BRIDGEWAY HANDBOOK LIGHT

POWER CROPS, SECURE YIELD

2022

- Growth & development
- Stress protection
- Nutrient-use-efficiency
- Natural & renewable

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PRODUCTS FOR AGRICULTURE

Welcome to the **Bridgeway Handbook** Light

Bridgeway is the leading amino acid and peptide biostimulant that promotes healthier, higher-yielding crops by stimulating growth, optimising resource-use-efficiency and increasing immunity against stressful growing conditions. Rich in all vegetal amino acids critical to growth, metabolism, nutrition and defence, Bridgeway is the natural renewable solution for growers looking to reduce dependence on synthetic inputs for more resilient and sustainable crop production.

Manufactured by Interagro UK, Bridgeway is a class leading biostimulant sourced only from plants, and produced with unique extraction methods that ensure the highest purity and quality for your crops, backed by rigorous UK and EU trials.

With the need for more renewable and sustainable inputs, the plant health benefits of amino acids offers growers a chemical-free alternative to growth enhancement, nutrient-use-efficiency and stress mitigation. Bridgeway provides the optimum concentration of amino acids and stimulating peptide complex that crops need for more efficient and resilient growth, with a wealth of data behind it.

Contents

Naturally rich building blocks for your plants

Bridgeway is the leading amino acid biostimulant that contains the richest, purest source of all L-amino acids required by plants for healthy growth and development. Sourced exclusively from plants, Bridgeway is the perfect nature-based solution for growers looking to incorporate the benefits of amino acids into their agronomy programmes because it contains all 18 essential L-amino acids that have a physiological, biochemical and morphological effect on plant health:

- Every L-amino acid in an immediately available and usable form that can be readily absorbed, transported, and utilised, saving the energy usually expended by plants to reduce organic matter, synthetic nitrates and ammonia into amino acids
- Provides the ready-made building blocks for protein synthesis critical for plant structure, metabolism, hormones, nutrient transport and amino acid stock
- Novel approach for regulation and modification of physiological processes in the plant to stimulate growth, mitigate stress-induced limitations, and increase yield
- Provides glutamic acid, central to plant metabolism, in high concentrations

Contents

Composition	%
Vegetable amino acids and peptides	31.25%
Organic nitrogen	5%
Biological organic carbon	17.8%
Carbohydrates	9%

Bridgeway L-amino acids and function in plants

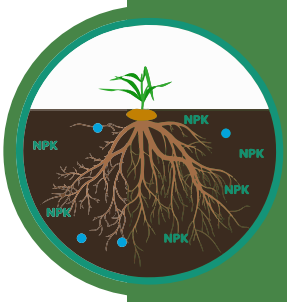
L-Amino Acids	Function in plants
Glutamic Acid	The precursor to all other amino acids; stimulates plant development; aids absorption of inorganic nitrogen; increases resistance against weather related stress
Aspartic Acid	An important metabolic hub for the biosynthesis of many metabolites, amino acids, proteins and hormonal conjugates that play a crucial role in growth and development, and response to environmental conditions
Lysine	A precursor for glutamate, an important signalling molecule amino acid that regulates plant growth and responses to the environment
Arginine	Due to the highest nitrogen to carbon ratio among the 21 proteinogenic amino acids, arginine is a major storage and transport form for organic nitrogen in plants in addition to its role as an amino acid for protein synthesis, a precursor for essential metabolites for many cellular and developmental processes. In seed proteins of different plant species 40–50% of the total nitrogen reserve is represented by arginine
Serine	Plays a fundamental role in plant metabolism, development and cell signalling including rooting
Valine	Branched forms serve as alternative energy source. Involved in seed development and amino acid homeostasis
Tryptophan	Fundamental precursor of auxin which regulates plant growth and development. Core to cell division, elongation and differentiation, embryonic development, root and stem tropisms, apical dominance, and transition to flowering
Methionine	Precursor to ethylene which stimulates ripening
Proline	Protects plants from stress and helps plants to recover more rapidly
Histidine	Plays a critical role in plant growth and development. Supports metal ion homeostasis
Isoleucine	Branched forms serve as alternative energy source
Leucine	Important role in plant defence systems. Leucine-rich repeat receptors detect pathogens as part of immune response
Phenylalanine	Serves as a building block for many compounds essential to plant structure, reproduction, defence and communication
Threonine	Significant role in chemical defence against abiotic stresses. Also involved in plant growth and development, cell division, and regulates the phytohormones
Tyrosine	Precursor of many specialised metabolites that have diverse physiological roles e.g. electron carriers, anti-oxidants and defence compounds
Alanine	Important role in plant physiology and metabolism, and directly as a defence compound by enabling plants to withstand stress, such as waterlogging and drought
Cysteine	Central role in fixing sulphur from the environment and a precursor for many bio-molecules e.g. plant defence compounds
Glycine	Increases nitrogen status and concentration of nutrients in plant tissues, helping to mitigate fertiliser requirements in crops

The biostimulant to nourish and protect

Bridgeway provides triple action power to crops through biostimulation, nutrition, and anti-stress action to nourish and protect your crops under increasingly adverse growing conditions. Chemical free and produced using our cutting-edge enzymatic hydrolysis techniques to preserve all the bioactivity and natural goodness, you can be confident in knowing Bridgeway amino acids are the best source for healthy higher yielding crop production.

- **Optimises plant growth and development**
- **Increases nutrient-use-efficiency**
- **Protects against abiotic and biotic stress**
- **100% natural and renewable**

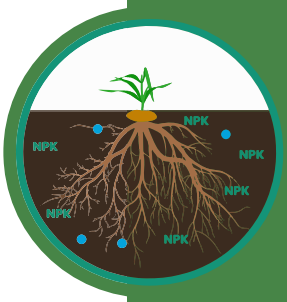
Powers crops, secures yield



Optimises plant growth and development

Stimulates growth and strengthens all plant parts

Bridgeway contains high levels of root stimulating amino acids and peptides that increase the lateral roots and root length density of plants. The more robust and expansive root systems enable crops to capture nutrients readily available in the soil and leached water and nutrients lower down. Building strong root systems with Bridgeway early in the life of the crop ensures the supply of water for photosynthesis and transpiration that is needed for highly efficient crop production. The stimulation of growth regulating phytohormones also promotes shoot growth and biomass production, supported by more abundant resources to optimise plant growth and development.



Increases nutrient-use-efficiency

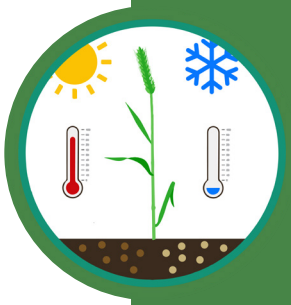
Maximises nutrient uptake, transport and use

Bridgeway increases nutrient uptake and the translocation of both macro- and micro-nutrients within the plant, by changing root morphology, improving micronutrient mobility in the plant, and by increasing activity of NO3-assimilation enzymes. The small molecular weight of L-glycine and L-glutamic acid, natural chelating agents, also support the assimilation of metals such as Fe, Zn, Mn and Cu, by making them more readily absorbable through roots and leaves. The efficient provision of all L-amino acids in an immediately available and useable form, could help reduce the dependence on nitrate and ammonium fertiliser as an N source for amino acid and protein synthesis. Supplementing crops with Bridgeway offers huge potential to increase nutrient-use-efficiency and enhance the quality and health of plants.

Supplies more energy to the crop

Speeds up photosynthesis

Bridgeway increases chlorophyl production in plants, increasing the rate of photosynthesis. The higher glucose production provides more energy for crop growth which is particularly advantageous at key development growth stages when energy demand is high. The ability of Bridgeway to help stabilise photosynthesis during the season is key to protecting the yield and quality potential of the crop when abiotic and biotic stress would usually reduce the plant's energy supply, suppressing growth.



Protects against abiotic and biotic stress

Supports the defence systems of plants

Bridgeway provides an immediate supply of stress-acting amino acids that signal the defence systems of plants, avoiding the recycling of proteins to amino acids at huge cost to the plant. Under low temperature, water deficit, salinity stress, and high UV exposure, stress-busting proline accumulates in cells where it is needed to suppress oxidative stress, and secure osmotic balance to maintain cell turgor when water is limited. Under heat stress, Glutamic Acid (in high concentration in Bridgeway) acts as an osmotic agent triggering stoma to open, enabling photosynthesis, water and nutrient absorption to continue, even during stressful growing conditions. Bridgeway helps plants to adapt to stressful growing conditions and rapidly resets the balance between stress resistance and growth, critical to secure yield and quality potential.

Key situations to use Bridgeway

- Help build robust root systems in winter and spring crops to increase ability for water and nutrient scavenging at depth
- Pre-T0 + T0 in moderate and high input wheat varieties to build the plant's natural defences against invading diseases
- Prior to fertiliser applications to minimise leaf scorch and optimise nutrient uptake and assimilation in the plant
- Early fodder and sugar beet establishment to maintain photosynthesis and increase tap root bulking - 3 applications optimal
- To optimise the chelation of metal ions within the plant
- Barley to minimise stress which can be a trigger for ramularia

- Support recovery from abiotic, biotic and chemical stress. Apply ahead of anticipated stress for best results
- In potato crops to maintain photosynthesis during heat stress to optimise yield – 2 to 3 applications optimal
- Alleviate transplanting and establishment stress

Performance in UK and EU trials

Improved growth and development

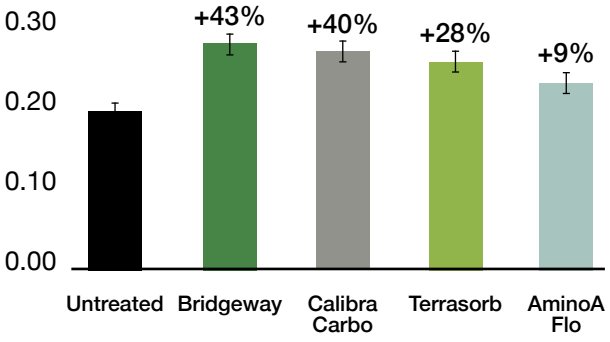
Rooting

+43% roots, + 31% shoots

The rooting ability of crops has huge consequences on plant health. Research at the University of Nottingham over the last few years in wheat, barley and oilseed rape, has shown Bridgeway significantly increases root and shoot growth, and is one of the best biostumulants on the market.

