Improving on-farm water management by introducing wetting front detectors to small scale irrigators in Ethiopia

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IRRIGATION IN ETHIOPIA

- Smallholder irrigation is developing fast in Ethiopia

- On-farm water management:
  
  Simple technical advisory units on water application to high value crops will lead to a reduction in water demand

- Consequences:
  
  - Over-irrigation in schemes has led to periodic water scarcity issues in large schemes
  
  - Low yield and water productivity
  
  - Fertilizer leaching and increased groundwater tables
WETTING FRONT DETECTORS

- A mechanical device to monitor the wetting front
- 2004©CSIRO (http://www.agriplas.co.za/)
- Installation depth depends on the application, soil & crop type
IRRIGATION OF ONION

20 cm

40 cm
Field capacity at the top layer is reached within the entire root zone: **over irrigation**
STUDY SITES, CROPS & MANAGEMENT

- Water lifting and irrigation:
  - Manual lifting & overhead
  - Motorized lifting & furrow
  - Gravitational & furrow

- Crops:
  - Onion, tomato, cabbage, green pepper
  - Wheat
  - Potato

- Measurements:
  - Irrigation quantity
  - Crop performance and yield
  - Soil moisture and management
Soil moisture change throughout the first 60 cm before (0 min), during (5-15 min) and after irrigation (30-60 min)

\[ \theta_{FC} 10\, cm = 32.7\% \]
\[ \theta_{WP} 10\, cm = 21.2\% \]

The shallow WFD was installed at 20 cm, the deep at 40 cm

\[ \Rightarrow \theta_{20\, cm, 15\, min} = 33.3\% \]
\[ \theta_{40\, cm, 15\, min} = 20\% \]
**MANUAL WATER LIFTING**

- Farmers practice (FP) uses 30% less water compared to WFD
- Water application was higher at critical growth stages
- Yield increased with a factor 2.1
- Impact increased in year 2 as experience increased

⇒ WFD guided farmers who are new in irrigation to double their yield when increasing their irrigation by 30%. The method slightly used less water compared to the TDR.

(T. Asnakaw, in prep)
Farmers preferred the CWR and WFD yield as fruits were bigger and fields had a higher marketable yield.
MOTORIZED VS. MANUAL LIFTING

Installation at the same depth:

⇒ Effect depends on:
- Water availability
- Method of application
- Method of lifting
- Soil type
- Land size/ experience?
Onion

Simple technical advisory on water application will lead to a reduction in water demand and efficient use of inputs

OPTIMIZING RESOURCES BEYOND WATER

- Similar effect of WFD as for motorized lifting
- Water management improves yield by 7%
- Reduction of fertilizer: 20% N and 50% P
- 1,153 USD/ha profit (90% water, 10% fert.)

(B. Endrie, in prep)
INCREASING IRRIGATION COMMAND AREA

- Experiment was repeated using full farmer fields with WUA (1 WFD for 0.5 ha)
- Three blocks: Chihona, Tagel, Adibera
- Is water saving achieved?
- Does it impact yield?
- Can land be increased?
INCREASED WATER PRODUCTIVITY IN THREE BLOCKS

- High variability between farmers remains
- 25% reduction in water consumption
- 22% increase in water productivity
When WUA distribute the information and manage water accordingly

=> increased irrigable land by 37% (onion) & 85% (potato)

(B. Mengstie, in prep)
CONCLUSION AND FURTHER OUTLOOK

• The **impact on water and crop** productivity depends strongly on **water lifting technology and management** (data on 300 fields being compiled)

• **Impact goes beyond** the hypothesis- reduction in costs through reduced fertilizer; positive impact on quality of produce (bigger and better); compliments existing indigenous knowledge

• Efficiency gains in both water and fertilizer **contribute** to move towards **sustainability** (reducing water demand, reduction in loss of nutrients etc.) and meeting the **SDG on water** (e.g 6.4)

• Influences farmers’ thinking about water use to **compliment their existing indigenous** skills (build trust in research for development) => well liked by farmers

• **Interest by National key stakeholders** to conduct National Research on irrigation scheduling using WFD
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