E.4 Animal Husbandry

1. Animal Husbandry in Master Plan Area

In Study Area, almost one each of cattle, water buffalo, sheep are raised according to the agricultural census data in 1989/90. Respectively 74% of cattle and 90% of buffaloes are female, producing baby and milk.(refer to E.4.1 and E.4.2).

2. Animal Husbandry in Priority Area

In Priority Area, on the average two or three heads of water buffalo and cows as total are raise by a farmer according to the result of Farm Economy Survey in Priority Area(refer to E.4.3)

E.5 Agricultural Supporting Services

1. Agricultural Supporting

The approach of demand driven IIP should be taken through full participation of farmers as well as strengthening the supporting organization not only from MPWWR but also from MALR. The farmers organization of WUA Federation shall be organized to utilize the timely and adequately irrigation in the line of hydraulic decentralization.(refer to E.5.2,E.5.3and E.5.4)

2. Improvement of Land Leveling

Presently, the land leveling by laser beam is applied mostly only by large scaled landowners because the employed land leveling technology is suitable for the large scaled plots. Majority of the farmers are small scaled farmers, who cultivate less than three feddan(1.3 ha). There are about 62 % of sample farmers who are interested in land leveling by laser beam according to Farm Economy Survey in Priority Area. However, most of the farmers may have a difficulty to apply the technology in their farms, because the existing land leveling is not efficient in the small plots. Recently the land leveling technology is developed for the small scaled plots , of which the operation area has increased. This land leveling employs the mounting typed land leveler with three point links, having efficient operation in the small scaled plots. There is a possibility to drive the leveler by the ordinal tractors which are introduced widely in Study Area. (refer to Table E.5.1)

3. Organization of Ministry of Agriculture and Land Reclamation

The organization of the Ministry of Agriculture and Land Reclamation at central and Governorate level is shown respectively in Figure E.5.5 and Figure E.5.6.

Table E.1.1 Distribution of Agricultural Land Owner by Category of Size (1996/97)

Governorate/District	Item	Less than 1fed.	1～3fed.	3～4fed.	5～10fed.	10～50fed.	50～100fed.	100fed. and over	Total	Average Size (fed)
A. Upstream										
(1) Zifta	Area	13,666	19,737	3,538	2,062	723	423	1,159	41,308	1.0
	No. of Owners	29,761	11,548	586	157	29	13	10	42,104	
(2) Samanoud	Area	7,124	12,093	2,616	1,885	680	409	344	25,151	1.2
	No. of Owners	14,021	6,002	393	148	28	13	7	20,612	
(3) El Mahalla Kubra	Area	13,658	35,228	10,045	8,797	2,982	971	3,717	75,398	1.6
	No. of Owners	29,105	17,284	1,508	576	123	28	1	48,625	
Subtotal	Area	34,448	67,058	16,199	12,744	4,385	1,803	5,220	141,857	1.3
	No. of Owners	72,887	34,834	2,487	881	180	54	18	111,341	
B. Midstream										
(1) Sherbinn	Area	8,356	15,225	8,779	7,393	10,719	0	0	50,472	1.7
	No. of Owners	16,377	9,774	2,488	1,196	637	0	0	30,472	
(2) Talkha	Area	6,025	11,731	3,212	2,670	4,875	0	0	28,513	1.3
	No. of Owners	12,851	7,986	917	391	284	0	0	22,429	
(3) Biyala	Area	4,492	15,543	7,172	8,067	8,318	0	0	43,592	2.2
	No. of Owners	8,225	8,601	1,487	1,176	467	0	0	19,956	
Subtotal	Area	18,873	42,499	19,163	18,130	23,912	0	0	122,577	1.7
	No. of Owners	37,453	26,361	4,892	2,763	1,388	0	0	72,857	
C. Downstream										
(1) Bilqas	Area	4,998	20,099	12,582	14,681	17,423	0	0	69,783	2.6
	No. of Owners	9,103	11,358	3,412	2,232	973	0	0	27,078	
(2) El Hamoul	Area	2,013	8,934	6,848	7,528	4,539	0	0	29,862	2.6
	No. of Owners	3,407	5,097	1,610	1,106	269	0	0	11,489	
(3) Burullus	Area	556	5,809	4,994	6,543	4,243	0	0	22,145	3.5
	No. of Owners	883	2,904	1,257	961	256	0	0	6,261	
(4) Kafr Soad	Area	7,605	18,576	9,235	9,141	8,109	905	6,352	59,923	2.2
	No. of Owners	12,320	10,032	2,966	1,603	584	15	1	27,521	
(5) Damietta	Area	2,356	4,270	2,265	2,302	2,741	0	0	13,934	1.4
	No. of Owners	6,746	2,421	585	323	144	0	0	10,219	
Subtotal	Area	17,528	57,688	35,924	40,195	37,055	905	6,352	195,647	2.4
	No. of Owners	32,459	31,812	9,830	6,225	2,226	15	1	82,568	
Total	Area	70,849	167,245	71,286	71,069	65,352	2,708	11,572	460,081	1.7
	No. of Owners	142,799	93,007	17,209	9,869	3,794	69	19	266,766	
		(53.6%)	(34.9%)	(6.4%)	(3.7%)	(1.4%)	(0.0%)	(0.0%)	(100.0%)	

Source : MALR

Table E. 1. 2 Cultivated Area and Number of Land Holdings (1989/90)

Item	Upstream				Midstream				Downstream						Total
	Gharbia			Subtotal	Dakahlia		K. El. S	Subtotal	Dakahlia	Kafr El Sheikh		Damietta		Subtotal	
	Zifta	Samanoud	El Mahalla Kubra		Sherbin	Talkha	Biyala		Bilqas	El Hamoul	Burullus	Kafr Saad	Damietta		
1. Total area (fed)	44, 297	30, 467	92, 820	167, 574	64, 290	63, 380	57, 403	176, 073	106, 743	74, 947	32, 501	62, 292	14, 683	290, 166	632, 813
2. Cultivated area (fed)	44, 043	30, 288	92, 366	166, 697	64, 113	63, 167	56, 745	174, 026	103, 743	72, 187	27, 901	61, 726	13, 430	278, 987	619, 709
- Crops/Vegetables	36, 911	26, 024	89, 358	161, 293	62, 808	61, 383	56, 317	170, 508	101, 471	71, 889	26, 771	64, 812	12, 389	267, 332	599, 133
- Fruit& Other Trees	8, 132	4, 264	3, 008	15, 404	1, 305	1, 784	428	3, 517	2, 272	298	1, 130	6, 914	1, 041	11, 655	30, 576
3. No. of Holding	28, 540	16, 758	37, 787	83, 086	16, 917	32, 109	15, 094	64, 120	22, 406	17, 200	6, 468	15, 934	5, 746	67, 754	214, 959
- Fully owned	20, 455	10, 836	19, 379	50, 670	12, 977	22, 296	10, 494	45, 767	19, 257	15, 245	5, 715	13, 599	3, 128	56, 944	153, 381
- Rented (Cash)	2, 944	3, 224	9, 265	15, 433	1, 555	6, 205	527	8, 497	555	836	339	550	1, 525	3, 925	27, 855
- Rented (Other Types)	36	22	454	512	799	407	2, 138	3, 344	1, 054	550	3	591	40	2, 348	6, 204
- Others & Associated	5, 105	2, 676	8, 689	16, 470	1, 484	3, 201	1, 835	6, 520	1, 530	469	411	1, 084	1, 052	4, 536	27, 526
4. Personally Owend															
- Area (fed)	44, 297	30, 467	92, 820	167, 574	64, 272	63, 285	57, 403	174, 960	104, 793	74, 831	31, 473	62, 269	13, 897	287, 263	629, 797
- No. of Owners	28, 530	16, 750	37, 769	83, 049	16, 908	32, 141	15, 091	64, 140	22, 390	17, 190	6, 464	15, 916	5, 737	67, 697	214, 886
- Area per owner (fed)	1, 5	1, 8	2, 5	2, 0	3, 2	2, 0	3, 8	2, 7	4, 7	4, 4	4, 9	3, 9	2, 4	4, 2	2, 9

Source : Agricultural Census, 1990

Table E.1.3 Cropping Intensity (1995/96)

Area	Cultivable Area a (fed)	Total of Cropped Area b=c+g (fed)	Annual Crop Area: Subtotal c=d+e+f (fed)	Winter d (fed)	Summer e (fed)	Nile f (fed)	Orchard g (fed)	Cropping Intensity h=b/a x 100 (%)	Rice Area i	% of Rice Area j=i/(a-g) x100
A. Upstream										
1. Gharbia										
(1) Zifta	43,626	80,687	75,090	38,612	35,748	730	5,597	185	3,729	9
(2) Samanoud	29,422	54,480	51,240	22,801	27,037	1,402	3,240	185	13,631	46
(3) El Mahalla Kubra	91,523	166,896	165,156	70,470	89,846	4,840	1,740	182	44,713	49
Subtotal	164,571	302,063	291,486	131,883	152,631	6,972	10,577	184	62,073	38
B. Midstream										
1. Dakahlia										
(1) Sherbin	59,806	114,307	113,846	54,079	56,350	3,417	461	191	31,250	52
(2) Talkha	62,176	122,455	121,700	56,123	63,329	2,248	755	197	30,145	48
2. Kafr El Sheikh										
(1) Biyala	77,023	108,776	108,562	55,652	48,320	4,590	214	141	30,145	39
Subtotal	199,005	345,538	344,108	165,854	167,999	10,255	1,430	174	91,540	46
C. Downstream										
1. Dakahlia										
(1) Bilqas	178,530	161,943	161,235	53,542	105,072	2,621	708	91	31,145	17
2. Kafr El Sheikh										
(1) El Hamoul	133,056	185,852	185,651	96,023	89,600	28	201	140	40,837	31
(1) El Burullus	45,736	37,250	34,295	16,337	13,204	4,754	2,955	81	1,077	2
3. Damietta										
(1) Kafr Saad	76,054	104,381	99,416	49,294	44,539	5,583	4,965	137	29,091	38
(2) Damietta	23,400	25,037	24,186	13,746	8,408	2,032	851	107	8,037	34
Subtotal	456,776	514,463	504,783	228,942	260,823	15,018	9,680	113	110,187	24
Total	820,352	1,162,064	1,140,377	526,679	581,453	32,245	21,687	142	263,800	32

Source : MALR

Table E.1.4 Aea by Crop (1996), Winter

(Unit: feddan)

Crop	Upstream				Midstream				Downsream						Ground Total
	Gharbia			Total	Dakahlia		K.El S	Total	Dakahlia	Kafr El Sheikh		Damietta		Total	
	Zifta	Samanoud	El Mahalla Kubra		Sherbeen	Talkha	Biyala		Bilqas	El Hamoul	Burullus	Kafr Saad	Damietta		
Total	38,612	22,801	70,470	131,883	54,079	56,123	55,652	165,854	53,542	96,023	16,337	48,346	13,757	228,005	525,742
1. Barley	0	0	0	0	27	0	11	38	4	2,265	0	1	0	2,270	2,308
2. Beets	0	0	1,006	1,006	0	234	4,099	4,333	2,634	12,744	552	353	4	16,287	21,626
3. Beans	647	75	2,819	3,541	4,419	379	5,551	10,349	9,514	2,533	320	5,881	79	18,327	32,217
4. Chickpeas	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5. Fenugreek	0	0	0	0	0	0	5	5	0	0	0	0	0	0	5
6. Garic	6	8	25	39	84	166	3	253	15	0	0	118	0	133	425
7. Lentil	10	0	3	13	25	0	296	321	0	0	0	0	0	0	334
8. Flax (Fiber)	947	877	1,440	3,264	672	47	119	838	277	1,771	150	578	0	2,776	6,878
9 Onion dry	1,375	79	746	2,200	61	195	292	548	0	507	0	22	0	529	3,277
10. Onion fresh	0	0	0	0	0	0	0	0	55	0	0	13	7	75	75
11. Vegetables	337	1,117	980	2,434	1,065	858	632	2,555	436	2,513	5,297	2,799	1,074	12,119	17,108
12. Wheat	13,635	7,623	32,637	53,895	21,036	18,688	21,017	60,741	37,540	21,570	6,812	10,635	689	77,246	191,882
13. Clover (Long)	13,917	9,576	20,462	43,955	16,740	21,560	16,766	55,066	341	32,223	2,872	16,439	11,904	63,779	162,800
14. Clover (Short)	7,016	2,471	10,035	19,522	7,824	13,996	6,861	28,681	2,367	19,897	334	11,507	0	34,105	82,308
15. Potato&Others	722	975	317	2,014	2,126	0	0	2,126	359	0	0	0	0	359	4,499

Source :MALR

Table E. 1. 5 Area by Crop (1996), Summer

(Unit: feddan)

Crop	Upstream				Midstream				Downstream						Ground Total
	Gharbia			Total	Dakahlia		K. El S.	Total	Dakahlia	Kafr El Sheikh		Damietta		Total	
	Zifta	Samanoud	El Mahalla Kubra		Sherbin	Talkha	Biyala		Bilqas	El Hamoul	Burullus	Kafr Saad	Damietta		
Total	35,748	27,037	89,846	152,631	56,350	63,329	48,320	167,999	105,072	89,600	13,204	44,539	8,408	260,823	581,453
1. Cotton	6,580	4,136	22,307	33,023	14,326	14,705	12,246	41,277	38,982	30,676	1,450	13,384	0	84,492	158,792
2. Maize	23,109	7,397	20,701	51,207	7,321	11,274	4,624	23,219	2,281	11,182	4,944	2,136	152	20,695	95,121
3. Potatos	1,141	1,185	852	3,178	1,471	4,373	47	5,891	820	13	10	369	41	1,253	10,322
4. Rice	3,729	13,631	44,713	62,073	31,260	31,145	31,145	93,540	58,704	40,837	1,090	25,849	7,141	133,621	289,234
5. Soybean	31	24	49	104	40	0	45	85	4	0	20	0	0	24	213
6. Sugarcane	717	24	33	774	81	29	35	145	96	19	0	2	0	117	1,036
7. Vegetables	441	640	1,191	2,272	1,861	1,803	178	3,842	4,185	6,873	6,690	2,799	1,074	20,621	26,735

Source :MALR

Table E. 1. 6 Area by Crop (1996), Main Nile

(Unit: feddan)

Crop	Upstream				Midstream				Downstream						Ground Total
	Gharbia			Total	Dakahlia		K. El S.	Total	Dakahlia	Kafr El Sheikh		Damietta		Total	
	Zifta	Samanoud	El Mahalla Kubra		Sherbin	Talkha	Biyala		Bilqas	El Hamoul	Burullus	Kafr Saad	Damietta		
Total	730	1,402	4,840	6,972	3,417	2,248	4,590	10,255	2,621	28	4,754	6,583	2,032	15,018	32,245
1. Maize	280	752	3,490	4,522	2,278	2,023	3,265	7,566	2,023	0	0	4,325	1,298	7,646	19,734
2. Potatos	350	250	100	700	772	225	1,068	2,065	62	28	0	0	56	146	2,911
3. Vegetables	100	400	1,250	1,750	367	0	257	624	536	0	4,754	1,258	678	7,226	9,600

Source :MALR

Table E.1.7 Aea by Fruit Crops (1996)

(Unit: feddan)

Crop	Upstream				Midstream				Downsream						Ground Total
	Gharbia			Total	Dakahlia		K.El S	Total	Dakahlia	Kafr El Sheikh		Damietta		Total	
	Zifta	Samanoud	El Mahalla Kubra		Sherbin	Talkha	Biyala		Bilqas	El Hamoul	Burullus	Kafr Saad	Damietta		
Total	5,597	3,240	1,740	10,577	461	755	293	1,509	708	201	2,955	4,965	851	9,680	21,766
1. Apple	32	62	48	142	0	0	0	0	0	0	0	2	1	3	145
2. Appricots	0	0	12	12	11	68	0	79	8	0	0	0	0	8	99
3. Banana	104	153	80	337	174	366	0	540	0	0	0	2	1	3	880
4. Grape	1,990	513	819	3,322	44	56	22	122	117	41	1	317	0	476	3,920
5. Guava	33	54	57	144	6	6	4	16	2	15	2,868	4,342	32	7,259	7,419
6. Lemon	108	1	18	127	0	0	1	1	0	1	4	266	758	1,029	1,157
7. Mangoes	7	0	34	41	0	0	1	1	0	0	11	3	12	26	68
8. Orange	3,271	2,267	654	6,192	226	259	250	735	390	124	31	8	8	561	7,488
9. Peaches	52	62	0	114	0	0	0	0	0	0	0	3	5	8	122
10. Pears	0	128	18	146	0	0	15	15	0	0	0	20	13	33	194
11. Plum	0	0	0	0	0	0	0	0	191	20	33	0	0	244	244
12. Others	0	0	0	0	0	0	0	0	0	0	7	2	21	30	30

Source : MALR

Table E.1.8 Permitted and Actual Area of Rice Cultivation

(Unit:feddan)

Governorate	1997		1996		1995		1994		1993		1992		1991	
	Actual	Permitted	Actual	Permitted	Actual	Permitted	Actual	Permitted	Actual	Permitted	Actual	Permitted	Actual	Permitted
1. Ghalbia	160,722	79,905	118,160	79,905	151,184	100,093	132,216	100,093	124,567	75,053	91,141	75,053	98,385	70467
2. Dakahlia	429,991	292,539	395602	292,526	404,473	297,735	364,478	298,835	382,183	298,835	368,868	298,835	343,163	298835
3. Kafr El Sheikh	321,980	303,777	283,699	202,777	305,038	285,510	259,927	285,510	255,053	277,879	307,283	277,828	297,921	277828
4. Damiettaa	66,031	53,088	66,947	53,077	24,044	52,077	67,444	53,088	65,373	53,088	65,346	63,088	60,452	53088
Total	978,724	729,309	864,408	628,285	884,739	735,415	824,065	737,526	827,176	704,855	832,638	714,804	799,921	700,218
Whole Egypt	1,565,933	1,086,530	1,418,287	1,086,530	1,501,285	1,084,760	1,318,121	1,084,760	1,328,262	1,057,039	1,315,618	1,046,715	1,222,056	1015129

Source:MPWWR

Table E.1.9 Present Cropping Area (M/P Area)

Item	Upstream		Midstream		Downstream		Total
	Area (fed)	Intensity (%)	Area (fed)	Intensity (%)	Area (fed)	Intensity (%)	Area (fed)
1. Cultivated Area	167,400		223,900		303,900		695,200
2. Cropped Area							
Winter Season							
(1) Wheat	61,940	37	69,410	31	66,860	22	198,210
(2) Broad bean	5,020	3	13,430	6	15,200	5	33,650
(3) Winter Crops	5,020	3	6,720	3	15,200	5	26,940
(4) Long Berseem	50,220	30	53,740	24	54,700	18	158,660
(5) Short Berseem	26,780	16	49,260	22	60,780	20	136,820
(6) Vegetables	8,370	5	6,720	3	12,160	4	27,250
Subtotal	157,350	94	199,280	89	224,900	74	581,530
Summer Season							
(1) Cotton	31,810	19	49,260	22	60,780	20	141,850
(2) Maize	55,240	33	35,820	16	30,390	10	121,450
(3) Rice	61,940	37	109,710	49	100,290	33	271,940
(4) Summer Vegetables	8,370	5	15,670	7	21,270	7	45,310
Subtotal	157,360	94	210,460	94	212,730	70	580,550
Orchard	10,044	6	2,240	1	6,080	2	18,364
(Double Counting for Orchard)		(200)		(135)		(148)	
Total	324,754	194	411,980	184	443,710	146	1,180,444

Note: The representative crops of winter crops and vegetables in winter and summer seasons are as follows;
- Winter crops in upstream and midstream.....flax
- Winter crops in downstream..... sugar beet
- Vegetables in winter season in the whole area....onion
- Vegetables in summer season in the whole area....tomato
- Orchard.....orange

Source: Study Team

Table E.1.10 Proposed Cropping Area(200%)

Crop	Upstream		Midstream		Downstream		Total
	Area (fed)	Intensity (%)	Area (fed)	Intensity (%)	Area (fed)	Intensity (%)	Area (fed)
1. Cultivated Area	167,400		223,900		303,900		695,200
2. Cropped Area							
Winter Season							
(1) Wheat	70,310	42	76,130	34	91,170	30	237,610
(2) Broad bean	5,020	3	4,480	2	21,270	7	30,770
(3) Winter Crops	5,020	3	6,720	3	18,230	6	29,970
(4) Long Berseem	41,850	25	60,450	27	69,900	23	172,200
(5) Short Berseem	20,090	12	51,500	23	66,860	22	138,450
(6) Vegetables	15,070	9	22,390	10	30,390	10	67,850
Subtotal	157,360	94	221,670	99	297,820	98	676,850
Summer Season							
(1) Cotton	31,810	19	49,260	22	66,860	22	147,930
(2) Maize	83,700	50	94,040	42	60,780	20	238,520
(3) Rice	26,780	16	47,020	21	100,290	33	174,090
(5) Sunflower	-	-	-	-	24,310	8	24,310
(4) Summer Vegetables	15,070	9	31,350	14	45,590	15	92,010
Subtotal	157,360	94	221,670	99	297,830	98	676,860
Orchard	10,040	6	2,240	1	6,080	2	18,360
(Double Counting for Orchard)		(200)		(200)		(200)	
Total	324,760	194	445,580	199	601,730	198	1,372,070

Note: The representative crops of winter crops and vegetables in winter and summer seasons are as follows;
Winter crops in upstream and midstream.....flax
Winter crops in downstream..... sugar beet
Vegetables in winter season in the whole area....onion
Vegetables in summer season in the whole area....tomato
Orchard.....orange
Source: Study Team

Table E.1.11 Proposed Cropping Area(170%)

Crop	Upstream		Midstream		Downstream		Total
	Area (fed)	Intensity (%)	Area (fed)	Intensity (%)	Area (fed)	Intensity (%)	Area (fed)
1. Cultivated Area	167,400		223,900		303,900		695,200
2. Cropped Area							
Winter Season							
(1) Wheat	70,310	42	76,130	34	85,090	28	231,530
(2) Broad bean	5,020	3	4,480	2	21,270	7	30,770
(3) Winter Crops	5,020	3	6,720	3	18,230	6	29,970
(4) Long Berseem	41,850	25	60,450	27	69,900	23	172,200
(5) Short Berseem	20,090	12	51,500	23	66,860	22	138,450
(6) Vegetables	15,070	9	22,390	10	30,390	10	67,850
Subtotal	157,360	94	221,670	99	291,740	96	670,770
Summer Season							
(1) Cotton	31,810	19	49,260	22	36,470	12	117,540
(2) Maize	83,700	50	94,040	42	27,350	9	205,090
(3) Rice	26,780	16	47,020	21	100,290	33	174,090
(5) Sunflower	-	-	-	-	18,230	6	18,230
(4) Summer Vegetables	15,070	9	31,350	14	30,390	10	76,810
Subtotal	157,360	94	221,670	99	212,730	70	591,760
Orchard	10,040	6	2,240	1	6,080	2	18,360
(Double Counting for Orchard)		(200)		(200)		(170)	
Total	324,760	194	445,580	199	510,550	168	1,280,890

Note: The representative crops of winter crops and vegetables in winter and summer seasons are as follows;
Winter crops in upstream and midstream.....flax
Winter crops in downstream..... sugar beet
Vegetables in winter season in the whole area....onion
Vegetables in summer season in the whole area....tomato
Orchard.....orange

Source: Study Team

Table E.1.12 Present Cropping Pattern(F/S Area)

Item	Upstream		Midstream		Downstream		Total	
	%	Area	%	Area	%	Area	%	Area
1. Cultivated Area		10,500		20,600		25,800		56,900
2. Area by Crop								
Winter								
(1) Wheat	37	3,890	40	8,240	33	8,510	36	20,640
(2) Broadbean	7	740	10	2,060	5	1,290	7	4,090
(3) Sugarbeeet	4	420	7	1,440	13	3,350	9	5,210
(4) Berseem, Long	26	2,730	20	4,120	17	4,390	20	11,240
(5) Berseem, Short	16	1,680	22	4,530	29	7,480	24	13,690
(6) Vegetables(Onion)	9	950	1	210	3	770	3	1,930
Subtotal	99	10,410	100	20,600	100	25,790	100	56,800
Summer and Nile								
(1) Maize	6	630	7	1,440	9	2,320	8	4,390
(2) Cotton	16	1,680	11	2,270	29	7,480	20	11,430
(3) Rice	60	6,300	58	11,950	45	11,610	52	29,860
(3) Water Melon Seeds	10	1,050	21	4,330	14	3,610	16	8,990
(4) Vegetables(Tomato)	7	740	3	620	3	770	4	2,130
Subtotal	99	10,400	100	20,610	100	25,790	100	56,800
Orchard								
(1) Citrus(Orange)	1	110	0	0	0	0	0	110
Total	199	20,920	200	41,210	200	51,580	200	113,710

Note: The crops in the parenthesis show the representative crops

Table E.1.13 Proposed Cropping Pattern(F/S Area, Case 1)

Item	Upstream		Midstream		Downstream		Total	
	%	Area	%	Area	%	Area	%	Area
1. Cultivated Area		10,500		20,600		25,800		56,900
2. Area by Crop								
Winter								
(1) Wheat	37	3,890	40	8,240	33	8,510	36	20,640
(2) Broadbean	7	740	10	2,060	5	1,290	7	4,090
(3) Sugarbeeet	4	420	7	1,440	13	3,350	9	5,210
(4) Berseem, Long	19	2,000	13	2,680	12	3,100	14	7,780
(5) Berseem, Short	16	1,680	22	4,530	29	7,480	24	13,690
(6) Vegetables(Onion)	16	1,680	8	1,650	8	2,060	9	5,390
Subtotal	99	10,410	100	20,600	100	25,790	100	56,800
Summer and Nile								
(1) Maize	21	2,210	22	4,530	20	5,160	21	11,900
(2) Cotton	16	1,680	11	2,270	29	7,480	20	11,430
(3) Rice	38	3,990	37	7,620	29	7,480	34	19,090
(3) Water Melon Seeds	10	1,050	19	3,910	14	3,610	15	8,570
(4) Vegetables(Tomato)	14	1,470	11	2,270	8	2,060	10	5,800
Subtotal	99	10,400	100	20,600	100	25,790	100	56,790
Orchard								
(1) Citrus(Orange)	1	110	0	0	0	0	0	110
Total	199	20,810	200	41,200	200	51,580	200	113,700

Note: The crops in the parenthesis show the representative crops

Table E.1.14 Proposed Cropping Pattern(F/S Area, Case 2)

Item	Upstream		Midstream		Downstream		Total	
	%	Area	%	Area	%	Area	%	Area
1. Cultivated Area		10,500		20,600		25,800		56,900
2. Area by Crop								
Winter								
(1) Wheat	37	3,890	40	8,240	33	8,510	36	20,640
(2) Broadbean	7	740	10	2,060	5	1,290	7	4,090
(3) Sugarbeeet	4	420	7	1,440	13	3,350	9	5,210
(4) Berseem, Long	19	2,000	13	2,680	12	3,100	14	7,780
(5) Berseem, Short	16	1,680	22	4,530	29	7,480	24	13,690
(6) Vegetables(Onion)	16	1,680	8	1,650	8	2,060	9	5,390
Subtotal	99	10,410	100	20,600	100	25,790	100	56,800
Summer and Nile								
(1) Maize	32	3,360	33	6,800	30	7,740	31	17,900
(2) Cotton	16	1,680	11	2,270	29	7,480	20	11,430
(3) Rice	27	2,840	26	5,360	19	4,900	23	13,100
(3) Water Melon Seeds	10	1,050	19	3,910	14	3,610	15	8,570
(4) Vegetables(Tomato)	14	1,470	11	2,270	8	2,060	10	5,800
Subtotal	99	10,400	100	20,610	100	25,790	100	56,800
Orchard								
(1) Citrus(Orange)	1	110	0	0	0	0	0	110
Total	199	20,810	200	41,210	200	51,580	200	113,710

Note: The crops in the parenthesis show the representative crops

Table E.2.1 Crop Unit Yield by Area (M/P Area 1994/95-1996/97)

Area	Wheat (ardab) (150kg)	Broad-bean (ardab) (155kg)	Sugar-beet (ton)	Flax (ton)	Vegetables (Onion) (ton)	Berseem (Long) (ton)	Berseem (Short) (ton)	Cotton (kantar) (157.5kg)	Maize (ardab) (140kg)	Rice (ton)	Vegetables (Tomato) (ton)	Orange (ton)
1. Upstream												
- Zifta	17.38	9.79	-	2.90	8.70	25.36	9.56	5.68	18.50	3.58	13.12	9.45
- Samanoud	18.27	10.30	-	2.63	13.32	23.41	7.18	6.18	19.98	3.42	10.03	9.05
- El Mahalla Kubra	17.20	10.26	26.06	2.63	12.13	26.47	7.18	6.28	19.84	3.36	9.70	8.30
Average	17.62	10.12	26.06	2.72	11.38	25.08	7.97	6.05	19.44	3.45	10.95	8.93
(ton/ha)	6.29	3.73	62.05	1.91	27.10	59.71	18.98	2.27	6.48	8.22	26.07	21.27
2. Midstream												
- Sherbin	16.63	9.17	21.26	1.06	7.06	21.83	8.26	5.53	17.34	3.15	10.14	8.04
- Talkha	17.36	8.46	20.84	1.11	8.99	23.18	7.02	5.33	17.64	3.08	9.20	8.39
- Biyala	16.75	10.62	17.70	0.87	7.32	18.38	12.24	6.02	20.14	3.07	10.54	11.00
Average	16.91	9.42	19.93	1.01	7.79	21.13	9.17	5.63	18.37	3.10	9.96	9.14
(ton/ha)	6.04	3.36	47.46	2.32	18.55	50.31	21.84	2.11	6.12	7.38	23.71	21.77
3. Downstream												
- Bilqas	16.35	8.80	20.27	1.05	6.48	22.23	7.19	5.39	19.87	3.61	7.33	7.49
- El Hamoul	16.00	8.99	16.54	0.70	5.78	22.95	10.13	4.89	15.00	3.17	12.33	10.11
- El Burullus	15.21	7.23	16.33	-	-	16.17	7.49	4.51	14.49	2.52	9.17	10.34
- Kafr Saad	14.13	7.86	19.22	0.98	6.25	19.94	7.02	5.80	16.14	3.16	7.77	5.39
- Damietta	11.81	7.26	10.00	0.99	8.00	22.77	-	-	19.17	2.85	6.13	4.65
Average	14.70	8.03	16.47	0.93	6.63	20.81	7.96	5.15	16.93	3.06	8.55	7.60
(ton/ha)	5.25	2.87	39.22	2.21	15.78	49.55	18.95	1.93	5.64	7.29	20.35	18.09

Note: MALR,DOS

Table E.2.2 Crop Unit Yield with Project per Feddan (M/P Area)

Crop	Unit	kg per unit	Upstream		Midstream		Downstream		Rate of Yield Increase			
			Per feddan	Ton per ha	Per feddan	Ton per ha	Per feddan	Ton per ha	Upstream	Midstream	Downstream	Subsurface Drainage
											(%)	
Winter Crops												
- Wheat	Ardab	150.0	19.03	6.80	19.92	7.11	18.36	6.56	8	12	12	15
- Broadbean	Ardab	155.0	11.03	8.47	12.77	4.71	10.45	3.86	9	13	13	20
- Sugarbeet	ton	1,000.0	-	-	26.79	-	21.25	43.74	-	12	12	20
- Flax	ton	1,000.0	2.94	7.00	-	-	-	-	8	-	-	20
- Berseem(Long Term)	ton	1,000.0	27.34	65.10	25.49	60.69	27.07	64.45	9	13	13	20
- Berseem(Short Term)	ton	1,000.0	8.37	19.93	10.57	25.17	9.90	23.57	5	8	8	20
- Vegetables(Onion)	ton	1,000.0	12.29	29.26	12.32	29.33	8.83	21.02	8	12	12	20
Summer crops												
-Cotton	Kantar	157.5	7.32	2.75	8.04	3.02	8.07	3.03	21	32	32	25
- Maize	Ardab	140.0	23.72	7.91	25.71	8.57	25.88	8.63	22	33	33	15
- Rice	ton	1,000.0	4.11	9.79	4.04	9.62	4.07	9.69	19	28	28	5
- Sunflower	ton	1,000.0	-	-	-	-	1.20	2.86	-	-	30	15
- Vegetables(Tomato)	ton	1,000.0	13.47	32.07	14.55	34.64	13.70	32.62	23	35	35	25
Fruit trees(Orange)	ton	1,000.0	10.49	24.98	12.66	30.14	11.56	27.52	19	28	28	25

Note:
The increase rate of unit yield in the mid and downstream areas is estimated from the yield without IIP and the yield difference between the top and tail in Farm for the downstream area, while 67percent of the rate are applied for the upstream area because of the favorable irrigation conditions in the areas.
The unit yield without IIP is estimated for the mid and downstream areas, referring the feasibility study report on Farmland Environmental Improvement Project in Omoum Area.

