Evaluation of technologies for removal of PPPs from Greenhouse Horticultural Discharge Water

Jim van Ruijven, Erik van Os, Marieke van der Staaij & Ellen Beerling



Ministerie van Economische Zaken, Landbouw en Innovatie

Productschap Tuinbouw

syngenta

innovatieprogramma watertechnologie

Bayer

BASF The Chemical Company

CERTIS

evides waterbedrijf

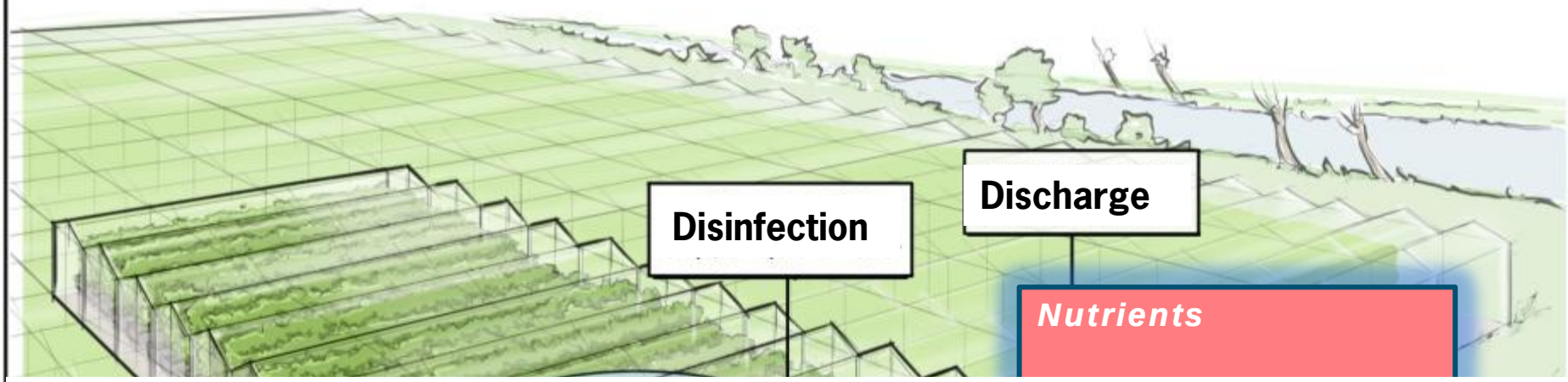
WAGENINGEN UR For quality of life

Hoogheemraadschap van Schieland en de Krimpenerwaard

Hoogheemraadschap van Delfland

Ministerie van Infrastructuur en Milieu

Substrate grown production



Purification technologies will be obligatory in Dutch horticulture by the end of 2016

(Nota 'Gezonde groei, duurzame oogst', May 14th 2013)



Research goal: purification technologies

- Decrease PPP emission levels
- Economically feasible
- Implementable in greenhouse situation

Technologies



Electrochemical flocculation
Hellebrekers Technologies



H_2O_2-MPUV
Priva



H_2O_2-LPUV
HortiMaX B.V.



Ozone + activated charcoal
Van Antwerpen Milieutechniek B.V.

Standardised Water: PPPs

Active ingredient	Formulated product	Concentration (µg/L)
azoxystrobine	Ortiva	2
boscalid	Collis	4
kresoxim-methyl		2
carbendazim	Topsin M	2
methiocarb	Mesurol	2
imidacloprid	Admire	2
iprodione	Rovral Aquaflo	2
methoxyfenozide	Runner	2
pirimicarb	Pirimor	2
pymetrozine	Plenum 50 WG	2
thiacloprid	Calypso	2
tolclofos-methyl	Rizolex	2

