



## Are you an Almond Grower?

### Use of GrowGreen Biofertilisers to Increase Yield and Quality in Almond Trees

Almonds (*Prunus dulcis*), are a deciduous fruit tree within the rose (*Rosaceae*) family, along with other tree fruits such as peaches, apples, pears, plums, cherries, and apricots. Within the genus, almonds are most closely related to the peach, and hybrids of the two are used as rootstocks.

#### *Importance of Almond Production Worldwide.*

The seed of the almond tree is an economically important tree crop worldwide. Sweet Almonds, are consumed as raw nuts, used in cooking or as a source of oil or meal. It is a multibillion-dollar industry. Bitter Almonds used to produce oil used in the production of flavouring extracts for foods and liquors. California produces almost 80% of the world's supply because of its Mediterranean climate, in which almond trees thrive.



#### Almond Orchards produce 4 different products:

- 1) Nuts are used for eating and oil production (plant nutrition very important);
- 2) Hulls/shells are used for livestock feed (plant nutrition somewhat important) and bedding;
- 3) Trees are recycled and composted at end of productive life to improve soil quality (plant nutrition somewhat important);
- 4) Trees are recycled and burned at end of their productive life to create alternative energy.

Sustainable almond production practices are crucial to continued livelihood of the industry (optimised nutrition is very important).

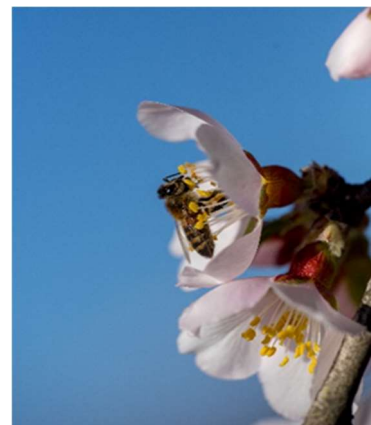


*Almond pollen is a key nutritious food source for bees.*

## Challenges Facing Almond Protection.

- Bee Colony Collapse Disorder (CCD) has led to a drastic decline in global honeybee populations and threatens the almond industry because bees are critical for pollination in all almond orchards.

Insuring healthy and nutritious almond pollen is critical to bee health and GrowGreen products will have a positive impact on the quality of almond pollen. Also, due to the lack of any hazardous chemicals in their production, the use of GrowGreen products in almond production will not negatively impact honeybee populations.



- Almond trees use about as much water as most other fruit and nut trees, but water supplies around the world are threatened by population growth, so plant water use efficiency is key. The beneficial cocktail of fungi and bacteria in GrowGreen products improves soil health and water holding capacity, thus optimising plant water use efficiency.
- Nutrition over fertilisation can cause two important diseases, botryosphaeria canker - a fungal disease that kills the bark and cambium layer, and Hull rot - another fungal disease which invade hulls and produces a toxin that kills the spur and eventually the shoot attached to the fruit. Both diseases cause yield loss, but with the optimised nutrition achieved when using GrowGreen fertilisers, almond trees are provided a natural protection against these two diseases.

## Benefits of Biostimulants in Nut and Fruit Production.

### Yield and Quality

Biostimulants, or “metabolic enhancers”, as they are sometimes called, are biologically derived substances that have been shown to enhance overall plant growth and health, resulting in higher quality and yield. They function by promoting a plants natural processes, thereby enabling more energy to be shunted directly towards plant growth.

GrowGreen has several biostimulant products such as AminoElite™, Microbe Plus™ Kelp, and AminoKelp™, which has been shown to increase shoot leaf area, number of leaves per shoot and shoot length in almonds (Saa, Olivos-Del Rio, Castro and Brown, 2015). According to Lampien, et. al., 2011, (Previous Year Leaf Area, PYLA), of almond trees was not only a reliable predictor for the number of flowers per shoot in the following year but was indicative of fruitfulness as well. In subsequent years, the survival of non-bearing shoots, as well as bearing shoots, was almost certain when shoot PYLA was > 20 cm<sup>2</sup>.

*By increasing plant vigour, thus health, the plants are more resistant to pests and disease.*



*GrowGreen products, by virtue of their balanced nutrient profile, will also help insure a balanced carbon supply-demand ratio.*



Shoots with PYLAs >50 cm<sup>2</sup> had > 80% probability of producing at least one flower if the shoot did not bear in the previous year. Use of GrowGreen biostimulant products will help ensure that shoots reach the PYLA>50 cm<sup>2</sup> threshold, positively impacting yield components like shoot viability and flowering, and contributing to yield as well. Polito et al. (2002) and Heerema et al. (2008) asserted that shoot carbon supply-demand balance strongly influences shoot viability and flowering.

Brooks Bauer, an independent research contractor (*Two Bees Agricultural Research & Consulting*), applied foliar treatments similar to GrowGreen Microbe Plus™ Kelp, AminoKelp™, and AminoElite in a multi-year almond trial. These treatments combined to increase almond vigour, health and nut meat production by increasing nutrient uptake and optimising existing beneficial microbial populations such as Mycorrhizal fungi, which maximises nutrient availability (*AGRO-K Research Bulletin : Boost almond nut yield and tree health with new foliar and soil nutrient program; December, 2016*). The use of Glycine in GrowGreen products, whilst acting as a chelating agent, also helps accelerate nutrient absorption through both the foliar surface and the root system, therefore increasing nutrient uptake and transport to the rest of the plant.

