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PREFEASIBILITY STUDY

GENERAL SECTION

FRUIT AND VEGETABLE PROCESSING
VEGETABLE SEEDS PRODUCTION

FOR

NATIONAL PLANNING COUNCIL
THE HASHEMITE KINGDOM OF JORDAN

THOMAS H. MINER & ASSOCIATES
INCORPORATED
135 SOUTH LA SALLE STREET CHICAGO, ILL. 60603

DECEMBER, 1971

PREFEASIBILITY STUDY

FRUIT AND VEGETABLE PROCESSING

VEGETABLE SEEDS PRODUCTION

OUTLINE

GENERAL SECTION

FORM OF THE REPORT

In compliance with ARTICLE VI, B of the Contract between the HASHEMITE KINGDOM OF JORDAN AND THOMAS H. MINER & ASSOCIATES, INC., dated 5 December 1971 separate reports are submitted in two separate volumes: FRUIT & VEGETABLE PROCESSING and VEGETABLE SEEDS PRODUCTION.

General matter which applies equally to both reports is included in the volume which contains the report on Fruit and Vegetable Processing. The Seeds Survey is presented in two parts: DRY VEGETABLE SEEDS (Part 1) and (Part 2) POTATO SEEDS.

SURVEY METHOD

Due to the military situation investigative work during the first two weeks of the Survey was confined to the immediate vicinity of Amman. During this period pertinent statistical records were examined. Visits were made to the existing tomato paste plant.

Numerous agriculture and agriculture related reports prepared by the Government of Jordan, Food and Agriculture Division of the United Nations, Agency for International Development of the United States, and private consulting firms from the United States, Yugoslavia, the Netherlands, and England were reviewed and studied prior to and during the field study in Jordan in July and August 1971. Copies of these reports are cited in Annex A of this report and are on file in the library of the Jordan Development Board.

Conferences were held with personnel of the Jordan Development Board, the Ministries of Agriculture and National Economy and other Jordan Government Officials, industrialists and bankers.

Starting the third week, tours arranged by the Jordan Development Board of dry land and irrigated agricultural areas were conducted by Mr. Khaled Fayyad, Director of the Horticulture Department, Ministry of Agriculture and Mr. Mamoun Jayousi, Director of Agricultural Extension, Ministry of Agriculture. Forest and fruit tree

nurseries at Wadi Walla, Wadi Sheib, Al-Hussein and Al-Feisal, dryland areas near Amman, Irbid, Madaba, Kerak, Salt and Rumeimin and Qast and irrigated areas at Wadi Dhuleil, El Qatrana, Ghor Safi and the East Ghor were visited.

Team members of both the Seeds Survey and the Fruit & Vegetable Processing Survey generally traveled together on field trips, accompanied by the Soils Technologist. The Potato Seed Specialist who joined the Survey late, performed most of his field work independently.

Market Survey trips were made to Lebanon, Saudi Arabia, Sudan, Kuwait, United Arab Republic, Syria, Spain, Italy, Great Britain, and France. More extensive survey of European markets appeared unwarranted because the potential for Jordan exports to Europe uncovered in the above visits far exceeds its production potential for the near term.

Soil and Water analysis was made largely to confirm existing data. Financial analysis and projections for the Seeds Survey generally follow the format contained in USAID Publications "Cost estimating Methods for AID Capital Projects" and AIDTO CIRCULAR "XA 2402". Financial projections of the proposed fruit and vegetable processing operation are presented in abreviated form at the suggestion of USAID, Washington, concurred in by the Jordan Development Board.

BACKGROUND

Following the 1967 conflict, the West Bank, which constitutes 6% of the total land area of the Kingdom of Jordan, fell under Israeli military control. The impact on the economy of this event was hightened by the fact that the West Bank contains 29% of the cultivable land and historically produces more than 60% of Jordan's fruits and vegetables. In the pre-war years it accounted for 37% of the Agricultural Sector's contribution to Gross Domestic Product. The table below further illustrates the importance of the West Bank.

Use Distribution of Agricultural Land in Jordan
(area in dunums)

	Kingdom		West Bank		East Bank	
Total Area	94,740,000	100%	5,874,000	6%	88,866,000	94%
Cultivable Area	13,000,000	100%	3,245,000	26%	9,755,000	74%
Ratio of Cultivable to Total Area	13.7%		55.2%		11%	
Area Planted - 1965						
Fruits	100%		80%		20%	
Vegetables	100%		45%		55%	
Cerials	100%		25%		75%	
Agricultural Production - 1965						
Fruits	100%		60%		40%	
Vegetables	100%		65%		75%	

Cerials	100%	30%	70%
Olives	100%	80%	20%

Agriculture Contribution (25%)[1]
to Gross Domestic Prod.

[1] of total Gross Domestic Product.

Source: Ministry of National Economy.

In a representative pre-war year, the Kingdom of Jordan produced 379,068 tons of fresh vegetables and 197,770 tons of fresh fruit worth, at their current prices some 11.6 million Jordanian Dinars and 8.5 million Jordanian Dinars respectively. The depleted agricultural land now available has the capability of producting 120,704 tons of fruit and 171,520 tons of vegetables, assuming the same planting rates and yields as were realized in the pre-war years.

A number of factors have affected adversely the actual post-war agricultural production. The area of the land under control of Israel accounts only partially for the lost productivity. Farmers in areas close to the cease-fire lines have been subject to sporadic harassment. Some agricultural land, which is not actually occupied, was damaged to an extent which impaired its productivity. Such infrustractural facilities as irrigation works, roads and bridges were also damaged. The civil disturbances of 1970 and 1971 took further toll of agricultural production. Marketing processes were impared as were such vital elements of agricultural production as distribution of fertilizer, imports of seeds, etc.,

Farmers on the West Bank in most instances have continued to plant and harvest their crops some of which are shipped to the East Bank as in pre-war years. Shipments however are somewhat irregular and

undependable. Export of Jordanian agricultural products has been reduced by the effect of political differences with neighboring countries - particularly Syria and Iraq.

The efforts made to restore the agro-economy of Jordan to earlier levels of viability have been successful to the degree that time and resources have permitted; many of the foregoing ills have been cured or partially cured but many still remain.

ASSUMPTIONS

For purposes of projecting the factors of demand, supply and price which directly influence the viability potential of the proposed Vegetable Seeds and Fruit and Vegetable Processing enterprises it is necessary to make some critical assumptions. These must reflect the realities of the present political, military and economic situation in the Middle-East but at the same time consider some improvements which appear possible of accomplishment in the near term. The critical assumptions used are:

1. Air space and all borders with neighboring Arab States will be open to Jordan for unrestricted transport of goods and passengers.

2. Goods will be exchanged in accordance with now existing trade agreements and protocols.

3. Subsidy payments to Jordan by other Arab countries will be reinstated.

4. The economic, political and military status quo Vis-a-vis Israel (including the Suez Canal closing) will be unchanged.

5. No major international or internecine disturbances, adverse to the interest of Jordan, will occur in the course of the next five years.

Certain other assumptions are made on the premise that suggestions offered in the body of the Survey Reports will be adopted and that the economy will expand as predicted;

1. Laws and/or regulations will be enacted and enforced to control the quality of all seeds and other planting materials imported into Jordan.

2. Import prohibitions or effective import duties will be enacted to protect both the seeds and processed foods industries until they are in a position to complete effectively with foreign competitors.

3. Highly qualified and experienced management will be employed to direct the development of both projects for a sufficiently long period to give reasonable assurance of success.

4. The Ministry of Agriculture will make available to the projects, the research facilities needed to develop the raw material supply aspects of both seeds and processed foods industries.

5. There is some interdependance between the recommended seeds operation and the Fruit and Vegetable Processing. For instance, the tomato seeds by-product operation suggested will not be possible until the proposed new tomato processing operation is in production.

ACKNOWLEDGEMENTS

We wish to acknowledge with thanks the invaluable assistance given to the Survey Teams by the many Jordan and U.S. Government representatives, private businessmen and members of the Banking community with whom we made contact.

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Mr. Ma'moun Shakeeb Jayoucy
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Experiment Station, Veg. Ext. Service

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Research Officer
Horticulture Section
Agriculture Research Dept.,

Mr. Ghassan Qamhawi
Research Officer
Horticulture Section
Agriculture Research Dept.,

Mr. Jamil Awad Al-Quhewe
Head, Field Crops Section
Labrotary of Jubeiha.

Mr. Yousef Mohammad Rushdi
Director
Wadi Duleil Experiment Station

Mr. Ali Nimer Shoboul
Super-Intendant of Station in
East Ghor for Farm Demonstration.

Dr. Abdel Karim Tayeh
Director
Agricultural Marketing Organization.

Mr. Rageh Amine
Director
Agricultural Marketing Organization.

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Minister of National Economy

Mr. Tawfiq Batarseh
Director,
Jordan Center for Industrial Dev.,
Ministry of National Economy

STATISTICS DEPARTMENT

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Director of Statistics Dept.,

Mr. Wasef Azar
Head of Economic Section

Mr. Ziyad Annab
General Manager
Industrial Development Bank
Amman,

MINISTRY OF HEALTH

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Mr. Sami H. Khawaja
Biochemist
City Lab. for Food Control

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N.R.A.

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Director
Irrigation Department.

Dr. Saad Shammout
Soil Department.

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Agriculture Division

Mr. George Soussou
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Program Office.

Mr. Ayed Sweiss
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CD/ENG.

AID/WASHINGTON

Mr. F.J. Le Beau
Support & Assistant.

Mr. Charles R. Horton
AID/Washington.

U.N.

Dr. Murad Rustom Grace
Project Manager
Agricultural Marketing Project
Agricultural Marketing Organization

Mr. Jamil Mualla
Senior Agricultural Advisor
F.A.O. Country Representative

BANKS

Mr. Abdel Majeed Shoman
General Manager
Arab Bank Ltd.,

Mr. Abdallah M. Bushnak
Assistant General Manager
Arab Bank Ltd.,

Mr. F. Sh. Nammari
Weibdeh Branch Manager
Arab Bank Ltd.,

PRIVATE COMPANIES

Agricultural Processing Co.,
Amman, Jordan.

Mr. Rafat Qashu
Manager
Agricultural Materials Co.,
P.O.Box 431
Amman, Jordan.

Oustandi M. Bajjali Grocery
Jabal Weibdeh
Amman.

Elias B. Hoshe Stores
Faisal Street
Amman.

International Food Stuff Co.,
Amman.

Farid Khalaf Stores
Jabal Weibdeh
Amman.

Mr. Yassir Khammash
Civil Engineer
P.O. Box 8180
Amman.

Mr. Yousef M. Marto
Eastern Co. for Agricultural Materials
P.O. Box 131
Amman.

Mr. Ahmad Mango
Hamdi & Ibrahim Mango Co. Ltd.,
Amman.

Messrs. Yousef Nassar Co.,
Wadi Seer Street
Amman.

Oriental Mineral Water Factory Co.,
Amman.

Processed Food Factory
Amman.

Mr. Ghazi Qubain
Engineer
Jordan Television
P.O. Box 5019
Amman.

Mr. Zokhriddin Shoukeh
P.O. Box 6175
Amman.

ENVIRONMENTAL CONSIDERATIONS

Industrial Operations

If the prescribed proceedures are followed neither the proposed seeds operation nor the proposed vegetable processing operations will have adverse effect on the environment of Jordan. They are essentially "clean" industries which generate no air, soil or water polutants.

The major waste materials generated, uncontaminated vegetable fibres, are bio-degradable. If sufficient volume is generated these fibres can be packaged easily and cheaply into humus for sale to farmers and eventual return to the soil. Since Jordanian soil is somewhat difficient in textural properties humus should provide a readily saleable by-product.

Effluent from the processing plant will be a mildly acid mix of fruit and vegetable juices and wash water with some residual vegetable fibres. Fermentation processes used in the seeds operation and in preparation of pickles and olives will generate a somewhat acid (pH 3.8) waste. In view of the ambient alkalinity of water and soil commonly found in Jordan these acid wastes will be harmless - will merely tend to nutralize alkalinity.

Notwithstanding the fact that neither of the proposed operations present important environmental problems good "housekeeping" and sanitary practices should be considered a major responsibility of management of both seeds and processing operations.

Extent and Control of Environmental Pollution Hazards by the Proposed Seed Industry.

Extraction of Seed from Fleshy Vegetable Fruits

By-produce tomato seed extraction by tomato processing plant will have no pollution hazard--because flesh and juice are utilized and skins are disposed of through normal processing plant waste disposal procedures.

Straight tomato seed extraction by the seed company will require a small settling and evaporation pond for any tomato juice which is not marketed as a by-product of the operation. Skins and trash would be hauled to the country for animal feed.

Other extraction processes of melon, watermelon, squash, cucumber, pepper and other fleshy fruits will be done at the farm with rinds and flesh returned to the soil or fed to livestock by the farmer.

Flume washing or extracted seed at the plant will utilize recirculated water with flesh, rind and trash particles being screened out for return to the farm as feed or plow-back.

Dry Seed and Custom Processing Operations

Heavy culls and trash screened or blown from crops are bagged for return to farmer or for sale as feed.

Light air-blown trash is bagged for return to farm for feed.

Airblown dust is 99% removed by cyclone dust collectors for return to soil or for use as landfill. The 1% or less of

fine dust is discharged to the air from the plant if located in an outlying area or may be removed from discharge air by air filters or air scrubbers if the plant is located within 100 meters of a residential area.

Potato Seed Storage and Sorting Operations

Refuse from potato seed storage and sorting operations is limited to (1) soil adhering to the tubers which loosens and falls off during storage and handling, and (2) sprouts and rotten tubers removed by sorting and cutting operations.

Because of possible potato disease contamination, potato refuse is not returned to the farm for feed or fertilizer but rather is held at the potato seed plant until truckload amounts have accumulated. It is then hauled away for use as landfill for non-agricultural purposes.

Pollution of air, soil or water by the proposed vegetable seed industry poses minimal hazards which may be largely eleminated by good management procedures and entirely eleminated by combining good management practices with minimum use of pollution control equipment.

