

How can managing water in agriculture contribute to food security and public health?

Evidence from Africa, and propositions for further work.

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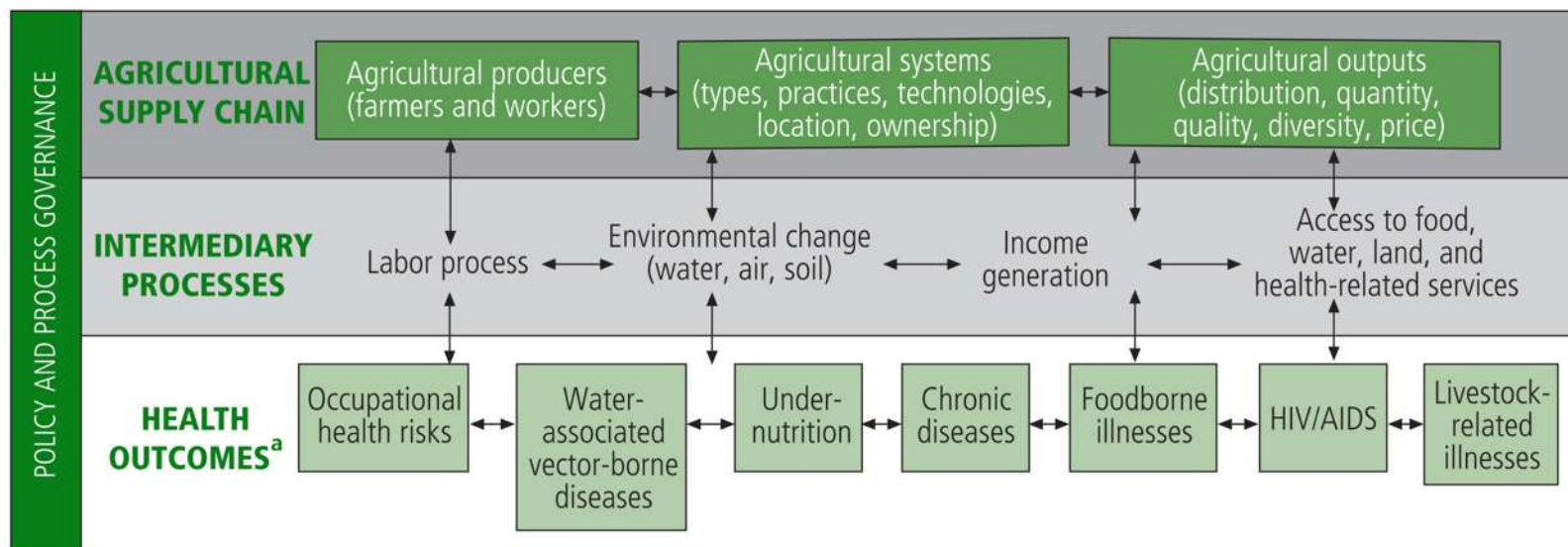
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Water, Food and Public Health in a Changing World



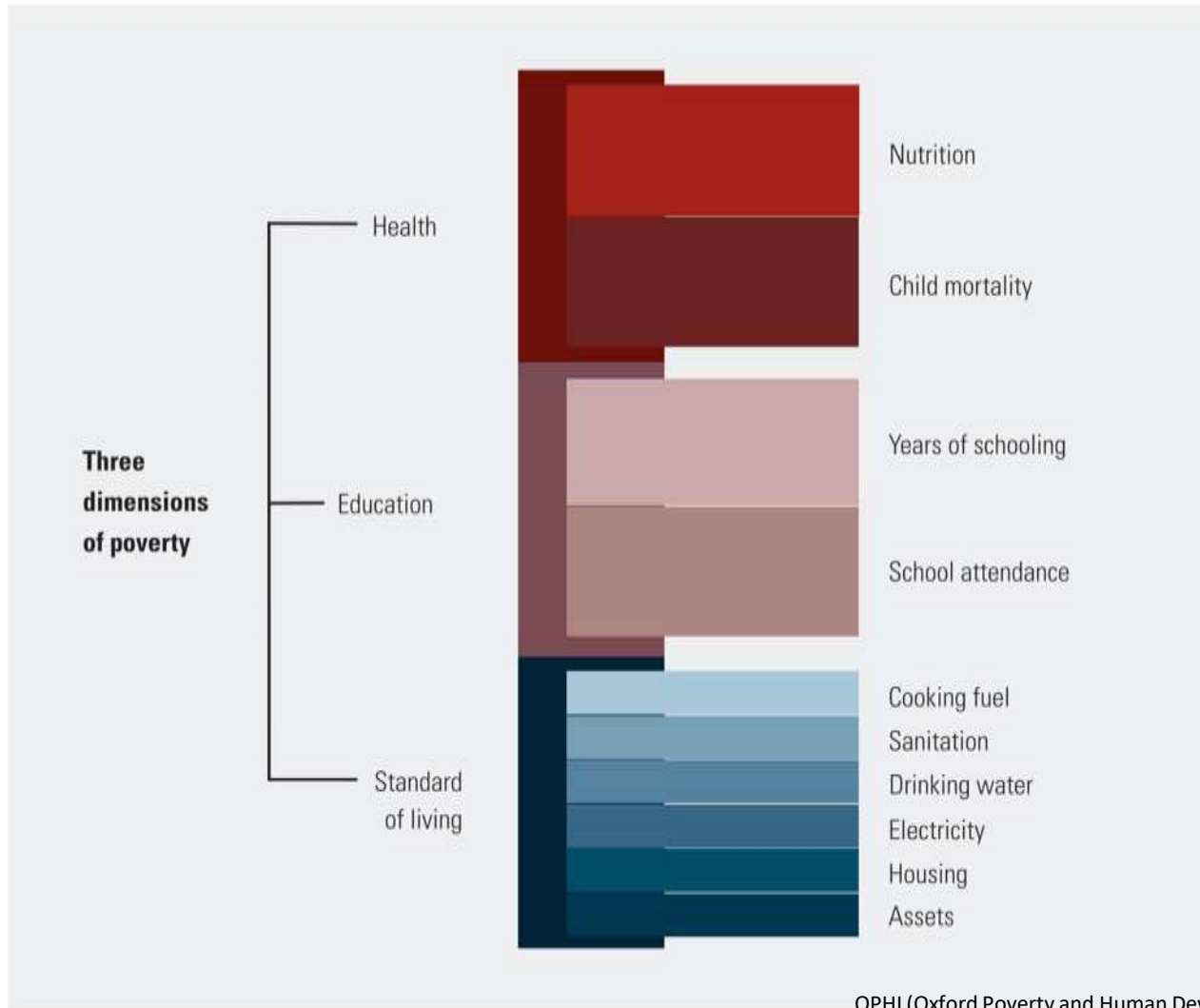
Conceptual framework of the links between agriculture and health

