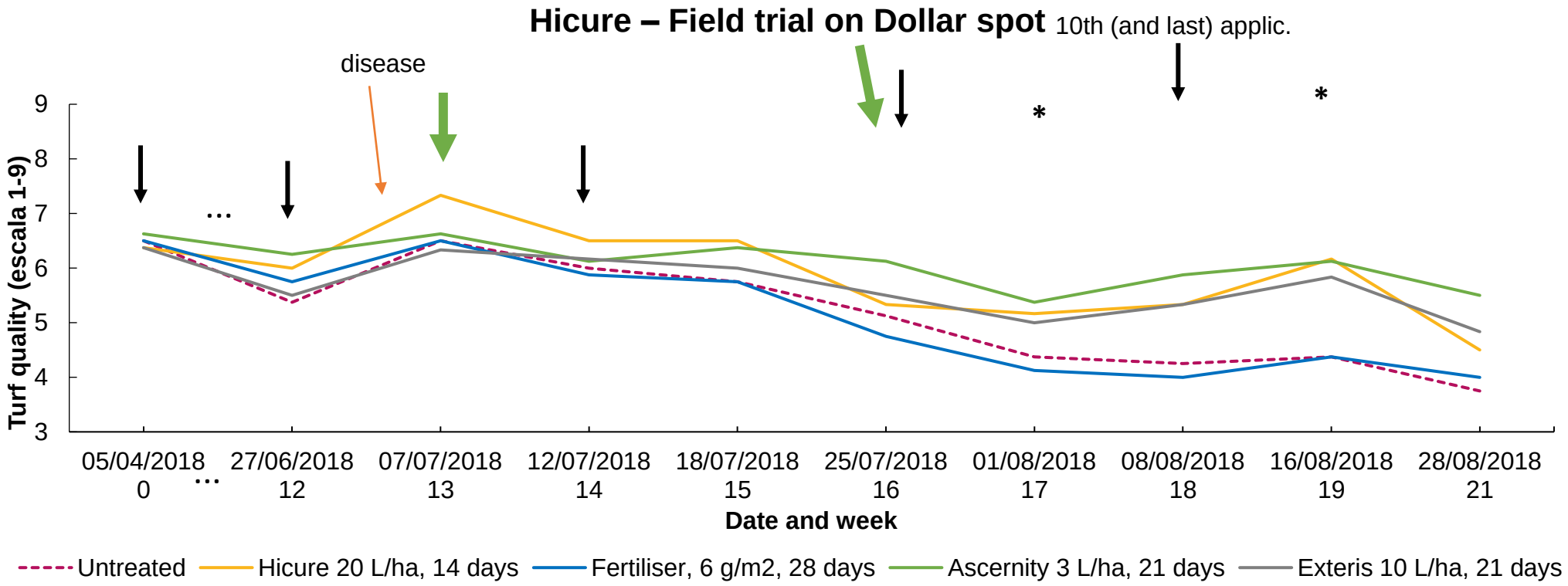
Hicure
(50 L/ha, 28 days)

Untreated

iprodine
(12 L/ha)

