APPLIED PLANT RESEARCH

Crop Rotation in Organic Farming

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2005

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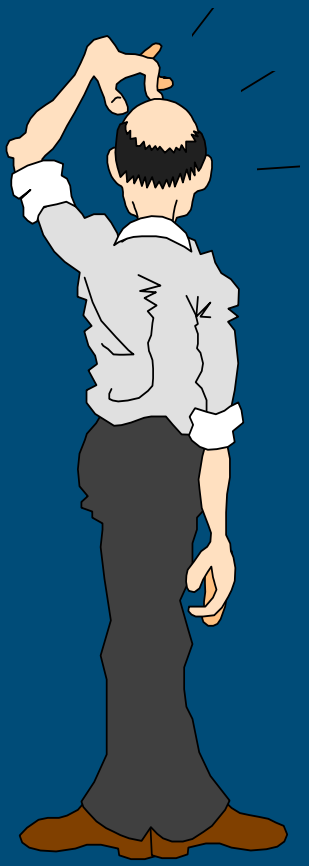
Elements for succesfull organic production

- Farm
- Knowledge
- Craftmenship
- Entrepeneurship
- Market



Toolsbox: farming methods

- Crop rotation
- Soil cultivation
- Crop protection
- Weed control
- Fertilisation/Nutrient management
- Ecological infrastructure management

Emphasis in farming methods

conventional *organic*

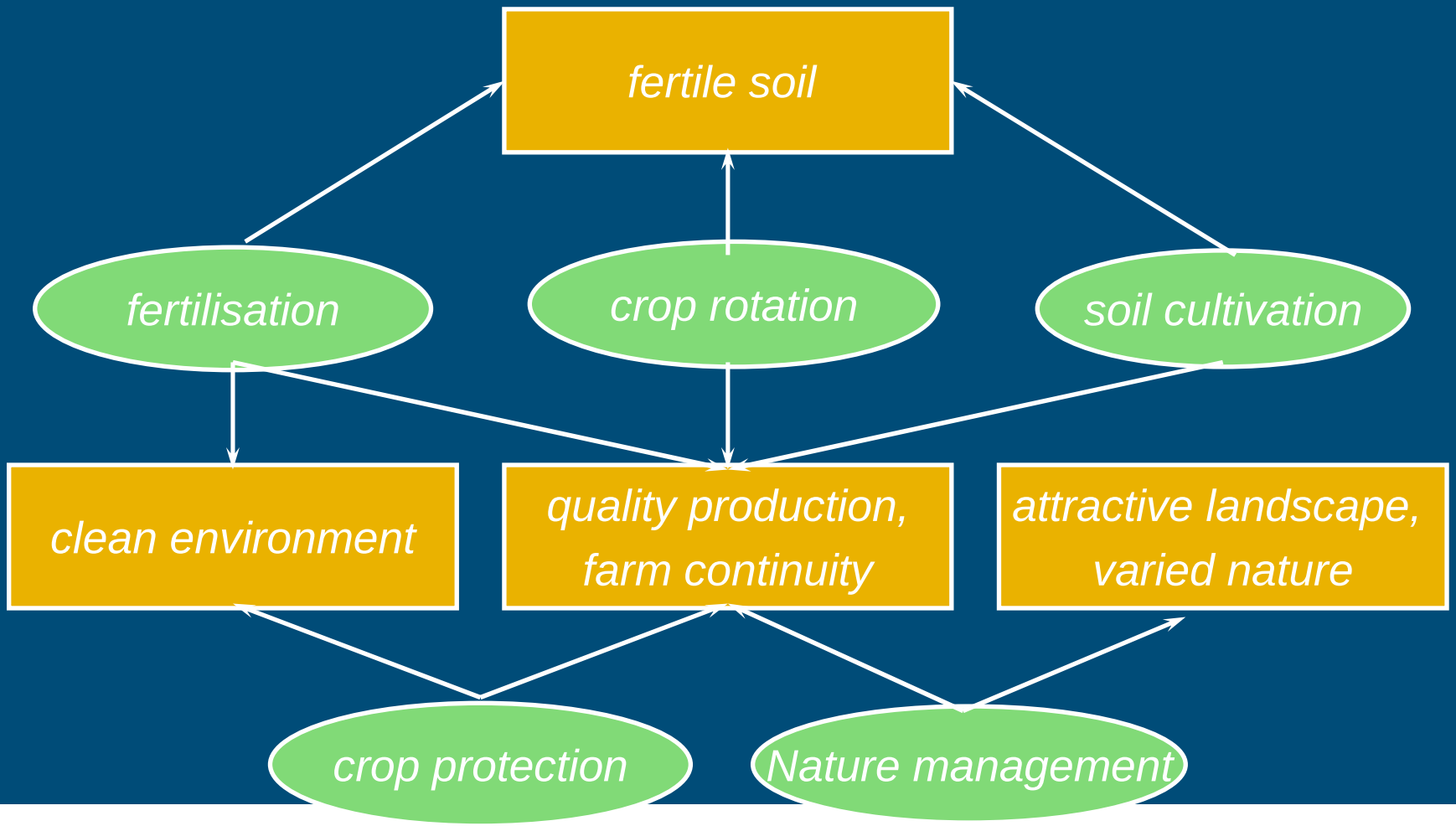
soil structure
- crop rotation
- organic manure
- green manure
- soil cultivation

nutrient supply
- crop rotation
- organic manure
- green manure
- mineral fertiliser

weeds
- crop rotation
- cropping system
- mech. control
- pesticides

pests and diseases
- crop rotation
- cropping system/ resistant varieties
- pesticides