Fig. 1. Conceptual framework of the links between agriculture and health



^a These health conditions are not mutually exclusive – livestock-related illnesses, for example, are also occupational health risks. The list of health outcomes is not necessarily inclusive. Other health conditions are also likely to interact with agriculture, but these have not yet been identified as such in the published scientific literature.

Multi-dimensional Poverty Index



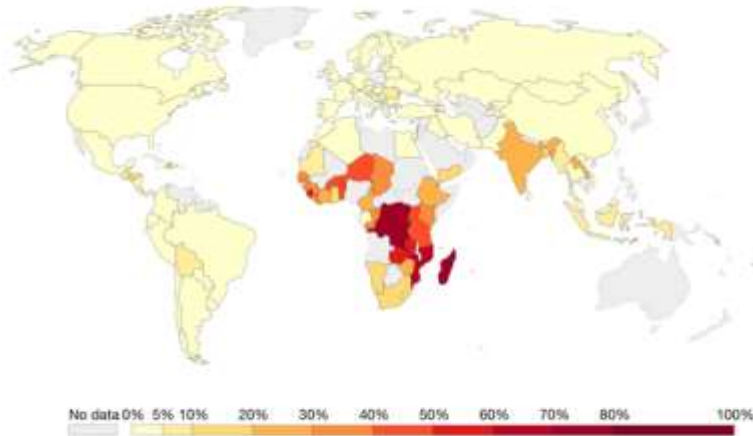
OPHI (Oxford Poverty and Human Development Initiative). 2018. Global Multidimensional Poverty Index 2018: The Most Detailed Picture to Date of the World's Poorest People. Oxford, UK. OPHI

Poverty and food security vs Multidimensional poverty

Share of the population living in extreme poverty, 2017

The share of individuals living below the 'International Poverty Line' of \$1.90 per day.

Our World
in Data



Source: World Bank

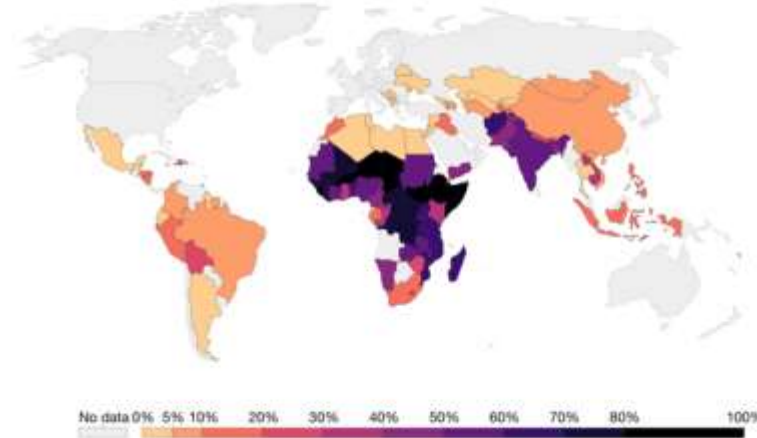
Note: Depending on the country and year, the poverty rate relates to either income or consumption. Figures are given in international-\$. This means they are adjusted for price differences between countries and adjusted for inflation to allow comparisons between countries and over time. Income/consumption is measured at the household level, and is assumed to be divided equally among all household members.

OurWorldInData.org/extreme-poverty/ - CC BY

Share of population living in multidimensional poverty, 2014

Proportion of people who are poor according to the Multidimensional Poverty Index (MPI). The MPI weights ten indicators of deprivation in the context of education, health and living standards. Individuals are considered poor if deprived in at least one third of the weighted indicators (see source for more details).

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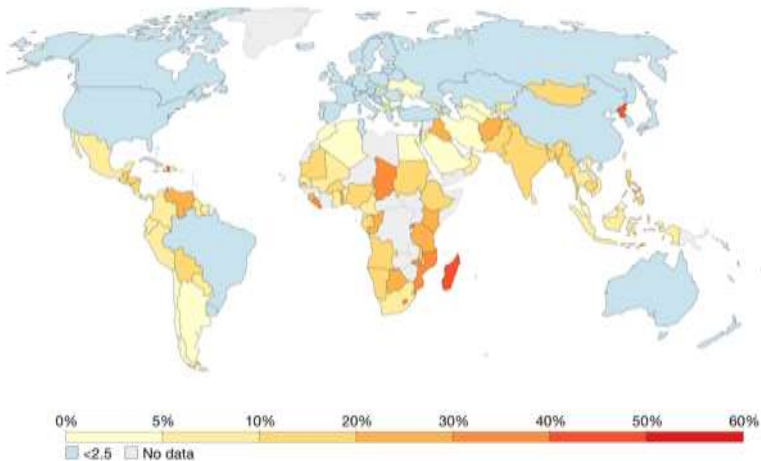
Source: OPHI Multidimensional Poverty Index - Alkire and Robeyns (2014)

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Share of the population that are undernourished, 2017

Share of individuals who have a habitual energy intake lower than their requirements.

