How Growgreen Fertilizers help Plants against 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).

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.

Plants have different mechanisms to avoid water deficit. Among them, stomatal conductance is reduced as part of the systemic response triggered by a signal that originates in the root system. One of these responses is the production of abscisic acid (ABA) (Mata and Lamattina., 2001)

Another plant response to low water conditions is to modify the cell wall proteins to avoid dehydration (Verslues *et al.*, 2006).

The application of bio stimulants, like Amino Acids, can assist the plan to resist 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 (N, P and K) under low water conditions.

The plant response to drought is similar to the plant response to salinity stress as they both relate to low water potential. Various studies show that Arginine, Proline, Isoleucine, Leucine, Histidine and GABA can mitigate against the effect of drought and salt stress

While underestimated, minerals such as Silicon (Si) 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 (Yongxing Zhu and Haijun Gong 2013).

Osmotic pressure plays a fundamental role in water stress responses and growth in plants (Osakabe *et al.*, 2013). Free amino acids are osmotically active substances that contribute in osmotic pressure adjustments during drought. Exogenous application of amino acids modulate membrane permeability and ion uptake which is how amino acids mitigate drought or even salt stresses. A study in corn revealed up to 30% more yield (in terms of mass per 1000 grains) when sprayed with amino acid under water deficient conditions (Kasraie *et al*., 2012). The study revealed that spraying of amino acids before water deficient stress is up to 20% more effective than spraying amino acid after water deficient stress. Another study on wheat revealed that amino acid reduced damage due to stress by 70% when applied at a concentration of 1 mL per Liter (Azimi *et al*., 2013).

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).

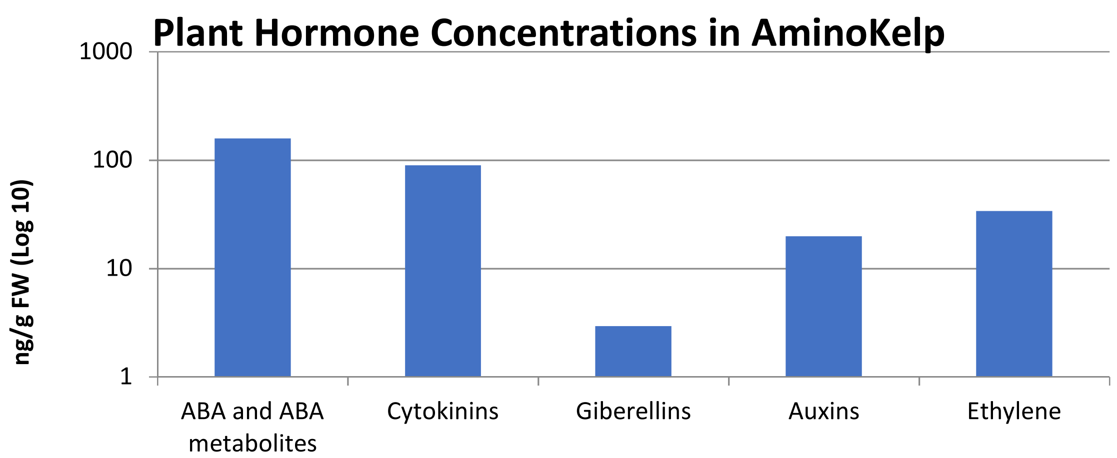
Although Abscisic Acid (ABA) is the most studied stress-responsive hormone, the role of cytokinins and auxins during environmental stress is emerging (Peleg and Blumwald 2011).

AminoKelp™

Growgreen AminoKelp™ contains a broad spectrum of amino acids, digested kelp as well as a broad spectrum of macro and micro nutrients including silica that help mitigate against many forms of abiotic stress including drought.

