Table 6.1.2 General Features of Available Data in Used Water Volume and Irrigated Area

Total Area	km^2				=			5,049	21,624	6,742	8,630	9,129	63,219	70,787
	Irrigation total		(Area:ha)		−			?	?	?	?	?	?	?
			(Water:MCM)		−			833	2,512	373	771	821	9,463	323
	(Area)	(Water)	Irrigation by surface water		(Area:ha)		=	?	?	?	?	?	?	?
					(Water:MCM)		=	647	1,083	224	187	274	3,598	100
			(Area)	(Water)	Irrigation by groundwater		(Area:ha)	?	?	?	?	?	?	?
							(Water:MCM)	186	1,429	149	584	547	5,865	224
					(Area)	(Water)	*Basin Governorate*	Costal	Orontes	Yaymouk	Barada	Aleppo	Euphrates	Steppe
18,137	73,066	?	22,074	?	50,992	?	R.Damascus							
1,861	4,444	?	1,339	?	3,105	?	Quneitra							
3,730	32,382	?	16,728	?	15,654	?	Dara							
5,550	2,133	?	0	?	2,133	?	Sweida							
40,931	58,461	?	29,065	?	29,396	?	Homs							
8,763	73,636	?	13,214	?	60,422	?	Hama				?			
1,408	79,602	?	46,914	?	32,688	?	Al Ghab							
2,297	29,985	?	25,485	?	4,500	?	Lattakia							
1,896	26,739	?	15,179	?	11,560	?	Tartous							
18,498	188,514	?	88,302	?	100,212	?	Aleppo							
6,097	52,039	?	7,905	?	44,134	?	Idleb							
19,617	195,948	?	121,594	?	74,354	?	Raqqa							
33,060	144,674	?	106,023	?	38,651	?	Deir Ezzor							
23,334	475,956	?	76,906	?	399,050	?	Hassakeh							
185,180	1,437,579	15,096	570,728	6,112	850,784	8,984								
(R1)	(R2)	(R3)	(R4)	(R5)	(R6)	(R7)								

R1: National Statistics
R2, R4 and R6: Agricultural Statistical Abstract 2005
R3, R5 and R7: Projected based on the data of "Syria Arab Republic Irrigatiojn Sector Report, 2001 (WB)"

There is an urgent need to overview the feature of irrigated agriculture with certain figures in the both aspects of governorates and river-basins at the same time. In order to attain this need, suitable data are not available directly for the reason above mentioned. The Project carried out a progressive study to outline the feature of irrigated agriculture merging data available in basin-wise and governorate-wise.

6.1.2 Area Distribution of the Country by Basin and Governorate Bases

In order to quantify the irrigated water for the purpose of comprehensive study, area distribution in entire country of Syria by basins and governorates was analyzed at beginning. Area distribution matrix between basins and governorates was completed utilizing the following data and information.

Table 6.1.3 Available Data/Information for Identification of Area Distribution Matrix

Category	Item of data	Data used for the analysis
River-Basin	Areas of river-basins	Applying data presented in "Syria Arab Republic Irrigation Sector Report, 2000 (WB)"
	Boundaries of river-basins	Referring figure presented in "Syria Arab Republic Irrigation Sector Report, 2000 (WB)"
Governorates	Areas of governorates	Applying data presented in "National Statistics 2005"
	Boundaries of governorates	Referring figure presented in "National Statistics 2005 "

The area-distribution-matrix was completed as showing in Table 6.1.4. Each area of the element of the area matrix is initially quantified on the basis of the measured results, then adjusted so as to hold an numerical consistency on the basis of relations with each matrix element.

Table 6.1.4 Basin-wised and Governorate-wised Area Distribution

(:Km^2)

Basin / *Governorate*	Coastal	Orontes	Yarmouk	Barada	Aleppo	Euphrates	Steppe
R.Damascus	0	2,031	472	7,400	0	0	8,234
Quneitra	0	0	1,675	186	0	0	0
Dara	0	0	2,798	933	0	0	0
Swelda	0	0	1,798	111	0	0	3,641
Homs	1,023	6,999	0	0	0	164	32,745
Hama	0	4,908	0	0	0	0	3,856
Al Ghab	0	1,408	0	0	0	0	0
Lattakia	1,952	345	0	0	0	0	0
Tartous	1,763	133	0	0	0	0	0
Aleppo	0	2,891	0	0	6,382	5,072	4,153
Idleb	309	2,910	0	0	2,573	0	305
Raqqa	0	0	0	0	177	11,770	7,670
Deir Ezzor	0	0	0	0	0	22,878	10,182
Hassakeh	0	0	0	0	0	23,334	0

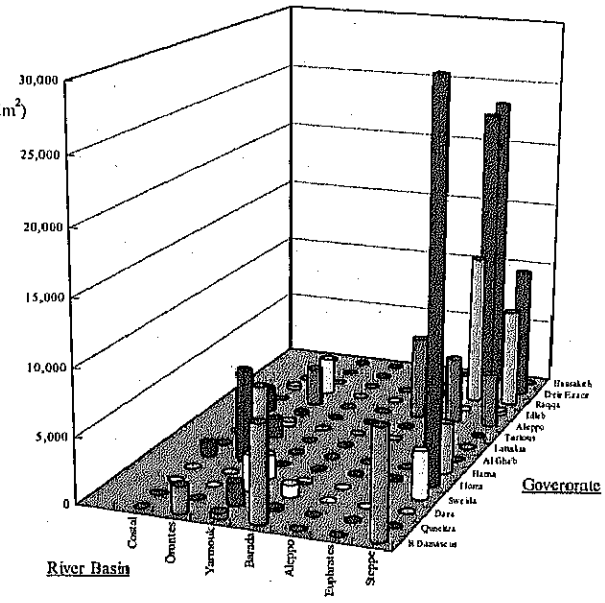


Fig.6.1.2 Feature of the Area Distribution Matrix

And, the obtained area distribution matrix is illustrated as a three-dimensional figure in the right side.

6.1.3 Quantifying Unknown Figures of Areas and Volumes in Water

Roughly speaking, type of irrigation in Syria is generally classified into 4 groups, namely, "traditional irrigation by surface water", "modern irrigation by surface water", "traditional irrigation by groundwater", and "modern irrigation by groundwater". In order to grasp the situation of irrigated agriculture in national level comprehensively, data of areas and volumes of water should be available by every irrigation type. However, available data concerning those irrigation types are partial as showing in the following table:

Table 6.1.5 Available Data in Used Water Volume and Irrigated Area by the Typical Irrigation Types

Total irrigation by surface water (Area)	Total irrigation by surface water (Water)	Traditional irrigation by surface water (Area)	Traditional irrigation by surface water (Water)	Modern irrigation by surface water (Area)	Modern irrigation by surface water (Water)	Total irrigation by groundwater (Area)	Total irrigation by groundwater (Water)	Traditional irrigation by groundwater (Area)	Traditional irrigation by groundwater (Water)	Modern irrigation by groundwater (Area)	Modern irrigation by groundwater (Water)	Basin / Goverorate	Costal	Orontes	Yaymouk	Barada	Aleppo	Euphrate	Steppe
													?	?	?	?	?	?	?
													647	1083	224	187	274	3598	100
													?	?	?	?	?	?	?
													?	?	?	?	?	?	?
													?	?	?	?	?	?	?
													?	?	?	?	?	?	?
													?	?	?	?	?	?	?
													186	1,429	149	584	547	5,865	224
													?	?	?	?	?	?	?
													?	?	?	?	?	?	?
													?	?	?	?	?	?	?
													?	?	?	?	?	?	?
22,074	?	17,794	?	4,280	?	50,992	?	41,105	?	9,887	?	R.Damascus							
1,339	?	1,140	?	199	?	3,105	?	1,234	?	1,871	?	Quneitra							
16,728	?	16,542	?	186	?	15,654	?	0	?	15,654	?	Dara							
0	?	0	?	0	?	2,133	?	0	?	2,133	?	Sweida							
29,065	?	26,086	?	2,979	?	29,396	?	16,788	?	12,608	?	Homs							
13,214	?	10,306	?	2,908	?	60,422	?	26,343	?	34,079	?	Hama				?			
46,914	?	46,914	?	0	?	32,688	?	19,232	?	13,456	?	Al Ghab							
25,485	?	24,515	?	970	?	4,500	?	2,735	?	1,765	?	Lattakia							
15,179	?	13,888	?	1,291	?	11,560	?	6,674	?	4,886	?	Tartous							
88,302	?	83,155	?	5,147	?	100,212	?	81,922	?	18,290	?	Aleppo							
7,905	?	5,579	?	2,326	?	44,134	?	11,112	?	33,022	?	Idleb							
121,594	?	119,821	?	1,773	?	74,354	?	71,286	?	3,068	?	Raqqa							
106,023	?	105,322	?	701	?	38,651	?	38,329	?	322	?	Deir Ezzor							
76,906	?	75,790	?	1,116	?	399,050	?	386,314	?	12,736	?	Hassakeh							
570,728	6,112	546,851	5,926	23,877	186	866,851	8,984	703,075	7,624	163,776	1,360								
(D1)	(D2)	(D3)	(D4)	(D5)	(D6)	(D7)	(D8)	(D9)	(D10)	(D11)	(D12)								

D1, D3, D5, D7, D9 and D11: Agricultural Statistical Abstract 2005
D2, D4, D6, D8, R10 and D12: Projected based on the data of "Syria Arab Republic Irrigatiojn Sector Report, 2000 (WB)"

On the basis of the previously identified area-distribution-matrix which relates river-basins and governorates in area, unknown figures in the above matrix could be estimated utilizing a mathematical inverting analysis method.

Results of the analysis are summarized by two ways of governorate-wise and basin-wise as described in following chapters.

6.1.4 Estimated Feature of Irrigation in Governorate-wise

Through the mathematical inverting analysis, every figures concerning irrigation types were estimated soundly.

Table 6.1.6 Estimated Feature of Irrigation in Governorate-wise

Governorate	River,Traditional			River,Modern			Groundwater,Traditional			Groundwater,modern		
	Area (ha)	Water Vol.(MCM)	Unit Consumed Water (mm)	Area (ha)	Water Vol.(MCM)	Unit Consumed Water (mm)	Area (ha)	Water Vol.(MCM)	Unit Consumed Water (mm)	Area (ha)	Water Vol.(MCM)	Unit Consumed Water (mm)
R.Damascus	17,793.8	231.9	1,303.2	4,279.9	37.3	871.0	41,105.2	517.1	1,257.9	9,887.1	94.9	960.1
Quneitra	1,140.1	16.2	1,417.7	198.9	1.9	964.6	1,233.9	14.1	1,139.1	1,871.1	13.1	699.2
Dara	16,542.0	231.0	1,396.7	186.2	1.9	994.4	0.0	0.0	0.0	15,653.8	155.0	990.1
Sweida	0.0	5.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2,133.0	19.3	904.0
Homs	26,085.5	298.5	1,144.3	2,979.5	23.6	791.5	16,788.5	196.4	1,169.8	12,607.5	102.6	813.6
Hama	10,306.5	127.4	1,236.4	2,907.5	23.8	817.3	26,342.5	322.7	1,224.9	34,079.5	265.3	778.5
Al Ghab	46,914.0	515.5	1,098.8	0.0	0.0	0.0	19,232.0	203.2	1,056.8	13,456.0	99.8	741.7
Lattakia	24,514.5	313.7	1,279.8	970.5	8.8	903.9	2,735.5	34.2	1,250.8	1,764.5	15.6	886.3
Tartous	13,888.1	185.7	1,337.0	1,290.9	12.0	930.3	6,673.9	85.3	1,278.2	4,886.1	43.6	891.9
Aleppo	83,154.5	809.8	973.8	5,147.5	35.2	683.5	81,922.5	877.0	1,070.5	18,289.5	149.9	819.8
Idleb	5,578.8	57.6	1,033.0	2,326.2	15.3	659.3	11,112.2	142.8	1,285.1	33,021.8	265.9	805.3
Raqqa	119,820.8	1,203.3	1,004.2	1,773.2	12.7	714.3	71,286.2	818.9	1,148.7	3,067.8	28.0	911.1
Deir Ezzor	105,322.0	1,111.0	1,054.9	701.0	5.3	752.1	38,329.0	451.7	1,178.4	322.0	3.0	941.1
Hassakeh	75,790.0	819.3	1,081.1	1,116.0	8.6	768.9	386,314.0	3,961.0	1,025.3	12,736.0	103.8	814.9
Total	546,850.7	5,926.1	1,083.7	23,877.2	186.2	779.9	703,075.3	7,624.3	1,084.4	163,775.8	1,359.8	830.3

The estimated figures are shown in the Fig.6.1.3 of "Irrigated Area and Quantity of Irrigated Water by Governorates". As the scale of rectangles presenting in the figure means the consumed volume of water, the figure makes easy to contrast actual consumed water for irrigation by the irrigation types by governorates.

Lattakia and Tartous consume relatively much water for irrigation because of cropping of citrus trees, which require much water in general. Besides those governorates, Rural Damascus, Daraa and Hama which compose the project area, utilize water for irrigation at a remarkable rate rather than other governorates. In this respect, it is convinced that the selection of the project area is mostly reasonable because three governorates selected are forefront requiring certain countermeasures of saving water.

6.1.5 Estimated Feature of Irrigation in Basin-wise

Similarly, through the mathematical inverting analysis, every figures concerning irrigation types by basins were estimated soundly.

Table 6.1.7 Estimated Feature of Irrigation in Basin-wise

Basin	River,Traditional			River,Modern			Groundwater,Traditional			Groundwater,modern		
	Area (ha)	Water Vol.(MCM)	Unit Consumed Water (mm)	Area (ha)	Water Vol.(MCM)	Unit Consumed Water (mm)	Area (ha)	Water Vol.(MCM)	Unit Consumed Water (mm)	Area (ha)	Water Vol.(MCM)	Unit Consumed Water (mm)
Costal	48,657.1	608.3	1,250.2	4,457.6	38.8	870.2	9,620.0	120.3	1,251.0	7,648.6	66.0	863.5
Orontes	91,299.5	1,025.6	1,123.3	7,339.2	57.6	784.4	75,642.3	877.3	1,159.8	70,547.8	551.7	782.0
Yaymouk	15,722.2	218.2	1,387.7	595.0	5.8	980.6	3,791.6	48.8	1,286.7	10,798.2	100.3	929.1
Barada	12,527.6	165.9	1,324.1	2,332.0	20.9	898.0	33,157.4	408.9	1,233.3	17,450.3	175.1	1,003.5
Aleppo	26,692.0	261.1	978.3	1,865.5	12.8	685.1	31,355.3	355.6	1,134.3	24,328.4	191.1	785.5
Euphrates	343,885.7	3,549.5	1,032.2	6,577.1	48.2	733.3	535,064.1	5,644.3	1,054.9	26,423.8	220.8	835.7
Steppe	8,066.6	93.8	1,163.4	710.9	5.8	810.6	14,444.6	167.7	1,160.8	6,578.7	56.0	851.1
Total	546,850.7	5,922.4	1,083.0	23,877.2	189.9	795.3	703,075.3	7,623.0	1,084.2	163,775.8	1,361.1	831.1

The estimated feature is shown in Fig.6.1.4 of "Irrigated Area and Quantity of Irrigated Water by Basins". As each square presenting in the figure shows consumed water volume, the figure makes easy to contrast actual consumed water for irrigation by the irrigation types by basins.

Euphrates Basin consumes remarkably much water for irrigation because of holding major river water source of Euphrates River. Besides the basin, Orontes, Yarmouk and Barada & Awaj Basins are at high rate of using much water for irrigation.

6.2 Agro-economic Analysis for the Advantages of Conversion to Modern Irrigation

6.2.1 General Description

The modernization of irrigation system is one of the most important issues in agriculture and water sector of the national development plan as mentioned previously, aiming at effective use and conservation of scarce water resources in Syria. From the standpoint of the government, the introduction of the water-saving irrigation system may greatly contribute to the sustainable development of agriculture. On the other hand, farmers are primarily interested in maximizing their production and income from their farmland. To show the economic impacts of the modern irrigation system is persuasive for common farmers. In this section, previous researches and studies on the economic evaluation of various irrigation systems in Syria are reviewed comprehensively.

6.2.2 Review of Agro-economic Analyses for Modern Irrigation

(1) Review of Study by MAAR

The Ministry of Agriculture and Agrarian Reform (MAAR) in Syria has published a large number of research papers on agriculture. The economic researches on the modern irrigation techniques were also compiled in a series of the papers. The prominent reports are summarized below.

The first relevant report is "Report No. 740; Modern Irrigation Techniques and Economics and Current Use Level; 1999". This report analyzed the cost of the modern irrigation methods including improved surface irrigation, sprinkler and drip. This detailed cost analysis was made in this report, taking the installation cost, operation and maintenance cost into consideration. The annual cost of the traditional surface irrigation was estimated at SP 78,180 /ha. While, the cost of the improved surface, sprinkler and drip irrigation were at SP 72,120, SP 65,500 and SP 67,827 per ha, respectively. The cost research concluded that the modern irrigation methods are more economical than traditional surface irrigation due to saving of labor and energy costs.

Table 6.2.1 Annual Cost of Irrigation by Method

(Unit: SP/ha/year)

Irrigation Method	Irrigation system cost	Land preparation	Labor	Energy	Maintenance	Total
Traditional Surface	31,500	3,720	18,200	18,760	6,000	78,180
Improved Surface	44,500	3,720	7,200	10,200	6,500	72,120
Sprinkler	35,700	3,720	7,200	14,070	4,810	65,500
Drip	41,787	3,720	5,400	10,880	6,040	67,827

Source: MAAR Report No. 740; Modern Irrigation Techniques and Economic and Current Use Level; 1999

The report describes economic benefit on the fertilizer supply dissolved with irrigation water, so called as "fertigation". This fertilizer application method brings up higher yield of crops compared with one under normal fertilizer application by 129 to 327 % in some experiments. This new fertilizing method can also save the amount of fertilizer due to high efficiency.

Table 6.2.2 Crop Productivity by Type of Fertilization

(Unit: kg/ha)

Crop	Traditional fertilization	Fertilization with irrigation water	Increment (%)
Potato	37,000	70,000	189
Carrot	42,000	54,000	129
Tomato (Greenhouse)	150,000	350,000	233
Tomato (Open field)	55,000	180,000	327
Cucumber (Greenhouse)	140,000	300,000	214
Watermelon, Red (Greenhouse)	60,000	115,000	192
Strawberry	20,000	48,000	240

Source: MAAR Report No. 740; Modern Irrigation Techniques and Economic and Current Use Level; 1999

The second important report is "Report No. 963; Technical and Economic Effects on Modern Irrigation Methods and Techniques Researches on Water Use Rationalization in Syria; 2002". The report describes technical and economic effects of modern irrigation on major crops including wheat, maize, sugar beet and cotton. The following factors are the basis of the evaluation.