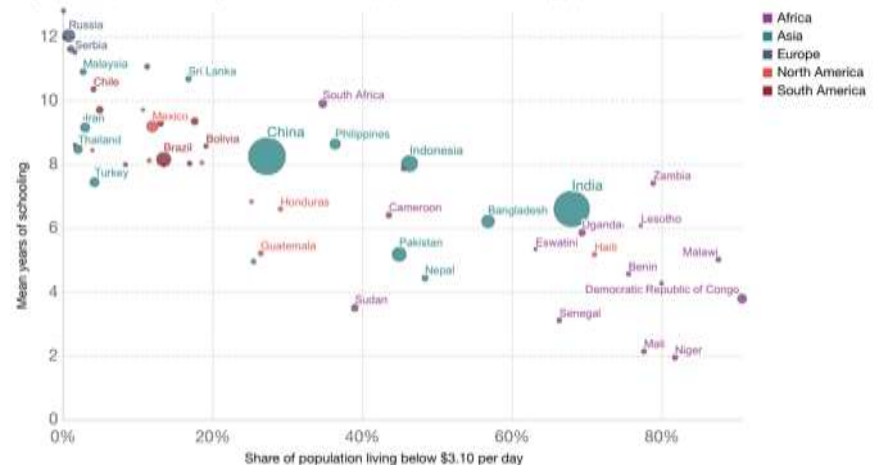
Our World
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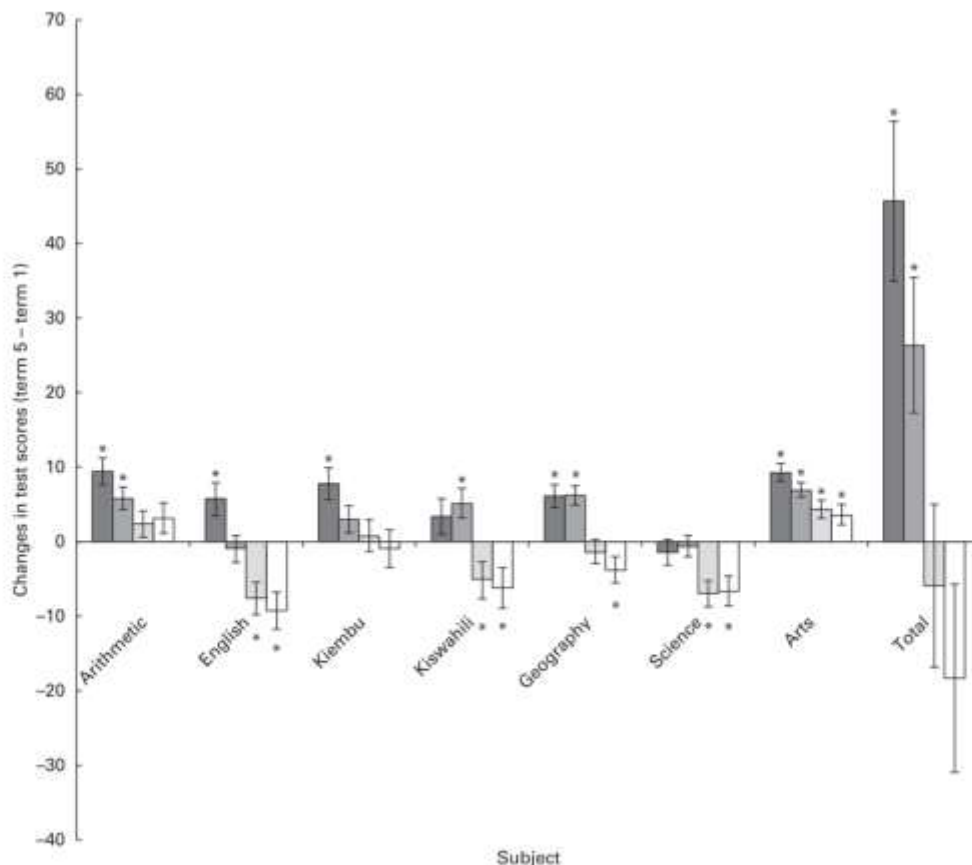
Poverty vs. educational attainment, 2014

Vertical axis measures the average number of years of total schooling across all education levels, for the population aged 15-64. Horizontal axis measures the share of population living below 3.10\$ international dollars per day. Colours represent world regions. Bubble sizes are proportional to the total country population.

Our World
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Animal source food supplements and cognitive development of children at primary schools in Kenya



Primary school children were provided with meat-, milk-, and vegetable & oil based meal supplements at schools in Kenya over the course of 5 terms. Initial test scores were subtracted from final test results to reveal the impact of supplements on cognitive development against that of a control group. Meat based supplements had the highest impact on test scores, followed by milk group.

Fig. 2. Change in test scores by group compared with baseline test scores (term 5 – term 1). Values show the change in test scores (term 5 – term 1) in each academic subject. Values are means, with their standard errors represented by vertical bars. * Mean values were significantly different between own term 5 and term 1 (baseline) scores ($P < 0.05$). ■, Meat; ▒, milk; □, plain Githeri; ◻, control.