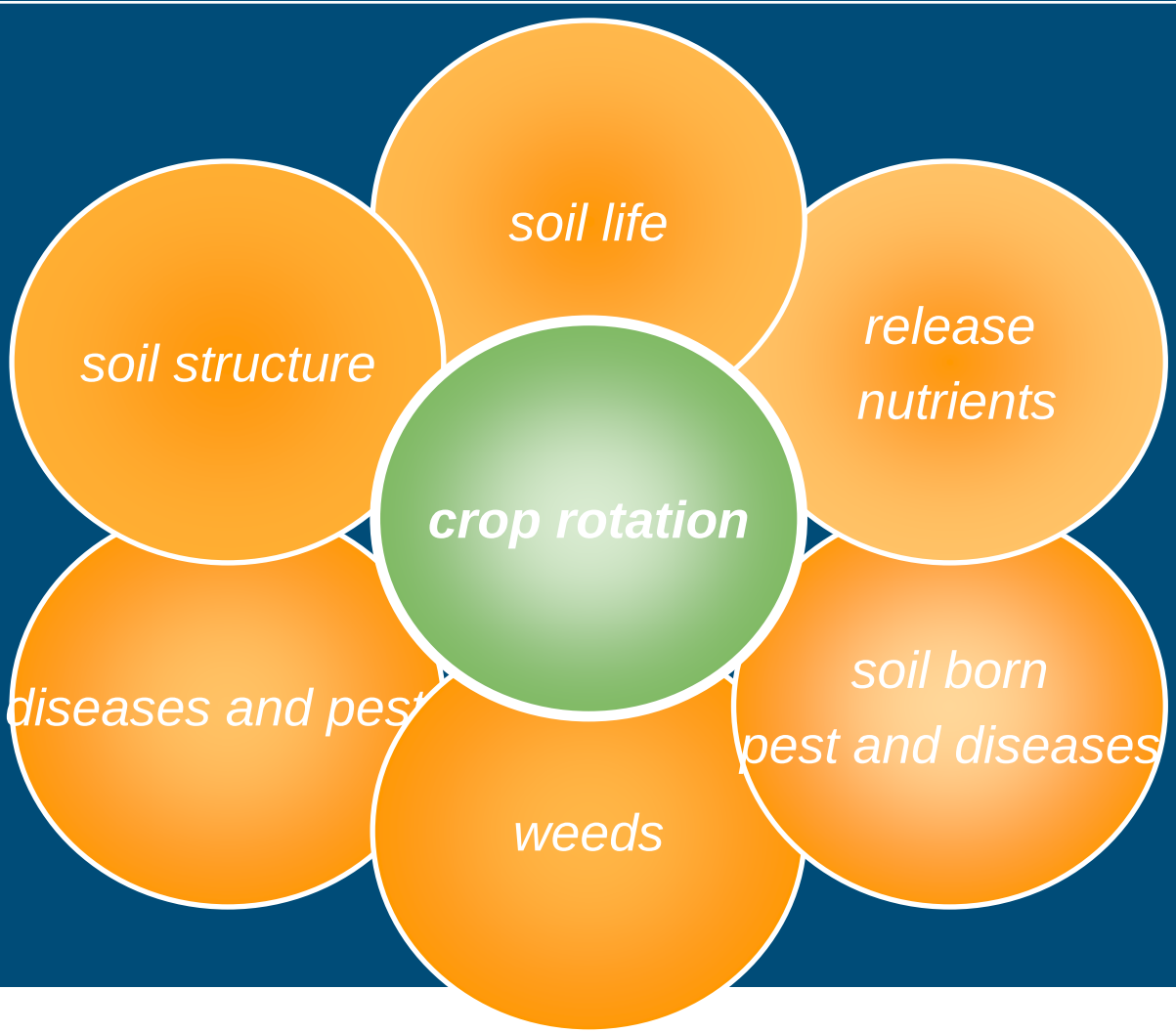
Farming practices and intentions



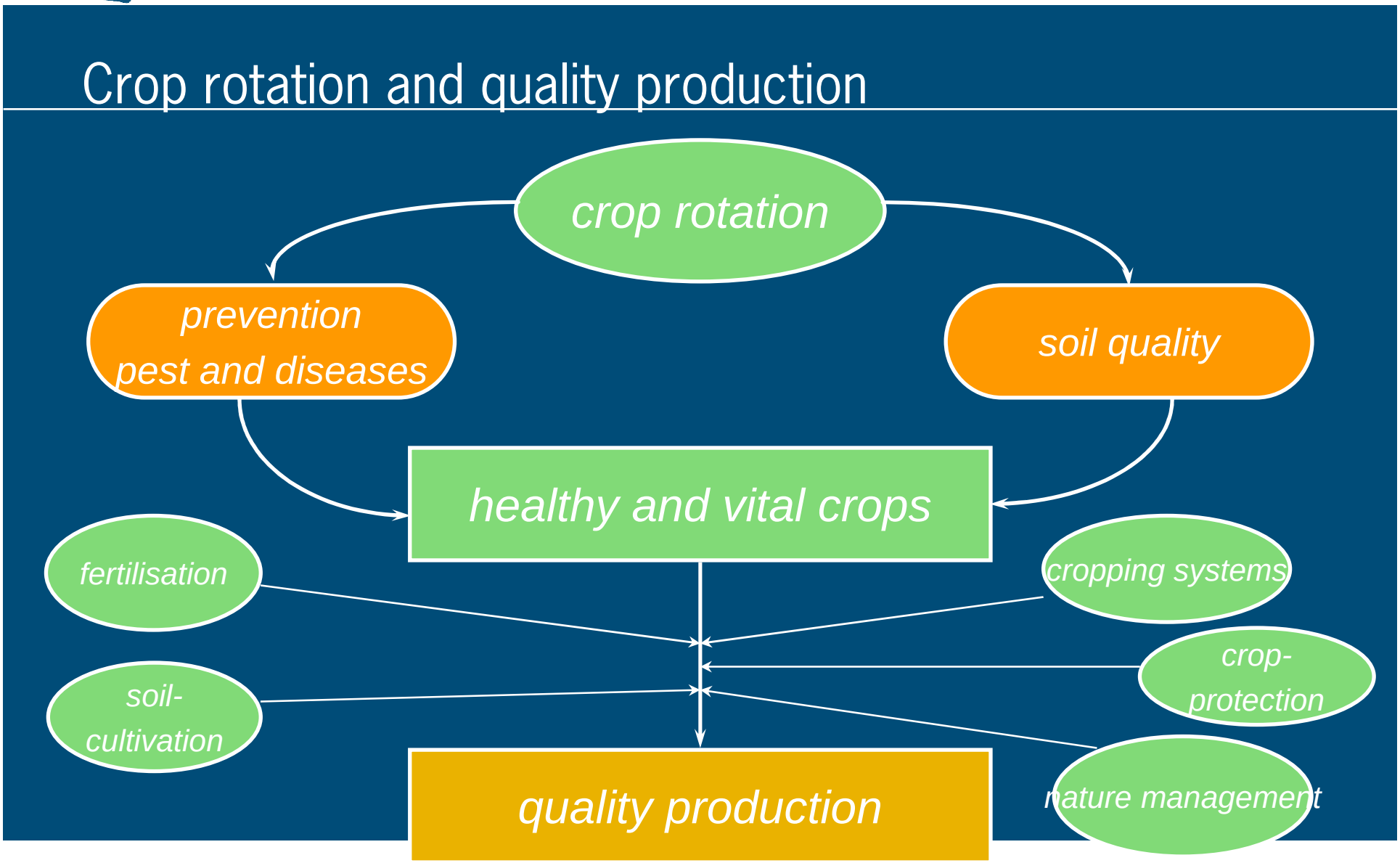
Farming methods

- agronomic toolbox
- all methods are interrelated
- infuence on various parameters

