The background is a deep blue with a subtle pattern of diagonal lines. Overlaid on this are several light blue, semi-transparent decorative elements: a large globe in the upper right, and various swirling, floral-like motifs scattered across the scene. The text is centered in a bold, black, sans-serif font.

Nitrogen Transformations in Aquaponic System

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Clyde S. Tamaru and Samir Kumar Khanal*

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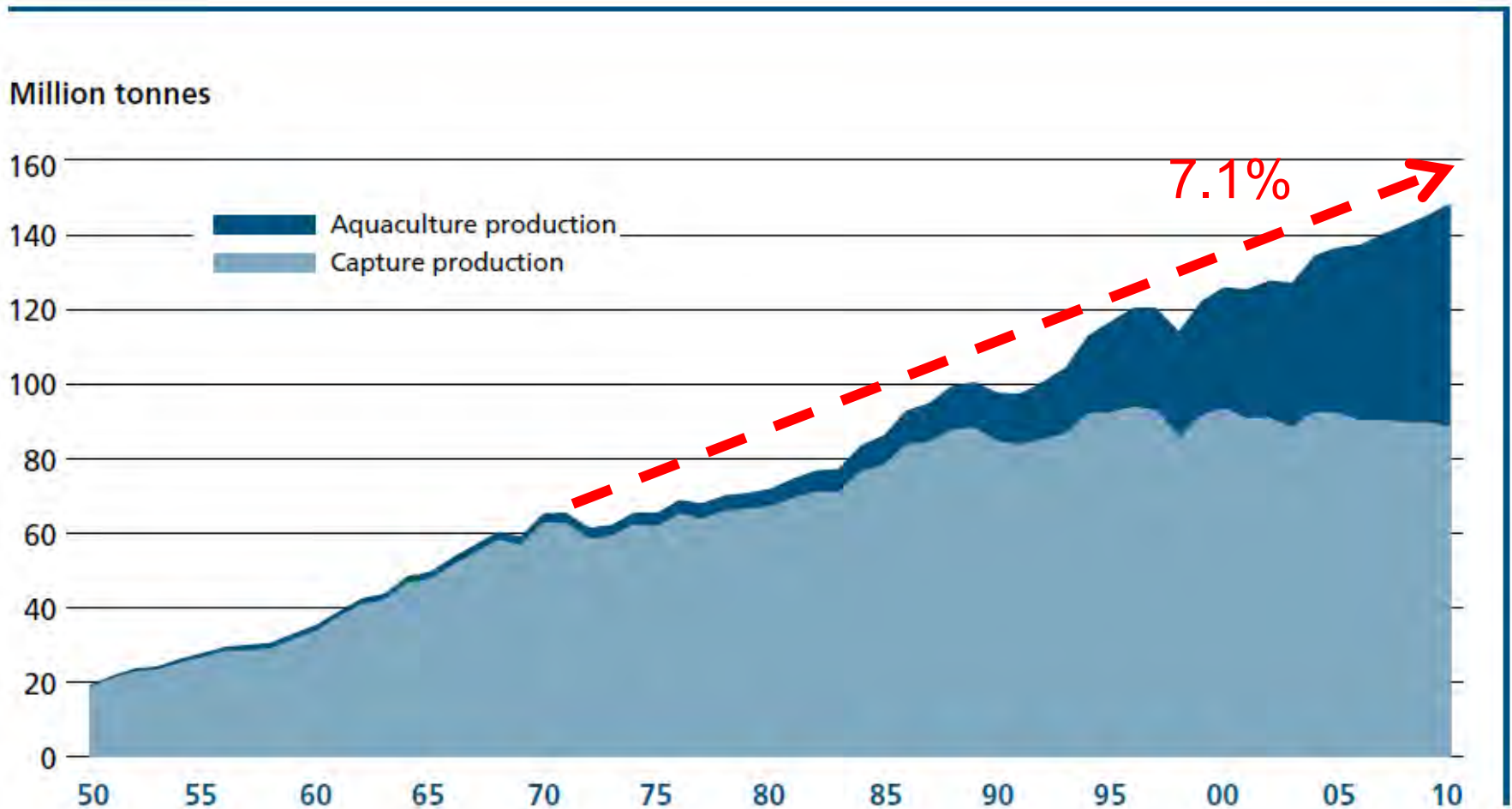
- Introduction
- Experiment setup
- Results and Discussion
- Conclusions

1. Introduction



- Aquaculture





World capture fisheries and aquaculture production.

