Nutrient management in organic greenhouse production; **navigation between constraints**

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Content

- Current restrictive issues
- Fertilizer use org. greenhouse hort.; state of the art
- Matching fertilization practice and legislative issues
- How to deal with restrictions coming next

Constraints related to soil fertility

Dutch context

- Organic principles: (EU 2091/2092).
- Legislative restrictions [1]
- New standards for manure and fertilizers[2]

[1] Conventional and organic farming

[2] Organic farming only

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Legislation

- Manure limitation (N) (overall agriculture)
  - EU directive: maximum 170 kg N ha^{-1} yr
- Limitation on total N and P input (greenhouse horticulture)

	kg/ha/yr	
	N	P
Tomato	1590	381
Cucumber	1590	324
Sw. pepper	1550	228
Lettuce	500	88

- Compost [1]
  - Quality standards (O.M., heavy metals)
  - Unlimited, if P and N limits not exceeded

[1] EU regulated

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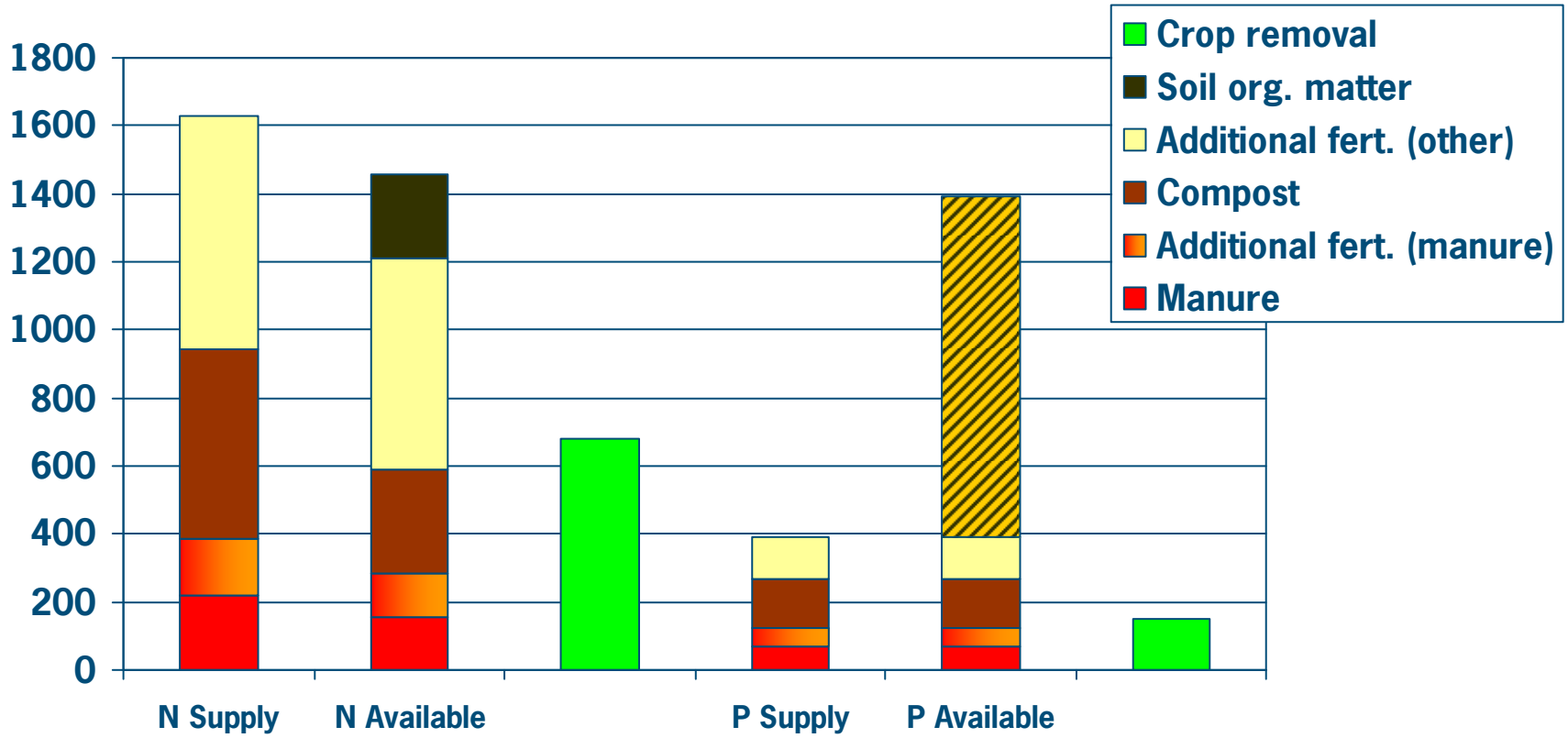
State of the art

- Monitoring:
  - 2002 – 2005 (→ 2009)
  - 5 – 8 organic greenhouses
  - Crop rotation: tomato – sw. pepper – cucumb.
    lettuce – paksoi - courgette -bean
- Results:
  - total N and P input
  - Measured/estimated crop removal
  - Simulated available N[1]

[1] (MOTOR / Janssen)

Average yearly N and P inputs and uptake at eight organic greenhouses (> 5 years)