Influence crop rotation



Crop rotation and quality production



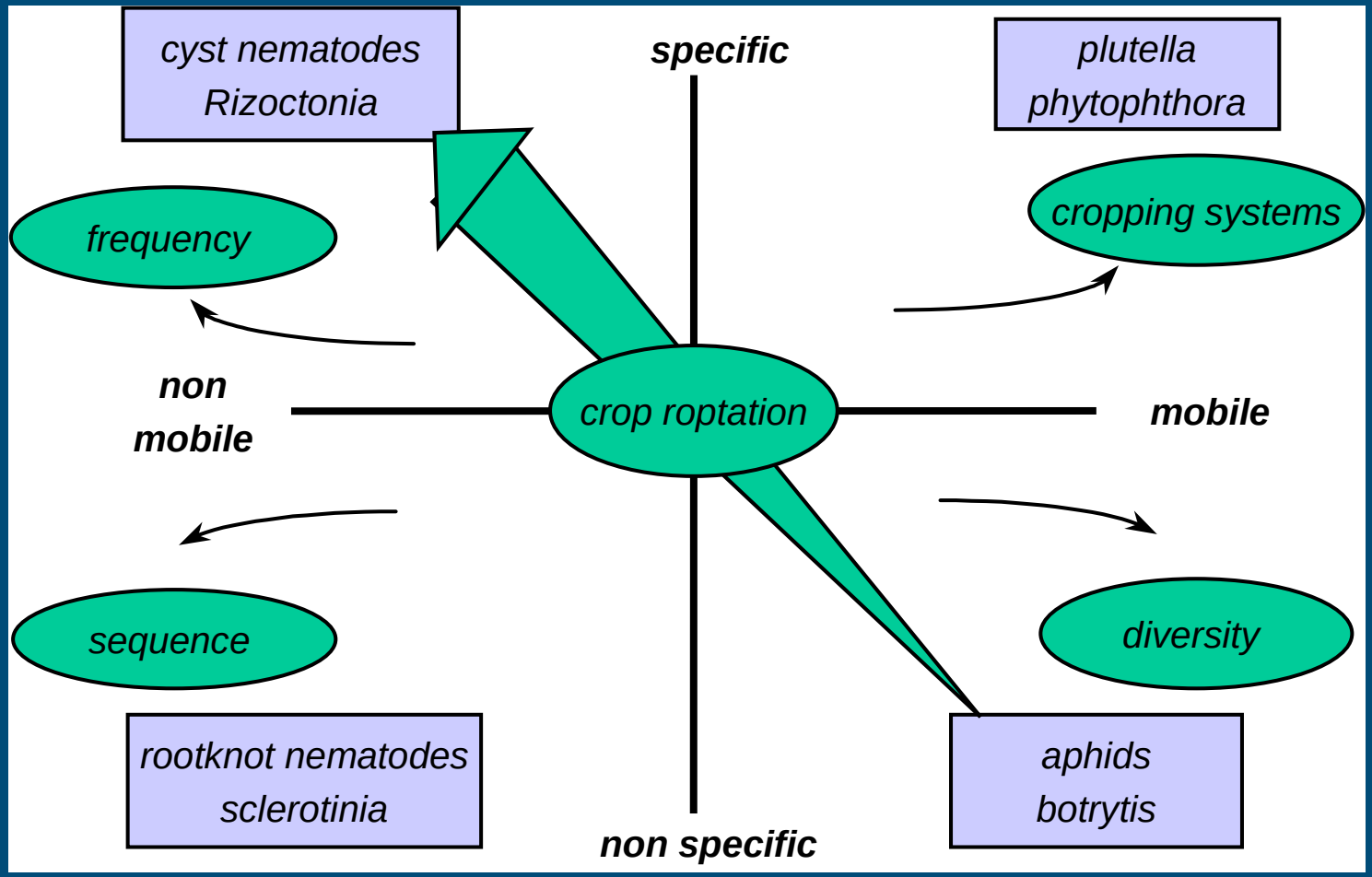
Crop rotation and nutrient management

- Total N demand of crops in rotation
  < N available by manure and transfer of N fixed in leguminous crops
- use of leguminous crops, where and how
- use of manure where and how
- sequence of crops, Nutrient transfer

Rotation, green manures and fertilisation (org)

	Crop	Green manure	Animal Manure
1.	seed potato	grass-clover	22 ton solid goat manure
2.	grass-clover	grass-clover	30 m^3 leak water
3.	sown onions/sugar beet	white mustard / -	30 ton solid goat manure
4.	spring wheat	Persian clover	12 ton solid goat manure
5.	winter carrot / chicory	- / -	-
6.	processing peas	Italian ryegrass	-

Crop Rotation, prevention of pests and diseases



Multifunctional Crop Rotation (MCR)

- basis for
  - soil fertility
  - healthy and vital crops
- optimise positive and minimise negative interaction
  - pest and diseases,
  - nutrient recovery etc.
- well balanced team of players
  - sequence and frequence

Crop rotation

- Crop choice (team of players)
- Crop frequency
- Crop sequence
- Spatial layout