Aquaculture

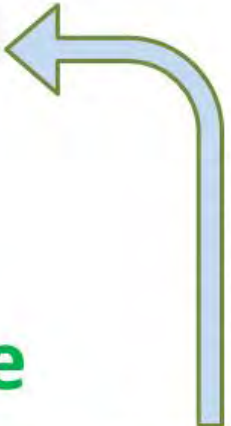


Fish produce waste



Aquaponics cycle

Clean water return to aquaculture tank



Microbes convert fish waste to fertilizers for plants



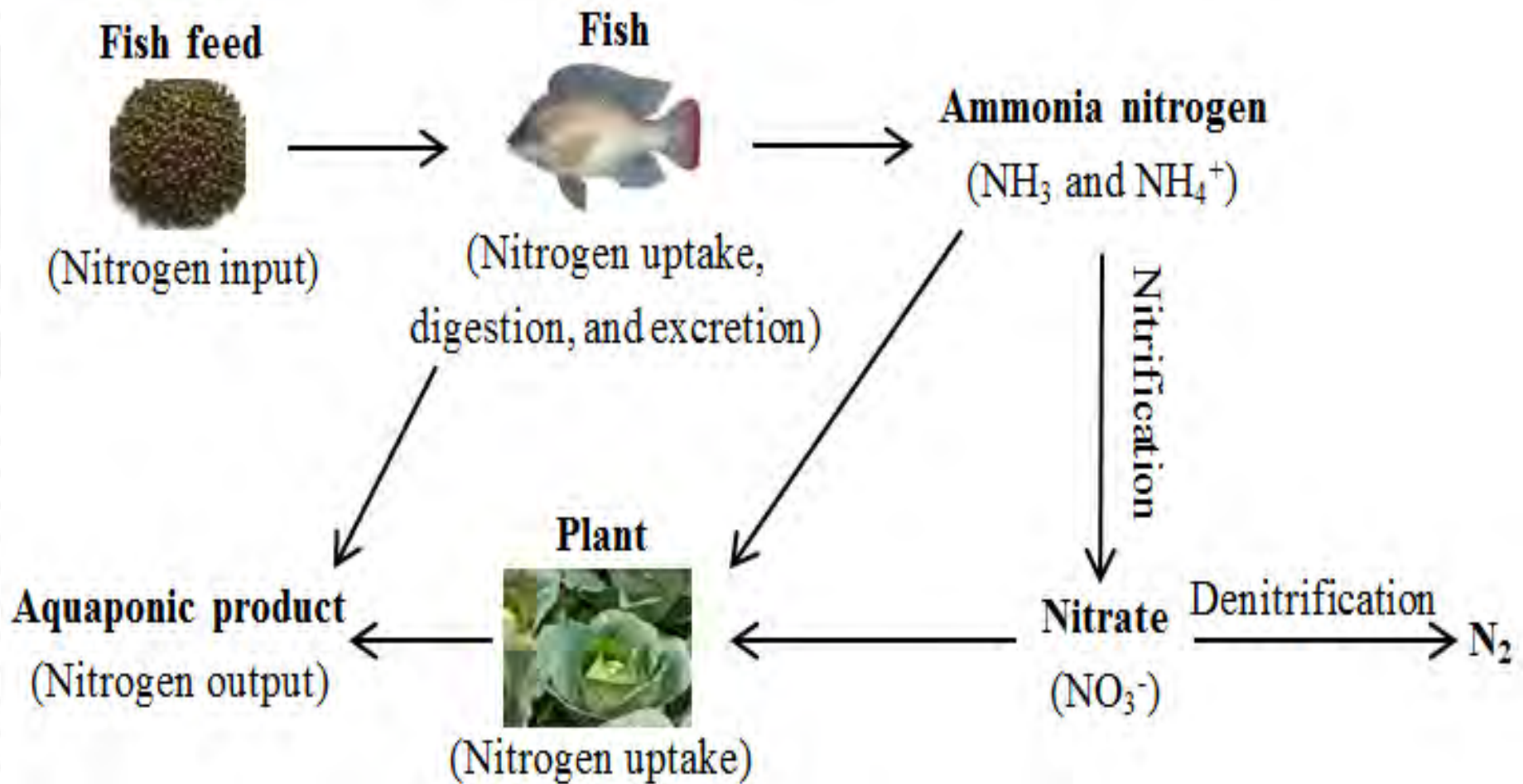
Microbes

Hydroponics

Aquaponics cycle

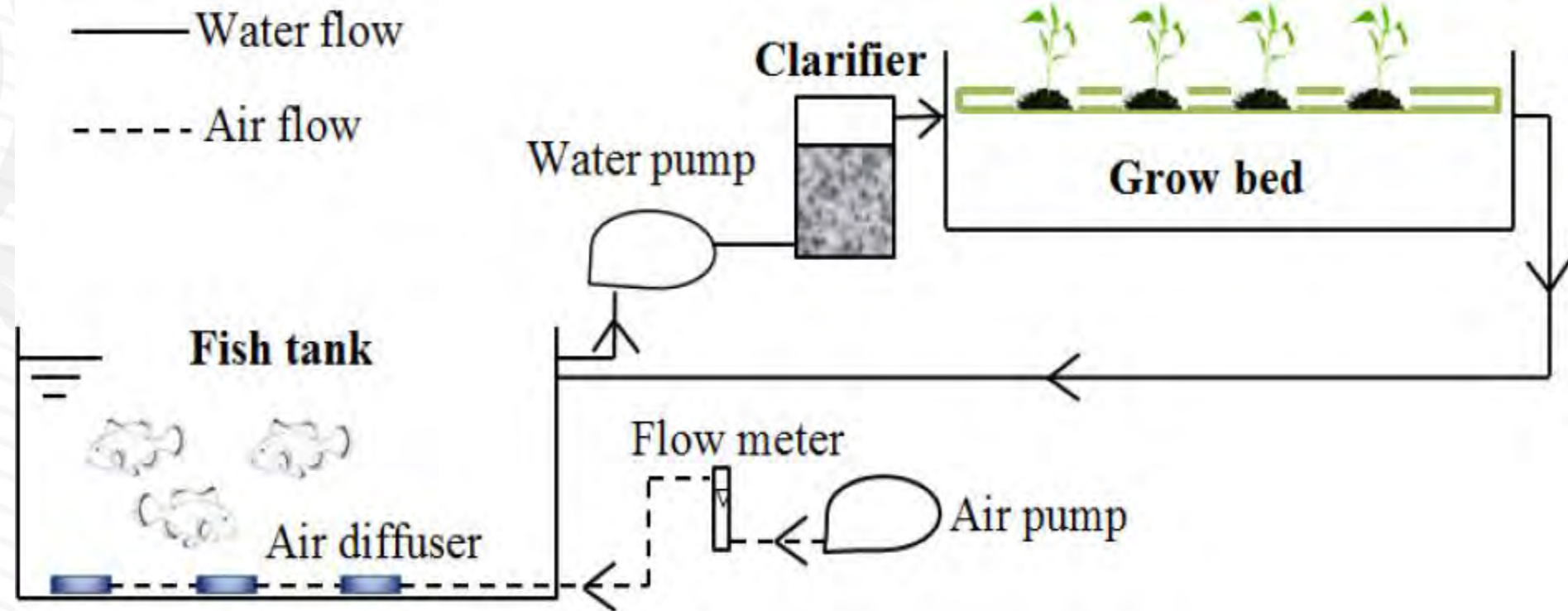
Advantages of aquaponics

- Improve nutrient retention efficiency
- Reduce water usage
- No wastewater discharge to the environment
- Two crops are produced from one input