Mycelium development 6 days after inoculation

Superior turf quality under when low level of dollar spot



2017MM50. (5-18). UPV. Spain. 2018, Creeping Bent

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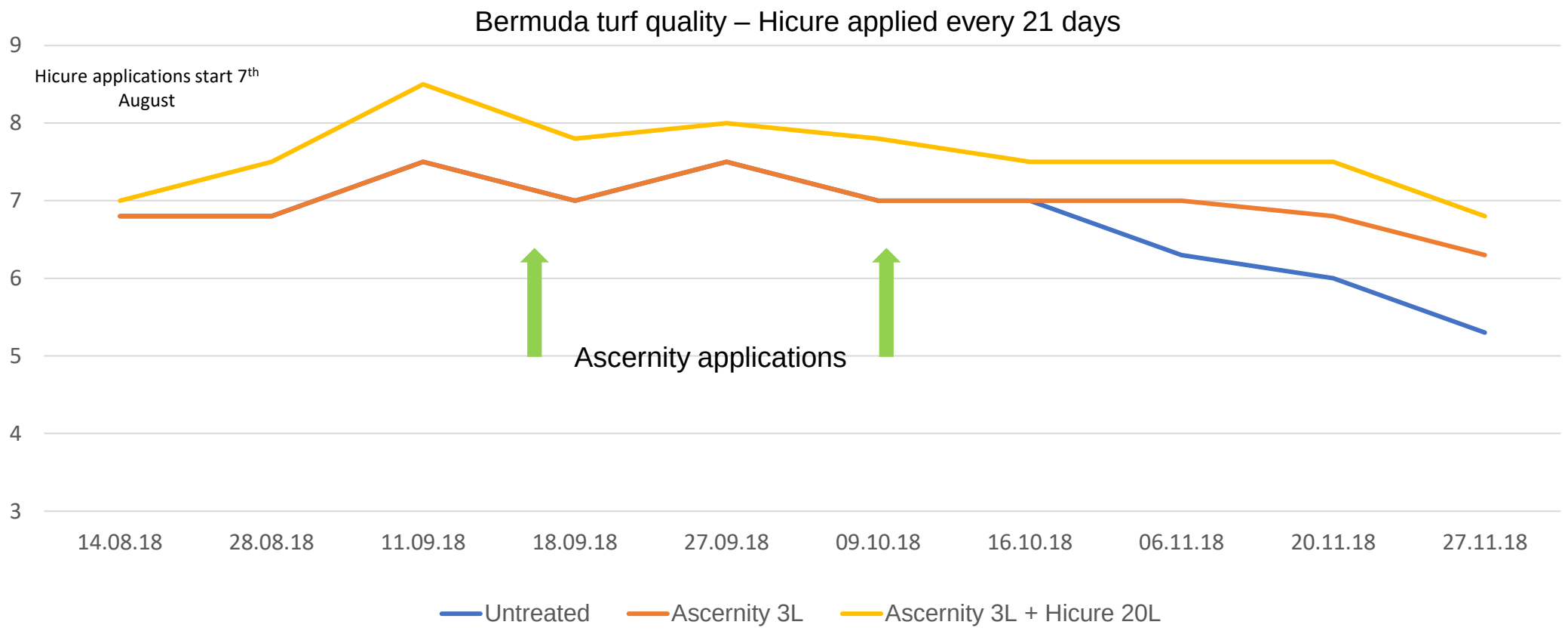
Bermuda turf quality under low dollar spot attack



MM1B 2018, Trialplan Portugal

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Greater tolerance to dollar spot

16.08.18

19 weeks after initial treatment

6 weeks after disease appearance

Hicure → 10 applications (1 week after last application)

Ascernity → 2 applications. (3 weeks after 2nd aplic.)

Untreated

Hicure
(20 L/ha, 14 days)

Ascernity
(3 L/ha, 21 days)

Hicure
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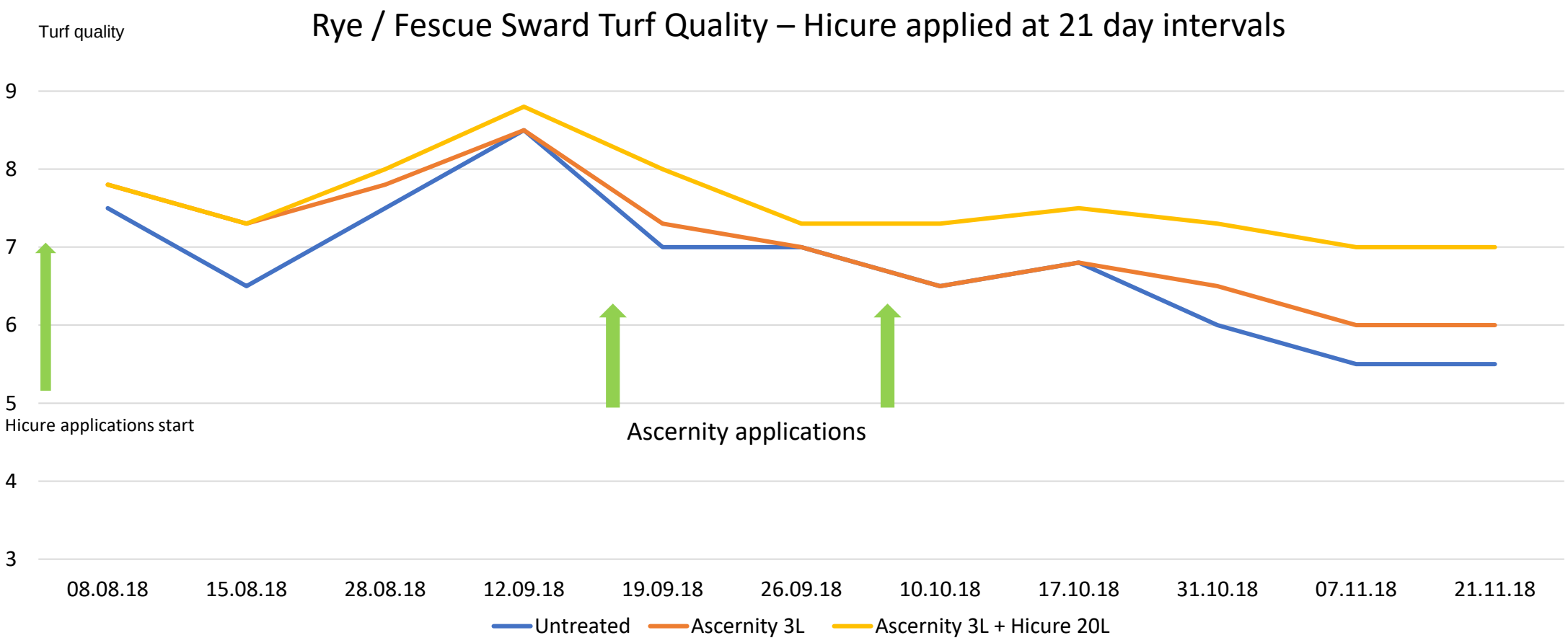
Superior turf quality when under low Dollar spot attack



