



Organisation



FERTCARE®



Nutrient Solutions

Turf & Landscape® Fertilizer Solutions

The Turf & Landscape® range of quality fluid fertilizers and microbial stimulants are supported by our comprehensive agronomy service and dealer network.

SLTEC has developed the Turf and Landscape Range® (T&L) to specifically cater for the needs of Turf and Amenity Horticulture

turfandlandscape.com.au



Activated Nutrients, 100% Plant Available
 Extensive Range of NPK Blends & Trace Elements
 Suited for Performance Turf,
 Amenity Horticultural and Nursery Situations
 Custom Blends Available for Larger Applications



Turf & Landscape® Benefits

- Nutrients are in 100% water soluble plant available forms for rapid uptake by both foliar and fertigation methods.
- A wide range of nutrient ratios are available to account for different nutrient demands in relation to the stage of plant growth.
- Products that contain trace elements are chelated where required, to reduce mineral lock-up and improve the efficiency of plant uptake.
- Liquids allow for small amounts of nutrients to be applied accurately (little-often) to more closely meet plant demand rather than in large single applications that can result in leaching and run-off.
- Uniform liquid blends are not subject to the segregation issues associated with solid fertilizer products, thus achieving uniform distribution of applied nutrients.
- Soluble nutrients eliminate the need to dissolve solid fertilizers and provide ease of application (no insoluble blockages in injection or spray equipment). Multinutrient blends reduce the possibility of human error when mixing dry fertilizer products.
- In Addition, liquid fertigation offers potential for a decreased number of field passes required to apply plant nutrients resulting in reduced fuel costs, machinery wear and tear and ultimately labour can be used more efficiently.
- Manual handling issues are reduced and there is no need to deal with fertilizer that may be dusty or set hard in the bag.
- The Turf & Landscape® product range uses chloride free sources of Potassium, helping reduce the amount of chloride applied to soils.
- Can be mixed with a wide variety of horticultural chemicals.

Contents

Why Choose Turf & Landscape® Fertilizers?...	3
Our Commitment to Quality	4
Nursery Blend Fact Sheet	5

Turf & Landscape® Product Range	6
NP Starter Blends	6
NPK Blends	6
High Nitrogen (N) Blends	6
High Potassium (K) Blends	7
High Calcium (Ca) Blends	7
Trace Element Blends	7
Single Trace Element Blends	8

Sustain & Gro® Product Range	9
Sustainable & Renewable Blends	9

Nutri Complete™ Fact Sheet	10
BiologiCAL® PLUS Fact Sheet	11
Ezyflo Lime 38™ Fact Sheet	12
QuadSHOT® Fact Sheet	14
Inputs that Stimulate Soil Biological Activity	15
Understanding Turf Seasonal Requirements	16
The Essential Turfgrass Nutrients	18
Turf Green 4™ Fact Sheet	19
Turbo P™ & Plant Booster™ Fact Sheet	20
Pro N Cal + TE™ & Pro NQ20™ Fact Sheet	21
Fertigation Tanks & Accessories	22
pH, Soil Acidity, Lime and Gypsum	23
Nutrient Function in Plants	24

Why Choose Turf & Landscape® Fertilizers?

Turf & Landscape® is a part of SLTEC® Fertilizers, a leading manufacturer of fluid Fertilizers, based in Northern Victoria.

Our Promise

Quality

Turf & Landscape® is committed to supplying consistently high quality products.

Investment

Turf & Landscape® will ensure that your fertilizer inputs maximise the return on your investment.

Service

Turf & Landscape® will provide professional, logistical and agronomic support to ensure a sustainable relationship.

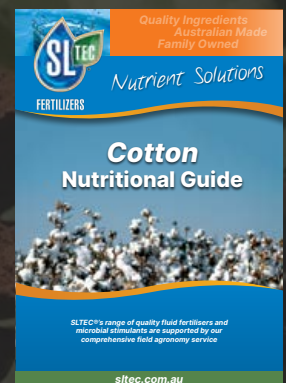
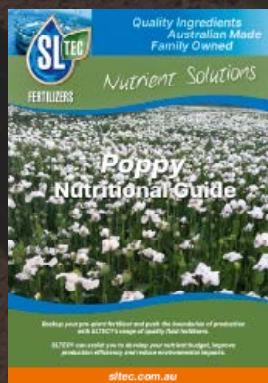
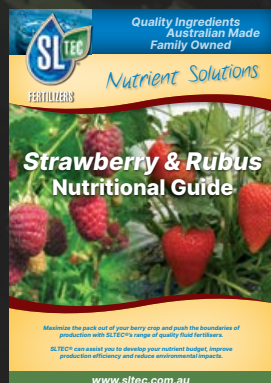
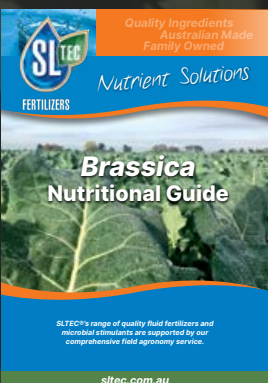
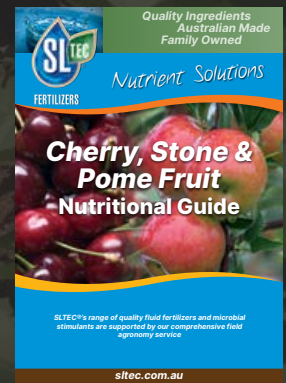
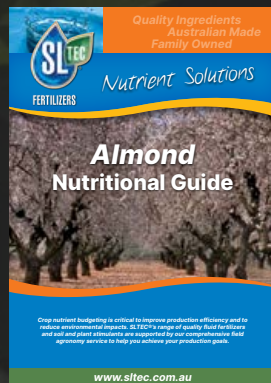
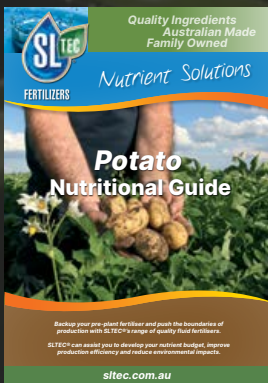
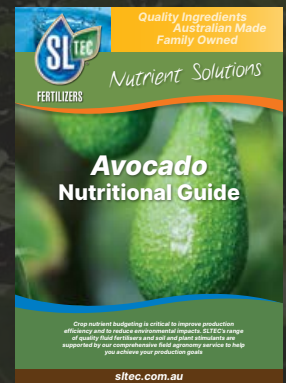
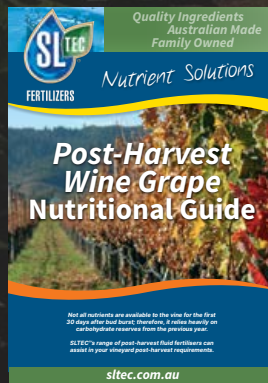
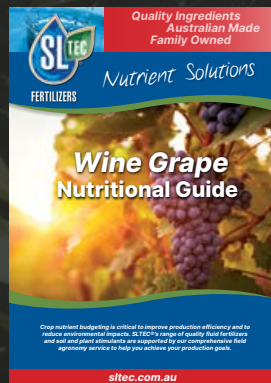
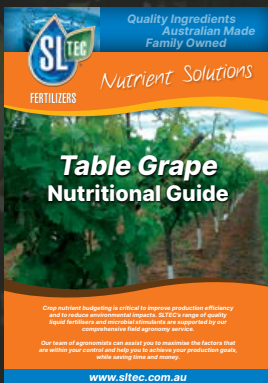
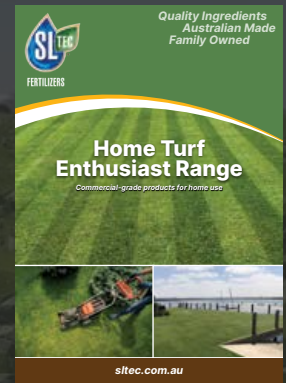
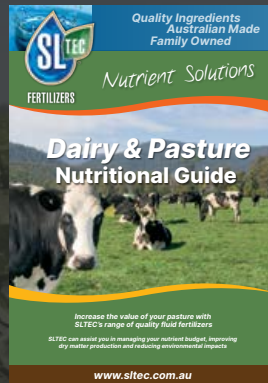
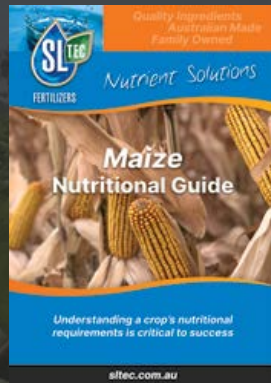
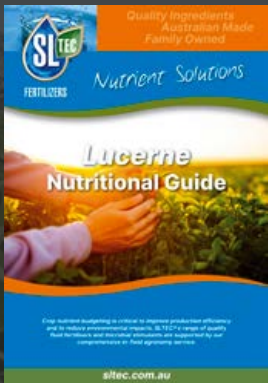
Read our quality assurance policy online at turfandlandscape.com.au/quality

Why use Fluid Fertilizer?

- Efficient and highly plant available
- Can deliver many nutrients with a single application
- Small and frequent applications reduce leaching and runoff
- Foliar and fertigation options allow flexible application timing unlike relying on broadcast application
- Consistency of product and uniform application across the soil
- Nutrients infiltrate to the root zone where maximum uptake is achieved
- Foliar application particularly of trace elements avoids tie up in the soil
- Can be mixed with a range of farm chemicals
- Labour savings and improved workplace safety



Nutritional Guides



Additional Nutritional Guides available at www.sltec.com.au/nutritionalguides

Our Commitment to Quality

Can your fertilizer supplier give you this sort of quality assurance?

Turf & Landscape® is committed to delivering quality products and services.

We continue to put a tremendous effort into ensuring that our products meet the tightest quality parameters.

