

Excerpt from Integral Hydroponics, Nutrient and Additive Production for the Home Grower.
Coming soon through Amazon.

Unedited material – work in progress.....

About Nutrients

There's an important point that needs to be made before we move on and discuss hydroponic nutrient formulation (and provide you with formulas for producing nutrients at home).

Over the years I have analysed numerous companies' formulas. What I have learned from this experience is that there are many approaches taken in formulation and, often, there can be significant variations between what these formulas ultimately provide to the plant in the way of mineral nutrition (i.e. ppm of each element delivered to the plant at a desired EC – e.g. 1.8 in grow).

Firstly, let's take a look at lab analyses of two Australian companies' coco grow and bloom formulas to demonstrate my point.

Product X

CUSTOMER:	INTEGRAL HYDROPONICS			
SAMPLE	Prod X	Prod X	Prod X	Prod X
NAME	COCO GROW A	COCO GROW B	COCO FLOWER A	COCO FLOWER B
SERIAL #	051180	051181	051182	051183
ELEMENT				
NH ₄ N (mg/L)	3686	5690	3732	2215.6
NO ₃ N (mg/L)	41460	9324	41640	6.7
S (mg/L)	63.9	20980	113.1	28840
P (mg/L)	9.11	6760	16.38	21080
K (mg/L)	31460	16770	30880	36580
Na (mg/L)	255.9	225.6	254.4	795
Ca (mg/L)	39220	119.8	35600	124
Mg (mg/L)	50.3	14290	91.6	11980
Cu (mg/L)	< 0.5	16.1	< 0.5	15.96
Zn (mg/L)	< 0.5	30.39	< 0.5	32.47
Mn (mg/L)	1.34	160.1	1.48	153.9
Fe (mg/L)	619	4.19	606	1.25
B (mg/L)	1.3	22.36	1.34	22.61
Cl (mg/L)	28.56	34.89	26.87	462.9
pH	4.84	3.78	4.76	3.43
COND. (dS/m)	125.9	132	142	150.9

Product Y

CUSTOMER:

SAMPLE NAME	PROD Y GROW COCO A	PROD Y GROW COCO B	PROD Y BLOOM COCO A	PROD Y BLOOM COCO B
SERIAL #	051130	051131	051132	051133
ELEMENT				
NH ₄ N (mg/L)	3868	566.2	3.1	1.4
NO ₃ N (mg/L)	31900	10786	32500	5280
S (mg/L)	296	12910	223.7	12450
P (mg/L)	115.3	7710	13.8	887
K (mg/L)	747	38930	9270	18520
Na (mg/L)	641	1466	468.4	474.6
Ca (mg/L)	41260	147.5	26290	174.2
Mg (mg/L)	78.2	7110	81.2	7670
Cu (mg/L)	< 0.5	27.2	0.6	27
Zn (mg/L)	0.53	37.6	< 0.5	40.7
Mn (mg/L)	4.2	146.2	2.5	132.4
Fe (mg/L)	270.4	25	318.5	10
B (mg/L)	0.8	47.1	1	41.9
Cl (mg/L)	105	1020	168.7	231
pH	3.76	4.36	5.04	3.33
COND. (dS/m)	96.6	796	668	178.5

OK, let's now have a look at some of the numbers (mg/L) of each element that are found in the two Australian companies formulations.

Product X and Product Y elemental comparison

	Prod X Coco Grow	Prod Y Coco Grow	Prod X Coco Bloom	Prod Y Coco Bloom
NH ₄ N (mg/L)	9376	4434.2	5947.6	4.5
NO ₃ N (mg/L)	50784	42686	41646.7	37780
S (mg/L)	21043.9	13206	28953.1	12673.7
P (mg/L)	6769.11	7825.3	21096.38	900.8
K (mg/L)	48230	39677	67460	27790
Ca (mg/L)	39339.8	41407.5	35724	26464.2

Note Product X's numbers against those of Product Y's formulas. They are extremely different no matter which way we pitch it (e.g. we could analyse concentrations etc but let's not go there for now).