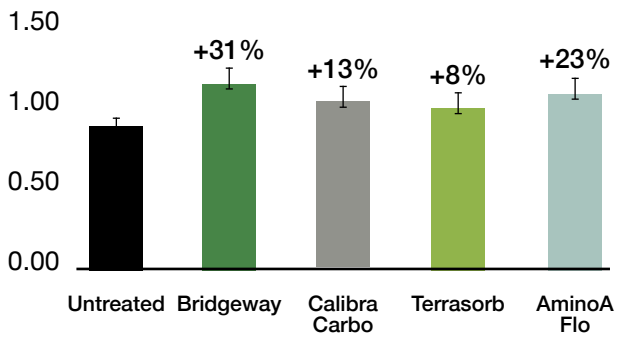
Bridgeway - biggest effect on roots

Effect of biostimulant on root growth in winter wheat
Mean root dry weight (g) at 95% CI



Bridgeway - biggest effect on shoots

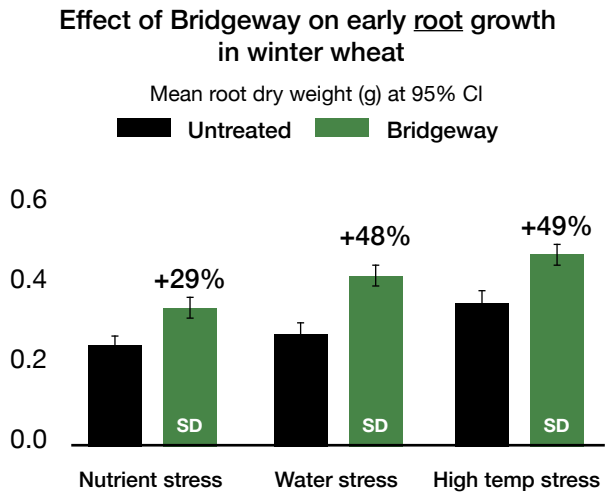
Effect of biostimulant on shoot growth in winter wheat
Mean shoot dry weight (g) at 95% CI

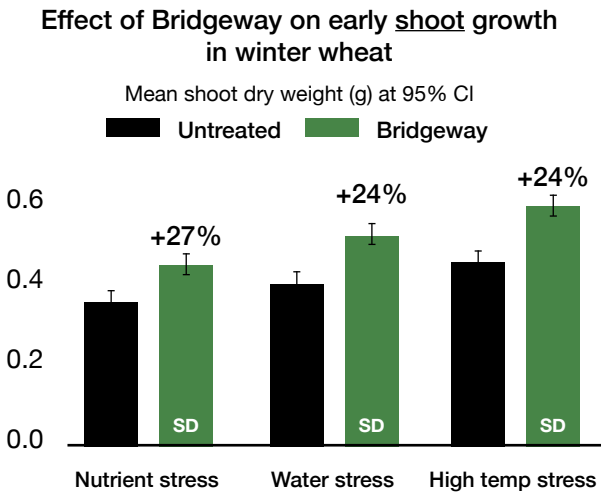


University of Nottingham 2019. Winter wheat cv Siskin. Trial terminated 30 days after treatment application. 10 replicates per treatment. Treatments applied at GS 14. Bridgeway applied at 1 L/ha; Terrasorb 2 L/ha; AminoA Flo 2 L/ha.

Significant increases in root and shoot growth under stress

Further research at the University of Nottingham looked at the effect of Bridgeway on early root and shoot growth in stress-induced winter wheat (Siskin). Plants were treated with Bridgeway at 2.0 L/ha, at GS14 and the effects on root and shoot growth were determined 24 days after application. Low nutrient stress was achieved by feeding with a 10% rate of the standard feed; water stress, by irrigation every fourth day rather than daily or when the plants started to show drought symptoms; and heat stress, where plants were under standard feed and irrigation at a constant 30^{0}C. Bridgeway increased root and shoot growth significantly in all scenarios tested.





Source: University of Nottingham 2018. Winter wheat cv. Siskin. Treatments applied at GS14. SD = significant difference compared to untreated.

High temperatures stress untreated control

High temperatures stress Bridgeway

Key takeaways

- Bridgeway gave very positive and statistically significant effects on plant growth, with larger effects consistently observed with root growth.
- Similar effects were seen with shoot growth, but the effects weren't so big suggesting the driving parameter is enhanced rooting.
- There was an indication that the enhanced root growth was greater when the plants were stressed, especially for water and high-temperature stress, yet the improvements were still very beneficial and statistically significant in non-stressed wheat.
- Best returns will be from using Bridgeway in a programmed approach, integrated with existing agronomic practices.

Improved protection against abiotic and biotic stress in Cereals

Anti-stress

Ramularia disease control in spring barley

Bridgeway is part of ongoing trials work at Scottish Agronomy investigating the use of non-fungicidal options for the control of Ramularia in spring barley. Ramularia is potentially the most yield limiting disease affecting barley in Scotland. If uncontrolled, the disease can reduce yields by over 20%, and significantly affect grain quality. Previously the disease has been well controlled by fungicides. Since 2017 however, the disease has developed resistance to systemic fungicides, rendering them almost completely ineffective. The only remaining non-systemic crop protection product is Folpet (Arizona).

In 2021 (year 2 of work), Bridgeway was included as one bio- option to help to delay or alleviate the severity of the disease. Bio-elicitors and other biological products can help to stimulate the host plants natural defence mechanism. Replicated trials in spring barley were established in three areas – Borders (South), Fife (Central) and Aberdeenshire (North), to ensure a good geographic spread. The levels of Ramularia disease were variable across sites, with low levels in the Borders and moderate on the Fife and Aberdeenshire sites.

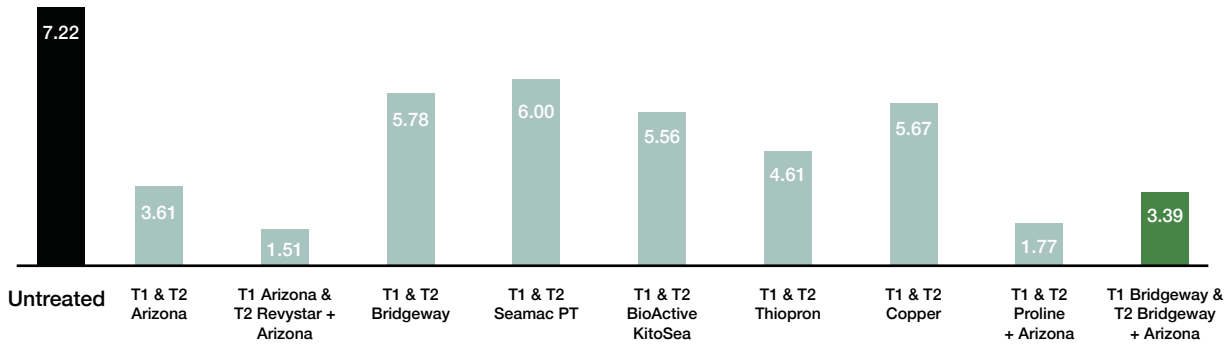
Bridgeway helped to reduce Ramularia infection and increased green leaf area, particularly in mix with Arizona.

Treatments rates and application timings

Site	Timing 1	Timing 2
South Central North	28/05/2021 27/05/2021 07/06/2021	18/06/2021 17/08/2021 29/06/2021
Growth Stage	GS 26-31	GS 39-49
1 - Untreated	Untreated	Untreated
2 - Arizona	Arizona 1.5 L/ha	Arizona 1.5 L/ha
3 - Arizona + T2 Revystar XE	Arizona 1.5 L/ha	Revystar XE 0.75 L/ha Arizona 1.5 L/ha
4 - Bridgeway	Bridgeway 2.0 L/ha	Bridgeway 2.0 L/ha
5 - Seamac	Seamac PCT 2.5 L/ha	Seamac PCT 2.5 L/ha
6 - Chitosan	BioActive KitoSea 4 L/ha	BioActive KitoSea 4 L/ha
7 - Sulphur	Thiopron 5.0 L/ha (UPL Liquid)	Thiopron 5.0 L/ha (UPL Liquid)
8 - Copper	Cuprokylt 2 kg (Liquid Copper 2.3 L/ha)	Cuprokylt 2 kg (Liquid Copper 2.3 L/ha)
9 - Standard Fungicide	Proline 275 0.2 L Arizona 0.74 L/ha	Proline 275 0.35 L Arizona 1.5 L/ha
10 - Bridgeway + T2 Arizona	Bridgeway 2.0 L/ha	Bridgeway 2.0 L Arizona 1.5 L/ha

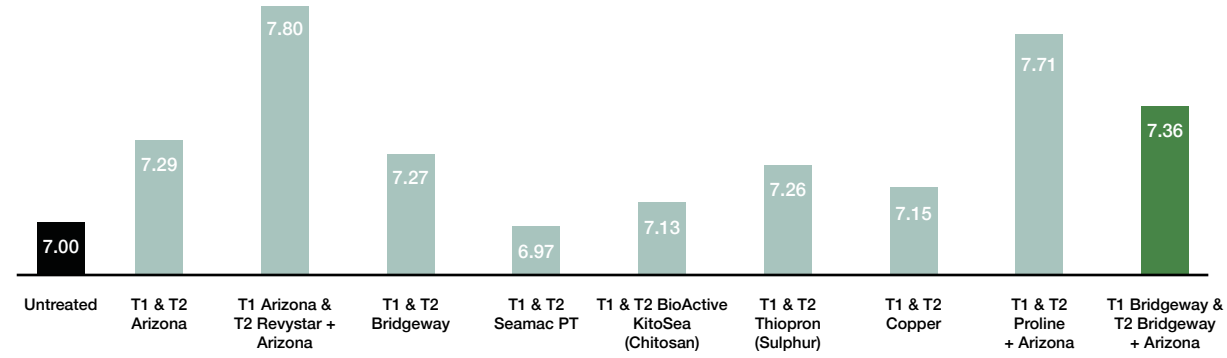
• Arizona contains folpet • Revystar XE contains fluxapyroxad + mefentrifluconazole • Thiopron contains sulphur • Proline contains prothioconazole

Efffect of treatment on Ramularia infection (%) 2021, 3 site average in spring barley c.v. Laureate



Source: Scottish Agronomy 2021. Trials Results for Mains of Loirston Trust in Spring Barley. Evaluation of non-fungicidal novel options for treatment of Ramularia in Spring barley – 2021 results. Final assessment. Work funded by Mains of Loirston Charitable Trust.

Efffect of treatment on yield (t/ha) 2 year, 3 site average in spring barley c.v. Laureate



Source: Scottish Agronomy 2021. Trials Results for Mains of Loirston Trust in spring barley. Evaluation of non-fungicidal novel options for treatment of Ramularia in spring barley – Mean of 2020 & 2021 results. Work funded by Mains of Loirston Charitable Trust.

Key takeaways

- The highest yielding treatments on all 3 sites were those containing conventional fungicides – Arizona + Revystar XE and Proline + Arizona, this reaching statistical significance on the Borders and Aberdeenshire sites.
- These treatments also resulted in the greatest reduction in Ramularia infection across the three sites.
- The non-systemic treatments containing Arizona tended to contribute to a lesser reduction in Ramularia and marginal increase in yield.
- By reducing abiotic stress, Bridgeway decreased ramularia infection and increased green leaf area compared to the untreated – this was significant at the central site.
- Bridgeway increased yield at all 3 sites compared to the untreated, although this was not statistically significant.
- Where Arizona was combined with Bridgeway there was an improvement in yield in 2020 and 2021 trials, although this was not significant.
- Work continues into 2022.

Straight Bridgeway was included at T1 and T2 for trials purposes. Agrisource does not recommend straight Bridgeway instead of fungicide for disease control.