Source: MALR,DOS

Table E.2.3 Crop Unit Yield without Project (F/S Area)

Crop	Unit	kg per unit	Upstream		Midstream		Downstream	
			Per feddan	Ton per ha	Per feddan	Ton per ha	Per feddan	Ton per ha
Winter Crops								
- Wheat	Ardab	150.0	16.53	5.90	16.53	5.90	14.33	5.12
- Broadbean	Ardab	155.0	8.48	3.13	8.48	3.13	7.81	2.88
- Sugarbeet	ton	1,000.0	18.83	44.83	18.83	44.83	15.91	43.74
- Vegetables(Onion)	ton	1,000.0	8.78	20.90	8.78	20.90	5.22	12.43
- Berseem(Long Term)	ton	1,000.0	22.06	52.52	22.06	52.52	18.38	43.76
- Berseem(Short Term)	ton	1,000.0	14.69	34.98	14.69	34.98	12.24	29.14
Summer crops								
-Cotton	Kantar	157.5	5.39	2.02	5.39	2.02	5.51	2.07
- Maize	Ardab	140.0	17.85	5.95	17.85	5.95	16.05	5.35
- Rice	ton	1,000.0	3.20	7.62	3.20	7.62	3.05	7.26
- Water Melon Seeds	ton	1,000.0	0.35	0.83	0.35	0.83	0.30	0.71
- Vegetables(Tomato)	ton	1,000.0	10.54	25.10	10.54	25.10	9.86	23.48
Fruit trees(Orange)	ton	1,000.0	8.93	21.26	-	-	-	-

Source: MALR,DOS

Table E.2.4 Crop Unit Yield with Project per Feddan (F/S Area)

Crop	Unit	kg per unit	Upstream		Midstream		Downstream		Rate of Yield Increase			
			Per feddan	Ton per ha	Per feddan	Ton per ha	Per feddan	Ton per ha	Upstream (%)	Midstream (%)	Downstream (%)	Subsurface Drainage (%)
Winter Crops												
- Wheat	Ardab	150.0	18.51	6.61	18.51	6.61	17.24	6.16	12	12	12	15
- Broadbean	Ardab	155.0	9.58	8.47	9.58	3.54	9.67	3.57	13	13	13	20
- Sugarbeet	ton	1,000.0	21.09	50.21	21.09	50.21	19.54	46.52	12	12	12	20
- Berseem(Long Term)	ton	1,000.0	24.93	59.36	24.93	59.36	22.78	54.24	13	13	13	20
- Berseem(Short Term)	ton	1,000.0	15.87	37.79	15.87	37.79	14.50	34.52	8	8	8	20
- Vegetables(Onion)	ton	1,000.0	9.83	23.40	9.83	23.40	8.68	20.67	12	12	12	20
Summer crops												
-Cotton	Kanta	157.5	8.13	3.05	8.13	3.05	8.13	3.05	32	32	32	25
- Maize	Ardab	140.0	23.74	7.91	23.74	7.91	22.93	7.64	33	33	33	15
- Rice	ton	1,000.0	4.10	9.76	4.10	9.76	4.01	9.55	28	28	28	5
- Water Melon Seeds	ton	1,000.0	0.42	1.00	0.42	1.00	0.42	1.00	20	20	20	20
- Vegetables(Tomato)	ton	1,000.0	14.23	33.88	14.23	33.88	14.16	33.71	35	35	35	25
Fruit trees(Orange)	ton	1,000.0	11.43	27.21					28			25

Note:
The increase rate of unit yield in the mid and downstream areas is estimated from the yield without IIP and the yield difference between the top and tail in Farm Economy Survey for the downstream area, while the rate of 67 % are applied for the upstream area because of the favorable irrigation conditions in the area.
The unit yield without IIP is estimated for the mid and downstream areas, referring the feasibility study report on Farmland Environmental Improvement Project in omoum Area.

Source: MALR,DOS

Table E.2.5 Proposed Unit Yield by Crop(Upstream Area, M/P Area)

Crop	Item	Unit	W/O Project	W/ Project			
				Yr.1	Yr.2	Yr.3	Yr.4
	Rate of Yield Increase	%		30	50	80	100
1. Wheat	MainProduct(Grain)	ardab	17.62	18.04	18.47	18.75	19.03
	Second Product(straw)	caml/load	14.10	14.43	14.77	15.00	15.22
2. Broad bean	MainProduct(Grain)	ardab	10.12	10.39	10.67	10.85	11.03
	Second Product	caml/load	7.59	7.79	8.00	8.14	8.27
3. Flax	MainProduct	ton	2.72	2.79	2.85	2.89	2.94
	Second Product	ton	0.53	0.17	0.17	0.17	0.57
4. Sugar beet	MainProduct	ton	-	-	-	-	-
	Second Product	caml/load	-	-	-	-	-
5.Winter Vegetables (Onion)	MainProduct	ton	11.38	11.65	11.93	12.11	12.29
6. Berseem(Long)	MainProduct	ton	25.08	25.76	26.43	26.89	27.34
7. Berseem(Short)	MainProduct	ton	7.97	8.09	8.21	8.29	8.37
8. Cotton	MainProduct(Grain)	kantar	6.05	6.43	6.81	7.07	7.32
	Second Product	caml/load	4.54	4.82	5.11	5.30	5.49
9. Maize	MainProduct(Grain)	ardab	19.44	20.72	22.01	22.86	23.72
	Second Product	caml/load	13.61	14.51	15.40	16.00	16.60
	Green Fodders	caml/load	1.22	1.31	1.39	1.44	1.49
10. Rice	MainProduct(Grain)	ton	3.45	3.65	3.84	3.97	4.11
	Second Product	caml/load	8.63	9.12	9.61	9.94	10.26
11.Sunflower	MainProduct	ton	-	-	-	-	-
	Second Product	ton	-	-	-	-	-
12. Summer Vegetable: (Tomato)	MainProduct	ton	10.95	11.71	12.46	12.96	13.47
13. Fruit(Orange)	MainProduct(Fruit)	ton	8.93	9.44	9.95	10.29	10.63

Source: Study Team

Table E.2.6 Proposed Unit Yield by Crop (Midstream, M/P Area)

Crop	Item	Unit	W/O Project	W/ Project			
				Yr.1	Yr.2	Yr.3	Yr.4
	Rate of Yield Increase	%		30	60	80	100
1. Wheat	MainProduct(Grain)	ardab	17.79	18.43	19.07	19.50	19.92
	Second Product(straw)	caml/load	14.23	14.74	15.26	15.60	15.94
2. Broad bean	MainProduct(Grain)	ardab	11.30	11.74	12.18	12.48	12.77
	Second Product	caml/load	8.48	8.81	9.14	9.36	9.58
3. Flax	MainProduct	ton		0.00	0.00	0.00	0.00
	Second Product	ton	0.00	0.00	0.00	0.00	0.00
4. Sugar beet	MainProduct	ton	23.92	24.78	25.64	26.22	26.79
	Second Product	caml/load	9.57	9.91	10.26	10.49	10.72
5.Winter Vegetables (Onion)	MainProduct	ton	11.00	11.40	11.79	12.06	12.32
6. Berseem(Long)	MainProduct	ton	22.56	23.44	24.32	24.91	25.49
7. Berseem(Short)	MainProduct	ton	9.79	10.02	10.26	10.42	10.57
8. Cotton	MainProduct(Grain)	kantar	6.09	6.67	7.26	7.65	8.04
	Second Product	caml/load	4.57	5.01	5.44	5.74	6.03
9. Maize	MainProduct(Grain)	ardab	19.33	21.24	23.16	24.43	25.71
	Second Product	caml/load	13.53	14.87	16.21	17.10	18.00
	Green Fodders	caml/load	1.22	1.34	1.46	1.54	1.62
10. Rice	MainProduct(Grain)	ton	3.16	3.43	3.69	3.87	4.04
	Second Product	caml/load	7.90	8.56	9.23	9.67	10.11
11.Sunflower	MainProduct	ton	-	-	-	-	-
	Second Product	ton	-	-	-	-	-
12. Summer Vegetable: (Tomato)	MainProduct	ton	10.78	11.91	13.04	13.80	14.55
13. Fruit(Orange)	MainProduct(Fruit)	ton	9.89	10.72	11.55	12.11	12.66

Note: The yiield of W/O Project——estimated yield with subsurface drainage

Source:Study Team

Table E.2.7 Proposed Unit Yield by Crop (Downstream Area , M/P Area)

Crop	Item	Unit	W/O Project	W/ Project			
				Yr.1	Yr.2	Yr.3	Yr.4
	Rate of Yield Increase	%		30	60	80	100
1. Wheat	MainProduct(Grain)	ardab	16.39	16.98	17.57	17.96	18.36
	Second Product(straw)	caml/load	13.11	13.58	14.06	14.37	14.69
2. Broad bean	MainProduct(Grain)	ardab	9.25	9.61	9.97	10.21	10.45
	Second Product	caml/load	6.94	7.21	7.48	7.66	7.84
3. Flax	MainProduct	ton	-	-	-	-	-
	Second Product	ton	-	-	-	-	-
4. Sugar beet	MainProduct	ton	18.97	19.65	20.34	20.79	21.25
	Second Product	caml/load	7.59	7.86	8.13	8.32	8.50
5.Winter Vegetables (Onion)	MainProduct	ton	7.88	8.16	8.45	8.64	8.83
6. Berseem(Long)	MainProduct	ton	23.96	24.89	25.83	26.45	27.07
7. Berseem(Short)	MainProduct	ton	9.17	9.39	9.61	9.76	9.90
8. Cotton	MainProduct(Grain)	kantar	6.11	6.70	7.28	7.67	8.07
	Second Product	caml/load	4.58	5.02	5.46	5.76	6.05
9. Maize	MainProduct(Grain)	ardab	19.46	21.39	23.31	24.60	25.88
	Second Product	caml/load	13.62	14.97	16.32	17.22	18.12
	Green Fodders	caml/load	1.23	1.35	1.47	1.55	1.63
10. Rice	MainProduct(Grain)	ton	3.18	3.45	3.71	3.89	4.07
	Second Product	caml/load	7.95	8.62	9.29	9.73	10.18
11.Sunflower	MainProduct	ton	0.92	1.00	1.09	1.14	1.20
	Second Product	ton					
12. Summer Vegetable: (Tomato)	MainProduct	ton	10.15	11.22	12.28	12.99	13.70
13. Fruit(Orange)	MainProduct(Fruit)	ton	9.03	9.79	10.55	11.05	11.56

Note: The yield W/O project—— estimated yield with subsurface drainage

Source:Study Team

Table E.2.8 Proposed Unit Yield by Crop (Upstream and Midstream, F/S Area)

Crop	Item	Unit	W/O Project	W/ Project			
				Yr.1	Yr.2	Yr.3	Yr.4
	Rate of Yield Increase	%		30	60	80	100
1. Wheat	MainProduct(Grain)	ardab	16.53	17.13	17.72	18.12	18.51
	Second Product(straw)	caml/load	13.22	13.70	14.18	14.49	14.81
2. Broad bean	MainProduct(Grain)	ardab	8.48	8.81	9.14	9.36	9.58
	Second Product	caml/load	6.36	6.61	6.86	7.02	7.19
3. Sugar beet	MainProduct	ton	18.83	19.51	20.19	20.64	21.09
	Second Product	caml/load	7.53	7.80	8.07	8.26	8.44
4.Winter Vegetables (Onion)	MainProduct	ton	8.78	9.10	9.41	9.62	9.83
5. Berseem(Long)	MainProduct	ton	22.06	22.92	23.78	24.35	24.93
6. Berseem(Short)	MainProduct	ton	14.69	15.04	15.40	15.63	15.87
7. Cotton	MainProduct(Grain)	kantar	5.39	5.91	6.42	6.77	7.11
	Second Product	caml/load	4.04	4.43	4.82	5.08	5.34
8. Maize	MainProduct(Grain)	ardab	17.85	19.62	21.38	22.56	23.74
	Second Product	caml/load	12.50	13.73	14.97	15.79	16.62
	Green Fodders	caml/load	1.12	1.24	1.35	1.42	1.50
9. Rice	MainProduct(Grain)	ton	3.20	3.47	3.74	3.92	4.10
	Second Product	caml/load	8.00	8.67	9.34	9.79	10.24
10.Water Melon Seed	MainProduct	ton	0.35	0.37	0.39	0.41	0.42
	Second Product	ton	-	-	-	-	-
11. Summer Vegetables (Tomato)	MainProduct	ton	10.54	11.65	12.75	13.49	14.23
12. Fruit(Orange)	MainProduct(Fruit)	ton	8.93	9.68	10.43	10.93	11.43

Source: Study Team

Table E.2.9 Proposed Unit Yield by Crop (Downstream Area , F/S Area)

Crop	Item	Unit	W/O Project	W/ Project			
				Yr.1	Yr.2	Yr.3	Yr.4
	Rate of Yield Increase	%		30	60	80	100
1. Wheat	MainProduct(Grain)	ardab	15.39	15.94	16.50	16.87	17.24
	Second Product(straw)	caml/load	12.31	12.76	13.20	13.49	13.79
2. Broad bean	MainProduct(Grain)	ardab	8.56	8.57	9.23	9.45	9.67
	Second Product	caml/load	6.42	6.67	6.92	7.09	7.25
3. Flax	MainProduct	ton	-	-	-	-	-
	Second Product	ton	-	-	-	-	-
4. Sugar beet	MainProduct	ton	17.45	19.09	18.71	19.13	19.54
	Second Product	caml/load	6.98	7.23	7.48	7.65	7.82
5.Winter Vegetables (Onion)	MainProduct	ton	7.75	8.03	8.31	8.49	8.68
6. Berseem(Long)	MainProduct	ton	20.16	20.16	21.73	22.26	22.78
7. Berseem(Short)	MainProduct	ton	13.43	13.43	14.07	14.29	14.50
8. Cotton	MainProduct(Grain)	kantar	6.16	6.75	7.34	7.74	8.13
	Second Product	caml/load	4.62	5.06	5.51	5.80	6.10
9. Maize	MainProduct(Grain)	ardab	17.24	18.95	20.65	21.79	22.93
	Second Product	caml/load	12.07	13.26	14.46	15.25	16.05
	Green Fodders	caml/load	1.09	1.19	1.30	1.37	1.44
10. Rice	MainProduct(Grain)	ton	3.13	3.39	3.66	3.83	4.01
	Second Product	caml/load	7.83	8.48	9.14	9.58	10.02
11.Water Melon Seeds	MainProduct	ton	0.35	0.37	0.39	0.41	0.42
	Second Product	ton					
12. Summer Vegetables (Tomato)	MainProduct	ton	10.49	11.59	12.69	13.43	14.16
13. Fruit(Orange)	MainProduct(Fruit)	ton		0.00	0.00	0.00	0.00

Note: The yield W/O Project---estimated yield with subsurface drainage

Source:Study Team

Table E.2.10 Percentage of Increase in Crop Production with Land Improvement

(Unit : %)

Crop	1st Year	2nd Year	3rd Year	4th Year
Wheat	26.9	23.9	13.5	4.8
Broad bean	39.0	36.8	25.8	7.9
Rice	47.0	46.1	37.8	10.7
Cotton	27.7	25.5	18.2	7.6
Maize	20.8	38.1	20.8	4.0
Sugarcane	25.1	29.6	25.6	20.8
Summer potato	34.2	40.5	18.6	6.5

Source:GARE,1992

Table E.2.11 Percentage of Water Saving by Precise Land Leveling

(Unit : cub. meter/feddan)

Crop	Without Leveling	Leveling without Laser	Leveling by Laser Beam	% of Water Saving
	(1)	(2)	(3)	[(1)-(2)]/(1) x100
Wheat	2,295	n.a	1,541	23
Maize	3,305	n.a	2,307	30
Onion	2,201	n.a	1,271	42
Sugarcane	10,705	9,840	8,410	21

Source: Land Improvement Authority,1997

Table E.2.12 Crop Yield of Crop Sampling Survey, Biyala District

Crop	Unit	1995/96		1996/97		1997/98		Average				No. of
		Area	Yield	Area	Yield	Area	Yield	Area	Yield	kg/unit	(ton/ha)	Sample
		(fed)		(fed)		(fed)		(fed)				(1997/98)
Winter Crop(Total)		56,031		56,369		57,010		56,470				
1.Wheat	ardab	21,029	16.80	21,891	16.50	23,220	16.30	22,047	16.53	150.0	5.12	44
2.Barley	ardab	11	13.13			1	12.00	4	8.38	120.0	3.35	4
3.Sugarbeets	ton	4,099	17.29	4,841	10.55	5,891	20.38	4,944	18.83		37.85	28
4.Broadbean	ardab	5,551	12.59	5,852	8.77	5,721	8.18	5,708	8.48	155.0	2.88	14
5.Lentil	ardab	298	4.94	228	4.21	221	4.08	249	4.08	160.0	1.55	n.a
6.Flax	ardab	1,488	5.75	402	6.00	29	6.00	640	5.92	122.0	1.69	n.a
7.Onion Alone	ton	119	6.83	0	0.00	80	5.79	66	4.21		15.17	n.a
8.Onion intercropped	ton	0	4.36	65	3.82	248	4.14	104	3.98		8.71	2
9.Clover(Long)	ton	14,342	22.06	14,990	22.06	14,402	22.06	14,578	22.06		126.97	n.a
10.Clover(Short)	ton	8,831	14.69	7,970	14.69	7,081	14.69	7,961	14.69		158.74	n.a
11.Vegetables	ton	n.a		n.a	n.a	n.a		n.a	n.a			n.a
12.Potato	ton	263	10.00	128		116	8.98	169	189.50		92.85	4
13.Others				2				1				n.a
Summer Crop(Total)		56,269		56,369		44,357		52,332				
1.Cotton	kantar	12,246	4.09	9,602	6.39	10,051	5.69	10,633	5.39	157.5	1.93	76
2.Maize	ardab	4,634	19.47	4,255	21.44	3,770	22.10	4,220	21.00	140.0	5.35	12
3.Potato	ton	47	5.90	30	6.50	117	9.22	65	64.67		21.43	16
4.Rice	ton	30,075	3.56	30,004	3.75	30,280	3.36	30,120	3.56		7.81	54
5.Sorgahm	ton	19	0.67	11	0.90	0	0.00	10	0.00		142.85	n.a
6.Fodder Maize	ton					109	20.00	36	20.0		47.62	n.a
7.Sugarcane						30	40.00					
8.Vegetables		2,545	n.a	2,406				1,650				
9.Others		6,703		10,061				5,588				

Source :MALR

Table E.2.13 Crop Yield of Crop Sampling Survey, Homoul District

Crop	Unit	1995/96		1996/97		1997/98		Average				No. of
		Area	Yield	Area	Yield	Area	Yield	Area	Yield	kg/unit	(ton/ha)	Sample
		(fed)		(fed)		(fed)		(fed)				(1997/98)
Winter Crop(Total)		45,590		97,403		100,014		81,002				
1.Wheat	ardab	21,570	16.16	23,875	13.44	23,499	13.38	22,981	14.33	150.0	5.12	48
2.Barley	ardab	2,265	10.85	2,144	12.08	1,862	12.26	2,090	11.73	120.0	3.35	4
3.Sugarbeets	ton	12,744	14.42	13,389	15.39	19,079	17.91	15,071	15.91		37.85	92
4.Broadbean	ardab	2,533	7.69	4,094	8.85	4,649	6.89	3,759	7.81	155.0	2.88	10
5.Lentil	ardab							0	0.00	160.0	1.55	n.a
6.Flax	ardab	2,990	5.75	660	6.00	769	6.00	1,473	5.92	122.0	1.69	n.a
7.Onion Alone	ton	18	4.44	7	4.87			8	3.10		15.17	n.a
8.Onion intercropped	ton	384	3.36	255	3.27			213	2.21		8.71	2
9.Clover(Long)	ton	18.38	20.00	27,137	18.38	26,666	18.38	17,940	18.92		126.97	n.a
10.Clover(Short)	ton	12.24	10.00	22,991	12.24	22,055	12.24	15,019	11.49		158.74	n.a
11.Vegetables	ton	2,456	n.a	2,351	n.a	1,406	n.a		n.a			n.a
12.Potato	ton	49	7.99			29	9.80	26	39.00		92.85	4
13.Others		550		500				350				n.a
Summer Crop(Total)		95,066		98,595		80,404		91,355				
1.Cotton	kantar	30,676	5.67	24,120	5.56	26,530	5.30	27,109	5.51	157.5	1.93	64
2.Maize	ardab	11,197	16.14	14,438	15.90	8,964	16.11	11,533	16.05	140.0	5.35	24
3.Potato	ton	13	5.86			14	4.83	9	9.00		21.43	4
4.Rice	ton	40,743	2.82	44,572	3.66	41,176	3.61	42,164	3.36		7.81	64
5.Sorgahm	ton					2,461	35.00	820	35.00		142.85	n.a
6.Fodder Maize						1,259	20.00	420	20.0		47.62	n.a
7.Sugarcane												
8.Vegetables		4,305		5,404				3,236				
9.Others		8,132		10,061				6,064				

Source :MALR

Table E.2.14 Comparative Crop Yield by Area in Study Area

Crop	Unit	kg per unit	Egypt	Project Governorates					Biyala	Hamoul	M/P Area			F/S Area	
				Gharbia	Dakahlia	Kafr El Sheikh	Damietta	Average			Upstream	Midstream	Down-stream	Upstream	Down-midstream
Winter Crops															
- Wheat	Ardab	150.0	15.56	16.23	16.77	17.13	14.00	16.03	16.53	14.33	17.62	16.91	14.70	16.53	14.33
- Broadbean	Ardab	155.0	8.63	9.43	8.36	8.63	7.64	8.52	8.48	7.81	10.12	9.42	8.03	8.48	7.81
- Flax	ton	1,000.0	3.12	2.81	3.48	2.44	3.27	3.00	1.69	2.72	2.94				
- Sugarbeet	ton	1,000.0	17.61	25.78	19.37	18.48	21.33	21.24	18.83	15.91	26.06	19.93	16.47	18.83	15.91
- Berseem(Long Term)	ton	1,000.0	25.44	23.87	21.59	26.34	21.88	23.42	22.06	18.38	25.08	21.13	20.81	22.06	18.38
- Berseem(Short Term)	ton	1,000.0	11.28	7.78	8.36	15.11	7.51	9.69	14.69	12.24	7.97	9.17	7.96	14.69	12.24
- Vegetables(Onion)	ton	1,000.0	10.02	11.85	9.88	6.00	6.97	8.68	4.21	4.66	11.38	7.79	6.63	8.78	5.22
Summer crops															
-Cotton	Kantar	157.5	6.25	5.64	5.02	5.59	4.64	5.22	5.39	5.51	6.05	5.63	5.15	5.39	5.51
- Maize	Ardab	140.0	20.41	21.13	20.96	2.83	18.42	15.84	21.00	16.05	19.44	18.37	16.93	17.85	16.05
- Rice	ton	1,000.0	3.48	3.47	3.45	3.46	3.03	3.35	3.56	3.36	3.45	3.1	3.06	3.20	3.05
- Water Melon Seeds	ton	1,000.0	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	-	-	-	0.35	0.30
- Vegetables(Tomato)	ton	1,000.0	14.39	N.A	9.16	12.48	7.68	9.77	N.A	N.A	10.95	9.96	8.55	10.54	9.86
Fruit trees(Orange)	ton	1,000.0	7.84	9.90	8.89	9.97	5.03	7.96	N.A	N.A	8.93	9.14	7.6	8.93	-

Source: MALR,DOS(Egypt, Smapling Survey for Biyala and Hamoul Districts 1994/95-1996/97, Project Governorates 1993/94- 1995/96)
Study Team for M/P Area and F/S Area

Table E.2.15 Farm Input by Crop per Feddan

Item	Unit	Wheat	Broad bean	Flax	Sugar beet	Long Berseem	Short Berseem	Winter Vegetables	Cotton	Maize	Rice	Sunflower	Water Melon Seed	Summer Vegetable	Citrus
1. Seeds	kg	60	60	50	5	25	25	1.3 *95,000	40	25	65	5	2	0.1 *12,000	L.S
2. Fertilizer															
- Manure	cubic m	15	15	0	0	0	0	30	20	15	5	20	10	10	20
- N	kg	75	15	66	70	20	10	80	80	80	60	18	80	80	120
- P_2O_5	kg	15	15	15	22	30	15	50	45	30	20	30	15	15	30
- K_2O	kg	0	0	24	38	0	0	0	0	0	0	0	0	0	0
3. Chemicals															
- Insecticide	liter	0	1	0	1	0	0	1.5	5	1	1	0	3.0	1.5	172
- Fungicides	liter	0	2	0	0	0	0	3.0	1	1	0	0	0	3	10
- Herbicides	liter	0	0	0	1	0	0	0	0	0	2	0	0	0	0
4. Animal Work															
- Cultivation	Cow hour	0	0	0	0	0	0	0	0	0	10	0	0	0	0
- Manure transport	donkey hour	38	38	0	0	0	0	75	50	38	13	50	25	25	50
- Product transportat	donkey hour	18	14	15	38	22	15	49	7	33	23	8	6	68	49
5. Labor															
- Excluding harvesting	hour	102	108	96	168	72	48	114	230	128	172	146	100	295	180
- Harvesting	hour	77	66	102	90	164	109	181	240	77	90	60	72	174	110
Subtotal	hour	179	174	198	258	236	157	295	470	205	262	206	172	469	290
6. Machinery															
- Land preparation (tractor)	hour	2.5	3.0	2.5	3.0	2.5	0	3.5	3	3	2	3	3	3.5	4.2
- Threshing	hour	3.0	2.2	0	0	0	0	0	0	0	2	0	0	0	0
- Winnowing	hour	2.6	2.0	0	0	0	0	0	0	0	2	0	0	0	0
- Irrigation(pump set)	hour	20	15	16	15	25	12	15	32	27	70	22	15	35	60

Source: Estimated by Study Team, base on the Result of Farm Economy Survey, JICA, 1998

Table E.3.1 Crop Production without Project, M/P Area

Crop	Unit	kg per unit	Upstream			Midstream			Downstream			Total
			Area	Unit Yield	Production	Area	Unit Yield	Production	Area	Unit Yield	Production	
			(fed)		(ton)	(fed)		(ton)	(fed)		(ton)	(ton)
Winter Crops												
- Wheat	ardab	150.0	61,940	17.62	163,707	69,410	16.91	176,058	66,860	14.70	147,426	487,192
- Broad been	ardab	155.0	5,020	10.12	7,874	13,430	9.42	19,609	15,200	8.03	18,919	46,402
- Sugar beet	ton	1,000.0	-	-	-	6,720	19.93	133,930	15,200	16.47	250,344	384,274
- Flax	ton	1,000.0	5,020	2.72	13,654	-		0	-	-	-	13,654
- Berseem(long Term)	ton	1,000.0	50,220	25.08	1,259,518	53,740	21.13	1,135,526	54,700	20.81	1,138,307	3,533,351
- Berseem(Short Term)	ton	1,000.0	26,780	7.97	213,437	49,260	9.17	451,714	60,780	7.96	483,809	1,148,960
- Vegetables(Onion)	ton	1,000.0	8,370	11.38	95,251	6,720	7.79	52,349	12,160	6.63	80,621	228,220
Subtotal			157,350			199,280			224,900			
Summer Crops												
- Cotton	kantar	157.5	31,810	6.05	30,311	49,260	5.63	43,680	60,780	5.15	49,300	123,291
- Maize	ardab	140.0	55,240	19.44	150,341	35,820	18.37	92,122	30,390	16.93	72,030	314,493
- Rice	ton	1,000.0	61,940	3.45	213,693	109,710	3.10	340,101	100,290	3.06	306,887	860,681
- Sunflower	ton	1,000.0										
- Vegetables(Tomato)	ton	1,000.0	8,370	10.95	91,652	15,670	9.96	156,073	21,270	8.55	181,859	429,583
			157,360			210,460			212,730			
Fruits(Citrus)	ton	1,000.0	10,040	8.93	89,657	2,240	9.14	20,474	6,080	7.60	46,208	156,339

