



## *Complementary supply*

For hydroponic production in coconut fiber substrate



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## WARNING

This mini-guide is an overview of several crop information. Its use remains the sole responsibility of the reader. For more complete information, please consult more detailed works (such as those in the “references” section at the end of this document) or an agronomist specialized in the production of your crop.

## WATER SUPPLY

### Water quality

A sufficient supply of good quality water is very important. You must have the water analyzed initially to find out if it is suitable for use in hydroponic cultivation on coconut substrate.

The parameters to be analyzed are generally: pH, EC (electrical conductivity), hardness, total dissolved solids (TDS), NO<sub>3</sub> (nitrates), Na (sodium), P (phosphorus), K (potassium), Mg (magnesium), Ca (calcium), Cl (chlorides), sulfates, bicarbonates, Zn (zinc), Fe (iron), Mn (manganese), Cu (copper), B (boron), Si (silicon), Mo (molybdenum). Some of these results are used to calculate the quantities of fertilizer to add, others are necessary to assess whether or not the water can be used for the crop.

For nutrient absorption, the pH of irrigation water should be around pH 6.0.

It often happens (depending on the region) that the pH must be lowered. Through a water analysis, it is possible to assess the approximate quantity and type of acid required to lower the pH of the water. (see the “fertilizer” section of this document for more information on acid injection).

### Quantity of water



For estimation purposes, the amount of water required to water mature tomato plants on a nice sunny day is approximately **2 to 3 liters/plant/day**. For young plants, we can estimate the need at around **1 liter/plant/day**.

**1 dripper/plant** connected to a microtube and a spike usually supplies the plants at a flow rate of **2 liters per hour**.

### Irrigation frequency



Tomato roots need water as much as air. Too much or too little water can cause problems. In coconut fiber substrate, you can expect to irrigate approximately **6-12 times per day** in summer. The watering duration is approximately **100-200 ml** each time, so **3 to 6 minutes** at a time when 2 liter/hour drippers are used.

The irrigation strategy (amount of water, frequency and timing of watering) can have important effects on the crop. For more details, please consult more detailed works.

## SEEDS

For tomatoes, it is usually necessary to sow at least **20-35% extra seeds** to be able to select the most beautiful plants.



It is also possible to graft the plants. Grafting attaches a desired fruit tomato cultivar (scion) to the roots of a root disease-resistant cultivar (rootstock). If you choose this method, you must sow seeds of **2 types of seeds** (rootstock + scion). Rootstock usually grows faster and should be sown first. You must then select the size of grafting clip (grafting clip) that is closest to the stems you have sowed.



## GROWTH BLOCKS



Seedlings are usually transplanted into rock wool growing blocks (**1 plant per block**) saturated with fertilizer solution approximately 14-21 days after sowing.



## PLANT SPACING

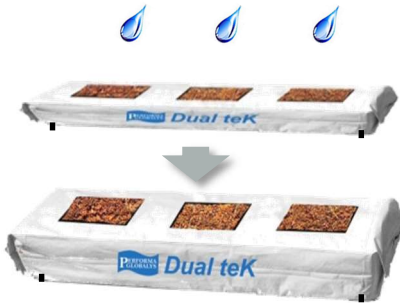
The usual density of adult plants is approximately **2.4 to 3.5 plants per square meter**. Plants can be arranged in double rows (example: **space of 0.6-0.8 meters between rows and 0.9-1.2 meters for paths**).

## SUBSTRATE



In coconut fiber, there can be between **3 and 6 tomato plants** per 100 cm long bag. 3 plants/bag for tomatoes where we keep 2 heads/plant and 5-6 plants for tomatoes 1 head/plant. We can also say that we use **between 3.5 and 5L of coconut substrate per plant**.

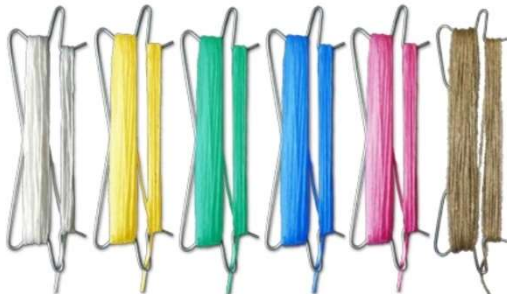
In the greenhouse, the “dry” bags must be placed on a hard, level surface. Leave a space of **3 cm between the bags** so that the substrate swells evenly. All damaged or broken bags should be put aside.