MM1A 2018, Trialplan, Portugal 2018

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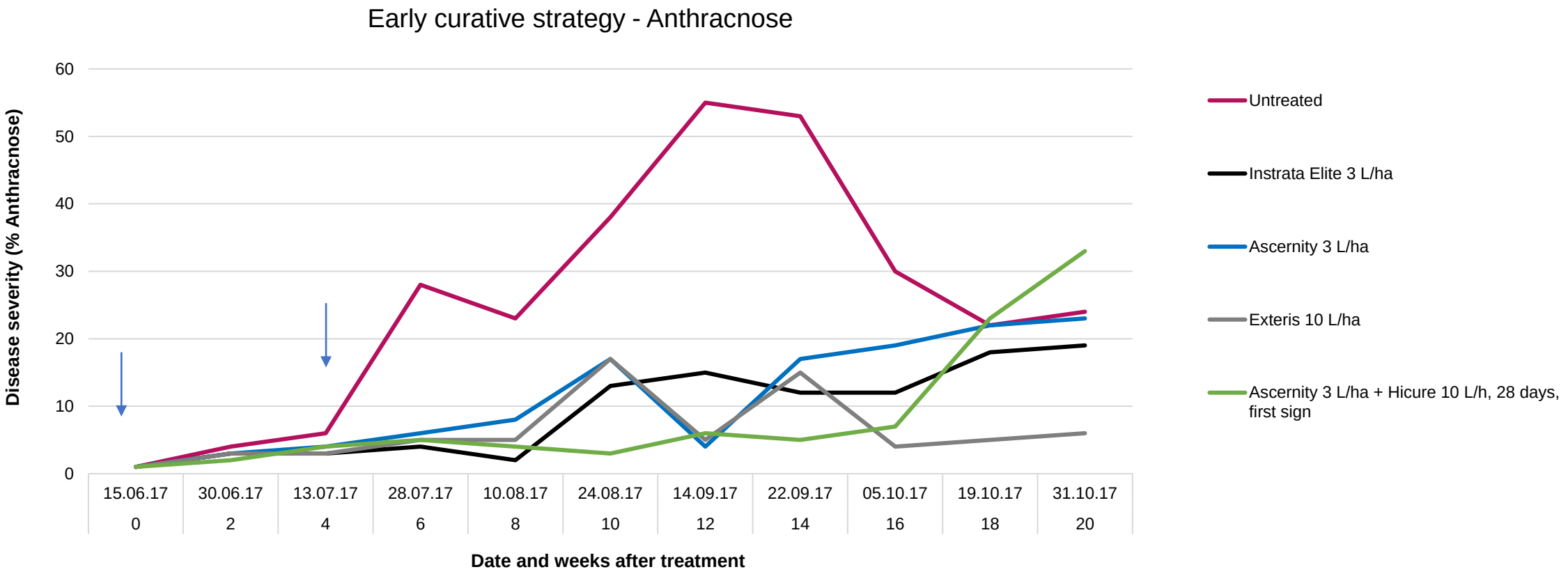
Greater recovery and tolerance to Anthracnose