Source: Study Team

Table E.3.2 Crop Production with Project(200%, M/P Area)

Crop	Unit	kg per unit	Upstream			Midstream			Downstream			Total
			Area	Unit Yield	Productior	Area	Unit Yield	Productior	Area	Unit Yield	Production	
			(fed)		(ton)	(fed)		(ton)	(fed)		(ton)	(ton)
Winter Crops												
- Wheat	ardab	150.0	70,310	19.03	200,700	76,130	19.92	227,476	91,170	18.36	251,082	679,259
- Broad been	ardab	155.0	5,020	11.03	8,582	4,480	12.77	8,867	21,270	10.45	34,452	51,902
- Sugar beet	ton	1,000.0				6,720	26.79	180,029	18,230	21.25	387,388	567,416
- Flax	ton	1,000.0	5,020	2.94	14,759						0	14,759
- Berseem(Long Term)	ton	1,000.0	41,850	27.34	1,144,179	60,450	25.49	1,540,871	69,900	27.07	1,892,193	4,577,243
- Berseem(Short Term)	ton	1,000.0	20,090	8.37	168,153	51,500	10.57	544,355	66,860	9.90	661,914	1,374,422
- Vegetables(Onion)	ton	1,000.0	15,070	12.29	185,210	22,390	12.32	275,845	30,390	8.83	268,344	729,399
Subtotal			157,360			221,670			297,820			
Summer Crops												
- Cotton	kantar	157.5	31,810	7.32	36,674	49,260	8.04	62,378	66,860	8.07	84,981	184,032
- Maize	ardab	140.0	83,700	23.72	277,951	94,040	25.71	338,488	60,780	25.88	220,218	836,657
- Rice	ton	1,000.0	26,780	4.11	110,066	47,020	4.04	189,961	100,290	4.07	408,180	708,207
- Sunflower	ton	1,000.0							24,310	1.20	29,172	29,172
- Vegetables(Tomato)	ton	1,000.0	15,070	10.49	158,084	31,350	14.55	456,143	45,590	13.70	624,583	1,238,810
Subtotal			157,360			221,670			297,830			
Fruits(Citrus)	ton	1,000.0	10,040	10.63	106,725	2,240	12.66	28,358	6,080	11.56	70,285	205,368

Source: Study Team

Table E.3.3 Crop Production with Project(170%, M/P Area)

Crop	Unit	kg per unit	Upstream			Midstream			Downstream			Total
			Area	Unit Yield	Production	Area	Unit Yield	Production	Area	Unit Yield	Production	
			(fed)		(ton)	(fed)		(ton)	(fed)		(ton)	(ton)
Winter Crops												
- Wheat	ardab	150.0	70,310	19.03	200,700	76,130	19.92	227,476	85,090	18.36	234,338	662,514
- Broad been	ardab	155.0	5,020	11.03	8,582	4,480	12.77	8,867	21,270	10.45	34,452	51,902
- Sugar beet	ton	1,000.0				6,720	26.79	180,029	18,230	21.25	387,388	567,416
- Flax	ton	1,000.0	5,020	2.94	14,759							14,759
- Berseem(Long Term)	ton	1,000.0	41,850	27.34	1,144,179	60,450	25.49	1,540,871	69,900	27.07	1,892,193	4,577,243
- Berseem(Short Term)	ton	1,000.0	20,090	8.37	168,153	51,500	10.57	544,355	66,860	9.90	661,914	1,374,422
- Vegetables(Onion)	ton	1,000.0	15,070	12.29	185,210	22,390	8.04	180,016	30,390	8.83	268,344	633,570
Subtotal			157,360			221,670			291,740			
Summer Crops												
- Cotton	kantar	157.5	31,810	7.32	32,599	49,260	8.04	62,378	36,470	8.07	46,354	141,331
- Maize	ardab	140.0	83,700	23.72	277,951	94,040	25.71	338,488	27,350	25.88	99,095	715,533
- Rice	ton	1,000.0	26,780	4.11	110,066	47,020	4.04	189,961	100,290	4.07	408,180	708,207
- Sunflower	ton	1,000.0							18,230	1.20	21,876	21,876
- Vegetables(Tomato)	ton	1,000.0	15,070	10.49	158,084	31,350	14.55	456,143	30,390	13.70	416,343	1,030,570
Subtotal			157,360			221,670			212,730			
Fruits(Citrus)	ton	1,000.0	10,040	10.63	106,725	2,240	12.66	28,358	6,080	11.56	70,285	205,368

Source: Study Team

Table E.3.4 Crop Production without Project(F/S Area)

Crop	Unit	kg per unit	Upstream			Midstream			Downstream			Total
			Area	Unit Yield	Productior	Area	Unit Yield	Productior	Area	Unit Yield	Production	
			(fed)		(ton)	(fed)		(ton)	(fed)		(ton)	(ton)
Winter Crops												
- Wheat	ardab	150.0	3,890	16.53	9,645	8,240	16.53	20,431	8,510	14.33	18,292	48,369
- Broad been	ardab	155.0	740	8.48	973	2,060	8.48	2,708	1,290	7.81	1,562	5,242
- Sugar beet	ton	1,000.0	420	18.83	7,909	1,440	18.83	27,115	3,350	15.91	53,299	88,322
- Flax	ton	1,000.0										
- Berseem(Long Term)	ton	1,000.0	2,730	22.06	60,224	4,120	22.06	90,887	4,390	18.38	80,688	231,799
- Berseem(Short Term)	ton	1,000.0	1,680	14.69	24,679	4,530	14.69	66,546	7,480	12.24	91,555	182,780
- Vegetables(Onion)	ton	1,000.0	950	8.78	8,341	210	8.78	1,844	770	8.83	6,799	16,984
Subtotal			10,410			20,600			25,790			
Summer Crops												
- Cotton	kantar	157.5	1,680	5.39	1,268	2,270	5.39	1,927	7,480	5.51	6,491	9,686
- Maize	ardab	140.0	630	17.85	1,574	1,440	17.85	3,599	2,320	16.05	5,213	10,386
- Rice	ton	1,000.0	6,300	3.20	20,160	11,950	3.2	38,240	11,610	3.05	35,411	93,811
- Water Melon Seeds	ton	1,000.0	1,050	0.35	368	4,330	0.35	1,516	3,610	0.30	1,083	2,966
- Vegetables(Tomato)	ton	1,000.0	740	10.54	7,800	620	10.54	6,535	770	9.86	7,592	21,927
Subtotal			10,400			20,610			25,790			
Fruits(Citrus)	ton	1,000.0	110	8.93	982							982

Source: Study Team

Table E.3.5 Crop Production with Project(F/S Area, Case 2)

Crop	Unit	kg per unit	Upstream			Midstream			Downstream			Total
			Area	Unit Yield	Productior	Area	Unit Yield	Productior	Area	Unit Yield	Production	
			(fed)		(ton)	(fed)		(ton)	(fed)		(ton)	(ton)
Winter Crops												
- Wheat	ardab	150.0	3,890	18.51	10,801	8,240	18.51	22,878	8,510	17.24	22,007	55,686
- Broad been	ardab	155.0	740	9.58	1,099	2,060	9.58	3,059	1,290	9.6	1,920	6,077
- Sugar beet	ton	1,000.0	420	21.09	8,858	1,440	21.09	30,370	3,350	19.54	65,459	104,686
- Flax	ton	1,000.0										
- Berseem(Long Term)	ton	1,000.0	2,000	24.93	49,860	2,680	24.93	66,812	3,100	22.78	70,618	187,290
- Berseem(Short Term)	ton	1,000.0	1,680	15.87	26,662	4,530	15.87	71,891	7,480	14.50	108,460	207,013
- Vegetables(Onion)	ton	1,000.0	1,680	9.83	16,514	1,650	9.83	16,220	2,060	8.68	17,881	50,615
Subtotal			10,410			20,600			25,790			
Summer Crops												
- Cotton	kantar	157.5	1,680	8.13	1,912	2,270	8.13	2,907	7,480	8.13	9,578	14,397
- Maize	ardab	140.0	3,360	23.74	11,167	6,800	23.74	22,600	7,740	22.93	24,847	58,615
- Rice	ton	1,000.0	2,840	4.10	11,644	5,360	4.1	21,976	4,900	4.01	19,649	53,269
- Water Melon Seeds	ton	1,000.0	1,050	0.42	441	3,910	0.42	1,642	3,610	0.42	1,516	3,599
- Vegetables(Tomato)	ton	1,000.0	1,470	14.23	20,918	2,270	14.23	32,302	2,060	14.16	29,170	82,390
Subtotal			10,400			20,610			25,790			
Fruits(Citrus)	ton	1,000.0	110	11.43	1,257							1,257

Source: Study Team

Table E.4.1 Number of Livestock and Poultry by District

Area	Cattle	Buffaloes	Sheeps	Goats	Donkey	Mules	Chicken	Ducks	Rabbits
A. Upstream									
1. Gharbia									
(1) Zifta	17,499	31,759	24,993	18,617	23,356	184	304,142	143,730	35,425
(2) Samanoud	6,864	30,703	15,556	6,945	10,373	16	183,696	98,224	26,336
(3) El Mahalla Kubra	40,319	74,961	43,234	22,597	32,553	72	504,620	310,827	80,874
Subtotal	64,682	137,423	83,783	48,159	66,282	272	992,458	552,781	142,635
Per No. of Holdingg	0.8	1.7	1.0	0.6	0.8	0.0	11.9	6.7	1.7
B. Midstream									
1. Dakahlia									
(1) Sherbin	24,211	27,753	21,790	5,429	13,023	69	316,413	166,501	273,326
(2) Talkha	21,856	35,973	26,626	16,484	24,556	167	451,816	203,375	59,660
2. Kafr El Sheikh									
(1) Biyala	17,315	49,017	19,400	6,216	13,790	21	282,676	183,050	34,731
Subtotal	63,382	112,743	67,816	28,129	51,369	257	1,050,905	552,926	367,717
Per No. of Holdingg	1.0	1.8	1.1	0.4	0.8	0.0	16.4	8.6	5.7
C. Downstream									
1. Dakahlia									
(1) Bilqas	28,250	5,760	20,516	7,901	19,949	54	298,029	237,727	54,252
2. Kafr El Sheikh									
(1) El Hamoul	28,103	15,058	24,398	11,707	15,973	19	391,875	241,002	59,468
(2) El Burullus	6,006	1,120	7,257	6,904	3,275	0	77,036	38,857	6,073
3. Damietta									
(1) Kafr Saad	36,630	11,594	30,944	10,525	13,055	76	231,101	136,277	21,920
(2) Damietta	21,424	34,678	1,938	349	5,348	8	88,492	39,767	15,252
Subtotal	98,989	33,532	83,115	37,037	52,252	149	998,041	653,863	141,713
Per No. of Holdingg	1.5	0.5	1.2	0.5	0.8	0.0	14.7	9.7	2.1
Total	227,053	283,698	234,714	113,325	169,903	678	3,041,404	1,759,570	652,065
	1.1	1.3	1.1	0.5	0.8	0.0	14.1	8.2	3.0

Note: Number of head per number of holdings is the estimated number of head per number of land holding in 1989/90 Agricultural Census
Source : 1989/90 Agricultural Census

Table E.4.1 Number of Livestock and Poultry by District

Area	Cattle	Buffaloes	Sheeps	Goats	Donkey	Mules	Chicken	Ducks	Rabbits
A. Upstream									
1. Gharbia									
(1) Zifta	17,499	31,759	24,993	18,617	23,356	184	304,142	143,730	35,425
(2) Samanoud	6,864	30,703	15,556	6,945	10,373	16	183,696	98,224	26,336
(3) El Mahalla Kubra	40,319	74,961	43,234	22,597	32,553	72	504,620	310,827	80,874
Subtotal	64,682	137,423	83,783	48,159	66,282	272	992,458	552,781	142,635
Per No. of Holdingg	0.8	1.7	1.0	0.6	0.8	0.0	11.9	6.7	1.7
B. Midstream									
1. Dakahlia									
(1) Sherbin	24,211	27,753	21,790	5,429	13,023	69	316,413	166,501	273,326
(2) Talkha	21,856	35,973	26,626	16,484	24,556	167	451,816	203,375	59,660
2. Kafr El Sheikh									
(1) Biyala	17,315	49,017	19,400	6,216	13,790	21	282,676	183,050	34,731
Subtotal	63,382	112,743	67,816	28,129	51,369	257	1,050,905	552,926	367,717
Per No. of Holdingg	1.0	1.8	1.1	0.4	0.8	0.0	16.4	8.6	5.7
C. Downstream									
1. Dakahlia									
(1) Bilqas	28,250	5,760	20,516	7,901	19,949	54	298,029	237,727	54,252
2. Kafr El Sheikh									
(1) El Hamoul	28,103	15,058	24,398	11,707	15,973	19	391,875	241,002	59,468
(2) El Burullus	6,006	1,120	7,257	6,904	3,275	0	77,036	38,857	6,073
3. Damietta									
(1) Kafr Saad	36,630	11,594	30,944	10,525	13,055	76	231,101	136,277	21,920
(2) Damietta	21,424	34,678	1,938	349	5,348	8	88,492	39,767	15,252
Subtotal	98,989	33,532	83,115	37,037	52,252	149	998,041	653,863	141,713
Per No. of Holdingg	1.5	0.5	1.2	0.5	0.8	0.0	14.7	9.7	2.1
Total	227,053	283,698	234,714	113,325	169,903	678	3,041,404	1,759,570	652,065
Per No. of Holdingg	1.1	1.3	1.1	0.5	0.8	0.0	14.1	8.2	3.0

Note: Number of head per number of holdings is the estimated number of head per number of land holding in 1989/90 Agricultural Census
Source : 1989/90 Agricultural Census

Table E.4.2 Number of Cattle and Buffaloes by District

Area	Cattle							Buffaloes						
	Total	Male			Female			Total	Male			Female		
		Subtotal	For Raising	Others	Subtotal	>3Years	<3Years		Subtotal	For Raising	Others	Subtotal	>3years	<3years
A. Upstream														
1. Gharbia														
(1) Zifta	17,499	1,281	1,227	54	23,356	9,579	6,639	37,250	2,019	1,959	60	35,231	22,161	13,070
(2) Samanoud	6,864	789	760	29	10,373	3,453	2,622	20,249	1,617	1,552	65	18,632	11,053	7,579
(3) El Mahalla Kubra	40,319	7,156	6,735	421	32,553	19,654	13,509	54,312	5,870	5,189	681	48,442	30,409	18,033
Subtotal	64,682	9,226	8,722	504	66,282	32,686	22,770	111,811	9,506	8,700	806	102,305	63,623	38,682
B. Midstream														
1. Dakahlia														
(1) Sherbin	24,211	1,491	1,314	177	13,023	13,057	9,663	20,538	1,537	1,439	98	19,001	11,060	7,941
(2) Talkha	21,856	2,269	2,122	147	24,556	12,342	7,245	51,129	6,011	5,557	454	45,118	29,962	15,156
2. Kafr El Sheikh														
(1) Biyala	17,315	2,332	2,059	273	13,790	9,609	5,373	25,920	3,276	3,042	234	22,644	13,308	9,336
Subtotal	63,382	6,092	5,495	597	51,369	35,008	22,281	97,587	10,824	10,038	786	86,763	54,330	32,433
C. Downstream														
1. Dakahlia														
(1) Bilqas	28,250	1,151	1,005	146	19,949	15,151	11,948	21,410	3,886	3,682	204	17,524	1,874	15,650
2. Kafr El Sheikh														
(1) El Hamoul	28,103	1,633	1,353	280	15,973	14,714	11,756	23,289	1,939	1,706	233	21,350	12,487	8,863
(2) El Burullus	6,006	223	173	50	3,275	3,562	2,221	1,752	60	25	35	1,692	1,060	632
3. Damietta														
(1) Kafr Saad	36,630	2,751	2,387	364	13,055	21,084	12,795	14,626	1,227	1,159	68	13,399	8,469	4,930
(2) Damietta	21,424	3,452	3,059	393	5,348	11,334	6,638	6,501	2,188	1,992	196	4,313	2,415	1,898
Subtotal	98,989	5,758	4,918	840	52,252	54,511	38,720	61,077	7,112	6,572	540	53,965	23,890	30,075
Total	227,053	21,076	19,135	1,941	169,903	122,205	83,771	270,475	27,442	25,310	2,132	243,033	141,843	101,190

Source : 1989/90 Agricultural Census

Table E.4.3 Inventory of Livestock and Poultry per Farmhousehold (N= 130 Farm Households)

(Unit:head)

Item	Oct. 1997	Bought	Born	Dead	Consumed at Home	Sold	Oct. 1998
1. Cattle							
- Less than two years old	0.21	0.01	0.27	0.01	0.00	0.01	0.44
- More than two years old	0.66	0.01	0	0.00	0.00	0.02	0.65
Subtotal	0.87	0.02	0.27	0.01	0	0.03	1.09
2. Buffalo							
- Less than two years old	0.20	0.01	0.46	0.00	0.00	0.26	0.41
- More than two years old	1.03	0.00	0	0.00	0.00	0.04	0.99
Subtotal	1.23	0.01	0.46	0.00	0.00	0.30	1.40
3. Chiken							
- For Meat	26.71	16.54	1.19	5.99	22.30	0.64	15.51
- For Egg	14.15	6.74	1.24	3.24	4.97	0.36	13.56
4. Sheep or Goat	0.89	0.05	0.47	0.01	0.02	0.07	1.45

Source : Famr Economy Survey, 1998, JICA

Table E. 5.1 Comparison of Land Leveling Work by Laser beam between Egypt and Japan

Items	Egypt (USA Method)	Japan (Revised USA Method)	Proposed
1. Preparatory works(Topsoil)	Plowing by chisel plow (Without laser beam) No land leveling for bottom of topsoil	Plowing by plow with laser beam Precise land leveling for bottom of topsoil	Plowing by stable cultivator without laser beam No land leveling for bottom of topsoil
2. Land leveling	Precise land leveling by trailing typed scraper tine with springand coil-packer	Precise land leveling by three- point -link mounting typed leveler with spring-tine and coil-packer	Precise land leveling by three- point -link mounting typed leveler with spring-tine and coil-packer
3. Tractor	Wheel type(80-100 HP) scraper(no three-point-magnetic controler)	Rubber crawler typed tractor (80-100HP)	Wheel type(80-100 HP)
4. Merit/Demerit	-hardening of topsoil due to frequent passing of tractor with drawing typed scraper - structure of topsoil is not well developed for crops - impossible operation for the corners	- reducing degree of hardening for topsoil because of efficient land leveling work - structure of topsoil is favorable favorable throughout the stratum	- reducing degree of hardening for topsoil because of efficient land leveling work - structure of topsoil is rather favorable throughout the stratum
4. Estimated Cost fo Lnad Leveli	* LE150/feddan(every four years)		LE100/feddan(every four years)

Note: *——Estimated by EALIP

Source: Study Team

Table E.6.1 Status of Principal Bank for Development and Agricultural Credit

LE(mn)

ITEM	92/93	93/94	94/95	95/1996	96/1997
Deposites & Savings	2,292	2,949	3,519	4,759	5,231
Demand Deposites	454	484	531	615	683
Time deposites	832	1,198	1,382	2,128	2,055
Saving Certificates	217	226	232	245	159
Saving deposites	721	966	1,283	1,668	2,098
Others	68	75	91	103	236
Loans	4,205	4,583	5,756	6,699	7,932
Short term loans	1,969	2,201	3,020	3,622	4,306
Medium team loans	2,070	2,155	2,286	2,647	3,224
Long term loans	166	212	182	192	197
Soft Loans	0	15	268	238	205
Equity Capital	881	1,134	1,423	1,475	1,623
Capital	62	269	289	289	289
Reserves	230	235	237	240	246
Grants	589	630	897	946	1,088
Due to Banks	933	764	373	40	801
Financial Investment	44	46	47	50	50
Storage	438	373	211	352	392
Fixed Assets	97	111	178	228	247
Provisions	472	313	386	431	495
Surplus-befor Taxes	79	47	54	70	21

Source: PBDAC Annual Report 1997

Table E.6.2 No. and Amount of Loan by Type and Year in the Priority Area

Type of Loan			Name of Village Bank: Biwala			Abshan			Abo Badwa			Hamoul			Kafr El Shanbu			Bashbeesh			Dreen			Total		
			No.	(000 LE)	Ave.(LE)	No.	(000 LE)	Ave.(LE)	No.	(000 LE)	Ave.(LE)	No.	(000 LE)	Ave.(LE)	No.	(000 LE)	Ave.(LE)	No.	(000 LE)	Ave.(LE)	No.	(000 LE)	Ave.(LE)	No.	(000 LE)	Ave.(LE)
Agriculture Investment Loan		1995/96	12,260	16,657	1,358	4,040	2,514	622	550	2,601	4,547	8,160	18,224	2,233	1,340	738	551	1,672	2,999	1,908	1,820	2,992	1,968	29,446	46,626	1,583
		1996/97	11,221	22,830	2,036	4,020	2,208	549	8,100	2,976	488	8,360	19,877	2,380	1,200	832	693	2,852	2,635	924	1,190	3,325	2,794	34,933	54,682	1,565
		1997/98	13,155	22,366	1,700	4,025	2,017	501	3,140	1,102	351	6,466	15,304	2,367	1,040	1,131	839	1,582	2,725	1,723	1,334	2,179	1,633	31,061	46,857	1,509
Short Term Investment Loan	Total	1995/96	22,803	18,276	801	607	2,566	4,227	1,125	2,873	2,554	5,008	13,466	2,690	1,187	1,566	1,318	1,964	2,277	1,669	643	1,633	2,540	35,057	49,094	1,400
		1996/97	22,627	22,899	1,012	818	3,284	4,016	770	2,369	3,064	7,562	8,929	1,181	198	1,967	9,934	1,606	2,938	1,825	502	2,464	4,908	35,873	50,474	1,407
		1997/98	19,789	24,646	1,245	1,267	5,207	4,110	1,099	4,504	4,406	7,704	10,641	1,771	1,026	2,690	1,960	1,646	2,299	1,398	642	3,001	5,607	35,598	65,700	1,846
	Animal Wealth	1995/96	2,106	7,494	3,560	320	1,786	5,581	450	1,624	3,609	2,361	6,130	2,597	988	1,109	1,120	982	1,484	1,569	580	573	988	8,513	22,603	2,773
		1996/97	4,966	16,509	3,331	450	2,556	5,680	44	222	5,045	6,645	6,526	982	106	1,207	12,392	920	1,312	1,426	420	577	1,374	14,034	31,777	2,264
		1997/98	5,638	20,762	3,680	886	4,433	5,003	676	3,975	5,880	6,314	10,841	1,717	1,201	2,160	1,801	1,010	840	832	402	827	2,057	17,089	57,249	2,964
	Poultry Wealth	1995/96	1,126	752	668	0	0		0	0		0	0		5	45	9,000	56	429	6,600	27	43	1,593	1,222	1,268	1,038
		1996/97	530	345	651	0	0		0	0		12	80	6,000	3	45	15,000	72	693	9,238	1	20	20,000	618	1,064	1,722
		1997/98	604	395	654	0	0		16	157	9,813	6	67	10,875	2	3	1,500	86	563	6,605	116	299	2,578	847	1,649	1,947
	Fish Wealth	1995/96	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1996/97	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1997/98	0	0		0	0		0	0		1	30	30,000	0	0		0	0		0	0		1	30	30,000
	Works related to Agriculture	1995/96	13,613	1,597	117	137	480	3,504	626	619	990	950	1,641	1,727	150	134	893	942	1,347	1,430	38	1,011	26,868	17,214	7,929	461
		1996/97	11,868	1,629	137	2	7	3,500	650	646	994	60	417	6,940	45	108	2,400	816	1,030	1,268	80	1,886	23,575	14,163	6,360	449
		1997/98	13,647	3,489	256	1	1	1,000	262	262	1,000	976	1,369	1,565	75	148	1,973	560	906	1,647	23	1,876	81,522	15,596	8,013	533
	Youth Loan	1995/96	40	307	7,675	0	0		0	0		0	0		2	22	11,000	0	0		0	0		42	329	7,833
		1996/97	144	96	667	6	66	11,000	0	0		0	0		0	0		6	0		0	0		156	218	1,397
		1997/98	0	0		2	17	8,500	0	0		1	9	9,000	3	45	15,000	0	0		0	0		8	88	11,000
	Other	1995/96	5,920	8,126	1,373	150	300	2,000	50	630	12,600	1,705	5,696	3,340	40	260	6,778	6	18	3,000	1	6	6,000	8,076	16,966	1,977
		1996/97	5,129	4,319	842	360	656	1,819	76	1,491	19,618	865	1,928	2,255	45	516	11,467	0	0		1	1	1,000	6,902	11,055	1,602
		1997/98	0	0		378	757	2,003	76	141	1,880	505	1,066	2,586	45	269	5,978	0	0		1	1	1,000	1,467	3,270	2,313
Medium Term Investment Loan	Total	1995/96	5,842	6,716	1,150	690	1,910	3,068	775	1,896	2,446	3,197	6,973	1,874	177	580	3,277	2,097	3,072	1,465	313	1,061	3,390	14,346	24,812	1,730
		1996/97	5,195	6,789	1,307	512	1,898	3,316	786	2,260	2,863	1,492	5,593	3,742	109	956	7,853	2,645	3,598	1,414	139	986	6,413	12,076	26,606	2,121
		1997/98	5,347	6,936	1,297	212	463	2,184	821	2,182	3,514	583	7,097	12,173	42	450	10,714	2,468	4,484	1,817	183	1,979	10,781	10,289	26,230	2,549
	Animal Wealth	1995/96	4,810	4,264	886	120	526	4,383	160	391	2,640	1,276	1,320	1,036	26	337	13,480	620	602	971	39	49	1,256	7,309	8,379	1,146
		1996/97	4,582	3,323	725	250	1,902	4,008	300	1,316	4,383	262	1,906	7,240	12	190	16,000	806	1,020	1,267	30	364	12,133	6,792	11,426	1,682
		1997/98	4,895	4,374	894	10	44	4,400	316	1,436	4,556	324	2,910	8,981	26	391	15,038	1,125	2,192	1,948	70	1,268	18,114	7,090	14,093	1,988
	Poultry Wealth	1995/96	0	0		50	150	3,000	25	120	4,800	0	0		143	29	203	26	278	11,120	0	0		318	847	2,664
		1996/97	0	0		0	0		2	13	6,500	0	0		77	190	2,468	15	162	10,800	0	0		96	377	3,927
		1997/98	8	102	12,750	0	0		0	0		68	119	2,062	12	16	1,333	22	126	5,682	0	0		100	361	3,610
	Agriculture Machine	1995/96	262	910	3,227	150	402	2,680	240	306	1,276	0	0		6	141	23,500	560	824	1,489	58	262	4,517	1,686	3,563	2,113
		1996/97	357	1,457	4,081	0	0		376	573	1,528	17	224	13,176	3	80	26,667	1,413	2,042	1,446	42	256	6,095	2,582	5,206	2,016
		1997/98	275	811	2,949	0	0		75	185	2,467	150	2,314	15,427	0	0		6	101	16,833	18	127	7,056	599	3,723	6,215
	Fish Wealth	1995/96	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1996/97	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1997/98	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
	Plants Production	1995/96	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1996/97	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1997/98	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
	Cultivation	1995/96	0	0		0	0		0	0		0	0		0	0		0	0		1	48	48,000	1	48	48,000
		1996/97	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1997/98	0	0		0	0		0	0		0	0		0	0		0	0		1	100	100,000	1	100	100,000
	Works related to Agriculture	1995/96	416	524	1,260	140	380	2,714	90	250	2,811	412	1,172	2,846	3	73	24,333	892	1,360	1,522	191	670	3,000	2,373	4,958	2,094
		1996/97	63	1,680	26,667	157	471	3,000	100	297	2,970	12	527	43,917	2	26	13,000	312	374	1,199	6	13	2,167	909	4,166	4,671
		1997/98	0	1,189	#DIV/0!	150	309	2,060	130	360	2,769	50	1,724	34,480	0	0		1,315	2,066	1,571	84	423	5,036	2,009	6,741	3,356
	Youth Loan	1995/96	85	654	7,694	0	0		0	0		0	0		0	0		0	0		0	0		85	654	7,694
		1996/97	0	0		3	20	7,667	4	42	10,500	0	0		15	380	25,333	0	0		0	0		29	508	17,517
		1997/98	168	449	2,673	51	109	2,137	101	201	1,990	1	30	30,000	4	43	10,750	0	0		0	0		477	1,142	2,394
	Other	1995/96	250	374	1,496	130	361	2,700	270	836	3,093	1,500	3,478	2,319	0	0		0	0		24	129	5,375	2,374	6,364	2,469
		1996/97	193	329	1,705	102	203	1,990	5	10	2,000	1,200	2,927	2,439	0	0		0	0		60	253	4,217	1,667	3,936	2,361
		1997/98	1	11	11,000	1	2	2,000	0	0		0	0		0	0		0	0		10	55	5,500	13	70	5,385
Long Term Investment Loan	Cultivating & Reclaiming	1995/96	0	0		0	0		0	0		0	0		1	4	4,000	0	0		0	0		1	4	4,000
		1996/97	0	0		0	0		0	0		0	0		4	127	31,750	0	0		0	0		4	127	31,750
		1997/98	0	0		0	0		0	0		2	50	25	2	22	11,000	0	0		0	0		4	72	18,000
	Establish & improve irrigation Method	1995/96	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1996/97	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1997/98	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
	Construct Garden	1995/96	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1996/97	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1997/98	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
	Other	1995/96	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1996/97	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	
		1997/98	0	0		0	0		0	0		0	0		0	0		0	0		0	0		0	0	

Source: PBDAC

Table E.6.3 Wholesale Price and Supply at Tanta Wholesale Market (Vegetables and Fruits)