- Results of past irrigation researches at ANRR (DIWU)
- Production costs calculated on local prices and labor wages
- Rent of land accounts by 15% from the value of the production
- Cost of irrigation
- Cost of irrigation equipment

The irrigation costs were calculated by source of water and irrigation method, as shown in the following table. Under state irrigation systems, sprinkler and drip irrigation is

more costly than surface irrigation. However, the most important conclusion was the total water costs of modern irrigation, i.e., improved surface, sprinkler and drip, are not very costly compared with traditional irrigation in case of pumping from deep well. The cost of sprinkler is lower and drip irrigation is slightly higher than traditional irrigation. These unit costs of the water were used for crop budget estimation.

Table 6.2.3 Financial Unit Cost of Irrigation Water by Water Source and Irrigation Method

Item	State Irrigation	Pumping from River	Pumping from Deep Well			
			50m	100m	150m	200m
Depreciation, maintenance & interest of establishments & pumping units (SP/hr)	-	0.99	8.6	13	19	31
Depreciation, maintenance & interest of establishments & pumping units (SP/m^3)	-	0.07	0.14	0.21	0.27	0.36
Value of fuel and oils (SP/m^3)	-	0.112	0.226	0.45	0.68	0.90
Value of Fuel and oils (SP/hr)	-	28	56	112	168	224
Total costs of traditional surface irrigation (SP/m^3)	0.546	0.627	1.25	1.88	2.51	3.16
Total costs of improved surface irrigation (SP/m^3)	0.520	0.528	1.10	1.65	2.23	2.64
Total costs of sprinkler irrigation (SP/m^3)	0.689	0.693	1.10	1.73	2.35	3.00
Total costs of drip irrigation (SP/m^3)	0.870	0.935	1.36	1.99	2.52	3.27

Note: Pumping capacity is set at 40 m3/hr. Source: MAAR Report No. 963, 2002

The report investigated the economic effects of the installation of the modern irrigation to the traditional irrigation area. The net profits of the major crops were calculated by irrigation method and water source.

- Wheat (Sprinkler and traditional irrigation)
- Maize (Sprinkler and traditional irrigation)
- Sugar Beet (Sprinkler and traditional irrigation)
- Cotton (Improved surface, sprinkler, drop and traditional irrigation)
- Eggplant (Sprinkler and traditional irrigation)
- Olive (Localized and traditional irrigation)
- Grape (Drip and traditional irrigation)

The selected results of the economic assessments are briefly summarized in the following table. The crop value (gross return) of sugar beet under sprinkler irrigation, cotton under drip irrigation, eggplant under drip irrigation, olive under sprinkler irrigation, and grape under drip irrigation is higher than those under traditional irrigation due to higher crop yield. The total production cost of sugar beet, cotton and olive under modern irrigation is lower than traditional irrigation, while the total production cost of

eggplant and grape under modern irrigation is higher than traditional irrigation. The net profit (net return) of all five crops under modern irrigation is higher than them under traditional irrigation.

Table 6.2.4 Economic Effects of Modern Irrigation Method Compared with Traditional Irrigation on Major Crops

Item	Sugar Beet (Deir Zor)		Cotton		Eggplant (Nashabieh)		Olive (fruit)		Grape (Homs, Deir Zor)	
	Trad.	Spr.	Trad.	Drip	Trad.	Drip	Trad	Spr.	Trad.	Drip
Crop yield (kg/ha)	60,790	75,401	3,337	4,515	37,171	50,862	3,974	5,120	26,440	34,695
Crop value (SP)	121,580	150,802	102,613	138,867	260,197	356,034	89,415	115,200	211,520	277,560
Irrigation water (m^3/ha)	8,509	5,288	14,446	6,113	9,060	6,952	5,376	2,697	9,009	6,014
Irrigation cost (SP/ha)	15,997	9,148	27,158	12,559	17,033	13,834	10,109	5,367	16,936	11,968
Total costs (SP/ha)	79,243	72,394	93,952	86,761	166,509	188,238	78,893	76,516	137,653	144,823
Net profit (SP/ha)	42,337	78,408	8,661	52,106	93,688	167,796	10,522	38,684	73,867	132,737
Incremental profit (SP/ha)	-	36,071	-	43,445	-	74,108	-	28,162	-	58,870

Note: Irrigation water source = Deep well (100m) Source: MAAR Report No. 963, 2002

Other related reports are listed as; "Report No. 782; Technical and Economic Effects of Irrigation Methods and Techniques on Irrigation Water Use Rationalization in Syria; 2000", "Report No. 871; Technical and Economic Effects of Modern Irrigation Methods and Techniques Used on Cotton; 2002", and "Report No. 887; Technical and Economic Effects of Modern Irrigation Methods and Techniques Research Findings on Water Use Rationalization in Agriculture; 2001".

These research papers conclude the modern irrigation method not only contributes conservation of water resources, but also gives positive economic impacts to farmers. We have to notice the following points.

- The condition of the researches can not be always realized in farmers level. More case studies are necessary in various conditions.
- The estimation of the irrigation system cost sometimes seems optimistic. For example, life span of GR pipe is assumed 5 years (while it may be 2 to 3 years only).
- The share of energy and labor cost for irrigation in total production cost is low (few percent). Therefore, farmers may have little incentive for saving water use.

(2) Review of FAO Study

The FAO report of "Final Report on Agricultural Water Use; 2001" under Assistance in

Institutional Strengthening and Agricultural Policy program provided the important idea to the agricultural policy making. The report gave the financial effects of modern irrigation by farm type and water source. The following three farm types were set for the assessment.

- Large Farmer (Hassake zone(14ha): Wheat 70% (9.8ha), Cotton 30% (4.2ha))
- Medium Farmers (Hama zone(5ha): Wheat 20% (2.5ha), Cotton 15% (1.0ha), Sugar beet 15% (0.75ha), Potato 15% (0.75ha))
- Small Farmers (Lattakia zone(1.5ha): Tomato 50% + overlap 25% (1.125ha), Potato 25% (0.375ha), Orange 25% (0.375ha))

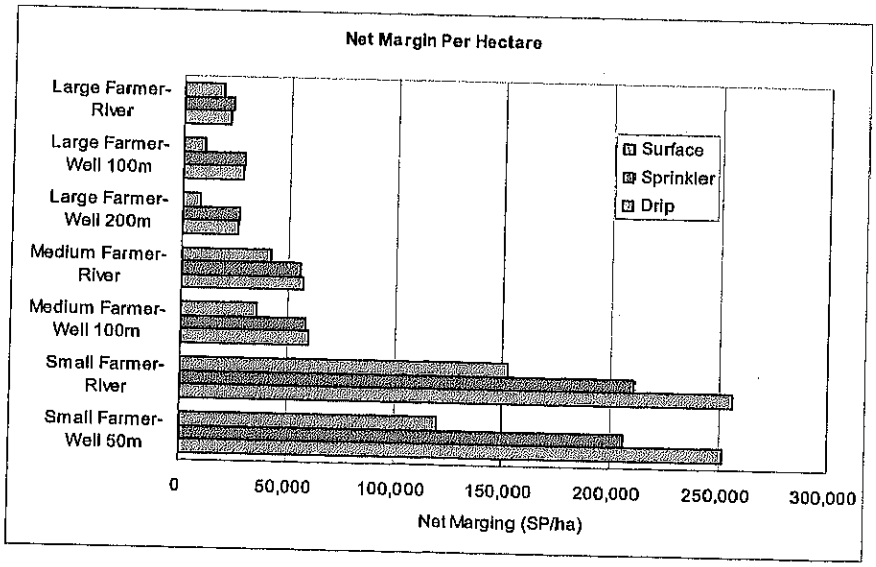
The crop budget was calculated by relevant crop, farm type, irrigation method and water source. The typical crop budgets are shown in the following table.

Table 6.2.5 Crop Budget Analysis of Major Crops

Crop	Gross Revenue (SP/ha)	Total Cost (variable cost and fixed cost) (SP/ha)	Net Margin (SP/ha)
Wheat (Large, River, Surface)	44,000	30,338	13,662
Cotton (Large, River, Surface)	101,500	55,269	46,231
Sugar Beet (Medium, Well-100, Surface)	125,000	81,625	43,375
Potato (Medium, Well-100, Surface)	167,063	127,250	39,813
Tomato (Small, Well-50, Drip)	322,812	106,767	216,045
Orange (Small, Well-50, Drip)	492,800	180,529	312,271

Source: FAO; Final Report on Agricultural Water Use; 2001

Finally, the net margin was calculated by farm type, water source and irrigation method. From the following chart, it is clear that the sprinkler and drip irrigation could provide higher return to farmers compared with traditional surface irrigation in all cases. In case of the small farmer who grows vegetable and fruit, the drip irrigation is more profitable than the sprinkler irrigation.



Source: FAO; Final Report on Agricultural Water Use; 2001

Fig.6.2.1 Farmers' Income by Irrigation Methods

The FAO report gives some suggestions, as follows:

- The calculation method on typical farm type is more realistic compared with the pure research level. This methodology could be applied to the target areas of the DEITEX project.
- The shift to the modern irrigation method might be profitable for farmers of all farm types.
- The crop budget seems optimistic. For example, the farmgate price of tomato was SP 9 /kg, which was almost the same as the wholesale market price, but the tomato farmers receive only SP 1 /kg at Daraa wholesale market in high-season of certain years. More assessment is necessary.

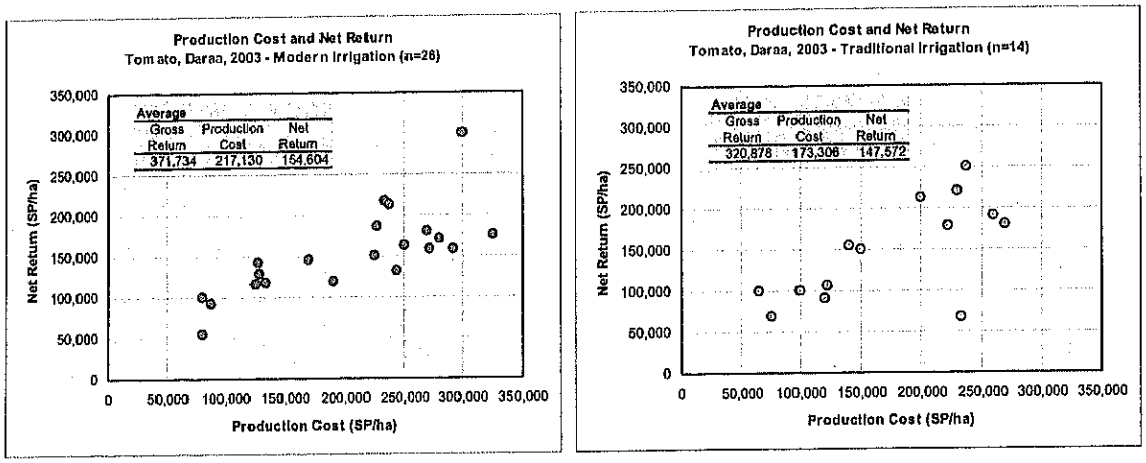
(3) Review of Farmers' Interview Survey by JICA Long-term Expert

The JICA long-term expert conducted the questionnaire survey for farm households, concerning to modern irrigation and extension services in Daraa and Rural Damascus in 2003/04. The farmers' survey can provide some information on crop budget. The data are not be very accurate and detailed, but direct information from farmers themselves without any arbitrary adjustments.

The target farmers were 54 advanced farmers in Daraa and 21 in Rural Damascus. The survey provides some information on profitability of major crop production by irrigation method. For example, in Daraa, tomatoes are the most important crop. Out of 54 sample farmers, 40 farmers grow tomatoes. Of which, 26 farmers use the modern

(drip) irrigation system for the crops, while the rest 14 farmers plant tomatoes under the traditional irrigation method.

The data of gross return, production cost and net return of tomatoes were obtained for every farmer, although the data were not always precise very much. These data were wide-ranging as shown in the following charts. Although there was big variance, the average production cost was about SP 217,000 /ha under the modern irrigation and SP 173,000 /ha under the traditional irrigation. The net return was about SP 155,000 /ha under the modern irrigation and SP 148,000 /ha under the traditional irrigation. We can not conclude that the modern irrigation is slightly profitable statistically because of large variance of data.



Source: JICA Expert (Mr. Koto); 2004; unpublished; *revised by the Team*

Fig.6.2.2 Investigated Production Costs and Returns

The farmers' data are not precise and wide-ranging, because;

- Farmers do not keep record
- Farmers sometimes do not answer sincerely to enumerator
- Agricultural data are naturally fluctuated season by season, and farmer by farmer
- Technical and financial capacities might be different between modern irrigation farmers and traditional irrigation farmers
- An inflexible questionnaire can not follow every types of farming

However, these could give a general view of the profitability of irrigated agricultures according to the irrigation methods.

(4) Summary of Former Economic Studies on Modern Irrigation

As mentioned above, there are several kinds of information to assess the economic impacts of the modern irrigation methods. These former economic studies can be summarized tentatively as follows:

- Proper modern irrigation might be profitable for farmers, due to higher crop yield and sometimes lower irrigation cost.
- Gross return of crop production under modern irrigation is higher than one under traditional surface irrigation in all cases (crop, irrigation method, water source, place, etc.), due to higher crop yield.
- Net return of crop production under modern irrigation is also higher than one under traditional surface irrigation in all cases.
- Total cost (including irrigation cost) of crop production under modern irrigation is lower than one under traditional surface irrigation in some cases, but sometimes higher in other cases.
- The improved fertilizer application method using dissolved fertilizer in irrigation water might bring up higher yield of crops compared with one under common fertilizer application method.
- Research-level data and farmer-level data are not match very well.
- Farmer-level data are always wide-ranging.
- More case studies are necessary especially in farmers' fields.

In this context, the DEITEX Project carried out the demonstration activities at the demonstration farms, in which economic impacts of the modern irrigation were investigated in order to confirm the positive impacts on farmers in consideration with the effects in saving water. The economic impacts of the modern irrigation could be partly clarified within the demonstration activities because of having constraints in the available period of investigation and the availability of individual information. Nevertheless, outcomes about the analysis on the economic impacts concerning to the project activities are mentioned. And, it makes one justification of the irrigation modernization in the aspect of economy through the project implementation.

6.3 Justification of Irrigation Modernization in Syria

6.3.1 General Description of Case Study

The demonstration farms have been operated at Kafr Zeita of Hama, Tafas of Daraa,

and Kafr Hour of Rural Damascus since early spring of 2006, in order to realize the scheduled irrigation manner in properly installed irrigation facilities. The responsible farmers have kept records on farm operation including irrigation water supply, under support of the responsible extension workers. In addition to them, the monitoring farms have been set around the demonstration farms in order to compare the water use.

The important point of the demonstration activities was to collect useful information on the relationship of crop production and water use. The relevant data on field crops in Hama can be obtained more easily than the others. The production of fruit-type vegetables in Daraa could be affected by many other factors than irrigation. In case of small-scale fruit cultivation in Rural Damascus, the significant portion of products was consumed by farmers themselves. Although the useful data for the analysis are limited, some key information are presented below.

6.3.2 Potato (Autumn) in Kafr Zeita, Hama

The three farmers of HDF, HMF1, and HMF2 planted autumn potato in the same season from August 2006 to February 2007, and they gave very important information on the irrigation and crop production. The basic data were summarized in the following table.

Table 6.3.1 Summary of Water Use and Productivity of Potato (Autumn) in Kafr Zeita, Hama

Items	HDF	HMF1	HMF2	Reference (FAO, 2001)
	Hama Demonstration Farm	Hama Monitoring Farm 1	Hama Monitoring Farm 2	
Cropped Area (donum)	9.5	21.0	24.0	
Cropped Period	Aug. '06 - Feb. '07	Aug. '06 - Feb. '07	Aug. '06 - Feb. '07	
Irrigation Method	Sprinkler	Sprinkler	Sprinkler	Drip
Irrigation Water (m3/d)	421 Aug. 8 - Oct. 19	643 Jul. 20 - Oct. 17	438 Aug. 9 - Oct. 19	413
Unit Yield (kg/d)	1,500	1,500	700	
Gross Income (SP/d)	28,500	28,500	13,300	167,063
Production Cost (SP/d)	9,078	4,128	8,387	127,250
Net Income (SP/d)	19,422	24,372	4,913	39,813
Remarks			Failure in germination due to excess water.	Cropped period is uncertain.

The yield of the autumn potato was about 1,500 kg/donum at HDF and HMF1, which is normal rate compared with the average yield (1,590 kg/donum) of autumn potatoes in Hama in 2005 (MAAR statistics). The potato yield at HMF2 was only 700 kg/donum due to poor germination caused by excess moisture. The irrigation water amount at HDF and HMF1 was 421 m^3/donum and 643 m^3/donum. Compared the two farms, the

HDF produced the normal amount of potato using only 65 % of irrigation water. Therefore, it can be said that the proper layout of irrigation system and irrigation schedule has worked well in the demonstration farm.

The FAO report said that the irrigation water amount of drip system was 413 m^3/donum for potato (cropping season was unknown), which was similar to the 2006 autumn potato in HDF with sprinkler irrigation.

6.3.3 Cotton in Kafr Zeita, Hama

The two farmers of HDF and HMF2 cropped cotton in 2007 season. The HMF2 employed common irrigation method combined with sprinkler and surface irrigation (siphone). On the other hand, HDF employed a pilot irrigation method with drip tube. It could be very meaningful to compare water use and crop production under the two different irrigation methods.