- We carefully select the ingredients we use in our formulations from suppliers all over the globe.
- We routinely seek independent laboratory testing to confirm the levels of all nutrients listed on our product labels. We also regularly test for heavy metals or other contamination.
- Our blends are developed by our formulation chemist, who has now developed over 400 different blends, some of which have been servicing very sensitive crops in hygienically clean glass house environments.
- We invest annually in formulation research and advanced chemistries for the fluid fertilizer and industrial water treatment sectors.
- Our team has specialized formulation software that aids the development of each blend, from basic chemistry building blocks into complex and sophisticated formulations for applications such as hydroponics, foliar fertilizer, fertigation, water treatment etc.
- Our batching and mixing systems are calibrated every 6 months by an external certifying body.
- Each batch must meet a variety of tests and quality specifications before being released for dispatch.
- Our labels state accurately the nutrient content of each blend and comply fully with state and federal legislation and the Fertilizer Australia Labelling Code of Practice.
- We retain samples of each and every blend made with a unique batch number, enabling traceability of batches.
- Our staff are qualified and thoroughly trained to ensure our products and services remain at the highest standards of excellence.

In summary, quality is an absolutely essential component of the culture and processes at Turf & Landscape® and we pride ourselves on it. Development, manufacture, storage, labelling and transport of our products is carried out in a manner that aims to provide our customers with the assurance that the products they receive are of the highest quality, ready to use and will deliver the outcomes desired.

Further information on our quality policy is available on our website.



Turf & Landscape® Product Range

Product Code	Name	N% (w/v)	P% (w/v)	K% (w/v)	S% (w/v)	Ca% (w/v)	Bio. Stim. ¹	Chel. ²	SG (kg/L)	pH range	Typical Application Rates		
											Fertigation Overhead Sprinkler, Drip Irrigation	Recreational & Amenity Horticulture, Parks, Gardens, Tees & Greens Use at least 100 L / 100 m ² water	Foliar Top-Dress (Boomspray or Back-Pack) Use a minimum of 200 to 600 L/ha water
NP Starter Blends - designed for plant establishment													
TL0012	Turbo P™ N as NH ₄ 11.3%, P as PO ₄ 15.6%	11.3	16.0	-	-	-	-	-	1.29 - 1.30	6.0 to 7.0	10 to 80 L/ha	100 to 800 mL/100 m ²	2 to 20 L/ha
TL0013	Turbo P + Zinc™ N as NH ₄ 10.1%, P as PO ₄ 14.0%, Zn 1.0%	10.1	14.0	-	-	-	-	Y	1.29 - 1.30	6.0 to 7.0	20 to 100 L/ha	200 to 1000 mL/100 m ²	2 to 20 L/ha
NPK Blends - with a choice of nutrient ratios to match different seasonal demands													
TL0021	Turbo NKS™ N as NO ₃ 1.2%, N as NH ₄ 1.2%, N as Urea 15.1%	17.5	-	17.7	14.7	-	-	-	1.33 - 1.34	7.0 to 8.0	10 to 80 L/ha	100 to 800 mL/100 m ²	1 to 7 L/ha
TL0018	Nutri Complete™ N as NO ₃ 0.02%, N as Urea 11.7%, P as PO ₄ 4.8%, Mg 0.2%, Mn 0.01%, Zn 0.01%, Cu 0.01%, B 0.02%, Fe 0.01%, Fulvic Acid 0.01%, Fish Hydrolysate 0.4%, Humic Acid 0.3%, Molasses 0.4%, Kelp 0.4%	11.8	4.8	13.6	2.0	-	Y	Y	1.29 - 1.32	7.5 to 8.5	10 to 80 L/ha	100 to 800 mL/100 m ²	5 to 20 L/ha
TL0065	Nutri Phos Complete™ N as Urea 11.7%, P as PO ₄ 2.5%, P as Phosphonic Acid 2.4%, Mg 0.2%, Mn 0.006%, Zn 0.01%, Cu 0.005%, B 0.02%, Fe 0.01%, Fulvic Acid 0.01%, Fish Hydrolysate 0.4%, Humic Acid 0.3%, Molasses 0.4%, Kelp 0.4%	11.7	4.9	13.6	2.0	-	Y	Y	1.29 - 1.32	7.5 to 8.5	10 to 80 L/ha	100 to 800 mL/100 m ²	5 to 20 L/ha
All the benefits of Nutri Complete™ plus Phosphonic Acid. Phosphite has been shown to enhance to Turf quality through disease suppression*.													
TL0061	Plant Booster™ N as NO ₃ 2.1%, N as NH ₄ 2.9%, P as PO ₄ 15.0%, Mg 0.2%, Mn 0.4%, Zn 0.4%, Cu 0.5%, Mo 0.01%, B 0.05%, Fulvic Acid 0.5%	5.0	15.0	2.1	-	4.0	Y	Y	1.30 - 1.32	< 2.0	10 to 100 L/ha	100 to 1000 mL/100 m ²	2 to 10 L/ha
High Nitrogen (N) Blends - provide choice of N% with or without additional trace and biostimulants													
TL0006	Pro AN25™ N as NO ₃ 12.7%, N as NH ₄ 12.7%	25.4	-	-	-	-	-	-	1.27 - 1.28	5.0 to 6.0	10 to 80 L/ha	100 to 800 mL/100 m ²	5 to 10 L/ha
TL0052	Pro N Cal + TE™ N as NO ₃ 8.8%, N as NH ₄ 8.5%, N as Urea 17.0%, Zn 0.4%, Cu 0.25%, B 0.05%, Fulvic Acid 0.001%, Kelp 0.04%, Fish Hydrolysate 0.04%, Humic Acid 0.03%, Molasses 5.5%	34.3	-	0.3	0.2	0.8	Y	Y	1.30 - 1.31	5.0 to 6.0	10 to 100 L/ha	100 mL to 1 L/100 m ²	10 to 60 L/ha

* Reference: Landschoot & Cook. (2005). Research Science for the Golf Course.

¹Biological Stimulant ²Chelating Agent

Product Code	Name	N% (w/v)	P% (w/v)	K% (w/v)	S% (w/v)	Ca% (w/v)	Bio. Stim. ¹	Chel. ²	SG (kg/L)	pH range	Typical Application Rates		
											Fertigation Overhead Sprinkler, Drip Irrigation	Recreational & Amenity Horticulture, Parks, Gardens, Tees & Greens Use at least 100 L / 100 m ² water	Foliar Top-Dress (Boomspray or Back-Pack) Use a minimum of 200 to 600 L/ha water
High Nitrogen (N) Blends (cont...)													
TL0039	Pro NQ3™ N as NO ₃ 10.3%, N as NH ₄ 10.3%, N as Urea 20.6%, P as PO ₄ 0.1%, Fe 0.001%, Fulvic Acid 0.01%, Fish Hydrolysate 0.2%, Humic Acid 0.2%, Kelp 0.2%, Molasses 0.2%	41.2	0.1	0.1	-	-	Y	Y	1.30 - 1.32	6.0 to 7.0	10 to 80 L/ha	100 to 800 mL /100m ²	10 to 60 L/ha
TL0064	Pro NQ20™ N as NO ₃ 8.6%, N as NH ₄ 8.5%, N as Urea 17.0%, P as PO ₄ 0.3%, Fe 0.006%, Fulvic Acid 0.05%, Fish Hydrolysate 1.5%, Humic Acid 1.3%, Kelp 1.5%, Molasses 1.5%	34.1	0.3	0.5	-	-	Y	Y	1.30 - 1.32	6.0 to 7.0	10 to 80 L/ha	100 to 800 mL /100m ²	10 to 60 L/ha
TL0001	Turbo Iron™ N as Urea 10.6%, Fe 8.3%	10.6	-	-	4.8	-	-	-	1.25 - 1.30	2.0 to 4.0	10 to 60 L/ha	100 to 600 mL/100 m ²	1 to 7 L/ha
High Potassium (K) Blends - including options with or without Magnesium and Sulphur													
TL0068	Driver KP™ P as PO ₄ 12.3%	-	12.3	36.4	-	-	-	-	1.55 - 1.57	12.0 to 13.0	10 to 80 L/ha	100 to 800 mL/100 m ²	1 to 5 L/ha
-	Pot30™	-	-	30.0	-	-	-	-	1.44 - 1.45	6.5 to 7.5	10 to 80 L/ha	100 to 800 mL/100 m ²	2 to 10 L/ha
TL0008	Driver KS™	-	-	30.1	25.0	-	-	-	1.47 - 1.49	7.0 to 9.0	10 to 80 L/ha	100 to 800 mL/100 m ²	2 to 5 L/ha
TL0050	Driver Max K™	-	-	43.8	-	-	-	-	1.54 - 1.55	13.0 to 14.0	10 to 80 L/ha	100 to 800 mL/100 m ²	1 to 5 L/ha
High Calcium (Ca) Blends - for strong balanced growth													
TL0004	CalGreen MgB™ N as NO ₃ 12.4%, Mg 3.4%, B 0.2%	12.4	-	-	-	12.3	-	Y	1.47 - 1.49	2.0 to 3.0	10 to 100 L/ha	100 mL to 1 L/100 m ²	5 to 10 L/ha
TL0003	CalGreen™ N as NO ₃ 12.8%	12.8	-	-	-	18.3	-	-	1.48 - 1.50	3.0 to 7.0	10 to 100 L/ha	100 mL to 1 L/100 m ²	5 to 10 L/ha
Trace Element Blends - to maximize plant health and photosynthesis													
TL0011	Turf TE™ N as NO ₃ 2.6%, Mg 2.4%, Mn 3.2%, Zn 3.2%, Cu 0.5%, Mo 0.02%, B 0.2%, Fe 0.7%, Fulvic Acid 0.5%	2.6	-	0.1	4.2	-	Y	Y	1.29 - 1.30	1.0 to 2.0	10 to 25 L/ha	100 to 250 mL/100 m ²	2 to 10 L/ha
TL0062	Turf Green 4™ Zn 0.3%, Mg 3.4%, Mn 1.0%, Fe 3.4%	-	-	-	7.3	-	-	-	1.27 - 1.28	1.0 to 2.0	5 to 10 L/ha	50 to 100 mL/100 m ²	1 to 3 L/ha

