Strategies to reduce emission of N and P to the environment: rose growing with temporarily or permanently lower N.

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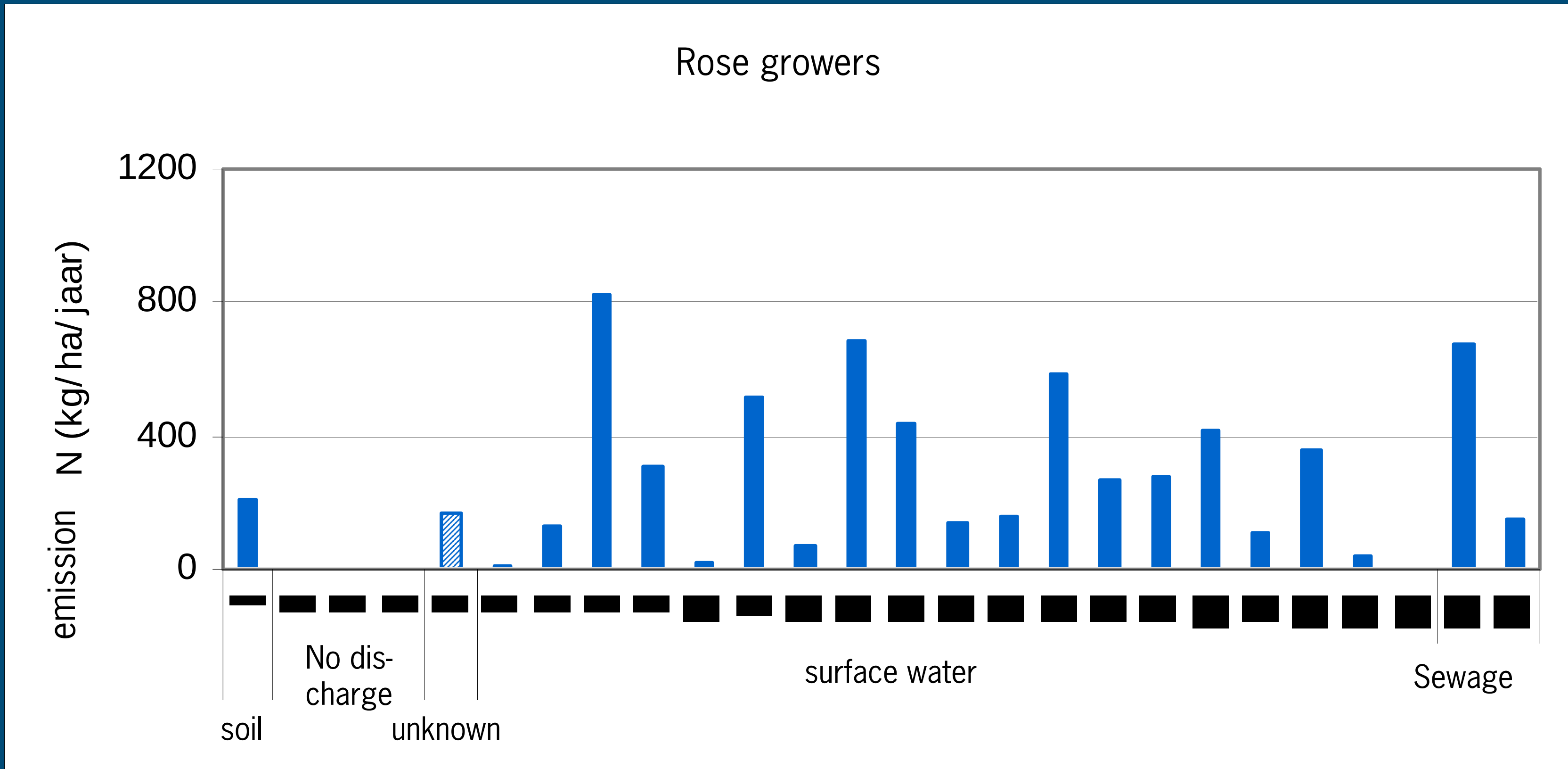
Introduction: Why this research project?

- Rose cultivation in closed systems is compulsory in The Netherlands (substrate)
- Discharge allowed if [Na]>4 mmol/l
- High N and P concentrations found in surface water in areas around rose greenhouses

Introduction: Why this research project?