Experiments



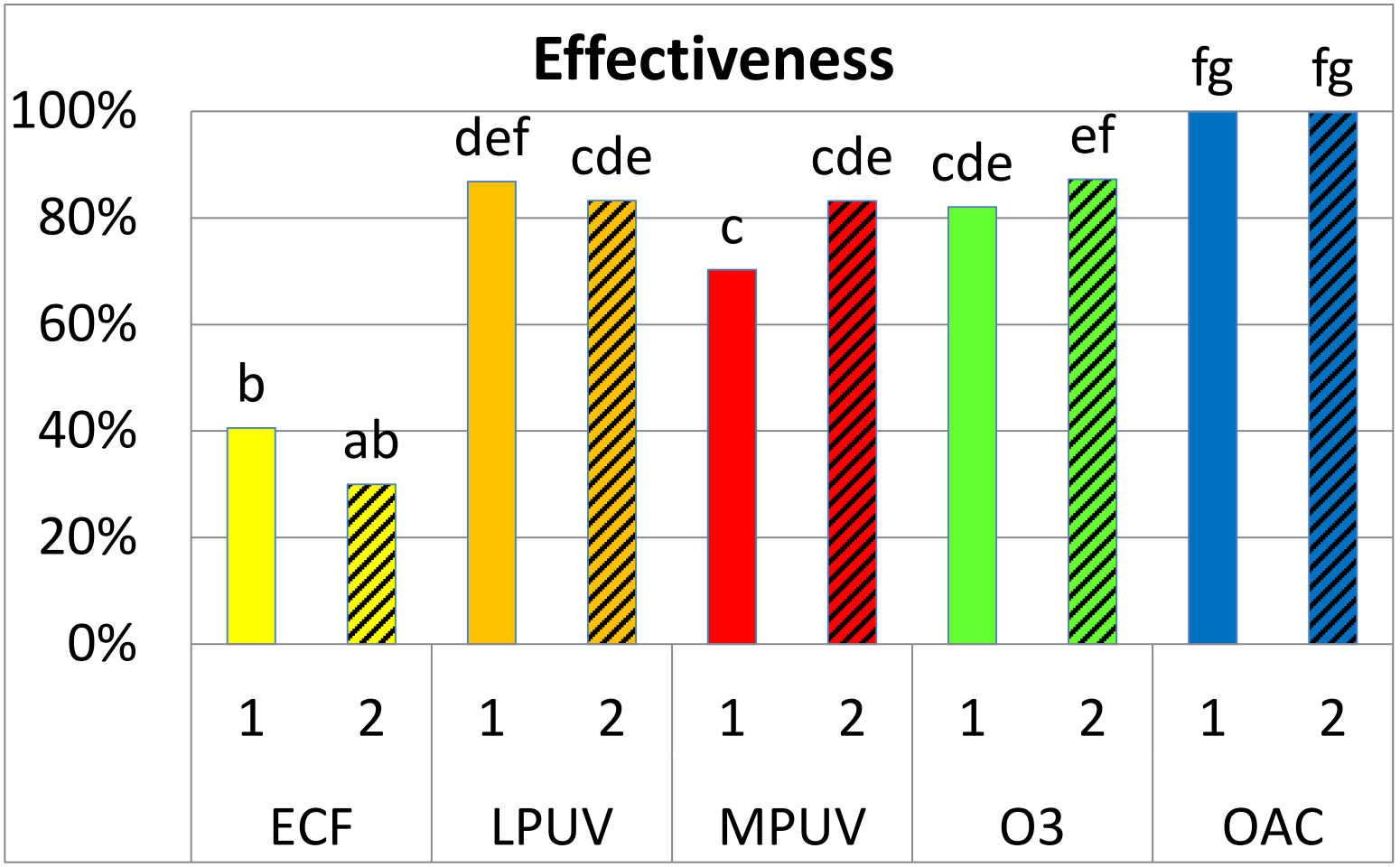






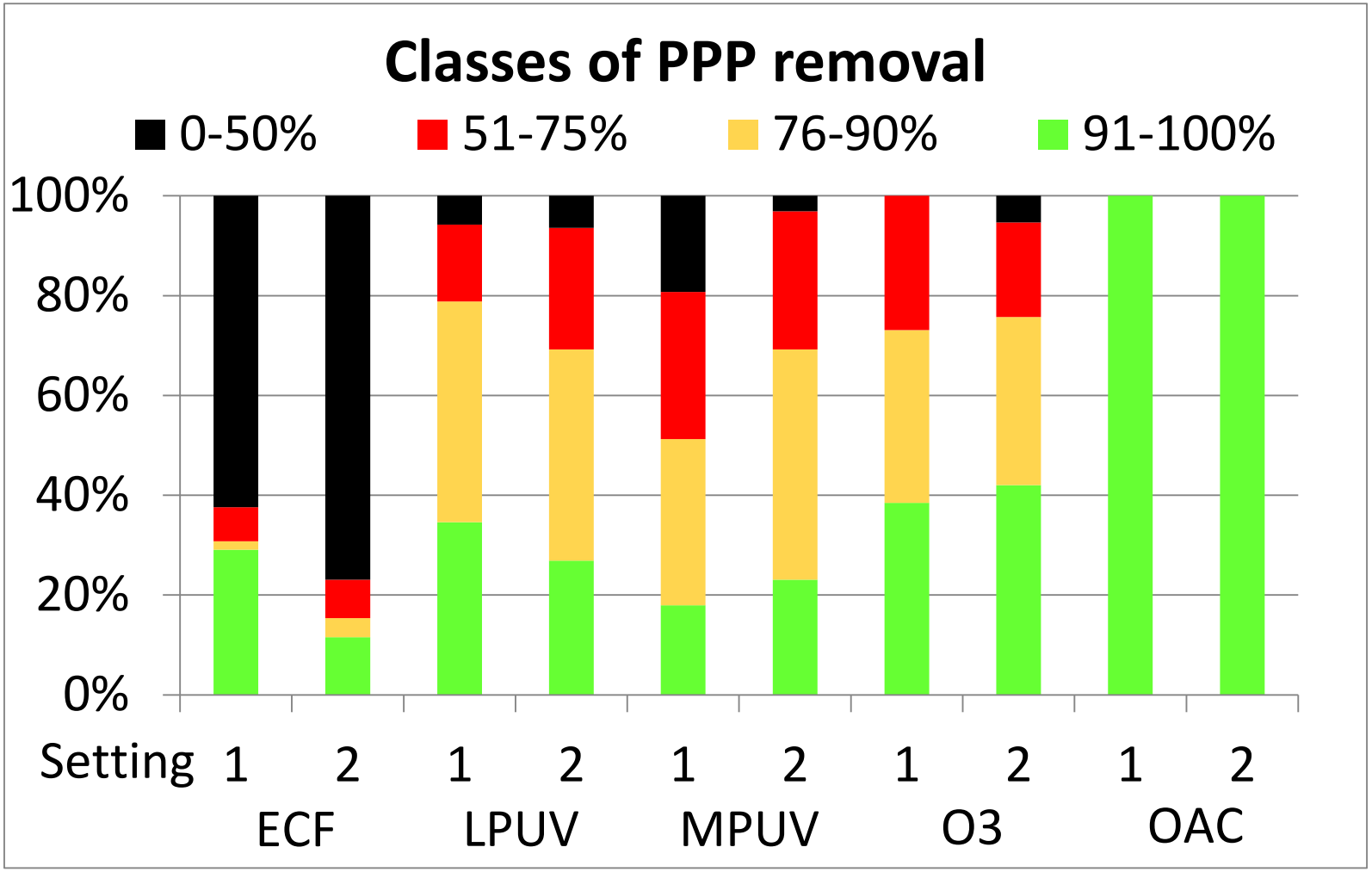


Results (1): Overall effectiveness



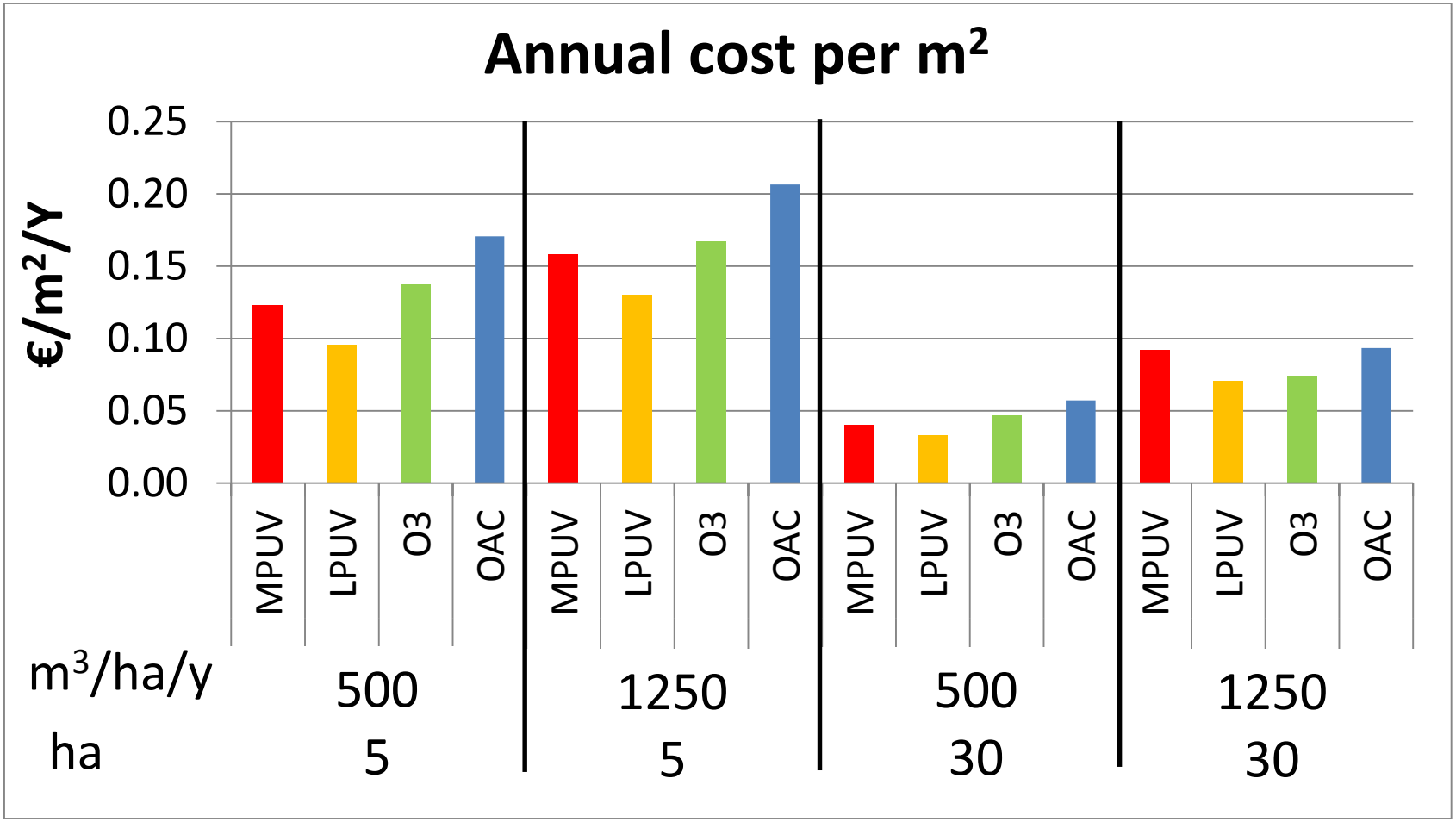
WAGENINGEN UR
For quality of life

Results (2): Individual PPPs



WAGENINGEN UR
For quality of life

Results (3): Economics



WAGENINGEN UR
For quality of life

Conclusions

- 80-100% removal of PPPs (LPUV, MPUV, O_3)
- Variation in removal of individual PPPs
- €0.10-0.17/m^2 (5ha, 500m^3/ha)
- Activated charcoal adds €0.03/m^2/y



Thank you for your attention!

