Table 2-5-54 Result of storage test of Fuji apple(1995)

Observ-ed date	Duration from storage started days	Weight per fruit before Storage g	Weight per Fruit after Storage g	Reduced Rate of Weight per Fruit %	Sugar Cont-ent Brix	Acid-ity pH	Color of Peri-carp*	Eating quali-ty **
11. 1	14	230.9	228.6	99.0	18.4	3.95	4	++++
11.15	28	244.7	241.3	98.6	18.8	4.10	3	++++
11.29	42	222.4	217.9	98.0	16.6	4.45	4	++++
12.13	56	233.5	224.7	96.2	18.6	4.05	6	++++
12.27	70	228.9	221.2	96.6	16.9	4.40	4	+++
1.10 ***	84	255.0	244.1	95.7	17.4	4.45	6	+++

Notes: 1. Storage starting date was October 17, 1995.
2. Figures are average of 2 samples.
3. *; Numbers of color classified are those used in Japanese standard color chart for scaling the maturity level from class 1 of immature to class 8 of over-mature.
4. ** ; To be classified as same manner as in Table 2-5-52.
5. *** ; In 1996.

According to the result of the storage test, the variety of Fuji harvested in normal harvesting time could be stored without any reduction of its quality in the storage chamber during the period of 8 weeks from the starting of storage. Where there are more number of samples it can be studied more detail in both the cases of fruits harvested in several harvesting times, and will get better storage method for them.

2-5-5. Evaluation of Wind Break Net and Wind Break Trees for Orchard Ares

(1) Outline of Countermeasures Against Wind Blow

1) Wind Break Net for Orchard Area

In order to alleviate the wind blow against fruits trees, a wind break net with six(6) meters in height was provided in 1993, along the three(3) borders of orchard area, from the northeast end through the west and the south up to the end of kiwi lot. After one(1) year, two(2) lines of net with the same height ware provided along the row of kiwi vines from the west to the east, to be divided the area into three(3) equal area.

Since the net was provided, an favorable effects was observed on the fruit trees planted near by the net mainly planted along the north border, especially on the kiwi vines.

2) Wind Break Trees for Orchard Area

In 1995 after one(1) year and more passed, a Canadian poplar seedling with one(1) year old were planted to be surrounded the full orchard area, on purpose to form a shelter belt to protect all fruit trees from the wind blow.

After planted the seedlings, a irrigation system for supply water to the row of poplar, was planned and provided before the irrigation period in 1995. The system is consisted of four(4) lines and diverted water from the supply pipa of orchard irrigation system at the four(4) points.

After one(1) year passed, these young trees of Canadian poplar was growing successfully and became about three(3) to four(4) meters in height.

(2) Evaluation

1) Effect of the wind break facilities

The wind break facilities, both of net and trees, work well against the northern hard blow, so called "Poyraz" during summer season, for the trees planted in close to the facilities.

In future, the extent of effective area will be expanded in proportion to the growth of poplars. Regarding to the density of wind break facilities in future, it is not enough to cover all orchard, only by the present lines of poplar trees even if it will growing successfully.

[3] Research on Marketing, Distribution and Management

(3) Research on Marketing, Distribution and Management

The Japan International Cooperation Agency conducted research on the marketing and distribution of vegetables and fruits produced in Turkey and on the possibility of export of them as well as the possibility of investment to promising products, with a view to contributing to the promotion of investment by Japanese enterprises. In 1993, research was conducted in Japan, while field researches were conducted in 1994 in not only Turkey but also Germany, Italy and Belgium. The following were targets of research.

① Fresh vegetables and fruits
   Tomatoes, net melons, melons other than net melons, lettuce, broccoli, Japanese radishes, plums, peaches, kiwi fruit, pears, persimmons
② Vegetable seeds
   Japanese radishes, tomatoes, melons, lettuce, broccoli
③ Processed vegetables and fruits
   Canned or bottled provisions: peaches, plums, tomatoes
   Juice: peach juice

The research results which need special mention are described in the following pages.

3-1. Present Conditions of Marketing and Distribution in the Republic of Turkey

3-1-1. Situation of Demand and Supply of Vegetables and Fruits

① The total production of vegetables in Turkey was approximately 19,050 thousand tons in 1992 (accounting for 4% of the world production), which was the fifth largest production in the world. The total production of fruits was 9,350 thousand tons in 1992 (accounting for 3% of the world production), which was the ninth largest production in the world.

② Among the target products, tomatoes and melons hold the second place, while plums, peaches, pears (Western variety) hold the eighth place in the world production.

③ Self-sustenance rates in Turkey are 110% for vegetables and 107% for fruits, which are the highest in the world. A variety of agricultural products are not only consumed domestically but also exported as fresh products or processed provisions.

④ The quantities of fresh vegetable and fruit exports in 1993 were 487 thousand tons and 407 thousand tons, accounting for 2.5% and 4%, respectively, of the total production. Main destinations of exports include the Kingdom of Saudi Arabia, the Federal Republic of Germany and the Republic of Iraq. Exports to the Socialist Republic of

Rumania have been increasing in recent years.

⑤ In Turkey, vegetables and fruits are mostly consumed as fresh products. The consumption of processed products such as fruit juice, tomato paste and canned provisions is small.

3-1-2. Distribution of Vegetables and Fruits

(1) Conditions of Relevant Infrastructure

① People have well-established highway networks. Domestic transportation depends mainly on trucks (open trucks). The construction of expressways is making progress.

② The wholesale market includes traditional markets and newly-constructed modern markets. In Ankara, Istanbul and Adana, wholesale markets have been established in recent years, but there are no ancillary facilities such as freezing/cooling warehouses, packing facilities and encasing facilities. All selling and buying are conducted in negotiated transactions.

③ Most cooling/refrigerating warehouses, having been constructed by private companies, are used also as vegetable and fruit storehouses. Large exporters possess their own storage facilities and lease them to small- and medium-scale exporters. Even export ports are not equipped with public cooling/refrigerating facilities.

(2) Present Conditions of Domestic Distribution System

① Services concerning domestic distribution are available in coastal cities in the western and the southern regions such as Bursa, Istanbul, Izmir, Adana and Antalya.

② In the domestic distribution of agricultural products, distributors such as wholesalers and middlemen have been playing an important role. Collection and shipment are generally carried out by middlemen.

③ Agricultural products sent to markets via the wholesale market are almost uniform in quality. On the other hand, those sold by farmers directly to retail markets are often unequal in quality.

④ Water melons, melons and oranges, whose distribution ranges are wide, are mostly bought by merchants before the harvest. Merchants take charge of undertakings ranging from harvest to transport.

(3) Present Conditions of Export Distribution System

① The growing of vegetables and fruits for export is often entrusted to exporters. In this case, exporters conduct a series of work including harvest, selection, encasing and transport. Exporters sometimes give technical advice to farmers.

② Exporters are mostly small- and medium-scale exporters, who sell products through distributing agents on commission. It is difficult for them to formulate sales strategy.

③ First-class agricultural products are exported to Europe and second-class products are exported to Middle East, while products of classes lower than these are shipped for domestic consumption.

④ As Europe has well-established expressway networks, fresh vegetables and fruits are transported overland in cooler cars from Turkey to Germany in most cases.

⑤ There are two main routes from Istanbul to Frankfurt, 1,900 km away from the former. One of the routes passes through Sofia, Belgrade, Zagreb and Munich. The other routes passes through Belgrade, Vienna and Prague. It takes three or four days from Istanbul to Frankfurt. As the civil war prevents the passage through former Yugoslavia at present, it takes about one week.

3-1-3. Prices of Vegetables and Fruits

① Seasonal fluctuations of agricultural product prices are considerable. Peach prices, which are comparatively stable, show a fluctuation of 1.5 times, while lettuce prices, which fluctuate most, show a fluctuation of four times to seven times.

② Retail prices in large cities such as Istanbul are generally higher than those in smaller cities and rural regions. This seems to be attributable to the fact that products of higher quality are brought to large cities.

3-1-4. Situation of Export and Evaluation of Fresh Vegetable and Fruit Exports

(1) Export

① Among the target products, tomatoes were exported in the largest quantity in 1993 (77 thousand tons, 33.9 million dollars), followed by peaches (9.7 thousand tons, 4.7 million dollars), plums (4.9 thousand tons, 3.1 million dollars), melons (6.3 thousand tons, 2.7 million dollars), and pears (3.9 thousand tons, 1.9 million dollars) in that order.

② Major destinations of these products and shares in the total export are shown below.

Product	Major destinations and shares (1993)
Tomatoes	Saudi Arabia (83%)
Peaches	Saudi Arabia (80%)
Plums	Saudi Arabia (72%), Germany (19%)
Melons	Germany (45%), Saudi Arabia (16%), Jordan (12%)
Pears	Saudi Arabia (69%), Germany (13%)

(2) Evaluation of Fresh Vegetables and Fruits Produced in Turkey

① Exports from Turkey to the EC are intended mainly for Turkish people residing in Germany. No claims have been made regarding their quality, and they are competitive enough from the viewpoint of price.

② Farmers, however, do not place so much importance on quality, because they can sell their products in Turkey, where importance is laid on price,if it becomes difficult to export them to the EC.

③ German people place importance on the quality, including shapes, of vegetables and fruits. Brands are also important for them. Companies as well as people are increasingly attentive to the environment, and in evaluation of products it often becomes important whether recyclable packaging materials are used or not.

④ In German markets, vegetables and fruits produced in Turkey are regarded inexpensive but inferior in quality.

(3) Problems in Export Business

① It is necessary for exporters to secure cooling warehouses by themselves. This makes Turkish farmers and distributors, except for some large-scale enterprises, reluctant to export agricultural products.

② It is pointed out that it takes time to clear the necessary procedure for export, and that payment of export credit is delayed.

3-1-5. Conditions of Production and Export of Processed Vegetables and Fruits

(1) Outline

① In Turkey, a variety of processed vegetables and fruits are produced, including canned provisions, bottled provisions, dried fruits, juice and jam, as well as frozen vegetables and fruits. The production of these, however, is only several tens of thousand tons annually, and extremely small quantities of vegetables and fruits, except tomatoes, are consumed for this purpose.

(2) Processed Tomatoes (Tomato Paste)

① In 1992, 225 thousand tons of tomatoes was processed, which was the third largest in the world. In 1993, 125 thousand tons of processed tomatoes was exported to more than 35 countries. Most of it was tomato paste.

② One million tons to 1.5 million tons of tomatoes, which account for about one quarter of the total production, are processed. As the production of processed tomatoes increases, stable supply of tomatoes becomes important. The growing of tomatoes for processing is conducted mainly in coastal regions of the Sea of Marmara and the Aegean Sea.

(3) Canned Fruits and Vegetables

① The production of canned vegetables and fruits was approximately 40 thousand tons in 1987, and about 30 thousand tons of it was exported to EC countries. Canned peach and canned plum exports amounted to only 1,500 tons.

(4) Fruit Juice

① The production of fruit juice was 53 thousand tons in 1990. Production and production capacity have been gradually increased.

② Fruit juice export began declining from 1991. In 1993, it decreased to about one third of that in 1991.

3-1-6. Situation of Production and Exports of Vegetable Seeds

① The dry weather during summer is suitable for seed production in Turkey. In addition to this, production cost consisting mainly of personnel expenses is low, and incentives are provided for foreign investment. These provide Turkey with favorable conditions for seed production. In recent years, not only major European seed and seedling companies but also Japanese seed and seedling companies have commenced their business in Turkey.

② Twenty-nine Turkish seed companies are producing seeds of grains and various vegetables, with the link-up or the cooperation with foreign companies.

③ The production of vegetable seeds was 940 tons in 1993.

④ The domestic demand for vegetable seeds became increasingly stronger. The domestic consumption was 1,025 tons in 1993. With the increasing demand,imports increased as well, amounting to 225 tons in 1993. One hundred forty tons was exported, and 500 kg of it was hybrids.

3-2. Marketing and Distribution Conditions in Europe

3-2-1. Situation of Demand for Vegetables and Fruits in EC

For the purpose of studying the possibility of the exportation of vegetables and fruits from Turkey to European markets (EC), the conditions of supply and demand and the situation of importation are surveyed below. Targets of survey are fresh and processed vegetables and fruits.

In the EC, self-sustenance on vegetables and fruits has been almost achieved. This is thought to be attributable to agricultural countries such as Spain and Greece having joined the Community. (For Spain, the border measures equivalent to measures for importation from outside the EC, which had been taken as transitional measures, were discontinued in 1995, and consequently exportation from Spain to the EC was expected to increase.)

Tomatoes and fruits except citrus fruits and dried fruits almost satisfy the demand of Turkish people, and the EC is included in the destinations of processed tomato exports.

In the EC, all member countries except for Germany and Switzerland show high self-sustenance rates on vegetables, while Spain, Greece and Italy have achieved a self-sustenance rate of more than 100% on fruits.

The EC imported vegetables in 1990/1991 amounting to 2,800 thousand tons in total, which was an increase of 36% as compared with that in 1988/1989. Fruit imports amounted to 5,830 thousand tons in 1990/1991, which was an increase of 12% as compared with that in 1988/1989.

Table 3-2-1 Self-sustenance rates on vegetables and fruits in EC (1990/1991)

Unit: thousand tons

	Production	Import	Export	Stock change	Domestic consumption	Rate of self-sustenance
Vegetables						
Fresh vegetables	47,101	2,802	4,663	104	45,136	104
Cauliflower	1,770	8	38	0	1,740	102
Fresh tomatoes	12,102	330	98	12,334	12,334	98
Processed tomatoes	6,790	597	1,674		5,713	119
Fruits						
Fresh fruits*	21,201	5,833	1,416	12	25,606	83
Apples	7,258	699	257	-40	7,640	95
Pears	2,337	227	166	-32	2,430	96
Fresh peaches	3,178	8	94	0	3,092	103
Fresh grapefruit	2,410	565	211	0	2,975	81
Citrus fruits	9,222	4,626	907	0	12,940	71
Oranges	5,184	2,348	613	593	6,326	82
Processed peaches	566	145	252	30	429	132

Notes: Borrowed from "The Agricultural Situation in Community 1992 Report
*) Fresh fruits do not include citrus fruits.

Regarding the ratio between provisions within the EC and imports from Turkey, self-sustenance on tomatoes is achieved in summer from May to

October, while imports from outside the EC account for as high as 46% of the total distribution during winter from November to May. Imports from Turkey, however, account for only 1% of the imports from outside the EC. Tomatoes are imported during winter mainly from the Kingdom of Morocco and the Canary Islands. Imports of smothered or frozen tomatoes from Turkey, on the other hand, account for 58% of the imports from outside the EC, and imports of processed tomatoes from Turkey, with a concentration between 12% and 30% and a concentration exceeding 30%, account for more than 42% of the imports from outside the EC. Imports of melons and peaches from Turkey account for 8.5% to 8.7%. Table 3-2-2 shows ratios between provisions within the EC and imports from Turkey.

3-2-2. Situation of Demand for Vegetables and Fruits in Germany

(1) Situation of Supply of Vegetables and Fruits

In Germany, the rate of self-sustenance on vegetables is only 38% on the whole, and that on tomatoes is as low as 4%. Most of the domestic consumption of tomatoes depends on imports. The rate of self-sustenance on fruits except citrus fruits is 22%. That on apples is comparatively high, while all peaches are imports. The rate of self-sustenance on citrus fruits is 0%.

Table 3-2-3 shows provisions of vegetables and fruits within the EC and ratios of imports from Turkey. During winter from November to May, imports of fresh tomatoes account for 12.6%, those of smothered/frozen tomatoes account for nearly 40%, and those of concentrated tomatoes (a concentration between 12% and 30% and a concentration exceeding 30%) account for 80% to 90% of the imports from outside the EC. Imports of peaches from Turkey, accounting for 48% of the imports from outside the EC, account for only 0.3% of the total consumption, as most of peaches are provided within the EC. Imports of plums from Turkey account for 22% of the imports from outside the EC from October to June.

(2) Situation of Import of Vegetables and Fruits

Table 3-2-4 shows the situation of the import of vegetables and fruits in Germany. Imports of tomatoes show an increase during both summer (April to November) and winter (December to March). Imports of headed lettuce show a considerable increase, while imports of lettuce other than headed lettuce show a decrease during summer. Imports of both melons and peaches show an increase.

Regarding imports of tomatoes on a monthly basis, the largest amount is imported in July, and tomatoes are relatively expensive in April. The quantity of tomato imports from Turkey becomes large from March to April and in November, when the total quantity of imports becomes large. Prices of tomatoes produced in Turkey are relatively low, but they become almost equal, in winter from November to January, to the average price of the imports from other countries.

Regarding lettuce, the quantity of imports becomes large in December

Table 3-2-2 Provisions and imports of vegetables and fruits within the EC and ratios of imports from Turkey (1990)

	Total distribution (tons)	Provisions within the EC (tons)	Imports from outside the EC (tons)	Ratio of imports from outside the EC (%)	Imports from Turkey (tons)	Ratio to imports from outside the EC (%)	Ratio to the total distribution (%)
Vegetables							
Tomatoes (11-5/15)	619.674	335.861	283.797	45.8	2.605	0.9	0.4
Tomatoes (5/16-10)	559.511	555.381	4.131	0.7	409	9.9	0.1
Cauliflower. broccoli							
(4/15-11)	85.157	84.394	762	0.9			
(12-4/14)	172.550	172.392	159	0.1			
Lettuce	35.962	35.897	65	0.2			
Other root crops	157.428	152.864	4.565	2.9			
Melons	236.993	167.457	49.536	20.9	4.198	8.5	1.8
Tomatoes (smothered/frozen)	14.442	7.787	6.656	46.1	3.872	58.2	26.8
Dried tomatoes	3.462	2.394	1.070	30.9			
Processed tomatoes							
Whole/cut tomatoes (slices)	417.067	400.098	16.968	4.1	1.572	9.3	0.4
Whole/cut tomatoes (other than slices)	48.265	47.159	1.105	2.3			
Concentration not exceeding 12%	65.578	63.836	1.742	2.7			
Concentration between 12% and 30%	201.822	170.165	31.656	15.7	13.464	42.5	6.7
Concentration exceeding 30%	128.270	89.873	38.598	29.9	16.200	42.2	12.6
Fruits							
Peaches (including nectarines)	571.551	560.170	11.386	2.0	990	8.7	0.2
Plums (7-9)	66.228	50.626	15.605	23.6			
Plums (10-6)	37.558	18.031	19.528	52.0	654	3.3	1.7
Kiwi fruit	323.322	195.645	127.678	39.5			
Dried peaches	1.317	190	1.127	85.6			
Vegetable seeds	25.142	12.817	12.300	48.9	1.835	14.9	7.3

Source: External Trade 1990 (EUROSTAT)

Table 3-2-3 Provisions and imports of vegetables and fruits in Germany and ratios of imports from Turkey (1990)

	Total distribution (tons)	Provisions within the EC (tons)	Imports from outside the EC (tons)	Ratio of imports from outside the EC (%)	Imports from Turkey (tons)	Ratio to imports from outside the EC (%)	Ratio to the total distribution (%)
Vegetables							
Tomatoes (11-5/15)	172.779	153.918	18.862	10.9	2.383	12.6	1.4
Tomatoes (5/16-10)	285.063	282.485	2.578	0.9			
Cauliflower, broccoli							
(4/15-11)	43.681	43.147	534	1.2			
(12-4/14)	80.852	80.839	13	0.0			
Lettuce	20.299	20.288	11	0.1			
Other root crops	54.539	54.095	444	0.8			
Melons	40.229	32.167	8.062	20.0	3.248	40.3	8.1
Tomatoes (smothered/frozen)	5.878	2.307	3.571	60.8	1.380	38.6	23.5
Dried tomatoes	589	393	196	33.3			
Processed tomatoes							
Whole/cut tomatoes (slices)	105.819	97.073	8.746	8.3	4	0.0	0.0
Whole/cut tomatoes (other than slices)	7.341	7.295	46	0.6			
Concentration not exceeding 12%	19.267	19.016	251	1.3			
Concentration between 12% and 30%	75.774	65.510	10.264	13.5	8.004	78.0	10.6
Concentration exceeding 30%	15.766	15.086	680	4.3	586	86.2	3.7
Fruits							
Peaches (including nectarines)	303.454	301.521	1.934	0.6	920	47.6	0.3
Plums (7-9)	23.654	16.704	6.950	29.4			
Plums (10-6)	7.119	4.605	2.514	35.3	563	22.4	7.9
Kiwi fruit	103.857	94.382	9.476	9.1			
Dried peaches	855	67	788	92.2			
Vegetable seeds	3.675	1.331	2.344	53.8	1	0.0	0.0

Source: External Trade 1990 (EUROSTAT)

Table 3-2-4 Situation of imports in Germany

Unit: million tons. million marks

	1988		1989		1990		1991		1992	
	QTY	Value	QTY	Value	QTY	Value	QTY	Value	QTY	Value
Vegetables										
Fresh tomatoes										
(11/1-5-14)	1.642	353	1.724	361	1.728	395	2.110	464	2.476	461
(5/15-10/30)	2.462	422	2.458	393	2.851	433	3.190	572	3.220	507
Fresh lettuce										
Headed lettuce (4-11)	168	29	209	31	248	38	306	49	321	58
Other varieties of lettuce (4-11)	510	82	519	83	459	82	502	86	485	82
Headed lettuce (12-3)	153	34	156	30	189	38	234	54	351	71
Other varieties of lettuce (12-3)	531	135	562	139	483	124	507	139	539	132
Other varieties of lettuce	193	48	189	43	203	53	184	52	187	48
Root crops	539	87	546	85	545	82	559	94	589	98
Tomatoes (frozen)	49	5	44	4	59	5	57	5	67	6
Broccoli (frozen)	98	26	112	29	132	33	153	37	179	44
Tomatoes (dried)	5	4	6	6	6	6	13	12	13	12
Fruits										
Melons (fresh)	321	41	299	48	402	56	519	76	462	74
Peaches (fresh)	1.164	162	1.237	176	1.471	223	1.492	297	1.555	275
Plums (7-9)	175	18	171	17	237	28	403	61	202	23
Plums (10-6)	56	11	65	16	71	19	167	33	141	29
Processed provisions										
Tomatoes (slices)	975	92	925	96	1.058	102	1.097	97	1.217	104
Tomatoes (other than slices)	80	10	56	6	73	10	113	13	120	13
Tomatoes (concentration not exceeding 12%)	120	15	152	19	193	26	241	30	285	32
Tomatoes (concentration between 12% and 30%)	634	90	662	114	758	136	772	126	702	98
Tomatoes (concentration exceeding 30%)	125	37	117	42	158	60	201	67	254	76
Plum puree	14									
Tomato juice (sweetened)	25	1	2	0	2	0	4	0	5	0
Tomato juice (not sweetened)	85	6	130	10	143	11	157	12	134	10

Source: Spezialhandel nach Waren

and from March to April. Imports are thought to be increased, for the purpose of meeting demand in Christmas and Easter. Although fluctuations of import prices are not so considerable as those of quantities of imports, prices are relatively low during summer from June to October. Regarding fruits, quantities of imports become large during summer, with the quantity of peach imports becoming especially large in July and August. Prices of melon imports are relatively high from February to May, before quantities of imports increase, while prices of peaches and plums are relatively high during winter from November to May.

Imports of melons and peaches from Turkey reach a peak in August, while the whole imports reach a peak in July.

Although prices of melons imported from Turkey are relatively low, those of peaches are much the same as the average of the prices of peaches from other countries. While plums are imported mostly from July to September on the whole, the quantity of plums imported from Turkey becomes largest in May and June, and their prices are almost the same as the average of the import prices.

Regarding other fruits, persimmons do not appear in the statistics, while imports of pears show a considerable increase. Imports of pears from Japan have been gradually decreased. This seems to be attributable to higher unit import prices of pears from Japan than those of pears from other countries and regions.

3-2-3. Production of Vegetables and Fruits in Italy

(1) Policy on the Marketing of Agricultural Products

Italy's policy on the marketing of agricultural products is basically in conformity with the EC's common agricultural policy (CAP), and EC standards are applied to the quality of agricultural products of Italy. Agricultural products are managed in accordance with these standards.

(2) Export of Agricultural Products

Among the EC countries, Italy is an important exporter of fresh vegetables and fruits, which are exported mainly to Germany, France and Switzerland. Within the EC, Italy competes with Spain in the export of fresh vegetables and fruits.

Germany is an important destination of Italy's exports of tomatoes, broccoli, lettuce, melons, pears and peaches, which are included among the items studied in this report.

Crops of good export quality are produced in the northern part of Italy, and there are a number of exporters in this region.

(3) Production Cost

As a measure for controlling ever rising personnel expenses (labor cost), which account for a high percentage of the cost of fresh vegetable/fruit production, an increasing number of workers from abroad are accepted in Italy. Especially in southern regions of Italy, about 30 thousand Africans are employed in farming. Cost reduction is promoted through the mechanization of farming.

Products are exported to Germany overland by truck. Overland freight costs DM 3,500 (from North Italy to South Germany) and DM 4,700 (from North Italy to North Germany) per truck.

(4) Processing of Agricultural Products

Italy is, together with the USA, the most advanced country in the processing of agricultural products. Most of raw materials for processing are products of Italy.

CON. CO. O. SA and other cooperatives organized by Italian farmers producting crops for processing regulate the production and shipment of agricultural products, control quality, and negotiate with processors about prices.

3-2-4. Supply-demand Situation and Import of Vegetable Seeds

(1) EC

Table 3-2-5 shows quantities of imports of vegetable seeds in the EC member countries. The ratio of provision within the EC was 51% in quantity and 71% in amount of money in 1990. It is likely that expensive products are provided within the EC. The largest importer is the Netherlands, followed by Italy and France in that order. Imports from Turkey amount to 1,835 tons,accounting for 15% of imports from outside the EC. Most of this amount is imported by Greece.

Major seed companies have large shares in the production and selling of vegetable seeds, extending activities in production sites and seed consuming regions beyond national borders (seed consuming regions = countries/regions where vegetables are produced by using seeds purchased from these companies). Where production sites and seed consuming regions are in different countries, seed imports are generally reexported as follows.

From a production site (or a country) to the country where the company's headquarters are situated, and further to consuming regions (or countries)

Export-import data, therefore, do not always define production sites and consuming sites.