Before receiving the seedlings, the coconut fiber mats must be fully saturated with the nutrient solution. Using a conductivity meter, ensure that the salinity is between 2.5 and 3 mS/cm before placing the plants on the substrate. Please see the Coir Substrate Bags How to Use document for details on the inflation procedure.

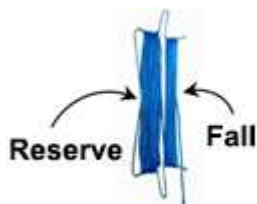
## PRUNING AND STAKING

### Pre-wound hooks and tomato clips



Metal wires are suspended 3-3.5 meters above the rows. **1 pre-wound hook per plant** is installed on the metal wire and a string falls to the plant.

The hooks are custom wound in 2 parts:



Fall: by pulling the string, you easily obtain the necessary length which will allow the plant to grow up to the wire.

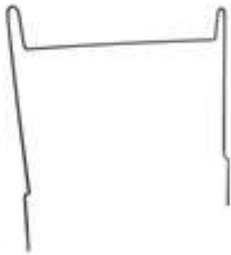
Reserve: corresponds to the length of twine necessary for the growth of the plant during production depending on the height of the greenhouses, the production schedule, etc.



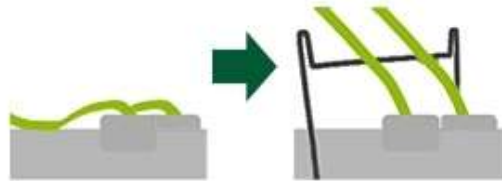
Tie the twine to the base of the plants, then add tomato clips to secure the stem to the twine as the plants grow. Tomato plants can grow at a rate of approximately **25 cm/week**. When the plant reaches the wire, untie the string to lower it periodically. We can calculate approximately **1 clip / plant / week**.



## Plant stem holder



Plant stem holder (single or double row width) can be added to raise the stems off the ground. In general you need approximately **1 support for every 4 feet**.



## FERTILIZERS

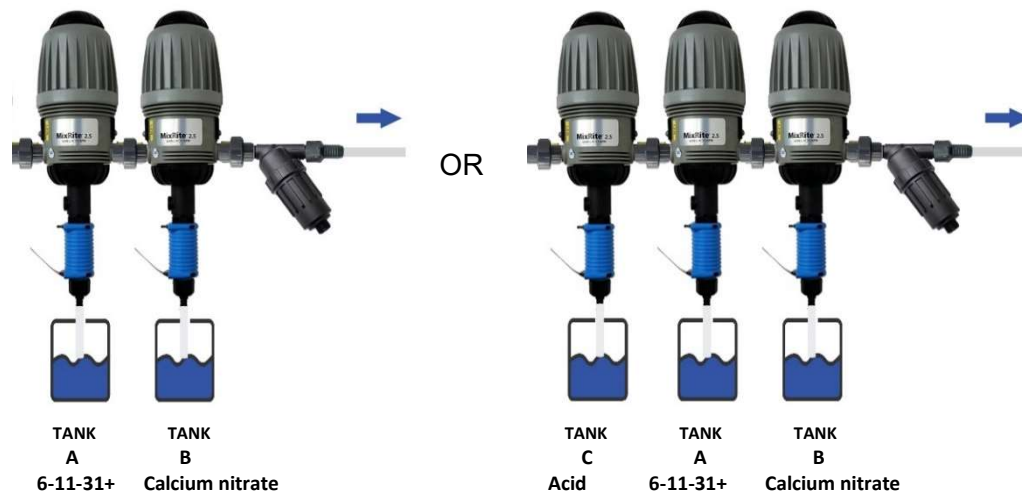
### Performa Globalys® 6-11-31+ combined with calcium



A fertilizer formulation with microelements such as Performa Globalys® 6-11-31+ combined with calcium nitrate can be used. This formulation is designed to meet the general needs of hydroponic greenhouse vegetables considering that irrigation water generally contains some calcium and magnesium.

