



Profitability of drip irrigation investment in almond plantations in south-east Anatolia

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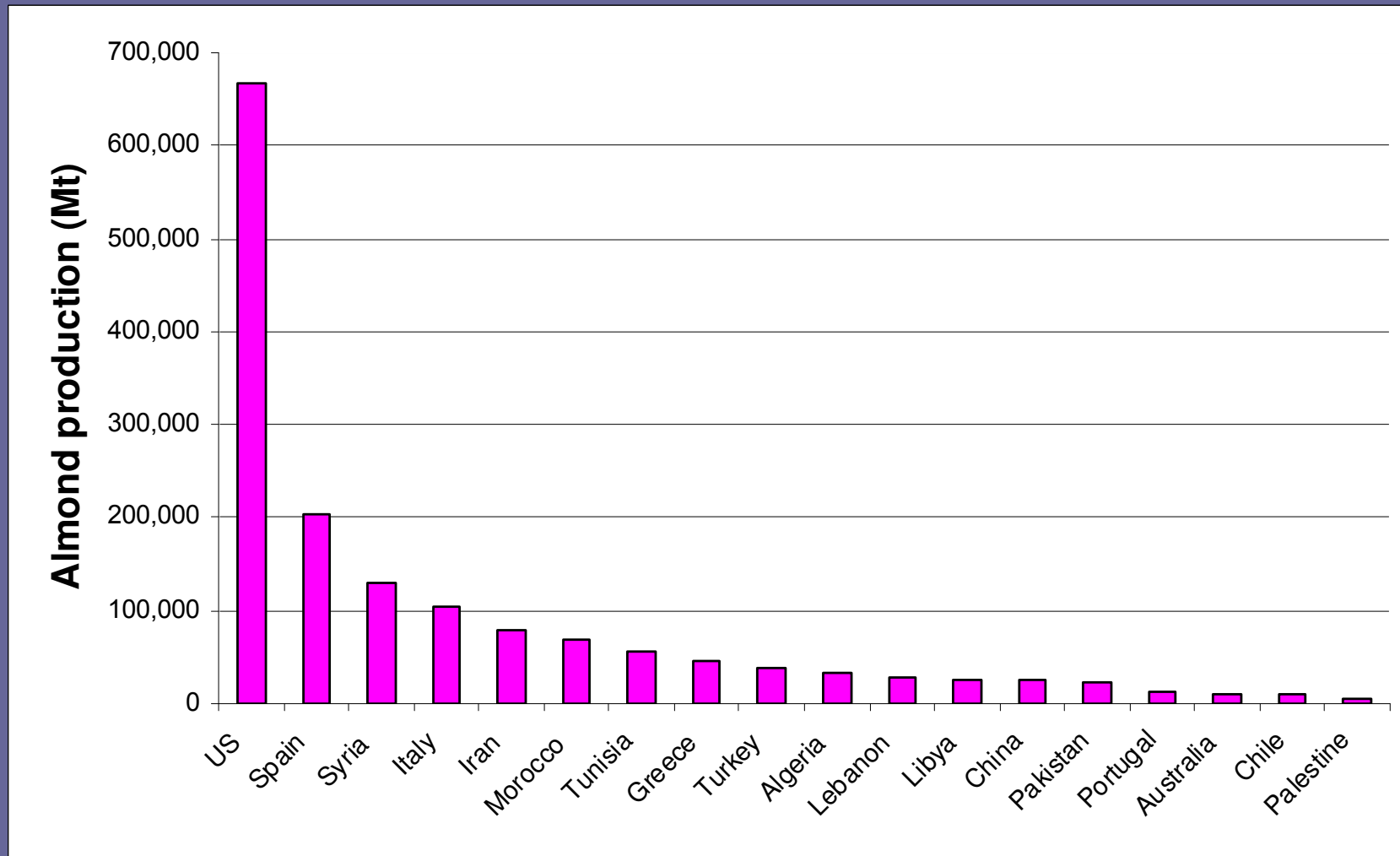
Choice of an irrigation system

- Water source
- Plant
- Land
- Soil type
- Profitability



Almond production in 2005

(source : FAOSTAT, 2005)