(2) Germany

The ratio of the provision of vegetable seeds within the EC is 73% in quantity and 79% in amount of money, which are higher than in the other EC countries. Imports from Turkey, amounting to about 1 ton, account for only 0.04% of imports from outside the EC (Tables 3-2-3 and 3-2-5).

Table 3-2-5 Imports of vegetable seeds in the EC member countries (1990)

	Imports (tons)			Sum (ECU 1,000)		
	Total	Within EC	Ratio of provision within EC	Total	Within EC	Ratio of provision within EC
Germany	3,675	1,331	36.2	22,524	18,000	79.9
France	2,217	1,282	57.8	30,651	23,709	77.4
Italy	5,660	2,431	43.0	34,229	18,639	54.5
Holland	7,494	4,929	65.8	55,430	32,805	59.2
Belgium	613	600	97.9	10,049	9,940	98.9
English	920	448	48.7	18,276	16,327	89.3
Denmark	811	574	70.8	5,625	3,914	69.6
Greece	2,659	416	15.6	10,187	6,433	63.1
Ireland	244	184	75.4	1,329	1,254	94.4
Portugal	311	259	83.3	3,890	3,047	78.3
Total of the EC	25,142	12,817	51.0	215,016	153,515	71.4

Source: External Trade 1990 (EUROSTAT)

3-3. Marketability of Vegetables and Fruits

3-3-1. Evaluation of Vegetables and Fruits from the Viewpoint of Suitability as an Enterprise

In this chapter, marketability of fresh vegetables and fruits is appraised, from the viewpoint of suitability as an enterprise. For this purpose, a study is made on problems in the growing of target items and gross profits from them. Gross profits in this case are determined by production cost, selling expenses, selling prices and so on. Analysis on these is made, regarding vegetables, on the basis of the results from the JICA verification field, while analysis is made, regarding fruits, on the basis of the results of interviews with nearby farmers.

There is little difference in production cost and selling expenses between products, except melons of tunnel cultivation, so long as they are not injured by outbreaks of diseases and harmful insects (vegetables: $3,000/ha,fruits: $4,700/ha). Selling expenses amount to about $1,000/ha. There is, however, difference of several times in unit yield and unit selling price,and the difference determines the size of gross profit. The following table shows evaluation of the target products, with this being taken into consideration. As promising agricultural products as an enterprise, tomatoes, net melons, Japanese radishes, peaches and pears are identified. Evaluation is made, with the remunerative line being approximately $3,000/haof net receipts for vegetables, and approximately $4,700/ha of net receipts for fruits. Gross profits are estimated, with $2,000/ha being the standard. Kiwi fruit, which are a new product for Turkish farmers, are given the evaluation of "a further study necessary", because it is difficult to estimate unit yield and unit selling price at this point of time.

Table 3-3-1 Evaluation of suitability of products as an enterprise

Product	Eval.	Comments
Tomato	O	- No problem in the growing of tomatoes - Unit yield: 103 t/ha: 2.5 times the average in Turkey (39 t/ha) - Selling price: ¢ 17/kg - Net receipts: $14,000/ha - Gross profit: $11,000/ha (very large)
Net melon	O	- No problem in the growing of net melons - Unit yield: 40 t/ha: twice the average in Turkey (17 t/ha) - Selling price: ¢ 67/kg - Net receipts: $26,700/ha - Gross profit: $13,000/ha (very large)
Lettuce	×	- No problem in the growing of lettuce - Unit yield: 33 t/ha - Selling price: ¢ 10/kg - Net receipts: $3,300/ha - Gross profit: $300/ha (small)

Product	Eval.	Comments
Japanese radish	○	- No problem in the growing of Japanese radishes - Unit yield: 55 t/ha - Selling price: ¢ 17/kg - Net receipts: $9,170/ha - Gross profit: $6,170/ha (large)
Broccoli	△	- No problem in the growing of broccoli - Unit yield: 10 t/ha: almost the same as that in Japan - Selling price: It is estimated as higher than that of lettuce (twice to three times) - Gross profit: It is estimated as equal to or smaller than that of lettuce. (small) (* Sufficient data are not available.)
Peach	○	- No problem in the growing of peaches - Unit yield: 10.8 t/ha (local varieties) - Selling price: ¢ 53/kg - Net receipts: $5,770/ha - Gross profit: $1,070/ha (average)
Plum	×	- No problem in the growing of plums (local varieties) - Unit yield: the same level as peaches: assumed to be 10 t/ha - Selling price: ¢ 43/kg - Net receipts: $4,300/ha - Gross profit: red ink
Kiwi fruit	△	- Yield test has not yet been completed, because of poyraz (dry northerly winds). - The climate of the coastal region of the Black - Sea is suitable for the growing of kiwi fruit. It is important to grow them in suitable regions. - Although the unit selling price is uncertain, kiwi fruit are said to be sold at higher prices than other fruits. It is necessary to study their marketability.
Pear	○	- No problem in the growing of pears - Unit yield: 13.0 t/ha (local varieties) - Selling price: ¢ 43/kg - Net receipts: $6,300/ha - Gross profit: $1,600/ha (average)
Persimmon	△	- No problem in the growing of persimmons - Unit yield: 13 t/ha (local varieties) - Selling price: ¢ 17/kg - Net receipts: $2,170/ha - Gross profit: red ink - It is necessary to investigate difference in yield and selling price among the varieties.

Note: ○ : Promising as an enterprise.
△ : A further study necessary.
× : Not suitable as an enterprise.

3-3-2. Study on Marketability

(1) Marketability of Fresh Vegetables and Fruits (for Germany)

1) Selection of Target Products

A study on marketability was conducted for those fresh vegetables and fruits which were given a circle (i.e., evaluated as "promising as an enterprise") or a triangle (i.e., "a further study necessary") in "Evaluation of Vegetables and Fruits from the Viewpoint of Suitability as an Enterprise." German people were assumed to be consumers of these products.

2) Study Results

Table 3-3-2 shows the details of the study. As a result, melons were identified as a promising product in German markets.

It was true that there was the possibility of peaches, kiwi fruit and pears being marketed in Germany. The growing of these, however, did not seem suitable as an enterprise until profit ratios remarkably exceeded those of vegetables, because fruit growing was attended with a greater risk than vegetable growing, due to the following reasons.

- It is more difficult to change production items than in the growing of vegetables.
- It takes several years from planting until harvest.
- Fruit trees may be injured by the weather.

In the previous section, the gross profits of the fruit other than kiwi fruit are estimated as either "average" or "red ink", and consequently it can be concluded that they are not suitable for commercial production for export to Germany.

Regarding kiwi fruit, a further study is necessary, and data need to be accumulated for this purpose, on unit yield and expenses for production and management, before a conclusion is reached. Some farmers grow kiwi fruit and obtain favorable results in the suburbs of Adana.

Table 3-3-2 Marketability of fresh vegetables and fruits (for Germany)

Product	Eval.	Comments
Tomato (fresh)	X	- Imports from within the EC account for about 95% through the year. During summer, imports are mostly from EC member countries such as the Netherlands, Spain and Belgium, while imports from outside the EC account for 10% to 20% during winter, with Morocco having the largest share. - It is not advantageous for Turkey to export tomatoes during summer, in view of border measures including customs duties and reference prices. - During the between-crop season in EC countries, Morocco becomes a competitor against Turkey. As prices of tomatoes produced in Morocco are slightly lower than those of tomatoes produced in Turkey, partly due to weather conditions, products of Turkey do not seem to have an advantage in competition.

Product	Eval.	Comments
Melon	○	- Imports from within the EC account for about 85% through the year. Imports are mostly from member countries such as Spain during summer, while imports from outside the EC account for 30% to 50% during winter. - It cannot be expected that net melons, not being so popular, are given as preferential treatment as in Japan. Melons produced in the JICA experimental farm, however, have been sold at a higher price than ordinary melons. - Imports of melons produced in Turkey account for about 40% annually of the imports from outside the EC (about 3,000 tons), the largest share. Melons are exported from Turkey mainly from August to October. - The competitor against Turkey is Israel. Prices of Turkish products are lower than those of Israeli products. Lower prices of Turkish products are attributable to not only production cost but also qualitative evaluation of products. It can be expected therefore that export prices will be raised by improvement of the quality of melons produced in Turkey.
Japanese radish	×	- German people hardly eat Japanese radishes, and the consumption is small. Japanese radishes are not suitable as exports to Germany.
Broccoli	△	- Imports of broccoli and cauliflower from outside the EC are very small, accounting for almost 0% (about 10 tons) during summer and about 1% (about 500 tons) during winter. - One ton to 20 tons is exported from Turkey mainly to Greece. The price is about ¢ 30/kg, which is on the same level as lettuce and not so high.
Peach	△	- Imports from outside the EC account for less than 1% annually. - Among the importers within the EC, Italy has the largest share. Peaches are imported from countries in the southern hemisphere such as South Africa and Chile from December to April. - Turkey exported 100 tons to 1,000 tons of peaches from June to September (1991 - 1993).
Kiwi fruit	△	- Imports from outside the EC account for about 10%, amounting to 9,000 tons. - A further study is necessary on the competitiveness in price and quality, based on a further accumulation of data on production and management. - Kiwi fruit are a new agricultural product introduced to Turkey just recently.

Product	Eval.	Comments
Pear	△	- As pears of Japanese produce are not popular to consumers of EC countries, it is difficult to make a judgment. It is necessary to do research through trial marketing. As hundreds of tons of pears are exported from Japan, their marketability cannot be entirely denied.
Persimmon	△	- Persimmons of Japanese varieties have not been sold, and it is therefore difficult to make a judgment. It is necessary to do research through trial marketing.

(2) Marketability of Processed Vegetables and Fruits

1) Identification of Target Markets

Potential markets of processed vegetables and fruits include Germany (and other EC member countries) and Japan. It cannot be expected, however, that Japanese food companies produce goods in Turkey and sell them in Germany (and other EC countries), for the following reasons. Japan is therefore assumed to be the potential market of processed vegetables and fruits.

- In selling products in Germany (and EC), brands become important. As the EC is a maiden market for Japanese food companies, they need a large amount of marketing costs including expenses for brand establishment. In Germany (EC), the market of existing processed foods is thought to be in saturated condition, and the possibility is small in recovering a large amount of investment in marketing.

- It is therefore possible for Japanese food companies to do business in Turkey, with Germany (EC) being the target market, only in the following cases.

  (a) Where Japanese companies possess original products which cannot be easily imitated.
  (b) Where Japanese companies conduct OEM production.

- Case (a) is, however, not realistic in the present conditions in the food industry where similar products are produced and sold one after another.

- Although Case (b) is possible, Japanese companies hardly seem to initiate business in Turkey for that purpose. Case (b) is, therefore, not dealt with in this report.

2) Study on Marketability of Processed Vegetables and Fruits in Japan

Table 3-3-3 shows the details of the study on the marketability of the target products, namely, peaches (canned/bottled), peaches (juice), processed tomatoes, and plums (canned/bottled). It can be concluded that peaches (canned/bottled) are marketable in Japan, in view of the present conditions and trend in the Japanese market, and payability, as well.

Table 3-3-3 Study on marketability in Japan

Product	Details of study
Peach canned/ bottled	- The consumption of canned peaches is the second largest, following that of canned tangerines. Canned peaches are imported in large quantities, amounting to 50 thousand tons to 55 thousand tons annually. As the domestic production of peaches has been decreasing (to about 18 thousand tons of white- and yellow-flesh peaches), Japan is an attractive market. (As the production process of canned peaches requires lots of manual work, the rising personnel cost gives restraint on domestic production.) - Canned peaches (mainly yellow-flesh peaches) are imported mainly from South Africa, Greece and the USA. The price of imports from South Africa and Greece is about ¥100/kg, which is the lowest. - In the tentative calculation of canned peach production cost, the payable line is estimated at ¥90/kg, which is lower than the lowest import price of ¥100/kg (from South Africa and Greece). It can be concluded therefore that the production of canned peaches is payable. - In the production costs, raw material cost is the largest. It is important therefore to secures table supplies of raw material at low prices. - For Japanese food companies, it is possible to initiate business in the Adana district (Turkey), but a final decision should be made after a comprehensive study on competitiveness against products of other countries. (Some companies plan to grow peaches in China and import canned peaches to Japan. As about ¥26/kg is needed to transport products from Turkey to Japan, importation of processed peaches from China is more advantageous from the viewpoint of price.)
Peach	- Fruit juices consumed in Japan are mostly citrus fruit juices and apple juice, while the consumption of peach juice amounted to 5,000 tons in 1991, accounting for only 2.4% of the total consumption. - While the consumption of fruit juices is growing, the growth of peach juice consumption is below the average. - Unlike canned fruits, fruit juices are mainly produced with machines. Lower personnel cost is therefore not so advantageous as in the production of canned fruits. Higher operation rates are more important.
Processed tomato	- Regarding purees and paste, which are also intermediate products for ketchup, Turkey is already the most important exporter to Japan. As importers try to disperse risks caused by seasonal fluctuations as much as possible, a considerable increase of exports cannot be expected. - In selling ketchup, one of the end products of tomatoes, brand images become important. As new participation in

Product	Details of study
Processed tomato	in the business has few investment effects, the possibility of export is small.
Plum canned/ bottled	- The Japanese market, which is small, is little attractive as a destination of exports of canned/bottled plums.

(3) Marketability of Vegetable Seeds

1) Special Characters of Vegetable Seed Production

The production of vegetable seeds has special characters as mentioned below, as compared with the production of fresh vegetables and fruits.

① Original seeds are used.

② The selling of seeds produces a high rate of gross profit, and more importance is laid on whether good seeds are produced in the region or not than on whether production cost is low or not.

Explanations on these special characters are given below.

a. Using Original Seeds

The production of vegetable seeds as an enterprise completely differs in basic resources from the production of fresh/processed vegetables and fruits. (Basic resources refer to original seeds in the production of vegetable seeds, seeds and seedlings in the production of fresh vegetables and fruits, and vegetables and fruits in the production of processed provisions.)

It is possible to buy ordinary seeds and seedlings, and vegetables and fruits for processing, in the market, apart from prices. Original vegetable seeds, however, belong to basic know-how of seed companies, and they are not placed on the market.

It is therefore imperative for a seed company which intends to initiate seed production to possess competitive original seeds. In other words, even if production cost is reasonable in comparison with the selling price, the seed company cannot initiate seed production until the company has a monopoly position regarding specific seeds. A company can initiate seed production either in cases where it is a monopolistic enterprise or in cases where it has succeeded in the development of original seeds competitive enough to allow it to make inroad into the monopolistic market. The possession (and the development) of original seeds becomes a decisive factor. It is impossible to foresee the situation of the development of original seeds, which is veiled in business secrets.

b. More Importance is Given to Production Sites of Favorable Seeds than to Production Cost

Added value of seeds is considerable, and selling prices of seeds for ordinary production usually exceed their production costs greatly.

Unlike in the production of fresh vegetables, a slight difference in production cost does not play an important role in selecting seed production sites. It is more important to secure the conditions in which high-quality seeds can be produced on a stable basis. In addition, special attention is often paid, such as by selecting several sites for seed production, for the purpose of dispersing risks caused by unusual weather or natural disasters.

2) Turkey as a Production Site of Favorable Seeds

Turkey, which has dry weather in summer, is considered suitable as a production site of seeds. It is also advantageous in that production cost is lower than that in industrialized countries under similar weather conditions. It can be concluded therefore that Turkey can provide production sites for those companies which possess competitive original seeds (including the development of new original seeds). This does not depend on items such as Japanese radishes, lettuce, broccoli, tomatoes or melons.

Especially in cases where seeds are sold in the Japanese market, and in cases of the production of vegetable seeds whose demand is smaller than that for grain crops such as wheat, it is difficult in the USA (in California, one of the three largest seed production regions) to entrust the production of small quantities of seeds to farmers who grow seeds on a large scale. On the other hand, growing can be entrusted in Turkey even on a small scale, which is another advantage.

3) Scope of Market

Seed companies which produce vegetable seeds abroad generally export their products from the producing country to their home country, and further export them to other countries. For Japanese seed companies, the market need not be confined to Japan. The possibility of marketing in conformity with companies' business activities needs to be taken into consideration.

4) Possibility in the Short Run

In the short run, it is more important whether companies currently possess original seeds or not than whether they have developed original seeds or not.

The collection of lettuce seeds is conducted in the season which falls under the rainy season of Japan. Lettuce seeds are not grown in Japan, and all the necessary quantity depends on imports. Japanese seed companies do not seem to possess original seeds, either. There is therefore little possibility that Japanese companies initiate lettuce seed production abroad.

The production of seeds of Japanese radishes, tomatoes, melons and broccoli is considered possible. The production of seeds of these items except for Japanese radishes largely depends on intentions of specific companies which possess original seeds, for the reasons mentioned below.

Regarding broccoli and melons, a Japanese company (Company S) possesses highly competitive original seeds, enjoying a share of 80% for broccoli seeds in Europe and the USA and a domestic share of 70% for melon seeds. This company, which has already initiated business in Turkey, has the possibility of producing seeds on a trial basis in Turkey. Regarding tomatoes, a Japanese company (Company T) has the largest share in Japan. The production of tomato seeds in Turkey largely depends on this company's intention.

[4] Basic Plans for Agricultural Development

[4] Basic Plans for Agricultural Development

4-1. Foreword

The Government of the Republic of Turkey places importance on the following points in the agricultural sector of its Seventh Five-year Development Plan (1996 - 2000).

① From a macroeconomics viewpoint, the Turkish government intends to attain an annual economic growth rate of 5.5% to 7.1% on the whole. Growth rates expected in individual sectors are: 2.9% to 3.7% in the agricultural sector, 6.0% to 7.7% in the industrial sector, and 5.1% to 6.8% in the service sector. Exports, being increased at an annual rate of 15.9% to 17.5% on the average from 1996 to 2000, are expected to amount to $42.7 billion to $43.7 billion in 2000. Imports, being increased at an annual rate of 17.5% to 19.0%, are expected to amount to $68.8 billion to $73.2 billion.

② The share of the agricultural sector in GNP has been decreased from 17.5% in 1990 to 15% in recent years. Still, private employment in this sector continues to account for 45% of the total employment in the country. Although agriculture has become less important in Turkey's economy, the greater part of the people still live on farming.

③ Basic objectives of Turkey's agricultural policy are to provide the Turkish people with sufficient, well-balanced food, to increase the production and export of more profitable products, and to provide producers with opportunities to gain increased, stable incomes.

④ As farm land development has reached the limit in the Republic of Turkey, it is only improved productivity that can increase agricultural production. For the purpose of increasing areas of irrigated land, modern irrigation systems are employed in irrigable farm land, so long as they do not disturb harmony with the environmental conditions.

In addition to the expansion of irrigated areas, it is important that farmers use good, high-productivity seeds and a wide range of pure-bred animals. It is also necessary that soil analysis be conducted, the administration of effective fertilizer be promoted, proper machines and instruments be selected, pest control be conducted, and farmers be kept informed of the results of various studies and examinations.

These will correlatively raise agricultural productivity and consequently improve product quality.

It is expected, therefore, that further agricultural investments from Japan and activities attended with technology transfer will answer requests from the Turkish government. This chapter deals with basic plans for vegetable/fruit production in the Republic of Turkey, in expectation of providing a reference for those who intend to initiate agricultural enterprises in this country.

4-2. Agricultural Management Models

4-2-1. Cropping System Models

Based on the conclusion reached in the previous section "Marketability of Vegetables and Fruits", promising items fresh and processed at present include melons, Japanese radishes and peaches.

Cropping system models are shown below, with the ongoing types of vegetable and fruit growing being taken into consideration. Target items of the models include the above-mentioned three items and water melons and eggplants from which high payability can be expected, with a view to dispersing risks in agricultural management.

For the purpose of improving the rate of land utilization and increasing farmers' earnings, the following combinations of crops have been defined for vegetable-growing farmers according to their farming scales.

- Small-scale farmers: spring growing of net melons, fall growing of Japanese radishes
- Medium-scale farmers: spring growing of net melons, fall growing of Japanese radishes, ordinary growing of eggplants
- Large-scale farmers: spring growing of net melons and water melons, fall growing of Japanese radishes, ordinary growing of eggplants

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Many medium- and large-scale farmers are engaged in complex farming, growing both vegetables and fruits. Cropping models have been defined as follows for these farmers according to their farming scales. It is assumed that small-scale farmers are not engaged in complex farming, and they are not included in these models.

- Medium-scale farmers: fall growing of peaches and Japanese radishes
- Large-scale farmers: fall growing of peaches and Japanese radishes, ordinary growing of eggplants

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These cropping system models are shown in Figs. 4-2-1 and 4-2-2.

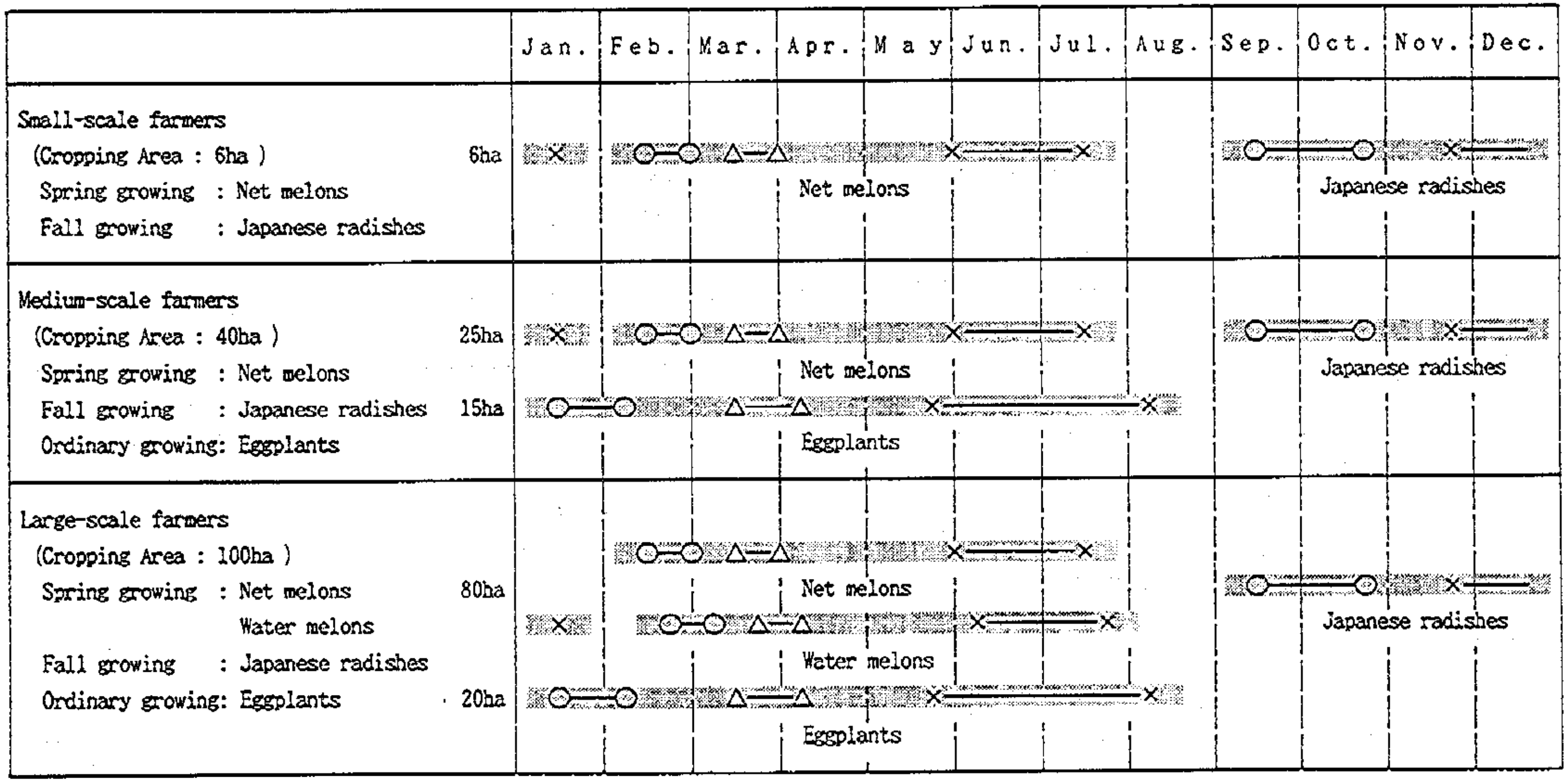


Fig.4-2-1 Cropping system models for Vegetable-growing farmers

Note: ○—○ Seeding   △—△ Planting   ×—× Harvesting

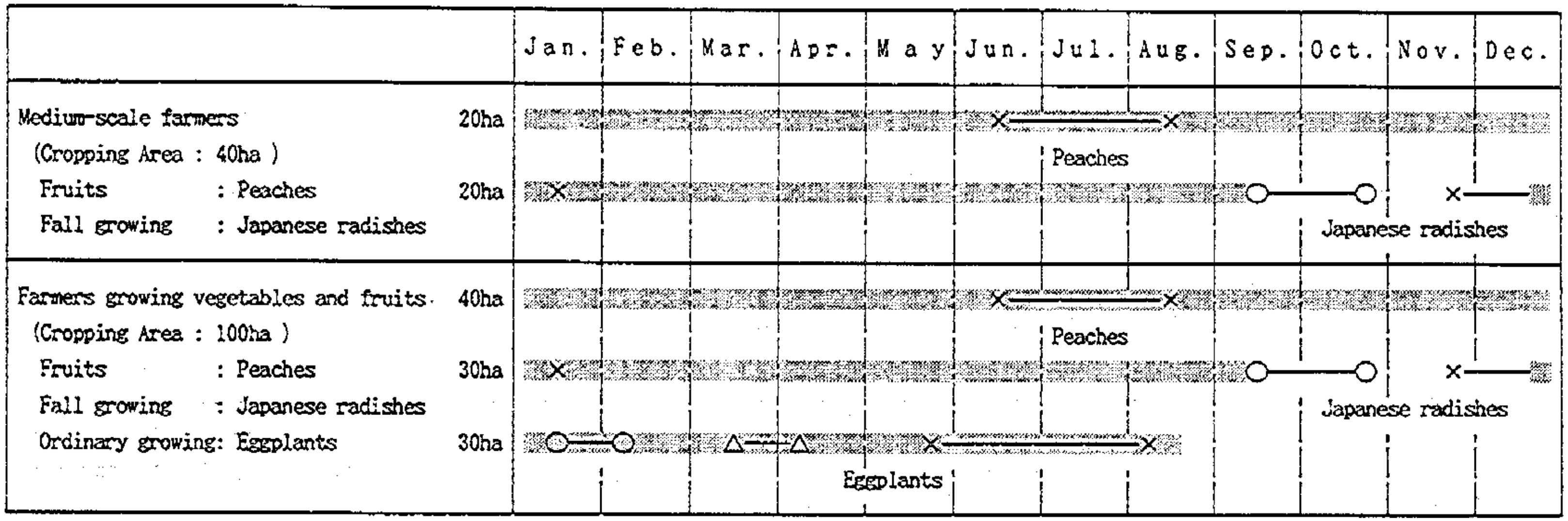


Fig.4-2-2 Cropping system models for Farmers growing vegetables and fruits

Note: ○—○ Seeding　△—△ Planting　×—× Harvesting

4-2-2. Farming Models

(1) Cropping Area

Areas of small-, medium- and large-scale farming are assumed to be 6 ha, 40 ha and 100 ha, respectively, and cropping systems are defined as follows.