STRI 2017, RS106757. Bingley. Golf green, Sandy loam. Poa/bent composition

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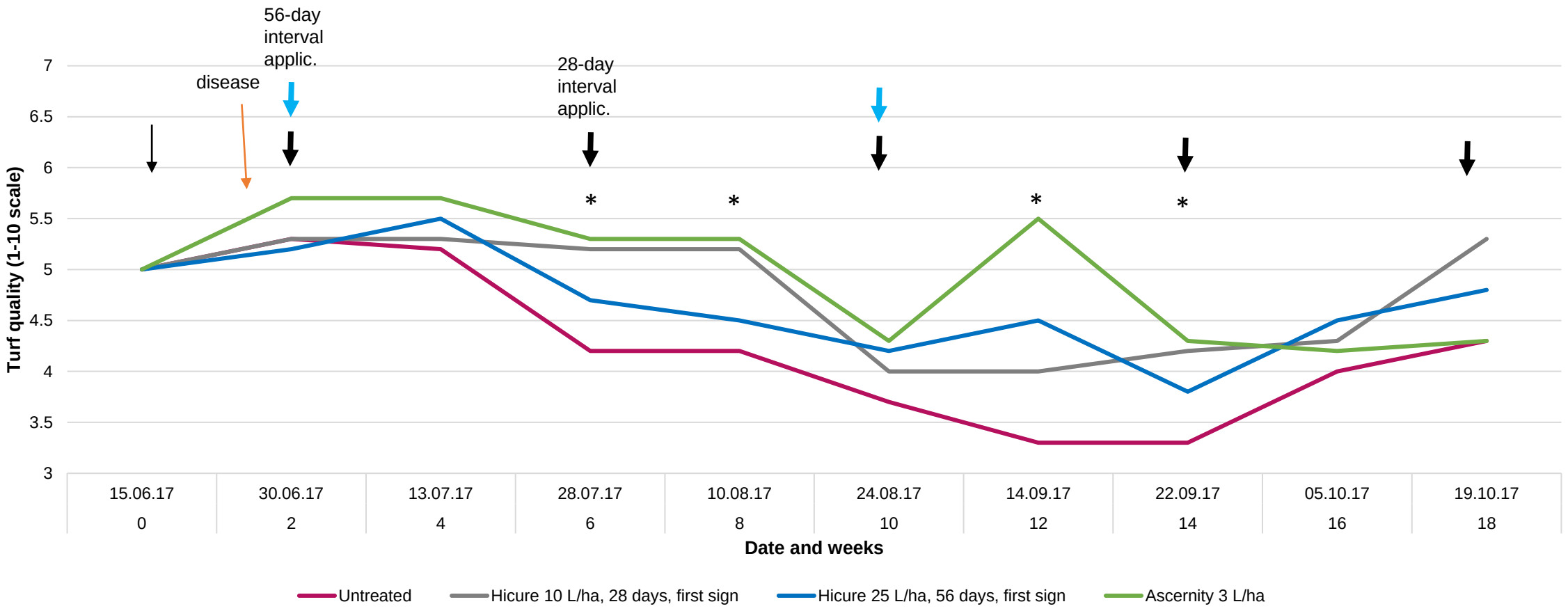
Superior turf quality when Anthracnose attack



STRI, Bingley UK, 2017

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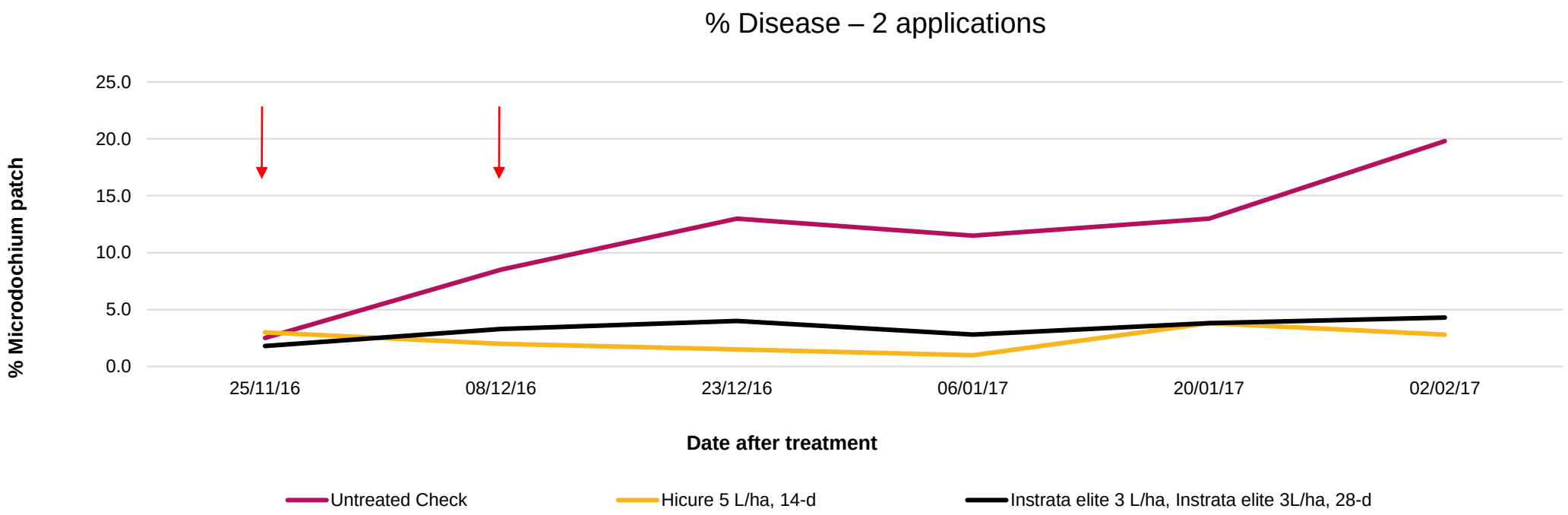
Greater tolerance when Microdochium patch