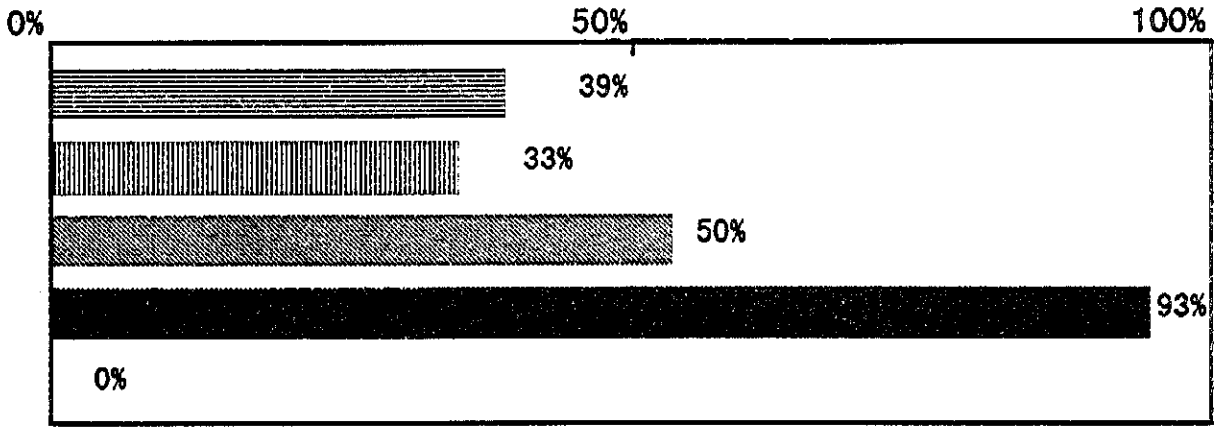
Crop (Vegetables)	Price (Piaster/Kg)						Supply (kg)			
	94 - 96			97 - 98			94 - 96		97 - 98	
	Average	Max.	Min.	Average	Max.	Min.	Total	Share(%)	Total	Share(%)
Tomato	76	150	10	51	90	10	22,288,601	(33.8)	35,733,108	(49.8)
Potato	56	100	20	68	130	20	24,755,920	(37.5)	19,882,630	(27.7)
Egg plant	49	155	10	45	150	10	4,682,530	(7.1)	2,341,490	(3.3)
Vegetable marrow	46	85	15	47	90	10	1,063,595	(1.6)	1,035,166	(1.4)
Pepper	71	150	20	74	230	15	835,910	(1.3)	943,975	(1.3)
Lemon	95	260	15	143	400	40	2,526,965	(3.8)	3,136,704	(4.4)
Onion	40	90	20	38	80	20	1,391,720	(2.1)	347,070	(0.5)
Egyptian cucumber	33	50	20	38	150	15	1,346,640	(2.0)	609,020	(0.8)
Cucumber	74	225	20	75	140	20	1,204,630	(1.8)	1,004,939	(1.4)
Jew's mallow	123	200	30	68	140	20	200,720	(0.3)	120,753	(0.2)
Kidney beans	71	180	20	70	110	40	120,590	(0.2)	380,910	(0.5)
Sweet potato	31	80	20	35	70	20	3,695,405	(5.6)	4,706,500	(6.6)
Elephant's ear	59	80	35	63	85	35	719,295	(1.1)	205,100	(0.3)
Olive	123	150	90	103	150	80	14,670	(0.0)	11,150	(0.0)
Garlic	66	125	40	62	100	20	46,560	(0.1)	37,000	(0.1)
Carrot	22	35	10	26	60	10	657,590	(1.0)	1,057,400	(1.5)
Peas	101	200	20	89	180	40	255,600	(0.4)	142,920	(0.2)
Spinach	60	75	45	35	40	30	0	(0.0)	1,000	(0.0)
Beet	19	60	10	11	30	10	4,430	(0.0)	5,500	(0.0)
Cabbage	67	100	40	40	50	30	23,700	(0.0)	2,420	(0.0)
Beans	34	80	20	35	65	20	173,020	(0.3)	48,400	(0.1)
Okra	94	120	70	-	-	-	2,125	(0.0)	-	-
Cauliflower	45	60	30	-	-	-	875	(0.0)	-	-
Grand Total							66,011,091		71,753,155	

Crop (Fruits)	Price (Piaster/Kg)						Supply (Kg)			
	94 - 96			97 - 98			94 - 96		97 - 98	
	Average	Max.	Min.	Average	Max.	Min.	Total	Share(%)	Total	Share(%)
Banana	136	230	50	135	230	50	5,751,500	(7.9)	10,866,500	(14.1)
Water Millon	68	200	40	86	200	30	12,112,000	(16.7)	13,500,000	(17.5)
Sweet Millon	53	90	30	53	80	30	1,521,000	(2.1)	1,731,000	(2.2)
Grapes	88	160	40	142	200	70	5,585,345	(7.7)	6,435,385	(8.3)
Apple	400	900	70	384	700	40	4,347,335	(6.0)	8,955,583	(11.6)
Orange	65	130	27	83	160	30	15,974,105	(22.0)	14,184,225	(18.4)
Apricot	149	250	80	210	300	120	303,520	(0.4)	481,755	(0.6)
Pine apple	97	400	25	88	275	30	3,761,280	(5.2)	3,301,935	(4.3)
Plum	115	200	55	154	300	20	690,306	(1.0)	445,050	(0.6)
Mango	298	500	30	372	700	50	1,174,160	(1.6)	1,810,631	(2.3)
Fig	93	250	20	145	300	40	2,017,895	(2.8)	1,867,805	(2.4)
Peach	120	250	70	122	200	50	1,459,776	(2.1)	1,497,866	(1.9)
Pears	133	250	60	154	250	60	409,650	(0.6)	766,991	(1.0)
Guava	62	100	30	85	170	30	3,350,260	(4.6)	5,131,626	(6.6)
Dates	98	180	40	101	170	50	4,363,735	(6.0)	3,569,529	(4.6)
Pomegranate	65	100	50	100	180	60	318,325	(0.4)	383,860	(0.5)
Persimmon	205	250	120	161	250	90	201,345	(0.3)	206,750	(0.3)
Manderin	59	150	25	75	140	20	8,347,940	(11.5)	1,852,280	(2.4)
Presses dates	90	110	70	111	120	100	171,345	(0.2)	5,950	(0.0)
Strawberry	125	300	30	180	400	90	555,405	(0.8)	301,600	(0.4)
Grape fruit	40	60	15	53	55	50	4,050	(0.0)	709	(0.0)
Coconut	206	250	150	-	-	-	20,500	(0.0)	-	-
Loquat	90	100	80	-	-	-	14,950	(0.0)	-	-
Grand Total							72,495,766		77,291,021	

Source: Gharbia Governorate Tanta Wholesale Market

Figure E.1.1 Reason to Grow Rice and Intension to Grow Other Crops than Rice

Reason to Grow Rice at Present(N=130, Farm Economy Survey)



Intention on Decrease Rice Area after Improvent of Saline Soils (N=130. Farm Economy Survey)

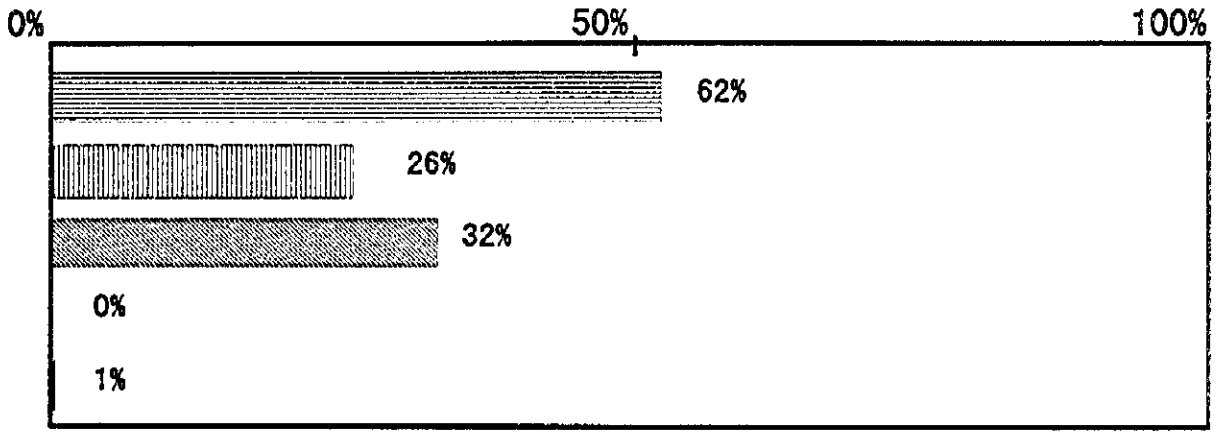
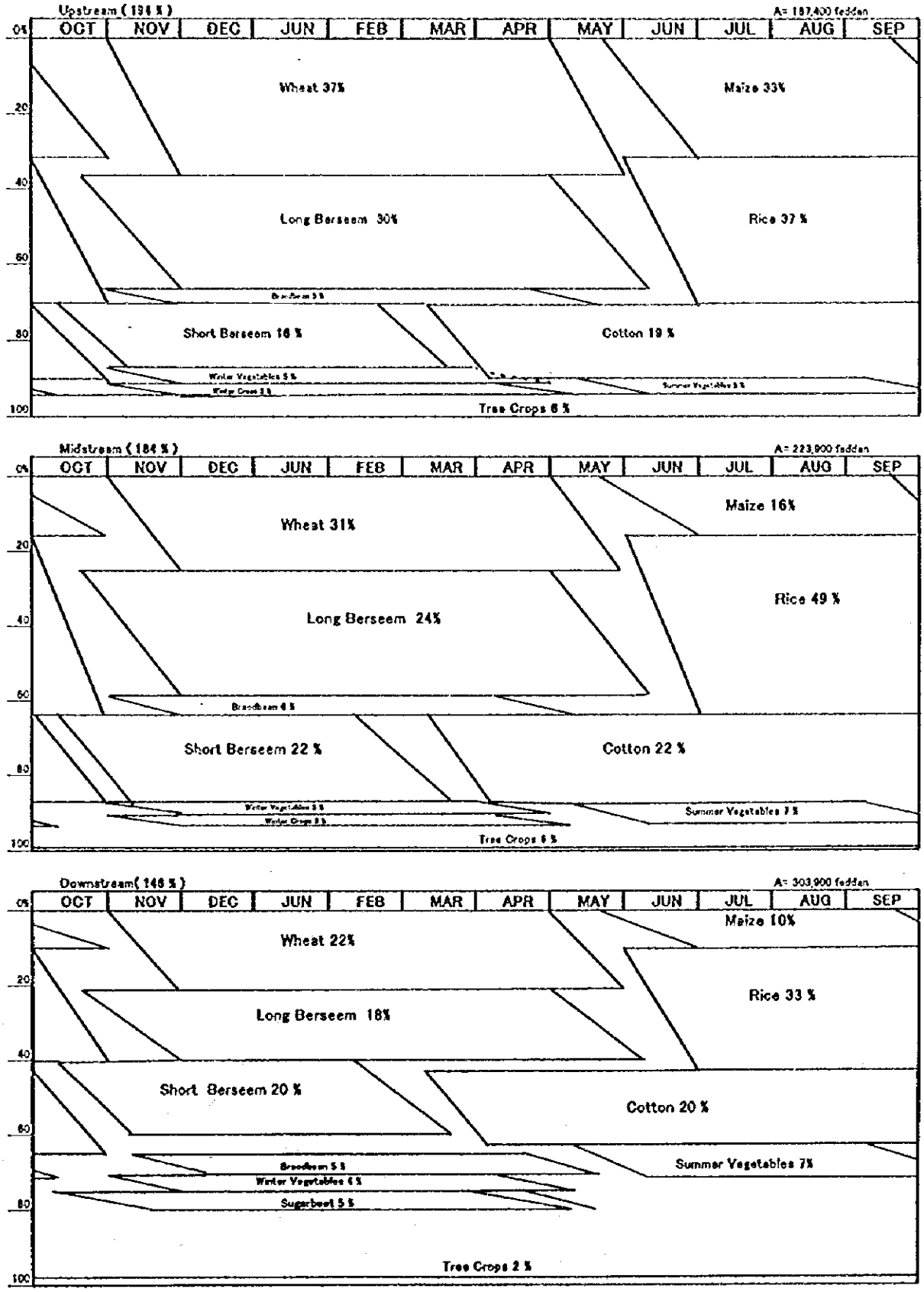
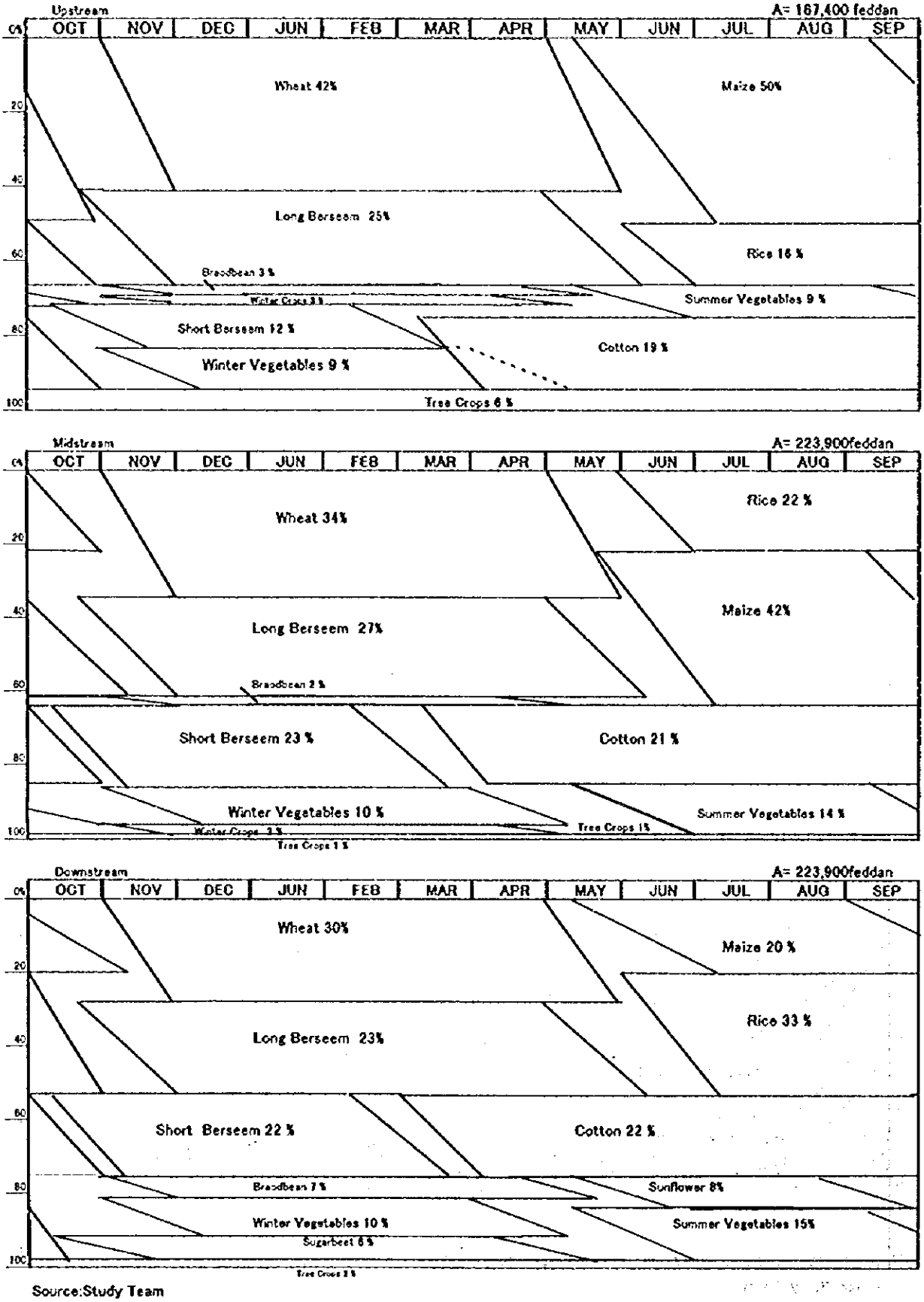


Figure E.1.2 Present Cropping Pattern(M/P Area)



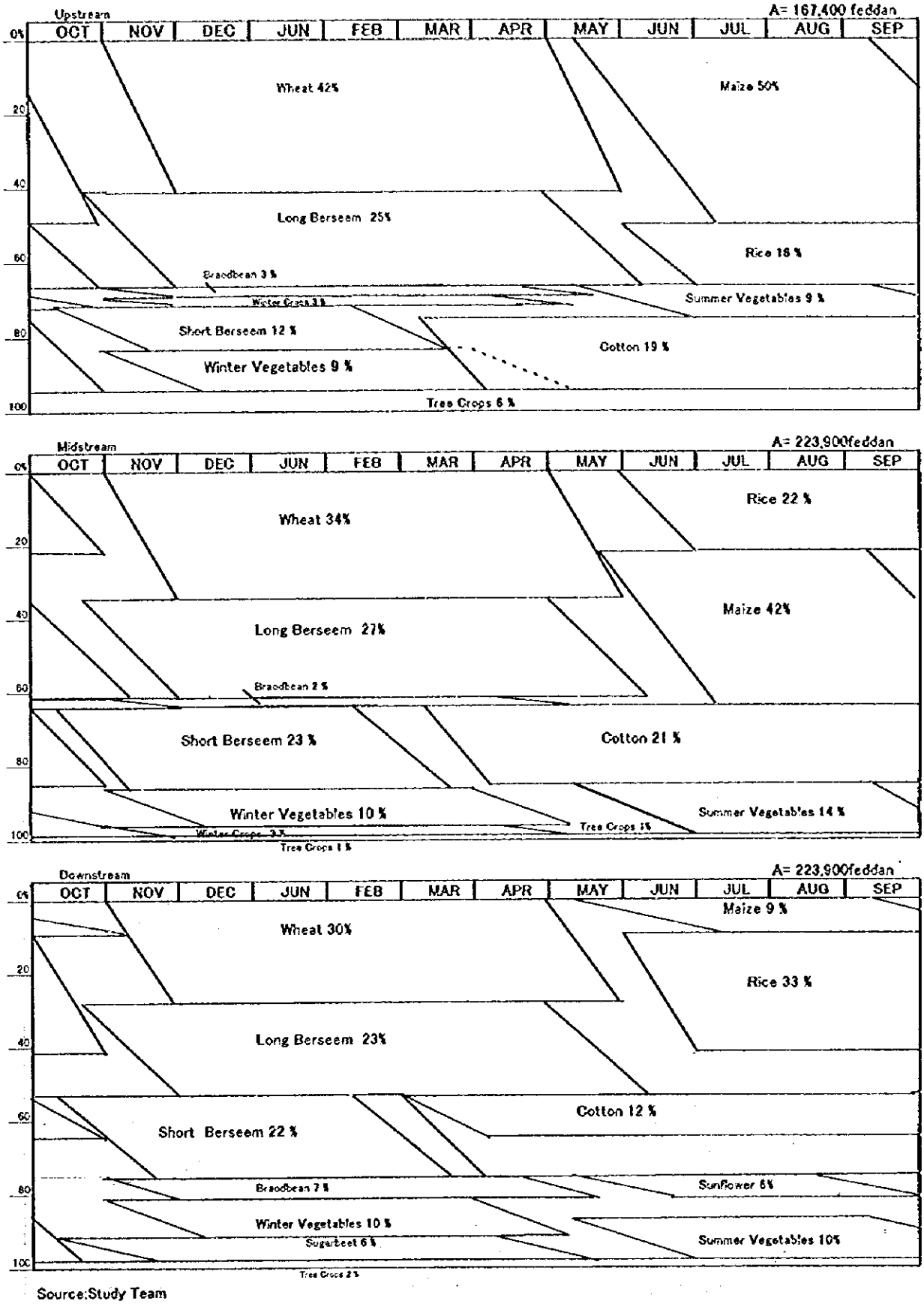
Source: Study Team

Figure E.1.3 Proposed Cropping Pattern (M/P Area, 200 %)



Source:Study Team

Figure E.1.4 Proposed Cropping Pattern (M/P Area, 170 %)



Source:Study Team

Figure E.1.5 Present Cropping Pattern(F/S Area)

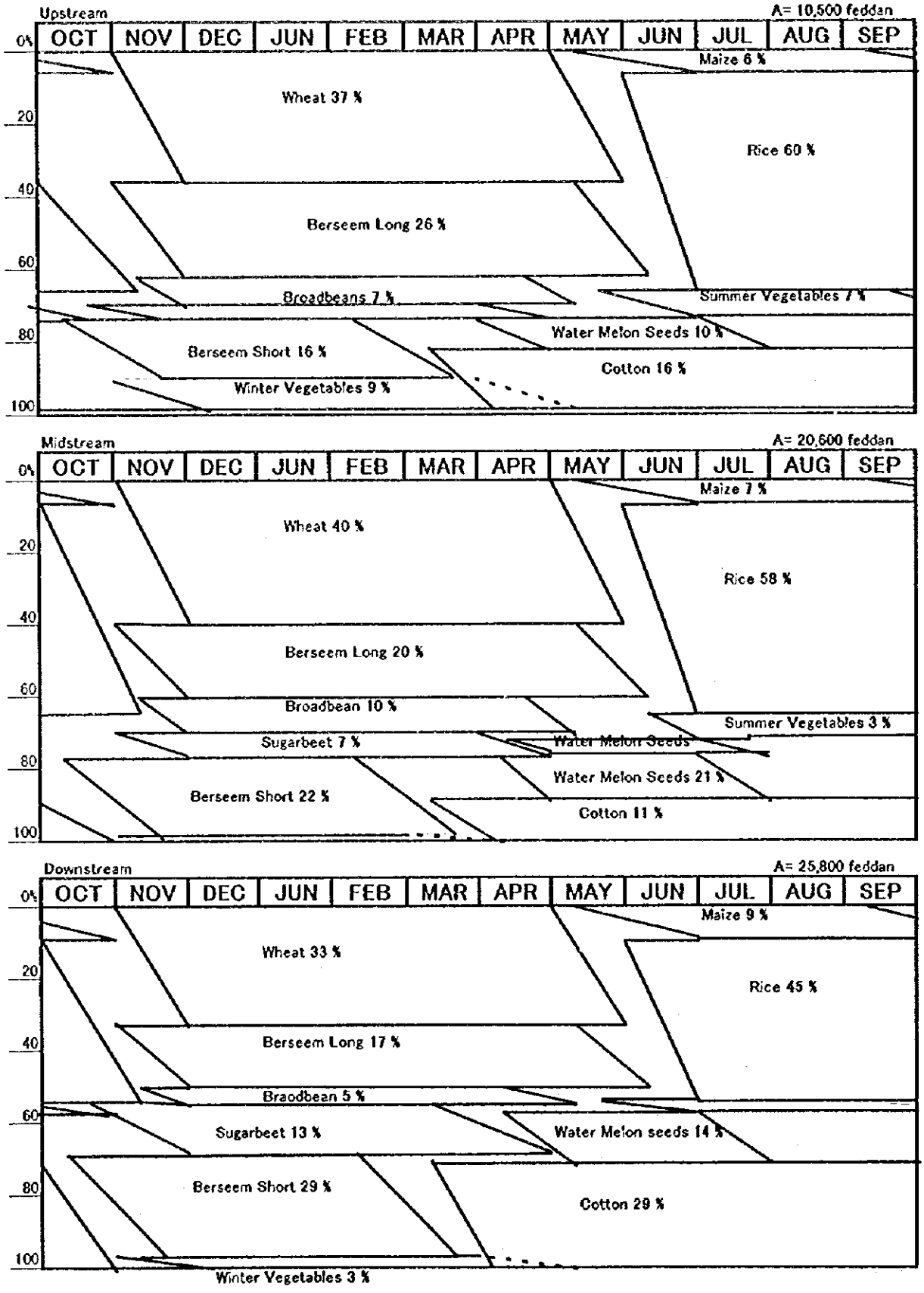


Figure E.1.6 Case Study on Proposed Cropping Pattern

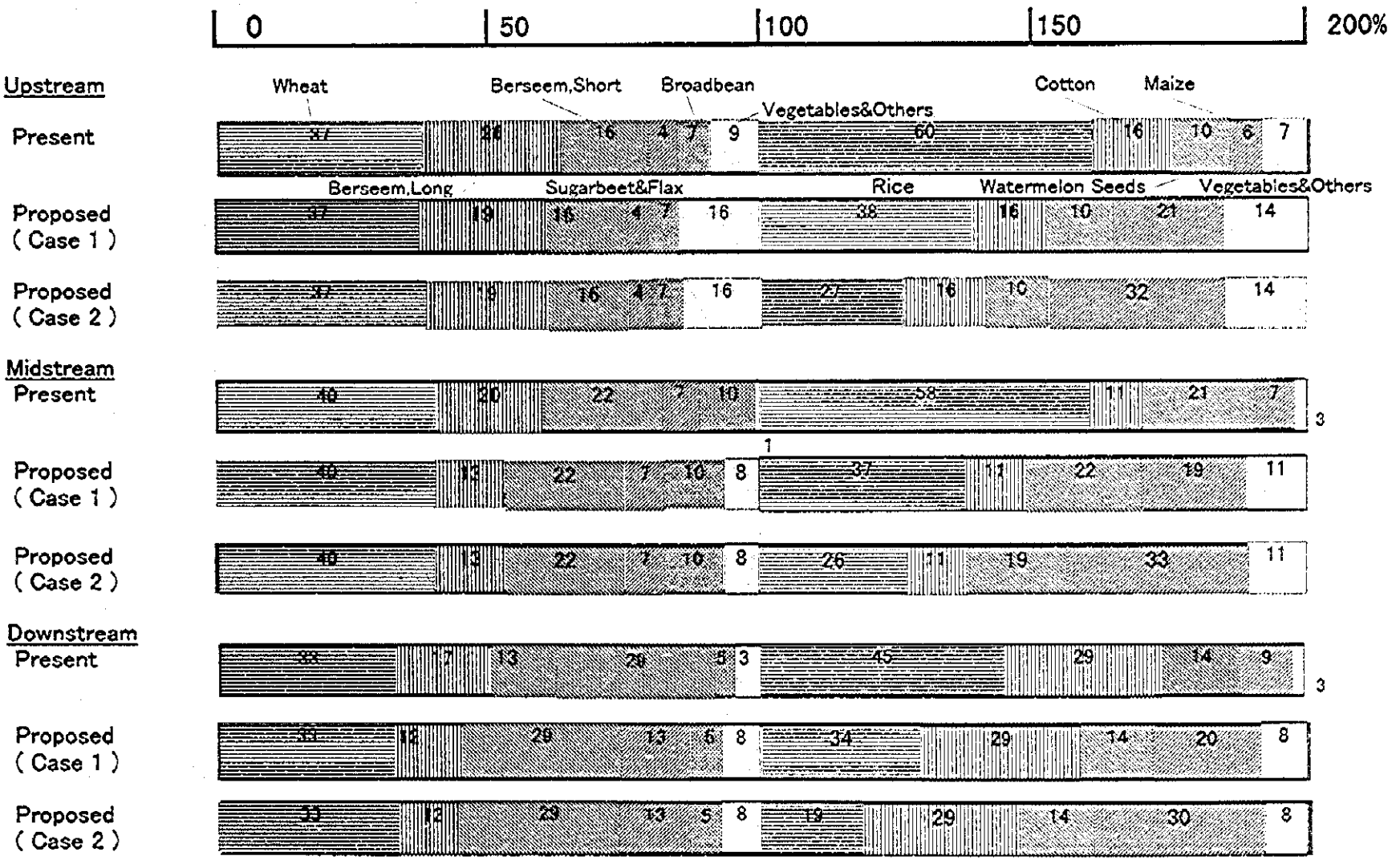


Figure E.1.6 Case Study on Proposed Cropping Pattern

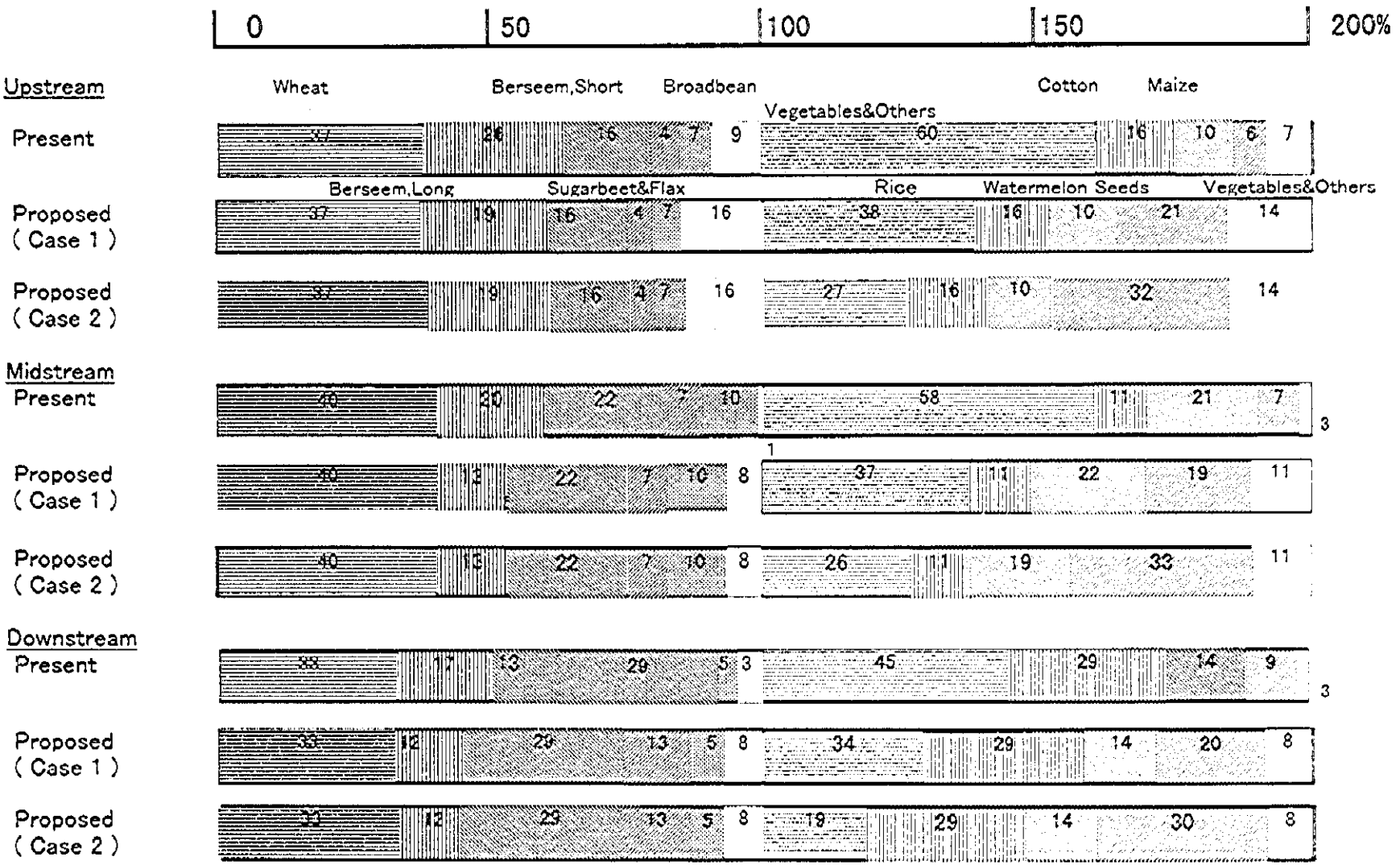


Figure E.1.7 Proposed Cropping Pattern(F/S Area)

