



L-CBF **BOOST**TM

TECHNICAL GUIDE

INTRODUCING L-CBF BOOST[™]

This technical guide gathers everything you need to know about QLF Agronomy's L-CBF BOOST, from how it works, trial results, case studies from farmers using it, crop-by-crop recommendations, and frequently asked questions.

L-CBF BOOST[™] IS A REVOLUTIONARY WAY OF FERTILISING CROPS BY IMPROVING SOIL FERTILITY. THE IDEA FOR A MOLASSES-BASED CARBON FERTILISER INITIALLY INSTIGATED BY US ORGANIC FARMER, GARY ZIMMER.

Known as one of the “fathers” of biological agriculture, Gary is the owner of Otter Creek Organic Farm in Wisconsin, and author of The Biological Farmer. It was after feeding organic molasses his dairy cows that he had an “Eureka” moment, realising that soil life was crucial to converting nutrients into a plant available form, just as microbes in the rumen were crucial for converting feed into usable protein and energy sources.

Making that connection was the moment L-CBF BOOST[™] and its organic variant, L-CBF TERRA FED[™] were born.

Once he had tested the concept of applying molasses to soil to ensure its effectiveness, he set up a business, MidWest BioAg, to sell the products in the USA, with Quality Liquid Feeds (QLF) manufacturing them.

These QLF Agronomy products have been sold in the UK since around 2012, and independent and university trials have demonstrated significant yield responses across a variety of crops.

“L-CBF BOOST[™] is a revolutionary way of fertilising crops by improving soil fertility”

FIND OUT MORE IN THE REST OF THIS GUIDE:

- P3** • How does L-CBF BOOST[™] work?
- P9** • Trials data on nutrient availability, nutrient use efficiency and yield
- P11** • Case studies from farmers using L-CBF BOOST[™]
- P14** • Recommendations for cereals, oilseed rape, maize, grassland, potatoes, sugar beet and fodder beet
- P20** • Other frequently asked questions about L-CBF BOOST[™]
- P22** • Other products and contact details for QLF Agronomy

HOW DOES L-CBF BOOST™ WORK?

FORGET ABOUT NPK, IT IS ALL ABOUT C:N

Maintaining a healthy carbon-to-nitrogen balance in your soil is the key to having thriving soil microbes, which in turn increase the availability of plant nutrients in a healthy and sustainable way.

24:1 IS THE GOLDEN NUMBER

The carbon to nitrogen (C:N) ratio is the mass of carbon atoms compared to nitrogen. Soil scientists consider 24 units of carbon to 1 unit of nitrogen the ideal balance.

Most soil microorganisms have a C:N of 8:1 (see table 1). However, they also use carbon as a source of energy in respiration, which is why 24:1 is so important. A soil microbe's version of a well-balanced meal is 16 parts carbon for energy and eight parts carbon with one part nitrogen for maintenance.

The C:N ratio must be considered when applying anything to the soil to ensure thriving microbial life.

Adding inputs with a C:N lower than 24:1 will result in nitrogen mineralisation. Microbes will consume the carbon from this source at the ideal ratio of 24:1 and release excess nitrogen, which is available for the plant.

The opposite is true for inputs like wheat straw, which has a C:N of 80:1. If an excess of straw is incorporated into the soil, like following overwintered parsnips or carrots, soil microbes will scavenge nitrogen to process the carbon.

“The C:N ratio must be considered when applying fertiliser, compost or manure to ensure thriving microbial life.”

This is nitrogen immobilisation. As microbes are more efficient at scavenging for nitrogen in the soil, the nitrogen available to plants in the soil will decrease. However, the nitrogen will be slowly made available again in the soil as the microbes die and break down.

Applying nitrogen to crops without considering the carbon element can damage soil biology. Urea or ammonium nitrate (AN) skews the C:N ratio drastically in favour of nitrogen until the crop uses up the excess, leached away, or lost to the atmosphere.

Material	C:N ratio
Wheat straw	80:1
Cattle manure	20:1
Finished compost	17-20:1
Chicken manure	7:1

Table 1. Average carbon-to-nitrogen ratios

HOW DOES L-CBF BOOST[™] WORK?

PERFECTLY FORMULATED TO FEED YOUR SOIL BIOLOGY

L-CBF stands for liquid carbon-based fertiliser. Unlike many other fertilisers, it is formulated specifically for your soil microbes, because if you look after them, they look after you (and your bottom line).

L-CBF BOOST[™] IS DERIVED FROM MOLASSES, A COMPLEX MIX OF AVAILABLE CARBON, YEASTS, AND OTHER MICROBIAL GROWTH FACTORS. QLF PROCESSES THE RAW MATERIAL TO ENSURE IT IS COMPATIBLE WITH MODERN SPRAY EQUIPMENT AND FORMULATES IT WITH LIQUID NITROGEN.

THE RESULT IS A PRODUCT THAT IS EASY TO USE AND DELIVERS THE IDEAL 24:1 C:N RATIO - THE PERFECT MICROBE FOOD.

HOW DO MICROBES HELP MY CROPS?

Your soil is a living organism. Microbes compose the second trophic level of the soil food web (see page five) and exist symbiotically with your crops, the first trophic level.

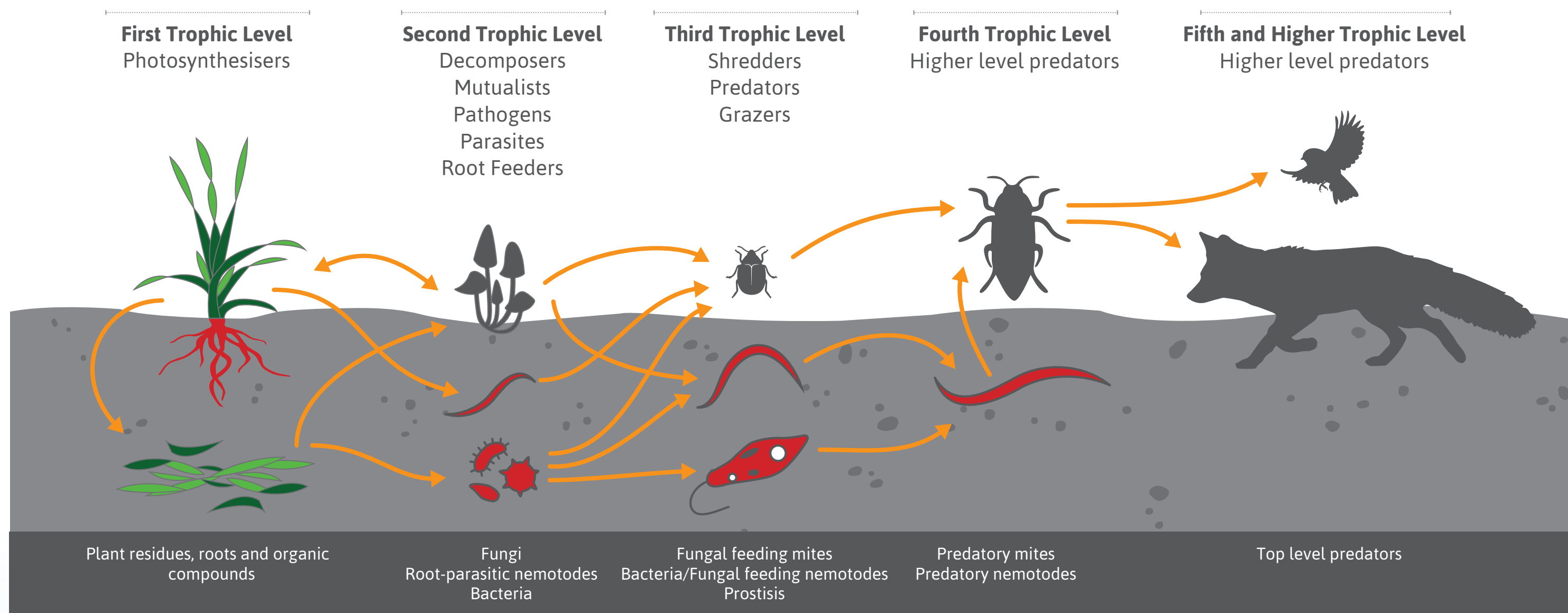
Microbes process and make available a host of essential plant nutrients. The healthier the microbial population, the greater the capacity to process complex compounds for the plant.