Agricultural Operations

Ideally, Jordan should have laws designed to control the use of insecticides, weedicides, pesticides and other toxic materials. From a practical standpoint it must be recognized that such laws in force in the United States for instance, have fallen far short of protecting men, fish and animals from harmful effects of these materials.

Conservative use of all agricultural chemicals is suggested in the two reports. Recommented levels of application are generally levels which have been found to have no effect or acceptable adverse effect on the environment in the United States.

The contract growing program recommended include employment of a fieldman who will be conversant with the latest environmental protection laws and controls on effect in other countries. He will control use of agricultural chemicals in consonance with these practises.

THOMAS H. MINER & ASSOCIATES, INC.

PREFEASIBILITY STUDY
FRUIT AND VEGETABLE PROCESSING

FOR

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DECEMBER, 1971

PREFEASIBILITY STUDY

FRUIT AND VEGETABLE PROCESSING

OUTLINE

FINDINGS AND RECOMMENDATIONS

SECTION I

JORDAN'S AGRICULTURAL RESOURCES AS THEY RELATE TO THE FEASIBILITY OF PRODUCING FRUITS AND VEGETABLES FOR PROCESSING

FINDINGS

1. Yields, growth rates and quality of most crops in Jordan are far below world averages. Both yield and quality deficiencies are due principally to technological and varietal problems rather than to basic limitations of climate or soil and given sufficient water, in large measure can be corrected.

2. Low levels of annual rainfall, inadequate irrigation water, use of improper seed varieties and seeds which are often infested with viruses and plant parasites, inadequate use of fertilizer and other agricultural chemicals are the principal factors limiting agricultural production. The average farm is too small to make use of modern agricultural techniques practical.

3. Fresh tomatoes are the principal cash crop in Jordan and a significant sources of foreign exchange. Tomato yields from irrigated land, however, are chronically far below those of the rest of the world. Quality of the fresh market type fruit is inferior to minimum acceptable standards for processing.

4. The existing tomato processing plant produces an inferior product due principally to the use of inferior raw materials, primarily tomatoes salvaged from the fresh produce market.

   Certain deficiencies in manufacturing equipment and practice which contribute to poor product quality can be corrected. Managerial deficiencies found in the plant however

appear to be serious and not likely to be corrected without a complete change in managerial personnel.

5. The practice of purchasing distress merchandise from the fresh produce market on the assumption that it supports fair farm prices, is in fact contra-productive. It tends to support prices at levels which are below growers' costs.

6. Of the irrigated areas, Ghor Safi, because of the "off-season" timing of its harvest, high delivery cost, and the resulting high price it receives for its fresh produce, is not a suitable source of vegetables for processing under present conditions. Small, narrow fields and limited water supply militate against Wadi Shuieb and Wadi Walla as sources of processing vegetables.

   Significant agroclimatic analogs are found between Wadi Duleil, East Ghor, Deir Alla and viable agricultural areas of the United States. These areas offer excellent opportunity to raise vegetables for processing if adequate water is supplied.

7. There is sufficient demand for processed tomato products--paste and canned whole peeled tomatoes in Europe and in the Arab States to support a Jordan-based processing plant.

   However, over-production in Europe, and Asia particularly of tomato paste, may, at times, pour over into the Arab area and depress prices to unprofitable levels.

8. There is adequate present and potential domestic and export demand for fruit nectars and drinks to support a reconstituting operation on a co-product basis. These fast moving

products will provide an early cash flow to the proposed multi-product company. Their term of viability may, however, be short-lived. The capital and skill requirements are low for a reconstitution line and once the market is disclosed, competitors will follow Jordan's lead into the field.

9. Increasing production costs, due principally to increasing labor rates, will, in the near future militate against Spain's dominant position as the world's largest producer of table olives. These developments offer an opportunity for Jordan to penetrate this lucrative export market and at the same time create a viable cottage industry. A long-term agro-industrial program to grow, pack and market stuffed and unstuffed table olives and pickles will be required. Since Jordan already is embarked on a vigorous and apparently successful oil olives program the agricultural aspects should offer no problems.

10. The General Section preceeding the individual Fruit and Vegetable Processing and Seeds Reports discusses the environmental implications of both industrial operations and the agricultural supply programs. The potential hazard to the environment of the industrial operations is minimal; the hazards from use of toxic agricultural chemicals must be minimized by carefully monotoring by trained personnel.

RECOMMENDATIONS

1. Initiate a horticultural program to improve both quality and yields of tomatoes using selected processing varieties having resistance to wilts and nematode infestation.

2. Apply fertilizer chemicals under a closely monitored program at the following rates: Nitrogen 10 Kg/dunum, P_2O_5 at 9 Kg/dunum)1:1 ratio) for vegetable seed; and metallic zinc at 1.2 Kg/dunum for those crops that are considered zinc sensitive.

3. Institute a nematode control program incorporating crop rotation, solar dessication, fumigation, culture timing and intensity control.

4. Use pesticides on a limited basis until trained personnel can be made available to manage a control program.

5. Undertake a soil tillage educational program.

6. Initiate a program to plant table olive trees as an extension of the on-going oil olive tree program.

7. As results are forthcoming from the horticultural program, as described in items 1-6 above, form a company to initiate a multi-product food processing facility to produce first, high quality tomato paste and reconstituted fruit nectar from imported concentrates, followed in subsequent years by canned whole peeled tomatoes and fermented pickles and olives.

8. Update, refine, verify and expand market data provided in SECTION II of this PREFEASIBILITY STUDY. Prepare a marketing program.

9. Undertake a full-scale engineering study which will update, refine and provide detailed construction engineeding data, drawings and specifications in extension of the data provided SECTION III, of this PREFEASIBILITY STUDY.

The Engineering Study will specify:

Plant Location	Equipment Selection
Building Design	Plant Layout
Site Preparation	Plant and Equipment Cost

10. Prepare a Pre-operating Program consisting of:

- Critical path program
- Equipment ordering proceedure, lead-time, supplier credit, insurance, down payment, delivery schedule, specification control.
- Construction schedule - supervision
- Installation program - engineering, supplier assistance, rigging requirements, utilities connection, licenses and permits, installation mechanics, installation schedule.
- Start-up plan
- Employee training program

11. In accordance with Engineering Study specifications, construct a new factory and warehouse to contain the proposed operation, abandoning the present inadequate building.

12. Purchase new, modern equipment for this facility in accordance with Engineering Study recommendations.

13. Implement a minimum cost, interim program to improve operation of the present paste plant until the proposed new

facility is in production.

14. Organize and implement an Agricultural Support Program to supply the operation thru grower contracts.

15. Employ an experienced US or European food processing manager who will have full control of the operation until a Jordanian can be trained.

16. Employ a "fieldman", trained in techniques of insecticide, fungicide, fertilizer application and disease control to establish and maintain contact between farmers and any processing operation which might be initiated.

SECTION I

JORDAN'S AGRICULTURAL RESOURCES AS THEY RELATE TO THE FEASIBILITY OF PRODUCING FRUITS AND VEGETABLES FOR PROCESSING

A. General Observations

1. Availability of Data

Detailed climatological information is available for most of Jordan; the soils have been well mapped and classified and the information from prior reports and records are available from the several ministries, agencies and departments of the Jordanian government; especially the Ministry of Agriculture and the Natural Resources Administration. The irrigated experiment stations under the Ministry of Agriculture are doing some very fine work and their findings will continue to be of considerable value.

2. Land Use

The land area of Jordan is 9,470,000 hectares (94,700,000 dunums) of which approximately 1,300,000 hectares (13,000,000 dunums) is classified as agricultural area. The agricultural area is composed of 75,900 hectares (759,000 dunums) of irrigable farm land; 952,000 hectares (95,200,000 dunums) dry farm lands and 271,600 hectares of uncultivated lands. The remainder, slightly over 8,000,000 hectares, is given over to public lands, deserts and other non-agricultural uses.

Over half of the agricultural lands, 57%, is in farms of 30 dunums or less, and approximately 30% is in farms from 30 to 100 dunums in area with the remaining 13% in holdings exceeding 100 dunums.

3. Climate, Rainfall and Irrigation

Low rainfall and inadequate irrigation water are the primary factors limiting agricultural production in Jordan. Only 6% of the land receives the average minimum rainfall (300 mm annually) required for dry farming. Of the 6 million dunums of crop land available less than 5% (about 300,000 dunums) are irrigated.

The East Ghor has 120,000 dunums of irrigated land along 65 kilometers of the Jordan River Valley. The area being developed near Mafraq, with the Station at Wadi Duleil as its center, may add another 30,000 dunums of irrigated land in the near future.

4. Water Analysis

The East Ghor project of 120,000 dunums has approximately 10,000 dunums in citrus and bananas leaving 100,000 dunums for other production. The land is all calssified for cultivated use. The soil chemistry data given in prior reports bears this out. A water sample taken on August 14, 1971 from the East Ghor canal showed on EC of 790 micromhos/cm which is considered to be a medium-high salinity hazard. This presents a situation to be monitored in the future for tomato production on the medium textured soils, more than for the sandy loam soil types.

The water sample registered a pH value of 7.1.

5. Soil Analysis

A soil sample was taken to a depth of 25 cm. on a field at the Deir Alla Experiment Station in Jordan Valley and analyzed at the University of Idaho Soils Laboratory. The data indicated a normal soil for crop production and, if this is representative of the Jordan Valley, should not present any problems in the near future, with the exception of zinc deficiency. The level of zinc in the

soil sample was only slightly above the level considered to be minimum for most crop production. Further, citrus trees on the irrigated lands of the Jordan Valley indicated a shortage of available zinc or iron. It is reported iron chelate compounds have been tried with no visible response. Therefore, it would be advisable to study the response of zinc fertilizers to both citrus and vegetable crops grown on the irrigated lands of the valley. With increased use of phosphorus fertilizers, zinc availability is usually lowered. The pH of the soil sample was 7.65 which puts it in the range of low available zinc due to zinc-fixation in the soil. Tomato is generally classified as mild sensitive to zinc deficiency.

See also Exhibits and

Soil samples were taken that represented each of three general areas of Jordan. (1) High altitude dry land farming, as represented by area around Irbid, north of Amman, (2) Jordan River Valley irrigated agriculture, sample from Deir Alla Experiment Station, where fertilizer P is regularly added, (3) desert, rainfall about 200 mm per year, no farming except some very small plots of wheat, nor properly cultured. Native soil P is good, pH and O.J. normal for desert soils, electric conductivity of soil extract is relatively low and zinc shows low for all areas, indicating the possibility of a universal need for zinc fertilizers in all of the desert soils of Jordan.

Soil analysis summary is given below:

		pH	EC mmhos	O.M.	P	K	Zn	Mn
					(ppm)			
1.	Irbid nursery	7.30	0.5	1.53	17.0	103(1)	1.20	11.50
2.	Deir Alla Sta.	7.85	1.5	1.42	28.0	585	1.10	4.00
3.	Desert, Zarka	7.90	0.6	1.89	17.0	452	0.80	11.50

(1) Potassium level very low - may well be an error.

Analysis by: Dr. F. P. Park, Dept. of Ag.Biochem. & Soils, University of Idaho, Moscow, Idaho

Sample period: August 10 - 14, 1971

Sample depth: No. 1, 3, 20cm; No 2, 25cm.

6. Environmental Suitability

The irrigated areas are all suitable for the production of many vegetables and tomatoes for sale as fresh products or as raw material for processing operations. They are equally suitable for production of vegetable seeds.

The salt-sensitive group of vegetable crops is an exception to the foregoing generalization. For instance, snap beans grown at Wadi Duleil exhibit characteristically necrotic tissue and reduced plant growth caused by an excess of salts in the soil.

7. Crop Yields

Yield of wheat, the principal dry land crop, is among the lowest in the world. Yield fluctuates widely from year to year in close association with the erratic rainfall. Crop yields are greater and more stable when irrigated but are lower than in most similar areas. Average yield of tomatoes, the major irrigated crop in Jordan, is 1/2 that of Europe and 1/3 that of the United States as reported for the 1961-64 period. See Table 2.

8. Quality of Vegetables

(1) The quality of vegetables, originating principally from dryland areas at this time, was observed at the Amman Central Market and at retail shops in other cities. Cantaloupes, water-melon, cucumbers and eggplant, in general, were of satisfactory quality. However, a condition of poorly ripened and not uniformly colored tomato fruit was quite prevalent throughout Jordan. This condition was noted and cited by Sherbini as one cause for the poor quality tomato paste packed in Jordan. The color of tomatoes was of questionable quality for good fresh market produce and definitely below standard as compared to red-ripe, highly pigmented fruits needed for concentrated tomato products.

B. Area Analysis - Potential for Fruit and Vegetable Production

1. Dryland Areas

Although rainfall is limited and concentrated during the winter months, tomatoes, okra, eggplant, cucumber, cantaloupe and watermelon are growing in dryland areas. Stands of these crops are low and erratic, plant size is small and fruit set poor. Growth rate appeared slow and foliage displayed the symptomatic color of moisture stress and inadequate nutrition. There is considerable variation in plant growth and development within individual fields. Diseases and other plant parasites are common. Powdery mildew is especially serious and prevalent in epidemic proportion on all cucurbits observed.

Temperature conditions during the time dryland tomatoes are ripening are satisfactory for developing lycopene,

the desirable red pigment in tomato fruit. Exposure of fruit to direct sunlight, however, reduces lycopene formation. Because of poor growing conditions, foliage of dryland plants is scant, exposing ripening fruit to the sun. This condition and the customary practice of harvesting fresh market tomatoes at less than red ripe maturity produce poor quality tomatoes for processing.

Because of low and unstable yields, numerous small producing units, a complex marketing system, unstable prices and poor quality, dryland areas must be considered a less than satisfactory source of produce for a modern commercial tomato processing operation until these conditions are improved.

2. Irrigated Areas

Low quality seed stock, poor land preparation, need for crop rotation, inadequate fertilizer and other agricultural chemicals, small farm size, lack of farm machinery and inefficient use of irrigation water are responsible for low yields on irrigated land. High yields obtained from properly managed research trials, however, demonstrate that production problems on irrigated land are technological and not basic limitations of climate or soil that cannot be overcome.