16-201 (MM-12). AgroChemex 2016

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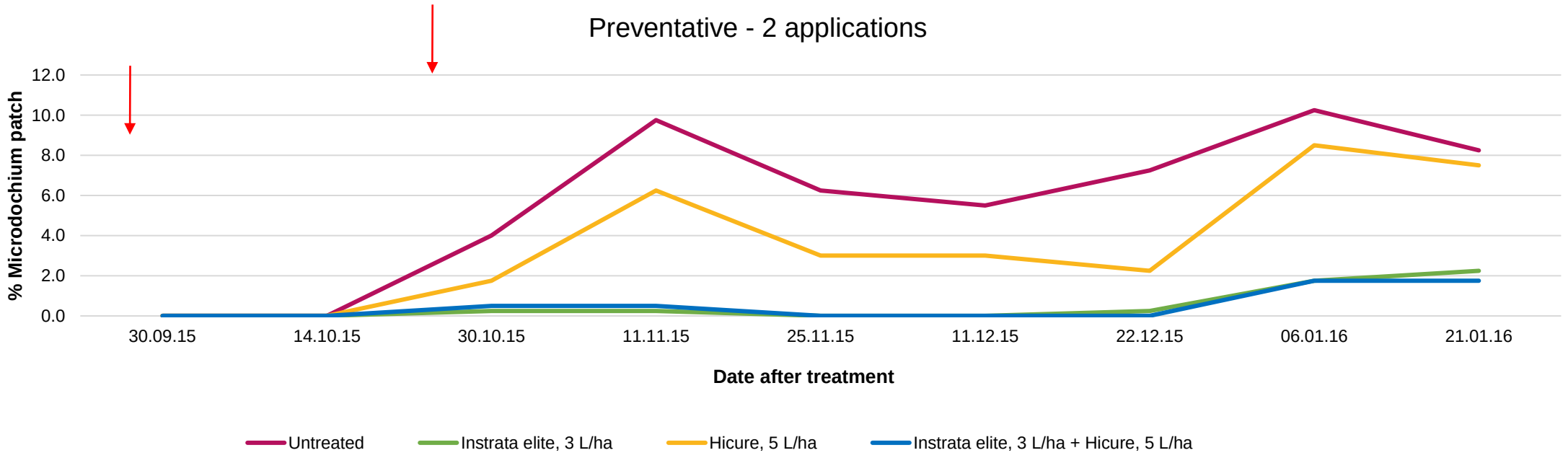
Greater tolerance when Microdochium in the autumn



RS105488. STRI. UK. 2015. Preventative 2 applications

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Microdochium patch, STRI trial

Untreated

Hicure
(5 L/ha, every 14 days)

Hicure
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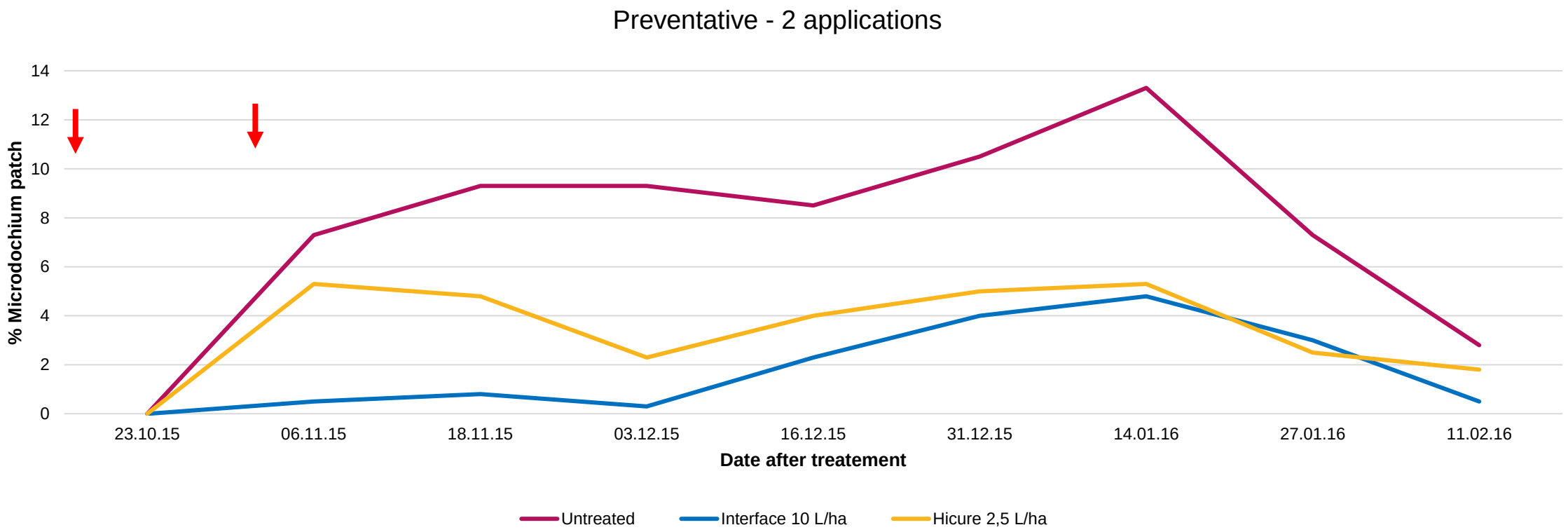
Tolerance to Microdochium with Hicure



