WELCOME TO NATURLAND

Naturland –
Association for Organic Agriculture

Crop Rotation Management in Organic Protected Production Systems

The Example of Italy and Spain

CONTENTS

How do you use crop rotation to maintain or improve soil health?

Alternate mainly solanaceae, cucurbitaceae and legumes

is commonly practiced, if and when schedules permit

cucurbitaceae-solanaceae, or with legumes, mustard, cereals...

Due to our organic farming we rotate 3 different families in 5 years

We follow instructions according to organic production regulations.

PROJECT BACKGROUND

- Main supervisor: Prof. Dr. Anna Keutgen
- Co-Supervisor: Dr. Sabine Zikeli
- Naturland e.V., Gräfelfing, Germany
- Best practices organic greenhouses, Campiña Verde

PROJECT BACKGROUND

- What are the key influencing factors impacting the design of crop rotation of organic protected production systems?
- How are the crop rotation guidelines currently implemented? And what recommendations for action can be derived from these practices?
- To what extent can the experiences and practices of Italian crop rotation planning be applicable and beneficial for implementing guidelines in Spanish organic protected production systems?

MATERIAL AND METHODS

Abbrev.	Country	Region	Main Crops
P-1	Italy	Veneto	Tomato, Aubergine, Cucumber, Celery, Zucchini, Leafy greens
P-2	Italy	Veneto	Tomato, Aubergine, Cucumber, Celery, Leafy greens
P-3	Italy	Veneto	Tomato, Aubergine, Celery, Zucchini, Leafy greens
P-4	Italy	Veneto	Tomato, Aubergine, Celery, Zucchini, Melon, Strawberry, Leafy greens

Abbrev.	Country	Region	Main Crops
P-5	Spain	Almería	Tomato, Aubergine, Watermelon, Paprika
P-6	Spain	Almería	Tomato, Melon, Watermelon
P-7	Spain	Almería	Peppers, Cucumber, Beans
P-8	Spain	Almería	Melon, Watermelon, Cucumber, Paprika, Aubergine
P-9	Spain	Almería	Tomato, Paprika, Watermelon
P-10	Spain	Almería	Tomato, Paprika, Watermelon
P-11	Spain	Málaga	Tomato, Cucumber
P-12	Spain	Málaga	Tomato, Zucchini, Cucumber

- 16 Interviews
- 4 Producers in Italy
- 8 Producers in Spain
- 4 External Experts (control bodies, agronomist)

ORGANIC PRINCIPLES

Health

Ecology

Fairness

Care

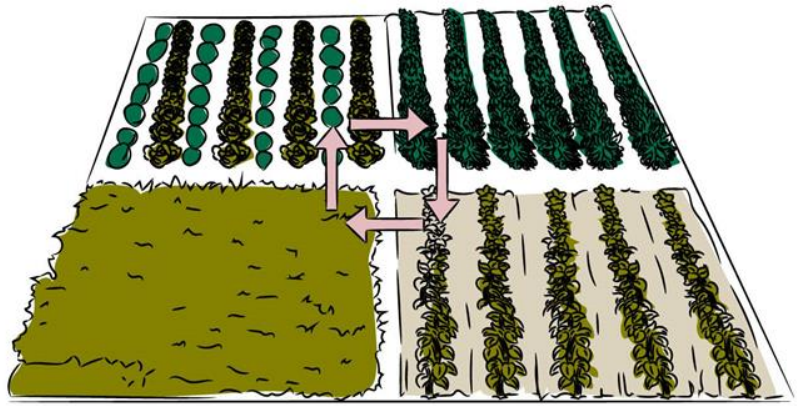
Protection of the environment and the climate, as well as the production of safe and high-quality food

➔ Maintaining the fertility and biological activity of the soil
➔ Species-appropriate and land-based animal husbandry
➔ Use of natural regulatory mechanisms of the ecosystem
➔ Seed and planting material from organic sources and propagation

FUNDAMENTALS

Crop Rotation = chronological sequence of different crops in the same area

- Type and variety of crop
- Growing area and its size
- Crop cultivation measures
- Non-cash crops, e.g., agro-ecological service crops (ASCs)



Weed control

Prevents and protects against pests and diseases

Increases and maintains soil fertility and biological soil activity

BENEFITS OF CROP ROTATION

Weed control

- Growing different crops or plant species that suppress competing weeds through their presence
- Allelopathic effects on weed species: certain chemicals of Brassicaceae or certain legume species
- Varying cropping management practices (soil preparation, planting, …)

