Fertilization in hydroponic horticulture

Technical information sheet No. 4 1

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Hydroponic fertilizers

In hydroponics, plant nutrients are supplied dissolved in the irrigation water. Usually irrigation water is delivered to the plant via drip irrigation. There are important differences between fertilization for soil and for hydroponic rooting media. Soil fertilizers may reduce growth by too much ammonium, urea, sulphates, bicarbonates or trace elements.

The A,B and C tanks

The fertilizers need to be dissolved in water before use. To limit the storage tank volume, stock solutions are concentrated, usually 100 times, less is possible. To avoid precipitation in tanks and in irrigation lines:

- Fertilizers are fairly pure.
- Water for dissolving is preferably pure.
- The A tank holds Ca fertilizer and chelate.
- The B tank holds all sulphates and phosphates and other elements and the trace elements.
- KNO_3 is divided over the A and B tanks in such a way that the weight of fertilizer in the A and B tank is equal.
- The C tank holds the acid.

Single fertilizers

Single fertilizers are used because:

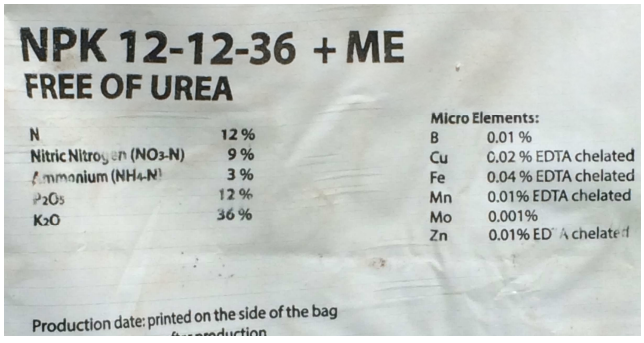
- Cheaper than compound fertilizers.
- Accuracy of ammonium dose.
- Accuracy of individual trace elements.
- More flexible recipes.
- Slightly worse water quality can be used.

Compound fertilizers

Compound fertilizers can only be used if they:

- Contain no ammonium nor urea
- Contain enough N and K
- Contain no sulphate
- Contain proper ratio of trace elements (or none at all)
- Are complemented by using calcium nitrate

All in all only compound fertilizers especially produced for hydroponic growing are reliable.



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Irrigation Water Quality

It is recommended to use irrigation water with the following quality parameters:

- EC should be <1.0 mS/cm, because yield drops 5-15% per unit EC excess
- Sodium (Na) should be < 1.0 mmol/L, because yield drops 5-15% per excess mmol/L Na
- Sulphates cause precipitations
- Bicarbonates must be neutralized with acid
- Fertilizer dosing must be reduced for elements present such as Ca, Mg, SO_4, B etc.

Recipes

Each crop has its specific need for elements:

- Recipes need to be corrected for elements already present in the irrigation water.
- Recipes need to be corrected for 2-4 crop stages:
  - filling the substrate
  - initial weeks after planting
  - vegetative growth
  - generative growth
- Recipes for open and close systems are different!
- Close system starts with a special start recipe to saturate the substrate.
- There is difference in EC between supply (irrigation, root environment and drain:

Crop	EC Root environment	EC Drain	EC Irrigation
Tomato	4	5	3.2
Cucumber	3.5	4	2.8
Lettuce	2.5		2.3
Lettuce winter	3.5		3
Sweet pepper	3.5	4	2.8
Egg-plant	3.7	4.3	3

Fertilizer calculation in kg/tank

To minimise the chance of not finding a required recipe, a certain order is used:

1. Add acids to neutralize bicarbonate & pH
2. Add ammonium as NH_4NO_3 or $NH_4H_2PO_4$
3. Add phosphates as KH_2PO_4
4. Add calcium as calcium nitrate
5. Add magnesium as $Mg(NO_3)_2$ or $MgSO_4$
6. Add Sulphates as K_2SO_4
7. Add potassium as KNO_3 and K_2SO_4

It is a good idea to use a calculator app:
http://www.wageningenur.nl/en/Research-Results/Projects-and-programmes/Euphoros-1/Calculation-tools/Nutrient-Solution-Calculator.htm

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