Nitrogen transformations in aquaponic system

2. Experiment setup



Schematic diagram of an aquaponic system



Our greenhouse



Tank and fish



Grow bed



Photo of our aquaponic systems

3. Results and Discussion

■ 3.1 Aquaponics performance

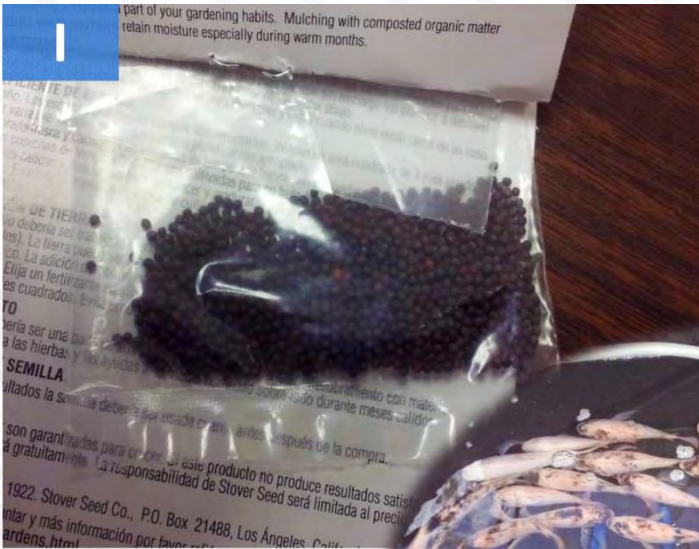


Tomato



Pak Choi

13.9 kg Tomato fruits, and 24.9 kg Pak Choi leaves.