Wadi Dhuleil and the East Ghor, both newly developed irrigated areas, have the good potential for raising fruits and vegetables for processing. Soil and water in these areas have been thoroughly analyzed and reported on in previous research studies by both government agencies and consultants. Ghor Safi also has

great potential, but is understandably committed to raising winter crops - particularly tomatoes - which command very high prices on the off-season export market. Winter tomatoes raised in the Ghor Safi sell for JD.35. to 40 per ton versus JD.20 per ton in the Amman Market. The remoteness of the area necessitates long-farm-to-market truck hauls, 335 km to Amman at an average trucking cost of JD. 20. per ton.

Wadi Walla and Wadi Shueib are less feasible sources of raw products for commercial processing. They suffer from limited water supply, small narrow fields and limited agricultural area suitable for processing vegetables.

3. Agroclimatic Analogs

Agroclimatic analogs are areas sufficiently alike with respect to important climatic elements that varieties and agricultural techniques from a developed area have possibility of success when introduced in its developing counterpart. Agroclimatic analogs of Wadi Dhuleil and the East Ghor are found in the San Joaquin Valley in California and the Lower Rio Grande Valley in Texas where fruits and vegetables are grown for processing.

Climatic data from Brownsville, Texas representative of the Lower Rio Grande Valley and analogs to Deir Alla, representative of the East Ghor; and from Sacramento, california representative of the San Joaquin Valley and analogs to Mafraq representative of Wadi Dhuleil are presented below.

The Lower Rio Grande Valley of Texas is an important area for producing vegetables in the winter and early

spring. Carrots, onions, tomatoes, cantaloupe, cabbage, green pepper, watermelon, white potato, sweet corn, snap beans, lettuce, cucumbers, broccoli, spinach, and red beets in that order are the principal vegetables grown. Of these, tomatoes, snap beans, cabbage (for sour kraut), carrots, onions, spinach and red beets are processed. Citrus is the most important fruit in the Rio Grande Valley which is noted for the quality of its grapefruit.

With its wide range of climates, California produces a variety of fruits and vegetables. The San Joaquin Valley is well recognized as one of the outstanding agricultural areas in the World. The area around Sacramento leads the world in production of peaches, tomatoes asparagus.

Though much smaller in extent, the climates of the East Ghor and Wadi Dhuleil, temperature regime in particular, are respectively quite similar to the Lower Rio Grande Valley and the Sacramento area. The annual mean temperature at Deir Alla is 23.5° C compared with 23.0° C at Brownsville. Mean daily maximum temperature at Deir Alla is higher than at Brownsville, particularly during the summer months, but the mean daily minimu is lower. Brownsville received twice the annual precipitation, but the major difference results from rainfall in the summer and early fall when many annual crops are not usually grown. Irrigation is necessary for vegetable crops in the Lower Rio Grande Valley.

C. The Potential for Growing Processing Tomatoes

Since the tomato is the most important cash crop grown in Jordan and the principle vegetable export, a more detailed evaluation was made of it than of any other type of produce.

1. Comparative Tomato Yields

Presented for comparison in Table 1 are average yields of tomatoes for the United States and European countries in the Organization for Economic Cooperation and Development established in Paris 1966. Except for Yugoslavia where significant increases in yield are anticipated, all countries have yields that are 2-3 times higher than Jordan's irrigated tomatoes.

Tomato production for processing is increasing in all areas of the world and in Europe in particular. Production of tomatoes in Italy which is second only to the United States increased 750,000 tons between 1960-1965. In 1970 production was estimated at 3,400,000 tons. Spain which produced an average of 1,021,000 tons of tomatoes per year in 1957-60 is estimated to have produced 1,280,000 tons in 1970. Production in Greece jumped from an average of 196,000 tons in 1957-60 (slightly higher than Jordan's 1970 crop) to an estimated 756,000 tons in 1970.

Exports of tomato paste from Portugal, Tunisia, Spain and other nonmember countries are such that measures are being considered to prevent their shipment into the European Economic Community.

TABLE 1

Tomato yields in important producing areas 1961-64.

	Metric tons/Hectare
United States	35.6
Italy	22.1
Spain	23.2
France	21.5
Portugal	27.3 *
Greece	24.5
Yugoslavia	11.1
Jordan	12 (irrigated) 6 (dry land)

* Estimated

TABLE 2

Tomato yields in the United States 1935-1969.

	Metric tons/Hectare
1935-39	8.1
1940-44	12.4
1945-49	14.6
1950-54	21.8
1955-59	26.2
1960-64	35.0
1965-69	38.7

Intelligence reports also indicate possible construction of tomato processing plants in Turkey and Saudi Arabia. Lebanon is reported to have plants with excess tomato processing cpacity. Competition among tomato producing nations is becoming increasingly sever.

Presented in Table 2 are average yields of tomatoes in the United States for different 5-year periods beginning in 1953 during a period of sever economic depression or drought. Since this time agricultural technology has resulted in a phenomenal 475% increase in yield. In addition to government programs, a significant contribution to this yield increase resulted from research and field services supplied by processors to contracting growers. Italy, Spain, France, Greece and Portugal are among the nations where grower contracts are used in producing tomatoes for processing. All have trends for increase in yield.

2. Yield Potential in Producing Areas

a. East Ghor

If the cropping intensity of the East Ghor follows the general pattern for irrigated agriculture in Jordan for tomatoes at 21%, this means there is approximately 21,000 dunums producing tomatoes annually. At 1200 kilograms per dunum, the present production potential at any time is 25,000 metric tons. However, the research personnel at Wadi Duliel Station stated that the farmers got an average yield of 4 tons of tomatoes per dunum and that experiment station yields have been as high as 12 tons of tomatoes per dunum. If the yield of tomatoes

in East Ghor could be increased to an average of five tons per dunum, which seems reasonable, the potential production of tomatoes from this area could be approximately 100,000 metric tons.

If the tomato production of the East Ghor occupied only 10 per cent of the irrigated farm land available (10,000 dunums) and production was five tons per dunum, this would still give an annual production of 50,000 tons. Further, if 25,000 tons or half of this production were processed, a plant requiring 200 tons per day could operate for approximately 125 days per year on tomatoes alone from the East Ghor. Additional irrigated production of tomatoes from the Mafraq district may well supplement this in tonnage and also extend the processing season when the land of this district is fully developed.

The mean annual temperature at Mafraq is only about 1^{o} C higher than at Sacramento. This difference is primarily the result of slightly higher maximum temperatures. Minimum temperatures are very close. Sacramento received more than twice the annual precipitation of Mafraq but the winter seasonal distribution of both are typical of Mediterranean type climates. These comparative analysis, visits to and interviews with agricultural staffs at Wadi Duleil and the East Ghor indicate the resources are satisfactory for producing the high vegetable yields necessary for processing if water is available.

b. Deir Alla

Minimum daily temperature at Deir Alla is usually below the lower threshold for good fruit set (12° C) until about the first week of March. About 60 days are required from fruit set to red ripe maturity so first harvest is estimated about the first week in May. Although minimum daily temperature remains favorable for fruit set (below 22° C upper limit) until early July, fruit set later than mid April would be maturing during increasingly adverse temperatures (above 30° C) so that yields of high quality fruit would become severely affected by the middle of June. This temperature pattern would give one processing period of about 5 weeks (May 7–June 15). It would become increasingly difficult to obtain tomatoes with good red fruit color after June 1.

Minimum daily temperatures drop below 22° C (upper temperature threshold) and again become favorable for fruit set about the last week in September. First set at this time would be ready for harvest about the last of November. Temperatures are decreasing and remain favorable for good fruit set (above 12° C) until the last of December. In favorable locations where frost does not occur, the harvest season could continue until late February. This would give a harvest and processing season of about 11 weeks (December 1 - February 20). These two periods would give a combined harvest and processing season at Deir Alla of about 16 weeks. The winter period (December–January) would be the most favorable for processing concentrated tomato products.

c. Wadi Duleil

Minimum daily temperature at Wadi Duleil does not become sufficiently warm for good fruit set until about May 15. The 60 day requirement for red ripe maturity would make first harvest about July 15. Temperature remains favorable for fruit set (over 12 and under 22° C) until about October 10 so latest harvest is projected into the first week in December except when terminated by earlier frost. Best colored fruit for processing concentrated tomato products would be available during September and October. The harvest and processing season from tomatoes at Wadi Duleil would be aoout 20 weeks.

3. Potential Harvest Season

Since tomato is the most important vegetable grown on irrigated land and the principal vegetable exported, an evaluation was made of its potential harvest season for processing. The procedure used was described by Neild and Young and is based upon the response of tomatoes to climate.

In a situation where produce from Wadi Duleil and the East Ghor were supplying a single factory, a 36 week processing season could be possible. If produce were contracted, as would be recommended, planting schedules would be necessary to provide a uniform flow of produce in balance with daily operating capacity. Care would be needed to avoid excess tonnage at the end of the fall

1) Neild, R.E. and J.O. Young, 1966. An agroclimatological Procedure for Determining and Evaluating Time and Length of Harvest Season for Processing Tomatoes. Amer. Soc. Hort. Sci. 89:549-558.

season at Wadi Duleil and beginning of the winter harvest season in the East Ghor. Presented in Table 3 are data showing the actual times and lengths of harvest season at Brownsville, Texas and Sacramento, California in comparison with estimates from the East Ghor and Wadi Duleil.

Similarities in the times and lengths to tomato harvest seasons for comparative locations in Jordan and the United States can be seen in these data. Brownsville has warmer early spring minimu daily temperature than Deir Alla so the harvest season begins earlier, April 15 vs. May 7. Maximum summer temperatures are higher at Deir Alla than Brownsville so the season there does not continue as long (June 15 vs. July 15). Fall minimum temperatures are quite similar at Brownsville and Deir Alla and winter harvest at both begin on December 1. A higher frequency of freezing temperature terminates the season at Brownsville about the middle of January while harvesting at Deir Alla could continue into February The total length of harvest season at Brownsville and Deir Alla are respectively 19 and 16 weeks.

Temperatures at Mafraq and Sacramento are quite similar but slightly higher minimum daily temperatures beginning in May at Mafraq permit earlier fruit set and consequent earlier fruit set and consequent earlier harvest. This give Wadi Duleil an estimated harvest season about 3 weeks longer than at Sacramento.

TABLE 3

Comparisons of tomato harvest seasons.

	First Harvest	Last Harvest		Weeks
Brownsville (Summer)	15/4	15/7		13
Brownsville (Winter)	1/12	15/1		6
			Total	19
Sacramento	1/6	30/11		17
Deir Alla (Spring)	7/5	15/6		5⅔
Deir Alla (Winter)	1/12	20/2		11
			Total	16
Wadi Duleil	15/7	7/12		20

D. A Recommended Program For Improving Yields And Quality of Processing Tomatoes

1. Background

As shown elsewhere in this report the tomatoes which come on the Amman Wholesale Market are of very poor quality and in any case varieties are inappropriate for processing. Better quality tomatoes, grown in Ghor Safi in winter, are sold on the export market where they command substantially higher prices than they would in Amman. Even the Ghor Safi tomatoes however are of mediocre quality by European or American standards. A wholesale market is generally a poor source of raw materials for food processing operations; the deficiencies in supply and quality are particularly visible in the Amman market.

Extremely low yield are the common experience of tomato farms in Jordan.

Agricultural and industrial programs are recommended to amiliorate these conditions. The agricultural program which will assure quality and adequate supply of raw material to the proposed tomato processing operation and the industrial program which will assure a ready market at fair prices for the tomato farmer are mutually dependant should be undertaken simultaneously. Both programs will require government assistance and surveillance.

The common denominator of the two programs is the supply contract between the grower and the processing plant which is described in Section IV of this Report.

2. Agricultural Program

a. Objectives

To assure an adequate supply of tomatoes of varieties suitable for processing, to the processing plant at a price which will enable both the farmer and the industrialist to make a profit.

To raise the quality and yield of tomatoes to generally accepted levels by introducing modern agricultural techniques.

b. Control Measures

The following measures are recommended to reach the stated objectives:

NEMATODE CONTROL

Nematodes are universally present in the East Ghor soils. Control is necessary to obtain high yields of almost all crops. It has been concluded by Wallace that various soil factors are not as important in nematode build-up as is the intensity of single crop production. Therefore, crop rotation is important. Other factors that will help control nematode are (a) culture such as the timing of planting and harvest; (b) fallow periods - hot relatively dry climates offer an opportunity for control by plowing the soil 2-3 times per season, which will induce dessication of the nematode; (c) soil fumigation or chemical control is the most nearly complete control method, but is also very expensive. Typical chemicals which are used for this purpose are Shell D-D @ 26 liters/dunum or Telone @ 23 liters/dunum.

a. Steps involved in controlling diseases and nematodes are as follows:

(1) Evaluate varieties, sources and/or select segregating generations from hybrids for resistance to nematodes and diseases. Some varieties, hybrids and sources are suggested:

Bonita - nematodes-resistant variety developed in France. Paste tomato type fruit similar to Toma but larger. Plant tends to grow bushy and wild in warmer growing areas.

VFN8 - developed at University of California, Davis, California, U.S.A. Some resistance to verticillum, fusarium and nematodes (VFN) but fruit tends to crack.

Nema Red - good hybrid developed at Oklahoma State University U.S.A. Performed very well in adverse growing conditions in Panama. Seed not available in quantity for producing tomatoes for processing, but is a promising genetic source for selecting and developing self-pollinated varieties from segregating populations.

Other Sources - Dr. Gilbert of the University of Hawaii, Honolulu, Hawaii, U.S.A. has developed and is working with varieties resistant to nematodes and bacterial wilt, both serious pests in warmer growing areas.

(2) Fumigate seed beds where transplants are produced with Dow Fume, Dibrome 2 or other materials containing chloropicrin or methyle bromide. Since seedlings for a large area can be produced in a small space, this necessary operation is both biologically and economically practical.

