a Welke twee zoutoplossingen zou hij daarvoor kunnen gebruiken? Geef de oplosvergelijkingen voor beide zouten.
Noem de oplossingen resp. oplossing A en oplossing B

b Geef de reactievergelijking van de bereiding van het ijzer(III)sulfide

Vervolgens filtreert hij het reactieproduct.
Edwin had van te voren kunnen uitrekenen hoeveel hij van oplossing A en hoeveel van oplossing B bij elkaar had moeten doen om van geen van beide oplossingen een overmaat te hebben. Hij heeft dat echter niet gedaan.

c Beredeneer welke ionen in het residu zitten als hij een overmaat van oplossing A heeft gebruikt.

d Doe dat ook als hij een overmaat van oplossing B had gebruikt.

e Welke vaste stoffen kunnen er ontstaan als hij bij vraag d het residu gaat indampen. Geef één van de mogelijke indampreacties.

ACTIVITEIT 7 WAT ATEN DE PLANTEN EN WAT DEDEN ZE ERMEE?

In **Practicum 2** heb je onderzocht welke elementen voorkomen in planten-as. Die elementen hebben planten blijkbaar uit de bodem of voedingsoplossing opgenomen.
We kunnen uit het onderzoek aan de as niet meteen uitsluiten dat sommige elementen als het ware zijn binnengedrongen zonder dat ze nodig waren.

Vragen

67 Zou er in jouw huid zout zitten als je lang in zee gezwommen hebt?

68 Welke proef laat zien dat alle elementen die in as voorkomen ook nodig waren?

69 Waar komen de elementen H, C en O in plantenmateriaal vandaan?

De andere elementen komen niet zomaar aanwaaien.

70 Waar komen die vandaan?

71 Hoe kom je te weten of je iets moet geven en hoeveel dan wel?

Planten hebben nogal wat elementen nodig. Behalve de aangegeven elementen, is er nog een hele lijst met sporenelementen. Dit zijn elementen waar maar heel weinig van nodig is, maar waarbij het ontbreken tot ziekten en sterfte kunnen leiden.

72 Lees het volgende artikel:

Nutrient Concentration and Function in Plants

Plants require 13 mineral nutrient elements for growth. The elements that are required or necessary for plants to complete their life cycle are called essential plant nutrients. Each of these nutrients has a critical function in plants and are required in varying amounts in plant tissue (Table 1). Macronutrients (nitrogen, phosphorus, potassium, calcium, magnesium and sulfur) are plant nutrients required in the largest amount in plants. Micronutrients (iron, copper, manganese, zinc, boron, molybdenum and chlorine) are required in relatively smaller amounts. Additional mineral nutrient elements which are beneficial to plants but not necessarily essential include sodium, cobalt, vanadium, nickel, selenium, aluminum and silicon. The nutrient elements differ in the form they are absorbed by the plant, by their functions in the plant, by their mobility in the plant and by the plant deficiency or toxicity symptoms characteristic of the nutrient.

Nutrient Deficiency or Toxicity

Nutrient deficiency or toxicity symptoms often differ among species and varieties of plants. A nutrient deficiency occurs when the nutrient is not in sufficient quantity to meet the needs of the growing plant. Nutrient toxicity occurs when a plant nutrient is in excess and decreases plant growth or quality. One way to understand the differences in nutrient deficiency symptoms among the plants is knowing the function and the relative mobility of the nutrient within the plant. Table 2 describes the general symptoms of nutrient deficiency and excess often observed for those nutrients. Some nutrients, such as nitrogen, phosphorus, potassium, magnesium, chlorine and zinc, can be easily remobilized within the plant from old plant parts to actively growing plant parts such as young leaves. Other nutrients, such as sulfur, iron, copper, manganese, boron and calcium, are not easily remobilized within the plant. Therefore, the deficiency of the mobile elements usually initially occurs with older leaves while that of the immobile nutrients occurs with the young leaves or stem tips. Five types of deficiency or toxicity symptoms are observed:

- Chlorosis - yellowing of plant tissue due to limitations on chlorophyll synthesis. This yellowing can be generalized over the entire plant, localized over entire leaves or isolated between some leaf veins (i.e. interveinal chlorosis).
- Necrosis - death of plant tissue sometimes in spots.
- Accumulation of anthocynanin resulting in a purple or reddish color.
- Lack of new growth.
- Stunting or reduced growth - new growth continues but it is stunted or reduced compared to normal plants.

Nutrient deficiencies may not be apparent as striking symptoms such as chlorosis on the plant, especially when mild deficiency is occurring. However, significant reductions in crop yields can occur with such deficiencies. This situation is termed "hidden hunger" and can only be detected with plant tissue analysis or yield decline. However, experience with growing a specific plant species or variety can greatly help in distinguishing poor crop performance and possible nutrient deficiency symptoms from normal plant growth.

