Table A.4.1.2-5 Water Balance Calculation by Developed Area (1)

IRRIGATION AREA: 4800 (ha)

[x1000 m3]

		Driving Canal Capacity					
		3 m3/sec			4 m3/sec		
Year	Qout	Qin	Qdef(+)	Qdef(-)	Qin	Qdef(+)	Qdef(-)
1967	49284	49293	31477	31468	56577	38761	31468
1968	49284	63991	45330	30623	74061	55400	30623
1969	49284	74322	56033	30995	86911	68622	30995
1970	49284	55642	39223	32865	64381	47789	32692
1971	49284	55058	39325	33551	62397	46664	33551
1972	49284	19443	9995	39836	20501	11052	39835
1973	49284	65301	47272	31255	77188	59159	31255
1974	49284	45566	33972	37690	52383	40789	37690
1975	49284	39225	22456	32515	45527	28691	32448
1976	49284	40810	26162	34636	45779	31044	34549
1977	49284	21887	11081	38478	23714	12908	38478
1978	49284	55132	27602	21754	60813	33283	21754
1979	49284	50388	35590	34486	57698	42814	34400
1980	49284	54513	35660	30431	62095	43243	30432
1981	49284	57756	23951	21479	64224	36419	21479

		Driving Canal Capacity					
		5 m3/sec			6 m3/sec		
Year	Qout	Qin	Qdef(+)	Qdef(-)	Qin	Qdef(+)	Qdef(-)
1967	49284	61231	43415	31468	65190	47374	31468
1968	49284	83031	64370	30623	90578	71917	30623
1969	49284	98648	80359	30995	109039	90759	31004
1970	49284	72276	55684	32692	79608	62997	32673
1971	49284	68504	52771	33551	73917	58184	33551
1972	49284	21424	11976	39836	22170	12722	39836
1973	49284	88078	70049	31255	98156	80127	31255
1974	49284	58345	46752	37691	63426	51833	37691
1975	49284	50794	33958	32448	55276	38440	32448
1976	49284	50038	35231	34477	53845	39038	34477
1977	49284	25089	14283	38478	26203	15397	38478
1978	49284	65895	38365	21754	69989	42459	21754
1979	49284	63816	48846	34314	69434	54377	34227
1980	49284	68718	49865	30431	74694	55841	30431
1981	49284	68205	40400	21479	71148	43343	21479

		Driving Canal Capacity		
		7 m3/sec		
Year	Qout	Qin	Qdef(+)	Qdef(-)
1967	49284	68422	50606	31468
1968	49284	96962	78301	30623
1969	49284	118363	100074	30995
1970	49284	86378	69767	32673
1971	49284	78922	63189	33551
1972	49284	22775	13327	39836
1973	49284	106508	88479	31255
1974	49284	67764	56171	37691
1975	49284	59380	42544	32448
1976	49284	57330	42523	34477
1977	49284	27153	16347	38478
1978	49284	73482	45952	21754
1979	49284	74571	59496	34209
1980	49284	79835	60982	30431
1981	49284	73331	45526	21479

Table A.4.1.2-5 Water Balance Calculation by Developed Area (2)

IRRIGATION AREA: 4350 (ha)

[x1000 m3]

		Driving Canal Capacity					
		3 m3/sec			4 m3/sec		
Year	Qout	Qin	Qdef(+)	Qdef(-)	Qin	Qdef(+)	Qdef(-)
1967	44664	49293	32593	27963	56577	39877	27963
1968	44664	63991	46567	27240	74061	56637	27240
1969	44664	74322	56815	27157	86911	69404	27157
1970	44664	55642	40056	29077	64381	48622	28904
1971	44664	55058	40061	29667	62397	47400	29667
1972	44664	19443	10428	35649	20501	11485	35648
1973	44664	65301	48270	27632	77188	60157	27632
1974	44664	45566	34725	33823	52383	41542	33823
1975	44664	39225	23613	29052	45527	29848	28985
1976	44664	40810	26995	30848	45779	31877	30761
1977	44664	21887	11518	34295	23714	13345	34295
1978	44664	55132	29074	18606	60813	34755	18606
1979	44664	50388	36408	30683	57698	43632	30597
1980	44664	54513	36442	26593	62095	44025	26594
1981	44664	57756	31052	17960	64224	37520	17960

		Driving Canal Capacity					
		5 m3/sec			6 m3/sec		
Year	Qout	Qin	Qdef(+)	Qdef(-)	Qin	Qdef(+)	Qdef(-)
1967	44664	61231	44531	27963	65190	48490	27963
1968	44664	83031	65607	27240	90578	73154	27240
1969	44664	98648	81141	27157	109039	91541	27166
1970	44664	72276	56517	28904	79608	63830	28885
1971	44664	68504	53507	29667	73917	58920	29667
1972	44664	21424	12409	35649	22170	13155	35643
1973	44664	88078	71047	27632	98156	81125	27632
1974	44664	58345	47505	33824	63426	52586	33824
1975	44664	50794	35115	28985	55276	39597	28985
1976	44664	50038	36064	30689	53845	39871	30689
1977	44664	25089	14720	34295	26203	15834	34295
1978	44664	65895	39837	18606	69989	43931	18606
1979	44664	63816	49664	30511	69434	55195	30424
1980	44664	68718	50647	26593	74694	56623	26593
1981	44664	68205	41501	17960	71148	44444	17960

		Driving Canal Capacity		
		7 m3/sec		
Year	Qout	Qin	Qdef(+)	Qdef(-)
1967	44664	68422	51722	27963
1968	44664	96962	79538	27240
1969	44664	118363	100856	27157
1970	44664	86378	70600	28885
1971	44664	78922	63925	29667
1972	44664	22775	13760	35649
1973	44664	106508	89477	27632
1974	44664	67764	56924	33824
1975	44664	59380	43701	28985
1976	44664	57330	43356	30689
1977	44664	27153	16784	34295
1978	44664	73482	47424	18606
1979	44664	74571	60314	30406
1980	44664	79835	61764	26593
1981	44664	73331	46627	17960

Table A.4.1.2-5 Water Balance Calculation by Developed Area (3)

IRRIGATION AREA: 4000 (ha)

[x1000 m3]

		Driving Canal Capacity					
		3 m3/sec			4 m3/sec		
Year	Qout	Qin	Qdef(+)	Qdef(-)	Qin	Qdef(+)	Qdef(-)
1967	41070	49293	33460	25237	56577	40744	25237
1968	41070	63991	47530	24609	74061	57600	24609
1969	41070	74322	57424	24172	86911	70013	24172
1970	41070	55642	40703	26131	64381	49269	25958
1971	41070	55058	40726	26738	62397	48065	26738
1972	41070	19443	10769	32396	20501	11826	32395
1973	41070	65301	49045	24814	77188	60932	24814
1974	41070	45566	35333	30838	52389	42151	30838
1975	41070	39225	24536	26381	45527	30771	26314
1976	41070	40810	27642	27902	45779	32524	27815
1977	41070	21887	11894	31077	23714	13721	31077
1978	41070	55132	30288	16226	60813	35969	16226
1979	41070	50388	37055	27737	57698	44279	27651
1980	41070	54513	37050	23608	62095	44634	23609
1981	41070	57756	32011	15325	64224	38479	15325

		Driving Canal Capacity					
		5 m3/sec			6 m3/sec		
Year	Qout	Qin	Qdef(+)	Qdef(-)	Qin	Qdef(+)	Qdef(-)
1967	41070	61231	45398	25237	65190	49357	25237
1968	41070	83031	66570	24609	90578	74117	24609
1969	41070	98648	81750	24172	109039	92149	24181
1970	41070	72276	57164	25958	79608	64477	25939
1971	41070	68504	54172	26738	73917	59585	26738
1972	41070	21424	12750	32396	22170	13496	32396
1973	41070	88078	71822	24814	98156	81900	24814
1974	41070	58345	48114	30839	63426	53195	30839
1975	41070	50794	36038	26314	55276	40520	26314
1976	41070	50038	36711	27743	53845	40518	27743
1977	41070	25089	15096	31077	26203	16210	31077
1978	41070	65895	41051	16226	69989	45145	16226
1979	41070	63816	50311	27565	69434	55842	27478
1980	41070	68718	51256	23608	74694	57232	23608
1981	41070	68205	42460	15325	71148	45403	15325

		Driving Canal Capacity		
		7 m3/sec		
Year	Qout	Qin	Qdef(+)	Qdef(-)
1967	41070	68422	52589	25237
1968	41070	96962	80501	24609
1969	41070	118363	101464	24172
1970	41070	86378	71247	25939
1971	41070	78922	64590	26738
1972	41070	22775	14101	32396
1973	41070	106508	90252	24814
1974	41070	67764	57533	30839
1975	41070	59380	44624	26314
1976	41070	57330	44003	27743
1977	41070	27153	17160	31077
1978	41070	73482	48638	16226
1979	41070	74571	60961	27460
1980	41070	79835	62373	23608
1981	41070	73331	47586	15325

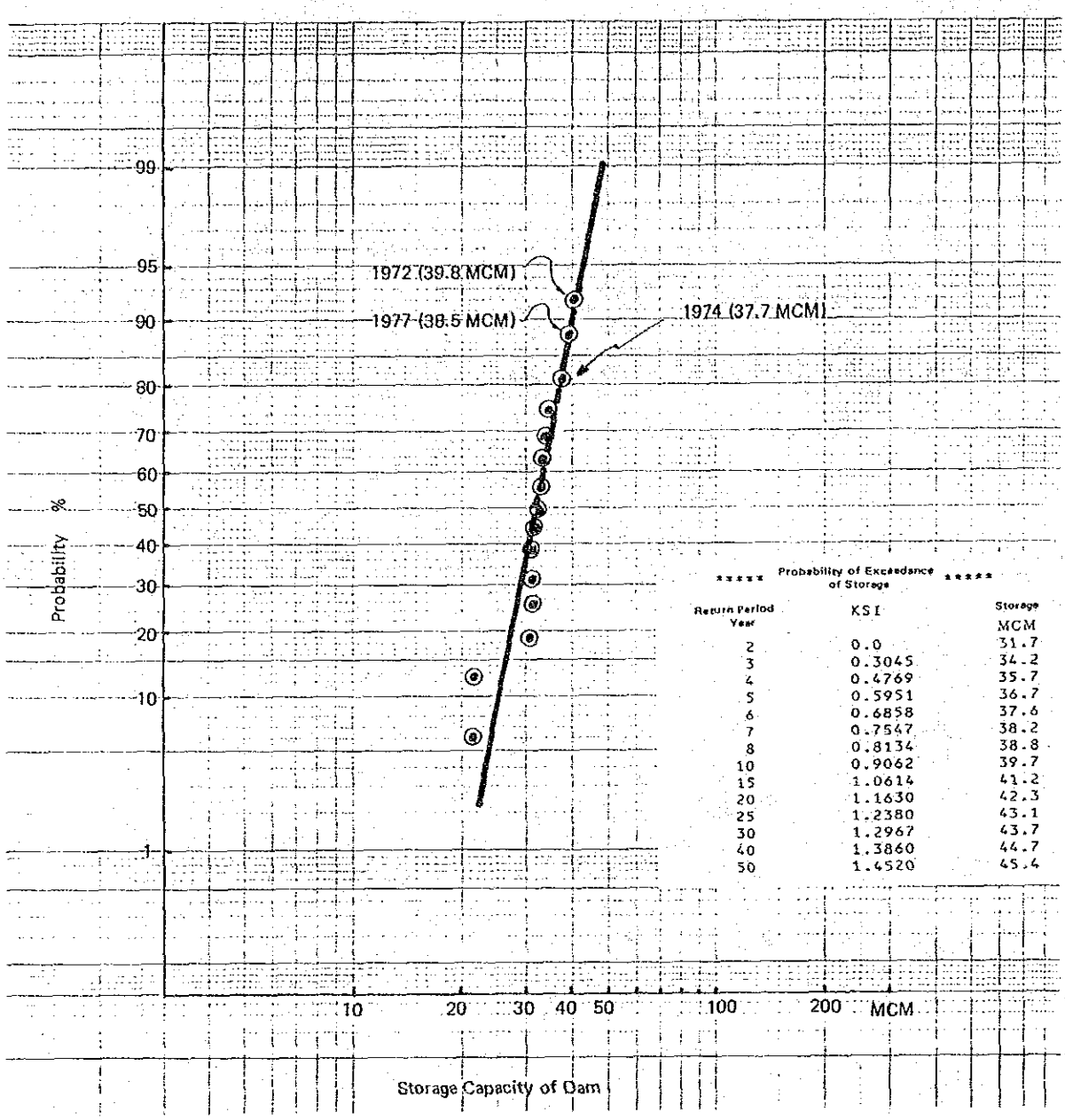


Fig. A.4.1.2-2 Probability of EXceedance on Reservoir Storage of Guirila Dam

Table A.4.1.2-6 Probability of Exceedance on Reservoir Storage of Guirila Dam by Iwai's Method (Driving Canal; 4.0 m^3/s)

Order	Year	X	LOG(X)	X+B	Y=LOG(X+B)	Y**2	Thomas Plot (%)	Hazen Plot (%)	X**2	Return Period
1	1972	39.8	1.59988	39.8	1.59988	2.55963	93.75	96.67	1584.04	10.3
2	1977	38.5	1.58546	38.5	1.58546	2.51369	87.50	90.00	1482.25	7.5
3	1974	37.7	1.57634	37.7	1.57634	2.48485	81.25	83.33	1421.29	6.2
4	1976	34.5	1.53782	34.5	1.53782	2.36489	75.00	76.67	1190.25	3.2
5	1979	34.3	1.53529	34.3	1.53529	2.35713	68.75	70.00	1176.49	3.1
6	1971	33.6	1.52634	33.6	1.52634	2.32971	62.50	63.33	1128.96	2.7
7	1970	32.7	1.51455	32.7	1.51455	2.29385	56.25	56.67	1069.29	2.3
8	1975	32.4	1.51054	32.4	1.51054	2.28174	50.00	50.00	1049.76	2.2
9	1967	31.5	1.49831	31.5	1.49831	2.24493	43.75	43.33	992.25	2.0
10	1973	31.3	1.49554	31.3	1.49554	2.23665	37.50	36.67	979.69	1.9
11	1969	31.0	1.49136	31.0	1.49136	2.22416	31.25	30.00	961.00	1.8
12	1968	30.6	1.48572	30.6	1.48572	2.20737	25.00	23.33	936.36	1.7
13	1980	30.4	1.48287	30.4	1.48287	2.19891	18.75	16.67	924.16	1.7
14	1978	21.8	1.33846	21.8	1.33846	1.79146	12.50	10.00	475.24	1.0
15	1981	21.5	1.33244	21.5	1.33244	1.77539	6.25	3.33	462.25	1.0
Total		481.6	22.51091		22.51091	33.86432			15833.26	
1/N		32.1	1.50073		1.50073	2.25762			1055.55	

(4) Operation of Dam

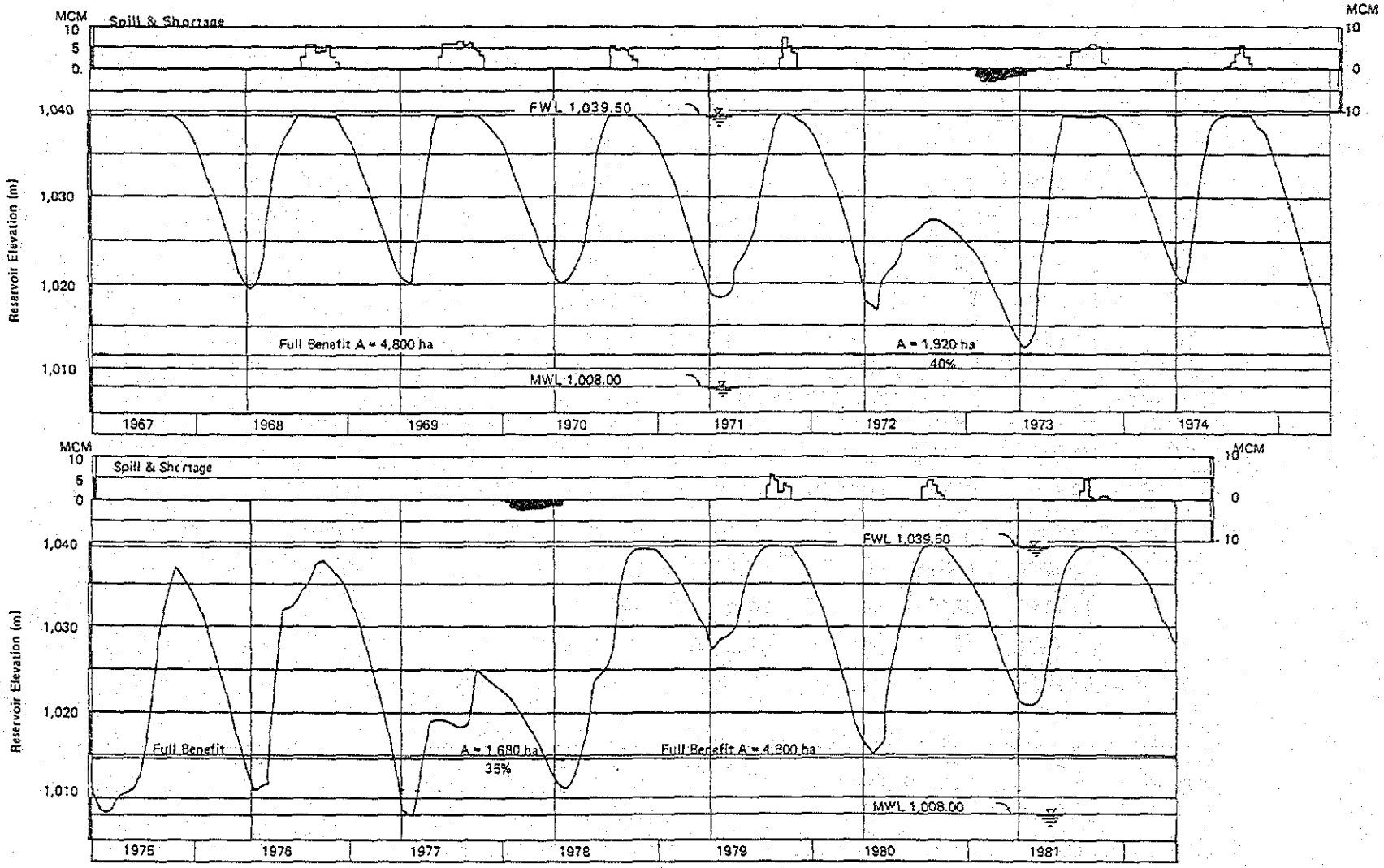


Fig. A.4.1.2-3 Result of Reservoir Operation Study

Table A.4.1.2-7 Operation Study of Guirila Dam (1)
(irrigation area 4800ha, intake capacity $4m^3/s$)

Year 1967

	Period	Inflow *1 (Qin)	Demand (Qout)	Difference (+)	Difference (-)	Loss *2	Storage *3 V	Stage H	Spill Q	Shortage
	1	811	721	90	0				0	0
MAY	2	1,296	539	757	0				0	0
	3	623	488	135	0				0	0
	4	1,018	168	850	0				0	0
JUN	5	1,004	140	865	0				0	0
	6	2,394	115	2,297	0				0	0
	7	2,332	141	2,191	0				0	0
JUL	8	2,164	209	1,955	0				0	0
	9	2,108	286	1,822	0				0	0
	10	2,146	409	1,737	0				0	0
AUG	11	6,103	681	5,422	0				0	0
	12	6,046	623	5,423	0				0	0
	13	3,427	748	2,679	0				0	0
SEP	14	4,158	718	3,440	0				0	0
	15	3,906	526	3,380	0				0	0
	16	5,261	1,060	4,201	0				0	0
OCT	17	5,041	914	4,127	0				0	0
	18	2,297	1,117	1,180	0		39,600	1,039.50	0	0
	19	3,180	2,297	883	0	-80	39,600	1,039.50	0	0
NOV	20	1,439	2,020	0	581	-80	38,939	1,039.15	0	0
	21	884	1,982	0	1,098	-80	37,761	1,038.70	0	0
	22	610	2,003	0	1,393	-80	36,288	1,037.90	0	0
DEC	23	405	2,086	0	1,681	-80	34,527	1,037.10	0	0
	24	403	2,355	0	1,952	-80	32,495	1,036.30	0	0
	25	266	2,501	0	2,235	-80	30,180	1,035.20	0	0
JAN	26	191	2,608	0	2,417	-80	27,683	1,033.80	0	0
	27	122	2,834	0	2,712	-80	24,891	1,032.00	0	0
	28	145	2,831	0	2,686	-80	22,125	1,030.85	0	0
FEB	29	111	2,636	0	2,525	-80	19,520	1,029.30	0	0
	30	82	2,452	0	2,370	-80	17,070	1,027.70	0	0
	31	81	2,279	0	2,198	-80	14,792	1,026.10	0	0
MAR	32	89	2,055	0	1,966	-80	12,746	1,024.50	0	0
	33	97	1,992	0	1,895	-80	10,771	1,023.20	0	0
	34	482	1,769	0	1,287	-80	9,404	1,021.00	0	0
APR	35	397	1,603	0	1,206	-80	8,118	1,020.85	0	0
	36	112	1,378	0	1,266	-80	6,772	1,019.80	0	0
Balance		61,231	49,284	43,415	31,468				0	0

*1; Inflow = Guirila river discharge + Ostua river discharge
*2; Evaporation and percolation loss; 4.3 mm/day, Reservoir area; 200 ha
*3; Full storage capacity: 39,600 x 10^3 m^3

Table A.4.1.2-7 Operation Study of Guirila Dam (2)

Year 1968

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	(-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	325	721	0	396		6,376	1,019.40	0	0
MAY	2	816	539	277	0		6,653	1,019.70	0	0
	3	1,375	488	887	0		7,540	1,020.40	0	0
	4	3,566	168	3,998	0		10,938	1,023.20	0	0
JUN	5	5,502	140	5,362	0		16,300	1,027.10	0	0
	6	6,128	115	6,013	0		22,313	1,030.90	0	0
	7	5,367	141	5,226	0		27,539	1,033.70	0	0
JUL	8	4,129	209	3,920	0		31,459	1,035.80	0	0
	9	2,061	286	1,775	0		33,234	1,036.70	0	0
	10	2,417	409	2,008	0		35,242	1,037.40	0	0
Aug	11	1,982	681	1,311	0		36,553	1,038.05	0	0
	12	2,307	623	1,684	0		38,237	1,038.90	0	0
	13	4,506	748	3,758	0		39,600	1,039.50	2,395	0
SEP	14	6,010	718	5,292	0		39,600	1,039.50	5,292	0
	15	6,077	526	5,551	0		39,600	1,039.50	5,551	0
	16	4,695	1,060	3,635	0		39,600	1,039.50	3,635	0
OCT	17	5,092	914	4,178	0		39,600	1,039.50	4,178	0
	18	7,223	1,117	6,106	0		39,600	1,039.50	6,106	0
	19	4,976	2,297	2,679	0	-80	39,600	1,039.50	2,599	0
NOV	20	3,330	2,020	1,310	0	-80	39,600	1,039.50	1,230	0
	21	1,475	1,982	0	507	-80	39,013	1,039.20	0	0
	22	932	2,003	0	1,071	-80	37,862	1,038.75	0	0
DEC	23	607	2,086	0	1,479	-80	36,303	1,037.95	0	0
	24	523	2,355	0	1,832	-80	34,391	1,037.05	0	0
	25	358	2,501	0	2,143	-80	32,168	1,036.40	0	0
JAN	26	267	2,608	0	2,341	-80	29,747	1,034.80	0	0
	27	205	3,834	0	2,629	-80	27,038	1,033.30	0	0
	28	129	2,831	0	2,702	-80	24,256	1,032.00	0	0
FEB	29	111	2,636	0	2,525	-80	21,651	1,030.60	0	0
	30	51	2,452	0	2,401	-80	19,170	1,029.00	0	0
	31	67	2,279	0	2,212	-80	16,878	1,027.55	0	0
MAR	32	56	2,055	0	1,999	-80	14,799	1,026.10	0	0
	33	73	1,992	0	1,919	-80	12,800	1,024.60	0	0
	34	101	1,769	0	1,668	-80	11,052	1,023.40	0	0
APR	35	74	1,603	0	1,529	-80	9,443	1,022.00	0	0
	36	108	1,378	0	1,270	-80	8,093	1,020.85	0	0
Balance		83,031	49,284	64,370	30,623				30,986	

