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Crop diversification for sustainable farming

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Visegrad Fund

Monocropping – a global problem

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FAO Report *The State of the World's Biodiversity for Food and Agriculture* 2019:

"In many parts of the world, biodiverse agricultural landscapes have been, or are being, replaced by large areas of monoculture, farmed using large quantities of external inputs such as pesticides, mineral fertilizers and fossil fuels," Only 9 plant species account for almost two-thirds of total crop production.

Solution1: landscape diversification

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Solution 2: Crop diversification within fields

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FAO 2019: Diversifying crop cultivation reduces risk of economic shocks. Integrating intercrops, hedgerows, cover crops and rotation, particularly involving legumes, into a system can reduce drought stress, preserve soil fertility, mitigate pest damage and weed invasions.

Additional ecosystem services provided by diversified cropping are numerous: reduced greenhouse gas (GHG) emissions, enhanced carbon sequestration, erosion control, increased above and below-ground biodiversity etc.

An EU project:

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Crop diversification and low-input farming across Europe: from practitioners' engagement and ecosystems services to increased revenues and value chain organisation

E, I, FIN, D, GB, H, NL

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Distribution of work

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The impact of crop diversification on the provision of ecosystem services can vary with the pedoclimatic regions – 26 case studies designed in six countries representing 6 pedoclimatic regions of Europe: Boreal, Atlantic, Continental, Pannonian, North Mediterranean, South Mediterranean – strong coordination needed

Crop diversification 10 Work Packages: breakdown into natural and social sciences research tasks (data mining, crop production and quality, biodiversity, ecosystem services, value chain analysis, economic and policy assessments)

Survey of problems rising from monocropping

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Example: Soil fertility

Questions to be answered:
How does enhanced concentration, intensification and specialisation of crop production affect soil fertility? What land degradation can be expected without consideration of site-specific soil and climate conditions? What partly irreversible damage will derive from soil compaction, water and wind erosion, waterlogging, chemical changes and loss of organic matter? How can microbial diversity (species richness, functional groups and key species) be used as indicators of soil fertility/health?

Globalization aspects of crop diversification research

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- Sustainable farming is a foremost global environmental goal.
- It is closely related to climate change.
- International market of farm produces (e.g. asparagus exported to Switzerland and Sweden)
- Scholarship-holding PhD students from developing countries (China in Wageningen; Bangladesh in Portsmouth; India, Egypt in Pécs) contribute to investigations. They will spread knowledge to the developing world.
- Useful practices can be imported not only from European countries, but also North American and Australian farming experiences can be utilized.
- Uniform methodology: laboratory protocols have to be observed for all case studies.
- The globalization aspect also means that results are to some extent comparable with those from other continents.

Geographical aspects of the project

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- How variable are the opportunities of raising the performance of ecosystem services (soil erosion, prevention of contamination and soil structure deterioration, enhancing biodiversity and carbon sequestration etc.) in the different pedoclimatic regions of Europe?

- How can be plot observations extended to microregion scale?

- How climatic trends influence the success of crop diversification?

Case studies in Hungary

CS10: Nedel-Market Ltd. (engaged in vegetable and fruit production in a blown-sand region) in Jakabszállás

Asparagus field

CS11: Gere Attila Winery in Villány (loess-covered foothills) eminent in environmentally low-impact and sustainable practices