N input and legislative standards

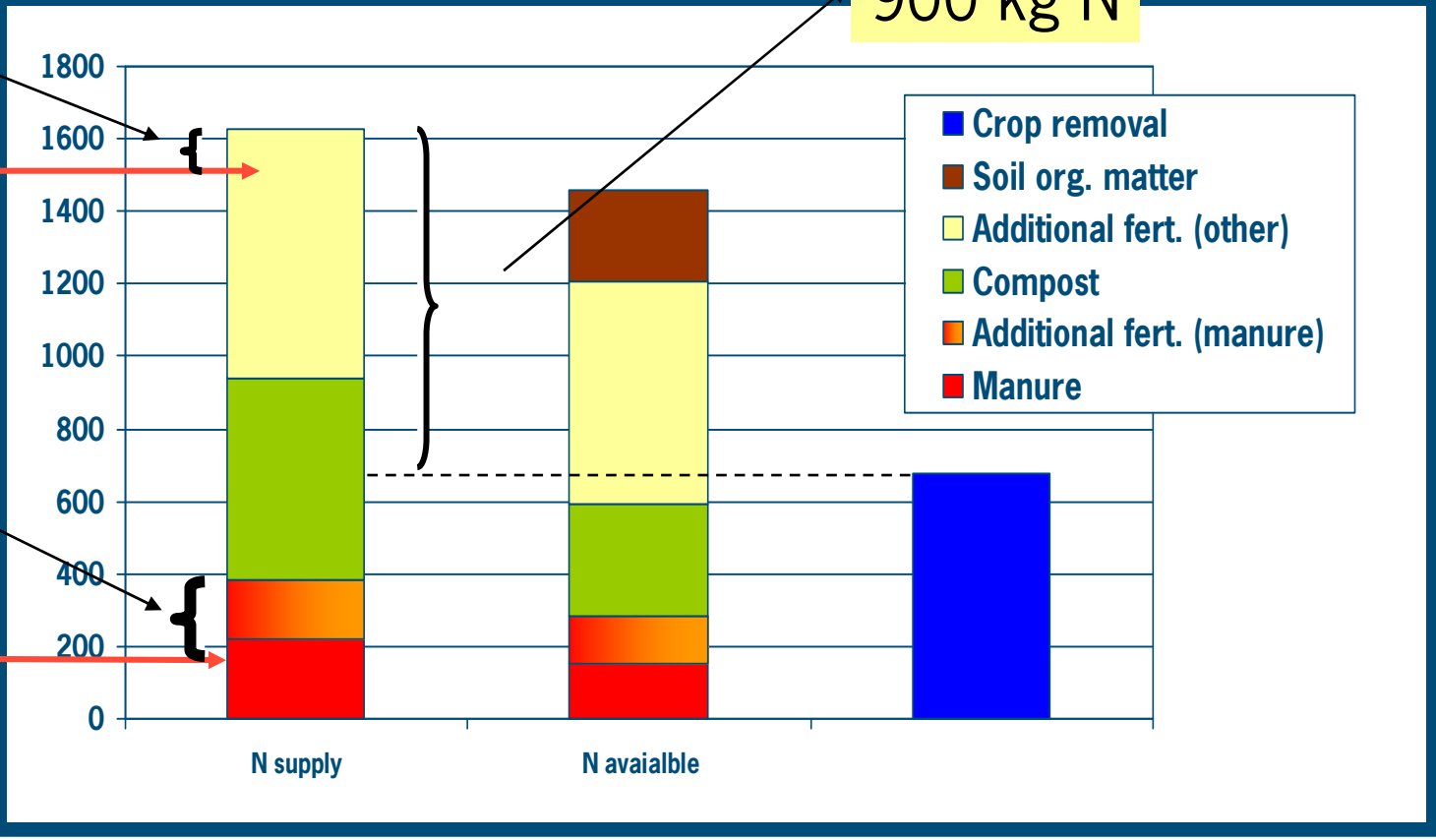
Excess
220 kg N

Maximum input
1550 kg/ha

Excess
220 kg N

Source animal manure Limit
170 kg N/ha

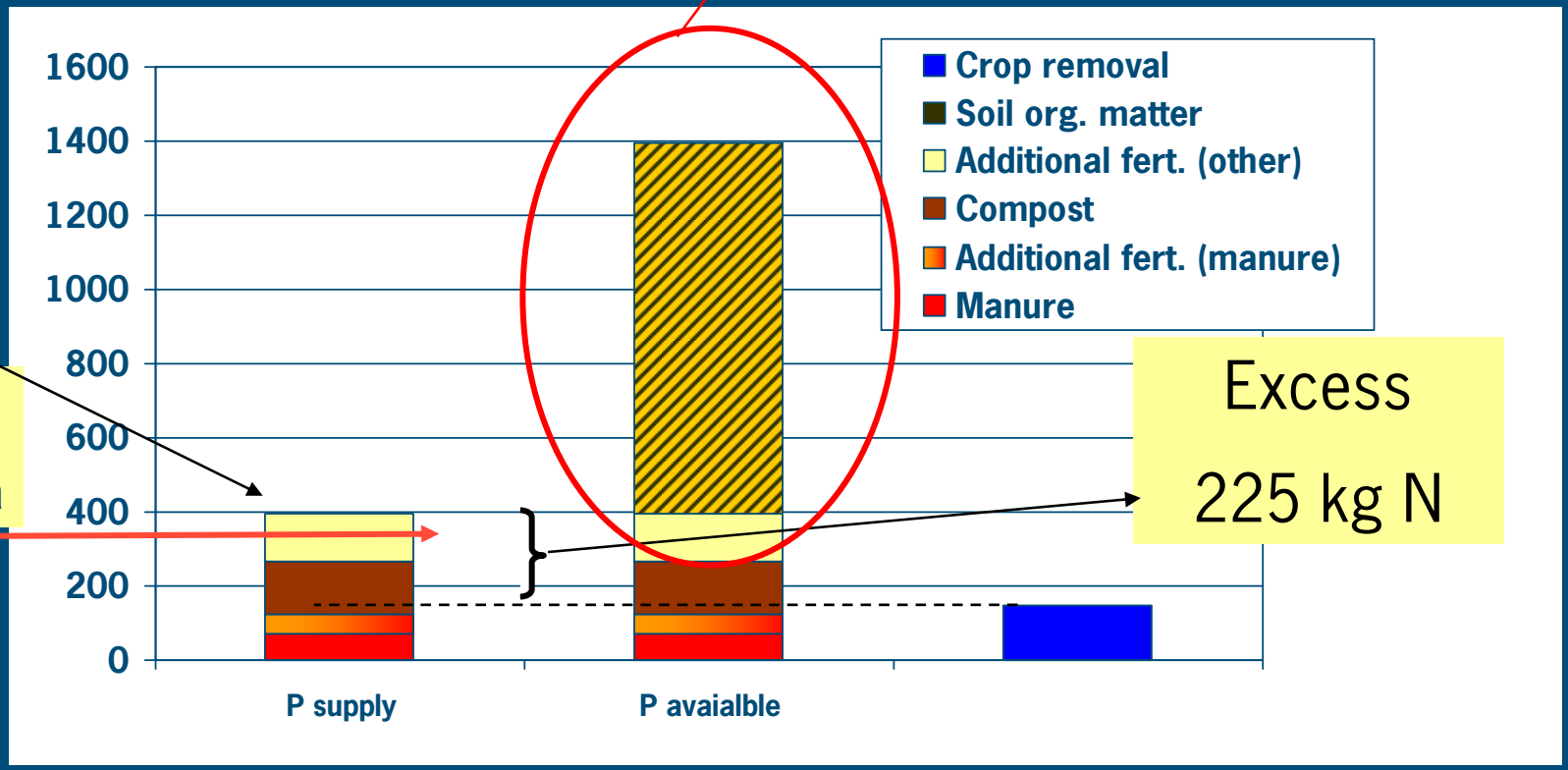
Excess
900 kg N



P inputs and legislative standards

Standard fertilizer recommendation:

zero P application !



Excess

50 kg P

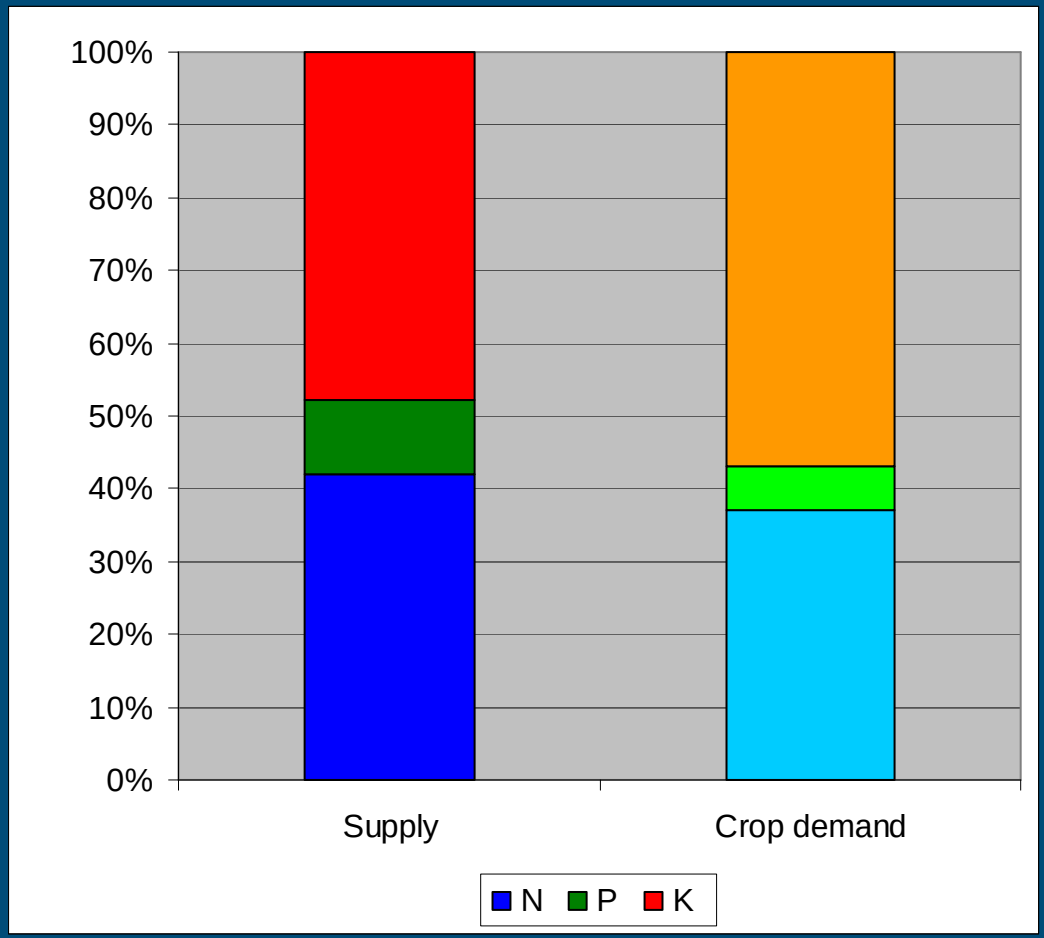
Limit

350 kg P/ha

Excess

225 kg N

Average ratio N:P:K in supply and crop removal



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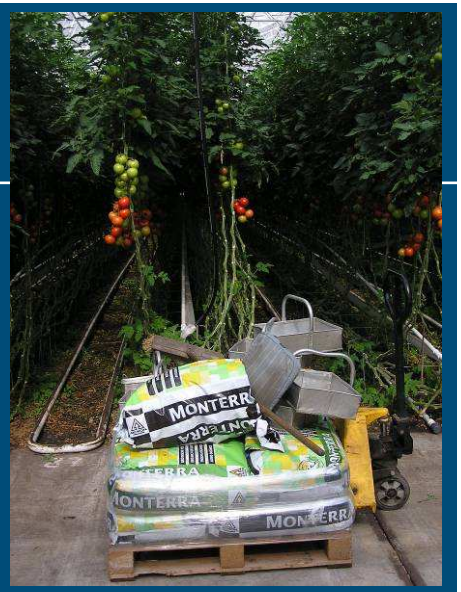
Situation: organic greenhouse horticulture

