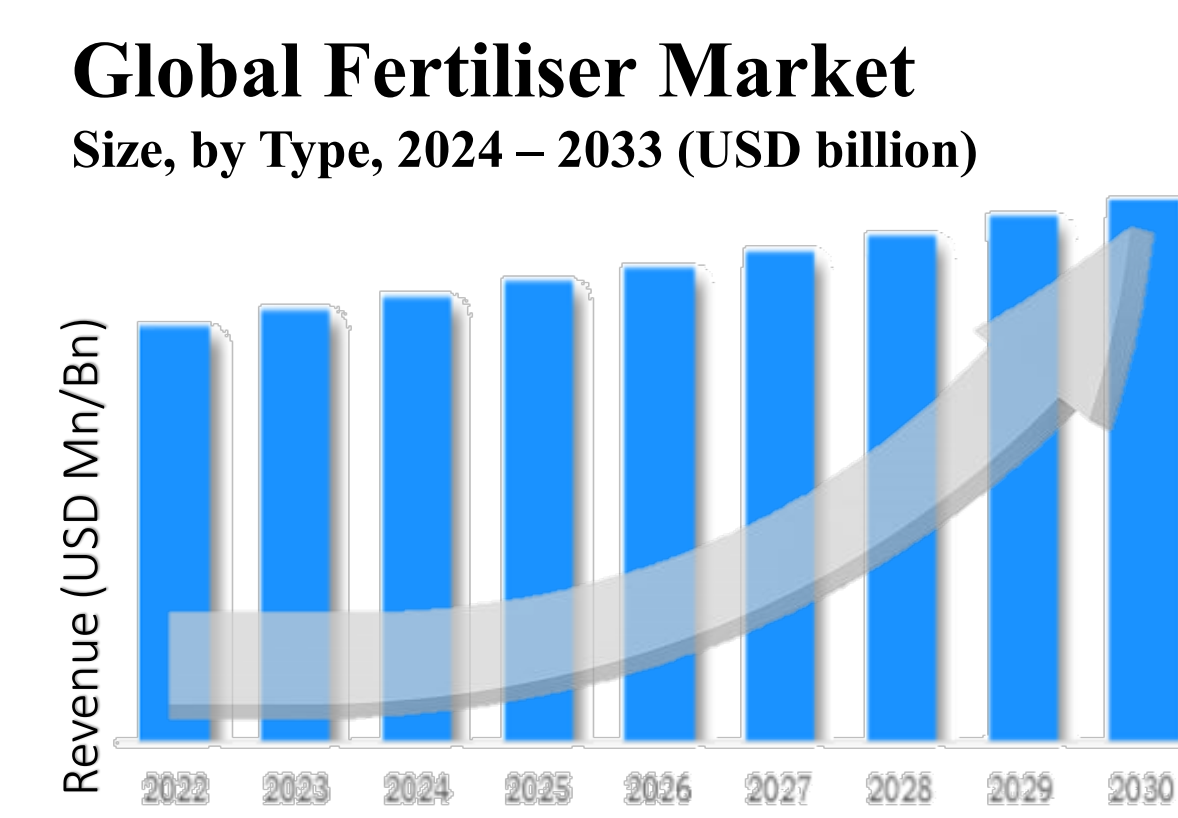