- Results of close monitoring of emission of N by 26 rose growers conducted by the water management services



Source: Research of the emissions of N and P from horticulture, RIZA, 2005

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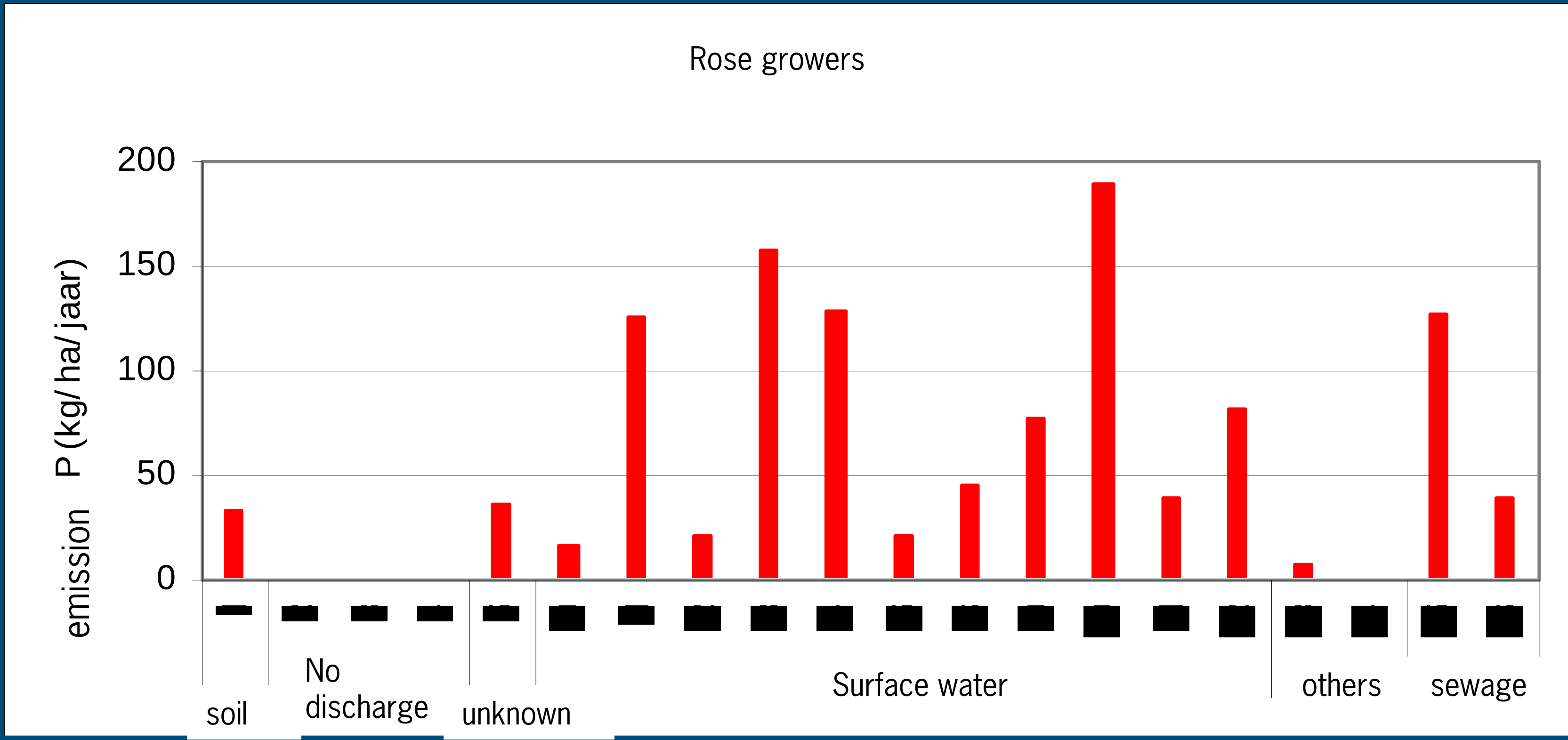
- Results of close monitoring of emission of P by 26 rose growers conducted by the water management services



