

Hydroponic nutrient management for better crop yield and environmental sustainability

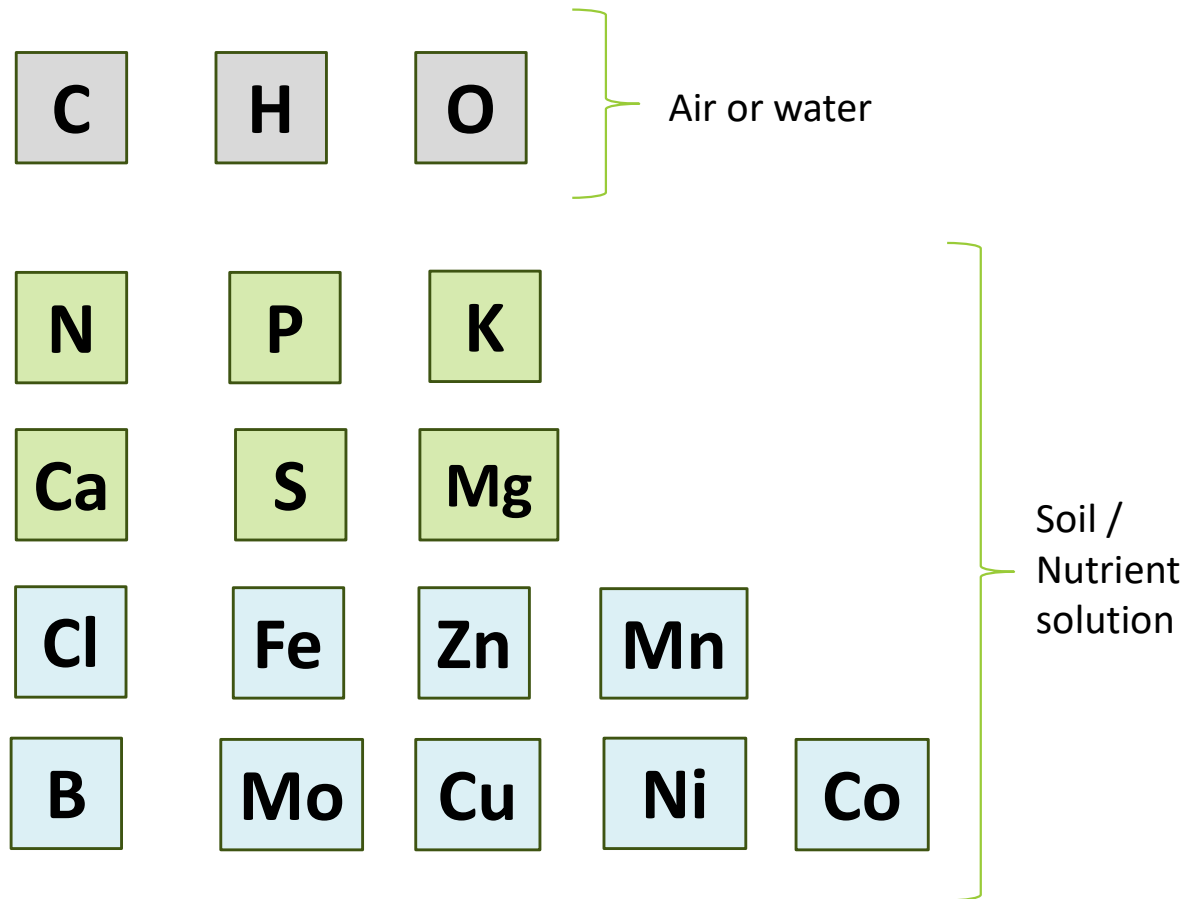
Shizuoka-Singapore Agri Food Forum 2023

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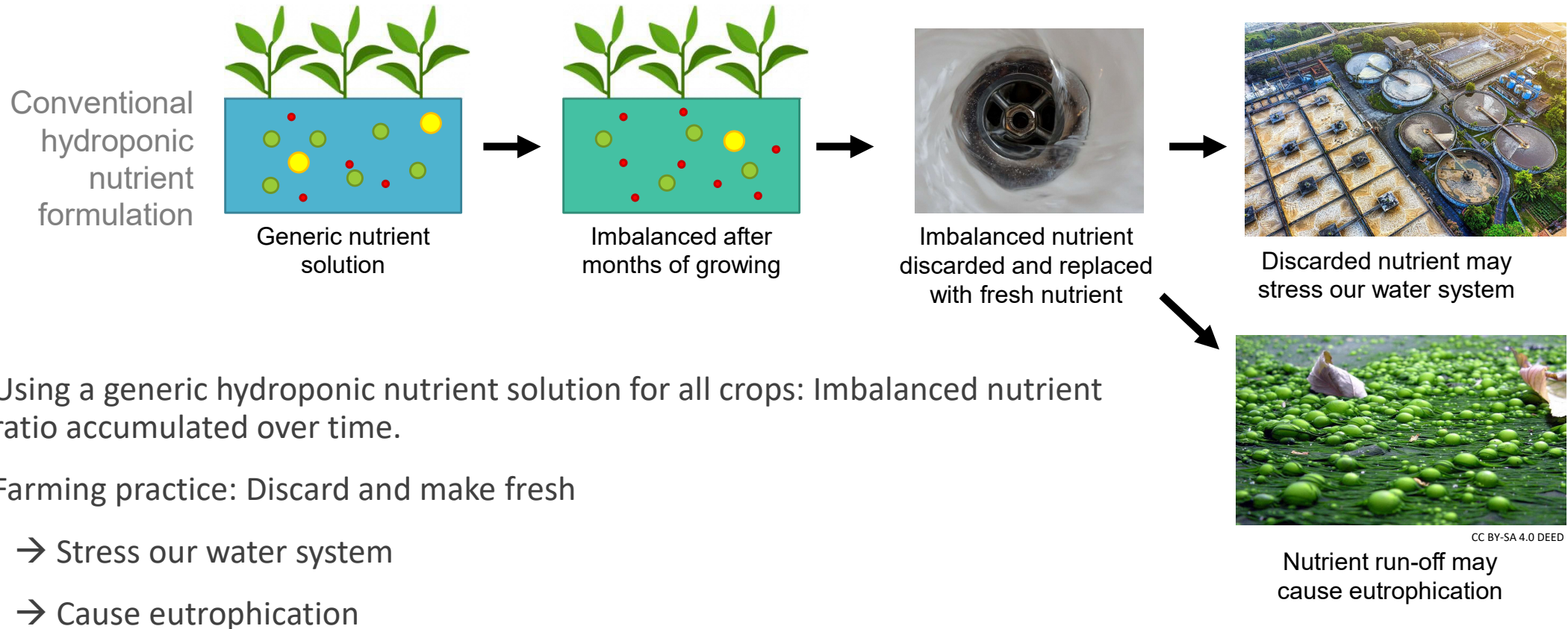
AGRICULTURE RESEARCH AND INNOVATION CENTRE, REPUBLIC POLYTECHNIC

Plant nutrient requirement

- Plant requires 16 – 18 nutrients for healthy growth.
- Majority of nutrients come from soil, or nutrient solution for hydroponics.
- Plant requires different nutrients at different developmental stages.
- Different plant species and cultivars have different nutrient requirements.



Conventional hydroponic nutrient formulation



Plant-specific nutrient formulation



Image: Flaticon.com

Formulate nutrient

- >10 solution recipes

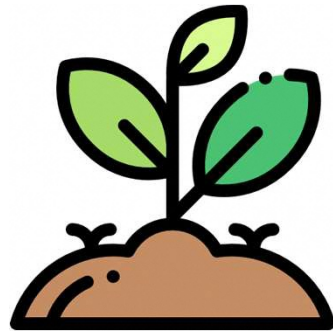
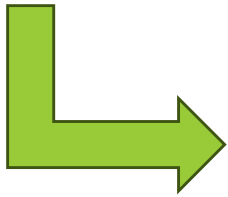


Image: www.freepik.com

Test on various vegetables

- Asian leafy greens (e.g. Kailan, Cai Xin, Mustard)
- Temperate crops (e.g. Lettuce, Kale, Mizuna)