- Surplus in total N supply → leaching → emission
- Exceed N supply limitations from animal source
- Exceed N and P limitations
- Imbalance of nutrients: excess in N and P

Tuning supply and demand



Decision support tool

I. Basic data soil, greenhouse, growing system
   - calculation soil mineral buffer (N,P,K)

II. Cropping plan + estimated yield
   - estimation of crop requirement (N,P,K,Ca,Mg,S)

III. Growers choice of manure
   - limitation to 170 kg N input

IV. Growers choice of compost

V. Growers choice of add. fertiliser + quantity

VI. Iteration steps

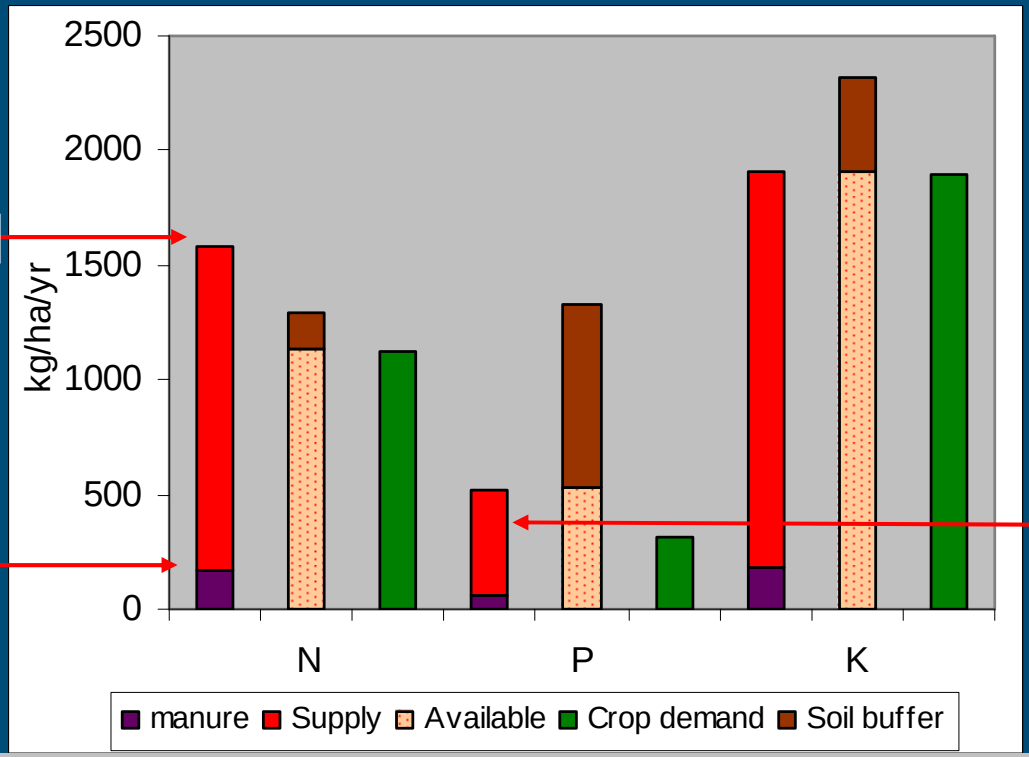
VII. Equilibrium between supply /(available) and demand
   + mutual rations of N P K

Calculation of available N

Example Fertilization schedule Tomato 50 kg/m2

1600 kg N

170 kg N



380 kg P

	Base dressing	top dressing
	ton/ha	ton/ha
Farm yard manure	30	
Greencompost	100	
Mixed fert. 9 6 12		9.5
Potassium sulphate	1	

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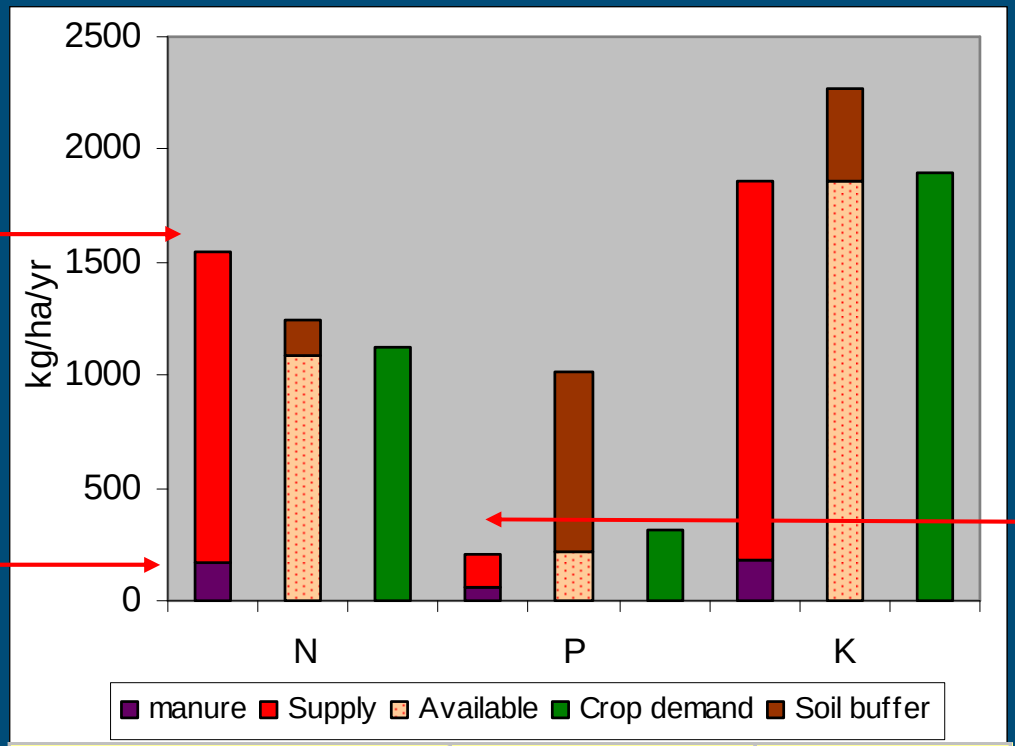
Option 2 Fertilization schedule Tomato 50 kg/m2