National Institute of Agricultural Botany (NIAB), UK trials in 2020 showed Bridgeway has a role to play in moderate-high input varieties

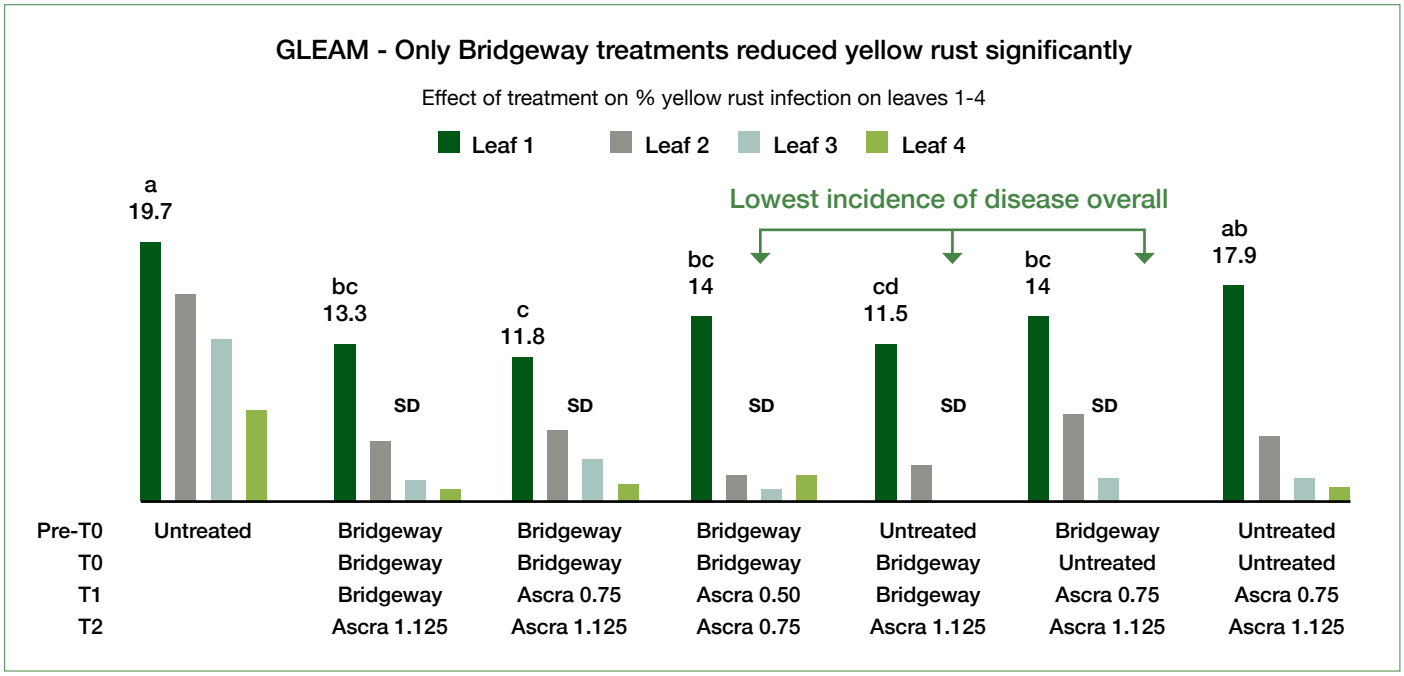
It is well reported that some biostimulants have host defence trigger properties, meaning they can improve the resilience of the host plant to disease infection. To have the maximum effect on the host defence mechanism, biostimulants should be applied in advance of disease attack i.e. at pre-T0 and at T0. Variety trials at NIAB in 2020 showed that Bridgeway significantly reduced yellow rust infection and increased yield and margin over input cost in low and medium disease resistant varieties, whereas high disease resistant varieties showed a flat response.

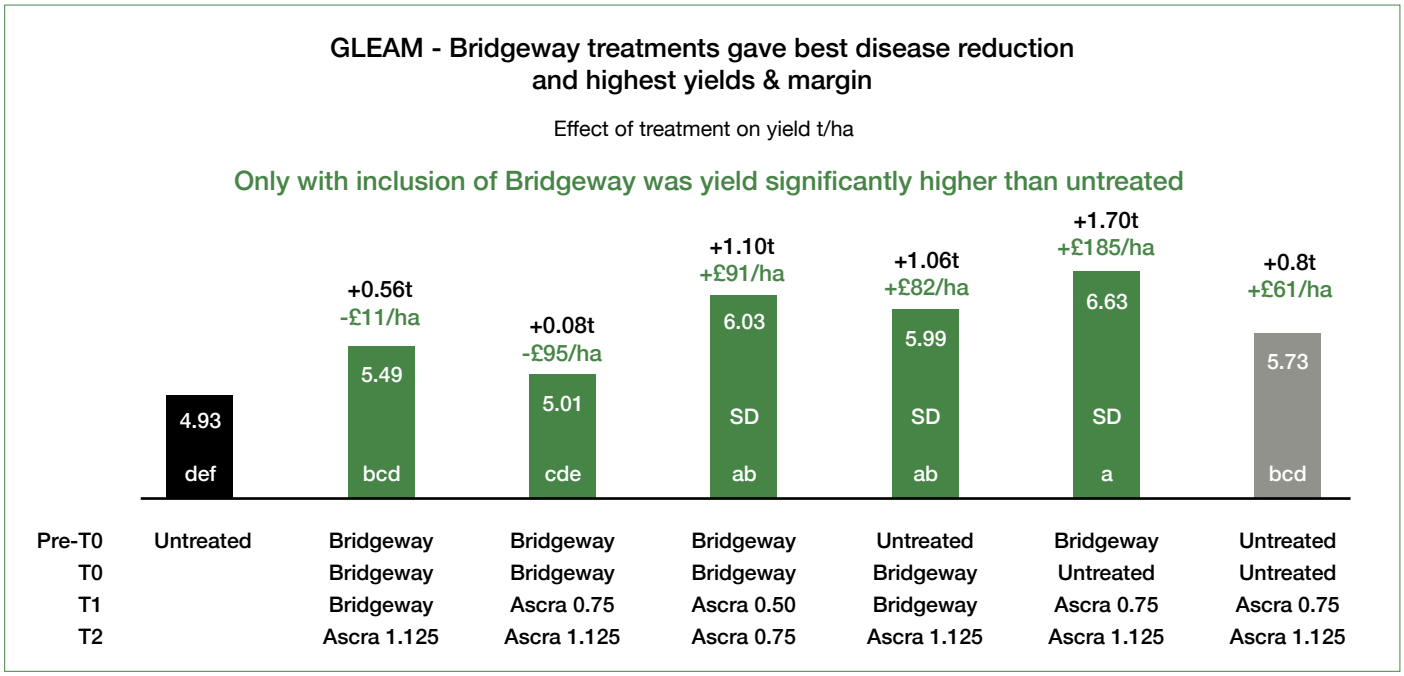
3 variaties were selected to test:

- **RGT Gravity** - low disease resistance, high fungicide input
- **Gleam** - moderate disease resistance, moderate fungicide input
- **KWS Extase** - high disease resistance, low fungicide input

3 Bridgeway (2L/ha) application timing to test:

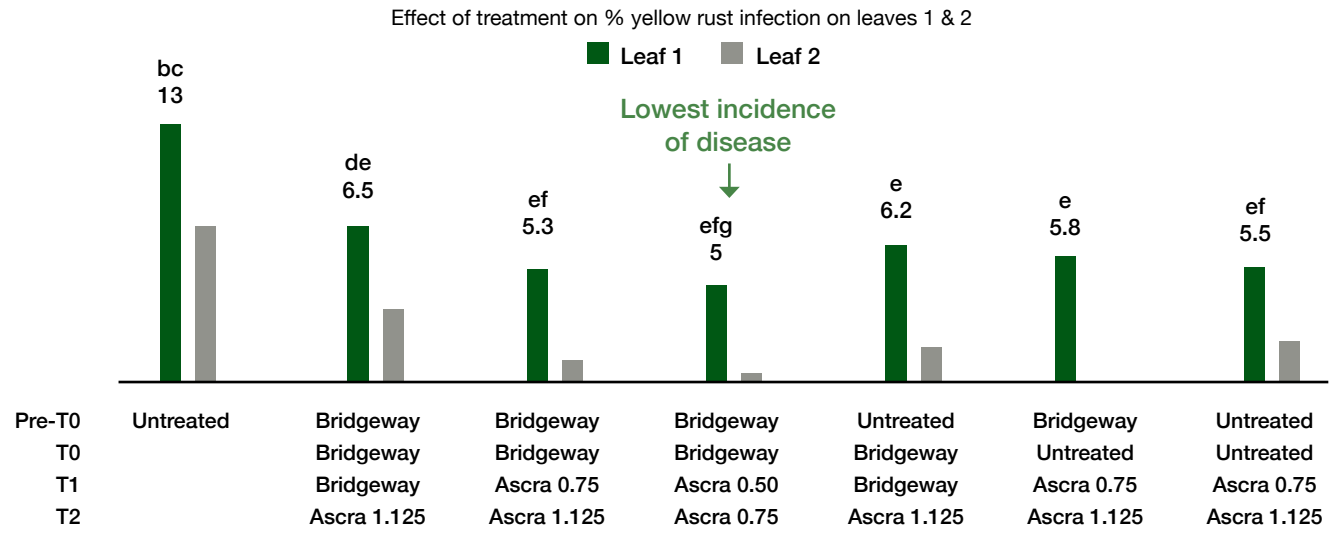
- **Pre-T0**
- **T0**
- **T1**





• Ascra contains bixafen + fluopyram + prothioconazole

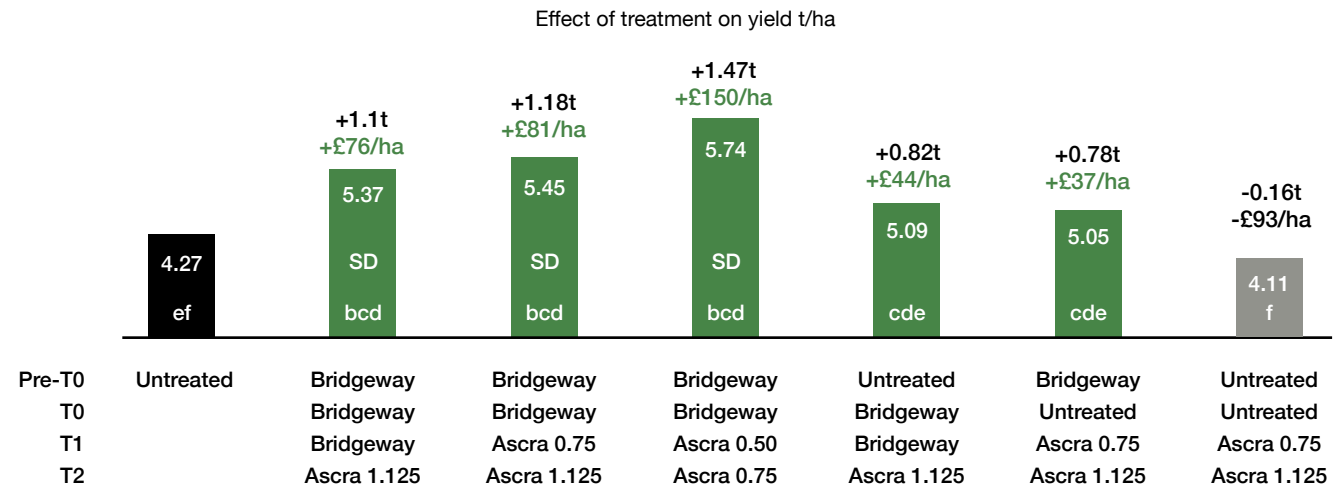
GRAVITY - Inclusion of Bridgeway at pre-T0+T0 gave the best reduction in % yellow rust infection



Key takeaways

- Bridgeway pre-T0+T0 was more effective than single applications at pre-T0 or T0 but not significantly
- All treatments reduced yellow rust infection significantly over the untreated.
- Bridgeway pre-T0+T0 gave the best overall reduction of yellow rust.