Constraints in almond productivity

- Low rainfall
- Water scarcity
- High water demand in summer

Objective

- Water balance of drip irrigated almond trees
- Profitability analyses of almond orchards

Description of the study area

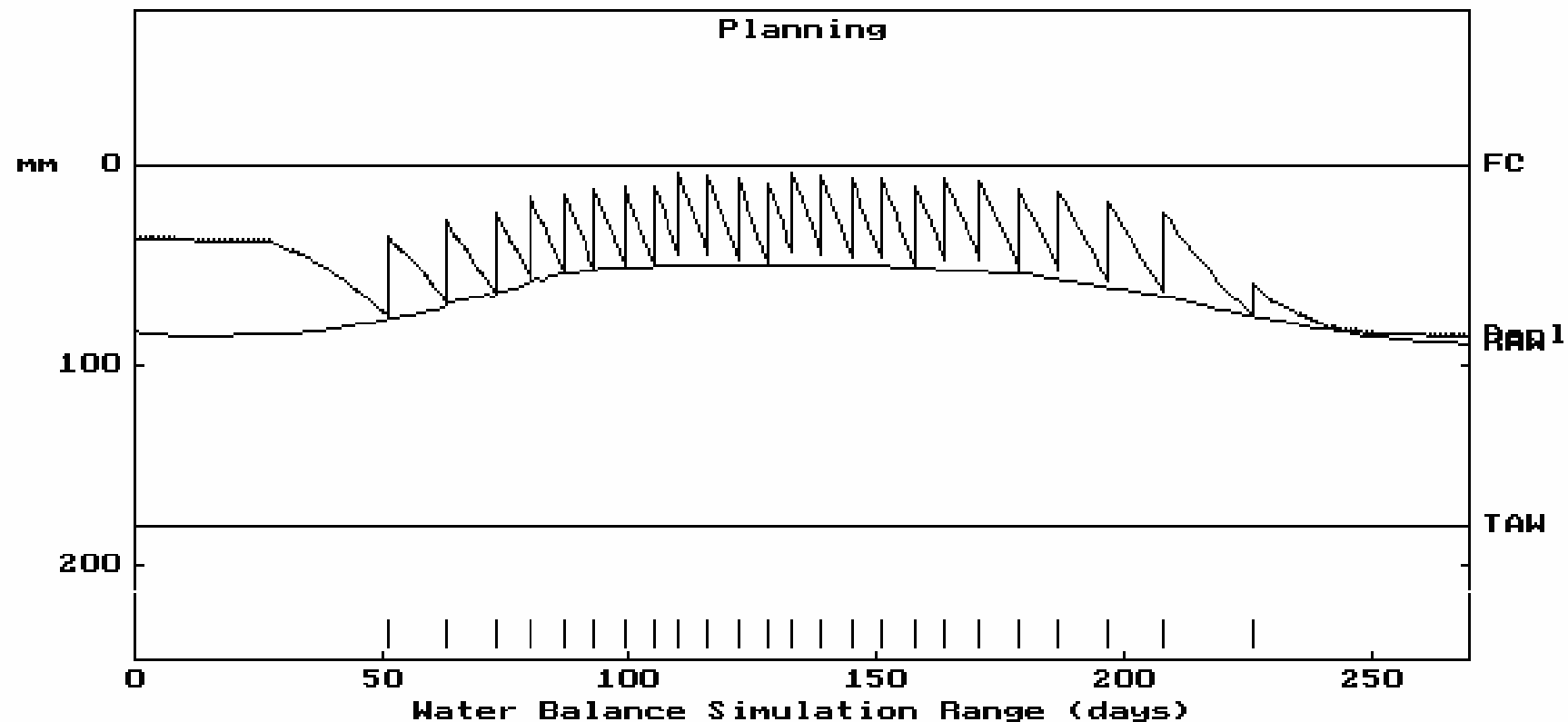
- 7 year old almond orchard
- 17.5 ha size
- Harran plain (36°42`N; 39°00`E, altitude: 375m)
- Mean max temp: 35°C; min temp: -2.3°C
- Annual rainfall: 215 mm
- Clay soil, 1.5m deep



Investment cost for a drip irrigated almond orchard (17.5 ha)