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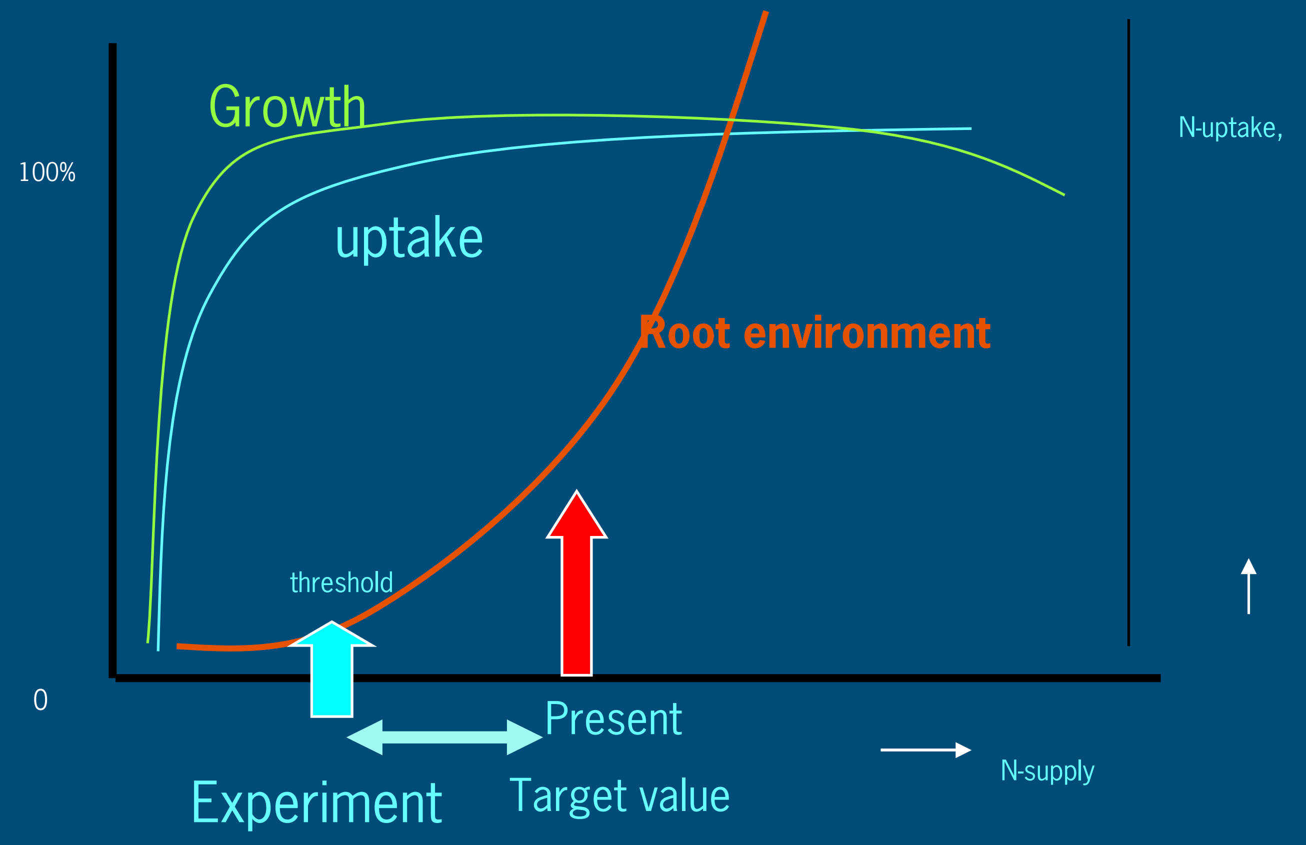
Proposed solution for high N,P in environment

- Reducing N and P load in discharged water

Research questions

- Is it possible to grow roses with a lower $[NO_3]$?
- How much lower?
- Permanently or just prior to discharge?
- What would be the N and P emission with the proposed strategies?

Working hypothesis: N supply > N demand



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Experimental design

- Existing crop cv.'Passion' (1,5 years old), own roots
- Rockwool, lighted (10.000 lux) during 20 h/day

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Experimental design

- 6 treatments, 4 replicates, (24 blocks), closed system
- Target EC in slab 1.5, NO_3 compensated with Cl and SO_4
- Trial Feb-Aug and Aug-Feb

Initial treatments (Feb-Aug)

		EC	N	N at discharge	P	N at discharge
1	standard solution	1.5	10		0.75	
2	low [N]	1.5	6		0.75	
3	very low N	1.5	4		0.75	
4	very low [N]	1.5	2		0.75	
5	low [N] at discharge	1.5	10	< 3	0.75	< 0.75
6	very low [N] at dischar	1.5	10	< 2	0.75	< 0.5

Expected emission reduction with the proposed treatments

N-load in discharged water (kg /ha.year)

			NO_3 concentration		
Discharge strategy		**8 mmol/l**	**6 mmol/l**	**4 mmol/l**	**<2 mmol/l**
continuously	25% of drainage	205	154	103	
	15% of drainage	123	92	62	
periodically all drain	1 discharge /week	594	445	297	
	1 discharge /2 weeks	291	218	146	
periodically with	Treat. 5				58
low N at discharge	Treat. 6				39

Results trial 1 (February- August)

treatment NO3	prod kg/m2	avg stem length	avg stem weight
10	2.5	80.9	43.0
6	2.5	80.1	44.2
4	2.6	81.0	44.7
2	2.3	79.8	42.6
10 - < 3)*	2.4	80.1	43.5
10 - < 2)*	2.5	81.3	44.0

Results: after 3 months first signs in crop

Results trial 1 (February- August)

- Lowest applied NO_3 concentration 2 mmol/l too low
  - Leaf yellowing, leaf abscission, lower production
- Continuously 4 or 6 mmol NO_3/l without visual problems
- Variable NO_3 (10 mmol NO_3/l to low NO_3 prior to discharge) without visual problems