GRAVITY - Inclusion of Bridgeway pre-T0+T0 gave highest yields and margins

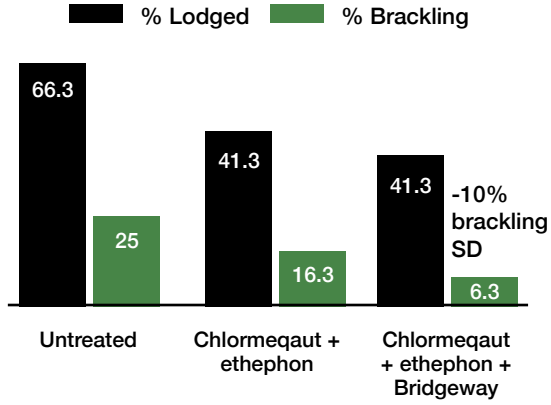


Key takeaways

- Only where Bridgeway was included were yields higher than the untreated.
- The highest yield and margins was achieved where Bridgeway was included at pre-T0+T0 and Ascra rate was reduced at T1 and T2.
- Only where Bridgeway was included at pre-T0+T0 were yields significantly higher than the untreated
- Fertiliser and crop protection products can stress the crop and this is the likely reason why Ascra only treated crop yield (without Bridgeway), was reduced.

Significant reduction in brackling

Bridgeway has been shown to reduce brackling in both winter barley and spring barley when applied with plant growth regulators (PGR's). A replicated field trial was set up in winter barley in 2020 to further investigate the benefits of using Bridgeway 1.0 L/ha to reduce PGR stress on the crop at T2



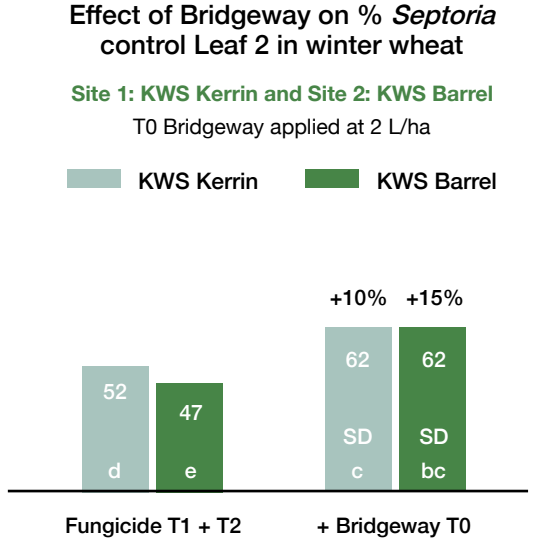
2020. UK. Winter barley KWS Gimlet. Applied at GS37. Part of a standard PGR programme. Lodging NSD, Brackling LSD 18.09.

Key takeaways

- PGR + Bridgeway resulted in less lodging than PGR only treatment - the difference was not significant.
- Yields were statistically higher than untreated crops.
- Bridgeway reduced brackling by 10% compared to PGR alone, which was statistically significant over the untreated
- Bridgeway increased yield by +0.13 t/ha over PGR alone.

Building plant health early provided significant benefits later

Replicated field trials by Prime Crop Research in 2021 looked at the effects of T0 Bridgeway applications on *Septoria.* The trial was set up in winter wheat KWS Kerrin and KWS Barrel on two separate sites. A standard T1 and T2 fungicide programme of Aviator + Arizona fb Elatus Era + Arizona was applied to both varieties.



Prime Crop Research 2021 - Wyken, Suffolk. cv Barrel. Untreated 25.3% on 7th July. Standard Fungicide programme: Aviator 1L + Arizona 1L fb Elatus Era 0.8 + Arizona 1L

Prime Crop Research 2021 - Fulbourn, Cambridgeshire cv Kerrin. Untreated 19.3% on 22nd June. Standard Fungicide programme: Aviator 1L + Arizona 1L fb Elatus Era 0.8 + Arizona 1L.
SD = Significant difference

Key takeaways

- In KWS Kerrin, fungicide at T1 + T2 gave 52% *Septoria* control on leaf 2 by the final assessment. In Barrel it was 47%.
- The addition of T0 Bridgeway helped improve plant health and biotic stress protection.

• Aviator contains bixafen + prothioconazole • Elatus Era contains benzovindiflupyr

Improved protection against abiotic stress in Cereals

Anti-stress

Following crop benefits 1 & 2 years on

Back in 2017 Bridgeway was investigated in UK tramline trials in winter wheat cv KWS Siskin. Bridgeway was applied as an additive to the fungicide programme at GS 31, 39 and 65, each at 2 L/ha. A base application of phosphate was also applied at GS30. The Bridgeway treated tramlines not only yielded an extra 3 t/ha, the stubble was also more golden due to improvements in plant health. Following the wheat harvest, an oilseed rape trial was planted in the field, and in the Bridgeway strip there was noticeable improvement in the rape, likely due to the recycling of nutrients from the wheat crop enhancing the oilseed rape. One year later and back into cereals, there was a noticeable reduction in liquid fertiliser scorch to the exact line where Bridgeway had been applied 2 years earlier (see image right).

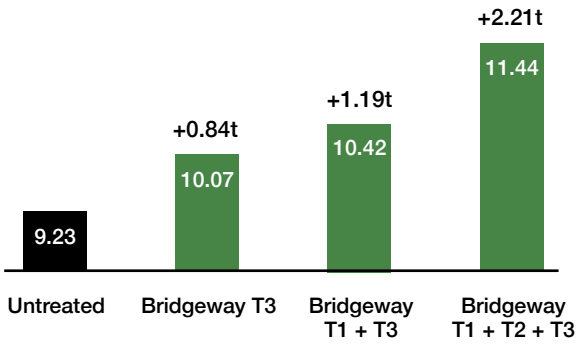
Source: Dick Neale, HL Hutchinsons, 2019.

Reducing stress increased yield

A tramline trial in feed wheat cv Relay was used to test the stress-busting capabilities of Bridgeway in 2018 - a year that was particularly stressful for crops. Three different tramlines were used to asses a single application, 2x applications and programme of 3x. The crop was stressed at T1 due to waterlogging and T2 was applied just before some very hot days. The crop was drought stressed at T3. All applications of Bridgeway helped to reduce stress in treated crops, with a signifcant yield increase as a result.

Effect of Bridgeway on yield (t/ha)

Tramline trials harvested over weighbridge



Source: Sally Morris, HL Hutchinsons 2018.

Improved plant health and yield in winter oilseed rape trials

Anti-stress

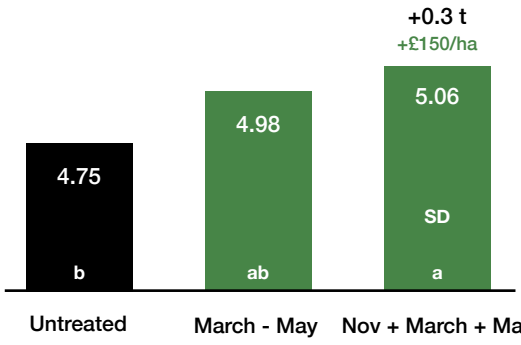
Higher yield and margins in WOSR

A replicated field trial was conducted in winter oilseed rape at Cropworks in Scotland in 2020 to assess the potential of Bridgeway to alleviate crop stress during the growing season and increase yield. Bridgeway applied in March and May increased yield but this was not significantly different to the untreated. Bridgeway applied 3x in the growing season increased yield significantly and increased margin over input costs by £150/ha.

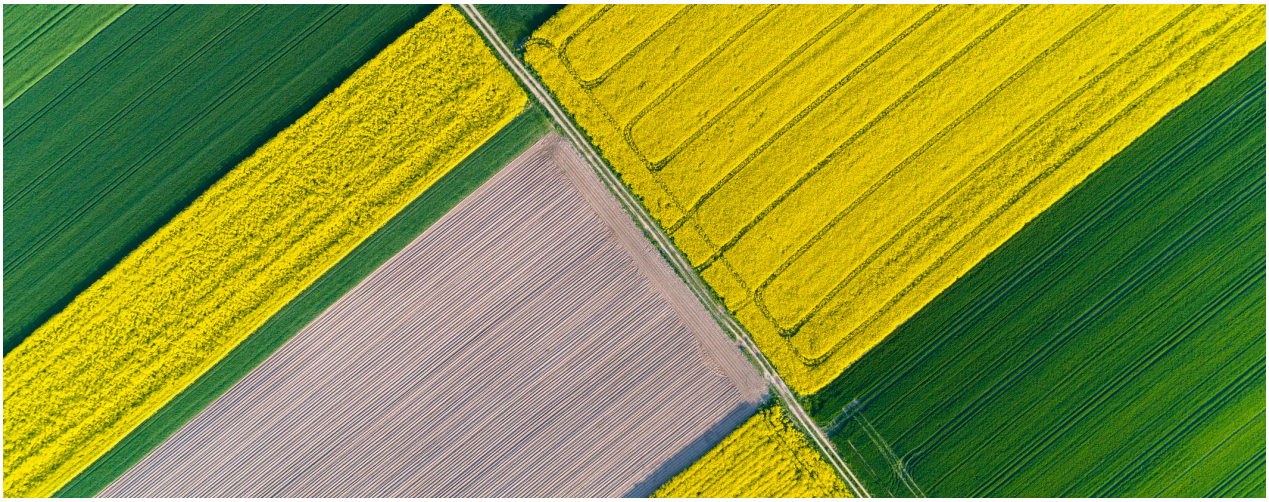
Effect of Bridgeway on WOSR yield (t/ha)

All treatments applied at 2 L/ha

Cropworks Ltd.
Arable Trial Solutions



Cropworks Ltd, Perth, Scotland 2020. WOSR cv DK Exalte. Drilled 25th August 2019, harvested 21st August 2020. Bridgeway application dates - 5th November (GS 6 leaves unfolded), 20th March (GS flower buds enclosed by leaves), 5th May (GS mid flowering). Margin over input cost calculated using OSR price of £500/t and Bridgeway at £10/L. SD = Significant difference to untreated control.