¹Biological Stimulant ²Chelating Agent

Single Trace Element Blends

Product Code	Name	N% (w/v)	P% (w/v)	K% (w/v)	S% (w/v)	Ca% (w/v)	Bio-Stim. ¹	Chel. ²	SG (kg/L)	pH range	Typical Application Rates		
											Fertigation Overhead Sprinkler, Drip Irrigation	Recreational & Amenity Horticulture, Parks, Gardens, Tees & Greens Use at least 100 L / 100 m ² water	Foliar Top-Dress (Boomspray or Back-Pack) Use a minimum of 200 to 600 L/ha water
Complex and Activated Trace Elements													
<i>An inter-compatible range of trace enhanced with high uptake efficiency</i>													
TL0041	Turf Cop 7™ Cu 6.7%	-	-	-	3.6	-	-	-	1.16 - 1.18	2.0 to 3.0	5 to 10 L/ha	50 to 100 mL/100 m ²	1 to 3 L/ha
TL0038	Turf Mag 6™ Mg 6.3%	-	-	-	8.3	-	-	-	1.27 - 1.28	3.0 to 6.0	5 to 10 L/ha	50 to 100 mL/100 m ²	2 to 15 L/ha
TL0040	Turf Man 17™ Mn 17.7%	-	-	-	10.6	-	-	-	1.42 - 1.44	6.0 to 7.0	5 to 10 L/ha	50 to 100 mL/100 m ²	1 to 7 L/ha
TL0034	Zinc-Link™ Zn 15.9%, Fulvic Acid 0.5%	-	-	0.1	7.8	-	Y	Y	1.36 - 1.38	2.0 to 3.0	5 to 10 L/ha	50 to 100 mL/100 m ²	1 to 3 L/ha
High Analysis Trace Elements													
<i>Good inter-compatibility with each other and the High Nitrogen and High Calcium Ranges</i>													
TL0054	Top Cop™ N as NO ₃ 10.0%, Cu 22.7%	10.0	-	-	-	-	-	-	1.50 - 1.52	1.0 to 2.0	500mL to 3 L/ha	5 to 30 mL/100 m ²	100 mL to 300 mL/ha
TL0055	Top Mag™ N as NO ₃ 9.8%, Mg 8.8%	9.8	-	-	-	-	-	-	1.36 - 1.37	< 2.0	12 to 25 L/ha	120 to 250 mL/100 m ²	2 to 3 L/ha
TL0056	Top Man™ N as NO ₃ 12.2%, Mn 23.9%	12.2	-	-	-	-	-	-	1.55 - 1.56	2.5 to 3.5	1 to 5 L/ha	10 to 50 mL/100 m ²	500 mL to 2 L/ha
TL0053	Top Zinc™ N as NO ₃ 8.3%, Zn 19.3%	8.3	-	-	-	-	-	-	1.46 - 1.47	<2.0	1 to 4 L/ha	10 to 40 mL/100 m ²	500 mL to 1 L/ha
Boron and Molybdenum Blends													
<i>Two elements often over-looked when aiming for high quality turf.</i>													
TL0017	Turf B 15™ N as amine 6%, B 15%	6.0	-	-	-	-	-	-	1.34 - 1.38	7.5 to 8.5	2 to 5 L/ha	20 to 50 mL/100 m ²	1 to 3 L/ha
-	Mo Turf™ Mo 23.7%	-	-	-	-	-	-	-	1.39 - 1.41	8.0 to 9.0	Up to 150 mL/ha	4 to 30 mL/ha	40 to 300 mL/ha
Chelated Trace Elements													
<i>Convenient EDTA liquids for sustained soil availability</i>													
TL0066	Copper Claw™ Cu 6.0%	-	-	-	-	-	-	-	1.19 - 1.20	6.0 to 7.0	1 to 3 L/ha	10 to 30 mL/100 m ²	200 to 1000 mL/ha
TL0043	Iron Claw™ N as NH ₄ 1.8%, Fe 6.0%	1.8	-	-	-	-	-	-	1.21 - 1.22	7.0 to 8.0	2 to 5 L/ha	20 to 50 mL/100 m ²	400 mL to 1.5 L/ha
TL0023	Zinc Claw™ N as NH ₄ 2.8%, Zn 6.5%	2.8	-	-	-	-	-	Y	1.18 - 1.19	7.0 to 8.0	2 to 5 L/ha	20 to 50 mL/100 m ²	400 mL to 1.5 L/ha

¹Biological Stimulant ²Chelating Agent

Product Code	Name	N% (w/v)	P% (w/v)	K% (w/v)	S% (w/v)	Ca% (w/v)	Bio. Stim. ¹	Chel. ²	SG (kg/L)	pH range	Typical Application Rates		
											Fertigation Overhead Sprinkler, Drip Irrigation	Recreational & Amenity Horticulture, Parks, Gardens, Tees & Greens Use at least 100 L / 100 m ² water	Foliar Top-Dress (Boomspray or Back-Pack) Use a minimum of 200 to 600 L/ha water
SG0003	Bio Kelp Kelp 22%	0.1	1.1	4.2	-	-	Y	Y	1.05 - 1.11	10.0 to 11.0	5 to 20 L/ha through sprinkler or drip systems.	50 to 200 mL/100 m ²	5 to 20 L/ha
SG0015	Bio Kelp Guardian (Frost protection product)	0.1	2.9	9.2	0.5	-	Y	Y	1.15 - 1.16	9.0 to 10.0	5 to 20 L/ha through sprinkler or drip systems.	50 to 200 mL/100 m ²	2 to 10 L/ha
SG0017	BiologiCAL® PLUS N03 0.3%, P as PO4 0.1%, B 0.1%, C 6.1%, Fulvic Acid 0.3%, Fish Hydrolysate 0.3%, Kelp 1.0%, Molasses 20.0%	0.3	0.1	2.0	1.8	6.5	Y	Y	1.27 - 1.30	8.0 to 10.0	20 to 60 L/ha through sprinkler or drip systems.	200 to 600 mL/100 m ²	5 to 40 L/ha
SG0031	BiologiCAL® PLUS TE N as NO ₃ 0.16%, P as PO ₄ 0.1%, Zn 0.6%, Mn 0.3%, Cu 0.1%, Mo 0.005%, B 0.05%, Fulvic Acid 0.008%, Fish Hydrolysate 0.3%, Humic Acid 0.2%, Kelp 0.3%, Molasses 37.9%	0.8	0.1	1.8	1.6	5.7	Y	Y	1.27 - 1.29	6.5 to 7.5	20 to 60 L/ha through sprinkler or drip systems.	200 to 600 mL/100 m ²	5 to 40 L/ha
SG0012	Fish Hydrolysate Fish Hydrolysate 100%	2.5	0.3	0.3	-	0.5	Y	Y	1.05 - 1.07	3.0 to 4.0	5 to 20 L/ha through sprinkler or drip systems.	50 to 200 mL/100 m ²	5 to 20 L/ha
SG0011	Fulvic 10™ Fulvic Acid 10%	-	-	2.4	-	-	Y	Y	1.05 - 1.07	5.0 to 6.0	N/A	N/A	1 to 3 L/ha
SG0016	Humic K 26™ Mn 0.001%, Zn 0.001%, Cu 0.001%, Fe 0.2%, Si 0.1%, Fulvic Acid 1.0%, Humic Acid 25.0%	0.1	-	6.0	0.1	-	Y	Y	1.10 - 1.12	10.0 to 11.0	2 to 20 L/ha through sprinkler or drip systems.	20 to 200 mL/100 m ²	N/A
SG0007	QuadSHOT® - Now Organically Certified P as PO ₄ 2.5%, Mn 0.001%, B 0.002%, Fe 0.006%, Fulvic Acid 0.3%, Fish Hydrolysate 8.0%, Humic Acid 6.6%, Kelp 8.0%, Molasses 8.0%	0.4	2.6	3.1	0.2	0.2	Y	Y	1.10 - 1.20	2.5 to 3.5	20 to 60 L/ha through sprinkler or drip systems.	200 to 600 mL/100 m ²	5 to 40 L/ha

At Last! A Complete Fluid Nutrient Solution

Nutri Complete™

A combination of 11 Essential Nutrients & 5 Biostimulants

Nutri Complete has a complete and balanced NPK analysis suitable for fertigation and foliar application across a wide range of turf and landscape situations. The analysis is perfect for plant establishment and maintained growth where a N : K ratio near 1 : 1 or a mid-season nutrient boost is required.

Benefits of Nutri Complete

- Chelated trace elements for rapid plant uptake and to drive the NPK metabolism.
- Contains SLTEC®'s **QuadSHOT®** - These ingredients stimulate soil biological activity; improving the cycling and availability of plant nutrients, plant uptake efficiencies and soil fertility and health.
- **Nutri Complete™** has a high analysis compared to other liquid products and provides economic and efficient supply of nutrients plus the capacity to reduce rates compared to common prilled complete fertilizers.
- Efficiencies can be made with **Nutri Complete™** in fertigation applications by placing the nutrients at the root mass where they will be taken up by the plant; reducing loss or waste of nutrients.
- Chloride free.

Also Available;

Nutri Phos Complete™

The analysis of Nutri Complete™ with Phosphonic Acid to aid in suppression of diseases including Pythium, Fusarium and Phytophthora.

Guaranteed Analysis

Nitrogen (N):	11.8%
Phosphorus (P):	4.8%
Potassium (K):	13.6%
Sulfur (S):	2.0%
Calcium (Ca):	0.01%
Magnesium (Mg):	0.2%
Manganese (Mn):	0.006%
Zinc (Zn):	0.01%
Copper (Cu):	0.005%
Boron (B):	0.02%
Iron (Fe):	0.01%
Molybdenum:	0.005%
Fulvic Acid:	0.01%
Fish Emulsion:	0.42%
Humic Acid:	0.34%
Kelp:	0.42%
Molasses:	0.42%
Specific Gravity:	1.29 - 1.32 kg/L
pH Range:	7.5 - 8.5

Typical Application Rates

Fertigation

10 to 80 L/ha towards the end of the irrigation shift.

Recreational, Amenity

Horticulture (rates per 10 L of water)

At Planting or Transplanting;

200 - 300 mL (2 - 3% conc.)

Established Trees & Shrubs

(to cover up to 4.0m)

300 - 400 mL (3 - 4% conc.)

Foliar Top-Dress

5 to 20 L/ha with a minimum of 200 to 600 L/ha water.



1800 768 224 | turfandlandscape.com.au
enquiries@turfandlandscape.com.au

Highly Available, Activated Calcium Plus Organic Boost

Biological⁺⁺ PLUS

Supplying an available form of calcium to plants in turf and horticultural situations has always been a challenge.