Irrigation amounts, input costs and crop yields were compared between drip system of HDF and siphone system of HMF2 for cotton cultivation. The results obtained were shown in the following tables;

Table 6.3.2 Comparison of Cultivation Details in HDF and HMF2

Items	HDF	HMF2
	Hama Demonstration Farm	Hama Monitoring Farm2
Irrigation System	Drip Irrigation System	Siphone Irrigation System
Cultivation Area (Donum)	9.5	10.0
Cultivation Date	11/04/2007	16/04/2007
Distance between Row (cm)	55	70
Irrigation System	Drip line spacing 80cm	Siphon line spacing 70cm
Irrigation Interval (Days)	5	10
Number of Irrigation	17	11
Total Irrigated Amount (m^3)	6,800	9,000
Yield (kg/ha)	5,350	4,850

Table 6.3.3 Comparison of Cost and Benefit in HDF and HMF2

Items	HDF	HMF2	Saved Amount (SP)
	Hama Demonstration Farm	Hama Monitoring Farm2	
Irrigation System	Drip System	Siphon System	-
Fuel cost (SP/ha)	14,500	24,500	10,000
Fertilizer cost (SP/ha)	3,000	5,000	2,000
Labor cost (SP/ha)	-	3,000	3.000
Machinery cost (SP/ha)	-	1,000	1,000
Value of Product (SP/ha)	160,500	145,500	15,000
Total			31,000

Total saved amount was 31,000 SP/ha that is equivalent to 37.5% of the cost of

irrigation network. By considering the network durability as 5 – 7 years, it is quite feasible to introduce drip irrigation for cotton cultivation. Under the drip field, the number of fallen flowers was less. Furthermore, cotton flourished at the same time and could be harvested in one time. These are other advantages of the drip irrigation system. Therefore, it can be said that the introduction of drip irrigation system is economically feasible for the cultivation of cotton under the proper irrigation schedule.

6.3.4 Vegetables in Tafas, Daraa

Some kinds of vegetables, such as tomatoes, eggplant, green pepper, cucumber and cabbage, were cultivated in DDF, DMF1 and DMF2. As there are many factors affecting vegetable production, such as irrigation, fertilizer, varieties, plant density, planting period, and pest and disease control, it is very difficult to determine the effect of irrigation to production. The following table shows some selected data of the vegetable production in DDF and DMF1 as case studies.

The production of tomato, eggplant and cucumber in DDF was 6,594, 4,018 and 1,751 kg/donum, respectively. They were better than the 2005 average yield in Daraa except tomatoes, for example the yield of the DDF eggplant was 49 % higher than the average of 2,696 kg/donum. The irrigation water efficiency (= gross return / irrigation water use) ranged from SP 22.1 /m^3 for eggplant to SP 54.8 /m^3 for cucumber.

In case of cabbage in DMF1, first harvest was 4,534 kg/donum in September and October and second harvest from offshoot was 1,179 kg/donum in January. The total yield of DMF1 cabbage was 5,713 kg/donum and the efficiency was SP 43.9 /m^3. On the other hand, the DDF cabbage was harvested in January and February at 2,922 kg/donum.

Table 6.3.4 Selected Data of Water Use and Productivity of Vegetables in Tafas, Daraa

Items	DDF	DDF	DDF	DMF1
	Daraa Demonstration Farm	Daraa Demonstration Farm	Daraa Demonstration Farm	Daraa Monitoring Farm 1
Crop Cultivated	Tomato	Eggplant	Cucumber	Cabbage
Cropped Area (donum)	5.0	5.0	5.0	11.0
Cropped Period	May - Oct. '06	May - Nov. '06	May - July '06	July '06 - Jan. '07
Irrigation Method	Drip	Drip	Drip	Drip
Irrigation Water (m3/d)	729 May 28 - Oct. 13	729 May 28 - Oct. 13	220 May 28 - July 24	790 June 27 - Oct. 15
Unit Yield (kg/d)	6,594	4,018	1,751	5,713
Gross Return (SP/d)	35,399	16,136	12,064	34,704
Irrigation Cost (SP/d)	2,187	2,188	660	2,370
Return/Water (SP/m^3)	48.6	22.1	54.8	43.9
Remarks	2005 average yield in Daraa = 10,285 kg/d.	2005 average yield in Daraa = 2,696 kg/d.	2005 average yield in Daraa = 1,366 kg/d.	First harvest in Sept. - Oct., then offshoot in Jan.

6.3.5 Conclusion

According to the case study results mentioned above, the effect of modern irrigation was obvious for the cultivation of field crops such as potato and cotton in Hama. In both cases, the amount of irrigation water could be minimized under the condition of maintaining or even increasing the yield of crops. In case of cotton, specially, farmer could save the input costs such as fuel, fertilizer and labor in addition to the amount of irrigation water. As for the other crops such as fruits and vegetables, the yield can be maintained or increased under the proper operation of the irrigation system. Regarding the detailed information about the effect for saving water and various input costs, however, the continuous investigation might be needed.

6.4 Possible Target of Irrigation Modernization in Syria

At the beginning stage of promoting modern irrigation in Syria, a plain target of irrigation modernization in acreage was symbolically advocated in the national program as follows:

> "1,439,487ha which is an equivalent whole irrigated area as of 2005 was set as an provisional target of irrigation modernization in Syria. Taking current modernized area of 221,037ha into consideration, irrigated area of 1,218,450ha was to be modernized during 10 years from 2006 to 2015."

While the target figure of 1,218,450ha is sensational, it is less reality to modernize the whole irrigated area evenly without considering about differences of adoptability and

feasibility. Because, area irrigated for winter crops like wheat is not affordable to apply modern irrigation equipment, and irrigated area providing surface water by gravity is difficult to change pressurized system unless investing much money in its alteration. Target irrigation modernization should be scientifically quantified according to the actual situation based on the agronomical and hydrological evidence.

As it is discussed about target of irrigation modernization in the next section, criteria of assessing applicability for irrigation modernization should be clarified. The criteria was proposed as follows:

(from the viewpoint of irrigated agriculture)

- Irrigated area for summer vegetables and crops is given first priority to the irrigation modernization,
- Modern irrigation equipment which is introduced for summer vegetables and crops can be also utilized for the irrigation of winter vegetables and crops,
- Irrigated area for winter vegetables and crops only is given less priority because of low affordability

(from the viewpoint of adoptability of existing facility)

- The area being irrigated by pressurized system is easily adoptable for modern irrigation,
- Farmers applying rainfed farming are difficult to shift to the modern irrigation at a single bound.

(from the viewpoint of water source)

- Farmers applying well sources are easier rather than others

The Project team studied possible target of irrigation modernization in Syria in accordance with above mentioned criteria. Most possible area of irrigation modernization are extent within the irrigated area of summer vegetable and crops, tree crops utilizing wells as shown in Table 6.4.1. The target area was estimated at 816,487ha, it is equivalent of 56.7% of the above-mentioned initial target area of 1,439,487ha.

Table 6.4.1 Possible Target of Irrigation Modernization in Syria

by crop / by water source		Total Irrigated Area 1,425,811 ha			
		Fruite trees 148,321 ha	Irrigated Area in Summer 418,170 ha	Irrigated Area in Winter 997,337 ha	
			Summer Vege. & crops only 280,153 ha	Summer and winter Vege. & crops 138,017 ha	Winter Vege. & crops only 859,320 ha
1,425,811 ha	Irrigated by wells 865,367 ha	*Modern irrigation 244,373*			
		148,321	*280,153*	*138,017*	*298,876*
	Irrigated by river water by motor 326,113 ha	-	-	-	*326,113*
	Irrigated by river water by gravity 234,331 ha	-	-	-	*234,331*

Possible Irrigation Moderninzing 816,487 ha

6.5 Savable Quantity of Water by Introduction of Efficient Irrigation

According to the above-mentioned wide-ranging analysis on the possibility of irrigation modernization, it is acknowledged that realistic target of irrigation modernization must be far short of the figure of current irrigated area. Based on such recognition, more study is required on how quantity of irrigation water could be saved through irrigation modernization. The Project also studied about savable quantity of water by introduction of modern efficient irrigation in the project area.

(1) Pre-analysis about Introducible Area of Modern Irrigation

Irrigation areas by different irrigation types based on the data in 2005 concerning to the Project area are summarized below, those are rounded because fractional parts of the figures are unreliable and meaningless.

Table 6.5.1 Irrigation areas by different irrigation types in the Project Area (ha)

Irrigation types	Hama	Daraa	Rural Damascus	Remarks
Traditional surface	36,000	16,500	55,000	
Improved surface	-	-	-	Not yet adopted within the project area
Sprinkler with supplemental use	7,000	-	-	It is mainly applied for cotton production
Sprinkler with exclusive use	28,000	3,500	2,000	
Drip	2,500	12,000	13,000	
Total	73,500	32,000	70,000	
Rate of irrigated area	*24.5%*	*19.4%*	*54.7%*	*Reference*

By the way of the above identification of irrigation areas by irrigation types, current irrigated area by crops are also quantified on the bases of the data of cropped areas. It is

no doubts that supplementary irrigated crops in winter like wheat are not affordable for modern irrigation, and irrigated crops with traditional surface method by gravity are also not suited for pressurized modern irrigation, furthermore even current modernized area are needed to be refined more. In this respect, changeable areas from current methods to more refined modern methods are analyzed as follows:

Table 6.5.2 Modernizable Irrigation Areas by crops in the Project Area (ha)

Types of crops	Hama		Dara		Rural Damascus	
	Irrigation Area	Modernizable Area	Irrigation Area	Modernizable Area	Irrigation Area	Modernizable Area
Summer crops	10,000	10,000	2,000	2,000	4,000	3,000
Summer vegetables	7,500	7,000	6,000	4,000	5,000	5,000
Winter crops	39,300	13,000	13,500	0	21,000	7,000
Winter vegetables	2,700	0	3,000	3,000	4,000	4,000
Tree crops	14,000	10,000	7,500	6,000	36,000	24,000
Total	73,500	40,000	32,000	15,000	70,000	43,000

Notes: Above figures were rounded its fractions based on the statistics in 2005.
Changeable irrigation area were estimated through the analysis shown in Table 6.4.1.

(2) Savable Quantity of Water by Introduction of Efficient Irrigation

Prior to clarifying savable quantity of water according to the irrigation modernization about the modernizable areas, savable water unit by types of irrigation modernization should be quantified. For this purpose, classification of irrigation modernization (i.e. irrigation level) of which irrigation efficiencies are corresponded to, are set as follows:

Table 6.5.3 Level of Irrigation Modernization by Crops

Grade in saving water	Wheat		Maize		Sugar beat		Cotton		Eggplant		Potato		Apple		Grape	
	Irrigation Type	Efficiency	Irrigation Type	Efficiency	Irrigation Type	Efficiency	Irrigation Type	Efficiency	Irrigation Type	Efficiency	Irrigation Type	Efficiency	Irrigation Type	Efficiency	Irrigation Type	Efficiency
Zero level	Traditional surface	~40%	Traditional surface	~50%	Traditional surface	~40%	Traditional surface	~40%	Traditional surface	~40%	Traditional surface	~45%	Traditional surface	~50%	Traditional surface	~50%
1 level		~50%	Improved surface *	~60%		~50%	Improved surface	~60%		~50%	Sprinkler	~65%		~55%	Spaghetti tube	~65%
2 level	Improved surface	~60%	Improved surface (2)**	~70%	Sprinkler	~75%	Sprinkler with surface	~75%	Drip	~75%		~70%	Drip or micro-eq.	~80%	Drip or micro-eq.	~80%
3 level	Sprinkler	~75%	Sprinkler	~80%		~80%	Drip	~85%		~85%	Drip	~75%	Drip	~90%	Drip	~90%

Note: Values of irrigation efficiencies by crops and by irrigation methods in above table are based on the results in the ANRR Research Reports
* : "Improved surface" is the surface irrigation mathod with elaborated land leveling lusing ike laser instrument
**: "Improved surface(2)" is the surface irrigation mathod with more elaborated treatments besides land leveling

Taking available irrigation efficiencies by irrigation levels into consideration, required quantity of irrigation water in current situation could be calculated. At the same time,

savable quantity of irrigation water by means of irrigation modernization could be estimated based on the differences of irrigation efficiencies of current and targeted irrigation types and levels. It is summarized in Table 6.5.4.

Table 6.5.4 Savable Quantity of Water by Introduction of Efficient Irrigation in the Project Area

Governorate	Crop type	Crops	Irrigated Area (ha)	Target area for irrigation modernization (ha)		Present Level in Irrigation		Target Level of Irrigation		Standard Irrigation Water requirment (mm)	Present Irrigation Water Amount (m3)	Target Irrigation Water Amount (m3)	Ratio of Water-saving
Hama	Summer Crops	Cotton, Sugar Beet	10,000	10,000	7,000	Level 2	75%	Level 3	85%	550	51,333,333	45,294,118	
					3,000	Level2-3	80%	Level 3	85%		20,625,000	19,411,765	
	Summer Vegetables	Tomato, Potato, Eggplant,	7,500	7,000	500	Level 3	85%	-		550	3,235,294	3,235,294	
					7,000	Level2-3	80%	Level 3	85%		48,125,000	45,294,118	
	Winter Crops	Wheat	39,300	13,000	14,000	Level 0	40%	-		560	196,000,000	196,000,000	
					10,000	Level 0	40%	Level 2	70%		140,000,000	80,000,000	
					12,300	Level 2	75%	-			91,840,000	91,840,000	
					3,000	Level 2	75%	Level2-3	80%		22,400,000	21,000,000	
	Winter Vegetables	Pea, Onion	2,700	0	2,700	Level 2	75%	-		350	12,600,000	12,600,000	
	Tree Crops	Apples, Pears	14,000	10,000	2,000	Level 0	40%	-		600	30,000,000	30,000,000	
					10,000	Level 0	40%	Level 3	85%		150,000,000	70,588,235	
					2,000	Level 3	85%	-			14,117,647	14,117,647	
	Total		73,500	40,000							780,276,275	629,381,176	0.807
Daraa	Summer Crops		2,000	2,000	2,000	Level 2	75%	Level 3	85%	550	14,666,667	12,941,176	
	Summer Vegetables		6,000	4,000	2,000	Level 2	75%	-		550	14,666,667	14,666,667	
					4,000	Level 2	75%	Level 3	85%		29,333,333	25,882,353	
	Winter Crops		13,500	0	12,000	Level 0	40%	-		560	168,000,000	168,000,000	
					1,500	Level 2	70%	-			12,000,000	12,000,000	
	Winter Vegetables		3,000	3,000	2,000	Level 0	45%	Level 3	85%	350	15,555,556	8,235,294	
					1,000	Level 2	75%	Level 3	85%		4,666,667	4,117,647	
	Tree Crops		7,500	6,000	1,500	Level 0	50%	-		600	18,000,000	18,000,000	
					1,000	Level 0	50%	Level 3	90%		12,000,000	6,666,667	
					5,000	Level 2	80%	Level 3	90%		37,500,000	33,333,333	
	Total		32,000	15,000							326,388,889	303,843,137	0.931
Rural Damascus	Summer Crops		4,000	3,000	1,000	Level 2	75%	-		550	7,333,333	7,333,333	
					3,000	Level 2	75%	Level 3	85%		22,000,000	19,411,765	
	SummerVegetables		5,000	5,000	5,000	Level 2	75%	Level 3	85%	550	36,666,667	32,352,941	
	Winter Crops		21,000	7,000	13,000	Level 0	40%	-		560	182,000,000	182,000,000	
					7,000	level 0	40%	Level 3	75%		98,000,000	52,266,667	
					1,000	Level 2	75%	-			7,466,667	7,466,667	
	Winter Vegetables		4,000	4,000	3,000	Level 0	40%	Level 3	85%	350	26,250,000	12,352,941	
					1,000	Level 2	75%	Level 3	85%		4,666,667	4,117,647	
	Tree Crops		36,000	24,000	12,000	Level 0	50%	-		600	144,000,000	144,000,000	
					20,000	Level 0	50%	Level 3	90%		240,000,000	133,333,333	
					4,000	Level 2	80%	Level 3	90%		30,000,000	26,666,667	
	Total		70,000	43,000							798,383,333	621,301,961	0.778

(3) Expectable Water Saving in Reality

Through irrigation modernization in the project area, expectable water saving in reality was clarified. These are to be set as the target of the Project. According to the results, 19.3% (=1.0-0.807), 6.9% and 22.2% of current irrigation water could be savable in total in Hama, Daraa and Rural Damascus, respectively. It is roughly mentioned that approximately 10% -20% of current used water in irrigation could be saved in the project area depend on the governorate. Indicator of PDM for target of water saving was reflected its results.

However, the expectable rate of water saving is on the basis of the whole governorate. Considerable differences from the expectable rate could be observed on the spot level

according to its current irrigation type and irrigation condition. As demonstration farms are only a spot of the project area, results of demonstration activities of saving water sometimes differ from the common rate of saving water of each governorate.

6.6 Mind-setting for Water Saving

DEITEX Project was promoted comprehensive project activities on enhancement of water-saving mind as well as aspects of hardware improvement and software capacity building in the context of general improvement of modern irrigation. The Project was introduced the method of extension in two ways, i.e. Collective (or Media) extension and Individual (or Dialogue) extension as referred in the descriptions within this report.

In Syria, Collective extension such as TV program and mobile theater is well organized and conducted actively. On the contrary, Individual extension is not established as common style, depending on individual abilities of extension workers. Even so it is claimed there is existing a thousand of extension units in the region and extension structure or organization in the rural area, Individual extension is not systematically coming into operation.

Enhancement of water-saving mind have been promoted through extension activities from extension workers to farmers. Since extension of water-saving mind has tendency to be obtrusive to farmers, it is indispensable to avoid high-handed act of extension with deep consideration. This is the reason to take care of mind setting or incentive factors for water saving of farmers in order to work out effective and efficient extension.

The principal incentive factors, which are motivational to willingly adopt modern irrigation method for the farmers in the Project area were clarified. Based on the social survey activities in the village level, observed farmers behaviors seem to be caused by certain motives like incentives. Through the qualitative analysis, it is assumed that such incentive factors can be summarized into five following items:

Monetary Benefit: Profit to be provided through water saving

Mutual Relation: Good relation with neighborhood to be promoted through water-saving

Religious Belief: Conformity of water saving with religious doctrine

Scientific Rationality: Conformity of water saving with scientific rationality, and

Problem Solving: Problem solving to be provided through water saving

It was also identified that degree of impact on each incentive factor varies by the farmers in the target governorate according to their history and physical/social circumstances. To investigate further features of five items, several indicators related to characteristics of farmers in three governorates were compared as shown in the table below:

Table 6.6.1 Farmers Characteristics in Three Governorates

Items	Project Area		
	Hama	Daraa	Rural Damascus
Village, Site	Kafr Zeita	Tafas	Kafr Hour
Target Crops	Field Crop	Vegetables	Fruits
Crops	Wheat, Sugar Beet, Potato, Cotton	Wheat, Broad Beans, Peas, Tomato, Eggplant, Green Pepper, Cucumber, Cabbage, Cauliflower, Lettuce	Apple, Pear, Olive, Other Tree Crops (with Barley, Peas and Broad Beans)
Shipment way for crops	Sell to the government and market	Sell to the market and middleman	Sell to the market and middleman
Fluctuation in market price	Low	Extremely High	High
Economical Interest	Strong	Very Strong	Strong
Individualism	Strong	Very Strong	Strong
Mutual Relationship	Fairly good	Good but strong individuality, Skeptical	Fairly good
Interest in Technical Skills for Modern Irrigation	Already sufficient	Strong interest	Strong interest
Awareness for saving water	High	Middle	Middle

Social relations and interaction between demonstration farm and surrounding farms were referred to farmers' awareness survey (See Progress Report 5, pp51-56). In addition, wide varieties of valuable observations were provided through the DEITEX Project through training and extension activities.