Table A.4.1.2-7 Operation Study of Guirila Dam (3)

Year 1969

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	Difference (-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	101	721	0	620		7,473	1,020.40	0	0
MAY	2	380	539	0	159		7,314	1,020.30	0	0
	3	2,862	488	2,374	0		9,688	1,022.20	0	0
	4	4,927	168	4,759	0		14,447	1,025.80	0	0
JUN	5	4,736	140	4,596	0		19,043	1,028.90	0	0
	6	6,284	115	6,169	0		25,212	1,032.40	0	0
	7	7,584	141	7,443	0		32,655	1,036.45	0	0
JUL	8	5,937	209	5,728	0		38,383	1,038.95	0	0
	9	4,325	286	4,039	0		39,600	1,039.50	2,822	0
	10	5,879	409	5,470	0		39,600	1,039.50	5,470	0
Aug	11	5,919	681	5,238	0		39,600	1,039.50	5,238	0
	12	5,917	623	5,294	0		39,600	1,039.50	5,294	0
	13	7,521	748	6,773	0		39,600	1,039.50	6,773	0
SEP	14	5,976	718	5,258	0		39,600	1,039.50	5,258	0
	15	6,462	526	5,936	0		39,600	1,039.50	5,936	0
	16	5,668	1,060	4,608	0		39,600	1,039.50	4,608	0
OCT	17	4,826	914	3,912	0		39,600	1,039.50	3,912	0
	18	3,879	1,117	2,762	0		39,600	1,039.50	2,762	0
	19	1,736	2,297	0	561	-80	38,959	1,039.20	0	0
NOV	20	1,202	2,020	0	818	-80	38,061	1,038.85	0	0
	21	793	1,982	0	1,189	-80	36,792	1,038.15	0	0
	22	670	2,003	0	1,333	-80	35,379	1,037.50	0	0
DEC	23	583	2,086	0	1,503	-80	33,796	1,036.85	0	0
	24	555	2,355	0	1,800	-80	31,916	1,035.95	0	0
	25	433	2,501	0	2,068	-80	29,768	1,034.85	0	0
JAN	26	348	2,608	0	2,260	-80	27,428	1,033.60	0	0
	27	341	2,834	0	2,493	-80	24,855	1,032.25	0	0
	28	329	2,831	0	2,502	-80	22,273	1,030.90	0	0
FEB	29	312	2,636	0	2,324	-80	19,869	1,029.50	0	0
	30	245	2,452	0	2,207	-80	17,587	1,028.10	0	0
	31	272	2,279	0	2,007	-80	15,495	1,026.60	0	0
MAR	32	212	2,055	0	1,843	-80	13,572	1,025.20	0	0
	33	222	1,992	0	1,770	-80	11,722	1,023.80	0	0
	34	210	1,769	0	1,559	-80	10,083	1,022.60	0	0
APR	35	733	1,603	0	870	-80	9,133	1,021.70	0	0
	36	269	1,378	0	1,109	-80	7,944	1,020.40	0	0
Balance		98,648	49,284	80,359	30,995				48.073	

Table A.4.1.2-7 Operation Study of Guirila Dam (4)

Year 1970

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	Difference (-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	130	721	0	591		7,353	1,020.30	0	0
MAY	2	713	539	174	0		7,527	1,020.45	0	0
	3	561	488	73	0		7,600	1,020.50	0	0
	4	404	168	236	0		7,836	1,020.60	0	0
JUN	5	828	140	688	0		8,524	1,021.20	0	0
	6	1,453	115	1,338	0		9,922	1,022.50	0	0
	7	2,347	141	2,206	0		12,128	1,024.10	0	0
JUL	8	4,969	209	4,760	0		16,888	1,027.55	0	0
	9	6,684	286	6,398	0		23,286	1,031.40	0	0
	10	5,730	409	5,321	0		28,607	1,034.25	0	0
Aug	11	5,935	681	5,254	0		33,861	1,036.90	0	0
	12	5,934	623	5,311	0		39,172	1,039.30	0	0
	13	6,294	748	5,546	0		39,600	1,039,50	5,118	0
SEP	14	5,193	718	4,475	0		39,600	1,039.50	4,475	0
	15	5,455	526	4,929	0		39,600	1,039.50	4,929	0
	16	5,385	1,060	4,325	0		39,600	1,039.50	4,325	0
OCT	17	3,584	914	2,670	0		39,600	1,039.50	2,670	0
	18	3,097	1,117	1,980	0		39,600	1,039.50	1,980	0
	19	1,679	2,297	0	618	-80	38,902	1,039.15	0	0
NOV	20	1,089	2,020	0	931	-80	37,891	1,038.70	0	0
	21	833	1,982	0	1,149	-80	36,662	1,038.10	0	0
	22	527	2,003	0	1,476	-80	35,106	1,037.40	0	0
DEC	23	402	2,086	0	1,684	-80	33,342	1,036.70	0	0
	24	402	2,355	0	1,953	-80	31,309	1,035.70	0	0
	25	297	2,501	0	2,204	-80	29,025	1,034.40	0	0
JAN	26	267	2,608	0	2,341	-80	26,604	1,033.15	0	0
	27	283	2,834	0	2,551	-80	23,973	1,031.80	0	0
	28	177	2,831	0	2,654	-80	21,239	1,030.30	0	0
FEB	29	152	2,636	0	2,484	-80	18,675	1,028.70	0	0
	30	79	2,452	0	2,373	-80	16,222	1,027.00	0	0
	31	673	2,279	0	1,606	-80	14,536	1,025.90	0	0
MAR	32	151	2,055	0	1,904	-80	12,552	1,025.40	0	0
	33	99	1,992	0	1,893	-80	10,579	1,022.90	0	0
	34	265	1,769	0	1,504	-80	8,995	1,021.60	0	0
APR	35	135	1,603	0	1,468	-80	7,447	1,020.40	0	0
	36	70	1,378	0	1,308	-80	6,059	1,019.10	0	0
Balance		72,276	49,284	55,684	32,692				23,497	

TAble A.4.1.2-7 Operation Study of Guirila Dam (5)

Year 1971

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	(-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	77	721	0	644		5,415	1,018.30	0	0
MAY	2	425	539	0	114		5,301	1,018.20	0	0
	3	441	488	0	47		5,254	1,018.10	0	0
	4	908	168	740	0		5,994	1,019.00	0	0
JUN	5	2,713	140	2,573	0		8,567	1,021.25	0	0
	6	1,192	115	1,077	0		9,644	1,022.20	0	0
	7	561	141	420	0		10,064	1,022.55	0	0
JUL	8	3,259	209	3,050	0		13,114	1,024.80	0	0
	9	2,596	286	2,310	0		15,424	1,026.50	0	0
	10	4,686	409	4,277	0		19,701	1,029.40	0	0
Aug	11	3,533	681	2,852	0		22,553	1,031.00	0	0
	12	7,476	623	6,853	0		29,406	1,034.60	0	0
	13	5,909	748	5,161	0		34,567	1,037.15	0	0
SEP	14	3,748	718	3,030	0		37,597	1,038.55	0	0
	15	5,088	526	4,562	0		39,600	1,039.50	2,559	0
	16	8,368	1,060	7,308	0		39,600	1,039.50	7,308	0
OCT	17	5,874	914	4,960	0		39,600	1,039.50	4,960	0
	18	4,715	1,117	3,598	0		39,600	1,039.50	3,598	0
	19	1,972	2,297	0	325	-80	39,195	1,039.30	0	0
NOV	20	1,224	2,020	0	796	-80	38,319	1,038.90	0	0
	21	922	1,982	0	990	-80	37,249	1,038.30	0	0
	22	675	2,003	0	1,328	-80	35,841	1,037.70	0	0
DEC	23	526	2,086	0	1,560	-80	34,201	1,037.00	0	0
	24	378	2,355	0	1,977	-80	32,144	1,036.10	0	0
	25	273	2,501	0	2,228	-80	29,836	1,034.90	0	0
JAN	26	162	2,608	0	2,446	-80	27,310	1,033.50	0	0
	27	145	2,834	0	2,689	-80	24,541	1,032.10	0	0
	28	113	2,831	0	2,718	-80	21,743	1,030.65	0	0
FEB	29	85	2,636	0	2,551	-80	19,112	1,029.00	0	0
	30	62	2,452	0	2,390	-80	16,642	1,027.40	0	0
	31	59	2,279	0	2,220	-80	14,342	1,025.80	0	0
MAR	32	77	2,055	0	1,978	-80	12,284	1,024.30	0	0
	33	31	1,992	0	1,961	-80	10,243	1,022.70	0	0
	34	30	1,769	0	1,739	-80	8,424	1,021.10	0	0
APR	35	31	1,603	0	1,572	-80	6,772	1,019.70	0	0
	36	100	1,378	0	1,278	-80	5,414	1,018.30	0	0
Balance		68,504	49,284	52,771	33,551				18,425	

Table A.4.1.2-7 Operation Study of Guirila Dam (6)

Year 1972

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	Difference (-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	63	721	0	658		4,756	1,017.50	0	0
MAY	2	549	539	10	0		4,766	1,017.50	0	0
	3	298	488	0	190		4,576	1,017.30	0	0
	4	3,039	168	2,871	0		7,447	1,020.40	0	0
JUN	5	1,091	140	951	0		8,398	1,021.10	0	0
	6	804	115	689	0		9,087	1,021.60	0	0
	7	384	141	243	0		9,330	1,021.80	0	0
JUL	8	357	209	148	0		9,478	1,022.10	0	0
	9	4,332	286	4,046	0		13,524	1,025.10	0	0
	10	1,323	409	914	0		14,438	1,025.85	0	0
Aug	11	571	681	0	110		14,328	1,025.80	0	0
	12	1,622	623	999	0		15,327	1,026.40	0	0
	13	1,408	748	660	0		15,987	1,026.90	0	0
SEP	14	992	718	274	0		16,261	1,027.10	0	0
	15	697	526	171	0		16,432	1,027.20	0	0
	16	571	424* (1,060)	147 (0)	0 (489)		16,579	1,027.40	0	0
OCT	17	456	365* (914)	91 (0)	0 (458)		16,670	1,027.45	0	0
	18	313	446* (1,117)	(0)	133 (804)		16,537	1,027.35	0	0
	19	185	919* (2,297)	(0)	734 (2,112)	-80	15,723	1,026.70	0	0
NOV	20	487	808* (2,020)	(0)	321 (1,533)	-80	15,322	1,026.40	0	0
	21	217	792* (1,982)	(0)	575 (1,765)	-80	14,667	1,026.00	0	0
	22	171	801* (2,003)	(0)	630 (1,882)	-80	13,957	1,025.50	0	0
DEC	23	171	834* (2,086)	(0)	663 (1,915)	-80	13,214	1,024.90	0	0
	24	174	942* (2,355)	(0)	768 (2,181)	-80	12,366	1,024.30	0	0
	25	144	1,000* (2,501)	(0)	856 (2,357)	-80	11,430	1,023.60	0	0
JAN	26	120	1,043* (2,608)	(0)	923 (2,488)	-80	10,427	1,022.80	0	(-2,192)
	27	127	1,134* (2,834)	(0)	1,007 (2,707)	-80	9,340	1,022.00	0	(-2,787)
	28	127	1,132* (2,831)	(0)	1,005 (2,704)	-80	8,255	1,021.00	0	(-2,784)
FEB	29	92	1,054* (2,636)	(0)	962 (2,544)	-80	7,213	1,020.20	0	(-2,624)
	30	73	981* (2,452)	(0)	908 (2,379)	-80	6,225	1,019.30	0	(-2,459)
	31	75	911* (2,279)	(0)	836 (2,204)	-80	5,309	1,018.20	0	(-2,284)
MAR	32	65	822* (2,055)	(0)	757 (1,990)	-80	4,472	1,017.20	0	(-2,070)
	33	64	796* (1,992)	(0)	732 (1,928)	-80	3,660	1,016.10	0	(-2,008)
	34	77	707* (1,769)	(0)	630 (1,692)	-80	2,950	1,015.10	0	(-1,772)
APR	35	93	641* (1,603)	(0)	548 (1,510)	-80	2,322	1,014.00	0	(-1,590)
	36	92	551* (1,378)	(0)	459 (1,286)	-80	1,783	1,013.00	0	(-1,366)
Balance		21,424	(49,284)	(11,976)	(39,836)					(-23,966)

*; Drought year demand; Q x Cd
Q; Demand for 4,800 ha (figure with ( ))

$$Cd = \text{Irrigable area percent} = \frac{\text{Storage in september}}{\text{Total storage}} = \frac{16,432}{39,600} \fallingdotseq 0.40$$

TAble A.4.1.2-7 Operation Study of Guirila Dam (7)

Year 1973

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	Difference (-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	111	288* (721)	0	177 (610)		1,606	1,012.50	0	(-610)
MAY	2	131	215* (539)	0	84 (408)		1,522	1,012.40	0	(-408)
	3	934	488	446	0		1,968	1,013.40	0	0
	4	705	168	537	0		2,506	1,014.50	0	0
JUN	5	4,599	140	4,459	0		6,965	1,019.90	0	0
	6	5,490	115	5,375	0		12,343	1,024.30	0	0
	7	4,170	141	4,029	0		16,372	1,027.20	0	0
JUL	8	2,215	209	2,006	0		18,378	1,028.50	0	0
	9	5,598	286	5,312	0		23,690	1,031.70	0	0
	10	5,065	409	4,656	0		28,346	1,034.10	0	0
Aug	11	5,903	681	5,222	0		33,568	1,036.80	0	0
	12	7,037	623	6,414	0		39,600	1,039.50	382	0
	13	5,144	748	4,396	0		39,600	1,039.50	4,396	0
SEP	14	5,003	718	4,285	0		39,600	1,039.50	4,285	0
	15	5,585	526	5,059	0		39,600	1,039.50	5,059	0
	16	6,071	1,060	5,011	0		39,600	1,039.50	5,011	0
OCT	17	7,021	914	6,107	0		39,600	1,039.50	6,107	0
	18	6,110	1,117	4,993	0		39,600	1,039.50	4,993	0
	19	4,039	2,297	1,742	0	-80	39,600	1,039.50	1,662	0
NOV	20	1,653	2,020	0	367	-80	39,153	1,039.30	0	0
	21	1,396	1,982	0	586	-80	38,487	1,039.00	0	0
	22	788	2,003	0	1,215	-80	37,192	1,038.30	0	0
DEC	23	554	2,086	0	1,532	-80	35,580	1,037.65	0	0
	24	431	2,355	0	1,924	-80	33,576	1,036.85	0	0
	25	391	2,501	0	2,110	-80	31,386	1,035.75	0	0
JAN	26	318	2,608	0	2,290	-80	29,016	1,034.40	0	0
	27	303	2.834	0	2,531	-80	26,405	1,033.00	0	0
	28	189	2,831	0	2,642	-80	23,683	1,031.60	0	0
FEB	29	168	2,636	0	2,468	-80	21,135	1,030.30	0	0
	30	96	2,452	0	2,356	-80	18,699	1,028.70	0	0
	31	290	2,279	0	1,989	-80	16,630	1,027.40	0	0
MAR	32	289	2,055	0	1,766	-80	14,784	1,026.10	0	0
	33	107	1,992	0	1,885	-80	12,819	1,024.10	0	0
	34	58	1,769	0	1,711	-80	11,028	1,023.30	0	0
APR	35	65	1,603	0	1,538	-80	9,410	1,022.00	0	0
	36	51	1,378	0	1,327	-80	8,003	1,020.80	0	0
Balance		88,078	49,284	70,049	31,255				31,795	(-1,018)

Table A.4.1.2-7 Operation Study of Guirila Dam (8)

Year 1974

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	(-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	119	721	0	602		7,401	1,020.30	0	0
MAY	2	328	539	0	211		7,190	1,020.20	0	0
	3	4,376	488	3,888	0		11,078	1,023.40	0	0
	4	4,334	168	4,166	0		15,244	1,026.00	0	0
JUN	5	5,650	140	5,510	0		20,754	1,030.00	0	0
	6	5,901	115	5,786	0		26,540	1,033.15	0	0
	7	4,965	141	4,824	0		31,364	1,035.75	0	0
JUL	8	4,544	209	4,335	0		35,699	1,037.70	0	0
	9	2,612	286	2,326	0		38,025	1,038.85	0	0
	10	1,071	409	662	0		38,687	1,039.10	0	0
Aug	11	896	681	215	0		38,902	1,039.10	0	0
	12	1,338	623	715	0		39,600	1,039.50	17	0
	13	2,332	748	1,584	0		39,600	1,039.50	1,584	0
SEP	14	4,484	718	3,766	0		39,600	1,039.50	3,766	0
	15	5,922	526	5,396	0		39,600	1,039.50	5,396	0
	16	3,892	1,060	2,832	0		39,600	1,039.50	2,832	0
OCT	17	1,661	914	747	0		39,600	1,039.50	747	0
	18	1,088	1,117	0	29		39,574	1,039.50	0	0
	19	676	2,297	0	1,621	-80	37,873	1,038.70	0	0
NOV	20	415	2,020	0	1,605	-80	36,188	1,037.85	0	0
	21	338	1,982	0	1,644	-80	34,464	1,037.00	0	0
	22	318	2,003	0	1,685	-80	32,699	1,036.40	0	0
DEC	23	242	2,086	0	1,844	-80	30,775	1,035.50	0	0
	24	221	2,355	0	2,134	-80	28,561	1,034.25	0	0
	25	134	2,501	0	2,367	-80	26,114	1,032.95	0	0
JAN	26	86	2,608	0	2,522	-80	23,512	1,031.50	0	0
	27	66	2,834	0	2,768	-80	20,664	1,030.00	0	0
	28	61	2,831	0	2,770	-80	17,814	1,028.25	0	0
FEB	29	36	2,636	0	2,600	-80	15,134	1,026.30	0	0
	30	30	2,452	0	2,422	-80	12,632	1,024.50	0	0
	31	41	2,279	0	2,238	-80	10,314	1,022.70	0	0
MAR	32	40	2,055	0	2,015	-80	8,219	1,021.00	0	0
	33	35	1,992	0	1,957	-80	6,182	1,019.20	0	0
	34	31	1,769	0	1,738	-80	4,364	1,016.90	0	0
APR	35	27	1,603	0	1,576	-80	2,708	1,014.70	0	0
	36	35	1,378	0	1,343	-80	1,285	1,011.50	0	0
Balance		58,345	49,284	46,752	37,691				14,342	

Table A.4.1.2-7 Operation Study of Guirila Dam (9)

Year 1975

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	Difference (-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	61	721	0	660		625	1,009.70	0	0
MAY	2	109	539	0	430		195	1,008.70	0	0
	3	465	488	0	23		172	1,008.50	0	0
	4	313	168	145	0		317	1,009.00	0	0
JUN	5	293	140	153	0		470	1,009.40	0	0
	6	238	115	123	0		593	1,010.00	0	0
	7	407	141	266	0		859	1,010.50	0	0
JUL	8	202	209	0	7		852	1,010.50	0	0
	9	511	286	225	0		1,077	1,011.40	0	0
	10	707	409	298	0		1,375	1,012.00	0	0
Aug	11	859	681	178	0		1,553	1,012.40	0	0
	12	2,736	623	2,113	0		3,666	1,016.10	0	0
	13	5,367	748	4,619	0		8,285	1,021.00	0	0
SEP	14	6,044	718	5,326	0		13,611	1,025.20	0	0
	15	5,003	526	4,477	0		18,088	1,028.40	0	0
	16	5,541	1,060	4,481	0		22,569	1,031.05	0	0
OCT	17	5,551	941	4,637	0		27,206	1,033.40	0	0
	18	4,957	1,117	3,840	0		31,046	1,035.60	0	0
	19	4,632	2,297	2,335	0	-80	33,301	1,036.70	0	0
NOV	20	2,762	2,020	742	0	-80	33,963	1,036.90	0	0
	21	895	1,982	0	1,087	-80	32,796	1,036.50	0	0
	22	708	2,003	0	1,295	-80	31,421	1,035.80	0	0
DEC	23	262	2,086	0	1,824	-80	29,517	1,034.70	0	0
	24	303	2,355	0	2,052	-80	27,385	1,033.50	0	0
	25	163	2,501	0	2,338	-80	24,965	1,032.30	0	0
JAN	26	121	2,608	0	2,487	-80	22,400	1,030.95	0	0
	27	76	2,834	0	2,758	-80	19,562	1,029.35	0	0
	28	88	2,831	0	2,743	-80	16,739	1,027.50	0	0
FEB	29	109	2,636	0	2,527	-80	14,132	1,025.60	0	0
	30	100	2,452	0	2,352	-80	11,700	1,023.80	0	0
	31	77	2,279	0	2,202	-80	9,418	1,022.00	0	0
MAR	32	70	2,055	0	1,985	-80	7,353	1,020.30	0	0
	33	61	1,992	0	1,931	-80	5,342	1,018.00	0	0
	34	477	1,769	0	1,292	-80	3,970	1,016.50	0	0
APR	35	207	1,603	0	1,396	-80	2,494	1,014.30	0	0
	36	319	1,378	0	1,059	-80	1,355	1,012.00	0	0
Balance		50,794	49,284	33,958	32,448				0	0

Table A.4.1.2-7 Operation Study of Guirila Dam (10)

Year 1976

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	(-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	351	721	0	370		985	1,010.90	0	0
MAY	2	608	539	69	0		1,054	1,011.20	0	0
	3	737	488	249	0		1,303	1,011.50	0	0
	4	2,747	168	2,579	0		3,882	1,016.40	0	0
JUN	5	5,337	140	5,197	0		9,079	1,021.70	0	0
	6	6,092	115	5,977	0		15,056	1,026.30	0	0
	7	5,999	141	5,858	0		20,914	1,030.10	0	0
JUL	8	3,508	209	3,299	0		24,213	1,031.90	0	0
	9	1,292	286	1,006	0		25,219	1,032.40	0	0
	10	610	409	201	0		25,420	1,032.50	0	0
Aug	11	926	681	245	0		25,665	1,032.70	0	0
	12	1,127	623	504	0		26,169	1,033.00	0	0
	13	2,772	748	2,024	0		28,193	1,034.10	0	0
SEP	14	1,408	718	690	0		28,883	1,034.30	0	0
	15	1,665	526	1,139	0		30,022	1,035.00	0	0
	16	5,195	1,060	4,135	0		34,157	1,037.00	0	0
OCT	17	2,919	914	2,005	0		36,162	1,037.90	0	0
	18	1,171	1,117	54	0		36,216	1,037.95	0	0
	19	667	2,297	0	1,630	-80	34,506	1,037.10	0	0
NOV	20	611	2,020	0	1,409	-80	33,017	1,036.60	0	0
	21	522	1,982	0	1,460	-80	31,477	1,035.80	0	0
	22	376	2,003	0	1,627	-80	29,770	1,034.95	0	0
DEC	23	316	2,086	0	1,770	-80	27,920	1,033.90	0	0
	24	319	2,355	0	2,036	-80	25,804	1,032.85	0	0
	25	214	2,501	0	2,287	-80	23,437	1,031.45	0	0
JAN	26	206	2,608	0	2,402	-80	20,955	1,030.20	0	0
	27	247	2,834	0	2,587	-80	18,288	1,028.40	0	0
	28	201	2,831	0	2,630	-80	15,578	1,026.65	0	0
FEB	29	187	2,636	0	2,449	-80	13,049	1,024.80	0	0
	30	137	2,452	0	2,315	-80	10,654	1,023.00	0	0
	31	169	2,279	0	2,110	-80	8,464	1,021.15	0	0
MAR	32	162	2,055	0	1,893	-80	6,491	1,019.50	0	0
	33	218	1,992	0	1,774	-80	4,637	1,017.30	0	0
	34	125	1,769	0	1,644	-80	2,913	1,015.10	0	0
APR	35	691	1,603	0	912	-80	1,921	1,013.40	0	0
	36	206	1,378	0	1,172	-80	669	1,009.90	0	0
Balance		50.038	49,284	35,231	34,477				0	0