For the plant's part, they secrete nutrients for the microbes. 30-50% of the carbon produced by a plant through photosynthesis is expelled through the roots. This is a lot of energy that could be utilised by the plant if the soil C:N ratio is just right.

"...easy to use and delivers the ideal 24:1 C:N ratio - the perfect microbe food."



THE SOIL FOOD WEB



HOW DOES L-CBF BOOST[™] WORK?

MAKING THE MOST OF YOUR NITROGEN

Nitrogen is the biggest variable cost in growing a cereal crop, but the average nitrogen use efficiency (NUE) in the UK is just 65%. Improving NUE increases yield and reduces cost.

SOIL BIOLOGY IS THE GATEWAY TO IMPROVED NUE. IF THE MICROBES HAVE A CARBON SOURCE, THEY CAN ALSO HELP TO MAXIMISE THE EFFICIENCY OF THE NITROGEN YOU APPLY TO YOUR CROPS.

Imagine a soil with a typical C:N ratio of 14:1. Applying 100 Kg of N per hectare results in a massive spike in available N. It is available to the plant but also mobile and can just as easily be leached away.

If a carbon source like L-CBF BOOST[™] accompanies the same 100 Kg of N per hectare, it skews the C:N ratio towards the magic 24:1 number. This allows your soil to immobilise some available nitrogen, moving nitrogen

from the leaky nitrogen cycle to the more stable carbon cycle and releasing it slowly into the soil as the microbes break down. The result is that mineralised nitrogen is available to the plant as it needs it following the huge initial nitrogen spike when fertiliser is applied and reduces environmental losses.

Why should we expect to give the plant all its nutrition in spring to see it through to harvest – we don't eat all our food on Monday to see us through to Sunday!

“L-CBF BOOST moves N from the leaky nitrogen cycle to the more stable carbon cycle”



HOW DOES L-CBF BOOST™ WORK?

THE CARBON CYCLE:

The carbon cycle is the movement of carbon through the soil as part of the Earth's biogeochemical cycle:

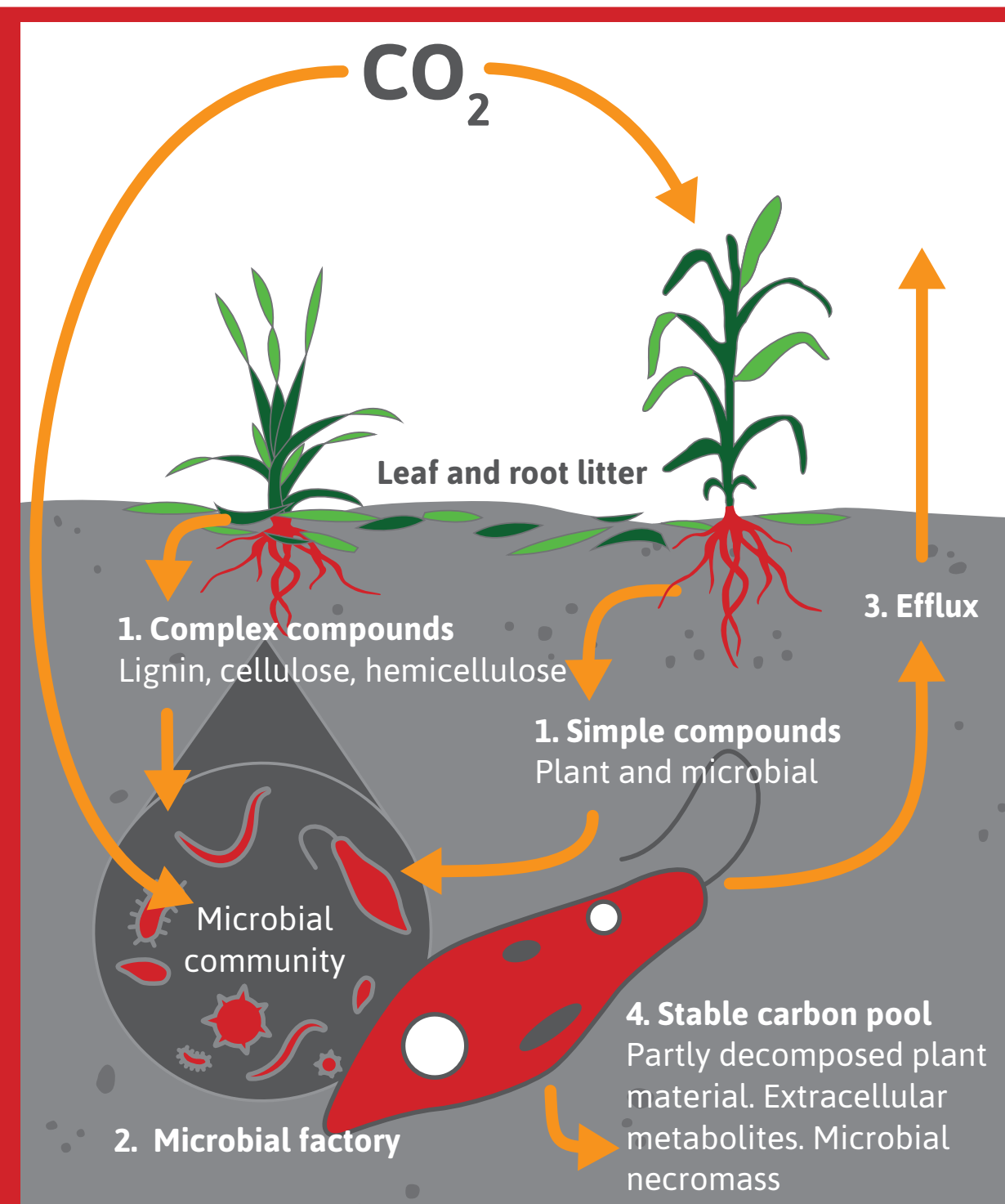
- Carbon enters the soil. Plant roots release organic compounds into the soil, or plant material and soil organisms decay when they die.
- Microbes break down organic matter, releasing nutrients that plants use for growth.
- Carbon facilitates nutrient cycling by being a vital component of soil structure, crop health, and microbial activity.

ONE GRAMME OF SOIL CONTAINS:



=

3 miles of fungi
500 beneficial nematodes
100,000 protozoa
1,000,000 bacteria



HOW DOES L-CBF BOOST[™] WORK?

HOW CAN CARBON IMPROVE UPTAKE OF FOLIAR NUTRITION?

Most fertiliser molecules are positively charged cations, but the leaf surface is negatively charged, which creates a barrier to nutrient absorption.

Adding a carbon source binds the positively charged nutrients, neutralising them and stopping the lock-up effect on the leaf surface. This helps maximise uptake and increases nutrient use efficiency especially in with Foliar N (urea)

Using a molasses-based carbon fertiliser, such as L-CBF BOOST[™], also provides a direct source of amino acids. Carbon is required for plants to make amino acids from urea, so including carbon with nitrogen means plants don't have to run down their own stocks.