(3) Evaluate use of nematocide powder for use in transplant water. Dow Chemical Company, Midland, Michigan, U.S.A. manufactures such materials.

The use of pesticide chemicals will be of increasing importance as culture intensifies. It is vitually impossible to make a meaningful estimate of pesticide cost per dunum because of the many variables involved: objective, season, crop, type of soil and class of plant to which applied.

(4) Develop a government certification program for preventing disease spread through transplants by controlling production methods and inspecting transplants. This should be instituted immediately at all government nurseries. Strong measures should be taken with transplant growers in Ghor Safi and the East Ghor to assure that no infected transplants are produced.

CROP ROTATION

A crop sequence which includes other economically valuable crops should become a part of the fresh tomato and vegetable seed production programs. Suggested crops are cereals such as wheat and barley with the straw residue returned to the soil, alfalfa and perhaps broadbean. Crops that will increase the soil organic matter content and improve soil tilth will also reduce soil borne diseases. Any area where the summer or off-season irrigation water supply is not adequate should use low water requiring crops such as cereals in preference to alfalfa. In any event, an effort should be made to return more crop residue to the soils.

CULTIVATION PRACTICES

Seed bed or pre-plant soil preparation is an important step in vegetable production. We were not able to observe these operations while in Jordan during July-August 1971, except plowing in a case or two. Soils were too dry and a turnover of plow layer and covering of crop residue was not accomplished as well as might have been done. Normal preplant activities required that the soil be plowed to a depth of 20-25 cm and then resettled and leveled. This usually requires at least four operations after the plowing.

Cultivation for weed control varies considerably for each crop; however, if no weed control chemicals are used, an average figure should be two cultivations per season. Hand weeding would surely require at least three additional man days per dunum. In fact, chemical control with selective weedicides should not be recommended until completely appropriate equipment and excellent supervision are available to all farmers. Too many crop losses can result from improper use of such practices.

FERTILIZER

Fertilizers-nitrogen, phosphorus and zinc will be needed. Discussions with local experiment station and extension personnel in Jordan as well as limited soil test data indicate a maximum recommendation of 12/kg/dunum of P_2O_5 or 26 kg/dunum of triple super phosphate (45% P_2O_5). The average amount of triple super phosphate fertilizer used will be about 20 kg/dunum for irrigated East Ghor production. (9 kg/dunum P_2O_5).

Exact recommendations can only be made after a soil analysis and the prior cropping history are known. Tomatoes will respond to phosphorus fetilizer if the level in the soil is low.

Relatively simple fetilizer programs are required for agricultural operations in Jordan. The optimum amount applied at the most convenient time by the most practical means will usually produce the greatest profit to the farmer from season to season.

PLANT POPULATION

Plant population is an important factor in the use of chemical fertilizers. For example, if the population of tomatoes is increased from the average of 1700 plants per dunum to 3000 plants per dunum, the average fertilizer application should not increase more than 20%. On this basis the recommendation for N is 12-14 kg/dunum (60 kg/dunum ammonium sulphate - 40 kg/dunum ammonium nitrate) and P_2O_5 at 11-12 kg/dunum (26 kg/dunum of triple super phosphate).

TOMATO CULTURE - OTHER AREAS

If tomato production is initiated in the Mafraq district, the same cultural practices and fertilizer uses would apply as those given for the East Ghor lands. This could easily add another 2000 tons of tomatoes for processing annually in Jordan. The dry-land soils from Amman to the North of Jordan have high moisture holding capacity and are capable of tomato production to supplement the irrigated production discussed above. The statistics for agriculture for Jordan (11) show approximately 10,000 tons of tomatoes produced in the Amman and Irbid districts in 1970. This production fluctuates and is spread over several months, is of poor quality and so not an important area to consider here. An average fertilizer use figure is not readily available for this type of production area, if in fact much fetilizer is required. An estimated normal recommendation however, would be N at 5 kg/dunum (25 kg/dunum ammonium sulphate or 15 kg/dunum ammonium nitrate); P_2O_5 at 5-6 kg/dunum (12-13 kg/dunum triple super phosphate). Tillage operations would be reduced very little, if any. The production per dunum might reach 600 kg/dunum (an estimate by writer -- no data).

c. Implementation

As described in Section III INDUSTRIAL ASPECTS OF ESTABLISHING FRUIT & VEGETABLE OPERATIONS IN JORDAN the most effective way to implement a program to improve yields and quality of tomatoes is to bring it under control of a processing company - the farmers' major customer.

Conceivably the Agriculture Program could be initiated simultaneously with construction and equipping the tomato processing plant proposed in Section III.

Meanwhile a great deal of progress can be made on the Agricultural Program under the direction of the Ministry of Agriculture.

Interim steps would include:

- Continue research and emphasize extension efforts on improved cultural practices such as crop nutrition, land preparation, irrigation efficiency, plant population, weed control, insect control, etc.
- Establish a joint research program with the Agricultural Marketing Organization tomato paste processing plant for commercial-scale production demonstrations on farm sized plots at Wadi Duleil and Deir Alla using the latest proven varieties and cultural techniques. These tomatoes should be harvested at the red-ripe maturity suitable for canning and be processed by the AMO plant separately for comparison with tomatoes of fresh market origin. Field and factory yields and costs should be collected from these operations.
- Initiate yield improvement programs with key influential tomato growers, supplying transplants, supplies, equipment and other technical services at cost or limited subsidy to promote acceptance of desirable agricultural practices.

The size of demonstration farm operations should be increased so as to supply 10-20% of the needed produce. As tomato yields improve contracts should be written with selected high yielding growers.

E. Production of Table Olives and Other Vegetables for Processing

1. Background

At one time Jordan imported most of its olive oil.

Inorder to reverse its balance of trade in respect to olive oil and to relieve itself of the drain on foreign exchange, in 1952 it instituted an ambitious olive tree planting program.

The kingdom of Jordan is now a net exporter of Olive oil as shown below; 1970 imports amount to little more than 10% of exports.

TABLE 4

FOREIGN TRADE IN OLIVE OIL 1970

Country of Destination or Origin	IMPORTS Kg.	IMPORTS JDs	EXPORTS Kg.	EXPORTS JDs
Lebanon	5500*	1510*	36	11
Kuwait	17606*	4694*	421271	1143161
Quatar	-	-	5973	1640
Saudi Arabia	3200	800	46609	14208
Abu Dhabi	-	-	1400	406
Iraq	-	-	7377	1948
Dubi	-	-	3600	871
France	-	-	110	20
Syria	23513	6827	-	-
Italy	25	236	-	-
TOTAL	50536	14082	486376	133420

The successful olive tree planting program which is largely centered on the East Bank offers the additional bonus of helping to reforest the area which was denuded of its trees many years ago.

A well conceived research program is running concurrently with the planting program. It is designed to test various cultural techniques suitably of various species of oil olives.

In 1970 Jordan (East Bank) had 200,901 dunums planted in oil olive trees the plantations are centered principally in the Irbid District.

Olive production, altho interupted by the 1967 and 1970 conflicts showed signs of vigorous growth in 1969 and 1971.

PRODUCTION OF OIL OLIVES
EAST BANK
TONS

1964	17156
1965	13606
1966	9732
1967	NA
1968	16715
1969	16423

SOURCES : FAO Report.

Olive culture is ideally suited to the climate of Jordan since it flouriches in dry, upland areas which receive very little precipitation. Projections of the yield of olives from the planting program indicate that Jordan will be self-sufficient in olive oil by the mid-1970s and will have surplusses available for export in alternate years starting 1977. Eventually the planting program will even-out the off-year harvest by alternate-year planting.

This favorable prospect however may not materially benefit Jordan since estimates from the International Olive Oil Council, Madrid, Spain* indicate that concurrent increases in production in Italy, Greece, Turkey, and Tunisia will raise world production to a point at which it will exceed consumption; probably by 1975. Except for Italy, production will far exceed consumption in all major olive-growing countries by 1980. Increasing competition and possible lower prices for olive oil should be anticipated. The outlook for future oil exports from Jordan therefore should be viewed with scepticism.

Table olives, not currently a part of the olive tree planting program, are a higher value crop than oil olives. Prices for premium table olives in Spain are as much as five time as high as for olives used for manufacture of oil.

At current prices, considering that it requires 5 tons of olives for 1 ton of oil, the equivalent value of one ton of oil olives sold as oil, FOB Spanish ports is $140 (50 JD). Fermented whole Manzanilla olives

sell for $350-700 per ton (125-250 JD) and stuffed Manzanilla for $700-900 (25-321 JD) FOB Spanish ports. Fermented whole queen variaties sell for $500-780 (178-278 JD) and stuffed for $650-1,000 (232-357 JD) per ton. Table olives are an important source of income for farmers in Southwestern Spain and contribute significantly to the government's foreign exchange earnings.

Production, processing and marketing of table olives in Spain are closely regulated by a government syndicate. Harvesting, sorting, curing, pitting, stuffing, and place-packing table olives requires considerable labor. The United States imports over 60% of Spain's fermented table olives. Because of high labor costs, a major US importer of olives has place-packing done in Spain. Spain's improving standard of living and associated increasing return for labor however are may limit the highly labor intensive production of table olives in Spain. Tree shakers and other devices for mechanically harvesting olives in Spain are being tested in hope of reducing the farm labor input but no viable substitute for hand-pitting hand-stuffing and - packing has been developed.

2. Proposed Agriculture Program

   a. Fermented Table Olives

      The foregoing circumstances possibly point the way for development of a new agro-industry in Jordan i.e. production and packing of stuffed and unstuffed fermented table olives.

      Since culture of oil olive trees is well advanced and the agriculture Ministry is already geared-up

to handle the necessary research and plant propogation work, it should be comparatively easy to add table olives to the program.

Since the culture of olive trees and the raising of pimentos, and other stuffing materials is already established in Jordan and is itself labor-intensive and the harvesting, fermenting, pitting, stuffing and packing is equally so, this project would fit well into the cottage industry sector of the Jordan Economy. As in Spain, families and small villages having limited resources and few economic alternatives will find this enterprise a rewarding income earner or suppliment.

The following steps are suggested:

1. Immediately procure buds from known Manzanilla olive tree and start tree multiplication.
2. Concurrent with the planting program, set up a food processing research laboratory in which facilities are provided for fermenting and processing fermented olives.
3. Employ a highly trained food technologist and send him to Spain and the US to study olive processing and marketing.
4. Assign the research laboratory the job of evaluating fruit from the first trees which come into bearing and to prepare detailed manufacturing and quality control techniques for the various styles and kinds of olives.

5. Further assign the food technologist the task of completing a thorough economic and technological feasibility study on olive processing in Jordan.

6. Provide budgetary support for the food technologist to permit annual review of his program and progress by an expert in the profession.

The fermented table olive program will take approximately 5 years to bring into fruition. In the meanwhile a co-product fermented vegetables program could be initiated. It will use the same manufacturing equipment and technique and has the same labor-intensive characteristics in every phase of its operation as table olives.

b. Fermented Vegetables

Examples of these products are cucumber pickles, mixed relishes, and sauerkraut (fermented cabbage). Consumption of pickled cucumbers is increasing in the United States. With increasingly high labor cost growers are forced to resort to mechanical harvesting of pickle-size cucumbers. The small, high value "midget" pickles are expected to increase in price and become more difficult to obtain. With the background of raising snake cucumbers it should be an easy transition for Jordan to raise, harvest and process midget pickles to fill this prospective market vacuum.

Pickling cucumbers, a highly labor intensive crop, necessitating frequent hand harvesting, are one of the few vegetables which are well adapted to small

producing units. Preservation is relatively simple and after size-grading and washing involves bulk storage in tanks. Later packaging, usually in glass, is largely a hand operation and non-seasonal. Capital required for vegetable fermentation is much less than with seasonal packs of more perishable products. Production of the lower volume of high-value, specially, gourmet-type pickles would need to be supported by products enjoying higher volume regional demand and/or by other high-value specialty items such as pimentos, peeled tomatoes, peeled asparagus, etc.

Pickled cauliflower, pepper and onions are popular throughout much of the world; all are grown successfully in Jordan and could be processed successfully.

No special agricultural development is required for these miscellaneous pickling vegetables altho, as in the case of tomatoes, a system of contract planting will be required to assure the processing plant of the quality and quantity it will require.

SECTION II

MARKETING

A. Market For Tomato Paste

1. Demand Characteristics

Tomato paste is primarily a concentrated flavor and color additive for food. It also adds some bulk but since it is by definition 28 to 30% solids, it adds less moisture, for instance, than would an equivalent value of whole fresh or canned tomatoes. It is popular as an enrichment to otherwise bland foods which are the staples of diet in many parts of the world.

It is unique as a condiment in the universality of its appeal and the fact that it sells as a mass market, high voluem product. Although it is not highly perishable it must be given good container protection and must be packed and distributed in small retail units--particularly in areas where refrigeration is not available, and where, as in Jordan, artificial preservatives are prohibited. Most tomato paste for household use is sold throughout the world in 70, 100, 170 or 200 gram cans--2½-oz., 6-oz. or 7-oz. cans in the non-metric system areas.

FAO estimated 1966 world production of tomato paste and related purees and sauces as follows:

TABLE 5

WORLD CONSUMPTION OF TOMATO PASTE,
SAUCE AND PUREES--1966

Area	Tons Production	Per Cent Share of Total
Total (excluding the USSR & China Mainland)	1,500,000	—
United States	400,000	26
Mediterranean Region	400,000 plus	28
Italy	150,000	10
Portugal	150,000 plus	11

Tomato paste accounts for over half of the international trade of tomato products:

Tomato Paste	350,000 tons (est.)
Total Tomato Products	600,000 tons (est.)

As is characteristic of most products which have a mass market, retail price is critical. Quality is standardized at a level below which the public will not buy, and above which the public will not pay - even for higher quality.

Jordanians may have become accustomed to the poor quality of the industrially produced paste to the point that reeducation of taste will be required before good quality will be universally demanded. The proposed new production unit will be able to make only very gradual improvement in the quality of its paste, which should resolve the problem of taste education.