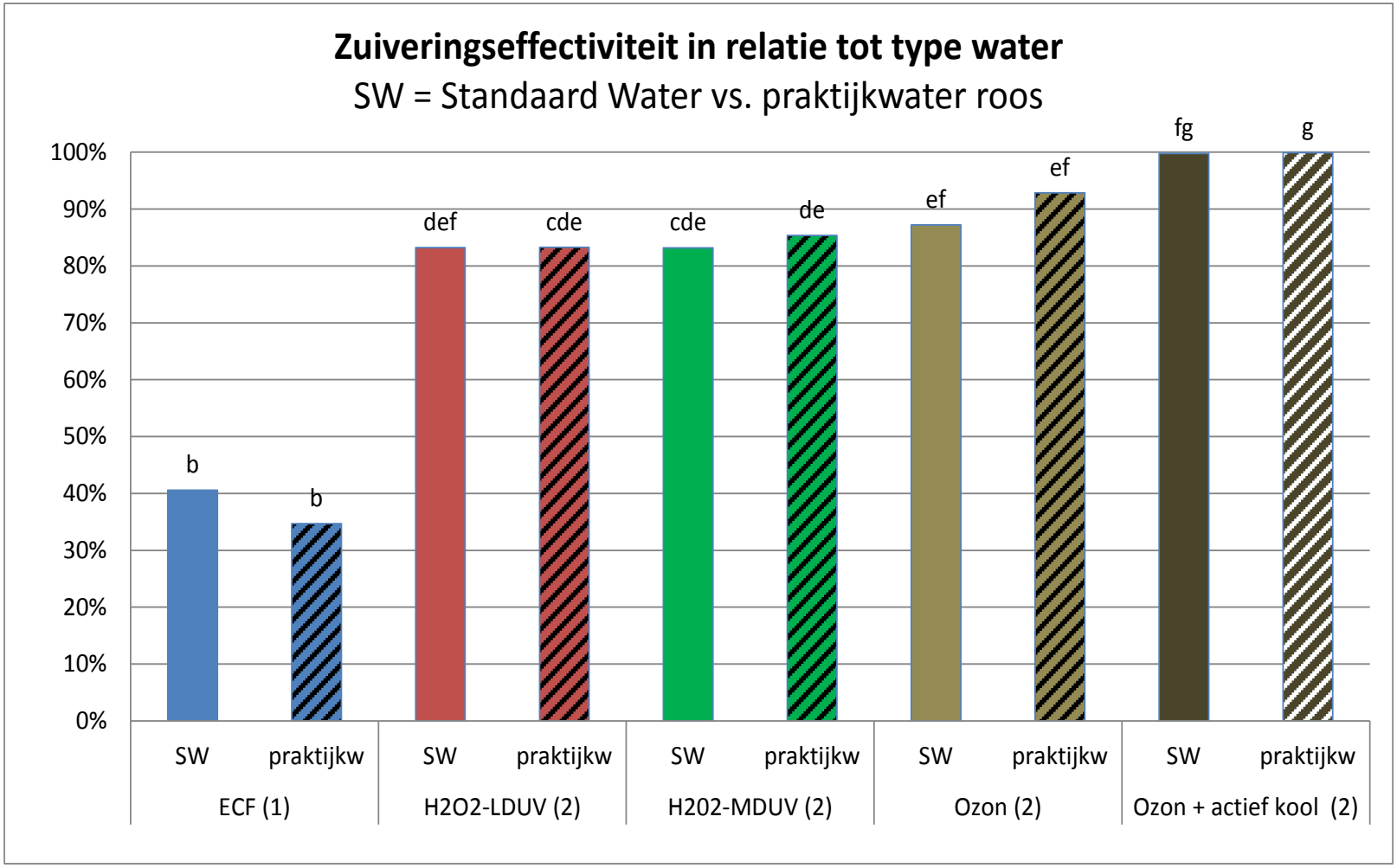


In the Netherlands, purification technologies will be obligatory in horticulture by the end of 2016

(Nota ‘Gezonde groei, duurzame oogst’, May 14th 2013)