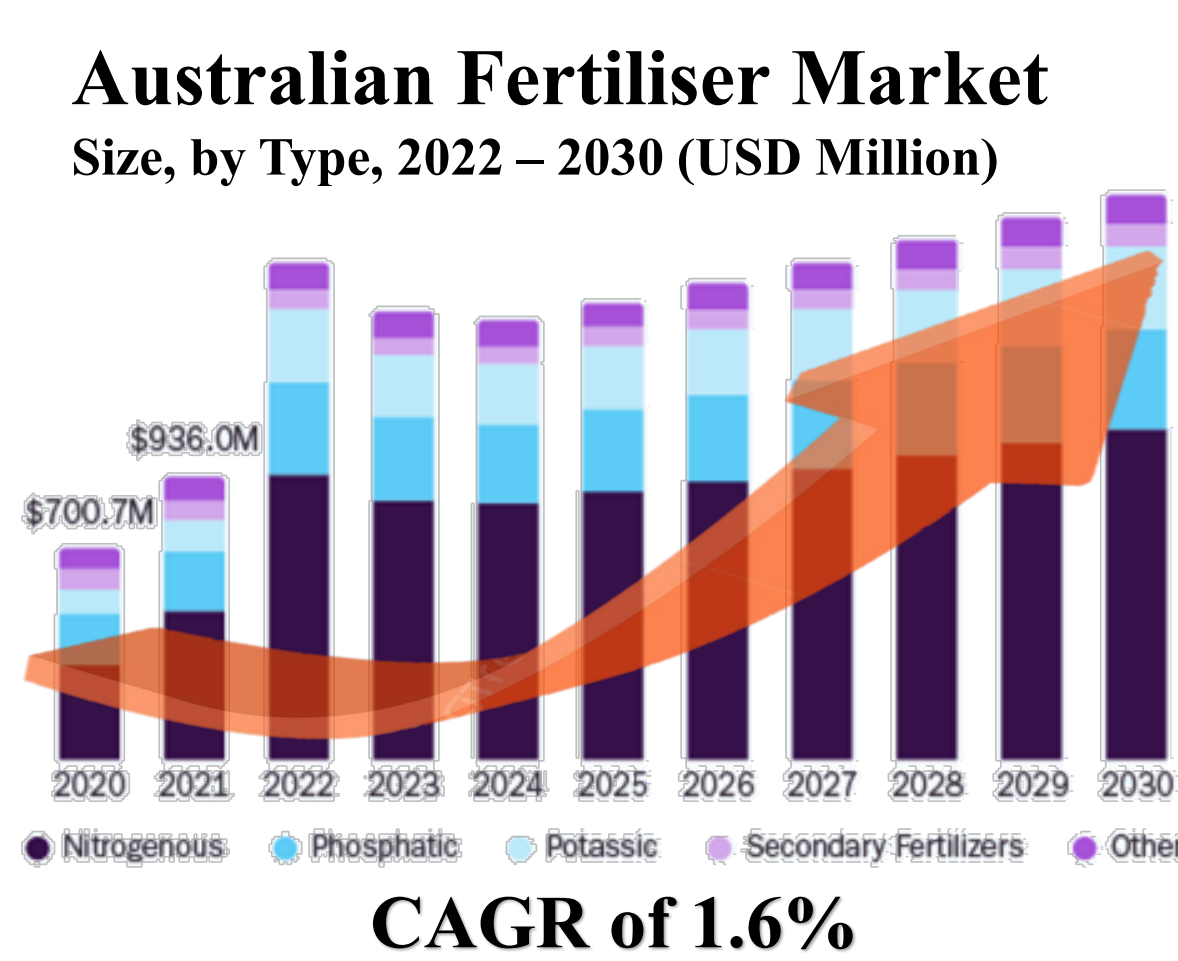