In one hand, such kind of interests related to religious belief or strong adoration to families seems to be common to all farmers in three governorates. On the other hand, inclination originated in subsistence economic behavior shows uniqueness between regions. In Daraa, vegetable productions such as tomato and eggplants are widely observed. Due to high fluctuation of prices in the wholesale market, farmers are naturally compelled to competitive production. Farmers relation between other neighbor farmers are not extremely bad but have tendency to warn against each other and keep secret on information about their production. In Hama, main crops are sugar beat, potato and cotton. Contrastingly to the agricultural condition and shipping behavior in Daraa, amount of production is allocated in advance and products are insured to take up

by the government. There is no strong competition between farmers and impression of farmer's character is mild and gentle as a whole. Mutual relation of farmers is completely free from awkward relationship and they are eager to communicate each other and exchange information together.

In Rural Damascus, characteristics of farmers do not show distinct contrast as illustrated in Daraa and Hama. Fruit tree production is dominated and scale of farming size are comparatively small among three governorates. In the meanwhile, seasonal conjunction of surface water and ground water is universal in water use. Since historical and sociological custom and experience to share water in the region, water-saving mind is brewed in the process basically. Nevertheless introduction of modern irrigation is still staying low in rate. It gets a glimpse that farmers have strong intellectual interest on modern irrigation to save water as well as production cost. But farmers are facing overwhelming difficulties to adopt modern irrigation system in their farm.

Consequently, among five incentive factors described above, religious belief and scientific rationality do not show clear difference among three governorates. However, other incentive items such as monetary benefit, mutual relation and problem solving present concrete difference each other. Five incentive factors in each governorate are described as follows.

Table 6.6.2 Evaluation of Five Incentive Factors in Each Governorate

Governorate	Major Characteristics	Monetary Benefit	Mutual Relation	Religious Belief	Scientific Rationality	Problem Solving
Hama	- Cooperative and inquiring	◎	●	○	○	●
Daraa	- Less cooperative - Mutual wariness - Strong interest	●	△	○	○	◎
R. Damascus	-Water sharing experience -Dilemma to introduce MI	◎	◎	○	○	●

Note: Degree of impact is based on the results of rural society survey and classified from minimum to maximum (△→○→◎→●)

It is emphasized that consideration to the farmers' incentives as described above is essential in order to perform an effective extension work. Similar approach of mind setting is advised to apply in the extension activities in other subjects and other regions.

6.7 Participatory Approach

(1) Significance of Participation

DEITEX Project put the most efforts on developing sufficient irrigation system on ground water and laid out activities around the wells since the beginning of the Project. The main targets for training and extension in the project activities were focused on extension workers and final beneficiaries were consistently assumed as individual farmers. Through consideration on mind setting for water saving as described in Section 6.6, the Project worked on to the farmers in each region with individualized extension methods. It is realized as such kind of participatory approaches without organizing farmers group in direct manner under the circumstances of individualized farmers in the region.

In order for a society to familiarize with saving-water, first of all, every members of the society have to recognize that saving-water is crucial for the existence of their society. However, if doing nothing but recognizing its importance, saving-water dose not always become thorough in the community. Such situation that members of social don't move into action to realize the obvious social objectives due to considering their own momentary interests, is called as "Social Dilemma " in terms of sociology. An issue of social dilemma in natural resources management which has been highlighted in the world, has close connection with the subject of saving-water that is the objective of the Project.

In the Project, the method of encouraging saving-water by means of motivating farmers with direct and indirect incentives, were given a priority. However, besides the method taken within the Project, different measures to deal with the social dilemma directly could be taken in future. It is generally recognized that cooperation and participation with farmers' each other are greatly effective to solve the social dilemma. Establishment of water users association (WUA) is one of the specific approaches for the cooperation and participation of farmers.

(2) Brief Description about WUA in Irrigation

In this section, "development of public water ownerships and WUAs in Syria" is described as a reference for participatory approach.

In the context of 'Irrigation committees' or 'Irrigation turn' or 'Water committee', which are familiar for all farmers and consist of some farmers who share the same water resources, water users association (WUAs in the following sentences) is not totally new idea in irrigation sector and irrigated cultivation in Syria. Traditional types of WUAs

have been played important role in participatory water use. Despite there is no systematic or full research on traditional WUAs in Syria to the present, it is acknowledged that there were around 350 traditional WUAs in the past. Some cases of traditional WUAs are shown below.

Table 6.7.1 Typical Existing of Traditional WUAs in Syria

Name	Location	Water resources	Way to convey water	Irrigation method at the field	Existence of WUA	Body of management
Qarah	R.Damascus	Spring	Roman qanat	Surface	Existing	Community
Deir Atieh	R.Damascus	Wells	Newly developed qanat	Surface	Existing	Community
Maksar	R.Damascus	Spring	Newly developed qanat	Surface	Existing	Community
Brek	R.Damascus	Spring	Newly developed qanat	Drip	Existing	Community
Arne	R.Damascus	Spring	Qanat	Surface	Existing	Community
Kafr Hour	R.Damascus	Spring	Fixed qanat	Surface	Existing	Community

The committee of traditional WUAs has the authority of distributing irrigation water according to the area and the water resources in each irrigation rotation (e.g. every 10 days). It is approved by the government and known as acquired right. The committees are responsible for maintaining and cleaning the soil canals and force farmers to do it themselves. These public water managements in traditional irrigation system are considered at the present stage that it could be improved and modified to suit modern irrigation systems and group irrigation by using modern technologies such as drip and sprinkler. In Arne in Rural Damascus, where fruit trees production is dominant, advanced trials to convert into modern irrigation by governmental project have been started recently after long research period in 1990s.

(2) Challenges and failure in organizing farmers group around combined wells

Even though it is assumed that it is difficult to formulate farmers irrigation group around wells as ground water is generally considered as private ownership, there are some cases for water use by participatory rotational irrigation initiated by farmers groups. Allocation schedules, water duties and instructions for rotational water use are arranged by farmers themselves. Deficit of irrigation water with limited number of effective wells is considered in the background to force farmers to drive into the rotational water use.

Since irrigation groups around wells have fragile aspects and easily to dissolve themselves according to the situations, it was not viewed as stable and permanent group

form for irrigation. Moreover, wells have increased in number recently as described above and not even formed common status for group irrigation in Syria. Forming irrigation group around the well through the project was once challenged at Abou Kalkal in Allepo. It seems to be coming along during the period of the project. But farmers irrigation group was disrupted soon after the project. Not only the incentives of farmers to formulate groups were obscure, it is reflected that series of training courses for farmers to know the advantages and disadvantages of group irrigation or WUAs were not enough.

Beside advanced movement of group irrigation led by some voluntary farmers, it is generally considered that there is no successful case of group irrigation around wells led by governmental or public sector. Since illegal wells take over large portion in number, it is still supposed important to target and tackle with these illegal water sources by combined wells and grouping methods in context of saving water. Enlightenment and continuous training for farmers focusing on the characteristics of participatory group irrigation will increase demand in the future. Some farmers are getting tired of owning and managing individual wells by themselves, which means it is effective to show the direction and merits of co-management of wells to farmers groups.

Specific way to handle the situation of unlicensed wells is discussed. Handling the situation of unlicensed wells was settled by converting to group irrigation under the WUAs management, through giving license for one or more wells according to the watering capacity, and closing all the other wells, at least one well out of others related each other should be licensed to follow this system. Loan system to introduce modern irrigation systems, such as drip and sprinkler in combination with the policy to decrease the number of unlicensed wells has come under review by the DMIC. Organizing farmers group is expected to be one of the influential participatory ways for efficient irrigation, converting consciousness of farmers from private water ownership to public water ownership.

The system of WUAs for all water resources in general was recently attested in the Syrian water legislation. Syrian water law was issued by the decision number '31' in 2005 and partly revised in 2006. The WUAs is defined as follows:

"Obligatory non governmental cooperative organizations managed by their members for their own benefit and for better water management."

WUAs are to be established by the decision of the Ministry of Irrigation. 'General commission of water resource', 'Complementary management department', 'Water users association department' are organized at the Ministry of Irrigation, and related to the same departments under the directorate of water resources in the governorates.

Under the current circumstance in water, it is expected that establishment of WUA in irrigation is enhanced more and more on the bases of the farmers' skills and knowledge which were fostered through indigenous WUA management like *Addern*.

7. Future Project Management

7.1 Current Status of the Post-Project

The Project was implemented with good collaboration between Syrian counterpart organizations concerned, consisting of GCSAR, Directorate of Extension and DMIC. GCSAR is reliable to pursue research activities for the subjects of irrigated agriculture in accordance with the project purpose. Extension Directorate is also dependable to continue and expand extension activities in line with the project implementation. DMIC is much motivated to extend irrigation modernization by means of providing technical and financial services. DMIC's work is much reciprocal with the project implementation for the attainment of overall target of the Project. Training activities on the irrigation modernization are being promoted by the counterpart organizations under the administrative support of Training Directorate.

In addition to those, Agricultural Governorates plan an important role for the promotion of irrigation modernization in local level. As described in section 4.7.3, the Project completed necessary arrangement in local level having full cooperation with the local counterparts and trained extensionists. In this respect, necessary measures of training/extension activities were already arranged in line with the project strategy.

Taking the current situation for the circumstances of the Project into consideration, post-project seems to be optimistic in general.

7.2 Management on Training Work

During the DEITEX Project period, training system for irrigation SMS and water extensionists have been established along with necessary training curriculum, teaching materials and training guideline. These products shall be fully utilized in the post-Project period as well, so that continuous training activities will be conducted in order to achieve the ultimate goal of saving water in agriculture. The following actions are required to ensure continual and successful training implementation during the post-Project stage.

Those were already arranged through a series of discussions between the project team and Syrian organizations concerned.

7.2.1 Establishment of National Team for SMS Training

In order to conduct future SMS training course in efficient and sustainable way,

formation of a National Team (or a Task Force Team) is needed. The National Team will consist of engineers of GCSAR, DMIC, Extension Directorate, and Training Directorate in order to make use of their experiences obtained through the previous training activities during the DEITEX Project period. This team can be reinforced by the qualified personnel of the governorate level from the relevant organizations in order to form a branch team for the training activity in the specific Governorate. The National Team will take in charge of planning and implementation of SMS training course. An action program for the training shall be formulated with timetable in order to initiate the activity of the National Team.

SMS candidate should preferably be selected from the trained water extensionists to make full use of their experiences in the previous training course.

7.2.2 Effective Utilization of the Trained SMS in conducting Training Activity

The trained SMS shall be fully utilized in conducting training activities, in order to make use of the outcomes of the DEITEX Project efficiently. These SMS have attained basic knowledge and skills as trainers for water extensionists through the Project training activities, but they still need more experience. So, it is very necessary to give them more chance to work as trainers. They can learn more from the experience of teaching, which will work as practical TOT by on-the-job training.

Support from the Syrian side is also essential to make use of them effectively. A special program to utilize the trained personnel is now under preparation by the Extension Directorate, which would be helpful to push forward the movement. In addition, training proposal for water extensionists has been prepared in some of the Governorates, and it is anticipated that training courses will be conducted with utilizing the DEITEX teaching materials under the initiative of relevant provincial organizations. The trained SMS shall be nominated as trainers in such training programs.

7.2.3 Securing Official Status of the Trained WE and SMS

In order to make use of the trained water extensionists and SMS effectively, it is crucial to secure their official status so that they can devote themselves to their anticipated work such as water extension and/or training, instead of engaging unrelated duties.

The trained SMS and WE were qualified by the Project, which may help to secure their official status to some extent. So far, training course participants received "attendant certification" which does not endorse their capability of the concerned duties. In

addition to the attendant certification, "technical certification" was given to SMS and WE those who have adequate ability which is acknowledged by the Project.

7.2.4 Conducting well-organized Training Activities

Many training courses regarding saving water and modern irrigation have been conducted both as central and provincial activities, which are organized by GCSAR, DMIC and provincial Agriculture Directorate. More linkage and cooperation shall be promoted among the related organizations, so as to make the training courses more effective by avoiding unnecessary duplication in the activities as well as in the selection of trainees.

All the related training courses should be planned through the discussion among the relevant organizations such as GCSAR, Directorate of Extension and DIMC under the adjustment of Directorate of Training in order to avoid unnecessary duplication in training activities. Under the process mentioned above, all such training courses should be included in the annual training plan.

In addition, it is also crucially needed to appoint an organizer (or a coordinator) of the training course for adequate management of training activities. The main duty of organizer is coordinating a training course from A to Z, including all necessary preparation works such as preparing training program, arrangement of suitable trainers, preparing distributing materials, setting up venue for training, and so on. He may not necessarily do everything by himself, but he may assign somebody else to do so. However, the organizer should understand the whole picture of a training program, and should grasp every situation regarding on-going training course, so that he can facilitate the training course to be conducted smoothly and effectively.

7.2.5 Necessity of establishing training standard

It is expected that training courses for water extensionists are going to be separately organized in each Governorate during the post-Project period. It is therefore necessary to establish training standard, in order to avoid unevenness of training in terms of the contents and the quality among different Governorates. The four steps training courses employed under the DEITEX Project can be such standard because those four steps can cover all the necessary requirements for the water extensionist. Trainers of training courses shall take responsibility to teach water extensionists in each governorate according to the training standard.

It is also recommended to utilize the training guideline which have been prepared for effective application of the teaching materials of the four training courses. The guideline describes overview of the training course, including objective, major expecting outcomes, structure of the course, and recommendable timetable. In addition, summary sheet is attached to each presentation, containing objective, learning goal, teaching materials, teaching process, and time allocation. Following to the summary sheet, description of each presentation slide is given in details, including essential contents to be explained, important points to be learned by the trainees, and allocated time for explanation.

7.2.6 Evaluation System of Training Activity

The evaluation system of training activities which was applied in the Project consists of pre-evaluation, final evaluation, examination, evaluation meeting, and homework. The system shall be kept working during the post-Project period with keeping in mind on the followings.

1) Pre-Evaluation

   Current type of pre-evaluation should be carried out for the selection of participants prior to the commencement of training course in order to have uniform class. Examination type of pre-evaluation (or benchmark test) might be needed to assess the improvement obtained through the training by comparing the result with final examination.

2) Final Evaluation

   Final evaluation was very useful to improve the training even within the current series of 4 training courses. According to the requirement on "more practice" by many participants, for example, the time allocated for field practices was increased from the second training courses. Furthermore, the exchange visit (Hama participants visited Daraa for familiarization with drip irrigation system) was performed based on the request on the visit of other Governorate.

3) Examination

   Examination was useful to judge the understandability of the participants and the training method or materials can be modified according to the results. This might be more useful to assess the improvement of each participant if similar examination can be done before training activities as previously described.

4) Evaluation meeting

Evaluation meeting based on the results of Pre-Evaluation, Final Evaluation and Examination was indispensable for sharing the results by all trainers from different Governorate and also for setting up the direction of the next training.

5) Homework

Most participants were eager to perform their homeworks and it was a good chance for them to make use of the skills, knowledge and information that they have learned through the training course. Furthermore, some of the homework results, like posters and brochures in the 3rd training homework, can be used as materials for next training and extension activities such as explaining problems which farmers are facing.

7.3 Management on Extension Work

7.3.1 Proper Allocation and Effective Utilization of Trained Staff

The distribution of the trainees qualified as Water Extensionist and SMS in the Governorate office, district office, Unit and DMIC office is shown in Table 7.3.1. In order to perform the effective extension activities from now on, those qualified staff should be allocated properly without haphazard transfer for them to make full use of their knowledge and skills obtained through the training course and the model extension activity. Furthermore, the active utilization of those staff can be promoted in the following manner.

Those were already arranged through a series of discussions between the project team and Syrian organizations concerned.

(1) Extension Activity by Water Extensionist

Chief of Extension Unit should give chances for the trained Water Extensionists to perform their extension activities to promote water saving agriculture in the area. Once such extension activities were proved effective, chief of Extension Unit should plan as many such activities as possible and list them in the annual activity plan. In order to design the effective extension activities, various suggestions from SMS and researchers of irrigation station should be invited if such personnel are available in the area. In this way, the trained staff under the Project can perform their duties toward water saving.

(2) Training Activity by SMS

In order to increase the number of Water Extensionists in the area, the training course

should be executed in the Governorate level. In this case, the trained SMS under the Project should be utilized as trainers not only for Water Extensionist to receive training as trainee but also for SMS to accumulate their experience as trainer. The principle of 4 steps training courses employed in the Project can basically be applied as a standard training program in each Governorate.

(3) Irrigation Modernization by DMIC

The trained staff of DMIC in Governorate level should also be utilized effectively in the implementation of irrigation modernization. They are ready to perform various activities such as farm survey, diagnosis of existing irrigation system and also design, installation, maintenance and operation of irrigation system. Those activities are indispensable for the proper implementation of irrigation modernization. Furthermore, the trained staff of DMIC is ready to perform extension activities in collaboration with the staff of Extension Unit.