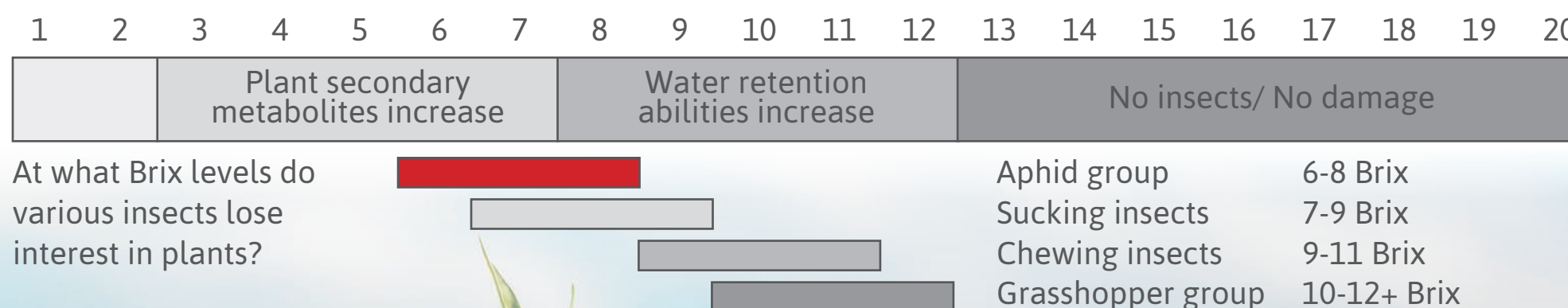
The plant uses the urea applied in foliar nitrogen applications to build amino acids, the building blocks of protein. To achieve this, the plant needs carbon. The plant can source this naturally from the C6 carbon sugars it produces from photosynthesis. However, this will reduce the plant's Brix level (a measurement of sugars). If the plant is stressed, it may need more sugars to meet its requirements.

“Adding a carbon source alongside foliar nitrogen allows the plant to quickly assimilate amino acids”

Adding a carbon source alongside foliar nitrogen allows the plant to quickly assimilate amino acids, reducing the risk of scorch while remaining sweeter, thus avoiding potential pest and/or disease challenges.

The diagram below highlights how increased Brix levels improve the resistance to pests:

LEAF BRIX CHART



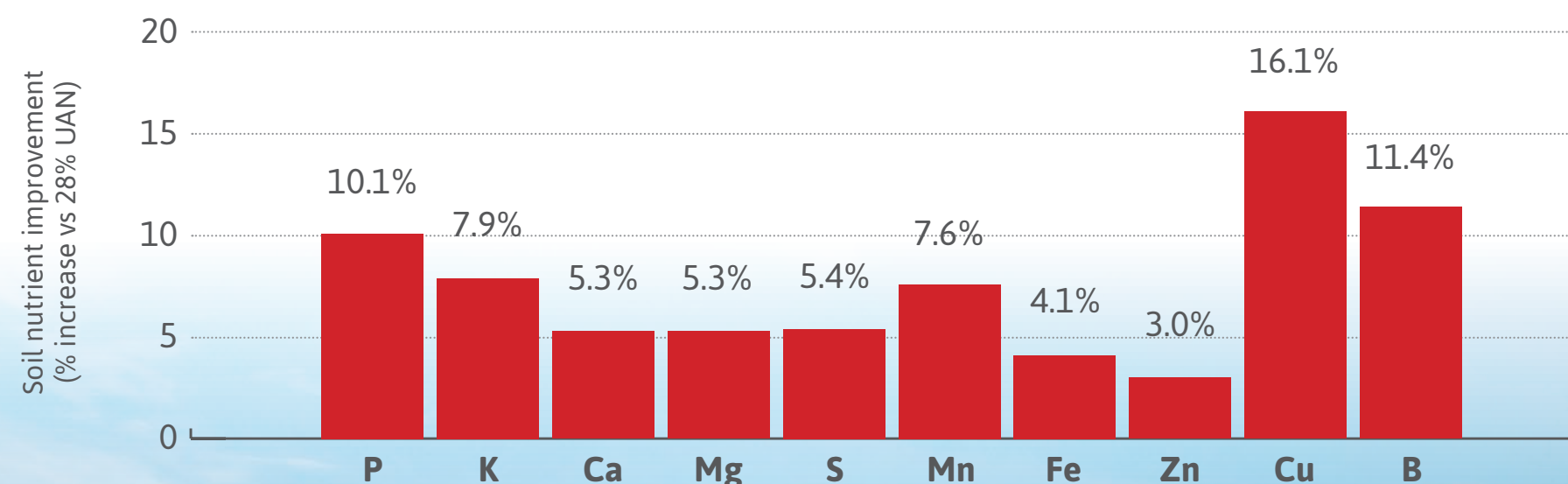
TRIALS DATA: NUTRIENT AVAILABILITY

NUTRIENT EFFICIENCY & YIELD

TRIALS DATA POINTS TO A UNIVERSAL NUTRIENT IMPROVEMENT WITH THE ADDITION OF L-CBF BOOST.

Studies conducted by QLF Agronomy in 2020 and 2021 highlight how L-CBF BOOST not only capitalises on N use efficiency but also unlocks the remaining primary, secondary, and micronutrient abilities.

QLF Agronomy Research compared a blend of 10% L-CBF BOOST (4-0-3-2) and 90% Urea Ammonium Nitrate (UAN 28%) instead of a full rate of UAN 28%. Six-inch depth soil samples were acquired in a grid pattern before applying fertiliser. Samples were retaken two weeks later and evaluated to the first set of soil samples exercising Haney's Soil Health Test Procedure.



QLF Agronomy research, two year mean (2020-21). Soil nutrient improvement 90% rec. dose of urea +10% L-CBF Boost vs 100% rec. dose of urea.