Key Questions:

- How can we increase yields and reduce post-harvest losses to secure access to nutritious food?
- What can farmers do to increase productivity/profitability to secure their access to nutritious food – interdependencies with resilience, ecosystems and infrastructure?
- How can better understanding of soil moisture and nutrient dynamics reduce water use and fertilizer losses?
- How can farmers integrate into a wider food system as part of rural economies: value adding, job creation, and better diets?
- How can integrating dryland, irrigation, inland fisheries, aquaculture, and livestock production provide more profitable outcomes, and improve diets and health?

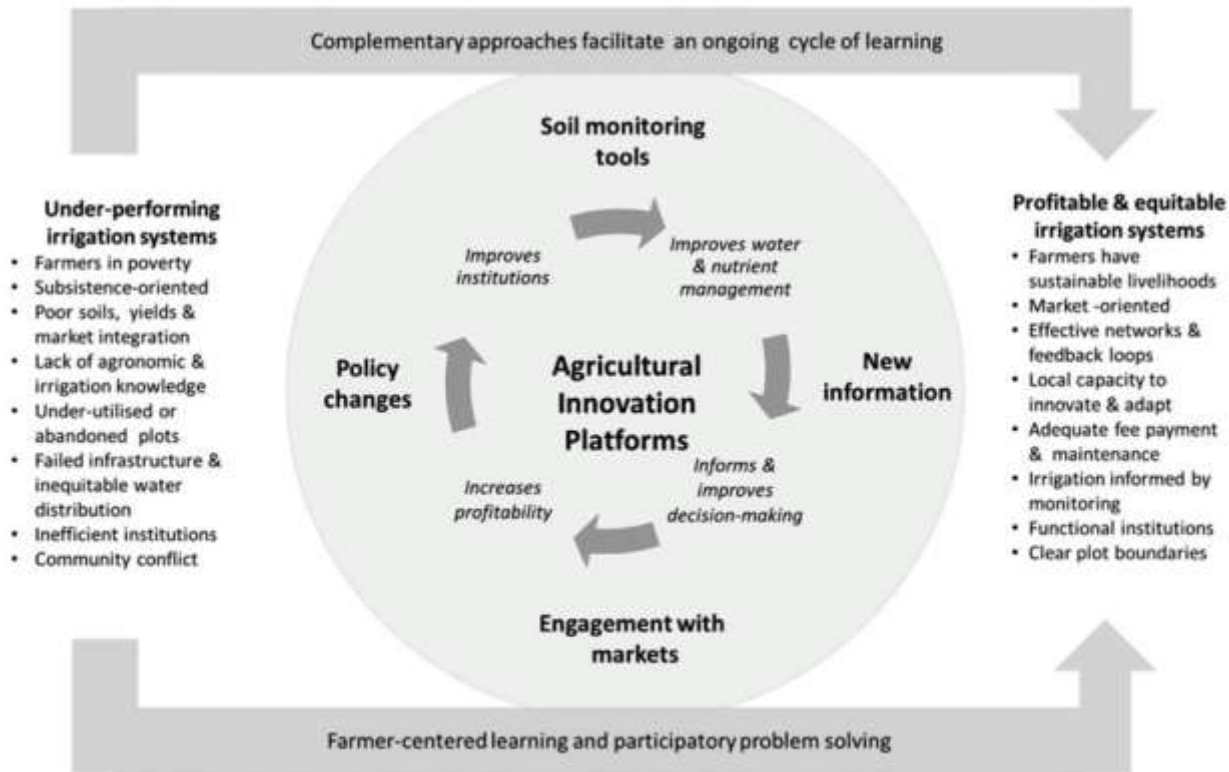


Figure 1. Transitioning underperforming smallholder irrigation schemes in Africa towards profitable and equitable irrigation systems (Bjornlund et al., 2018).

Building absorptive and adaptive capacity, addressing systemic challenges and creating feedbacks from markets to build human livelihoods, dignity and pride

Innovation systems:
Inclusive system analysis
& innovation



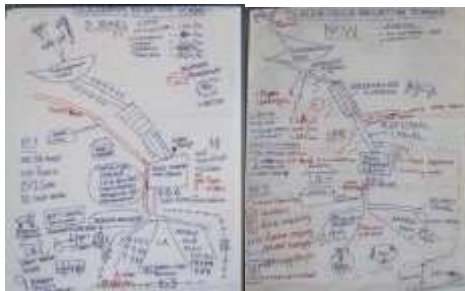
Interventions and learning:
Building adaptive capacity



Inputs and production:
Profitable & resilient
cropping systems



Market development:
Accessible and functional
markets



Building analytical capacity to identify and act on strong leverage points



Interventions with farmer friendly technologies



Developing diverse and integrated sustainable production systems



Generating income, stimulating rural economies and the capacity to reinvest.

Learning systems: Creating and environment for learning and sharing

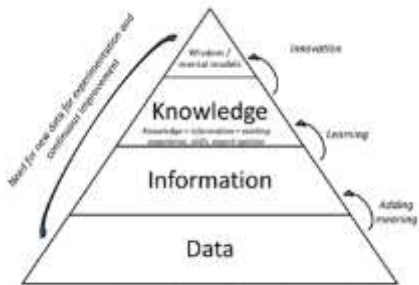


Figure 2. Integration of the data-information-knowledge-wisdom hierarchy with knowledge processes.

