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GrowGreen Fertilisers help Cotton plants to recover after drought

Drought is a devastating natural hazard, *due to the negative effects of the climatic* change, the percentage of the planet *affected by drought has more than doubled* in the last 40 years (FAO).

According to the Bureau of Meteorology (Australian government), Australia has been under the negative effect of the drought for more than 21 months (Fig 1).

Current rain forecast is showing a much better scenario where farmers could start re-cropping on their paddocks.

Water deficit in plants is considered as one of the major abiotic stresses (Jaleel et al., 2009). Plants exposed to severe draught experience changes in metabolic functions such as losses of photosynthesis pigments. Lower photosynthesis rate means low plant biomass and consequently a reduction in yield.

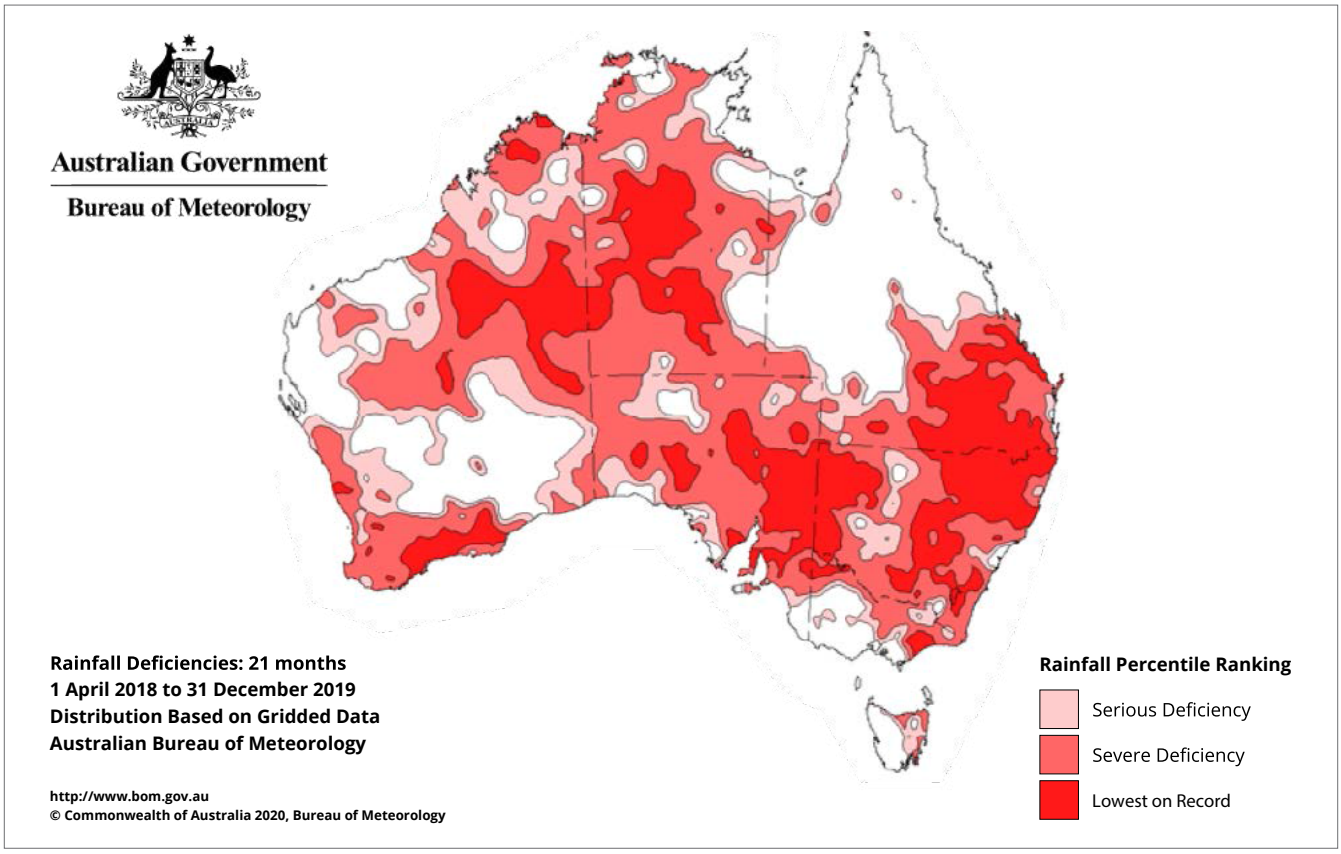

Fig 1. 21-month rainfall deficiencies in Australia

Physiology of plants recovery after stress

While recovering from drought stress, plants will activate different mechanisms to re-hydrate the tissues. Among them, stomatal conductance and production of abscisic acid (ABA) have been described (Mata and Lamattina., 2001). Cell wall proteins will start to modify their configuration in order to increase the exchange of water and nutrients with their surroundings (Verslues et al., 2006).