- Vegetable-growing farmers

	Spring growing		Fall growing	
Small-scale farmers	Net melons	6 ha	Japanese radishes	6 ha
Medium-scale farmers	Net melons	25 ha	Japanese radishes	25 ha
			Eggplants 15 ha	
Large-scale farmers	Net melons	40 ha	Japanese radishes	80 ha
	Water melons	40 ha	Eggplants	20 ha

- Farmers growing vegetables and fruits

	Fruits		Fall growing	
Medium-scale farmers	Peaches	20 ha	Japanese radishes	20 ha
Large-scale farmers	Peaches	40 ha	Japanese radishes	30 ha
			Eggplants	30 ha

(2) Buildings and Equipment for Farming

Floor areas of farming buildings are set at 101 m^2, 611 m^2 and 1,511 m^2 for small-, medium- and large-scale farmers, based on interviews with them.

In Adana, farmers generally possess the following agricultural machines.

Tractor, trailer, disk harrow, plow, lister, cultivator, roller, seeder, spray

Farmers are assumed to have these machines, irrespective of farming scale. Medium- and large-scale farmers are assumed to have one truck each, in addition to these machines. Large-scale farmers are assumed to have more than one tractor each (see Table 4-2-1).

(3) Field Management

As in the case of the JICA verification field, vegetables were managed in the following manner.

	Melons/water melons	Radishes/eggplants
Plowing	Tractor plowing	Tractor plowing
Land preparation	With tractor	With tractor
Irrigation	Drip irrigation	Boom irrigation

Table 4-2-1 Fixed costs of model farmers

Item	Unit Cost ($)	Small 6 ha Area or No.	Small 6 ha Sum ($)	Medium 40 ha Area or No.	Medium 40 ha Sum ($)	Large 100 ha Area or No.	Large 100 ha Sum ($)
Farming bldg.		101	14,342	611	86,762	1,511	214,562
Agric. equip.							
1 Tractor	14,233	1	14,233	1	14,233	2	28,467
2 Trailer (4-wheel)	2,223	-	-	1	2,223	1	2,223
3 Trailer (2-wheel)	1,418	1	1,418	1	1,418	1	1,418
4 Disk harrow	767	1	767	1	767	2	1,533
5 Plow	500	1	500	1	500	2	1,000
6 Lister	567	1	567	1	567	1	567
7 Cultivator	400	1	400	1	400	2	800
8 Roller	233	1	233	1	233	2	467
9 Seeder	2,500	1	2,500	1	2,500	2	5,000
10 Spray	2,000	1	2,000	1	2,000	2	4,000
11 Truck	16,333	-	-	1	16,333	1	16,333
12 Other			2,262		4,118		6,181
Total			24,880		45,293		67,989
Fixed labor cost							
Family		2	4,008	2	4,008	2	4,008
Employee		-	-	3	6,012	6	12,024
Land rent		6	1,398	40	9,320	100	23,300

Note: Labor cost; $167/month per capital
Land rent ; $233/ha

Peaches were managed in the following manner.

Training	Open-center, natural system with three main branches
Irrigation	Combination of drip irrigation and row-spacing irrigation

(4) Working Hours

To working hours for the growing of melons and Japanese radishes, the results from the JICA verification farm have been applied, while the results of interviews have been applied to working hours for the growing of water melons and eggplants. Working hours for the growing of peaches have been defined on the basis of Japan's "Report on Agricultural Production Costs, 1994, the Ministry of Agriculture, Forestry and Fisheries", with interviews being reference (see Table 4-2-2).

Regarding small-scale farming, it is assumed that two family members including the manager manage and operate the farm. In medium-scale farming, two family members and three full-time employees manage and operate the

Table 4-2-2 Working hours and labor expenses per 1 ha

	Working hours (hours/ha)	Labor cost ($/ha)
Melon	3,920	3,360
Japanese radish	858	736
Water melon	526	451
Eggplant	1,183	1,014
Peach	525	450

Note: Unit cost per person: $0.6/day

farm. In large- scale farming, two family members and six full-time employees manage and operate the farm.
Extra labor is supplied by temporary employees.

(5) Administration of Fertilizer and Pesticides

To the administration of fertilizer and pesticides, the results from the JICA verification farm have been applied, regarding melons and Japanese radishes. The results of interviews have been applied regarding water melons and eggplants. Regarding peaches, expenses for the administration of fertilizer and pesticides have been defined on the basis of Japan's "Report on Agricultural Production Costs, 1994, the Ministry of Agriculture,Forestry and Fisheries", with the results of interviews being reference (see Table 4-2-3).

Table 4-2-3 Expenses for fertilizer and pesticides per 1 ha
($/ha)

	Fertilizer	Pesticides
Melon	640	204
Japanese radish	510	240
Water melon	671	522
Eggplant	300	330
Peach	640	300

4-2-3. Financial Analysis of Farming

(1) Vegetable-producing Farmers

1) Small-scale Farmers (see Table 4-2-4)

It is assumed that a small-scale farmer conducts the spring growing of net melons and the fall growing of Japanese radishes in a 6-ha farm.

The farmer gains earnings of 28 thousand dollars and 12 thousand dollars from melons and Japanese radishes, respectively, which are a satisfactory profit. It is recommended that other crops be grown, in addition to melons and Japanese radishes, for the purpose of compensating for expected losses due to fluctuations of prices of these products.

2) Medium-scale Farmers (see Table 4-2-5)

It is assumed that a medium-scale farmer conducts the spring growing of net melons and the fall growing of Japanese radishes in 25 ha of a 40-ha farm,and the growing of eggplants in the remaining 15 ha.

The farmer gains earnings of 128 thousand dollars, 60 thousand dollars and 56 thousand dollars from melons, Japanese radishes and eggplants, respectively, amounting to as high as 244 thousand dollars. It is easier for medium-scale farmers to diversify crops than small-scale farmers, and this results in more stable management. The medium-scale farmer possesses one unit each of agricultural machines, such as tractors, per 40 ha to 50 ha. The efficiency of the utilization of agricultural machines is higher in medium-scale farmers than in small-scale farmers.

3) Large-scale Farmers (see Table 4-2-6)

It is assumed that a large-scale farmer conducts the ordinary growing of eggplants in 20 ha of a 100-ha farm, the spring growing of net melons and water melons in 40 ha respectively, and the fall-growing of Japanese radishes in 80 ha.

The large-scale farmer gains earnings of 212 thousand dollars from melons, 269 thousand dollars from water melons, 205 thousand dollars from Japanese radishes, and 78 thousand dollars from eggplants, totaling to as high as 916 thousand dollars. Regarding spring growing, it is possible to disperse risks of price drops or natural disasters to a certain extent by growing water melons on the same scale as melons. The ordinary growing of eggplants is also effective for risk dispersion.

Table 4-2-4 Income and expense by vegetable in small-scale farming

Unit: $

	Melon	Japanese radish	Total
Cropping area (ha)	6	6	12
I . Gross profit	78,120	28,800	106,920
1. Production (ton)	180	240	
2. Selling price (¢ /kg)	57.0	20.0	
3. Sales	102,600	48,000	150,600
4. Selling expense	24,480	19,200	43,680
5. Selling expense per kg (¢ /kg)	13.6	8.0	
II . Production cost	49,764	16,833	66,597
1. Current goods expenses	24,321	7,133	31,454
a. Seeds	18,365	1,099	19,464
b. Fertilizer	3,840	3,060	6,900
c. Pesticides	1,224	1,440	2,664
d. Fuel and light expense,power rate	780	1,422	2,202
e. Irrigation	112	112	224
2. Fixed goods expenses	2,581	2,581	5,161
a. Depreciation expense	2,064	2,064	4,128
- Farming buildings	287	287	574
- Agricultural machines	1,777	1,777	3,554
b. Repairs and maintenance expense	517	517	1,033
- Farming buildings	143	143	287
- Agricultural machines	373	373	746
3. Labor expenses	22,164	6,420	28,584
a. Family members	2,004	2,004	4,008
b. Full-time employees	-	-	-
c. Temporary employees	20,160	4,416	24,576
4. Land rent	699	699	1,398
III . Income from farming	28,356	11,967	40,323

Table 4-2-5 Income and expense by vegetable in medium-scale farming

Unit: $

	Melon	Japanese radish	Eggplant	Total
Cropping area (ha)	25	25	15	65
I. Gross profit	325,500	120,000	102,750	548,250
1. Production (ton)	750	1,000	750	
2. Selling price (¢/kg)	57.0	20.0	22.0	
3. Sales	427,500	200,000	165,000	792,500
4. Selling expense	102,000	80,000	62,250	244,250
5. Selling expense per kg (¢/kg)	13.6	8.0	8.3	
II. Production cost	197,115	59,900	47,234	304,250
1. Current goods expenses	101,336	29,721	23,209	154,265
a. Seeds	76,520	4,580	9,000	90,100
b. Fertilizer	16,000	12,750	4,500	33,250
c. Pesticides	5,100	6,000	4,950	16,050
d. Fuel and light expense, power rate	3,250	5,925	4,200	13,375
e. Irrigation	466	466	559	1,490
2. Fixed goods expenses	5,013	5,013	3,008	13,035
a. Depreciation expense	3,823	3,823	2,294	9,941
- Farming buildings	1,335	1,335	801	3,470
- Agricultural machines	2,489	2,489	1,493	6,470
b. Repairs and maintenance expense	1,190	1,190	714	3,094
- Farming buildings	667	667	400	1,735
- Agricultural machines	523	523	314	1,359
3. Labor expenses	87,854	22,254	17,522	127,630
a. Family members	1,542	1,542	925	4,008
b. Full-time employees	2,312	2,312	1,387	6,012
c. Temporary employees	84,000	18,400	15,210	117,610
4. Land rent	2,913	2,913	3,495	9,320
III. Income from farming	128,385	60,100	55,516	244,000

Table 4-2-6 Income and expense by vegetable in large-scale farming

Unit: $

	Melon	Water melon	Japanese radish	Eggplant	Total
Cropping area (ha)	40	40	80	20	180
I. Gross profit	520,800	369,600	384,000	137,000	1,411,400
1. Production	1,200	2,400	3,200	1,000	
2. Selling price (¢/kg)	57.0	24.0	20.0	22.0	
3. Sales	684,500	576,000	640,000	220,000	2,120,000
4. Selling expense	163,200	206,400	256,000	83,000	708,600
5. Selling expense per kg (¢/kg)	13.6	8.6	8.0	8.3	
II. Production cost	308,936	100,984	178,784	59,382	648,087
1. Current goods expenses	162,177	70,585	95,186	30,593	358,541
a. Seeds	122,432	8,480	14,656	12,000	157,568
b. Fertilizer	25,600	26,840	40,800	6,000	99,240
c. Pesticides	8,160	20,880	19,200	6,600	54,840
d. Fuel and light expense, power rate	5,200	13,600	18,960	5,600	43,360
e. Irrigation	785	785	1,570	393	3,533
2. Fixed goods expenses	5,472	5,472	10,945	2,736	24,626
a. Depreciation expense	4,066	4,066	8,131	2,033	18,295
- Farming buildings	1,907	1,907	3,814	954	8,582
- Agricultural machines	2,158	2,158	4,317	1,079	9,713
b. Repairs and maintenance expense	1,470	1,470	2,814	703	6,331
- Farming buildings	954	954	1,907	477	4,291
- Agricultural machines	453	453	907	227	2,040
3. Labor expenses	136,627	20,267	63,333	21,393	241,620
a. Family members	891	891	1,781	445	4,008
b. Full-time employees	1,336	1,336	2,672	668	6,012
c. Temporary employees	134,400	18,040	58,880	20,280	231,600
4. Land rent	4,660	4,660	9,320	4,660	23,300
III. Income from farming	211,864	268,616	205,216	77,618	763,313

(2)Farmers Growing Vegetables and Fruits

1) Medium-scale Farmers (see Table 4-2-7)

It is assumed that a medium-scale farmer conducts the fall growing of Japanese radishes in 20 ha, in addition to the growing of peaches in 20 ha.

The medium-scale farmer gains earnings accounting for 20% of the input for the growing of peaches. This is not a satisfactory rate of return on investment. Earnings from the growing of Japanese radishes amount to 41 thousand dollars, accounting for 80% of the total agricultural earnings.

Although it is possible to conduct the spring growing of melons or water melons in the area where Japanese radishes have been harvested, the overlap of the harvest time of the spring crops and that of peaches makes labor intensive. Spring growing is therefore not conducted in this model farm.

2) Large-scale Farmers (see Table 4-2-8)

It is assumed that a large-scale farmer conducts the fall growing of Japanese radishes in 30 ha and the ordinary growing of eggplants in another 30 ha, in addition to the growing of peaches in 60 ha.

The large-scale farmer gains earnings of 25 thousand dollars from peaches, 67 thousand dollars from Japanese radishes, and 109 thousand dollars from eggplants, totaling to 278 thousand dollars. As in the case of medium-scale farmers, the payability of peaches is low, and the most part of the earnings is from Japanese radishes and eggplants. It is, however, possible to disperse risks of price drops and natural disasters to a certain extent by crop diversification.

Table 4-2-7 Income and expense by vegetables and fruits in medium-scale farming

Unit: $

	Peach	Japanese radish	Total
Cropping area	20	20	40
I . Gross profit	59,280	96,000	155,280
1. Production	240	800	
2. Selling price (¢/kg)	35.0	20.0	
3. Sales	84,000	160,000	244,000
4. Selling expense	24,720	64,000	88,720
5. Selling expense per kg (¢/kg)	10.3	8.0	
II . Production cost	50,232	55,056	105,289
1. Current goods expenses	25,045	24,149	49,194
a. Seeds		3,664	3,664
b. Fertilizer	12,800	10,200	23,000
c. Pesticides	6,000	4,800	10,800
d. Fuel and light expense, power rate	5,460	4,740	10,200
e. Irrigation	785	745	1,530
2. Fixed goods expenses	6,517	6,517	13,035
a. Depreciation expense	4,970	4,970	9,941
- Farming buildings	1,735	1,735	3,470
- Agricultural machines	3,235	3,235	6,470
b. Repairs and maintenance expense	1,547	1,547	3,094
- Farming buildings	868	868	1,735
- Agricultural machines	679	679	1,359
3. Labor expenses	14,010	19,730	33,740
a. Family members	2,004	2,004	4,008
b. Full-time employees	3,006	3,006	6,012
c. Temporary employees	9,000	14,720	23,720
4. Land rent	4,660	4,660	9,320
III . Income from farming	9,048	40,944	49,991

Table 4-2-8 Income and expense by vegetables and fruits in large scale farming

Unit: $

	Peach	Japanese radish	Eggplant	Total
Cropping area (ha)	40	30	30	100
I. Gross profit	118,560	144,000	205,500	468,060
1. Production (ton)	480	1,200	1,500	
2. Selling price (¢/kg)	35.0	20.0	22.0	
3. Sales	168,000	240,000	330,000	738,500
4. Selling expense	49,440	96,000	124,500	269,940
5. Selling expense per kg (¢/kg)	10.3	8.0	8.3	
II. Production cost	93,673	77,491	96,025	267,189
1. Current goods expenses	50,090	36,224	46,418	132,731
a. Seeds		5,496	18,000	23,496
b. Fertilizer	25,600	15,300	9,000	49,900
c. Pesticides	12,000	7,200	9,900	29,100
d. Fuel and light expense, power rate	10,920	7,110	8,400	26,430
e. Irrigation	1,570	1,118	1,118	3,805
2. Fixed goods expenses	9,850	7,388	7,388	24,626
a. Depreciation expense	7,318	5,489	5,489	18,295
- Farming buildings	3,433	2,575	2,575	8,582
- Agricultural machines	3,885	2,914	2,914	9,713
b. Repairs and maintenance expense	2,532	1,899	1,899	6,331
- Farming buildings	1,716	1,287	1,287	4,291
- Agricultural machines	816	612	612	2,040
3. Labor expenses	24,413	26,890	35,230	86,532
a. Family members	1,603	1,202	1,202	4,008
b. Full-time employees	4,810	3,607	3,607	12,024
c. Temporary employees	18,000	22,080	30,420	70,500
4. Land rent	9,320	6,990	6,990	23,300
III. Income from farming	24,887	66,509	109,475	200,871

4-3. Basic Policy

4-3-1. Basic Objectives of Vegetable/Fruit Production

The following are basic objectives of vegetable/fruit production.

① Fresh vegetables and fruits are produced mainly as exports for Germany, and products which can be accepted by Turkish people are produced for domestic consumption, with a view to stabilizing agricultural management.

② Processed vegetables and fruits are produced mainly as exports for Japan.

③ Vegetable seeds are basically marketed to Japan, and the EC as well, from which seeds can be reexported.

4-3-2. Components of Agricultural Development Activity

According to the study up to the preceding chapter, agricultural development activity can include three components as mentioned below. Activities are, however, not feasible regarding pears of Japanese varieties, persimmons, kiwi fruit and broccoli, until an accumulation of data becomes available on the production of these products.

Table 4-3-1 Components of agricultural development activity

Component		Product	Consumer	Details of activity
1	Fresh vegetables and fruits	Melon	Export (to Germany)	Growing/selling
		Japanese radish, etc.*	Turkish people	
2	Processed vegetables and fruits	Canned/peaches	Export (to Japan)	Growing/processing/selling
3	Vegetable seeds	Japanese radish, tomato, etc.**	Export (to Japan, etc.)	Growing/selling

Note: * ; Water melons, eggplants, etc. are included for stable agricultural management.
** ; Irrespective of product, as a general rule, though Japanese radishes and tomatoes are most promising.

Agricultural development activities can be conducted as combinations of these components. The industrialization of combinations of more than one component will be more payable to a certain extent than that of a single component, because offices can be used more efficiently, the necessary number of managerial staff members can be smaller, and temporary workers can be employed more effectively.

From the viewpoint of an entrepreneur who intends to commercialize vegetable/fruit production, it is imperative that individual components be certainly payable. Importance is therefore laid on the feasibility of the commercialization of individual components. Activities in individual components are studied in detail in the following pages.

The following table shows considerations to be given in the commercialization of individual components.

Table 4-3-2 Considerations to be given in commercialization of vegetable/fruit production

Component	Considerations
Fresh vegetables/ fruits (growing/ selling)	- Companies take charge of the production and selling of agricultural products. Japanese companies are not so familiar with this area of activity. - Payability of this area of activity is not low, though it is attended with risks due to such as weather conditions.
Processed vegetables/fruits (growing/ processing/ selling)	- As the processing of purchased peaches is not counted among the forms of trial commercialization, companies need to take charge of the growing of (at least part of) raw material peaches. - It takes about five years for peaches to reach economic age after being planted. - Although it is possible to produce not only canned peaches but also more than one kind of canned provisions and juices through entrusting as necessary, these are not studied in this section, because mere processing is not included in the forms of trial commercialization.
Vegetable seeds (production/ selling)	- As mentioned earlier, vegetable seed production produces very high value added. It can be concluded that the production and selling of vegetable seeds are payable on the whole development costs.

4-3-3. Commercialization Forms and Production Systems

(1) Commercialization Forms

Commercialization forms are classified into commercialization by individual companies and that by joint ventures. Table 4-3-3 shows merits and demerits of these forms. Commercialization by joint ventures seems more reasonable.

Table 4-3-3 Comparison of commercialization forms

	Merit	Demerit
Individual company	- Discretionary management is possible. - Returns become larger.	- Know-how on management in Turkey may be insufficient. - Larger capital investments are necessary, and risks become large accordingly.
Joint venture	- It is possible to utilize know-how of local companies (business practice, workers, trustees, domestic sales, farming suitable in local conditions, etc.) - Smaller capital investments are necessary, and risks become smaller accordingly. - Production cost can be reduced by entrusting local tests to joint ventures.	- Coordination becomes necessary between advancing companies and joint ventures. - Returns become smaller.

(2) Production Systems

Production systems include direct management and entrusting. Direct management and entrusting are defined as follows.

- Direct management:
  Companies advancing into Turkey take charge of entire production.
- Entrusting:
  Companies advancing into Turkey entrust the production of fresh vegetables/fruits (including those used as raw materials) to local farmers and buy products thus produced. The production of canned peaches is conducted in existing canneries in Turkey.

It can be one option for companies to entrust entire production, but it is appropriate in trial commercialization that they take charge of production at least partially under direct management. In Table 4-3-4, therefore, a comparison is made between entrusting and a combination of direct management and entrusting.

It is true that successful direct management produces large profits, but it is attended with large risks. Especially in the production of fresh vegetables/fruits, decentralized fields result in reduced risks. A combination of direct management and partial entrusting seems more appropriate in that smaller capital investments are needed and risks are dispersed.

On the other hand, peach canneries can be operated with a comparatively small initial investment. It seems more appropriate to operate them under direct management, which is timesaving in quality control and can take effective measures for production cost reduction.

In this report, it is assumed that the growing of peaches (which provide raw materials of canned peaches) is partially conducted in peach canneries under direct management, for trial commercialization. There seems, however, the possibility of a system in which peaches are purchased from farmers, canned under the entrusting system, and exported to Japan. In this case, canning may be conducted in either existing canneries or canneries newly constructed in peach-producing districts. Newly constructed canneries can be operated by cooperatives, and canned peaches produced there can be purchased by Japanese companies.

In seed production, too, it is possible to produce seeds of vegetables/fruits in great demand, with the cooperation of companies which possess original seeds, and distribute them among farmers. The companies can gain profits through the distribution of original seeds.

These forms of commercialization are, however, not studied in this report, because they are not suitable as means of trial commercialization.

Table 4-3-4 Comparison of production systems (fresh vegetables/fruits)

	Merit	Demerit
Direct management	- Production cost (raw material cost in the production of canned peaches) is smaller than under the entrusting system. - Guidance to trustees is not necessary.	- Larger fields and larger capital investments are needed, and risks become larger accordingly. - Limited fields result in larger risks due to natural disasters and weather conditions.
Direct management + entrusting	- As fields under direct management become smaller in scale, capital investments become smaller, and risks become smaller accordingly. - Decentralized fields increase the stability of harvests, and the ensuring of raw materials results.	- Cost becomes larger than in cases where production is not entrusted, and the rate of profit is lowered. - Guidance to trustees is necessary for ensuring product quality.

Table 4-3-5 Comparison of production systems (peach cannery)

	Merit	Demerit
Direct management	- Production cost is smaller than under the entrusting system. - Guidance in quality control and quality inspection are necessary only within the company's cannery. - This enables the production of stable - quality products and contributes to cost reduction.	- Canneries become larger in scale, and larger capital investments become necessary, being attended with accordingly larger risks.
Direct management + entrusting	- Smaller capital investments are necessary, and risks become smaller accordingly. Scale merits are lost, and product cost is raised, depending on the scale of direct management. - Decentralized canneries make it easy to ensure workers.	-Cost becomes larger than in cases where production is not entrusted, and the rate of profits becomes lower. -Guidance and inspection are necessary for quality control.

4-3-4. Scale of Commercialization

The following factors determine the scale of commercialization. Production plans of fresh vegetables/fruits, processed vegetables/fruits, and vegetable seeds are formulated, on the basis of the scale thus determined.

- Production of the amount which can gain a certain share in the market.
- Production in profit-generating scale.
- Suitability of the amount of funds for trial commercialization.
- Production of vegetables of new varieties in such amounts as sufficient for them to be recognized in the market.

4-4. Commercialization Plan for Fresh Vegetable/Fruit Production

4-4-1. Details of Activity

The deatails of the commercialization activity are the following:

① Target products: melons and Japanese radishes
② Form of commercialization: joint venture with local companies
③ Production system: direct management
④ Scale of production:
- Area ; 80 ha
- Production ; 2,480 tons of melons and 3,040 tons of Japanese radishes
- Labor force; 41,400 man-days (Melons 33,100 Japanese radishes 8,300)

⑤ Selling:
- Melons
  - Export for Germany ; 600 tons × 89 ¢/kg = $ 534,000
  - Domestic consumption; 1,880 tons × 57 ¢/kg = $ 1,071,600
- Japanese radishes
  - Domestic consumption; 3,040 tons × 27 ¢/kg = $ 820,800

⑥ Financial conditions:
- Initial investment: $ 1,470,000
  - JICA financing; $ 1,200,000
  - Own funds ; $ 270,000
- Net profit : $ 423,000 (from the third year)
- Profit after taxes: $ 215,000 (from the third year)

4-4-2. Selling plan

Export for Germany and domestic consumption of net melons are planned as main selling item, considering that net melons have been the most profitable crop perunit area in accordance with the trial selling results in 1994 and 1995 by theProject experiment farm. And also Japanese radishes are adopted, which have gained good results through trial selling in several domestic markets,such as inIstanbul,Ankara, Adana,Izmir and so on.

Production planned area is 80 ha. It is supposed to produce approximate 3,000 tons of Japanese radishes, which corresponds to 2 - 3% of national production of red-round radishes in Turkey. Melons are prouduced around 2,480 tons in almost same area.

About net melons, it is planned 600 tons for export to Germany, which corresponds to 20% of total current export of melons from Turkey to Germany, and remains (1,880 tons) for domestic markets.