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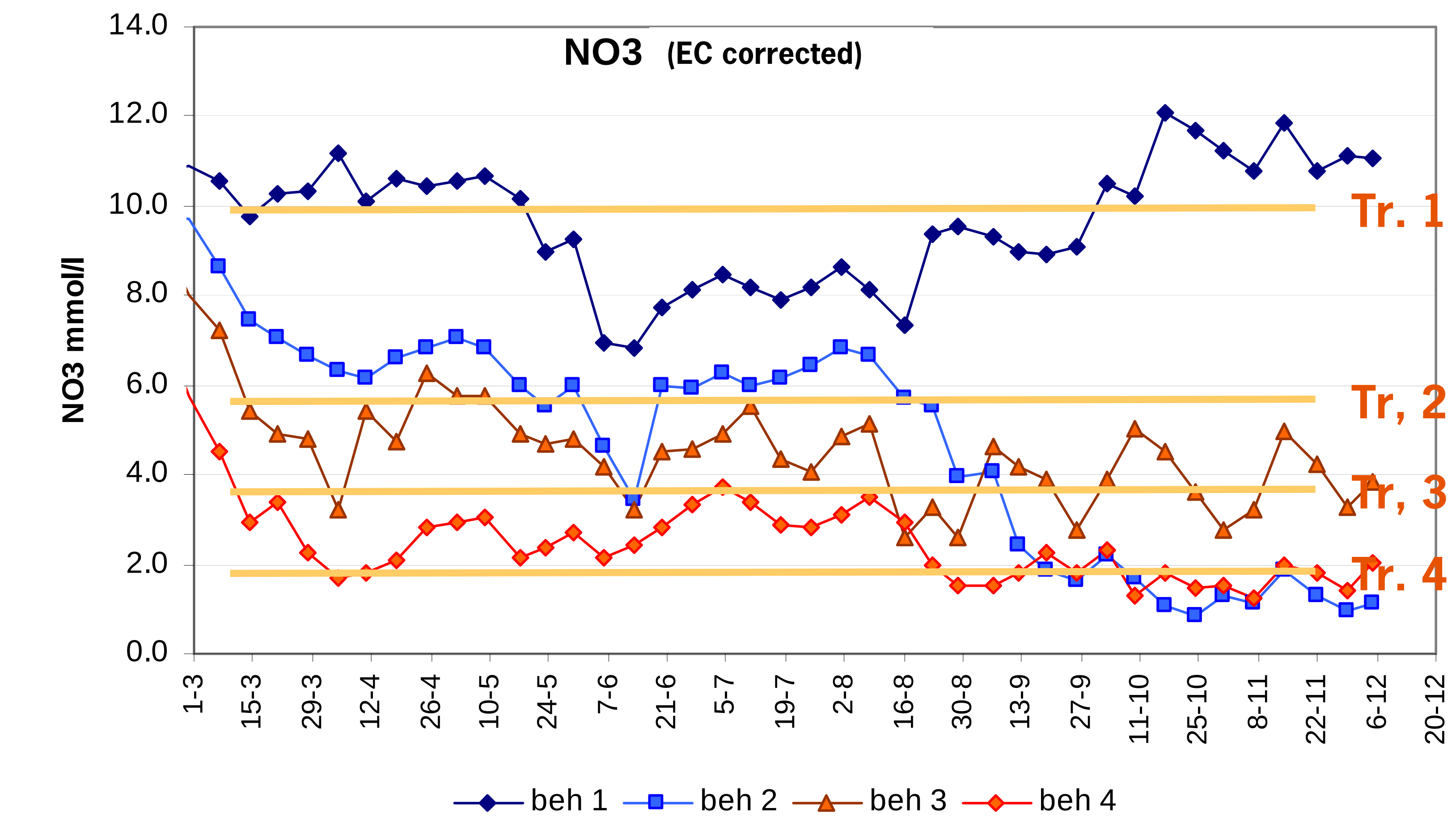