TRIALS DATA: NUTRIENT AVAILABILITY

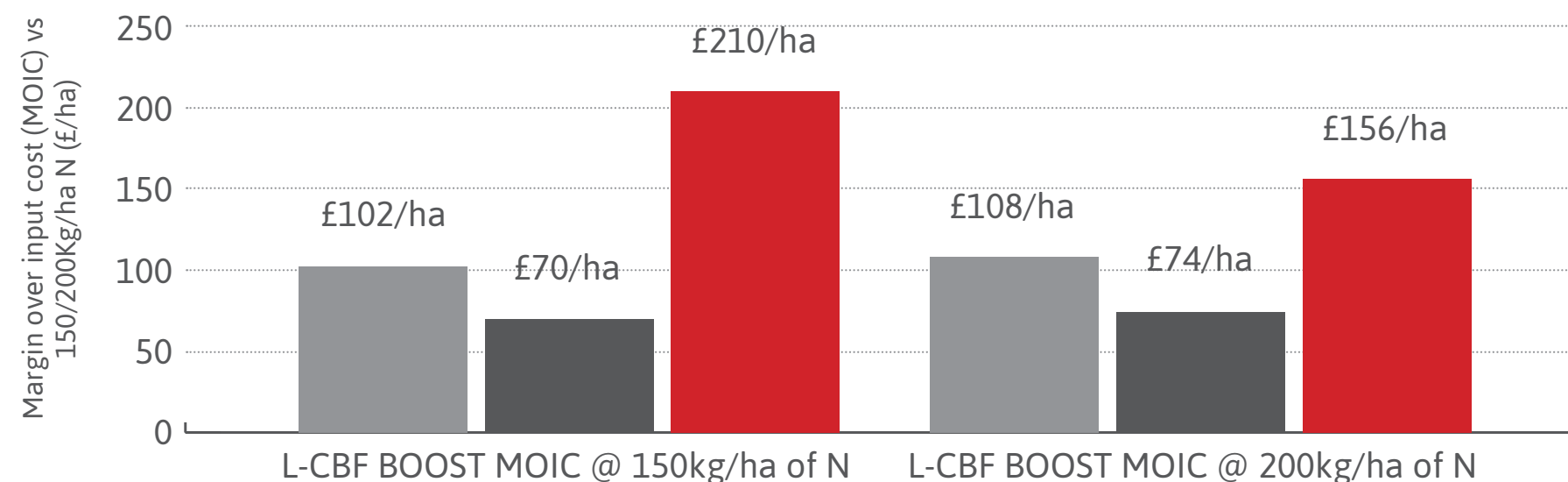
NUTRIENT EFFICACY & YIELD

NIAB TRIALS DEMONSTRATE THE VALUE OF QLF-BOOST AT GROWTH STAGES 25 AND 32

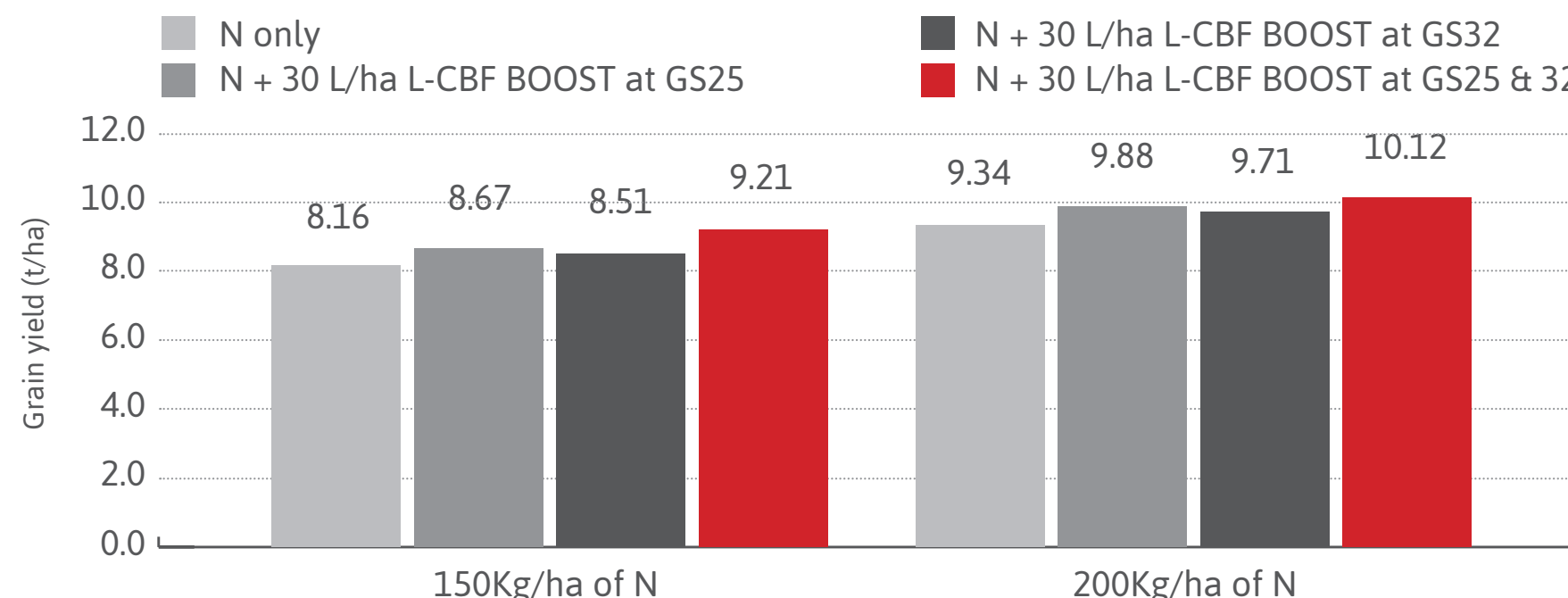
In 2020, NIAB investigated the role of L-CBF BOOST when combined with spring nitrogen applications on winter wheat (KWS Zyatt). The nitrogen was split at GS25 (tillering) and GS32 (leaf three emergence). Suboptimal (150 kg/ha) and optimal (200 kg/ha) nitrogen programmes supplemented by 30 L/ha of L-CBF BOOST at each of the timings.

The results were clear. L-CBF BOOST increased yield whenever it was included, especially when used twice in the season.

The benefits are accentuated when the margin over input cost is calculated using the returns from the increased yield and accounting for the programme's cost.



NIAB trial calculated to account for the margin over input cost (MOIC) of the treatment. MOIC calculated using wheat @£200/T, AN (34.5%) @ £350/T and L-CBF BOOST @ £0.95/L.



NIAB trial (2020); effect of L-CBF BOOST on the grain yield of winter wheat (Zyatt)

CASE STUDIES

JOHN BUBB NEWPORT, SHROPSHIRE



Using the organic carbon-based fertiliser L-CBF TERRA FED has been an integral part of an overall package of measures that has helped Shropshire grower John Bubb reduce nitrogen fertiliser use on his 800ha farm by 20%.

One of the very first changes was to include L-CBF TERRA FED to mitigate the impact of either cultivation or liquid fertiliser on soil biology.

In potatoes, the planter is equipped with an in-furrow applicator through which he applies L-CBF TERRA FED mixed with liquid fertiliser along with humic acid. "It's the obvious way to apply it."

"...., we did a trial comparing the farm standard with the new recommendations. Nitrogen was reduced from 210 kgN/ha to 180 kgN/ha, plus the L-CBF TERRA FED. The soil test showed enough available phosphate, so we didn't add any in the new recommended treatment and just enough potash to meet the peak demand from the crop.

"(using L-CBF TERRA FED) gave me a saving of £345 /ha from the new programme."

"During the growing season, we did a couple of sap tests and realised that nutrient levels were the same in both crops, despite putting a lot less nutrient on in the new programme.

"And at the end of the season both crops yielded 74t/ha with an identical marketable yield, which gave a saving of £345/ha from the new programme," he concludes.

CASE STUDIES

DAVID MILLER WHEATSHEAF FARMING, HAMPSHIRE

An early advocate of regenerative farming practices, David Miller, farm manager for Wheatsheaf Farming in Hampshire, has been including 5 L/ha of L-CBF BOOST[™] with liquid fertiliser applications across his rotation.

Nitrogen rates have been capped at 180 kg/ha, with the focus on biology in the soil to provide more of the nutrition.

"We have been using L-CBF BOOST[™] for five or six years now," David says. "The idea is that we are adding a carbon source to the fertiliser to limit the negative effect fertiliser has on our soil biology, which is well documented."

"... we are adding a carbon source to the fertiliser to limit the negative effect fertiliser has on our soil biology."

One very visual effect David is seeing is a difference in scorch. *"If the conditions are less than ideal and we are using L-CBF BOOST[™], it does alleviate the effect."*

"We are an AHDB Strategic Farm with several trials on the farm. One of the trials required us not to use L-CBF BOOST[™] across some of the tramlines, and it was clear to see from the scorch where we hadn't used it."

JAKE FREESTONE OVERBURY ESTATE, GLOUCESTERSHIRE

Farm manager of Overbury Estates, Jake Freestone farms 1600ha of varying soil types on the edge of the Cotswolds. He has embraced regenerative farming and changed the whole farming system, using direct drilling, growing a wide range of crops including companion crops and cover crops, and making his own compost.

Jake has been using L-CBF BOOST[™] for more than five years as a low-cost, consistent and reliable carbon source to buffer his inputs and improve the efficiency of liquid fertiliser applications.

"We include L-CBF BOOST[™] with all synthetic applications to all crops, which has allowed us to cut back our use of artificial inputs by enough to keep it cost-neutral, without compromising the efficacy of the input and reaping the added benefit of improving soil health," Jake says.