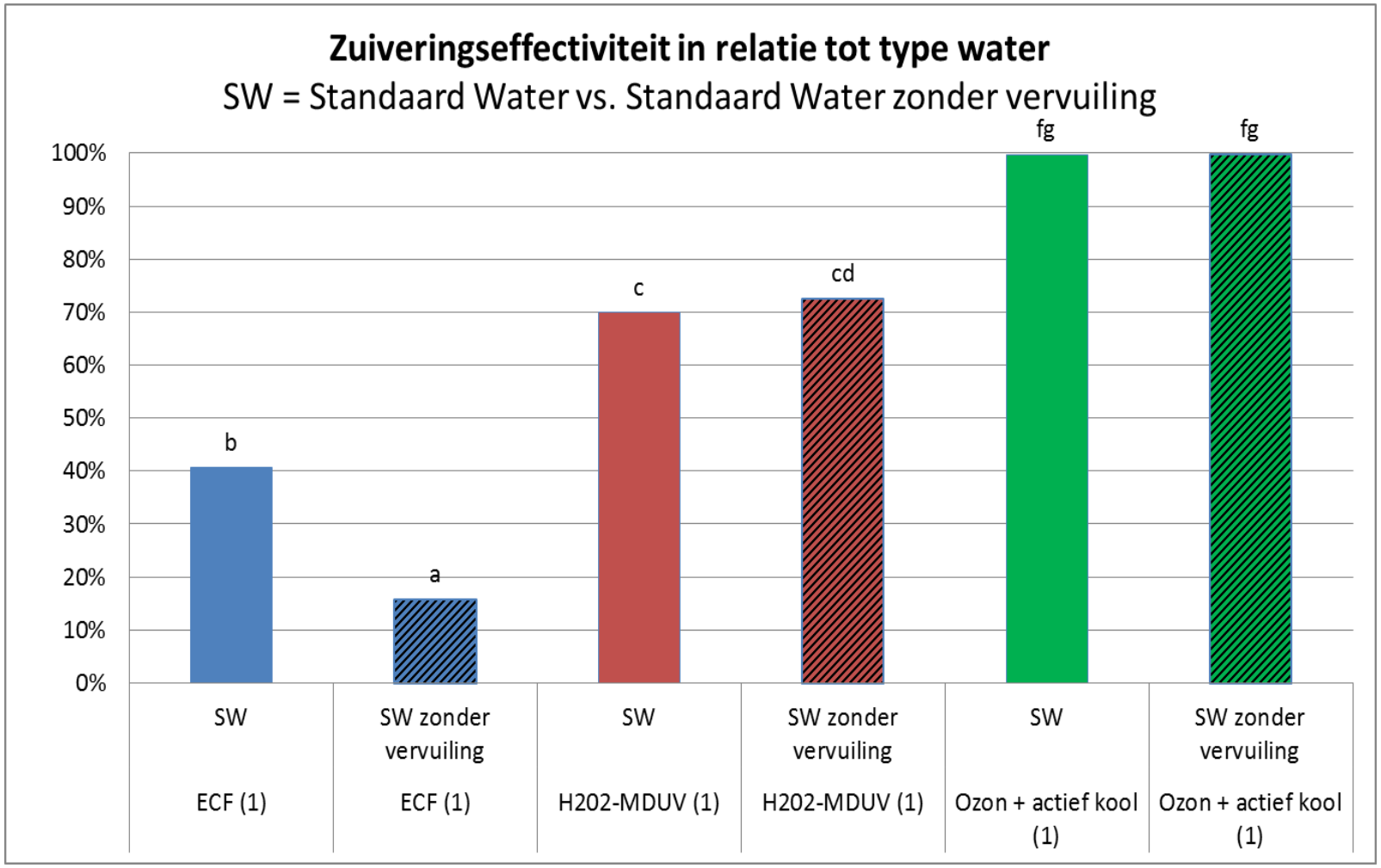
WAGENINGEN UR
For quality of life

Rose production discharge water



WAGENINGEN UR
For quality of life

SW without organic waste



WAGENINGEN UR
For quality of life

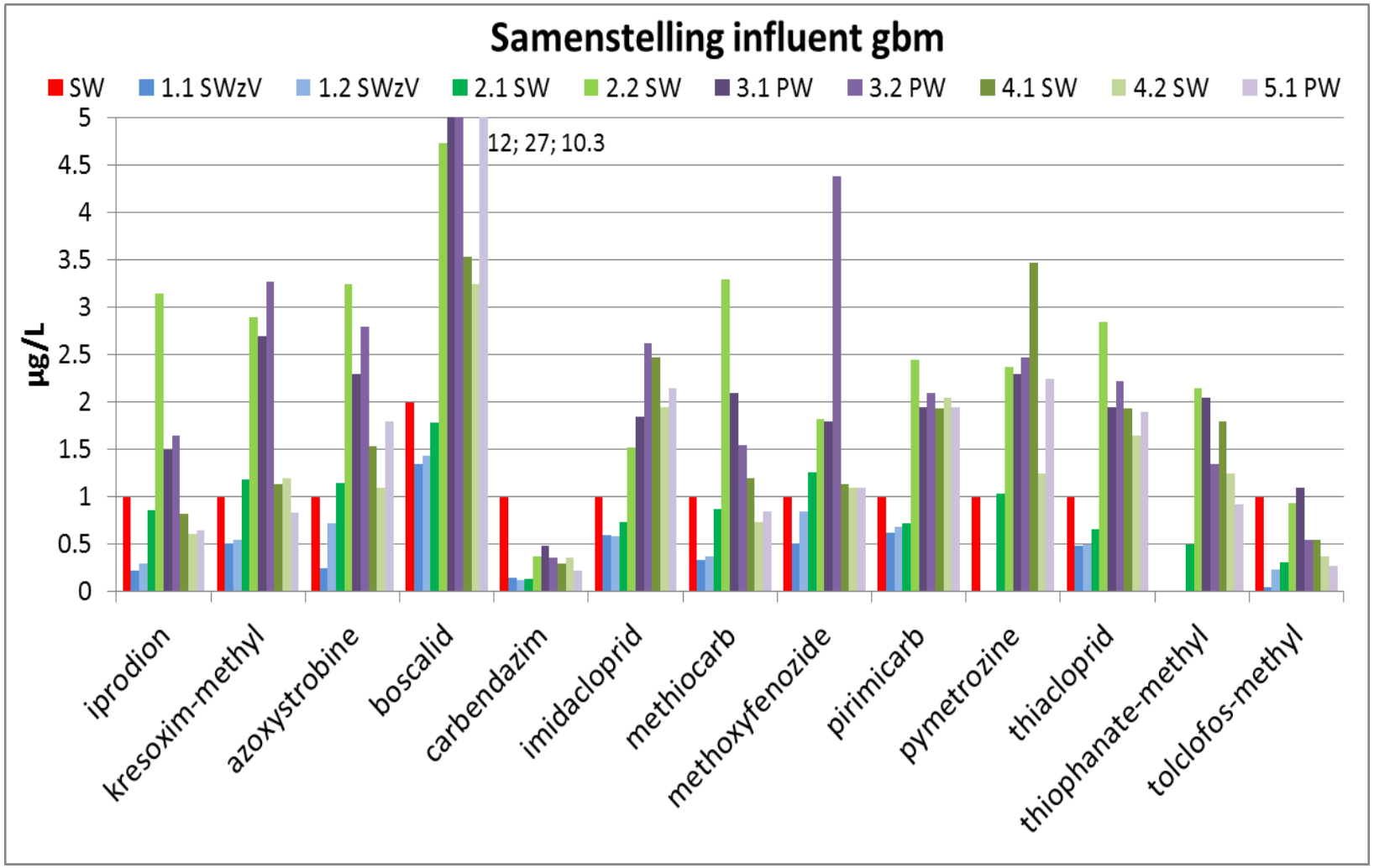
Standardised Water (1): nutrients

	Unit	Aimed Value	Boundaries		Unit	Aimed Value	Boundaries
EC	mS/cm	3.0	2.5 – 3.5	**SO_4**	mmol/l	6.0	3.5 – 6.5
pH		5.5	5 – 6	**HCO_3**	mmol/l	1.0	0.1 – 1.0
NH_4	mmol/l	0.5	0.1 – 0.5	**P (H_2PO_4)**	mmol/l	0.7	0.5 – 1.5
K	mmol/l	7.0	5 – 8	**Fe**	µmol/l	50	40 – 60
Na	mmol/l	6.0	1 – 8	**Mn**	µmol/l	20	15 – 25
Ca	mmol/l	8.0	5 – 8	**Zn**	µmol/l	5	3 – 10
Mg	mmol/l	3.5	2.5 – 4.5	**B**	µmol/l	50	35 – 65
NO_3	mmol/l	17.0	13 – 21	**Cu**	µmol/l	2	0.5 – 3.5
Cl	mmol/l	6.0	1 - 8	**Mb**	µmol/l	1	0.5 – 1.5