Table 7.3.1 Distribution of Water Extensionist and SMS in the Project Area

Governorate Office	District Office	Unit	WE	SMS	Total
R. Damascus Extension				1	
	Haramoun			1	
		Kafr Hour*		1	
	Qatana			1	
		Arne	1		
		Bait Sabar	1		
		Bait Tima	2		
	Zabadani				
		Surghaya	1		
		Dimas	1		
		Dair Qanoun	1		
	Douma				
		Nashabie	1		
	Gouta				
		Zubdin*	1		
	Harran				
		Harran*	1		
Damas DMIC			6	1	
2 Governorate Office	**6 District Office**	**10 Unit**	**16**	**6**	**22**
Daraa Extension			1		
	Tafas		1		
		Daiel*	2		
		Ebtaa	1		
		Jillin	1		
		Mzeirib	1		
		Tafas	1		
	Nawa		1		
		Jasim	1	1	
		Nawa	1		
		Sheikh Saad		1	
		Tsael	1		
		Namer	1		
	Daraa				
		Ghazale	1		
		Karak	1		
	Sanamain				
		Sanamain	1		
		Enkhal	1		
	Jillin	Irrigation Station	1		
Daraa GCSAR			3	1	
Daraa DMIC					
3 Governorate Office	**4 District Office**	**14 Unit**	**21**	**3**	**24**

Hama Extension				2	
	Kafr Zeita			1	
		Al Hamamyat	1		
		Al Latamna		1	
		Kafr Zeita*	2		
	Mharde				
		Halfaya	1		
		Maarzaf	1		
		Majdal	1		
		Zlaqiat	1		
	Hama		1		
		Al Shikha	1		
		Al Rabiaa	1		
		Tizeen		1	
		Khattab	1		
	Souran				
		Tibet Al Imam	1		
		Mourek	1		
	Salamiya				
		Taldara	1		
	Horbenafso				
		Deir Faradees	1		
Hama DMIC			2	1	
2 Governorate Office	6 District Office	15 Unit	17	6	23
Ghab DMIC			1		
Lattakia DMIC			1		
9 Governorate Office	16 District Office	39 Unit	56	15	71

7.3.2 Monitoring for Extension Activities

Extension activities are being carried out for the behavior modification of farmers. In other words, even if the extension activities are properly carried out, they are useless in case farmers are not modifying their behavior by introducing irrigation systems or improving irrigation practices. It is therefore important to monitor the behavior modification of farmers after the implementation of extension activities. Conceivable monitoring activities are as follows.

(1) Observation by Water Extensionists

Water Extensionists should perform the monitoring activities by visiting or observing the farmers who participated into extension activities. In case the reaction of farmers are not satisfactory enough, it might be better to investigate the reasons by asking the farmers and to reflect the results of investigation into the following extension activities.

(2) Observation through Agricultural Material Shop

Water Extensionists should also perform the monitoring activities by visiting the agricultural material shops. The trend of behavior modification of surrounding farmers can be observed through the investigation of material purchasing record and also various inquiries from farmers to the shopkeeper. This is indirect but effective method of monitoring for behavior modification of farmers.

(3) Observation through DMIC Activities

Monitoring activities can also be performed through the observation of DMIC activities. In case farmer decided to introduce modern irrigation system to his farmland, he may apply for loan if informed. It is therefore important to investigate the applicants from where they have received the information about modern irrigation and loan system. Based on the results of such investigation, the concept and the method of extension activities can be modified.

7.3.3 Further Expansion of the System

The training and extension system for the efficient irrigation techniques is so far initiated in the Project areas of Rural Damascus, Daraa and Hama. This system should be continued as an annual rotation of trainee and trainer cycle. As a first step, the ordinary extensionist will be trained as Water Extensionist. Trained Water Extensionist will then carry out the extension activities. The competent Water Extensionist will then be trained as SMS. Trained SMS will then carry out the training activity as a trainer for the next group of Water Extensionist trainee. Through this kind of annual rotation of trainee and trainer cycle, Water Extensionist and SMS can be developed effectively. Once this cycle is established in the first three Governorates, this system should be expanded to the surrounding areas from Governorate to Governorate.

7.4 Needs of Project Expansion

Taking the determination of Syrian side on the future project management into consideration, it could be expected that the Project is maintained and managed with appropriate project cycle. Necessary materials and management plan of the future project management were already prepared, and owned in common together with. What required from now on, is to pursue by own efforts of Syrian side. The project period is terminated, however, the Project shall be continued by the efforts of Syrian side.

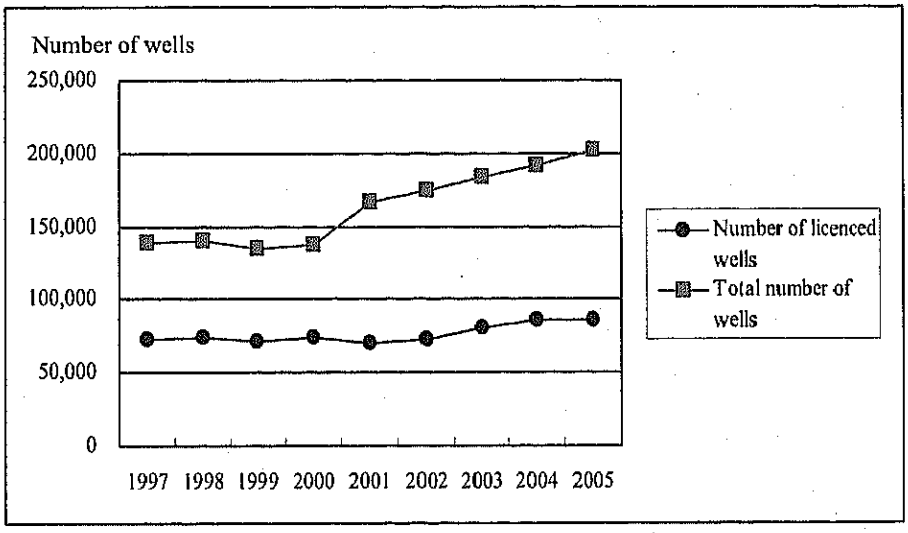
This Project is an undertaking to expand in the selected three governorates. Need of the expansion of the modern water-saving irrigation is not limited within the three governorates in Syria. More endeavors to expand the outcomes of the Project to other regions are highly expected.

8. Conclusion and Suggestion

8.1 Conclusion

At the closing of the Project, the DEITEX Project is concluded as follows:

(1) In order to attain saving-water in irrigation, there are two streams of "controlling and guiding by external authority/forces" and "intending saving-water and refraining wasting-water by farmers' own initiatives". However, it is difficult to realize saving-water in irrigation by the efforts specified within the former stream only. Even the licensing of farmers' water uses, that is a precondition of control by regulation, is very tough as shown in the figure below.



Source: Agricultural Statistics in 2005

Fig.8.1.1 Transition of the Number of Licensed Wells

DEITEX Project intends to attain saving-water in irrigation in accordance with the later stream. And, the Project proved that the later approach is effective, and it could be accomplished by means of training and extension activities. In Syria the former stream for saving-water have been much more highlighted. Saving-water could be realized under the situation with good harmony of the both.

(2) The conclusion of the achievement of the Project was given through the terminal evaluation study. It could be referred in the Section 5.4.

(3) Through hydrological analysis in nation-wide done within the Project as described in section 6.1, distribution of available water in Syria, and comparative situation of irrigation water use between every governorates and river basins, were remarkably clarified.

(4) By the analysis in quantity of savable water through modernization as described in Section 6.4 and 6.5, a concrete procedure of quantification for savable water in irrigation was indicated.

(5) The Project prepared "Technical Manual" for the convenient of technicians and extension workers when they try to improve the current water-wasting irrigation. As it is the first comprehensive guideline on modern irrigation in Syria, to utilize this in various purposes is highly expected. The technical manual is expected to be kept on among technicians and extension workers concerned.

(6) The Project developed and extended systematic training/extension methods and system for its operation. The project team also prepared "Training Guideline" and "Extension Manual" which covered every aspect in training/extension activities and training/extension methods available.

(7) The Project highly concerned about farmers' mind in the face of promotion of modern water-saving irrigation. On the occasion of expanding an innovation, consideration to peoples' mind should be carefully given in every developing sector, likely this project dealt with farmers' mind.

8.2 Suggestions

In addition to the recommendations given by the Terminal Evaluation Study Team, the DEITEX Project also give following suggestions so that project cycle of the Project moves well and in sustainable:

(1) The recommendation in terms of the achievement of the Project was given through the terminal evaluation study as described in the Section 5.4. Syrian Government is requested to follow the recommendation in the course of post-implementation of the DEITEX Project, and to take appropriate arrangement for the improvement of

(2) There are some effective measures to reduce quantity of water use in agricultural purpose as enumerated as follows:

(a) Introducing draught-tolerant crops (including improvement draught-tolerance of crops by means of breeding research)

(b) Physical and chemical treatments reducing water consumption of crops

(c) Reducing area of irrigation

(d) Optimizing cultivation period and selecting less water consuming crops

(e) Minimizing waste water and leakage by means of improving water management

(f) Minimizing conveyance and delivery losses of water by means of improving irrigation facilities

(g) Introducing modern irrigation method (method by handy pressurized irrigation equipment, method by large-scale pressurized irrigation devices, Improved surface irrigation method)

The DEITEX Project dealt with the modernization of irrigation method by handy pressurized irrigation equipment which is categorized as (g) mentioned above. Syrian Government is recommended to apply other approaches of reducing quantity of water use in agricultural purpose at the same time.

(3) It is undeniable that groundwater use is subject to its physical and hydro-geological characteristics. As far as lifting much groundwater above its capacity, irrigation water supply could not be sustainable, even though applying modern irrigation methods. Modern irrigation is certainly manageable to realize saving water, however, it is beyond its management when some basic conditions and circumstances are not allowable.

(4) Legalization like water legislation involves two contradictory sides of restrictions and protections. Farmers always bother the aspect of restrictions of the legalization, on the other hand they don't recognize the advantage of water legislation. Once farmers' water uses legalized, they become to deserve protection from any infringements like others disturbances and accidental failure of water use. More efforts to publicize the effectiveness of the legislation should be made.

(5) Syrian Government is required to work out more accurate and strategic planning of irrigation modernization in consideration with the results of hydrological analysis in nation-wide done within the Project as described in section 6.1.

(6) Syrian organizations concerned to modern irrigation is required to carry out deep analysis in possible quantity of water saving through modernization by governorates, in consideration with the result of analysis in quantity of savable water through modernization as described in Section 6.4 and 6.5.

(7) Organizations concerned to extension work in central and local level are required to effectively utilize the training/extension manual in their duties, which were prepared within the Project.