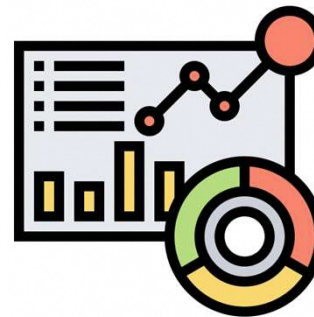
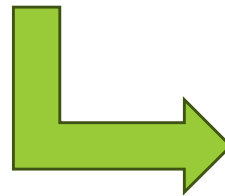


Image: Flaticon.com

Measure

- Fresh weight
- Nutrient consumption
- Water consumption

Optimized nutrient recipe: Better plant growth

Plant growth using our nutrient solution recipes.

- Tested on Asian leafy greens (e.g. Cailan, Cai Xin, Mustard) and several temperate crops (e.g. Lettuce, Kale, Mizuna).
- Some of our formulae were superior compared to control commercial nutrient solution.

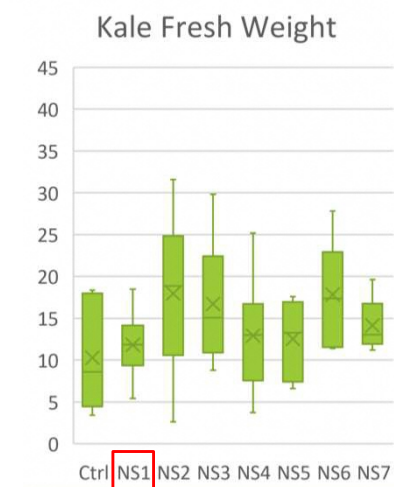
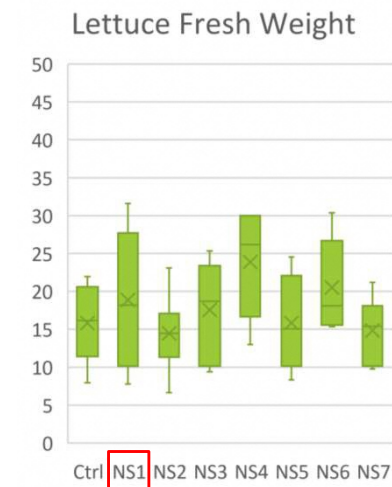
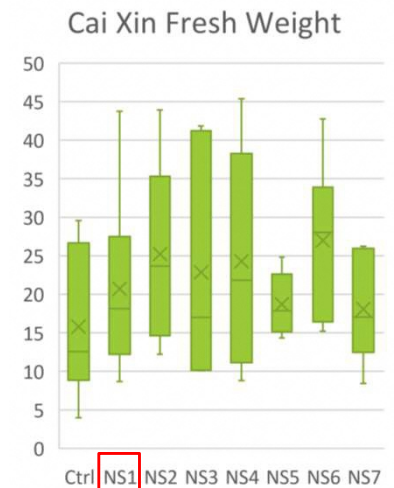
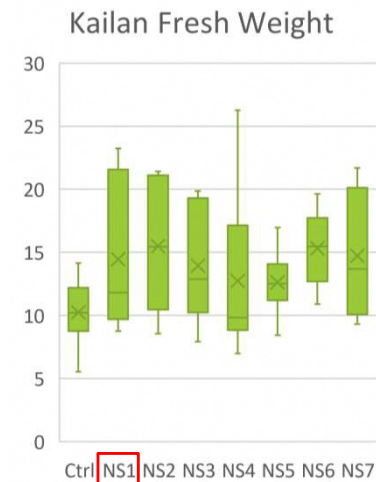
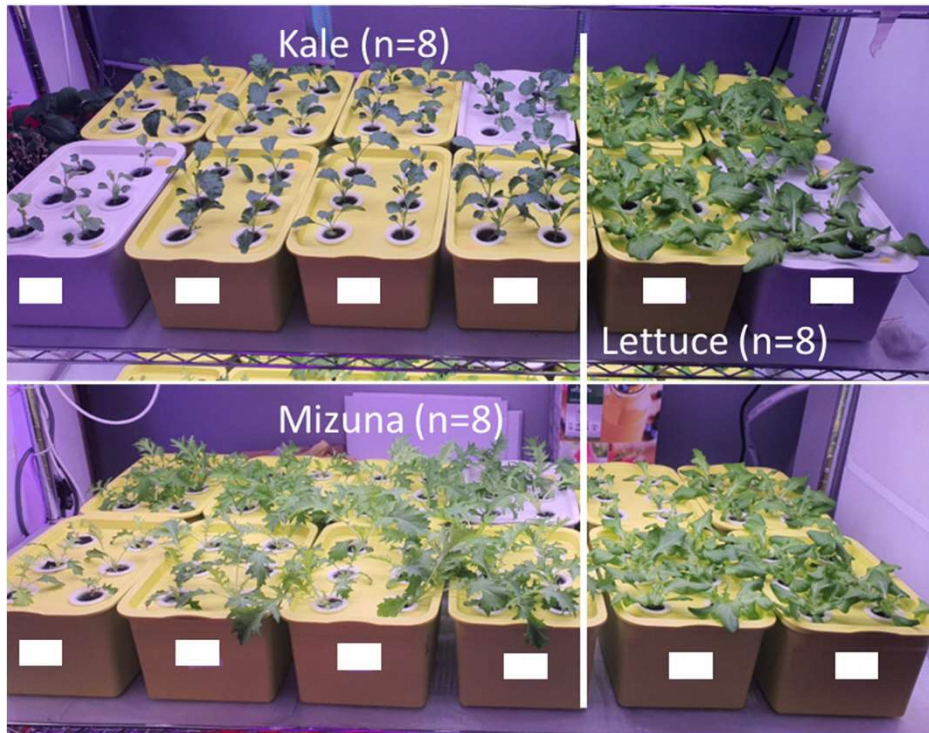