Diversification options for the Hungarian case studies

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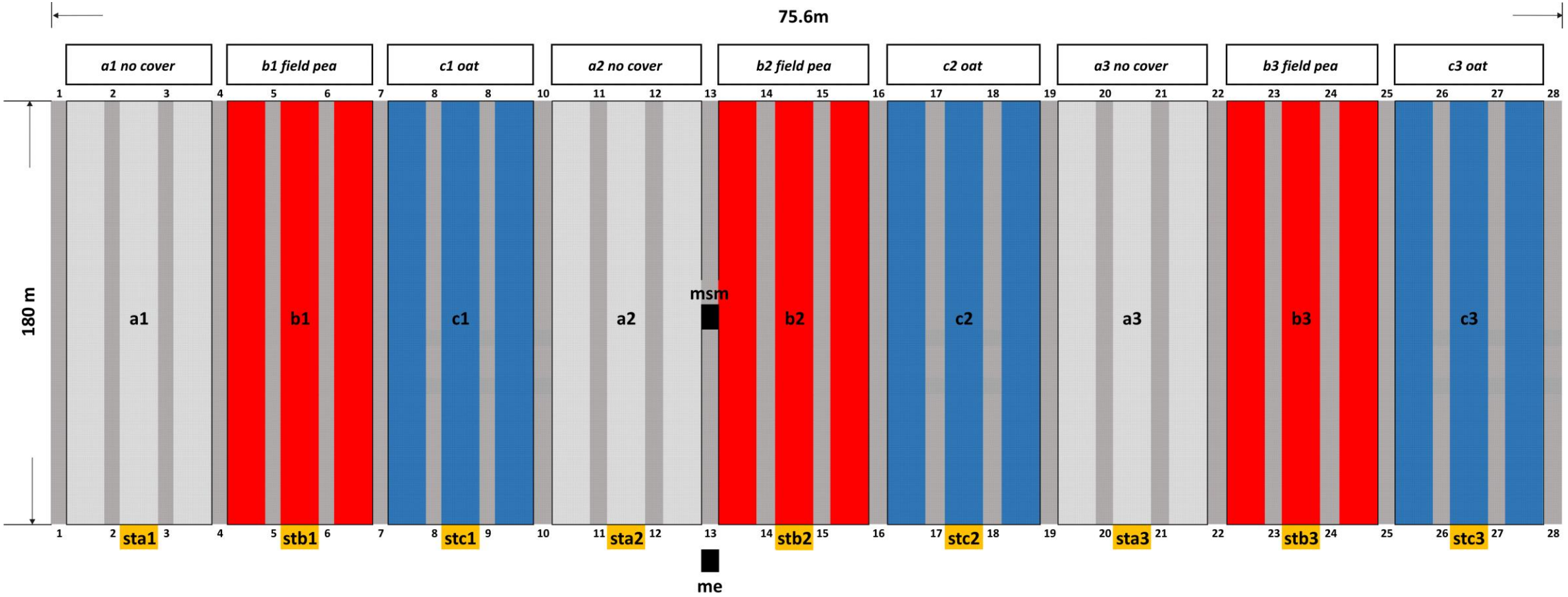
CS10 (horticulture): cereal intercropping (barley, oats)



1, 2, 3, ...rows
me in situ monitoring for erosion
msm in situ monitoring for soil moisture
sta1,2,3.. sediment traps

Diversification options for the Hungarian case studies

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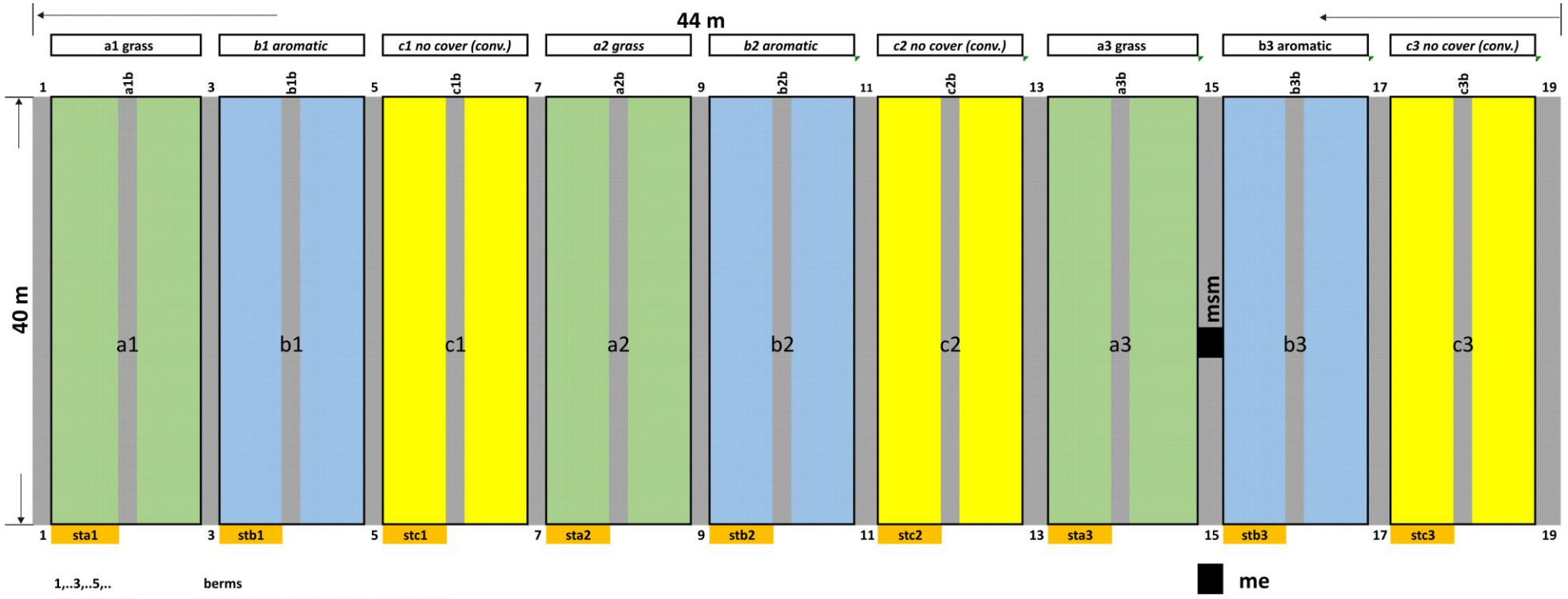
CS11 (vineyard): grass mixture and aromatic herbs (yarrow) in inter-row alleys