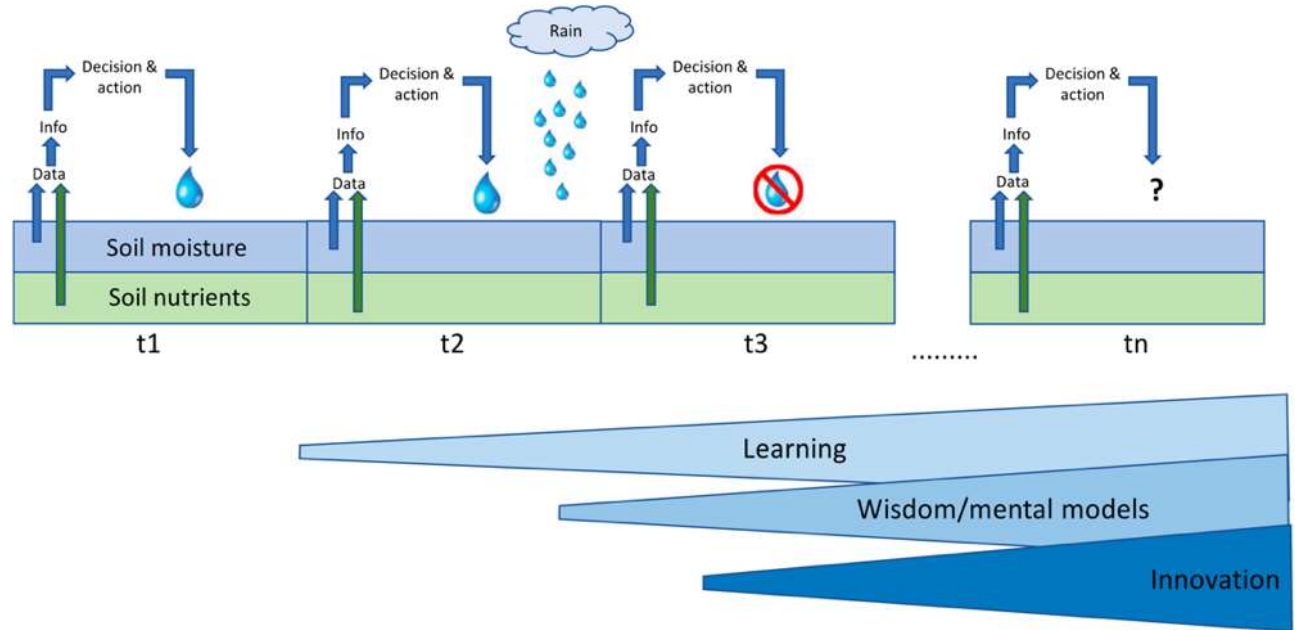


Figure 3. Knowledge system developed from Chameleon and Wetting Front Detectors.

Increases in water productivity by farmers with and without tools

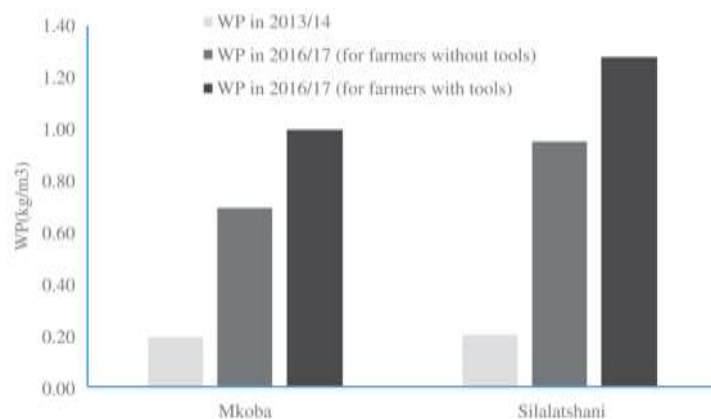


Figure 8. Water productivity (WP) before and after the introduction of the tools, for farmers with and without tools.

Increases in yield and income with reduced irrigation

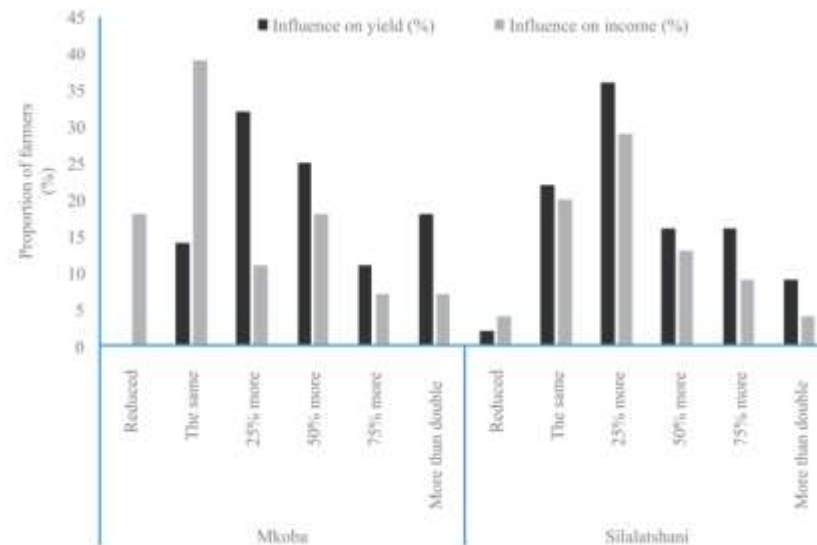


Figure 10. Influence of changes on households' yield and income (for those reporting changes).

