

PRACTICE ABSTRACT n° 11

Upgraded hydroponic systems for Tunisian farmers optimize soil and water use and increase farmers salary

A simplified Nutrient Film Technique (NFT) system was introduced on five private farms, each covering 12 m² (cultivable area) inside a greenhouse of 24 m² (3 x 8 m). Briefly, the system is composed of horizontal tubes slightly tilted (2%) to ensure the water recirculation. A pump continuously provides the nutrient solution which flows inside the tubes, where plants are transplanted. Any growing substrate is adopted here, and roots float in the nutrient solution. This system incorporated an insect-proof net, a shading net on the roof, and an automated intermittent irrigation is included as well (45-minute watering alternated to 15-minute drying cycle). Yield per year (kg m⁻² year⁻¹) outperformed the plastic bottle system developed during the WP4 (Fig. 1), and the traditional

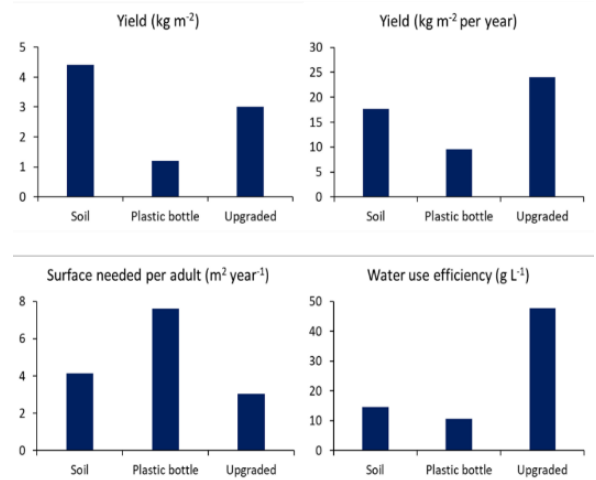


Figure 1: Simplified hydroponic system and agronomic performances as compared with on soil and on plastic bottle hydroponic system developed in WP4

In the upgraded simplified hydroponic system around 54 kg N ha⁻¹, while in soil N rates typically ranges between 100 and 150 kg N ha⁻¹. From this analysis, the nitrogen use efficiency in the upgraded system resulted 29% higher than the NUE of the on-soil system. A cost-benefit analysis (CBA) was conducted to evaluate operational costs and revenues under two irrigation scenarios: continuous irrigation (24 hours day⁻¹) and intermittent irrigation (12 hours day⁻¹ with 15-minute drying cycle per hour, and with nighttime irrigation pauses). The cost of sensors (pH and EC meters) was depreciated over one year to determine the daily cost. The CBA clearly showed

that energy costs for irrigation significantly impact total costs, resulting in negative profit under continuous irrigation. However, with intermittent irrigation, as adopted by local farmers during validation trial, the profit margin became positive. With the average salary of farmers in Jendouba at approximately € 100 per month, the adoption of the upgraded hydroponic system with intermittent irrigation led to a 16% salary increase.

Table 1 Cost benefit analysis for upgraded hydroponic system under continuous and intermittent irrigation

on-soil cultivation, simultaneously improving the water use efficiency and the surface needed to feed one adult.

			Continuous irrigation		Intermittent irrigation	
			Use (n unit)	Cost	Use (n unit)	Cost
Unit	€ unit ⁻¹					
Fertilizers (NPK, Ca, Mg, acid)	g	0.0013	1154	1.49	1154	1.49
Electricity	kW	0.100	810	81.0	304	30.4
Sensors	daily	0.472	48	22.6	48	22.6
Plants	n	-	300	5	300	5
Other	-	-		5		5
Total				115.1		64.5
Unit	Value		Revenue		Revenue	
Yield	kg m ⁻²	3.03				
Total production	kg	36.4				
Market price	€ kg ⁻¹	2.5	90.9		90.9	
Profit	per crop cycle		-24.2		26.4	
	per month		-15.1		16.5	