AA		Metabolic functions of AA
Aspartic Acid	7.6%:	Seed germination
Threonine	4.1%:	Improve drought tolerance
Serine	5.7%:	Chlorophyll production, Stomata regulation, Improve Pollination
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

AminoKelp™ is made with multiple kelp species to provide a broad spectrum of plant growth promoting hormones (auxins, cytokinins), Absisic Acid, Gibberellins, Alginates and Ethylene.



Studies have shown that in combination, amino acids and kelp compliment and augment one another to produce a result that is better than the sum of the parts.

AminoKelp™ has been designed to be used in all the different types of crops as it helps plants to build resilience and overall vigor. It also helps the crop to deal with both biotic and abiotic stress e.g. insect attack, foliar and root disease, drought, frost, heat sunburn etc.

AminoKelp can be applied as either a foliar, down the line at planting or through fertigation. Amino Kelp can be applied individually or with most commonly used pesticides, however we strongly recommend checking labels for compatibility as well as pretesting in a small area prior to widespread application.

Crop	Application rate l/ha	No. of applications (l)	Timing
Horticultural crops	1.5-2 l	3-4	-Pre flowering -Post flowering -Fruit enlargement
Broad acre winter crops	1.5-2 l	1-2	-Mid tillering -Grain filling stage
Broad acre summer crops	1.5-2 l	2-3	-Pre flowering -Post flowering -Grain filling stage
Annual and perennial pasture	2-3 l	3-4	-Post grazing

For more information contact info@growgreenfertilisers.com.au

References:

Azimi M.S. et al (2013), Evaluation of Amino Acid and Salicylic Acid application on yield and growth of wheat under water deficit, International Journal of Agriculture and Crop Sciences, Vol. 8 pp 816-819

Cheruth Abdul Jaleel., Paramasivam Manivannan., Abdul Wahid., Muhammad Farooq., Hameed Jasim Al-Juburi., Ramamurthy Somasundaram and Rajaram Panneerselvam. 2009. Drought Stress in Plants: A Review on Morphological Characteristics and Pigments Composition. *Int. J. Agric. Biol.*, 11: 100–105.

Mata, CG and Lamattina, L. 2001. Nitric Oxide Induces Stomatal Closure and Enhances the Adaptive Plant Responses against Drought Stress. *Plant Physiology*, July 2001, Vol. 126, pp. 1196–1204

Mohamed, A.M., 2006. Effect of Some Bio-chemical Fertilization Regimes on Yield of Maize. M.Sc. Thesis, Fac. of Agric., Zagazig Univ., Egypt, pp. 70–177.

Paul E. Verslues, Manu Agarwal, Surekha Katiyar-Agarwal, Jianhua Zhu and Jian-Kang Zhu, Methods and concepts in quantifying resistance to drought, salt and freezing, abiotic stresses that affect plant water status. The Plant Journal (2006) 45, 523–539

Pia Walch-Liu, Et Al (2006) Nitrogen Regulation Of Root Branching, Annals Of Botany.

P. Kasraie Et Al (2012), The Effects Of Time Spraying Amino Acid On Water Deficit Stress On Yield, Yield Component And Some Physiological Characteristics Of Grain Corn, Scholars Research Library

Yongxing Zhu, Haijun Gong,Beneficial effects of silicon on salt and drought tolerance in plants. Agronomy for Sustainable Development, Springer Verlag/EDP Sciences/INRA, 2014, 34 (2), pp.455-472.

Yuriko Osakabe, Naoko Arinaga, Taishi Umezawa, Shogo Katsura, Keita Nagamachi, Hidenori Tanaka, Haruka Ohiraki, Kohji Yamada, So-Uk Seo, Mitsuru Abo, Etsuro Yoshimura, Kazuo Shinozaki, Kazuko Yamaguchi-Shinozaki, Osmotic Stress Responses and Plant Growth Controlled by Potassium Transporters in Arabidopsis. Plant Cell. 2013 Feb; 25(2): 609–624.

Zvi Peleg and Eduardo Blumwald, Hormone balance and abiotic stress tolerance in crop plants. Current Opinion in Plant Biology 2011, 14:290–295