Agrochemex 2015, 15-148A, UK. Preventative 2 applications

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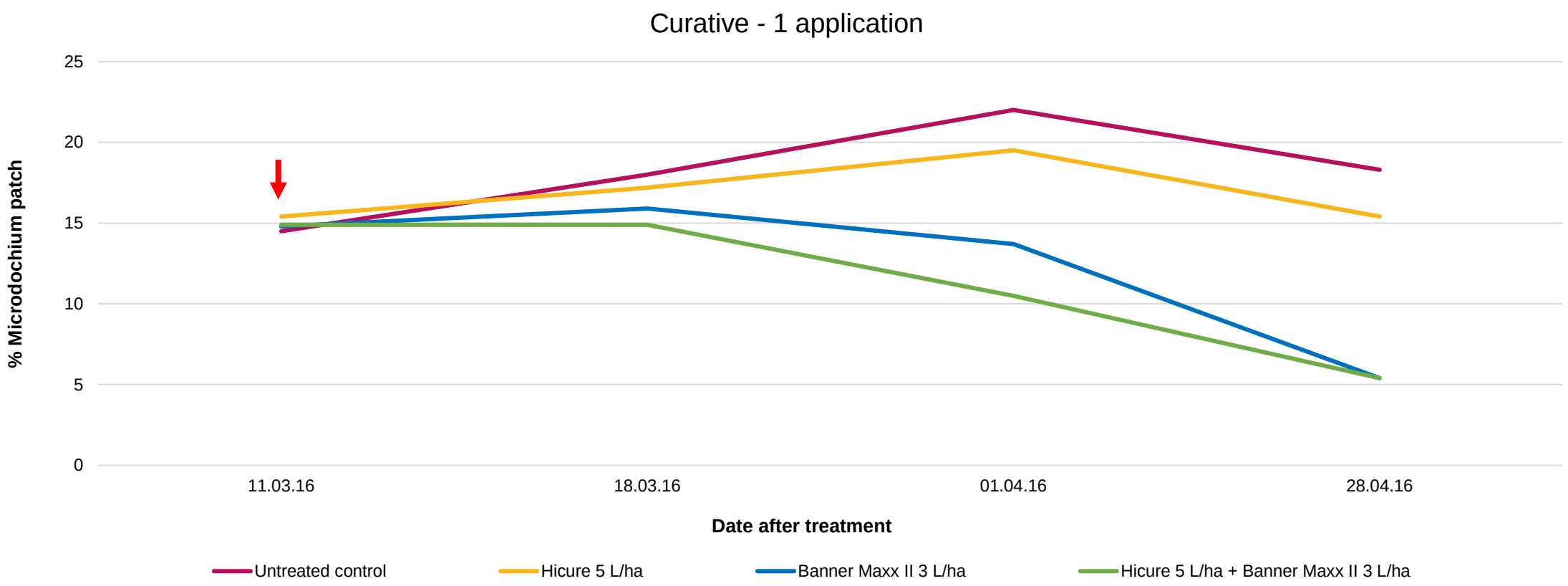
Apply Hicure preventatively or use in mixture of fungicides