Biological⁺⁺ PLUS has been specifically formulated to provide a highly available and activated calcium source that is complimented with potassium and QuadSHOT[®] biological stimulant.

Plants require calcium in relatively large amounts for many functions including cell division & strength, root system and leaf development. Calcium is also an essential element necessary for healthy soils, influencing both the physical, chemical and biological aspects.

Benefits of Biological⁺⁺ PLUS

- Improves nitrogen efficiency; compatible with a wide range of nitrogen-based products.
- Helps to displace sodium and magnesium in challenging soils
- Improves soil structure and friability
- Improving moisture penetration/infiltration
- Free of chlorides and nitrates
- A unique form of activated calcium that stimulates plant uptake
- Built-in soil and plant stimulants to enhance soil fertility and plant health
- Improves plant resistance to disease and overall resilience
- Enhances turf durability and stress tolerance
- Assists in reduction of soil nematodes that inhibit root growth and plant productivity
- Helps displace sodium and magnesium in difficult soils, especially if using recycled water.

Guaranteed Analysis

Nitrogen (N)	0.3%
N as nitrate	0.3%
Phosphorus (P)	0.1%
Potassium (K)	2.0%
Sulphur (S)	1.8%
Calcium (Ca)	6.5%
Boron (B)	0.1%
Fulvic Acid	0.3%
Fish Hydrolysate	0.3%
Kelp	1.0%
Molasses	20.0%
Carbon (C)	6.1%
Specific Gravity	1.177 kg/L
pH Range	6.0 - 8.0

Also available

Biological⁺⁺ PLUS TE

All the benefits of Biological⁺⁺ PLUS with an additional 5 trace elements
Zn 0.6%, Mn 0.3%, Cu 0.15%,
Mo 0.005%, B 0.05%



1800 768 224 | turfandlandscape.com.au
enquiries@turfandlandscape.com.au

AquaLIME 38™ (Flowable Lime)

Product Code: SG0037



Liquid Lime 38™ is a highly flowable calcium carbonate suspension designed to deliver high purity, micronized particles to the soil to raise pH and improve soil structure. Through foliar application it provides an extremely efficient source of calcium to crops.

Liquid Lime 38™ utilizes a highly advanced industrial process to hold the micronized particles in suspension, thereby improving the dispersion of the product when applied to the soil or foliage.

Liquid Lime 38™ is an extremely concentrated and reactive form of calcium carbonate (or “lime”). It is produced by a specialised milling process where the high purity raw material is ground to 1 micron in size. The product’s extreme fineness delivers an impressive surface area of 13 square metres per gram, significantly enhancing its reactivity within the soil compared to all other forms of calcium carbonate.

Liquid Lime 38™ has a superior Neutralising Value (NV) of 99 (pure calcium carbonate at NV 100 is the benchmark) compared to other fluid lime sources on the Australian market. This is only part of the story however - because of the fineness of the Liquid Lime 38™, its Effective Neutralising Value is considered to be 99, because every particle is 100% reactive in the soil.

Also, it is far more effective in higher pH soils. A coarse aglime will struggle to lift soil pH above 6 because the logarithmic response of the pH scale means the soil environment isn’t acidic enough to react and dissolve coarser lime particles. Liquid Lime 38™ can further assist in pH adjustment.



“The high-grade material in Liquid Lime 38™ means responses are extremely fast in the drip zone – in Thailand on red tropical soil, for example, the pH increased from 4.6 to 5.7 in three weeks after an application of 32 litres/ha!”

Why Use Liquid Lime 38™?

- Highly uniform, extremely fine particle size (1 micron)
- Highly reactive, high purity calcium carbonate
- Neutralizing Value of 99
- Flowable for easy pumping
- Can be applied to soil as a broadcast or banded application or via irrigation systems
- Can be applied to crops as a foliar calcium treatment

Guaranteed Analysis

Calcium (Ca)	38.0%
Carbonate (CO ₃)	57.7%
Carbon (C)	11.6%
pH	9.0 - 10.0
Specific Gravity	1.60 kg/L
Neutralising Value	99

Application Rates (Soil)

Soil Type/Textural Class	L per ha Liquid Lime 38™ (per 0.1 pH improvement)
Sands / Loamy Sands	30 - 40
Sandy / Silty Loams	50 - 70
Sandy Clay Loams	70 - 85
Light to Medium Clays	95 - 90
Heavy Clays	90 +

Application Rates (Foliar)

Foliar Applications						
Crop Type	Growth Stage					
Apples	Pink Bud	Flowering	Fruit Set	Fruit Development	Ripening	Total
	5 – 10 L/ha with >1500 L/ha Water	No application during this period	5 – 10 L/ha with >1500 L/ha Water	5 – 10 L/ha with >1500 L/ha Water	5 – 10 L/ha with >1500 L/ha Water	25 - 50 L/ha
Cherry	Pre-Flowering	Fruit Development	Ripening	Post Harvest		Total
	5 – 10 L/ha with >1500 L/ha Water	5 – 10 L/ha with >1500 L/ha Water	5 – 10 L/ha with >1500 L/ha Water	5 – 10 L/ha with >1500 L/ha Water		20 - 40 L/ha

Nutrient Efficiency versus Soil pH

Element	pH 4.5	pH 5.0	pH 5.5	pH 6.0	pH 6.5
Nitrogen (N)	30%	43%	77%	89%	100%
Phosphorus (P)	23%	31%	48%	52%	100%
Potassium (K)	33%	52%	77%	100%	100%

Four Essential Plant & Soil Microbial Stimulants



QuadSHOT® contains a carefully selected range of organic additives and biological stimulants. These ingredients stimulate soil biological activity, thereby improving the cycling and availability of plant nutrients and soil fertility and health. Together with management practices that enhance organic matter and soil structure development, this product assists in mobilizing available nutrients and improving plant uptake efficiencies.

Humic acid – increases nutrient holding capacity of the soil

Kelp – enhances plant and root growth development

Fish Hydrolysate – stimulates nitrogen cycling

Molasses -promotes beneficial soil biology

Each of these stimulants are also available as individual products

Benefits of QuadSHOT®

- Improves saline and sodic soils
- Improves the moisture holding capacity of soils
- Enhances nutrient cycling and availability
- Can be blended with a wide range of SLTEC products to improve plant uptake efficiencies - (*check SLTEC Compatibility Chart*)
- QuadSHOT® can be used to soften a range of foliar fertilizers, allowing higher use rates without the potential for phytotoxic burn - e.g. **Pro NQ3™** or **Pro NQ20™**
- **QuadSHOT®** is designed to aid in the soils mineralisation and nutrient availability. It also increases the plants uptake efficiency of essential minerals.
- Improves overall soil health and vitality.
- Chloride free.



Guaranteed Analysis

Fish Hydrolysate	8.0%
Kelp	8.0%
Molasses	8.0%
Humic Acid	6.6%
Fulvic Acid	0.3%
Nitrogen (N)	0.3%
Potassium (K)	3.5%
Calcium (Ca)	0.2%
Iron (Fe)	0.005%
Carbon (C)	3.3%
Specific Gravity (Kg/L)	1.1 to 1.2
pH Range	10.0 to 11.0

Typical Application Rates

Fertigation

20 to 60 L/ha towards the end of the irrigation shift.

Recreational, Amenity

Horticulture (rates per 10 L of water)

At Planting or Transplanting;

300 - 400 mL (3 - 4% conc.)

Established Trees & Shrubs

(to cover up to 4.0m)

400 - 500 mL (4 - 5% conc.)

Foliar Top-Dress

5 to 40 L/ha with a minimum of 200 to 600 L/ha water.



1800 768 224 | turfandlandscape.com.au
enquiries@turfandlandscape.com.au

Inputs that Stimulate Soil Biology

Kelp

Bio Kelp (22% Kelp)

Kelp Extracts contain amino acids such as glycine and plant hormones including auxins, betaines and cytokinins which in combination stimulate plant growth. They should not be regarded as fertilizers as the nutrient levels are typically too low to have any direct value. Kelp extracts do have strong effects on soil microbes and in particular stimulate activity of photosynthetic bacteria and actinomycetes which can help provide protection against soil-borne pathogens.

Fish Emulsion

Fish Emulsion (100% Fish Emulsion)

Fish Emulsions are a source of readily available organic Nitrogen and can be especially useful when this is needed to improve the Carbon-Nitrogen ratio in the soil. They are also beneficial in stimulating growth and activity of many micro-organisms. The net effect is an increase in the potential for Nitrogen cycling and so also a somewhat reduced requirement for Nitrogen inputs. Lower application rates (2 L/ha) appear to stimulate fungi and cellulose utilisers that do not respond well to high Nitrogen. Higher rates (10 L/ha) appear to promote photosynthetic bacteria and actinomycetes and suppress lactic acid bacteria.

Humate

Humic K 26™ (25% Humic Acid)

Humates are soil conditioners with high Carbon content. They are useful materials where adjustment of the Carbon-Nitrogen ratio is required. Humates are also important in releasing bound nutrients into plant available forms and helping to improve soil structure at relatively low application

rates. These materials produce significant biological effects with a strong suppression of lactic acid bacteria and stimulation of fungi, especially cellulose utilisers, which as the name suggests are important in the breakdown of cellulose and certain other resistant materials, thus increasing the formation of humus and helping to improve soil structure.