If quality and price are acceptable, tomato paste from Jordan should receive a cordial welcome in other Arab countries where its fresh tomatoes are sold in large volume and are well known.

2. Raw Material Supply

Tomatoes are grown in Jordan exclusively for the domestic and export fresh markets. There are two major crops per year. (Table 6) The summer crop, June through November, which is grown in the highlands on rain fed, dry-land farms and on irrigated land as well as in the north and middle Ghor areas, is sold largely on the Amman Central Market through commission agents. The agents are supplied directly by growers with whom they generally have informal agreements under which the agent supplies the grower with credit to purchase boxes, seed, fertilizer, insecticide, etc.; the farmer in return sells exclusively through his commission agent. As described elsewhere in this report the quality of the summer crop is generally poor and the varieties grown for the fresh market are unsuitable for processing.

Supply has always been erratic-subject to the whims of the weather and in recent years subject to the effect of political disturbances and military activity which have disrupted both planting and harvesting schedules; periods of scarcity are common. See Table 8. Periodic shortfalls in production of the summer crop are compensated partially by imports. As shown on Table 8, historically, the West Bank has been a major source of tomatoes in Jordan, accounting on average for some 20% of the total production.

Even after the Israeli occupation of the West Bank tomatoes continued to be shipped to the East Bank: 4140 tons and 49,582 tons having been received from the West Bank in 1968 and 1970 respectively, and 2469 tons from the Gaza Strip in 1970. Shipments from occupied areas are reported to have been discontinued in mid-1971. It is understood that the resulting shortage was partly compensated by tonnage obtained from Syria.

The winter tomato crop, grown from November to May, comes from Ghor Safi and is almost entirely exported to nearby Arab countries--Iraq, Saudi Arabia and Kuwait. These off-season tomatoes command export prices which are often several multiples of the domestic price of the summer crop. Because the converter cannot afford to pay the high farm prices and shipping expense from the South Ghor to Amman very little of the winter crop is made into tomato paste.

Fresh tomato prices are highly sensitive to supply and gyrate through wide ranges in the market. See Table 8.

TABLE 6

PRODUCTION BY CROP

EAST BANK--1970

Summer Crop	Dunum Planted	Production (Tons)
Production of Dry and Irrigated Land	67,627	14,265
Production--North Ghor	24,381	73,143
Production--Middle Ghor	15,700	23,050
Total Summer Crop. .	107,708	110,458
Winter Crop		
South Ghor	24,120	26,920
TOTAL PRODUCTION. . .	131,828	137,378

SOURCE: Ministry of Agriculture
Statistics Department

TABLE 7

SOURCES OF FRESH TOMATOES--TONS

Year	Dunums Planted	Production			Received on Amman Market	Exported
		East Bank	West Bank	Total		
1964	164,908	175,125	52,661	227,786	-	56,014
1965	145,340	146,121	42,082	188,503	-(1)	40,307
1966	130,372	172,065	50,289	222,345	18,175	94,033
1967	165,327	216,307	42,079	258,386	27,608	62,370
1968	170,680	194,674	NA	NA	27,722	61,610
1969	139,017	154,997	NA	NA	27,248	44,827
1970	131,828	137,378	NA	NA	25,570	53,085

SOURCES: Ministry of Agriculture
Statistic Department
Marketing Department

Note: (1) Amman Market established at the end of 1965

TABLE 8

RANGE OF PRICES AND RECEIPTS OF FRESH TOMATOES SOLD ON THE AMMAN CENTRAL WHOLESALE MARKET 1966-1970

1966

Month	Tons Received	PRICES--Fils per Kg. Most Freq.	High Est.	Low Est.
Jan.	1,152	27	37	(1)
Feb.	1,559	15	22	(1)
Mar.	1,200	21	35	(1)
Apr.	1,364	16	20	(1)
May	1,171	20	33	(1)
June	2,055	22	50	15
July	1,764	24	36	18
Aug.	1,765	22	37	14
Sept.	1,350	30	47	20
Oct.	2,626	26	41	17
Nov.	1,319	31	46	18
Dec.	950			
TOTAL.....	18,175			

1967

Jan.	951	37	52	21
Feb.	2,697	27	34	20
Mar.	3,131	25	48	17
Apr.	1,405	46	85	26
May	1,597	63	102	25
June	3,476	17	27	9
July	2,759	27	44	7
Aug.	3,219	12	22	3
Sept.	3,175	8	25	3
Oct.	2,512	9	25	2
Nov.	1,282	22	47	2
Dec.	1,404	32	67	3
TOTAL	27,608			

		1968		
Jan.	1,306	23	38	5
Feb.	3,064	21	33	6
Mar.	2,862	26	52	7
Apr.	2,213	32	73	5
May	2,153	38	70	10
June	1,765	40	56	21
July	4,078	18	34	10
Aug.	2,055	20	54	4
Sept.	2,360	25	58	4
Oct.	2,622	14	33	5
Nov.	1,550	32	51	7
Dec.	1,694	34	48	18
TOTAL.....	27,722			
		1969		
Jan.	2,004	28	39	21
Feb.	2,212	42	62	20
Mar.	2,388	56	90	30
Apr.	1,819	77	110	30
May	4,425	40	65	20
June	2,764	44	65	15
July	2,134	44	80	20
Aug.	3,406	11	20	5
Sept.	2,260	18	40	7
Oct.	1,805	27	55	9
Nov.	1,192	51	90	15
Dec.	839	66	90	25
TOTAL.....	27,248			
		1970		
Jan.	1,843	40	70	20
Feb.	2,652	33	43	18
Mar.	3,563	34	42	20
Apr.	4,200	34	55	10
May	3,764	34	65	10
June	1,440	42	16	20
July	3,332	20	26	13
Aug.	2,614	15	19	10
Sept.	(1)	(1)	(1)	(1)
Oct.	1,148	24	31	19
Nov.	1,004	41	51	33
Dec.	10	45	51	37
TOTAL.....	25,570			

(1) Not recorded

SOURCE: Statistics Division of the Marketing Department, Ministry of National Economy

3. Domestic Demand

The current demand for tomato paste in Jordan has never been satisfied; the current market potential has never been fully exploited. Imports of paste are prohibited. Sixty-five per cent of the paste manufactured was sold to a single "captive" customer, the Jordan army, in 1970 at a controlled price. The quality produced by the single plant in Jordan is so far below internationally accepted standards that it fails to test the real potential demand for paste for household use.

The local paste is generally of poor color, flavor and consistancy; a comparatively high mold count and numerous black and red specks due to faulty equipment which were reported in past studies were also observed during the current survey. Cans of paste observed in retail stores showed signs of rust; high indidence of seepers and leakers was reported by retail dealers.

Most of the paste which is produced locally is packed in units which are inconveniently large and expensive for household consumption.

TABLE 9

PRODUCTION OF TOMATO PASTE--1970

Customer	Size of Can	Price	Volume (tons)
Army	5 kg	550 fils	650
Retail Stores	1 kg.	150	150
Retail Stores	½ kg.	80	200

SOURCE: The Arab Co., Amman, Jordan, 1971

The smaller, more convenient 100-gram and 200-gram cans of paste which sell for 20 and 35 fils respectively were not found on the retail market at the time of the survey; 500-gram cans were in very scarce supply.

The reasons for the inadequate response to the demands of the market relate to the manner in which the production plant is organized and operated. It enjoys a monopolistic position with an assured sales volume at a predetermined price but suffers from both quantitative and qualitative deficiencies in supply of raw materials.

These long standing conditions have been discussed in previous reports and were observed to exist during conduct of the present survey although there has been some recent strengthening of the government's position regarding management of the plant.

The salient elements of the situation so far as they are known are worthy of brief review:

a. The Processing Company

The Arab Company, which owned and still operates the only tomato processing plant in unoccupied Jordan, was formed in 1951 by private entrepreneurs who also own and operate other industrial and commercial enterprises. The net paid-in capital is reported to be JD 72,000 (1968). Ownership is now understood to be 80% in the hands of government as represented by the Agricultural Marketing Organization. The plant has capacity to process 70 tons of fresh whole tomatoes which yield 10 to 12 tons of tomato paste per 8-hour day.

The operation has enjoyed certain benefits: (1) Selling prices fixed by the government at a point which permits profitable operation and highly satisfactory return on investment (estimated to be 20%) even when the plant is producing at 20 to 30% of capacity; (2) Exclusion of foreign competition; (3) Supply contracts with large government institutional buyers--specifically, the Jordan Army; (4) Ineffective quality demands on the part of the consumer; (5) Minimum "interference" with management policy by the major equity holder, the Agricultural Marketing Organization. (In spite of the government holding 60% of the equity, board of directors' representation has been composed of eight private and only one government member.)

The Arab Company Ltd. operates in response to price fluctuations. It purchases tomatoes on the Amman Central Wholesale Market when the price is low and only then produces tomato paste. When prices are high, it either ceases operations or produces only enough to fulfill its supply commitments to the army. Occasionally the company buys tomatoes directly from the farmer or imports from the farmer or imports from Syria or other nearby countries. Much of the supply obtained from the Amman market consists of otherwise unsalable culls purchased late in the market day at distress prices.

Reliable financial and operating data on the company are unobtainable. The customary reluctance of management to disclose details of its business, inadequate accounting, co-mingling of accounts with other operations in which the management has an interest, combine to obscure the picture.

Earlier reports published by consultants offer some financial analysis based on sketchy information which indicates that the company operates very profitably. If it does so, it is at the expense of the public interest since the whole operation militates against efficient use of the scarce resources at its disposal and satisfaction of demand for good quality paste. Some operating data supplied by the Arab Company Ltd. is given in Table 10 below.

TABLE 10

COST, PRICE AND PRODUCTION DATA
THE ARAB CO. LTD.--1970

Size of Can Sold To	No. Cans Paste Manufactured/ 8-hr. Day	Selling Price Per Can
5 kg.-Army	5,000	550
5 kg.-market	4,000	700
1 kg.-market	7,000	155
½ kg.-market	7,000	80
200 gm.-market	7,000	35.5
100 gm.-market	7,000	20

Apparently one objective of the Government in protecting the company against competition was to provide a take-off of surplus tomatoes from the fresh market at a price which would at least let the farmer recover his cost. The system actually works to depress prices and, since production volume is kept low, the hoped for supply relief does not materialize.

By purchasing the lowest quality tomatoes and storing them in unprotected areas before processing, the company virtually quarantees poor quality paste.

In the period during which the field work of the present survey was being conducted a number of factors aggravated the problems of the paste operation: The late 1970 and early 1971 planting seasons were disrupted by the internecine disturbances in the country with consequent short-falls in the 1971 harvest. Purchase of tomatoes from the West Bank were halted; some purchases were made from Syria in order to enable the plant to fill its ever increasing army orders. Perhaps a hopeful element in the general picture is the fact that the Government is taking over full control of the Agricultural Marketing Organization which owns majority interest in the Arab Company Ltd. (Temporary Law No. 64-1971)

The Agricultural Marketing Organization is giving some attention to the possbility of building a new tomato paste plant on a tract of land on the outskirts of Amman which was purchased earlier.

The plant would be equipped by transferring the present batch-line equipment to the new building and adding a second, parallel, continuous production line. The expanded operation would have capacity to consume 200 tons of tomatoes per day. It would be financed in part by the Food and Agricultural Organization of the United Nations.

b. Sales Potential

The supply deficit arising from the foregoing combination of scarcity and poor quality is met, in part, by home-made paste. The latent household demand could only be measured by a laborious sampling of the views of potential customers or by offering the private consumer an adequate supply of good quality paste at reasonable price. For the foregoing reasons the present consumption of paste and the prospective demand for paste under circumstances of adequate supply, good quality and reasonable price cannot be arrived at imperically— from consumption statistics. It can be reasoned, however, that other things being equal, the per-capita consumption of tomato paste in Jordan should approximate that of other Arab countries—conservatively estimated at 1 to 1.5 kg. per capita or, for Jordan, an aggregate of 2000 to 2500 tons per year.

Of this potential market, perhaps one third will continue to be satisfied by home-made paste—particularly in rural areas. For purposes of planning future operations it is hypothecated that at

the present price of 155 fils per kilo there is a reliable domestic demand for 1500 tons of paste per year which will grow at a compound rate of 3%. Although, if cost reductions can be made and passed on to the consumer, domestic volume could reach 2000 tons within two years.

c. Domestic Prices

The following table shows the domestic selling prices of tomato paste decreed by the Ministry of National Economy in Jordan.*

TABLE 11

SELLING PRICES OF TOMATO PASTE

Size of Can (Gross Wt.)	Approximate Net Weight	Price Per Can	
		Retail	Wholesale
100 gm.	85 gm.	20 fils	17 fils
200	170	35.5	32.5
500	425	80	77.5
1 kg.	820	155	150
5	4100	700	680
5	4100		550 (institutional)

* Decree of 14 January 1963

4. Export Demand

a. Demand for Tomato Paste in Arab Countries

As a member of both the ARAB LEAGUE and the ARAB COMMON MARKET Jordan enjoys the position of preferential trading partner with seven near-by Arab countries.

Saudi Arabia, Kuwait, Iraq and Lebanon depend on imports for their supply of tomato paste; the Sudan imports a very small amount primarily from the U.A.R. Syria and the U.A.R. are exporters. Lebanon has the capacity to be self-sufficient but imports a small quantity of high quality paste—higher quality than it manufactures.

The principal market targets for Jordan are Kuwait, Saudi Arabia and Iraq. Demand in these nearby Arab states as indicated by current imports is shown in Table 13 and is sufficiently large to absorb any exportable surpluses which are likely to be available from Jordan in the near term—if quality and price are acceptable.

Historically, the principal supplier to the east end of the Mediterranian has been Italy, which supplied 76.4% of the imported tomato paste to three principal importers in the area in the 1968-1970 period. Shipments from Greece and from the centrally planned economies, particularly People's Republic of China, Hungary, Bulgaria and Romania have been increasing at a rapid rate over the past

few years. The remainder of the supply pattern, however, is confused. About twenty countries sporadically ship paste into the area and about 10% of the imports are reshipped. A portion of the export shipments from countries which are also importers arise from instances where paste is imported in bulk and repacked in retail size cans for export as well as for domestic consumption.