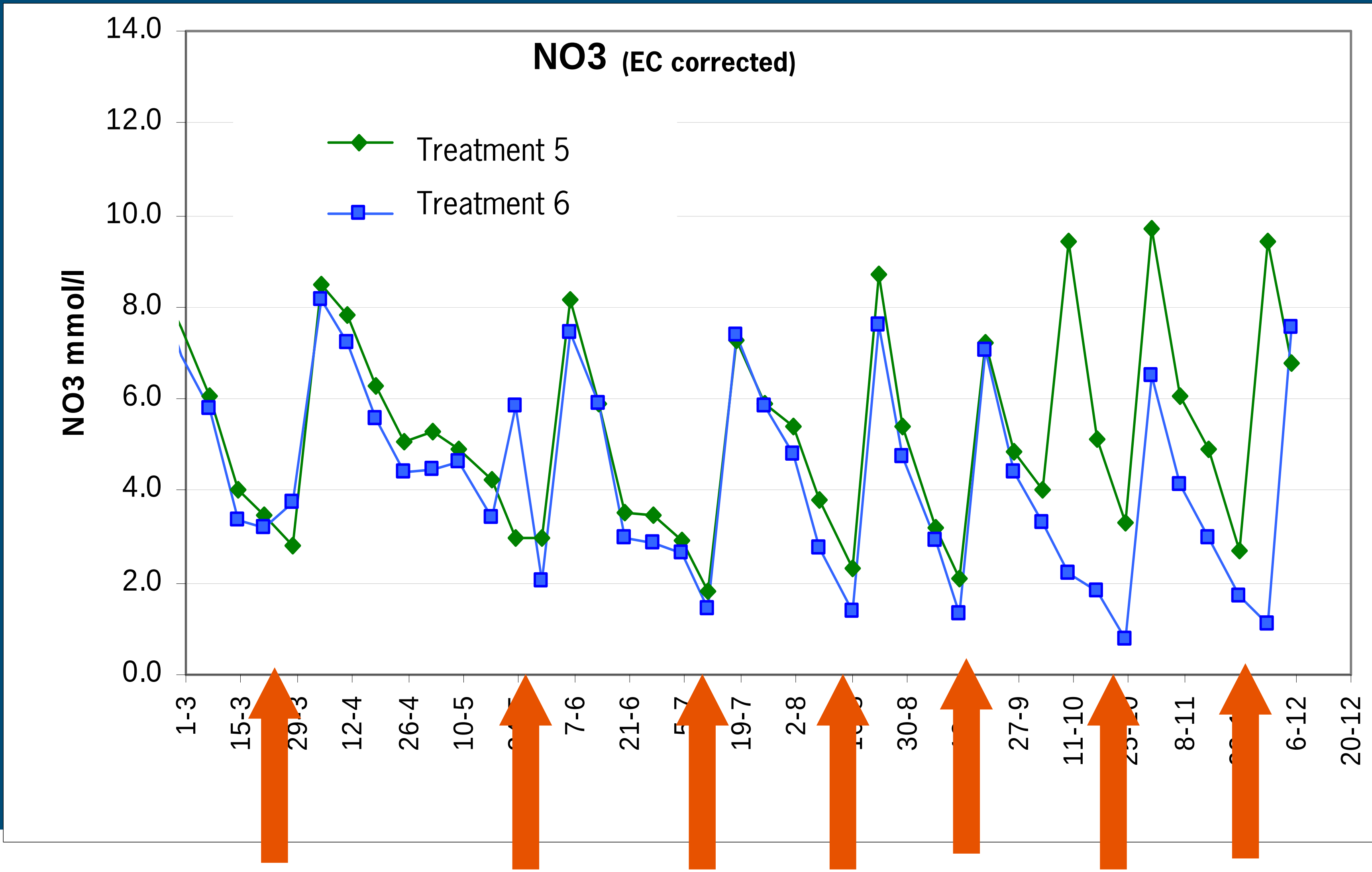
Modified treatments (Aug-Feb)