BENEFITS OF CROP ROTATION

Pest and disease management

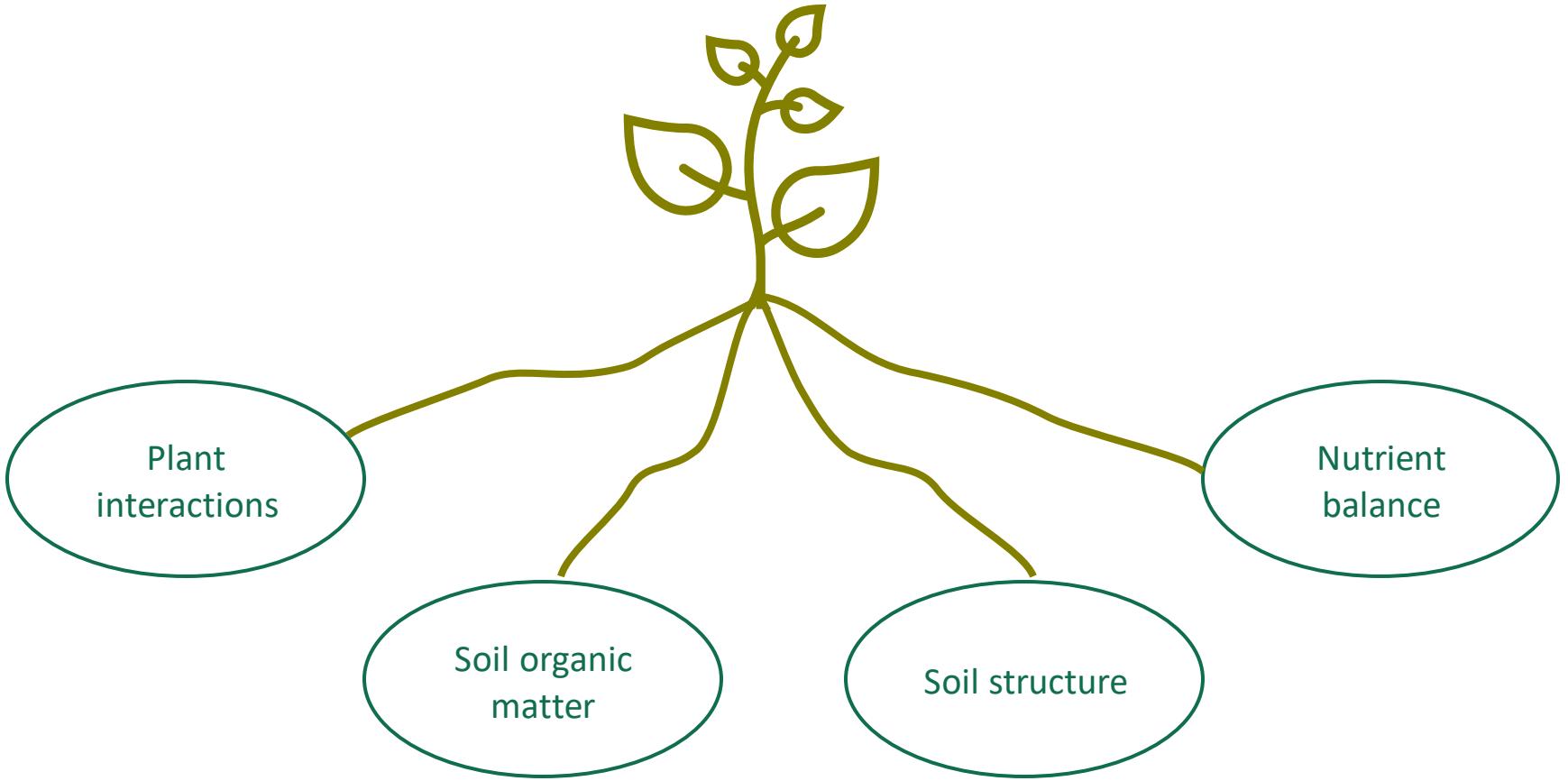
- Chemical components in plants with effects on soil-borne pathogens like fungi or nematodes (e.g., glucosinolates in Brassicaceae)
- Interruption of pest life cycles – temporal and spatial barrier when non-host plants are used

BENEFITS OF CROP ROTATION

Soil fertility

Soil microorganisms

Nutrients



BENEFITS OF CROP ROTATION

Poaceae:

Rapid build-up of biomass

e.g., sorghum

Legumes:

Nitrogen supply

e.g., vetch, broad beans

Brassicaceae:

Soil disinfection

e.g., rocket, field mustard

REGULATIONS

EU ORGANIC REGULATIONS

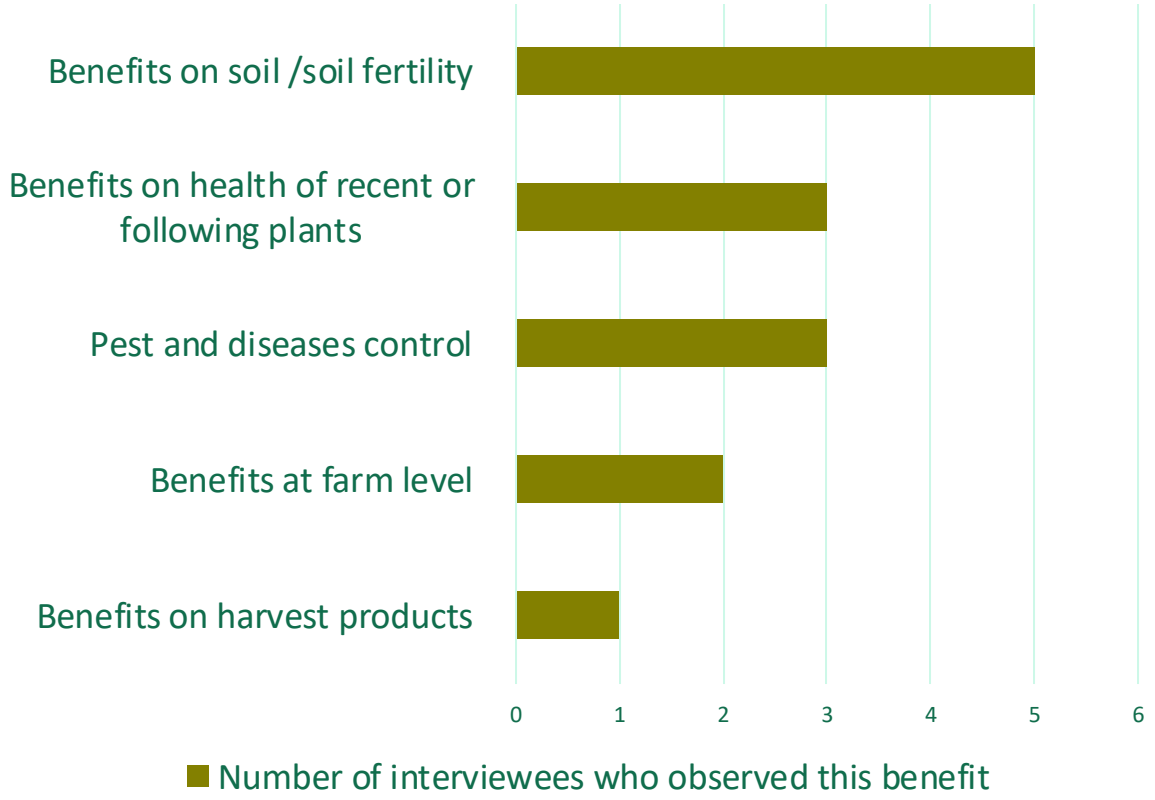
Regulation (EU) 2018/848

Decreto ministeriale No. 229771 del 13/10/2022

Naturland Standards on Production (05/2023)