Italy, the U.S.A. and European Common Market countries which make occasional shipments of tomato paste into the Middle East generally maintain high standards of quality. Quality from Mainland China and other supplier countries is less consistant.

As shown in Tables 12 and 13, the landed cost of tomato paste at Middle Eastern ports of entry presents an irregular pattern. The only discernable price trend is in the landed cost of Italian tomato paste which has increased in recent years.

TABLE 12

1970 C.I.F. COST PER KG

Source	Fils Per Kg. C.I.F. Kuwait	Lebanon
Mainland China	110	88
Italy	134	129
Greece	146	92
Romania	129	84
Hungary	117	96
Bulgaria	124	—
Syria	115	142

In summary, the evidence seems to indicate that superimposed on its regular demand pattern, the Middle East offers an opportunistic market for tomato paste in which otherwise unsalable surpluses from periodic overproduction or sub-standard quality are unloaded.

It is estimated that the demand for imported tomato paste in three nearby Arab countries will be over 30,000 tons per year by 1973. A 5% share of this export market would equal Jordan's estimated current total demand and would justify construction of a 3000 ton per year paste line.

b. Prices in Nearby Arab States

There does not appear to be much rationale to the price structure of tomato paste in neighboring Arab countries. Landed costs vary widely from year to year from importer country to importer country and supplier to supplier. No doubt quality differences, shipping distances, as well as domestic production costs, varying supply situations and special duty arrangements combine to create the wide discrepancies.

Recent wholesale paste prices in Saudi Arabia average 158 fils per kilo compared to an average landed cost (C.I.F.) of 92 fils, providing mark-up of 53%. Assuming a retail mark-up of 15%, price to the consumer would average approximately 182 fils per kilo.

Landed cost of 1 kilo of paste in Iraq averaged 130 fils in 1970. Assuming a continuation of its historic wholesale mark-up of 30%, wholesale price should be about 169 fils with retail price 189 fils.

Prices in Kuwait dropped from 218 fils per kilo in 1965 to 140 fils in 1967. In 1970, the retail price of a brand of paste of Mainland China origin in 200-gram cans was 150 fils/kg. A competing Greek brand sold for 210 fils per kg., which would indicate C.I.F. cost of 82.5 and 115.5 fils respectively.

TABLE 13

AVERAGE ANNUAL IMPORTS OF TOMATO PASTE FROM PRINCIPAL SUPPLIERS BY SELECTED ARAB COUNTRIES 1968-1970

Importer	Source	Kilograms	CIF Value Jordan Dinars	CIF Value Fils/Kg.
Kuwait	China	1,049,253	106,717	101.7
	Italy	2,304,211	305,493	132.6
	Greece	313,038	41,613	132.9
	Romania	192,851	25,495	132.0
	Hungary	432,341	51,337	118.7
	Bulgaria	330,167	40,763	132.5
	TOTAL	4,621,861	571,418	123.6
Saudi Arabia	Italy	10,506,941	842,903	80.0
	USA	122,094	16,921	138.6
	Lebanon	201,119	20,395	101.4
	Jordan	113,309	10,639	93.9
	TOTAL	10,943,463	890,858	81.4
Lebanon	Syria	127,157	18,631	146.5
	Italy	180,375	22,348	123.9
	Hungary	67,073	6,266	93.4
	TOTAL	374,605	47,245	126.1
Iraq(1)	UAR	11,416,000	1,317,140	110.0
	Syria			110.0
	Lebanon			(160 to 180
	USA			(avg. 115.4

(1) Average of 1965, 1966, 1969

c. Demand For Tomato Paste in European Countries

Europe consumed 157,000 tons of tomato paste in 1969 while producing 190,000 tons, and was thus a net exporter in the amount of some 33,000 tons, of which about 18,000 tons went to the Arab countries.(1)

France, Italy, Holland and Belgium produce tomato paste; Great Britain is a non-producer, is the major importing country (accounting for 50.5% of total imports) and has the highest rate of consumption: .93 kgs. per capita. France, Holland, Belgium and West Germany are both producers and importers. Italy is the major exporter.

Per capita consumption in Europe dropped 14% from 1966 to 1969 while total consumption dropped 16%. It is projected in the source report that European consumption will level off in the 1975 to 1980 period at about the 1969 level. Per capita consumption will continue to go down in those years. However, the effect will be offset by population growth.

Italy's dominance in the European market appears to be unassailable at this time. Although it might be possible for Jordan to find a market for paste in Europe at some point in the future, it will not be in a position to compete with Italy until qualit quantity and price are established. Great Britain perhaps offers a potential market for Jordan tomato paste. However, its recent entry into the Common

(1) **SOURCE:** LE MARCHE DES PRODUITS ALIMENTAIRES ET DES FLEURS COUPEES EN EUROPE - SOGENOR - 1971.

Market may militate against Jordan as a source of supply. In view of the fact that Europe is a net exporter it is recommended that European market be excluded from sales projections for Jordan-made paste for the near term.

B. The Market for Tomato Juice

1. Demand Characteristics

Tomato juice is a highly nutritious, highly palatable, refreshing drink and diet supplement, particularly rich in Vitamin A. Its demand and production are concentrated in the United States, which produces 75% of the world supply and increased its consumption over 600% in 30 years, and Canada, second largest consumer, which produces and consumes approximately 15% of the world's supply of some 600,000 tons of juice. The Mediterranean area consumes less than 5% of the world supply. Only about 8½% of the production of tomato juice moves in international trade.

The taste for tomato juice must be acquired, for while all tomato products have some of the same basic flavor, texture and "mouth-feel" differs. The taste appeal of tomato juice is destroyed by dilution. It has never been concentrated and reconstituted successfully in spite of much experimentation and research. In the United States, consumption was promoted by means of vigorous and imaginative advertising campaigns, the effects of which no doubt poured over into Canada.

Since juice is both a natural by-product and a logical co-product of tomato paste production and since tomato flavor is already popular in the Arab World, a viable demand should not be difficult to develop. A tomato canning line can be adapted to yield 250 kilograms of juice for every ton of raw tomatoes thru-put on a by-product basis or 654 kilograms of juice on a co-product basis with very little added equipment.

2. Domestic Demand

Jordan import records, as published in "External Trade Statistics," do not segregate canned whole tomatoes from tomato juice. In 1969, 136,730 kilos of the two products were imported; value C.I.F. port of entry was JD12573. Going back to original customs records at Aqaba, Rumtha and Amman, the data for 1969 to 1970 discloses that only a few tons of juice came into the country. This was substantiated by analysis of invoices of importing companies. Maximum-minimum estimates by the seven largest importers in Jordan indicate that 1971-2 imports of juice will run from five to ten tons per year.

Landed cost averaged around 100 fils per kilo, retail price 120 fils. Juice was imported from Syria (1969). China, Romania, Portugal and re-exports (origin unrecorded) from Iraq and Lebanon.

In short, present domestic demand for tomato juice is too small to support even a minimum-size operation. Demand must be developed.

3. Export Demand

Demand for tomato juice in other Arab countries aggregates not more than 2000 tons per year; Saudi Arabia is the largest importer with slightly over 1000 tons average annual imports over the past three years.

Landed cost in Lebanon averaged 125 fils/kg., in Saudi Arabia, 117 fils/kg.

TABLE 14

IMPORTS OF TOMATO JUICE

INTO SAUDI ARABIA--TONS

1965	1966	1967	1968
1105	1099	1046	1050

It is estimated that Europe will have a supply deficit of 19,000 tons of tomato juice by 1975 and that Jordan might well capture 4 to 5% of that market—850 tons per year.

In 1970 the U.S. shipped the following quantities of juice to the Middle East:

Country	Kilos	CIF Value	Fils Per Kilo
Kuwait	303,803	JD 35,803	117.8
Saudi Arabia	973,664	108,591	111.5
Libya	45,784	5,001	109.2
Bahrain	302,550	37,219	123.0
	1,625,801	186,614	114.8 avg.

4. Market Potential For Tomato Juice

The possibility of demand for tomato juice developing to a point where it would be an attractive product for Jordan is conjectural--will depend on the success of promotional programs. On the other hand, since it can be manufactured cheaply as a by-product of the tomato paste line, the proposed processing plant could manufacture and can small quantities from time to time for local test marketing and promotional purposes.

Demand in other parts of the Middle East and Europe is sufficiently developed to support a juice line in Jordan.

C. The Market for Canned Whole Peeled Tomatoes

1. Demand Characteristics

Approximately 800,000 tons of canned whole tomatoes are produced annually throughout the world, 50% being produced in the United States, 40% in Italy, and the remaining 10% produced by Canada, France and Spain.

About 200,000 tons are exported, 150,000 tons of which is from Italy.

Canned whole, peeled tomatoes are eaten as a vegetable, are also popularly used as a color, flavor and bulk additive, and as such are successfully competing with tomato paste in several countries--notably Italy.

2. Domestic Demand

As might be expected, in Jordan, where fresh tomatoes are available at low cost during most of the year, there is virtually no demand for canned whole tomatoes. None is manufactured locally. A search through two years of customs records revealed only five cases of goods identified as "canned whole tomatoes" entering Jordan. This record may be misleading since much of the imported canned goods is simply listed as "canned Vegetables" with no more specific identity and may include tomatoes.

Examination of records of the seven largest importing companies disclosed only the five cases previously mentioned.

"External Trade Statistics," published by the Jordan Department of Statistics, groups canned tomatoes and tomato juice together and indicates imports of the two products were 136,739 kilos valued at JD12,573 CIF point of customs clearance in 1969.

3. Export Demand

a. Demand in Arab Countries

Lebanon imported 18,268 kg. of canned tomatoes, mostly from Syria, in 1970--CIF value JD2257, or about 123.5 fils per kilo.

Saudi Arabia imported 38,402 kg. of tomatoes valued at JD4530 or 117.9 fils per kilo also in 1970.

As in the case of Jordan, more canned whole tomatoes may be entering Arab countries than can be identified by import statistics because vegetables are generally grouped together for duty purposes.

b. Demand for Canned Whole Tomatoes in Europe

Canned whole tomatoes, peeled or unpeeled, are gradually supplanting tomato paste in Europe. Total consumption of canned whole tomatoes increased 75% from 1966 to 1969 while paste consumption decreased 16%. It is estimated that by 1980, per capita consumption of the canned whole tomato will increase from 1.54 kg. (1969) to 2.84 kg. By contrast, tomato paste consumption will drop slightly from .64 kg. per capita in 1969 to .61 kg. in 1980.

It is estimated that total production of fresh tomatoes in Europe, particularly in Italy, will not keep up with demand so that by 1980 the net deficit in supply for the fresh market as well as raw materials for processed tomato products will more than double—will increase from 324,000 tons in 1969 to 506,000 tons in 1975 to 663,000 tons in 1980.

This growing deficit will provide market opportunity for Jordan for both its raw and processed tomatoes. A 5% share of the projected demand for canned whole tomatoes would give Jordan a sales volume of 12,000 tons per year valued at JD 1.416,000 f.o.b. Beirut.

4. Market Potential For Canned Tomatoes

D. The Market for Reconstituted Fruit Juices, Fruit Drinks and Nectars, Jams and Jellies

1. Demand Characterictics

Natural fruit juices and nectars reconstituted by addition of water to frozen or canned concentrates and synthetically manufactured fruit flavored drinks are commanding an increasing share of the consumer's expenditure for food. They are growing in popularity, particularly in the hot, dry areas of the world, as an alternative to traditional hot beverages--tea and coffee. They provide a variety of flavors which are often indigenous to areas thousands of miles from where they are consumed. Following the lead of the manufacturers of cola drinks who manufacture, market and ship low cost concentrated flavors, food technologists have developed methods of concentrating fruit and vegetable juices in low cost growing areas to be shipped, reconstituted and packed in single strength cans or bottles at distant and widely scattered points of consumption. The economics of the saving in eliminating the costs of shipping bottles, sugar and water are obvious and of particular significance to Jordan where shipping costs from Europe are high.

The market for all reconstituted products must be evaluated in light of the fact that it is relatively easy and inexpensive to start a reconstituting operation. If Jordan were to start such an operation, it should do so with the almost certain knowledge that other countries in the area will soon follow suit and some or all of the export market will be lost.

On the other hand it is a quick and relatively sure way of generating cash flow in a new food processing operation. Since the capital commitment is low, return on investment is comparably high. Even if some volume decline is felt from loss of export sales, after a few years, the plant will have bought time to build up demestic sales to compensate.

2. Domestic Demand

In 1970, Jordan imported approximately 240 tons (net) of single strength fruit juices and nectars, having a landed cost of 43,228 dinars according to Customs Department records. This volume is somewhat down from the 295 tons imported in 1969. Principal suppliers were Lebanon, United Arab Republic, Netherlands, and the United States. Estimates of sales volume of the seven largest importers in Jordan for twelve months, 1971-72, ranged from a minimum of 108 tons to a maximum of 328 tons.

A small volume of jams and jellies was imported.

Selling prices for the most popular package sizes is shown in Table

Nectars, Drinks, and Juices	Fluid Oz. Net	Approx. Net Wt. Contents-- Grams	Retail Price/Can Fils
Apple Juice	32 glass	909	350
Grape Juice	8	227	380
Cranberry Cocktail	16	454	260
Apricot Nectar	5½	156	80

Nectars, Drinks, and Juices	Fluid Oz. Net	Approx.Net Wt. Contents— Grams	Retail Price/Can Fils
Fruit Flavored Drinks	26½	752	250
Pineapple Juice	6	170	50
Orange Juice	6	170	50
Grapefruit Juice	6	170	50
Jams, Jellies, Preserves, etc.			
Apricot Jam	16	227	170
Pear Preserves	12	340	230
Pineapple Jam	440 grams	440	200

3. Export Demand

Demand for reconstituted fruit drinks and nectars in the Arab countries is growing at a rapid rate. In 1970, the United States alone shipped 500 tons net weight of single strength fruit juices to Saudi Arabia--landed cost JD62,582--575 tons to Libya, 135 tons to Kuwait, 168 tons to Lebanon. Lebanon is a net exporter of fruit juices and drinks, however, having exported 8500 tons in 1968, 13694 tons in 1969 and 15,500 tons in 1970.