CASE STUDIES

BLEDDYN PUGH **DOLIAGO FARM, POWYS**

Using a combination of foliar urea and L-CBF BOOST[™] has enabled Welsh mixed farmer Bleddyn Pugh to reduce nitrogen inputs by 75% compared with a traditional granular nitrogen programme, while increasing overall grass yields.

Farming in mid-Wales, seven minutes away from the Royal Welsh Showground, Bleddyn grows crops of cereals and fodder beet to make his beef and sheep enterprise self-sufficient in feed.

But it was a comparison with a neighbour's organic pasture fields that led him to the conclusion he needed to reduce reliance on continued applications of nitrogen fertiliser.

Applications of nitrogen to grazing fields before lambing started in April saw grass growth a fortnight ahead of the organic neighbour through that month, he explains. "However, by the beginning of May the tables had turned. Their grass was still growing and ours was going backwards as it waited for the next top-up of fertiliser.

"This started us thinking we should try something different."

In the old system, after 50 kgN/ha in April, those that were cut for silage would receive an additional 90 kgN/ha after the first cut. That initial application has been dropped in the new programme, while he uses TL 17 foliar nitrogen, which delivers 18% N and 17% L-CBF BOOST[™] for after-cut or grazing applications.

"We are seeing our grass growing before the first fertiliser applications in the spring, which I think is because our soil biology is improving."

"We were getting twice as many fat lambs in the autumn off the areas that had been in the foliar system for two years."

"We were able to compare two holdings that had grass leys resown after roots, where we put almost identical flocks of lambs onto the two areas on the same date in the autumn."

"We were getting twice as many fat lambs in the autumn off the areas that had been in the foliar system for two years. You could definitely see this was a result of the quality of the grass that had come from the land in the foliar system for longer,"
Bleddyn concludes.

RECOMMENDATIONS

FOR CEREALS AND OILSEED RAPE

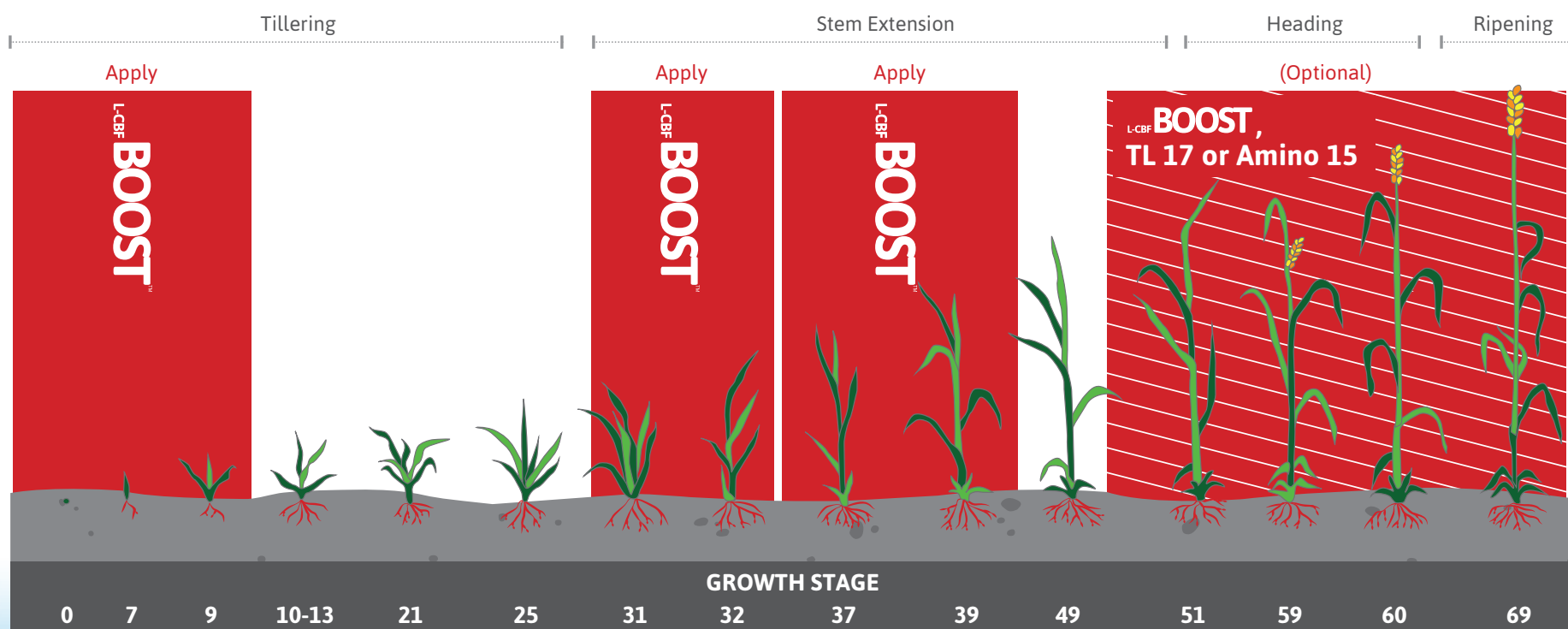
BENEFITS OF L-CBF BOOST™ IN CEREALS AND OILSEED RAPE

- Enhances existing soil biology
- Improves efficiency of applied fertiliser
- Increases nutrient cycling
- Releases soil phosphate
- Builds a bigger root system & healthier plant
- Acts as a carbon buffer when applied with other inputs, balancing C:N ratios

HOW AND WHEN TO USE L-CBF BOOST™ IN CEREALS

- Best results when used in well-structured soils as air (along with water and food) is crucial for biology to thrive
- Apply at or close to planting followed by 2-3 further applications in the growing season for optimal growth
- Late applications of L-CBF BOOST™ are beneficial for protein building in milling wheat in combination with foliar N. See TL 17 our premixed foliar N and L-CBF BOOST

CEREAL GROWTH STAGES



RECOMMENDATIONS

FOR CEREALS AND OILSEED RAPE

WHY AND HOW TO USE L-CBF BOOST™ IN OILSEED RAPE

- Helps get oilseed rape off to a good start by improving early growth
- Stimulates soil biology to improve rooting, helping crops access nutrients required through the growing season
- Improves efficiency of applied inputs to help plants grow away from pests and start developing tap root
- Apply at or close to planting followed by 2-3 further applications in the growing season for optimal growth

