



USAID
FROM THE AMERICAN PEOPLE



Hydroponic Green Farming Initiative (HGFI)





USAID
FROM THE AMERICAN PEOPLE

Agricultural Sector in Jordan

- Irrigated agriculture has important social, economic, and political benefits
- Irrigated agriculture underpins the JV economy
- Agricultural exports represent about 9% of Jordan's total exports in 2011
- Fruits & Vegetable exports amount JD 452 million (75% of total agricultural exports) in 2011 with a big potential for growth
- Exports grew in 2012 and 2013 and declined in 2014 due to the crises in Syria



USAID
FROM THE AMERICAN PEOPLE

Water Use and Gross Value Added

	Water Use MCM	GVA JOD/m3
Summer Vegetables JV	18	0.72
Summer Vegetables Highlands	101	0.52
Winter Vegetables JV	47	1.55
Winter Vegetables Highlands	33	0.91
Trees Highlands	206 MCM	0.26
Trees Jordan Valley	82.5 MCM	0.58



USAID
FROM THE AMERICAN PEOPLE

Economic and Financial Returns of Water Use

- Is Jordan getting enough economic and financial returns of using 65% or more of its water for irrigation?
- Can Jordan achieve the same or higher returns with using much less water through technological advancement and growing higher value crops



USAID
FROM THE AMERICAN PEOPLE

HGFI Program Objectives

- Water saving in agriculture through expanding hydroponic farming in Jordan
- Increase land and water productivity per sq meter and cubic meter
- Introducing photovoltaic systems as alternatives to electricity and fossil fuel as energy sources for hydroponic farming



USAID
FROM THE AMERICAN PEOPLE

Components and Activities

- Assessment of hydroponic farming application at commercial and household levels
 - review of hydroponic farming in Jordan,
 - feasibility analysis, analysis of capital and operating expenditures for various crops,
 - input/output parameters for feasibility
 - and monitoring/evaluation of implementation,
 - covering both commercial and rural household farming.
- Implementation of hydroponic system demonstrations at commercial level and households/communities.