FIGURES and TABLES

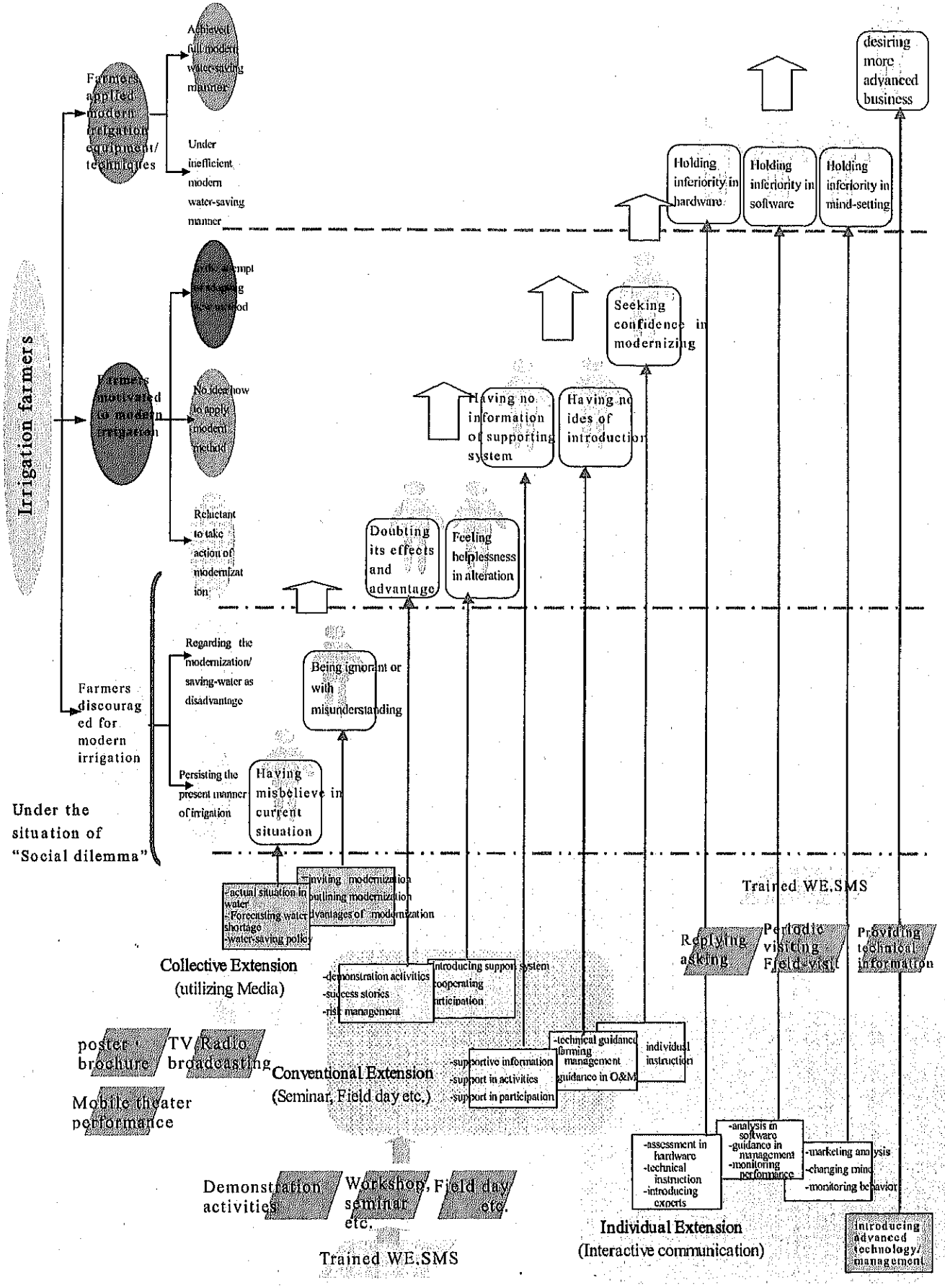


Fig.4.9.1 Extension Structure of the DEITEX Project

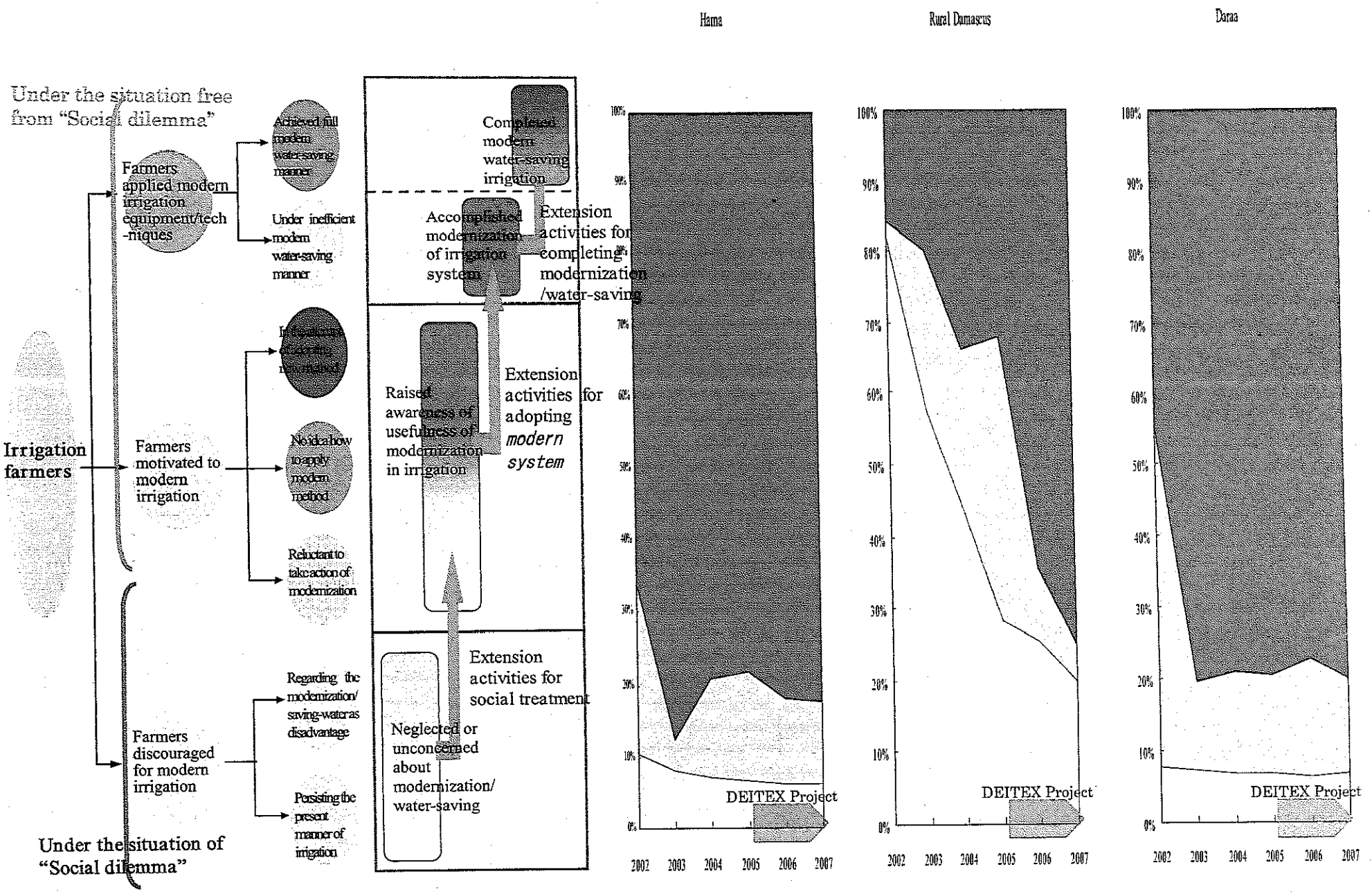


Fig.5.1.2 Farmers' Types Categorized by Reluctancy to Irrigation Modernization

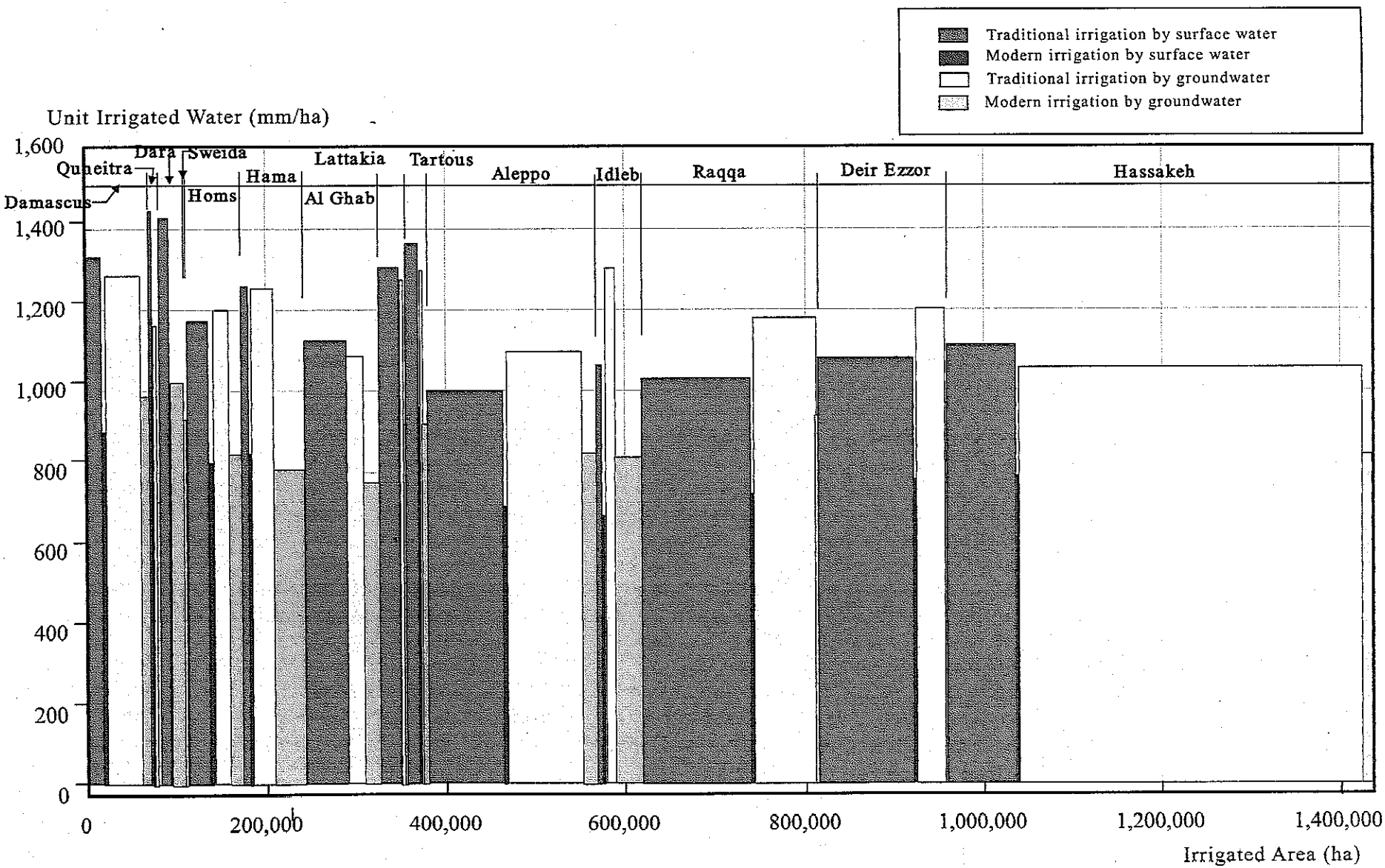


Fig.6.1.3 Irrigated Area and Water by Governorates

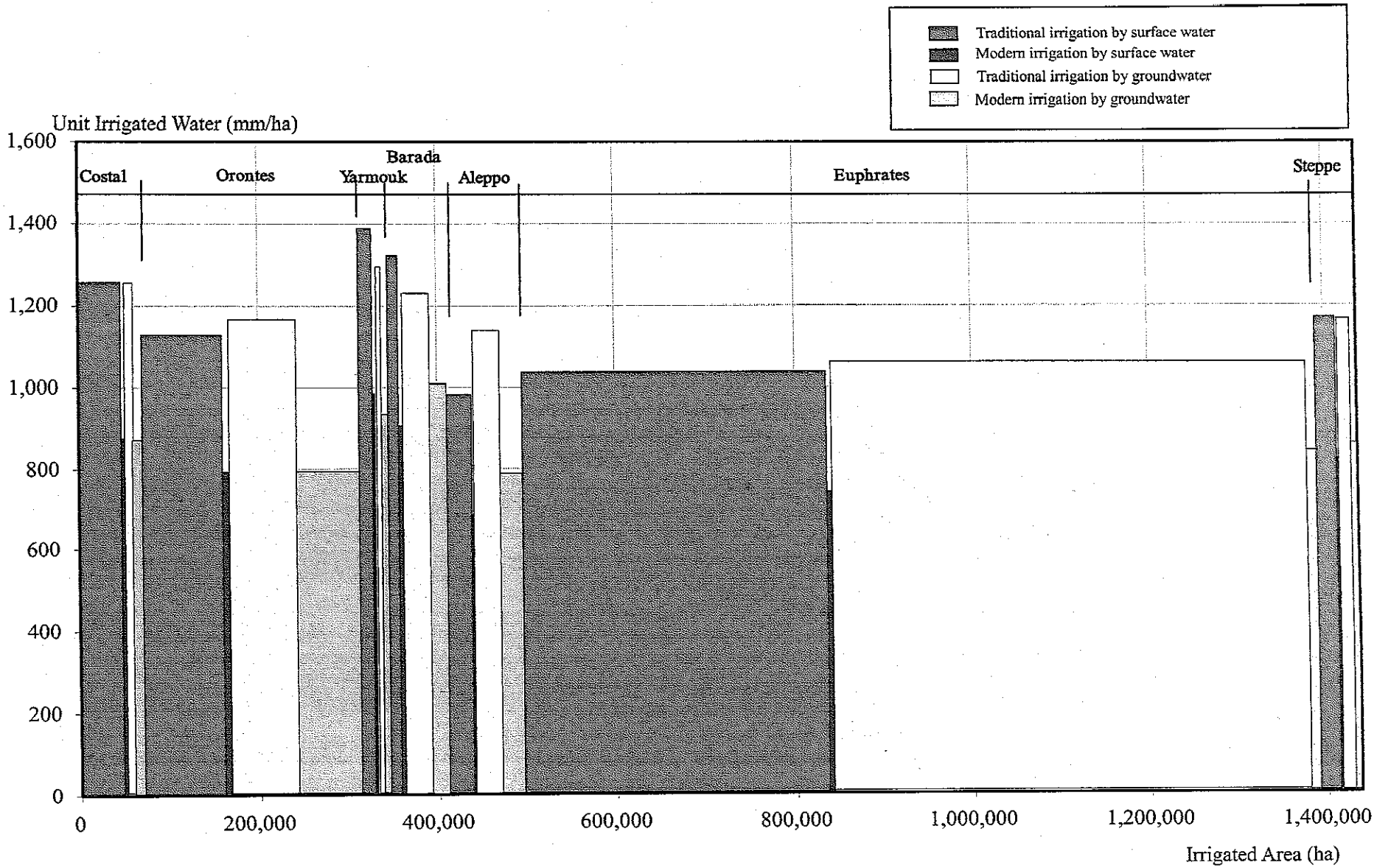


Fig.6.1.4 Irrigated Area and Water by River Basins

Table 2.4.2 Tentativre Plan of the DEITEX Project

Date: October 2007

Component No.	Expected Outcomes in the PDM	Planned Project Activities in the PDM	Project Term	Project Tasks	Person in charge	Implementer	Equipment	Cost	Remarks
Component-1	Outcome 1: Satisfactory water saving efficient irrigation techniques are established according to the local conditions in the project sites.	1-1 Review past and present research activities of ANRR.	1st Field Work	[6] Review the past and present activities of MAAR.	Project Director	Project Team			
			3rd Field Work	[19] Recommend research method on efficient irrigation to ANRR.	Project Director	Project Team			
		1-2 Conduct a baseline survey of the project areas in which project sites are located.	1st Field Work	[5] Collect and analayze general data and information.	Project Director	Project Team		Hiring cost of a local consultant	
			2nd Field Work	[7] Execute Baseline Survey.					
			1st Work in Japan	[9] Prepare the Baseline Survey report.					
		1-3 Conduct a preliminary study on the selection of the project sites.	1st Field Work	[7] Execute Baseline Survey.	Project Director	Project Team		Hiring cost of a local consultant (excluding the above)	
			1st Work in Japan	[10] Examine the nominated sites for the project sites.					
			2nd Field Work	[13] Select the project sites.					
		1-4 Prepare the detailed plan of operation of the project.	1st Field Work	[4] Confirm the project implementation plan.	Project Director	Project Team			
		1-5 Organize farmers' group(s) for introducing group water management, if necessary.	2nd Field Work	[14] Establish the pilot demonstration farms in the project sites.	Project Director	Project Team			
			4th Field Work	[23] Implement training and extension services.	Project Director	Project Team	Training materials,	Cost for holding	
		1-6 Establish the (pilot) demonstration farms in the	2nd Field Work	[14] Establish the pilot demonstration farms in the project sites.	Project Director	Project Team	Irrigation equipment &	Equipment cost	
		1-7 Investigate suitable modern water-saving irrigation method for the project areas.	2nd Field Work	[14] Establish the pilot demonstration farms in the project sites.	Project Director	Project Team	Irrigation equipment &	Equipment cost	
			3rd Field Work	[19] Recommend research method on efficient irrigation to ANRR.					
			3rd Field Work	[20] Prepare draft design standard and on-farm irrigation manuals.	Project Director	Project Team, Other concerned org.			
			4th Field Work	[24] Prepare design standard and on-farm irrigation manuals.					
		1-8 Prepare manuals and/or guidelines on the efficient irrigation techniques.	3rd Field Work	[20] Prepare draft design standard and on-farm irrigation manuals.	Project Director	Project Team, Other concerned org.			
			4th Field Work	[24] Prepare design standard and on-farm irrigation manuals.					
		Additional Activities			Project Director	Counterpart Team		Operation cost	Acting without interruption
Component-2	Outcome 2: Irrigation engineers and extension workers concerning the project, are able to transfer knowledge to farmers in terms of water saving modern irrigation method.	2-1 Review past and present training activities.	1st Field Work	[6] Review the past and present activities of MAAR.	Project Director	Project Team			
		2-2 Identify needs and confronted problems in	1st Field Work	[5] Collect and analayze general data and information.	Project Director	Project Team	Training materials		
		2-3 Improve the training curriculum and teaching materials.	2nd Field Work	[15] Prepare training curriculum and materials.	Project Director, General Director of GCSAR, Director of Extension	Project Team	Training materials, Training facilities	Cost for holding training courses	
			2nd Field Work	[16] Implement training and extension services.					
			3rd Field Work	[18] Implement training and extension services.					
			4th Field Work	[23] Implement training and extension services.					
		2-4 Carry out the training courses to irrigation engineers and extension workers concerned.	1st Field Work	[6] Review the past and present activities of MAAR.	Project Director, General Director of GCSAR, Director of Extension	Project Team, Other concerned org.			Preconditioning for improvement of the relevant organizations
			2nd Field Work	[16] Implement training and extension services.					
			3rd Field Work	[18] Implement training and extension services.					
			4th Field Work	[23] Implement training and extension services.					
		Counterpart training			Project Team Leader	Project Team		Cost for training	Japan and/or other countries
		Additional Activities			Project Director	Counterpart Team		Operation cost	Acting without interruption
Component-3	Outcome 3: Farmers in the project areas are guided so as to adopt efficient irrigation for each crop individually through providing extension services.	3-1 Review past and present extension activities.	1st Field Work	[6] Review the past and present activities of MAAR.	Project Director	Project Team			
		3-2 Identify needs and confronted problems in	1st Field Work	[5] Collect and analayze general data and information.	Project Director	Project Team	Materials for extension		
		3-3 Improve the extension materials.	2nd Field Work	[16] Implement training and extension services.	Project Director, General Director of GCSAR, Director of Extension	Project Team	Materials and facilities for extension activities	Cost for holding extension sessions	
			3rd Field Work	[18] Implement training and extension services.					
			4th Field Work	[23] Implement training and extension services.					
		3-4 Provide extension services to the farmers in and surrounding the project sites.	1st Field Work	[6] Review the past and present activities of MAAR.	Project Director, General Director of GCSAR, Director of Extension	Project Team, Other concerned org.			Preconditioning for improvement of the relevant organizations
			2nd Field Work	[14] Establish the pilot demonstration farms in the project sites.					
			2nd Field Work	[16] Implement training and extension services.					
			3rd Field Work	[18] Implement training and extension services.					
			4th Field Work	[23] Implement training and extension services.					
		Holding additional extension events			Project Director, Director of	Extension Directorate		Cost of services	
		Additional Activities			Project Director, Director of	Extension Directorate		Cost of services	Acting without interruption

Table 3.1.2 Actual Time Schedule Finally Implemented

Date: October 2007

Planned Tasks	Activity in PDM	Project Period: CY 2005 / JapaneseFY. 2005 (3 4 5 6 7 8 9 10 11 12 1 2 3)	CY 2006 / JapaneseFY. 2006 (4 5 6 7 8 9 10 11 12 1 2 3)	CY 2007 / JapaneseFY. 2007 (4 5 6 7 8 9 10 11 12 1 2 3)	CY2008
Year 1					
Preparatory Work in Japan					
[1] Prepare the draft implementation plan of the Project.					
[2] Prepare the Project Document.					
Year 2					
1st Field Work					
[3] Explain and discuss for the Project Document.					
[4] Confirm the project implementation plan.	1-4				
[5] Collect and analyze general data and information.	1-2 2-2 3-2				
[6] Review the past and present activities of MAAR.	1-1 2-1 2-4 3-1 3-4				
[7] Execute Baseline Survey.	1-2 1-3				
[8] Prepare the Progress Report 1.					
1st Work in Japan					
[9] Prepare the Baseline Survey report.	1-2				
[10] Examine the nominated sites for the project sites.	1-3				
[11] Report to the supporting agencies in Japan.					
2nd Field Work					
[12] Explain and discuss the Baseline Survey Report.					
[13] Select the project sites.	1-3				
[14] Establish the pilot demonstration farms in the project sites.	1-5 1-6 1-7 3-4				
[15] Prepare training curriculum and materials.	2-3				
[16] Implement training and extension services.	2-3 2-4 3-3 3-4				
[17] Prepare the Progress Report 2.					
Year 3					
3rd Field Work					
[18] Implement training and extension services.	2-3 2-4 3-3 3-4				
[19] Recommend research method on efficient irrigation to ANRR.	1-1 1-7				
[20] Prepare draft design standard and on-farm irrigation manuals.	1-7 1-8				
[21] Support to the JICA Mid-term Evaluation Mission.					
[22] Prepare the Progress Report 3 and 4.					
Year 4					
4th Field Work					
[23] Implement training and extension services.	1-5 2-3 2-4 3-3 3-4				
[24] Prepare design standard and on-farm irrigation manuals.	1-7 1-8				
[25] Support to the JICA Terminal Evaluation Mission.					
[26] Prepare the Progress Report 5.					
[27] Prepare the Project Completion Report.					

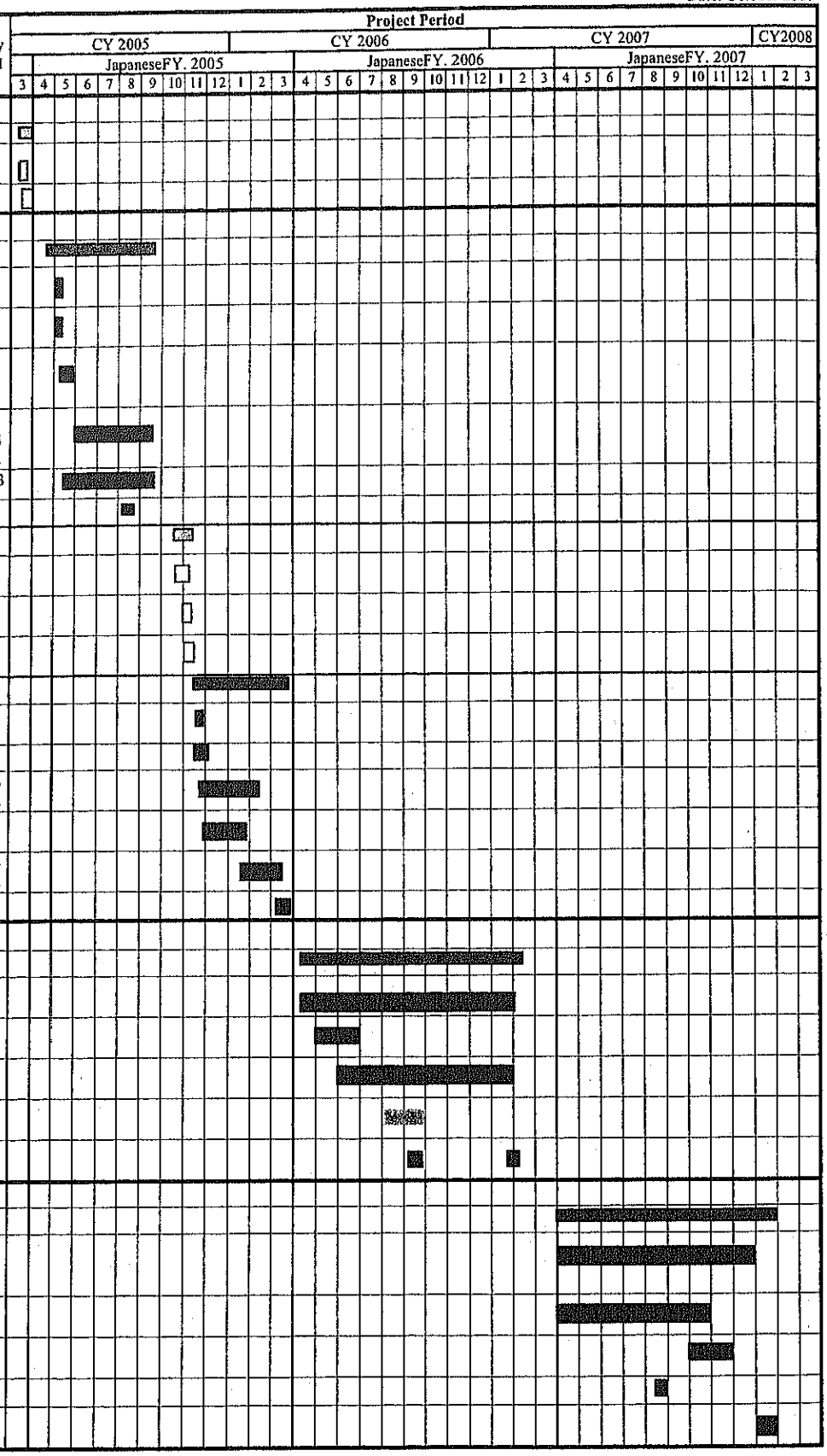


Table 4.3.10 Summer of Results in Demonstration Activities

Irrigation water use:

Governorate	Crops	Irrigated water depth in demonstration farms (A) (mm)	Remarks	Irrigated water depth in monitoring farms (B) (mm)	Remarks	Ratio of (A) to (B) =(A)/(B)	Avarage ratio of crops	Avarage ratio of whole demonstration farms
Hama	Potato	510.5	during full period of crop cultivation	478.3	during full period of crop cultivation	1.067	0.909	
	Sugar beet	680.0		749.0		0.908		
	Cotton*	406.0		541.0		0.750		
Daraa	Tomato	744.5	during full period of crop cultivation	1,220.5	estimated utilizing the records during available terms	0.610	0.653	
	Cucumber	790.1		1,177.6		0.671		
	Eggplant	802.3		1,219.1		0.658		
	Green pepper	889.4		1,273.4		0.698		
	Green pepper	207.0	during up to August '07	330.0	during up to August '07	0.627		0.786
Rural Damascus	Apple	255.3	during full period of crop cultivation	359.9	estimated assuming to apply traditional surface irrigation method	0.709	0.797	It can be assumed that irrigation water was saved in the whole demonstration farms at 21.4% (=1.0-0.786).
	Apple	358.7		359.9		0.997		
	Apple	300.1		359.9		0.834		
	Apple	256.9		359.9		0.714		
	Pear	382.1		359.9		1.062		
	Pear	278.7		359.9		0.774		
	Pear	204.8		359.9		0.569		
	Pear	241.9		359.9		0.672		
	Olive	320.7		319.8		1.003		
	Olive	202.1		319.8		0.632		

Note: Achieved extent of water-saving in demonstration farms can be evaluated comparing the irrigated amounts of water with monitoring farms. When the records are not available for the monitoring farms, the estimated amounts of water applying traditional surface irrigation method are substituted for that.