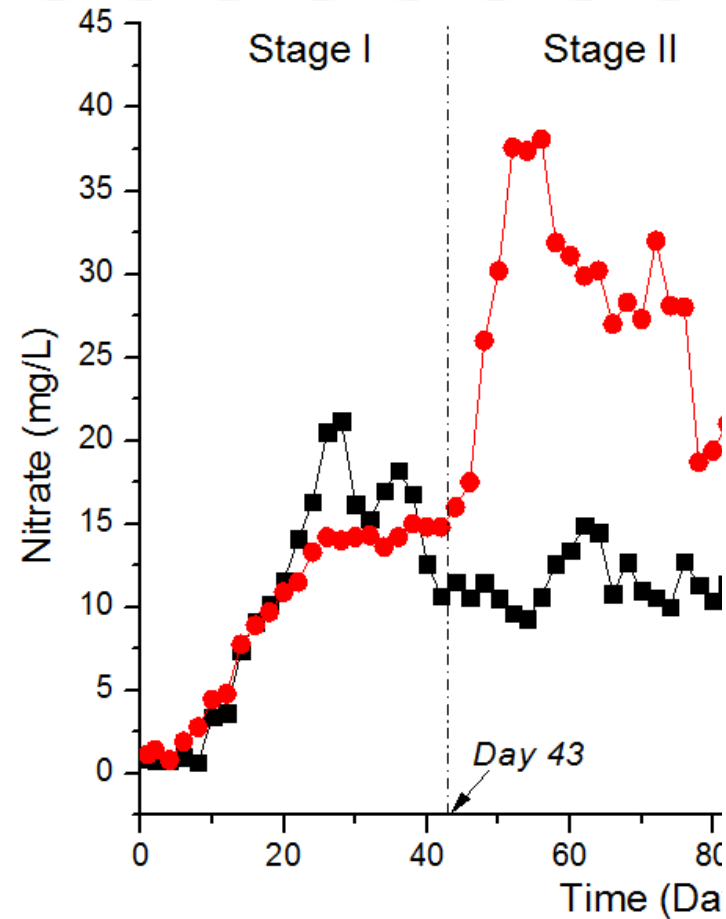


Life cycle of Pak Choi in aquaponics

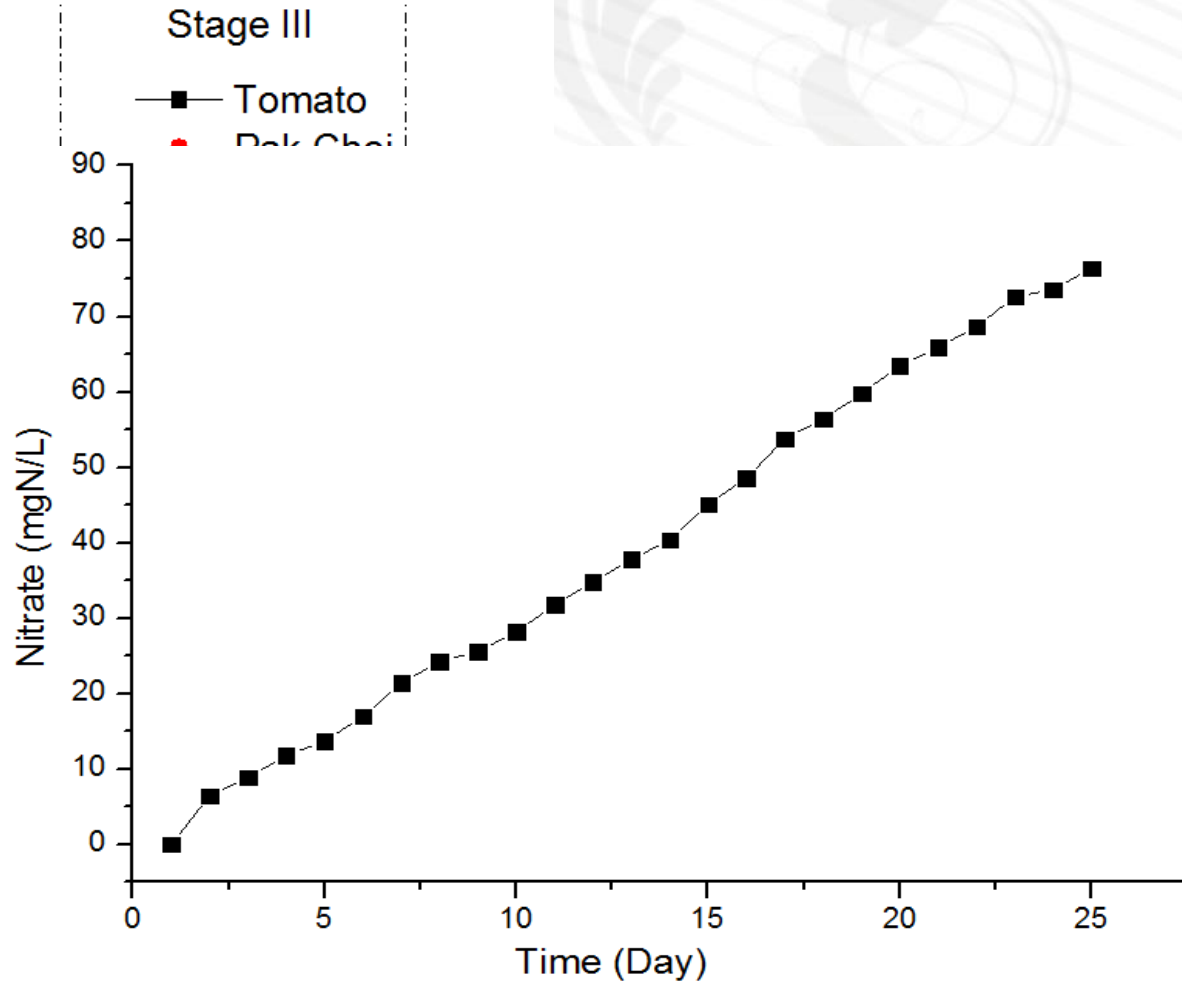