Increased spending on food, education and assets

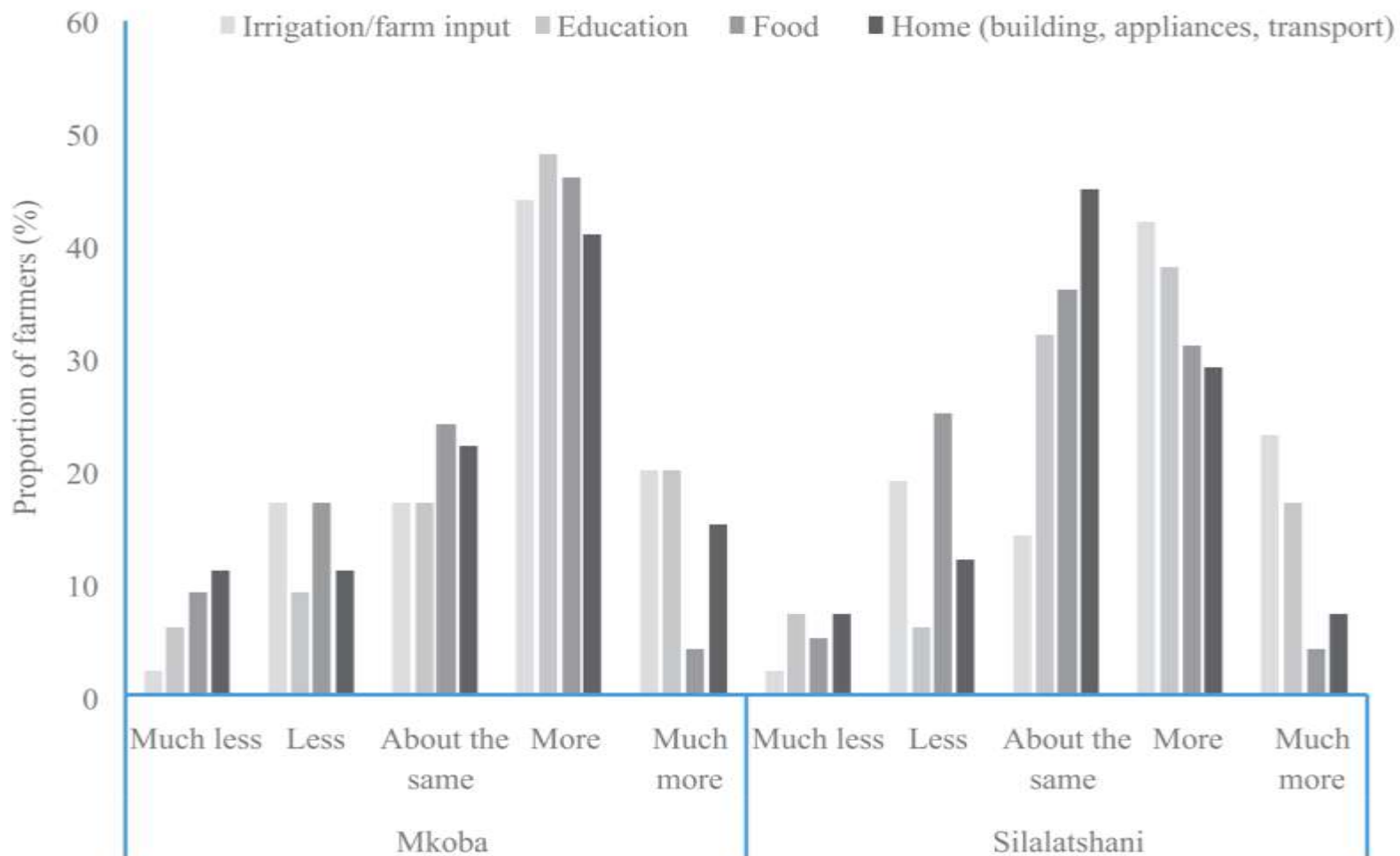


Figure 11. Changes in household spending patterns in the last four years (showing the proportion of farmers now spending on different activities compared to four years ago).