Crop production:

Governorate	Crops	Unit production in demonstration farms (A) (ton/donum)	Remarks	Unit production in monitoring farms (B) (ton/donum)	Remarks	Ratio of (A) to (B) =(A)/(B)	Avarage ratio of crops	Avarage ratio of whole demonstration farms
Hama	Potato	1.50		1.50		1.000	1.061	
	Sugar beet	8.00		7.40		1.081		
	Cotton*	0.54		0.49		1.103		
Daraa	Tomato	6.59		10.29	applying average values of statistices in governarate	0.640	1.100	
	Cucumber	1.75		1.37		1.277		
	Eggplant	4.02		2.70		1.489		
	Green pepper	1.83		1.84		0.995		
	Green pepper	not available	not harvested now	-		-		1.002
Rural Damascus	Apple	0.88		0.98	applying average values of statistices in Syria	0.900	0.846	It can be assumed that unit production was shown in the whole demonstration farms at 100.2%.
	Apple	0.66		0.98		0.673		
	Apple	not available		-		-		
	Apple	not available		-		-		
	Pear	0.36		0.58		0.621		
	Pear	0.59		0.58		1.017		
	Pear	0.59		0.58		1.017		
	Pear	not available		-		-		
	Olive	not available		-		-		
	Olive	not available		-		-		

Table 4.6.2 Selected Posts for Delivering Copy of Technical Manual

Delivering Office	Responsible Person	Delivered No.
Central		
GCSAR, Central	Dr. Awandis Arslan	No. 1 – 5
Extension Department, Central	Dr. Mohamad Abudallah	No. 6 – 8
Training Department, Central	-----	No. 9
DMIC, Central	Dr. Ahmad Kadri	No. 10 - 13
Hama		
Agriculture Director, Hama	Abdullakareem Laham	No. 14
GCSAR, Hama	Dr. Abdelnaser Alomar	No. 15
Tizeen Irrigation Station	Mohamad Jazzar	No. 16 – 17
Extension Department, Hama	Bassam Bunni	No. 18 – 19
Training Department, Hama	Hikmat Jarah	No. 20
DMIC, Hama	Muhammad Zwaikly	No. 21 - 22
Hama Maslaha	Obaida Murad Agha	No. 23
Kafr Zeita Maslaha	Hasan Bazow	No. 24
Mharde Maslaha	-----	No. 25
Souran Maslahsa	-----	No. 26
Salamiya Maslaha	-----	No. 27
Horbenafso Maslaha	-----	No. 28
Kafr Zeita Supporting Unit	Abdul Munem Shaar	No. 29
Kafr Zeita Extension Unit	Mohammed Haj Hasan	No. 30
Latamne Extension Unit	Omar Khaled Omar	No. 31
Hamamiat Extension Unit	Abdul Nasser Qassoum	No. 32
Latmeen Extension Unit	-----	No. 33
Majdal Extension Unit	Aasi Aasi	No. 34
Halfaya Extension Unit	Ahmad Othman	No. 35
Maerzaf Extension Unit	Ahmad Abdul Malek Hasan	No. 36
Zalaqiat Extension Unit	Mahmoud Aziz al-Abd	No. 37
Shaikha Extension Unit	Muhammed Omar Khatib	No. 38
Rabiaa Extension Unit	Saleh Rashed Mansour	No. 39
Tizeen Extension Unit	Mohammed Fouad Najar	No. 40
Tibet Al Imam Extension Unit	Mohamed Al Khalil	No. 41
Morek Extension Unit	Mohidin Adel Al Khalaf	No. 42
Khatab Extension Unit	Abdul Moaen Gazallah	No. 43
Tal Al Dara Extension Unit	Abdullah Hayder	No. 44
Deir Al Fardes Extension Unit	Hasan Shino	No. 45
Rural Damascus		
Agriculture Director, R. Damas	Ali Saadat	No. 45
Nashabie Irrigation Station	Aiman Hijaz	No. 47 – 48
Extension Department, R. Damas	Marwan Shikh Fttouh	No. 49 – 50
Training Dept, R. Damas	Rateb Rageh	No. 51
DMIC, Rural Damascus	Najeeb Hasson	No. 52 – 53
Haramoum Maslaha	Walif Hassoun	No. 54
Qatana Maslaha	-----	No. 55
Zabadani Maslaha	-----	No. 56
Douma Maslaha	-----	No. 57
Gouta Maslaha	-----	No. 58
Harran Maslaha	-----	No. 59
Arne Extension Unit	Majd Al Housh	No. 60
Bait Tima Extension Unit	Amal Nour Din	No. 61
Bait Saber Extension Unit	Ahmad Ali Mhammad	No. 62
Qarat Jandar Extension Unit	-----	No. 63
Baqasem Extension Unit	Mazen Daher	No. 64

Kafr Hour Extension Unit	Amer Mazoukh	No. 65
Surgaya Extension Unit	Hussam Nakhleh	No. 66
Dimas Extension Unit	Hussam Ghabra	No. 67
Deir Qanoun Extension Unit	Ilham Zaidan	No. 68
Zubdin Extension Unit	Ossama Muhanna	No. 69
Nashabie Extension Unit	Rafiq Labbad	No. 70
Aqraba Extension Unit	Yahiya Al Idi	No. 71
Haran Extension Unit	Dalal Koshuha	No. 72
Taibe Extension Unit	Mhd Ali Talshan	No. 73
Daraa		
Agriculture Director, Daraa	Taha Gasem	No. 74
GCSAR, Daraa	Hussein Ali Kottuma	No. 75
Jileen Irrigation Station	Mohamad Hayek	No. 76 – 77
Extension Department, Daraa	Mahammood Baradan	No. 78 – 79
Training Department, Daraa	Mohammad Al Sh'hadat	No. 80
DMIC, Daraa	Mohamoud Shahadat	No. 81 – 82
Daraa Maslaha	-----	No. 83
Tafas Maslaha	Nabil Kiwan	No. 84
Nawa Maslaha	Ibrahim Itesan	No. 85
Sanamain Maslaha	-----	No. 86
Tafas Extension Unit	Marwan Ibrahim Kiwan	No. 87
Daiel Extension Unit	Walid Sharif	No. 88
Ebbta Extension Unit	Mohamed Ali Husain	No. 89
Mzerieb Extension Unit	Muamer Zaki Khalil	No. 90
Jileen Extension Unit	Husain Mahmoud Ramadan	No. 91
Jasem Extension Unit	Haitham Ibrahim al-Jalm	No. 92
Sheikh Saed Extension Unit	Kasem Mhd Abu Jabal	No. 93
Tseel Extension Unit	Ayham Zain Abideen	No. 94
Nawa Extension Unit	Nidal Khaled Khalil	No. 95
Ghazale Extension Unit	Imad Haj Ali	No. 96
Karak Extension Unit	Abdul Razak Saleme	No. 97
Sanamein Extension Unit	Ahmad Ali Rifai	No. 98
Enkhal Extension Unit	Abdul Hakim Al Nablsi	No. 99
Namer Extension Unit	Khaldoun Al Ghazale	No. 100

ANNEXES

Annex 1

Inputs of the Project

(TableA-1) List of Long-Term Japanese Experts

No.	Name of Expert	Field	Employer	Original Plan / Performed	Assignment	M/M	Remarks
					JFY 2005 (3 4 5 6 7 8 9 10 11 12 1 2 3) / JFY 2006 (4 5 6 7 8 9 10 11 12 1 2 3) / JFY 2007 (4 5 6 7 8 9 10 11 12 1 2 3)		
1	Dr. MATSUSHIMA Shuichi	Team Leader / Irrigation	Nippon Giken Inc.	Original Plan	(15) (90) (45) (30) (120) (90) (60) (45) (60) (45) (60) (6)	22.5	
				Performed	(15) (90) (30) (30) (111) (45) (60) (45) (60) (60) (30) (6)	19.4	
2	Mr. KOTO Akira	Sub-Leader / Training	Appropriate Agriculture International Co.	Original Plan	(15) (150) (30) (120) (180) (90) (180) (90)	28.5	
				Performed	(15) (150) (111) (129) (90) (135) (105)	24.5	
3	Mr. ONUMA Hiroyasu	Agricultural Extension	Appropriate Agriculture International Co.	Original Plan	(15) (90) (120) (150) (90) (150) (90)	23.5	
				Performed	(15) (90) (111) (9) (90) (66) (120) (90)	19.7	Contract Basis: 19.4 M/M

(TableA-2) List of Short-Term Japanese Experts

No.	Name of Expert	Field	Employer	Original Plan / Performed	Assignment	M/M	Remarks
					JFY 2005 (3 4 5 6 7 8 9 10 11 12 1 2 3) / JFY 2006 (4 5 6 7 8 9 10 11 12 1 2 3) / JFY 2007 (4 5 6 7 8 9 10 11 12 1 2 3)		
1	Mr. NISHIYA Mitsuo	Agro-Economy / Agronomy	Nippon Giken Inc.	Original Plan	(90) (60) (60)	7.0	
				Performed	(78) (48) (60) (1) (30) (1) (45)	8.8	Contract Basis: 8.7 M/M
2	Mr. HOTTA Tomoki	Irrigation System Designing	Nippon Giken Inc.	Original Plan	(15) (75) (75)	5.5	
				Performed	(69) (8) (13) (90) (90) (45)	10.5	Contract Basis: 9.8 M/M
3	Mr. KOGA Naoki	Socio-Economy	Appropriate Agriculture International Co.	Original Plan	(45) (30) (60) (60)	6.5	
				Performed	(45) (30) (90) (4) (90) (15)	9.1	Contract Basis: 8.5 M/M
4	Mr. TAKIGAWA Eiichi	Irrigation Water Management	Nippon Giken Inc.	Original Plan		0.0	
				Performed	(35) (14) (60)	3.7	Contract Basis: 3.2 M/M
5	Mr. TAKIGAWA Eiichi	Coodinator	Nippon Giken Inc.	Original Plan	(30) (30) (30) (30)	(-.-)	
				Performed	(30) (122) (30) (81) (30) (48) (30) (73) (30) (16) (90) (30)	20.3	Contract Basis: (-.-) M/M

Field Work in Syria (Original Plan on March 2005)
Field Work in Syria (Ad hoc)
Field Work in Syria (Contract Basis)
Work in Japan

Original Plan in Total	93.5	
Performed in Total	116.0	

(TableB) Procurement of the Equipment

Note:

R/P:Route of Procurement (J: From Japan, L: Local, E: With Expert)
Frequency of Use (A: Always B: Often C: Sometimes)
Condition (A: Good B: Fair C: Bad)

No.	Date of Delivery	Description				Q'ty	Unit Price Currency	S-total	Place of Storage	Frequency of Use	Condition	Remarks
		Item	Supplier	Spesification	R/P							
1	2005/05/30	EC Meter	TEC-JAM Inc.	EH-173	J	3 pieces	JPY 25,000	JPY 75,000	Project Offices	Always	Good	Purchased by DEITEX Project
2	2005/05/30	Water Level Meter	SUIMONKEISOKUKI Corp.	WL-30BLB	J	3 pieces	JPY 35,000	JPY 105,000	Project Offices	Always	Good	Purchased by DEITEX Project
3	2005/05/31	Soil Moisure Measurement (TDR)	Judi Studies & Scientific Supplies	IMKO TRIME-FM2, TRIME-P2G	L	2 pieces	JPY 354,255	JPY 708,510	Project Offices	Always	Good	Purchased by DEITEX Project
4	2005/06/28	PDF File Scanner	Yodobashi Camera Co.	FI-5110EOX3	J	1 piece	JPY 47,429	JPY 47,429	Project Offices	Always	Good	Purchased by DEITEX Project
5	2005/08/01	Soil Moisure Measurement (TDR)	Judi Studies & Scientific Supplies	IMKO TRIME-HD, TRIME-EZ	L	1 piece	JPY 333,261	JPY 333,261	Project Offices	Always	Good	Purchased by DEITEX Project
6	2005/08/31	Projector	Computer Corner	Acer PD116P	L	3 pieces	JPY 127,200	JPY 381,600	Project Offices	Always	Good	Purchased by DEITEX Project
7	2005/08/31	Screen	Computer Corner	Diplomat 213cm*213cm	L	3 pieces	JPY 44,520	JPY 133,560	Project Offices	Always	Good	Purchased by DEITEX Project
8	2006/02/13	Video/DVD Recorder	NEHLAOUI & CO.	NV-VP33GC-S	L	1 piece	JPY 29,876	JPY 29,876	Project Offices	Always	Good	Purchased by DEITEX Project
9	2006/02/23	Water Flow Meter (3 inch)	Agricultural Services	3 inch Diameter	L	6 pieces	JPY 24,343	JPY 146,058	Demonstration Sites	Always	Good	Purchased by DEITEX Project
10	2006/02/23	Water Flow Meter (4 inch)	Agricultural Services	4 inch Diameter	L	6 pieces	JPY 30,982	JPY 185,892	Demonstration Sites	Always	Good	Purchased by DEITEX Project
11	2005/06/01	4WD Vehicle	Shoneez Traiding Co.	Mitsubishi PAJERO	J	3 pieces	JPY 3,234,000	JPY 9,702,000	Project Offices	Always	Good	Purchased by JICA Syria Office
12	2005/05/08	Copy Machine	ALRAED FON OFFICE EQUIPMENT	Konica 7115	L	1 piece	JPY 174,827	JPY 174,827	Project Offices	Always	Good	Purchased by JICA Syria Office
13	2005/05/08	Fax Machine	Acttware	Canon B820	L	1 piece	JPY 19,917	JPY 19,917	Project Offices	Always	Good	Purchased by JICA Syria Office
14	2005/05/12	Digital Camera	Mall Tech	Konica CX7530	L	1 piece	JPY 46,473	JPY 46,473	Project Offices	Always	Good	Purchased by JICA Syria Office
15	2005/05/12	Digital Video	Mall Tech	Sony DCR-DVD101E	L	1 piece	JPY 121,715	JPY 121,715	Project Offices	Always	Good	Purchased by JICA Syria Office
16	2005/05/08	Television	NEHLAOUI & CO.	Syronics TV	L	1 piece	JPY 33,195	JPY 33,195	Project Offices	Always	Good	Purchased by JICA Syria Office
17	2005/05/08	Computer (Desk Top)	Cerberus Systems	Acer Veriton 7600GT, Microsoft Window XP Prc	L	3 pieces	JPY 217,980	JPY 653,940	Project Offices	Always	Good	Purchased by JICA Syria Office
18	2005/05/08	Laser Printer	Acttware	Canon LPB3200	L	3 pieces	JPY 34,301	JPY 102,903	Project Offices	Always	Good	Purchased by JICA Syria Office
19	2005/05/08	Inkjet Printer	Cerberus Systems	HP1220	L	3 pieces	JPY 35,961	JPY 107,883	Project Offices	Always	Good	Purchased by JICA Syria Office
20	2006/06/01	Modern Irrigation Equipment	Al Kheirat Est	-	L	1 set	JPY 9,390,150	JPY 9,390,150	Demonstration Farm	Always	Good	Purchased by JICA Syria Office

(TableC) Counterpart Training in Japan & Counterpart Study Tour of the Third Country