Crop rotation design 1

1. Selection crops and green manure
2. Characterising role and potential

Characterise crops

- Lettuce
- Leek
- Tomatoes
- Springwheat
- Snap beans

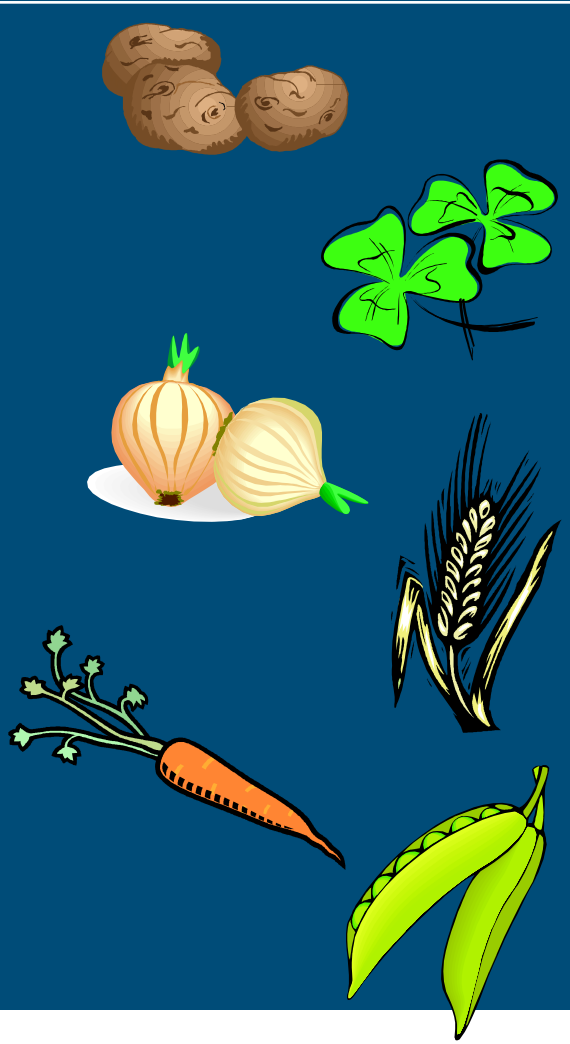
Balanced Crop choice

Characterising role and potential

- High and low nutrient demand, oftake, residue, transfer
- Nitrogen fixating crops
- Intensive and superficial rooting
- High and low weed suppression
- High and low labour demand
- Different species and families
- Susceptability pest and diseases
- Gross margin
- Cropping period

Crop Rotation Example

1. Potatoes
2. Grass/clover
3. Onions
4. Springwheat
5. Carrots
6. Peas

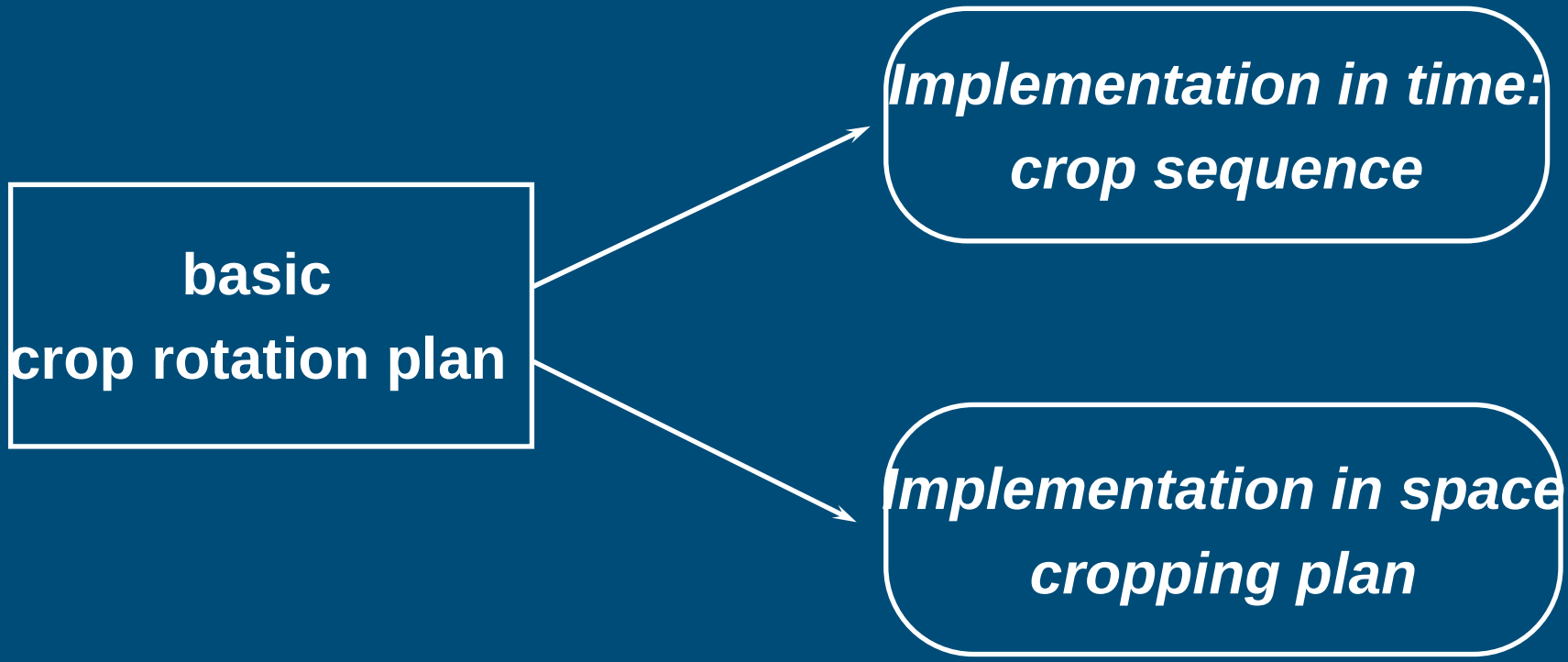


Crop rotation = cropping plan + sequence

- *crop rotation*
  carefully designed sequence of crops in which the succession is to a high degree positive
- *cropping plan*
  the partitioning of crops over the available area
- *cropping sequence*
  the succession of crops in time on one parcel

(agrarische winkler prins 1954)