Table A.4.1.2-7 Operation Study of Guirila Dam (11)

Year 1977

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	Difference (-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	182	721	0	593		130	1,008.20	0	0
MAY	2	150	539	0	389		0	1,008.00	0	0
	3	203	488	0	285		0	1,008.00	0	0
	4	1,318	168	1,150	0		1,150	1,011.30	0	0
JUN	5	1,418	140	1,278	0		2,428	1,014.20	0	0
	6	2,767	115	2,652	0		5,080	1,017.90	0	0
	7	684	141	543	2		5,623	1,018.60	0	0
JUL	8	605	209	396	0		6,019	1,019.00	0	0
	9	284	286	0	2		6,017	1,019.00	0	0
	10	465	409	56	0		6,073	1,019.10	0	0
Aug	11	319	681	0	362		5,711	1,018.60	0	0
	12	553	623	0	70		5,641	1,018.50	0	0
	13	371	748	0	377		5,264	1,018.10	0	0
SEP	14	1,416	718	698	0		5,962	1,019.00	0	0
	15	4,546	526	4,020	0		9,982	1,022.50	0	0
	16	4,421	1,060	3,361	0		13,343	1,024.95	0	0
OCT	17	1,043	914	129	0		13,472	1,025.00	0	0
	18	527	1,117	0	590		12,882	1,024.60	0	0
	19	409	803* (2,297)	0	394 (1,888)	-80	12,408	1,024.30	0	0
NOV	20	254	707* (2,020)	0	453 (1,766)	-80	11,875	1,023.95	0	0
	21	267	693* (1,982)	0	426 (1,715)	-80	11,369	1,023.60	0	0
	22	193	701* (2,003)	0	508 (1,810)	-80	10,781	1,023.10	0	0
DEC	23	171	730* (2,086)	0	559 (1,915)	-80	10,142	1,022.60	0	0
	24	178	824* (2,355)	0	646 (2,177)	-80	9,416	1,022.00	0	0
	25	203	875* (2,501)	0	672 (2,298)	-80	8,664	1,021.30	0	(-1,247)
JAN	26	203	912* (2,608)	0	709 (2,405)	-80	7,875	1,020.70	0	(-2,485)
	27	210	991* (2,834)	0	781 (2,624)	-80	7,014	1,020.00	0	(-2,704)
	28	177	990* (2,831)	0	813 (2,654)	-80	6,121	1,019.10	0	(-2,734)
FEB	29	177	922* (2,636)	0	745 (2,459)	-80	5,296	1,018.15	0	(-2,539)
	30	141	858* (2,452)	0	717 (2,311)	-80	4,499	1,017.20	0	(-2,391)
	31	195	797* (2,279)	0	602 (2,084)	-80	3,817	1,016.30	0	(-2,164)
MAR	32	201	719* (2,055)	0	518 (1,854)	-80	3,219	1,015.50	0	(-1,934)
	33	224	697* (1,992)	0	473 (1,768)	-80	2,666	1,014.70	0	(-1,848)
	34	165	619* (1,769)	0	454 (1,604)	-80	2,132	1,013.80	0	(-1,684)
APR	35	385	562* (1,608)	0	177 (1,218)	-80	1,875	1,013.15	0	(-1,298)
	36	64	482* (1,378)	0	418 (1,314)	-80	1,377	1,011.90	0	(-1,394)
Balance		25,089	(49,284)	14,283	(38,478)				0	(-24,422)

*; Drought year demand: Q x Cd

Cd; $\frac{12,882 \times 10^3}{39,600 \times 10^3} \fallingdotseq 0.35$

Q; Demand for 4,800 ha (figure with ( ))

Table A.4.1.2-7 Operation Study of Guirila Dam (12)

Year 1978

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	Difference (-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	43	180* (721)	0	209 (678)		1,168	1,011.40	0	(-678)
MAY	2	44	134* (539)	0	144 (495)		1,024	1,011.00	0	(-495)
	3	561	488	73	0		1,097	1,011.25	0	0
	4	641	168	473	0		1,570	1,012.55	0	0
JUN	5	627	140	487	0		2,057	1,013.60	0	0
	6	1,054	115	939	0		2,996	1,015.20	0	0
	7	1,773	141	1,632	0		4,628	1,017.35	0	0
JUL	8	3,429	209	3,220	0		7,848	1,020.70	0	0
	9	3,808	286	3,522	0		11,370	1,023.55	0	0
	10	1,182	409	773	0		12,143	1,024.10	0	0
Aug	11	948	681	267	0		12,410	1,024.30	0	0
	12	2,002	623	1,379	0		13,789	1,025.35	0	0
	13	5,592	748	4,844	0		18,633	1,028.70	0	0
SEP	14	4,783	718	4,065	0		22,698	1,031.10	0	0
	15	5,680	526	5,154	0		27,852	1,033.90	0	0
	16	5,455	1,060	4,395	0		32,247	1,036.15	0	0
OCT	17	5,368	914	4,454	0		36,701	1,038.10	0	0
	18	3,558	1,117	1,441	0		39,142	1,039.35	0	0
	19	2,356	2,297	59	0	-80	39,121	1,039.25	0	0
NOV	20	2,208	2,020	188	0	-80	39,229	1,039.30	0	0
	21	1,932	1,982	0	50	-80	39,099	1,039.25	0	0
	22	1,965	2,003	0	38	-80	38,981	1,039.20	0	0
DEC	23	1,712	2,086	0	374	-80	38,527	1,039.00	0	0
	24	1,460	2,355	0	895	-80	37,552	1,038.50	0	0
	25	1,112	2,501	0	1,389	-80	36,083	1,037.85	0	0
JAN	26	822	2,608	0	1,786	-80	34,217	1,037.00	0	0
	27	761	2,834	0	2,073	-80	32,064	1,035.05	0	0
	28	627	2,831	0	2,204	-80	29,780	1,034.85	0	0
FEB	29	627	2,636	0	2,009	-80	27,691	1,033.80	0	0
	30	480	2,452	0	1,972	-80	25,639	1,032.70	0	0
	31	573	2,279	0	1,706	-80	23,853	1,031.70	0	0
MAR	32	573	2,055	0	1,482	-80	22,291	1,030.90	0	0
	33	620	1,992	0	1,372	-80	20,839	1,030.10	0	0
	34	519	1,769	0	1,250	-80	19,509	1,029.30	0	0
APR	35	519	1,603	0	1,084	-80	18,345	1,028.50	0	0
	36	481	1,378	0	897	-80	17,368	1,027.90	0	0
Balance		65,895	49,284	38,365	(21,754)				0	(1,173)

Table A.4.1.2-7 Operation Study of Guirila Dam (13)

Year 1979

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	(-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	596	721	0	125		17,243	1,027.80	0	0
MAY	2	1,614	539	1,075	0		18,318	1,028.50	0	0
	3	473	488	0	15		18,303	1,028.50	0	0
	4	594	168	426	0		18,729	1,028.75	0	0
JUN	5	1,838	140	1,698	0		20,427	1,029.85	0	0
	6	405	115	290	0		20,717	1,030.05	0	0
	7	5,529	141	5,388	0		26,105	1,032.95	0	0
JUL	8	3,540	209	3,331	0		29,436	1,034.65	0	0
	9	3,790	286	3,504	0		32,940	1,036.60	0	0
	10	2,807	409	2,398	0		35,338	1,037.50	0	0
Aug	11	2,072	681	1,391	0		36,729	1,038.10	0	0
	12	6,886	623	6,263	0		39,600	1,039.50	0	0
	13	5,786	748	5,038	0		39,600	1,039.50	3,392	0
SEP	14	6,153	718	5,435	0		39,600	1,039.50	5,435	0
	15	4,727	526	4,201	0		39,600	1,039.50	4,201	0
	16	2,729	1,060	1,669	0		39,600	1,039.50	1,669	0
OCT	17	4,719	914	3,805	0		39,600	1,039.50	3,805	0
	18	4,051	1,117	2,934	0		39,600	1,039.50	2,934	0
	19	1,664	2,297	0	633	-80	38,887	1,039.15	0	0
NOV	20	713	2,020	0	1,307	-80	37,500	1,038.50	0	0
	21	532	1,982	0	1,450	-80	35,970	1,037.80	0	0
	22	420	2,003	0	1,583	-80	34,307	1,037.05	0	0
DEC	23	329	2,086	0	1,757	-80	32,470	1,036.30	0	0
	24	276	2,355	0	2,079	-80	30,311	1,035.20	0	0
	25	201	2,501	0	2,300	-80	27,931	1,033.95	0	0
JAN	26	168	2,608	0	2,440	-80	25,411	1,032.55	0	0
	27	173	2,834	0	2,661	-80	22,670	1,031.05	0	0
	28	118	2,831	0	2,713	-80	19,877	1,029.55	0	0
FEB	29	107	2,636	0	2,529	-80	17,268	1,027.80	0	0
	30	74	2,452	0	2,378	-80	14,810	1,026.10	0	0
	31	65	2,279	0	2,214	-80	12,516	1,024.40	0	0
MAR	32	72	2,055	0	1,983	-80	10,453	1,022.90	0	0
	33	93	1,992	0	1,899	-80	8,474	1,021.20	0	0
	34	159	1,769	0	1,610	-80	6,784	1,019.80	0	0
APR	35	185	1,603	0	1,418	-80	5,286	1,018.10	0	0
	36	158	1,378	0	1,220	-80	3,986	1,016.60	0	0
Balance		63,816	49,284	48,846	34,314				21,436	0

Table A.4.1.2-7 Operation Study of Guirila Dam (14)

Year 1980

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	Difference (-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	129	721	0	592		3,394	1,015.75	0	0
MAY	2	146	539	0	393		3,001	1,015.20	0	0
	3	776	488	288	0		3,289	1,015.75	0	0
	4	650	168	482	0		3,771	1,016.20	0	0
JUN	5	5,208	140	5,068	0		8,839	1,021.50	0	0
	6	5,230	115	5,115	0		13,954	1,025.50	0	0
	7	1,448	141	1,307	0		15,261	1,026.40	0	0
JUL	8	1,256	209	1,047	0		16,308	1,027.15	0	0
	9	5,701	286	5,415	0		21,723	1,030.65	0	0
	10	5,619	409	5,210	0		26,933	1,033.25	0	0
Aug	11	3,765	681	3,084	0		30,017	1,035.00	0	0
	12	4,476	623	3,853	0		33,870	1,036.85	0	0
	13	4,926	748	4,178	0		38,048	1,038.80	0	0
SEP	14	5,661	718	4,943	0		39,600	1,039.50	3,391	0
	15	5,205	526	4,679	0		39,600	1,039.50	4,679	0
	16	4,357	1,060	3,297	0		39,600	1,039.50	3,297	0
OCT	17	2,252	914	1,338	0		39,600	1,039.50	1,338	0
	18	1,678	1,117	561	0		39,600	1,039.50	561	0
	19	1,161	2,297	0	1,136	-80	38,384	1,039.15	0	0
NOV	20	1,116	2,020	0	904	-80	37,400	1,038.45	0	0
	21	1,129	1,982	0	853	-80	36,467	1,038.00	0	0
	22	802	2,003	0	1,201	-80	35,186	1,037.40	0	0
DEC	23	692	2,086	0	1,394	-80	33,712	1,036.85	0	0
	24	742	2,355	0	1,613	-80	32,019	1,036.00	0	0
	25	562	2,501	0	1,939	-80	30,000	1,035.00	0	0
JAN	26	476	2,608	0	2,132	-80	27,788	1,033.90	0	0
	27	454	2,834	0	2,380	-80	25,328	1,032.50	0	0
	28	402	2,831	0	2,429	-80	22,819	1,031.15	0	0
FEB	29	372	2,636	0	2,264	-80	20,475	1,029.90	0	0
	30	277	2,452	0	2,175	-80	18,220	1,028.45	0	0
	31	328	2,279	0	1,951	-80	16,189	1,027.00	0	0
MAR	32	417	2,055	0	1,638	-80	14,471	1,025.90	0	0
	33	361	1,992	0	1,631	-80	12,760	1,024.55	0	0
	34	266	1,769	0	1,503	-80	11,177	1,023.40	0	0
APR	35	297	1,603	0	1,306	-80	9,791	1,022.40	0	0
	36	381	1,378	0	997	-80	8,714	1,021.40	0	0
Balance		68,718	49,284	49,865	30,431				13,266	

Table A.4.1.2-7 Operation Study of Guirila Dam (15)

Year 1981

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	(-)	Loss	Storage V	Stage H	Spill Q	Shortage
	1	350	721	0	371		8,343	1,021.10	0	0
MAY	2	309	539	0	230		8,113	1,020.90	0	0
	3	604	488	116	0		8,229	1,021.00	0	0
	4	500	168	332	0		8,561	1,021.25	0	0
JUN	5	973	140	833	0		9,394	1,022.00	0	0
	6	3,216	115	3,101	0		12,495	1,024.40	0	0
	7	4,240	141	4,099	0		16,594	1,027.35	0	0
JUL	8	4,808	209	4,599	0		21.193	1,030.25	0	0
	9	4,983	286	4,697	0		25,890	1,032.85	0	0
	10	2,803	409	2,394	0		28,284	1,034.10	0	0
Aug	11	4,441	681	3,760	0		32,044	1,036.00	0	0
	12	3,719	623	3,096	0		34,140	1,037.40	0	0
	13	3,716	748	2,968	0		38,108	1,038.85	0	0
SEP	14	4,482	718	3,764	0		39,600	1,039.50	2,272	0
	15	5,374	526	4,848	0		39,600	1,039.50	4,848	0
	16	1,421	1,060	361	0		39,600	1,039.50	361	0
OCT	17	800	914	0	114		39,486	1,039.45	0	0
	18	1,859	1,117	742	0		39,600	1,039.50	628	0
	19	2,847	2,297	550	0	-80	39,600	1,039.50	470	0
NOV	20	2,160	2,020	140	0	-80	39,600	1,039.50	60	0
	21	1,716	1,982	0	266	-80	39,254	1,039.35	0	0
	22	1,480	2,003	0	523	-80	38,651	1,039.05	0	0
DEC	23	1,263	2,086	0	823	-80	37,748	1,038.65	0	0
	24	1,502	2,355	0	853	-80	36,815	1,037.90	0	0
	25	1,162	2,501	0	1,339	-80	35,396	1,037.55	0	0
JAN	26	910	2,608	0	1,698	-80	33,618	1,036.80	0	0
	27	889	2,834	0	1,945	-80	31,593	1,035.85	0	0
	28	721	2,831	0	2,110	-80	29,403	1,034.65	0	0
FEB	29	707	2,636	0	1,929	-80	27,394	1,033.60	0	0
	30	566	2,452	0	1,886	-80	25,428	1,032.55	0	0
	31	707	2,279	0	1,572	-80	23,776	1,031.65	0	0
MAR	32	630	2,055	0	1,425	-80	22,271	1,030.90	0	0
	33	636	1,992	0	1,356	-80	20,835	1,030.10	0	0
	34	555	1,769	0	1,214	-80	19,541	1,029.30	0	0
APR	35	578	1,603	0	1,025	-80	18,436	1,028.60	0	0
	36	578	1,378	0	800	-80	17,556	1,028.05	0	0
Balance		68,205	29,284	40,400	21,479				8,639	0

(5) Operation and Maintenance Cost of Alternative Plan

1) O & M cost for Dam service area

(Unit: Q)

Items	Case 1	Case 2	Case 3
Salary and Weges[1]	479,050	479,050	479,050
Equipment	94,127	85,302[2]	78,439[2]
Material and Supplies	18,700	16,947[2]	15,583[2]
Administration	71,857	71,857	71,857
Total	663,734	653,156	644,929
Irrigation Area	4,800	4,350	4,000
O/M Cost per hectare	138	150	161

Note 1/; Number of O & M staff for Case 1, Case 2, Case 3 is same, respectively.

2/; Equipment, Material and supplies cost is estimated in proportion to service area

2) O & M cost for ground water irrigation area

(Unit: Q)

Area	Electric Charge	Rehabilitation Cost	Total
Mojarritas	353	79	432
San Pedro	353	87	440
Average	353	83	436

(6) Rate of Water Utilization Cost (Operation and Maintenance Expenses) to Production Cost

The Government of Guatemala places emphasis on expanded production of exports vegetables as well as production of maize and kidney beans both of which are basic crops for self-supply.

Maize is the least profitable crop of the Study area. Productions of maize and kidney beans are estimated for each case in order to study influrnce of water utilization cost (operation and maintenance cost) on profitability.

Operation and maintenance cost of the proposed plan are Q138/ha and Q150/ha per year for Case 1 and Case 2, respectively, both of which depend on the dam. As to Case 3, the expenses are about Q232/ha depending on wells and about Q232/ha in average depending on both dam and well.

Assuming double type cropping per year, water utilization cost will be half. The following table shows water utilization cost, production cost, net productions, etc.

The rate of water utilization cost to production cost is 5.5 to 6.6% for Case 1, 5.9 to 7.0% for Case 2, 18.7 to 21.6% for Case 3 depending on the well, and 8.7 to 10.2% for Case 3 in average. In Case 3, the net production of maize becomes minus, proving that maize is not suitable for production. Utilization of groundwater makes maize production economically infeasible, and impeded attainmaint of the basic policy of the agricultural management "never to reduce production of maize and kidney beans, i.e. two basic crops."

Table A.4.1.2-8 Relationship between Water Charge and Production Value

Case	Annual O/M Cost (Q/ha)	Water Charge (% of Product. value) (Q/ha)	(%)	Production Value (Q/ha)	Gross Production Value (Q/ha)	Net Production Value (Q/ha)
Present						
Maize		21	1.8	1210	1280	70
Kidney Beans		21	2.1	1010	1526	516
Case 1						
Maize	138	69	5.5	1266	1280	14
Kidney Beans	138	69	6.	1066	1526	460
Case 2						
Maize	150	75	5.9	1273	1280	7
Kidney Beans	150	75	7.0	1073	1526	453
Case 3						
- Groundwater Irrigation						
Maize	545	273	18.1	1506	1280	-226
Kidney Beans	545	273	20.9	1306	1526	220
- Average						
Maize	225	113	8.6	1317	1280	-37
Kidney Beans	225	113	10.1	1117	1526	409

4.2 Development Plan

4.2.1 Irrigation Plan

(1) Evapotraspiration for Crops

Table A.4.2.1-1 Monthly Evapotranspiration (ET crop) for Crops
Table A.4.2.1-2 Evapotranspiration (ET crop) for Crops
Fig. A.4.2.1-1 Reference Crop Evapotranspiration (ET crop)

(2) Crop Coefficient

Fig. A.4.2.1-2 Crop Coefficient (Kc)

(3) Irrigation Area by Crops

Table A.4.2.1-3 Irrigation Area by Crops

(4) Irrigation water Requirememt by Crops

Table A.4.2.1-4 Irrigation Water Requirement for Maize (I), (II)
Table A.4.2.1-5 Irrigation Water Requirement for Maize (III)
Table A.4.2.1-6 Irrigation Water Requirement for Maize (IV)
Table A.4.2.1-7 Irrigation Water Requirement for Tomato (I)
Table A.4.2.1-8 Irrigation Water Requirement for Tomato (II)
Table A.4.2.1-9 Irrigation Water Requirement for Broccoli
Table A.4.2.1-10 Irrigation Water Requirement for Kidney Beans (I)
Table A.4.2.1-11 Irrigation Water Requirement for Kidney Beans (II)
Table A.4.2.1-12 Irrigation Water Requirement for Kidney Beans (III)
Table A.4.2.1-13 Irrigation Water Requirement for Tobacco
Table A.4.2.1-14 Irrigation Water Requirement for Onion

(5) Effective Rainfall

Table A.4.2.1-15 Effective Rainfall

(6) Irrigation Efficiency

(7) Calculation of Leaching Requirement

Table A.4.2.1-16 Leaching Requirement

(8) Intake Rate

Fig. A.4.2.1-3 Location Map of Intake Rate Test
Fig. A.4.2.1-4 Result of Cylinder Intake Rate
Table A.4.2.1-17 Summary of TRAM
Table A.4.2.1-18 Calculation of TRAM

(9) Unit Water Requirement for Designed Canal

(10) Irrigation Area during the Construction

Table A.4.2.1-19 Deversion Water Requirement by Crops during the Construction Period
Table A.4.2.1-20 Water Balance Study during the Construction Period
Fig. A.4.2.1-5 Cropping Period during the Construction Period

4.2.2 Agricultural Plan

(1) Production Plan

(2) Farming Program

4.2.3 Marketing and Processing of Agricultural Products

(1) Marketing Channel of Agricultural Products

4.2.4 Related Agricultural Institutions

(1) Reinforcement of Agricultural Extension System

(2) Creation of Farmer's Organizatin

Table A.4.2.1-1 Monthly Evapotranspiration (ET crop) for Crops

(Units; mm)

Crops	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Mean
Maize (I), (II)	57.9	60.7	90.1	109.9	117.7	107.7	95.3	72.2	-	-	-	-	711.5
" (III)	-	-	-	-	-	52.1	70.4	86.9	108.9	136.0	139.6	111.0	704.9
" (IV)	-	-	-	-	52.2	70.5	84.5	93.2	109.1	101.9	-	-	511.4
Tomato (I)	-	-	-	-	-	-	49.8	68.5	93.5	129.8	161.9	145.8	649.3
" (II)	-	55.1	84.5	100.2	104.4	113.2	96.8	-	-	-	-	-	554.2
Broccoli	-	-	-	-	-	-	58.7	82.3	93.7	129.2	146.7	-	510.6
Kidney bean (I)	129.0	125.7	105.0	-	-	-	-	-	-	59.1	96.4	127.2	642.4
" (II)	61.2	77.8	107.0	110.9	112.4	84.2	-	-	-	-	-	-	553.5
" (III)	143.5	97.1	-	-	-	-	-	-	52.2	88.5	124.9	146.6	652.8
Tabaco	61.2	77.8	107.5	115.4	115.4	93.3	-	-	-	-	-	-	570.6
Onion	-	-	-	-	51.8	64.9	78.3	88.0	106.5	120.7	-	-	510.2
Average	90.5	82.4	98.8	109.1	92.3	83.7	76.2	81.8	94.0	109.3	133.9	132.7	547.6
Total	452.8	494.2	494.1	436.4	553.9	585.9	533.8	491.1	563.9	765.2	669.5	530.6	6,571.4