About selling chanells, in case of export for Germany it is delivery to exporter's proper packing place in Mersin. In case of domestic consumptions, it is transportation to Tarsus (located 95 km from project site) for cities in central-west regions and to Osmaniye (located 50km from project site) for citiesin east and southeast regions, and then to transfer for wholesale markets in each cities.

A cold storehouse shall be established to arrange gap of harvest and sellingperiod for melons.

Table 4-4-3 shows the sales price of melons and Japanese radishes. Those areresults gained in trial selling by the Project, and domestic sales price of melons is an average of Istanbul's price sold as high grade and Ankara's pricesold as normal grade.

4-4-3. Production Plan

As the growing of net melons needs certain levels of skill, the entrusting of it is not appropriate. Net melons are grown under direct management.

Cultivation area is 80 ha as mentioned in 4-4-2. An agricultural building and acold storehouse, having an area of 1,200 m^2 and an area of 200 m^2, respectively are constructed in an area of 3,000 m^2. The field under direct management isleased, while the construction site is purchased by the joint venture.

The same cropping system as adopted in large-scale, vegetable growing farmersis employed.

Working hours, expenses for materials and machinary and so on are in accordance with those mentioned in Chapter [5], 5-1. Details of production cost are as showned in Table 4-4-4.

4-4-4. Financial Plan

Construction cost,income and expenditure are shown in Tables 4-4-1 through 4-4-4.

The growing of these products produces an annual net profit of $ 414,000 from the third year onward, which comprises $ 200,000 from melons and $ 214,000 from Japanese radishes. This activity, to which about $ 1,470,000 is invested, produces an annual net profit of $ 414,000 from the third year onward and a net profit after taxes of$ 211,000. In view of the amount of profit after taxes, the invested capital canbe recovered in about nine years.

Table 4-4-1 Construction cost for fresh vegetable/fruit growing

Item		Sum ($)	Service life (years)	Depreciation expense ($)	Repairing expense Rate(%)	Repairing expense ($)
1. Purchase of site	3,000m²	250,000	-	-	-	-
2. Agricultural building	1,200m²	170,400	25	6,816	2	3,408
3. Cold storage for prechilling	200m²	600,000	20	30,000	2	12,000
4. Farm construction	80ha	368,000	20	18,400	-	-
5. Agricultural machines and instruments	including in production cost				3	2,040
Total		1,388,400	-	55,216		17,448

Table 4-4-2 Production of fresh vegetables/fruits

Item	Melons	Japanese radishes
1. Cropping area (ha)	80	80
2. Unit yield (tons/ha)	31	38
3. Gross production (tons)	2,480	3,040

Table 4-4-3 Sales of fresh vegetables/fruits

Item	Total	Melons	Japanese radishes
1. Export to Germany			
a. Exports (tons)	-	600	-
b. Selling price (¢/kg)	-	89	-
c. Sales ($)	534,000	534,000	-
2. Domestic sales			
a. Sales (tons)	-	1,880	3,040
b. Selling price (¢/kg)	-	57	27
c. Sales ($)	1,328,400	1,071,600	820,800
3. Gross sales ($)	2,426,400	1,605,600	820,800

Table 4-4-4 Expenditures in vegetable/fruit growing

Item	Total	Melons	Japanese radishes
1. Production cost	1,903,840	1,351,680	552,160
2. Land rent	18,640	9,320	9,320
3. Repairing expense	24,808	12,404	12,404
4. Depreciation expense	55,216	27,608	27,608
Total	2,002,504	1,401,012	601,492

4-5. Commercialization Plan for Vegetable/Fruit Processing

4-5-1. Details of Activity

The following are details of commercialization.

① Product : Canned peaches

② Form of commercialization: Joint venture with local companies

③ Production system:

Canneries ; direct management

Peach growing; direct management and entrusting

④ Production

Canned peaches

- Production: 10,000 tons

  Yellow peaches initially

  2,200 tons of yellow peaches and 7,800 tons of white peaches from the fourteenth year and onward

- Number of workers

  20 full-time employees

  500 temporary employees

Raw material (i.e., peaches) production in the field under direct management

- Area: 100 ha
- Production: 1,200 tons
- Number of workers

  8 full-time employees

  Temporary employees: 67,700 man-days

  Harvest time: approximately 200 workers x 50 days

⑤ Sales

Exports for Japan: 10,000 tons x $1.0 to $1.2/kg

= $11,560 thousand (from the fourteenth year onward)

⑥ Financial situation

- Initial investment : $3,910 thousand

  JICA funding $1,200 thousand

  Own funds $2,710 thousand

- Net profit : $1,120 thousand (from the fourteenth year onward)
- Net profit after tax: $570 thousand (from the fourteenth year onward)

4-5-2. Selling Plan

Then thousand tons of canned peaches, which account for 20% of Japan's total import of canned peaches, are exported from Turkey to Japan. As Japanese people prefer white peaches to yellow peaches, white peaches for canning are produced both in the field under direct management and by entrusting to local farmers.

Canned yellow peaches and white peaches are exported from Turkey at a price of 100 yen/can (a 1 kg capacity can) and at a price of 120 yen/can, respectively. The total amount of export is expected to reach about $10,700 thousand in the fourteenth year.

Table 4-5-4 shows the sales of canned white peaches and yellow peaches.

4-5-3. Production Plan

White peach seedlings are imported from Japan for replacing yellow peaches. These seedlings are planted in the 100 ha field under direct management and in 500 ha of fields of neighboring farmers. The farmers entrusted with the growing of white peaches finish replacing yellow peaches in five years.

For six years until white peach trees bear fruit, yellow peaches are produced, and gradually replaced by white peaches until the latter account for 80% of the total peaches. In other words, 10,000 tons of canned yellow peaches are produced initially, and 2,200 tons of canned yellow peaches and 7,800 tons of canned white peaches are produced from the fourteenth year onward (assuming that solid content accounts for 60% of the volume of a can, with a yielding percentage of peaches being 65%, 9,231 tons of peaches are needed for canning). Table 4-5-1 shows production and provision schedules for white peaches and yellow peaches.

Production cost of peaches in the field under direct management and cost of peach canning are shown in Table 4-5-3.

The production of peaches needs eight full-time employees and 67,700 temporary man-days (approximately 200 workers x 50 days in harvest time). Peach canning needs 20 full-time employees and 500 temporary employees.

4-5-4. Financial Plan

Construction cost, incomes and expenditures are shown in Tables 4-5-2 to 4-5-5, respectively. Table 4-5-6 shows a statement of profit and loss, and a table of cash position.

Peach trees can produce about half the quantity of production at their peak,in five years after being planted, and it takes eight years for them to reach economic age. For the first seven years, the enterprise will be in the red, because the company needs to bear expenses for producing peaches for canning in the company, without producing any canned product, and purchase raw material peaches from external sources. Net profit, turning to the black in the eighth year, continues to grow until the fourteenth year and levels off after that. Net profit in the fourteenth year accounts for about 10% of the inputs. This shows that peach canning is not so payable.

Net profit turns to the black in the eighth year, though an initial surplus is not so large. The accumulated deficit is not wiped out until the twelfth year. Funds totaling to about $426 thousand are needed between the third year and the sixth year, and additional funds needed in the tenth year amount to $355 thousand. These sums are provided by own funding. As a result, a total investment of approximately $3,500 thousand is not recovered until the fourteenth year. This does not show efficiency of investment is high.

It is difficult to continue the activity with financing from a general bank, under an FIRR after taxes of 4.7%, but it is possible to do so with financing for trial commercialization (at an interest rate of 0.75%). In view of this, it is necessary to provide own funds, which do not need interest payments, in addition to funds for trial commercialization. This enterprise, however, does not seem attractive for private companies.

Sensitivity analysis results are shown in the following table. FIRR after taxes is 9.4% in Case 7. To be effective, the following considerations are necessary.

① As no white peaches have been grown in Turkey, it is impossible to price them in the market. In the Basic Case, purchasing prices of white peaches grown on commission are set 15% higher than those of yellow peaches, with a view to encouraging farmers to shift from yellow peaches to white peaches. Purchasing prices could be lowered in negotiations with trustee farmers.

② Japanese people prefer white peaches to yellow peaches, and retail prices of canned white peaches are higher by 20% to 25% than those of canned yellow peaches (import prices are not identified because almost all canned white peaches are of domestic production). There is, however, no difference between white peaches and yellow peaches in production cost and canning cost. The rate of return is consequently higher in white peach canning than in yellow peach canning. This will encourage trustee farmers to shift from the growing of yellow peaches to the growing of white peaches, and the production of canned yellow peaches will be discontinued earlier.

Table 4-5-1 Sensitivity analysis results

No.	Case	FIRR
1	Basic Case	4.7%
2	Where purchasing prices of white peaches produced by trustee farmers are lower by 5%	5.5
3	General and administrative expenses in the canning division are lowered by 5%	6.2
4	Where the growing of white peaches in 500-ha fields is entrusted simultaneously in the first year	6.1
5	Where white peaches are grown on commission in a total area of 650 ha, and shift from yellow peaches to white peaches is completed in five years (annual shift by 130 ha)	6.3
6	Where white peaches are grown in a 25-ha field under direct management, and the area for the entrusted growing of white peaches is increased by 75 ha in the first year to cover the reduced area of the field under direct management	4.9
7	Where general and administrative expenses in the canning division are reduced by 5%, purchasing prices for white peaches are reduced by 5%, white peaches are grown on commission in 200 ha, 200 ha, 200 ha and 69 ha every year from the first year, totaling to 669 ha, and the shift from yellow peaches to white peaches is thus completed in four years	9.4

③ Efforts are made to reduce production costs of white peaches. General and administrative expenses usually account for around 15% in the canning industry, but selling expenses can be restrained if the investing companies ensure purchasers. General and administrative expenses in the canning division can be reduced in this manner.

Table 4-5-2 Construction cost for vegetable/fruit processing

Item		Sum ($)	Service life (years)	Depreciation expense ($)	Repairing expense Rate (%)	Repairing expense ($)
1. Purchasing of site	4.000 m²	333.333	-	-	-	-
2. Production of raw materials						
a. Agricultural building	500 m²	71.000	25	2.840	2	1.420
b. Farm construction	100 ha	960.000	20	48.000	2	19.200
c. Agricultural machines and instruments	One set	68.000	7	9.714	3	2.040
3. Cannery						
a. Building	2.000 m²	350.000	25	14.000	2	7.000
b. Processing facilities	One set	1.100.000	7	157.143	2	22.000
c. Cold storehouse	One set	1.000.000	7	142.857	2	20.000
Total		3.882.333	-	374.554	-	71.660

Table 4-5-3 Quantities of raw materials and funding

Item	3 1987	4 1988	5 1989	6 1990	7 1991	8 1992	9 1993	10 1994	11 1995	12 1996	13 1997	14 1998	15-20 -2014
① Quantity of raw material (tons)	9.231	9.231	9.231	9.231	9.231	9.231	9.231	9.231	9.231	9.231	9.231	9.231	9.231
1. White peaches	-	-	-	-	1.200	2.200	3.400	4.800	6.000	6.600	7.000	7.200	7.200
a. Company-produced white peaches	-	-	-	-	600	800	1.000	1.200	1.200	1.200	1.200	1.200	1.200
b. White peaches produced by trustee farmers	-	-	-	-	600	1.400	2.400	3.600	4.800	5.400	5.800	6.000	6.000
2. Yellow peaches	9.231	9.231	9.231	9.231	8031	7.031	5.831	4.431	3.231	2.631	2.231	2.031	2.031
a. Yellow peaches produced by trustee farmers	5.000	5.000	5.000	5.000	5.000	5.000	4.000	4.000	3.231	2.631	2.231	2.031	2.031
b. Purchased yellow peaches	4.231	4.231	4.231	4.231	3.031	2.031	1.831	431	-	-	-	-	-
② Sum for raw material provisions (thousand dollars)	3.231	3.231	3.231	3.231	3.051	3.021	3.001	2.991	3.051	3.081	3.101	3.111	3.111
1. White peaches : entrusting 0.40 $/kg	-	-	-	-	240	560	960	1.440	1.920	2.160	2.320	2.400	2.400
2. Yellow peaches : entrusting 0.35 $/kg	1.750	1.750	1.750	1.750	1.750	1.750	1.400	1.400	1.131	921	781	711	711
purchasing 0.35 $/kg	1.481	1.481	1.481	1.481	1.061	711	641	151	-	-	-	-	-

Table 4-5-4 Sales of canned peaches

		3 1987	4 1988	5 1989	6 1990	7 1991	8 1992	9 1993	10 1994	11 1995	12 1996	13 1997	14 1998	15-20 - 2014
Total		10,000	10,000	10.000	10.000	10.260	10,477	10,737	11.040	11.300	11.430	11.517	11.560	11.560
White peach	1.20 $/PC (kg)	-	-	-	-	1.560	2,860	4,420	6.240	7,800	8.580	9.100	9.360	9.360
Yellow peach	1.00 $/PC (kg)	10,000	10,000	10.000	10.000	8.700	7.617	6.317	4.800	3.500	2.850	2.417	2,200	2,200

Table 4-5-5 Expenditures in vegetable/fruit processing

Item	1 1995	2 1996	3 1997	4 1998	5 1999	6 2000	7 2001	8 2002	9 2003	10 2004	11 2005	12 2006	13 2007	14 2008	15 -2014
- Total	23,300	47,522	10,417,747	10,440,613	10,463,479	10,486,345	10,509,212	10,532,078	10,554,944	10,577,810	10,577,810	10,577,810	10,577,810	10,577,810	10,577,810
① Canning cost	-	-	7,099,928	7,099,928	7,099,928	7,099,928	7,099,928	7,099,928	7,099,928	7,099,928	7,099,928	7,099,928	7,099,928	7,099,928	7,099,928
1. General and administrative expenses	-	-	926,078	926,078	926,078	926,078	899,078	894,578	891,578	890,078	899,078	903,578	906,578	908,078	908,078
2. Purchasing of main raw material	-	-	3,230,850	3,230,850	3,230,850	3,230,850	3,050,850	3,020,850	3,000,850	2,990,850	3,050,850	3,080,850	3,100,850	3,100,850	3,110,850
3. Purchasing of secondary raw material	-	-	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000	240,000
4. Cans	-	-	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000	1,800,000
5. Light, fuel and power expenses	-	-	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000
6. Labor expenses	-	-	440,000	440,000	440,000	440,000	440,000	440,000	440,000	400,000	440,000	440,000	440,000	440,000	440,000
a. Full-time	-	-	330,000	330,000	330,000	330,000	330,000	330,000	330,000	330,000	330,000	330,000	330,000	330,000	330,000
b. Temporary	-	-	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000	110,000
7. Repairing expense	-	-	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000	49,000
8. Depreciation expense	-	-	314,000	314,000	314,000	314,000	314,000	314,000	314,000	314,000	314,000	314,000	314,000	314,000	314,000
② Expenses for canned peach transportation	-	-	3,172,000	3,172,000	3,172,000	3,172,000	3,172,000	3,172,000	3,172,000	3,172,000	3,172,000	3,172,000	3,172,000	3,172,000	3,172,000
③ Production cost of main raw material (i.e., peaches)	23,300	47,522	145,819	168,685	191,552	214,418	237,284	260,150	283,017	305,883	305,883	305,883	305,883	305,883	305,883
1. General and administrative expenses	-	-	13,256	15,335	17,414	19,493	21,571	23,650	25,729	27,808	27,808	27,808	27,808	27,808	27,808
2. Current goods expenses	-	-	19,088	34,250	49,413	64,575	79,738	94,900	110,063	125,225	125,225	125,225	125,225	125,225	125,225
a. Fertilizer	-	-	8,000	16,000	24,000	32,000	40,000	48,000	56,000	64,000	64,000	64,000	64,000	64,000	64,000
b. Pesticides	-	-	3,750	7,500	11,250	15,000	18,750	22,500	26,500	30,000	30,000	30,000	30,000	30,000	30,000
c. Light, fuel and power expenses	-	-	3,413	6,825	10,238	13,650	17,063	20,475	23,888	27,300	27,300	27,300	27,300	27,300	27,300
d. Irrigation expense	-	-	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925	3,925
3. Labor expenses	-	-	6,961	12,585	18,211	23,836	29,461	35,086	40,711	46,336	46,336	46,336	46,336	46,336	46,336
a. Full-time	-	-	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336	1,336
b. Temporary	-	-	5,625	11,250	16,875	22,500	28,125	33,750	39,375	45,000	45,000	45,000	45,000	45,000	45,000
4. Land rent	23,300	23,300	23,300	23,300	23,300	23,300	23,300	23,300	23,300	23,300	23,300	23,300	23,300	23,300	23,300
5. Repairing expense	-	-	22,660	22,660	22,660	22,660	22,660	22,660	22,660	22,660	22,660	22,660	22,660	22,660	22,660
6. Depreciation expense	-	24,222	60,554	60,554	60,554	60,554	60,554	60,554	60,554	60,554	60,554	60,554	60,554	60,554	60,554

Table 4-5-6 Statement of profit and loss, and table of cash conditions in vegetable/fruit processing

Unit: thousand dollars

	1 1995	2 1996	3 1997	4 1998	5 1999	6 2000	7 2001	8 2002	9 2003	10 2004	11 2005	12 2006	13 2007	14 2008	15 2009	16 2010	17 2011	18 2012	19 2013	20 2014
Statement of profit and loss																				
1. Income (proceeds from canned provisions)	-	-	10.000	10.000	10.000	10.000	10.260	10.477	10.737	11.040	11.300	11.430	11.517	11.560	11.560	11.560	11.560	11.560	11.560	11.560
2. Expenditures	-	52	10.427	10.450	10.472	10.495	10.311	10.298	10.298	10.308	10.377	10.411	10.433	10.444	10.433	10.433	10.442	10.442	10.441	11.440
a. Canning expense	-	-	6.737	6.737	6.737	6.737	6.530	6.495	6.472	6.461	6.530	6.564	6.587	6.599	6.599	6.599	6.599	6.599	6.599	6.599
b. Expense for transportation of canned provisions	-	-	3.172	3.172	3.172	3.172	3.172	3.172	3.172	3.172	3.172	3.172	3.172	3.172	3.172	3.172	3.172	3.172	3.172	3.172
c. Production cost of main raw materials	23	23	63	85	108	131	154	177	200	223	223	223	223	223	223	223	223	223	223	223
d. Repairing expense	-	-	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72	72
e. Depreciation expense	-	24	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375	375
f. Interest	-	5	9	9	9	9	8	8	7	7	6	5	5	4	4	3	2	2	1	1
3. Profit before depreciation and interest payment	-	-23	-43	-66	-89	-112	322	561	821	1.113	1.304	1.399	1.403	1.495	1.495	1.495	1.495	1.495	1.495	1.495
4. Net profit	-	-52	-427	-450	-472	-495	-51	178	439	732	923	1.019	1.084	1.116	1.117	1.117	1.118	1.118	1.119	1.120
5. Corporate tax	-	-	-	-	-	-	-	88	216	360	454	502	533	549	550	550	550	550	551	551
6. Net profit after taxes	-	-52	-427	-450	-472	-495	-51	91	223	371	469	518	550	567	567	567	568	568	568	569
7. Total loss after taxes	-	-52	-479	-928	-1.401	-1.896	-1.947	-1.769	-1.330	-598	325	1.344	2.428	3.544	4.060	5.778	6.895	8.014	9.133	10.252
Table of cash position																				
1. Sources	1.600	2.282	0	-	-	80	324	465	597	1.101	843	892	925	941	942	942	942	942	943	943
a. Own funds	1.000	1.710	52	75	98	201	-	-	-	355	-	-	-	-	-	-	-	-	-	-
b. JICA funds	600	600	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
c. Internal funds generated in the current term	-	-28	-52	-75	-98	-121	324	465	597	746	843	892	925	941	942	942	342	942	943	943
2. Use of funds	1.553	2.329	-	-	-	80	80	80	80	2.248	80	80	80	80	80	80	2.248	80	80	80 80
a. Construction	1.553	2.329	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
b. Refunding	-	-	-	-	-	-	-	-	-	2.168	-	-	-	-	-	-	2.168	-	-	-
c. Repayment of JICA funds	-	-	-	-	-	80	80	80	80	80	80	80	80	80	80	80	80	80	80	80
3. Total own funds	1.000	2.710	2.762	2.837	2.935	3.136	3.136	3.136	3.136	3.492	3.492	3.492	3.492	3.492	3.492	3.492	3.492	3.492	3.492	3.492
4. Outstanding JICA funds at the term end	600	1.200	1.200	1.200	1.200	1.120	1.040	960	880	800	720	640	560	480	400	320	240	160	80	-
5. Accumulated internal funds after taxes	47	0	-	-	-	-	244	629	1.147	-	763	1.575	2.420	3.281	4.143	5.005	3.699	4.561	5.424	6.287

Notes: 1) Conditions of JICA funding
- Interest 0.75%
- Moratorium 5 years
- Repayment period 20 years (including moratorium)

2) Corporate tax 49.22%

3) Internal funds generated in the current term = Net profit after taxes + Depreciation expense

4-6. Recommendations

Recommendations are made as follows, on the basis of the study results, regarding the accumulation of data on agricultural management, trial marketing, partners of joint venture, and the commercialization of seed production.

4-6-1. Promotion of Activity

Plans for fresh vegetable/fruit production and vegetable/fruit processing have been studied in this report. The financial internal rate of return (FIRR) after taxes is 14.3% in the production of fresh vegetables/fruits, while an FIRR of about 10% can be ensured in the processing of vegetables/fruits, through cost reduction, early shift from yellow peaches to white peaches, etc.

These study results show the plan's implementation is feasible, and it is hoped that the plan will be implemented as early as possible.

4-6-2. Accumulation of Data on Agricultural Management

Under the "Trial Agricultural Development Project for Semiarid Areas", which is under way in the Republic of Turkey, the establishment of technologies for vegetable/fruit growing and the collection of relevant data and information have been promoted. It takes, however, more time until sufficient data become available for identifying payability of certain items of products. It is recommended that more data on agricultural management be collected.

Items for which more data are needed include kiwi fruit, pears of Japanese varieties, persimmons, and broccoli.

4-6-3. Trial Marketing

Among the items studied in this report, items which are not familiar in Germany and Turkey are included, such as Japanese radishes, pears (Japanese varieties), and persimmons (Japanese varieties). It is too risky to estimated marketability of these items only on the basis of payability. It is significant first to understand German and Turkish people's preference for vegetables and fruits. Even if these items are accepted by German and Turkish consumers, careful pricing is necessary, without determining their prices on the basis of domestic prices in Japan. Data need to be collected through trial marketing.

Trial marketing is significant also in that the quality of vegetables and fruits produced in the experiment field are evaluated in the market and given selling prices accordingly.

With this being taken into consideration, net melons and Japanese radishes produced in the JICA verification farm are on the market on a trial basis in Amsterdam and Istanbul, respectively. It is recommended that trial marketing of Japanese pears, peaches, kiwi fruit, etc., be conducted in suitable markets, for the purpose of identifying payability and reasonable selling prices of these products. It is also expected that trial marketing will enable more accurate estimation of distribution costs.

4-6-4. Partners of Joint Venture

The Government of the Republic of Turkey is now formulating its Seventh Five-year Development Plan, and an agricultural development program will be formulated in accordance with the Five-year Plan. Although the Turkish government says there are no significant changes from the previous plans, it is necessary to be informed of the contents of the Plan and the programmes their formulation is finished.

As the Government of Turkey intends to promote the privatization of the public sector in its Plan, it is important to ascertain what operational policy TIGEM will employ. There is the possibility that TIGEM will become a partner of joint venture, depending on details of its operational policy.

4-6-5. Selection of Seed Production Sites

As mentioned earlier, the land of Turkey is generally suitable for seed production. Commercialization of the production of a variety of seeds is possible, without being limited to the items studied in this report. Many companies from industrialized countries are engaged in seed production in Turkey, and some Japanese companies are doing business there.

Meteorological conditions, however, differ from place to place in Turkey, and suitable production sites for specific varieties differ accordingly. It is recommended therefore that the commercialization of seed production be promoted by selecting joint venture partners most suitable for the production of specific varieties of seeds and efficiently utilizing their know-how and information. Partners need not be limited to those in the Adana district, and suitable sites for seed production need to be selected nationwide.

[5]   Manual

[5] Manual

5-1. Vegetables Farming Manual

5-1-1. Tomatoes

(1) Methods of Cultivation

Perform sowing in the latter half of January and raise seedlings in unheated greenhouses. In the latter half of March, plant seedlings in mulched open-fields without support. Gather harvest during the period from the end of May through the latter half of July.

1) Raising of Seedlings and Setting

Sow seeds in row in sowing boxes placed in a heated greenhouse. After germination, store the seedlings under an unheated polyvinyl tunnel in the greenhouse and then transplant the seedlings into black plastic pots 12 cm in diameter. Plant seedlings in the ground before or after the first flower bud blooms. Use a mixture of manufactured peat moss and field soil as a bed soil. Plant seedlings at the spacing of 50 cm x 160 cm at the rate of 1,250 plants per 10 a., but raise 20% extra seedlings, at the rate of 1,500 per 10 a. Cover the 80 cm wide semicylindrical ridges with black mulching film, and provide watering by means of a drip irrigation system using tubes placed under the mulching.

2) Field Husbandry and Management

Do not thin or pinch the tops of plants, leave plants as natural. Spray chemicals to kill aphids and prevent various bacterial diseases at a frequency of once a week or once every two weeks. Perform watering as required, checking the operating condition of pump and the irrigation system.

3) Harvesting and Shipping

Gather harvest at the rate of once a week. Pack fruits after simple selection in wooden boxes, and ship them by trucks. Limit the point of shipping to the local wholesale market in Adana.

(2) Cultivation Cost

Cultivation costs were calculated based on the data gathered from the 0.5 hectare field cultivated in 1993, on the assumption a field of one hectare would be cultivated. As funds to be required for the initial year, estimation was made on expenditures to be made at the first year of cultivation without a depreciation. Annual funds in the following years were simply calculated with the cost of facilities and equipment to be continuously used divided by the life cycle. Taxes are not included in the costs. (Normally a 15% excise tax is imposed.) The unit cost of expenditures was expressed by dollar values exchanged at the rate when payment was actually made or quotations were obtained. The cost concerning the land utilization was not appropriated for calculation.

