



Manure, an important input in sustainable vegetable production

Manure use in field vegetable production in the Netherlands

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Manure is an important input in vegetable production

- For farmer
 - (Cheap) nutrient source
 - Organic matter source to maintain soil fertility
 - Improve crop yields and financial return
- For society
 - Closing nutrient and carbon cycles
 - Reducing greenhouse gas emissions
 - Improving water quality
- Conditions
 - Apply manure with 4 R's of Nutrient Stewardship
 - Apply manure with the right technique



Manure cheap source of nutrients in NL

Manure production

- Surplus of slurry in the Netherlands
 - Negative prices slurry
- Production 170 Mkg P_2O_5
 - Average 90 kg/ha

Manure use in vegetables

- Maximum use of organic fertilizers within legislation
- Preference for manures with high organic matter content

	Cattle slurry	Pig slurry
Manure disposal costs per ton	€ 0-10	€ 10-20
Value of nutrients in manure per ton	€ 10	€ 13
Total value per ton	€ 10-20	€ 23-33
Amount of manure by limit of 60 kg P_2O_5 ton/ha	40	13
Total value for vegetable farmers per ha	€ 400-800	€ 300-430

Value of organic matter in manure: Experiment Soil quality of sandy soils

Conventional

*No organic
matter input*

AF

*Normal organic
matter input*

MAN



Slurry and chemical
fertilizers

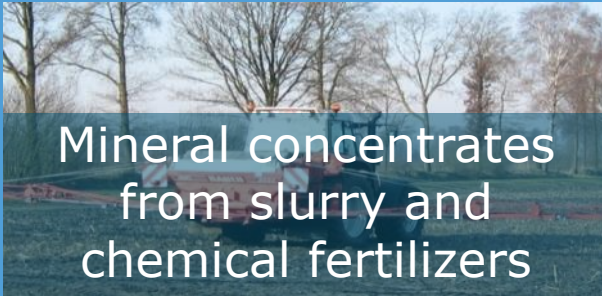
Organic

*High organic
matter input*

BIO



Farmyard manure and
slurry

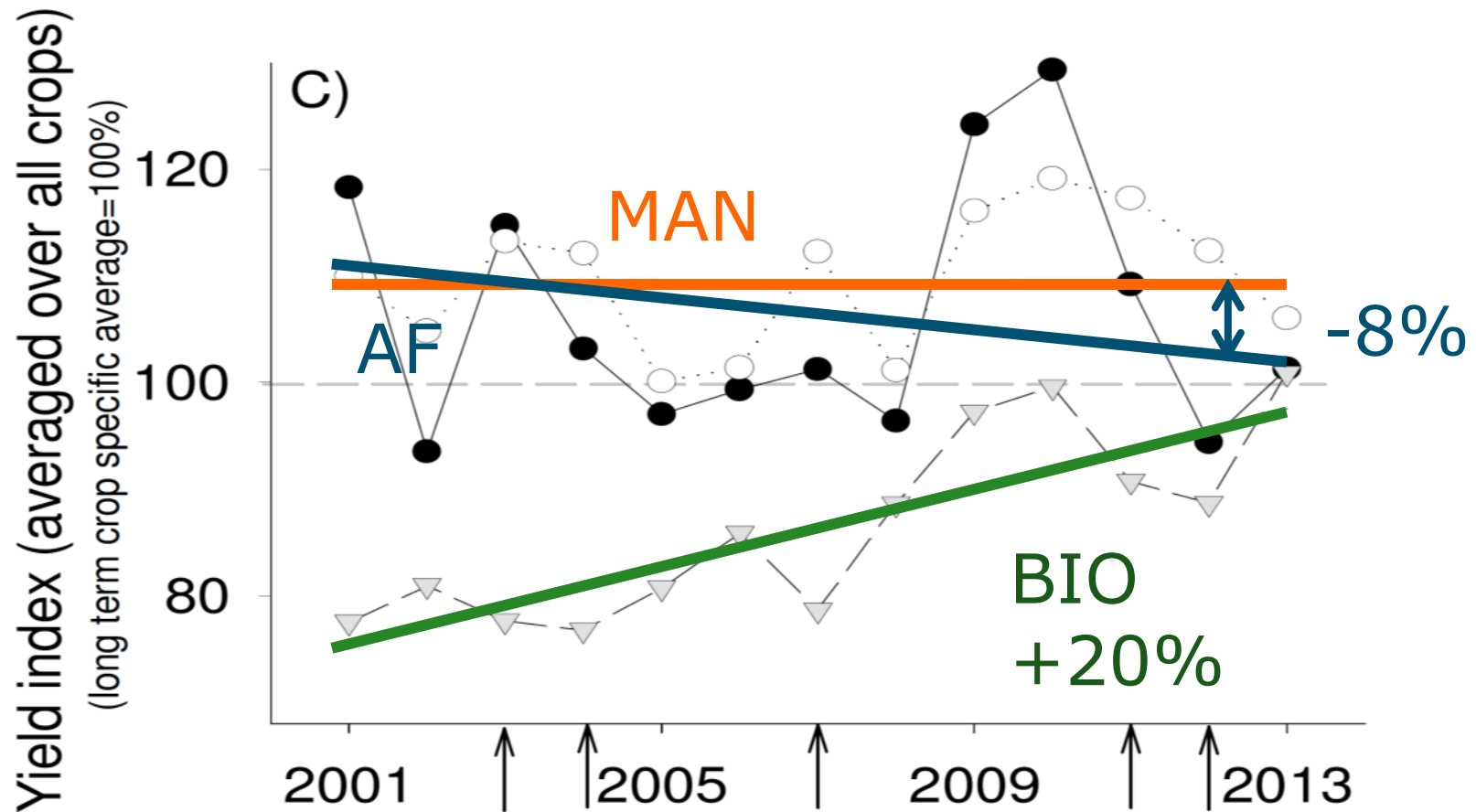


Mineral concentrates
from slurry and
chemical fertilizers



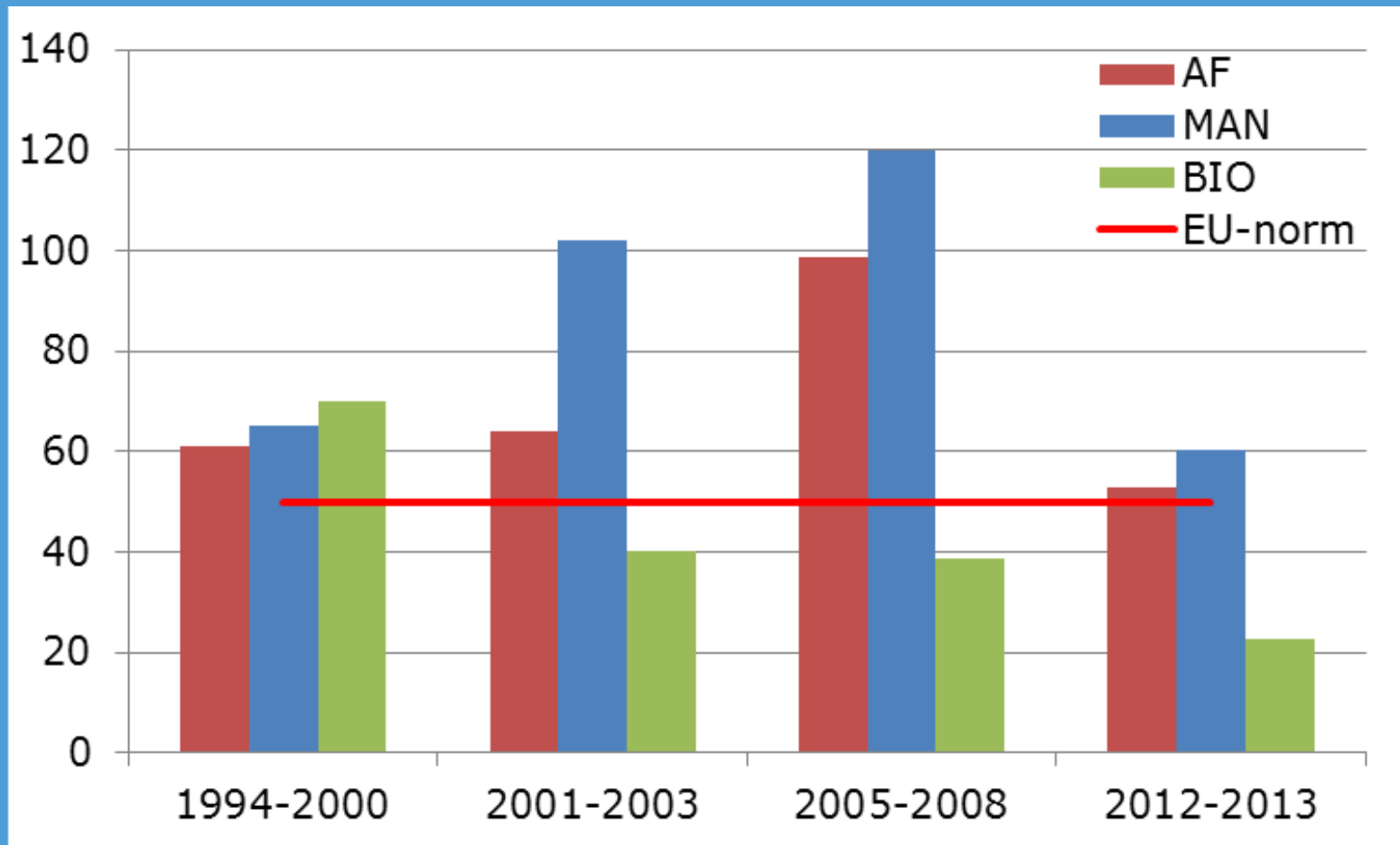
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Crop yield trend 2001-2013



