



Transition paths to sustainable legume-based systems in Europe

Development of PAT-led agronomy for strip-sown crop and forage-legume living mulch combinations

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Main Objective(s)

- Leguminous living mulches have been shown to provide potential multifunctional positive impacts within crop production systems, e.g. on the biotic and abiotic health of soils while simultaneously helping to reduce weed, pest and disease burdens.
- Key challenges remain in terms of establishment and management, and these must be resolved to encourage uptake in industry, particularly in 'conventional' cropping systems.
- Case Study aims to:
 - Investigate in-crop living clover mulch management options within growing seasons for multi-scale field production, using Precision Agriculture Technology (PAT) approaches.
 - Develop, where appropriate, and assess novel machinery solutions.
 - Evaluate impact on and compatibility of clover living mulches within existing agronomy.

Progress of the work during the second reporting period

Barriers inhibiting greater uptake of this approach

- Completed 2019 set of field trials:
 - Repeated trials to evaluate different clover types (white, red and berseem) as living mulches in maize and sugar beet crops.
 - Repeated trial to assess impact of herbicide regimes on clover living mulch performance in cereal crop.
 - Continued efforts to develop novel machinery solution for in-crop clover management. Machinery platform identified and under development, software platform for automation determined.
 - 19 SOPs submitted (16 in 2018, 3 in 2019).
 - 6 MEFs and associated data-frames submitted (3 each in 2018, 3 each in 2019).
- Lack of crop varieties optimised for use in combination with clover living mulches and green understoreys.
 - Achieving good, consistent initial establishment (and associated coverage) of clover can be challenging.
 - Often depends on environmental circumstances and seasonal conditions of a specific year.
 - Limited options for in-crop management of clover competition against cash crop that can be deployed within a growing season.
 - Limited options for in-crop management of weeds.
 - Poor establishment or post-winter recovery of clover can allow weeds to gain a foothold.
 - Perceived complexity of system establishment and management relative to existing conventional approaches, and associated changes required, with limited policy support.
 - Machinery availability and development.

Next steps:

- Continue work to determine broad, key principles that can be applied to establishment and management of clover living mulches.
- Continue supporting activity in development of machinery platforms for in-crop clover living mulch management, to address key crop competition challenges and deliver case study outcomes.
- Ensure gaps in knowledge or areas showing key opportunities for development are highlighted.
- Draw parallels from existing knowledge (e.g. in organic systems) to support uptake and knowledge in more conventionally farmed systems.
- Above steps should support confidence in industry uptake of clover living mulches, and show gaps where further development is still required to support further broadening of uptake.
 - These could be, for example, in agronomic approaches and programmes, crop or clover varieties and their performance, machinery.

Innovations

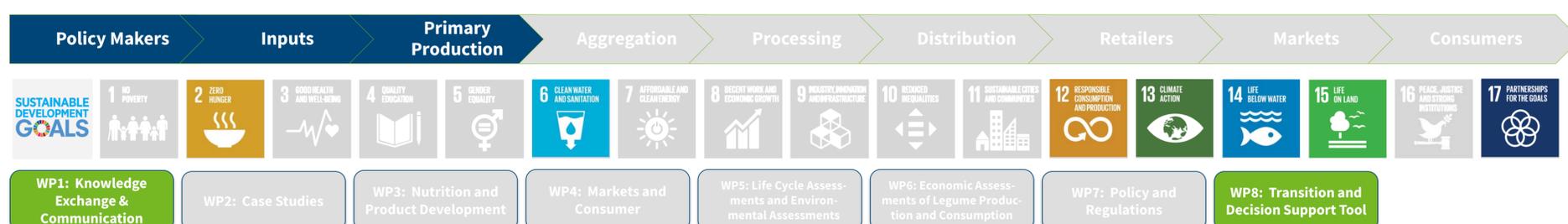
- Combine modern machinery platforms with existing approaches to support resilience in cropping systems.
- Potential prototypes of novel PAT machinery solution may be developed to deliver in-crop living mulch management solutions.

Impact

- Testing and development of agronomic practices to manage broad-acre crops with in-crop clover living mulches.
- Validate PAT assisted strip-tilled living mulch production systems.
- Encourage uptake of leguminous living mulches within industry.

Recommendations to realise this transition in practice

- Identification and validation of compatibility with existing systems, and development and integration within novel production systems, to encourage potential uptake.
- Evaluation and mitigation of key challenges to use of in-crop clover living mulches and impact on farming viability.
- Plant breeding – varietal performance optimisation for use in these cropping systems.
- Machinery development – to facilitate in-crop management of systems, and support use and uptake as appropriate.
- Farmer-led demonstration of agronomic system at commercial scales.
- Develop ecosystem and soil function/resilience-based market and policy support for cropping systems.



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