1) Material Cost

a. Greenhouse Construction Materials (see Table 5-1-1)

Use continuous-roof steel pipe houses consisting of individual units 5 m wide and 42 m long, 210 m^2 in area. The life span of greenhouses is set to 10 years. Replace the polyvinyl covering every year.

Table 5-1-1 Greenhouse construction materials cost

Description	Unit Price	Quantity	Cost/Year
House materials	$ 3,370	6 continuous-roof units	$ 337 (3,370)
Replacement covers	1.97/m	0.3 mm x 6.4 m x 400 m	788

Note: ( ) shows the initial investment.
Total initial investment = $4,158
Annual cost = $1,125

b. Materials for Raising of Seedling (see Table 5-1-2)

Install a small bamboo shed, heated by a small panel heater, within the greenhouse described in a. above. Place seedlings after germination and those after transplanting under control in 12 tunnels, 1.5 m wide and 40 m long, located in the greenhouse. Use polyvinyl covering sheets used for greenhouse in the previous year as a tunnel covers in the second year and later. Use wooden boxes for harvesting as seedbeds only one time. Use black plastic pots, 12 cm in diameter, made in Japan. Double the Japan price of the plastic pots for estimation, with a depreciation of 5 years.

Table 5-1-2 Cost of materials required for raising of seedlings

Description	Unit Price	Quantity	Cost/Year
Seeds (Kagome 77)	$ 900/kg	15,000	$ 45
Seedbed box	0.58	100	58
Plastic pot	0.07	15,000	210 (1,050)
Peat moss	0.19/l	80 l x 115	1,748
Chemicals	16/cycle	3 cycles	48
Fertilizer (liquid fertilizer)	2.5/kg	4 kg	10
Steel wires (for tunnel supports)	0.43/kg	6 mm x 2.7 m x 480	25 (124)
Covering (initial year only)	0.46/m	0.1 mm x 2.7 m x 500	23 (230)
Heater	133/unit	6	114 (798)
Shoulder-type sprayer	83/unit	2	55 (166)
Custodial materials (hoses, etc.)		As required	50

Note: ( ) shows the initial investment.
Total initial investment = $4,971
Annual cost = $2,386

Plastic pots can be manufactured in Turkey on custom orders, therefore, transportation cost is not added. The depreciation of tunnel supports was set to 5 years, heaters to 7 years, and sprayers to 3 years.

c. Field Materials (see Table 5-1-3)

Construct fields in rectangular shapes 100 m wide and 105 m long (including the center road of 5 m wide), with a total of 124 ridges, 50 m long, uniformly divided on both sides of the center road. Dispose of mulching after each use. Assume the irrigation system includes all accessories such as filters, water flow meters, and valves, except for a pump that is to be located at a point 100 m away from the fields, and has a depreciation of 5 years. Pumps shall have a 7 years depreciation. Include water and all energy costs such as electrical costs in the material cost.

Table 5-1-3 Cost of materials for preparation of fields

Description	Unit Price	Quantity	Cost/Year	
Black mulching film	$ 0.15/m	52 m x 124 rows	$ 967	
Fertilizer	0.32/kg	100: 200: 100 kg	380	
Barnyard manure	38/ton	20 tons	760	
Chemicals	123	5 times	615	
Drip irrigation system	4,386	1 set	877	(4,386)
Pump (15 kw)	1,230	1 unit	178	(1,230)
Water	2.8/10 a.	1 ha	28	
Electrical power	0.03/kWh	64 hrs.	30	

Note: ( ) shows the initial investment.
Total initial investment = $8,396
Annual cost = $3,835

d. Shipping Materials (see Table 5-1-4)

Use wooden boxes used for domestic markets on shipping. Prepare materials of a sufficient quantity to handle three shipments, of 6 tons for each. Collect all used boxes from the market and recycle them for two years.

Table 5-1-4 Shipping materials cost

Description	Unit Price	Quantity	Cost/Year
Wooden box	$ 0.85	900	$ 382 (765)
Custodial materials (including buckets)		As required	50

Note: ( ) shows the initial investment.
Total initial investment = $814
Annual cost = $432

2) Equipment and Machinery

a. Machines for raising of seedling

Do not include the cost of machines because seeding and raising operations are performed by hand, without using soil block machines.

b. Operation Equipment (see Table 5-1-5)

The cost of equipment, including tractors and various attachments, should be based on the assumption such equipment is leased from TIGEM, an owner of equipment. The estimation has been obtained based on the unit lease price and the work load required. For ridging machine, attachments from Japan were used, but the cost estimate is based on the lease of a rotary ridging machine owned by TIGEM. The cost for lease of tractor ($12/hr) and operator ($2/hr) is included. In the case of the joint contract with TIGEM, the unit price is discounted to a half of the standard price.

Table 5-1-5 Operation equipment cost

Description	Unit Price	Working Hours	Cost/Year
Sub-soiler	$ 3.0/hr.	14.5	$ 243 (121)
Disc-harrow	1.0/hr.		
Rotary	3.5/hr.		
Ridging machine	3.5/hr.		
Water storage tank	2.6/hr.	8	133 (85)
Trailer	3.2/hr.	8	138 (90)
Power sprayer	4.9/hr.	40	756 (516)

Note: ( ) shows the lease price discounted by TIGEM.
Annual cost = $1,270 ($812)

c. Harvesting and Shipping Equipment (see Table 5-1-6)

Trucks will be hired from shipping agents.

Table 5-1-6 Harvesting and shipping equipment cost

Description	Unit Price	Working Hours	Cost/Year
Truck	$ 77/6 ton	13 times	$ 1,001

Note: Annual cost = $1,001

3) Labor Cost

Labor cost has been estimated based on the minimum wage (gross pay) applied for common worker in Turkey. The listed below is the labor cost of employees actually working, and does not include the cost of engineers.

a. Raising of Seedling (see Table 5-1-7)

Table 5-1-7 Labor cost for raising of seedlings

Description	Unit Price	Working Hours	Cost/Year
Preparation for sowing	$ 7.5/8hrs.	7	$ 7
Sowing work	7.5/8hrs.	15	14
Raising of seedlings	7.5/8hrs.	560	525

Note: Annual cost = $546

The cost for raising of seedlings has been estimated, including the labor cost required from sowing to planting, watering, and the disinfection.

b. Field Management (see Table 5-1-8)

Labor cost required for various tasks in fields other than harvesting is calculated. Preparation of fields includes the labor cost of assistants to be engaged in the installation of materials required for construction of irrigation system and mulching tunnels, and in the spraying of chemicals by tractors.

Table 5-1-8 Labor cost for field management work

Description	Unit Price	Working Hours	Cost/Year
Preparation of fields	$ 7.5/8hrs.	34	$ 32
Planting	7.5/8hrs.	320	300
Management of fields	7.5/8hrs.	80	75
Management of irrigation system	7.5/8hrs.	40	38
Spray of chemicals	7.5/8hrs.	200	188

Note: Annual cost = $633

c. Shipping Work (see Table 5-1-9)

Shipping work includes all work processes from harvesting, selection of fruits in fields, packing, and loading on trucks.

Table 5-1-9 Labor cost for shipping work

Description	Unit Price	Working Hours	Cost/Year
Harvesting	$ 7.5/8hrs.	1,400	$ 1,312
Fruit selection and handling	7.5/8hrs.	1,500	1,406

Note: Annual cost = $2,718

(3) Farming Estimate

1) Sales Revenue (see Tables 5-1-10 and 5-1-11)

Test sales of tomatoes were conducted with the 1993 spring crop. Since the scale of transactions was too small to use as basic data, estimation was made based on the whole sale price at the Adana Wholesale Market. The wholesale prices between the months of June and July of the year were as shown in Table 5-1-10. Estimation was made based the average price of TL 25,000, taken from the prices on the first day and 10th day of the peak price zone before June 10. In the following period, the reference price was revised based on the average price for every 10 days. The shipping record of Kagome 77 (No.2)from the 1993 testing for the selection of varieties was used for the estimation of shipping weight. Estimated shipping weight was calculated based on the weight of 80% of estimated yield. As a result, estimated shipping weight of tomatoes per every hectare totals 83,048 kg and amounts TL 677,110,000. Since tax is deducted at the rate 18%, and labor cost is deducted for each box from this amount, approximate net revenue totals TL 542,780,000. This is equivalent to US$ 12,335 at the exchange rate of June 9 and July 31.

Table 5-1-10 Wholesale price of tomatoes in 1995 (Adana)

TL/kg

	6/1	6/10	6/21	7/1	7/10	7/21
House products	12,000	38,000				
Open-field products			5,000	5,000	6,000	5,000

Table 5-1-11 Estimated proceeds

	Shipment before 6/1	Proceeds	Shipment after 6/12	Proceeds
Kagome 77	12,208 kg	TL 305,200,000 $ 7,102	70,840 kg	TL 371,910,000 $ 8,285

Note: Gross Proceeds = TL 677,110,000
$ 15,387
Net Revenue = TL 542,780,000
$ 12,335

2) Profit and Loss

Revenue and expenditures were obtained from the sales revenue, described in (3) - 1) above, with cultivation costs deducted. The total annual cost of construction materials, equipment and machinery, and labor reaches $7,778, $2,271, and $3,897, respectively. Cultivation cost totals $13,946. If watering is performed by the furrow irrigation method, cost of materials required for construction of drip irrigation system, equivalent to $877, can be deducted. If it is assumed that a joint contract is agreed with TIGEM, cost of equipment and machinery can be saved by $458, and annual cost can be reduced to $12,611. The initial investment with out depreciative calculation totals $22,759. Net processes estimated based on the wholesale price of tomatoes at the Adana Wholesale Market in 1995 totals $12,335. After cultivation costs of $12,611 (reduced cost) is deducted from the net proceeds, the amount of $276 is left as a loss. Calculation shows that a loss of $276 can be obtained from cultivation of a one hectare farm field, but this loss can be obtained only when tomatoes are dealt at the whole sale price between $0.58/kg and $0.11/kg. It will be necessary to continue analyses to verify the future variations of the wholesale price of tomatoes.

5-1-2. Melons

(1) Methods of Cultivation

Perform sowing in the latter half of February and raise seedlings in unheated greenhouses. In early April, plant seedlings in mulched open-fields without support. Gather harvest during the period from the middle of June through early July.

1) Raising of Seedlings and Setting

Sow seeds in rows in sowing boxes placed in a heated greenhouse. After germination, store the seedlings under an unheated polyvinyl tunnel in the greenhouse and then transplant the seedlings into black plastic pots 12 cm in diameter. Plant seedlings after the tops of seedlings are pinched, leaving four foliage leaves, to the field. Use a mixture of manufactured peat moss and field soil as a bed soil. Plant seedlings at a spacing of 60 cm x 250 cm at the rate of 666 plants per 10 a., but raise 20% extra seedlings, for a rate of 800 per 10 a. Cover the 135 cm wide level rows with mulch and tunnel, and provide watering by means of a drip irrigation system using tubes placed under the mulch.

2) Field Husbandry and Management

Train plants in two-branch and one-way trimming. Perform fruit thinning, leaving two fruits per one branch.Spray chemicals to kill aphids and prevent downy mildew at a frequency of once a week or every two weeks. Perform watering as required, checking the operating conditions of pump and irrigation system.

3) Harvesting and Shipping

Gather harvest after sugar content has been checked. Pack fruits after simple selection in wooden boxes and ship them by trucks. Deliver packages to the packing yard of the export agent in Mersin. Product is repacked and shipped to Germany.

(2) Cultivation Cost

Cultivation cost was estimated on the assumption that a field of one hectare was cultivated, using the cost data of materials, equipment and machinery, and labor actually used for the cultivation of the 0.8 hectare field, including various tests carried out in 1995. The initial investment at the start of cultivation without depreciate calculation was estimated. Annual cost was obtained with all items to be continuously used divided by the life span. Taxes are not included in the cost. (Normally a 15% excise tax is imposed.) Unit price was expressed by US dollars at the exchange rat eon the day of actual payment or on the day of receipt of quotation. The cost concerning the land utilization was not appropriated for calculation.

1) Material Cost

a. Greenhouse Construction Materials (see Table 5-1-12)

Table 5-1-12 Greenhouse construction materials cost

Description	Unit Price	Quantity	Cost/Year
House materials	$ 2,264	4 continuous-roof units	$ 226 (2,264)
Replacement covers	1.97/m	0.3 mm x 6.4 m x 300 m	591

Note: ( ) shows the initial investment.
Total initial investment = $2,855
Annual cost = $817

Use continuous-roof steel pipe houses consisting of individual units 5 m wide and 42 m long, 210 m² in area. The life span of greenhouse is set at 10 years. Replace polyvinyl covering every year.

b. Materials for Raising of Seedling (see Table 5-1-13)

Install a small bamboo shed, heated by a small panel heater, within the greenhouse described in a. above. Place seedlings after germination and those after transplanting under control in 12 tunnels, 1.5 m wide and 40 long, located in the greenhouse. Use polyvinyl greenhouse covers used in the previous year as a tunnel mulching in the second year and later. Use wooden boxes for harvesting as seedbeds only one time. Use 12 cm diameter black plastic pots, made in Japan. Double the Japan price of the plastic pot for estimating purposes, with the life span set to 5 years. Plastic pots can be manufactured in Turkey on custom orders, therefore, transportation cost is not added. The life span of tunnel supports was set to 5 years, heaters to 7 years, and sprayers to 3 years.

Table 5-1-13 Cost of materials required for raising of seedlings

Description	Unit Price	Quantity	Cost/Year
Seeds (Bardi Red)	$ 35.4/100	8,000	$ 2,832
Seedbed box	0.58	80	46
Plastic pot	0.07	8,000	112 (560)
Peat moss	0.07/l	80 l x 61	343
Chemicals	16/cycle	3 cycles	48
Fertilizer (liquid fertilizer)	2.5/kg	4 kg	10
Steel wires (for tunnel supports)	0.43/kg	6 mm x 2.7 m x 280	15 (72)
Covering	0.46/m	2.7 m x 300 m	14 (138)
Heater	133/unit	6	114 (798)
Shoulder-type sprayer	83/unit	2	55 (166)
Custodial materials (hoses, etc.)		As required	50

Note: ( ) shows the initial investment.
Total initial investment = $5,063
Annual cost = $3,639

c. Field Materials (see Table 5-1-14)

Construct fields in a rectangular shape, 100 m wide and 105 m long (including a 5 m wide center road with a total of 74 ridges 50 m long uniformly divided to both sides of the center road. Dispose of mulching after each use. Assume the irrigation system includes all accessories such as filters, water flow meters, and valves (but not the pump which is to be 100 m away from the fields), and that accessories have a life span of 5 years. Pumps shall have a 7 years life span. Melon pads are planned to be manufactured in Turkey at a price two times that of those made in Japan. The life span for melon pads was set to three years.

Table 5-1-14 Cost of materials for preparation of fields

Description	Unit Price	Quantity	Cost/Year
Polyvinyl mulching film	$ 0.45/m	52 m x 74 rows	$ 1,731
Covering	0.31/m	54 m x 74 rows	1,238
Steel wires (for tunnel supports)	0.43/kg	6 mm x 2.7 m x 3,330	172 (858)
Melon pads	0.06/piece	27,000	540 (1,620)
Fertilizer	0.32/kg	100: 200: 100 kg	380
Barnyard manure	38/ton	20 tons	760
Chemicals	123	8 times	984
Drip irrigation system	3,887	1 set	777 (3,887)
Pump (5.5 kw)	730	1 unit	104 (730)
Water	2.8/10 a.	1 ha	28
Electrical power	0.03/kWh	63 hrs.	14

Note: ( ) shows the initial investment.
Total initial investment = $12,230
Annual cost = $6,728

d. Shipping Materials (see Table 5-1-15)

Use wooden boxes that are normally used in domestic markets for shipping. Prepare materials of a sufficient quantity to handle three shipments of 10 tons for each. Collect all used boxes from the market and recycle them for two years.

Table 5-1-15 Shipping materials cost

Description	Unit Price	Quantity	Cost/Year
Wooden box	$ 0.58	800	$ 232 (464)
Custodial materials (including buckets)		As required	50

Note: ( ) shows the initial investment.
Total initial investment = $514
Annual cost = $282

2) Equipment and Machinery

a. Machines for raising of seedling

Do not include the cost of machines because seeding and raising operations are performed by hand without using soil block machines.

b. Operation Equipment (see Table 5-1-16)

The cost of equipment, including tractors and various attachments, should be based on the assumption that such equipment is leased from TIGEM, an owner of equipment. An estimate has been obtained based on the unit lease price and the workload required. For ridging machine, attachments from Japan were used, but the cost estimate is based on the lease of a rotary ridging machine owned by TIGEM. The cost for lease of tractor ($12/hr) and operator ($2/hr) is included. In the case of a joint contract with TIGEM, the unit price is discounted to a half of the standard price.

Table 5-1-16 Operation equipment cost

Description	Unit Price	Working Hours	Cost/Year
Sub-soiler	$ 3.0/hr.		
Disc-harrow	1.0/hr.	6.8	$ 114 (73)
Rotary ridging machine	3.5/hr.		
Ridging machine	3.5/hr.		
Water storage tank	2.6/hr.	8	132 (85)
Trailer	3.2/hr.	8	89 (137)
Power sprayer	4.9/hr.	32	605 (413)

Note: ( ) shows the lease price discounted by TIGEM.
Annual cost = $940 ($708)

c. Harvesting and Shipping Equipment (see Table 5-1-17)

Trucks will be hired from transportation agents.

Table 5-1-17 Harvesting and shipping equipment cost

Description	Unit Price	Working Hours	Cost/Year
Truck	$ 133/5 ton	6 times	$ 798

Note: Annual cost = $798

3) Labor Cost

Labor cost has been estimated based on the minimum wage (gross pay) applied for common labor in Turkey. The list below shows the labor cost of employees actually working, and does not include the cost of engineers.

a. Raising of Seedling (see Table 5-1-18)

The cost for raising of seedlings has been estimated, including the labor cost required, from sowing to planting, watering, and the disinfection.

Table 5-1-18 Labor cost for raising of seedlings

Description	Unit Price	Working Hours	Cost/Year
Preparation for sowing	$ 7.5/8hrs.	4	$ 4
Sowing work	7.5/8hrs.	32	30
Preparation for transplanting	7.5/8hrs.	70	65
Transplanting work	7.5/8hrs.	120	112
Raising of seedlings	7.5/8hrs.	480	450

Note: Annual cost = $661

b. Field Management (see Table 5-1-19)

Labor cost required for various tasks in fields other than harvesting is calculated. Preparation of fields includes the labor cost of assistants to be engaged in the installation of materials requires for construction of irrigation system and mulching tunnels, and in the spraying of chemicals by tractors.

Table 5-1-19 Labor cost for field management work

Description	Unit Price	Working Hours	Cost/Year
Preparation of fields	$ 7.5/8hrs.	450	$ 422
Planting	7.5/8hrs.	600	562
Trimming and Fruit selected	7.5/8hrs.	374	350
Management of fields and irrigation system	7.5/8hrs.	480	450
Spray of chemicals	7.5/8hrs.	128	120

Note: Annual cost = $1,904

c. Shipping Work (see Table 5-1-20)

Shipping work including all processes from harvesting, selection of fruits in fields, packing, and loading on trucks.

Table 5-1-20 Labor cost for shipping work

Description	Unit Price	Working Hours	Cost/Year
Harvesting, Fruit selection and handling	$ 7.5/8hrs.	580	$ 543

Note: Annual cost = $543

(3) Farming Estimate

1) Sales Revenue

Test sales of melons were conducted from the 1994 spring crop. Estimated revenue from shipment to domestic markets and from exports to Germany was obtained based on the sales record of 1995. As this sales record is published in the Comprehensive Reports, Appendix [4] 2-6 (2) -2), the description is omitted. Estimate was expressed in US$ at the exchange rate of July 12, 1995. Shipping weight was estimated at the rate of 80% of expected yield calculated from the result of 1995. As a result, the yield of melons per every hectare totaled 31.04 tons and gross proceeds totaled TL 992,827,033 ($22,322) in Istanbul. Net revenue totaled TL 903,637,120 ($20,317) after all expenditures including fees and taxes were deducted. Gross proceeds from the export to Germany totaled DM 50,341 ($35,855) and net revenue DM 38,946 ($27,739).

2) Profit and Loss

Revenue and expenditures were obtained from the sales revenue, described in (3)-1) above, with cultivation cost deducted. The total annual cost of construction materials, equipment and machinery, and labor reaches $12,050, $1,738, and $3,108, respectively. Cultivation cost totals $16,896. If it is assumed that a joint contract is agreed with TIGEM, cost savings for equipment and machinery will be $232,and annual cost can be reduced to $16,664. Reviewing the proceeds estimated from the test sales of melons in 1995, net revenue from transactions in Istanbul totals $20,317 and $27,739 from transactions in Germany. Since the truck transportation cost is based on the assumption that shipment is made to Germany, a profit of $10,843 is left after this cost is deducted from the net revenue obtained from the exports to Germany. Estimated profit in the case there is a joint contract agreed with TIGEM becomes $11,075. Shipping cost is slightly different, but after the net revenue obtained from Istanbul with this cost deducted, $3,653 is left as profit.

5-1-3. Daikon(Japanese Radish)

(1) Cultivation Method

Perform seeding in the beginning of September through the beginning of October under the open-field culture, and harvest in the beginning of November through the later part of January.

1) Seeding

The seed shall be planted by the manual seeder, and the plant distance shall be 80 cm x 30 cm, and the number of plants shall be 4,166 per 10 a. The ridge shall be high triangular shape with the width of 60 cm, and furrow of 20 cm. The fertilizers shall be given in the ratio of 15:20:15 kg/10 a.

2) Field Husbandry and Management

Thinning and weeding shall be carried out between the intervals of irrigation. Chemical spraying shall be carried out once or twice for aphid in the initial stage of cultivation. The irrigation shall be carried out as occasion call by using a overhead boom-type sprinklers.

3) Harvesting and Shipment

Harvesting shall be carried out at any time. After the radishes are pulled out, the leaves shall be cut off by leaving approximately 10 cm in the field. Then, they are transported to the washing place, and after being roughly washed by the water pressured by a pump, they shall be washed again by hand for finish. They shall be packed in a plastic bag or wooden box for shipment,depending on the market demand. The shipment volume shall be 3.8 tons per 10 a.

(2) Cultivation Cost

The cost calculation shall be based on the cultivation in one hectare, and was based on the data of materials, equipment and labor force on cultivation of 5.7 hectares in 1995 including a variety of testing. The overhead boom-type sprinkler was actually used as the irrigation method, but the data assuming the use of normal sprinkler was used for calculation of the cost. However, as a reference, the cost of the overhead boom-type sprinkler was also described in the list (with the * mark). As the cost in the initial year, the general cost at the start of cultivation without consideration to the number of depreciating years was calculated. The cost divided by the number of depreciating years was calculated as the yearly cost concerning the equipment to be used continuously. The cost does not include the taxes. (Usually, 15% of the excise tax is imposed.) The prices are indicated in the US dollars at the rate when the payment was actually made or estimation was made. The cost concerning the land utilization was not appropriated for calculation.

1) Material Cost

a. Field Materials (see Table 5-1-21)

The shape of field shall be rectangular with the width of 51 meters and the length of 208 meters. The ridges shall be made to the direction of the longer edge, and a passage with the width of 3 meters shall be made in the center for the overhead boom-type sprinkler. When the irrigation boom is used, the pump shall not be automatically operated, but be manually operated by an operator. The transportation and setting of the boom shall be carried out by one tractor with a operator and three assistants. Concerning the cost when the normal sprinkler is used, it was assumed that the irrigation pump is installed at the point 100 meters distant from the field, and that it can irrigate the whole one hectare at on time. The price

Table 5-1-21 Field materials cost

Description	Unit Price	Quantity	Cost/Year
Seed (Mikura Cross)	$ 20/100 g	2,400 g	$ 480
Seed (Fukumi)	41/2 dl	2,400 g	703 (+ shipping cost)
Fertilizer	0.32 kg	150:200:150 kg	345
Manure	38/ton	20 tons	760
Chemicals	25	Once	25
Manual seeder	320/unit	2 units	128
Sprinkler	4,090	1 unit	409 (4,090)
Pump (28.5 HP)	3,774	1 unit	377 (3,774)
Water fee	2.8/10 a.	1 ha	28
Fuel	0.47/l	63 hrs.(126 l)	60
Management materials (Weeding equipment, etc.)		Appropriate	300

Note: ( ) shows the initial investment.
Total initial investment = $9,990
Annual cost: $2,912

of the normal sprinkler was used for calculation of the cost. As for seeds, the prices of the Japanese variety which can be purchased in Turkey from 1995 and another Japanese variety with excellent testing results were described respectively. But, in cost calculation, the prices of the locally marketed species were used. The manual seeder is a Japanese product, but the price in Japan was described without including the transportation cost with depreciation in five years.

b. Shipping Materials (see Table 5-1-22)

Wooden boxes or plastic bags shall be used for shipping. As for the quantity, one shipment shall be 10 tons and the materials shall not be recollected. The cost of wooden boxes was appropriated for in cost calculation.

Table 5-1-22 Shipping materials cost

Description	Unit Price	Quantity	Cost/Year
Wooden box	$ 1.0	1,520	$ 1,520
Plastic bag	11/100	1,730	190

Note: Annual cost = $1,520

2) Equipment and Machinery

a. Operation Equipment (see Table 5-1-23)

The costs of tractors and all kind of attachments were calculated on the basis of the unit price and work load when the equipment owned by TIGEM were rented out. The Japan-made attachment was used for the ridge-making, but the usage cost of the TIGEM's rotary was used in cost calculation. The costs include the tractor ($12/hr) and an operator ($2/hr). In the case of joint contract with TIGEM, the unit price is discounted to a half of the standard price.

Table 5-1-23 Operation equipment cost

Description	Unit Price	Working hours	Cost/Year
Sub-soiler	$ 3.0/hr.	8.5	$ 142 (91)
Disk hallow	1.0/hr.		
Rotary	3.5/hr.		
Ridging machine	3.5/hr.		
Power Sprayer	4.9/hr.	4	76 (52)
Irrigation management (tractor)	14.0/hr.	13	182 (104)

Note: ( ) shows the lease price discounted by TIGEM.
Annual cost = $400 ($247)

b. Harvesting and Shipping Equipment (see Table 5-1-24)

The truck shall be chartered from shipping agents.