		EC	N	at discharge	P	at discharge
1	standard solution	1.5	10		0.75	
2	low [N]	1.5	~~6~~ **< 2**		0.75	
3	very low N	1.5	4		0.75	
4	very low [N]	1.5	2		0.75	
5	low [N] low EC at discharge	1.5	10	~~< 3~~ **EC=0.7 [N] = 4**	0.75	< 0.75
6	very low [N] at dischar	1.5	10	< 2	0.75	< 0.5

Results: root zone analysis control and low N

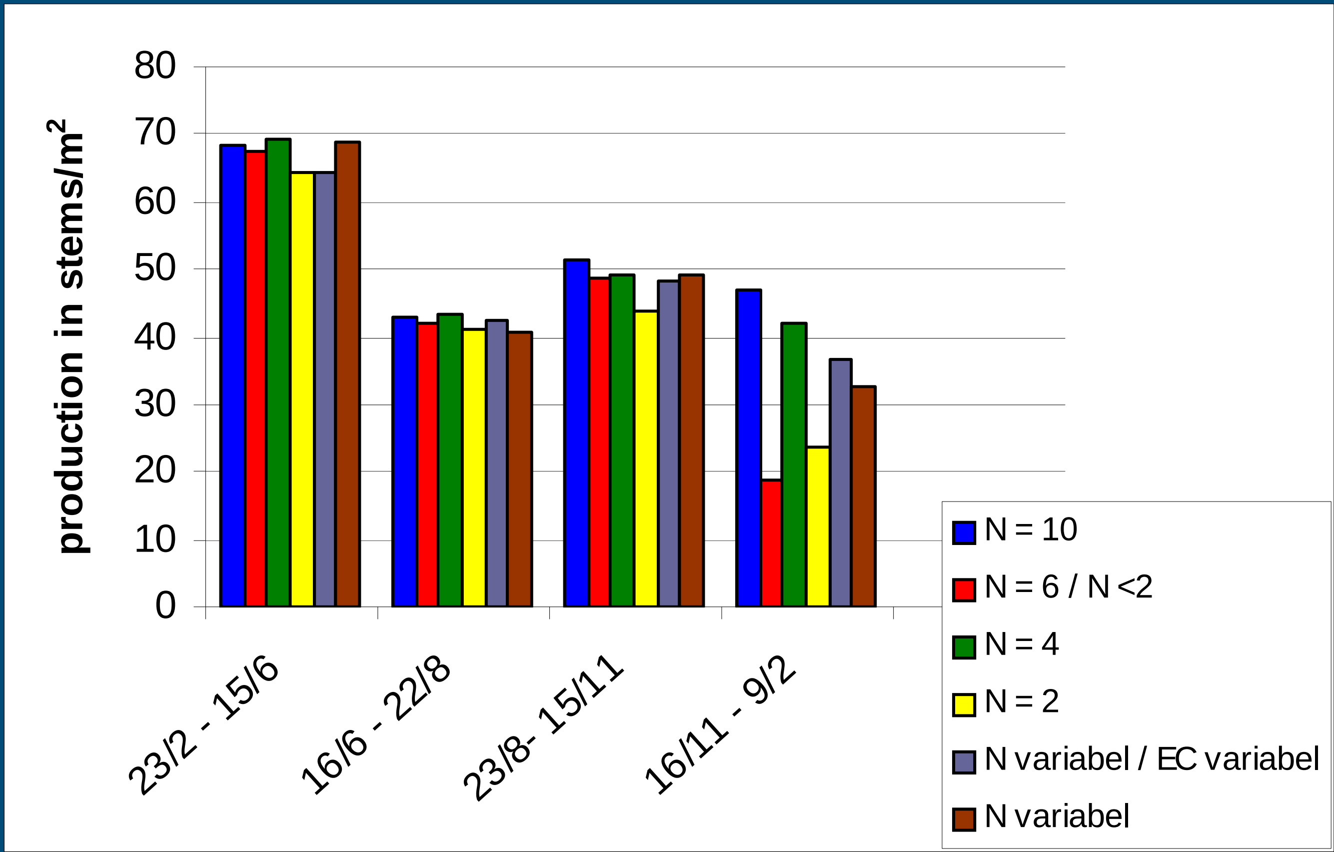


Results: root zone analysis variable NO_3



Results

- Production per treatment per period



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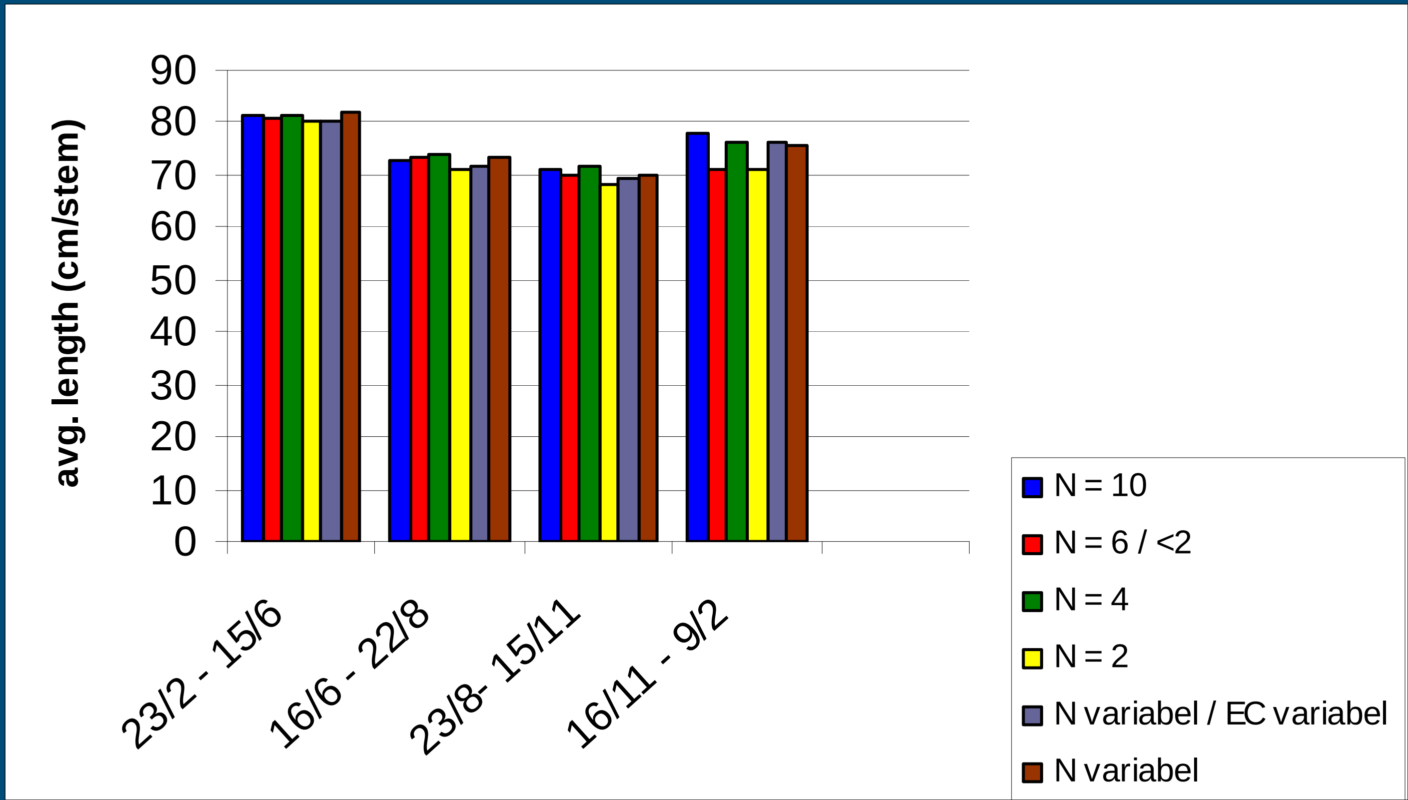
Results

