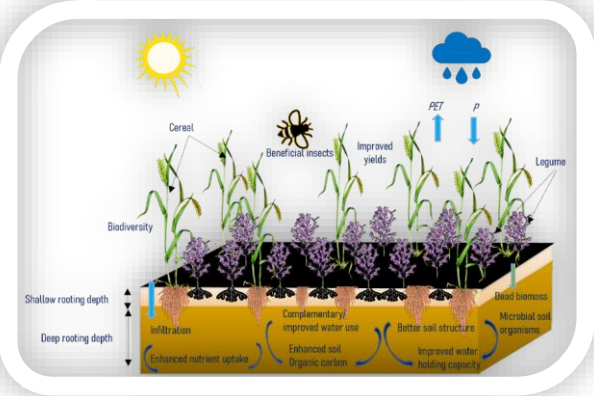
Hydro Nation Scholars Programme

Tracing water use patterns and carbon interactions in agricultural co-cropping systems using stable water isotopes



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Background

- Multiple benefits of co-cropping systems:
  - higher yields,
  - increased land productivity,
  - improved soil health and biodiversity.

- Potential drought measure by improving water use efficiency (Yin et al., 2020).

- The underlying mechanisms for successful co-cropping systems are not fully understood.

Description of co-cropping systems

❖Co-cropping is the practice of growing two or more crop species simultaneously.

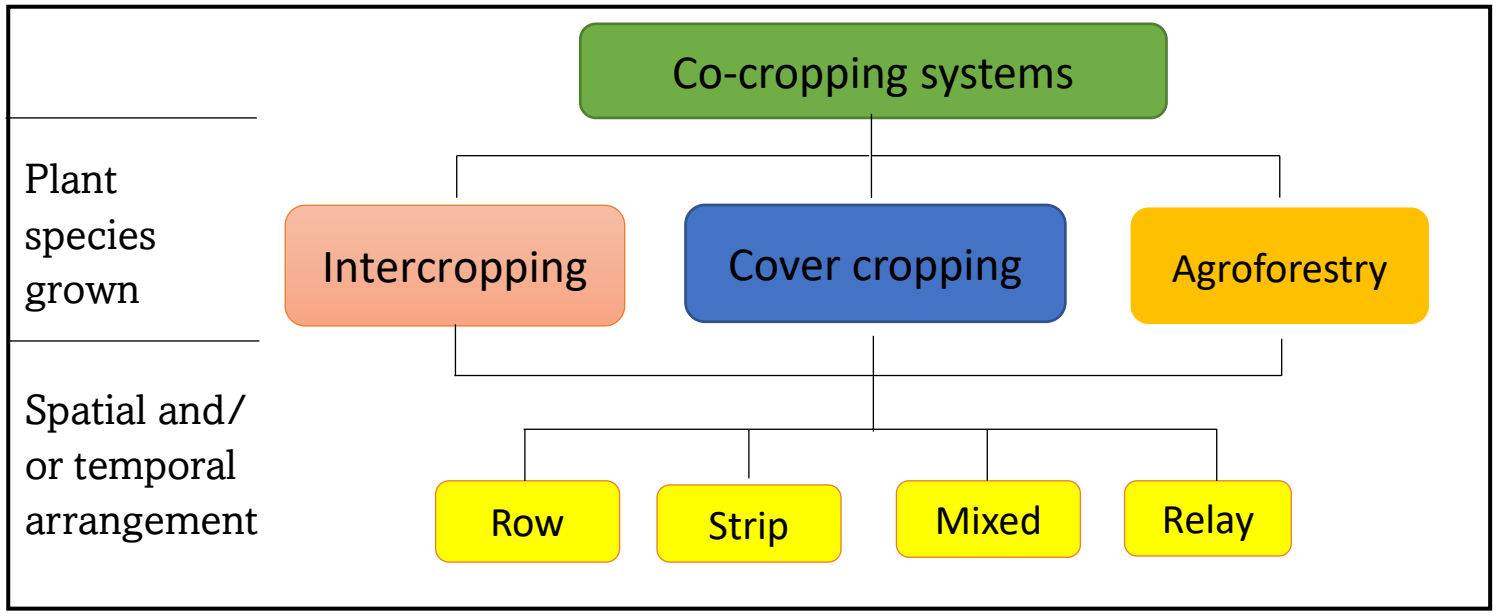
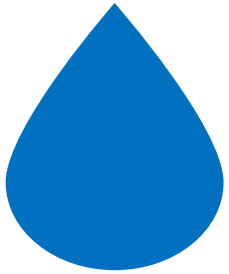


Fig. 1: Classification of types of co-cropping systems

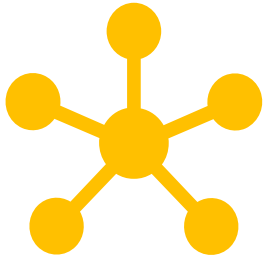
Fig. 2A: Barley and pea mixed intercrop at the James Hutton Institute's Balruddery Farm, UK
(B) Maize and wheat strip intercrop. (Source: J. Evers, Wageningen University and Research)

Knowledge gaps



Water use strategy of intercropping is largely missing while such information is still limited in agroforestry.