I'm now going to throw in another analysis from a coco bloom formulation made by the same company that makes our 'product Y' formulas. The new analysis (numbers) are from a coco bloom formula that company Y manufactures for a store that has its own home brand label. What I'll do is put company Y's Bloom formula numbers/analyses (that we've already looked at) next to that of our new example so we can compare the differences.

CUSTOMER:

SAMPLE NAME SERIAL # ELEMENT	STORE COCO PT A BLOOM 051134	STORE COCO PT B BLOOM 051135	PROD Y BLOOM COCO A 051132	PROD Y BLOOM COCO B 051133
NH ₄ N (mg/L)	603.6	0.5	3.1	1.4
NO ₃ N (mg/L)	37940	11292	32500	5280
S (mg/L)	29.4	10670	223.7	12450
P (mg/L)	6.1	9450	13.8	887
K (mg/L)	22040	41320	9270	18520
Na (mg/L)	811	1282	468.4	474.6
Ca (mg/L)	41270	180.8	26290	174.2
Mg (mg/L)	230.8	6320	81.2	7670
Cu (mg/L)	< 0.5	29.7	0.6	27
Zn (mg/L)	< 0.5	58.8	< 0.5	40.7
Mn (mg/L)	0.8	156	2.5	132.4
Fe (mg/L)	479.3	3.8	318.5	10
B (mg/L)	1.1	55.2	1	41.9
Cl (mg/L)	855	1207	168.7	231
pH	4.63	3.85	5.04	3.33
COND. (dS/m)	199.2	817	668	178.5

Product Y and Product "Store" numbers comparison

	Prod Y Coco Bloom	Store Coco Bloom
NH ₄ N (mg/L)	4.5	604.1
NO ₃ N (mg/L)	37780	49232
S (mg/L)	12673.7	10699.4
P (mg/L)	900.8	9456.1
K (mg/L)	27790	63360
Ca (mg/L)	26464.2	41450.8

Note the differences in the P and K levels (among other things) – these formulas are completely different and yet they are made by the same company (at the same location) as a coco bloom formula for Australian growers.

Let's now have a look at another company's coco formulation. This European company takes an entirely different approach and makes a one size fits all two part formula for both grow and bloom (we'll talk about their philosophy later in the "Coco Science" chapter of the book. [Page](#)).

SAMPLE NAME	Product Z COCO A	Product Z COCO B
SERIAL #	051147	051148
ELEMENT		
NH ₄ N (mg/L)	117	1184
NO ₃ N (mg/L)	42200	6780
S (mg/L)	47.1	7930
P (mg/L)	14.4	16190
K (mg/L)	6880	16780
Na (mg/L)	39.8	122.3
Ca (mg/L)	53600	620
Mg (mg/L)	7470	12310
Cu (mg/L)	1.2	9.4
Zn (mg/L)	1	69.2
Mn (mg/L)	3.2	122.9
Fe (mg/L)	199.5	2.1
B (mg/L)	0.9	63.4
Cl (mg/L)	13.4	34.3
pH	2.8	3.04
COND. (dS/m)	103.4	82

Again, compare all the numbers of all the formulations and you will note significant differences.

	Prod X Coco Bloom	Prod Y Coco Bloom	Store Coco Bloom	Product Z
NH ₄ N (mg/L)	5947.6	4.5	604.1	1301
NO ₃ N (mg/L)	41646.7	37780	49232	48980
S (mg/L)	28953.1	12673.7	10699.4	7977.1
P (mg/L)	21096.38	900.8	9456.1	16204.4
K (mg/L)	67460	27790	63360	23660
Ca (mg/L)	35724	26464.2	41450.8	54220

As you can see our numbers are all over the place and what is ultimately delivered to the plant in the form of nutrition will reflect this.

Let's now put the NPK ratios of all the formulas next to each other and have a look at them.