Nutrient absorption rate varies depending on the growth stage of the plants and the concentration of fertilizer in the water must be adjusted over the weeks according to a desired electrical conductivity such as for example:

Germination: 0.0-1.0 mS/cm  
Production of young plants: 2.5-3.0 mS/cm  
Transplantation: 2.5-3.0 mS/cm  
Start of harvest: 2.7-3.5 mS/cm  
Full harvest: 2.7-4.0 mS/cm



DO NOT MIX 6-11-31+ and calcium nitrate concentrated stock solution in the same tank as they may form a precipitate. When 2 fertilizer injectors are used, the 6-11-31+ is put in a basin (tank A) and the calcium nitrate in a 2nd basin (tank B).

To obtain a daughter solution of 200 ppm of nitrogen, add 115 grams of 6-11-31+ and 85 grams of calcium nitrate in 100 liters of water.

Formula for estimating fertilizer requirements for a season:

**For example, if a production season lasts approximately 10 months (approximately 300 days)** and each plant consumes approximately 2.5 liters of solutions per day, for 500 plants the nutrient solution requirement is: 500 plants x 2.5L x 300 day = 375,000 liters of solution.

**Performa Globalys® 6-11-31+:** 115g (0.115kg) of 6-11-31 per 100L of water:  $375,000 / 100 * 0.115\text{kg} = 431\text{ kg}$  of 6-11-31+ (sold in 15kg bags), **so 29 bags / season**

**Calcium nitrate:** 85g (0.085kg) of calcium nitrate per 100L of water:  $375,000 / 100 * 0.085\text{kg} = 319\text{ kg}$  of calcium nitrate (sold in 25kg bags), therefore **13 bags / season**

Formula to calculate a quantity of soluble fertilizer to dilute according to any desired concentration in ppm:

$$\text{Quantity of fertilizer (g)} = \frac{\text{Desired concentration (ppm)} \times \text{volume of stock solution (litres)} \times \text{dilution factor}}{\% \text{ active ingredient} \times 10}$$

*Example :* for 100ppm of 6-11-31 nitrogen in a 20L bucket stock solution with a 1:100 injector:  $100\text{ppm} \times 20\text{L} \times 100 / (6 \times 10) = 3333\text{g}$  of fertilizer (or 3.3 kg)

## Fertilizing Using Simple Fertilizer Recipes

For an optimal effect of fertilization on the crop, it is best to weigh and mix different quantities of simple fertilizers (examples: potassium nitrate, calcium nitrate, monopotassium phosphate, potassium sulfate, magnesium sulfate, chelated iron, sulfate copper, manganese sulfate, zinc sulfate, boric acid, sodium molybdate) to make recipes that evolve with the growth of the plants. Please consult more detailed books (such as those in the “References” section at the end of this document) or an agronomist for more details on acid injection.

## Acid injection to lower pH



If phosphoric acid (or another type of acid) must be added to the water to lower the pH, this should be added to the water before adding fertilizer using a proportional injector dedicated to the acid or directly (diluted) a basin of daughter solution. Please consult more detailed books (such as those in the “References” section at the end of this document) or an agronomist for more details on acid injection.

## Measurement of pH and electrical conductivity

Regularly measure electrical conductivity using an EC meter (conductivity meter) and pH using a pH meter.



These 2 instruments need to be calibrated using a buffer solution (pH 4, pH 7 or 5 mS/cm solution) several times during the season, at a frequency which depends on the use made.

## HARVESTING AND STORAGE



The fruits are often harvested 3 times/week or every 2 days. They are picked by hand in the morning, pinching or breaking the calyx to preserve the green part of the fruit. Then carefully place the fruits flat to prevent the stems from puncturing the other tomatoes. Plastic boxes with or without cells help transport fruits while avoiding damage. Depending on the size of the fruit, **a box can contain between 16 and 66 fruits.**

## REFERENCES

- OMAFRA (2005) Growing Vegetables in Greenhouses, Publication 371E, Ontario Ministry of Agriculture, Food and Rural Affairs.
- SPSQ (2015) Guide to greenhouse tomatoes in Quebec, guide prepared by Agrisys consultants inc. for the Quebec greenhouse producers union.