Measurements, monitoring for three years

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- *Soil* properties: *physical* (WRB soil type, bulk density, texture, aggregate stability, hydraulic conductivity, moisture content, water table depth etc.) and *chemical* (pH, metals and metaloids, exchangeable cations, N-forms, biostimulants, pesticides etc.)
- *Vegetation* cover, *soil life* (root growth parameters, earthworms, weeds) and *microbiology* (DNA analyses, C and N in microbial biomass)
- *Crop properties* (Leaf Area Index, stem diameter, harvest data, cover crop properties etc.)

Example of first results: C and N at CS10

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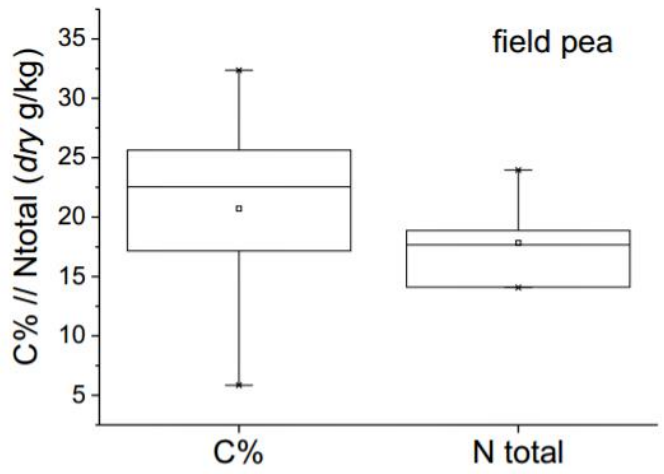

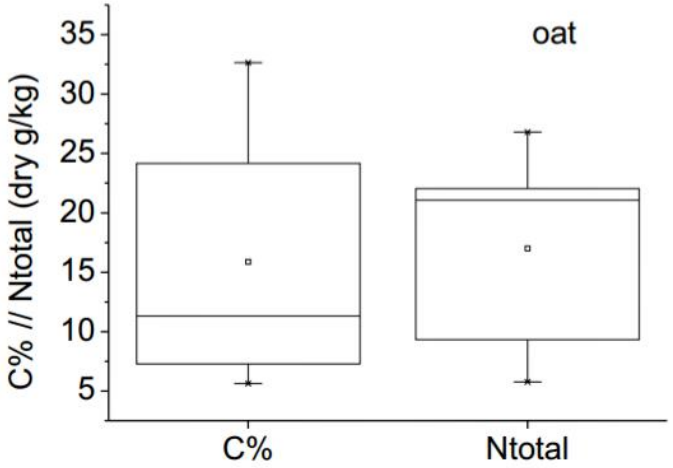

Intercropped with asparagus, field pea produces a higher biomass (179.6 kg/ha vs. 155 kg/ha) and a better C/N ratio (8.4–10) than oats.

Crop Diversification Cluster

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