Table A.4.2.1-2 Evapotranspiration (ET crop) for Crops (1)

(mm/day)

Date			Maize (I, II)		Maize (III)		Maize (IV)		Tomato (I)		Tomato (II)	
Mon.	10 Day	ETo	Kc	ETcrop	Kc	ETcrop	Kc	ETcrop	Kc	ETcrop	KC	Etcrop
	B	5.27	0.40	2.11								
May	M	4.66	0.40	1.86								
	L	4.56	0.40	1.82								
	B	4.09	0.43	1.76							0.42	1.72
Jun	M	4.24	0.47	1.99							0.42	1.78
	L	4.37	0.53	2.32							0.46	2.01
	B	4.53	0.60	2.72							0.53	2.40
Jul	M	4.66	0.66	3.08							0.62	2.89
	L	4.52	0.71	3.21							0.70	3.16
	B	4.32	0.79	3.41							0.76	3.28
Aug	M	4.33	0.87	3.77							0.80	3.46
	L	4.05	0.94	3.81							0.81	3.28
	B	3.84	1.06	4.07			0.45	1.73			0.86	3.30
Sep	M	3.81	1.05	4.00			0.45	1.71			0.92	3.51
	L	3.70	1.00	3.70			0.48	1.78			0.98	3.63
	B	3.60	1.00	3.60	0.46	1.66	0.56	2.02			1.03	3.71
Oct	M	3.68	0.98	3.61	0.46	1.69	0.64	2.36			1.04	3.83
	L	3.71	0.96	3.56	0.50	1.86	0.72	2.67			1.02	3.78
	B	3.66	0.93	3.40	0.57	2.09	0.77	2.82	0.45	1.65	0.98	3.59
Nov	M	3.64	0.89	3.24	0.65	2.37	0.79	2.88	0.45	1.64	0.85	3.09
	L	3.53	0.82	2.89	0.73	2.58	0.78	2.75	0.48	1.69	0.85	3.00
	B	3.49	0.75	2.58	0.78	2.72	0.82	2.86	0.56	1.95		
Dec	M	3.46	0.65	2.25	0.82	2.84	0.88	3.04	0.65	2.25		
	L	3.68	0.65	2.39	0.85	3.13	0.93	3.42	0.72	2.65		
	B	3.73			0.91	3.39	0.96	3.58	0.78	2.91		
Jan	M	3.77			0.95	3.58	0.96	3.62	0.82	3.09		
	L	4.08			0.96	3.92	0.91	3.71	0.82	3.35		
	B	4.44			0.99	4.40	0.82	3.64	0.87	3.86		
Feb	M	4.61			0.98	4.52	0.69	3.18	0.93	4.29		
	L	4.88			0.96	4.68	0.69	3.37	0.99	4.83		
	B	5.02			0.94	4.72			1.03	5.17		
Mar	M	5.09			0.90	4.58			1.04	5.29		
	L	5.62			0.83	4.66			1.02	5.73		
	B	5.55			0.74	4.11			0.98	5.44		
Apr	M	5.51			0.65	3.58			0.85	4.68		
	L	5.25			0.65	3.41			0.85	4.46		
Total												

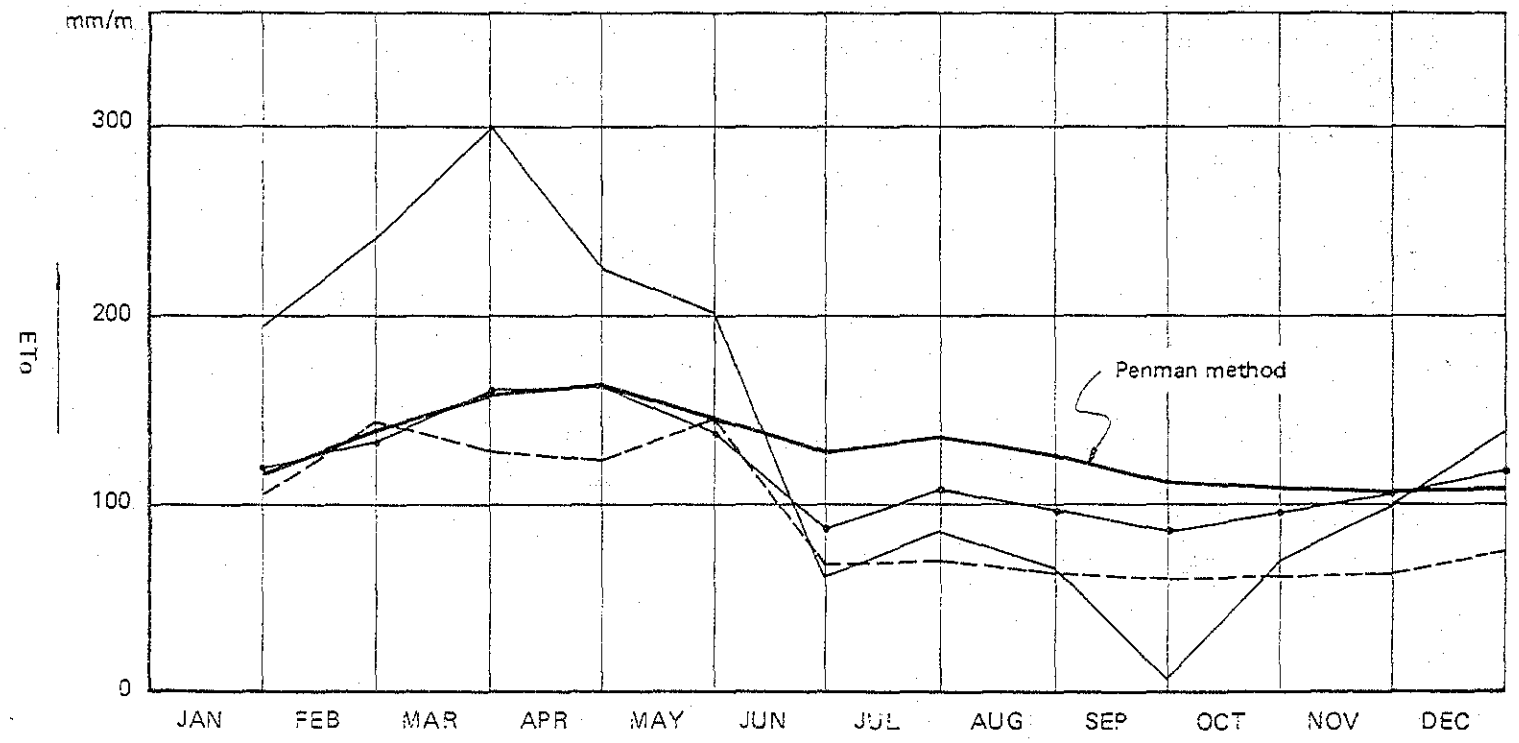
Table A.4.2.1-2 Evapotranspiration (ET crop) for Crops (2)

(mm/day)

Date			Broccoli		Kidney Bean (I)		Kidney Been (II)		Kedney Bean (III)		Tabaco		Onion	
Mon.	10 Day	ETo	Kc	ETcrop	Kc	ETcrop	Kc	ETcrop	Kc	ETcrop	Kc	Etcrop	Kc	ETcrop
	B	5.27			0.83	4.37	0.41	2.16	1.00	5.27	0.41	2.16		
May	M	4.66			0.89	4.15	0.41	1.91	1.00	4.66	0.41	1.91		
	L	4.56			0.96	4.38	0.45	2.05	0.97	4.42	0.45	2.05		
	B	4.09			1.00	4.09	0.52	2.13	0.90	3.68	0.52	2.13		
Jun	M	4.24			1.00	4.24	0.61	2.59	0.70	2.97	0.61	2.59		
	L	4.37			0.97	4.24	0.70	3.06	0.70	3.06	0.70	3.06		
	B	4.53			0.90	4.08	0.75	3.40			0.75	3.40		
Jul	M	4.66			0.70	3.26	0.80	3.73			0.80	3.73		
	L	4.52			0.70	3.16	0.79	3.57			0.80	3.62		
	B	4.32					0.83	3.59			0.85	3.67		
Aug	M	4.33					0.89	3.85			0.91	3.94		
	L	4.05					0.90	3.65			0.97	3.93		
	B	3.84					1.00	3.84			1.02	3.92	0.45	1.73
Sep	M	3.81					1.00	3.81			1.03	3.92	0.45	1.71
	L	3.70					0.97	3.59			1.00	3.70	0.47	1.74
	B	3.60					0.90	3.24			0.95	3.42	0.53	1.91
Oct	M	3.68					0.70	2.58			0.80	2.94	0.59	2.17
	L	3.71					0.70	2.60			0.80	2.97	0.65	2.41
	B	3.66	0.46	1.68									0.70	2.56
Nov	M	3.64	0.53	1.93									0.73	2.66
	L	3.53	0.64	2.26									0.74	2.61
	B	3.49	0.73	2.55									0.78	2.72
Dec	M	3.46	0.78	2.70									0.82	2.84
	L	3.68	0.81	2.98									0.88	3.24
	B	3.73	0.81	3.02					0.44	1.64			0.91	3.39
Jan	M	3.77	0.81	3.05					0.44	1.66			0.93	3.51
	L	4.08	0.81	3.30					0.47	1.92			0.92	3.75
	B	4.44	0.87	3.86	0.41	1.82			0.55	2.44			0.90	4.00
Feb	M	4.61	0.94	4.33	0.41	1.89			0.64	2.95			0.85	3.92
	L	4.88	0.97	4.73	0.45	2.20			0.71	3.46			0.85	4.15
	B	5.02	0.96	4.82	0.52	2.61			0.77	3.87				
Mar	M	5.09	0.92	4.68	0.61	3.10			0.81	4.12				
	L	5.62	0.92	5.17	0.70	3.93			0.80	4.50				
	B	5.55			0.75	4.16			0.84	4.66				
Apr	M	5.51			0.80	4.41			0.90	4.96				
	L	5.25			0.79	4.15			0.96	5.04				

Total

(Units; mm)



Penman	115.8	139.3	157.3	163.1	144.9	127.0	137.1	127.0	113.5	110.0	108.3	106.3
Christiansen*	195.6	242.0	301.7	225.8	203.5	63.4	85.9	68.0	5.7	71.3	98.8	139.0
Evaporimetro*	116.3	132.2	160.6	162.0	137.3	85.5	106.9	95.5	85.5	95.5	101.5	118.7
Blaney-criddle*	105.3	143.5	128.3	123.7	146.2	65.6	69.8	63.2	59.9	62.4	63.4	75.1

* : Operation criteria of Hoyo irrigation project

Fig. A.4.2.1-1 Reference Crop Evapotranspiration (ET crop)

(2) Crop Coefficient

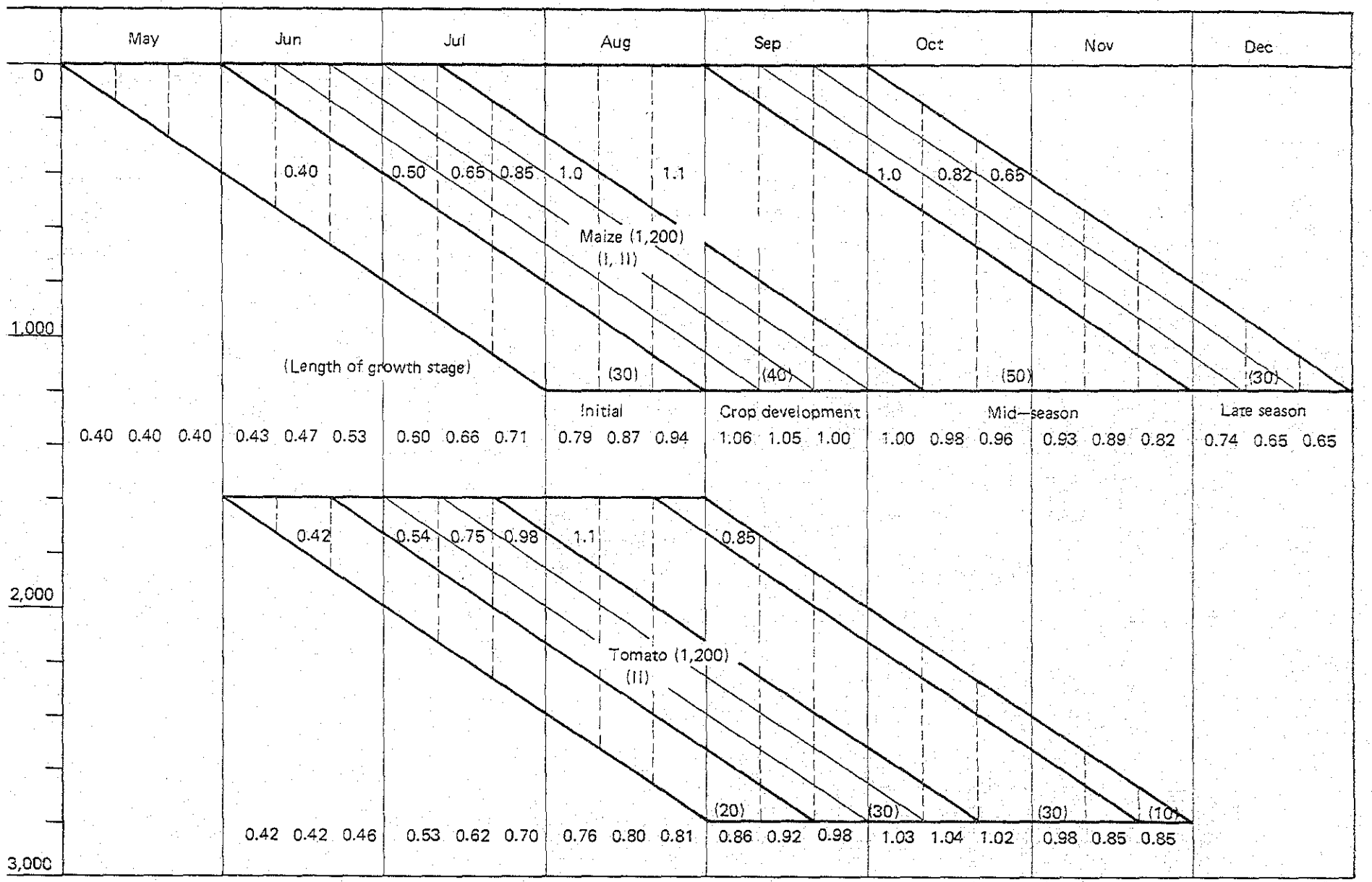
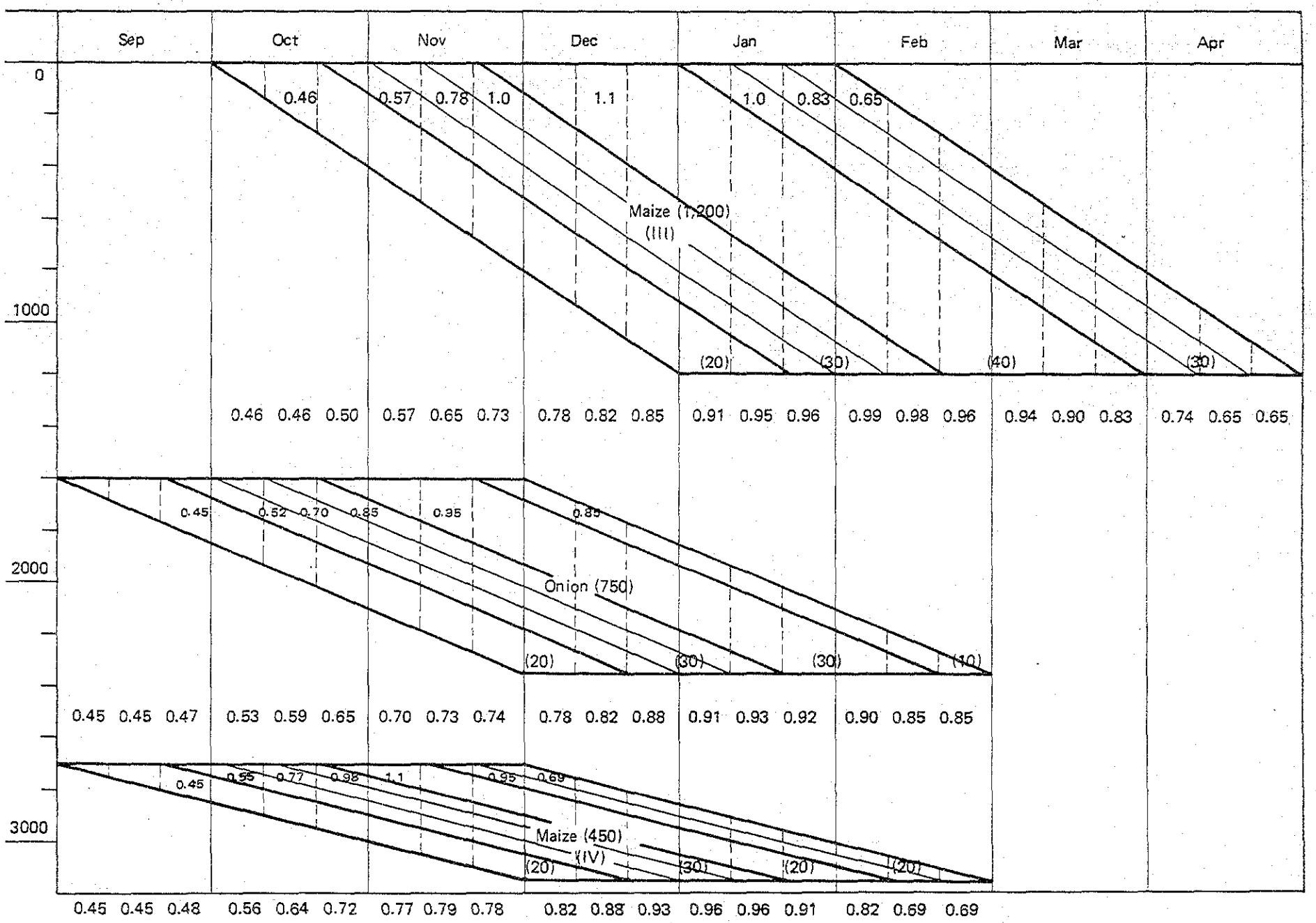
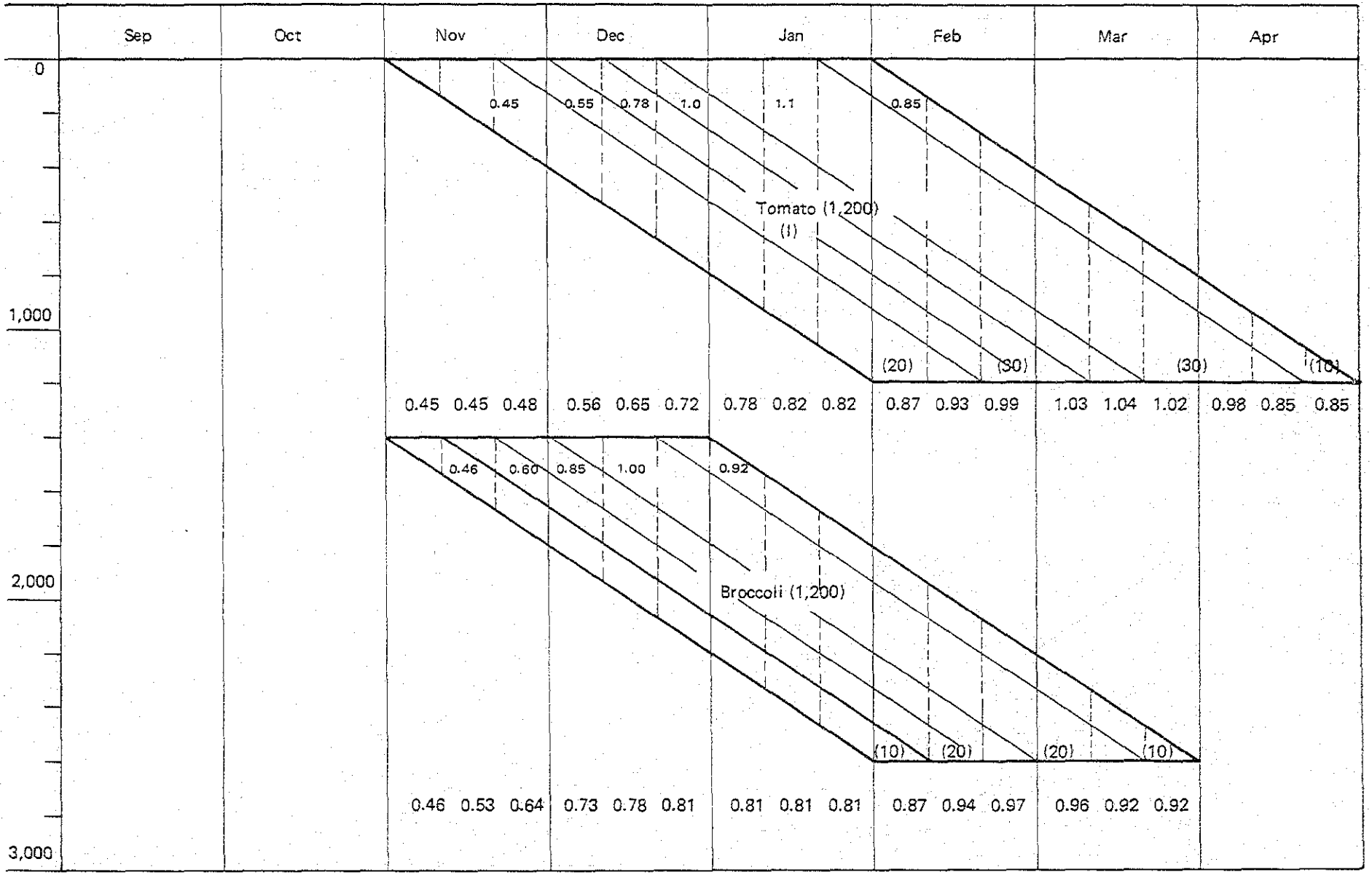
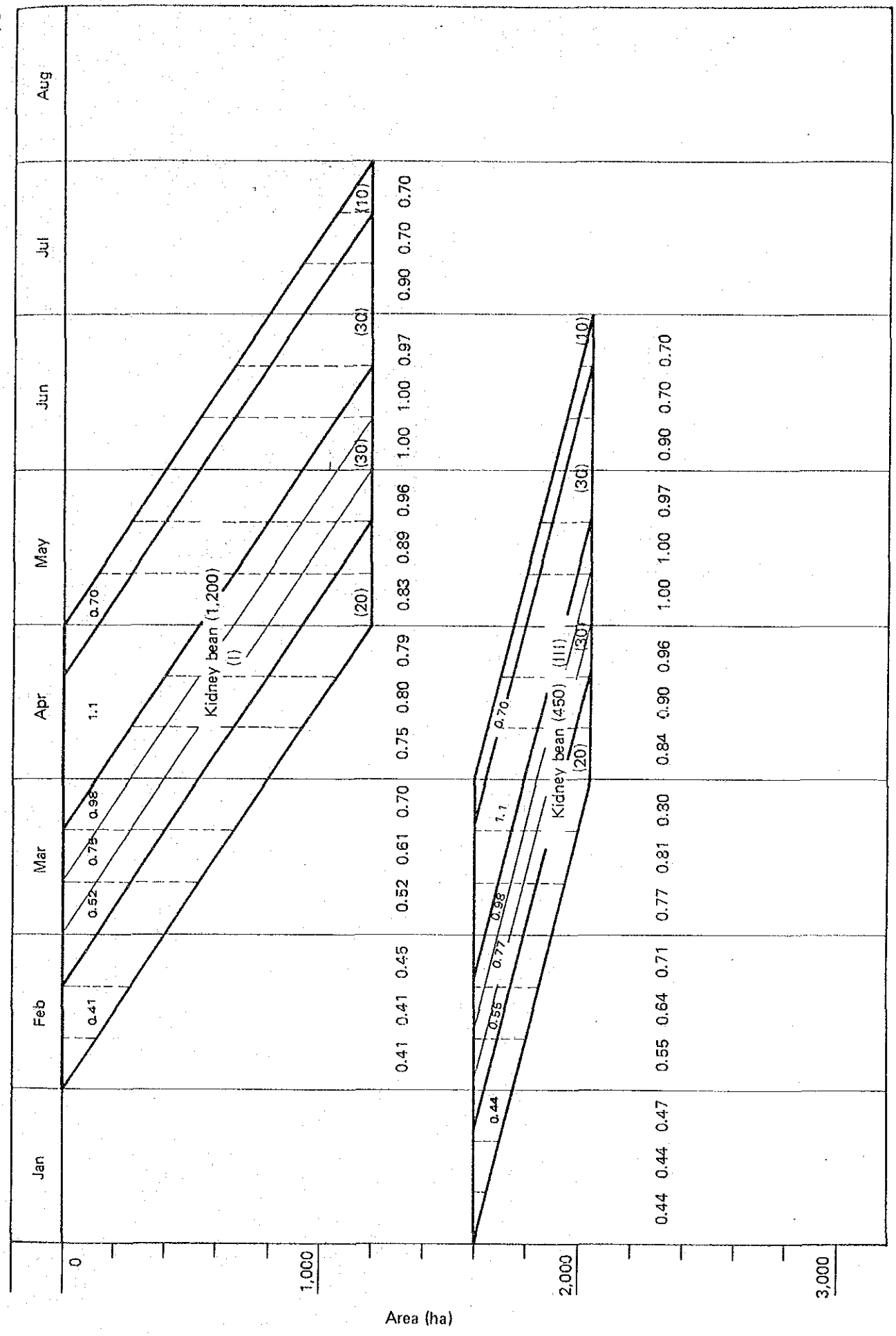
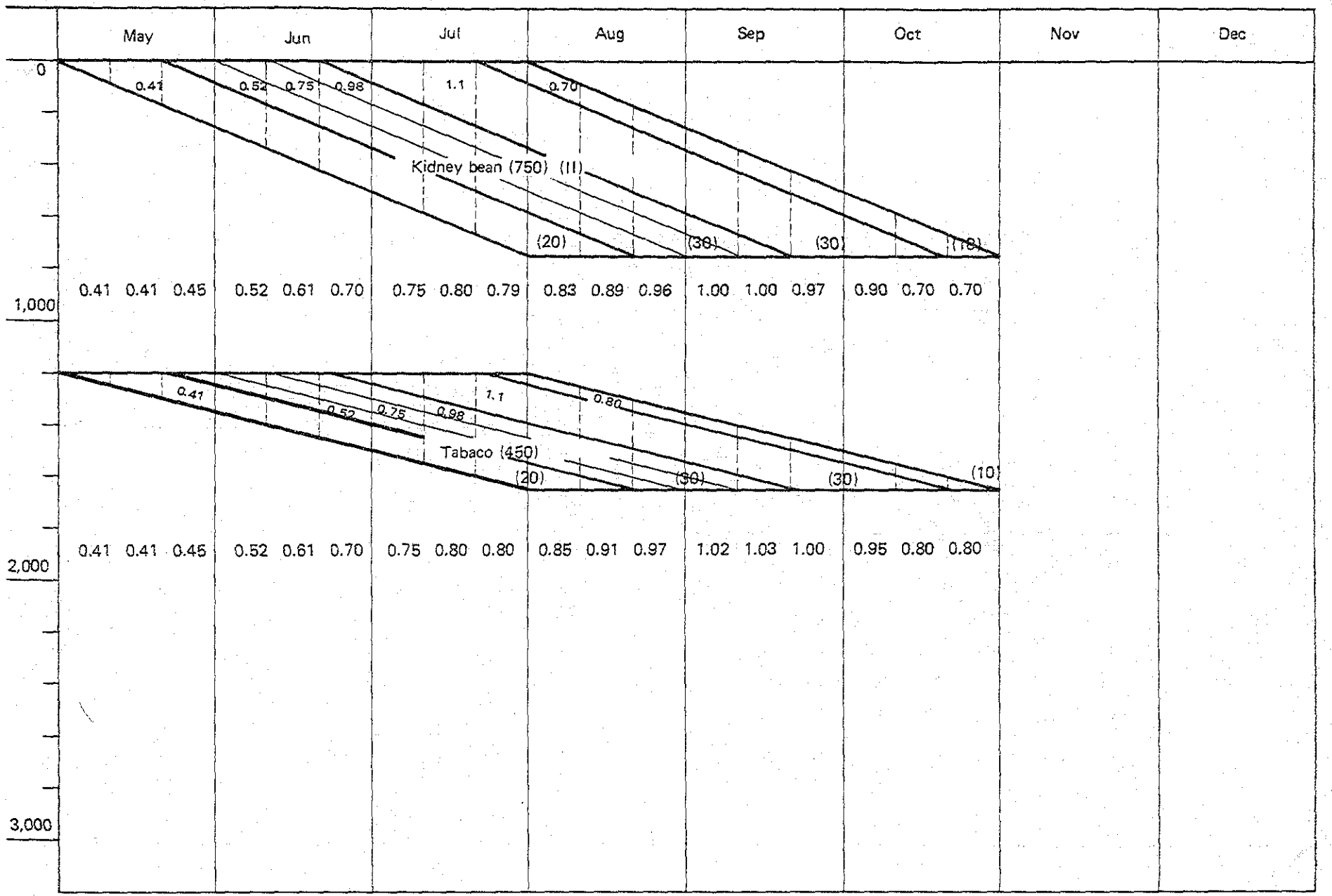