Molasses

Molasses (100% Molasses)

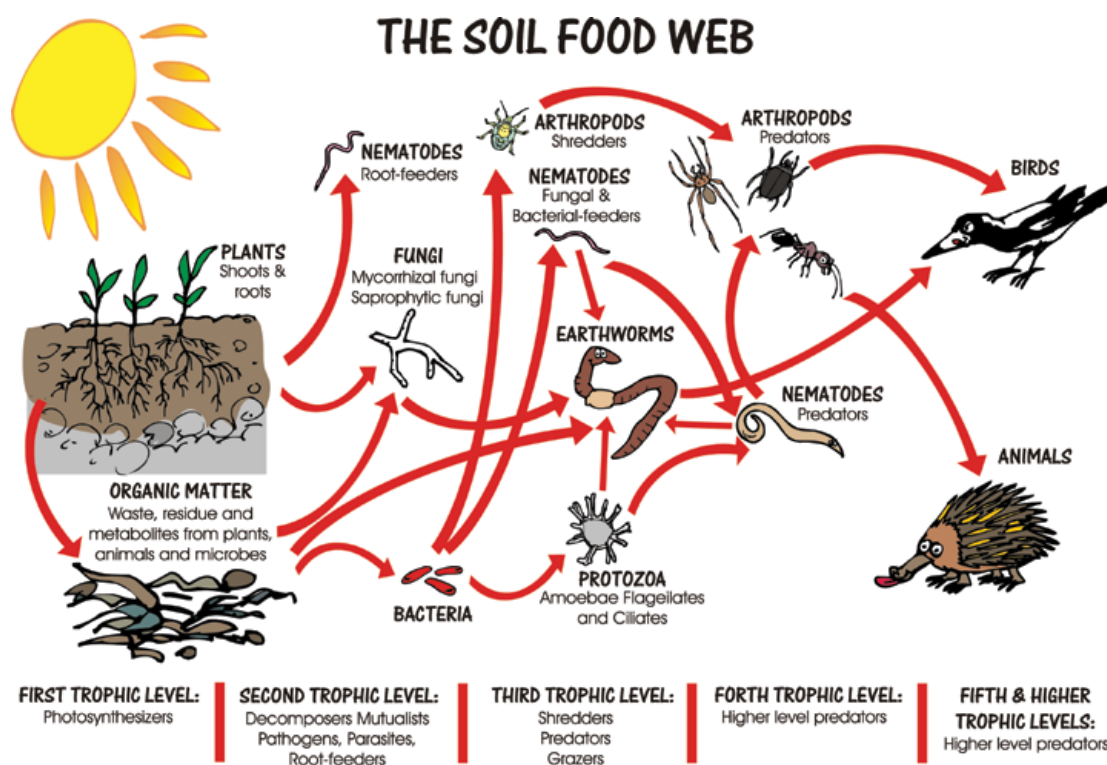
Molasses provides a readily metabolisable Carbon and energy source that can be utilised by most organisms. Low rates (2 L/ha) can be effective in stimulating most groups of microbes and in particular fermenters like lactic acid bacteria and yeasts. However, being quickly utilised, it will provide only a short-term benefit unless other actions have been taken to improve the soil environment.

Mulch / Green Manure / Compost

are an effective means of improving organic matter levels, providing a longer term source of nutrients and protecting soil structure. The breakdown of this material is initially conducted by soil fungi (especially in clay soils).

Adapted from - Mikhail, E – "Understanding & Achieving Optimum Soil Balance - The Mikhail System" - 2009

For further information contact
SWEP Pty Ltd Analytical Laboratories
47/174 Bridge Rd, Keysborough, VIC 3173
(03) 9701 6007 - services@swep.com.au
www.swep.com.au



Understanding Your Turf's Seasonal Nutrient Requirements

January - February

High Potassium : Nitrogen ratio fertilizers and Kelp will aid in tolerance to drought and disease such as dollar spot. Begin to prepare for renovation in February.

Suggested Products:

- Driver Max K™
- Bio Kelp

March

Apply Lime and Calcium at renovation time as required. Pre and Post renovation applications of a 1:1 N to K foliar for quick recovery.

- Maintain and increase Potassium ready for winter stress
- Disease pressure from dollar spot, *Pythium*, *Rhizictonia* & *Anthracoze* can occur at this time.

Suggested Products:

- Nutri Phos Complete™
(Phosphonic Acid)
- Turbo NKS™
- Driver Max K™
- BiologiCAL® PLUS
- QuadSHOT®

April

Use high Potassium, low Nitrogen fertilizers with some key trace elements ready for winter. Can apply organic soil ameliorations now while the soil temperature adequate.

Suggested Products:

- Turbo Iron™
- Turf Green 4™
- QuadSHOT®
- BiologiCAL® PLUS

May - June

Maintain low Nitrogen, high Potassium. Apply Key Trace Elements and Kelp products to -

- increase stress tolerance
- help protect your Turf from frost
- promote winter colour retention

Soil test and set programmes for coming season. Monitor for *Fusarium*.

Suggested Products:

- 8 Iron™
- Turf Green 4™ (Colour Retention)
- Bio Kelp Guardian (Frost Protectant)

July

Maintain Potassium levels to combat disease pressure and increase turf durability. Cool, wet soils provide poor trace element uptake and Nitrogen cycling during winter.

Suggested Products:

- Driver Max K™
- Turf Trace Range
- Turf Green 4™

August

Soil amendments as per soil test results in conjunction with any up coming renovation.

Suggested Products:

- Turf Trace Range
- Turf Green 4™
- 8 Iron™

September

First Macro nutrient applications (particularly Nitrogen and Phosphorus for early root development) as weather warms and with renovation or in preparation for spring tournaments (club championships). Pre renovation foliar application to stimulate growth and recovery / root development.

Suggested Products:

- Turbo P™
- Pro NQ20™
- Pro N Cal TE™
- Plant Booster™
- Nutri Complete™
- Use of Biostimulants such as QuadSHOT® to encourage early root activity and Bio Kelp Guardian for frost protection

October

First applications of seaweed to pre condition for drought stress and applications to enhance root development can be continued through summer.

- High growth period
- Match nutrient demand when cutting frequently.

Suggested Products:

- Bio Kelp
- Nutri Complete™
- Turf Trace Range
- Turf Green 4™
- Pro NQ20™
- Pro N Cal TE™

November

1 : 1 Nitrogen & Potassium to promote growth (after dethatch). Humates can assist to retain nutrients as the irrigation season starts.

Suggested Products:

- Turbo NKS™
- Nutri Complete™
- Humic K 26™
- QuadSHOT®

December

Reduce Nitrogen as growth slows and maintain Potassium for wear resistance over peak playing periods. BiologiCAL® PLUS can enhance root development and reduce drought, disease, insect and nematode pressure. Monitor for dollar spot at this time.

Suggested Products:

- Driver K Mag™
- Driver Max K™
- BiologiCAL® PLUS™

The Essential Turfgrass Nutrients

Tissue Analysis Levels

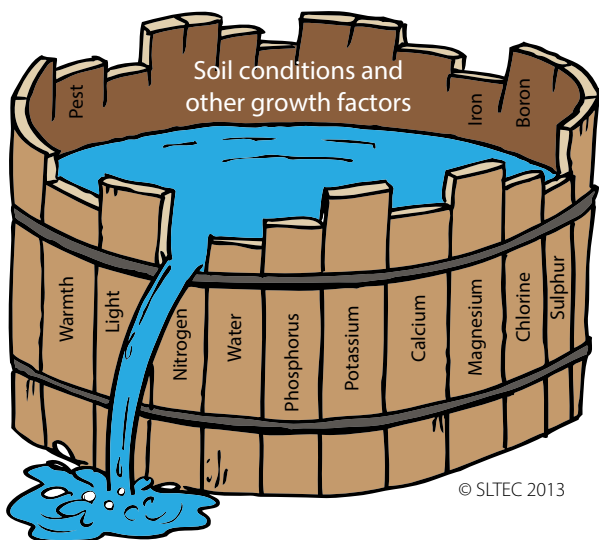
Table 1 lists the 16 essential nutrients, the form in which grass plants are able to use them, and the approximate amounts of each found in healthy turf.

The exact amounts of needed nutrients vary among species, cultivars, soil moisture contents, and time of year; hence, the amounts listed under “sufficiency range” should be used as a guide only.

Reference: Peter, L. (2003). Turfgrass Fertilization: A Basic Guide for Professional Turfgrass Managers. Penn State University. Available at: <http://plantscience.psu.edu/research/centers/turf/extension/factsheets/turfgrass-fertilization.pdf>

Macronutrients	Symbol	Available Form(s)	Sufficiency Range
Nitrogen	N	NO_3^- , NH_4^+	2.7 - 4.2%
Phosphorus	P	H_2PO_4^- , HPO_4^{2-}	0.3 - 0.55%
Potassium	K	K^+	1.0 - 2.5%
Calcium	Ca	Ca^{2+}	0.5 - 1.25%
Magnesium	Mg	Mg^{2+}	0.2 - 0.6%
Sulphur	S	SO_4^{2-}	0.2 - 0.45%

Micronutrients	Symbol	Available Form(s)	Sufficiency Range
Iron	Fe	Fe^{2+} , Fe^{3+}	35 - 100 ppm
Manganese	Mn	Mn^{2+}	25 - 150 ppm
Zinc	Zn	Zn^{2+} , ZnOH^+	20 - 55 ppm
Boron	B	B(OH)_3	10 - 60 ppm
Copper	Cu	Cu^+ , Cu^{2+}	5 - 20 ppm
Molybdenum	Mo	MoO_4^+	0.15 - 0.5 ppm



© SLTEC 2013

The Law of the Minimum

In the 1800's Von Liebig proposed that growth is limited to the extent that an essential element is lacking. If an element is 'functional or metabolic' it may be considered essential.

Conventional fertilizer programs focus on Macro-nutrients such as Nitrogen, Phosphorus and Potassium (NPK), and occasionally Sulphur. However, plants require a total of sixteen nutrient elements for optimal growth, with each required in different amounts. Therefore if one of the essential trace elements – Zinc (Zn), Copper (Cu), Boron (B), Manganese (Mn), Molybdenum (Mo), etc – is deficient from the soil, the plant will not perform at its optimum capacity and yield, and reproduction and immune function will diminish.

For Perfect Green at Harvest

Turf Green 4™

Four essential Micronutrients in a highly plant available form with ratios for turf application.

Turf Green 4™ contains key elements that promote photosynthesis, thereby enhancing Turf colour.

Magnesium

Magnesium is an essential component of chlorophyll and is needed for many processes including the transfer of energy and protein synthesis and cell structure.

Manganese

Manganese is directly involved in photosynthesis where it functions in chloroplasts as part of electron transfer (oxidation/reduction) reactions.

Iron

Iron is involved in the production of chlorophyll and is indispensable as a catalyst during oxidation/reduction reactions that involve oxygen and electron transport to release energy from sugars and starches.

Zinc

Zinc is essential in the production of other essential enzymes that function in electron transfer during protein synthesis and degradation.