1600 kg N

170 kg N



380 kg P

	Base dressing	top dressing
	ton/ha	ton/ha
FYM	30	
Greencompost	100	
Feathermeal		5
Pot. Sulph.	4.5	

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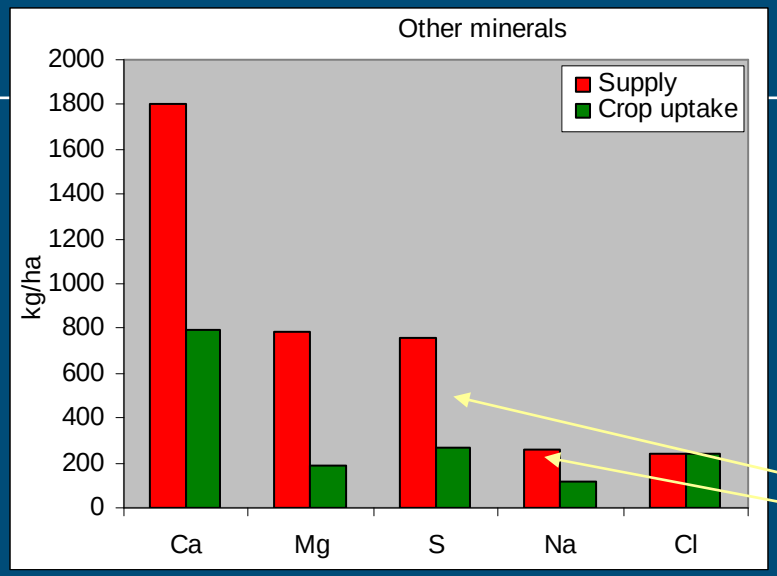
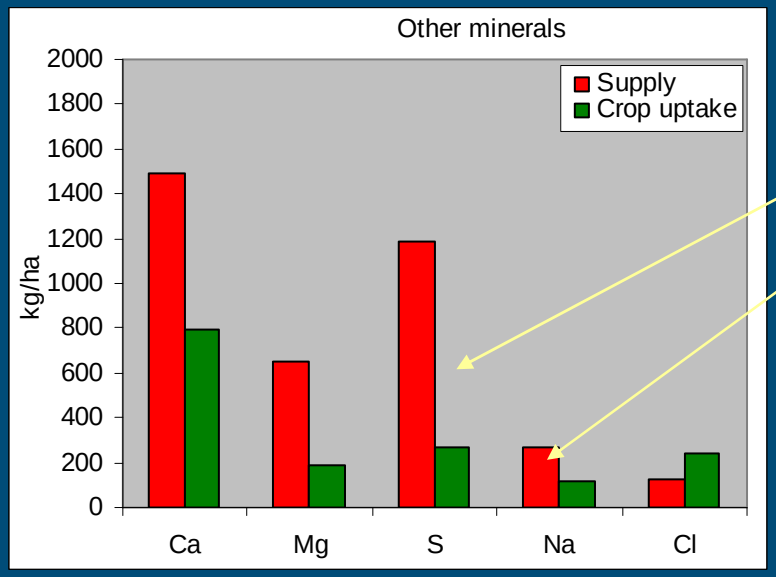


Schedule 1:

mixed fertiliser

	Base dressing	top dressing
	ton/ha	ton/ha
Farm yard manure	30	
Greencompost	100	
Mixed fert. 9 6 12		9.5
Potassium sulphate	1	



Potassium sources

Schedule 2:

feather meal

	Base dressing	top dressing
	ton/ha	ton/ha
FYM	30	
Greencompost	100	
Feathermeal		5
Pot. Sulph.	4.5	