Improved protection against abiotic stress in UK Potato trials

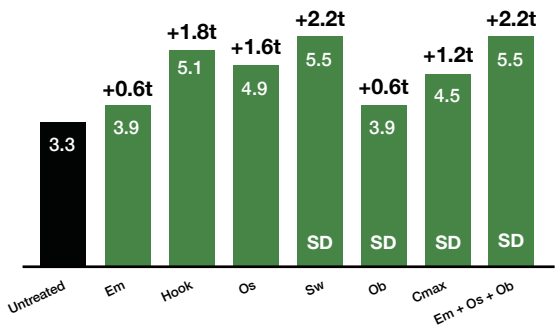
Anti-stress

Bridgeway protection against heat stress has been well proven in trials 2017-19

Potato productivity is greatly reduced at temperatures above the optimum of 20°C. The earlier in the season heat stress occurs, the more negative its impact on growth and yield. At 25°C tuberisation can be delayed, at 30°C it can stop altogether. Replicated field trials at Crop Management Information Ltd 2017-2019 have shown that Bridgeway helps to minimise the effect of temperature and moisture stress on the crop, and enables photosynthesis and tuberisation to be maintained even under very high temperature duress.

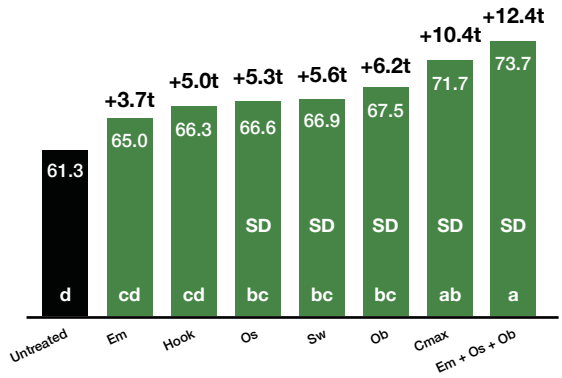
All Bridgeway applications increase tuber bulking

Effect of Bridgeway on tuber bulking (t/ha per week)



All Bridgeway applications increased tuber yield

Effect of Bridgeway on tuber yield (t/ha)



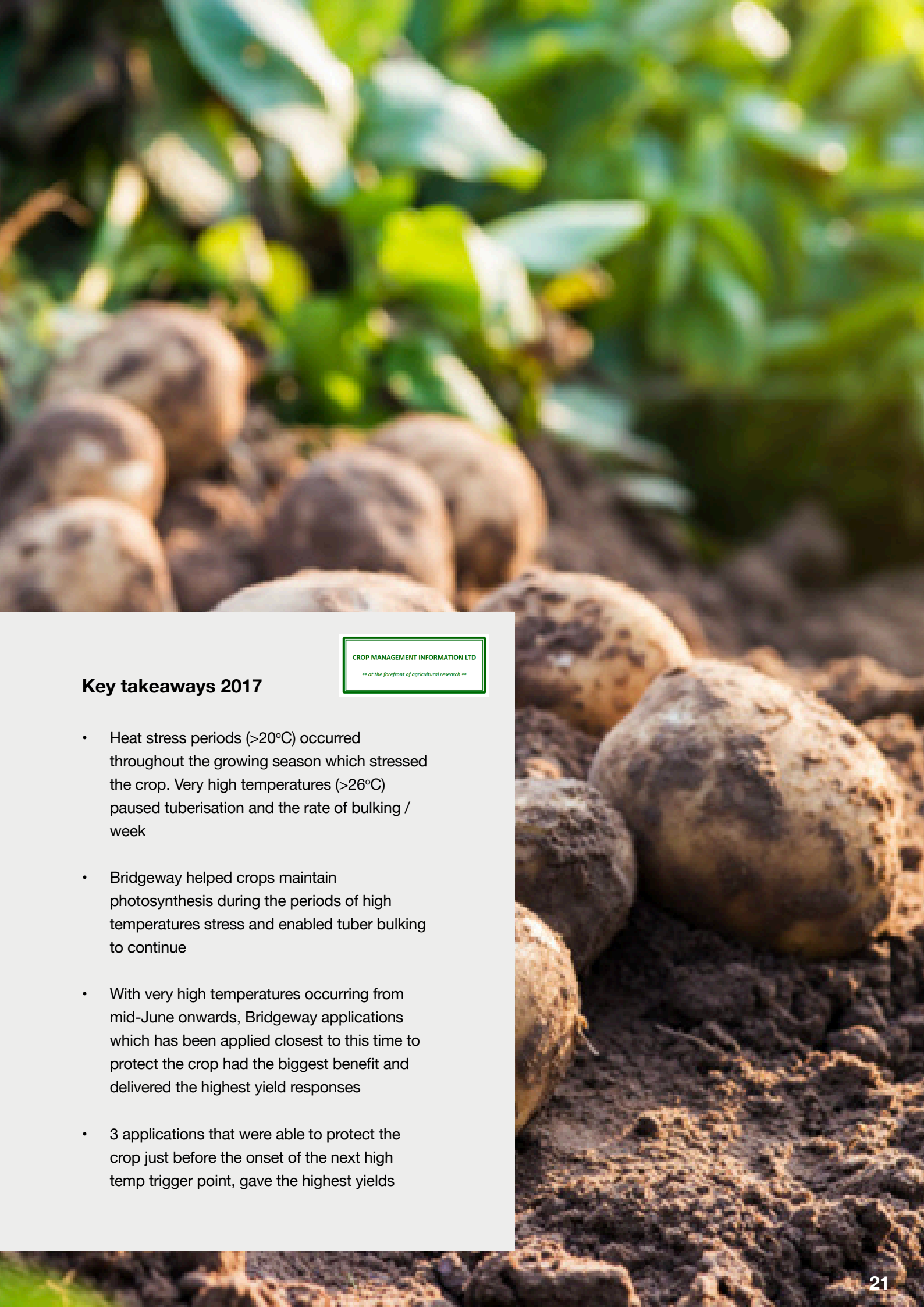
2017 cv Desiree. Yield assessment P=0.0007. SD = Significant difference to untreated control. Bridgeway applied at 2.0 L/ha per application

Bridgeway application timings

Application	Growth stage of application	Application date
Em	95% emergence < 5cm tall	9th June
Hook	Stolons extending, tips hooked	14th June
Os	Onset of stolon tip swelling, 1st visible tip swelling	22nd June
Sw	Mid stolon tip swelling, stolon tips swelling, <10mm	28th June
Ob	Onset of tuber bulking, first tubers > 10mm	7th July
Cmax	Max. canopy size, mid tuber bulking / onset of senescence	20th July

Temperature data - Lincolnshire trial area

Month	Date >20°C (above optimum, every 5°C above can decrease photosynthesis by 25%)	Date >26°C (delay in photosynthesis, tuberisation inhibited)	No. of stressful days
June	1st, 10th, 13th, 14th, 15th, 16th	17th, 18th, 19th, 21st	10
July	1st-5th, 7th, 8th, 15th-19th, 21st, 22nd, 26th	6th, 9th, 17th	16
August	1st, 3rd, 14th-17th, 22nd, 23rd, 25th-27th	28th	15



Key takeaways 2017

- Heat stress periods (>20°C) occurred throughout the growing season which stressed the crop. Very high temperatures (>26°C) paused tuberisation and the rate of bulking / week

- Bridgeway helped crops maintain photosynthesis during the periods of high temperatures stress and enabled tuber bulking to continue

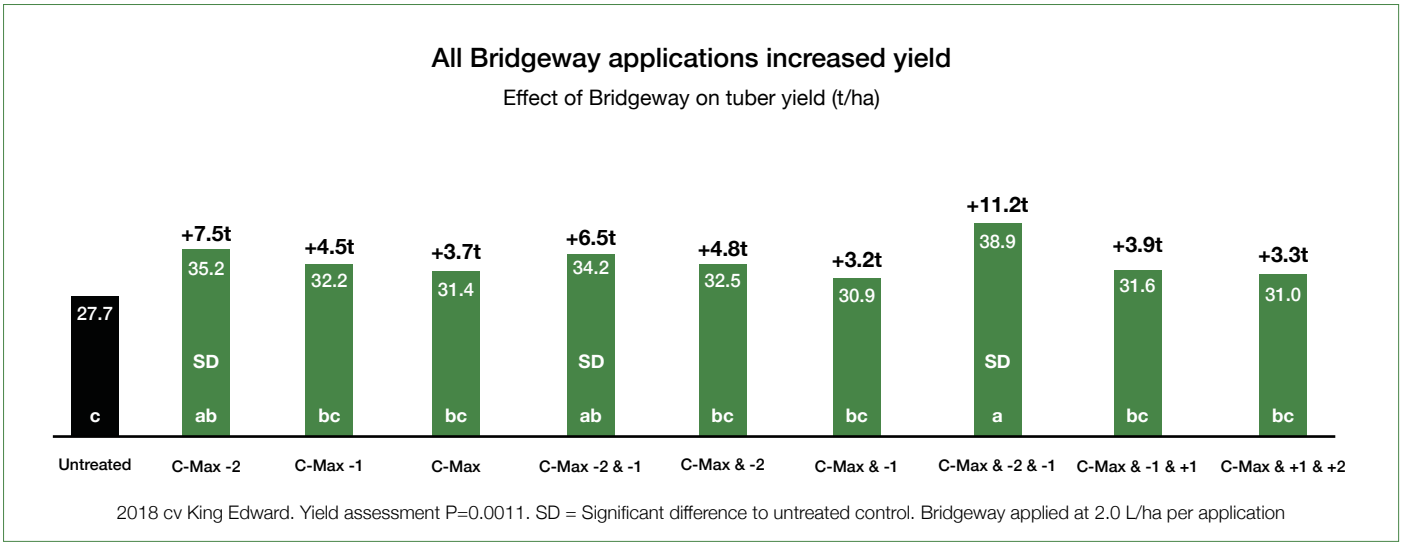
- With very high temperatures occurring from mid-June onwards, Bridgeway applications which has been applied closest to this time to protect the crop had the biggest benefit and delivered the highest yield responses

- 3 applications that were able to protect the crop just before the onset of the next high temp trigger point, gave the highest yields

Crop Management Information trials 2018

Bridgeway increased yield - 3 applications optimal

2018 trials investigated Bridgeway timings around full canopy (CMax) – up to 2 weeks before and 2 weeks after