Kuwait is a major importer of both fruit and vegetable juices, imports having averaged 4700 tons in the years 1968 through 1970.

Saudi Arabia has averaged 4500 tons of imported fruit and vegetable juices in the 1968-70 period.

4. Jams and Jellies

The manufacture of jams and jellies, fruit paste and similar products is a cottage industry in Jordan.

While a small industrial operation might well succeed, the possible social-economic effects of such an undertaking should be examined to assess the net benefit to the country.

The export market holds some promise, Lebanon, for example, imports a substantial voluem:

TABLE 15

IMPORTS OF JAMS, JELLIES
AND FRUIT PASTE BY LEBANON

1968		1969		1970	
Kg.	JD	Kg.	JD	Kg.	JD
312,754	40,204	291,481	28,389	428,120	42,242
9,700	2,219	20,065	2,471	72,410	7,404
322,454	42,423	311,546	30,860	500,530	49,646

E. The Market for Fermented Table Olives and Pickles

1. General Characteristics of Demand and Supply

Fermented table olives are a high priced, high margin luxury commodity generally produced and packed in countries with low labor rates for sale to countries with high per capita disposable incomes--typically, the United States, Canada and some European countries.

Of the seven million tons of olives harvested annually in the world, Italy, Spain and Greece produce five million tons or about 74% of the total. Of the seven million tons produced 6.4 million tons, or 91% are

oil olives which are pressed to yield 1.4 million tons of olive oil. This is the low-cost, high volume, end of the olive business. The remaining 600,000 tons of olives are for the most part specially grown processing olives which are fermented and packed in glass jars or tin cans, for table use. This is the high prices, small volume, luxury end of the olive business.

Jordan produces no processing olives and has only very small local demand for them.

2. Export Demand

a. Arab States

As shown below the Arab States import only a very small quantity of fermented olives and vegetables. None of the Arab States produces these products.

TABLE 16

IMPORTS OF PRESERVED OLIVES

							1970
KUWAIT							
Olives	-Tons	841	994	1234	1429	1137	1218
	-JDs	98357	118600	167075	210324	153083	209796
Pickles	-Tons	-	-	-	1186	1244	1226
	-JDs	-	-	-	135384	172814	166464
LEBABNON							
	-Tons	-	-	-	122	636	1130
	-JDs	-	-	-	19977	79692	142939
SAUDI ARABIA	-Tons	-	184	482	309	-	-
	-JDs	-	30541	71855	56249	-	-

b. United States and Europe - 1970

Spain exported over 66 thousand tons of preserved (fermented) olives having a value of 17.5 million Jordan dinars 21000 ton, less than one-third of the volume exported was packaged in cans, the remainder, 45 thousand tons, was packaged in galss. 12800 tons of the canpack (61%) 27,500 tons of the glass pack (61%) was shipped to the United States. European countries receive approximately 20% of the exported olives.

This market is so vast it will be some years before olives from Jordan will have much impact on the market. Jordan exports will be limited by production capacity rather than by market.

SECTION III

INDUSTRIAL ASPECTS OF ESTABLISHING FRUIT AND VEGETABLE PROCESSING OPERATIONS IN JORDAN

A. Some Fundamental Considerations in Food Processing

1. High field and factory yields are a basic requirement of a successful food processing operation.

   To establish a strong viable processing industry, a system must be developed that is mutually beneficial to the raw produce grower, the processor, and the consumer. Excessive advantages to any single segment or group within the system at the expense of others are usually of only short duration; if not corrected, they prevent the system from growing and doom it to failure.

2. The size and cost of field equipment, processing, and storage facilities for perishable produce are inversely related to the length of season during which produce may be efficiently grown. For a certain production budget, daily capacities (size of processing plant) must be in balance with length of harvest season. Over-head is costly when the processing plant is too large. Produce is costly when the processing plant is so small that production capacity must be obtained by growing produce in an unfavorable part of the season.

3. The complexity of food processing increases with the rate of maturation and consequent degree of perishability of raw produce. For example, canned baked

beans and rice pudding are easier to process than fresh snap beans or peas. Fruit drinks and nectars reconstituted from concentrates are easier to pack than single strength juice and nectars from fresh fruit.

4. Many processing facilities (receiving and washing equipment, boilers, retorts, closing machines, etc.) and staff have common usage across product lines. Products that may be grown or procured in such a manner that they do not compete with each other for the use of common facilities are complementary. They may be used to lengthen the processing season, provide greater product mix for sale and lower unit production costs.

5. Fruit juices, nectars, and fruit ades consist largely of water. Reconstituting these products from concentrates close to the demand at nonseasonal peaks is relatively simple, permits considerable freight savings, adds to product mix, and helps reduce overhead. They are a good "beginning product" for a new processing venture.

6. There is a relatively brief time during which perishable produce is at an optimum condition for processing. During this brief period yield and quality change rapidly--often in opposition. Many fruits and vegetables are subject to annual and seasonal uncertaintly in quality and yield. This uncertainty results in great price instability in the open market. Production budgets, produce contracts, planting and harvest schedules, and crop forecasts are important for controlling

quantity, quality, and costs for stabilizing price for the grower, processor, and consumer.

7. Processing operations are best controlled from review and analysis of daily operating reports of quality, yield, and costs. These data are essential for a critical review of operations at the end of the season for future systems improvement.

8. Procedure manuals product-by-product, concerning quality control, plant sanitation, cost control, and field operations, are essential for training and for maintaining continuity of operations involving seasonal personnel.

9. Special seeds, supplies, equipment, and crdit not commonly available to growers are often furnished at cost by the processor. These technological services and supplies are usually provided as a consideration in supply contracts negotiated between growers and processors. They help improve yield and quality and benefit the grower, processor, and consumer.

10. Pack budgeting, forecasting, and scheduling are procedures commonly used by processing plants for internal control.

B. Proposed Food Processing Enterprise

1. General Plan of Operation

a. Interim Program for the Existing Tomato Paste Plant.

The present plant and its operations are described in this Report (SECTION II, 3, a) and resumes of earlier reports by Sherbini, Samman and Godson are given in Annex A.

The numerous attempts to bring this plant into more successful operation have failed due, apparently, to circumstances beyond the control of the managers who have been assigned to it. There is no reason to think that remedial recommendations offered in this Report would be followed. On the other hand the tomato paste plant is the largest food processing operation in Jordan, is important to the agro-economy, employs people and obviously cannot be ignored by the survey.

It is recommended that the present operation be continued until the full-scale program to create a multi-product food processing plant is implemented in accordance with the recommendations in Part C of this SECTION III.

In the interim, certain improvements can be made to the present plant and equipment; some operating proceedures can be improved without large commitments of new capital:

- Shade-over receiving and holding area
- Dump newly received tomatoes in water and pass them by wheeled conveyor under high pressure spray jets for washing
- Replace old, worn-out produce boxes
- Sort, trim and/or remove bad fruit before crushing

- Install new screens and nylon brushes in finishing screen
- Install magnetic device in line to remove nails which are lossened from produce boxes and now fall into and damage separating sieves.
- Up-date repair and improve can making operation
- Initiate vigorous programs of:
  - inspection
  - quality control
  - plant sanitation
  - cost control
  - waste control

Design and lay-out of the proposed multi-product plant should incorporate plans to canibalise some equipment from the old plant which will be vacated. Equipment from the old plant which is uneconomic or undesirable to use in the new plant should be scrapped.

b. Proposed Multi-Product Operation

Product Mix

The proposed operation consists of a plant to produce three groups of converted packaged food product:

- Converted Tomato Products

  Paste and Puree,
  Whole peeled tomatoes,
  Tomato juice

- **Reconstituted Products** from imported concentrates -

  Fruit drinks, nectars, jam, jelly etc.,

- **Fermented Vegetables** -

  Pickles and olives.

TOMATO PRODUCTS

Processed tomato products are generally classified in the food industry as high-volume, low margin items. Eight to ten tons per hour raw fruit consumption is considered the minimum production rate for profitable operation and processing equipment has been evolved with this lower limit of capacity for use in multi-product plants.

Equipment for single product line plants (tomato products only) has been designed, usually, with higher minimum production rates. Small capacity equipment has virtually disappeared from the United States and Europe.

Some unit cost saving can be achieved by labor saving equipment; however such equipment is high cost and is suitable only for high volume operation. Packaging and other supplies represent 55% to 65% of cost of production. Tin cans are the single highest priced item of cost.

Some yield data is given below:

Product	Tons Yield from One ton of Fresh Tomatoes	
Canned tomatoes	0.641 tons	55 cases *
Tomato catsup, 33% solids	0.405 "	30 "

* 24 432 gram cans per case
Source: Canners almanac (U.S.)

Product	Tons Yield from One ton of Fresh Tomatoes	
Tomato juice	0.654 tons	55 cases
Tomato paste, 33% solids	0.184 "	14 "

Tomatoes are the major cash crop of Jordan and altho the varieties grown are not processing tomatoes they lend themselves reasonably well to processing to fill the demand for paste, juice and whole peeled tomatoes in domestic and nearby Arab markets. Since Jordan already has a raw material supply and operating and marketing experience with paste it is a logical choice for first year operation. Canned whole tomatoes and possibly juice will follow in the second year with volume building up to the limit capacity of the first paste line in the fourth year. A second paste line will be installed in the seventh year. Canned whole peeled tomato volume will reach capacity in the third year and remain constant thereafter.

Based on the experience in other countries these products offer the best profit potential in the processed tomato line. For example in the US in August, 1971, Fancy California peeled tomatoes in juice were quoted at $4.35 per case of 24 No. 303 cans (24 cans per case; 432 grams per can). At the same time, tomato juice was selling for $3 per case of 12 46-ounce cans (12 cans per case; 1306 grams per can). These prices are of value only for comparative purposes.

At the price quoted the whole peeled tomatoes have a value of $0.0157 per ounce, while paste has a value of $0.0187 per ounce. However, from a ton of fresh tomatoes we get 20,512 ounces of canned tomatoes for a value of $322 per ton of raw fruit; while from a ton of fresh tomatoes we get 5,888 ounces of paste for a value of $110 per ton raw fruit. Labor intensity is somewhat higher for canned tomatoes than for paste, Capital requirement is lower for canned tomatoes due to the high cost of the evaporator required for paste manufacture.

OTHER CANNED VEGETABLES

The processing line for tomato products can handle a few other vegetables; however most vegetable processing requires special equipment suited to each product. Broadening the canned vegetable product line is properly a management decision to be made on the basis of market opportunity - when and if such opportunity develops. No attractive market opportunity for other canned vegetables was discovered during the Survey.

One of the major problems facing Jordan in marketing canned vegetables is that it is not in position to offer a full-line of products. In most European countries and in the United States the market is dominated by international companies -

Monarch,Libby etc. - which offer twenty or thirty varieties of canned goods to the retail dealer. The retailer offers the customer an imposing selection of uniformaly good products sold under one lable.

Jordan will do well to specialize in canned tomato products for the near term.

RECONSTITUTED PRODUCTS

Production of fruit drinks and nectars can be started very early in the life of the proposed enterprise as cash generators. Volume of production will be geared to the domestic market.

Reconstituted products are easy to produce; market demand generally grows with availability of the product. Reconstituted products will provide quick cash flow to support the early stages of the operation.

Reconstituted products complement most seasonal products and can be used to carry overhead and train production and sales staff for more complex operations.

Some products will be sold in export for a few years. However, it should be noted that capital requirements for a reconstituting plant and equipment are minimal. Any country that offers an attrative export opportunity for Jordan can easily enter the business as a compatitor.

FERMENTED VEGETABLES

Fermented pickles and olives are selected to fill what appears to be a growing vacuum in supply to export markets.

A supply of raw fermenting vegetables is already available in Jordan. It is estimated that export demand will have built up sufficiently by the fourth year to warrant an operation in Jordan. Due to their manufacturing characteristics they are a good co-product fit with other, more seasonal production. In semi-finished (salted) state they have long shelf-life. Final processing can be done when other products such as tomatoes are no longer being produced.

Olives are a long-range products. It will take eight to nine years to bring the agricultural development to a point where a reliable supply of raw material is available. Once operating however the table olives line should contribute substantially to the success of the company and to the economy of Jordan.

DRY-PACK PRODUCTS

Like reconstituted products dry-pack production can be started easily, with low capital investment, consuming imported materials. The market survey however did not show sufficient demand available to Jordan for these products to warrant incorporating them in the proposed enterprise.

A market may develop however, and company management should be alert to exploit it, if this occurs. For this reason pack dry products process description is included in the Report.

2. The Tomato Paste Line

a. Process description - Paste and Juice

Dry Sorting

During times of high mold count, or when tomatoes are of poor quality, dry sorting is a good practice. The fruit is dumped on a conveyor, preferably a roller conveyor, prior to being wet. Green, decomposed, moldy, or otherwise unsuitable fruit is discarded and not introduced into the processing line. It is easier for sorters to detect unusable fruit when it is dry. This practice also reduces contamination of the processing equipment with mold, yeast, and bacteria.

Dumping

This operation involves getting the fruit from the field boxes into the processing stream. Facilities should be provided for washing the containers prior to their return to the field for reuse. Generally a plastic box or one constructed of some impervious material which will not absorb tomato juice and which is easily washed and sanitized should be used. This is to prevent mold buildup on the containers and subsequent inoculation of good fruit with mold and yeast spores.

Generally a system of conveying the boxes through a tunnel about 10 feet long equipped with 80-100 psi water pressure sprays will effect excellent cleaning of the boxes.

The first step in washing the tomatoes involves a soaking treatment. The tomatoes are discharged from the drysorting conveyor into the soak tank.