Table 5-1-24 Harvesting and shipping equipment cost

Description	Unit Price	Working hours	Cost/Year
Truck	$ 100/10 tons	4 times	$ 400
Trailer	3.2/hr.	32 hrs.	550 (358)

Note: The figures in parenthesis are the prices for internal use by TIGEM.
Annual cost = $400 ($247)

3) Labor Cost

The labor cost was calculated from the minimum wage (gross) applied for common worker in Turkey. The cost appropriated for here is the labor cost for those to be engaged in the actual work, and the cost of engineers, etc. are not appropriated for.

a. Field Management (see Table 5-1-25)

The field management work includes the seeding work, etc. and all kind of works in the field except harvesting. The cost of field preparation work includes the cost of assistant workers for fertilization, etc.

Table 5-1-25 Labor cost for field management work

Description	Unit Price	Working hours	Cost/Year
Field preparation	$ 7.5/8hrs.	8	$ 8
Seeding	7.5/8hrs.	13	12
Field management	7.5/8hrs.	172	161
Irrigation management	7.5/8hrs.	85	160
Chemical spraying	7.5/8hrs.	12	90

Note: Annual cost= $431

b. Shipping Work (see Table 5-1-26)

The shipping work includes harvesting of radish, washing at the washing place, packing and loading on the truck.

Table 5-1-26 Labor cost for shipping work

Description	Unit Price	Working hours	Cost/Year
Harvesting, product selection and loading	$ 7.5/8hrs.	735	$ 689

Note: Annual cost = $689

(3) Farming Estimate

1) Sales Revenue

The radish sales testing was carried out from the 1993 autumn crop. Here, the cost was calculated on the basis of the sales results in 1994 and 1995. The results are already reported in the Comprehensive Reports, Appendix [4] 4.4 (3), (4), the description is omitted here. The exchange rates as of January 31, 1995 ($1 = TL 37,384) and January 31, 1996 ($1 = TL 56,277) were used for calculation. The shipment volume was calculated as 38 tons per hectare by referring to the selection test of variety in the respective years. As a result, in the case of 1994, the total sales was TL 501,412,060 ($13,412) in Istanbul with the net income of TL 382,149,990 ($10,221) after deducting such costs as handling charges and tax. In the case of 1995, the total sales in Istanbul was TL 507,870,000 ($9,024) with the net income of TL 348,574,000 ($6,193) after deducting such costs as handling charges and tax. In the case of Osmaniye, the total sales was TL 337,668,000 ($6,000) with the net income of TL 285,038,000 ($5,064).

2) Profit and Loss

Revenue and expenditure were calculated by deducting the cultivation cost in (2) from the sales income in (3)-1). The totals of materials cost, equipment cost and labor cost were $4,432, $1,350 and $1,120, respectively, and the cultivation cost was a total of $6,902. If it is assumed that a join contract is agreed with TIGEM,the equipment cost is reduced by $345, resulting in the total expenditure of $6,557. Sales in Istanbul as calculated from the sales testing in 1994 was the net income of $10,221. When the cultivation cost of $6,902 is deducted from this amount, the profit of $3,319 is obtained. The profit in the case there is a joint contract agreed relationship with TIGEM becomes $3,664. On the contrary, the sales as estimated from the sales testing in 1995 were the net income of $6,193 in Istanbul and $5,064 in Osmaniye. Since the trial cost calculation is assuming the truck fee for Istanbul, when the cost is deducted from the net income available in Istanbul the loss of $709 is incurred. Even when there is a joint contract agreed with TIGEM exists, the loss of $364 is incurred. However, in the case of 1994, the wooden boxes are mainly used for shipment, but plastic bags were used in 1995. The balance of this expenditure is $1,330,resulting in some profit.

3) Consideration

The calculation of revenue and expenditure indicated the profit of $3,319 in 1994 and a small profit in 1995. This is based on the shipping volume of 3.8 tons per hectare. However, it would be possible to actually increase the harvesting volume to approximately 5 tons in the future. So far, the number of plants was less due to the specifications of the ridge-making machine, and the harvesting volume was, therefore, suppressed. Therefore, if the radish is traded at the current price, sufficient profit is expected. As for the shipping material, the wooden boxes are more expensive, and exceed the loss in the case of plastic bags (The radish gets broken.) and the price difference due to appearance of package. Since some customers demand the wooden boxes, the cost shall be suppressed by using them depending on the customers of package. Since the trial cost calculation per hectare shows profit, by introducing a more large area cultivation and combining with cultivation of other products, the cost reduction of the shared machines and equipment is expected and the profitability would be improved.

5-1-4. Broccoli

(1) Method of Cultivation

The crop type of this broccoli shall be that in the open-field cultivation seeding in the beginning of July through the beginning of August and harvest in the later part of October through the beginning of November.

1) Seeding and Setting

The seed shall be sown by using the soil block of 4 cm square with the cultivation distance being 65 cm x 45 cm and the number of plants being 3,418 stocks/10 a. Fertilizers shall be given in the ratio of N:P:K = 15:16:22 kg/10 a.

2) Field Management

Weeding and earning up shall be carried out between the intervals of irrigation. Chemical spraying shall be carried out several times for aphid and powdery mildew in the initial stage of cultivation. Irrigation shall be carried out as occasion call by using the overhead boom-type sprinkler.

3) Harvesting and Shipment

Harvesting shall be carried out at any time, and after harvest in the field, the broccolis shall be adjusted in the work shop and 5 kg of them shall be packed in the corrugated box.

(2) Cultivation Cost

The cost calculation is based on the cultivation per hectare. Since a large-scale cultivation test was not carried out, the estimated values were used when there was no data available. While the irrigation method actually adopted the overhead boom-type sprinkler, the data assuming the case of using the mobile sprinkler was used for cost calculation. However, as a reference, the cost of the overhead boom-type sprinkler was described in the list (with the * mark). As the cost in the initial year, the general cost at the start of cultivation without consideration to the number of depreciating years was calculated. The cost divided by the number of depreciating years was calculated as the yearly cost concerning the equipment to be used continuously. The cost does not include the taxes. (Usually, 15% of the excise tax is imposed.) The prices are indicated in the US dollars at the rate when the payment was actually made or estimation was made. The cost concerning the land utilization was not appropriated for calculation.

1) Material Cost

a. Materials for Raising and Seedling (see Table 5-1-27)

The house shall be the single steel pipe house with the width of 5 meters and length of 42 meters with the number of depreciation of 10 years. The price in Japan was quoted for the shading net to cover the house with depreciation in 2 years. The number of seedlings grown shall be 41,000, approximately 20% increase of the number of seedlings to be planted. The prices in Japan for purchase of seeds and a unit of soil block machine are used and for the machine cost is calculated with depreciation of the 10 years. The beet moss available in Turkey was mixed with the field soil as the cultivation soil.

Table 5-1-27 Cost of materials required for raising and seedling

Description	Unit Price	Quantity	Cost/Year
Seed (Green Comet)	$ 40/20 ml	600 ml	$ 1,200
Block machine	21,500	1 unit	2,150 (21,500)
Floor panel	4.5/panel	570	256 (2,565)
Peat moss	0.19 l	80 l x 98	1,490
Greenhouse	773	1	77 (773)
Shading net	650/net	9 m x 50 m	325 (650)
Working material	300	As required	300

Note: ( ) shows the initial investment.
Total initial investment = $28,478
Annual cost = $5,798

b. Field Materials (see Table 5-1-28)

The shape of field shall be rectangular with the width of 51 meters and the length of 208 meters. A passage with the width of 3 meters shall be made in the center of the direction to the longer edge for the overhead boom-type sprinkler. When the sprinkler is used, the pump shall not be automatically operated, but be manually operated by an operator. The transportation and setting of the boom shall be carried out by one

Table 5-1-28 Field materials cost

Description	Unit Price	Quantity	Cost/Year
Fertilizer	$ 0.32 kg	150:160:220 kg	$ 372
Manure	38/ton	20 tons	760
Agricultural chemicals	123	5 times	615
Sprinkler	4,090	1 unit	818 (4,090)
Pump (28.5 HP)	3,774	1 unit	539 (3,774)
Water fee	2.8/10 a	1 ha	28
Fuel	0.47/l	63 hrs.(126 l)	60
Management materials (Weeding equipment, etc.)		As required	300

Note: ( ) shows the initial investment.
Total initial investment = $9,990
Annual cost = $2,912

tractor with an operator and three assistants. Concerning the cost when the normal sprinkler is used, it assumed that the irrigation pump is installed at the point 100 meters distant from the field, and that it can irrigate the whole one hectare at on time.

c. Shipping Material (see Table 5-1-29)

The corrugated box shall be used as the shipping packing. One box shall be packed as 5 kg.

Table 5-1-29 Shipping material cost

Description	Unit Price	Quantity	Cost/Year
Corrugated box	$ 0.8	1,600	$ 1,280

Note: Total initial investment = $1,298
Annual cost = $1,280

2) Equipment and Machinery

a. Operation Equipment (see Table 5-1-30)

The costs of the tractor and all kind of attachments were calculated on the basis of the unit prices of the equipment owned by TIGEM to be rented out and also the work load. While the Japan-made attachment was used for the ridge-making, the usage cost of the TIGEM's rotary was used in cost calculation. The cost includes the tractor ($12/hr) and an operator ($2/hr). In the case of a joint contract with TIGEM, the unit price is discounted to a half of the standard price.

Table 5-1-30 Management equipment cost

Description	Unit Price	Working hours	Cost/Year
Sub-soiler	$ 3.0/hr.	6.5 (Sub-soiler, Disk hallow, Rotary)	$ 107 (68)
Disk hallow	1.0/hr.		
Rotary	3.5/hr.		
Motored spray	4.9/hr.	20	378 (210)
Irrigation management (tractor)	14.0/hr.	13	182 (104)

Note: The figures in parenthesis are the prices for internal use by TIGEM.
Annual cost = $485 ($278)

b. Harvesting and Shipping Equipment (see Table 5-1-31)

The truck shall be chartered from shipping agents.

Table 5-1-31 Harvesting and shipping equipment cost

Description	Unit Price	Working hours	Cost/Year
Truck	83/4 tons	3 times	$ 249
Trailer	3.2/hr	24 hrs.	412 (268)

Note: The figures in parenthesis are the prices for internal use by TIGEM.
Annual cost = $661 ($517)

3) Labor Cost

The labor cost was calculated from the minimum wage (gross) applied for common worker in Turkey. The cost appropriated for here is the labor cost for those to be engaged in the actual work, and the cost of engineers, etc. are not appropriated for.

a. Raising of Seedling (see Table 5-1-32)

Calculation was made on all kind of work for raising of seedling including the seeding, transplanting, watering and chemical spraying before setting.

Table 5-1-32 Labor cost for raising of seedling

Description	Unit Price	Working hours	Cost/Year
Sowing work	$ 7.5/8hrs.	84	$ 79
Raising of seedling	7.5/8hrs.	240	225

b. Field Management (see Table 5-1-33)

The field management work includes the transplanting work, etc. and all kind of works in the field except harvesting. The cost of field preparation work includes the cost of assistant workers for fertilization, etc.

Table 5-1-33 Labor cost for field management Work

Description	Unit Price	Working hours	Cost/Year
Field preparation	$ 7.5/8hrs.	6.5	$ 6
Seed planting	7.5/8hrs.	24	23
Field management	7.5/8hrs.	172	161
※ Irrigation management	7.5/8hrs.	85	160
Irrigation management	7.5/8hrs.	85	160
Chemical spraying	7.5/8hrs.	60	56

Note: Annual cost= $566

c. Shipping Work (see Table 5-1-34)

The shipping work includes harvesting of broccolis, adjustment, packing and loading on the truck.

Table 5-1-34 Labor cost for shipping work

Description	Unit Price	Working hours	Cost/Year
Harvesting	$ 7.5/8hrs.	320	$ 300
Adjustment and packing	7.5/8hrs.	384	360

Note: Annual cost = $660

(3) Farming Estimate

1) Sales Revenue

Test sales of broccolis was carried out from the 1994 autumn crop. Here, the cost was calculated on the basis of the sales results in 1994. The results are already reported in the Comprehensive Reports, Appendix [4] 5.4 (1), the description is omitted here. The exchange rates as of January 31, 1995 ($1 = TL 37,384) was used for calculation. The shipment volume was calculated as 8 tons per hectare by referring to the selection test of variety in the respective years. As a result, in the case of 1994, the total sales was TL 434,240,000 ($11,615) in Istanbul with the net income of TL 351,592,000 ($9,404) after deducting such costs as handling charges and tax.

2) Profit and Loss

Revenue and expenditure were calculated by deducting the cultivation cost in (2) from the sales income in (3)-1). The totals of materials cost, equipment cost and labor cost were $10,570, $1,146 and $870, respectively, and the cultivation cost was a total of $12,586. If it is assumed that a joint contract is agreed with TIGEM, the equipment cost is reduced by $351, resulting in the total expenditure of $12,235. Sales in Istanbul as calculated from the sales testing in 1994 was the net income of $9,404. When the cultivation cost is deducted from the net income, the loss of $3,182 is incurred. The loss in the case there is a joint contract agreed with TIGEM becomes $2,831. The calculation shows that when one hectare is cultivated, such a loss is incurred. However, the cultivation in a larger area is possible, depending on the facilities. For example, as the irrigation facility, it is considered that the land area of 5 hectares can be irrigated. In other words, assuming the cultivation of 5 hectares, the cost s of soil block machine and pump are reduced by 1/5th per hectare. As the price of seeds for export is usually cheaper, and the cost reduction can be expected. Since there are also the Europe-made soil block machines available in Turkey, purchasing them at lower price would be possible. The above-mentioned cost reduction would amount to over $3,600, resulting in some profit.

5-1-5. Others

(1) Combined Cultivation of Vegetables

From the result of revenue and expenditure as calculated on the trial basis in 5-1-1 through 5-1-4, the combination of cultivating melon as spring crop and radish as autumn crop is judged to be the most advantageous in terms of management. The above-mentioned calculation of revenue and expenditure was made in terms of the cultivation area of 1 hectare. Here, the cost calculation was made by assuming a more large cultivation area. However, the cost concerning the land utilization was not appropriated for calculation.

1) Cultivation Area

Since cultivation of net melon requires a certain level of skills, the cultivation area shall be limited to 10 hectares. On the contrary, the area for radish shall be 5 - 10 times. Here, 50 hectares are assumed.

2) Cultivation Schedule

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
Melon		○——	——	△——	——	——	※※※					
Radish	※※※							○——	○——	——	——※※	※※※

Note: ○; Sowing, △; Planting, ※; Harvesting

As mentioned in the above chart, the melon shall be cultivated from the middle of February through the middle of July, and radish shall be cultivated from the later part of August through the end of January in the following year. Therefore, two kind of cultivations shall not be duplicated, and preparation for and cultivation post-cultivation work can be implemented with sufficient time allowance.

3) Cultivation Cost

The cost calculation was assumed from the cost calculated in the case of 1 hectare cultivation. The cost of the tractor and attachment are calculated from the rental fee by TIGEM. In reality, in order to respond to such a cultivation area, own machines and equipment would be required. However, since there are many uncertain factors concerning the number of tractors required, etc., the cultivation cost per hectare was used.

a. Melon

Even if the cultivation area is increased to 10 hectares, there is no cost to be saved. However, the pump is to be shared with radish cultivation. The total cost for melon cultivation in 1 hectares was $16,896. By deducting the cost of pump of $104 from this figure, the conversion into the cost of 10 hectares would become $167,920. When there is a joint contract with TIGEM, the cost would be $165,600. The sales income when melon was exported to Germany was $277,390, resulting in the profits of $109,470 in the former case, and $111,790 in the latter case.

b. Radish

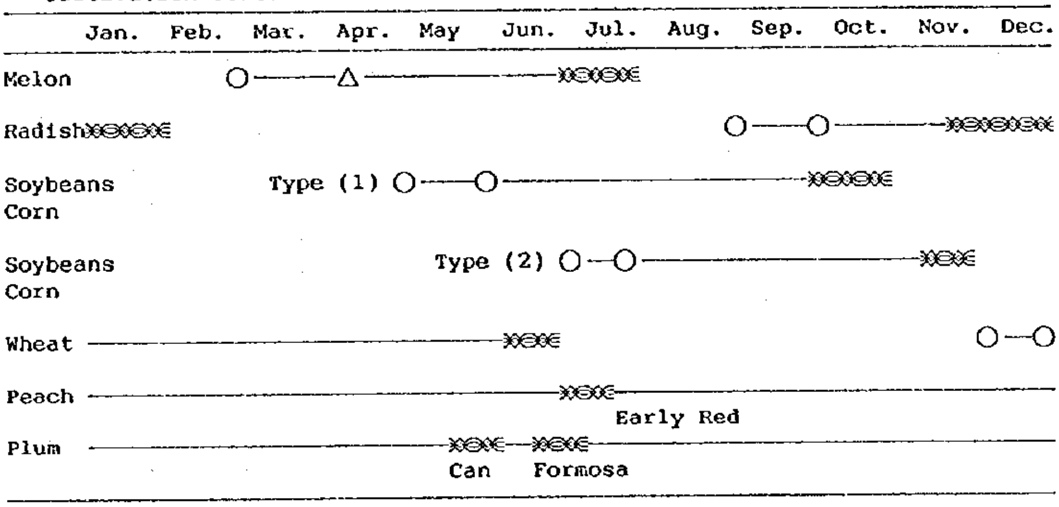
When irrigation is to be made every five days with the irrigation facility for one hectare, the irrigation for 5 hectares is possible. Therefore, the cost of irrigation facility for cultivation in 50 hectares is appropriated for as that for 10 hectares. The cost of cultivating radish in 1 hectare was $6,902. When this is converted into 50 hectares by taking the cost of irrigation facility into consideration, it would amount to $313,660. When there is a joint contract with TIGEM, this would reduced to $296,410. When the sales revenue is converted from the case when the radish was shipped to Istanbul in 1994, it would amount to $511,050. The profit is $197,390 in the former case, and $214,640 in the latter case.

c. Melon + Radish

From the trial calculations in a. and b., the total costs when 10 hectares of melon and 50 hectares of radish are cultivated in combination would amount to $481,580 ($462,010) with the total profit of $306,860 ($326,430).

(2) Combined Farming with Other Items

Cultivation Schedule



Note: ○; Sowing, △; Planting, ✻; Harvesting

1) Rotation with the Field Crops

In carrying out the economical cultivation of vegetables, the injury of continuous cropping is an unavoidable problem. Therefore, it would be necessary to continue sound vegetable cultivation by carrying out the farmland management together with the field crops which are the major products in this area. The schedule of the field crop cultivation in this area is roughly shown in the above-mentioned chart. Cultivation of the wheat crop and the summer crops (soybeans and corn) shall be combined. However, in this distinct there are two kind of summer crops include type (2) which is planted after harvest of wheat, and type (1) which increases the yield by planting in April through May without the wheat crop. Cultivation of soybeans and corn naturally requires irrigation. In the case of no irrigation, introduction of cotton or sunflower would be required. Here, assuming that all the farmland can be irrigated, the crop rotation is considered. As an example, the following crop rotation can be considered :

Radish ---> summer crops ---> wheat ---> summer crops ---> melon ---> wheat ---> summer crops ---> wheat ---> radish

In this case, the field where radish was cultivated in the first year, the radish will be cultivated again in the sixth year. In other words, if the cultivation area of one crop of radish is 50 hectares, the crop system is the five years' rotation in 250 hectares. The cultivation area of melon is 10 hectares per crop. If simply calculated, it would be the 25-years rotation. In reality, since the land suitable for melon cultivation is limited, 5 - 10 years' rotation is considered. If the rotation is maintained regularly, it is considered to cultivate together with the local melon which can be cultivated without thinning. It is confirmed in the selection test of variety that seeding at the same time, harvesting is 10 - 15 days earlier. Thus, the labor force can be also dispersed. As a shorter rotation, the following crop rotation is considered:

Radish ---> summer crop (1) (melon) ---> wheat ---> radish

In this case, in the field where radish was cultivated in the first year, the radish can be cultivated again in the third year. In other words, it is the crop system of 2-year rotation with the cultivation area of 100 hectares. Thus, it is possible to combine cultivation with the field crops depending on the size of the farmland. Combination of vegetables and field crops seems useful and essential to the economical farming.

2) Combined Farming with Fruits

Combined cultivation of vegetable and fruits will be performed if it is effective in consideration of risk in farming and labor force dispersion. Looking at the peach and plum which have good results in the fruit cultivation testing in this project, the harvesting period is middle and late of June, overlapping with that of melon. With the "Can" variety of plum, the middle through the later part of May is the harvesting period, and combination is possible. However, in consideration of training and thinning work for melon, this combination seems slightly difficult. With the "Formosa" variety, the harvesting period is the later part of June, and the harvesting period overlaps with that of melon in the similar manner with the peach. Thus, combination would be difficult from the viewpoint of labor force dispersion. Concerning the risk dispersion of farming, fruit trees need long time until they become to adult trees. When the vegetables are considered as the main crops, the risk is not dispersed during that period. During the period when the seedling is small, vegetable cultivation in the area of fruit trees can be considered, but in the case of large-scale management, there would be much loss in terms of mechanical work, and it seems in appropriate. Thus, when the vegetable cultivation is mainly considered, combined cultivation with fruits is considered to be difficult.

5-2. Operation and Maintenance Manual of Project Facilities

5-2-1. Collection and Arrangement of Basic Data

(1) Ground Water Survey

1) Location and Structure of Gauging Wells

a. Location

The location of gauging wells observed during the verification period is shown in Fig. 2-1-1 of the report. As a result of findings on groundwater, it may be almost clarified that seasonal fluctuation in the groundwater level will be resulted in the balance between rainfall, irrigated water and evapo-transpiration.

Periodical observations of the ground water shall be continued in the orchard areas, such as in peach area where presently observed and newly provided wells in both kiwi and grape areas in 1996. On the other hand, periodic observations will not continue in the other field crop areas, and the observation wells will be remained as they are, in order to be used these facilities whenever it is necessary to check the water level.

b. Observation Wells

When observation well for long term observation is made in the project area, it is recommended to make it as the the following methods and structure.

Structure and depth :

Casing pipe of three(3) m in depth. The well will be excavated manually during the dry season, about -2.5 m in depth from the ground surface. Because of the lowest records of ground water level in the orchard area indicated that it is -2.3 m from the ground surface, the well depth for -2.5 m will be enough,

Casing pipe:

The casing is made by a PVC pipe with a diameter of 0.1 m and a vertical length of 3 m, drilled holes with the rate of four holes in the horizontal section and 0.1 m in vertical pitch, from the bottom to one(1) m below from the top of the pipe,

Filter layer:

The filter layer is formed around the casing pipe by river sand, from the bottom of the trench to about 0.3 m below the ground surface, to collect the groundwater and prevent the soil around the casing pipe to enter it,

Setting of the well:

When the trench has been excavated, then the filter layer shall be formed around the casing pipe. First, a 0.3 m pipe with about one(1) m length is put on the bottom of the trench vertically, then set the casing pipe vertically in the middle of the 0.3 m pipe. Pour the sand between the outside pipe and the casing pipe and compact it. Second, fill in the trench with soil making horizontal layer, pull up the 0.3 m pipe vertically and pore sand between the two pipes, according to the progress of filling of the trench. These works are repeated till the trench is filled about a half in depth. Discontinue the fill works of the trench for one day or more to provide time for the settlement of filled soil.

2) Items Surveyed and Survey Instruments

a. Items Surveyed

Three(3) items related to the ground water, the depth of ground water surface (cm), electric conductivity (mS), and alkalinity (pH), were observed in these gauging wells and the collected water samples.

b. Survey Instruments

The following instruments, manufactured in Japan, are used for the observations and sample collections:

Electrical conductivity:
One(1) set of portable conductivity meter with thermometer and with temperature compensation function.

Alkalinity:
One(1) unit of portable pH meter with thermometer and with temperature compensation function.

One(1) unit of ion meter:
One(1) unit of ion meter with thermometer and with temperature compensation funotion.

Ground water depth:
Two(2) sets of water level measures.

Water sampler:
Two(2) sets of hand operated vacuum pumps.

3) Observation Period and Data Arrangement

a. Observation Days

Since November 1994, the observation days have been fixed to the last day of each five(5) days in months, or six(6) times for a month. The observation period is considered to be appropriate for data arrangement, in connection with rainfall records arranged at each five(5) days basis.

b. Processing of the Data

The collected data were arranged into two groups, one is in orchard area, and the other in field crop area, and all data were averaged in monthly basis.

4) Observations and Precautions

a. Groundwater Level Observations

The groundwater depth from the edge of well and the surface of groundwater is measured in the field by means of the water level measure. As the height of casing for each wells are known previously, the groundwater level is obtained from the field record in the office work.

b. Sampling the Ground Water

The value of electric conductivity and pH are measured by the samples of water collected at each wells after the measurement of groundwater level, by means of a hand operated vacuum pump. The sample of groundwater is put in a vessel marked with the number of the well where it was collected, then it is brought to the office for measurement.

c. Calibration of the pH Meter Scale

As the pH value of water in the Project area ranges from pH 7 to pH 8, based on the past observation records, one-point calibration method, by means of a buffer solution of pH 7, was applied for the calibration of the pH meter, based on the guide line of the calibration in the reference manual of the meter.

According to the past experience on pH measurement, the calibration of pH meter needs more often in summer season than the winter season. When something different value of pH from the usual value were observed, it must be perform the calibration without delay.

About 100 cc of buffer solution is required for the calibration of pH meter, and the solution is possible for the frequent use. Accordingly, the solution used for the calibration must be preserved in a bottle with cap, never returning to the original bottle, preserve it in the room temperature and free from direct sunshine, until it is no longer used. At this point, it is replaced with fresh buffer solution.

A pH meter manufactured in Japan requires the only buffer solution made in Japan, stipulated under the Japan Industrial Standards (JIS), which has a value of pH 6.90 at a 15 centigrade, and the meters are automatically calibrated based on this value. Never use another sort of buffer solution available in Adana such as made in Germany, because it is not possible to perform correct calibration by mean of this buffer solution.

d. Maintenance of the pH Meter

The sensor on the pH meter is composed of a glass electrode filled with a inner solution consisted of saturated solution of potassium chloride, and the electrode is required to keep the inner solution in saturated and the level up to about one(1) cm below from the injection hole.