Also consider Turf TE™ for a complete Trace Element Nutrient Solution -

Mg 2.4%, Mn 3.2%, Zn 3.2%, Cu 0.5%, Mo 0.02%, B 0.2%, Fe 0.7% & Fulvic Acid 0.5%

Guaranteed Analysis

Sulphur (S):	7.3%
Magnesium (Mg):	3.4%
Manganese (Mn):	1.0%
Zinc (Zn):	0.34%
Iron (Fe):	3.4%
Specific Gravity:	1.27 kg/L
pH Range:	1.0 - 2.0

Typical Application Rates

Fertigation

5 to 10 L/ha towards the end of the irrigation shift.

Recreational & Amenity

Horticulture, Parks & Gardens

50 to 100 mL/100m² with a minimum of 100L/100m² water.

Foliar Top-Dress

1 to 3 L/ha with a minimum of 200 to 600 L/ha water.

Ideal for pre game green up

Perfect for enhancing nutrient content for commercial turf pre-lift



1800 768 224 | turfandlandscape.com.au
enquiries@turfandlandscape.com.au

Performance Driven Liquid P Options

Turbo P™

100% plant available orthophosphate form of liquid phosphorus and ammonium nitrogen.

Why are Nitrogen & Phosphorus so Essential?

Nitrogen is an essential element for all living things and the mineral element needed in the largest amounts in most plants. It is a key component of enzymes vitamins, chlorophyll and other cell constituents.

Phosphorus is one of three primary nutrients needed by turfgrasses as a regular fertilizer addition. Phosphorus is involved in energy transfer, root development and has a direct effect on yield. The application of phosphorus increases the beneficial translocation of other nutrients, such as magnesium from the roots to the shoots of phosphorus deficient plants.

Plant Booster™

- Formulated to kick start turf from a stressed condition.
- An NPK blend with calcium and six essential micro nutrients – a total of 10 Nutrients.
- Plant Booster™ has been scientifically designed to give you plant all the benefits of the relationship between calcium and phosphorus in a liquid form.
- The addition of six essential micro nutrients to assist the plants growth potential.
- SLTEC® has added fulvic acid to Plant Booster™ to enhance its uptake efficiency working as an organic chelate.

Guaranteed Analysis

Nitrogen (N):	11.3%
Phosphorus (P):	16.0%
Specific Gravity:	1.30 Kg/L
pH Range:	6.0 to 7.0

Typical Application Rates

Fertigation

20 to 100 L/ha towards the end of the irrigation shift.

Recreational & Amenity Horticulture, Parks & Gardens

200 to 1000 mL/100m² with a minimum of 100L/100m² water.

Foliar Top-Dress

2 to 20 L/ha with a minimum of 200 to 600 L/ha water.

Guaranteed Analysis

Nitrogen (N):	5.0%
N as nitrate	2.1%
N as ammonium	2.9%
Phosphorus (P):	15.0%
Potassium (K):	2.1%
Calcium (Ca):	4.0%
Magnesium (Mg):	0.2%
Manganese (Mn):	0.4%
Zinc (Zn):	0.4%
Copper (Cu):	0.5%
Molybdenum (Mo):	0.008%
Boron (B):	0.05%
Fulvic Acid:	0.5 %
Specific Gravity:	1.31 kg/L
pH:	< 2.0

Typical Application Rates

Fertigation

10 to 100 L/ha towards the end of the irrigation shift.

Foliar Top-Dress

2 to 10 L/ha with a minimum of 200 to 600 L/ha water.

Recreational & Amenity Horticulture, Parks & Gardens

100 to 1000 mL/100m² with a minimum of 100L/100m² water.



1800 768 224 | turfandlandscape.com.au
enquiries@turfandlandscape.com.au

Get the Most Out of Your Nitrogen

Pro N Cal + TE™

A combination of 12 Nutrients and Biostimulants to maximise your Nitrogen utilisation.

A blend of **Pro N42™** and **Biological® PLUS** with added Zinc, Copper, Boron & Calcium.

Typical Application Rates

Fertigation

10 to 80 L/ha towards the end of the irrigation shift.

Foliar Top-Dress

2 to 15 L/ha with a minimum of 200 to 600 L/ha water.

Recreational & Amenity

Horticulture, Parks & Gardens

100 to 800 mL/100m² with a minimum of 100L/100m² water.

Guaranteed Analysis

Nitrogen (N):	34.3%
N as nitrate:	8.8%
N as ammonium:	8.5%
N as urea:	17.0%
Potassium (K):	0.3%
Sulphur (S):	0.2%
Calcium (Ca):	0.8%
Zinc (Zn):	0.4%
Copper (Cu):	0.3%
Boron (B):	0.05%
Humic Acid:	0.03%
Fulvic Acid:	0.001%
Kelp:	0.04%
Fish Emulsion:	0.04%
Molasses:	5.5%
Specific Gravity:	1.30 kg/L
pH:	5.0 to 6.0

Pro NQ20™

Pro NQ20™ is a high Nitrogen fluid fertilizer containing 20% **QuadSHOT®** biostimulant.

- 34.1% Nitrogen in three forms (nitrate, ammonium and urea) to provide immediately available and slower release forms of Nitrogen.
- During periods of slow growth **Pro NQ20™** will give your grounds and fairways the push they need to look their best.
- **Pro NQ20™** is ideal for follow-up nitrogen application after establishment.

Typical Application Rates

Fertigation

10 to 80 L/ha towards the end of the irrigation shift.

Foliar Top-Dress

2 to 15 L/ha with a minimum of 200 to 600 L/ha water.

Recreational & Amenity

Horticulture, Parks & Gardens

100 to 800 mL/100m² with a minimum of 100L/100m² water.

Guaranteed Analysis

Nitrogen (N):	34.1%
N as nitrate:	8.6%
N as ammonium:	8.5%
N as urea:	17.0%
Phosphorus (P):	0.3%
Potassium (K):	0.5%
Iron (Fe):	0.006%
Fulvic Acid:	0.05%
Fish Emulsion:	1.5%
Kelp:	1.5%
Molasses:	1.5%
Humic Acid:	1.3%
Specific Gravity:	1.27 kg/L
pH Range:	4.0 - 6.0



1800 768 224 | turfandlandscape.com.au
enquiries@turfandlandscape.com.au

N, P, K & Ca – Foundations to a Healthy Plant

Nursery Blend™

Nursery Blend™ is scientifically formulated to give your plants the nutrients they need to maximize their potential.

Nursery Blend™ consists of nitrogen, phosphorus, potassium, calcium & trace elements the foundations to strong plant growth & health.

Guaranteed Analysis

Nitrogen (N):	12.4%
N as nitrate	7.2%
N as ammonium	5.1%
Phosphorus (P):	3.1%
Potassium (K):	5.2%
Calcium (Ca):	2.0%
Magnesium (Mg):	0.3%
Manganese (Mn):	0.005%
Iron (Fe):	0.01%
Specific Gravity:	1.29 kg/L
pH:	2.0 to 3.0

Typical Application Rates

Fertigation

10 to 80 L/ha towards the end of the irrigation shift.

Recreational & Amenity Horticulture, Parks & Gardens

100 to 800 mL/100m² with a minimum of 100L/100m² water.

Foliar Top-Dress

1 to 7 L/ha with a minimum of 200 to 600 L/ha water.



by FERTILIZERS

pH, Soil Acidity, Lime and Gypsum

Optimum pH

A pH of 6.5-7.0 offers the best environment for turfgrass growth because nutrients are at their greatest level of collective availability. As pH moves away from the ideal range, a number of chemical and biological reactions occur that have a dramatic effect on nutrient availability and turfgrass health.

As soil pH decreases, aluminium (Al) and manganese (Mn) become increasingly soluble. Al toxicity is the most significant growth-limiting factor in soils with a pH less than 5.5. Hydrogen (H) also becomes toxic when pH is below 4.5. In acid soils, phosphorus (P) availability is impaired due to fixation with high levels of soluble Al. Acid soils are usually deficient in calcium, potassium and magnesium due to the dominance of H and Al on soil exchange.

Changing pH

In order to produce the healthiest turf possible, one that is able to thrive under today's stressful maintenance regimes, acidic soils should be amended with lime. Soils primarily low in only calcium should be limed calcium carbonate, while soils low in both calcium and magnesium should be limed with dolomite limestone. Due to its inherent insolubility, lime must be ground into a fine powder in order to be effective. Prilled limestone, which consists of finely ground lime powder in the form of a water dispersible prill, is not only effective but is also easy to apply. Though not practical on established turf, incorporating lime in the soil enhances its effectiveness. Small particles of insoluble limestone rock are essentially inert and should not be used for liming acid soils. The amount of lime required to neutralize a soil depends on a combination of the soil's Cation Exchange Capacity (CEC) and its hydrogen base saturation. Lime applications should always be based on soil test results and generally should not exceed 10kg / 100m² in a single application.

Managing Soil pH for Optimum Turf Quality

Acid soils tend to have very low microbe populations, which inhibits nutrient conversion as well as organic matter and thatch decomposition. In short, the agronomic problems in acid soils can severely inhibit turfgrass growth and health.

As pH rises Ca becomes increasingly soluble, reacting with P and micronutrients to form insoluble compounds. As a result, P, iron (Fe), Manganese (Mn) and Zinc (Zn) deficiencies are common in alkaline soils. Though serious, these problems are easier to manage and not quite as deleterious to plant growth as are the problems associated with acid soils. In the case of a high pH induced P deficiency, "build" applications of P fertilizers often produce a dramatic response in turfgrass growth and density. In addition, tissue analysis will reveal the extent of micronutrient deficiencies, which can then be managed with supplemental fertilization.