EXPERIENCES AND EXPERTISE OF PRODUCERS

Observed benefits of crop rotation by organic greenhouse producers

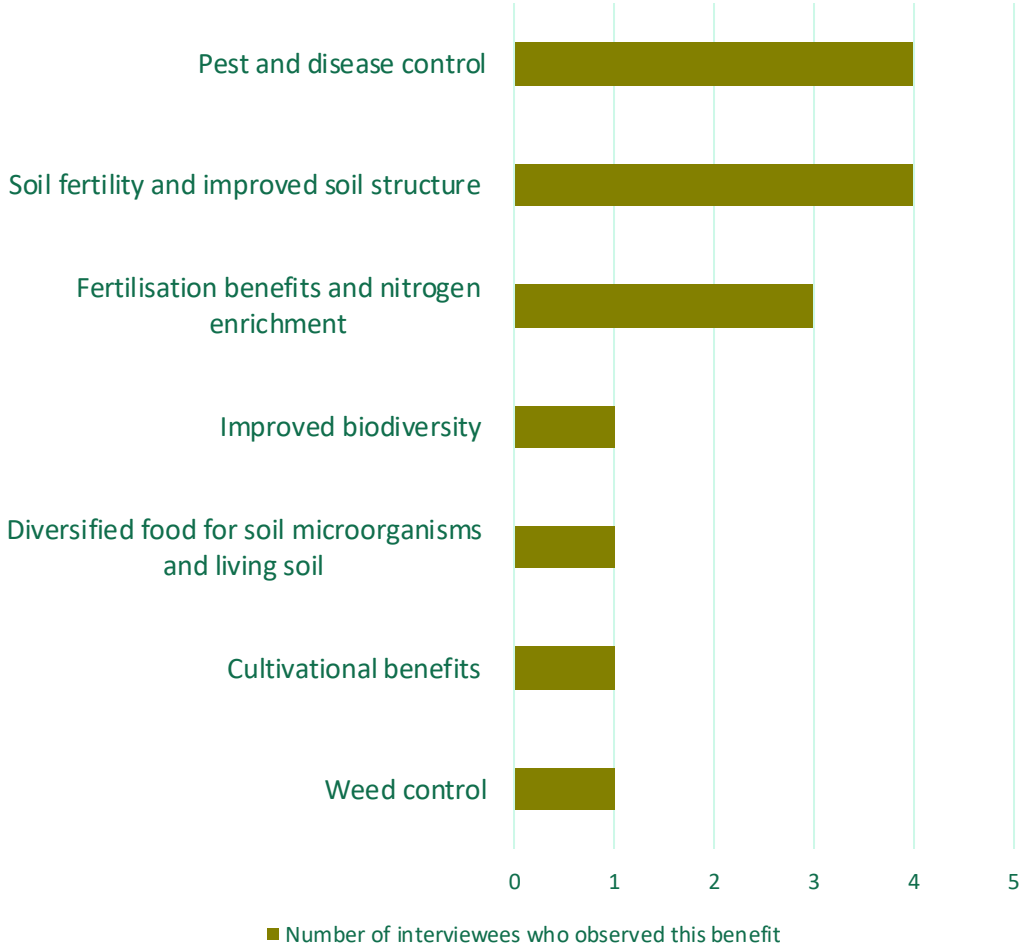


Perceived disadvantages of diverse crop rotations:

- Balance between too long and too short crop rotations,
- Loss of nutrients with too long crop rotations,
- Suitability of crops for organic cultivation and market,
- Absence of income during cultivation of ASCs,
- Limited availability of time or space for ASCs,
- Pressure on amortisation of greenhouse and economic sustainability of the farm,
- Minimal implementation of crop rotation due to economic constraints.

EXPERIENCE AND EXPERTISE OF EXTERNAL EXPERTS

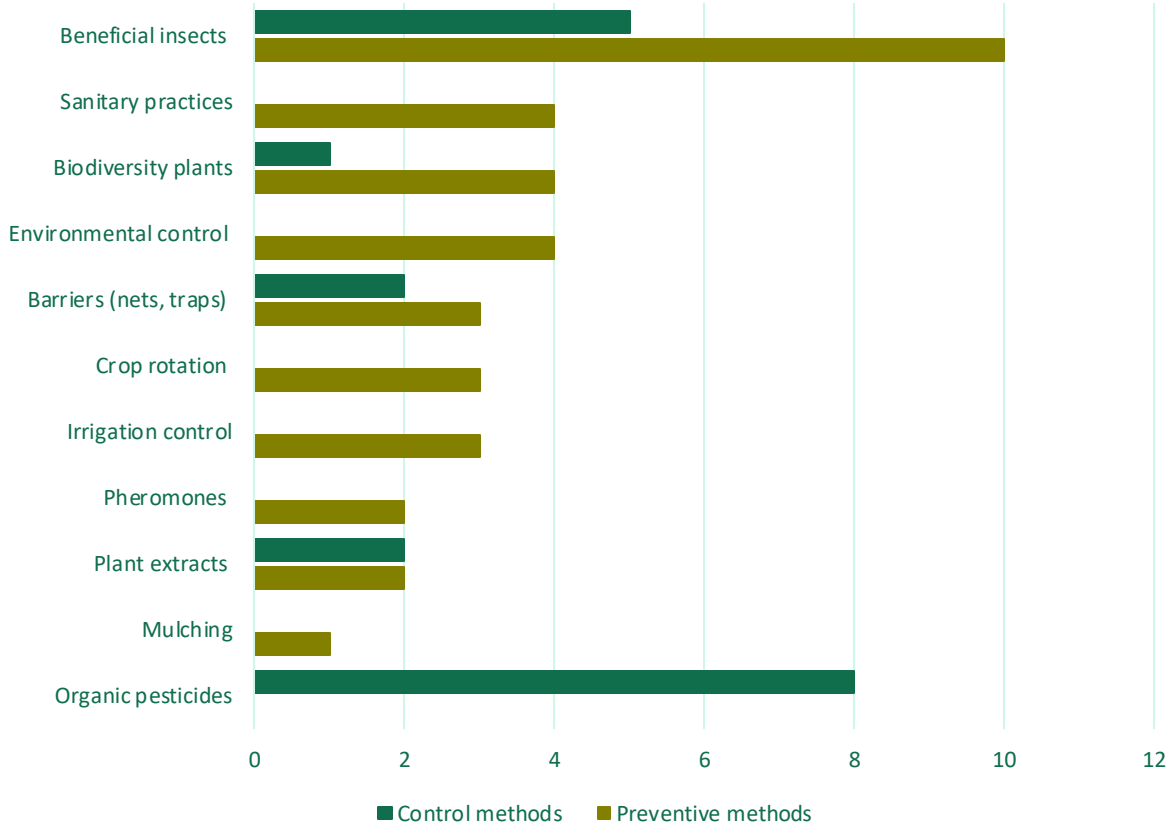
Observed benefits of crop rotation by interviewed external experts