As it is designed so that a little volume of this inner solution is seeped into the water during each measurement, it is necessary to keep the solution level within required height, and under saturated condition, which can be assured by existence of the crystals of potassium chloride inside the glass electrode.

e. Precautions to be Observed during pH Measurements

Just after the meter power is turned on, the meter tends to indicate a pH level higher than the actual level. So at first make calibration or test a sample of water such as tap water in the office is measured, and if the pH of this tap water becomes usual level, then the observations may be started.

Another method useful procedure for the alkalinity observation is to fix measured order of samples previously, and the sample measured in the first place is measured again at the final, when there is no significant difference in the pH value obtained from the two measurements, the results of all the measurements is assumed to be correct.

(2) Meteorological Survey

1) Equipment and Item Surveyed in the Project Office

a. Equipments Provided the Project Office

The following equipments are used for the meteorological data collections.

Meteorological station :
Principal equipments for meteorological observation. Presently data on pan evaporation rate are collected by another means without this computer system.

Automatic rain gauge:
This equipment is used for observation of daily rainfall, in addition, data on rainfall pattern and rainfall intensity are obtained from the recording charts.

Automatic water level gauge:
This equipments was introduced to observe a fluctuation of water level in the evaporation pan.

b. Item Surveyed in the Project Office

The following items are surveyed in the project office, by means of the meteorological station, and they are automatically printed out stationary record in a sheet of paper.

Temperature	: maximum, minimum and mean on daily basis,
Relative humidity	: maximum, minimum and mean on daily basis,
Atmospheric pressure	: maximum, minimum and mean on daily basis,
Wind velocity	: maximum, minimum and mean on daily basis,
Sunshine time	: Daily basis,
Solar radiation	: Maximum hourly rate and accumulated on daily basis,

Wind frequency	: Frequency of wind direction on daily basis classified to 16 direction, and calm, which is presented by per cent (%)
Rainfall depth	: Daily basis,
Evaporation depth	: Daily basis, It is observed manually by the float gauge appurtenant to evaporation pan.

In addition to the observation, full time record of rainfall and full time record of water level in the evaporation pan are collected by means of each sensor and automatic recorder. And each recorded papers are filed in the office for future use, when it is required.

2) Daily Data Collection

a. Sort of Data Collected

Meteorological station:

Four(4) sorts of record paper are automatically printed out, such as daily record, printed or each five(5) days record, 10 days record and monthly record, all of which is printed in each one sheet of paper from the printer.And these sheet are filed into three files, one is daily records, two is five(5) days records, and three is 10 days and monthly records.

The sheet of record paper is used common continual paper of 15 inches width with perforations.

Rainfall record by the rain gauge:

The record paper used in the project is one(1) day type, and the dimension record paper is based on the standard of the Weather Bureau of Japan.

Water level gauge:

The record paper used in the project is eight(8) day type, and the recording charts are specially printed by the manufacturer, and the dimension of the vertical range is 20 cm and width is 32 cm to fit on the 10 cm cylinder.

b. Calculation of Evaporation Rate

Since the sensor of water level gauge was not functioning well, evaporation rate on daily basis is calculated mathematically from the balance of water level. When it was rain, the corresponded rainfall record and water level record are used for the calculation.

The water level on the evaporation pan is measured by the float gauge once a day at fixed time in the early morning, and the value and observed time are recorded on the recording sheet of paper of the meteorological station for the last day, and the recording chart of the water level gauge at the corresponding place as well.

Usually, when it had no rain in the previous 24 hours, the evaporation depth for the yesterday is obtained by the balance of water level between the yesterday and today. When water is supplied in the evaporation pan, the water level at before operation and the after must be measured and take note for the reference of calculation.

When it rained during the observation period, the data on rainfall in both depth and the corresponding time were counted into the calculation factor, in addition to the record of water level.

It is recommended to record all observed water level in the evaporation pan by the line of water level at the corresponding time on the recording chart, as it is quite convenient to analyze the data concerned.

The sheet of recording chart must be replaced the new one at the fixed date of a week.

c. Rainfall Gauge

As the recording chart for the equipment is one(1) day record and it is required to adjust the time of dram clock once a day. And the setting of time is carried out at the fixed time in the every early morning. As to detailed procedures, refer to the operation manual prepared by the manufacturer.

The sheet of recording chart is not necessary to replace to the new one when it was no rain, and even it rained it is not necessary to replace for every day, because it is not only to save the chart but also it is to save worthless records in the file. However date of the rain must be recorded at the corresponding place whenever the sheet was not replaced.

d. Arrangement of Collected Data

During the Project operation period, the meteorological data on daily basis collected at the Project site was arranged monthly in a sheet of paper in a form as shown in the following Table 5-2-1.

3) Maintenance of Equipment

As to the general precautions operation and maintenance of equipment, refer to the manuals provided by the manufacturers.

a. Meteorological Station

As to routine maintenance of a evaporation pan, water level shown by the float gauge must be maintained between 5 cm to 2 cm as a standard. To keep mind to clean the small hole on the lower part of float chamber and mouth of the connection tube for water level recorder, it is quite important to collect a reliable data.

b. Rain Gauge

The equipment is consisted of a sensor and a automatic recorder, operated by two size of dry cell type batteries, one is for a cylindrical clock to drive a recorder, and the other is for a power source of a magnetic counter connected with a sensor.

During dray season for abut a half year of period, the rain gauge will

Table 5-2-1 Daily Meteorological Observation Record in _____ . 199_ No. _____

Day	Sun-shine min	Rain Fall mm	Radia-tion M.J	Evapo-ration mm	Atomos. Pressure hpa	Temperature °C			Humidity %			Wind Speed m/s			Major Wind Dir.
						Max.	Min.	Mean	Max.	Min.	Mean	Max.	Min.	Mean	
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30															
31															
Mean															
Max. or Min.															

have no work because of no rain, and the batteries for the magnetic counter tends to exhaust due to sever atmospheric conditions. In this connection, it is recommended to replace the batteries for new on prior rainy season. As to the clock for recorder on the other hand, the batteries must be replaced when the clock becomes late.

c. Water Level Gauge

The recording chart of the water level gauge is used for a reference and cross check of rainfall or evaporation rate in such a case, when the rain gauge had no record or something wrong data was found in the records. By the record of water level, hourly evaporation rate or pattern in a day are able to analyzed if necessary.

5-2-2. Irrigation System

(1) Intake System

1) System Structures

a. Outline of the Structures

The following is an introduction to the structures which make up the intake system and the role each performs. Out of these structures, the operation and maintenance of check is responsible for the irrigator's association.

Check: The check is built across the DSI canal at the downstream of the intake structure, with the purpose of control the water level of the canal to remain at the designed water level. However, the operation of check gates is presently conducted by the association's personnel, and two gates are usually remained in full open position.

Intake gates: The intake gates are built at the left side bank of the DSI canal, with the purpose of taking water into the irrigation system for the Project.

Intake Pipes: Pipes that carry the intake water to the storage pool.

Flap Valves: Valves installed to prevent the irrigation water once taken in the pool to back into the DSI lateral canal. Hinge joints are installed on top of each one.

Storage Pool: A pool used to temporarily store the irrigation water before used for irrigation. A suction channel for the pumps is installed along the south-west side of the storage pool.

Fig. 5-2-1 shows the arrangement of the structures, while each sort and dimension is described in Table 5-2-2.

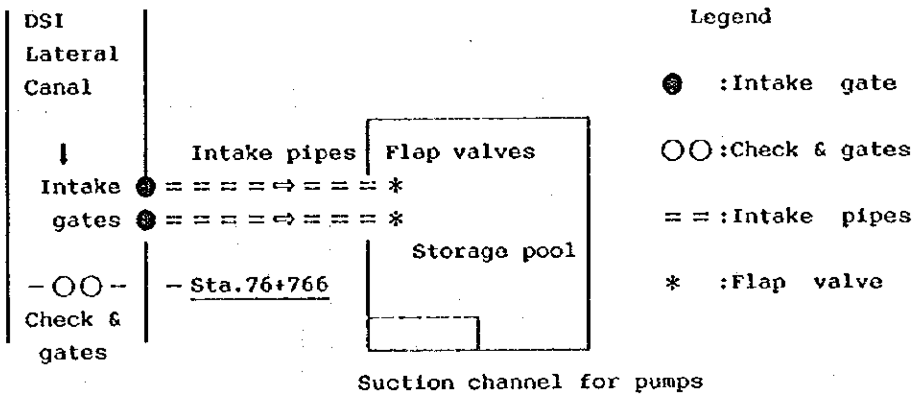

Fig. 5-2-1 Schematic plan of intake facilities

Table 5-2-2 Sort and dimension of intake structures

Sort of structures	Size and number of unit	Remarks
Check gates	W1.65m× H1.24m× 2-set	Steel sluice gate with a spindle controller
Intake gates	W0.60m× H0.60m× 2-set	-ditto-
Intake screens	W0.60m× H1.14m× 2-set	Made of steel bar
Storage Pool	W15.0m× L20.0m× H3.0m	Reinforced concrete
Intake pipe	D0.30m× L26.0m× 2-set	Concrete pipe
Flap valve	D0.30m× 2-set	Made of cast iron

b. Indications of Elevations of the Irrigation System

When the irrigation system is in operation, the altitude of the water surface is fundamental element to its operation. Water naturally flows from higher places to lower places, and the capacity of a gravity irrigation system is determined by the size of cross sectional area of the structures and by the longitudinal slope of the supply system.

To explain this principle simply, water in a higher position possesses more potential energy than water at a lower position, and the magnitude of this potential energy is equivalent to its elevation. And this energy is converted to the velocity of water and consumed as friction loss when it flows through the water conveyance facilities to move to a lower position.

Where the difference of height is great, the greater the energy which can be utilized for conveyance, and the greater the amount of water which can be allowed to flow in the system.

For this reason, the altitude of the irrigation system and the surface of its water is indicated as the elevation. The elevation indicates the vertical distance with the average water level of the sea as the standard level.

c. Elevation of the Structures and the Capacity of the Storage Pool

The following table indicates the elevation of the intake structure and the capacity of the storage pool.

Table 5-2-3 Elevation of intake structures and capacity of storage pool

Sort of facilities and Place	Elevation	Remarks
Intake structures		
Top of canal lining	El. 33.22 M	DSI lateral canal
Bottom of canal section	El. 31.72 M	-ditto-
Intake water level	El. 32.96 M	
Bottom of intake	El. 31.92 M	
Storage Pool		
Top of side wall	El. 33.25 M	
Bottom of pool	El. 30.25 M	
Full water level	El. 32.96 M	
Low water level	El. 31.05 M	Lowest water level for pump operation
Area in m^2	300.00 m^2	15m× 20m = 300 m^2
Effective volume in m^3	573.00 m^2	D1.91m× 300 m^2 = 573 m^3
Total volume in m^3	795.00 m^2	D2.65m× 300 m^2 = 795 m^3

2) Operation and Maintenance During the Irrigation Season

a. Definition of Irrigation Season

The irrigation season is defined as the period when irrigation water is supplied by the DSI lateral canal and irrigation is performed. The period when the DSI supplies water is not always constant, because it is used to be coordinated with each year's weather conditions, but as a standard, it is considered to extend from April to September.

Out of the irrigation season, when irrigation is required for vegetable cultivation or nursery of young trees, available water in the storage pool is used in the first place, when any water available from the lateral canal, such as drainage water entered at the upstream section, will be used as well. Then if more water is required for the irrigation purpose, available water from the existing drainage creeks or Project drainage canal will be collected by means of portable engine pumps and stored into the pool, and use for irrigation..

b. Operation of Intake Gates

The two intake gates are, in principle, fully open during the irrigation season.

c. Operation of Check Gates

The check gates is provided to control the water level in the DSI lateral canal at full water level during irrigation period, when the discharge of canal is small and the corresponding water level becomes low. However, as the Project irrigation system used for the intake system are pump irrigation system, water level control at the intake point is not always required, so far as it remains a certain level to possible required water is taken into the pool, even if the water level in the canal becomes much lower than usual.

When the intake water level lower and it becomes difficult to normal intake of water, the opening of the check gate may be controlled to rise water level at the front of the intake gates until the minimum height enough to water intake.

It is strictly prohibited to keep check gates in closed position, without gate keeper or watcher, even if the canal water is quite small. especially during night time, the check gates must be fully opened in order to secure the safety of canal.

The safety of the canal means to avoid the overflowing of canal section due to wrong control of the check gates. In general, an overflow is the most dangerous happening for open canal system, which might be induced a breach or collapse of the canal.

d. Inspection and Patrol of the System

During the irrigation season, the intake area is patrolled about three times a day, to make sure that the water level in the canal and the status of the system are in normal. And if any trash is found entangled in the bar screen at the intake or at the front of check gates, it must be removed.

e. Other Precautions

When the pump will not be operated for a long period of time or heavy rain is forecasted, the intake gates must be fully closed, and make sure that the check gates are fully open.

f. Storage Pool

Because the higher the water level in the adjustment pool, the higher the pressure on the delivery side of the pump, it is better to keep the water level inside the adjustment pool high unless there is a particular reason not to do so. When it is necessary to reduce the water level in the adjustment pool during pump operation, it is possible to carry out the required water level adjustment by shutting one intake gate and adjusting the degree the other is open.

The following figures represent the relationship of the adjustment pool water level with the pump operating time.

Effective Storage Capacity:

The storage capacity between the maximum and minimum water levels, it is approximately 570 m^3. This capacity permits about seven(7) hours of operation for one sprinkler irrigation pump.
And for one orchard pump, it permits about 34 hours of operation.

Sprinkler irrigation pump: $573\ m^3 \div 80\ m^3/h = 7.16\ h \fallingdotseq 7.0\ h$
Orchard irrigation pump : $573\ m^3 \div 17\ m^3/h = 33.7\ h \fallingdotseq 34.0\ h$

Maximum Storage capacity:

The total capacity of the storage pool, it is 795 m^3.

Minimum storage capacity :

The storage capacity below the minimum water levels, it is approximately 225 m^3. This capacity permits about seven(7) hours of operation for one portable engine pump, provided that the performance of the pump is to be 60 m^3 per hour.

Minimum Water level:

The minimum water level is determined at the 0.50 m higher level from the top edge of the screen of the foot valve of the sprinkler irrigation pumps.

3) Management of the Gates Out of Irrigation Season

As the DSI canal is collection inflow from the upstream during and after the rain, it will sometimes becomes a big flood at the intake site. In this connection, the check gates must be fully opened throughout the out of irrigation season, except for special operation such as water intake works for irrigation requirement at the presence of gate watcher.

As to intake gates operation during out of irrigation season, it must be fully closed, to prevent in flow of sediments might be carried by the flood.

4) Maintenance of System Equipment

a. Cleaning the Storage Pool

The pool must be cleaned and inspected inside visually once for every year, prior to the irrigation season for the year. After pump up the water in the pool as much as possible, by means of stationary pumps or engine pump, remained water, sediments, trash and aquatic plans are collected and removed by manual works or any more efficient means.

At the same time, the foot valves on the pumps, suction pipes, flap valves and other metal parts are inspected, and they are either repaired or replaced as required.

b. Maintenance of Metal Structures if Necessary

The spindles of gates and bolts are lubricated or greased as required. Other metal structures are painted as required before the lubrication works.

(2) Sprinkler Irrigation System

1) Structures of the Sprinkler Irrigation System

a. Outline of the Structures

The sprinkler irrigation system consists of the following structures. The arrangement and standard of the system are shown in Fig. 5-2-2 and

Table 5-2-4.

Pumps: In order to supply pressured water necessary for traveller irrigation practice by means of rain guns and rain boom, three(3) units of pumps com electric motor are installed in a pump house, together with a control system.

Water supply system: It is one (1) pipeline, made of polyvinyl chloride with a caliber of 300 mm and 200 mm, to supply pressured water to the farm lot.

Turnouts: Nine(9) units of turnouts named "Hydrand" are installed along the supply pipe. It is consisted of a vertical steel pipe branched from the supply pipeline and a detachable control valve mounted on top of the vertical pipe.

Air valves: The six(6) units of air valves are provided on the supply pipeline, one is at the terminal, and the other five(5) are installed in 1995 in the section of 300 mm pipe. The function of the valve is to exclude air from the supply pipe when pumps are in operation, and feed air into the supply pipe when the pumps have stopped.

Scouring sluice valve: It is installed at the terminal of the supply pipeline, with the purpose of flush away the sediments inside of the pipeline. It consists of a 75 mm sluice valve and a PVC pipe with a caliber of 90 mm.

Pressure gauge: It is attached to the pipeline in the pump house to measure and display the supply pressure for the pipeline system, at he same time the pressure signal is transmitted to the safety apparatus on pump operation.
And each two(2) sets of pressure gauges are also installed on each pump at suction side and delivery side respectively.

Flow meter: It measures discharge (liter/sec.) and cumulative flow volume (m^3) of the pumps at the head of the supply pipeline. It indicates the discharge with a dial indicator and the cumulative volume meter with digital numbers.

Safety Apparatus: It monitors the pressure signals from the pressure gauge and shuts off one of the pumps in operation when the pressure has exceeded 10 bars. It was installed when the pumps were modified in May 1995.

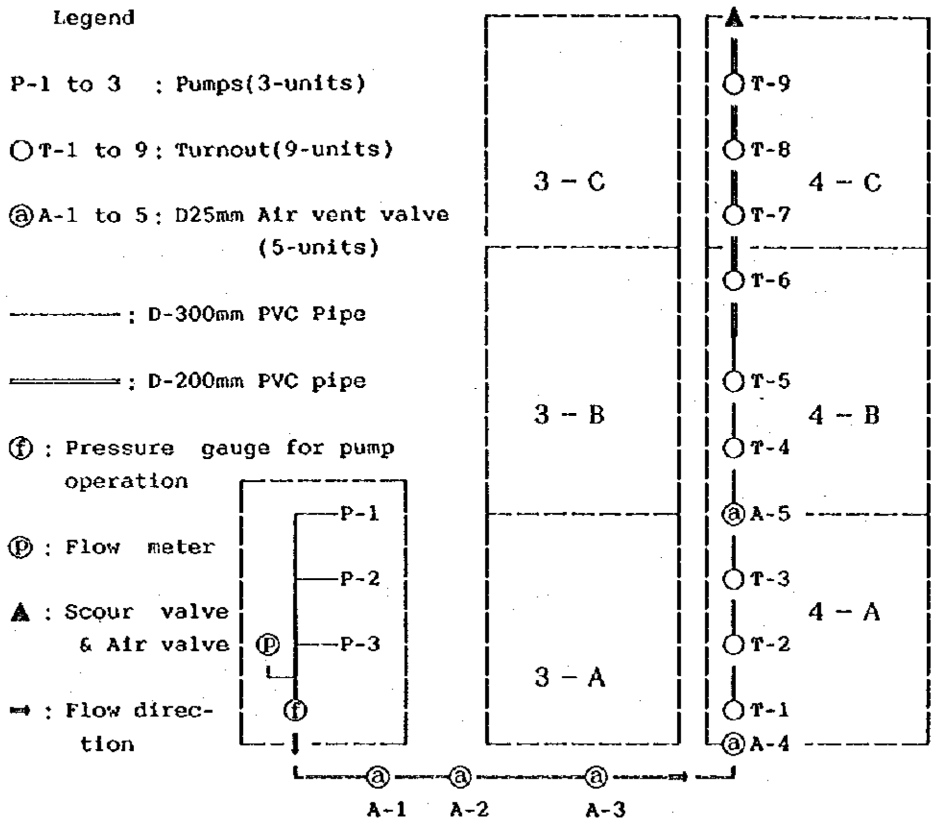

Fig. 5-2-2 Schematic plan of traveling sprinkler irrigation system

Table 5-2-4 Outline of traveling sprinkler irrigation system

Sort of structures	Number	Remarks
Pump facilities		
Pump	3 unit	Capacity 80 m³/h, Total head 8bar
Elect. Motor	3 unit	Voltage 380V, Output 37Kw
Foot valve	3 unit	φ 125 mm, Local made
Sluice valve	2 unit	φ 125 mm
Check valve	2 unit	φ 125 mm
Flow meter	1 unit	
Water Supply system		
Pipe line	1,228m	PVC-φ 300 mm Local made
Pipe line	360m	PVC-φ 200 mm Local made
Turnout valve	9 unit	φ 125 mm, for rain gun & rain boom
Air vent valve	1 unit	φ 75 mm, installed at terminal end
Air vent valve	5 unit	φ 25 mm, installed in 1995
Scour valve	1 unit	φ 75 mm, installed at terminal end

2) Pump Facilities

a. General Items

This section describes only technical informations necessary for pump operation and maintenance, such as hydraulic information, role of each equipment, procedures on start/stop of pumps and so forth. With regard to detailed information on the pump facilities and general items on its operation and maintenance, please refer to the instruction manual included among the technical documentation provided by the manufacturer when the pumps are installed.

b. Performance of Pumps after the Modification

A pump for sprinkler irrigation system was manufactured as five(5) stages volute pump, which is consisted of five(5) sets of unit pumps with an equal performance in its flow capacity and outlet pressure. The present pumps were modified into four(4) stages in 1995, removed one couple of liner and rotor out of the five(5) sets of unit pumps.

After the modification, the performance of pumps in discharge are not different, however with regard to the total pressure it decrease about 80 % from original performance.

c. Elevation of Pump and Pressure Gauges

The following numerical numbers are basic data regarding the water level and facility elevations required for pump operation.

Full water level of storage pool : EL. 32.96 m
  This water level is equal to the full water level in DSI canal at the intake point.

Pump elevation: EL. 32.665 m
  Elevation at the center line of rotating shafts of the pumps.

Elevation of suction pipe: El. 32.665 m
  This water level is equal to the Pump elevation.

Elevation of outlet pipe: EL. 32.435 m
  Elevation at the center line of the outlet pipe, outlet of the pressure tube and the flow meter at the head of the supply pipeline.

Elevations of pressure gauges of pumps: about EL. 33.000 m
  Each one(1) gauges was installed at suction side and delivery side. As the size of gauges are different from each other by the difference of manufacturers, it shows only the approximate value.

Elevations of pressure gauge for the supply pipeline: EL. 33.135 m
  It is the center of the needle indicator.

d. Performance of Pumps

A performance of pump is presented the relationship between discharge and output pressure. In general, the discharge is smaller the pressure becomes higher, on the contrary, the discharge is bigger the pressure becomes lower. In this connection, when checked the pressure of a pump at the outlet side we can catch an approximate discharge, in accordance with the performance table.

The following table shows the performance of the pumps, relations between outlet pressure and discharge, when the design discharge and outlet pressure after the modification is assumed to be 22 l/s and 8.0 bars respectively.

Table 5-2-5 Performance of a sprinkler irrigation pump

Rate of Discharge (%)	0	50	100	125	150
Discharge (L/sec)	0	11	22	27	33
Outlet Head (bar)	10.5	10.0	8.0	6.5	4.0

Functions and outline of appurtenant equipments of pumps, in dispensable to pump operation, are as follows. The equipments related to the starting of pumps and general procedure on starting the pumps will be omitted.

Pressure gauge at suction pipe:

The pressure gauge is used for monitoring the degree of negative pressure produced at suction side of pump during operation. In this connection, its scale is set from minus pressure to plus one, with zero at the middle, to measure mostly minus pressure.

Foot valve and screen:

The foot valve is used to check the water to flow backward into the pool when the pump is stopped. This valve is manufactured to open by the suction pressure generated by pump when it draws up water.

The screen covering the mouth of the valve is installed to prevent trash or materials from entering pump.

Pressure gauge at outlet pipe:

It is installed to monitor the outlet pressure of pump. Because the maximum pressure of the pumps is remained at the 11 bars level, the measurement range of this pressure gauge need only be as high as 12 bars.

Pressure gauge at supply pipe:

The gauge is installed between the flow meter and the filter system to monitor the pressure of supply canal at the beginning point. Because the maximum pressure of the pumps is remained at the 3.5 bar level, the measurement range of this pressure gauge need only be as high as 4 bars.

Sluice valve at outlet pipe:

This valve is used to control the outlet pressure of pump, during the period of fill up water into the pipe line system, until the pressure gauge for the supply canal system have indicated at normal operation pressure.

Check valve on the outlet pipe:
This valve, which is not shown on the schematic diagram, is installed between the pump and the sluice valve. The function is to prevent water flowing back from the supply system when the pump is shut off. Its function is just same as the foot valve, however it opens by the outlet pressure of the pump, and closes when that pressure is not existed.

e. Filling Water into Supply Pipe and Starting of Pumps

After turning on the pump and before starting irrigation, it is necessary to make sure that the pipeline system have been filled with water.

Preparatory works on irrigation practice:
At first make sure that all hydrant valves have been fully closed, except for one(1) valve which is ready for irrigation and located at the remotest distance.

Filling water into supply pipe and start of irrigation:
Then turn on one pump, and open the sluice valve on the end of outlet pipe until the needle of pressure gauge indicates about 8.0 bars.
When the pressure in the supply pipe reached 4 bars, The sluice valve at the outlet may fully open.
The second and third pumps are started one by one, after receiving the report from operator of the rain gun or rain boom that the water has begun sprinkling, with the same procedure as the first pump.

f. Stopping the Pumps

After the sluice valve of pump at the outlet is fully closed, the pump is shut off.

g. Pump Equipment Inspection

The normal pump inspection and maintenance instructions are omitted from this manual. Key points that must be observed during daily pump operation and maintenance are described.

Pressure Gauge on the Suction Side of Pumps:
When the pumps are running with the almost full water level in the storage pool, the needle on the pressure gauge indicates -0.1 bar more or less, the pressure gauge is operating normally. The value of minus pressure on the pressure gauge will increase to -0.2 bars when the water level in the pool lowered by 1 m from the full water level, the gauge is operating normally.

The reason why the pressure at the suction side of the pump will decrease when the pump is in operation, the minus pressure is generated by the hydraulic resistance by the foot a valve and a screen at the inlet of suction pipe.
And the value of the resistance or minus pressure will increase when the discharge of pump increase, or plugged by trash at the screen of the foot valve.