No.	Name of Counterpart	Field	Employement Status	Counterpart Training & Study Tour			Remarks
				Conducted Japanese Fiscal Year	Title	Duration	
1	Mr. Nasr Koki	Irrigation System Designing	Irrigation Engineer of Water Resources Management Division, ANRR	2005	Operation and Management of Irrigation Canal System	From July 4th, 2005 To December 3rd, 2005	Counterpart Training in Japan
2	Mr. Firas Salloum	Project Coodinator / Irrigation	Irrigation Engineer of Water Resources Management Division, ANRR	2005	Mdern Irrigation in Jordan Valley	From December 5th, 2005 To December 8th, 2005	Study Tour in Jordan
3	Mr. Bassam Al Husein	Training	Irrigation Engineer of Water Planning and Irrigation System Design Division, ANRR	2005	Mdern Irrigation in Jordan Valley	From December 5th, 2005 To December 8th, 2005	Study Tour in Jordan
4	Mr. Abdallah Khabbaz	Agricultural Extension	Engineer of Technical Division, Extension Directorate, MAAR	2005	Mdern Irrigation in Jordan Valley	From December 5th, 2005 To December 8th, 2005	Study Tour in Jordan
5	Mr. Bassam Al Husein	Training	Irrigation Engineer of Water Planning and Irrigation System Design Division, ANRR	2005	Irrigation Management and Agricultural Extension in Japan	From Mrach 11th, 2006 To April 8th, 2006	Counterpart Training in Japan
6	Mr. Yasser Muhammad	Irrigation	Irrigation Engineer of Khardier Research Center in Hama	2005	Irrigation Management and Agricultural Extension in Japan	From Mrach 11th, 2006 To April 8th, 2006	Counterpart Training in Japan
7	Mr. Firas Salloum	Project Coodinator / Irrigation	Irrigation Engineer of Water Resources Management Division, ANRR	2006	Sustainable Management of Irrigation and Drainage Project	From June 20th, 2006 To November 18th, 2006	Counterpart Training in Japan
8	Dr. Majd Jamal	Project Director	Director of GCSAR, MAAR	2006	Development of Efficient Irrigation Techniques and Extension	From Mrach 25th, 2007 To March 31st, 2007	Counterpart Training in Japan
9	Dr. Awandis Arslan	Sub Project Director	Director of ANRR, GCSAR, MAAR	2006	Development of Efficient Irrigation Techniques and Extension	From Mrach 25th, 2007 To March 31st, 2007	Counterpart Training in Japan
10	Dr. Mohamad Abudallah	Project Manager	Director of Extension Directorate, MAAR	2006	Development of Efficient Irrigation Techniques and Extension	From Mrach 25th, 2007 To March 31st,2007	Counterpart Training in Japan
11	Mr. Firas Salloum	Project Coodinator / Irrigation	Irrigation Engineer of Water Resources Management Division, ANRR	2007	Observation about Modern Irrigation in the Third Country	From October 15th, 2007 ToOctober 22nd,2007	Study Tour in Greece
12	Mr. Bassam Al Husein	Training	Irrigation Engineer of Water Planning and Irrigation System Design Division, ANRR	2007	Observation about Modern Irrigation in the Third Country	From October 15th, 2007 ToOctober 22nd,2007	Study Tour in Greece
13	Mr. Ali Kaisi	Advisor	Deputy Director of ANRR	2007	Observation about Modern Irrigation in the Third Country	From October 15th, 2007 ToOctober 22nd,2007	Study Tour in Greece
14	Mr. Husein Ali Kottuma	Research	Director of Jileen Research Center in Daraa	2007	Observation about Modern Irrigation in the Third Country	From October 15th, 2007 ToOctober 22nd,2007	Study Tour in Greece
15	Mr. Abdelnaser Alomar	Research	Director of Khardier Research Center in Hama	2007	Observation about Modern Irrigation in the Third Country	From October 15th, 2007 ToOctober 22nd,2007	Study Tour in Greece
16	Mr. Abdallah Khabbaz	Agricultural Extension	Engineer of Technical Division, Extension Directorate, MAAR	2007	Irrigation Management and Agricultural Extension in Japan	From October 1st, 2007 To October 28th, 2007	Counterpart Training in Japan
17	Mr. Marwan Shikh Fttouh	Extension	Chief of Extension Division, Natural Resource Directrate in Rural Damascus	2007	Irrigation Management and Agricultural Extension in Japan	From October 1st, 2007 To October 28th, 2007	Counterpart Training in Japan
18	Mr. Bassam Al Bunni	Extension	Director of Natural Resource Directorate, Hama	2007	Irrigation Management and Agricultural Extension in Japan	From October 1st, 2007 To October 28th, 2007	Counterpart Training in Japan

(TableD) Assignment of Counterparts

No.	Name of Counterpart	Field	Employement Status	Assignment	Remarks
				JFY 2005 / JFY 2006 / JFY 2007 (3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3 4 5 6 7 8 9 10 11 12 1 2 3)	
1	Dr. Majd Jamal	Project Director	Director of GCSAR, MAAR		
2	Dr. Awandis Arslan	Sub Project Director	Director of ANRR, GCSAR		
3	Dr. Riad Al Shayeb	Sub Project Director	Former Director of ANRR, GCSAR		Retired
4	Dr. Mohamad Abudallah	Project Manager	Director of Extension Directorate, MAAR		
5	Dr. Ahmad Kaderi	Sub Project Manager	Director of DMIC		
6	Dr. Mamoun Malakani	Sub Project Manager	Director of DMIC		Transferred
7	Mr. Ali Kaisi	Advisor	Deputy Director of ANRR		
8	Mr. Marcel Romhein	Technical Supervisor	Irrigation Engineer of Water Planning and Irrigation System Design Division, ANRR		
9	Mr. Radwan Yousef	Administration	Staff of Public Relation, ANRR		
10	Mr. Firas Salloum	Project Coodinator / Irrigation	Irrigation Engineer of Water Resources Management Division, ANRR		
11	Mr. Bassam Al Husein	Training	Irrigation Engineer of Water Planning and Irrigation System Design Division, ANRR		
12	Mr. Nasr Koki	Training	Irrigation Engineer of Water Resources Management Division, ANRR		
13	Mr. Nasr Koki	Irrigation System Designing	Irrigation Engineer of Water Resources Management Division, ANRR		
14	Mr. Elias Khouli	Agricultural Extension	Chief of Technical Division, Extension Directorate, MAAR		
15	Mr. Abdallah Khabbaz	Agricultural Extension	Engineer of Technical Division, Extension Directorate, MAAR		
16	Mr. Waleed Al Hazeem	Technology Transfer / Agro-Economy	Irrigation Engineer of Water Planning and Irrigation System Design Division, ANRR		
17	Mr. Mohamad Kabalan	Socio-Economy	Engineer of Economic Division, GCSAR		
18	Dr. Samer Roaidi	Research	Former Director of Nashabia Research Center in Rural Damascus		Transferred
19	Mr. Ayman Hijazi	Irrigation	Irrigation Engineer of Nashabia Research Center in Rural Damascus		
20	Mr. Najeeb Hasson	Irrigation	Director of DMIC in Rural Damascus		
21	Mr. Rateb Rageh	Training	Director of Natural Resource Division in Rural Damascus		
22	Mr. Marwan Shikh Fttouh	Extension	Chief of Extension Division, Natural Resource Directrate in Rural Damascus		

(TableD) Assignment of Counterparts

No.	Name of Counterpart	Field	Employement Status	Assignment	Remarks
				JFY 2005 / JFY 2006 / JFY 2007 (3 4 5 6 7 8 9 10 11 12 1 2 3 / 4 5 6 7 8 9 10 11 12 1 2 3 / 4 5 6 7 8 9 10 11 12 1 2 3)	
23	Mr. Mohaeden Abou Al Shams	Extension	Former Chief of Extension Division, Natural Resource Directrate in Rural Damascus		Transferred
24	Mr. Husein Ali Kottuma	Research	Director of Jileen Research Center in Daraa		
25	Mr. Mohammad Al Hayek	Irrigation	Chief of Jileen Irrigation Station in Daraa		
26	Mr. Mohammad Al Sh'hadat	Training	Staff of Training Division, Natural Resource Directrate in Daraa		
27	Ms. Mona Barakat	Extension	Chief of Rural Woman Development Division Natural Resource Directorate in Daraa		
28	Mr. Abdelnaser Alomar	Research	Director of Khardier Research Center in Hama		
29	Mr. Bassam Sarraj	Research	Former Director of Khardier Research Center in Hama		Retired
30	Mr. Aiman Hasani	Research	Deputy Director of Khardier Research Center in Hama		
31	Mr. Mohamood Al Samsam	Research	Former Deputy Director of Khardier Research Center in Hama		Transferred
32	Mr. Yasser Muhammad	Irrigation	Irrigation Engineer of Khardier Research Center in Hama		
33	Mr. Hikmat Jarah	Training	Chief of Training Division, Natural Resource Directorate, Hama		
34	Mr. Bassam Al Bunni	Extension	Director of Natural Resource Directorate, Hama		

Assignment

Assignment (Plan at Nov. 2007)

Counterpart Training in Japan

Counterpart Study Tour of the Third Countries

(TableE-1) Local Cost from Japanese Side

Unit: JPY

No.	Item	JFY 2004	JFY 2005	JFY 2006	JFY 2007	Total	Remark
1	General Affairs	0	1,658,378	1,361,310	1,447,836	4,467,524	Translation Works
2	Training Course	0	434,701	724,552	1,173,013	2,332,266	Training Material, Transportation Fee and so on
3	Extension Activity	0	47,405	0	2,394,719	2,442,124	Extension Material
4	Spare Modern Irrigation Parts for Demonstration Farm	0	0	0	603,456	603,456	
5	Counterpart Tranining of the Third Country	0	0	0	493,674	493,674	
6							
7							
8							
9							
10							
Total		0	2,140,484	2,085,862	6,112,698	10,339,044	

(TableE-2) Local Cost from Syrian Side

Unit: SYP

No.	Item	JFY 2004	JFY 2005	JFY 2006	JFY 2007	Total	Remark
1	Fuel for Project Cars	0.00	307,200.00	352,800.00	352,800.00	1,012,800.00	Three 4WD Vehicle (from 2005,Jun.) and One Car (until 2005, May)
2	Expense for Project Office	0.00	35,000.00	35,000.00	35,000.00	105,000.00	Paper, Stationary, Media and so on
3	Furniture for Project Office	0.00	50,000.00	25,000.00	10,000.00	85,000.00	Desk, Chair, Curtain, Trash Can and so on
4							
5							
6							
7							
8							
9							
10							
Total		0.00	392,200.00	412,800.00	397,800.00	1,202,800.00	

Annex 2

Revised Versions of PDM

Project Design Matrix (PDM)

Project Title (provisional): Project on Development of Efficient Irrigation Techniques and Extension in Syria — Project Period: 2005 ~ 2007

Target Area: to be decided — Target group: Agricultural engineers, extension workers, and farmers in the pilot area(s) — Version 0.0

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Super Goal: Sustainable irrigation water use is achieved in each basin in Syria	???		
Overall Goal: Water use in the farmers' fields around the pilot area(s) is reduced.	Elaborated water management method is replicated in and around the pilot area(s).	- Field survey	Population of Syria will not increase more than projected. Severe drought will not occur.
Project Purpose: Proper amount of irrigation water is used for each crop in the pilot area(s).	1) Total amount of irrigated water in the model area(s) decreased xx %. 2) Crop production remains at the same level as before the commencement of the Project	- Field measurement (irrigation pump operation hour, etc.) - Survey to farmers	Price of modern irrigation equipment does not rise sharply.
Outputs: (1) On-farm water management method and research are elaborated according to the local conditions in the pilot area(s). (2) Agricultural engineers, extension workers and core farmers assigned in the pilot area(s) are able to transfer knowledge to farmers in terms of on-farm management method. (3) Farmers in the pilot area(s) are capable of executing efficient irrigation for each crop independently through the extension activities.	(1)-1: Total amount of irrigated water in the pilot plot(s) decreased xx%. (1)-2: Design standard and on-farm irrigation manuals are prepared. (2)-1: xx% of trainees (agricultural engineers and extension workers) reaches the expected achievement level of each training items. (2)-2: Farmers are satisfied with the skill and knowledge of agricultural engineers extension workers and core farmers (3)-1: Irrigation equipment is properly installed and operated in the farmers' fields in the pilot area(s). (3)-2: Farmers recognize the appropriate volume of water use for irrigation for crops (3)-3: Farmers understand the significance of water saving.	(1)-1: Field measurement (1)-2:Review of Contents and quality of the documents (2)-1: Achievement test, interview, etc. (2)-2:Observation and monitoring of the degree of usage of attained knowledge and skills in the field. (3)-1:Review of contents and quality of extension materials / field observation. (3)-2: Interviews to farmers (3)-3: Interviews to farmers	

Project Design Matrix (PDM)

Project Title (provisional): Project on Development of Efficient Irrigation Techniques and Extension in Syria — Project Period: 2005 ~ 2007

Target Area: to be decided — Target group: Agricultural engineers, extension workers, and farmers in the pilot area(s) — Version 0.0

Activities:	**Inputs**		
	Japanese Side:	Syrian Side:	
(1)-1 Review of the past and existing research activities of ANRR. (1)-2 Conduct preliminary study on the selection of the pilot area(s). (1)-3 Conduct base-line survey of the pilot area(s). (eg. Field measurement of salinity) (1)-4 Selection of farmers for water management by farmer groups. (1)-5 Prepare detailed plan of operation. (1)-6 Establishment of the pilot demonstration farms. (1)-7 Conduct feasibility study in terms of the pilot demonstration farms. (2)-1 Review the past and present training activities. (2)-2 Identify needs and existing problems in terms of training activities. (2)-3 Establish practical training curriculum and teaching materials. (3)-1 Review the past and present extension activities. (3)-2 Identify needs and existing problems in terms of extension activities. (3)-3 Modify and improve the extension materials.	1. Dispatch of Japanese experts (1) Long-term experts *Irrigation & Drainage *Agricultural extension *Training, etc. (2) Short-term experts as required 2. Provision of equipment 3. Training 1) Counterpart Training in Japan - 1 to 2 persons per year 2) External training and/or study tour in neighboring countries. 3) Internal training	1. Personnel assignment of counterparts 2. Provision of facilities and equipment - Head quaters of ANRR, including office space for Japanese experts. - Existing research, extension and training facilities and equipment. 3. Local cost Project implementation cost - Recurrent cost for the project	**Pre-conditions:** 1. Security is maintained in the target area. 2. Farmers' cooperation and active participation to the project.

Project Design Matrix (PDM)

Project Title : Project on Development of Efficient Irrigation Techniques and Extension in Syria — Project Period: March 2005 – March 2008

Target Area: Rural Damascus, Dara and Hama Provinces — Target group: Irrigation engineers, extension workers, and farmers in the project areas — Version 1.0

Date: March 2005

Narrative Summary	Objectively Verifiable Indicators	Means of Verification	Important Assumptions
Super Goal: Sustainable irrigation water use is achieved in the basins concerned.	1) Total amount of irrigated water in the basin decreased xx % by the end of 20XX.	- Field measurement in the areas - Investigations/questionnaire to farmers	---
Overall Goal: Water use efficiency is improved, and water loss is reduced in the farmers' fields of project areas.	1) Total amount of irrigated water in the project areas decreased xx % by the end of 20XX. 2) Crop production in the project areas is sustained (and/or improved) after the commencement of the Project.	- Field measurement in the areas - Investigations/questionnaire to farmers	The efficient irrigation techniques are spread widely within the basins concerned. Farmers within the basins can purchase modern irrigation equipment easily as required in terms of quality and quantity.
Project Purpose: Proper amount of irrigation water is used for each crop in the project sites, through providing adequate supports by strengthened training/extension activities.	1) Total amount of irrigated water in the project sites decreased xx % by the completion of the project. 2) Crop production in the project sites remains at the same level as before the commencement of the Project	- Field measurement at the sites - Investigations/questionnaire to farmers at the sites	The outcomes obtained in the project spread and are utilized properly within the project areas. Farmers in the project areas can purchase modern irrigation equipment easily as required in terms of quality and quantity.
Outputs: (1) Proper on-farm water management method is elaborated according to the local conditions in the project sites. (2) Irrigation engineers, extension workers and core farmers concerning the project, are able to transfer knowledge to farmers in terms of on-farm water management method. (3) Farmers in the project areas are guided so as to adopt efficient irrigation for each crop individually through providing extension services.	(1)-1: Manuals on design standard of efficient irrigation system and on-farm irrigation management are prepared and used by the relevant personnel. (2)-1: xx% of the trainees (irrigation engineers and extension workers) reaches the expected achievement level of each training item. (2)-2: Farmers are satisfied with skill and knowledge of irrigation engineers and extension workers in the project sites. (3)-1: Irrigation equipment for efficient irrigation are properly installed and operated in more than xx farmers' plots in the project sites. (3)-2: More than xx% of farmers recognizes the appropriate volume of irrigation water for each crop in the project sites. (3)-3: More than xx% of farmers understands the significance of water saving in the project areas.	(1)-1: Inspection for using condition of the prepared manuals and documents (2)-1: Achievement test and interview. (2)-2: Observation and monitoring on the farmers' opinion. (3)-1: Field observation (3)-2:Interviews/questionnaire to the farmers (3)-3:Interviews/questionnaire to the farmers	Farmers in the project sites can purchase modern irrigation equipment easily as required in terms of quality and quantity. Trained irrigation engineers and extension workers do not leave from their duty. Marketing condition in the project sites do not aggravate drastically.

Project Design Matrix (PDM)

Project Title : Project on Development of Efficient Irrigation Techniques and Extension in Syria — Project Period: March 2005 – March 2008

Target Area: Rural Damascus, Daraa and Hama Governorates — Target group: Irrigation engineers, extension workers, and farmers in the project areas — Version 2.0

Date: October 2007

	(3)-3: More than 50% of farmers understands the significance of water saving in the project areas.		
Activities: (1)-1 Review past and present research activities of ANRR. (1)-2 Conduct a baseline survey of the project areas in which project sites are located. (1)-3 Conduct a preliminary study on the selection of the project sites. (1)-4 Prepare the detailed plan of operation of the project. (1)-5 Organize farmers' group(s) for introducing group water management, if necessary. (1)-6 Establish the (pilot) demonstration farms in the project sites. (1)-7 Investigate suitable modern water-saving irrigation method for the project areas. (1)-8 Prepare manuals and/or guidelines on the efficient irrigation techniques. (2)-1 Review past and present training activities. (2)-2 Identify needs and confronted problems in terms of training activities. (2)-3 Improve the training curriculum and teaching materials. (2)-4 Carry out the training courses to the irrigation engineers and extension workers concerned. (3)-1 Review past and present extension activities. (3)-2 Identify needs and confronted problems in terms of extension activities.	**Inputs** Japanese Side: 1. Dispatch of Japanese experts (1) Long-term experts - Irrigation/Leader - Agricultural extension - Training (2) Short-term experts - Agricultural economy/Agronomy - Irrigation system - Socio-economy - Irrigation water management 2. Provision of equipment - Cars to be used in the project - Office equipment to be used in the project - Audiovisual aids for training activities - Equipment for extension activities - Equipment and instrument for establishment of the demonstration farms 3. Training 1) Counterpart Training in Japan - 1 to 2 persons a year 2) Training and/or study tour of the third countries. 3) Training in Syria	Syrian Side: 1. Assignment of counterparts personnel 2. Provision of facilities and equipment - Rooms and spaces necessary for installation and storage of the equipment provided by Japanese side. - Office spaces for the project team in the head quarters of ANRR and in each project area. - Existing research, extension and training facilities and equipment. 3. Local cost Project implementation cost - Recurrent cost for the project	Availability of water resource in the project areas dose not change drastically. Farming circumstances in the project areas do not aggravate significantly.