- Quality (avg. stem length) per treatment per period



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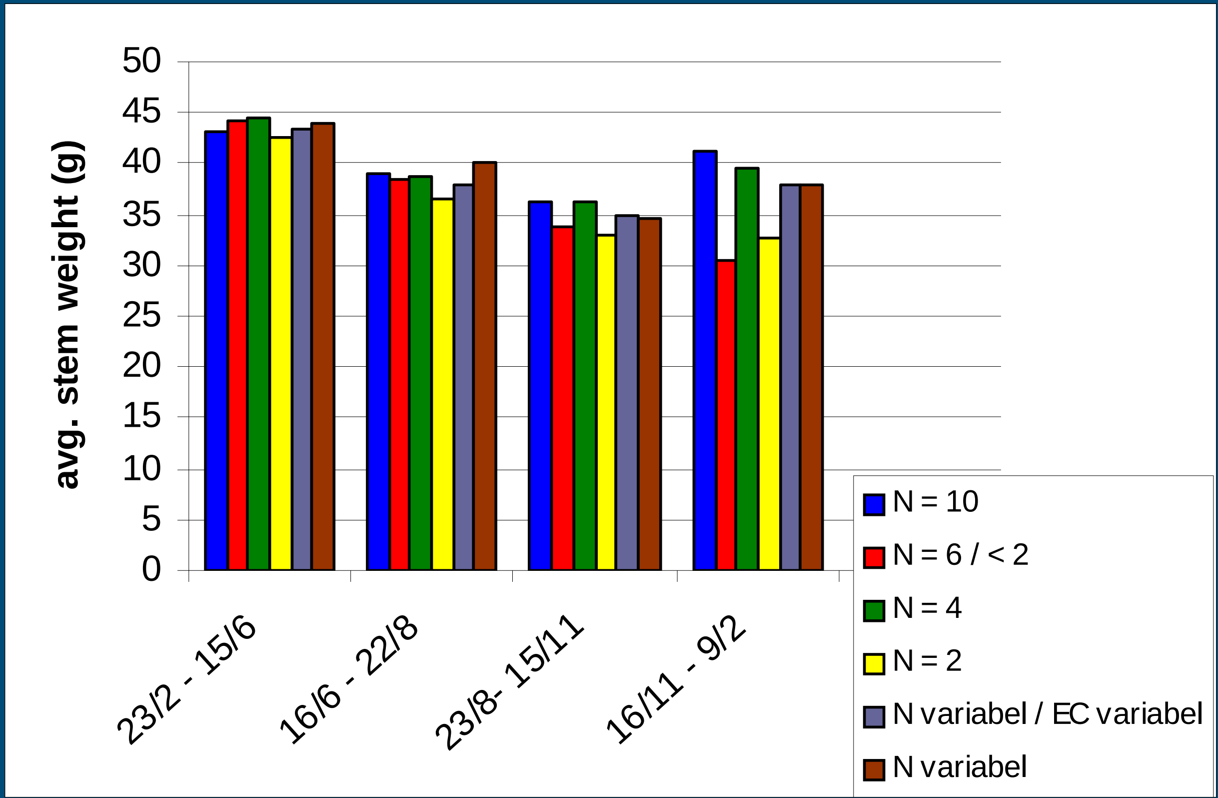
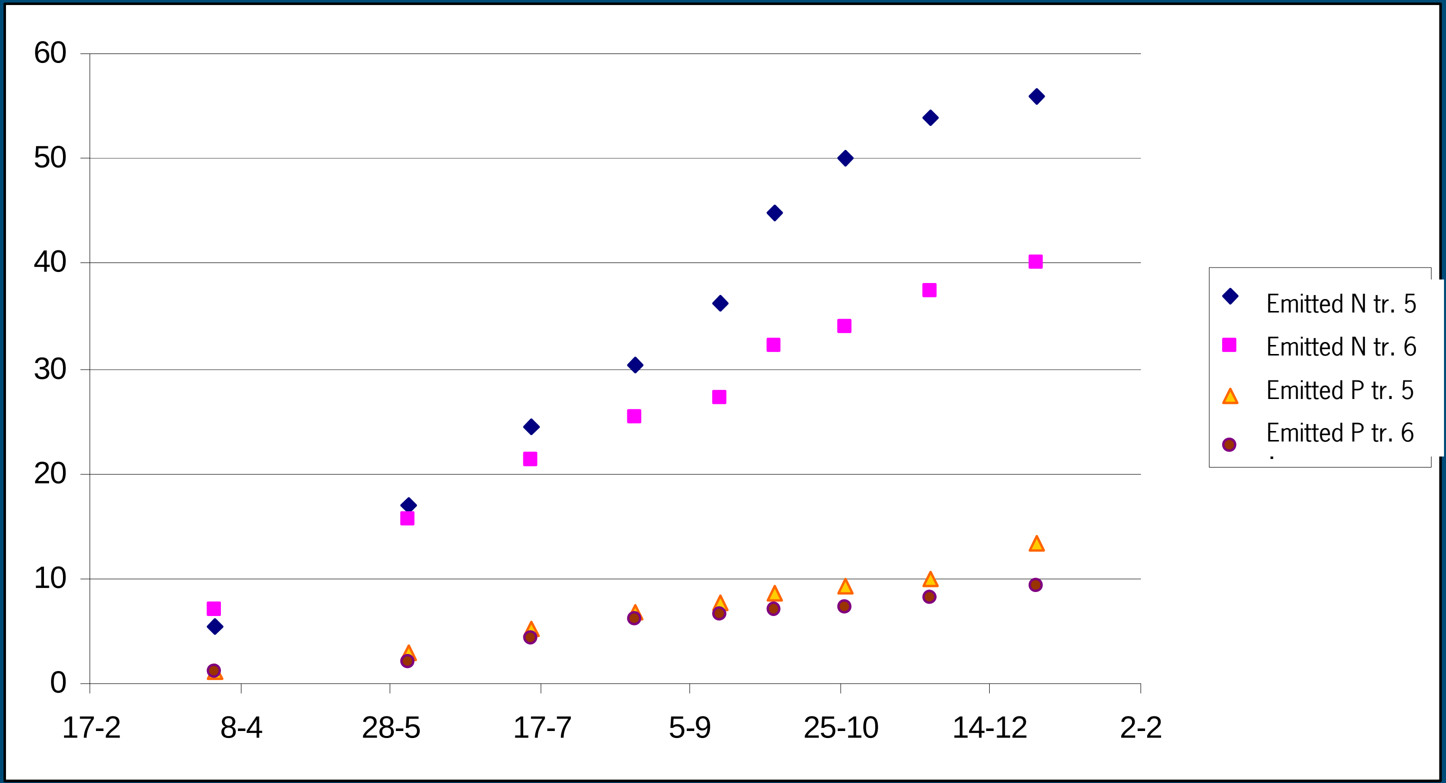
Results

- Quality (avg. stem weight) per treatment per period



Results

- Achieved cumulative emission variable N



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Conclusions

- It was possible to grow roses continuously during 8-9 months with a lower [NO_3] than the recommended 10 mmol/l.
- At 2 mmol/l problems started after three months
- 4 mmol/l proved to be too low in winter
- Variable [NO_3] and [P] (normal to <2 mmol/l prior to discharge) also affected the winter production
- The strategies with variable [NO_3] result in very low N and P emission to the environment

Current research

- Implementation project with a group of growers
- Development of on-line monitoring equipment for a precise adjustment of N and P concentration in solution at the moment of discharge
- Development of purification methods to remove other compounds from drainage solution
- Development of a short test method for growth inhibition with roses

Acknowledgements

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