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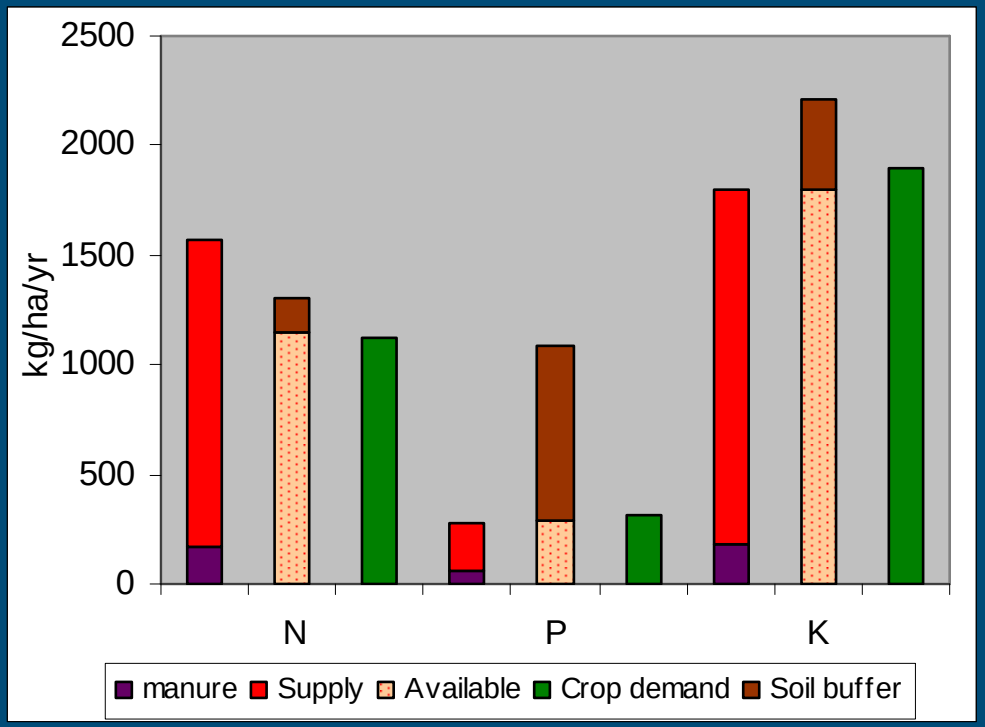
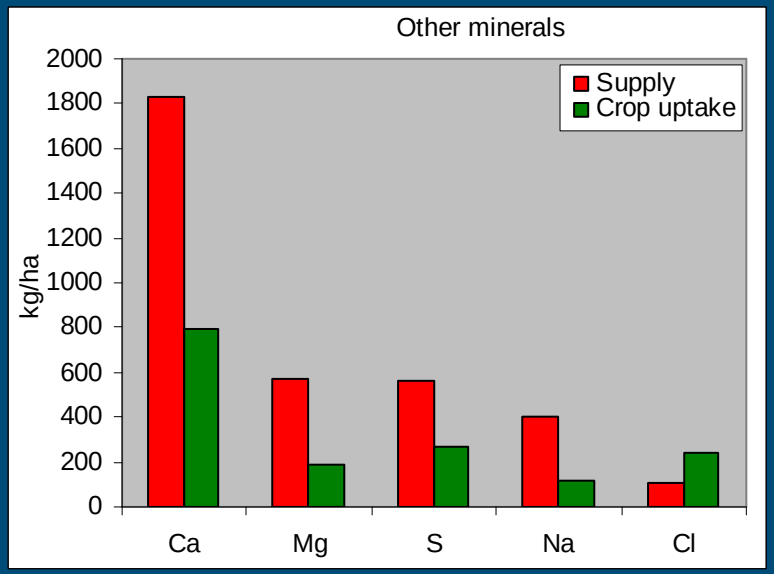
Alternative



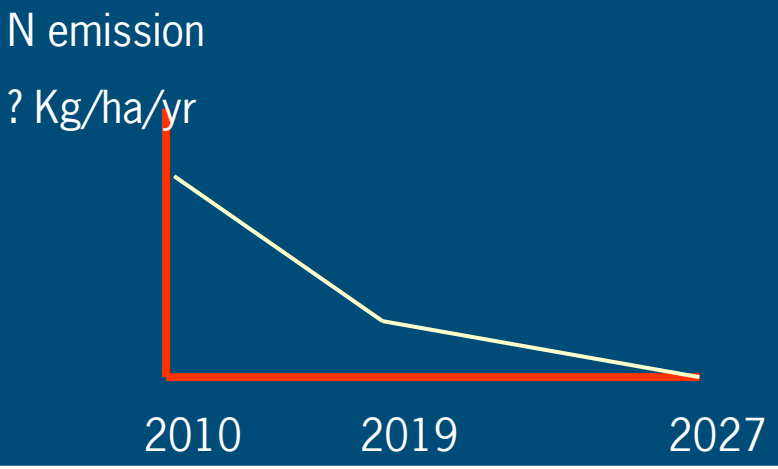
	Base dressing	top dressing
	ton/ha	ton/ha
FYM	30	
Greencompost	100	
Lucerne		23
Pot. Sulph.	1	