STRI. 2016 RS105489. Curative 1 application

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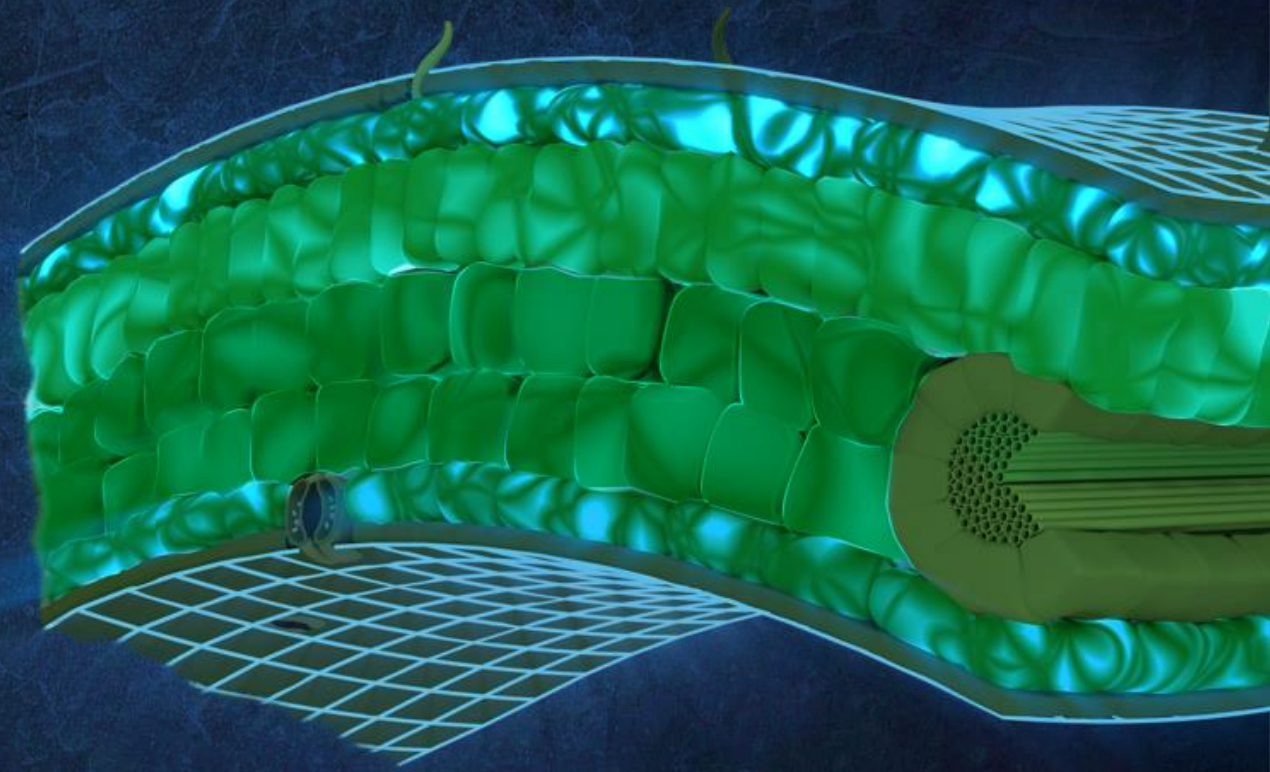
Programmes



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When to use: Year round performance with Hicure.

Hicure can be used year-round to improve winter quality, enhance spring recovery and pre-summer for stress conditioning. *Turf faces tough challenges right through the year.* Environmental impacts of weather are compounded by the rigours of essential everyday management along with the wear and damage caused by play.

Spring	Over winter damage	Low energy reserves	Low pigment levels
Summer	Drought/drying winds	Light and heat	Shorter HOC decline in root mass and high wear
Autumn	Slowing but variable growth	Less photosynthesis	Lower nutritional inputs
Winter	Slow/no growth	Low photosynthesis/depleting energy	Frost damage

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Guidelines for optimum results

» Use in programmes every two to four weeks, start before stress expected

» Use higher rates for monthly intervals and when conditions are more challenging