Reduced conflict

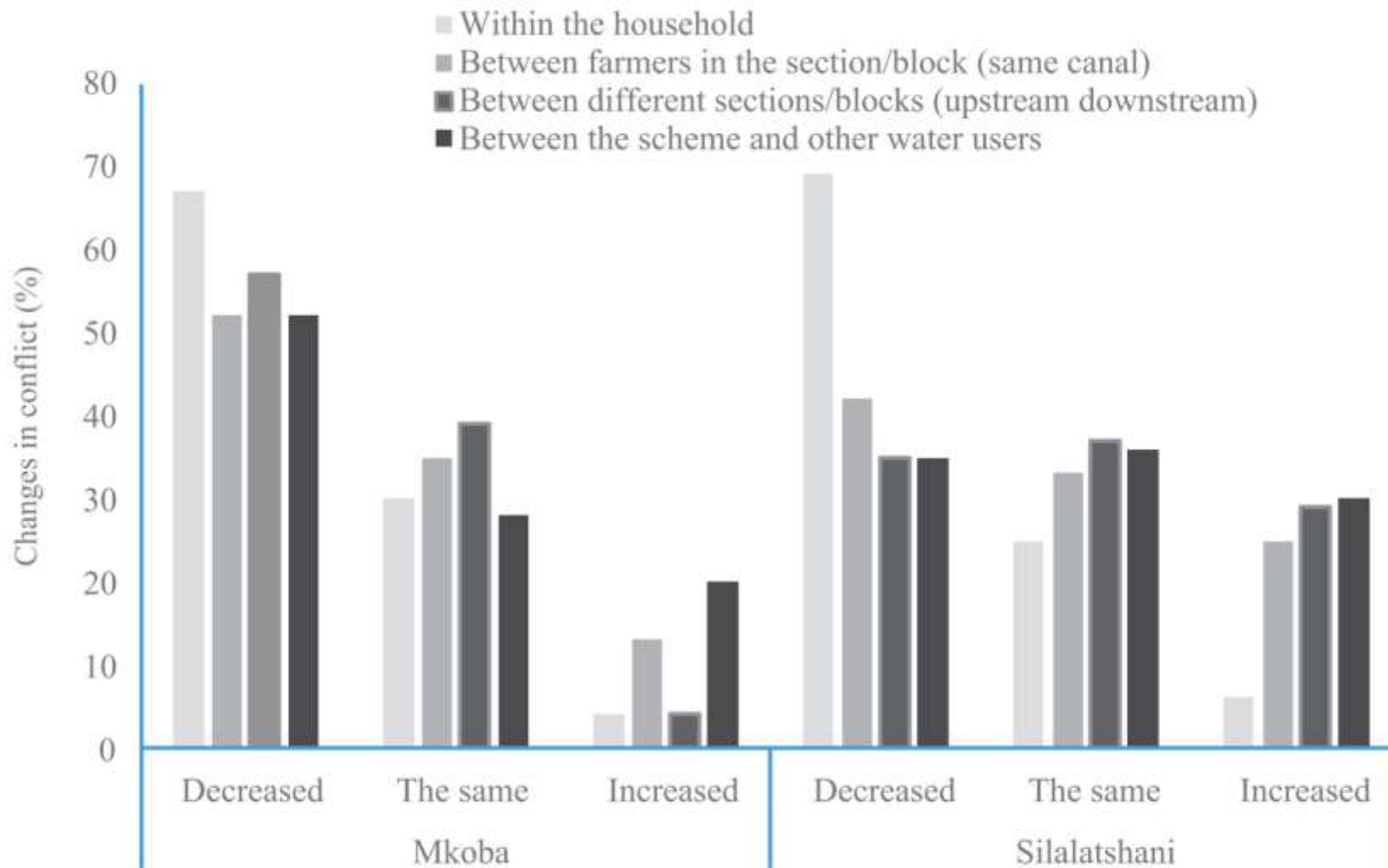


Figure 12. Households' perceptions of changes in conflict within the scheme over the last four years.

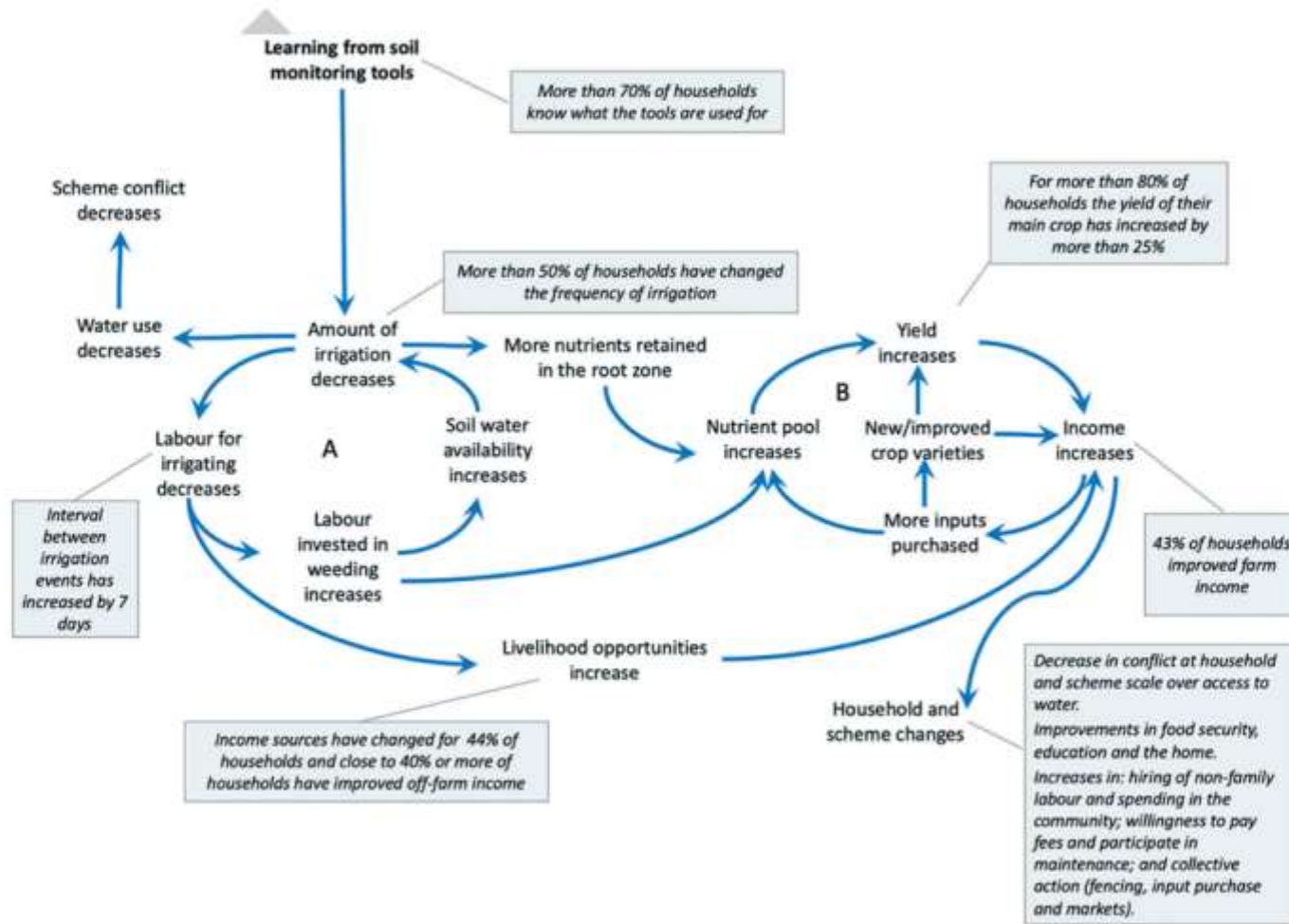
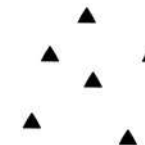
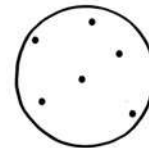
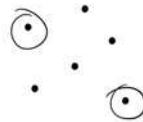
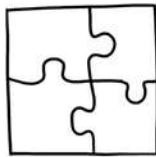
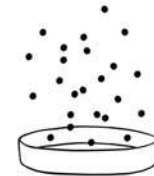
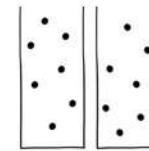
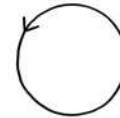
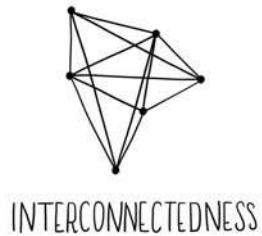