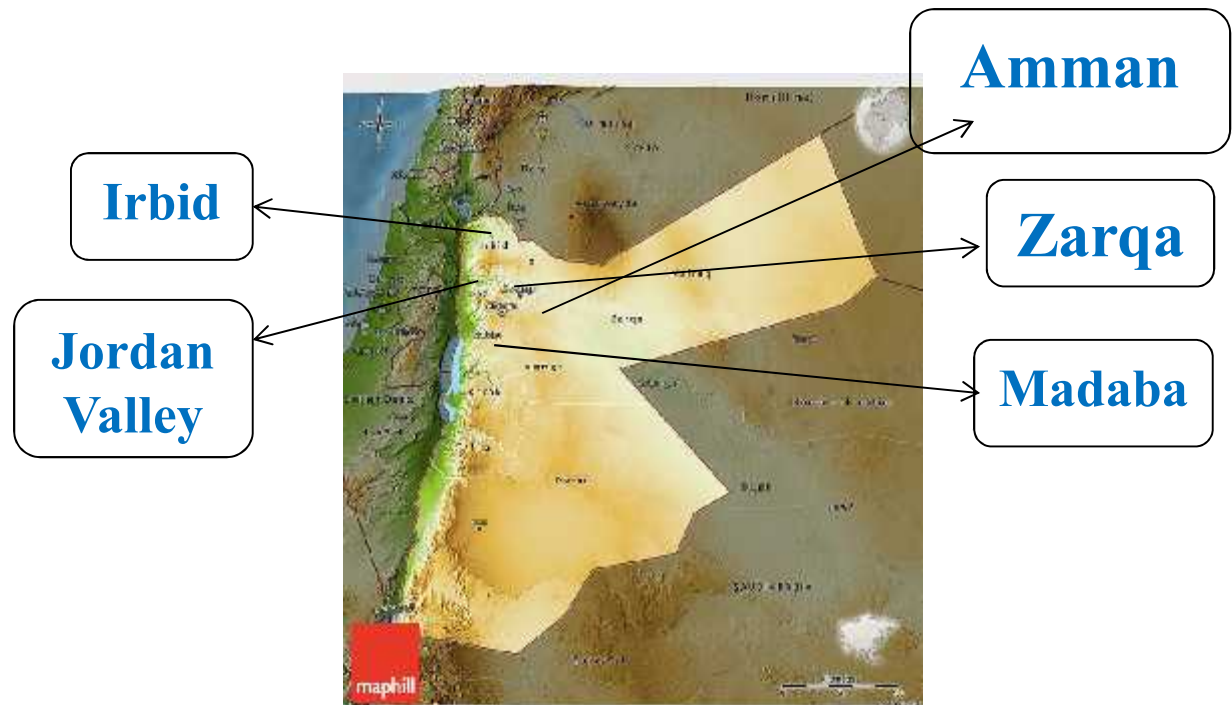
USAID
FROM THE AMERICAN PEOPLE

Components and Activities

- Analysis of farm-level and household results in different locations and for different farming seasons to refine system design and increase viability of implementation.
- Education and outreach through demonstration visits, training to farmers and engaging universities and research centers.
- Development of bankable or financeable business models for cooperating farmers to access finance from existing sources or develop additional financing facilities.

HGFI Approaches

- Demonstrating hydroponic farming on different crops at different areas



HGFI Approach

- Adaptation of international experiences to local context





USAID
FROM THE AMERICAN PEOPLE



HGFI Approach

- Field days to show real on ground hydroponic plantations





USAID
FROM THE AMERICAN PEOPLE



HGFI Approach

- Training sessions and exchange of experiences



HGFI Approach

- Supporting farmers through design and implementation of hydroponics solutions
- Supplementing farmers investments with HGFI grants





Field work

- ✓ 6 demonstration sites with 7 different crops
- ✓ Field days
 - ✓ More than 300 farmers attended
 - ✓ More than 150 requests to start hydroponics
- ✓ More than 70 site visits to farms, suppliers, and stakeholders
- ✓ More than 40 requests for training

Crops grown hydroponically

- Madaba: tomato, cherry tomato, sweet pepper and cucumber.
 - Zarqa: Lettuce
 - Jordan Valley: Hot pepper
- } Commercial level
- Irbed: Thyme
 - Madaba: Thyme
 - Jordan: Thyme
- } Household / CBO level



USAID
FROM THE AMERICAN PEOPLE
FOR THE AMERICAN PEOPLE



Crops





USAIDD
FROM THE AMERICAN PEOPLE
FOR THE AMERICAN PEOPLE



Crops





USAIDD
FROM THE AMERICAN PEOPLE
FOR THE AMERICAN PEOPLE



Results of three crops

Lettuce, Hot Pepper and Thyme

Lettuce

- Raft Hydroponic system
- 4800 heads in 288 sq m
- High quality lettuce
- Long shelf life at the retailer
- 28 m³ of water to produce 4800





Lettuce results

Parameter	HGFI soilless culture	Soil culture	Percentages
Area (m ²)	288	1000	
Number of plants	4800	4800	
Planting density, plant/m ²	17	5	+ 340 %
Water used(m ³)	28	200	
Water used per plant (liter)	5.83	41.66	-- 86 %
Sold production (head)	2000	4500	
Fertilizers used (JoD)	51	70	
Selling prices (average) JoD/head	0.5 -1.0	0.075 – 0.1	
Water productivity JoD/m ³	39.2	2.25	



Lettuce economics for 1 dunum (1000 m²)

Capital cost	5895 JOD
Annual capital cost after depreciation	1300 JOD
Possible number of cycles per year	6
Operational costs per year	3660
Total costs per year	4960
Production per cycle (90%), plants	12960
Selling price, JoD	0.15
Revenue per year, JoD	11646
Net profit	6686
Payback period	1 year



Pepper

- Drip/Top feeding close Hydroponic system
- 586 plants in 192 sq m
- High quality hot pepper ()
- 70 m³ of water to produce 780 kg