Crop rotation



Crop frequency

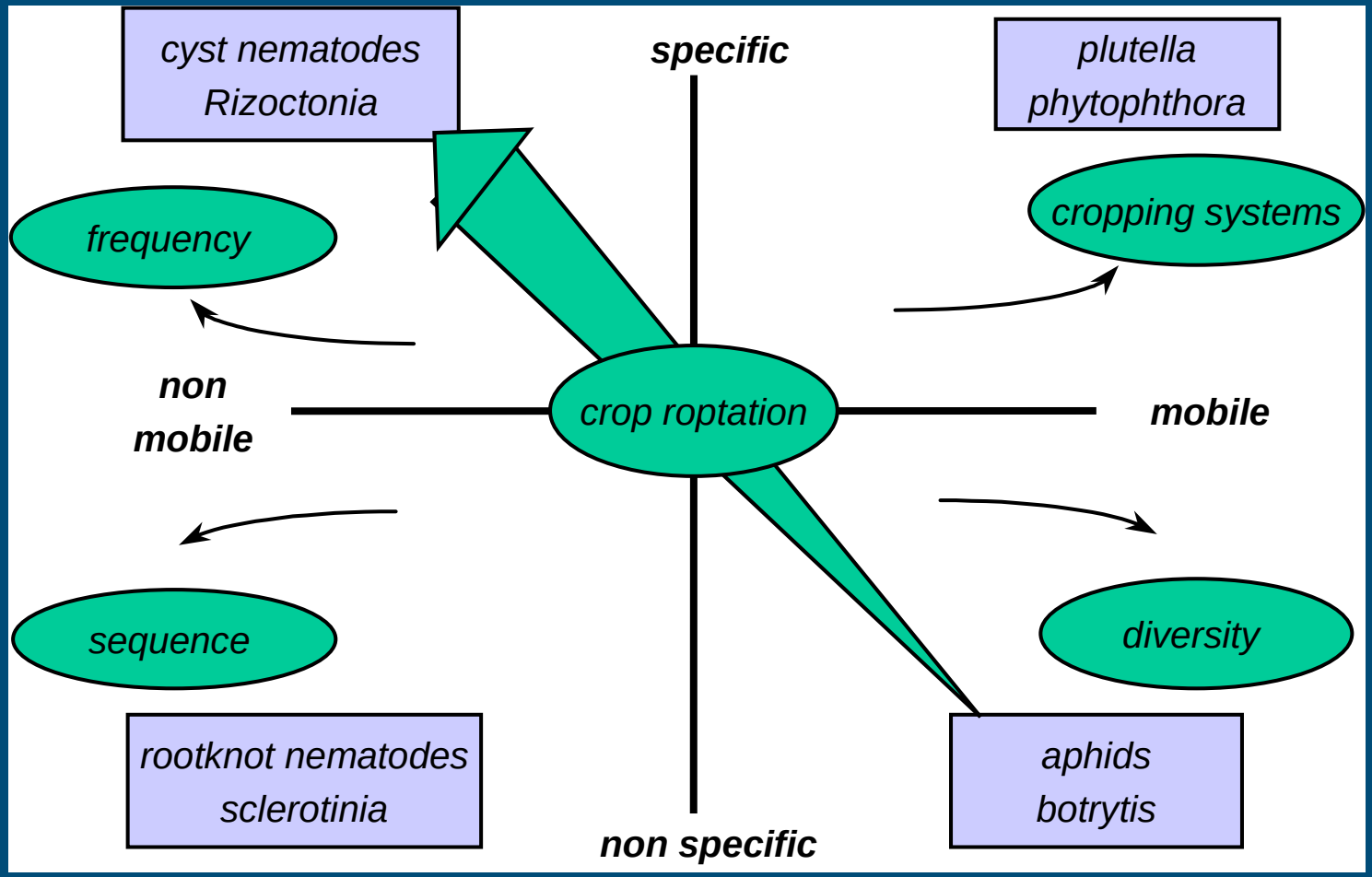
Of vital importance for

- specific non mobile soil born pests and diseases

classical example of crop rotation benefit

supported by cropping system (mainly cultivar resistance)

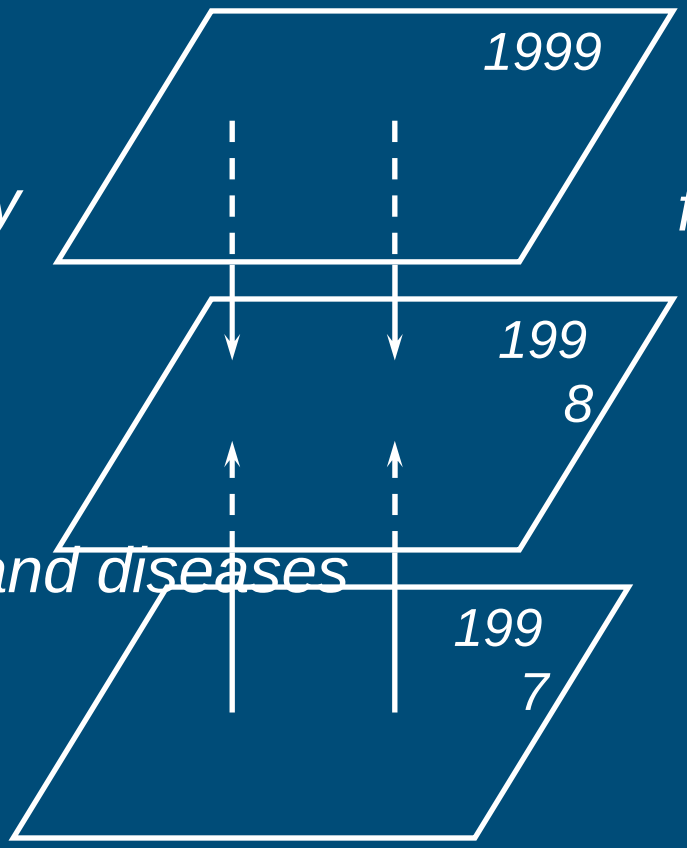
Crop Rotation, prevention of pests and diseases



