Nutrient solutions

In 1933 a recipe for a solution that provides every nutrient essential for plant growth was developed by Hoagland and Arnon. Over the years modifications have been made. Below are recipes for preparing a full nutrient solution. Deficiency effects may be investigated by omitting the nutrient to be investigated.

Stock solutions

Primary and secondary nutrients
- 1 mol dm$^{-3}$ potassium nitrate
- 1 mol dm$^{-3}$ calcium nitrate
- 1 mol dm$^{-3}$ potassium dihydrogenphosphate
- 1 mol dm$^{-3}$ magnesium sulfate
- 0.05 mol dm$^{-3}$ calcium hydrogenphosphate
- 0.01 mol dm$^{-3}$ calcium sulfate-2-water
- 0.5 mol dm$^{-3}$ potassium sulfate
- 1 mol dm$^{-3}$ magnesium sulfate
- 15 g dm$^{-3}$ Sprint 138 iron chelate (Fe-EDDHA)

Micronutrient stock solution
- 2.86 g dm$^{-3}$ boric acid
- 1.81 g dm$^{-3}$ manganese chloride-4-water
- 0.22 g dm$^{-3}$ zinc sulfate-7-water
- 0.08 g dm$^{-3}$ copper sulfate-5-water
- 0.02 g dm$^{-3}$ 85% molybdic acid

When diluted 1:1000 this provides the following:
- 0.5 ppm boron
- 0.5 ppm manganese
- 0.05 ppm zinc
- 0.02 ppm copper
- 0.01 ppm molybdenum

Full nutrient solution

Add the following quantities of stock solutions to 1 dm$^3$ of water
- 5 cm$^3$ of 1 mol dm$^{-3}$ potassium nitrate
- 5 cm$^3$ of 1 mol dm$^{-3}$ calcium nitrate
- 1 cm$^3$ of 1 mol dm$^{-3}$ potassium dihydrogenphosphate
- 2 cm$^3$ of 1 mol dm$^{-3}$ magnesium sulfate
- 1 cm$^3$ of micronutrient stock solution
- 1.5 cm$^3$ of 15 g dm$^{-3}$ Sprint 138 iron chelate (Fe-EDDHA) [about 3 ppm Fe in Hoagland solution]

Nutrient solution minus nitrogen

Add the following quantities of stock solutions to 1 dm$^3$ of water
- 10 cm$^3$ of 0.05 mol dm$^{-3}$ calcium hydrogenphosphate
- 200 cm$^3$ of 0.01 mol dm$^{-3}$ calcium sulfate-2-water
- 5 cm$^3$ of 0.5 mol dm$^{-3}$ potassium sulfate
- 2 cm$^3$ of 1 mol dm$^{-3}$ magnesium sulfate
- 1 cm$^3$ of micronutrient stock solution
- 1.5 cm$^3$ of 15 g dm$^{-3}$ Sprint 138 iron chelate (Fe-EDDHA)

Add some calcium nitrate to give a Hoagland’s solution with some nitrogen but less than 100% nitrogen, e.g. 10% nitrogen is supplied by 0.75 cm$^3$ of 1 mol dm$^{-3}$ calcium nitrate.