*Ctrl: Control commercial nutrient solution

Optimized nutrient recipe: Better plant growth

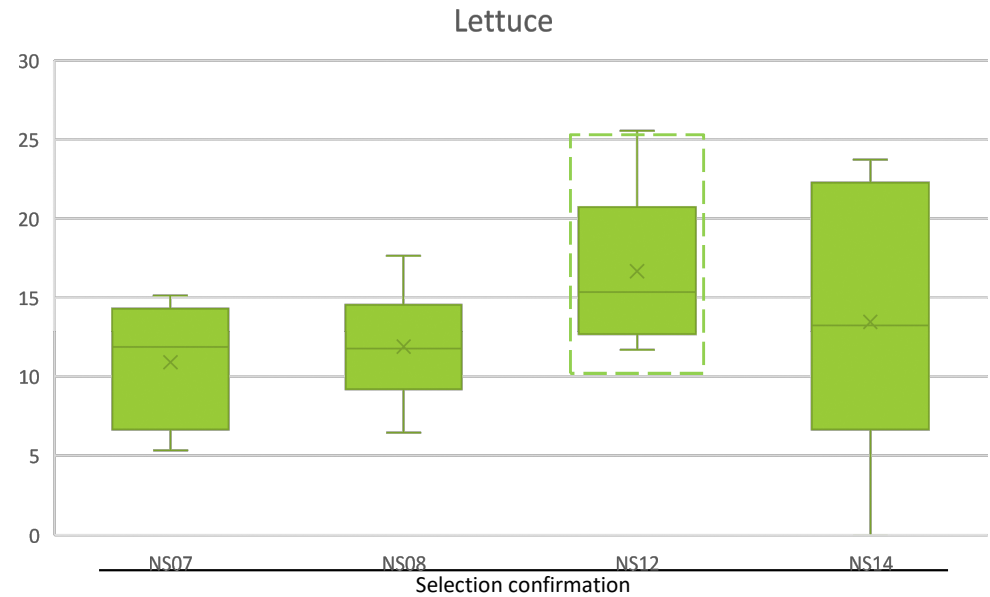
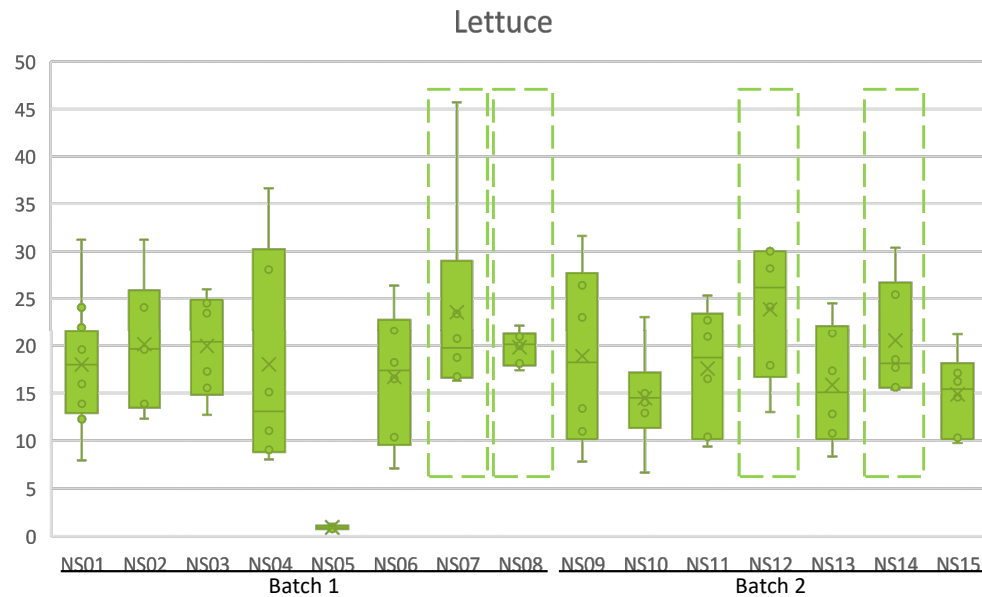
Crop species responded differently to each nutrient recipe:

- E.g. NS1 was found to be superior for Kailan and Lettuce, but not for Cai Xin and Kale.
- Supporting previous theory, that different crops have different nutrient requirements.



Optimized nutrient recipe: Better plant growth

Selection of superior formulation for further adjustment.



Optimized nutrient recipe: Reduced wastage

Analyze and optimize the nutrient usage:

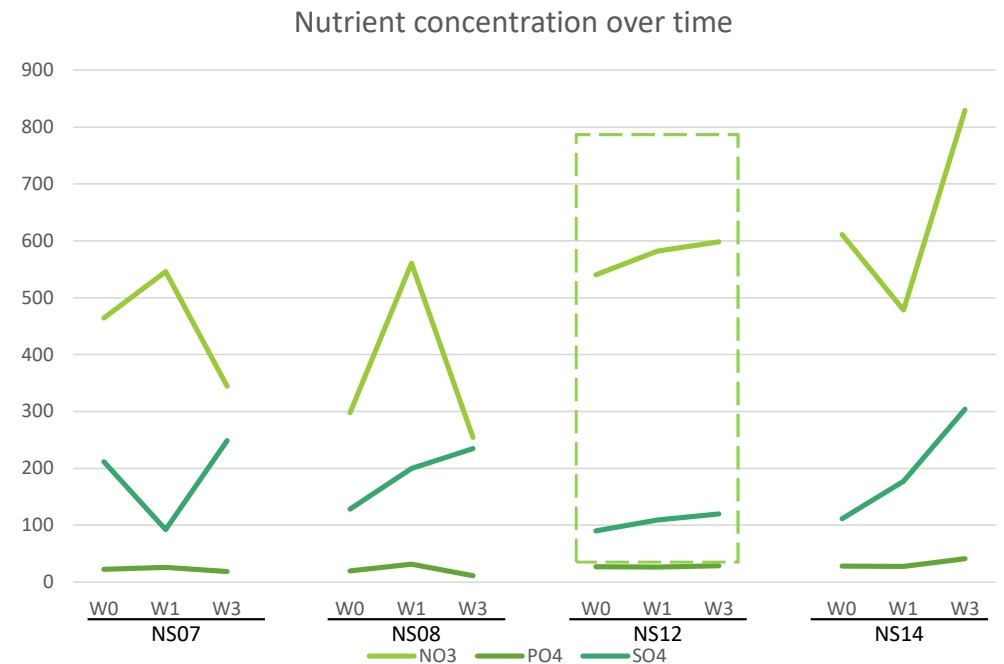