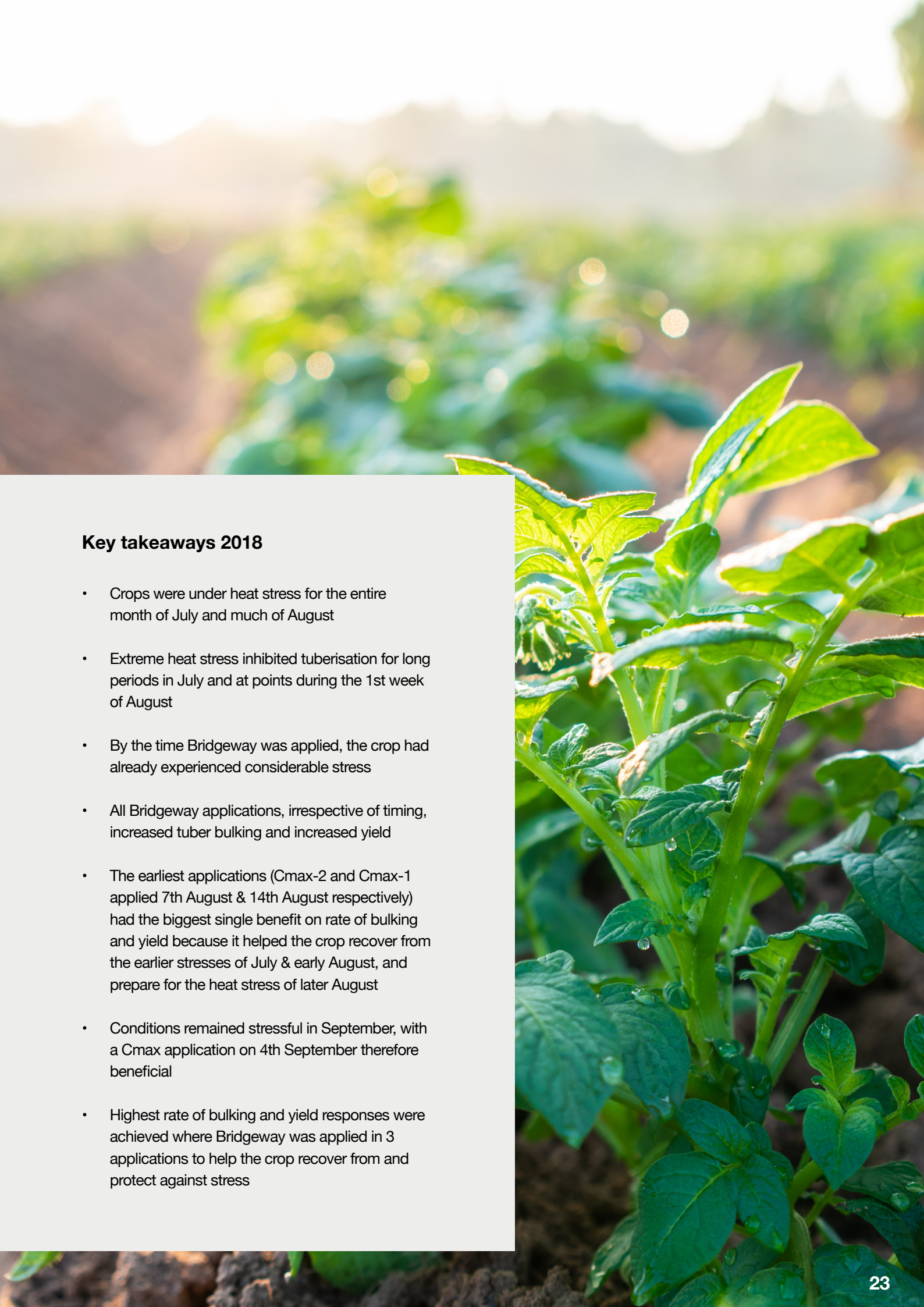
2018 cv King Edward. Yield assessment P=0.0011. SD = Significant difference to untreated control. Bridgeway applied at 2.0 L/ha per application

Bridgeway application timings & dates

Growth Stage	Application Date
2 Weeks before C-Max	7th August
1 Week before C-Max	14th August
C-Max	4th September
1 Week after C-Max	19th September
2 Weeks after C-Max	25th September

Temperature data - Lincolnshire trial area

Month	Date >20°C (above optimum, every 5°C above can decrease photosynthesis by 25%)	Date >26°C (delay in photosynthesis, tuberisation inhibited)	No. of stressful days
June	1st-4th, 9th-13th, 17th, 18th, 21st	5th-8th, 14th-16th, 19th, 20th, 22th-27th, 30th	28
July	1st, 4th, 8th, 11th-15th, 18th-22nd	2nd, 3rd, 5th-7th	18
August	1st-3rd, 17th-19th, 26th, 27th		8



Key takeaways 2018

- Crops were under heat stress for the entire month of July and much of August
- Extreme heat stress inhibited tuberisation for long periods in July and at points during the 1st week of August
- By the time Bridgeway was applied, the crop had already experienced considerable stress
- All Bridgeway applications, irrespective of timing, increased tuber bulking and increased yield
- The earliest applications (Cmax-2 and Cmax-1 applied 7th August & 14th August respectively) had the biggest single benefit on rate of bulking and yield because it helped the crop recover from the earlier stresses of July & early August, and prepare for the heat stress of later August
- Conditions remained stressful in September, with a Cmax application on 4th September therefore beneficial
- Highest rate of bulking and yield responses were achieved where Bridgeway was applied in 3 applications to help the crop recover from and protect against stress

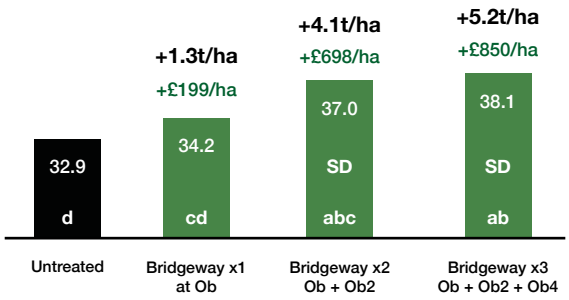
Crop Management Information trials 2019

Bridgeway increased yield under heat stress - 3 applications optimal

2019 trials investigated the impact of application number on yield and margins.

All Bridgeway applications increased yield & margins, 3 optimal

Effect of Bridgeway on tuber yield (t/ha)



2019 cv Sapphire. Yield assessment P=0.002. SD = Significant difference to untreated control. Bridgeway applied at 2.0 L/ha per application. Margin over input cost based on £175/t and Bridgeway £10/L.

Key takeaways 2019

- Temperatures exceeded the optimum of 20°C throughout July and August.
- A single application of Bridgeway applied on 5th July to crop already under stress helped.
- With regular heat stress events and periods of excessive heat that inhibited tuber bulking, further top ups on Bridgeway were needed to kick-start photosynthesis and enable bulking to restart and made a significant difference to the overall yield and margin over input cost.
- Three applications delivered the highest benefit to yield.

Bridgeway application timings

Growth Stage	Application Date
Ob = Onset of tuber bulking	5th July
Ob2 = Onset tuber bulking + 2 weeks	14th August
Ob4 = Onset of tuber bulking + 4 weeks	4th September

Temperature data - Lincolnshire trial area

Month	Date >20°C (above optimum, every 5°C above can decrease photosynthesis by 25%)	Date >26°C (delay in photosynthesis, tuberisation inhibited)	No. of stressful days
July	4th, 5th, 10th-12th, 15th-17th, 20th, 21st, 26th, 29th, 30th	22nd-25th	16
August	1st-11th, 17th, 18th, 21st, 22nd, 28th, 30th, 31st	23rd-27th	23

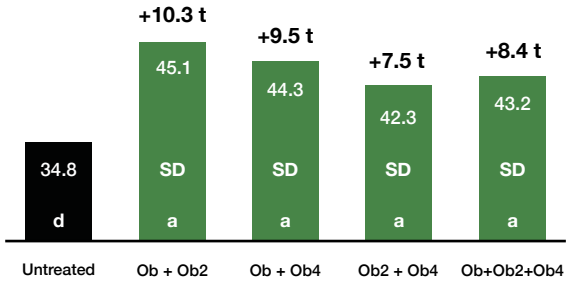
Green Crop Information
A branch of Dyson Farming

Stress-busting benefits of Bridgeway confirmed for 4th year

2021 trials by Green Crop Information at Dyson Farms repeated earlier work looking at optimal application timing. The early start of the growing campaign got off to a good start, but a period of heat stress (>25°C) started mid July.

All Bridgeway applications increased yield significantly

Effect of Bridgeway on tuber yield (t/ha)



2021 Green Crop Information, Nocton, Lincolnshire. Potatoes cv Sagitta. Yield assessment P=0.0100 18th August. SD = Significant difference to untreated control. Bridgeway applied at 2 L/ha.

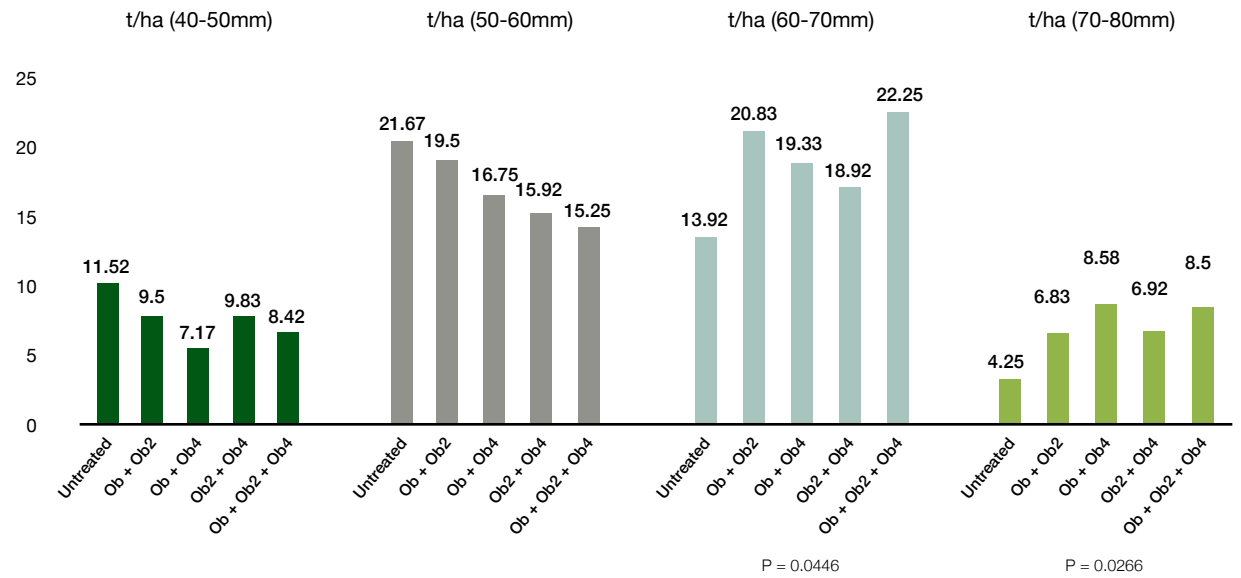
Bridgeway application timings

Growth Stage	Application Date
Ob = Onset of tuber bulking	30th June
Ob2 = Onset tuber bulking + 2 weeks	6th July
Ob4 = Onset of tuber bulking + 4 weeks	21st July

Key takeaways 2021

- A period of heat stress began mid July, after which, the rate of tuber bulking declined in untreated plots.
- Bridgeway enables bulking to continue during heat stress.
- All Bridgeway applications showed higher rates of bulking compared to untreated before and after the main heat stress period.
- All Bridgeway applications increased yield.
- Improved bulking compared to untreated lead to greater yields at top end of 40-80mm grade.
- Still proving earlier burndown possible.

Effect of Bridgeway on graded tuber weights (t/ha) – December lift



Consistent yield increases in replicated trials

CROP MANAGEMENT INFORMATION LTD

∞ at the forefront of agricultural research ∞

Green Crop Information
A branch of Dyson Farming

Significant yield and margin responses in stress & non-stress situations

During 2018 and 2019, Crop Management Information Ltd investigated the effect of biostimulant Bridgeway in commercial sugar beet crops to define optimum stages and sequences for the use of biostimulants. The growing season of 2018 provided an ideal opportunity to study application of amino acid solutions to a crop that was to become stressed by heat and potential water shortage. The experiment site was drilled into moist conditions after a wet spring, but the month of June proved very hot and below average rainfall. July and August followed similar trend. In 2019 the opposite was true with above average rainfall.