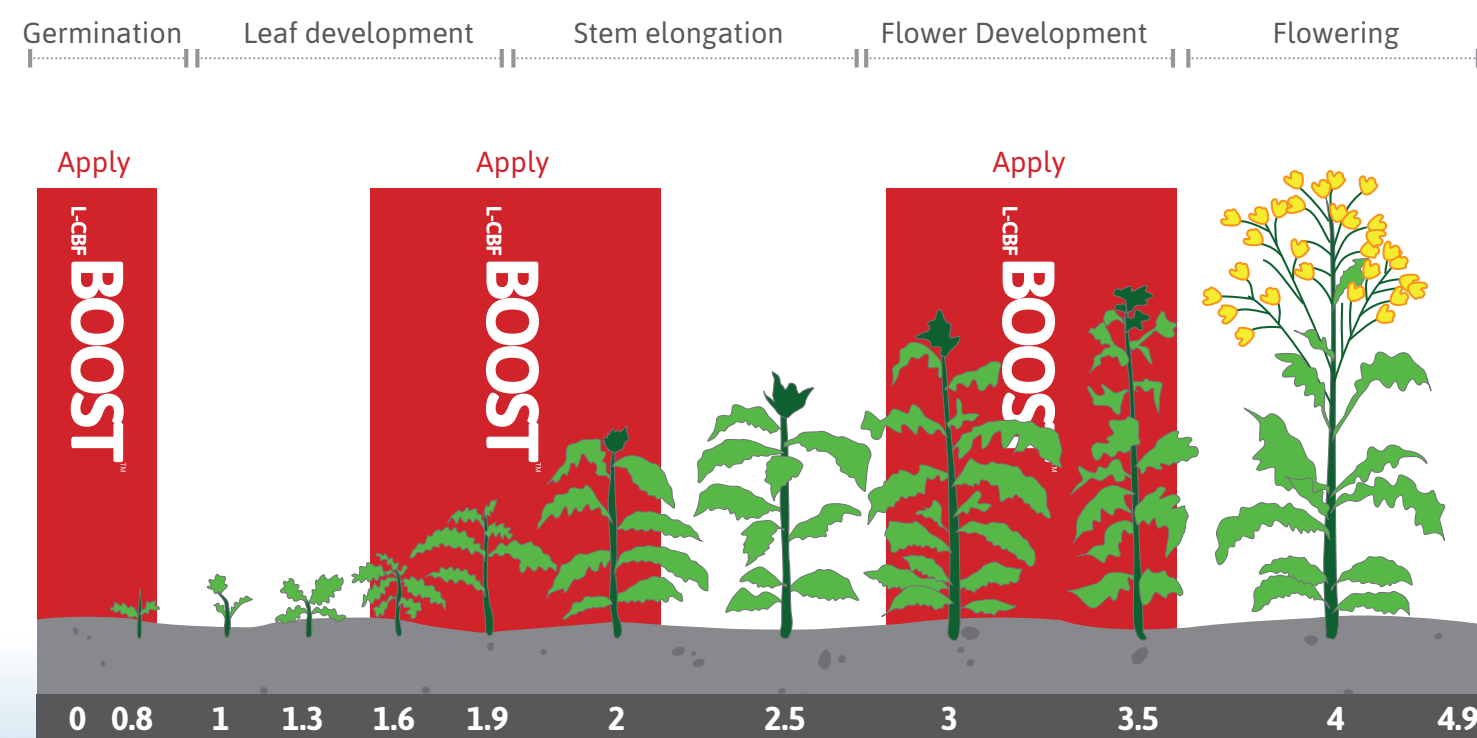
APPLICATION RATES

Crop	Rate
Winter Cereals / OSR	30 l/ha
At planting or pre-emergence or with herbicides	5-10 l/ha
Spring N applications	5-10 l/ha
With fungicides* - typically 3 applications	3-5 l/ha

Crop	Rate
Spring Cereals / OSR	20 l/ha
At planting or pre-emergence or with herbicides	5-10 l/ha
Spring N applications	5-10 l/ha
With fungicides* - typically 2 applications	3-5 l/ha

* Please consult with your agronomist, do a jar test or call QLF Agronomy for more information.

“L-CBF BOOST has been seen to deter flea beetle attacks.”



RECOMMENDATIONS

FOR MAIZE AND GRASS

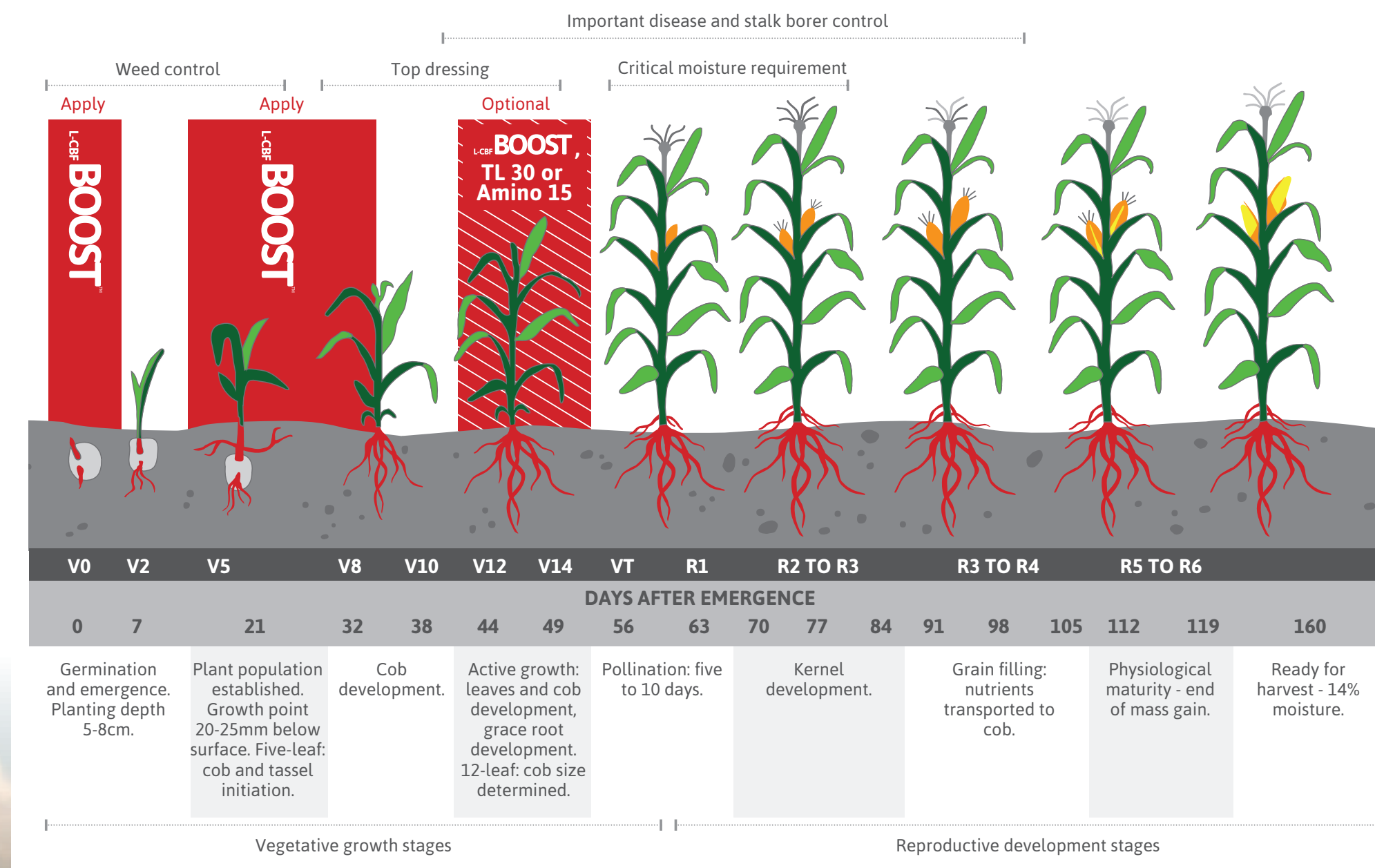
BENEFITS OF L-CBF BOOST™ ON MAIZE AND GRASSLAND

- Improves performance of applied fertilisers, FYM and slurry by working with soil biology
- Increases dry matter, starch and ME
- Produces larger, higher quality crops allowing reductions in bought-in feed

WHY USE L-CBF BOOST™ ON MAIZE

When maize grows above the boom or spinner on fertiliser spreaders, the ability to apply fertiliser is curtailed but the growing crop still has nutritional requirements. By applying L-CBF BOOST™ at planting and again around V5-V8 soil microbes will continue to work to make available nutrients available to the growing plant, when they can't be physically applied, helping to create a healthier plant and increase yields.