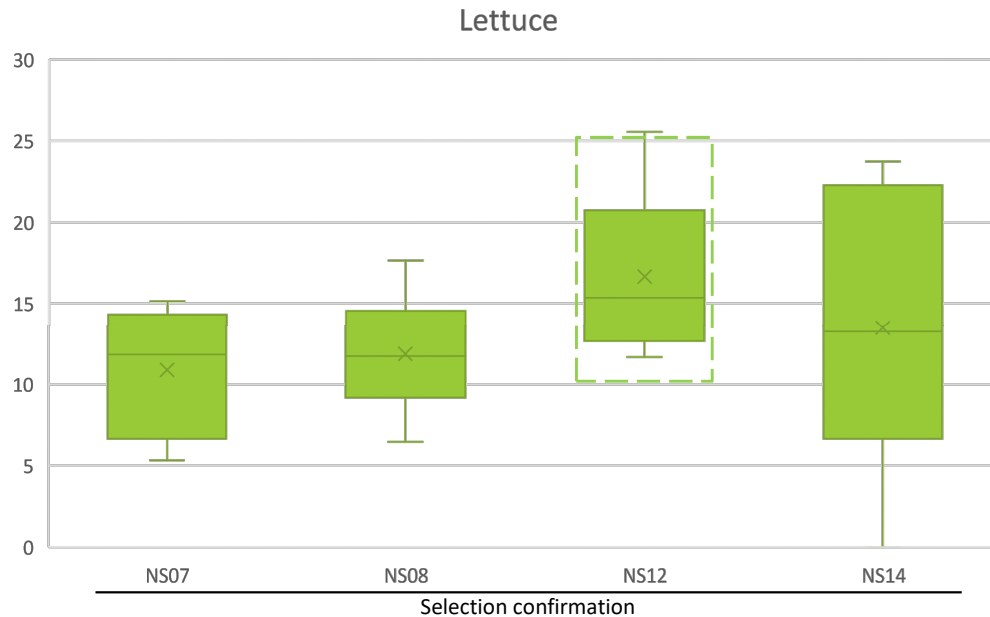
- Nutrient solutions collected periodically.
- Nutrient usage analyzed via ion chromatography and finetuned further.



Optimized nutrient recipe: Reduced wastage

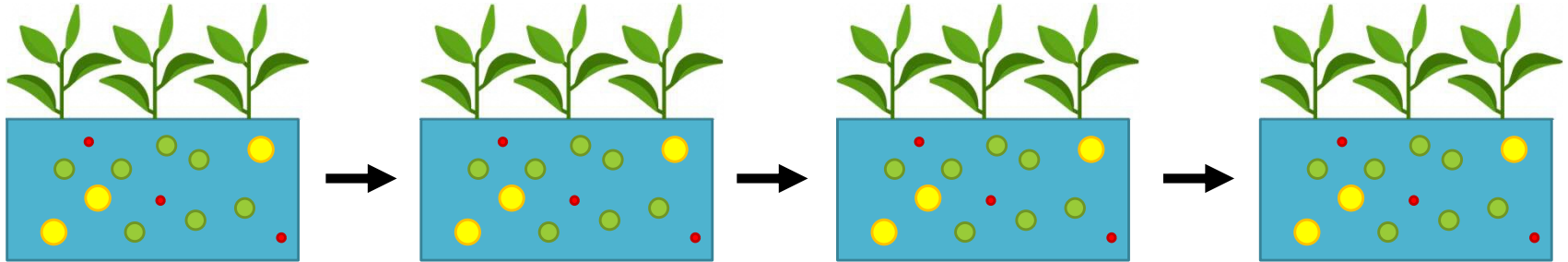
Some nutrient recipe showed fluctuation.

Results suggested a stable nutrient concentration in the solution is beneficial for plant growth.