Bridgeway application timings

2TL = 2 true leaves

4TL = 4 true leaves

6TL = 6 true leaves

3 timings = 2+4+6 true leaves

% = sugars

Trials 2018 & 2019

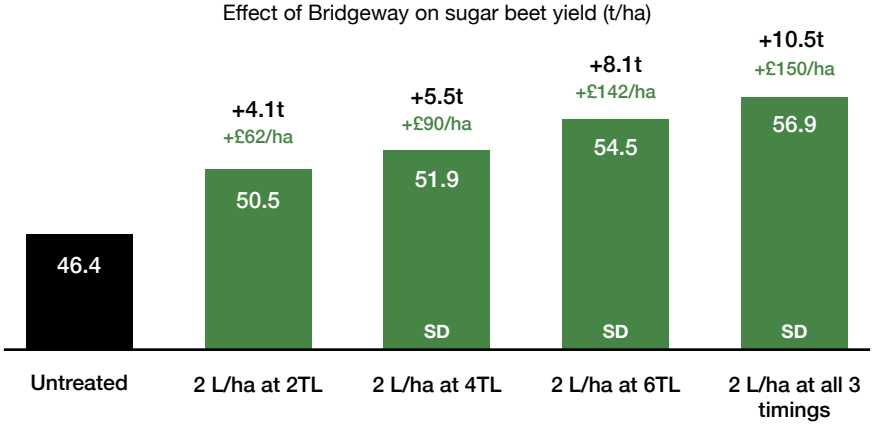
2019 Yield assessment P=<0.005. 2018 Yield assessment P=0.0011. SD = Significant difference to untreated control. Bridgeway applied at 2.0 L/ha per application. Margin over input cost based on £20/t and Bridgeway £10/L.

Trials 2021

Green Crop Information Sugar Beet trial cv KWS Kortessa 2021. Nocton, Lincolnshire, UK. Harvested 10th Dec. Unusually high yields so yield data represented as % over untreated. SD = Significant difference to untreated. Adjusted to 16% sugar.

2018 trial showed 3 applications optimal

Effect of Bridgeway on sugar beet yield (t/ha)

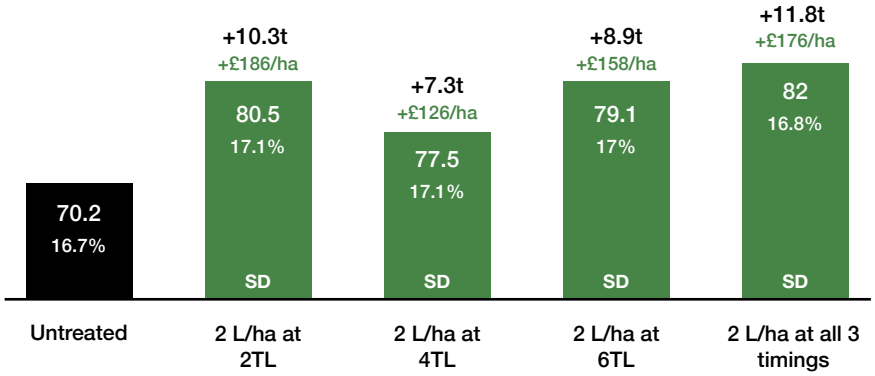


Key takeaways 2018

- In a drought stress year, Bridgeway helped the crop coper better with stress.
- No visual or green scan differences in season.
- Above ground was no indication of below ground.
- Bridgeway pushed bulking early on.
- Bridgeway increased beet yield at all timings.
- Yield were significantly higher from 4TL onwards.
- Highest yields and margins came from 3 applications.
- Nutrient analysis showed increases in zinc concentration in Bridgeway treated plants.

2019 trial showed 3 applications optimal

Effect of Bridgeway on sugar beet yield (t/ha) cv BTS1140 - adjusted



Key takeaways 2019

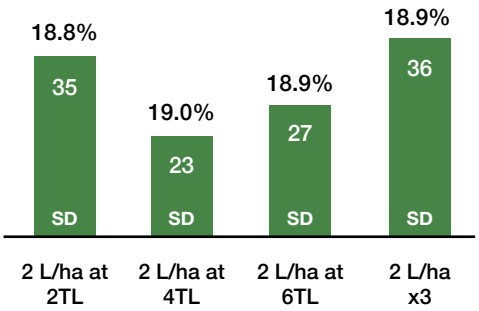
- With above average rainfall - no drought stress.
- No visual or green scan difference in season.
- Above ground was no indication of below ground, so the results were surprising.
- Bridgeway still increased yields significantly at all application timings.
- Bridgeway increased % sugars at 2TL, 6TL & at all 3 timings.
- Highest yield and margins came from 3 applications.

Stress-busting benefits of Bridgeway confirmed for 4th year

2021 trials by Green Crop Information at Dyson Farms repeated earlier work looking at optimal application timing. The early start of the growing campaign got off to a good start, but a period of heat stress (>25°C) started mid July.

2021 trial showed 3 applications optimal

Bridgeway adjusted yield benefit over untreated (%)



Key takeaways 2021

- Bridgeway increased yields significantly at all application timings
- All Bridgeway increased sugars over the untreated (18.6%)
- Highest yields and margins came from 3 applications

Key benefits summary

- **Builds stress resilient beet crops eliminating threat to yield**
- **Speeds up tap-root bulking to maximise yield potential**
- **Increases the metabolic efficiency of the crop, leading to higher sugars**
- **3 applications optimal for yield and margins – 2TL, 4TL & 6TL**

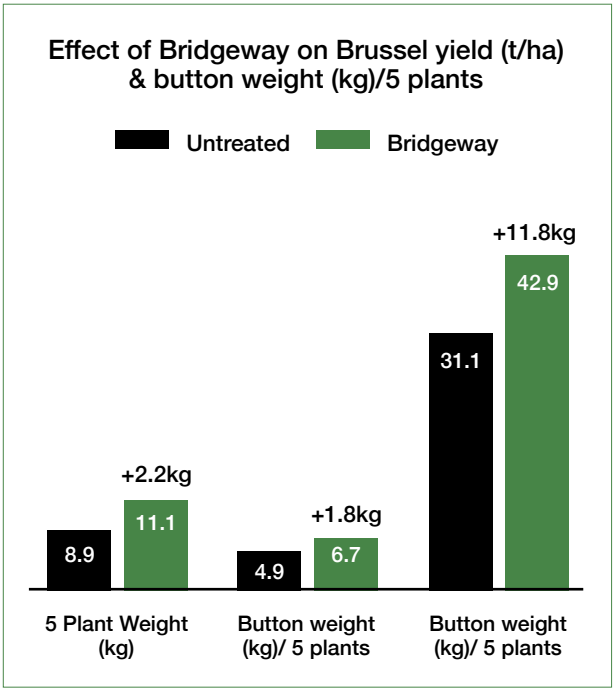
Improved plant health and yield in onion and brussel sprout trials

Rooting

Higher yield & quality in Brussel Sprouts

Bridgeway was put to the test in Brussel Sprouts at The Allium & Brassica Centre in 2018, where it increased plant health and overall yield. Bridgeway was applied at one rate of 2 L/ha and applied in 6 applications. In addition to improved rooting, there was a noticeable reduction in powdery mildew in plants treated with Bridgeway which led to an increase in plant weight, button weight and total yield. Bridgeway delivered the best overall yield of all biostimulants tested, with a calculated increase of 11.8 t/ha (+38%) over the untreated control.

Source: Allium & Brassica Centre, Boston 2018. Bridgeway 2 L/ha applied from 1st June in 6 applications. Control yields averaged over 6 plots. Final yield based on 32,000p/ha.



Bridgeway improved plant health leading to better disease resistance

Untreated

Bridgeway

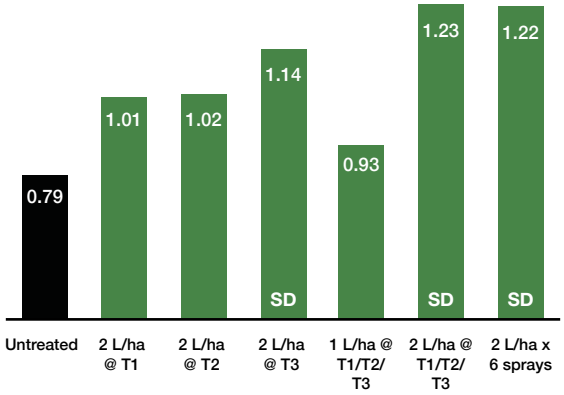
Higher yield in UK onion trials

Bridgeway trialled in maincrop onions by Crop Management Information Ltd in 2018 looked to define optimum growth stages and sequences. The onion growing season of 2018 proved problematic for numerous reasons: a very wet spring delaying drilling and establishment of spring crops, and a particularly hot, dry summer hastened senescence. The onions were very slow to emerge and subsequently grow. There were noticeable improvements in green leaf area and bulb size in plots treated with Bridgeway. Applications of 2 L/ha gave higher yields than 1 L/ha and 3 applications applied at 3-4 true leaves, 7-12 true leaves and bulb size at 2.5-5cm were optimal for yield.

Bridgeway application rates and timing

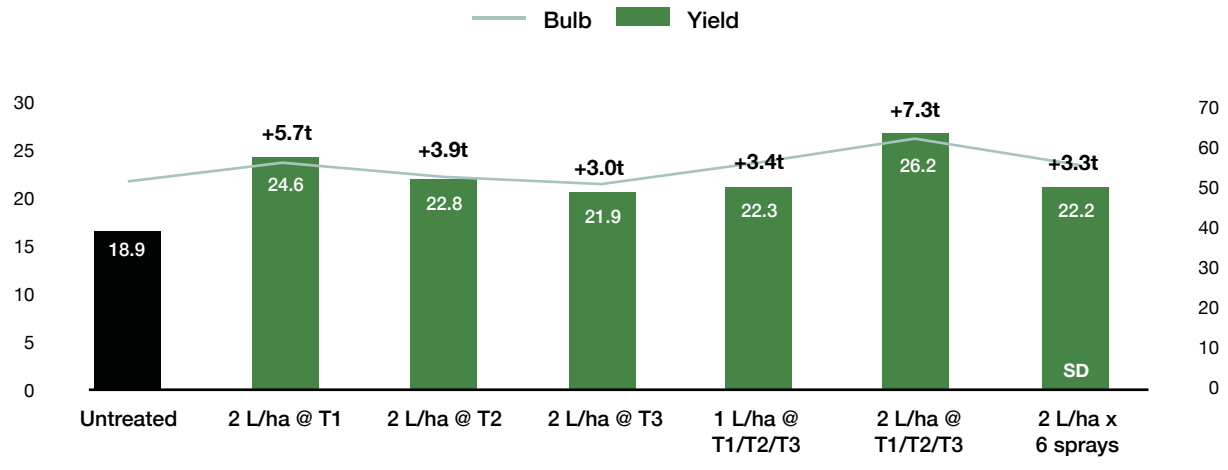
Bridgeway Timing	Onion growth stage	Dose rate per timing	Application Date
T1	3 - 4 true leaf	2 L/ha	22nd May
T2	7 - 12 true leaf	2 L/ha	13th July
T3	Bulb 2.5 - 5cm	2 L/ha	26th July
T1 + T2 + T3	All 3 timings	1 L/ha	9th August
T1 + T2 + T3	All 3 timings	2 L/ha	28th August
6 sprays	All 3 timings + more (10 - 14 day intervals)	2 L/ha	12th September

Effect of Bridgeway on onion green leaf area (GDVI)



GDVI scan assessed 6th September.
SD = significant difference to untreated.