Pak Choi roots two weeks (A) and six weeks (B) after transplantation

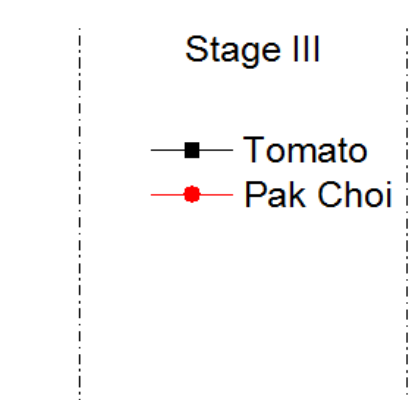
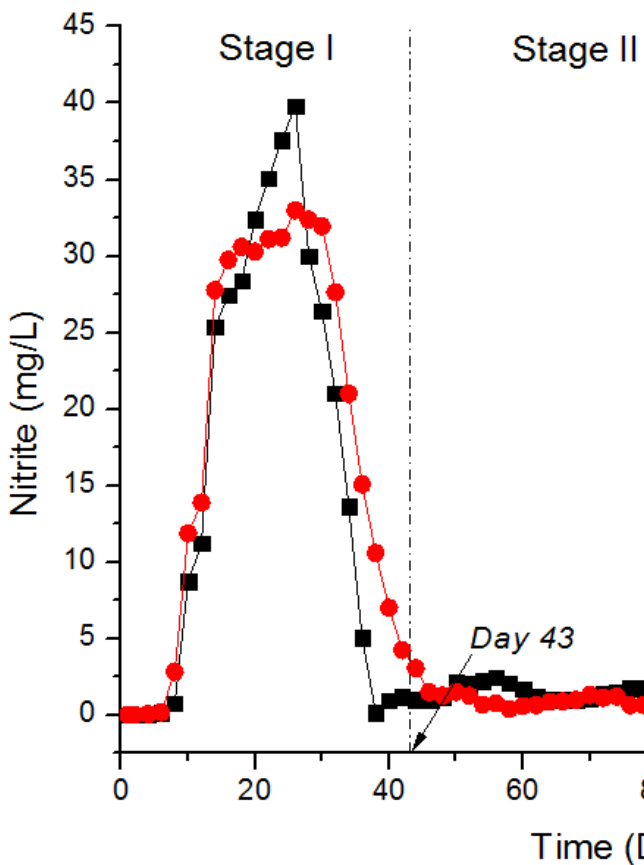