Item	Cost (US\$)
1st year	
<ul style="list-style-type: none"> Site establishment & planting cost (Initial tillage, soil preparation, saplings, planting, pesticides, fence, electricity, fertilizer, fertilizing, first irrigation) 	40843
<ul style="list-style-type: none"> Common costs (Capital investment, administration cost) 	18416
<ul style="list-style-type: none"> Irrigation system costs (Pump, control unit, pipes, drippers) 	21539
<ul style="list-style-type: none"> Application costs (Fertilizer and pesticide applications, irrigation) 	794
<ul style="list-style-type: none"> Total cost 	81591
2nd – 33rd year	
Operation & Maintenance Cost	1631

Outcomes of irrigation scheduling

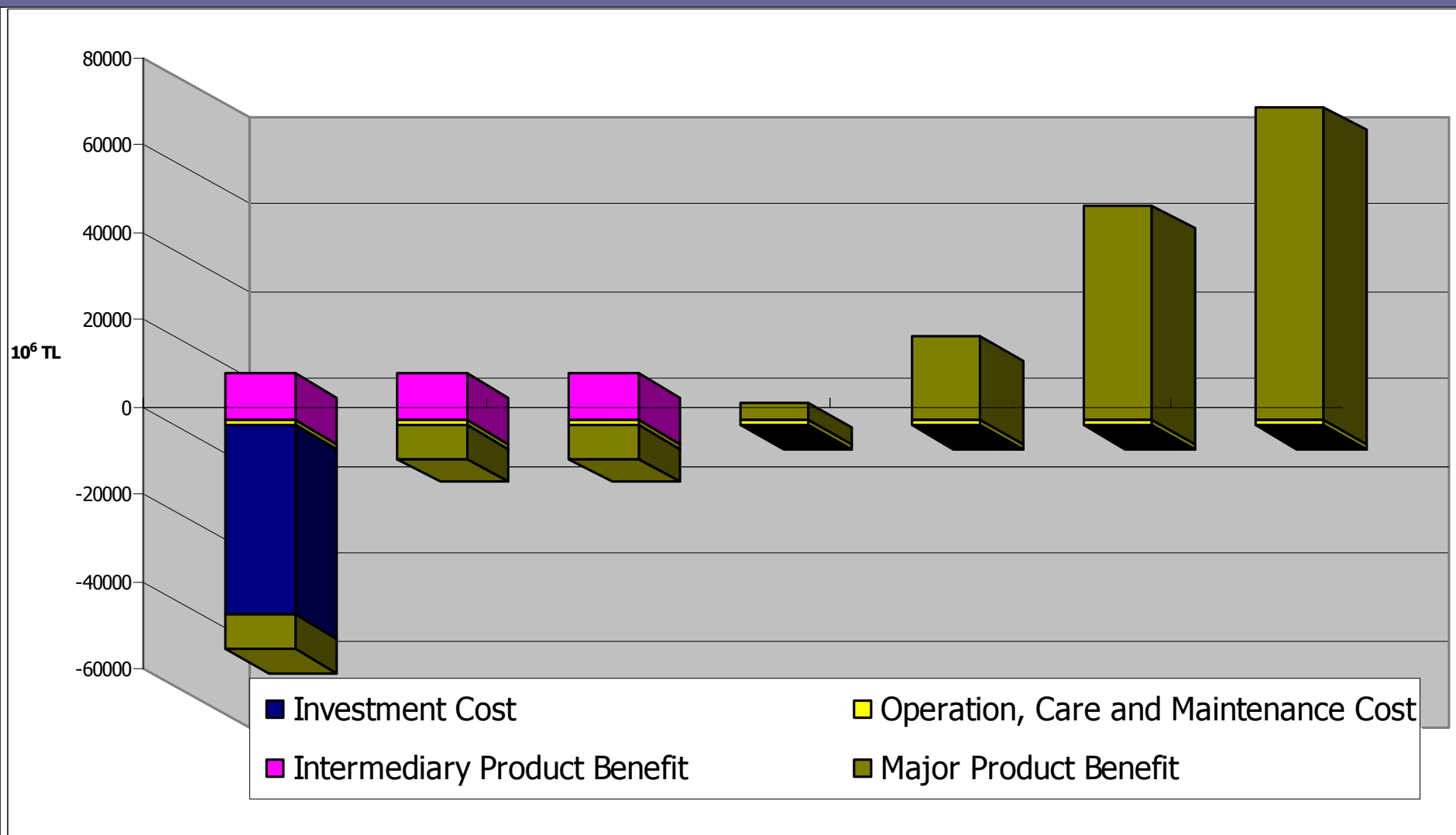


Outcomes of irrigation scheduling



Irrigation water application ratio	I (mm)	Ni	Iid	ETa (mm)	ETa/ETm	Ya/Ym (%)	Ya (kg/ha)	Nr (US\$/ha)
S1(Full)	936	24	5	1071	1.00	100	6000	9652
S2 (90%)	840	21	6	979	0.93	92	5514	8717
S3 (80%)	749	19	7	899	0.86	84	5046	7817
S4 (70%)	654	17	7	813	0.78	76	4554	6871
S5 (60%)	560	14	9	726	0.70	68	4050	5902
S6 (50%)	467	12	10	638	0.63	59	3540	4921
S7 (40%)	374	10	12	555	0.55	51	3060	3998
S8 (Rainfed)	-	-	-	204	0.26	17	1032	1796

Cash flow for drip irrigated almond orchard



Cash flow of drip irrigated almond orchard

Year	Investment cost	Operation, maintenance cost	Total Cost	Major Product Benefit	Intermediary Product Benefit	Total Return	Present value factor	Present value of cost	Present value of return
1	81591	1631	83222		16384	16384	0.833333	69352	13653
2		1631	1631	-11874	16384	4510	0.694444	1133	3132
3		1631	1631	-11874	16384	4510	0.578704	944	2610
4		1631	1631	-11874	16384	4510	0.482253	787	2175
5		1631	1631	7372		7372	0.401878	656	2963
6		1631	1631	61218		61218	0.334898	546	20502
7		1631	1631	101603		101603	0.279082	455	28356
8_38		1631	1631	168911		168911	1.390509	2268	234872