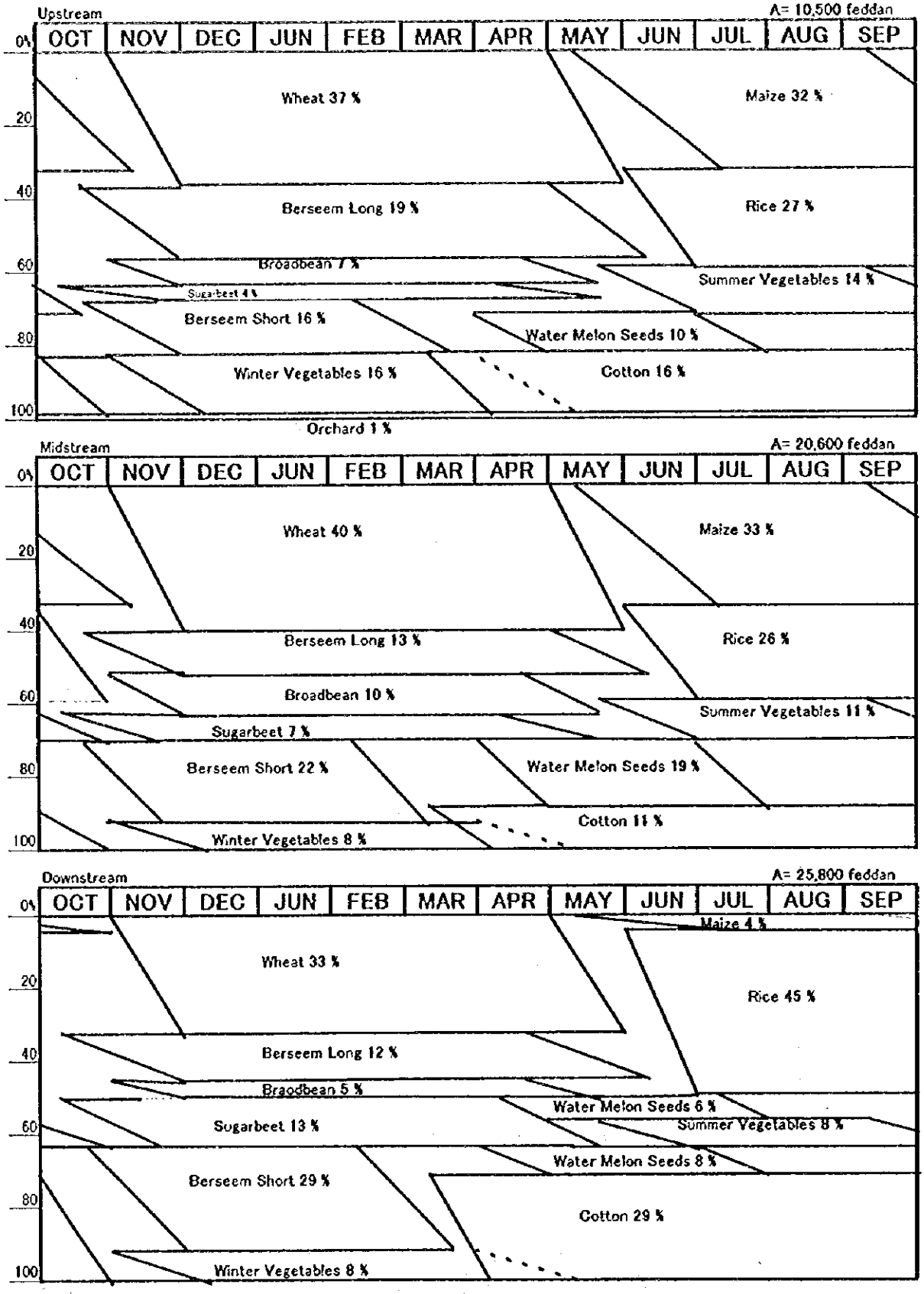
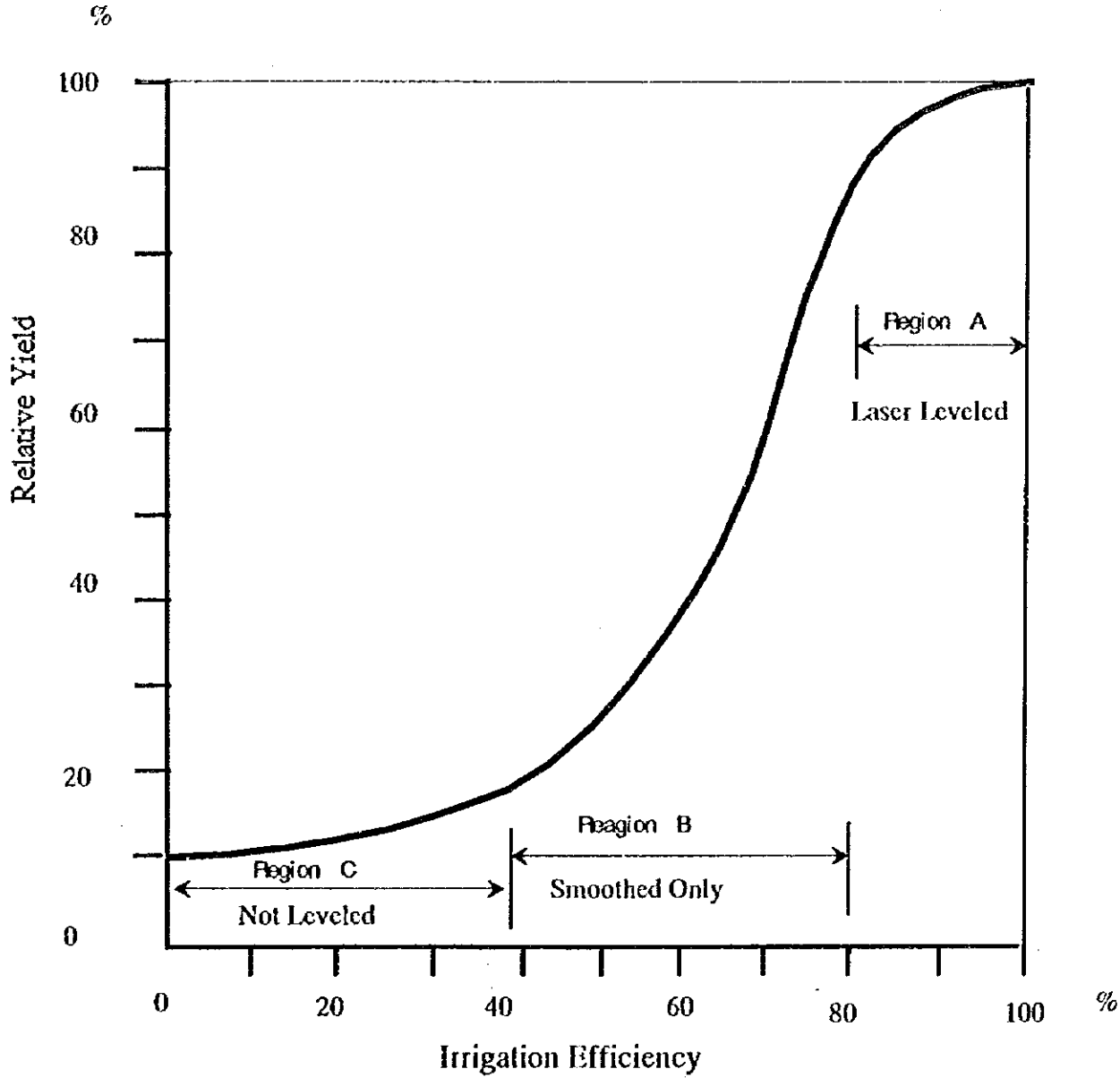


Figure E.2.1 General Relationship of Yield per Unit of Area and Water as a Function of Irrigation Efficiency



Source;"The Effect of Precision Land Leveling on Water Use and Onion Yield" , Agricultural Engineering Institute, ARC

Figure E.5.1 Needs on Various Land and On-Farm Irrigation (N=130, Farm Economy Survey)

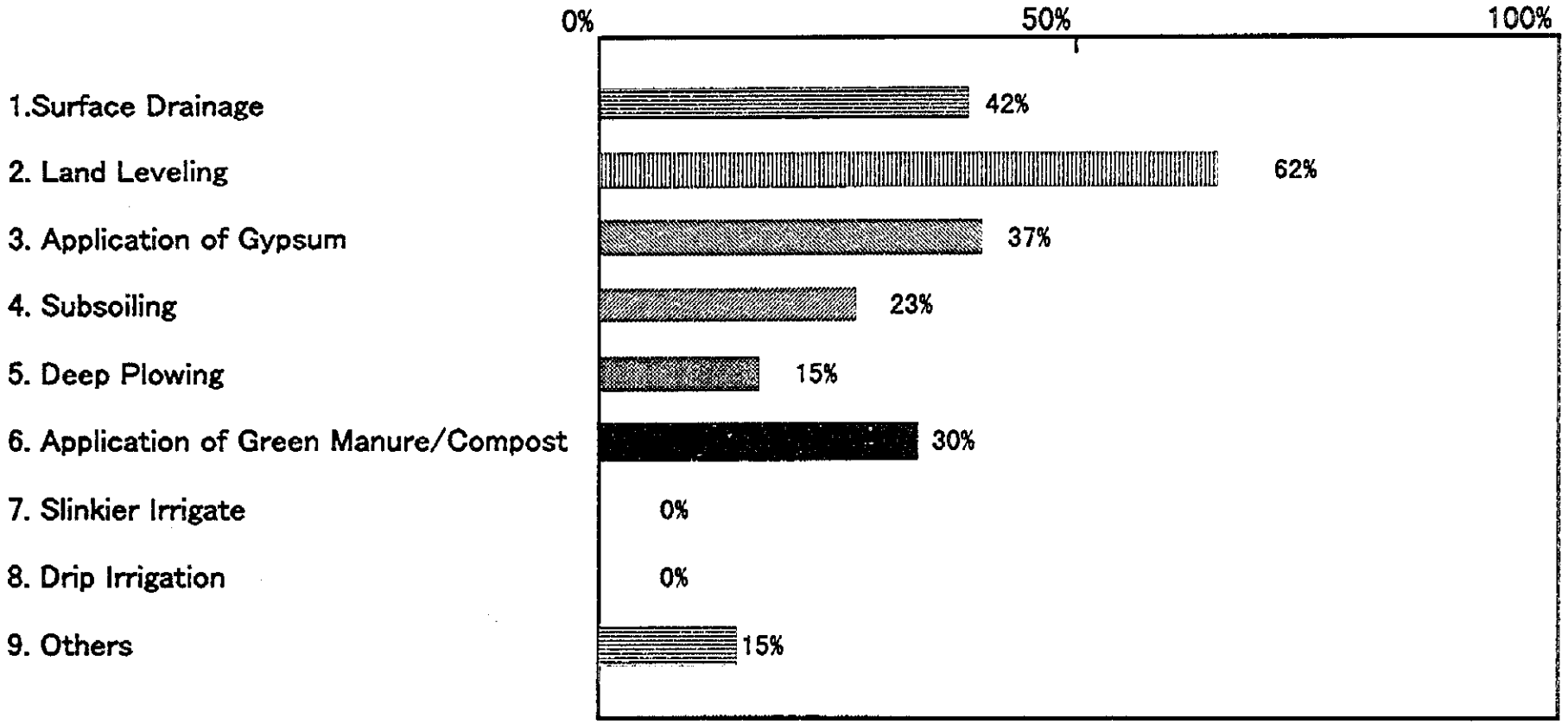


Figure E.5.2 Schema of Approach on Integrated Agricultural Development

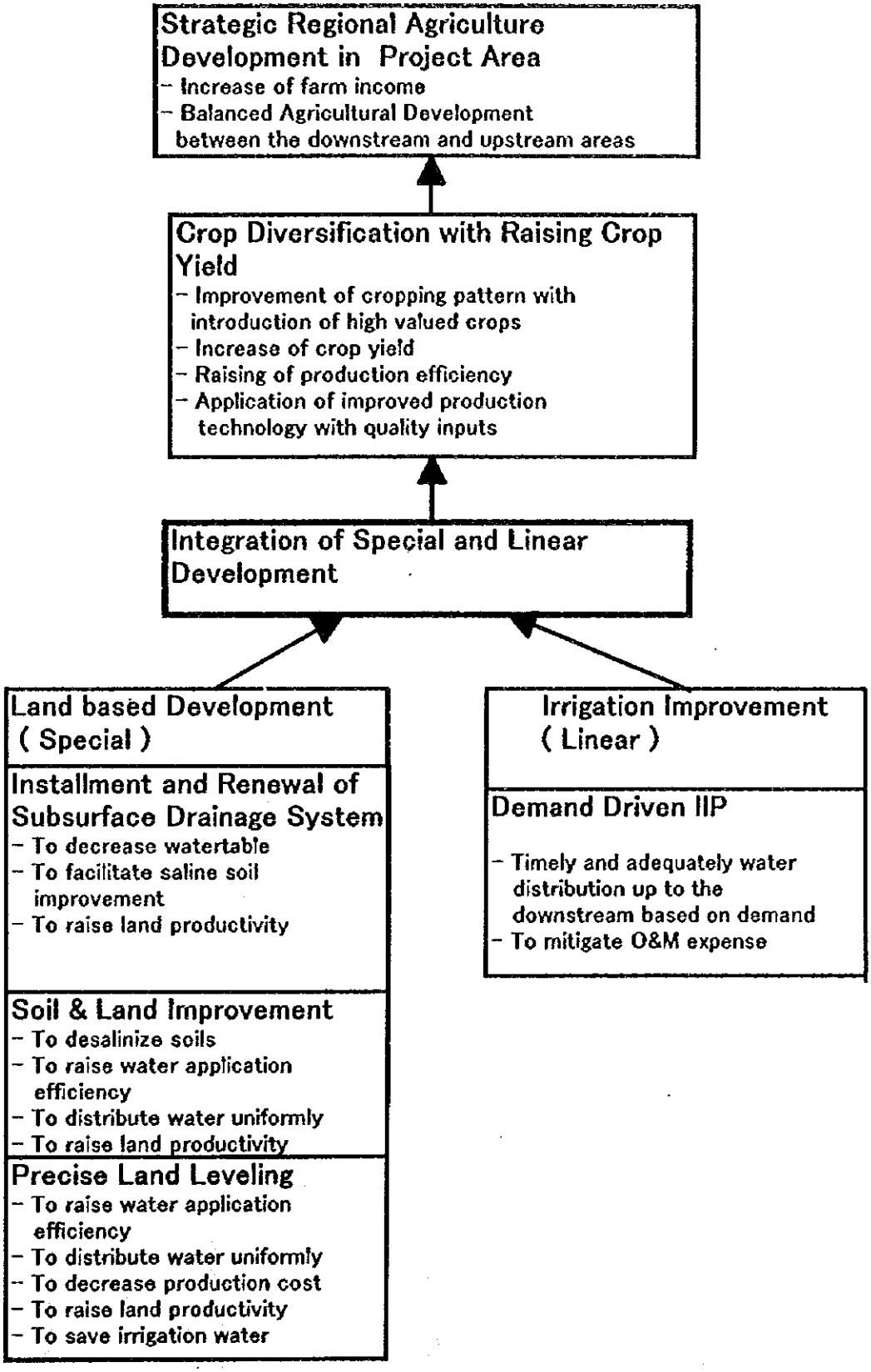


Figure E.5.3 Organization of Regional Agricultural Research Center

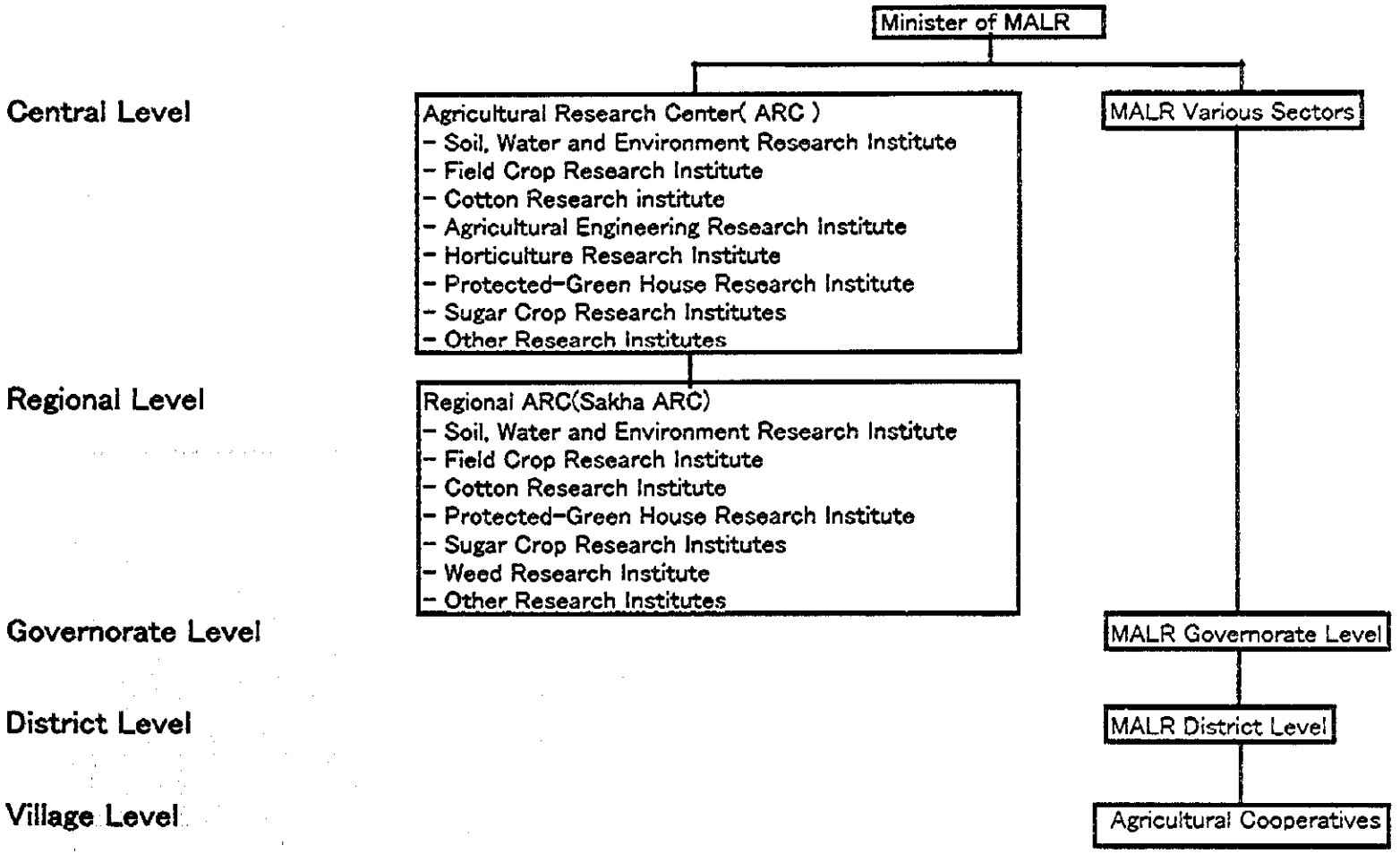


Figure E.5.4 Farmers' Organization and Agricultural Supporting Organization

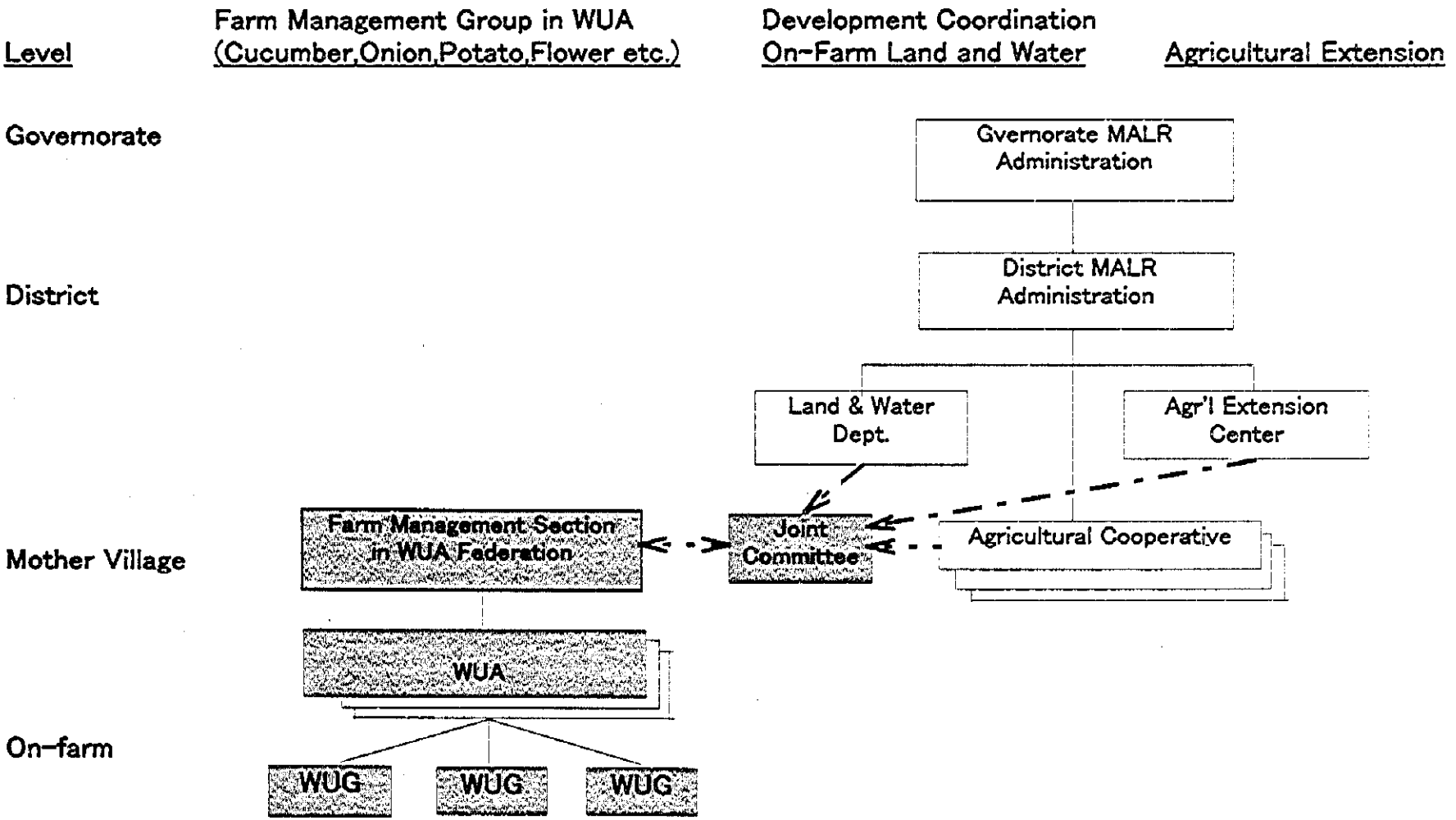


Figure E.5.4 Farmers' Organization and Agricultural Supporting Organization

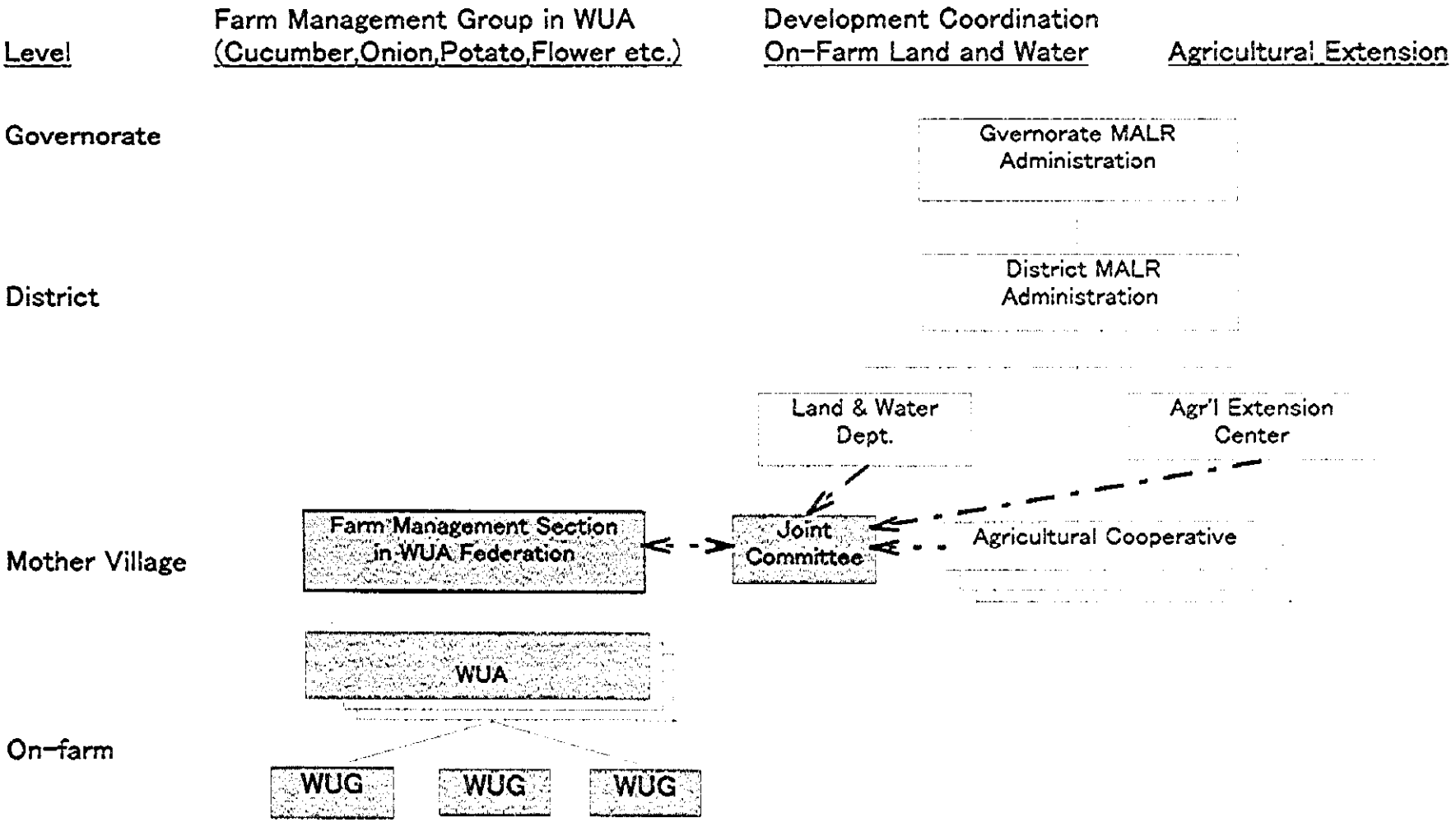


Figure E.5.5 Organaization Structure, Ministry of Aguriculture and Land Redamation (October 1997)