Source: <http://www.fusionfert.com/itn/articles/ph.pdf>

Optimum pH Range	
Turf	6.5 - 7.0

Desirable Soil Exchangeable Cation Balance

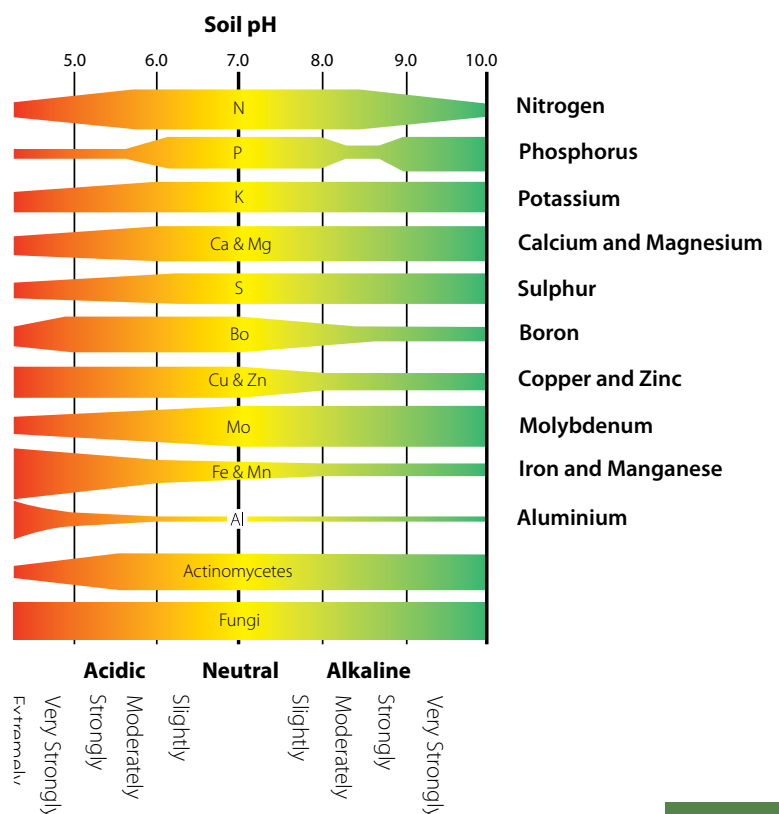
Element	Balance (%)
Calcium	60 - 70
Magnesium	12 - 15
Potassium	3 - 5
ESP	< 5
Hydrogen	< 20
Ca : Mg ratio	2 - 4

Typical Cation Exchange Values for Various Soil Textures.

(preferred level >10 meq/100g)

Texture	Typical CEC
Sand	< 5 meq / 100g
Sandy Loam	5 - 10 meq / 100g
Clay Loam	10 - 25 meq / 100g
Light Clay	25 - 30 meq / 100g
Medium Clay	30 - 35 meq / 100g
Heavy Clay	> 35 meq / 100g

(Based on Clay content only - eg: a high organic matter clay may have a CEC over 50 meq/100g)



Nutrient Function in Plants

Macronutrients

Nitrogen (N)

Pro NQ20™, Pro N Cal + TE™

Nitrogen is an essential element for all living things and the mineral element needed in the largest amounts in most plants. It is a key component of enzymes vitamins, chlorophyll and other cell constituents. Nitrogen is actively absorbed by plants through roots in two main forms, Nitrate (NO_3^-) and Ammonium (NH_4^+).

Conversion of ammonium to the nitrate form for uptake occurs in the soil and during this process losses are expected as other microorganisms return nitrogen to organic forms as part of their metabolism. Nitrogen availability can be enhanced by, increasing organic matter and by promoting better soil biology. As soil organic matter increases so does the level of naturally available nitrogen.

In the plant the NO_3^- ion is reduced to NH_4^+ by the nitrate reductase enzyme and subsequently converted to the amine form (NH_2^-) which is then utilised to form amino acids, proteins, nucleic acids (DNA, RNA), hormones and enzymes. Amino acids and NO_3^- are the main forms in which nitrogen is transported throughout the plant. As with all nutrients, interactions with other nutrients within the plant can influence nitrogen status. Potassium, phosphorus and sulphur are directly involved with Nitrogen is organic acid, enzyme and protein synthesis. Copper, iron and molybdenum can all influence nitrate reduction to NH_2^- and thus nitrogen assimilation. Nitrogen along with Magnesium, Manganese, Zinc and Sulphur are all involved in the production of chlorophyll.

Soil Nitrate and plant sap nitrate tests have a quick turn-around and can give a good indication of current nitrogen status at the time of testing.

Deficiency symptoms

Nitrogen is mobile within the plant, and can move from mature organs to areas of new growth. Therefore deficiency symptoms appear first on old leaves. Older leaves turn yellow green and little new growth is noticed.

Optimising Nitrogen Use

The goal of a nitrogen fertility program is to optimize plant uptake while minimizing leaching, runoff, and gaseous losses. To achieve this goal, you should understand how nitrogen behaves in the environment and know the conditions that influence its fate.

Although soil testing can provide guidelines for how much phosphorus, potassium, and lime turfgrasses need, it does not give reliable information about nitrogen requirements. Just how much nitrogen should be applied depends on the species you are attempting to maintain (and, in some cases, the cultivar), the soil conditions at the site, how the turf is managed, and how the site is used. Also, the amount of nitrogen that turfgrasses take up is influenced by application timing, the source(s) of nitrogen, and the amount of nitrogen applied per application.

Leaching

Leaching occurs when irrigation or rainfall carries nitrogen, primarily in the nitrate form, downward through the soil profile. As nitrate moves below plant root systems, it continues to move downward, eventually ending up in groundwater. How much nitrogen is leached from a lawn depends on the soil type; the amount and rate of precipitation; and the nitrogen source, rate, and timing of application.

The greatest potential for leaching is in sandy soils during periods of wet weather or under excessive irrigation, and following applications of quick-release nitrogen at high rates. Leaching

can be reduced by using slow-release nitrogen sources on high-sand content soils or by using low rate applications of quick-release nitrogen sources. Leaching can also be curtailed by restricting nitrogen applications when plants are not actively growing (during midsummer and winter) and/or during extremely wet periods of the year. Since leaching of nitrogen can sometimes occur even in loam soils, be sure always to follow good fertility and irrigation practices.

Phosphorus (P)

Turbo P™, Plant Booster™

While immobile in soils, P is mobile in the plants and is essential to photosynthesis, respiration, and many metabolic processes. P is also involved in energy transfer, root development and has a direct effect on yield. Phosphorus affects rate of seedling development, maturation, and root growth. The application of P increases the beneficial translocation of other nutrients, such as Mg from the roots to the shoots of P deficient plants.

Phosphorus is one of three primary nutrients needed by turfgrasses as a regular fertilizer addition. It is a component of nucleic acids, membranes, ATP (energy transfer) and several coenzymes.

Although it is present in small amounts in turfgrass tissues (0.3–0.55 percent on a dry weight basis), phosphorus is extremely important for rooting, seedling development, cell division, and the synthesis of various compounds used by plants. Phosphorus is available to turf grasses as H_2PO_4^- and HPO_4^{2-} and is mobile in plants (meaning that it can move from one portion of the plant to another).

The most important factors affecting phosphorus availability to turf grasses are soil pH and concentrations of iron, aluminium, manganese, and calcium in soils. In acid soils, the H_2PO_4^- form

of phosphorus predominates and combines with iron, aluminium, or manganese to form insoluble compounds that are unavailable to turf grasses. When the soil pH drops to 5.5 and below, enough phosphorus can be rendered unavailable to cause deficiencies in turf. Also, under acid conditions, some phosphorus can be “fixed” by silicate clays, resulting in reduced availability to plants.

In high-pH soils, HPO_4^- is the most common form of phosphorus. In these soils phosphorus combines with calcium to form insoluble calcium phosphates. As the soil pH approaches 8.0 or above, significant amounts of phosphorus are unavailable to turf grasses. Maximum amounts of plant available phosphorus (both inorganic and organic forms) are obtained by keeping the soil pH between 6.0 and 7.0.

Phosphorus deficiencies

Phosphorus deficiencies in turf are usually expressed in the early stages of seedling development, appearing as a purple or red colouring of leaf blades and as reduced growth and tillering.

Potassium (K)

Driver Max K™, Turbo NKS™

Potassium is a primary turf grass nutrient and is usually supplied annually as fertilizer to lawns.

Potassium activates enzymes used in protein, sugar, and starch synthesis. K is involved in the active translocation of sugars throughout the plant. K is also involved in the osmotic potential of cells as well as the turgor of the guard cells that open and close stomata. Potassium affects drought tolerance, cold hardiness, frost tolerance, pest and disease resistance.

Potassium is required in surprisingly large amounts for normal growth and development but it does not form a stable structural part of the plant. It can be taken up by plants both actively and passively, and uptake is strongly influenced by transpiration rate. It is

very mobile throughout the plant and it's mainly directed towards the growing point, the apical meristem.

It makes up about 1.0–2.5 percent of the plant's dry weight, and its primary role involves regulating several important physiological processes. Potassium activates plant enzymes used in protein, sugar, and starch synthesis.

Although large quantities of potassium are present in soils, only a small fraction is available to plants. In general, more plant-available potassium is present in fine textured mineral soils (soils that contain high amounts of clay) than in sandy soils, especially in areas that receive high amounts of rainfall or are regularly irrigated. The best way to determine potassium needs for turf grass is through soil testing.

Potassium Deficiencies

Deficiencies of potassium in turf may be expressed as increased susceptibility to drought, winter injury, and disease. Leaf tips and edges can look burned.

Calcium (Ca)

BiologiCAL® PLUS, CalGreen MgB™

Ca is a key component of cell walls maintaining membrane structure and nutrient uptake. It has a significant role in fruit quality, colour and aroma. Just like other nutrients, the key to understanding Ca nutrition is to understand its uptake.

Calcium does not move readily in the plant and uptake is passive, dependent on the transpiration stream (xylem) to enter the plant through young root tips. Due to this poor mobility of calcium within the plant, and it being stored and not relocatable from the older leaves, plants require a constant, accessible supply of calcium. During water stress, calcium deficiency can occur in turf as the transpiring leaves command a greater sink for the calcium. Excessive nitrogen fertilisation or poor application timing can result

in vegetative growth and subsequent calcium disorders.

The major roles of calcium are in the permeability of cell membranes and cell wall stabilisation in the form of calcium pectate which cements adjacent cell walls together. It is also involved in cell division and extension, formation of the cell nucleus (mitosis), starch metabolism as an activator of enzymes such as alpha – amylase, cation / anion balance, cell pH and osmoregulation. Calcium binds to organic acids and salts that may otherwise be toxic to cells. Calcium is necessary for new cells especially in new roots, root hair development and the apical meristem. Good calcium levels aid in stress and drought tolerance. As the plant grows we understand that calcium is therefore critical to plant vigour, pollen germination and seed formation.