Tabel 7: **Essential plant nutrients: their relative amounts in plants, functions and classification**
***Relative amounts of mineral elements compared to nitrogen in dry shoot tissue. May vary depending on plant species.**

Name	Chemical symbol	Relative % in plant*	Function in plant	Nutrient category
Nitrogen	N	100	Proteins, amino acids	Primary macronutrients
Phosphorus	P	6	Nucleic acids, ATP	
Potassium	K	25	Catalyst, ion transport	
Calcium	Ca	12.5	Cell wall component	Secondary macronutrients
Magnesium	Mg	8	Part of chlorophyll	
Sulfur	S	3	Amino acids	

➔ Vervolg tabel op pagina 33

➔ Vervolg van pagina 33

Name	Chemical symbol	Relative % in plant*	Function in plant	Nutrient category
Iron	Fe	0.2	Chlorophyll synthesis	Micronutrients
Copper	Cu	0.01	Component of enzymes	
Manganese	Mn	0.1	Activates enzymes	
Zinc	Zn	0.03	Activates enzymes	
Boron	B	0.2	Cell wall component	
Molybdenum	Mo	0.0001	Involved in N fixation	
Chlorine	Cl	0.3	Photosynthesis reactions	

Tabel 8: Generalized Symptoms of Plant Nutrient Deficiency or Excess

Plant Nutrient	Type	Visual symptoms
Nitrogen	Deficiency	Light green to yellow appearance of leaves, especially older leaves; stunted growth; poor fruit development.
	Excess	Dark green foliage which may be susceptible to lodging, drought, disease and insect invasion. Fruit and seed crops may fail to yield.
Phosphorus	Deficiency	Leaves may develop purple coloration; stunted plant growth and delay in plant development.
	Excess	Excess phosphorus may cause micronutrient deficiencies, especially iron or zinc.
Potassium	Deficiency	Older leaves turn yellow initially around margins and die; irregular fruit development.
	Excess	Excess potassium may cause deficiencies in magnesium and possibly calcium.
Calcium	Deficiency	Reduced growth or death of growing tips; blossom-end rot of tomato; poor fruit development and appearance.
	Excess	Excess calcium may cause deficiency in either magnesium or potassium
Magnesium	Deficiency	Initial yellowing of older leaves between leaf veins spreading to younger leaves; poor fruit development and production.
	Excess	High concentration tolerated in plant; however, imbalance with calcium and potassium may reduce growth.
Sulfur	Deficiency	Initial yellowing of young leaves spreading to whole plant; similar symptoms to nitrogen deficiency but occurs on new growth.
	Excess	Excess of sulfur may cause premature dropping of leaves.

➔ Vervolg tabel op pagina 34

➔ Vervolg van pagina 33

Plant Nutrient	Type	Visual symptoms
Iron	Deficiency	Initial distinct yellow or white areas between veins of young leaves leading to spots of dead leaf tissue.
	Excess	Possible bronzing of leaves with tiny brown spots.
Manganese	Deficiency	Interveinal yellowing or mottling of young leaves.
	Excess	Older leaves have brown spots surrounded by a chlorotic circle or zone.
Zinc	Deficiency	Interveinal yellowing on young leaves; reduced leaf size.
	Excess	Excess zinc may cause iron deficiency in some plants.
Boron	Deficiency	Death of growing points and deformation of leaves with areas of discoloration.
	Excess	Leaf tips become yellow followed by necrosis. Leaves get a scorched appearance and later fall off.

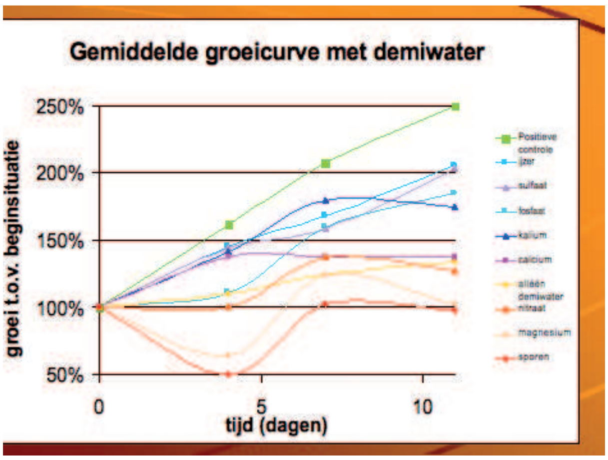
Adapted from: W.F. Bennett (editor), 1993. Nutrient Deficiencies & Toxicities in Crop Plants, APS Press, St. Paul, Minnesota.

Afkomstig:

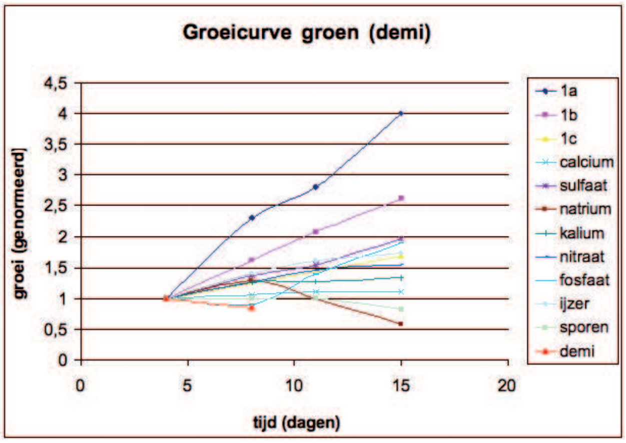
➔ http://www.cartage.org.lb/en/themes/Sciences/BotanicalSciences/PlantHormones/EssentialPlant/EssentialPlant.htm

Je kunt je wel voorstellen dat deze tabellen heel veel en zorgvuldig experimenteren hebben gekost.

73 Kijk eens terug naar de plantjes die jullie lieten groeien in Practicum 1. Probeer de deficiënties die je ziet te koppelen aan de bovenstaande tabellen. Kies drie elementen uit en maak een kort verhaaltje met als kernwoorden:
Element … is nodig om ervoor te zorgen……; het komt in de plant voor in …..
Geef ook antwoord op de vraag: En wat deden ze ermee?” Gebruik als het allemaal niet meer zo duidelijk is eventueel de onderstaande groeicurves.



Figuur: 6: groeicurves van planten met verschillende ionen



Figuur 7: groeicurve van planten met verschillende ionen, waarbij 1a, b en c planten zijn, die in de complete voeding zijn opgetrokken