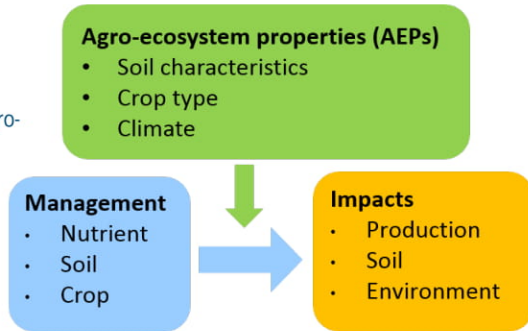


A DST for agricultural management of crop yield, soil quality and environment

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Introduction

Fig. 1:
Influence of agro-ecosystem properties on management impacts



Agricultural management practices affect crop growth, soil quality and environmental quality. Integrated and optimal combinations of farm measures are needed to intensify sustainably. We develop a decision support tool (DST) to evaluate benefits and trade-offs of management on crop yield, soil organic carbon (SOC) balance, soil compaction, as well as N and P use efficiency (NUE, PUE) and environmental losses. The DST integrates a range of soil, crop, and nutrient management practices along variable local agro-ecosystem properties (AEPs).

Approach: impact assessment of agricultural measures

Effects estimated for: yield, SOC balance, NUE and PUE, N and P losses, and soil compaction on farms across Europe

Phase 1. Rough effect estimate via

1. Global meta-analytical studies
2. Simple process-based models

Phase 2. Integrated assessment via

1. Meta-regression models extended with simple process-based models
2. Evaluation procedures using cost-benefit analysis or distance to target values and critical limits
3. Multi-criteria analysis to assess trade-offs and synergies among management options

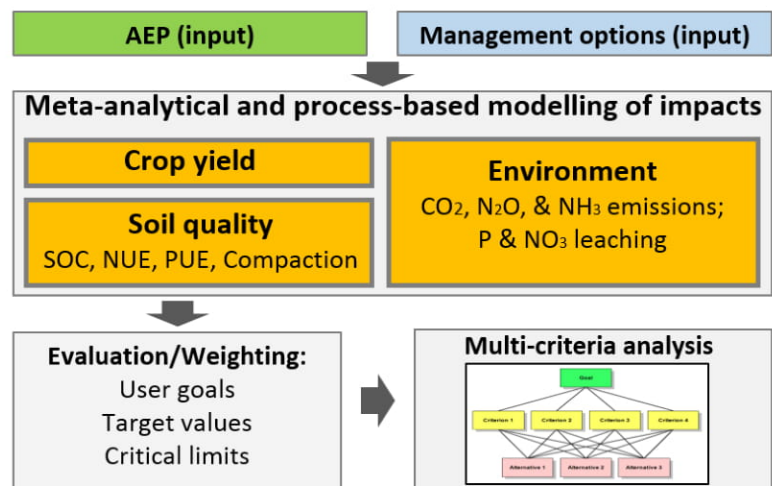


Fig. 2: Model framework for the DST

Results & Discussion

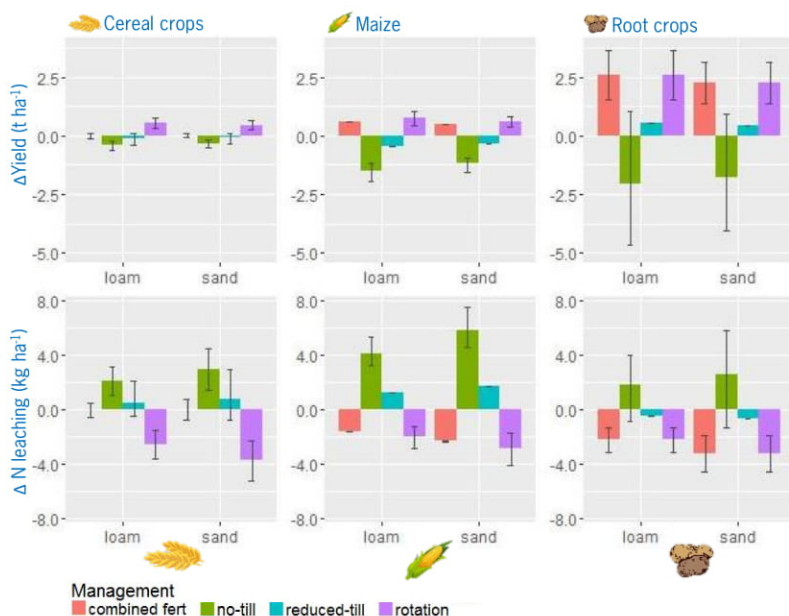


Fig. 3: Effects of management based on global meta-analysis results, East Groningen

Results

Effects of fertilizer management, crop and tillage practices are shown for a case study in East Groningen (fig. 3):

- Reduced and no tillage reduces yield.
- Organic fertilization and rotation practices increase yields and reduce N leaching.
- N leaching shows the opposite trend of crop yields and is less variable among crop types (partly due to the use of fixed nutrient contents of crops).
- SOC data shows positive annual changes from management (not shown), in particular for soil management measures.

Outlook

- Initial estimates show promise for further integration of management effects in meta-regression models combined with decision-support algorithms to provide farm-specific guidelines for sustainable intensification.

