Design and technical performance of a capillary irrigation system to produce neglected and underutilised vegetables

G. Esaïe KPADONOU and P. B. Irénikatché AKPONIKPE
Unit of Environmental Soil Physics and Hydraulics (ESPH),
Faculty of Agronomy (FA), Université de Parakou (UP), Bénin.
E-mail: kpadonoue@gmail.com; akponikpe@yahoo.com

Introduction

- Up to 70% of all water extraction is used in agriculture.
- But plants use only very little part of this water for its physiological needs. The remaining is lost.
- Existing and most used irrigation systems have serious problems of effectiveness
- High population growth is noticed in cities due to rural migration.
- Need to shift agriculture from rural areas to cities, and this calls for inovative irrigation systems which is suitable for the environment when enabling the production of vegetables rural population are used to
- **Objectives:** Designing and testing capillary irrigation systems for horticultural production mainly neglected and underutilized vegetables (NUV) with little resources input.

Methodology

- **Experimental site :** Application and Research Farm **(FAR)** of the Faculty of Agronomy **(FA),** Université de Parakou **(UP),** located in soudanian area of Northern Benin
- **Experimental design :** Split-plot with two factors: 1) the irrigation systems with two variants: Capillary Irrigation System (SIC) and Ordinary Irrigation System (SIO); and 2) the NUVs: *Moringa oleifera* and *Amaranthus cruentus.*
- **Data collection :** height, number of leaves and root collar diameter of seedlings; soil humidity and density and yields.
- **Data analysis:** ANOVA computed with the R statistical software at 0.05 level of significance.

Results and discussion

Description and functioning of the SIC

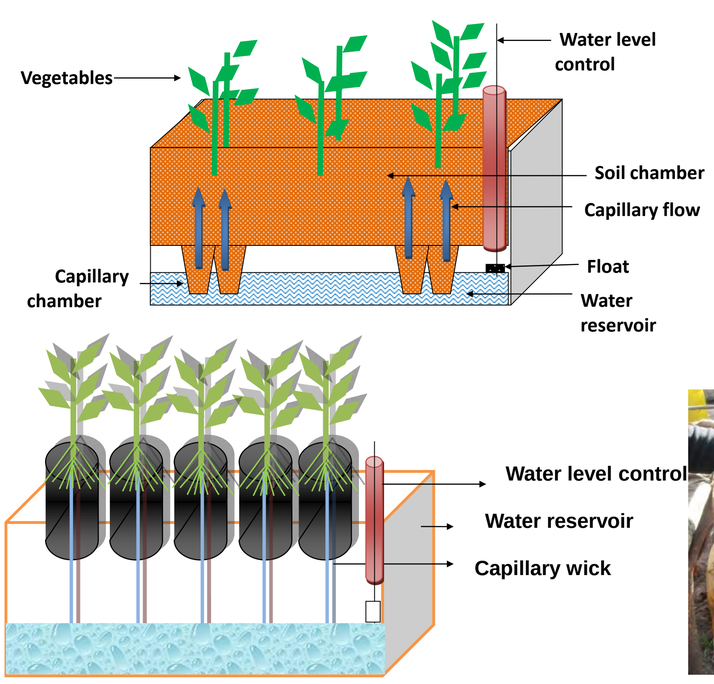


Figure 1: Description and functioning of capillary irrigation system (SIC) a)SIC for vegetables ; b)SIC for seedlings.

NOTICE: SIC is made of: a water reservoir; a soil chamber; capillairy chamber and water level control system.