Figure 4. Influence diagram illustrating the systemic changes brought about by the soil moisture and nutrient monitoring tools (Loop A) and the agricultural innovation platform (Loop B) at Silalatshani irrigation scheme.

Change the way we think



Thinking in systems

- The behaviour of the system is determined by the interactions and dynamics between the components of the systems – not only by the components itself.
- Need to intervene at a range of strong leverage points (multi- and trans-disciplinary teams)
- How can the multifunctionality of water be leveraged to improve public health?

More crop per drop: Water productivity

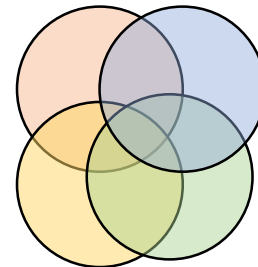
+ More nutrients per drop: Nutritional Water Productivity,

+ More income per drop

= Increased Food Diversity per drop

- To achieve positive outcomes R&D and policies should focus on the interdependencies between:

- Agriculture
- Environment
- Public health
- Education



- What are the trade-offs and synergies in use and investments between these three sectors?

Appreciate your Attention



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Wetting Front Detector

6 M. MOYO ET AL.

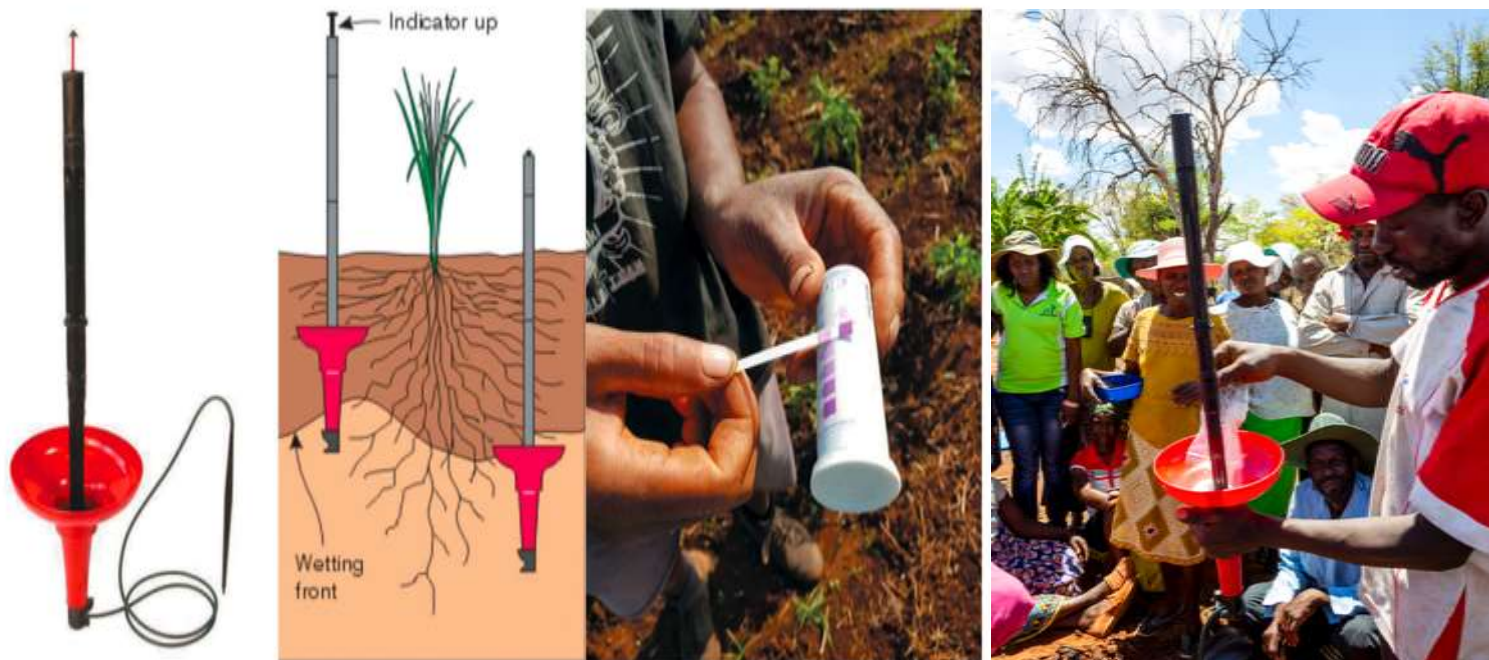


Figure 2. Wetting Front Detectors are placed at two depths in the ground and facilitate the testing of nitrate in the field (Virtual Irrigation Academy, 2019).