Fig. A.4.2.1-2 Crop Coefficient (Kc)


Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
0
1000
2000
3000
Area (ha)
0.46
0.57
0.78
1.0
1.1
1.0
0.83
0.65
Maize (1,200)
(III)
(20)
(30)
(40)
(30)
0.46 0.46 0.50 0.57 0.65 0.73 0.78 0.82 0.85 0.91 0.95 0.96 0.99 0.98 0.96 0.94 0.90 0.83 0.74 0.65 0.65
0.45
0.52
0.70
0.85
0.95
0.85
Onion (750)
(20)
(30)
(30)
(10)
0.45 0.45 0.47 0.53 0.59 0.65 0.70 0.73 0.74 0.78 0.82 0.88 0.91 0.93 0.92 0.90 0.85 0.85
0.45
0.55
0.77
0.98
1.1
0.95
0.69
Maize (450)
(IV)
(20)
(30)
(20)
(20)
0.45 0.45 0.48 0.56 0.64 0.72 0.77 0.79 0.78 0.82 0.88 0.93 0.96 0.96 0.91 0.82 0.69 0.69


Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
0
1,000
2,000
3,000
Area (ha)
0.45
0.55
0.78
1.0
1.1
0.85
Tomato (1,200)
(1)
(20)
(30)
(30)
(10)
0.45 0.45 0.48 0.56 0.65 0.72 0.78 0.82 0.82 0.87 0.93 0.99 1.03 1.04 1.02 0.98 0.85 0.85
0.46
0.60
0.85
1.00
0.92
Broccoli (1,200)
(10)
(20)
(20)
(10)
0.46 0.53 0.64 0.73 0.78 0.81 0.81 0.81 0.81 0.87 0.94 0.97 0.96 0.92 0.92


Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Kidney bean (1,200)
(I)
Kidney bean (450)
(III)
0.70
1.1
0.98
0.79
0.52
0.41
0.44
0.55
0.77
0.90
1.00
0.97
0.83
0.89
0.96
0.75
0.80
0.79
0.52
0.61
0.70
0.41
0.41
0.45
0.44
0.44
0.47
0.55
0.64
0.71
0.77
0.81
0.80
0.84
0.90
0.96
1.00
1.00
0.97
0.90
0.70
0.70
0.90
0.70
0.70
(10)
(30)
(20)
0
1,000
2,000
3,000
Area (ha)


May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
0
1,000
2,000
3,000
Area (ha)
0.41
0.52
0.75
0.98
1.1
0.70
Kidney bean (750) (11)
(20)
(36)
(30)
(18)
0.41 0.41 0.45 0.52 0.61 0.70 0.75 0.80 0.79 0.83 0.89 0.96 1.00 1.00 0.97 0.90 0.70 0.70
0.41
0.52
0.75
0.98
1.1
0.80
Tabaco (450)
(20)
(30)
(30)
(10)
0.41 0.41 0.45 0.52 0.61 0.70 0.75 0.80 0.80 0.85 0.91 0.97 1.02 1.03 1.00 0.95 0.80 0.80

(3) Irrigation Area by Crops

Table A.4.2.1-3 Irrigation Area by Crops

(A = 4,800 ha)

Date Mon.	10 Day	Maize (I) (1,200 ha)	Maize (II) (1,200 ha)	Maize (III) (1,200 ha)	Maize (IV) (450 ha)	Tomato (I) (1,200 ha)	Tomato (II) (1,200 ha)	Broccoli (1,200 ha)	Kindney Bean (I) (1,200 ha)	Kidney Bean (II) (750 ha)	Kidney Bean (III) (450 ha)	Tabaco (450 ha)	Onion (750 ha)	Total
	B	133	133						1,067	83	250	50		1,983
May	M	267	267						933	167	200	100		2,067
	L	400	400						800	250	150	150		2,150
	B	533	533				133		667	334	100	200		2,500
Jun	M	667	667				267		533	417	50	250		2,851
	L	800	800				400		400	500		300		3,200
	B	933	933				533		267	584		350		3,600
Jul	M	1,067	1,067				667		133	666		400		4,000
	L	1,200	1,200				800			750		450		4,400
	B	1,200	1,200				933			667		400		4,400
Aug	M	1,200	1,200				1,067			583		350		4,400
	L	1,200	1,200				1,200			500		300		4,400
	B	1,200	1,200		50		1,067			417		250	83	4,267
Sep	M	1,200	1,200		100		933			333		200	167	4,133
	L	1,200	1,200		150		800			250		150	250	4,000
	B	1,067	1,067	133	200		667			167		100	333	3,734
Oct	M	933	933	267	250		533			83		50	417	3,466
	L	800	800	400	300		400						500	3,200
	B	667	667	533	350	133	267	133					583	3,466
Nov	M	533	533	667	400	267	133	267					667	3,467
	L	400	400	800	450	400		400					750	3,600
	B	267	267	933	400	533		533					667	3,600
Dec	M	133	133	1,067	350	667		667					583	3,600
	L			1,200	300	800		800					500	3,600
	B			1,200	250	933		800			50		417	3,650
Jan	M			1,200	200	1,067		800			100		333	3,700
	L			1,200	150	1,200		800			150		250	3,750
	B			1,067	100	1,067		666	133		200		167	3,400
Feb	M			933	50	933		534	267		250		83	3,050
	L			800		800		400	400		300			2,700
	B			667		667		267	533		350			2,484
Mar	M			533		533		133	667		400			2,266
	L			400		400			800		450			2,050
	B			267		267			933		400			1,867
Apr	M			133		133			1,067		350			1,683
	L								1,200		300			1,500

(4) Irrigation water Requirememt by Crops

Tabel A.4.2.1-4 Irrigation Water Requirement for Maize (I), (II)

(A = 1,200 ha)

Date Mon.	10 Day	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area A (ha)	Water Requirment (MCM)
	B	21.1	20	1.1	133	0.003
May	M	18.6	20	0	267	0
	L	18.2	20	0	400	0
	B	17.6	30	0	533	0
Jun	M	19.9	30	0	667	0
	L	23.2	30	0	800	0
	B	27.2	30	0	933	0
Jul	M	30.8	30	0.8	1,067	0.018
	L	32.1	30	2.1	1,200	0.054
	B	34.1	30	4.1	1,200	0.107
Aug	M	37.7	30	7.7	1,200	0.200
	L	38.1	30	8.1	1,200	0.211
	B	40.7	30	10.7	1,200	0.278
Sep	M	40.0	30	10.0	1,200	0.260
	L	37.0	30	7.0	1,200	0.182
	B	36.0	20	16.0	1,067	0.370
Oct	M	36.1	20	16.1	933	0.325
	L	35.6	15	20.6	800	0.357
	B	34.0		34.0	667	0.491
Nov	M	32.4		32.4	533	0.374
	L	28.9		28.9	400	0.250
	B	25.8		25.8	267	0.149
Dec	M	22.5		22.5	133	0.065
	L	23.9		23.9		
	B					
Jan	M					
	L					
	B					
Feb	M					
	L					
	B					
Mar	M					
	L					
	B					
Apr	M					
	L					
Total						

$$W.R = \frac{A \times \text{Net ETcrop}}{1 - LR} \times \frac{10}{EP}$$

Ep = Irrigation Efficiency = 0.476 (Furrow 80%, sprinkler 20%)
LR = Leaching requirement (0.03)

Tabel A.4.2.1-5 Irrigation Water Requirement for Maize (III)

(A = 1,200 ha)

Date Mon.	10 Day	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area A (ha)	Water Requirment (MCM)
	B		20			
May	M		20			
	L		20			
	B		30			
Jun	M		30			
	L		30			
	B		30			
Jul	M		30			
	L		30			
	B		30			
Aug	M		30			
	L		30			
	B		30			
Sep	M		30			
	L		30			
	B	16.6	20	0	133	0
Oct	M	16.9	20	0	267	0
	L	18.6	15	3.6	400	0.031
	B	20.9		20.9	533	0.241
Nov	M	23.7		23.7	667	0.342
	L	25.8		25.8	800	0.447
	B	27.2		27.2	933	0.550
Dec	M	28.4		28.4	1,067	0.656
	L	31.3		31.3	1,200	0.813
	B	33.9		33.9	1,200	0.881
Jan	M	35.8		35.8	1,200	0.930
	L	39.2		39.2	1,200	1.019
	B	44.0		44.0	1,067	1.017
Feb	M	45.2		45.2	933	0.913
	L	46.8		46.8	800	0.811
	B	47.2		47.2	667	0.682
Mar	M	45.8		45.8	553	0.529
	L	46.6		46.6	400	0.404
	B	41.1		41.1	267	0.238
Apr	M	35.8		35.8	133	0.103
	L	34.1		34.1		

Total

$$W.R = \frac{A \times \text{Net ETcrop}}{1 - LR} \times \frac{10}{EP}$$

Ep = 0.476
LR = 0.03

Tabel A.4.2.1-6 Irrigation Water Requirement for Maize (IV)

(A = 450 ha)

Date Mon.	10 Day	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area A (ha)	Water Requirment (MCM)
	B		20			
May	M		20			
	L		20			
	B		30			
Jun	M		30			
	L		30			
	B		30			
Jul	M		30			
	L		30			
	B		30			
Aug	M		30			
	L		30			
	B	17.3	30	0	50	0
Sep	M	17.1	30	0	100	0
	L	17.8	30	0	150	0
	B	20.2	20	0.2	200	0.001
Oct	M	23.6	20	3.6	250	0.019
	L	26.7	15	11.7	300	0.076
	B	28.2		28.2	350	0.214
Nov	M	28.8		28.8	400	0.250
	L	27.5		27.5	450	0.268
	B	28.6		28.6	400	0.248
Dec	M	30.4		30.4	350	0.230
	L	34.2		34.2	300	0.222
	B	35.8		35.8	250	0.194
Jan	M	36.2		36.2	200	0.157
	L	37.1		37.1	150	0.121
	B	36.4		36.4	100	0.079
Feb	M	31.8		31.8	50	0.034
	L	33.7		33.7		
	B					
Mar	M					
	L					
	B					
Apr	M					
	L					
Total						

Tabel A.4.2.1-7 Irrigation Water Requirement for Tomato (I)

(A = 1,200 ha)

Date Mon.	10 Day	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area A (ha)	Water Requirment (MCM)
	B		20			
May	M		20			
	L		20			
	B		30			
Jun	M		30			
	L		30			
	B		30			
Jul	M		30			
	L		30			
	B		30			
Aug	M		30			
	L		30			
	B		30			
Sep	M		30			
	L		30			
	B		20			
Oct	M		20			
	L		15			
	B	16.5		16.5	133	0.047
Nov	M	16.4		16.4	267	0.094
	L	16.9		16.9	400	0.145
	B	19.5		19.5	533	0.223
Dec	M	22.5		22.5	667	0.322
	L	26.5		26.5	800	0.454
	B	29.1		29.1	933	0.582
Jan	M	30.9		30.9	1,067	0.707
	L	33.5		33.5	1,200	0.862
	B	38.6		38.6	1,067	0.883
Feb	M	42.9		42.9	933	0.858
	L	48.3		48.3	800	0.828
	B	51.7		51.7	667	0.739
Mar	M	52.9		52.9	533	0.604
	L	57.3		57.3	400	0.491
	B	54.4		54.4	267	0.311
Apr	M	46.8		46.8	133	0.133
	L	44.6		44.6		

Total

Ep = 0.765
LR = 0.002

Tabel A.4.2.1-8 Irrigation Water Requirement for Tomato (II)

(A = 1,200 ha)

Date Mon.	10 Day	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area A (ha)	Water Requirment (MCM)
	B		20			
May	M		20			
	L		20			
	B	17.2	30		133	
Jun	M	17.8	30		267	
	L	20.1	30		400	
	B	24.0	30		533	
Jul	M	28.9	30		667	
	L	31.6	30	1.6	800	0.027
	B	32.8	30	2.8	933	0.056
Aug	M	34.6	30	4.6	1,067	0.105
	L	32.8	30	2.8	1,200	0.072
	B	33.0	30	3.0	1,067	0.069
Sep	M	35.1	30	5.1	933	0.102
	L	36.3	30	6.3	800	0.108
	B	37.1	20	17.1	667	0.245
Oct	M	38.3	20	18.3	533	0.209
	L	37.8	15	22.8	400	0.196
	B	35.9		35.9	267	0.436
Nov	M	30.9		30.9	133	0.088
	L	30.0		30.0		
	B					
Dec	M					
	L					
	B					
Jan	M					
	L					
	B					
Feb	M					
	L					
	B					
Mar	M					
	L					
	B					
Apr	M					
	L					

Total

Ep = 0.476
LR = 0.02

Tabel A.4.2.1-9 Irrigation Water Requirement for Broccoli

(A = 1,200 ha)

Date Mon.	10 Day	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area A (ha)	Water Requirment (MCM)
	B		20			
May	M		20			
	L		20			
	B		30			
Jun	M		30			
	L		30			
	B		30			
Jul	M		30			
	L		30			
	B		30			
Aug	M		30			
	L		30			
	B		30			
Sep	M		30			
	L		30			
	B		20			
Oct	M		20			
	L		15			
	B	16.8		16.8	133	0.048
Nov	M	19.3		19.3	267	0.110
	L	22.6		22.6	400	0.194
	B	25.5		25.5	533	0.291
Dec	M	27.0		27.0	667	0.386
	L	29.8		29.8	800	0.511
	B	30.2		30.2	800	0.518
Jan	M	30.5		30.5	800	0.523
	L	33.0		33.0	800	0.566
	B	38.6		38.6	666	0.551
Feb	M	43.3		43.3	534	0.496
	L	47.3		47.3	400	0.406
	B	48.2		48.2	267	0.276
Mar	M	46.8		46.8	133	0.133
	L	51.7		51.7		
	B					
Apr	M					
	L					

Total

Ep = 0.476
LR = 0.02

Tabel A.4.2.1-10 Irrigation Water Requirement for Kidney Beans (I)

(A = 1,200 ha)

Date Mon.	10 Day	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area A (ha)	Water Requirment (MCM)
	B	43.7	20	23.7	1,067	0.537
May	M	41.5	20	21.5	933	0.426
	L	43.8	20	23.8	800	0.404
	B	40.9	30	10.9	667	0.154
Jun	M	42.4	30	12.4	533	0.140
	L	42.4	30	12.4	400	0.105
	B	40.8	30	10.8	267	0.061
Jul	M	32.6	30	2.6	133	0.007
	L	31.6	30	1.6		
	B		30			
Aug	M		30			
	L		30			
	B		30			
Sep	M		30			
	L		30			
	B		20			
Oct	M		20			
	L		15			
	B					
Nov	M					
	L					
	B					
Dec	M					
	L					
	B					
Jan	M					
	L					
	B	18.2		18.2	133	0.051
Feb	M	18.9		18.9	267	0.107
	L	22.0		22.0	400	0.187
	B	26.1		26.1	533	0.295
Mar	M	31.0		31.0	667	0.439
	L	39.3		39.3	800	0.667
	B	41.6		41.6	933	0.824
Apr	M	44.1		44.1	1,067	0.999
	L	41.5		41.5	1,200	1.057

Total

Ep = 0.476
LR = 0.01

Tabel A.4.2.1-11 Irrigation Water Requirement for Kidney Beans (II)

(A = 750 ha)

Date Mon.	10 Day	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area A (ha)	Water Requirment (MCM)
	B	21.6	20	1.6	83	0.003
May	M	19.1	20	0	167	0
	L	20.9	20	0.9	250	0.005
	B	21.3	30	0	334	0
Jun	M	25.9	30	0	417	0
	L	30.6	30	0.6	500	0.006
	B	34.0	30	4.0	584	0.050
Jul	M	37.3	30	7.3	666	0.103
	L	35.7	30	5.7	750	0.091
	B	35.9	30	5.9	667	0.084
Aug	M	38.5	30	8.5	583	0.105
	L	36.5	30	6.5	500	0.069
	B	38.4	30	8.4	417	0.074
Sep	M	38.1	30	8.1	333	0.057
	L	35.9	30	5.9	250	0.031
	B	32.4	20	12.4	167	0.044
Oct	M	25.8	20	5.8	83	0.010
	L	26.0	15	11.0		
	B					
Nov	M					
	L					
	B					
Dec	M					
	L					
	B					
Jan	M					
	L					
	B					
Feb	M					
	L					
	B					
Mar	M					
	L					
	B					
Apr	M					
	L					

Total

Ep = 0.476
LR = 0.01

Tabel A.4.2.1-12 Irrigation Water Requirement for Kidney Beans (III)

(A = 450 ha)

Date Mon.	10 Day	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area A (ha)	Water Requirment (MCM)
	B	52.7	20	32.7	250	0.173
May	M	46.6	20	26.6	200	0.113
	L	44.2	20	24.2	150	0.077
	B	36.8	30	6.8	100	0.014
Jun	M	29.7	30	0	50	0
	L	30.6	30	0.6		
	B		30			
Jul	M		30			
	L		30			
	B		30			
Aug	M		30			
	L		30			
	B		30			
Sep	M		30			
	L		30			
	B		20			
Oct	M		20			
	L		15			
	B					
Nov	M					
	L					
	B					
Dec	M					
	L					
	B	16.4		16.6	50	0.017
Jan	M	16.6		16.6	100	0.035
	L	19.2		19.2	150	0.061
	B	24.4		24.4	200	0.104
Feb	M	29.5		29.5	250	0.157
	L	34.6		34.6	300	0.220
	B	38.7		38.7	350	0.287
Mar	M	41.2		41.2	400	0.350
	L	45.0		45.0	450	0.430
	B	46.6		46.6	400	0.396
Apr	M	49.6		49.6	350	0.368
	L	50.4		50.4	300	0.321

Total

EP = 0.476
LR = 0.01

Tabel A.4.2.1-13 Irrigation Water Requirement for Tobacco

(A = 450 ha)

Date Mon.	10 Day	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area A (ha)	Water Requirment (MCM)
	B	21.6	20	1.6	50	0.002
May	M	19.1	20	0	100	0
	L	20.5	20	0.5	150	0.002
	B	21.3	30	0	200	0
Jun	M	25.9	30	0	250	0
	L	30.6	30	0.6	300	0.004
	B	34.0	30	4.0	350	0.030
Jul	M	37.3	30	7.3	400	0.063
	L	36.2	30	6.2	450	0.060
	B	36.7	30	6.7	400	0.055
Aug	M	39.4	30	9.4	350	0.071
	L	39.3	30	9.3	300	0.060
	B	39.2	30	9.2	250	0.049
Sep	M	39.2	30	9.2	200	0.039
	L	37.0	30	7.0	150	0.023
	B	34.2	20	14.2	100	0.030
Oct	M	29.4	20	9.4	50	0.010
	L	29.7	15	14.7		
	B					
Nov	M					
	L					
	B					
Dec	M					
	L					
	B					
Jan	M					
	L					
	B					
Feb	M					
	L					
	B					
Mar	M					
	L					
	B					
Apr	M					
	L					

Total

EP = 0.476
LR = 0.02

Tabel A.4.2.1-14 Irrigation Water Requirement for Onion

(A = 750 ha)

Date Mon.	10 Day	ETcrop (mm/10day)	Pe (mm/10day)	Net ETcrop (mm/10day)	Irrigation Area A (ha)	Water Requirment (MCM)
	B		20			
May	M		20			
	L		20			
	B		30			
Jun	M		30			
	L		30			
	B		30			
Jul	M		30			
	L		30			
	B		30			
Aug	M		30			
	L		30			
	B	17.3	30		83	
Sep	M	17.1	30		167	
	L	17.4	30		250	
	B	19.1	20		333	
Oct	M	21.7	20	1.7	417	0.016
	L	24.1	15	9.1	500	0.100
	B	25.6		25.6	583	0.329
Nov	M	26.6		26.6	667	0.388
	L	26.1		26.1	750	0.428
	B	27.2		27.2	667	0.397
Dec	M	28.4		28.4	583	0.362
	L	32.4		32.4	500	0.355
	B	33.9		33.9	417	0.309
Jan	M	35.1		35.1	333	0.256
	L	37.5		37.5	250	0.205
	B	40.0		40.0	167	0.146
Feb	M	39.2		39.2	83	0.071
	L	41.5		41.5		
	B					
Mar	M					
	L					
	B					
Apr	M					
	L					

Total

EP = 0.476
LR = 0.04

(5) Effective Rainfall

Effective rainfall can be determined by various computation methods. In this report, two methods were employed.

a. Operation criteria on Hoyo Lake Irrigation project
b. Evapotranspiration and precipitation ratio method (adopted from USDA)

The result shows that the average annual rainfall at La Ceibita meteorological station from 1963 to 1987 is 927 mm. The effective rainfall by operation criteria is 542 mm and 504 mm by evapotranspiration/ precipitation method. There is no large difference between the two, and therefore, effective rainfall was calculated by evapotranspiration/ precipitation ratio method. As a result, 475 mm as round figure, are adapted for the Study.