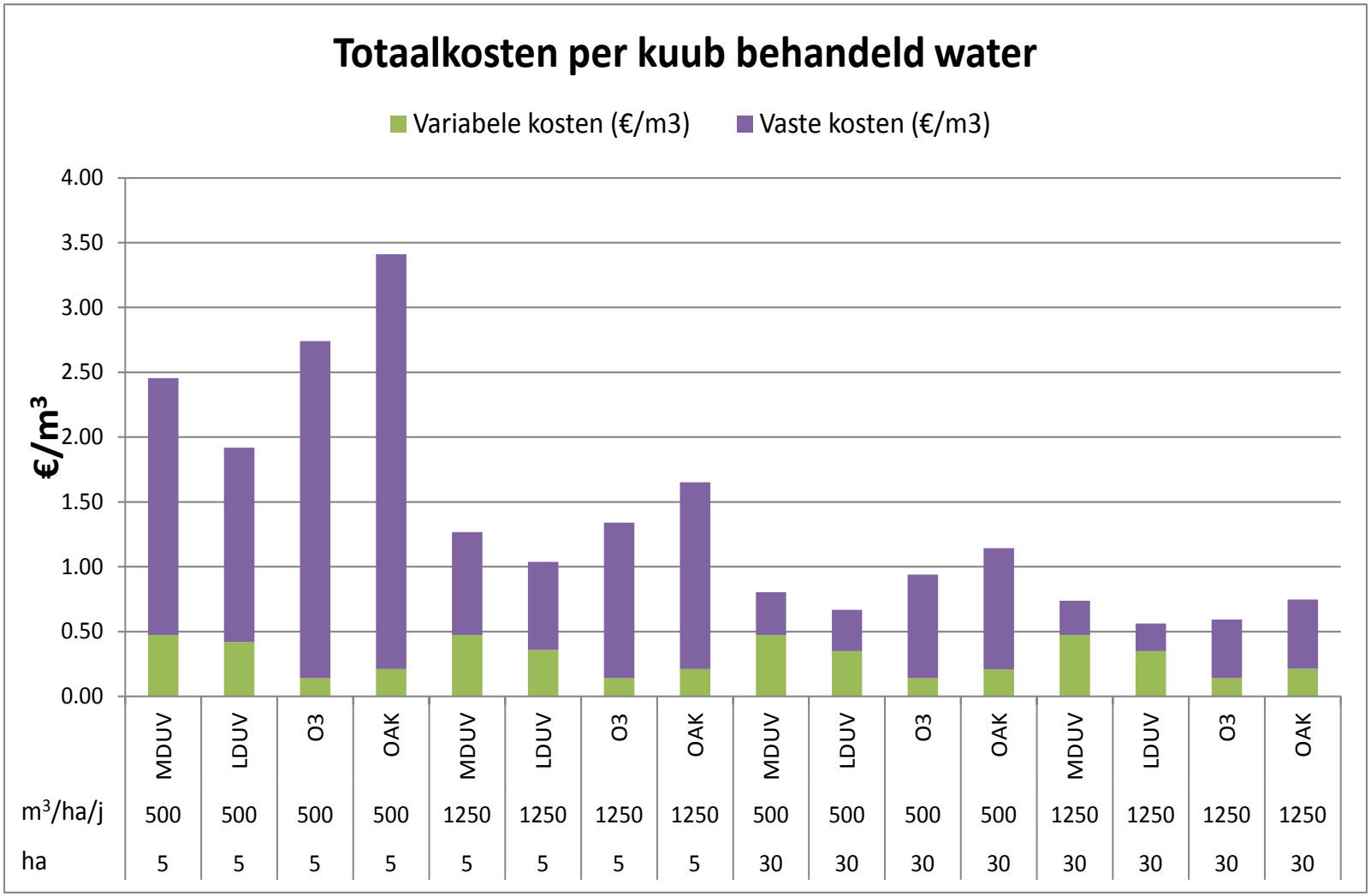
Standardised Water (2): organics

Product		**Concentration**
Illite	Mineral	6 mg/L
Leonardite	Organic	20 mg/L

PPPs in influent



€/m³



WAGENINGEN UR
For quality of life