% element	Grow X	Grow Y	Bloom X	Bloom Y	Store Bloom	Bloom Z
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N	6.016 (x)	4.712	4.759	3.778 (●)	4.983	5.028 (√)
P	0.679	0.783 (x)	2.11 (√)	0.09 (●)	0.945	1.62
K	4.283 (x)	3.967	6.746 (√)	2.779	6.336	2.366 (●)
NH ₄ N	0.937 (x)	0.443	0.595 (√)	Neg. (●)	0.06	0.13

(x) Highest grow

(√) Highest bloom

(●) Lowest bloom

Even when looking at these numbers you can see significant differences between the formulations and what will ultimately be delivered to the plants as mineral nutrition.

OK, now let's compare our product Y formulas to the European (Product Z) formulas when they are diluted at 1:250 (4ml/L).

We conducted comparative analysis on both formulas in the Netherlands in 2004 (with products purchased in Australia).

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Chemisch onderzoek van : PROD Y Coco Bloom A

Analyse	pH	EC	Kationen: ppm (mmol/l)					Anionen: ppm (mmol/l)					Spoorelementen: ppb (µmol/l)						
			NH ₄ ⁺	K ⁺	Na ⁺	Ca ²⁺	Mg ²⁺	Si	NO ₃ ⁻	Cl ⁻	SO ₄ ²⁻	HCO ₃ ⁻	H ₂ PO ₄ ⁻	Fe	Mn	Zn	B	Cu	Mo
Resultaat	5.8	1.0	<3.6 (-0.2)	43 (1.1)	<6.9 (-0.3)	152 (3.8)	<4.9 (-0.2)	<5.6 (-0.2)	515 (8.3)	<11 (-0.3)	<19 (-0.2)	<12 (-0.2)	<9.70 (-0.10)	1190 (21)	16 (0.3)	<13 (-0.2)	<54 (-5.0)	<13 (-0.2)	<9.6 (-0.1)
laag																			
Streefwaarden																			
hoog																			

< minder dan; n.b. = niet bepaald

Dit analysereport is tevens opdrachtbevestiging.

Gemeten in een 250x verdunde oplossing.

BEOORDELING VAN DE ANALYSERESULTATEN:

Zie tabel. Lees ook de opmerkingen aan de linkerkant.

Omrekening v/v %:

2.9 % NO₃

1.1 % K = 1.3 % K₂O

3.8 % Ca = 5.3 % CaO

0.029 % Fe

Indien er vragen zijn aarzel dan niet om contact met ons op te nemen.

Chemisch onderzoek van : PROD Y Coco Bloom B

Analyse	pH	EC	Kationen: ppm (mmol/l)					Anionen: ppm (mmol/l)					Spoorelementen: ppb (µmol/l)						
			NH ₄ ⁺	K ⁺	Na ⁺	Ca ²⁺	Mg ²⁺	Si	NO ₃ ⁻	Cl ⁻	SO ₄ ²⁻	HCO ₃ ⁻	H ₂ PO ₄ ⁻	Fe	Mn	Zn	B	Cu	Mo
Resultaat	4.9	0.8	<3.6 (-0.2)	152 (3.9)	<6.9 (-0.3)	<8.0 (-0.2)	36 (1.5)	<5.6 (-0.2)	118 (1.9)	<11 (-0.3)	163 (1.7)	<12 (-0.2)	167 (1.7)	84 (1.5)	615 (11)	170 (2.6)	222 (21)	121 (1.9)	38 (0.4)
laag																			
Streefwaarden																			
hoog																			

< minder dan; n.b. = niet bepaald

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BEOORDELING VAN DE ANALYSERESULTATEN:

Zie tabel. Lees ook de opmerkingen aan de linkerkant.

