Agroecological practices enhancing ecosystem services: potentials and constraints for future European agriculture

Agroecology and ecological intensification for a sustainable food future workshop
EXPO 2015, Milan and JRC, Ispra (IT)

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Which agriculture do we want?
And which practices?
California, USA

Allgäu, Germany
Main interpretations of agroecology

- **Scientific Discipline**
  - Plot/Field approach
    - Agroecosystem ecology
      - Ecology of food system
  - Agroecosystem ecology
  - Ecology of food system

- **Movement**
  - Environmentalism
  - Rural development

- **Practice**
  - Technique
    - Social/Political movement for sustainable agriculture

(Wezel et al. 2009, Agronomy for Sustainable Development)
Agroecological practices - definition

Agricultural practices aiming to **produce significant amounts of food**, which **valorise in the best way ecological processes and ecosystem services** in integrating them as fundamental elements in the development of the practices, and **not simply relying on ordinary techniques** such as chemical fertilizer and synthetic pesticide application, or technological solutions such as genetically modified organisms.

(Wezel et al. 2014, Agronomy for Sustainable Development)
Ecosystem services as a basis for agroecological practices

Services provided by ecosystems for humans:

- nutrient cycling
- biological nitrogen-fixation
- natural regulation of pests
- pollination
- soil conservation
- biodiversity conservation
- carbon sequestration
- water filtration and purification
Agroecological practices

Management of landscape elements
Integration of semi-natural landscape elements at field, farm, and landscape scales

Crop choice, spatial distribution, and temporal succession
Agroforestry, Intercropping and relay intercropping, Crop choice and rotations, Cultivar choice

Weed, pest, and disease management
Natural pesticides, Biological pest control, Allelopathic plants

Tillage management
Direct seeding into living cover crops or mulch, Reduced tillage

Crop fertilisation
Split fertilisation, Organic fertilisation, Biofertilizer

Crop irrigation
Drip irrigation

Scale of application of agroecological practice

Landscape scale

Cropping system scale

Field scale

(Wezel et al. 2014, Agronomy for Sustainable Development)
Some examples of agroecological practices
Biological pest control

Coccinellidae
(ladybirds/ladybugs)

Heteroptera
(bugs)

Chrysopidae
(green lacewings)

Syrphidae
(hoverflies)
Pupae of hoverflies in the middle of an aphid colony on chard in horticulture systems in south-eastern France
Direct seeding, seeding into cover crops

(Photo J. Peigné)
Cover crops

Mustard cover crop

Mustard helps also to reduce nematode populations (biological pest control)

Intercropping

Winter field pea and winter wheat intercropping in western France (Photo G. Corre-Hellou).

Relay intercropping of wheat and undersown lucerne in SE France.

Relay intercropping of wheat and undersown clover in SE France (Photo F. Boissinot).
Agroforestry

Walnut wheat agroforestry system, SE France

Grape vine-olive trees-walnut trees agroforestry system, central Italy

Walnut-lucerne agroforestry system, central Italy
Integration of semi-natural landscape elements at field, farm or landscape scale

Biological control, pollinisation, erosion, drinking water protection, biodiversity conservation
Potential of agroecological practices for the next decade

Integration of semi-natural landscape elements at field and farm scale

Direct seeding into living cover crops or mulch

Crop choice and rotations

Natural pesticides

Allelopathic plants

Integration of semi-natural landscape elements at field and farm scale

Biofertilizer

Intercropping and relay intercropping

Integration of semi-natural landscape elements at landscape scale

Agroforestry

Biological pest control

Drip irrigation

Reduced tillage

Organic fertilisation

Split fertilisation

Cultivar choice

Crop choice

Cultivar choice

Intercropping and relay intercropping

Intercropping and relay intercropping

Agroforestry

Biofertilizer

Biofertilizer

Biological pest control

Drip irrigation

Reduced tillage

Organic fertilisation

Split fertilisation

Cultivar choice

Integration in today’s agriculture

(Wezel et al. 2014)
Potential for conventional agriculture in the next decade

Integration in today's agriculture

- Crop choice and rotations
- Biological pest control
- Split fertilisation
- Cultivar choice
- Biofertilizer
- Intercropping and relay intercropping
- Reduced tillage
- Organic fertilisation

- nutrient cycling
- biological nitrogen-fixation
- natural regulation of pests
- pollination
- soil conservation
- biodiversity conservation
- carbon sequestration
- water filtration and purification
Conclusions

- A broad diversity of agroecological practices exists.
- Practices such as organic fertilisation, split fertilisation, reduced tillage, biological pest control and cultivar choice have already medium or high integration in today's agriculture and good potential to be more broadly implemented.
- For some practices a high level of systems change might be necessary (e.g. intercropping, agroforestry, reduced tillage, direct seeding).
Your questions?