Case of *Moringa oleifera*

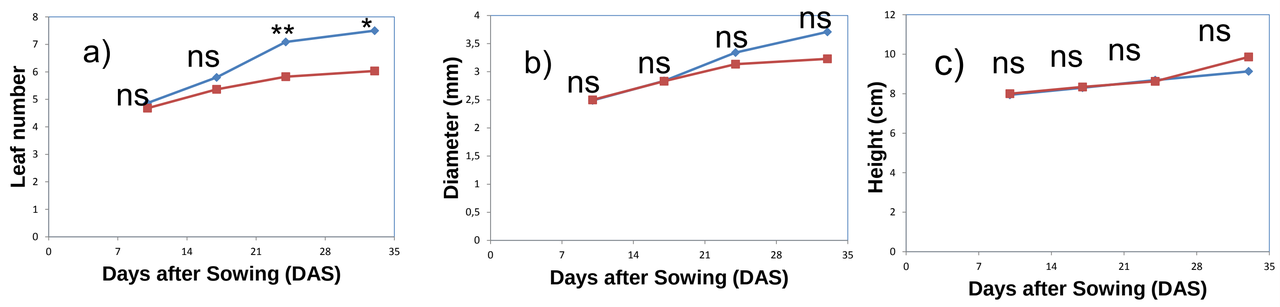


Figure 2: a) Evolution trend of leaf number b) collar diameter and c) height. SIC ; SIO ; ns: non significant; *significant at 5% level; **significant at 1% level; ***significant at 0.1% level.

Treatment effect on yields

SIC yield is four times greater than SIO (table 1, figure 2)

Table 1: Biomass yield of Amaranthus

Systems	Fresh biomass (g/m²)	Dry biomass(g/m²)
Ordinary SIO	1166.15	267.57
Capillarity SIC	4213.8	1247.50

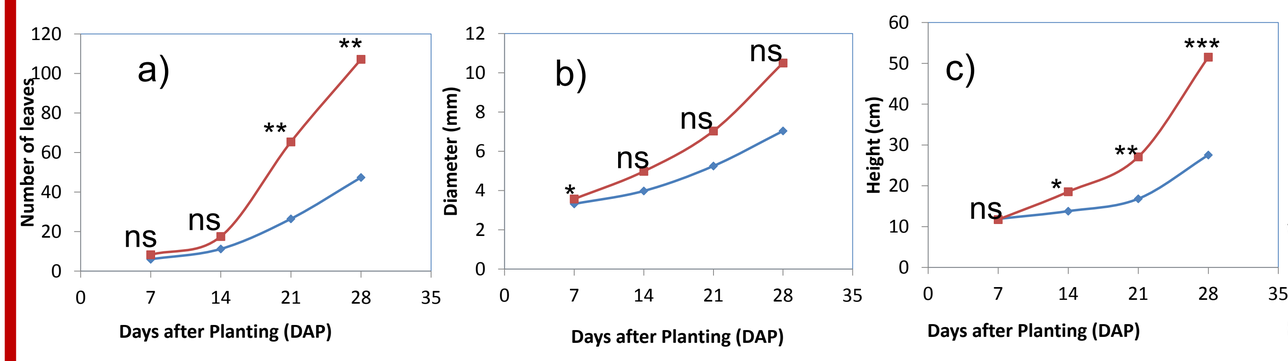
Figure 3 : Amaranthus under SIO (left) and under SIC (right)

Water use:

- **Amaranthus: SIC** recieved **246.59 mm** of water against **595.45 mm** for **SIO (41.42%)** with irrigation frequency **(FI) of once every three days.**
- **Moringa: SIC** recieved **270 mm** of water against **675 mm** for **SIO (40%)** with Irrigation Frequency (**FI**) of once every ten days. For both vegetables, **SIO** received water on a daily basis

Treatment effect on plant growth

Case *of Amaranthus cruentus*



Conclusion

- Capillary irrigation systems allowed to obtain better plant growth, better yields and efficient management of water. This is due to the easiness of plant to use optimal needs of water.
- Capillary irrigation is a technique that makes water consumption of plants automatic and automous. This system is promissing for a better and full time production of neglected vegetables.

Note

This work was done by the first author in order to obtain his Bachelor of Science (Bsc) degree under the supervison of the second author.