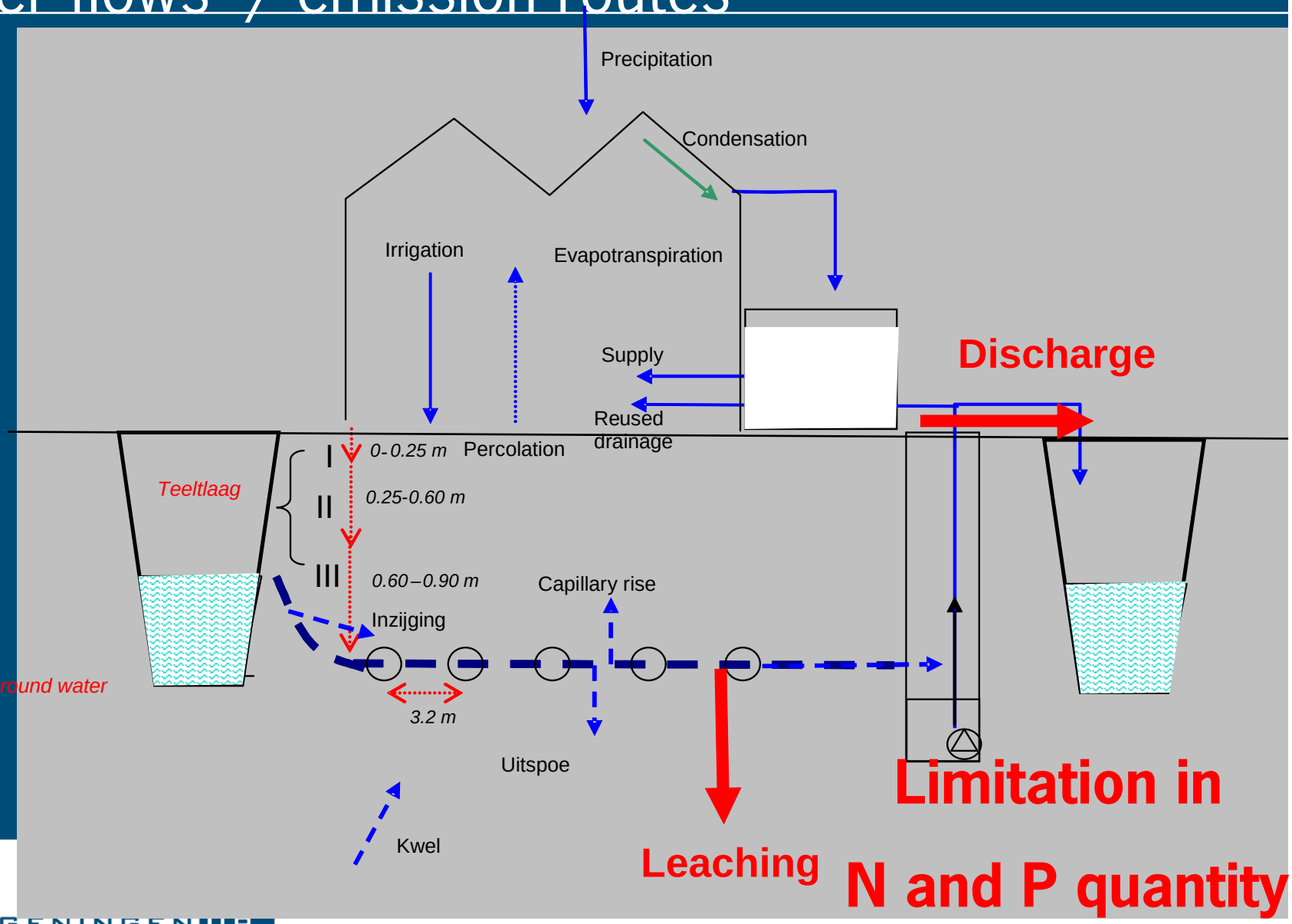
Upcoming constraints and restrictions

1) Substitution maximum input N and P standards

- → **<u>Emission targets</u>** for N and P
  - In development
  - Final goal 2027 zero emission



Water flows / emission routes



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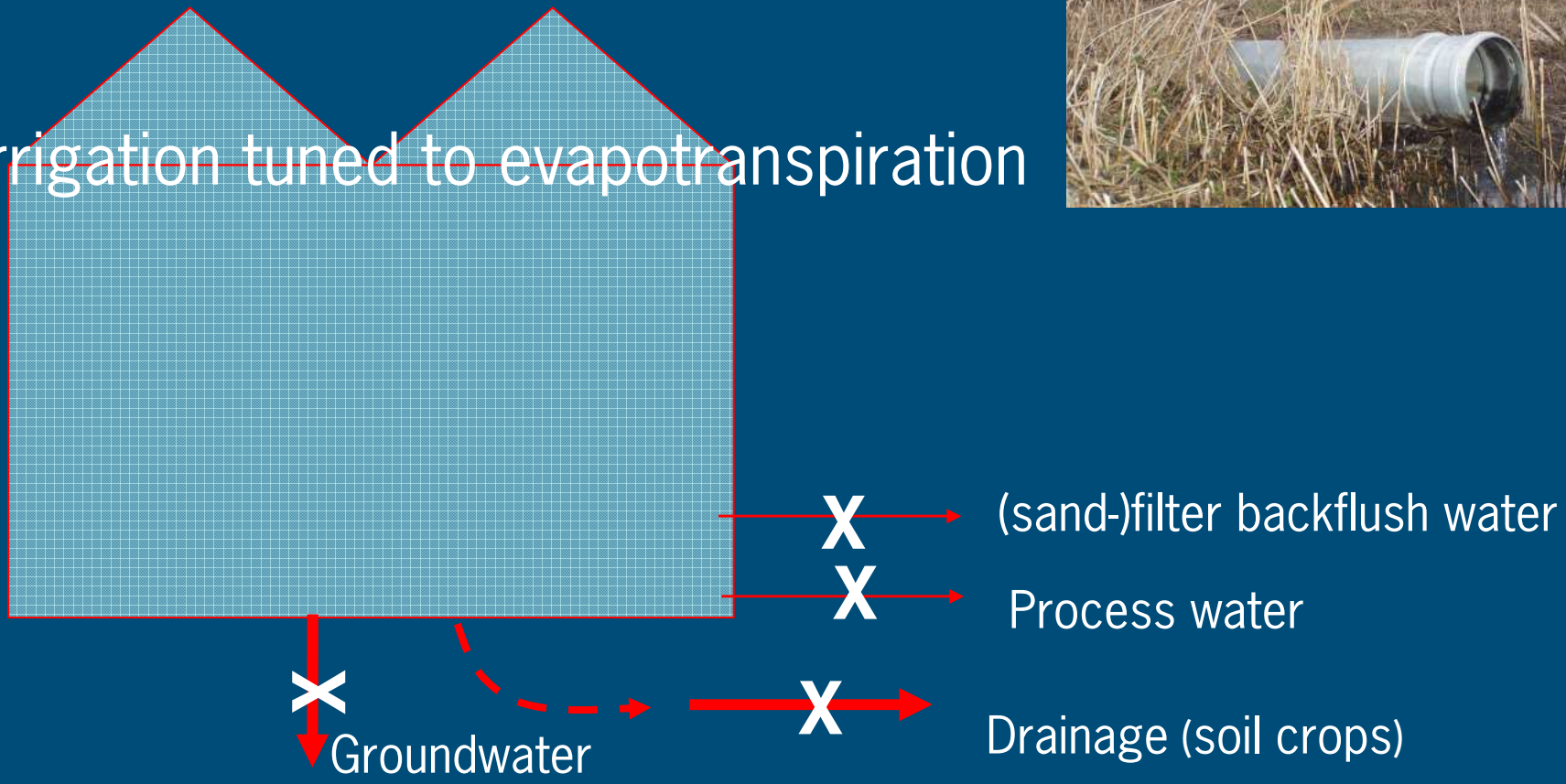
Improving Water Use Efficiency: reduction of wastewater flows