Omrekening v/v %:

0.7 % NO₃

1.3 % P = 3.0 % P₂O₅

3.8 % K = 4.6 % K₂O

0.9 % Mg = 1.5 % MgO

1.4 % S = 3.4 % SO₄

0.002 % Fe 0.006 % B

0.015 % Mn 0.003 % Cu

0.004 % Zn 0.001 % Mo

Chemisch onderzoek van : Cocos A

Analyse	Kationen: ppm (mmol/l)								Anionen: ppm (mmol/l)					Sporelementen: ppb (µmol/l)						
	pH	EC	NH ₄ ⁺	K ⁺	Na ⁺	Ca ²⁺	Mg ²⁺	Si	NO ₃ ⁻	Cl ⁻	SO ₄ ²⁻	HCO ₃ ⁻	H ₂ PO ₄ ⁻	Fe	Mn	Zn	B	Cu	Mo	
Resultaat	water	mS/cm	Ammonium	Kalium	Natrium	Calcium	Magnesium	Silicium	Nitrat	Chloride	Sulfat	Bicarbonaat	Fosfaat	IJzer	Mangaan	Zink	Borium	Koper	Molybdeen	
	4.7	1.4	<3.6 (-0.2)	20 (0.3)	<6.9 (-0.3)	205 (5.1)	19 (0.8)	<5.6 (-0.2)	756 (12)	<11 (-0.3)	<19 (-0.2)	<12 (-0.2)	<9.70 (-0.10)	749 (13)	<11 (-0.2)	<13 (-0.2)	<54 (-5.0)	<13 (-0.2)	<9.6 (-0.1)	
laag																				
Streefwaarden																				
hoog																				

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BEOORDELING VAN DE ANALYSERESULTATEN:

Zie tabel. Lees ook de opmerkingen aan de linkerkant.

Omrekening v/v %:

4.2 % NO₃

0.5 % K = 0.6 % K₂O

5.1 % Ca = 7.2 % CaO

0.4 % Mg = 0.8 MgO

0.018 % Fe

Indien er vragen zijn aarzel dan niet om contact met ons op te nemen.

Chemisch onderzoek van : Cocos B

Analyse	Kationen: ppm (mmol/l)								Anionen: ppm (mmol/l)					Sporelementen: ppb (µmol/l)						
	pH	EC	NH ₄ ⁺	K ⁺	Na ⁺	Ca ²⁺	Mg ²⁺	Si	NO ₃ ⁻	Cl ⁻	SO ₄ ²⁻	HCO ₃ ⁻	H ₂ PO ₄ ⁻	Fe	Mn	Zn	B	Cu	Mo	
Resultaat	water	mS/cm	Ammonium	Kalium	Natrium	Calcium	Magnesium	Silicium	Nitrat	Chloride	Sulfat	Bicarbonaat	Fosfaat	IJzer	Mangaan	Zink	Borium	Koper	Molybdeen	
	4.2	0.7	5.4 (0.3)	78 (2.0)	<6.9 (-0.3)	<8.0 (-0.2)	51 (2.1)	<5.6 (-0.2)	143 (2.3)	<11 (-0.3)	96 (1.0)	<12 (-0.2)	241 (2.5)	22 (0.4)	527 (9.6)	281 (4.3)	311 (29)	64 (1.0)	58 (0.6)	
laag																				
Streefwaarden																				
hoog																				

< minder dan; n.b. = niet bepaald

Dit analysereport is tevens opdrachtbevestiging.

Gemeten in een 250x verdunde oplossing.

BEOORDELING VAN DE ANALYSERESULTATEN:

Zie tabel. Lees ook de opmerkingen aan de linkerkant.

Omrekening v/v %:

0.8 % NO₃

0.1% NH₄

1.9 % P = 4.4 % P₂O₅

2.0 % K = 2.4 % K₂O

1.3 % Mg = 2.1 % MgO

0.8 % S = 2.0 % SO₄

0.001 % Fe 0.008 % B

Don't get hung up on the chemistry – the numbers for now are the important thing.

Look at the "Omrekening v/v %" to see the variants of elemental percentages contained in these products and note the differences. They are significantly different products.