Crop sequence

Target: homogenity

- *N supply*
- *soil structure*
- *soil fertility*
- *soil born pests and diseases*
- *weeds*



fine tuning on future

making plans

fine tuning on past

Crop sequence

Of vital importance for

- non specific soil born pests and diseases

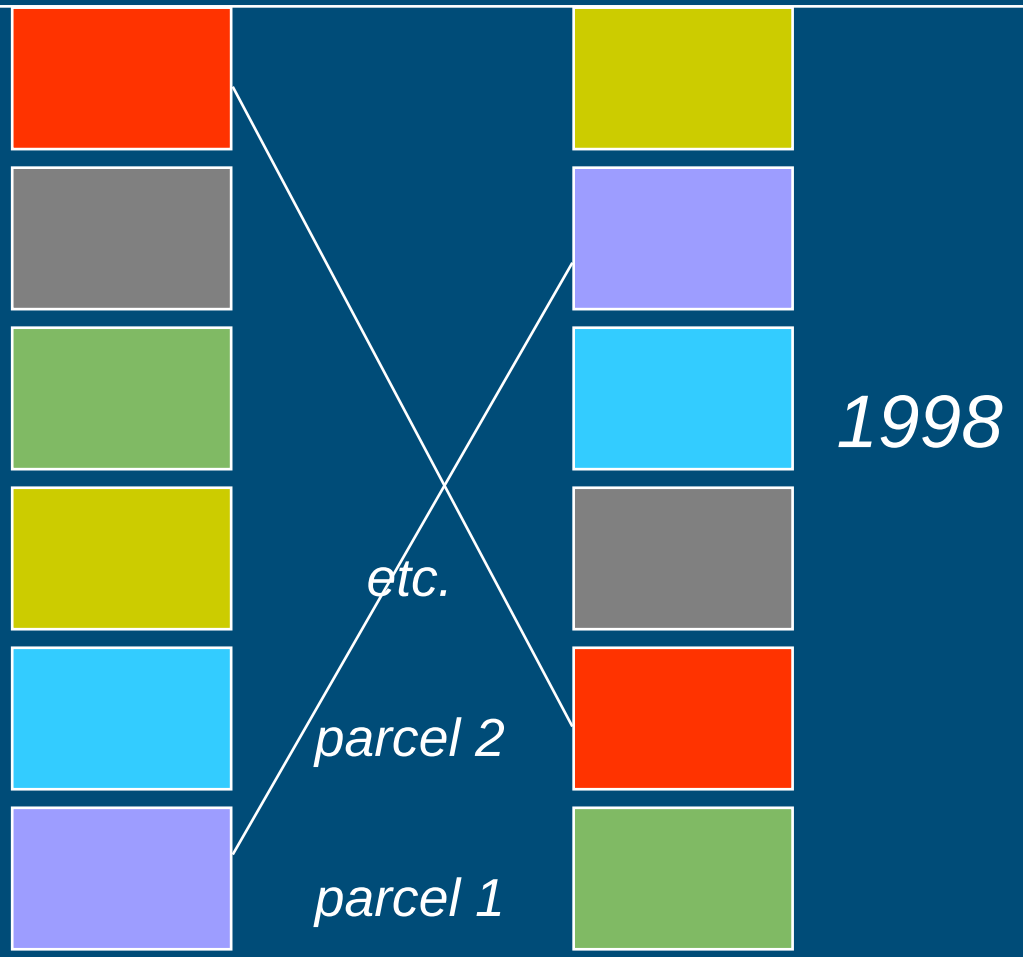
however also for (other non mobile aspects)

- weeds
- nitrogen availability
- soil fertility

supported by cropping system (cultivar, sowing date, etc.)

Spatial crop rotation

Supports prevention of semi mobile, specific organisms as cabbage fly



Crop rotation design 2

3. Design rotation

- frequence, sequence and spacial
- maximising + and minimising - interaction
  - soil fertility (N dynamics and soil structure)
  - soil health

Design cropping plan 3: guidelines

- crops 1 to 6
- green manures 1 to 3
- crop groups 1 to 3

  (incl. gr. manure excl. perennial crops)
- no green manure from same crop group before or after main crop

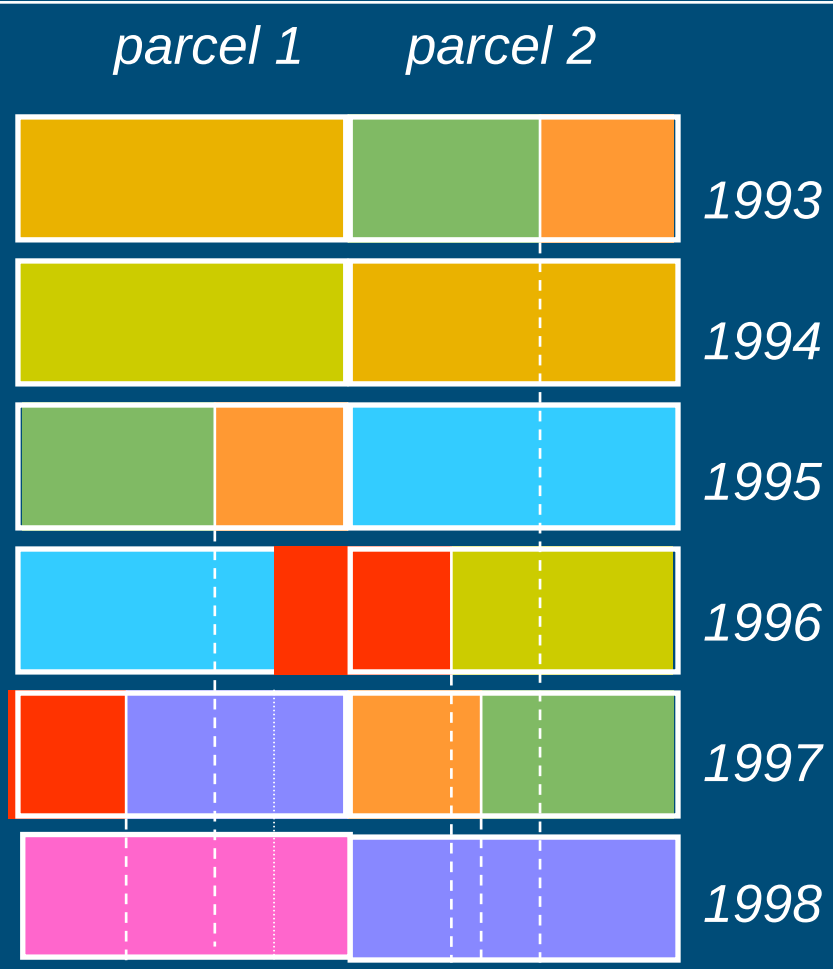
Crop rotation design 4: guidelines

- alternate combinable and root crops
- synchronise N need and supply
- agro ecological identity (infrastructure and spatial crop rotation)