Total	81591		94641	303482	65536	369018		76140	308262

Cash flow of surface irrigated almond orchard

Year	Investment cost	Operation, maintenance cost	Total Cost	Major Product Benefit	Intermediary Product Benefit	Total Return	Present value factor	Present value of cost	Present value of return
1	69212	1384	70596		16384	16384	0.833333	58830	13653
2		1384	1384	-40000	16384	-23616	0.694444	961	-16400
3		1384	1384	-40000	16384	-23616	0.578704	801	-13667
4		1384	1384	-40000	16384	-23616	0.482253	668	-11389
5		1384	1384	-4549		-4549	0.401878	556	-1828
6		1384	1384	49232		49232	0.334898	464	16488
7		1384	1384	89569		89569	0.279082	386	24997
8_38		1384	1384	156796		156796	1.390509	1925	218026
Total	69212		80286	171047	65536	236583		64591	229880

Drip vs. Surface

17.5 ha	Drip Irrigation	Surface Irrigation
Total Cost (US\$)	76,140	64,591
Total Return (US\$)	308,262	229,880
Benefit/Cost	4.05	3.56
Irrigation (mm)	936	2170

Internal interest rate of drip irrigated almond orchard

Year	Total Cost	Total Return	Annual Cash Flow	f:46		f:45	
				Rate of Reduction	Net Reduced Flow	Rate of Reduction	Net Reduced Flow
1	83222	16384	-66838	0.684932	-45780	0.689655	-29810
2	1631	4510	2879	0.469131	1350	0.475624	225
3	1631	4510	2879	0.321323	925	0.328017	155
4	1631	4510	2879	0.220084	634	0.226218	370
5	1631	7372	5741	0.150743	865	0.156013	2611
6	1631	61218	59587	0.103248	6152	0.107595	5049
7	1631	101603	99972	0.070718	7070	0.074203	5164
8_38	1631	168911	167280	0.153734	25717	0.164895	17699
Total					-3067		1462
Internal Interest Rate					45.32%		

Conclusion

- Full irrigation > 5 x rainfed production
- 50% total surface irrigation amount = Max yield in drip irrigation

Conclusion

- Drip irrigated almond orchard investment is significantly profitable
- The system reached a discounted payback in the 7th year of investment
- Policy makers should provide low interest rate credits to encourage farmers

Thank You