- Main goal: improve the soil structure and fertility
- A three-year crop rotation that first starts with green manuring with mustard and manure, then the cultivation of cucumbers, then tomatoes and finally beans, while the summer is used for solarisation.
- Three different plant families in two years. Each year, legumes should be grown as green manure and mustard for soil improvement.

CURRENT CHALLENGES OF OGH PRODUCERS

Methods against pests and diseases used by organic greenhouse producers



Cultivation management	Economic factors	Market for organic products
• Pest and diseases • Increasing yields • Plant protection • Soil exploitation • Climate (change) • Waste and water management	• Profitability • Increasing input prices • Employees • Economic and ecological sustainability • Amortisation greenhouse costs	• Market prices for products • Consumer expectations • Unfair competition

CURRENT CHALLENGES OF OGH PRODUCERS

- **Electrical conductivity of water,**
- **Water and irrigation management**,
- Availability of organic seedlings,
- Presence of not allowed substances for organic production,
- Lack of skilled employees,
- Need of specific information for good management of greenhouse cultivation,
- Pest and disease control,
- Availability of good-quality organic manure,
- Plant residue management,
- Reduction of the use of fertilizers and phytosanitary products,
- Improvement of biodiversity,
- Regulatory development.

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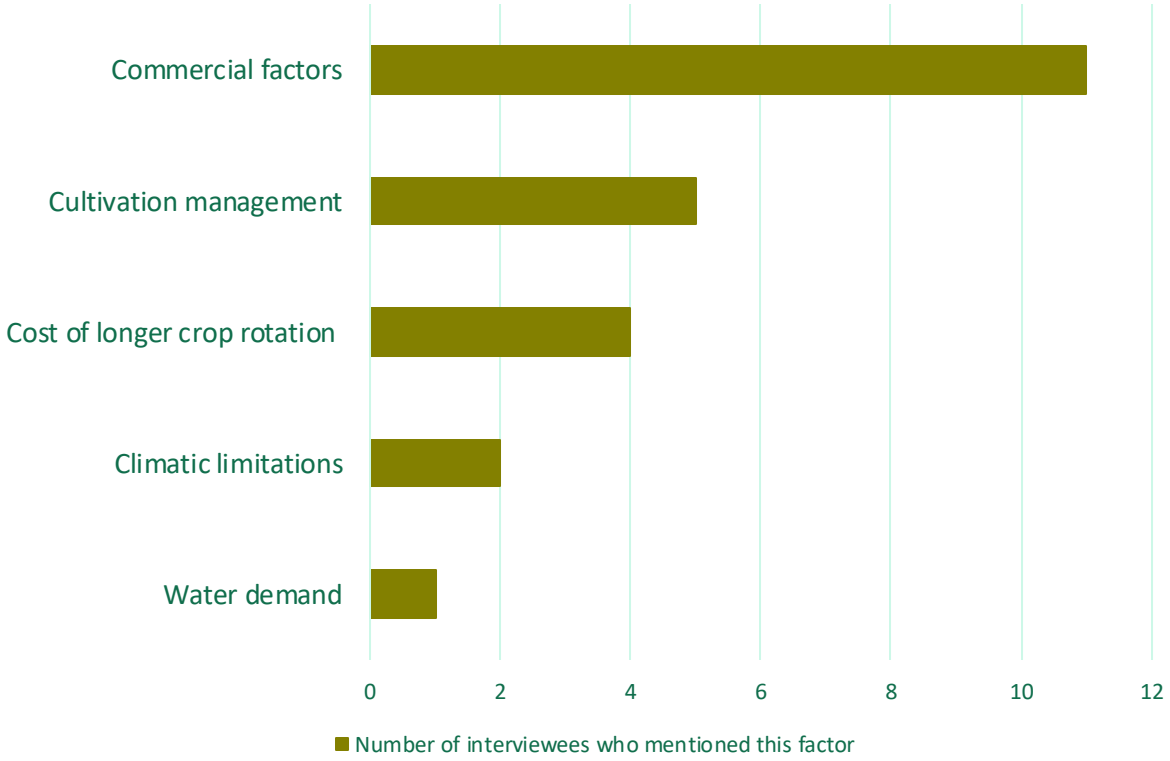
IMPACT OF EU ORGANIC REGULATION 2018/848 ON CROP ROTATION IMPLEMENTATION