Fragmentation of parcels

More than one crop per parcel creates heterogenity

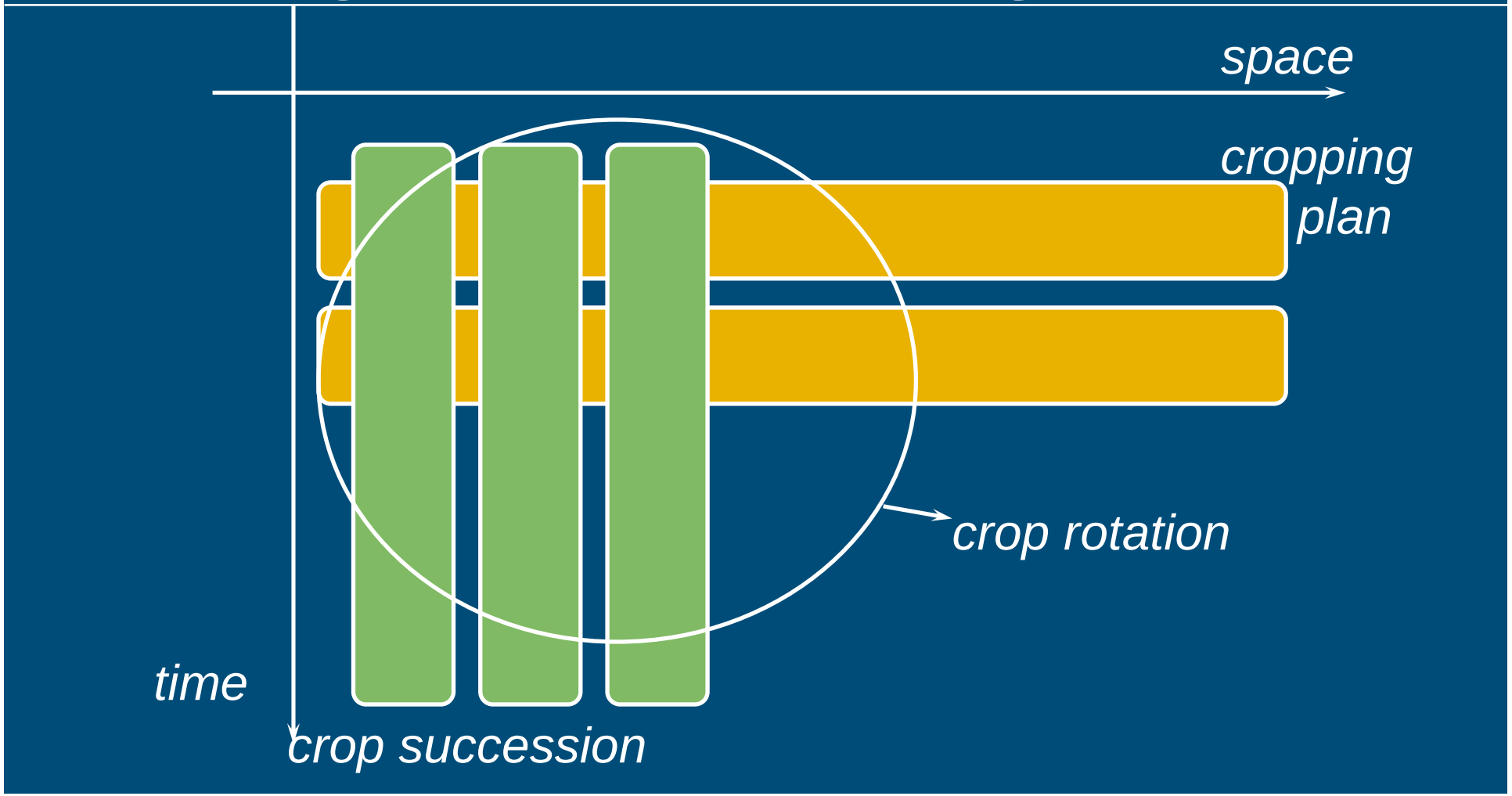
degree of heterogenity depends on differences between crops



Special cases

- Field heterogeneity
- Fragmentation of parcels
- Unequal size rotation blocks
- Large diversity of crops

Cropping sequence and cropping plan



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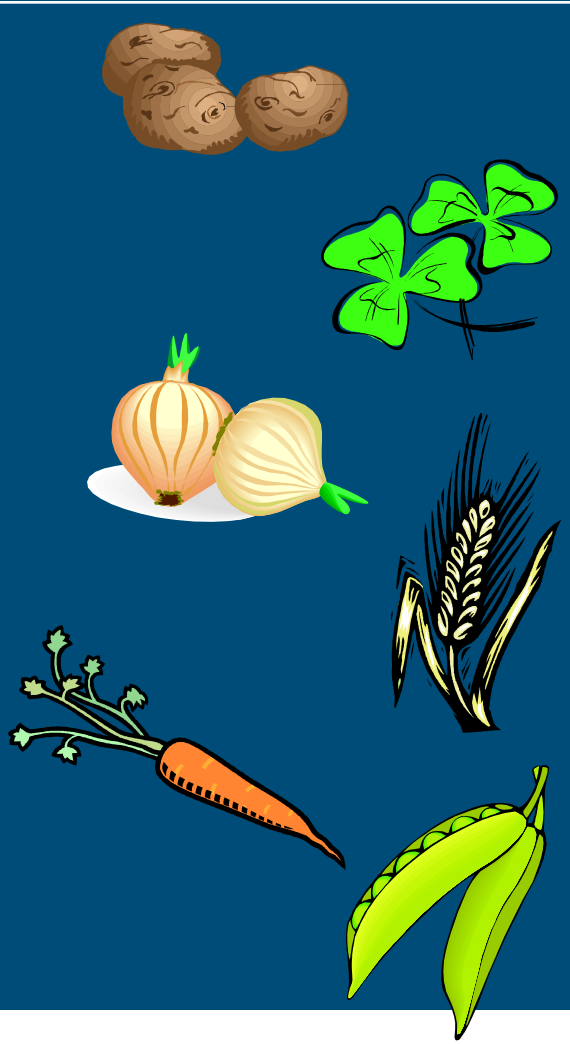


Control of pests and diseases

Prevention is crucial !!!

There are very few effective measures once you have a problem!!