» Tank mix with Primo Maxx in spring - summer

» Can be tank mixed with fungicides if required

» Apply at 200-400 liters of water per hectare

» Maintain good ITM practices, including aeration & nutrition

When to apply Hicure

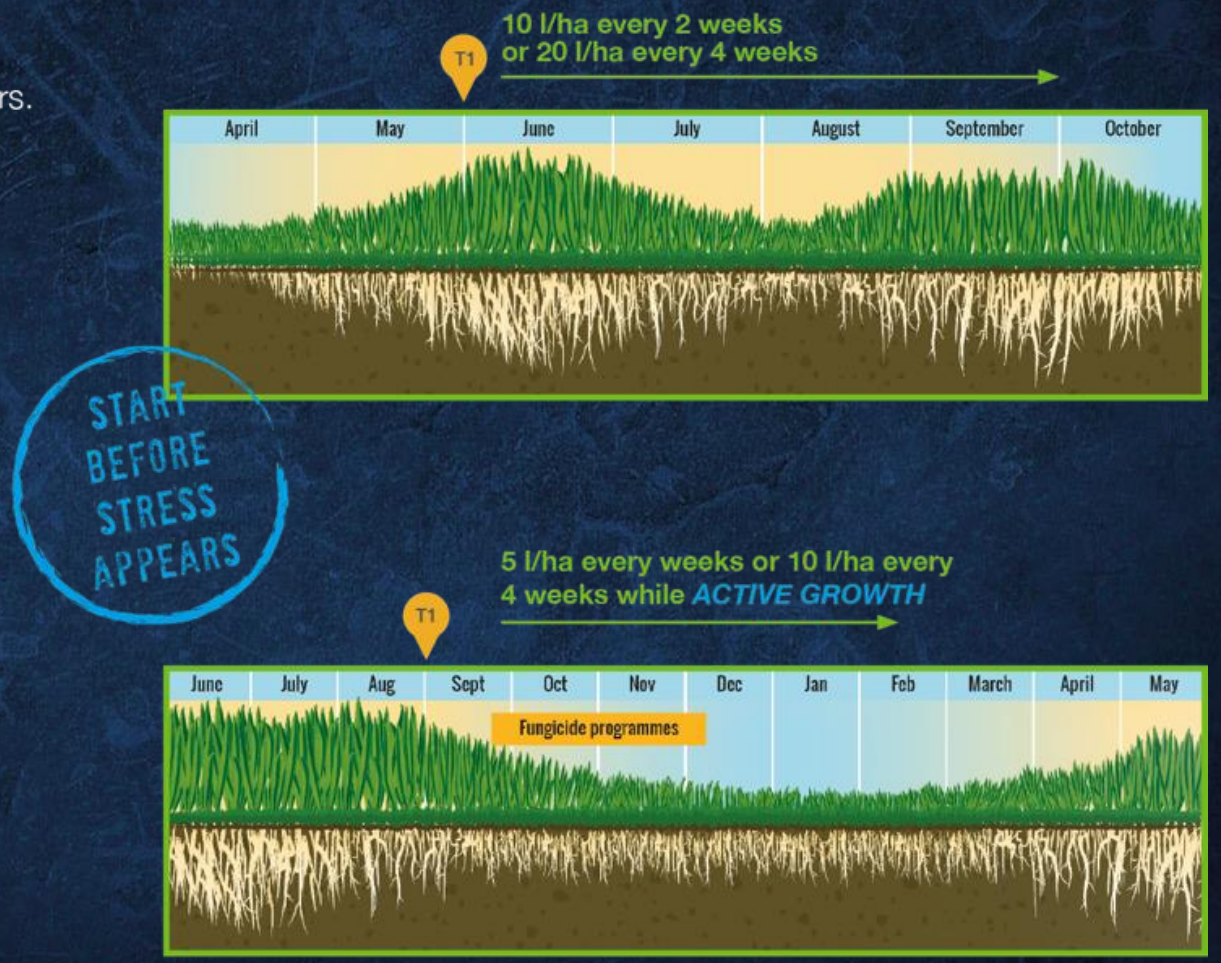
Apply during active turf growth before stress appears.

Spring - recover from winter stress, build conditioning to help get the optimum playing surface earlier.

Summer - maintain playability. Prevent summer stress from heat and drought. Sustain turf quality during stressful summer conditions.

Hicure can dovetail perfectly with regular summer Primo Maxx conditioning programmes.

Autumn - prepare for winter and mange though cold/frost and low light stress conditions.



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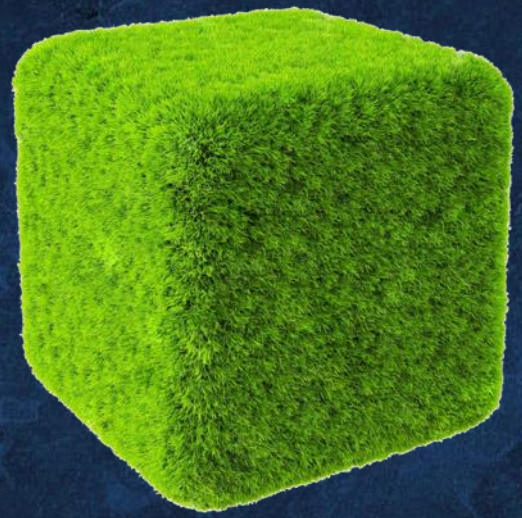
Hicure…build your turfs' natural energy

Growth

Density



Colour

Maintaining turf quality in challenging conditions

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