OK, so let's analyse the two companies' part A and B formulations (at 1:250 dilution) and put the numbers side by side.

	Product Y Part A	Product Z Part A	Product Y Part B	Product Z Part B
pH	5.8	4.7	4.9	4.2
EC	1.0	1.4	0.8	0.7
NH ₄	<3.6	<3.6	<3.6	5.4
K	43	20	152	78
Na	<6.9	<6.9	<6.9	<6.9
Ca	152	205	<8.0	<8.0
Mg	<4.9	19	36	51
Si	<5.6	<5.6	<5.6	<5.6
NO ₃	515	756	118	143
Cl	<11	<11	<11	<11
SO ₄	<19	<19	163	96
HCO ₃	<12	<12	<12	<12

H ₂ PO ₄	<9.70	<9.70	167	241
Fe	1190	749	84	22
Mn	16	<11	615	527
Zn	<13	<13	170	281
B	<54	<54	222	311
Cu	<13	<13	121	64
Mo	<9.6	<9.6	38	58

Author's note: Just in case you need to touch up on the math – “<” symbolises lower than.

These analyses are interesting in that they reflect what the plant will be delivered as mineral nutrition when our formulas are diluted in the reservoir/nutrient tank and fed to the plant/s.

As you can probably tell some of the elemental percentages are extremely different. Our European formulas have more Calcium (Ca), more Magnesium (Mg), more NO₃ Nitrogen, more NH₄ Nitrogen, more Phosphates (P), less Potassium (K) and lower levels of Iron (Fe) and Sulfates (SO₄). Other than this our European formulas possess lower levels of the micro elements Manganese (Mn) and Copper (Cu) while possessing higher levels of Zinc (Zn), Boron (B) and Molybdenum (Mo).

OK, so which product do I believe is better? That is, which product performs better than the other?

There's something I said in Integral Hydroponics about this. *“If you were to put a 100 hydroponic gardeners in the same room there would be a raging debate about the best nutrient to use (among other things).”*

Both of our formulas/products are sold worldwide. One product derives originally from a European manufacturer (although our formulas taken from an Australian sample presumably will be somewhat different to those of the European parent company's formulations) while the other originates from Australia and is distributed through affiliate companies in the UK and North America. Therefore, they are both multinational brand names with large followings and both products have good reputations.

Personally, I chose to work with the European product (actually I reverse engineered it and changed it somewhat) and preferred this over the Australian formulation. Coco has naturally high levels of Potassium and Sulfates and a nutrient developed for coco substrate should be formulated with this in mind. The European formulation – at least on paper – looks better all round (at least in theory) when considering the science of coco substrate ([we cover this on page](#)). For this reason, after using their formula I based my own formulation around their numbers, tweaking and changing a few things as I went. For instance, I added amino acids, fulvic acid, low levels of Auxins (as IBA), Nickel, and thiamine which definitely gave my formula an edge.

Having said this, I've also worked with the Australian company's products and found that they performed reasonably well.

The fact is, there is no off the Shelf “Hydro” nutrient that is perfect – that's something you need to know now.

For instance, at least from an agricultural science perspective, nutrients should be formulated factoring the water supply into the equation. Mains water contains varying levels of minerals/elements and these can ultimately play a major role on what a nutrient will look like when it is delivered to the plant. Mains water supplies vary city to city (often suburb to suburb), town to town, state to state and country to country and this is a significant factor in perfecting any nutritional regime for plants.

By way of example, a nutrient formulated for demineralised (RO or rain) water should look very different than a nutrient that is formulated for mains water and yet all of the examples we have covered are being used by growers in various locations who are using (in many instances) extremely different water supplies.

Water Supplies

Let's now have a look at a lab analysis of a tap water supply to demonstrate the point.