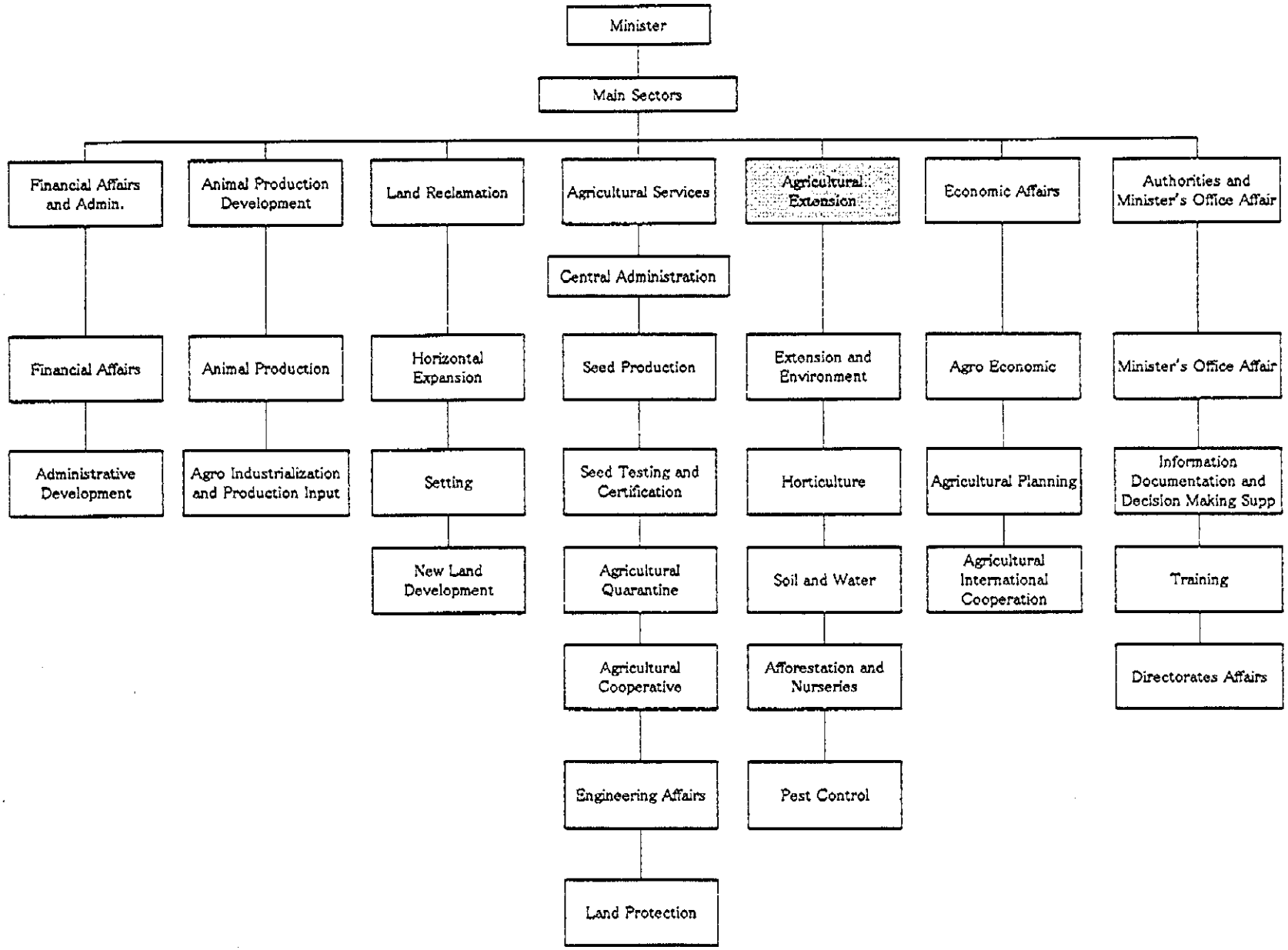
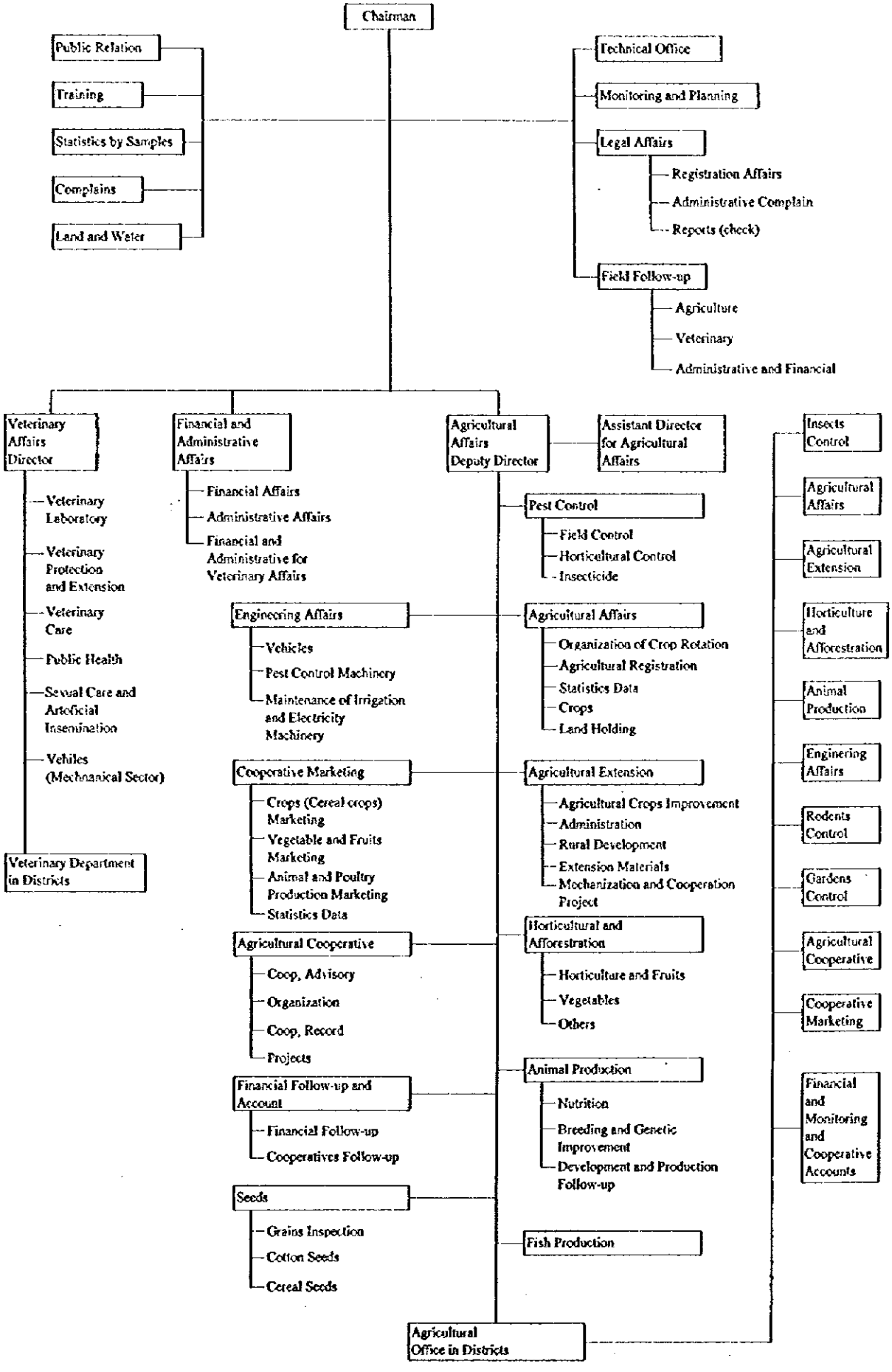


Figure E.5.6 Organaization Chart of Agricultural Office in Gharbia



APPENDIX F.

IRRIGATION AND DRAINAGE

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F.1 Brief History of Irrigation in Egypt

Irrigation has been practiced throughout Nile Valley since the earliest time in the history. Until the middle of 19th century, the irrigation had been facilitated by natural inundation from floodwater. Under the basin irrigation system, the land was divided into basins between 10,000 to 40,000 fed. with dikes. 40 to 60 days after the river level had fallen, these lands were drained and crops were grown undertaking soil moisture uptake.

The basin irrigation system continued to be the sole irrigation method in Egypt up until the year 1820 when the cultivation of cotton and sugar cane, requiring perennial irrigation, was first introduced. In 1826, Egypt developed, under the rule of Mohamed Ali, a system of deep canals for the irrigation of Lower Egypt with a view to growing cotton in the region. Along with the deep canals, also constructed were number of barrages such as Delta Barrages (constructed in 1861 and renovated in 1890) in Rosseta and Damietta branches of the Nile River, new Delta Barrages named the Mohomad Ali Barrages (completed in 1939), Assiut Barrage (constructed in 1902 and renovated in 1938), Zifta Barrage, Esna Barrage (constructed in 1908, renovated in 1947, and replaced in 1995), and Naga Hama Barrage (1930).

The Zifta Barrage, giving the Nile water into this Study Area, was completed in 1902 at 78 km downstream the Delta Barrage. The Zifta Barrage was later renovated during the years 1952 to 1954 in order to increase the head and thus provide the irrigation requirement for further expansion of cultivation in the northern Delta area.

Along with the construction of the barrages above, the Aswan Dam was constructed in 1902, and the dam height had been raised two times in years of 1912 and 1933. With the latter increase of the Aswan Dam height, almost whole agricultural lands in Egypt had become available under perennial irrigation. The area available for perennial irrigation is reported at about five-sixth of the total agricultural lands at that time. The conversion of the remaining lands (about one-sixth) had been achieved with the commissioning of the Aswan High Dam in 1968.

F.2 Irrigation Practice in Egypt

The overall irrigation in Egypt is unique. The water comes from a single source, the Aswan High Dam. Amount of water delivered into canals is controlled by water levels in channels rather than flow measurements. At some important barrages such as boundary barrages located between Irrigation Directorates, the water levels can be converted to discharge since H-Q relationship curve or formulas converting water levels to discharge have been established and those are periodically checked by Water Distribution Directorate or relevant Irrigation Directorate itself.

Egypt's irrigation delivery system consists of 31,000 km of public canals under the control of MPWWR, and 80,000 km of Meskas and farm ditches, 560 large number of pumping stations and over 22,000 water control structures. This system delivers water to about 7.4 million fed (3.1 million ha). The main irrigation system which receives irrigation water from the Nile River comprises main canals which deliver water successively into their branch canals, and then terminal canals.

The terminal canals, called distributor or delivery that are located at the terminal point under the control of the Government, deliver water into Meskas. The Meskas are channels owned by farmers and serve generally 100 to 500 fed. The Meskas, in turn, feed Marwas, which are on-farm ditches serving 10 to 100 fed. Both Meskas and Marwas are owned, operated and maintained by the farmers benefited. The water distribution by the Government and use by the farmers take place in a complex framework of rotation based on a canal system coupled with rotation among farmers at the Meska level. However, the rotation among farmers are not regulated, and the farmers generally tend to overuse irrigation water.

Most farmers in Old Land, typically in Delta area, receive irrigation water in the Meskas about one to half a meter below the elevation of the farm land, so that the farmers have to lift up the water to the Marwas from the Meskas. The mean lifting the water used to animal driven Sakias (water wheels), and now the majority use diesel engine driven pump or diesel engine driven Sakias.

On-farm irrigation is mostly practiced with basin irrigation or furrow irrigation, both of which fall in the category of surface irrigation. Sprinkler and drip irrigations are getting familiar but still the practice is limited to newly reclaimed areas opened in deserts but not in Old Land. It is observed that farmers are generally engaged in irrigation as much as 16 to 18 hours during peak irrigation period and in places certain number of pumps remain functioning throughout night. The latter case often takes place in case a pump serves a number of farms collectively, and this sometimes leads to over-irrigation.

F.3 Drainage Development in Egypt

Land drainage started shortly after the introduction of year-round irrigation during the 19th century, and has been already practiced more than 100 years in Egypt. Drains constructed at that time were gravity-fed type. However, the nature of the land, almost flat, soon gave a requirement of constructing drainage pumping stations. The first drainage pumping station was constructed in 1898 at El Max near Alexandria to drain out about 212,000 fed. (90,000 ha).

Following the construction of drainage pumping stations, subsurface drainage had also come into sight. Researches and studies were carried out in 1938 in 15 fields around the country. The outcome justified the introduction of sub-surface drainage, and then 18,900 fed. of sub-surface drainage had been constructed in Monofia during 1942 to 1948. The net benefit derived from the sub-surface drain was estimated at 30 % increase in the crop yields in addition to a land saving reaching to as much as 12 – 15 % compared to open ditch drains.

Lateral pipe (sub-surface drain pipe) is usually set at a depth of 1.25 m at the highest point in the field. The spacing between laterals is computed on basis of a steady state flow using Hooghoudt equation, with a limitation of 30m spacing at minimum, generally practiced but not always, for an economical reason. Plastic PVC corrugated tubes with a diameter of 80 mm are used for the lateral pipes, and synthetic envelopes and pre-wrapping techniques are now common which were introduced in the early 1990's.

Sub-surface drainage system requires adequate outlets, and open drains have to be designed

to offer such outlets. The surface water levels in the open drains have to meet with an average field drainage depth of 1.35 m. Therefore, the bed level of open drain requires at least 2.5 m below the field ground levels taking into consideration the capacity.

The drainage system in Nile Delta is now extensive and serves 4.7 million fed. of the 7.7 million fed. of whole agricultural land. Drainage water from 22 drainage catchments flows by gravity to main open drains, where it is either discharged to the Northern Lakes or Mediterranean Sea, or otherwise is pumped by 21 reuse pump stations into irrigation canals, mixed with fresh Nile water and reused for irrigation. The total length of the main drains in the Nile Delta is now about 1,600 km.

The drainage rate is very low in the south of the Delta, ranging between 0.40 mm/day and 1.0 mm/day where the water table is low and natural drainage can be expected with a certain level. The rate rises up as one goes to north, and reaches as much as 10 mm/day in such northern tips as nearby Alexandria and Lake Manzala. This extremely high rates, exceeding the corresponding irrigation rates, suggest that a significant portion of the drainage water is not merely excessive irrigation water, though the areas are practiced high intensive rice cultivation, but also subject to upward seepage of brackish water. The drainage rates in the northern part of Central Delta are relatively low as compared to those in nearby Alexandria and Lake Manzala, reaching 4 to 5 mm/day at maximum.

F.4 Responsibility of Irrigation and Drainage

The Ministry of Public Works and Water Resources (MPWWR) is responsible for all aspects of the irrigation and drainage systems, including planing, construction, operation, maintenance and management. MPWWR has four Departments; namely, Irrigation, Planning, Mechanical and Electrical and Finance, and five Authorities: Drainage, High Dam, Coastal Protection, Survey and Research Centers headed by Water Research Center. The Irrigation Department commands water supplies to each of 50 canals covering over 6.0 million fed of old lands and 1.0 million fed of recently reclaimed lands.

F.5 Irrigation Improvement Project

A project called "Irrigation Management Systems (IMS) Project" started as early as 1981 in order to improve operating efficiency of the irrigation system in the country and strengthen MPWWR's operation, maintenance and planning capabilities. The objectives of the IMS was to provide technical and capital assistance for the planning, design, construction, rehabilitation, and maintenance of the irrigation systems over this country.

The IMS was amended in 1984 to increase its potential impact and had advantage of six years of USAID funded research at Egyptian Water Use and Management (EWUP) Project. EWUP then merged into the Regional Irrigation Improvement Project (RIIP) jointly funded by MPWWR and USAID, and the RIIP was implemented with technical assistance from Consortium for International Development (CID) and Colorado State University (CSU).

With a further expansion of IMS, the Irrigation Improvement Project (IIP) began in 1987 with an assistance from USAID (Project Number 263-0132), and was one of ten sub-projects of the

IMS. The IIP is therefore a successor of EWUP and RIIP. IIP was designed to remove specific constraints to agricultural production by improving the effectiveness of the irrigation and drainage systems for about 400,000 fed. The IIP became more complex due to requirements for feasibility study prior to the implementation, the development of a cost recovery, and the formation and legalization of Water Users Associations (WUA). Throughout the IIP, technical assistance (TA) had been provided by Morrison-Kundsen Engineers (MKE) and Louis Berger International Inc. (LBII).

The IIP goal was to increase production and productivity in the agricultural sector through 1) improving the water delivery and distribution systems of at least 1,200 identified Meskas commanding 92,000 fed or more, and 2) organizing at least 1,200 WUAs, completion of 17 feasibility studies for 394,000 fed, finalization of contracts to permit construction of selected Meskas within the identified areas by the Project Activities Completion Date (PACD) of September 1995, monitoring and evaluation of improved Meska operation and maintenance, and providing help to farmers in on-farm water management practices.

The IIP purpose was to strengthen MPWWR's capacity to plan, design, implement and operate a rehabilitation and modernization program in eleven commands covering 337,000 fed. The IIP objectives were to 1) strengthen the institutional capacity of MPWWR in equipment, staffing, managerial and administrative skills, and in operational policies and procedures to continue IIP with limited expatriate expertise, 2) develop a rational interdisciplinary approach in planning, designing and implementing renovation of specific canal commands identified in MPWWR's then five year plan, 3) develop an Irrigation Advisory Service (IAS) to transfer water management technical information and technical assistance to WUAs, 4) organize operational WUA's in all IIP areas, coordinate scheduling of water delivery on Meskas, perform maintenance and resolve disputes, increase communication links between farmers and government officials, and 5) establish policies and procedures for the recovery of an appropriate portion of operation and maintenance (O&M) costs, and 100 percent of the nominal costs of Meskas and on-farm improvements.

Upon completion of the IIP dated September 1996, accomplished are such as 1) 17 feasibility studies covering 400,000 fed, 2) 91 USAID and IIP contracts, 3) 125,000 fed of main delivery improvement, 4) introduction of continuous flow over 100,000 fed, 5) 67,000 fed of Meska improvement comprising over 50,000 water users, and 6) registration of Water Users Association and others (See Table F.5.1).

Number of lessons had been learned, from which recommended future actions had also been suggested. Summarized below are the major lessons and the recommendations that shall be focused on in any future irrigation improvement projects (IIP Final Report, Sep. 21, 1996):

1. It is most important that the delivery improvements are due scheduled so they are completed before the first improved Meska come on line, since continuous delivery flow is absolutely essential for proper operation of the improved Meska systems as designed,
2. The answer to the issue which uses more water, continuous flow or traditional rotation system, is that the amount of water used depends on management as demonstrated in many countries, but not whether a system is on continuous flow or rotation,

3. The perception that continuous flow takes more water than rotation was partly a result of problems that occurred during the transition from rotation to continuous flow where the completion of main delivery and Meska were not properly coordinated, and
4. A greater portion of anticipated benefits from the IIP were expected to result from water management improvement at the on-farm level due under the control of the farmers, hence the benefits will not be realized unless on-farm water management is included in the future IIP programs,

With respect to the evaluation of the IIP, no information of how much water has been saved and how much irrigation efficiency has been increased is available at present. The task to prove the effectiveness and the achievement of the IIP in the fields is now under way by monitoring and evaluation staff under Irrigation Improvement Sector (then Irrigation Improvement Project).

F.5.1 Irrigation Improvement Project Funded by World Bank and KFW

A discussion was held in April 1993 between the World Bank (WB) and WPWWR concerning the possibility of the Bank involvement in further developing the aforementioned USAID assisted IIP projects. The Identification Mission arrived in Cairo in September 1993, following which a series of actions had been made such as; submission of Preparation Report in March 1994, visits of Pre-appraisal Mission in June to July 1994 and Appraisal Mission in October 1994. The Preparation Reports were made based on the feasibility studies under the USAID assisted IIP.

The Bank and MPWWR had reached an agreement in October 1996 that the IIP projects identified by the Identification Mission be implemented with a loan assistance from the Bank, and also KHW was involved as a co-financier. The project areas are 133,000 fed. in Mahmoudia, 42,000 fed. in Manaifa, and 75,000 fed in Wasat, total of which is 250,000 fed. (10,500 ha), and the project costs agreed by Appraisal Mission and MPWWR are 121.5 million US$ for the investment cost, and 18.1 million US$ for the recurrent cost, total of which including physical and price contingencies is 182.3 million US$. The loan provided by the WB and KFW is 130 million US$, consisting of about 71% (See Tables F.5.2 and F.5.3).

F.5.2 Overall Plan of Irrigation Improvement Project

In conjunction with above-mentioned projects, MPWWR had formulated overall plan of Irrigation Improvement Project in Old Land in June 1996 and revised in 1998. The original plan was to fulfill as much as 6.7 million fed (2.8 million ha) old land improvement with the total summed cost of about 26 billion LE until 2017 over 4 number of Five Years Plan. The annual averaged improvement area was to reach as much as 415,000 fed with 2,074 million LE per year during the last Five Years Plan 2012 – 2017 (See Table F.5.4).

Considering the ambitiousness of the original plan, a revision was made in 1998. The revised plan is to accomplish about 3.5 million fed (1.5 million ha) improvement, which is about half of the old land, until 2017. With this accomplished, about 2.5 billion cu.m irrigation water is to be saved annually on basis of an assumption that the project could save 17 cm as the water depth, which is equivalent to about 10 % of the presently applied water amount. The 2.5 billion cu.m to be saved is about 5% of 55.5 billion cu.m allocated to Egypt. Regarding the period of current Five Years Plan, about 780,000 fed

(330,000 ha) old land is to be improved (annual average is 156,000 fed), with which about 560 million cu.m is to be saved, equivalent to about 1% of the 55.5 billion cu.m (See Table F.5.5).

Table F.5.1 Accomplishment of IIP Funded by USAID

Major Task	Achievement
Feasibility Study:	17 studies covering 400,000 feddan
Preparation of Construction Contract Documents:	91 USAID/IIP Contracts, 112 MLE
Main Delivery Improvement:	125,000 feddans
Continuous Flow:	Over 100,000 feddan (75,000 water users)
Meska Improvement:	67,000 feddan (over 50,000 water users)
Registration of Water Users Association:	Over 1,100 feddan Meska Command Areas
Others:	Establishment of Irrigation Advisory Service
	Overseas and Domestic Training of IIP Staff
	Legalization of Water Users Association
	Legalization of Meska Cost Recovery

Table F.5.2 Project Areas financed by WB and KFW

Development Area	feddan	Directorate	Components
Mahmoudia	133,000	Damanhour	1. Mahmoudia Canal Improvement 2. Delivery System Improvement 3. Meska Improvement of 133,000 feddan
Manaifa	42,000	Kafr El Sheikh	1. Monaifa Canal Improvement 2. Delivery System Improvement 3. Meska Improvement of 42,000 feddan
Wasat	75,000	Kafr El Sheikh	1. Meet Yazid Cana; Improvement 2. Delivery Improvement 3. Meska Improvement of 75,000 feddan
Total	250,000 (10,5000ha)		

Table F.5.3 Costs of the WB and KFW funded Project in '000US$

Items	Cost, '000US$	Remarks
1. Investment Cost		
Civil Work	103,981.7	
Equipment and Material	14,445.7	
Vehicles	3,011.8	
Specialized Services	0.1	
Total Investment Cost	121,499.3	486$/feddan (1,157$/ha)
2. Recurrent Cost		
Vehicle	1,066.1	
Incremental Staff	4,015.5	
Specialized Services	4,488.4	
Training	8,534.7	
Equipment	37.7	
Total Recurrent Cost	18,142.4	72$/feddan (173$/ha)
Total Baseline Cost	139,641.7	558$/feddan (1,330$/ha)
Physical Contingencies	18,363.5	13% to the Total Baseline Cost
Price Contingencies	24,310.5	17% to the Total Baseline Cost
Total Project Cost	182,315.7	729$/feddan (1,736$/ha)

Table F.5.4 Original Overall Plan of Irrigation Improvement Project until 2017

Plan	Area	Cost/fed	Total Cost	Remarks
	1000 fed	1000 LE	MLE	
FY 1996/1997	90	1.8	162	
The Five Years Plan 1997 – 2002	1,046	2.5	2,615	
The Five Years Plan 2002 – 2007	1,388	3.1	4,303	
The Five Years Plan 2007 – 2012	2,136	4.0	8,544	
The Five Years Plan 2012 – 2017	2,074	5.0	10,370	
Total	6,734		25,994	

Table F.5.5 Revised Overall Plan of Irrigation Improvement Project until 2017

Plan	Area	Cost/fed	Total Cost	Remarks
	1000 fed	1000 LE	MLE	
The Five Years Plan 1997 – 2002	780	2.0	1,560	
The Five Years Plan 2002 – 2007	900	2.0	1,800	
The Five Years Plan 2007 – 2012	900	2.0	1,800	
The Five Years Plan 2012 – 2017	900	2.0	1,800	
Total	3,480		6,960	

F.6 Area Served in the Whole Study Area (Master Plan Study Area)

Total area served in this Study is worked out to be 751,233 fed (315,514 ha) including new reclamation area of 56,000 fed (23,520 ha) which has not yet been officially commissioned (still under the Horizontal Expansion Sector). Excluding the reclamation area is 695,223 fed (291,994 ha), and this is managed by 17 relevant Water District Offices; 5 in Gharbia Directorate, 4 in Kafr El Sheikh Directorate, 7 in West Dakahlia Directorate and 1 in Damietta Directorate (Refer to Tables F.6.1 to F.6.3).

With respect to areas served by principal and main canals, Bahar Shebin commands a total of 641,397 fed (269,387 ha), excluding new reclamation area, with supplements by drainage reuse and such irrigation pumping stations as Balamoun P.S. and Kafr Saad P.S. Of the total area, 67,080 fed (10%) is served by Bahr El Mallah, 163,665 fed (26%) by Bahr Tera, 149,709 fed (23%) by Raiah Bilqas, 59,137 fed (9%) by Basandila, and 120,762 fed (19%) by El Sahel. The remaining 81,044 fed (13%) is the direct command area (Refer to Table F.6.4).

Areas served by branch canals relevant to the principal and the main canals above are such as; 32,280 fed by Bahar El Maasara, 5,698 fed by Bahr El Banawan El Alaa, 31,481 fed by Bahr Hafir Shehab El Deen, and 67,460 fed by Balamoun, with some supplements by drainage reuse and the irrigation pumping stations (See Table F.6.4).

The total of 695,223 fed is served by either fresh water, mixed or otherwise drainage water only (Drainage water mixed by El Monofia M.P.S. at a location on Raiah Abbasee is not counted in considering the fresh water). The area irrigated by mixed water is 84,755 fed (35,597 ha), and this area is served by Hamoul M.P.S. A total of areas irrigated by drainage only is worked out to be 61,644 fed (25,890 ha), which are located in delivery canals of Bahr Tera, and tail portions of Basandila, El Nile and El Eslah canals. Of the 61,644 fed, 34,414 fed (14,454 ha) is usually irrigated by drainage only but sometimes mixed with fresh water according to the water levels balance between the feeder drainage and the irrigation canal conveying water from upstream (See Table F.6.4 below).

Table F.6.1 Area Served for Relevant Irrigation Directorates

Directorate	Inspection	Water District	Area, feddan	Area, ha	Remarks
Gharbia	Gharbia	Tanta	52,040	21,857	
		Kafr El Zaiat	46,970	19,727	
		Basyoun	37,340	15,683	
		Kotour	44,385	18,642	includes USAID project area
		El Santa	55,810	23,440	
		Sub Total	236,545	99,349	
	El Mahallah El Kubra	Bahary Zifta	42,695	17,932	Study Area
		Samanoud	27,790	11,672	Study Area
		Bishbeesh	39,190	16,460	Study Area
		East El Mahallah	34,345	14,425	Study Area
		West El Mahallah	23,400	9,828	part of S.A., Total Dire. 45,030
		Sub Total	167,421	70,317	
	Total		403,966	169,666	
Kafr El Sheikh	Disouk	Motobus	55,000	23,100	
		West Sidy Salem	54,500	22,890	includes USAID project area
		Fowa	47,600	20,076	
		Disouk	52,300	21,966	
		Sub Total	209,600	88,032	
	Kafr El Sheikh	East Sidy Salem	49,900	20,958	includes W. B. project area
		Kafin	44,600	18,732	
		Kafr El Sheikh	46,000	19,320	
		Reiad	47,100	19,782	includes W. B. project area
		Sidi Ghazi	50,600	21,252	
		Sub Total	238,200	100,044	
	Biyala	Balteem	37,605	15,794	Study Area
		Mansour	45,700	19,194	Study Area
		Hamoul	41,855	17,579	Study Area
		Biyala	38,605	16,172	Study Area
		Sub Total	163,665	68,739	
	Total		611,465	256,815	
West Dakahlia	Bilqas	Hafir	30,602	12,853	Study Area
		Basandila	62,162	26,108	Study Area
		Bilqas	45,469	19,617	Study Area
		Maasara	40,478	17,001	Study Area
		Zahraa	35,400	14,868	Study Area
		Sub Total	215,111	90,347	
	Talkha	Talkha	47,934	20,132	Study Area
		Sherbin	42,812	17,981	Study Area
		Sub Total	90,746	38,113	
	New Reclamation Area*		56,000	23,520	Study Area
	Total		361,857	151,980	
Damietta	Damietta	Damietta	12,787	5,371	
		Farskour	66,939	28,114	
		Kafr Saad	58,280	24,478	Study Area
		Sub Total	138,006	57,963	
	Total		138,006	57,963	

Note: This new reclamation area is to be transferred to West Dakahlia Directorate after the completion.

Table F.6.2 Area Served for Relevant Water Districts

Directorate	Inspection	Water District	Area, feddan	Area, ha	Remarks
Gharbia	El Mahallah El Kubra	Bahary Zifta	42,696	17,932	
		Samanoud	27,790	11,672	
		Bishbeesh	39,190	16,460	
		East El Mahallah	34,345	14,425	
		West El Mahallah	23,400	9,828	Part of the whole 45,030 feddan
		Sub Total	167,421	70,317	
Kafr El Sheikh	Biyala	Balteem	37,605	15,794	
		Mansour	45,700	19,194	
		Hamoul	41,855	17,579	
		Biyala	38,505	16,172	
		Sub Total	163,665	68,739	
West Dakahlia	Bilqas	Hafir	30,602	12,853	
		Basandila	62,162	26,106	
		Bilqas	46,469	19,517	
		Maasara	40,478	17,001	
		Zahraa	35,400	14,868	
		Sub Total	215,111	90,347	
	Talkha	Talkha	47,934	20,132	
		Sherbin	42,812	17,981	
		Sub Total	90,746	38,113	
	New Reclamation Area*		56,000	23,520	
Damietta	Damietta	Kafr Saad	58,280	24,478	
Total			751,223	315,614	Conversion to ha: 0.42

Note: *This new reclamation area is to be transferred to West Dakahlia Directorate after the completion.

Table F.6.3 Area Served with Respect to Major Canals Based on Water Districts

Directorate	Water District	Area, fed	Canal	Area, fed	Area, ha	Remarks
Gharbia	Bahary Zifta	42,696				
			Bahr Shebin	9,970	4,187	
			Omar Pick	23,626	9,923	
			G. Dahtoura	2,000	840	
			Bahr Shershaba	7,100	2,982	
	Samanoud	27,790				
			Bahr Shebin	18,470	7,757	
			Bahr El Mallah	1,300	546	
			El Sahel	8,020	3,368	
	Bishbeesh	39,190				
			Bahr El Mallah	39,190	16,460	
	East El Mahallah	34,345				
			Bahr Shebin	7,755	3,257	
			Bahr El Mallah	26,590	11,168	
	West El Mahallah	23,400				
			Bahr Shebin	2,300	966	
			El Korashia	21,100	8,662	
Kafr El Sheikh	Balteem	37,605				
			Bahr Tera	29,655	12,455	Mixed with Drainage
			El Magaz	*4,700*	*1,974*	*Drainage only**
			El Khashaa	3,250	1,365	Drainage only
	Mansour	45,700				
			Mansour	45,700	19,194	Mixed with Drainage
	Hamoul	41,855				
			Bahr Tera	25,855	10,859	
			Bahr Tera	9,400	3,948	Mixed with Drainage
			Bahr Tera	*6,600*	*2,772*	*Drainage only**
	Biyala	38,505				
			Bahr Tera	38,505	16,172	
West Dakahlia	Hafir	30,602				
			El Nile	11,621	4,881	
			El Eslah	18,981	7,972	
	Basandila	62,162				
			Bahr Shebin	3,025	1,271	
			Bahr Basandila	47,443	19,926	
			Bahr Basandila	*11,694*	*4,911*	*Drainage only**
	Bilqas	46,469				
			Bahr Shebin	3,240	1,361	
			Ralah Bilqas	11,748	4,934	
			Bahr Hafir Shehab El Deen	31,481	13,222	
	Maasara	40,478				
			Ralah Bilqas	2,500	1,050	
			Bahr El Maasara	32,280	13,558	
			Bahr El Banawan El Alaa	5,698	2,393	
	Zahraa	35,400				
			El Nile	23,980	10,072	Drainage only
			El Eslah	*11,420*	*4,796*	*Drainage only**
	Tafkha	47,934				
			Bahr Shebin	36,284	15,239	
			El Sahel	11,650	4,893	
	Sherbin	42,812				
			El Sahel	19,952	8,380	
			Balamoun	22,860	9,601	
Damietta	Kafr Saad	58,280				
			Balamoun	37,992	15,957	
				6,608	*2,775*	*Feeder from Damietta B.***
			El Sahel	7,260	3,058	
				1,000	*420*	*Feeder from Damietta B.***
			Nile canal	*5,400*	*2,268*	*Feeder from Damietta B.***
Total excluding New Reclamation Area				**695,223**	**291,994**	**conversion: 0.42**
Total including New Reclamation Area (56,000 fed)				**751,223**	**315,514**	**Not yet commissioned**
Irrigation by Fresh Water				**548,824**	**230,506**	
Irrigation by Mixed Water				**84,755**	**35,597**	
Irrigation by Drainage Water				**27,230**	**11,437**	
Irrigation by Drainage Water*				*34,414*	*14,454*	

Note: * (*Italics*) means area usually irrigated by dranage only but sometimes mixed with fresh water according to the water level balance.
Note: ** (*Italics*) means area usually fed by Damietta Branch but sometimes fed from upstream.