MAIZE GROWTH STAGES



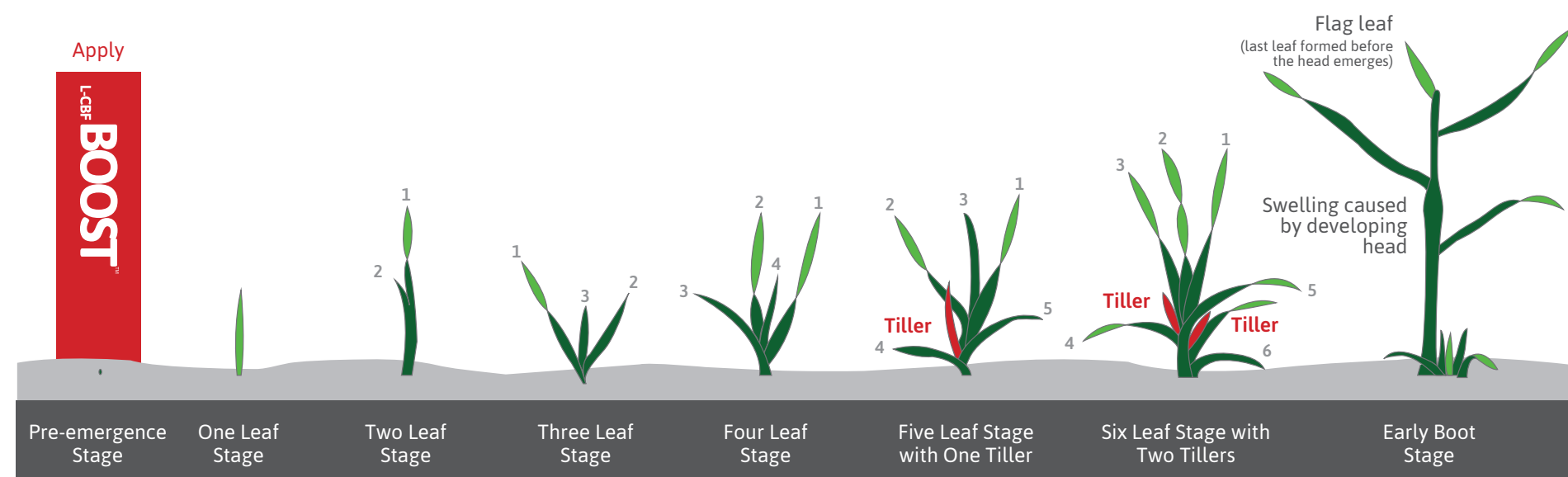
RECOMMENDATIONS

FOR MAIZE AND GRASS

WHY USE L-CBF BOOST™ ON GRASSLAND

- Improves sward density, drought tolerance and poaching resistance
- Improves nutritional value of grass
- Particularly effective on new swards to help with bringing land into production as soon as possible

GRASS GROWTH STAGES



APPLICATION RATES AND TIMINGS

Crop	Rate	Timings	Splits
Maize	40 l/ha	At planting or pre-emergence	20 l/ha
		Post emergence	20 l/ha
Grassland ley	Depends on the amount of cuts	Pre – emergence	20 l/ha
		With Spring N application	20 l/ha
		After cut application	20 l/ha
Conservation Grass / Other Grasses / Lucerne / Clover	Depends on the amount of cuts	With Spring N application	20 l/ha
		After cut application	30 l/ha

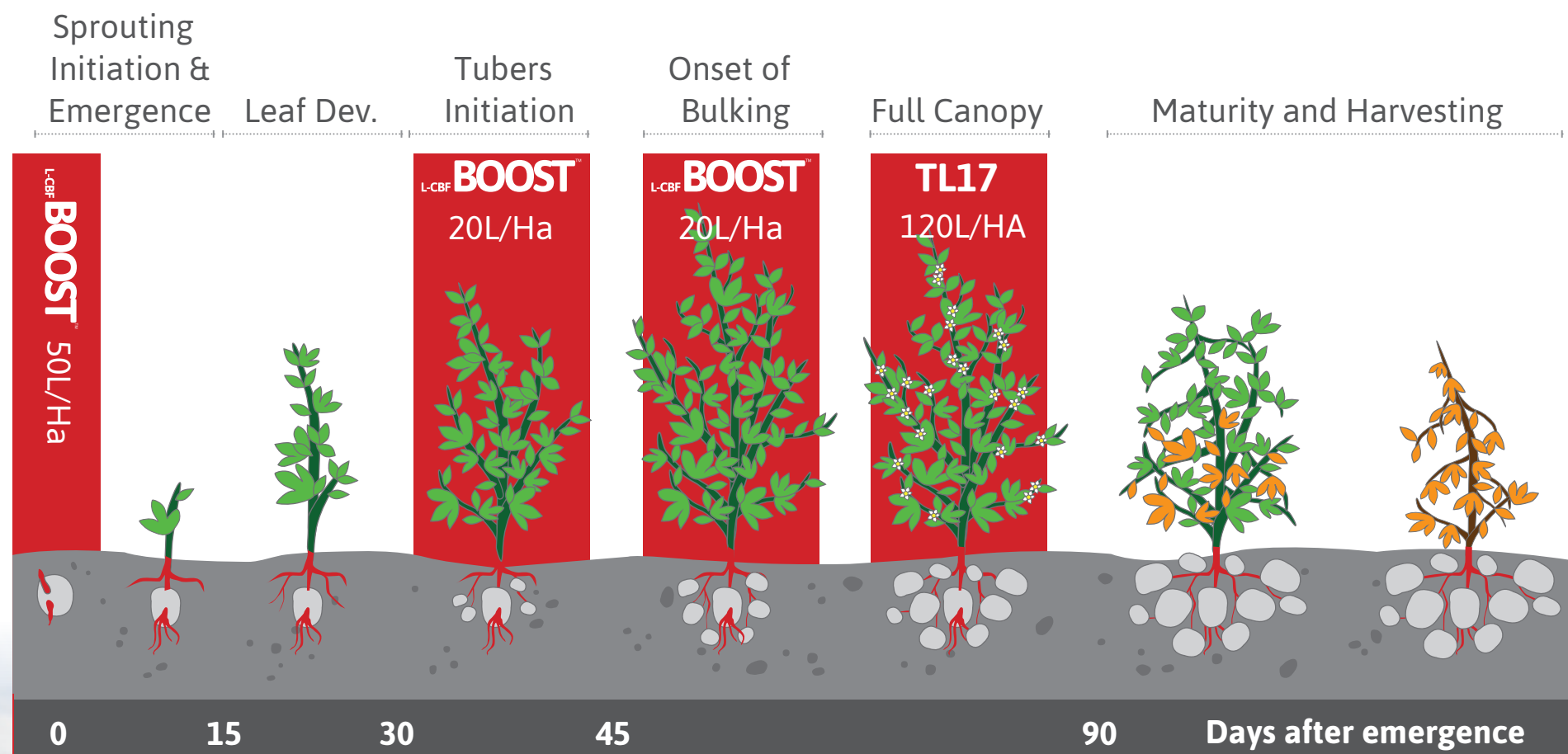


RECOMMENDATIONS

BENEFITS OF L-CBF BOOST™ ON POTATOES

WHY USE L-CBF BOOST™ ON POTATOES

- Helps soil biology recover following potato establishment
- Provides a boost to soil nutrient availability at planting and other key times in the growing season
- Reduces risk of scorch when applying liquid fertilisers
- Results in more foliar and tuber growth – typically around 10% yield increase



APPLICATION RATES AND TIMING IN POTATOES

Product	At planting	Tuber initiation	Onset of bulking	Full canopy
L-CBF BOOST™	50 L/ha	20 L/ha	20 L/ha	
TL17				120 L/ha