Nitrate concentrations in groundwater

mg NO₃⁻/l



Value of Organic Matter

Difference organic
matter input
MAN - AF

Balance difference
MAN - AF 480 €/ha
(30-2000 €/ha)

Value manure

Cattle slurry € 36/ton (6-300)

Pig slurry € 10/ton (2-90)

	Cattle slurry	Pig slurry
Manure disposal costs per ton	€ 0-10	€ 10-20
Value of nutrients in manure per ton	€ 10	€ 13
Values of organic matter in manure	€ 36	€ 10
Total value per ton	€ 46-56	€ 33-43
Amount of manure by limit of 60 kg P ₂ O ₅ ton/ha	40	13
Total value for vegetable farmer per ha	€ 1840-2240	€ 430-560

Application of manure: use of 4 R's

4R Principles of Nutrient Stewardship



RIGHT SOURCE

Matches fertilizer type to crop needs.



RIGHT RATE

Matches amount of fertilizer to crop needs.



RIGHT TIME

Makes nutrients available when crops need them.



RIGHT PLACE

Keeps nutrients where crops can use them.

5th R: right technique



Right source: selection of manure type

- Nutrient content: fertilizer replacement value
 - Nitrogen
 - Slurries: 55-80% of CAN
 - Solid manures: 30-60% of CAN
 - Compost 10% of CAN
 - Phosphate: 60-100%, (100% long term)
 - Potassium: 100%
- Crop requirements: nutrient ratios
- Organic matter content: org matter/nutrient ratio



Average composition of some organic manures (g/kg)

	Total N	% N- NH ₃	P ₂ O ₅	K ₂ O	N/P	Org. matter	Org. matter/P
Slurry (liquid manure)							
Cattle	4.1	49	1.5	5.8	2.7	64	43
Pigs	7.1	65	4.6	5.8	1.5	43	9
Solid manure							
Cattle (on straw)	5.3	17	2.8	6.1	1.9	152	54
Chickens	29	11	24	19	1.2	401	17
Compost							
Household compost	13	0.1	6.3	11	2.0	242	38
Green compost	5.0	0.1	2.2	4.2	2.3	179	81

New ways to change manure composition

Manure digestion

- Energy production
- Input: manure + other material
- Output: gas + digestate
- Increase NRF with 10%

Manure processing

- Separation of slurry + Reversed osmosis
- Output
 - Solid fraction (P-rich)
 - Mineral concentrate (N-K fertilizer)
 - Permeate



Example separation of pig slurry

Effect on the composition of the separated fractions (kg/ton)

	OM	N tot.	N-NH ₃	P ₂ O ₅	N-tot./ P ₂ O ₅
Input slurry	45	7.0	60%	4.0	1.8
<i>Separation (high efficiency technique)</i>					
Solid fraction	146	10.5	57%	18.7	0.6
Liquid fraction	25	6.4	58%	1.4	4.5
<i>Ultra filtration and reversed osmoses of the liquid fraction</i>					
Mineral concentrates	17	8.1	90%	0.5	17.3



Right application: prevention of ammonia volatilization

Application technique	NH ₃ -volatilization (% Nm)
Surface spreading	75-80%
Surface spreading + incorporation	20-30%
Injection	≤5%



Placement of manure (row application)

- Improves N P K fertilizer use
- Most effective on poor soils, slightly or not on rich soils
- Application at planting or before hilling of potato on clay soils



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Thank you for your attention

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