(6) Irrigation Efficiency

Concerning irrigation efficiency, discussions were made between the Survey Team and Staff of Hoyo Irrigation Project office. Followings are selected matter among many discussed.

Irrigation Method	Field Application Eff. (Ea)	Operation Eff.(Eb)	Conveyance Eff. (Ec)	Irrigation (Ep)
Furrow	0.60	0.9	0.85	0.46
Sprinkler	0.70	0.9	0.85	0.54

(7) Calculation of Leaching Requirement

Table A.4.2.1-16 Leaching Requirement

Crops	ECe MMHO/cm	ECw mmho/cm	Le	Lr
Maize	1.7	0.17	0.7	0.03
Broccoli	2.8	0.17	0.7	0.02
Tomato	2.5	0.17	0.7	0.02
Kidney beans	5.0	0.17	0.7	0.01
Onion	1.2	0.17	0.7	0.04
Tabacco	2.5	0.17	0.7	0.02

$$Lr = \frac{ECw}{5ECe - ECw} \times \frac{1}{Le}$$

Where,

Lr ; Leaching requirement
ECe; Salinity tolerance of Crop (mmho/cm)
ECw; Electric conductivity of Irrigation water (Ostua River)
EC = 135 mho/cm at 15 C, ; EC_{25} = 167 (mho/cm)
Le ; Leaching efficiency (70%)

Table A.4.2.1-15 Effective Rainfall

(Unit; mm)

Items	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	Total
1. Monthly Rainfall (1963 - 1987)	106	187	157	148	169	94	13	2	1	1	7	19	927
2. Average ETcrop (mm/month)	90.5	82.4	98.8	109.2	92.3	83.7	76.2	81.8	94.1	109.3	133.9	132.7	1,184.7
3. Effective Rainfall (Hoyo Project Criteria)	74	107	95	102	99	65	-	-	-	-	-	-	542
4. Effective Rainfall 1/	(67)	(100)	(100)	(93)	(100)	(61)	(9)	-	-	-	-	(15)	
(Calculated)	60	93	93	86	93	57	8	-	-	-	-	14	504
5. Effective Rainfall (Adapted)	60	90	90	90	90	90	55	-	-	-	-	-	475

1/ ... Evapotranspiration/precipitation ratio method (adapted from U.S.D.A)
The correction factor is 0.93, (soil water storage 66 + 33/2 = 49.5 ≒ 50 mm)

(7) Calculation of Leaching Requirement

Table A.4.2.1-16 Leaching Requirement

Crops	ECe mmho/cm	ECw mmho/cm	Le	Lr
Maize	1.7	0.17	0.7	0.03
Broccoli	2.8	0.17	0.7	0.02
Tomato	2.5	0.17	0.7	0.02
Kidney beans	5.0	0.17	0.7	0.01
Onion	1.2	0.17	0.7	0.04
Tobacco	2.5	0.17	0.7	0.02

$$Lr = \frac{ECw}{5ECe - ECw} \times \frac{1}{Le}$$

Where,

Lr; Leaching requirement
ECe; Salinity tolerance of Crop (mmho/cm)
ECw; Electric conductivity of Irrigation water (Ostua River)
EC = 135 mho/cm at 15°C, ; EC_{25} = 167 (mho/cm)
Le; Leaching efficiency (70%)

(8) Intake Rate

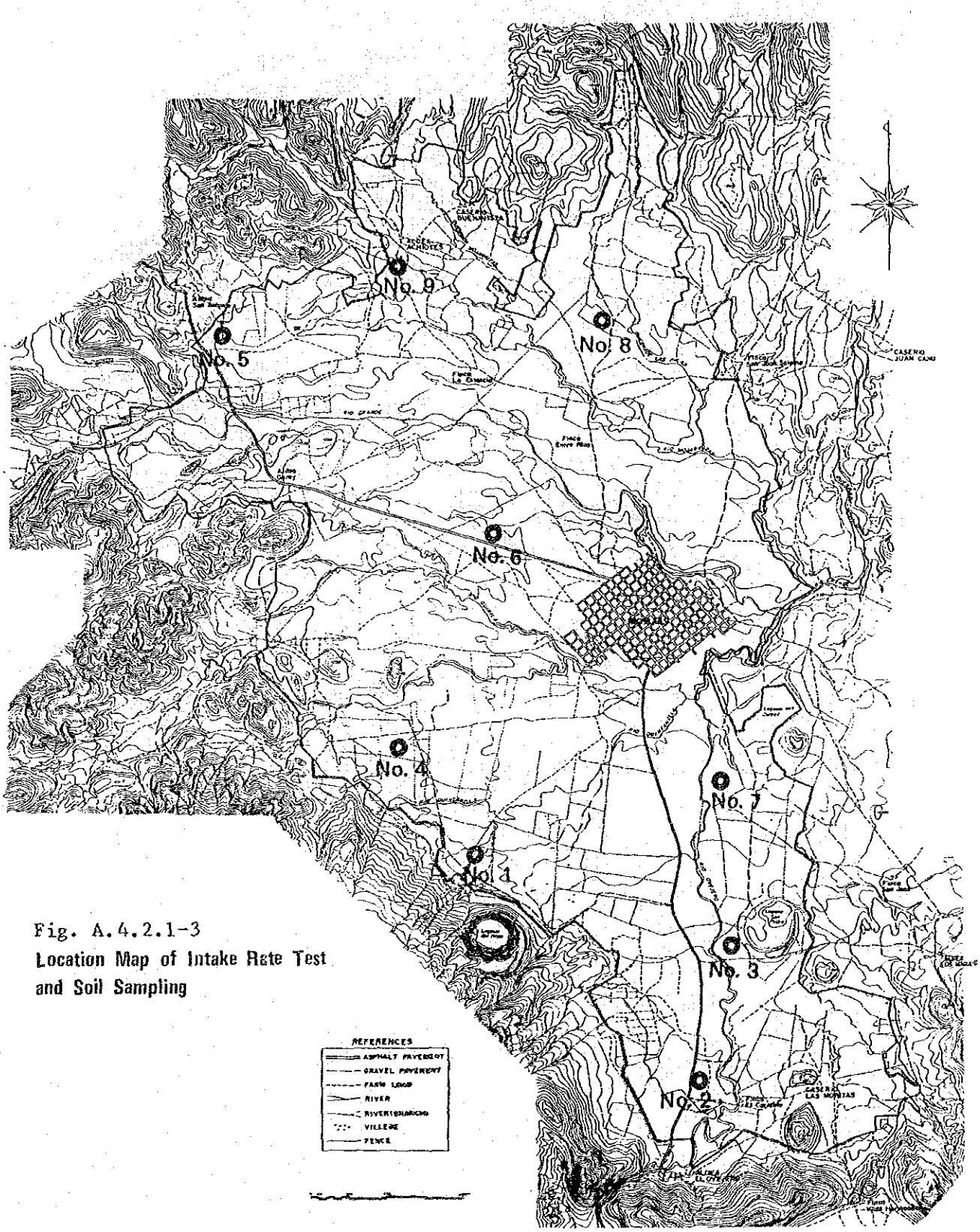


Fig. A.4.2.1-3
Location Map of Intake Rate Test and Soil Sampling

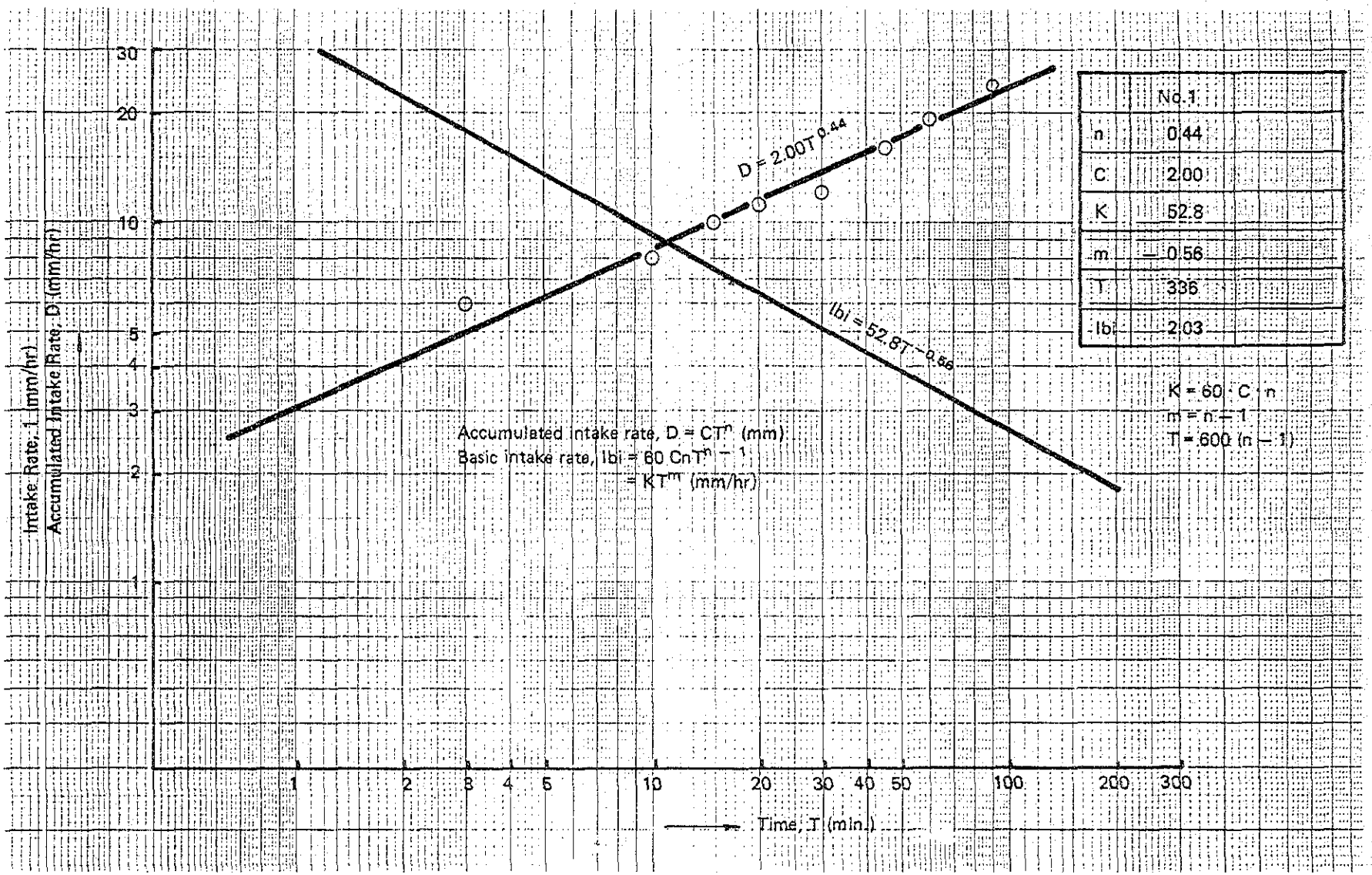
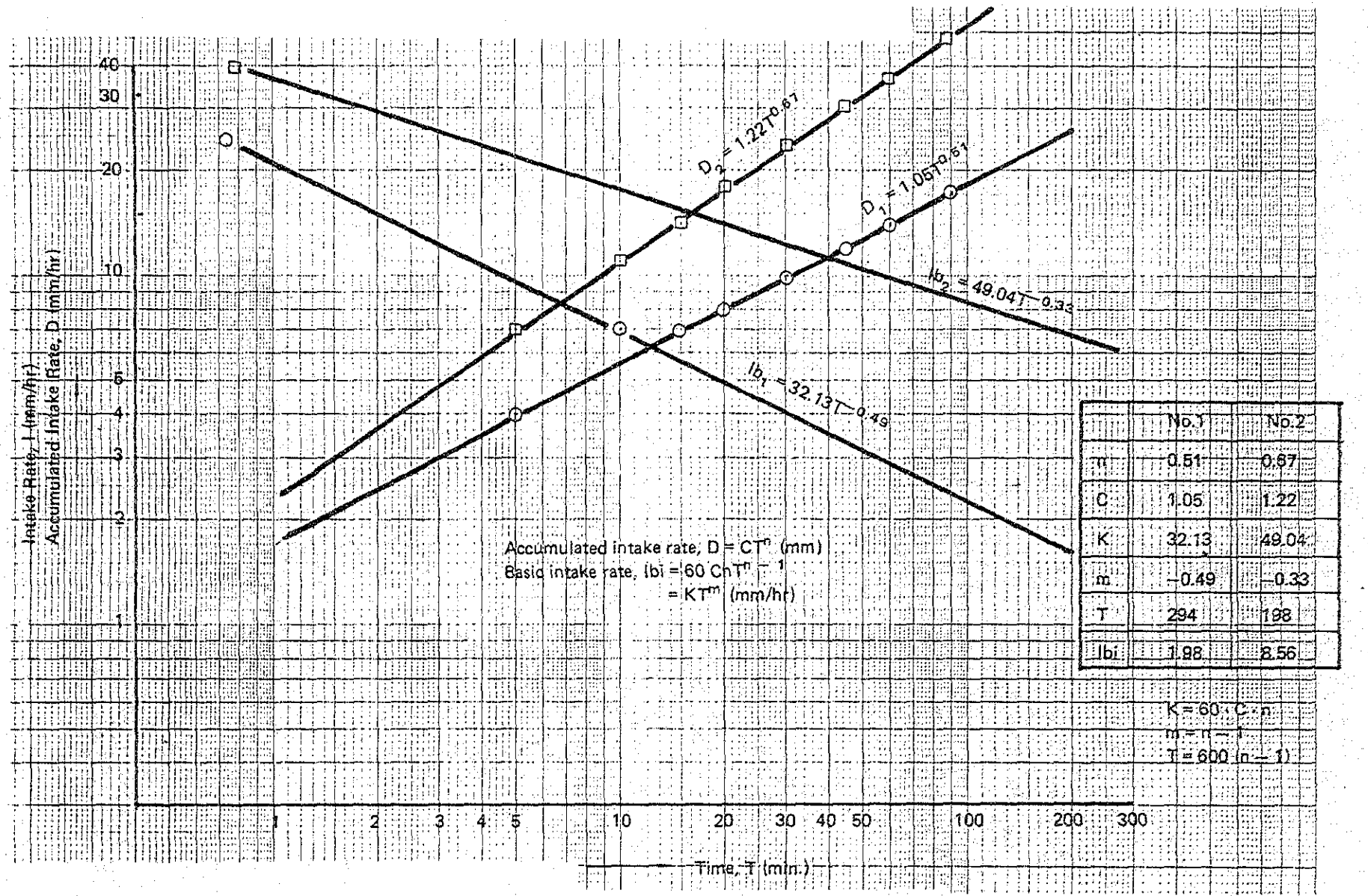


Fig. A.4.2.1-4 Result of Cylinder Intake Rate (1)



	No.1	No.2
n	0.51	0.67
C	1.05	1.22
K	32.13	49.04
m	−0.49	−0.33
T	294	198
Ibi	1.98	8.56

Fig. A.4.2.1-4 Result of Cylinder Intake Rate (2)

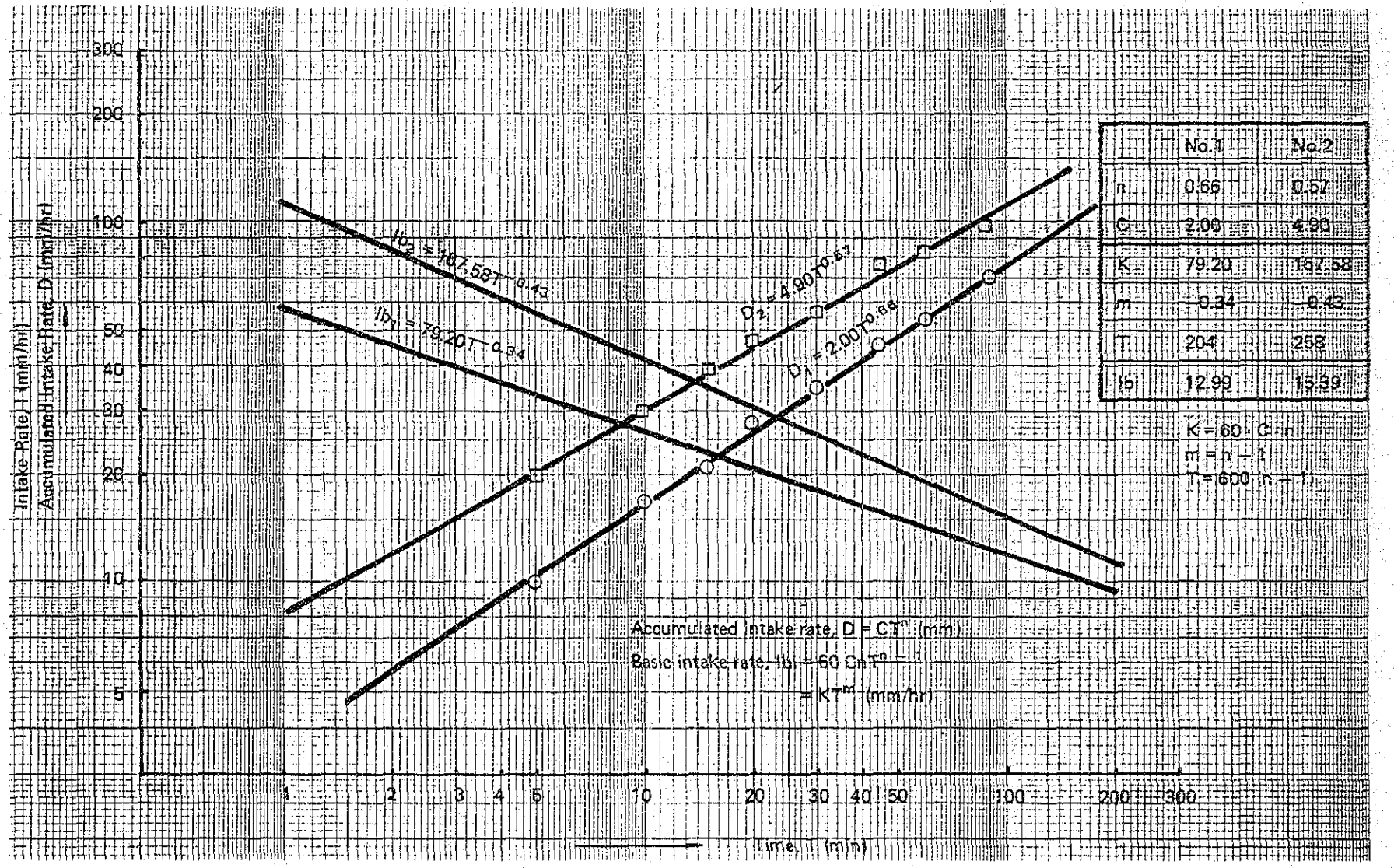


Fig. A.4.2.1-4 Result of Cylinder Intake Rate (3)