A high proportion of exchangeable Ca_2^+ ions is usually associated with a better structured soil. When exchangeable sodium is replaced with calcium in a sodic soil the Calcium improves aggregate stability. The soil Ca : Mg ratio is particularly important in determining physical properties of the soil and hence the availability of other nutrient cations.

Calcium Deficiencies

Low calcium can result in leaky cell membranes resulting in collapse of growing points and poor root development. New leaves may be small and grass will be rust colored.

Sulphur (S)

Driver KS™, Turbo NKS™

Sulphur can be taken up as SO_2 by the aerial parts of plants but it is mostly absorbed by the roots as the divalent anion SO_4^{2-} . Sulphur is highly mobile within the plant, and mainly moves in the xylem, in an upwards direction.

Sulphur is a component of ferridoxin which is essential to the production of chlorophyll and thus photosynthesis.

Sulphur is a structural component of amino acids (cysteine and methionine) and therefore plant proteins as well as sulpho-lipids, hormones and vitamins such as thiamine and biotin. The sulphhydryl group – SH is essential for the action of certain enzymes and co-enzymes in the respiratory function of the plant.

Sulphur is important for seed production and during the vegetative stages; it is actively involved in growth, resilience to stress and disease resistance.

Sulphur uptake through the roots, under certain conditions, may inhibit phosphate and nitrate.

Sulphur is easily leached and as such it is common to see low sulphur in soil analysis, particularly on coarse or sandy loam soils and in low pH soils. Adding organic matter and animal manures can help to improve sulphur levels.

Sulphur Deficiencies

Slow growth and fully-grown leaves turn yellow.

Magnesium (Mg)

CalGreen MgB™, Top Mag™, Turf Mag 6™

Mg is an essential component of chlorophyll and is needed for many processes including the transfer of energy and protein synthesis and cell structure. It is also responsible for the activation of many enzymes in photosynthesis, respiration and the formation of DNA and RNA.

Magnesium like calcium is absorbed in a passive manner. The competitive effects between other cations such as; Ca_2^+ , K^+ , NH_4^+ , occasionally result in poor uptake and can lead to deficiencies. Magnesium is relatively mobile within the plant and is transported in both the xylem and the phloem.

It is a co-factor activating many

enzymes involved in carbohydrate metabolism (phosphate transfer), nucleic acid synthesis and energy metabolism reactions. It activates formation of polypeptide chains from amino acids and the production of sugars, oils and fats. Magnesium is also involved in regulating cell pH through cation – anion balance and regulates the uptake of other elements while acting as carrier for them.

Magnesium deficiency

Foliage will appear yellowish green with red tinted edges.

Micronutrients

The seven micronutrients (sometimes called trace elements) required by turfgrasses include iron, manganese, zinc, copper, molybdenum, boron, and chlorine. As mentioned earlier, micronutrients are needed by turfgrasses only in minute amounts. When turfgrasses are grown in high-sand-content soils (golf course putting greens and some tees) or high-pH soils, micronutrient applications can be beneficial.

Iron (Fe)

Turbo Iron™, Turf Green 4™, 8 Iron™

Iron uptake seems to be controlled by metabolic processes. It appears that it is mainly absorbed through the root tips. It is inhibited by the uptake of other cations such as; manganese, copper, magnesium, potassium and zinc. Excess soil phosphorus is often associated with iron 'lock-up'. Due to iron immobility within the plant, young plant tissue requires a constant supply. The main function of iron within plants is in the production of chlorophyll and it is indispensable as a catalyst during oxidation/reduction reactions that involve oxygen and electron transport to release energy from sugars and starches. Lime-induced chlorosis may occur as the soil pH rises over 7, or in heavily-limed soils when iron becomes unavailable to plants.

Iron Deficiencies

Mild turf deficiency symptoms may exhibit as yellow mottling (interveinal chlorosis of terminal leaves), as the deficiency progresses uniform yellowing over greater areas may be observed. When severe whole leaves will turn pale yellow.

Manganese (Mn)

Top Mang™, Turf TE™

Manganese is relatively immobile within the plant and is transported to the apical meristem via the xylem.

Manganese is known as a co-factor in respiration (tricarboxylic acid cycle) and nitrogen metabolism (metallo-proteins) in roles which are also activated by magnesium. Manganese also activates one or more enzymes involved in fatty acid synthesis and RNA formation. It is directly involved in photosynthesis where it functions in chloroplasts as part of electron transfer (oxidation / reduction) reactions splitting water to liberate oxygen (energy catalyst). It is a component of several enzyme systems (fatty acid synthesis and RNA formation) that also require iron, zinc and copper and phosphorus. Manganese accelerates germination and seedling growth. Manganese deficiency is not uncommon particularly when soils are cool and wet and soil pH is over 7.0. In contrast manganese toxicity can occur on coarse-textured soils when the soil is very acid (pH below 5.0). Elevated manganese can cause antagonism of zinc and other trace elements.

Manganese deficiencies

In-terveinal yellowing across the whole leaf, leaves are generally smaller and light green in color. In severe cases small necrotic patches will appear.

Zinc (Zn)

Zinc-Link™, Zinc Claw™

Zinc is actively taken up by the plant. This takes place in greater amounts than copper and less than manganese.

Zinc absorption is greatly reduced in low temperatures and by inhibition from other elements. Copper and phosphorus are strong competitors for the same carrier sites, while magnesium, iron, and manganese can all depress the uptake of zinc. The pronounced effect of zinc deficiency on growth, especially internode length, is a consequence of its importance in the synthesis of tryptophan – a precursor to the auxin indole acetic acid (IAA) which is essential for the normal enlargement of cells in stems and in seed development. Zinc is essential in the production of other essential enzymes that function in electron transfer during protein synthesis and degradation. Along with potassium it has a regulatory role in the uptake and transportation of water within the plant. Zinc is also required for chlorophyll production, nucleotide synthesis

Zinc Deficiencies

Grass leaves will appear shrivelled, narrow bladed and smaller than usual. Zinc deficiencies can occur in both acid, leached soils or in calcareous, high pH soils.

Boron (B)

Turf B 15™

Boron is only required by plants in very small amounts. It seems to be both passive and active in its uptake mechanism as the negatively charged borate ion. Similarly with calcium, boron is quite immobile within the plant and only seems to move in the xylem towards the growing points. Boron has some association with auxins and with molybdenum in the synthesis and movement of sugars is involved in the production of carbohydrates and nitrate reduction. Boron is directly related to cell division and calcium assimilation. It is also extremely necessary for the germination and viability of pollen and flowering.

Without Boron the plant struggles to

utilise essential nutrients like calcium, magnesium, nitrogen, and phosphorus, with a subsequent reduction in new tissue development. Deficiencies are found in acid soils, heavily weathered and coarsely textured soils. Boron is easily leached below the root zone.

Boron Deficiencies

Yellowed grass and immature growth. Death of terminal buds, poor seed set and breakdown disorders are often associated with Boron deficiency.

Copper (Cu)

Top Cop™, Copper Claw™

Copper is actively taken up by plants and is able to displace other ions from root exchange sites. It is largely absorbed as the cupric or cuprous ions. It is mobile within the plant and yet its movement is governed by uptake and availability. Meaning, if availability is poor, and uptake is low, copper movement is restricted, even if the reproductive parts are requiring it. Copper is an integral component of chloroplasts and hence is involved in photosynthesis where it undergoes alternate oxidation and reduction as an electron carrier (plastocyanin) and as part of certain enzyme systems essential for respiration, energy and growth. Copper is vitally important for root metabolism, cell wall and pollen formation and fertilization.

Copper Deficiencies

Copper deficiency is not uncommon in sandy soils, soils high in organic matter or high pH or with elevated iron, manganese or zinc.

The leaves can appear pale and be smaller in size, in extreme cases there will be cessation of terminal growth (stunted leaves) and browning / curling of leaf blade tips.

Molybdenum (Mo)

Turf P-Mo™

Uptake is similar to that of iron. It generally occurs in soil as the molybdate oxyanion. Molybdenum uptake appears to be influenced by metabolic processes. Molybdenum is involved in two major enzymes; Nitrate reductase and Nitrogenase, and as such is also involved in Nitrogen fixation by legumes along with iron and cobalt. Molybdenum uptake is inhibited by high copper and especially manganese and aluminum in acid pH soils and highly weathered soils.

Molybdenum Deficiencies

Deficiencies can be associated with a lack of phosphorus, and often occur in acidic soil where leaves become thin and stunted. In many plants yellow/orange spotting occurs on leaves and these may drop prematurely - a likely association with poor Nitrogen assimilation. Fully grown and mature grass appears gray-green.

*Based on information from H. Marschner, 1995, Mineral Nutrition of Higher Plants, Academic Press, New York; E.

Epstein, 1972, Mineral Nutrition of Plants: Principles and Perspectives, John Wiley, New York; and F.



Resources

The following additional resources are available via our website www.turfandlandscape.com.au or by calling 1800 768 224

- Sustain & Gro® Product Advisory
- IBC Handling Guidelines
- Product Fact Sheets

Turf & Landscape® Fertilizers Deliver:

- **Cost Effective Nutrient Solutions for Planting**
- **Foliar Top Dress Options including Chelated Trace Elements and Organic Stimulants**
- **An Experienced Agronomy Team**
- **A wide range of nutrient blends (traditional and sustainable), to suit your specific needs**
- **State of the Art Liquid Fertilizer Manufacturing Technology**
- **Bulk Fertilizer Storage Tanks – 5,000 L to 32,000 L**
- **Injection & Application Technology**

For more information about this Product Catalogue or any of our products or services contact the Turf & Landscape® team

Free Call
1800 768 224

Fax
(03) 5859 1363

Email
enquiries@turfandlandscape.com.au

Web
www.turfandlandscape.com.au

Address
2055 Finlay Road, TONGALA
VICTORIA 3621

PO Box 43, TONGALA
VICTORIA 3621

ABN: 632 340 733 78 ACN: 113 670269

Turf & Landscape® distributes its products via a professional and extensive dealer distributor network.

Copyright © 2016
All rights reserved by Sustainable Liquid Technology Pty Ltd

 Follow @turfandland



Please contact
Turf & Landscape®
for details of your
local dealer

www.turfandlandscape.com.au