Glycine facilitates heat tolerance, as well as Proline, another amino acid that is used in GrowGreen fertilisers and is known to play a role in heat, salt and drought tolerance.

It is well known that nutrient deficiencies are possible in the early spring due to a high demand for macronutrients and likely weak uptake by roots. Foliar applications of NPK, as contained in the Microbe Plus range, have been recommended to correct these deficiencies. Where sandy soils exist or when using water low in Boron (**B**), applying Boron via foliar application early in post-harvest will alleviate the **B** deficiency problems of low nut set, excessive nut drop, malformed nuts and undesirable vegetative growth. Because of the positive impact of GrowGreen type products, which include NPK as well as Boron, on nutrient uptake, the issues with high demand versus weak uptake would be mitigated with their use.

A reduction in nutrient leaching was postulated to be responsible, in part, for higher yields in peaches in a study by Bussi et al., 1991. GrowGreen products have been designed to minimise leaching through use of a unique combinatorial technology that includes added beneficial plant microorganisms. This mixture also strengthens the natural occurring mycorrhizal fungi, allowing it to hold on to essential plant nutrients, thereby reducing nutrient leaching and promoting yield across the Rosacea family.

*GrowGreen AminoElite and AminoKelp products contain a range of amino acids, including a high percentage of Glycine.*

## Almond Nut Constituent Composition

Almond are nutrient dense (Zhu, 2014) and made up of the compounds listed in Table 1.

Table 1. Major constituents making up almonds.				
<u>Compound</u>	<u>Range</u>	<u>Type</u>	<u>Comments</u>	<u>GG Fertiliser that impacts</u>
<b><u>Lipids</u></b>	>50%	<b>Majority:</b> Oleic Acid (70%) Linoleic Acid (20%)	Crude Fat Content (CFC) can be impacted by Nitrogen fertilisation (Li, Wei Ping, et. Al., 2017)	AminoKelp, Amino Elite, Microbe Plus® Drip
<b><u>Protein</u></b>	15-22%	Globulin (74%) Albumin (21%)	Amino Acids are the building blocks of proteins.	AminoKelp Amino Elite
<b><u>Dietary Fibres</u></b>	10.8% - 13.5%	Pectin, cellulose and xyloglucans	Very low content of starch and sugar.	
<b><u>Amino Acids</u></b>	<200mg/100g		Building blocks of protein formation.	AminoKelp Amino Elite
<b><u>Vitamins</u></b>		Lipid-soluble E Type with major and minor homologues.	Plant Metabolites linked to nitrogen metabolism. Amino acids play roles in vitamin biosynthesis and metabolism. (Miret JA, 2014)	AminoKelp Amino Elite
<b><u>Minerals</u></b>	<b>Mainly:</b> Potassium – 705mg/100g Phosphorus - 484mg/100g	Calcium, manganese, magnesium, iron, phosphorous, zinc, selenium.		AminoKelp Amino Elite, Microbe Plus® Drip

Amino acids are the building blocks of proteins. Ahrens S., 2005, found that Methionine + Cysteine, (sulphur amino acids), Lysine and threonine are the 1<sup>st</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> limiting amino acids in almonds. Threonine improves drought tolerance, Methionine impacts ripening and stomata regulation, and Lysine is important in chlorophyll production and seed germination. All three of these are present in GG products in a balanced, natural ratio.



All three amino acids – Threonine, Methionine and Lysine are present in GrowGreen products in a balance and natural ratio.

## Almond Nut Constituent Composition

Finally, almond quality is directly related to the quantity of the fatty acids in the nut (Zhu, 2014). Of these, 50% of total kernel weight is attributable to lipids. Lipid composition is shown in **Table 2**.

Table 2. <u>Almond Fatty Acid Composition</u>				
<u>Fatty Acid</u>	<u>Structure</u>	<u>% of total</u>	<u>GG Fertiliser that impacts</u>	<u>Comments</u>
<u>Oleic Acid</u>	C18:1	65%	AminoKelp AminoElite Microbe Plus® Drip	Crude Fat Content CFC, can be impacted by Nitrogen fertilisation (Li, Wei Ping, et. al., 2017)
<u>Linoleic Acid</u>	C18:2	25%		
<u>Palmitic Acid</u>	C16:0	6.5%		
<u>Stearic Acid</u>	C18:0	2.5%		
<u>Palmitoleic Acid</u>	C16:0	0.7%		
<u>Myristic Acid</u>	C14:0	Trace		
<u>Arachidic Acid</u>	C20:0	Trace		

Since GrowGreen products contain the major constituent fatty acids that make up lipids, and the important proteins, amino acids, and plant metabolites, the use of these fertilisers will allow plants to reach their maximum genetic potential.

## Conclusion

GrowGreen's products are much more than just fertilisers, they also provide all the necessary macro and micronutrients needed to achieve maximum almond yield. Because biostimulants are incorporated, in the form of beneficial microbes, amino acids and plant hormones, and due to the careful manufacturing process, which does not use any inorganic hazardous chemicals, the almond tree receives all it needs to reach maximum genetic potential in terms of both nut yield and quality.

Application of GrowGreen products enhances the almonds innate protection response to diseases, resulting in healthier orchards and fewer inorganic and toxic treatments for disease control.

GrowGreen fertilisers also function to enhance and increase the natural soil microbial population, which not only results in more vigorous and healthy almond orchards, but a healthier and sustainable soil for future generations of farmers.



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