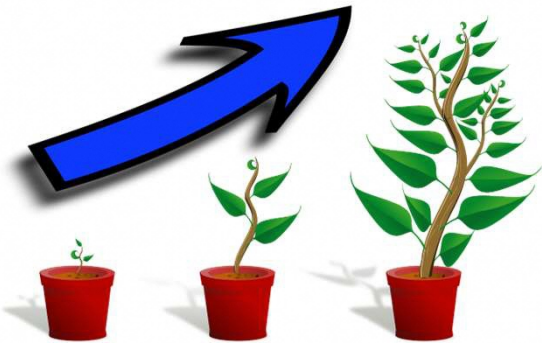


Plant-specific nutrient formulation

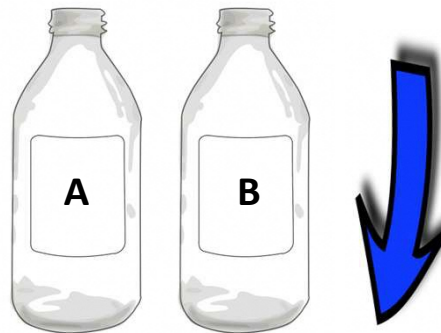
**Plant-specific
nutrient
formulation**



Optimized nutrient content throughout growth cycles: Need not be discarded after several growth cycles



Customized nutrient solution for each crop type ensures better growth (e.g. 10 – 30% increase observed in Cai Xin).

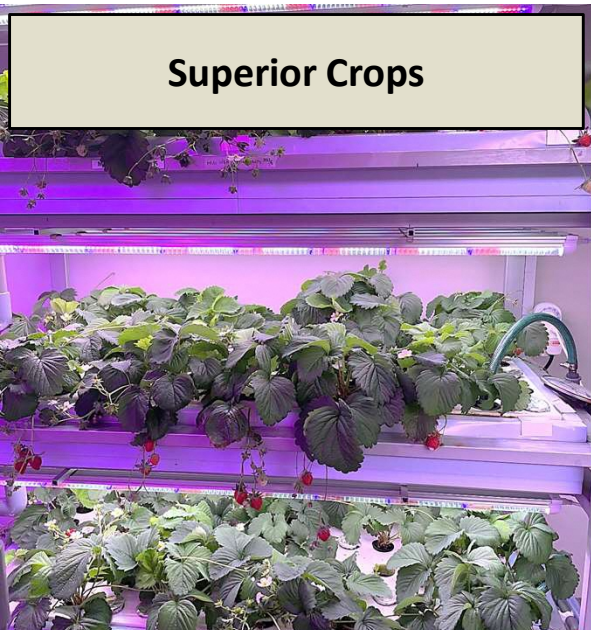


Reduce nutrient solution wastage. Cost-saving.



Reduce impact on environment.

Superior Crops



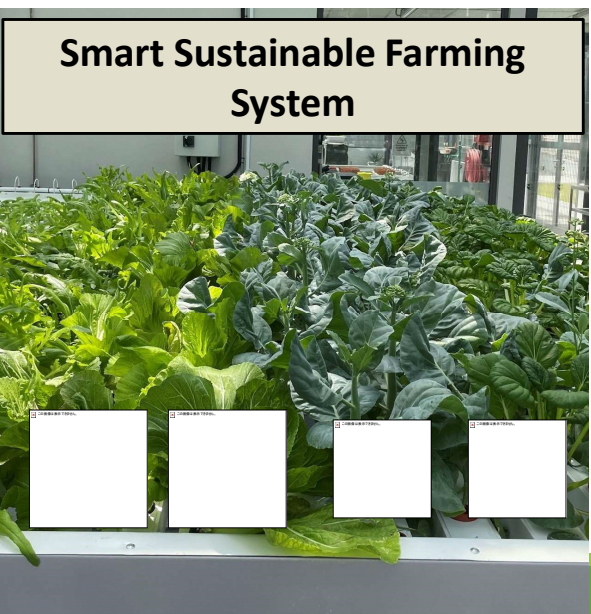
Resource Efficient and Productive Cultivation



Crop Protection



Smart Sustainable Farming System



Agriculture Research and Innovation Centre

Key research programmes to support
the Agri-tech industry

Agribusiness



Thank you!