Crop and agroforestry combinations that optimise water use are unknown.



Interlinkages among water, carbon, and other nutrients in co-cropping systems are needed.

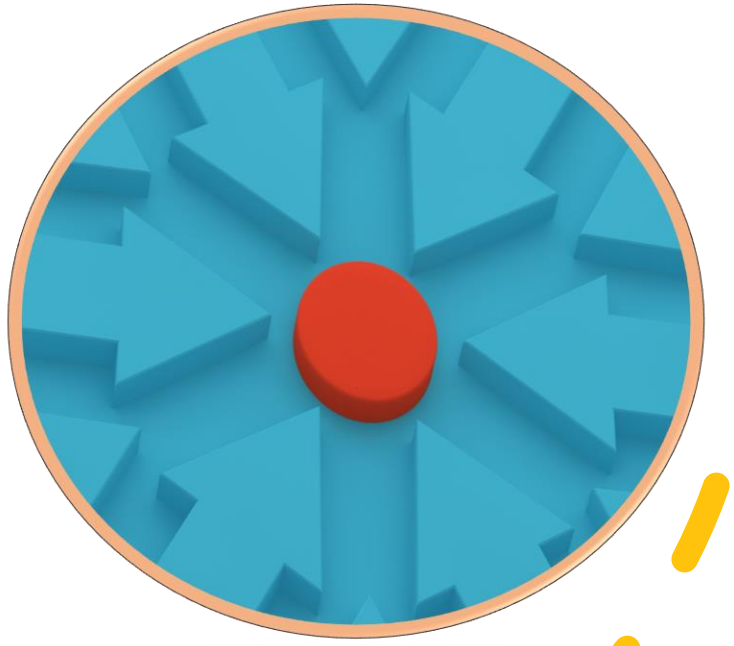
Aim and objectives

Aim:

To identify crop combinations that could optimise water use and sequester more carbon under climate change.

Objectives are to:

- Trace the sources and depths of water uptake by co-existing crops
- Determine changes in water use patterns during water-stressed conditions.
- Examine linkages between water and carbon interactions.



Specific question

How do water use strategies in co-cropping systems vary in space and time?

Experiment design

The experimental design is based on 3 levels:

A. Co-cropping versus monocultures - Year 1

1. Barley and pea
2. Wheat and faba bean

B. Changes in climatological conditions - Year 2

- 1 natural versus 1 drought manipulation

C. Soil water modelling – Year 3

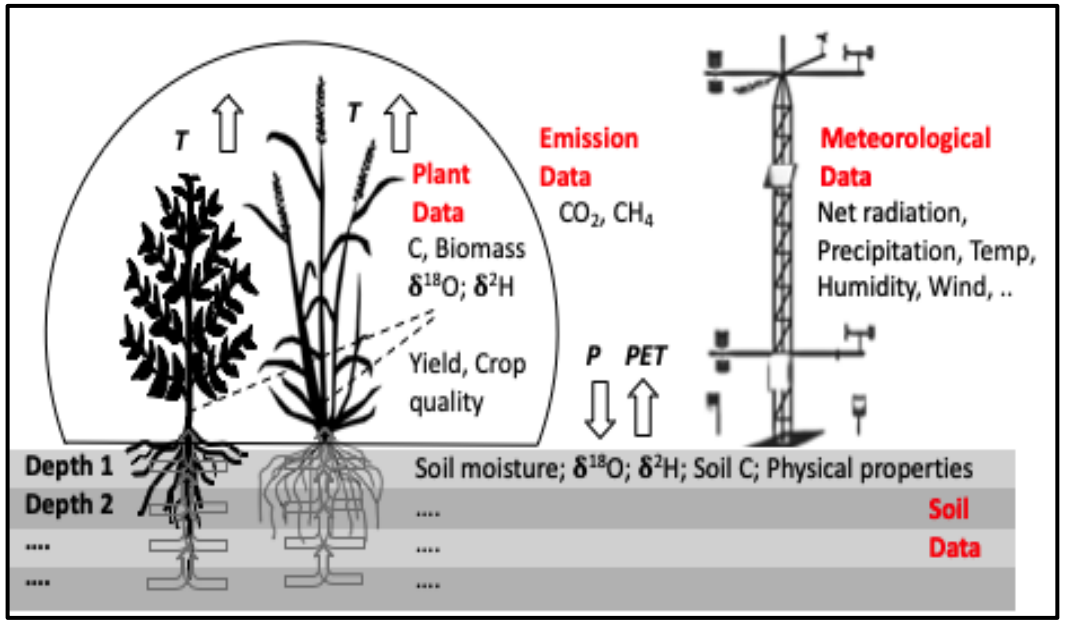


Fig. 3: Schematic representation of the methodological approach (not to scale) to be implemented at field site. Arrows represent water fluxes. *T* = Transpiration, *P* = Precipitation, *PET* = Potential evapotranspiration

Questions for discussion

1. What extraction method is appropriate for non-woody plants?

2. How can the use of stable water isotopes improve our knowledge on carbon cycling?