Plants recovering from stress accumulate specific amino acids (Vaňková et al., 2013), this is the case with proline. Proline has been found to act as osmoprotectant, a molecular, a pH buffer and a source of carbon and nitrogen during recovery (Szabados et al., 2009). Various studies have also shown that the concentration of other amino acids will also increase in the plant. This is the case with arginine, isoleucine, leucine and histidine.

How can GrowGreen products help plants recovery after stress?

The application of bio stimulants, like Amino Acids, can assist the plan recovery after drought stress. Amino Acids are the building blocks for protein production. Studies have established that even low doses of amino acids help reduce the impact of drought stress (Mohamed, 2006) and improve the uptake of essential nutrients.

Other forms of bio stimulants are Plant hormones. Plant hormones play central role in the ability of plants to adapt to changing environments by mediating growth development, nutrient allocation (Walch-Liu et al., 2006).

GrowGreen's AminoElite

AminoElite™ is produced through a unique microbial digestion process occurring at room temperature, that allows for the preservation of protein molecules and beneficial microbes that improve soil biology over time while improving plant nutrition. AminoElite contains plant absorbable amino acids.

Free amino acids are osmotically active substances that contribute in osmotic pressure adjustments. Osmotic pressure plays a fundamental role in water stress responses and growth in plants (Osakabe et al., 2013). But also, exogenous application of amino acids help plants recovery after stress as they modulate membrane permeability and increase nutrient uptake.

AminoElite's recipe incorporates silica. Silica can greatly assist in mitigating drought stress. Although silicon is generally considered nonessential for plant growth, silicon uptake by plants can alleviate both biotic and abiotic stresses. Silica application has been related to increasing photosynthesis rates, reduction of fruit drop, and protection against insects (Yongxing Zhu and Haijun Gong 2013).

GrowGreen's AminoElite amino acid analysis

AA	Metabolic functions of AA
Aspartic Acid 7.6%:	Seed germination
Threonine 4.1%:	Improve drought tolerance
Serine 5.7%:	Chlorophyll production, Stomata regulation, pollination, seed germination
Glutamic Acid 11.3%:	Chlorophyll production, stomata regulation, pollination, seed germination
Proline 7.1%:	Heat, Salt, and Drought tolerance
Glycine 21.6%:	Chelation, Heat tolerance, Chlorophyll production
Alanine 10.3%:	Chlorophyll production, seed germination
Valine 4.4%:	Drought tolerance, seed germination
Methionine 2.3%:	Ripening, stomata regulation
Isoleucine 3.1%:	Salt and Drought tolerance, pollination
Leucine 5.7%:	Salt and Drought tolerance, pollination
Phenylalanine 2.4%:	Humic compound, lignin formation
Histidine 1.8%:	Aids fruit ripening
Lysine 5.7%:	Chlorophyll production, seed germination
Arginine 4.8%:	Root development, induces Flowering and Fruiting Hormones
Tyrosine 2.2%:	Drought stress tolerance, pollination, pollen germination

Note: All the amino acids mentioned above (proline, arginine, isoleucine, leucine and histidine) are present in GrowGreen's AminoElite at a natural ratio.

GrowGreen's Microbe Plus Kelp

Microbe Plus® Kelp is created through a unique formulation process that digests and blends high-grade kelp with beneficial microbes and essential nutrients. The resulting product is a natural, biologically active fertiliser with constituents in 100% plant usable forms.

Seaweed extracts benefits include: strengthening cell walls to prevent insect and fungal attack, promoting budding and flowering, enhancing the ability to tolerate climatic stresses, improving germination rates, improving quality and yield of above ground and root crops, improving root nodulation, and helping to suppress soilborne diseases and nematodes (Craigie, 2011; Calvo, 2014).

Although Abscisic Acid (ABA) is the most studied stress-responsive hormone, the role of, not only cytokinins and auxins, but all of the plant hormones acting together has been described (Peleg and Blumwald 2011).

GrowGreen's Microbe Plus Kelp hormonal analysis

	M+Kelp 2019
Cytokinins	85
Abscisic Acid	103
Auxins	723
Gibberellins	11

Note: All the phytohormones mentioned above (Abscisic Acid, Cytokinin and auxins) are present in GrowGreen's Microbe Plus Kelp at a natural ratio.

