

# Computer assisted acidification and optimized nutrition program

## Introduction

This web-based program is to assist commercial nursery and greenhouse growers with the acidification of their irrigation water and an optimized nutrition program. The acidification program is based on the bicarbonate level in the water and not the pH. Once you know the bicarbonate level of your irrigation water and the target value for the bicarbonate level, then the program will provide you with the amounts of acid to use to achieve the difference. It also provides the grower with an idea of much nitrogen (for nitric acid), phosphorous (for phosphoric acid) or sulphur (for sulphuric acid) is added. For rockwool growers using a neutral fertiliser regimen, the target value is about 30 ppm or 0.5 mmol of bicarbonate/L. For growers who use an acid fertiliser and grow in soilless substrate, the target value can be set higher (1-2 mmol/L).

The second part of the program involves a more complete nutrition regimen as well, whereby all the macro- and micro-nutrients are considered *in addition to* the acidification. The program assumes the use of elemental 'greenhouse grade' fertilizers. This program is suitable for growers who either have a 2 tank system (A and B tank) or a multi-nutrient injector system with or without an acid / base injector system.

What the grower needs for this program to work are target values for all the nutrients for a particular crop. It also can incorporate the nutrients which are present in the water source. Most labs can provide a complete analysis for the grower's water source. Moreover, you can calculate the costs of your nutrient solution.

## Instructions

### *Acidification (Part 1 only)*

For the acidification program to work, one has to know the bicarbonate level of your water source. You start with clicking on the check box for 'Acidification only' and you enter the value for bicarbonate in the column. There are several units which one can use for bicarbonate, namely mmol/L or ppm. You can toggle back and forth to see the conversion. In the case your analysis report provides the alkalinity in ppm (= mg/L) of  $\text{CaCO}_3/\text{L}$ , then you have to multiply this number with 1.22 in order to get the bicarbonate level. So if the alkalinity is 100 ppm  $\text{CaCO}_3$ , then the equivalent value is 122 ppm of bicarbonate/L. After you have entered the final target value for the bicarbonate and provide the volume of the concentrate tank and dilution ratio, you click the 'Calculate' button to view the results.

## ***Optimized nutrition program (Parts 1 to 4)***

### **Part 1.**

You have to fill in the values of the different elements in the water. There are a number of options for filling in the values for the different elements. Note that you can use the elemental value but also the compounded version. E.g. for nitrogen: you can have the concentration in mg of nitrogen (N) / L (elemental) but also expressed as nitrate (NO<sub>3</sub>). If you have 14 ppm of N, then this is the same as 62 ppm of NO<sub>3</sub>. The same can be noted for ammonium, and sulphur. The micro elements are only provided in micromole/L (μmol/L) or in the elemental form (ppm). The grower can toggle back and forth and see the conversion. Once all the values are entered, the grower must click 'Submit Water Values' so that they are stored in the program and can be used in Parts 3 and 4.

#### ***Important: Saving Progress***

At any time after Part 1, should you decide to leave and continue later on, you may download a csv file by clicking 'Save progress' in the uppermost right green menu. The file format is 'cropsxxxx.yy.zz.csv' where xxxx.yy.zz represents the year, month and day respectively. This file is stored by default under 'C:\My Documents\Downloads\'. Should the grower wish to resume their progress simply upload the csv file in the Upload (green) menu and click 'Extract Data' afterwards.

*If successful, the filename will be shown in the orange menu.*

### **Part 2.**

The grower has to fill in the target values for their particular crop. The first 'rectangle' is for crop identification, e.g. gerbera. Then one fills in the target values for the crop. Once the values have been entered, one can press the 'Save new crop' button. *Once a crop is saved, the blue menu (on the left) will create a drop-down menu listing each new crop.*

### **Part 3.**

Once an option is selected from the drop-down (blue) menu created in Part 2, the program will provide a table whereby you get an overview of the target and water values.

***Important:*** *Both solutions should be balanced in terms of meq/L (see bottom row: 3<sup>rd</sup> and 4<sup>th</sup> column for target values; 6<sup>th</sup> and 7<sup>th</sup> column for water source)*

If the target and/or water values are not balanced (if difference is greater than 1 meq/L), then the grower cannot optimize the fertiliser program accurately. There is a priority incorporated in the calculation scheme so that the main nutrients (N, P, K, Ca and Mg) are considered before sulphur, which compensates for possible imbalances in the solutions.

#### Part 4.

Here the calculation for the amounts or needed fertilisers are made. The grower can select certain fertilisers or check 'Select All Standard Fertilisers'. The choice is on the user. After you have answered a few questions, the grower must click 'Submit Fertiliser Choices', and the calculation will be done and shown. Scrolling down will show fertilisers, acids and potassium bicarbonate separated in A, B, C and D tanks so that certain nutrients remain separated (e.g. Ca vs. sulphates and phosphates regarding Tanks A and B). An estimate for the Electrical Conductivity (EC in mS/cm) will be provided as well. This provides a means for the grower to see whether you get the right solution out of the system. The actual EC of the final fertilizer solution should be similar (within 10%) to the calculated target value.

Keep in mind that the calculated EC value is based on the macro nutrients of the fertilizers plus the elements in the water. If the grower wishes to deviate from the calculated EC and wants to increase the EC in the solution (e.g. winter conditions), then the amount of fertilizers in the A and B tanks should be increased proportional to the relative increase of the EC, but this does not apply to the acid amount(s). *If the acid is dosed in a separate acid tank, then this is no issue, as the amount of acid is based solely on the water quality.*

*Important:* If you are without an acid tank, then there is the issue of pH to consider. If the acid is going in Tank A, the pH should be controlled based on the type of iron chelate in order to maintain the stability of the chelate:

EDTA:	2.5 < pH < 5.0
DTPA:	1.5 < pH < 6.5
EDDHA:	3.5 < pH < 9.0

You may print the fertiliser schedule by clicking on the 'Print Report' button, and then select either the default printer or save as a pdf file. They may also determine the price of the fertiliser solution (not included is the price of the water) by \$/kg amounts in the areas next to the amounts of fertiliser.

This program is prepared with the best of intention for the commercial grower. The final responsibility remains with the user.