Phosphate	1.69
Nitrate	0.15
Ammonium	0.18
Potassium	7.7
Calcium	41.9
Magnesium	14.4
Sulfate	12.3
Iron	0.07
Sodium	161
Chloride	202
EC (ms cm ⁻¹)	0.78

It's important to note that Nitrate, Ammonium, Potassium, Calcium, Magnesium Sulfate, and Iron are all elements that are found in hydroponic formulations and depending on their levels in the feed water supply this will/should dictate how an optimised nutrient program is formulated.

Firstly there is approximately 400ppm (0.78 EC) of salts in this water supply and other supplies can/will contain even more ppm of elemental salts.

What this means is that the mains water in use in the hydroponic system begins with a relatively high degree (EC/ppm) of salts. For instance, if you were to begin with a tap water supply that contained 1 EC (500ppm) of salts and you were to grow with a total EC of 1.8 (nutrient in water) there would be minimal levels of balanced food salts available to the plants.

The only way to give the plants more balanced food is:

- 1) Up the EC to 2.0 – 2.2 (not a good option)
- 2) Reduce the existing salt levels in the water supply through using demineralised (RO) water
- 3) Formulate the nutritional regime with the water in mind and factor in the existing elements that are present in the water supply

Sodium (Na) and chloride (Cl) at bottom of water analysis table are the constituents of common salt. These normally occur together (i.e. sodium chloride = NaCl) and are not taken up to any degree by most plants, especially sodium. Therefore, they tend to accumulate if present in significant amounts.

You will note that we have 161ppm of sodium and 202ppm of chloride in our water analysis. Sodium Chloride (NaCl) can be toxic at even 50ppm to some plants (e.g. lettuce) while tomato plants can tolerate approximately (or over) 200ppm of NaCl.

Other elements that can cause problems are:

Iron (Fe): Although iron is a micronutrient, in this form (as a non iron fertiliser chelate) it can rapidly oxidise and precipitate as rust, which makes it unavailable as a nutrient.

Calcium (Ca) and Magnesium (Mg): These are constituents in hard water. As major nutrients they are useable in the nutrient solution. Their presence (if choosing to use mains water) should be allowed for in calculating precise nutrient formulations.

Bicarbonate (HCO_3) is also a constituent in hard water. It is alkaline and will raise the pH. It will need to be neutralised by acid, typically phosphoric or nitric. The amount of equivalent phosphorus or nitrogen added should be allowed for in calculating precise formulations.

Boron (B): Boron is the micronutrient with the narrowest range. If present in the water it can be omitted from your formulation. It can become a problem if its concentration is over 1ppm, or lower for sensitive crops. Boron only occurs in a few water supplies.

Tests carried out in the US and Canada in 2006 on water hardness (Calcium concentrations) demonstrated that water in Vancouver (by average) contained 1.4mg/L of Calcium while water in Phoenix (by average) contained 82-180mg/L of Calcium.

Take the worst case scenario for a moment and compare it to our "Chemisch onderzoek van: Cocos A" analysis (analysis at 1/250 dilution). The 1:250 diluted feed contains 205ppm of Calcium. Now add 180mg/L (1mg = 1ppm) of Calcium (as we may be doing in Phoenix) and we are left with 385ppm of Calcium in the feed solution. Compare this to our Vancouver supply of 1.4mg/L Ca (1.4ppm + 205ppm = 206ppm total Ca). Again, we are looking at very different numbers. I.e. Different water supplies can lead to very different outcomes where plant nutrition is concerned.

The Canadian tests found that Toronto had 34mg/L, Kitchener had 135.5mg/L, Waterloo 125.9mg/L, Vancouver 1.4mg/L, Montreal 32mg/L, and Halifax 6.8mg/L of Calcium present in their water supplies.

US tests in 33 regions/cities demonstrated that US drinking water supplies ranged from 8.2mg/L to 82-180mg/L of Calcium. By the way, many of these tests needed to be averaged due to multiple water supplies in any one city or region. ⁽¹⁾

Tests carried out in Sydney, Australia, on nine separate water supplies demonstrated total water hardness (Magnesium and Calcium as mg CaCO_3) variants of between 6-36mg/L in Illawarra to 52 – 62mg/L of mg CaCO_3 in the Cascade's supply.