GrowGreen's microbe plus kelp also contains other beneficial polysaccharides for plants such as alginates, carrageenans etc.

GrowGreen's AminoKelp

Microbe Plus® Kelp is created through a unique formulation process that digests and blends high-grade kelp with beneficial microbes and essential nutrients. The resulting product is a natural, biologically active fertiliser with constituents in 100% plant usable forms.

Seaweed extracts benefits include: strengthening cell walls to prevent insect and fungal attack, promoting budding and flowering, enhancing the ability to tolerate climatic stresses, improving germination rates, improving quality and yield of above ground and root crops, improving root nodulation, and helping to suppress soilborne diseases and nematodes (Craigie, 2011; Calvo, 2014).

Although Abscisic Acid (ABA) is the most studied stress-responsive hormone, the role of, not only cytokinins and auxins, but all of the plant hormones acting together has been described (Peleg and Blumwald 2011).

GrowGreen's AminoKelp amino acids and hormonal analysis

As this product combines the benefits of AminoElite and Microbe Plus Kelp, the analysis shown above for each individual crop applies for AminoKelp.

GrowGreen's Xtend

Another product offering great promise and many benefits to growers is Xtend™, a spray adjuvant used in conjunction with chemical applications to improve their efficiency.

Xtend™ is an organically certified, sticker/spreader made from food-grade canola oil. When mixed with products like fertilizers, herbicides, and insecticides it improves their spreading ability and efficacy.

Program recommendation for Cotton

If using AminoElite and Kelp together, then AminoKelp is not needed and viceversa.
Same for the Organic program

Conventional Growers

After seedling emerges (15 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite	**Cotton**	Foliar	2.0
Microbe Plus Kelp			2.0
AminoKelp			**2.0**
Microbe Plus Potassium			2.0
Xtend			0.2

Before flower buds (30 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite	**Cotton**	Foliar	2.0
Microbe Plus Kelp			2.0
AminoKelp			**2.0**
Microbe Plus Potassium			2.0
Microbe Plus Zinc			5.0
Xtend			0.2

Flower buds (50 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite	**Cotton**	Foliar	2.0
Microbe Plus Kelp			2.0
AminoKelp			**2.0**
Microbe Plus Potassium			2.0
Microbe Plus Zinc			5.0
Xtend			0.2

Organic Growers

After seedling emerges (15 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite Organic	**Cotton**	Foliar	3.0
Microbe Plus Kelp Organic			3.0
AminoKelp Organic			**3.0**
Xtend			0.2

Before flower buds (30 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite Organic	**Cotton**	Foliar	3.0
Microbe Plus Kelp			3.0
AminoKelp Organic			**3.0**
Xtend			0.2

Flower buds (50 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite Organic	**Cotton**	Foliar	3.0
Microbe Plus Kelp			3.0
AminoKelp Organic			**3.0**
Xtend			0.2

Flower buds (70 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite	**Cotton**	Foliar	2.0
Microbe Plus Kelp			2.0
AminoKelp			**2.0**
Microbe Plus Potassium			5.0
Microbe Plus Phoscal			2.0
Xtend			0.2

Flower buds (70 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite Organic	**Cotton**	Foliar	3.0
Microbe Plus Kelp			3.0
AminoKelp Organic			**3.0**
Xtend			0.2

Cotton bolls begin to fill (100 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite	**Cotton**	Foliar	2.0
Microbe Plus Kelp			2.0
AminoKelp			**2.0**
Microbe Plus Potassium			5.0
Microbe Plus Phoscal			2.0
Xtend			0.2

Cotton bolls begin to fill (100 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite Organic	**Cotton**	Foliar	3.0
Microbe Plus Kelp			3.0
AminoKelp Organic			**3.0**
Xtend			0.2

Cotton bolls begin to open (120 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite	**Cotton**	Foliar	2.0
Microbe Plus Kelp			2.0
AminoKelp			**2.0**
Microbe Plus Potassium			5.0
Xtend			0.2

Cotton bolls begin to open (120 days after plantation)

Product Name	Crop Type	Application Type	Total Litres/ha
AminoElite Organic	**Cotton**	Foliar	3.0
Microbe Plus Kelp			3.0
AminoKelp Organic			**3.0**
Xtend			0.2

For more information contact info@growgreenfertilisers.com.au

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