Introduction

Fertiliser Markets



CAGR of 3.8%



CAGR of 1.6%

Nutrients in a circular economy



Materials and method

Mobile toilet caravan for on-site urine treatment



Objective

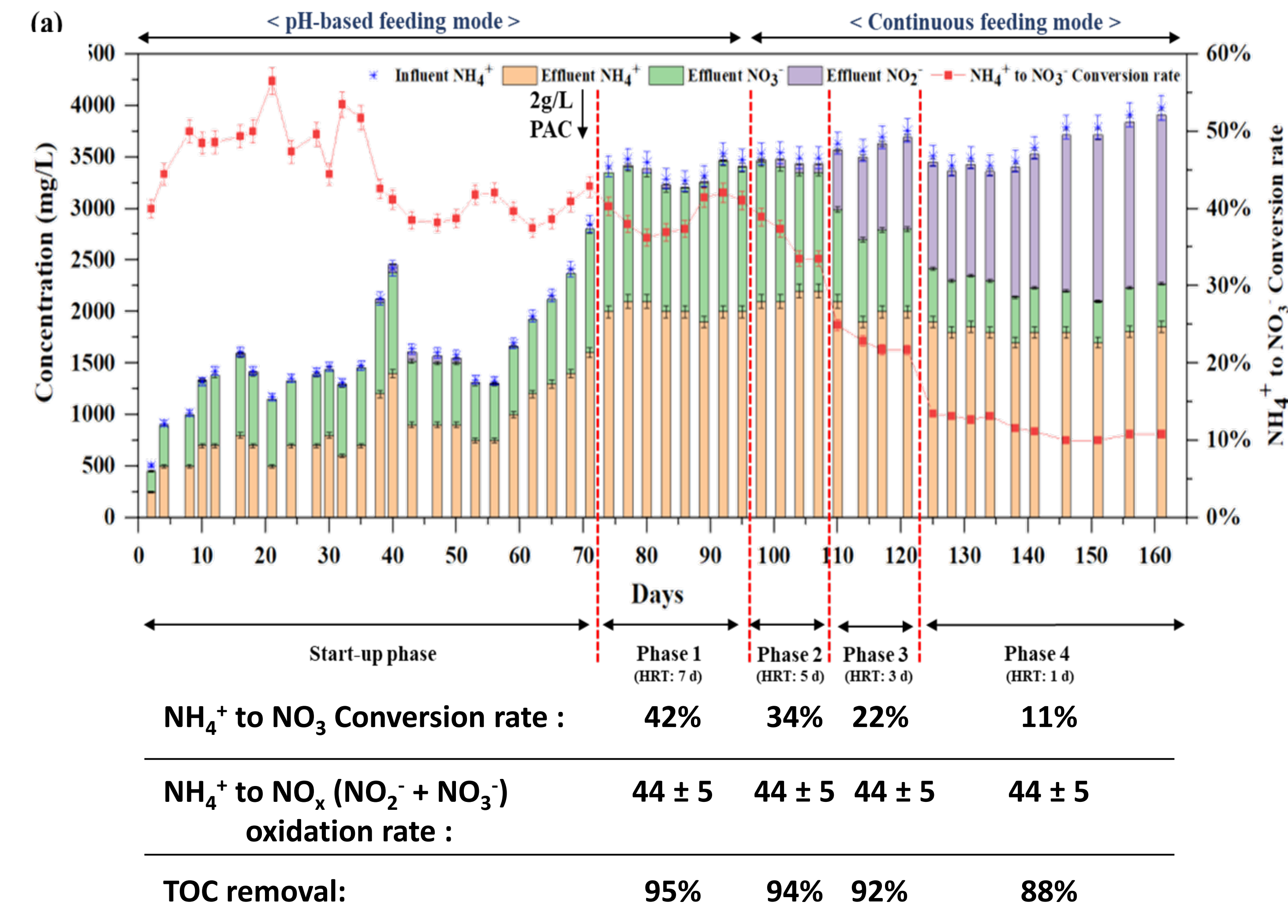
Long hydraulic retention time (HRT) remains a challenge during urine MBR operation under pH-based feeding mode. Thus, the effect of fixed HRT under continuous feeding mode on nitrification was investigated and the produced liquid fertiliser has been applied to hydroponics to determine the optimal HRT threshold.