Table F.6.4 Area Served with Respect to Major Canals

Principal	Main	Branch	Delivery	Area, fed	Br'k Dwn	Area, ha	Remarks
Bahr Shebin				641,397		269,387	
				81,044		34,033	
	Bahr El Mallah			67,080		28,174	
	Bahr Tera			163,665		68,739	
					64,360	27,031	
					39,055	16,403	Mixed with Drainage
					3,250	1,365	Drainage only
					11,300	*4,746*	*Drainage only**
			El Mansour		45,700	19,194	Mixed with Drainage
	Rajah Bilqas			149,709		62,878	
					14,248	5,984	
		Bahr El Maasara			32,280	13,558	
		Bahr El Banawan El Alaa			5,698	2,393	
		Bahr Hafir Shehab El Deen			31,481	13,222	
			El Nile		11,521	4,881	
					23,980	10,072	Drainage only
			El Eslah		18,981	7,972	
					11,420	*4,796*	*Drainage only**
	Basandila			59,137			
					47,443	19,926	
					11,694	*4,911*	*Drainage only**
	El Sahel			120,762		50,720	
					46,902	19,699	
					1,000	*420*	*Feeder Km 220***
		Balamoun			60,852	25,558	
					6,608	*2,775*	*Feeder Km 220***
			Nile Canal		*5,400*	*2,268*	*Feeder from Damietta B.***
	Omar Pick			23,626		9,923	
			G. Dahtoura	2,000		840	
			Bahr Shershaba	7,100		2,982	
			El Korashia	21,100		8,862	
Total				695,223		291,994	

Note; Total area does not include New Reclamation Area.

Break Down of Bahr Shebin

	Area, fed	Break down, fed		Area, ha	Remarks
Bahr Shebin	641,397			269,387	Total of Bahr Shebin
		494,998	481,990	202,436	Fresh Water
			13,008	*5,463*	*Feeder fr Damietta Branch***
		84,755		35,597	Mixed with Drainage
		61,644	27,230	11,437	Drainage only
			34,414	*14,454*	*Drainage only**

Note: * (*Italics*) means area usually fed by dranage only but sometimes mixed with fresh water a/c to the water balance.
Note: ** (*Italics*) means area usually fed by Damietta Branch but sometimes fed from upstream.

F.7 Drainage Rate in the Whole Study Area (Master Plan Study Area)

Drainage rate is defined as a drainage-water depth per day that is drained at a pumping station; namely, the drainage amount at the pump station divided by the drainage area served. Drainage rate increases as one goes close to the Mediterranean Sea. With reference to the pumped discharges given by Mechanical and Electrical Department, responsible for all pumping stations, the drainage rates relevant to the Study Area have been estimated (See Tables F.7.1 to F.7.13 and Figures F.7.1 to F.7.13).

Annual average drainage rate in the southern part of the Study Area is relatively small; namely, 1.51 mm/day at Sagaaya D.P.S. and 1.12 mm/day at Mahallah El Kubra D.P.S. Samatay D.P.S. and No.5 D.P.S., located mid of the Study Area, give 2.73 mm/day and 1.74 mm/day drainage rates respectively. No.6, No.4 and No.3 drainage stations show such annual average rates as 2.58, 3.38, and 3.39 mm/day respectively with those monthly maximums of 4.01 mm/day in July, 5.15 mm/day in July and 5.00 mm/day in September.

The stations located at most northern part of the Study Area give such annual average and monthly maximum rates as; 3.48 mm/day (4.77 in August) at Lower D.P.S. No.1, 3.55 mm/day (5.7 in September), 2.44 mm/day (3.13 in September) at Burullus D.P.S., 4.46 mm/day (6.66 in September) at Tera D.P.S., and 3.92 mm/day (5.29 in September) at Hafir D.P.S.

With respect to drainage amount, Lower No.1 D.P.S. discharges the biggest average annual volume, among the relevant pumping stations, of 881 MCM. No.2 D.P.S. discharges an annual average of about 343 MCM. A part of the both drainages discharged feeds a tail portion of Basandila canal, approximately 11,694 fed (4,911 ha), and a part of New Reclamation Area though not yet officially commissioned. The remaining volume goes into the Mediterranean Sea. Two drainage pumping stations, Burullus D.P.S. and Tera D.P.S., discharge an annual average of 56 MCM and 492 MCM respectively into Burullus Lake (Refer to Table F.7.16).

Considering the large amount of discharges lifted annually and high drainage rates for the drainage pump stations located northern part of the Study Area, there is a possibility that return ground-flow, originating in upstream part including even Monofy Directorate, contributes to the large discharge as goes to downstream part. Sea water intrusion into those drainage canals is also suggested since the bed levels are lower than mean sea level.

Table F.7.1 Summary of Pumping Stations related to the Study Area

Type	Name	Suction	Delivery	Area Served feddan	Area Served ha	Q/Unit CUM/S	No of Pump	Stand-by	Remarks
Irrigation	Balamoun I.P.S.	Damietta Branch	Balamoun & El Sahel	40,000	16,800	4.00	4	1	Area served is the area to be irrigated.
	Kafr Saad I.P.S.	Damietta Branch	Balamoun & El Sahel	70,650	29,673	8.00	4	1	Area served is the area to be irrigated.
Drainage Reuse	East El Monofia M.P.S.	Karone drain, Upsteram of Gharbia	Ratah Abbasee	139,000	58,380	2.50 7.79	3 2	1	Area served is the area to be assisted.
	Hemoul M.P.S.	Gharbia Drain	Bahr Tera	60,000	25,200	7.50	3	1	Area served is the area to be assisted.
Drainage	Upper D.P.S. No.1	Drain No.1	Damietta Branch	52,000	21,840	5.00	3	1	Operation ceased in August of 1994, so as not to affect municipality water supply nearby.
	Lower D.P.S. No.1	Drain No.1	Mediterranean	113,000 165,000	47,460 69,300	12.00	4	1	Area served including Upper DPS No.1
	D.P.S. No.2	Drain No.2	Mediterranean	63,000	26,460	7.50	4	1	
	D.P.S. No.3	Drain No.3	Gharbia Drain	56,000	23,520	5.20	4	1	
	D.P.S. No.4	Drain No.4	Gharbia Drain	66,000	27,720	7.50	5	1	
	D.P.S. No.5	Drain No.5 (upstream)	Gharbia Drain	73,000	30,660	6.00	4	1	
	D.P.S. No.6	Drain No.5	Gharbia Drain	34,400	14,448	5.00	3	1	
	Samatay D.P.S.	Samatay Drain	Gharbia Drain	55,000	23,100	5.00	4	1	
	Sagaaya D.P.S.	Sagaaya Drain	Gharbia Drain	75,000	31,500	5.00	5	1	
	Hafir D.P.S.	Hafir Drain	Gharbia Drain	68,500	28,770	5.00	5	1	
	Tera D.P.S.	Tera Drain	Burullus Lake	72,000	30,240	8.00	4	1	
	Burullus D.P.S.	Burullus Drain	Burullus Lake	15,000	6,300	3.16	3	1	
	El Mahallah El Kubra D.P.S.	Omar Tosson Drain	Damietta Branch	43,000	18,060	3.50	4	1	
	Sanania D.P.S.	Sanania Drain	Mediterranian	24,000	10,080	3.51	5	1	

Note: 1)"No of Pumps" is the total number of the pumps including stand-by pump. 2) Pumps are designed to be operated for a maximum of 16 hours per day during peak period.
Source: Mechanical and Electrical Directorate in Kafr El Sheikh

Table F.7.2 Discharge at Upper D.P.S. No.1 (Drain No.1 to Damietta Branch) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	761	0	150	0	0	4,808	6,942	6,471	4,302	1,707	581	2,624	28,346
1994	0	0	359	0	0	171	1,552	Operatio	Ceased				2,082
1995													
1996													
1997													
Average	381	0	255	0	0	2,490	4,247	6,471	4,302	1,707	581	2,624	23,057
mm/day	0.06	0.00	0.04	0.00	0.00	0.38	0.63	0.96	0.66	0.25	0.09	0.39	0.29

Source: MED Computer Center, Kafr El Sheikh

Table F.7.3 Discharge at Lower D.P.S. No.1 (Drain No.1 to Mediterranean) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	53,967	30,780	63,171	61,344	71,172	87,731	81,324	90,136	84,531	69,141	45,144	60,588	799,029
1994	53,006	32,875	56,651	62,424	50,245	78,040	86,400	90,309	86,918	100,526	67,888	57,132	822,614
1995	52,790	57,391	61,236	65,026	70,969	89,493	94,222	95,284	91,627	20,447	60,555	62,758	821,798
1996	52,920	57,480	64,346	62,150	84,017	87,600	110,850	114,154	112,309	68,360	72,273	68,106	954,765
1997	53,815	59,115	65,167	79,611	89,364	98,978	116,374	122,860	112,778	71,913	71,693	66,463	1,008,132
Average	53,300	47,528	62,154	66,111	73,153	88,408	97,834	102,549	97,633	66,077	63,511	63,009	881,268
mm/day	2.48	2.21	2.89	3.08	3.41	4.12	4.55	4.77	4.54	3.08	2.96	2.93	3.48

Source: MED Computer Center, Kafr El Sheikh

Table F.7.4 Discharge at D.P.S. No.2 (Drain No.2 to Mediterranean) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	25,253	18,955	23,228	21,216	25,092	34,304	34,676	40,094	66,700	28,165	17,554	30,337	365,574
1994	23,600	13,092	23,063	17,640	13,611	22,060	41,402	36,640	29,461	23,129	26,982	23,258	293,938
1995	19,399	22,254	20,870	23,526	23,027	24,724	32,370	37,697	38,597	22,976	23,120	24,495	313,055
1996	25,009	19,573	25,118	22,015	27,288	31,544	46,702	39,400	42,289	23,217	23,106	23,709	348,970
1997	22,039	20,758	26,231	30,824	33,572	39,678	36,663	49,704	49,136	29,292	29,992	26,138	394,026
Average	23,060	18,926	23,702	23,044	24,518	30,462	38,363	40,707	45,237	25,356	24,151	25,587	343,113
mm/day	2.81	2.55	2.89	2.90	2.99	3.84	4.68	4.96	5.70	3.09	3.04	3.12	3.55

Source: MED Computer Center, Kafr El Sheikh

Table F.7.5 Discharge at D.P.S. No.3 (Drain No.3 to Gharbia Drain) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	21,069	14,143	17,596	14,526	21,748	37,121	29,297	29,668	29,260	20,816	11,756	22,997	269,997
1994	19,609	6,093	31,576	19,737	14,354	29,446	27,733	28,173	34,519	20,797	23,203	18,649	273,889
1995	13,403	20,676	18,167	22,978	15,809	26,526	31,384	31,225	31,318	16,417	15,603	16,773	260,279
1996	17,877	17,475	16,988	20,837	20,648	34,735	39,939	38,647	40,244	18,121	17,344	18,950	301,805
1997	14,480	18,917	21,322	28,052	32,470	40,894	37,796	45,398	41,165	20,480	23,484	22,857	347,314
Average	17,288	15,461	21,130	21,226	21,006	33,744	33,230	34,622	35,301	19,326	18,278	20,045	290,657
mm/day	2.37	2.35	2.90	3.01	2.88	4.78	4.56	4.75	5.00	2.65	2.59	2.75	3.39

Source: MED Computer Center, Kafr El Sheikh

Table F.7.6 Discharge at D.P.S. No.4 (Drain No.4 to Gharbia Drain) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	28,143	13,014	20,614	23,881	26,784	42,182	35,842	36,733	28,795	20,263	13,259	20,952	310,462
1994	19,008	7,209	22,626	20,223	14,067	29,727	48,073	33,102	36,261	23,457	26,622	24,813	305,188
1995	16,551	25,029	19,386	23,814	21,843	32,967	36,504	36,531	34,911	16,281	14,990	18,441	297,248
1996	18,063	18,001	22,167	25,812	24,699	43,659	49,989	46,440	36,531	22,248	21,438	27,513	356,560
1997	21,276	22,707	30,780	44,010	41,418	45,792	50,787	53,433	47,790	26,869	27,405	29,214	441,481
Average	20,608	17,192	23,115	27,548	25,762	38,865	44,239	41,248	36,858	21,824	20,743	24,187	342,188
mm/day	2.40	2.22	2.69	3.31	3.00	4.67	5.15	4.80	4.43	2.54	2.49	2.81	3.38

Source: MED Computer Center, Kafr El Sheikh

Table F.7.7 Discharge at D.P.S. No.5 (Drain No.5 to Gharbia Drain) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	14,947	7,927	17,010	18,209	6,847	9,159	24,408	21,255	25,704	16,524	8,511	6,113	178,614
1994	15,747	4,104	16,341	14,710	10,908	15,790	25,963	17,604	23,415	15,984	18,943	17,410	196,919
1995	9,872	17,431	9,065	16,017	14,299	14,753	23,955	1,732	23,332	14,559	11,686	15,228	171,929
1996	13,457	12,384	14,580	18,101	17,928	21,319	24,862	22,723	26,417	13,047	11,315	15,340	211,473
1997	17,338	28,426	27,000	15,293	15,098	15,336	19,654	16,117	24,883	14,623	9,655	14,839	218,462
Average	14,272	14,054	16,799	16,466	13,016	15,271	23,808	15,886	24,750	14,947	12,022	13,786	195,079
mm/day	1.50	1.64	1.77	1.79	1.37	1.66	2.50	1.67	2.69	1.57	1.31	1.45	1.74

Source: MED Computer Center, Kafr El Sheikh

Table F.7.8 Discharge at D.P.S. No.6 (Drain No.5 to Gharbia Drain) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	9,393	4,673	6,871	7,209	9,562	17,086	15,430	13,491	12,432	9,121	5,971	10,210	121,449
1994	8,577	2,020	9,265	8,190	8,495	11,965	17,158	14,625	15,795	8,712	11,538	9,980	126,320
1995	8,060	9,030	6,858	11,479	9,351	13,788	18,632	16,245	15,493	8,505	8,496	9,886	135,823
1996	8,871	7,807	7,938	12,271	12,060	15,822	20,574	17,622	19,216	9,594	8,622	9,648	150,045
1997	6,696	7,992	9,234	11,646	12,672	15,912	17,982	19,044	16,020	8,838	9,342	11,394	146,772
Average	8,319	6,304	8,033	10,159	10,428	14,915	17,955	16,205	15,791	8,954	8,794	10,224	136,082
mm/day	1.66	1.56	1.79	2.34	2.33	3.44	4.01	3.62	3.64	2.00	2.03	2.28	2.58

Source: MED Computer Center, Kafr El Sheikh

Table F.7.9 Discharge at Samatay D.P.S. (Samatay Drain to Gharbia Drain) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	22,680	9,000	15,948	20,214	7,272	9,846	16,596	22,320	24,786	20,790	10,044	7,938	187,434
1994	22,644	2,916	19,512	21,042	16,596	20,034	31,104	21,510	31,770	18,954	22,950	18,360	247,392
1995	11,448	24,462	14,688	20,214	17,064	18,360	29,034	18,459	19,854	13,716	12,150	17,730	217,179
1996	12,222	20,934	22,534	19,188	22,482	23,266	27,288	26,694	17,737	12,762	11,322	16,074	232,503
1997	16,668	30,636	40,212	17,154	19,800	21,420	24,750	19,764	25,920	16,287	13,608	19,260	265,479
Average	17,132	17,590	22,579	19,562	16,643	18,585	25,754	21,749	24,013	16,502	14,015	15,872	229,997
mm/day	2.39	2.72	3.15	2.82	2.32	2.68	3.60	3.04	3.47	2.30	2.02	2.22	2.73

Source: MED Computer Center, Kafr El Sheikh

Table F.7.10 Discharge at Sagaaya D.P.S. (Sagaaya Drain to Gharbia Drain) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	13,374	6,309	15,426	8,298	2,790	7,740	14,310	17,100	21,816	16,560	3,132	5,814	132,669
1994	17,442	8,554	17,514	14,688	5,580	10,314	2,662	14,958	28,224	18,846	22,590	20,718	182,290
1995	4,554	10,512	2,178	12,528	4,410	8,478	21,042	20,052	19,800	6,156	5,580	11,808	127,098
1996	8,928	10,692	9,342	5,850	7,704	16,182	31,878	25,488	28,242	20,034	15,084	16,488	195,912
1997	13,032	29,844	34,704	13,806	8,262	16,542	22,860	26,784	22,716	10,386	10,458	19,476	228,870
Average	11,466	13,182	15,833	11,034	5,749	11,651	18,590	20,876	24,160	14,396	11,369	14,861	173,368
mm/day	1.17	1.49	1.62	1.17	0.59	1.25	1.90	2.14	2.56	1.47	1.20	1.52	1.51

Source: MED Computer Center, Kafr El Sheikh

Table F.7.11 Discharge at Hafir D.P.S. (Hafir Drain to Gharbia Drain) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	30,566	23,785	26,313	29,190	32,879	43,540	41,186	43,282	41,990	32,903	21,694	32,752	400,080
1994	31,220	15,284	30,195	27,363	21,081	27,432	40,324	36,737	45,721	32,963	31,630	35,620	375,570
1995	19,597	28,733	25,438	33,023	29,049	27,871	39,282	42,730	46,105	30,932	28,733	34,237	385,730
1996	34,988	31,177	31,309	32,437	35,715	37,014	48,745	43,895	47,762	28,970	28,753	34,535	435,300
1997	31,755	33,797	36,439	34,925	38,029	39,776	42,781	49,439	46,629	33,640	35,382	38,842	461,434
Average	29,625	26,555	29,939	31,388	31,351	35,127	42,464	43,217	45,641	31,882	29,238	35,197	411,623
mm/day	3.32	3.30	3.36	3.64	3.52	4.07	4.76	4.85	5.29	3.57	3.39	3.95	3.92

Source: MED Computer Center, Kafr El Sheikh

Table F.7.12 Discharge at Tera D.P.S. (Tera Drain to Burullus Lake) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	36,967	19,195	31,251	26,721	38,014	59,737	51,912	54,193	55,712	45,000	22,707	39,823	481,232
1994	33,647	11,492	34,447	36,966	27,230	37,440	57,780	46,709	61,126	44,493	39,287	33,363	463,960
1995	25,467	34,976	25,125	37,807	31,856	40,170	54,217	52,926	60,504	38,835	30,027	36,298	468,208
1996	38,585	32,821	33,312	38,650	37,389	46,959	64,140	52,832	63,316	35,136	33,815	39,480	516,435
1997	25,951	33,926	36,092	36,721	42,581	50,591	56,685	65,409	61,648	39,264	33,578	46,992	529,439
Average	32,123	26,482	32,045	35,373	35,414	46,979	56,947	54,414	60,461	40,546	31,883	39,191	491,859
mm/day	3.43	3.13	3.42	3.90	3.78	5.18	6.07	5.80	6.66	4.33	3.51	4.18	4.46

Source: MED Computer Center, Kafr El Sheikh

Table F.7.13 Discharge at Burullus D.P.S. (Burullus Drain to Burullus Lake) in '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	4,914	3,720	3,151	2,696	5,048	4,675	3,401	4,945	5,056	6,040	3,139	5,653	52,438
1994	5,642	2,980	3,975	4,078	3,117	2,258	5,006	4,203	5,699	5,750	5,483	6,325	54,516
1995	3,094	4,595	3,520	5,085	3,902	2,775	3,907	4,817	5,335	5,782	4,789	5,642	53,243
1996	6,421	4,351	4,163	4,209	4,152	3,611	5,676	5,227	6,827	5,670	5,079	5,995	61,381
1997	3,953	4,391	5,125	4,639	4,562	3,515	4,647	5,540	6,683	5,398	4,039	6,757	59,250
Average	4,805	4,007	3,987	4,141	4,156	3,367	4,527	4,946	5,920	5,728	4,506	6,074	56,166
mm/day	2.46	2.27	2.04	2.19	2.13	1.78	2.32	2.53	3.13	2.93	2.38	3.11	2.44

Source: MED Computer Center, Kafr El Sheikh

Table F.7.14 Discharge at El Mahallah El Kubra D.P.S. (Omar Tosson Drain to Damietta Branch) In '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	2,810	2,281	6,584	5,204	3,868	2,319	6,892	6,829	6,968	4,309	1,189	1,008	50,261
1994	3,717	958	6,866	5,796	4,536	5,254	7,488	6,779	8,064	3,616	8,140	5,154	66,368
1995	1,928	5,910	4,210	7,119	5,065	7,787	6,766	9,110	9,916	390	1,411	1,462	61,074
1996	3,037	4,700	5,771	5,494	4,466	7,573	8,874	9,223	9,022	3,654	5,469	4,486	71,789
1997	5,443	16,078	17,993	5,953	7,195	11,403	13,293	13,797	11,075	4,536	6,035	5,531	118,332
Average	3,387	5,985	8,285	5,913	5,030	6,867	8,663	9,148	9,009	3,301	4,449	3,528	73,565
mm/day	0.60	1.18	1.48	1.09	0.90	1.27	1.55	1.63	1.66	0.59	0.82	0.63	1.12

Source: MED Computer Center, Kafr El Sheikh

Table F.7.15 Discharge at Sananla D.P.S. (Sananla Drain to Mediterranlan) In '000CUM

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Total
1993	1,483	1,039	1,168	1,020	1,217	1,332	1,669	2,246	1,971	2,060	1,597	2,469	19,271
1994	1,341	793	687	845	1,019	1,060	1,890	1,806	2,305	2,062	1,614	935	16,376
1995	2,324	967	916	973	1,115	1,119	1,852	1,906	1,994	1,499	1,449	1,124	17,238
1996	1,455	887	1,045	885	1,030	1,171	1,971	2,774	2,437	2,145	1,575	1,134	18,509
1997	1,329	926	1,046	898	1,024	1,244	2,152	2,495	2,350	2,205	1,692	1,393	18,752
Average	1,586	922	972	924	1,081	1,189	1,907	2,245	2,211	1,994	1,585	1,411	18,029
mm/day	0.51	0.33	0.31	0.31	0.35	0.39	0.61	0.72	0.73	0.64	0.52	0.45	0.49

Source: MED Computer Center, Kafr El Sheikh

Table F.7.16 Summary of Mean Drainage Rate and Mean Annual Discharge based on 1993 - 1997 Operation Records

Drainge P.S.	Suction	Delivery	Max Rate mm/day	Month	Annual Avrg mm/day	Annual Dis. MCM	Remarks
Sanania	Sanania	Mediterranean	0.72	Aug	0.49	18	
Lower No.1	Drain No.1	Mediterranean	4.77	Aug	3.48	881	Partly reused into Basandila canal (11,694 fed, 4,911 ha)
No.2	Drain No.2	Mediterranean	5.70	Sep	3.55	343	-do- & also into New Reclamation Area
Burullus	Burullus Drain	Burullus Lake	3.13	Sep	2.44	56	
Tera	Tera Drain	Burullus Lake	6.66	Sep	4.46	492	
Su total of above						1,790	
Hafir Shehab El Deen	Hafir S. El D. Drain	Gharbia Drain	5.29	Sep	3.92	412	Partly reused into Nile canal (23,988 fed, 10,072 ha)
No.3	Drain No. 3	Gharbia Drain	5.00	Sep	3.39	291	Partly reused into El Eslah canal (11,420 fed, 4,796 ha)
No.4	Drain No. 4	Gharbia Drain	5.15	Jul	3.38	342	-do-
No.6	Drain No. 5	Gharbia Drain	4.01	Jul	2.58	136	
No.5	Drain No. 5	Gharbia Drain	2.69	Sep	1.74	195	
Samatay	Samatay Drain	Gharbia Drain	3.60	Jul	2.73	230	
Mahallah El Kubra	Omar Tosson Drain	Damietta Branch	1.66	Sep	1.12	74	
Sagaaya	Sagaaya Drain	Gharbia Drain	2.56	Sep	1.51	173	