Strategy crop protection

- Prevention
  - crop rotation, farm hygiene,...
- Need of control
  - asses if control is necessary
- Control
  - non-chemical control (mechanical, biological)
  - chemical,
    - pesticide selection
    - application technique

Prevention

- **Prevention of initial inoculum**:
  - • legal measures,
  - • farm hygiene and healthy seeds and plant material.
- **Enhancing (bio) diversity:**
  - • crop rotation and variety choice,
  - • design of the agro-ecological layout,
  - • other means of bio-diversification.
- **Creating unfavourable conditions for noxious organisms**:
  - • cultural methods,
  - • nutrient management.

Establishing need of control

- determine if organisms are harmful,
- monitor,
- prognosis of infestation or infection,
- prognosis of economic loss.

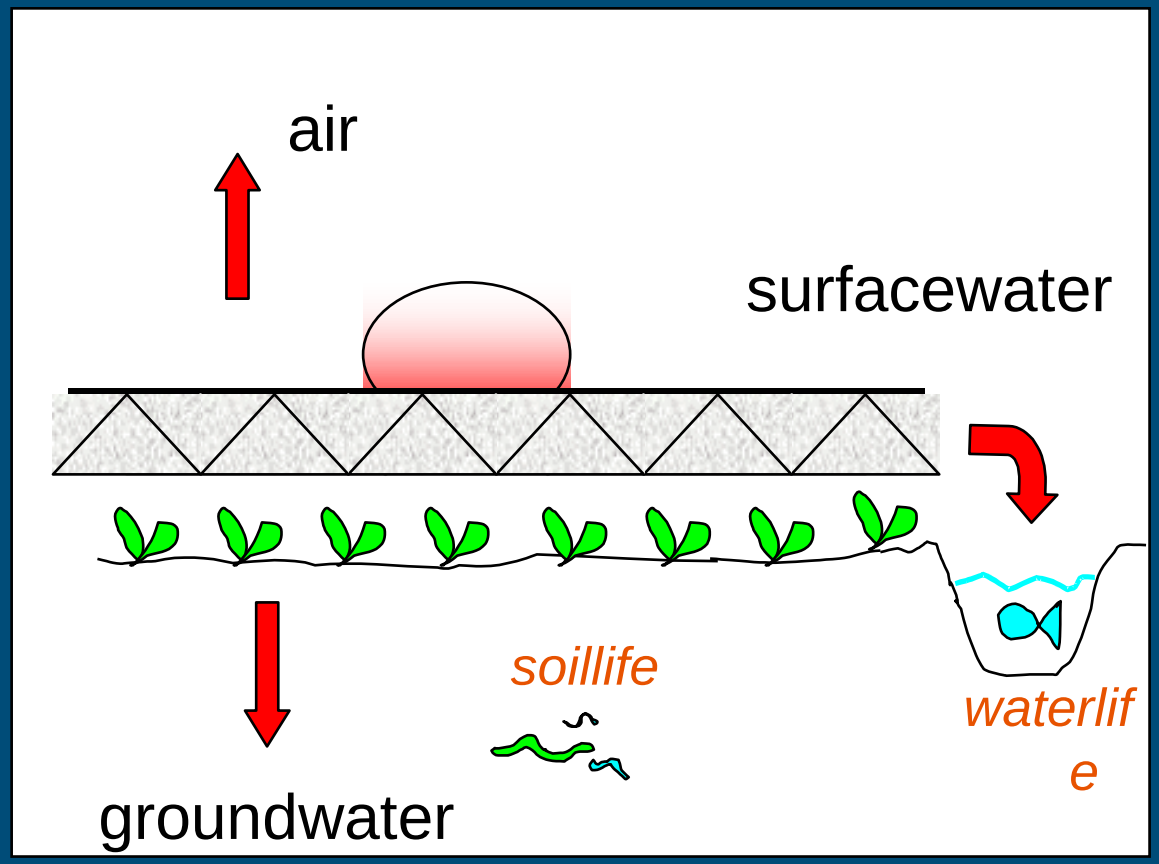
Control

- Physical
- Biological
- Chemical
  - pesticide choice
  - dose, timing and technique

Chemical control

- Choice of pesticides
  - selectivity
  - resistance development
  - emission and damage risks
- Application
  - timing, weather conditions
  - application technique
  - dose

Environmental effects pesticides



parameters

use

emission

damage

Prevention, strategic

- Crop rotation
- Farm hygiene
- Clean seeds
- Variety choice
- Soil structure
- Farm lay out
- Ecological infrastructure

Prevention, operational

- Timing of sowing
- Row distance
- Crop cover
- Fertilisation
- Irrigation

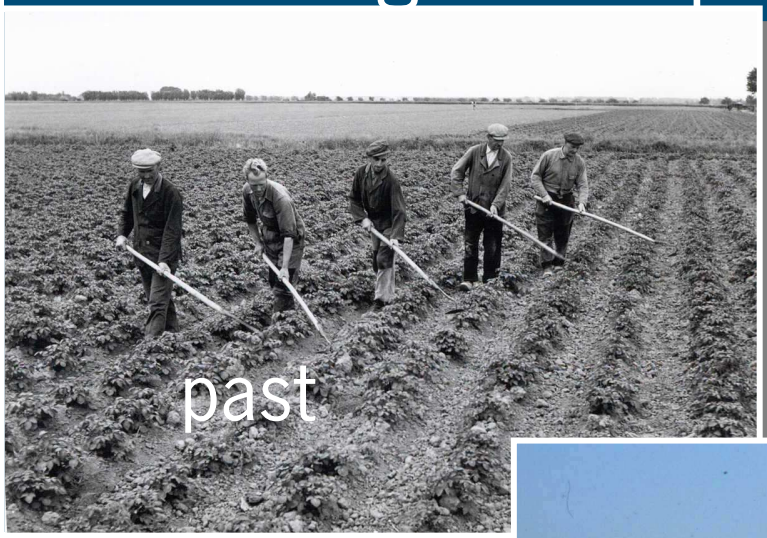
Control measures

- Non-chemical control (mechanical, biological)
- Chemical (bio-toxins),
  - bio pesticide selection
  - application technique, timing

Weed control

- Again pevention!!
- Mechanical control
  - Harrow
  - Hoe
  - .....
- Timing is crucial

Weeding techniques in organic farming



past

Nowaday's Mechanisation

But Weeding still needs handlabour

Questions?