Pilot-scale UF-MBR



Results and Discussions

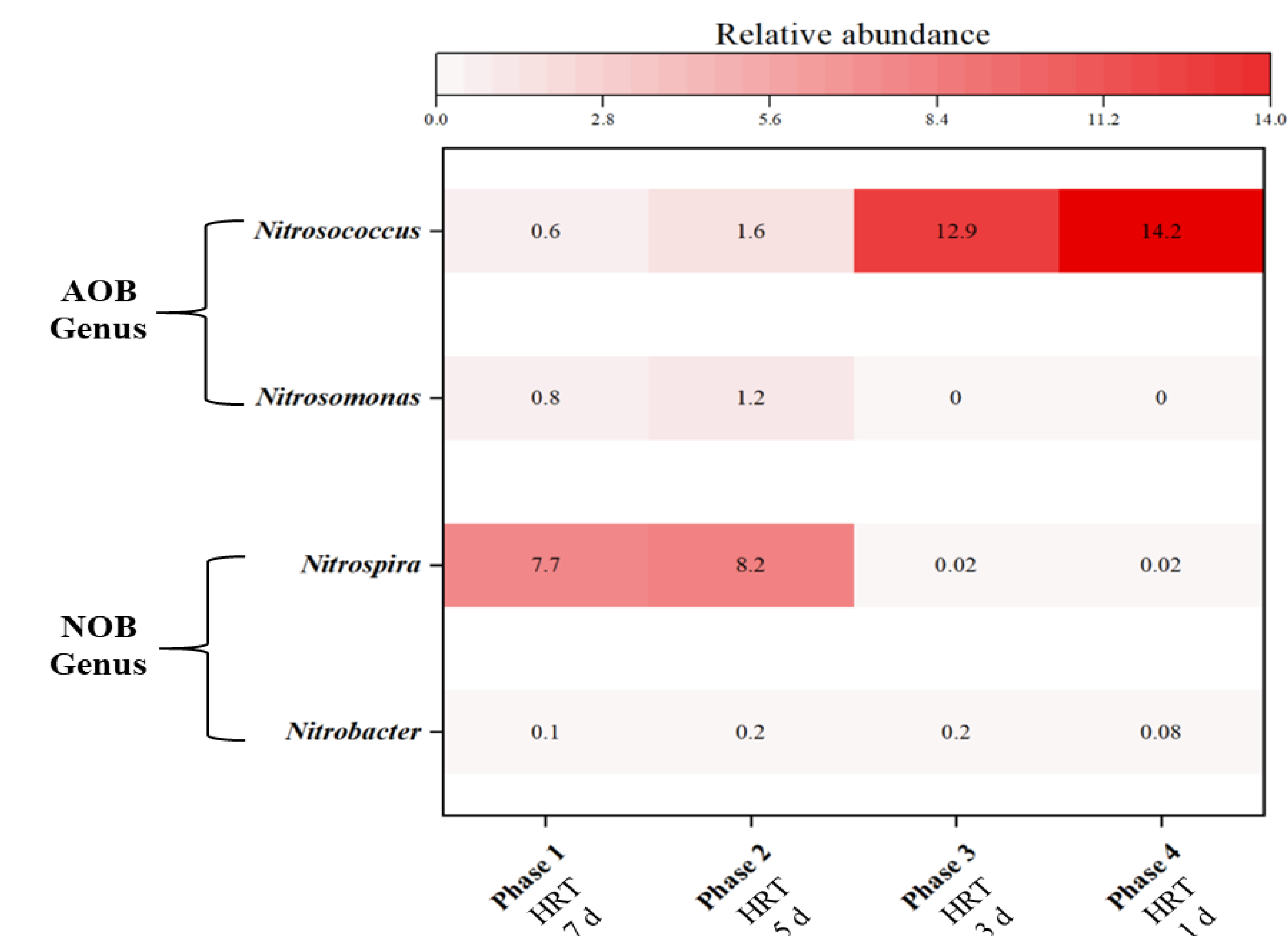
Nitrification performance under different HRT conditions



Start-up phase and phase 1 which were operated under pH-based feeding mode as typical, resulted in 7d HRT.

Systematic reduction of HRT from 5d, 3d, to 1d in phase 2-4 showed significantly increased nitrite and gradual decrease in ammonia to nitrate conversion rate.