Breaking this down even further and looking at best to worst case scenarios, Sulfate levels in the 9 water supplies ranged from 1 - 3mg/L to 38.9 – 65.3 mg/L; Sodium levels from 4.1 – 14.8mg/L to 38.9 – 65.3mg/L; Chloride levels from 15.0 – 26.5mg/L to 55.5 – 74.0mg/L and Potassium levels between 0.78 – 2.02 to 2.81 – 6.62mg/L. ⁽²⁾

You will no doubt note the differences between water supplies in a single city. This situation isn't uncommon and if we were to go on a state to state basis we would find even greater disparities

The bottom line.....

Technically speaking (from an agricultural science perspective) an optimised nutritional regime is formulated through establishing and meeting set (ideal) nutritional targets (ppm on delivery) of each element that the plant requires for the various stages of growth. This is something that "hydro" manufacturers typically forget to mention with some going so far as to state that their products are formulated for e.g. Australian water supplies. We've just looked at 9 water supplies in a single city, so the claim that a single formula can be made for vastly differing water supplies is largely misleading. I.e. Formulas for hard water – how hard is the water etc?

So, what does this information tell us?

Nutritional Tolerance of the Plant

In many ways the figures/formulas we've just looked at demonstrate the nutritional tolerance of the plant. I made this point in Integral Hydroponics by saying; *"The thing about nutrients that you ought to be aware of is the hype that goes with them. Be wary of paying too much for a product that probably isn't going to perform any better than the product next to it that is 30-40% cheaper. You may be paying extra for an extravagant label, importation costs, and the manufacturers advertising campaign.*

I have had some of the expensive brand names lab analysed only to discover that they aren't anything special compared to far cheaper brands. If you know what goes into a nutrient, the approximate cost of the constituents, and the tolerance of the plant to variations in nutrition, you tend to be a bit sceptical about using higher priced products."

To date, my thoughts about this haven't changed.

Dilution rates and how they come into play when looking at a formula

Some formulas/products are far more concentrated (mineral dense) than others.

A liquid concentrate nutrient that is formulated for use at 2.5ml/L to achieve 1.2 EC (final working solution) may contain 280grams/L of Calcium Nitrate while a nutrient formulated for use at 5ml/L to achieve 1.2EC may contain 140grams/L of Calcium Nitrate. That is (put simply), one product has half the Calcium Nitrate in the concentrate but requires twice as much of the product (added to the nutrient tank/reservoir) to achieve the same EC/ppm (and therefore represents equivalent levels of Calcium Nitrate – Calcium and Nitrogen - in the final working solution).

Keep this in mind when looking at the formulas we cover - formulas with higher dilution rates may/will have less gram/L (be less mineral dense) than formulas with lower dilution rates.

Company Philosophy in Formulation

There's another point that now needs to be made. This section of the book, in many ways, was written to help you understand that we'll be covering (in some instances) vastly different approaches in formulation.

The fact is that some company's do things very differently to others and therefore, a couple of the nutrient formulations we cover can only reflect this.

As you yourself come to learn the chemistry of nutrient formulation you will no doubt make up your own minds about which formulas are better than others (as is the case now as growers - and often industry interests posing as non industry interests - debate nutrients and additives on forums).

Other than this, as we progress through the book we will help you to come to understand the chemistry of perfecting crop specific and region specific nutrition.

⁽¹⁾ How Much Calcium Is in Your Drinking Water? A Survey of Calcium Concentrations in Bottled and Tap Water and Their Significance for Medical Treatment and Drug Administration Simon Morr,¹ Esteban Cuartas, MD,² Basil Alwattar, MD,³ and Joseph M. Lane, MD (2006)

⁽²⁾ Sydney Water Department 2007 www.nhmrc.gov.au/publications/synopses/eh19syn.htm