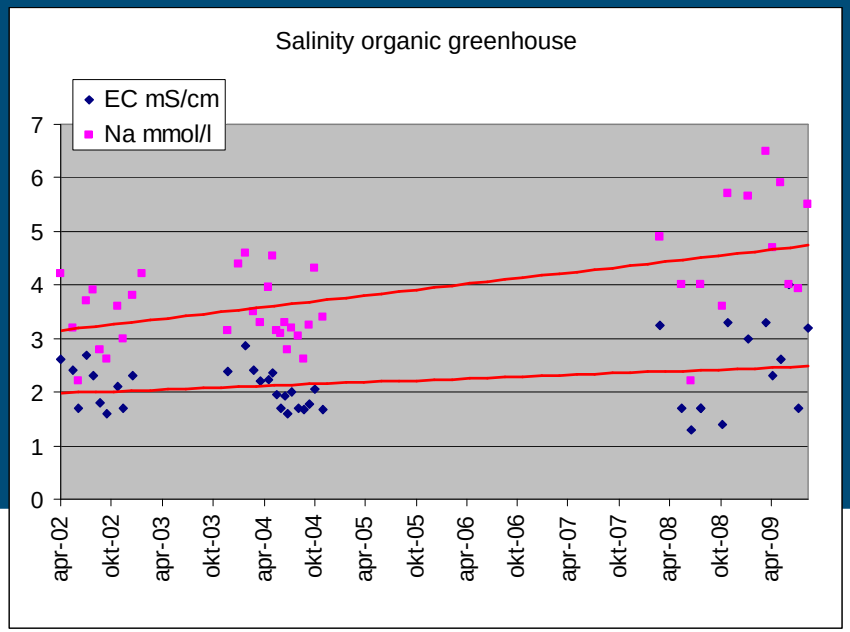
Irrigation tuned to evapotranspiration



Bottle neck:

Salinity problem

Na (SO4, Cl) quantity in manure, compost, add. fertilizers



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Regulation of organic manure

- A fertilizers
  - Organic manure
  - Organic crop compost (?)
  - Regular compost (until 2012)
- B fertilizers
  - Other fertilizers (EU 2091/92)

- In 2010: obligatory 50 % A fertilizers
- In 2020: 100 (?) % A fertilizers

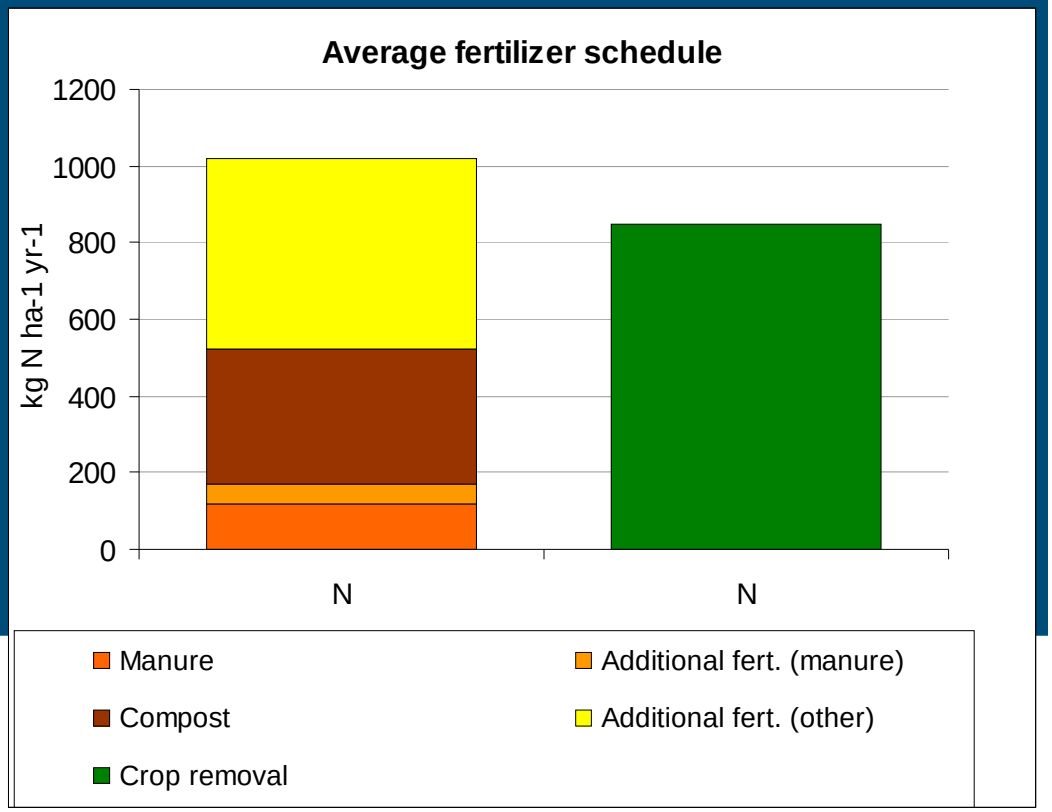
Regulation of organic manure

Manure is limited to 170 kg N

Serious problem, if compost is not accepted as A fertilizer

Manure+compost

+/- 50 %



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In conclusion

- Fertilization, some unsustainable characteristics
- Potential low NUE and WUE (compared to conventional)
- Easily, excess in P supply (relation to soil buffer)
- High risk of salinity problems

Required:

- Balanced fertilization plan + “smart” side-dressing schedule
- Combined with smart irrigation
- Compost with organic certification
- Variety of “plant” source fertilizers
  - Low in Na, Cl, SO_4
- Irrigation tuned to evapotranspiration

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