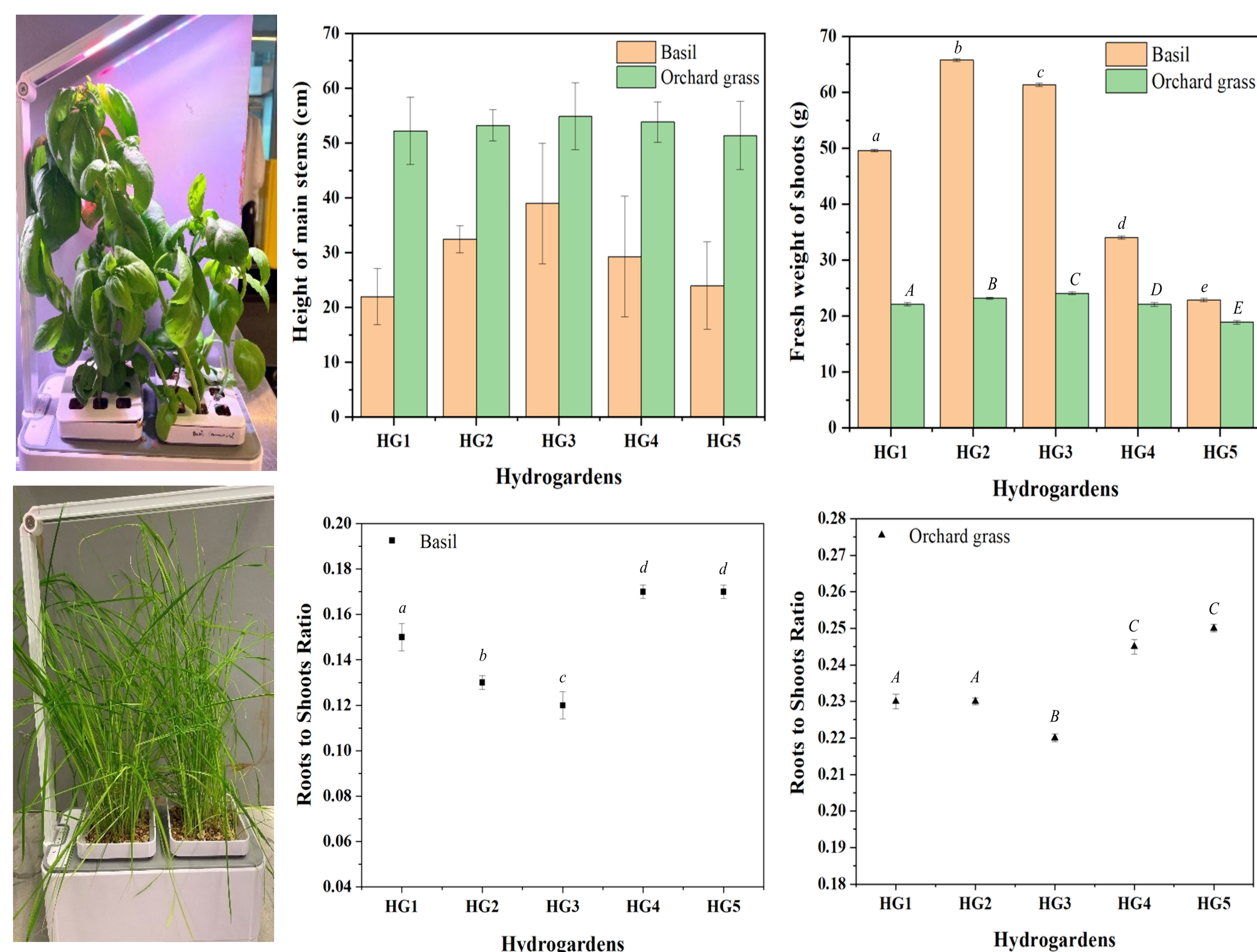
Microbial composition of nitrifying bacteria



The microbial diversity has been reduced along with HRT reduction.

The genera of AOB and NOB showed significantly high AOB and inhibited NOB in phase 3 and 4, which caused the nitrite accumulation in the system.

Basil and grass growth in hydrogardens under different treatment solutions



Hydrogarden	1	2	3	4	5
Treatment Solution	Commercial Fertiliser	HRT 7	HRT 5	HRT 3	HRT 1
TN (mg/L)			250		
NH_4^+ (mg/L)	50	140 ± 5	150 ± 5	130 ± 5	135 ± 5
NO_3^- (mg/L)	200	100 ± 5	85 ± 5	60 ± 5	30 ± 5
NO_2^- (mg/L)	0	0	5 ± 1	50 ± 1	80 ± 1
TDS (mg/L)	1,015	986	967	987	897

Pilot MBR operation at fixed HRT conditions resulted in different nitrogen compositions in hydroponic solutions, showing the potential of orchard grass as a target crop for fertilisers produced under short HRT.

Conclusions

- Pilot-scale compact MBR system was developed for urine to fertiliser conversion.
- pH-based urine feeding achieved stable nitrification with 7-day of HRT.
- Systematic HRT reduction led to gradual nitrite accumulation and AOB enrichment.
- Hydroponic basil and orchard grass growth was optimal at HRTs of up to 5 days.
- Orchard grass tolerated high-nitrite solution, showing potential at suboptimal HRT.