USAID
FROM THE AMERICAN PEOPLE



Parameter	HGFI soilless culture	Soil culture	Percentages
Area (m ²)	192	240	
Number of plants	586	870	
Water used(m ³)	70	190	
Water used per plant (liter)	119	218	45.4 % decreased
Production (Kg)	780	827	
Production per plant (Kg)	1.33	0.95	40 % increased
Fertilizer used per plant (JoD)	0.086	0.027	
Fertilizers used (JoD)	50.5	23.8	
Selling prices (average) JoD/Kg	0.6	0.6	
Water productivity liter/Kg	90	220	
Water productivity JoD/m ³	6.7	2.73	
Water productivity Kg/m ³	11.14	4.35	



USAID
FROM THE AMERICAN PEOPLE



Pepper economics for 5 dunums

Parameter	Hydroponics	Traditional	unit
Area	5000 (10 G.H)	5000 (10 G.H)	m2
# of plants	13000	13000	plant
Water used	1552.9	2839.1	m3
Water used per plant	0.12	0.22	m3
Production	17303.8	12357.5	Kg
Production per plant	1.33	0.95	Kg
Fertilizer used per plant	0.086	0.027	JoD
Fertilizers used	1120.3	355.6	JoD
Income	10382.25	7414.48	JoD



Capital cost	9000 JOD
Annual capital cost after depreciation over 5 years	1800 JOD
Operational costs	6000 JOD
Total costs per pepper plantation	7800 JOD
Income	10382 kg
Net profit	2582
Payback period	4 years



USAID
FROM THE AMERICAN PEOPLE



Thyme

- Drip/Top feeding Hydroponic open system
- 800 plants in 145 sq m
- High quality herbal
- 50 m³ of water to produce 232 kg (1st year)



Thyme economics at HH level

Parameter	HGFI soilless culture	Soil culture	Notes
Area (m ²)	145	324	
Number of plants	800	1100	
Planting density (plant/m ²)	5.5	3.4	60% increase in land use efficiency
Water used(m ³)	54	216	
Water used liter per m ²	372	666	44% water savings
Production (Kg)	240	100	
Production Kg per m ²	1.65	0.3	Five folds production in soilless culture /m ²
Selling prices (average) JoD/Kg	1.75	1.75	
Water productivity litre/Kg	225	2160	



USAID
FROM THE AMERICAN PEOPLE



Thyme economics at HH level

- Comparison with traditional farming from the farmer point of view

	Hydroponic	traditional
Water consumption	X	3X
Fertilizers	X	X
Number of cuts	5	3
Fresh weight	2X	X
Marketability	2X	X
Net profit	3X	X



USAID
FROM THE AMERICAN PEOPLE



Overall Viability Analysis

- Saves 25 - 75 % of water
- Saves 40 - 60 % of pesticides use
- Increases yields by 10 – 40 %



USAID
FROM THE AMERICAN PEOPLE

Developing Business Models

- HGFI provides commercial and household farmers approaches to increase productivity and improve water efficiency
- Farmers can retrofit their existing greenhouses to install hydroponic systems in the Jordan Valley and the Highlands – reducing the initial capital costs
- The manufacturing and supply industry in Jordan does not provide integrated hydroponic solutions
- The development of hydroponic farming industry in Jordan will create needs for specialized extension services
- A need for a separate effort to develop financing mechanisms for various potential customers including farmers, suppliers, packing businesses, or other businesses that will develop in the hydroponic industry and marketing of its produce.



USAID
FROM THE AMERICAN PEOPLE

CONCLUSIONS

- Irrigated agriculture is important to rural economy and rural employment
- The marginal costs for developing additional water supplies are high and not affordable. Jordan cannot continue to use high quality water for low value crops
- Need to increase water productivity to continue to provide jobs in the agriculture sector and increase market share in high value crops
- Jordan banking sector, micro-financing institutions, and the Agriculture Credit Corporation have the potential to play a role in financing the hydroponic systems but require different approaches to engage them and reduce financing risks
- Jordan needs to build the capacity of extension services in different organizations to support hydroponic farmers



USAID
FROM THE AMERICAN PEOPLE

Thank You