3.2 Water quality



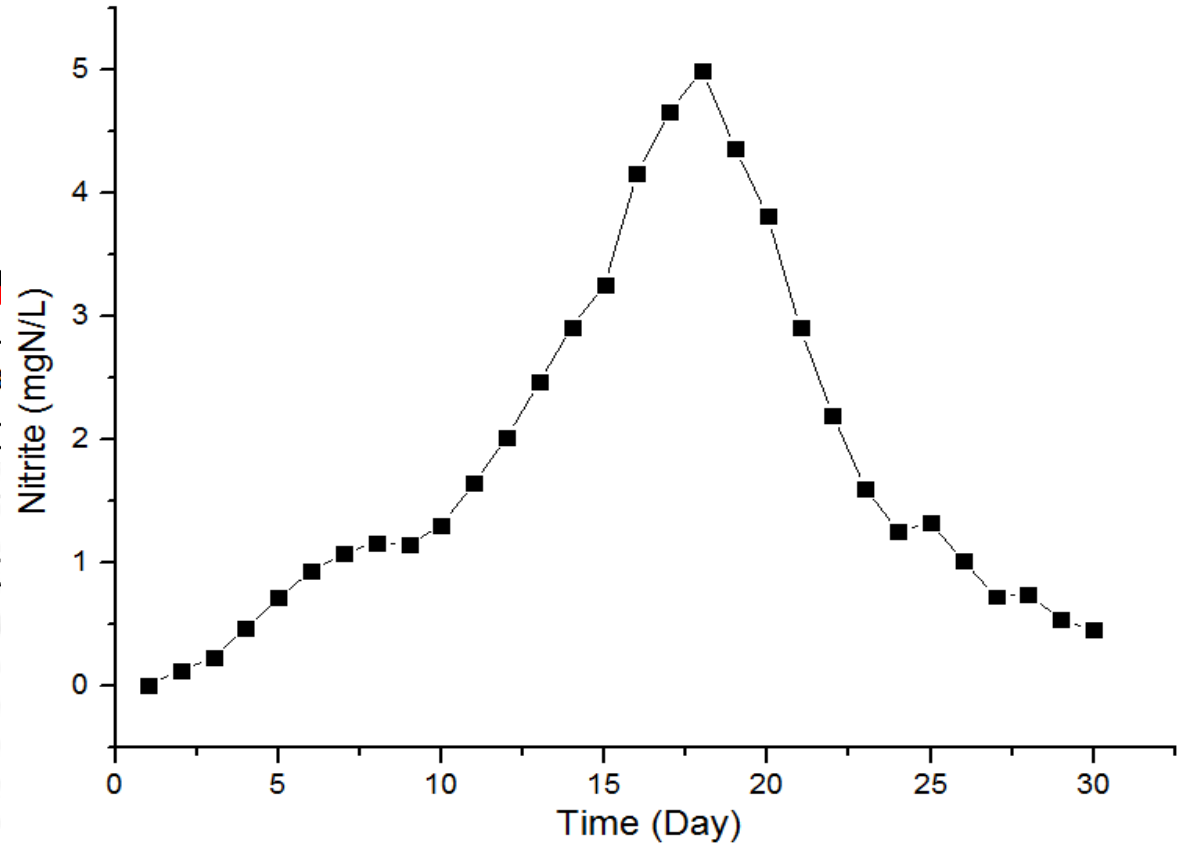
- Variation of NO_3^- conce during the study period