Effect of Bridgeway on onion yield (t/ha) & g/bulb



Crop Management Information Whittlesey 2018. Onions NSD. Assessed 16th October.

Key takeaways

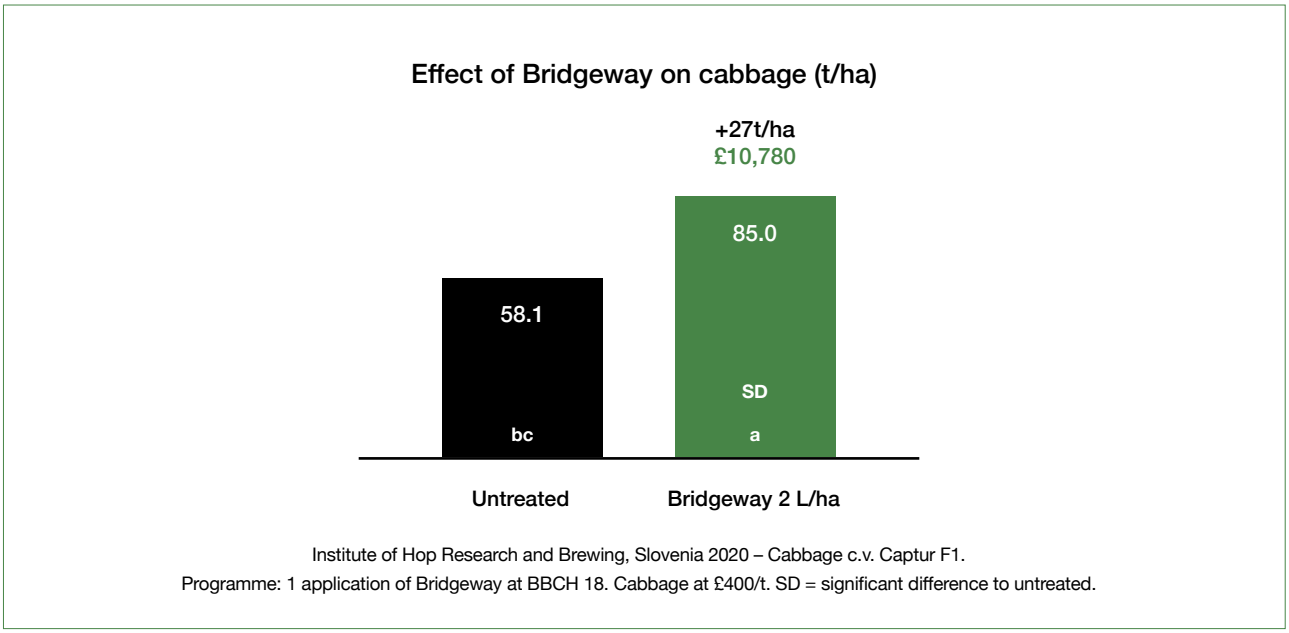
- All Bridgeway treatments increased green leaf area.
- All Bridgeway treatments increased onion weight and overall yield.
- There was a tendency for earlier treatments at 3-4 true leaves and 7-12 true leaves to produce the biggest yield increases.
- A later application at bulb diameter 2.5-5.0 cm, was made when the temperature was very high and drought conditions well established. This application was not as effective at increasing bulb weight. This may have been as much connected with timing according to the onset of stress.
- There was a tendency for multiple applications (up to three in this experiment) to increase weight of bulbs further; while increasing the number of applications to six had no further benefit.
- Calculated margin over input costs per hectare showed consideriable benefits from all Bridgeway applications.

Improved plant health in cabbage and swede

Rooting

Significantly higher yields in cabbage

Bridgeway was put to the test in cabbage at The Institute of Hop Research and Brewing in Slovenia in 2020. Plots were replicated and a single application of Bridgeway was applied at a rate of 2 L/ha at 8 true leaves. Bridgeway increased yield significantly, by 27 t/ha (+46%) over untreated plots and generated a calculated margin over input cost of £10,780/ha.

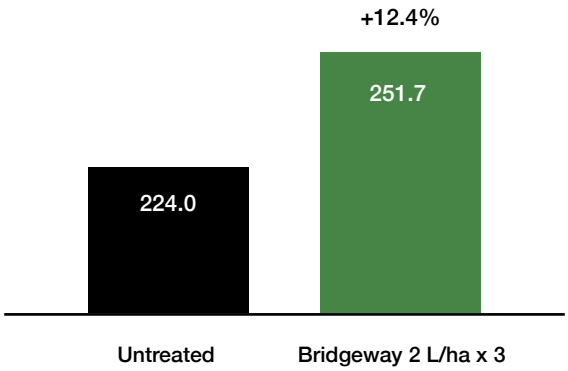


Institute of Hop Research and Brewing, Slovenia 2020 – Cabbage c.v. Captur F1.
Programme: 1 application of Bridgeway at BBCH 18. Cabbage at £400/t. SD = significant difference to untreated.

Plant health improvements seen in swede

Agricultural Development and Advisory Service (ADAS) trials in Fife in Scotland in 2020 assessed the benefit of Bridgeway applied to Swede at 3-4 true leaves with follow up applications at 6-8 true leaves and when foliage at 35cm height, root expanding. Growing conditions were optimal during the season. Samples taken from 4 replicates showed a yield increase of 12.4% over untreated plots. This was not statistically significant.

Effect of Bridgeway on main swede weight (g). Sampled from 4 replicates



ADAS Fife 2020. Swede biostimulant screen. Bridgeway applied at 2 L/ha at 3-4 true leaves on 2nd July, 6-8 true leaves on 6th August and when foliage at 35 cm in height on 28th August. Full destructive assessment 23rd September.

Bridgeway product and application information

Classification	Protein hydrolysate biostimulant
Composition	Vegetal amino acids and soluble peptides, 5% nitrogen, 17.8% biological organic carbon, minerals
Recommended crops	For use on arable and vegetable crops
Rates use by crop	Bridgeway is to be used at a rate of 1 – 2 litres per hectare, per application. Please find specific crop recommendations below.

Crop	Rate L/ha	Recommendations to support plant health
Cereals	1 - 2	Apply mid-tillering (pre-T0) and T0 in wheat. Apply at T1 and T2 in barley and oats.
Oilseed Rape	1 - 2	Apply at 4-6 true leaves, green bud and mid flowering.
Fodder/Sugar Beet	2	Apply at 2, 4 and 6 true leaves.
Potatoes	2	Apply at stolon tip swelling, onset of tuber bulking and at full canopy.
Vegetable crops in general	2	Apply every 14 days from crop establishment. Target key stages of development or crop stress
Leafy vegetables	2	Apply 10 days after transplanting; before and after head set.
Abiotic stress	1 - 2	For best results, apply 3-5 days before the onset of environmental stress. For stress recovery, apply as soon as possible.

Mixing	Shake the container well before use. Dilute the required quantity of Bridgeway in a minimum of 100 litres of water per hectare and apply as a foliar application to plants.
Compatibility	Bridgeway is compatible with the most common crop protection products and foliar fertilisers. However, before use, we recommend testing for compatibility to avoid any doubt.
Pack size	10 litres
Storage	Store in a cool, dry location away from direct sunlight. Keep cap closed when not in use.

With Bridgeway

- Renewable, plant-based solution for growth stimulation, nutrient-use-efficiency and stress resistance
- Unique and innovative extraction process guarantees the highest purity
- Fast and effective adsorption that is 100% water soluble
- The most effective and efficient method of feeding amino acids to your plants
- Class leading biostimulant on root and shoot growth*
- Backed by intense research

* Source: Growth stimulation trials conducted on winter wheat at The University of Nottingham in 2019. 10 replicates, 95% confidence limits.

Frequently asked questions

How long will Bridgeway last in the crop?

Approximately 10-14 days. However, the effect could last far longer depending on application and growing conditions.

How long does it take for Bridgeway to work in the plant?

Bridgeway is rapidly absorbed by the leaves and translocated in plant tissue. Within a few hours it can perform its function in the plant.

On what crops can Bridgeway be used?

Bridgeway can be used on arable and vegetable crops throughout the growing phase.

What is the optimal application timing for Bridgeway?

It depends on the purpose of the application. To protect against stress, we would recommend applying 3 - 5 days prior. To optimise root and shoot growth, this will be best achieved early and prior to stem extension.

Why should I use Bridgeway?

Replicated lab, field and commercial trials have shown Bridgeway can add significant benefits to plants, particularly in suboptimal growing conditions. It is best in class on root and shoot growth and replicated field trials have shown consistent benefits in crops which are highly susceptible to abiotic stress, such as potatoes and sugar beet. We believe Bridgeway is the best source of amino acids and peptides for plants because it contains all plant-based L-amino acids needed by plants, with the most important ones in higher concentration than many alternative sources due to our cutting-edge enzymatic hydrolysis techniques. With an intense research programme behind it, there's a wealth of proof that Bridgeway can optimise productivity and margins.

What is the function of amino acids and peptides in plants?

Amino acids and peptides are the building blocks of protein and are critical for healthy growth and development. They play a vital role in virtually every process within plants, including photosynthesis, regulating root and shoot growth, metabolic enzymes and stimulation, nutrient transport, stress defence and the regulation of crop growth. They are also responsible for the storage and transport of nitrogen and are therefore an important part of N metabolism. In abiotic and biotic stress conditions stress-busting amino acids are needed in high concentrations to provide tolerance and repair.

What's the benefit of using an amino acid biostimulant like Bridgeway?

Plants expend considerable energy breaking nitrate and ammonium down into nitrogen to make amino acids and proteins. Applying an amino acid biostimulant provides the ready-made building blocks for protein biosynthesis. In good conditions this reduces the amount of energy the plant channels into protein production. Under stress conditions, it enables the plant to conserve energy and avoids the waste of breaking down proteins to recycle amino acids for stress defence. Applying an amino acid biostimulant early on also helps to build more robust root systems that can scavenge for water and nutrients, increasing fertiliser uptake and adds to the nutrient-use-efficiency benefit.

Will I always get a yield benefit?

No not always. One of the key benefits of applying Bridgeway is to increase the productivity of the crop, by increasing nutrient transport and increasing the rate of photosynthesis. If the raw materials (CO_2, water and sunlight) are missing for photosynthesis to take place, it will not be possible for crops to photosynthesise, slowing crop growth. CO_2 and sunlight are rarely a problem, but water could be. Optimising early rooting will certainly help crops access water deeper down if supply does become short in season. This will give Bridgeway the best chance of delivering higher yields if water deficit becomes an issue later.

Bridgeway™ is distributed in New Zealand by Agrisource. For more information contact your crop agronomist or rural retailer.