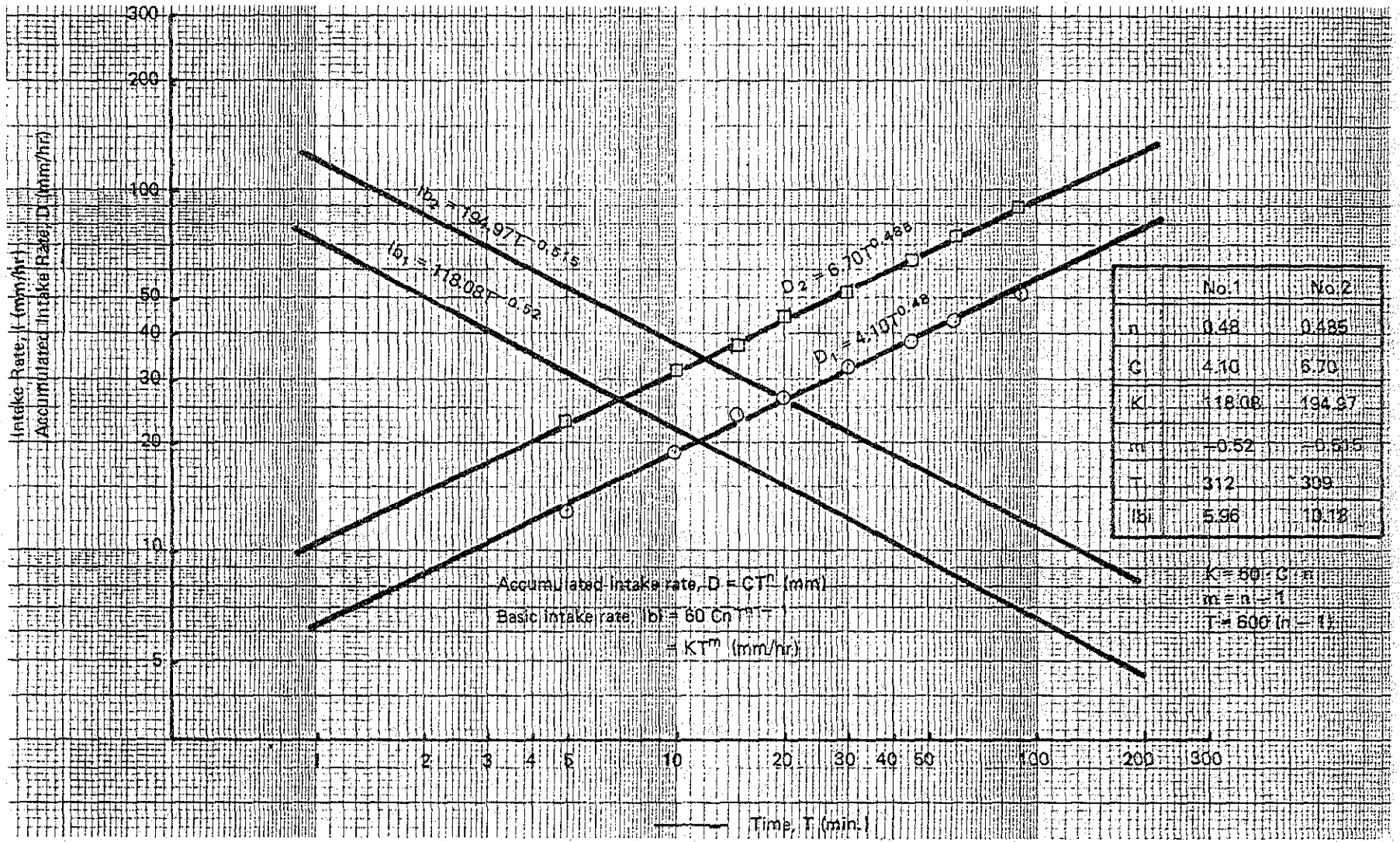


Fig. A.4.2.1-4 Result of Cylinder Intake Rate (4)

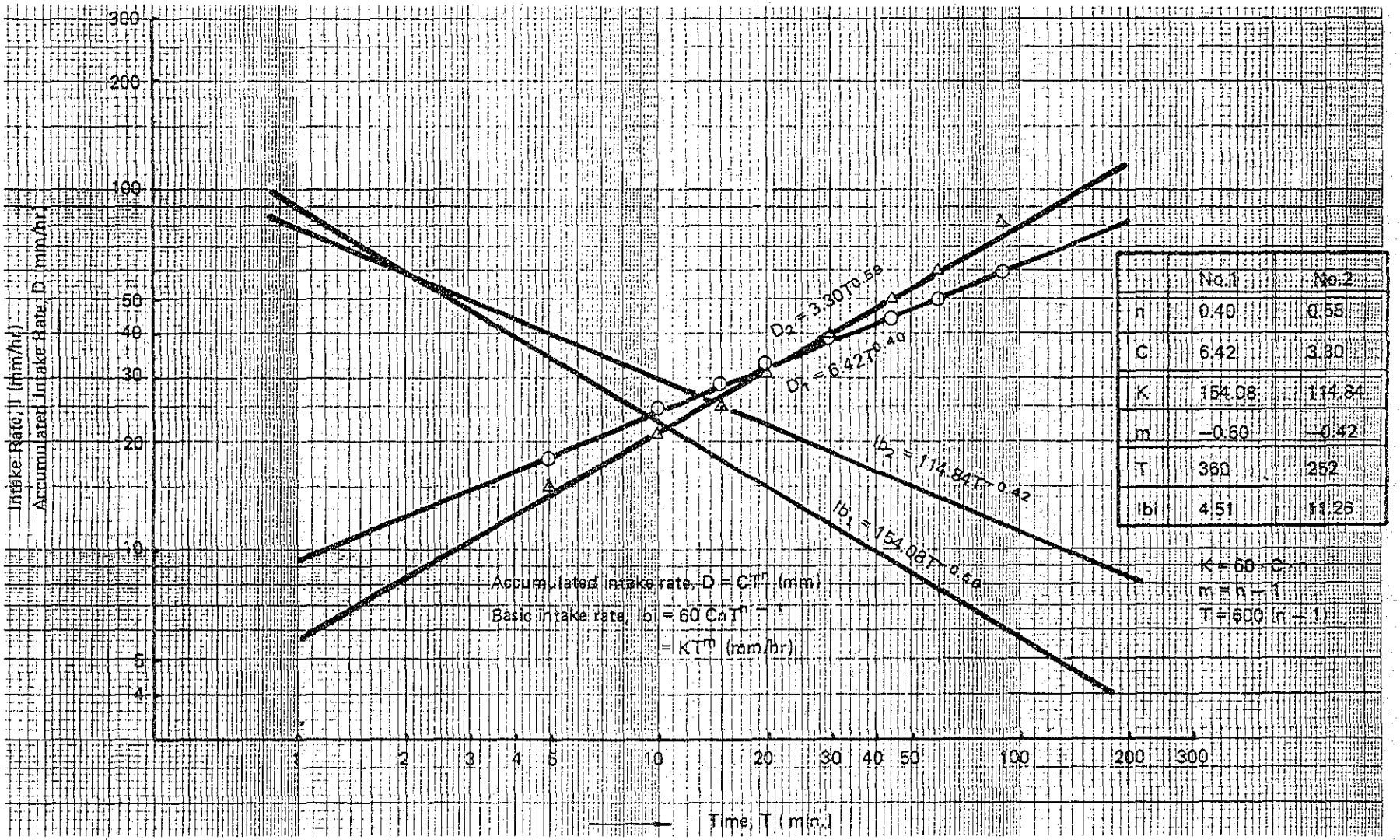


Fig. A.4.2.1-4 Result of Cylinder Intake Rate (5)

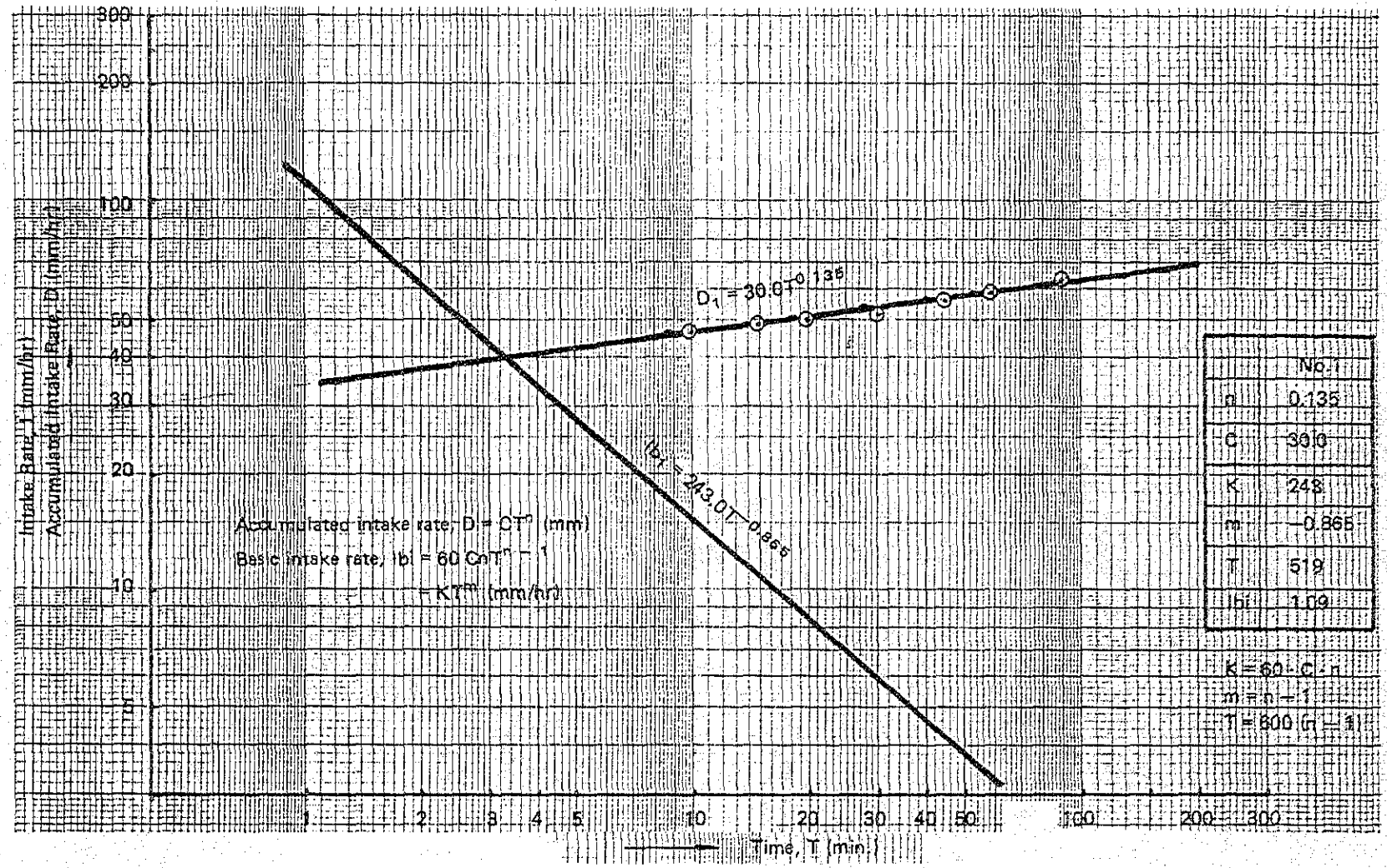


Fig. A.4.2.1-4 Result of Cylinder Intake Rate (6)

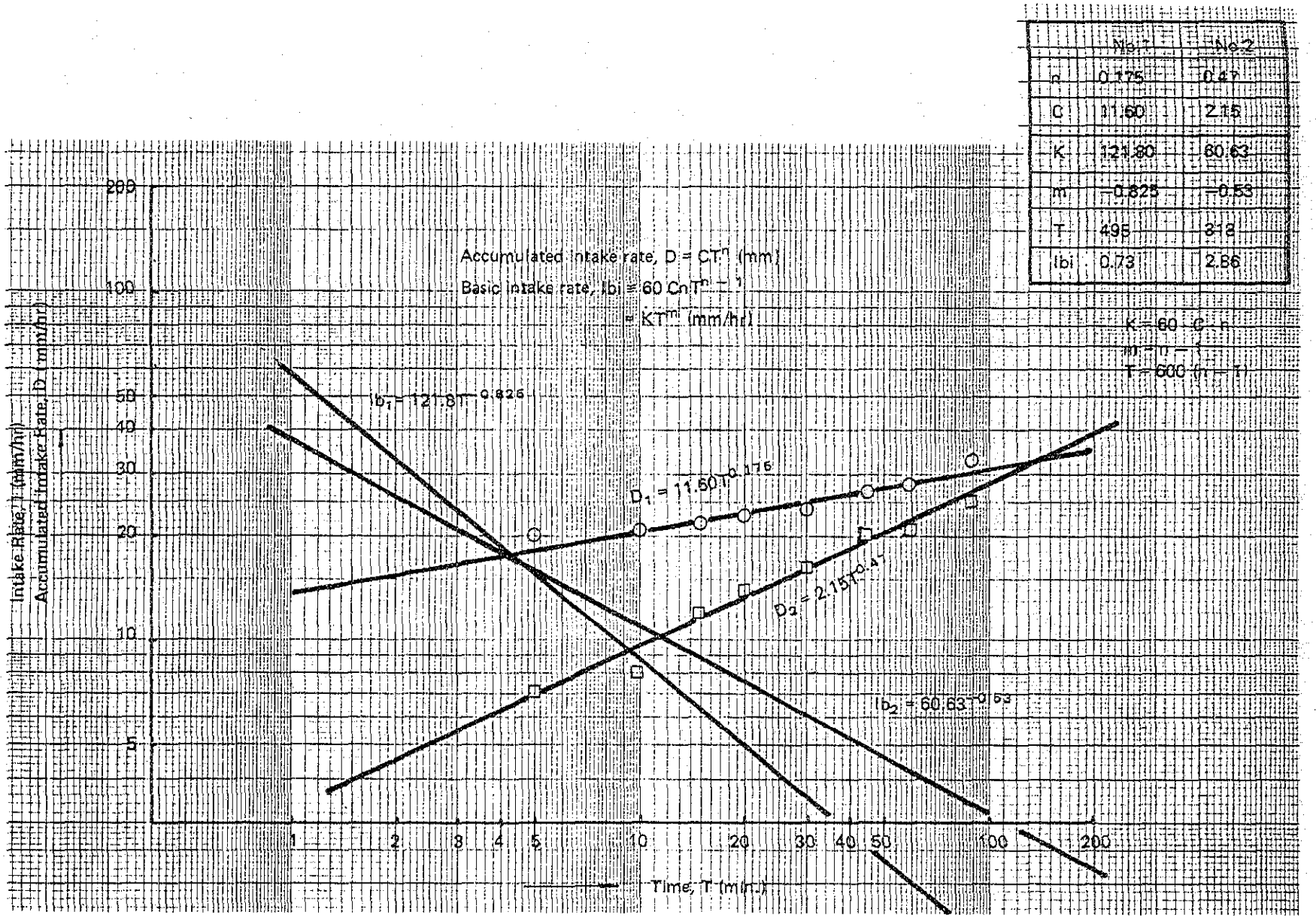


Fig. A.4.2.1-4 Result of Cylinder Intake Rate (7)

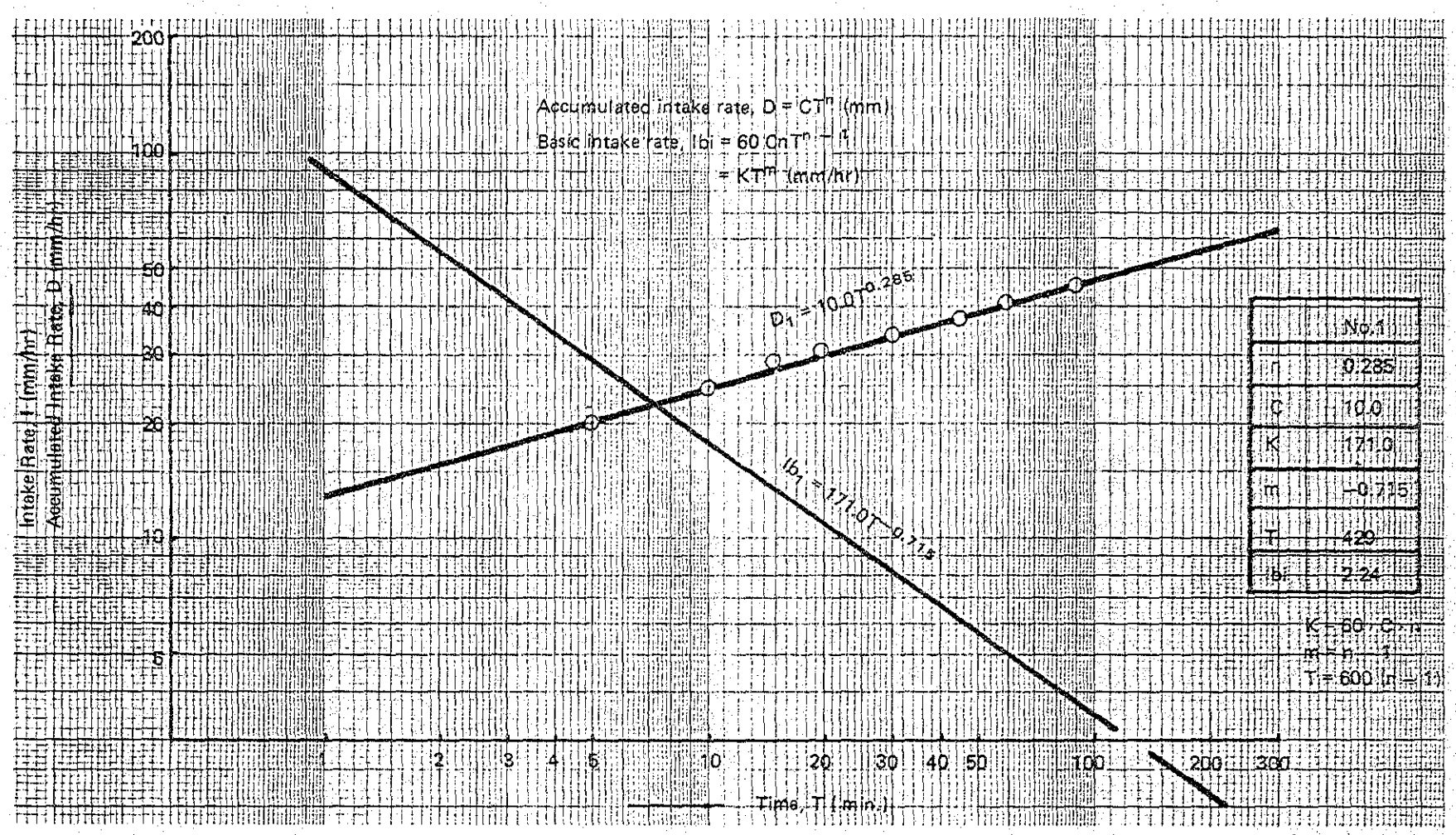


Fig. A.4.2.1-4 Result of Cylinder Intake Rate (8)

Table A.4.2.1-17 Summary of TRAM

Location	TRAM	
	Maize, Tobacco	Tomato, Onion, Broccoli, etc.
	(mm)	(mm)
No. 1	78	39
2	70	35
3	46	23
4	54	27
5	45	23
6	64	32
7	62	31
8	68	34
9	66	33
Average	61	31

Table A.4.2.1-18 Calculation of TRAM

Location No. 1; Hoyo irrigation project area

Maize, Tabaco

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 20	44.83	29.15	15.68	31.36	40	78	78
20 - 40	59.23	37.92	21.31	42.62	30	142	
40 - 60	59.23	37.92	21.31	42.62	20	213	
60 - 80	59.91	38.17	21.74	43.48	10	435	
80 cm				160.08	100		

Tomato, Broccoli, Onion, Kidney Beans

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 10	44.83	29.15	15.68	15.68	40	39	39
10 - 20	44.83	29.15	15.68	15.68	30	52	
20 - 30	59.23	37.92	21.31	21.31	20	107	
30 - 40	59.23	37.92	21.31	21.31	10	213	
40 cm				73.98	100		

Depth; Root Zone (cm)
F.C ; Field Capacity (1/3 ATM)
W.P ; Welting Point (15 ATM)
A.M ; Available Moisture
Rm ; Ratio of Moisture Extraction
Lr ; Restricting Layer of Moisture Extraction
TRAM ; Total Readly Available Moisture

Calculation of T.R.A.M

Location No. 2; Ovejero

Maize, Tabaco

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 20	28.82	14.83	13.99	27.98	40	70	70
20 - 40	32.68	19.94	12.74	25.48	30	85	
40 - 60	27.58	19.19	8.39	16.78	20	84	
60 - 80	36.30	25.95	10.35	20.70	10	207	
80 cm				90.94	100		

Tomato, Broccoli, Onion, Kidney Beans

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 10	28.82	14.83	13.99	13.99	40	35	35
10 - 20	28.82	14.83	13.99	13.99	30	47	
20 - 30	32.68	19.94	12.74	12.74	20	64	
30 - 40	32.68	19.94	12.74	12.74	10	127	
40 cm				53.46	100		

Depth; Root Zone (cm)
F.C ; Field Capacity (1/3 ATM)
W.P ; Welting Point (15 ATM)
A.M ; Available Moisture
Rm ; Ratio of Moisture Extraction
Lr ; Restricting Layer of Moisture Extraction
TRAM ; Total Readly Available Moisture

Calculation of T.R.A.M

Location No. 3; San pedro

Maize, Tabaco

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 20	30.14	20.95	9.19	18.38	40	46	46
20 - 40	39.00	25.46	13.54	27.08	30	90	
40 - 60	39.00	25.46	13.54	27.08	20	135	
60 - 80	40.85	24.06	16.79	33.58	10	336	
80 cm				106.12	100		

Tomato, Broccoli, Onion, Kidney Beans

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 10	30.14	20.95	9.19	9.19	40	23	23
10 - 20	30.14	20.95	9.19	9.19	30	31	
20 - 30	39.00	25.46	13.54	13.54	20	68	
30 - 40	39.00	25.46	13.54	13.54	10	135	
40 cm				45.46	100		

Depth; Root Zone (cm)
F.C ; Field Capacity (1/3 ATM)
W.P ; Welting Point (15 ATM)
A.M ; Available Moisture
Rm ; Ratio of Moisture Extraction
Lr ; Restricting Layer of Moisture Extraction
TRAM ; Total Readly Available Moisture

Calculation of T.R.A.M

Location No. 4; Guirila

Maize, Tabaco

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 20	24.25	13.38	10.87	21.74	40	54	54
20 - 40	28.63	18.90	9.73	19.46	30	65	
40 - 60	28.63	18.90	9.73	19.46	20	97	
60 - 80	30.55	18.74	11.81	23.62	10	236	
80 cm				84.28	100		

Tomato, Broccoli, Onion, Kidney Beans

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 10	24.25	13.38	10.84	10.87	40	27	27
10 - 20	24.25	13.38	10.87	10.87	30	36	
20 - 30	28.63	18.90	9.73	9.73	20	49	
30 - 40	28.63	18.90	9.73	9.73	10	97	
40 cm				41.20	100		

Depth; Root Zone (cm)
F.C ; Field Capacity (1/3 ATM)
W.P ; Welting Point (15 ATM)
A.M ; Available Moisture
Rm ; Ratio of Moisture Extraction
Lr ; Restricting Layer of Moisture Extraction
TRAM ; Total Readly Available Moisture

Calculation of T.R.A.M

Location No. 5; San Antonio

Maize, Tabaco

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 20	22.00	12.97	9.03	18.06	40	45	45
20 - 40	26.05	16.58	9.47	18.94	30	63	
40 - 60	24.81	15.79	9.02	18.04	20	90	
60 - 80	30.48	18.71	11.77	23.54	10	235	
80 cm				78.58	100		

Tomato, Broccoli, Onion, Kidney Beans

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 10	22.00	12.97	9.03	9.03	40	23	23
10 - 20	22.00	12.97	9.03	9.03	30	30	
20 - 30	26.05	16.58	9.47	9.47	20	47	
30 - 40	24.81	15.79	9.02	9.02	10	90	
40 cm				36.55	100		

Depth; Root Zone (cm)
F.C ; Field Capacity (1/3 ATM)
W.P ; Welting Point (15 ATM)
A.M ; Available Moisture
Rm ; Ratio of Moisture Extraction
Lr ; Restricting Layer of Moisture Extraction
TRAM ; Total Readly Available Moisture

Calculation of T.R.A.M

Location No. 6; Monjas (I)

Maize, Tabaco

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 20	30.04	17.31	12.73	25.46	40	64	64
20 - 40	45.38	26.36	19.02	38.04	30	127	
40 - 60	45.38	26.36	19.02	38.04	20	190	
60 - 80	45.24	26.29	18.95	37.90	10	379	
80 cm				139.44	100		