When the needle of pressure gauge does not move or indicates a unusual value when the pumps have started, the pressure gauge must be replaced with a normal one, and make sure whether the former gauge is in disorder or in normal.
When the pressure gauge it found to be normal, the cause of abnormal pressure must be investigated, and the necessary countermeasures must be taken. If the pressure gauge is shown to be out of order, it must be replaced.

Foot Valve and Screen:

When a foot valve is in normal condition, water inside the pump does not flow back into the storage pool, even if the water level in the pool is low, so the pump is always in ready to start. But when the foot valve has begun to leak, it is required to fill water into the pump and suction pipe before starting the pump.
The possible cause of leak are due to small materials suspended between valve and valve sheet, and structural problems. In either case, when the foot valve begins to leak considerably, it must be pulled out together with suction pipe to inspect and to repair.

Pressure gauge on the outlet pipe:

When a pump is in operation with the sluice valve fully closed, it must indicate a value almost 11 bars, and on the contrary when the pump is no operated, it must be indicated a value of o bars. If a pressure gauge indicates some different value, it must be taken some necessary countermeasures in the same procedure as mentioned in the above section.

Sluice Valve on the Discharge Pipe:

When the pumps are to be operated under controlled discharge, it is carried out by the adjustment of the sluice valve. In this operation, When aiming discharge to be controlled is small, it must be carefully manipulated the handle of the valve, because only a little rotate of the handle is resulted in the big change of discharge through the valve.
Furthermore, the gauge attached to the spindle of the valve to indicate the opening degree of the valve does not be reference on the discharge adjustment, and the sluice valve has a idling range when it turned reverse direction.

Discharge Shown by the Flow Meter:

As the dial gauge for discharge measurement in the flow meter is designed its scale based on the maximum discharge when the three pumps are operating simultaneously, it is difficult to measure small discharge, such as less than 10 l/s, directory from the dial gauge.

In such a case, it is recommended to calculate an average discharge within a certain interval of time, which is measured from the balance of water volume measured at the beginning and the ending of the interval of time.

3) Water Supply System

a. Standard of Water Supply Pipe

A pipe made from polyvinyl chloride with a standard pressure of 15 bars, made in Turkey is used for the supply pipeline. The pipe was manufactured in the factory by special order, and it is not available commonly in the market without special order at present. However, as sufficient number of pipes and the couplings used for the replacement of pipe are stocked in the Project office, there is no possibility of a shortage of materials in the future.

b. Friction Slope of the Water Supply Pipe

When water flows through a pipeline, a part of water pressure or potential energy of water is consumed as the friction loss. As the results, the outlet pressure became lower than the inlet pressure. The degree of the friction loss varies according to the magnitude of discharge, size of pipe, and pipe material or roughness of inside surface of pipe. The degree of friction is generally calculated as the slope of the energy line after lost energy. The friction slope of the supply pipeline is calculated using the following formula.

$$I = 10.67 \times C^{-1.85} \times D^{-4.87} \times Q^{1.85} \times 1.1$$

Where:

- I: Friction slope, which is the amount of reduction of the water level lost over a certain distance, when discharge Q flows through the pipeline.
- C: Coefficient of flow velocity, selected by material of pipe and its size, which is calculated as 150 in this case.
- D: Pipeline diameter
- Q: Discharge (m^3/sec).
- The coefficient 1.1: Accounts for other miscellaneous loss of the pipeline.

The rate of friction slope for the supply pipeline, the corresponding size of pipe, number of pumps in operation, calculates by the above formula assuming that the design discharge per pump is 80 m^3/hr (22 l/s), and shown in the following table.

Table 5-2-6 Rate of friction loss for supply pipeline

Number of Pump in Operation	Inner Diameter of Pipe	Discharge Q (L/s)	Friction Slope (I)	
			I	1/I
One(1) unit	300 mm 200 mm	22.2 22.2	0.000340 0.002447	1/2,945 1/408.8
Two(2) unit	300 mm 200 mm	44.4 44.4	0.001224 0.008819	1/816.8 1/113.4
Three(3) unit	300 mm 200 mm	66.7 66.7	0.002599 0.018720	1/384.7 1/53.41

c. Total Loss Head at the Turnout Points

Table 5-2-7 below shows the results of calculations of the total loss head through the supply pipeline, when three rain guns are in operation simultaneously.

Table 5-2-7 Total loss head by friction at each turnout(To)
Unit: m

Farm lot Served	Turnout Number	Size of Pipe (m)	Pipe Length (m)	Friction Loss (m)	Remarks
3A & 4A	B.P. No. 1 No. 2 No. 3	0.3 0.3 0.3 0.3	0 760 820 920	0.000 1.975 2.048 2.082	 760mX0.002599=1.975m 60mX0.001224=0.073m 100mX0.000340=0.034m
3B & 4B	No. 4 No. 5 No. 6	0.3 0.3 0.3	1,020 1,115 1,215 1,228	2.651 2.797 2.831 3.192	1020mX0.002599=2.651m 95mX0.001224=0.116m 100mX0.000340=0.034m 1228mX0.002599=3.192m
3C & 4C	No. 7 No. 8 No. 9	0.2 0.2 0.2	1,315 1,415 1,515	4.821 5.703 5.948	87mXm0.01872=1.629m 100mX0.008819=0.882m 100mX0.002447=0.245m

d. Water Pressure at the Hydrants

The water pressure at each hydrant is obtained by subtracting the friction loss head from the pump pressure at the outlet, then adding the difference in elevation between the pump and the hydrant. The difference in elevation becomes a positive value, as all hydrant is located in the lower position than the pumps.

The following table is shown the elevation, elevation of water level line,and water pressure at the outlet of hydrant located at the middle of each lot 4A, 4b and 4C.

In this table, the maximum difference of the connection pressure among hydrant is 3.0 m or 96 %, between No.5 and No.8 hydrant. Assuming that the discharge through the raingun is proportional to the square root of the connection pressure, the difference of discharge between No.5 and No.8

Table 5-2-8 Connection pressure at sprinkler irrigation hydrant

Unit: m

Farm Lot	Hydrant	Friction	W.L(m)	Elevation	Pressure	Ratio(%)
Pump Outlet			112.65	32.65	80.00	
3A & 4A	No.2	-2.05	110.60	31.50	79.10	100
3B & 4B	No.5	-2.80	109.85	31.20	78.65	99
3C & 4C	No.8	-5.70	106.95	30.85	76.10	96

hydrant is estimated to be only 2 %, and the difference of discharge is within the allowable error.

e. Maintenance of Air Valves

There are two(2) size of air valve have been installed on the supply pipeline, one is one(1) unit of air valve with a 75 mm size installed at the terminal of the pipeline, when the pipe line was constructed, and the other is five(5) units with a 25 mm size installed on the upper to middle section of the supply pipeline with 300 mm size in 1995.

The air valve installed along the supply pipeline in 1995 is consisted of a valve body, a steel pipe with an internal diameter of 25 mm and two(2) cocks set at the both ends of the steel pipe. The valve body is mounted on top of the steel pipe through the cock at the upper end, and the bottom end of the pipe is branched vertically from the supply pipe through the other cock.

The function of a air valve is, to release air from the pipe during pumps in operation, and supply air into the pipe when it stopped, in order to dissipate a water hammer action in the pipeline, which might be bursting the pipe.

During the irrigation practice and even after the irrigation, both cocks are always in open position, as far as the air valve works well. Usually the air valves require not special operation and maintenance. However as the air valves have a very important roll, it must be checked time to time by removing the cover on top the body to clean inside of valve and check its functions.

f. Scouring of Inside Pipe

At the terminal of the pipeline, a scour valve with drain pipe is provided to exclude sediments in the pipeline by flushing the pressured water from the pump. In addition this system is used for drain the water in the storage pool when it is cleaned.

As this irrigation system takes water from an storage pool after settled sediment in the canal water, it is expected that sediment from the canal is rarely mixed with the irrigation water into the pipe. In this connection, scouring works will not be required specially, it will enough when this facilities is used for the drainage of pool for once a year.

(3) Orchard Irrigation System

1) Structures of the Orchard Irrigation System

a. Outline of the Structures

The orchard irrigation system is consists of the following structures. This system was originally planed for the orchard irrigation, with a continual drip irrigation method. Since 1993 irrigation season, the system is used in common with the vegetable irrigation in 3A and 3B areas. Fig. 5-2-3 and Table 5-2-9 show the arrangement and outline of the structures.

Pump: Two(2) units of pumps with each one(1) electric motor are installed to supply the pressure and water for the orchard irrigation system, which is primarily designed for a drip irrigation method.

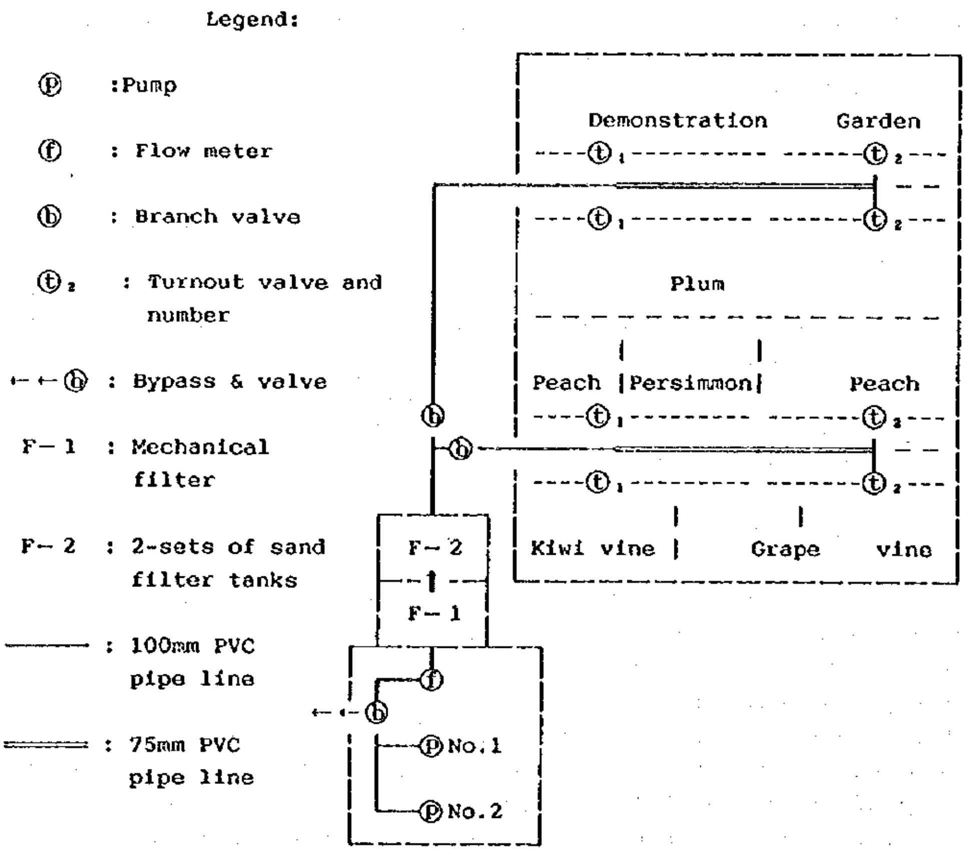

Fig. 5-2-3 Schematic diagram of orchard irrigation system

Filter system: The system is installed with the purpose of filtrate water used for the drip irrigation. It is consisted of a screen filter with stainless screen and two(2) units of sand filter tanks in which filled with river sand.

Supply Pipeline: It is a pipeline system to carry the pressured water to the orchard lots, made from polyvinyl chloride with two(2) size of 100 mm and 75 mm.

Turnout Valves: Two units of turnout valve with valve box per orchard lot are installed along the supply pipeline.

Farm Level Irrigation System: The farm level irrigation system is consisted of a pipeline with 45 mm diameter and terminal hoses branched from the pipeline. Emitters for drip irrigation and mini sprinklers were fit on the hoses.

2) Pumps

a. General Items

This section describes only technical informations necessary for pump operation and maintenance, such as hydraulic information, role of each equipment, procedures on start/stop of pumps and so forth. With regard to detailed information on the pump facilities and general items on its operation and maintenance, please refer to the instruction manual included among the technical documentation provided by the manufacturer when the pumps are installed.

b. Elevation of Pump and Pressure Gauges

The following numerical numbers are basic data regarding the water level and elevations of facilities required for pump operation.

Full water level of storage pool : El. 32.96 m
This water level is equal to the full water level in DSI canal at the intake point.

Pump elevation: El. 32.49 m
Elevation at the center line of rotating shafts of the pumps.

Elevation of suction pipe: El. 32.49 m
This water level is equal to the Pump elevation.

Elevation of outlet pipe: El. 32.39 m
Elevation at the center line of the pipe between the pumps and the flow meter where bypass pipe is branched.

Elevations of pressure gauges:
The following is shown an approximate numerical number due to difference size of gauges from different manufacturers.
Suction gauge is El. 32.55 m, and outlet one is El. 32.70 m.

c. Performance of Pumps

The following table shows the performance of the pumps, relations between outlet pressure and discharge, based on the performance test conducted by their manufacture at that time. At present, the performance of pumps will remain unchanged.

Table 5-2-9 Performance of orchard irrigation pump

Rate of Discharge (%).	0	34	75	100	123
Discharge (L/sec)	0	1.6	3.5	4.7	5.8
Outlet Head (m)	35	34	31	27	18

d. Appurtenant Equipments of Pumps

Functions and outline of appurtenant equipments of pumps, indispensable to pump operation, are as follows.

Pressure gauge at suction pipe:

The pressure gauge is used for monitoring the degree of minus pressure produced at suction side of pump during operation. In this connection, the scale on the dial is figured from minus pressure to plus one, with zero at the middle, to measure mostly minus pressure.

Foot valve and screen:

The foot valve is used to check the water to flow backward into the pool when the pump is stopped. This valve is to open by the suction pressure generated by pump when it draws up water.
The mouth of the foot valve is covered by a screen to prevent trash or materials to enter the pump.

Pressure gauge at outlet pipe:

It is installed to monitor the outlet pressure of pump. As to the standard of the gauge, the maximum pressure of the pumps is remained at the 3.5 bar level, the maximum scale of the pressure gauge is as high as 4 bars.

Pressure gauge at supply pipe:

The gauge is installed between the flow meter and the filter system to monitor the pressure of supply canal at the beginning point, for the convenience of pressure control by means of bypass valve.

Sluice valve at outlet pipe:

This valve is used to control the outlet pressure of pump, during the period of fill up water into the pipe line system, until pressure gauge of supply canal system have indicated normal operation pressure.

Check valve on the outlet pipe:

This valve, which is not shown on the schematic diagram, is installed between the pump and the sluice valve, for the purpose of preventing water to flow back from the supply system when the pump is shut off. Its function is just same as the foot valve, however it opens by the outlet pressure of the pump, and closes when that pressure is not existed.

Bypass pipe with a sluice valve:

The bypass pipe is branched between pumps and flow meter, in order to return surplus water to the storage pool before the filter system, the discharge for bypass pipe is controlled by the sluice valve installed at the head of bypass pipe.

The function is to control pressure or discharge in the supply pipeline by diverting a part of discharge from the pumps. When scheduled discharge for irrigation water is much less than one(1) or two(2) pump capacity, surplus discharge from the pump will be returned to the pool through the bypass valve.

e. Filling Water into Supply Pipe and Starting Irrigation

After turning on the pump and before starting irrigation, it is necessary to make sure that the pipeline system have been filled with water.

Preparatory works on irrigation practice:

At first make sure that the branch valve concerned and turnout valves for the area to be irrigated have fully opened, and the other branch valve and turnout valves have fully closed.

Filling Water into Supply Pipe:

Then turn on one pump, and open the sluice valve on the outlet side of the pump until the needle of pressure gauge indicates about 3.0 bars,, which about 4 l/s or about 85 % of standard discharge of a pump.

Then, release air remained in the filter system through the air valve and the air release cock, installed on the pipe over the sand filter tanks. When the air has been completely excluded from the filter system and the pressure gauge installed on the bottom of the sand filter tanks indicates more than one(1) bar, the water pipes are filled and ready for irrigation.

Start of irrigation:

Turn on the second pump if required and each outlet valve of the pump in operation are fully opened, and check the discharge of the flow meter and make sure that the discharge is on schedule. When scheduled discharge is less than capacity of a pump, it is required to control the pressure for the supply pipeline by means of the bypass valve as described in the following section.

f. Pump Operation With Small Discharge

When discharge from the pump is less than normal capacity, water pressure at the outlet of pump will be increased, as shown in the above table on performance pump. And it must be controlled water pressure with upper limit of 2kg/cm². Because, surplus pressure in the supply pipeline might breaks in deteriorated portion of the terminal irrigation system, although such surplus pressure has no problem on the pump system.

There are two(2) possible measure to control water pressure for the followed pipeline system, the one is by valve control at the outlet of pump, and the other is by means of bypass valve. In general the former method is not recommended as routine operation method except for temporary method. On the other hand, the latter method is more feasible for the pressure control and, at the same time, the bypass system will be worked to minimize a fluctuation of pressure caused by the change of discharge in the supply system.

g. Shut off the Pumps

When scheduled irrigation is over, turn off each pump after each sluice valve on the outlet side is fully closed. And at the same time or later, close the branch valve and turnout valve concerned on the supply pipeline.

h. Discharge Measurement by the Flow Meters

The flow meters is provided with two kinds of meters in the display plate,one is a flow meter and the other is a water meter. The flow meter is a dial meter with a needle to indicate flow from 2 l/s to 25 L/s. The water meter, on the other hand, is consisted of a digital indicator to display an accumulated volume of water by numerical number of 0.1 m³, and it is provided with a small dial meter with a revolving needle to indicate 0.1 m³ par a round.

Because the minimum discharge indicated on the flow meter is 2 l/s, it is impossible to measure by the meter when discharge declines below 2 L/s. In such cases, the flow volume may be calculated from the rotation speed of red needle which indicates 0.1 m³ per round, so that the discharge can be calculated by the second required for a round of red needle.

3) Filter System

a. Outline of the Filter System

Fig. 5-2-3 shows the outline of the filter system, which is consisted of a mechanical filter and two(2) sets of sand filter tanks.

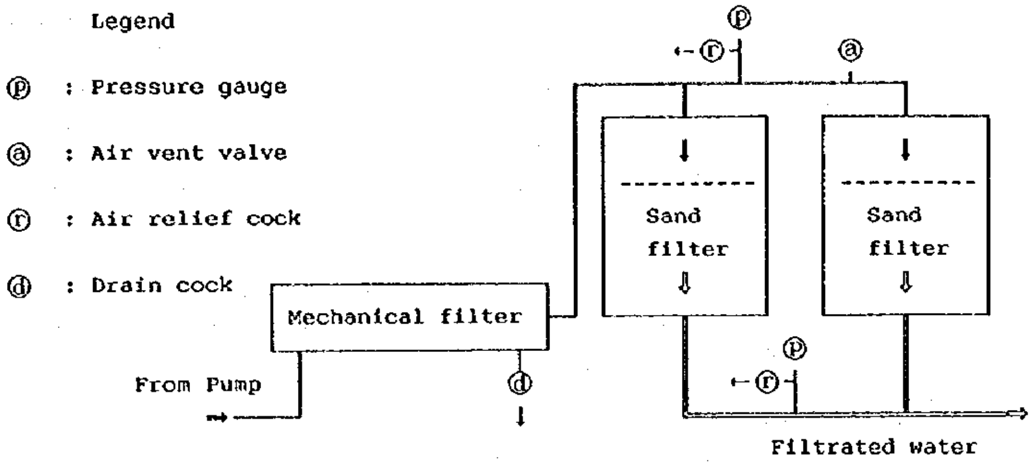

Fig. 5-2-4 Schematic diagram of filter system for orchard irrigation system

The following are the structures and its function of the filter system.

Mechanical Filter:

The filter is used to exclude materials in the irrigation water through the pumps. It is consisted of a cylindrical tube containing a cylindrical filter made from stainless steel plate with many punched fine holes. Pressed water from the pumps is entered into the inside of the screen and trashes of even fine size are remained around the screen.

Sand Filter:

The filter, consisted of sand packed in two(2) steel tanks, is used to filtrate water through the zone to exclude fine particle contained in the water. Water supplied through the mechanical filter by pump pressure is divided into two parts at the top of the tanks. As the water passes through the sand zone in each tank, the mud in the water is removed.

b. Operation Management

Pressure Loss caused by the Filter system:

Theoretically the pressure loss by the filter system is caused by resistance of filters against the flow. In this connection, the degree of pressure loss will be increased when discharge increased, and at the same time it will be increased when muddy particle on and in the filters increased.

Measurement of Pressure Loss:

Pressure loss is able to measured from the difference of pressure, indicated by three(3) pressure gauges, the first is in the pipe house installed after the flow meter, the second is top of the filter tank and the third is the bottom of filter tanks.

As to the degree of pressure loss caused by the mechanical filter, it is measured by the difference of pressure between the first and the second gauge. In this case it must be considered the difference of elevation between two gauges, as the position of the second gauge is about one(1) m higher than the second, the first gauge is always 0.1 bar higher when no pressure loss is generated by the mechanical filter.

And the same situation has between the second and the third gauges, the only difference is that the position of second gauge is about one(2) higher than the third.

Effects of the Pressure Loss:

When the pressure loss through the filter system increases, the pressure in the supply pipeline decreases as the same value, which in turn, resulted in a reduction of discharge.
On the other way, we must increase outlet pressure to coupe with the drop of pressure.

Allowable Pressure Loss:

A 0.5 kg/cm^2 or 5.0 m of pressure loss had been allocated to the filter system, in the original hydraulic design for the system at the planning. With regard to the allowable pressure loss in the filter system, in view of the performance of pumps, 0.5 kg/cm^2 in normal discharge of 9.4 l/s is considered to be the limit.

Accordingly, it is recommended to clean the sand filter when the difference of pressure between upper and lower gauges was reached at 0.5 kg/cm^2 in normal discharge of 9.4 l/s.

According to the actual operation, only slight drop op pressure was observed in the normal discharge about 10 l/s, after the filter system was cleaned in June 1996.

c. Maintenance

Cleaning of mechanical filter:

The mechanical filter is provided with a drain pipe with a cock installed under the cylindrical filter case, to eject material remained on the outside of the filter, separated from the water, by means of the pump pressure. Accordingly, the drain cock is occasionally opened to clean the mechanical filter in the cylindrical case.

In addition, take the cylindrical case apart and clean the filter and inside of the cylinder, at the same time when the sand filter is cleaned.

Backwash system of sand filters:

The sand filter system have been equipped with a back wash device to remove mud in the sand by shifting the flow direction. However, as the sand zones in the filter tanks are not always to be cleaned completely by this back wash method, according to the findings carried out by the Japanese expert, it is not recommended to use for the cleaning of the system.

Cleaning of sand filter:

Open the hatch on the top and bottom of tank, then take out sand from the bottom opening, wash thoroughly.
Next, Remove the pipes attached to the bottom of each tank, connect by a flexible hose between the supply pipe from pumps and the outlet of one tank. Clean the inside of one tank and the outlet of water at the bottom of tanks by back washing, by means of pressed water from the pump.

Close the caps on the bottom of the tanks, and replace the sand in the tanks, inject water into the sand zone from the hatch on top to settle the sand and to make sure it passes through the sand properly.

When water is not drained successfully through the outlet, it will be improved by repeated back wash in the same way mentioned the above. Finally, all pipes and hatch covers are restored in the same place.

4) Supply Pipe System

a. Size and Standard of Pipe

A six(6) bar pressure of the standard pipe made in turkey with caliber of 100 mm and 75 mm is used for the supply pipeline system. Because of the maximum pressure of the pumps is 3.5 bars, no rupture have been experienced in the system since initial operation.

b. Friction Slope of Supply Pipes

The friction slope of the supply pipes differs it's caliber and discharge, which is calculated using the following formula.

$$I = 10.67 \times C^{-1.85} \times D^{-4.87} \times Q^{1.85} \times 1.1$$

Where:

I : Friction slope, which is the amount of reduction of the water level between two(2) sections with a certain distance, the discharge Q flows in through the pipeline.

C : Coefficient of flow, depended on material of the pipe and size, which is calculated as 150 in case of the canal.

D : Caliber of pipe (m)

Q : discharge of flow (m^3/sec).

The coefficient 1.1 accounts for various loss caused by bending etc. of the pipeline.

The value of the friction slope by number of pumps in operation using the above formula and assuming that the planned water supply volume per pump is 17 m^3/hr (4.72 l/sec), is shown in the following table.

Table 5-2-10 Rate of friction loss for supply pipeline

No.of Pump Operating	Caliber	Discharge	Friction Slope
One(1) unit	100 mm	4.72 L/s	0.000340
	75 mm	4.72 L/s	0.002447
Two(2) units	100 mm	9.44 L/s	0.001224
	75 mm	9.44 L/s	0.008819

c. Loss Head To the Turnout Points

Table 5-2-11 below shows the results of calculations of the loss head in the supply pipeline by friction, up to the turnout valves from the beginning point, when two pumps are in operation. Turnout No. 1 in the table means located in closer from the pump, while turnout No. 2 is located farther from the pump.

Table 5-2-11 Total loss head by friction at each turnout(To)

Unit: m

lot	To.	Pipe	Length	Loss	El.	Remarks
Kiwi &	No. 1	100mm	241 m	0.295m	31.70 m	241mX0.001224=0.296m
Peach	No. 2	75mm	+158 m	0.677m	31.40 m	156mX0.002447=0.382m
Plum &	No. 1	100mm	381 m	0.466m	31.40 m	381mX0.001224=0.466m
Demo.	No. 2	75mm	+158 m	0.848m	31.20 m	156mX0.002447=0.382m

d. Field Elevation at Turnout Points

The following are the field elevations at the turnout points.

Kiwi and peach orchards: No. 1 El. 31.70 m, No. 2 El. 31.40 m
Plum and demonstration fields: No. 1 El. 31.40 m, No. 2 El. 31.20 m

e. Water Pressure at the Turnout Point

The water pressures at the turnout point are shown in the following table. According to these calculation results, the water pressures at each turnout points is not so different from each other. Accordingly, water pressure at the each turnout point may be assumed to be equal to the pressure gauge at the bottom of the sand filter tanks.