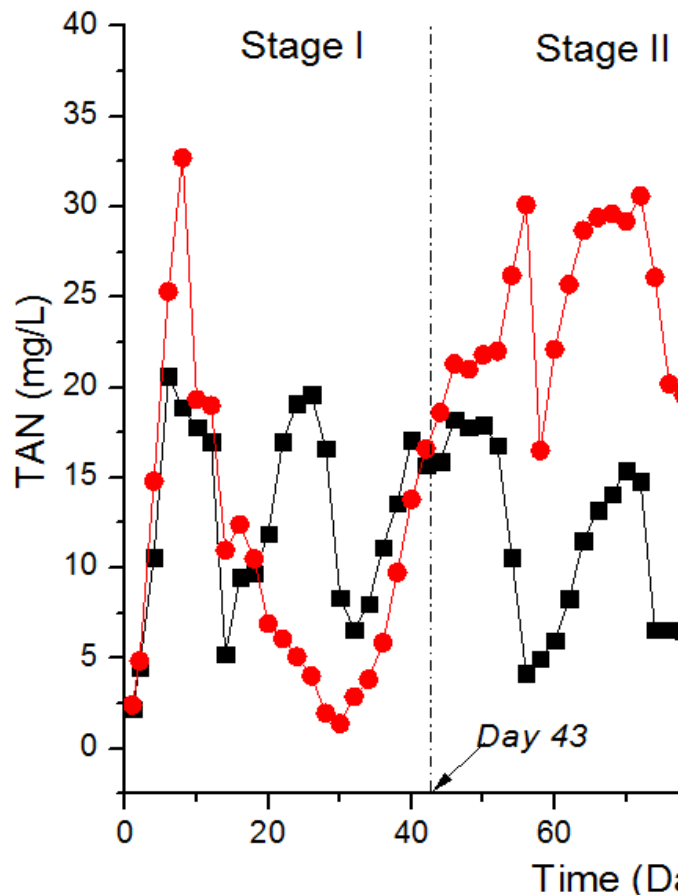
- Variation of NO_3^- concentration in aquaculture system