Tomato, Broccoli, Onion, Kidney Beans

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 10	33.04	17.31	12.73	12.73	40	32	32
10 - 20	30.04	17.31	12.73	12.73	30	42	
20 - 30	45.38	26.36	19.02	19.02	20	95	
30 - 40	45.38	26.36	19.02	19.02	10	190	
40 cm				64.0	100		

Depth; Root Zone (cm)
F.C ; Field Capacity (1/3 ATM)
W.P ; Welting Point (15 ATM)
A.M ; Available Moisture
Rm ; Ratio of Moisture Extraction
Lr ; Restricting Layer of Moisture Extraction
TRAM ; Total Readly Available Moisture

Calculation of T.R.A.M

Location No. 7; Monjas (II)

Maize, Tabaco

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 20	29.04	16.63	12.41	24.82	40	62	62
20 - 40	31.96	20.26	11.70	23.40	30	78	
40 - 60	39.95	26.13	13.82	27.64	20	138	
60 - 80	46.63	33.47	13.16	26.32	10	263	
80 cm				102.18	100		

Tomato, Broccoli, Onion, Kidney Beans

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 10	29.04	16.63	12.41	12.41	40	31	31
10 - 20	29.04	16.63	12.41	12.41	30	41	
20 - 30	31.96	20.26	11.70	11.70	20	58	
30 - 40	31.96	20.26	11.70	11.70	10	117	
40 cm				48.22	100		

Depth; Root Zone (cm)
F.C ; Field Capacity (1/3 ATM)
W.P ; Welting Point (15 ATM)
A.M ; Available Moisture
Rm ; Ratio of Moisture Extraction
Lr ; Restricting Layer of Moisture Extraction
TRAM ; Total Readly Available Moisture

Calculation of T.R.A.M

Location No. 8; Salamo

Maize, Tabaco

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 20	33.27	19.57	13.70	27.40	40	68	68
20 - 40	49.46	30.82	18.64	37.28	30	124	
40 - 60	57.48	34.51	22.97	45.94	20	230	
60 - 80	52.45	32.43	20.02	40.04	10	400	
80 cm							

Tomato, Broccoli, Onion, Kidney Beans

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 10	33.27	19.57	13.70	13.70	40	34	34
10 - 20	33.27	19.57	13.70	13.70	30	46	
20 - 30	49.46	30.82	18.64	18.64	20	93	
30 - 40	49.46	30.82	18.64	18.64	10	186	
40 cm							

Depth; Root Zone (cm)
F.C ; Field Capacity (1/3 ATM)
W.P ; Welting Point (15 ATM)
A.M ; Available Moisture
Rm ; Ratio of Moisture Extraction
Lr ; Restricting Layer of Moisture Extraction
TRAM ; Total Readly Available Moisture

Calculation of T.R.A.M

Location No. 9; Achiotes

Maize, Tabaco

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 20	27.73	14.47	13.26	26.52	40	66	66
20 - 40	54.45	35.15	19.30	38.60	30	129	
40 - 60	62.34	40.76	21.58	43.16	20	216	
60 - 80	62.41	44.31	18.10	36.20	10	362	
80 cm				144.48	100		

Tomato, Broccoli, Onion, Kidney Beans

Depth (cm)	F.C (%)	W.P (%)	A.M %	A.M mm	Rm %	Lr (h) mm	TRAM (mm)
0 - 10	27.73	14.47	13.26	13.26	40	33	33
10 - 20	54.45	35.15	19.30	19.30	30	64	
20 - 30	54.45	35.15	19.30	19.30	20	97	
30 - 40	62.34	40.76	21.58	21.58	10	216	
40 cm				73.44	100		

Depth; Root Zone (cm)
F.C ; Field Capacity (1/3 ATM)
W.P ; Welting Point (15 ATM)
A.M ; Available Moisture
Rm ; Ratio of Moisture Extraction
Lr ; Restricting Layer of Moisture Extraction
TRAM ; Total Readly Available Moisture

(9) Unit Water Requirement for Designed Canal

1) Diversion Canal

The South and the North Diversion Canals command the total benefited area of 4,800 ha extending in the Monjas basin, the capacity of the both diversion canals should be, therefore, decided in taking into account the cropping pattern, seasonal consumption of water by crops, and irrigation efficiency such as application and conveyance losses. And, consequently, the capacity of the main canal (Qm) is estimated with maximum values of equation mentioned below, including leaching requirement ;

$$Qm = \frac{Aj \times Net\ ETcrop}{1 - Lr} \times \frac{10}{Ep}$$

where,
Aj ; Seasonal irrigation area by crops (ha)
Net ETcrop ; Seasonal net irrigation requirement (mm/day)
Lr ; Leaching requirement (%)
Ep ; Irrigation Efficiency

As a result of calculation, the peak water requirement occurs at final 10 days of January in the dry season, and consequently, the diversion canal capacity is decided by qm = 0.87 liter/s/ha on the unit water requirement which is calculated by peak water requirement (3.28 m^3/s) and cropping area (3,750 ha) in late January (refer to Table 4.3.2-7). In principal, irrigation hours in peak irrigation season of January and February is 24 hours per day.

2) Main Canal

The main canal capacity also should be decided in consideration of concentration of cultivation with the same crop varieties, in addition to the above mentioned factors, and consequently, the maximum unit water requirement qmax = 1.12 liter/sec/ha is adapted (refer to Table 4.3.2-7). The main canal distribute the water requested to the lateral canals which has a service area of about 150 ha.

3) Lateral Canal

The service areas of the lateral canals are 60 to 150 ha (4 to 10 irrigation blocks), and the capacity of lateral canal is calculated by the following equation in taking into account the cultivatin by the same crop at the same season.

$$q1 = \frac{D \times A}{8.64 \times Ea} \times \frac{24}{T}$$

$$= \frac{5.73 \times 1}{8.64 \times 0.62} \times \frac{24}{18} = 1.43 \text{ liter/s/ha}$$

where,

q_1 = Unit water requirement for lateral canal (liter/sec/ha)

D = Maximum water requirement (5.73 mm/day for tomato in the dry season)

A = Unit irrigation area (1.0 ha)

Ea = Application Efficiency (Ea = 0.62)

	Efficiency	Area Ratio
Gravity Irr.	60%	80%
Sprinkler Irr.	70%	20%
Weighted Mean		62%

T; Irrigation hour per day (T = 18 hr)

4) Tertiary Canal

Capacity of supplemental canals in the irrigation rotation block are designed by 8.21 liter/sec/ha as unit water requirement. Equation is shown below;

$$qs = \frac{Do \times Ao}{8.62 \times Ea} \times \frac{24}{T} = \frac{33 \times Ao}{8.64 \times 0.62} \times \frac{24}{18}$$

$$= 8.21 \text{ Ao liter/s/ha}$$

where,

Do; Irrigation depth per time (33 mm/time)
Ao; Irrigation area per day (Ao = 1.4 - 2.1 ha)
Ea; Application efficiency (Ea = 62%)
T; Irrigation hour per day (T = 18 hour)

(10) Irrigation Area during the Construction.

As stated in the Basic Development Concept, a part of irrigation system will be operated to use partly for the effective land use during the construction of the irrigation facilities.
The estimation of irrigatin area during the construction was carried out under the such conditions stated below.

1) The following facilities should be completed as soon as possible

- Ostua diversion weir
- Driving canal
- North diversion canal
- No. 1, No. 2 regulating reservoirs
- Temporary conducting canal from the driving canal to the North diversion canal

2) Discharge from the Ostua river as normal year in corresepondence to return period of 2 year is employed for the water balance calculation.

Table A.4.2.1-19 Deversion Water Requirement by Crops during the Construction Period

(A = 2,723 ha, Unit; MCM)

Date Mon.	10 Day	Maize*2 (I) (600 ha)	Maize*2 (II) (600 ha)	Maize*1 (III) (60 ha)	Maize*1 (IV) (23 ha)	Tomato*1 (I) (60 ha)	Tomato*2 (II) (600 ha)	Broccoli*1 (60 ha)	Kindney*1 Bean (I) (60 ha)	Kidney*2 Bean (II) (375 ha)	Kidney*1 Bean (III) (23 ha)	Tabaco*2 (225 ha)	Onion*1 (37 ha)	Total (MCM)
	B	0.002	0.002						0.027	0.002	0.009	0.001		0.043
May	M								0.021		0.006			0.027
	L								0.020	0.003	0.004	0.001		0.028
	B								0.008		0.001			0.009
Jun	M								0.007					0.007
	L								0.005	0.003		0.002		0.010
	B								0.003	0.025		0.015		0.043
Jul	M	0.009	0.009						0.001	0.052		0.032		0.103
	L	0.027	0.027				0.014			0.046		0.030		0.144
	B	0.054	0.054				0.028			0.042		0.028		0.206
Aug	M	0.100	0.100				0.053			0.053		0.036		0.342
	L	0.106	0.106				0.036			0.035		0.030		0.313
	B	0.139	0.139				0.035			0.037		0.025		0.375
Sep	M	0.130	0.130				0.051			0.029		0.020		0.360
	L	0.091	0.091				0.054			0.016		0.012		0.264
	B	0.185	0.185		0.001		0.123			0.022		0.015		0.531
Oct	M	0.163	0.163		0.001		0.105			0.005		0.005	0.001	0.443
	L	0.179	0.179	0.002	0.004		0.098						0.005	0.467
	B	0.246	0.246	0.012	0.011	0.002	0.218	0.002					0.016	0.753
Nov	M	0.187	0.187	0.017	0.013	0.005	0.044	0.006					0.019	0.478
	L	0.125	0.125	0.022	0.013	0.007		0.010					0.021	0.323
	B	0.074	0.074	0.028	0.012	0.011		0.015					0.020	0.234
Dec	M	0.033	0.033	0.033	0.012	0.016		0.019					0.018	0.164
	L			0.041	0.011	0.023		0.026					0.018	0.119
	B			0.044	0.010	0.029		0.026			0.001		0.015	0.125
Jan	M			0.047	0.008	0.035		0.026			0.002		0.013	0.131
	L			1.051	0.006	0.043		0.028			0.003		0.010	0.141
	B			1.051	0.004	0.044		0.028	0.003		0.005		0.007	0.142
Feb	M			0.046	0.002	0.043		0.025	0.005		0.008		0.004	0.133
	L			0.041		0.041		0.020	0.009		0.011			0.122
	B			0.034		0.037		0.014	0.015		0.014			0.114
Mar	M			0.026		0.030		0.007	0.022		0.018			0.103
	L			0.020		0.025			0.033		0.022			0.100
	B			0.012		0.016			0.041		0.020			0.089
Apr	M			0.005		0.007			0.050		0.018			0.080
	L								0.053		0.016			0.069
Total		1.850	1.850	0.532	0.108	0.414	0.859	0.252	0.323	0.370	0.158	0.252	0.167	7.135

Table A.4.2.1-20 Water Balance Study during the Construction Period

1967 (Return period 2 Year)

(Unit; '000 m^3)

Period		Inflow (Qin)	Demand (Qout)	Difference (+)	Difference (-)
	1	811	43	768	
MAY	2	1,296	27	1,269	
	3	623	28	595	
	4	1,018	9	1,009	
JUN	5	1,004	7	997	
	6	2,394	10	2,384	
	7	2,332	43	2,289	
JUL	8	2,164	103	2,061	
	9	2,108	144	1,964	
	10	2,146	206	1,940	
AUG	11	6,103	342	5,761	
	12	6,046	313	5,733	
	13	3,427	375	3,052	
SEP	14	4,158	360	3,798	
	15	3,906	264	3,642	
	16	5,261	531	4,730	
OCT	17	5,041	443	4,598	
	18	2,297	467	1,830	
	19	3,180	753	2,427	
NOV	20	1,439	478	961	
	21	884	323	561	
	22	610	234	376	
DEC	23	405	164	241	
	24	403	119	278	
	25	266	125	141	
JAN	26	191	131	60	
	27	122	141	-	19
	28	145	142	3	-
FEB	29	111	133	-	22
	30	82	122	-	40
	31	81	114	-	33
MAR	32	89	103	-	14
	33	97	100	-	3
	34	482	89	393	
APR	35	397	80	317	
	36	112	69	43	
Balance		61,231	7,135	7,004	131

Note (1) Cropping area during the period of construction

During the period of construction, it is possible to irrigate some upland field by using a part of completed irrigation facilities such as diversion weir, driving canal, regulating reservoir and main cnal, etc. As a result of estimation under the below condition, the irrigable area as follows;

Wet season ----------	2,400 ha
Dry season ----------	323

The condition of estimation.

1) It is necessary to complete the construction of diversion weir and driving canal as soon as possible in order to supply irrigation water to North Diversion Canal through the temporary canal.

2) No. 1 and No. 2 regulating reservoirs (each net capacity of reservoir 210,000 and 160,000 m3) could be used.

3) The design year for water balance was adopted 1967 as normal year in correspondence to return period of 2 year.

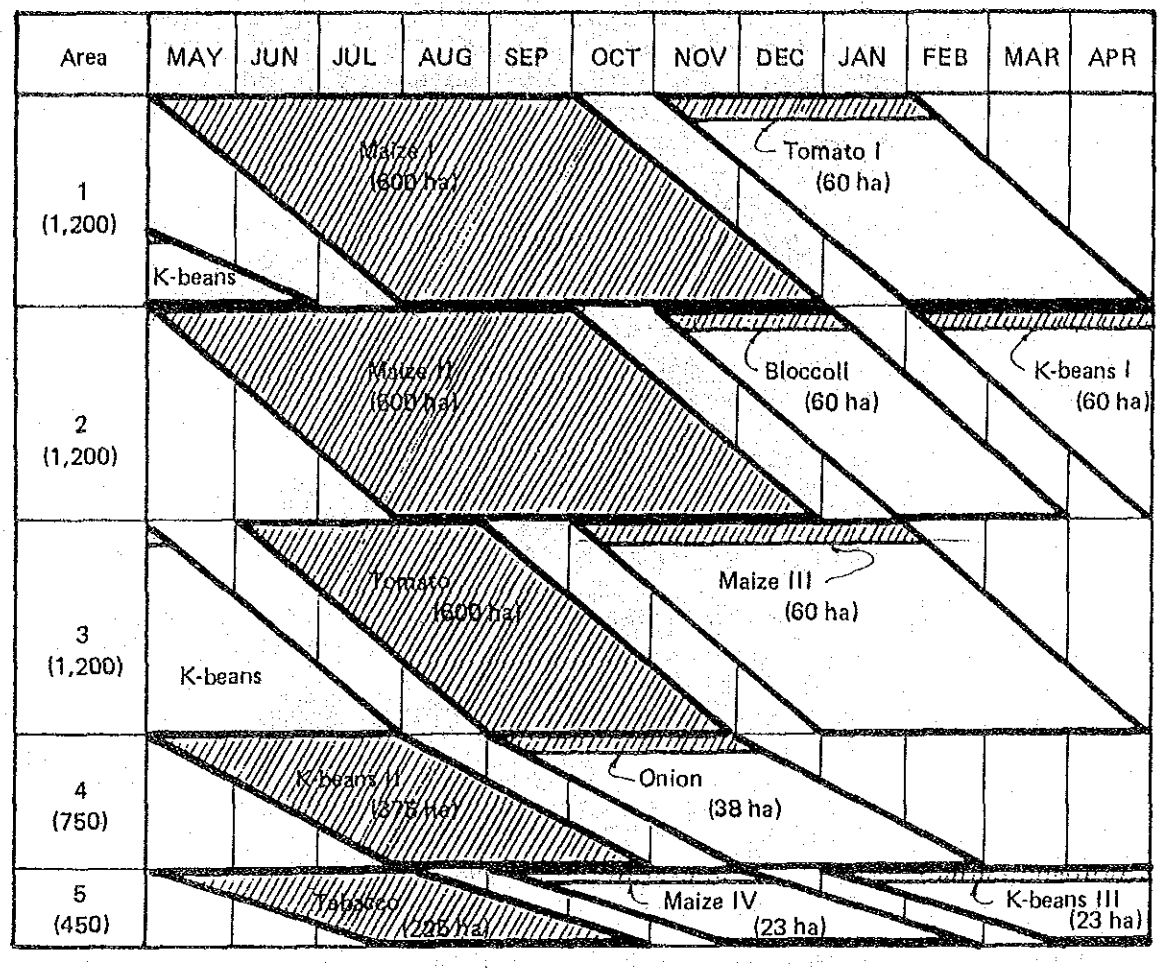
4) North Main Canal and its lateral canal, etc. are to be used.

Irrigable area in the wet season = 2,400 ha
Irrigable area in the dry season =
= 10 percont of irrigatble area
in the wet season

Note (2) Cropping area fed by rainfall except the above area is as follows,

4,800 ha - 2,400 ha = 2,400 ha

(Unit; ha)



Type	Area	Cropping Pattern	Proposed Cropping Area	During Cropping Irrigation	Const. Area Non Irr.
1	1,200	Maize + Tomato	2,400	660	Maize 600
2	1,200	Maize + Bro + K-bean	3,600	720	Maize 600
3	1,200	Tomato + Maize	2,400	660	Tomato 600
4	750	K-bean + Onion	1,500	413	K-bean 375
5	450	Tobacco + Maize + K-bean	1,350	271	Tobac. 225
Total	4,800		11,250	2,723	2,400
			(234%)		
					5,123 (107%)

Fig. A.4.2.1-5 Cropping Pattern during the Construction Period

Table A.4.2.2-1 Proposed Production Volume

		Present			Without			With		
		Area (ha)	Yield/ha (t)	Production (t)	Area (ha)	Yield/ha (t)	Production (t)	Area (ha)	Yield/ha (t)	Production (t)
Maize	W [1]	3,110	2.7	8,397	3,110	2.8	8,708	2,850	3.8	10,830
	D	24	3.2	77	24	3.4	82	1,200	4.1	4,920
Kidney bean	W	600	1.1	660	600	1.2	720	1,950	1.8	3,510
	D	57	1.4	80	57	1.5	86	450	2.0	900
Tobacco	W	480	1.4	672	480	1.4	672	450	1.9	855
Tomato	W	610	17.0	10,370	610	17.9	10,919	1,200	24.0	28,800
	D	259	18.5	4,792	259	19.4	5,025	1,200	26.0	31,200
Broccoli	D	340	8.3	2,822	340	8.3	2,822	1,200	10.5	12,600
Onion	D	130	8.5	1,105	130	8.7	1,131	750	12.0	9,000
Pasture		1,000	598.0 [2] 0.061 [3]	598,000 61	1,000	598.0 0.061	598,000 61	550	598.0 0.061	328,900 34
Total		6,610			6,610			11,800		

Note : 1) W : Wet season
D : Dry season
2) Milk : Unit ℓ
3) Beef : kg

Table A.4.2.2-2 Agricultural Work Plan

Crop	Seeding	Fertilizing; extermination of harmful insects	Weeding	Growth period; harvest
Maize	ICTA-B1.H3.H5	Base fertilizer : Combined fertilizer 210~260kg/ha	Herbicides	Growth period 90-120 days
	Sansareno (2-period action)	Additional fertilizer : Urea 138kg/ha	Manual weeding as required	Rainy season cropping : Oct.-Dec.
	Rainy season: May-Jul..Sep .-Dec.	Extermination of harmful insects		Dry season cropping: Feb.-Mar.
	Dry season : Oct.-Dec.			2-period cropping.Dec.-Feb.
	Seedings : 17kg/ha. footpath width:80-90cm distance between stubs 45-55 cm			
Kidney bean	ICTA-Quetzal.Suchitan	Base fertilizer: combined	Herbicides	GrowTh period : 90 days
	Rainy season:May-Jul.	fertilizer Rainy season: 184kg/ha	Manual weeding as required	Rainy season cropping: Aug.-Oct.
	Dry season~rainy season	Dry season : 195kg/ha		Dry season~rainy season :
	: Feb.-Apr.			May.-Jul.
	Dry season : Jan-Mar.	Extermination of harmful		Dry season cropping :
		insects carrying virus		Apr.-Jun
	Seedings : 49kg/ha			
	Footpath width :			
	30-40cm			
Tobacco	Virginia	Combined fertilizer 10 days	Herbicides	Growth period : 90 days
	Seedling : Apr.-Jun.	after planting 600kg/ha.	Manual weeding	Aug.-Oct.
	Planting : May-Jul.	40 days after planting	as required	
	Seedings : 43g/ha	Combined fertilizer :		
		320kg/ha		
Tomato	UC-82 ·B.Napoli	Base fertilizer :	Herbicides·	Growth period : 90 days
	RIO Grande	combined fertilizer	Manual weeding	Rainy season cropping :
	.Rainy season : Seedling	325kg/ha	as required	Sept.-Nov.
	Apr.-Jun.	Additional fertilizer :		Dry season cropping :
	Planting : May.-Jul.	30-40 days after planting		Feb.-Apr
	Dry Season : Seedling	Urea fertilizer 184kg/ha		
	Oct.-Dec.	3-4 times during growing		
	Planting : Nov.-Jan.	period		
	Seedings : 320kg/ha	Extermination of harmful		
	Planting density,	insects		
	footpath width :			
	90-120cm			
	distance between stubs :			
	40-60cm			
Broccoli	Green Valiant	Base fertilizer : 736kg/ha	Herbicides	Growth period : 60 days
	Seedling : Nov.-Dec.	10 days after planting	Manual weeding	Jan.-Mar.
	Planting : Nov.-Jan.	Boron feed at the same	as required	
	Seedings : 690g/ha	time : 20kg/ha		
	Footpath width :	Urea fertilizer : 460kg/ha		
	50-60cm	30 days after planting		
	distance between stubs	4-5 times during growing		
	40cm	period		
		Extermination of harmful		
		insects		
Onion	Chata Mexicana	Combined fertiliqer :	Herbicides	Growth period : 90 days
	Seedling : Aug.-Oct.	714kg/ha 10-15 days after	Manual weeding	Dec.-Feb
	Planting : Sept.-Nov.	planting	as required	
	Seedings : 3.2kg/ha	Urea fertiliger : 370kg/ha		
		30-45 days after planting		
		3-4 times during seedling		
		and growing period		
		Extermination of hamful		
		insects		

Table A.4.2.2-3 Proposed Volume of Input Materials per Hector

Input Materials	Unit	Maize		Kidney bean		Tobacco	Tomato		Broccoli	Onion	Pasture	
		Wet	Dry	Wet	Dry	Wet	Wet	Dry	Dry	Dry		
1. Seeds	kg	17	17	49	49	0.043	0.32	0.32	0.69	3.22		
2. Fertilizer												
16 − 20 − 0	kg	210	260	184	195		325	325				
15 − 15 − 15	kg								736	714		
20 − 20 − 0	kg					322					91	
15 − 10 − 20	kg					598						
46 − 0 − 0	kg	138	138				184	184	460	368		
Boron	kg								20			
3. Insecticides												
Lannate	kg					3	1.4	1.4		0.7		
Volaton	kg	13	13									
Folidol	ℓ			1.4	1.4	4				4		
Metasistox	ℓ								3			
Tamaron	ℓ			1.5	1.5		8	8	3			
Belmark	ℓ								3			
4. Fungicides												
Antracol	kg						6.5	6.5		5.1		
Trimiltox	kg									1.5		
5. Herbicides												
Gesaprin	kg	2	2									
Trifluralin	ℓ			2	2		2	2	2	2		
Hedonal Amin	ℓ					6						
Hedonal Ester	ℓ					3						
Gramoxom	ℓ										1	
6. Parasiticides												
Asuntol	ℓ										0.015	
Catosol	ℓ										0.020	
7. Pneventive injection												
Triple	ℓ										0.005	
8. Feed												
Salt	kg										76	