Factors that prevent organic greenhouse producers from implementing longer crop rotations



- 2 out of 12 producers have or will make further changes in their crop rotation
- Changes necessary due to EU organic regulation 2018/848
- However, all producers were generally positive about the adaptation to the requirements of the EU organic regulation 2018/848.

EXAMPLES CROP ROTATIONS

- Typical crop rotation in Spain:

  Solanaceae – Cucurbitaceae – Solanaceae – Curcurbitaceae – Legumes/Cover crops




EXAMPLES CROP ROTATIONS

- Typical crop rotation in Italy:

	Crop 1	**Crop 2**	**Crop 3**	**Crop 4**
Example Italy	Tomato March-August	Leafy greens Oct/Nov-March	Green manure >90 days March-June/July	Zucchini -

EXAMPLES CROP ROTATIONS

- Cucurbitaceae is cultivated as a secondary crop with shorter cultivation period
- Cover crops are cultivated for 2-3 months
- Hardly no intercropping on interviewed farms
- Seldomly cultivation of green beans as a main crop
- Farms are considerate with harvest residues and their utilization

CURRENT IMPLEMENTATION OF CROP ROTATION

Cash crops

- Breaks between crops are kept as short as possible to increase the profitability of greenhouse cultivation
- Strong specialisation on the cultivation of Solanaceae

➢ Possibility to explore more diverse crop rotations in organic greenhouse cultivation

Agro-ecological service crops

- Italian mixtures: field mustard, radish, sorghum, vetch, rocket
- Spanish pure seeds: vetch, broad beans, field mustard
- Different plants in the mixtures or pure seed serve different purposes – also in accordance with scientific literature

➢ Choice of cover and green manure crops should be adapted to local and climatic conditions

➢ Use of green manure crops, and ASCs in general, should be further promoted by the farms

INFLUENCING FACTORS ON THE DESIGN OF CROP ROTATION

Market conditions

- Influence on crop rotation design and implementation
- Greatest challenge: market and further economic factors
- Crop rotation planning by agricultural technicians

Recognition of crop rotation

- Motivation to carry out more divers crop rotations vs. influencing factors
- Potential of crop rotation in the greenhouse (e.g., benefits on soil fertility and pest prevention)
- Despite compliance with the current crop rotation requirements - uncertainties and ambiguities regarding the crop rotation regulations

Thank you for your attention.

SOURCES

- Decreto Ministeriale nr. 3757 del 09/04/2020 – Modifica del Decreto Ministeriale nr. 6793 del 18/07/2018 recante “Disposizioni per l’attuazione dei regolamenti (CE) n. 834/2007 e n. 889/2008 e loro successive modifiche e integrazioni, relativi alla produzione biologica e all’etichettatura dei prodotti biologici, che abroga e sostituisce il Decreto ministeriale 27 novembre 2009 n. 18354”., 2020. https://www.sinab.it/normativa/dm-n-3757-del-9-aprile-2020
- Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products and repealing Council Regulation (EC) No 834/2007, 2022. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02018R0848-20220101

- Pictures:
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