RECOMMENDATIONS

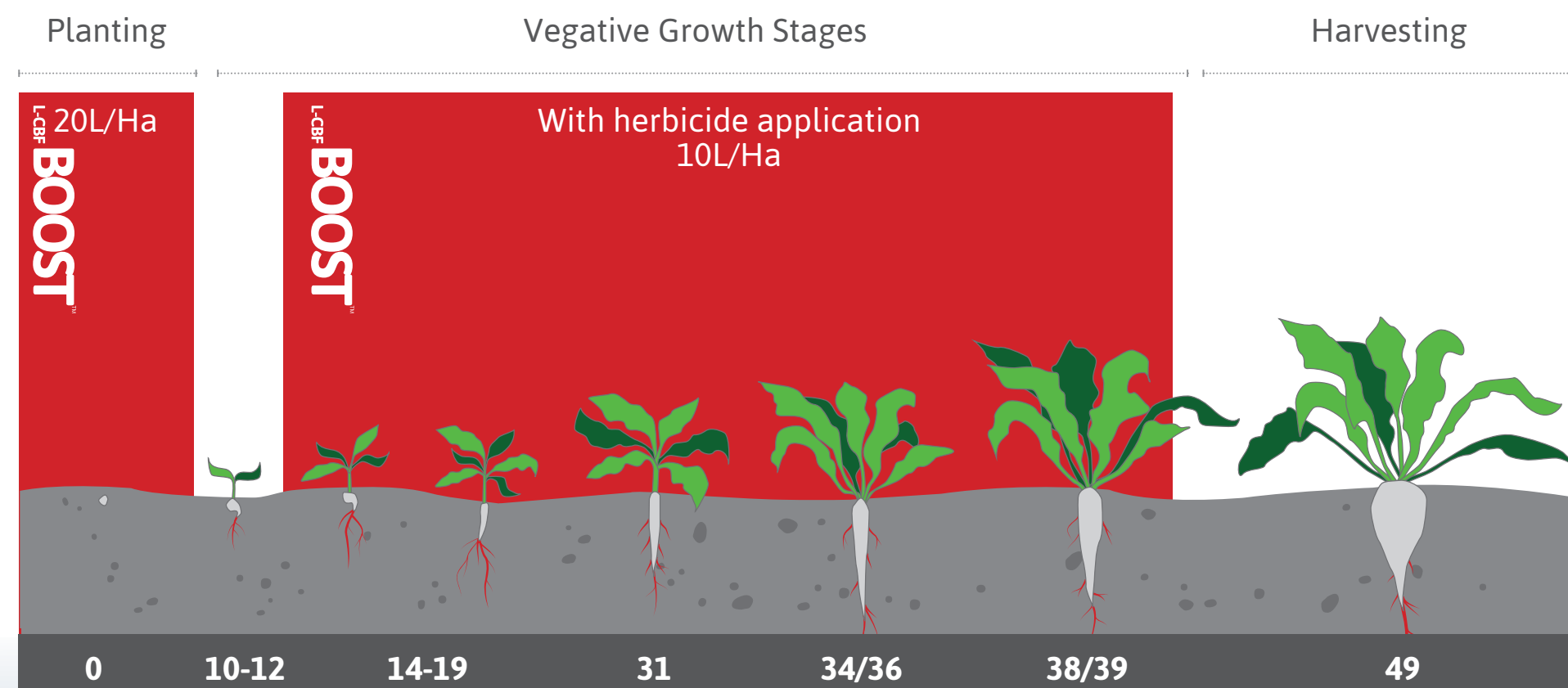
FOR SUGAR AND FODDER BEET

BENEFITS OF L-CBF BOOST™ ON SUGAR AND FODDER BEET

- Provides boost to soil nutrient availability at planting
- Helps with faster establishment of crops
- Reduces risk from virus yellows by getting crop past vulnerable growth stages earlier

APPLICATION RATES AND TIMING IN SUGAR AND FODDER BEET

Product	At planting or pre-emergence	With herbicides
L-CBF BOOST™	20 L/ha	10 L/ha



FREQUENTLY ASKED QUESTIONS

WHAT IS L-CBF BOOST™?

L-CBF BOOST™ is a carbon-based additive with balanced crop nutrients and beneficial biology designed to feed soil microbes, increase the efficiency and performance of applied fertilisers, build long-term soil fertility, and increase crop yield potential.

It contains complex carbon, balanced nutrients, enzymes, amino acids and trace elements. It increases the efficiency of the nitrogen you apply to your crops.

HOW DO I APPLY L-CBF BOOST™?

L-CBF BOOST™ can be applied on its own, with pesticides or easily mixed with liquid fertiliser. It is a versatile, convenient, consistent and cost-effective product.

WILL IT INCREASE MY YIELDS?

L-CBF BOOST™ has consistently shown yield increases of 5-10% on a range of crops.

WHAT FORM DOES IT COME IN?

L-CBF BOOST™ is a brown free-flowing liquid designed to be mixed with the chemical inputs. It is triple-filtered to ensure it can go through crop sprayers.

HOW DO I STORE IT?

L-CBF BOOST™ is a free-flowing, concentrated product that thickens slightly in colder weather. As soon as it is added to water and/or liquid fertiliser, it easily sprays. Ideally, it should be stored above freezing, ideally indoors in IBCs. Loosen the IBC cap to allow L-CBF BOOST™ to breathe, and remember it will need agitation if stored for more than three weeks.

HOW DO I APPLY IT?

Liquid fertiliser systems: L-CBF BOOST™ can be mixed directly with liquid fertiliser. Typically, it is mixed at 3-5% of the volume of liquid fertiliser to be applied. It can either be decanted into the induction hopper while filling or drawn straight into the tank after filling with liquid fertiliser.

Solid fertiliser systems: L-CBF BOOST™ can be applied with pre- or post-emergence herbicides at 10 L/ha. It can also be added in with each fungicide spray at 10 L/ha. Although L-CBF BOOST™ is compatible with most chemicals, it is sensible to carry out a jar test or call QLF Agronomy to discuss your programme.

Starter fertiliser: L-CBF BOOST™ can be mixed directly with liquid starter fertiliser at a ratio of 3:1 or greater.

FREQUENTLY ASKED QUESTIONS

CAN L-CBF BOOST™ BE USED WITH GLYPHOSATE?

Yes, L-CBF BOOST™ can be applied with glyphosate. It acts as a wetter and has a low pH, both of which help with glyphosate efficacy. “Wrapping” it in carbon – acting as a carbon buffer – helps get it into the plant more quickly, so you’ll see a quicker kill, while it also encourages quicker breakdown of the target weed or crop by decomposing microbes.

That also reduces glyphosate residues, as enhancing soil biology using L-CBF BOOST helps break down glyphosate in the soil. Run-off tests by a water company on an L-CBF BOOST user’s farm showed an over 50% reduction in glyphosate levels in water where L-CBF BOOST™ had been applied. Apply L-CBF BOOST™ at 5-10 L/ha with plenty of water.

DOES L-CBF BOOST™ HELP REDUCE FERTILISER SCORCH?

Research carried out by QLF Agronomy and its sister company in the USA shows applying L-CBF BOOST™ with liquid fertilisers reduces the risk of scorch.

L-CBF BOOST™ wraps the fertiliser in carbon, which acts as a buffer, reducing the harmful effect on the plant and maintaining green leaf area for as long as possible. L-CBF BOOST™ also helps improve efficiency by reducing leaching and volatilisation. Spray in still and cool conditions whenever possible, but an application of L-CBF BOOST™ could increase the window of opportunity.

WHERE CAN I BUY IT?

You can order it through QLF Agronomy’s merchant network (please call 01952 727754 to find your nearest merchant) or online through Landowner Products Ltd. We also work with many buying groups.

OTHER PRODUCTS YOU MAY BE INTERESTED IN FROM QLF AGRONOMY

- **TOPLEAF**
- **TL 17**
- **TL 30**
- **AMINO 15**





L-CBF **BOOST**TM

CONTACT US

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