Source; Computer Center, MED, Kafr El Sheikh

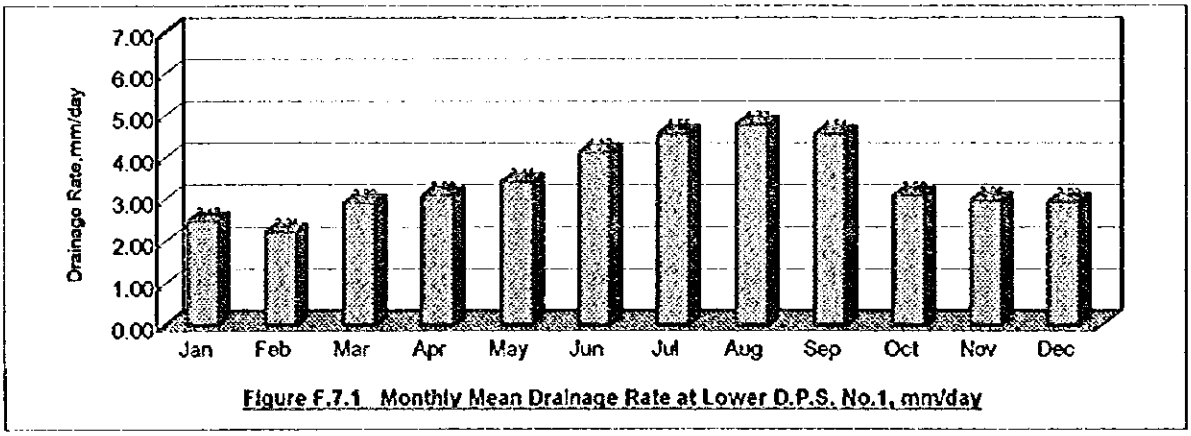

Figure F.7.1 Monthly Mean Drainage Rate at Lower D.P.S. No.1, mm/day

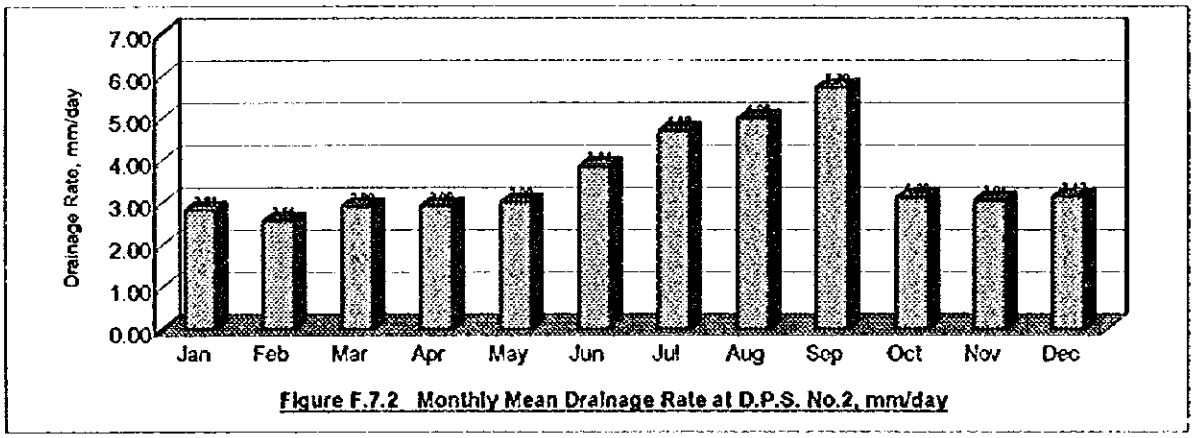

Figure F.7.2 Monthly Mean Drainage Rate at D.P.S. No.2, mm/day

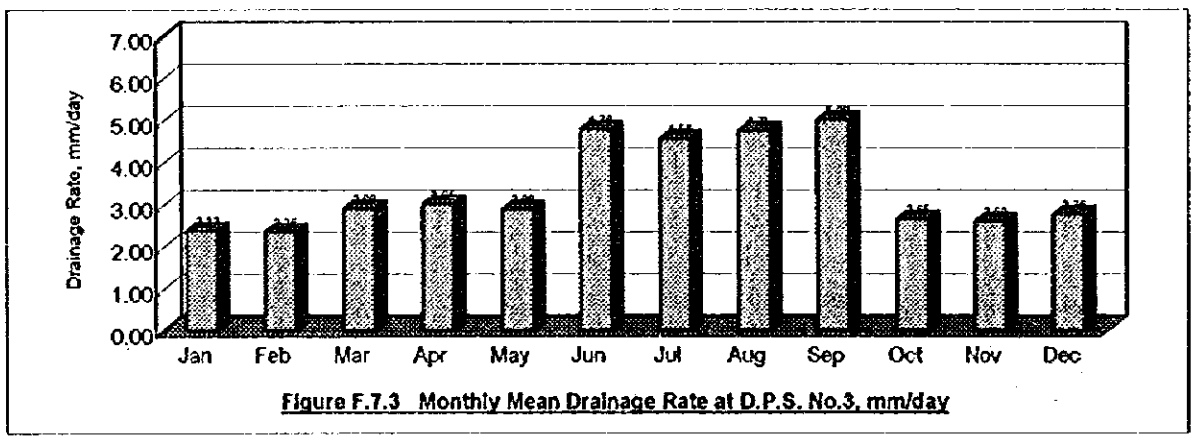

Figure F.7.3 Monthly Mean Drainage Rate at D.P.S. No.3, mm/day

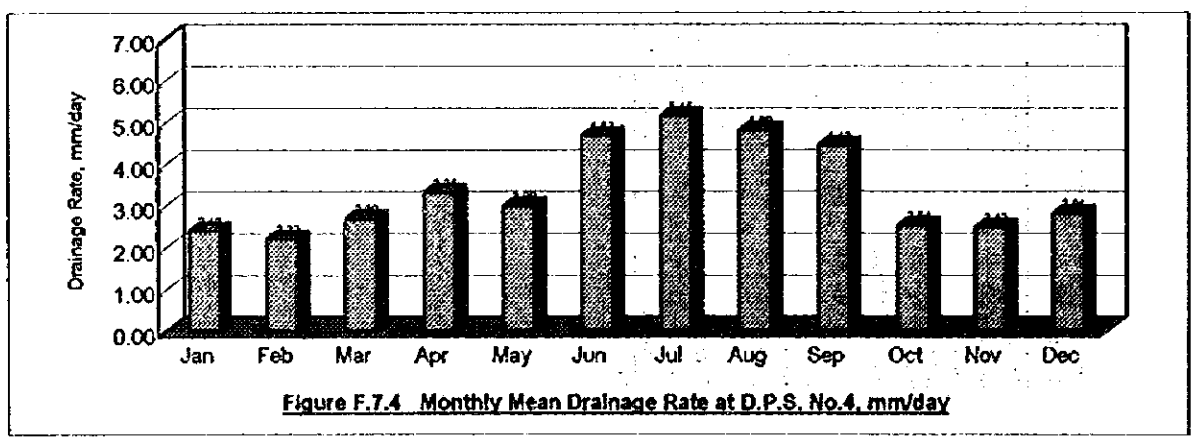

Figure F.7.4 Monthly Mean Drainage Rate at D.P.S. No.4, mm/day

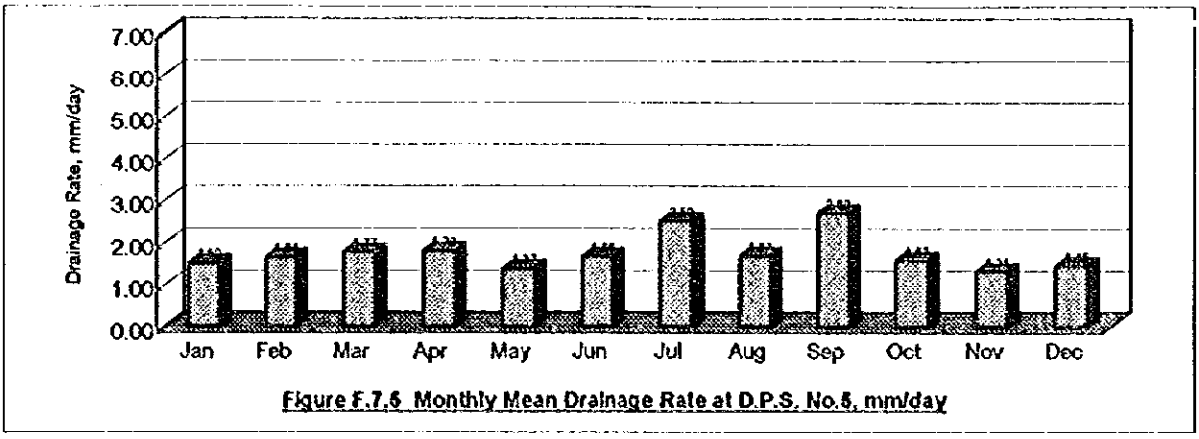

Figure F.7.5 Monthly Mean Drainage Rate at D.P.S. No.5, mm/day

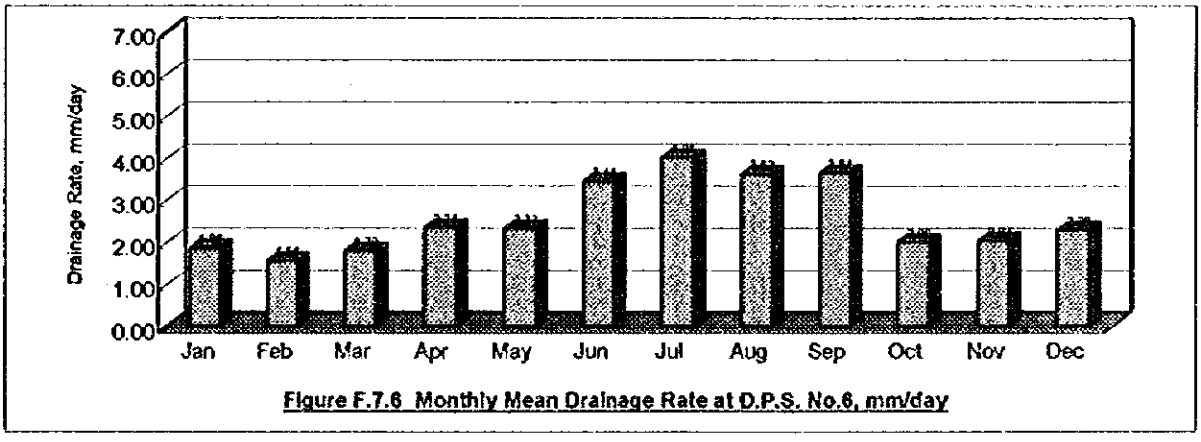

Figure F.7.6 Monthly Mean Drainage Rate at D.P.S. No.6, mm/day

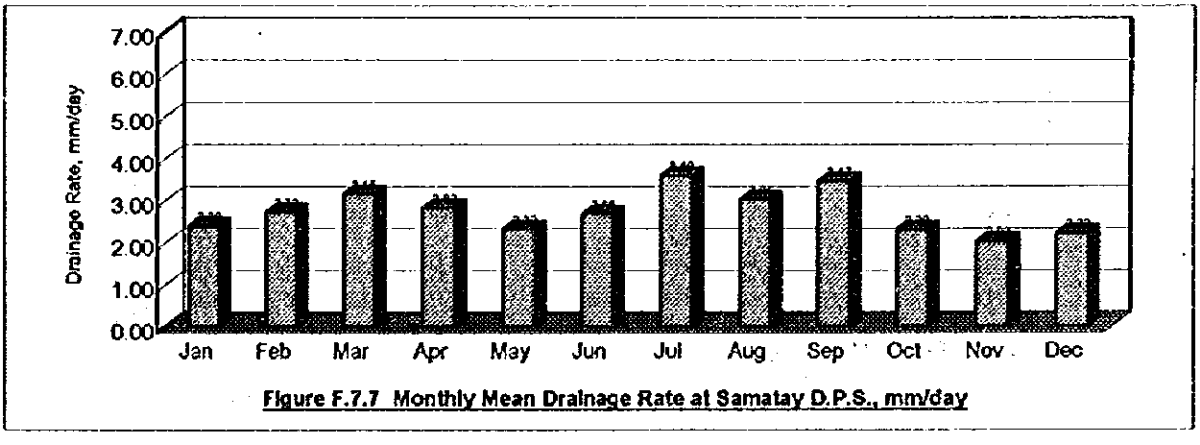

Figure F.7.7 Monthly Mean Drainage Rate at Samatay D.P.S., mm/day

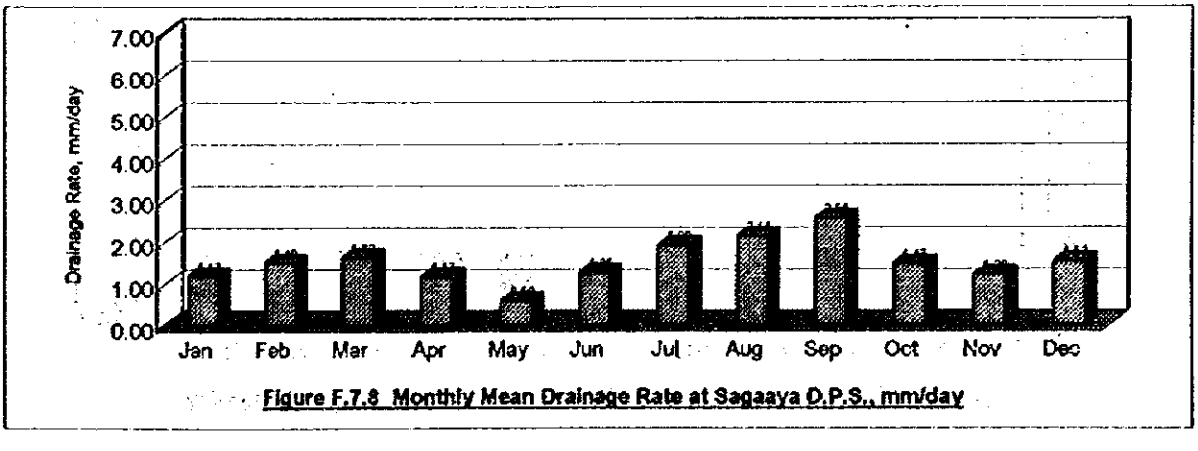

Figure F.7.8 Monthly Mean Drainage Rate at Sagaaya D.P.S., mm/day

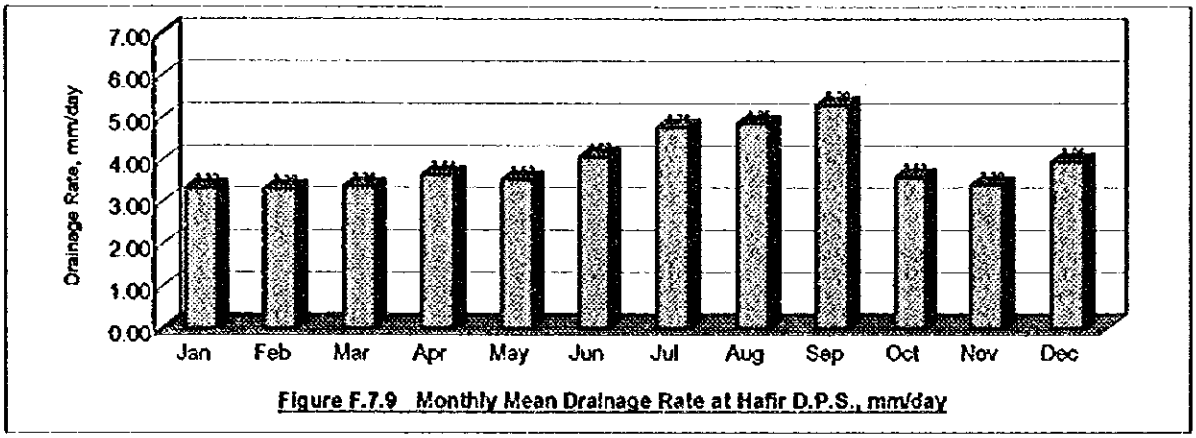

Figure F.7.9 Monthly Mean Drainage Rate at Hafir D.P.S., mm/day

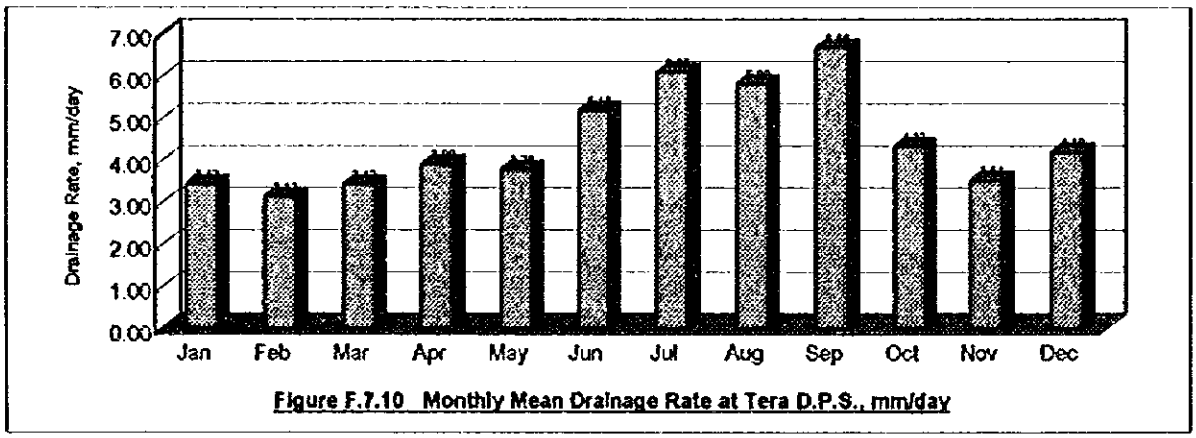

Figure F.7.10 Monthly Mean Drainage Rate at Tera D.P.S., mm/day

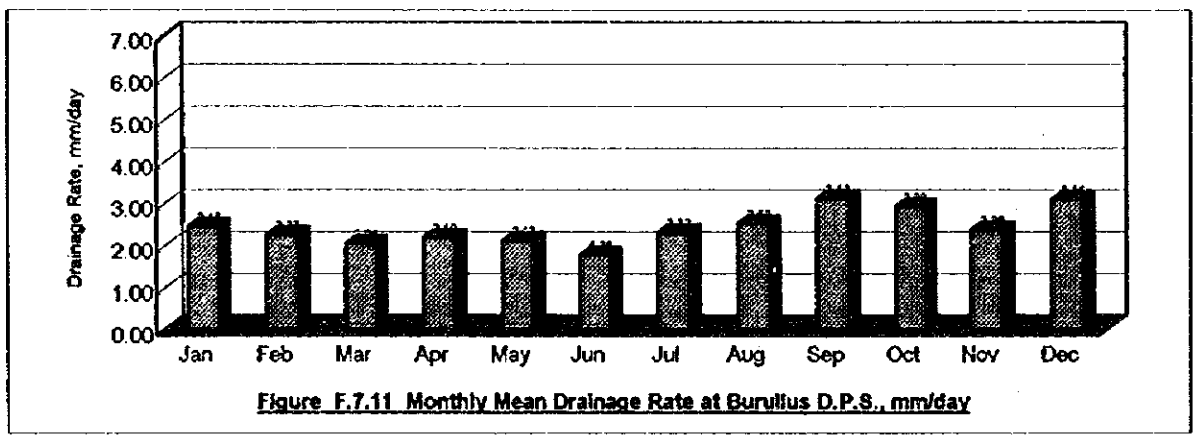

Figure F.7.11 Monthly Mean Drainage Rate at Burullus D.P.S., mm/day

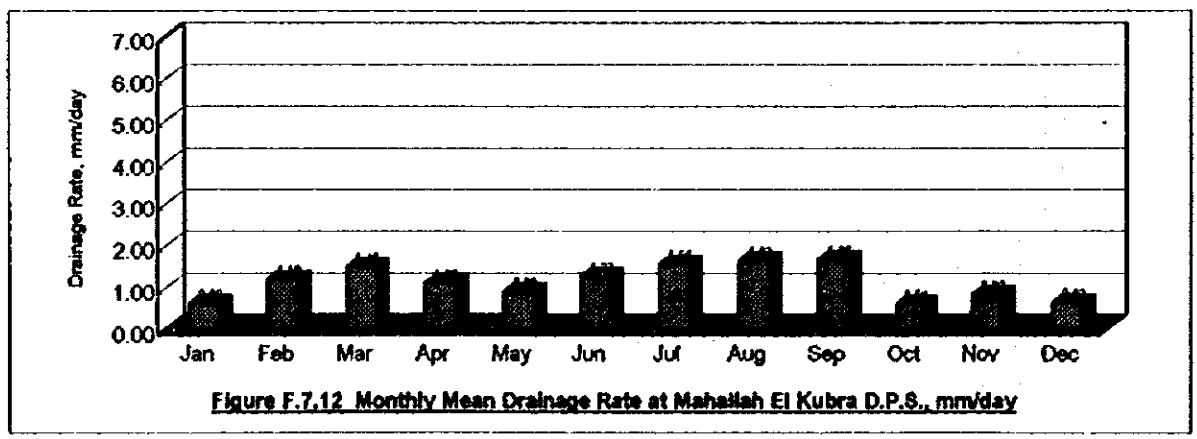

Figure F.7.12 Monthly Mean Drainage Rate at Mahallah El Kubra D.P.S., mm/day

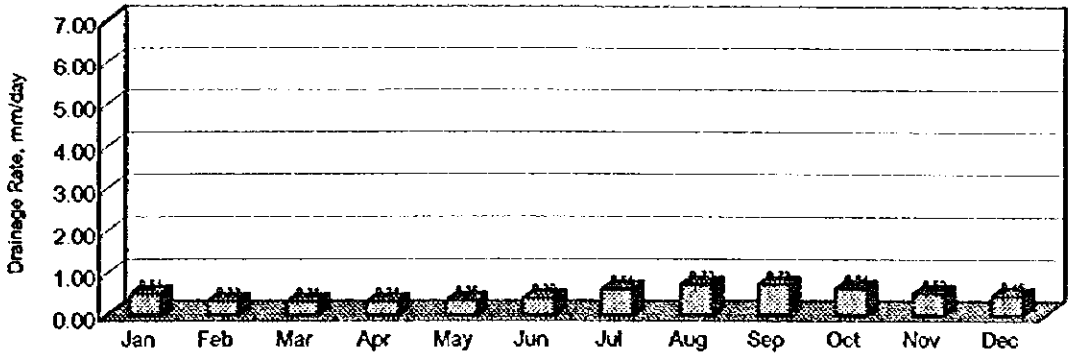

Figure F.7.13 Monthly Mean Drainage Rate at Samanla O.P.S., mm/day

F.8 Constraints, Problems and Probable Measures over Whole Study Area

To grasp present constraints and problems relevant to the irrigation and drainage system, following measures have been undertaken in addition to field observations and available data;

- Workshop; Workshop type meetings were held on May 12, 13, 14 with relevant irrigation officers such as directorates' directors, inspections' inspectors and district water engineers, during which present problems and probable measures had been discussed.
- Questionnaire; A questionnaire was provided to the 17 relevant water district officers, inquiring present condition such as water shortage and the reason, drainage reuse, tail condition and waste spillage from the tail, intake condition, domestic wastes and washing practice in canals.

The summary of the above workshops is presented in Tables F.8.1 to F.8.2, and the result of the questionnaire is also in a series of Table F.8.3. Though the relevant irrigation officers are very sure of assessing the present constraints and problems, it is noted that the issues raised by them may be mainly concerned to facility-related and limited to government controlled system but not enough include on-farm level constraints and problems.

Table F.8.1 Major Problems and Probable Measures Discussed with relevant Irrigation Officers during Workshop Meetings

Date: May 12, 1998 for Gharbia Directorate
May 13, 1998 for West Dakahlia and Damietta Directorates
May 14, 1998 for Kafr El Sheikh Directorate

Attendants: Relevant Irrigation Officers such as General Directors, Inspectors, Water District Engineers, and Under Secretary (Gharbia Directorate only)

Gharbia Directorate

Category	Problems	Probable Measures
Overall	• Water shortage at the tails of delivery canals during summer season due especially to illegal rice cultivation.	• Educate formers not to cultivate illegal rice in collaboration with government propaganda. • Strengthen the law suit execution.
	• Environmental problems, related to garbage disposal, domestic wastes, and sewerage emission, for canals running through residential areas.	• Educate residents living along the canals. • Introduce sanitary improvement projects.
	• Submerged weed problems especially during winter season, giving additional hydrological losses, so that design flow cannot be attained with the designated water level.	• Arrange equipment to remove the weed including the roots.
	• Large head loss at Rahbeen Regulator, reaching to as mush as 20-30 cm when the lock is opened and as much as 70 cm when the lock is closed. • Scarring, reaching as much as 6m depth, at right downstream of Rahbeen Regulator, due to incresed flow volume required by new reclamation area.	• Renovate the Rahbeen Regulator with modern design.
	• Large head loss, reaching as much as 22 cm, at Shesita bridge located at 11.5 km from the intake of Zifta Barrage (1 cm loss is equvalant to 50,000 cum/day discharge during winter and 70,000 cum/day during summer).	• Renovate the Shesita bridge with modern design.
	• Direct individual pumping being practiced between the intake of Meet Yazied and Biltag Barrage.	• Construct Ganabias running through Meet Yazied in parallel.
	• Poor maintenance of Meskas, associated with waste disposal and weeds.	• Involve field agents of agriculture cooperatives who make daily contacts with the farmers.
	• Poor on-farm water management associated especially with poor land leveling, leading to excessive water dosages.	• Introduce new technology of land leveling supplemented by laser survey equipment (but expensive).
	• Poor communication system between the Directorate and Water District Office.	• Supplement the telephone lines and introduce not-shared wireless communication system.
	• Maintenance of wide width canals such as Raiah Abbasee and Bahr Shebin.	
Bahary Zifta	• Submerged weed, giving additional losses.	• Arrange an equipment, fast and light equipment, to remove the weed from roots.

	• Environmental problems, cased by domestic wastage, for canals passing through residential areas.	• Cover the canals.
Samanoud	• Environmental problems, caused by domestic wastage, for canals passing through residential areas.	• Educate residents and cover the canals.
	• Bad communication between district engineer and the gatekeepers, associated with poor transportation (currently bicycles are used for the gatekeepers).	• Arrange motor cycles for the gatekeepers and the Engineer's assistants.
Bishbeeth	• Environmental problems, cased by domestic wastage, for canals passing through residential areas.	• Cover the canals.
	• Illegal rice cultivation, leading to excessive water dosages and lessening water to downstream.	• Educate the farmers not to cultivate illegal rice.
East El Mahallah	• Water shortage during June and July due to illegal rice cultivation,	• Educate the farmers not to cultivate illegal rice.
West El Mahallah	• Environmental problems, caused by domestic wastage, for canals passing through residential areas.	• Cover the canals.

Kafr El Sheikh Directorate

Category	Problems	Probable Measures
Overall	• Hamoul mixing P.S. sometimes stops when the water level in the Gharbia drain is low, requiring 1 MCM/day for the compensation from Tera. This causes dispute among Gharbia, West Dakahlia and Kafr El Sheikh. • The cross section between Abshan Reglator and Hamoul is not enough to convey the additional 1 MCM/day. Also, there are sections in the upstream from Abshan Regulator, which cannot convey the additional 1 MCM/day.	• Raise the bank of the sections that is not enough high to convey the additional 1 MCM/day. Widening the Tera's sections cannot be made due to the roads running along the canal and residential areas nearby.
	• Submerged weed problem during winter in Tera and its branches. This weed creates losses and decreases the volume of the flow under the deigned level. (No submerged weed exists after the Hamoul M.P.S. because of the saline water.)	• Arrange faster and light equipment with boat to remove the submerged weed including the roots (Using excavator or drag-line from the bank is not efficient to take out the roots.)
	• Illegal rice cultivation. The permitted area for rice cultivation in the upstream of Tera is 50 % but the actual rice cultivation area reaches as much as 70 %, leading to excessive usage and decreasing the water that has to be conveyed to the downstream. The actual rice cultivation in the downstream of Tera is about 40% against the permitted area of 30 %.	• Restrict the rice cultivation area and giving the idea of another profitable crops to the farmers.
	• Environmental problems such as sewerage emission and domestic wastes for the canals passing through residential area.	• Cover the canal.
	• Poor maintenance of Meskas associated with weeds, domestic wastes and waste spillage at the tail. • Farmers tend to lower the Meska bed level in order to in-take more water, and this invites saline groundwater.	• Educate farmers, and look for ways of incorporating agriculture cooperative staff.
	• Poor on-farm water management associated with poor land leveling.	• Introduce new equipment to achieve high standard land leveling.

	• Hamoul M.P.S. must be stopped when the water level of Tera is so low (winter season) that could affect municipal usage. But this is not often and does not happen during summer thanks to the much water volume.	
	• High salinity soils recognized in Mansour and Balteem districts.	• Leach the salinity, but requires more water.
Balteem	• When the water level in the Gharbia drain is low, El Khashaa canal cannot be fed. This requires compensation from Tera.	• Convey fresh water from Tera, and raise the bank of Tera to accommodate the additional discharge.
	• Canal bed, composed of pure sand, between 59 km and 64 km of Tera, leading to high seepage and soil erosion and giving difficulty to reform the section.	• Lining the section.
	• Water shortages during summer season.	
	• Police are not cooperative to prevent illegal water usage.	
	• The bed levels of Borollos and Balteem canals are low, -1.5m, so that saline ground water comes into the canals.	• Lining the canal.
Mansour	• A number of openings illegally made by the farmers, from which direct pumping is practiced.	• Rectify the openings and introduce one-point lifting Meska.
	• Water shortage, forcing special rotation of 2 days on and 8 days off among 7 major canals.	• Convey enough fresh water from Tera.
	• Wireless communication problem at the tail of Mansour canal. The distance of 15km between the tail and district office makes difficult to communicate via wireless.	
	• Roads become very muddy and sometimes inaccessible when raining.	• Pave the roads with asphalt or bricks.
Hamoul	• Such canals as El Walda, Walda Branch, El Wosta, Abo Soliman and El Magaz (Belteem District) are gravity fed by Gharbia drain, but need compensation when the water level in the Gharbia drain is low.	• Convey fresh water from Tera, and raise the bank of Tera to accommodate the additional discharge.
	• Environmental problems for canals passing through residential areas.	• Cover the canals or construct pipeline.
	• High bed levels of some canals, giving difficulty to intake designed water.	• Rehabilitate the canals.
Beila	• No communication mean between the district office and the gate keepers of Abshan and Tera intake.	• Arrange wireless or telephone communication mean.
	• Poor transportation problem. Most gate keepers and field agents do not have even bicycle.	• Arrange transportation mean.
	• Low level quality for field agents and gate keepers.	• Give a training to the staff.

West Dakahlia Directorate

Category	Problems	Probable Measures
Overall	• Environmental problems, related to garbage disposal and domestic wastes, for canals running through residential areas. This also decreases the canal section, so that designed flow cannot run with the designated water level.	• Educate residents living along the canals. • Cover the canals or introduce pipeline canals.
	• Rahbeen Regulator cannot discharge actually required irrigation water, especially after the new reclamation area started the irrigation.	• Renovate the regulator with the new design discharge.

	• Nabroh bridge (old), located at 55.7km of Bahr Shebin, gives about 15-20 cm head loss (1cm equivalent to about 30,000 – 40,000 cum/day flow).	• Renovate the Nabroh bridge. This bridge has not to be demolished since this is very important transportation mean for the residents of Nabroh city.
	• Gates at Belkas and Basandila locks do not work as designed, leading to additional losses.	• Rehabilitate the gates of the locks (the gates themselves of the intakes for irrigation are still good condition).
	• Submerged weeds especially during winter season. The removal of the weed is so difficult in case of wide-width canals.	• Arrange floating type equipment to remove the submerged weeds.
	• Canal dimension of Bahr Shebin and related canals to feed new reclamation area (Kalabsho and Zayan) may not be enough to irrigate the area. The area started the irrigation already two (2) years ago although official commission has not yet done. The area is composed of 30,000 fed. irrigated by fresh water (this may increase to 40,000 fed. during summer due to shortage of drainage water) and 26,000 fed. by mixing, and the latter's 10,000 – 14,000 by drainage only.	• Redesign and rehabilitate the canals including relevant regulators such as Rahbeen Regulator.
	• Due to narrow road caused by scarring and illegal cultivation on the banks, maintenance work cannot be well carried out.	• Rehabilitate the canals, associated with lining and prohibit the farmers' illegal cultivation.
	• Maintenance work for Sahel and Balamoun canals cannot be well done since Road Authority prohibits using the asphalt road for the maintenance.	• Introduce floating type maintenance equipment.
	• Direct pumping, leading to excessive water dosages.	• Educate farmers.
Hafir	• Illegal rice cultivation.	• Educate farmers and enforce strict measures.
	• Water quality associated with drainage water usage.	• Introduce supplemental fresh water via Nile canal.
Basandila	• Water pollution associated with domestic wastes for canals passing through residential areas.	• Cover the canals, and educate the residents not to pollute the canals.
	• Water quality, at the tail of Basandila canal, associated with drainage water usage.	• Supplement the fresh water from Basandila canal.
Belkas	• Water shortage at the tails of most canals due to direct irrigation practiced by farmers nearby the delivery canal.	• Enforce the prohibition of direct pumping.
Maasara	• Water pollution for canals passing through residential areas.	• Cover the canals, and educate the residents.
	• Water shortage during peak period in summer.	
	• The intake elevation (El. 0.8m) of Tahwela Bahr El Maasara (feeder) is high and also the bed level of a siphon is same as the intake level, so that design discharge cannot flow.	• Lower the intake level and the bed level of the siphon, and also consider widening of the feeder canal. This also works to compensate the head loss occurred at Belkas Bridge.
Zahraa	• Illegal rice cultivation.	• Educate farmers and enforce strict measures.
	• Water quality associated with drainage water usage.	• Introduce supplemental fresh water via Nile canal.
Talkha	• Poor tail escape condition for some delivery canals, leading to spillage waste.	• Rehabilitate the tail escapes.
	• Domestic wastes and water pollution for Nasha and Taiba canals passing through residential areas.	• Educate the residents and cover the canals.

	• Gate at Taiba canal intake does not work properly. • The section of a regulator, located 150m downstream of Taiba intake, is not enough to flow design discharge and the bed level is also high, since this regulator was constructed before the commission of High Aswan Dam.	• Replace the gate of the intake. • Replace the regulator with current design discharge.
	• No maintenance of Mesqas.	• Incorporate the agricultural cooperatives
	• The intake of Gezira canal is so high that design discharge cannot flow.	• Rehabilitate the intake.
Sherbin	• Illegal structures for direct pumping. • Police are not cooperative to demolish the illegal structures and also law suit process is very slow.	• Establish irrigation police under the MPWWR.
	• Water shortages at tails of some canals.	• Bring the water, pumped up at Kafr Saad P.S., into this district.

Damietta Directorate

Category	Problems	Probable Measures
Overall	• Environmental problems, related to garbage disposal and domestic wastes, for canals running through residential areas. This also decreases the canal section, so that designed flow cannot run with the designated water level.	• Educate residents living along the canals. • Cover the canals or introduce pipeline canals.
	• Meskas not equipped with intake and tail escape, leading to water wastage.	• Construct intake and tail escape structures.
	• Illegal cultivation on the banks of canals, narrowing maintenance roads.	• Educate farmers not to cultivate the bank area. • Arrange floating type maintenance equipment.
	• Direct pumping from main canal since farmers cannot waite rotational irrigation turn.	• Raise farmers' awareness.
	• Poor communication between the Directorate and the Water District office, also transportation in the District Office is poor.	• Arrange additional telephone lines and transportation.
Kafr Saad	• Pollution of canals passing through residential areas.	• Cover the canals. • Educate the residents not to dump wastes.
	• Water shortages at some canals.	• Construct mixing pumping stations at the tail (already under construction).