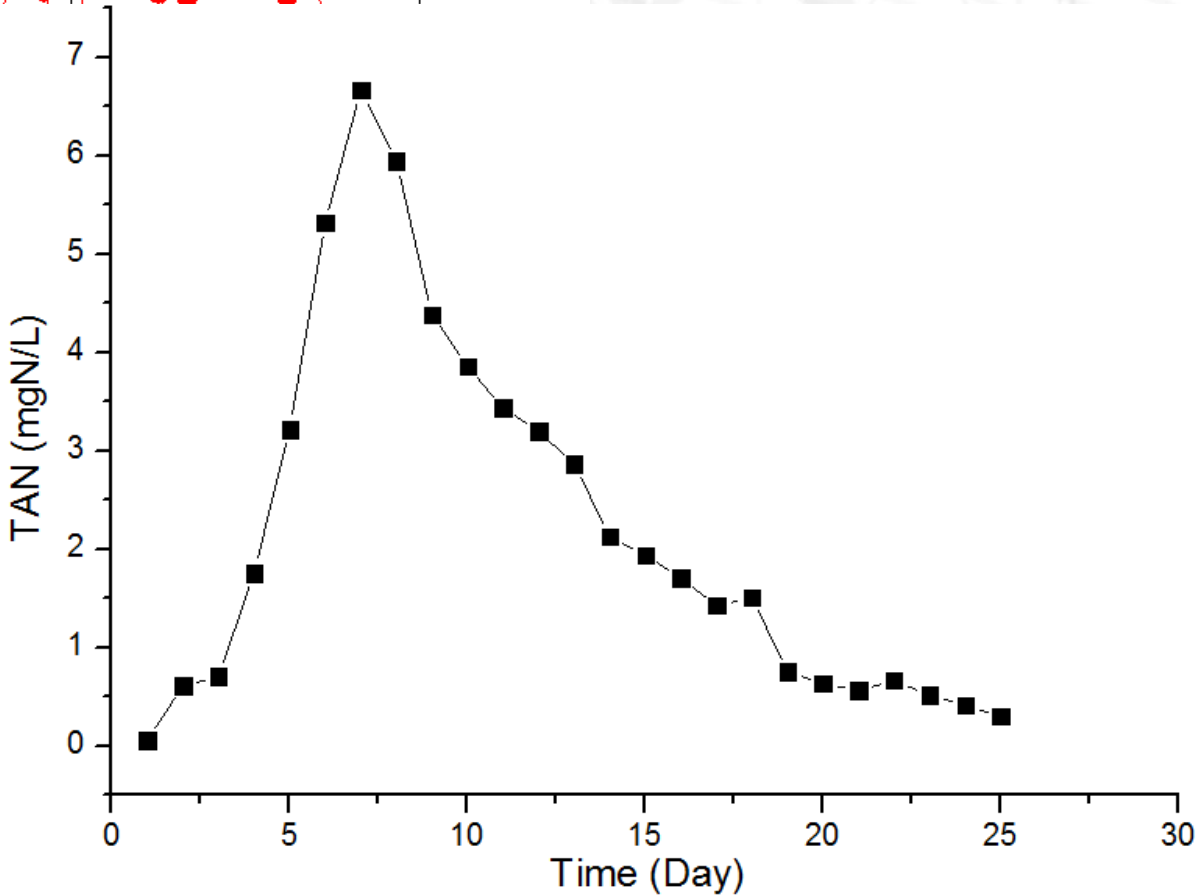
■ Variation of NO_2^- concentration in aquaponics during the stages



■ Variation of NO_2^- concentration in aquaculture system



- Variation of TAN concentration in aquaponics during the study



- Variation of TAN concentration in aquaculture system



■ 3.3 Nitrogen distribution

Aquaculture tanks

	Tomato tank	Pak Choi tank
Initial fish weight	6137.98 g	6030.93 g
Final fish weigh	10482.93 g	9316.48 g
Fish biomass increase	4344.95 g	3285.55 g
Fish feed input	6946.95 g	6606.38 g
Feed conversion ratio	1.6	2.0
Nitrogen input	449.47 g	427.43 g
Nitrogen uptake by fish	109.49 gN	82.8 gN
Nitrogen utilization efficiency of fish	24.40 %	19.37 %

Grow beds

	Tomato			Pak Choi	
	Fruit	Leaf & Vine	Root	Leaf	Root
Plant production (wet weight)	13858.17 g	19933.49 g	1260.94 g	24897.43 g	93.219 g
Plant production (dry weight)	1218.13 g	2423.91 g	123.95 g	1070.59 g	6.08 g
TN uptake by plant	24.00 gN	48.48 gN	4.29 gN	59.95 gN	0.26 gN
Nitrogen utilization efficiency of plant		17.08 %		14.09 %	



- Total nitrogen utilization efficiency

- (1) Tomato aquaponics: 42.2%;

- (2) Pak Choi aquaponics: 33.5%.

4. Conclusions

- (1) Aquaponics could improve the nitrogen utilization efficiency.
- (2) Tomato might be a better choice than Pak Choi for aquaponics.
- (3) Aquaponics has lower nitrate concentration, mainly because plants could absorb nitrate.
- (4) In the present experiment, aquaponics didn't reduce the TAN concentration, and further study is needed to elucidate this.

The background is a deep blue with a fine, diagonal line pattern. Overlaid on this are several light blue, stylized floral and scrollwork designs. A prominent white banner with a slight gradient is positioned horizontally across the lower half of the image.

Thank You For Your Attention!