The purpose of the soak is to wet and loosen soil and decomposed material and decayed fruit so as to reduce the load on the spray washer. The soak tank should be sized to result in a 4-6 minute exposure. Further efficiency in the cleaning action will result from use of some means of agitating the fruit and water, such as the use of compressed air, steam, or paddles. A continuous supply of fresh water to the soak tank is essential. A false bottom is highly recommended to permit continuous or at least periodic removal of the accumulated soil. Soaking the fruit prior to spray washing may be omitted if the fruit is flumed from the receiving yard to the plant so that the fruit is soaked for 4-6 minutes.

Spray Washing

Following the soak washer the tomatoes are elevated to the spray washer which consists of a roller driven conveyor belt of flexible steel mesh equipped with over and under sprays. An alternative to this system is to provide a roller conveyor which turns the fruit under the sprays. If this type of conveyor is provided, only overhead sprays are required.

The spray washer should be equipped with flat and solid cone type nozzles placed approximately 6" apart center to center. Best placement is flat spray followed by solid cone alternating through the washer. The washer should be operated at between 100 and 200 psi and 1.5 and 2.5 gallons of water per minute per nozzle. Generally a washer delivering a total of 90 gallons per minute will effectively remove soil, mold, decay, and yeast at these pressures if the fruit is turned at 6 to 10 revolutions per minute under the sprays and exposure time in the washer is a minimum of 3 minutes. When excessively dirty or decayed fruit is being run, the belt should be slowed so that time under the sprays is extended to 6 minutes in order to keep the mold count within acceptable limits.

Sorting and Trimming

The fruit is passed over a conveyor which turns the fruit at about 6 revolutions per minute (rpm). Decayed fruit not removed during dry sorting is discarded. Small areas of decay, discoloration, green, sunburn, etc., is cut away and discarded. All stems should be removed if any persist at this stage. Green areas and stems are particularly troublesome in the paste line as the chlorophyll turns brown upon heating, seriously lowering the color of the product.

Chopping and Pre-Heating

The washed, sorted, and trimmed fruit is conveyed into the chopper. From the chopper the crushed

tomatoes are pumped to a pre-heater where it is heated as rapidly as possible to 200 to 210° F.

The chopper essentially consists of a circular or tubular shell with a feed hopper. A circular stationary grid type shear plate and rotating cutter are located at the discharge end of the screw. The standard construction is with a 3-blade cutter. Whole tomatoes are conveyed into the hopper and fed into the rotating screw. The product is conveyed forward by the screw and forced through the openings in the shear plate. A rotating cutter cuts the tomatoes into small pieces as they are extruded through the discharge end of the shear plate. The product is discharged directly into or is pumped to the finisher. For the purpose of estimating electrical requirements a pulper with about the capacity we are concerned with would require an 8-10 H.P. electrical motor.

Pulping and Finishing

From the pre-heater the chopped tomatoes are conveyed to the pulper which is equipped with a 0.060 inch screen. The pulper is designed to separate such materials as seeds, skins, fibre, and other undesirable material from the tomato pulp . The pulper is equipped with paddles which force the pulp through the screens while the undesirable material is forced out through the discharge gate. Product recovery is controlled by adjustment of the tail-gate pressure, adjustment of paddle clearance in relation to the screens, and ajustment of the paddle angle as related to the shaft. A pulper with 5-10 tons per hour capacity will require about a 10 H.P. motor.

Essentially the only difference between the pulper and the finisher is the screen used. When a 0.060 inch pulper screen is used, generally a 0.027 inch finisher screen will result in an exeellent product. Power requirement for the finisher is usually about 0.75 per cent of that required for the pulper.

The pulped tomatoes are pumped or gravity flowed from the pulper directly into the pipe inlet to the finisher. The effluent is forced through the screens by the rotating paddles while the spent pomace is forced out of the chamber through the discharge gate. Yield control is regulated essentially the same as for the pulper. High yields in both the pulper and the finisher must be balanced with quality factors such as product color and black specks.

After finishing, the product is pumped into an accumulation tank equipped with a coil or jacket wherein steam at 125 psi is used to bring the product to 190° F and hold it at that temperature.

Concentration

From the surge tank the pulp is pumped into the cacuum pan where it is concentrated. The Food and Drug Administration of the U.S. requires that Tomato paste be concentrated to at least 25% salt free tomato solids. A savings can be realized in package costs by concentrating the paste to higher concentration as illustrated by the following ratios:

if we concentrate to 26% paste, the yield will be 57 No. 10 cans of paste, while by concentrating to 36% solids the yield would be 36 No. 10 cans. By saving 21 containers per ton, a significant saving results.

During concentration in the vacuum pan it is important that the product temperature be held at 150° F or lower to prevent damage to the color.

Mixing and Filling

From the vacuum pan the product flows to a mixing tank having about a one hour capacity. The purpose of this tank is to blend from the vacuum pan which will inevitably fluctuate in concentration from time to time.

From the mixing tank the product is pumped to the heater where it is brought to 200° F for filling and can closing. It is essential that the product be filled at not less than 195°F so that the sensible heat in the product will pasteurize the inside of the containers.

The filled and closed cans should be held at least three minutes prior to cooling to permit time for the heat of the product to pasteurize the inside of the containers.

Cooling

After three minutes from the time the cans are filled and closed, they should be cooled to a product temperature of about 100°F or near body

temperature. The cans may be labeled and cased directly or cased and held bright and labeled as orders are received.

Tomato Juice

The procedure for making tomato juice is the same as for paste through dumping, dry sorting, soaking and spray washing, sorting, and trimming.

Chopping

A hot break is used to produce a tomato juice with good yields in terms of cases per ton of juice with good viscosity and mouth-feel. The tomatoes may be chopped and pumped immediately through a tubular heat exchanger designed to bring the temperature up to 190° to 200°F. Another system which is acceptable is to mount a tomato crusher directly over a batch tank and to let the crushed fruit drop directly into the tank. The tank should be equipped with a steam coil which is turned on as soon as crushed fruit and juice covers the coil. Subsequent crushed tomatoes drop directly into the hot crushed tomatoes which are maintained at 210 to 212° F or just below the boiling point. Heating the crushed or chopped tomatoes as quickly as possible is useful as this will destroy pectinolytic enzymes which very quickly break down tomato pectin unless they are inactivated. Breakdown of the proto pectin

and pectin to shorter chain length pectin substances would result in loss of viscosity in the juice. Hot breaking the tomatoes also ensures a higher case yield per ton of juice. Heating the product also tends to drive out air and as a result reduces oxidation of ascorbic acid (Vitamin C).

If good juice varieties are used, the yield should be about 230 gallons of product weighing 8.6 pounds per gallon per ton of fruit.

Pulping or Juice Extraction

Once the crushed tomatoes have been heated to 200°F - 210°F they are pumped directly to the juice extractor which operatee essentially the same as the pulper and finisher described for paste manufacture; however, the screen size in the tomato juice extractor is usually 0.020 or 0.033 inch diameter perforations. A typical extractor will require a 5 H.P. motor to extract about 8 to 10 tons of tomatoes per hour.

From the time the fruit is crushed and pre-heated the temperature should be maintained above 140°F as thermophilic spre forming bacteria can grow at temperatures from ambient to 140°F.

If equipment is available to do so, it is useful to deaerate the tomatoes as soon after they have been crushed as is practical. The removal of the occluded and dissolved air may be accomplished by subjecting the tomato pulp to a vacuum of 15 to 25 inches in a good deaerator.

By removal of the air, oxidation of the tomato constituents is held to a minimum. The most noticeable benefit is the conservation of the vitamin C. After efficient removal of air, tomatoes can be held at high temperatures with no substantial losses of this vitamin. Color and flavor are also protected by deaeration. Even though deaeration has not been carried out immediately after breaking the fruit, some benefit will accrue from deaeration after pasteurization. This will prevent foaming in the filler bowl. Flashing the juice back to atmospheric pressure after high temperature short time (HTST) pasteurization will reduce the temperature to the proper filling temperature and deaerates the juice at the same time. After pasteurization a 10-15 inch vacuum is sufficient to accomplish deaeration.

All delivery lines to and from the pasteurizer, flash tanks, and filling equipment should extend to a point below the surface of the liquid to prevent reaeration.

Salting

The extracted juice is pumped directly from the extractor outlet to a batch or surge tank. Salt is added at the rate of 5 pounds to bulk granulated salt per 100 gallons of juice. The juice should be continuously agitated and be maintained at from 150 to 190°F to ensure getting the salt into solution.

An alternate method of salting is to use either bulk or pellet metering machines which deposit the proper amount of salt into each can either before or after the juice has been pasteurized and filled into the cans. When salt dispensing machines are used there is usually a problem of "skips" or cans which do not have salt added. Of course, with the batch salting method there is some risk of an entire tank not having salt added unless management is alert and quality control procedures are established and followed.

Pasteurization or Processing

The hot juice is pumped directly from the surge tank to the tubular heat exchanger. While juice from one salt tank is being pumped through the pasteurizer another tank is being filled and salt added. It is essential that a constant supply of juice be fed to the heat exchanger as it is essentially a continuous operation and any shutting down necessitates clearing the product out, cleaning the pasteurizer and starting up again. The pasteurizer consists of three sections which are:

1. Come-up
2. Holding
3. Cooling

The juice is rapidly brought up to 250°F in the come-up section. It is then held at 250°F for about 0.7 minutes which is sufficient to kill the spores of Bacillus thermoacidurans, the major organism of concern in tomato juice. This is an

aerobic, spore forming, rod-shaped, heat and acid tolerant bacteria which causes flat-sour spoilage of tomato juice. So long as the pH of the juice is below 4.5 there is no need for concern about Clostridium botulinium and the 0.7 minutes at 250°F will render the product safe.

From the holding section of the pasteurizer the product flows through a cooling section or is flashed back to 205 to 210°F.

Filling

The juice is pumped from the heat exchanger directly to the filler bowl. The empty cans are fed to the filler where each can is centered under each valve on the individual lift pads which raise the cans until they come in contact with the valve seal plates which seal the top of the cans. The juice flows by gravity into the cans until the lift pad lowers the can and closes the valve. The cans are then conveyed to the can closing machine and the lids are double seamed onto the cans.

The temperature of the juice in the filler bowl must be maintained at a minimum of 205°F.

Holding

Holding the filled closed cans sufficient time to ensure pasteurization of the inside of the cans is of the utmost importance. For large cans such as 2-kilo capacity, a closing temperature of 190 to 195°F is sufficient to provide for container pasteurization if the cans are held not less than three minutes after closing and prior to cooling.

For smaller cans, slightly higher closing temperatures such as 195 to 200°F are recommended.

If it is necessary to wash the outside of the cans after filling and closing, water at not less than 200°F should be used. The incidence of spoilage is generally higher in the smaller can sizes as the ratio of can surface to volume of juice is less, so the rate of cooling is more rapid in the smaller cans. If some cases it has been necessary to provide a cover over the holding track so that small cans may be held in an atmosphere of flowing steam at about 210-212°F during the three minute hold.

Cooling

At the end of the three minute hold, the cans should be cooled by use of clean, potable chlorinated water as rapidly as possible to about 100°F. They may be conveyed through the labeler and cased or cased bright (with no label) and labeled at time of shipment. Obviously it is more economical to label, case, and seal the cases on a continuous basis at the time of packing.

b. Equipment and Plant Cost

NB: Annex B indicates the cost, delivering time, conditions of sale, and utility requirements for a Tito Manzini & Figli tomato paste plant. This plant was discussed item by item by the food technologist on the MINER team and Mr. Ferari, technical director of Manzini, and

the equipment will fulfill the requirements for good tomato paste manufacture as covered elsewhere in this report.

The paste line is capable of processing 192 tons of raw stock in 24 hours or 8 tons per hour with an output of about 1.28 to 1.33 kgs. per hour of cold break tomato paste at 30% solids. When and if hot break paste is manufactured, the capacity of the plant decreases by about 20 to 25%. This reduction in capacity has probably been the main factor in preventing European and Middle Eastern processors from using a hot break as is generally the case in North America.

In the cold break system the tomatoes are washed, sorted, trimmed, scalded and cycloned (pulped) to separate pulp from skins, seeds, and cores. The cyclone juice is accumulated and held until concentrated. Conditions of holding are conducive to enzymatic pectin breakdown and as much as 95% of the pectin may be broken down to the extent that it contributes little to pulp vicosity.

By contrast in the hot break method, the tomatoes are washed, sorted, trimmed, and crushed directly into a vat of boiling tomatoes so that the temperature is rapidly brought to enzyme inactivation temperature (160° to 175°F). The crushed tomatoes are then cycloned and the pulp is concentrated.

This method prevents loss of pectin and results in dissolving some of the soluble gum-like substances from the tomato seeds. Retention of the pectin and the gums results in higher viscosity of the product at comparable tomato-solids content. When the hot break method is used, great care must be exercised in keeping greenish fruit out of the break-tank as cooking the tomatoes prior to extraction results in objectionable color from chlorophyll.

Table 17 shows the cost of the plant in Italian lire and the corresponding figure in Jordanian dinars on the basis of 2.80 per JD and 624.75 lire per dollar US. The cost of the paste plant FOB the Italian port is 66.851 JD.

Table 18 indicates the cost of the plant plus freight to Aqaba, the cost of the land, building, and office and laboratory equipment.

Cost of freight from the Italian port to Aqaba is estimated at 3,536 JD, but this figure needs to be reconfirmed close to the time of implementation. Including freight, the Manzini line is 70,387 JD.

A building of about 3,000 square meters would be required on at least a 40-dunum plot of land. More or less land would be required depending on regulations concerning method of waste disposal used. Cost of the land is estimated at 1,575 dinars and cost of the building at 12,000 JD.

Land costs are based on previous estimations made by Sherbini,[1] and the building cost on a conference with representatives of the Shahin Engineering Company. The building would be of concrete block with a poured concrete floor, tiled walls, concrete roof, poured concrete machine pads, electrical wiring, sewage piping and floor drains, and all windows and doors with screens.

Figure 3[2] indicates the utilities required for the Manzini paste line. The plant will utilize 5,240 kg. per hour of steam. Figure 4[2] is a quotation for a package boiler manufactured by Clarke Chapman - John Thomson, Ltd., of London, England. The boiler has a capacity of 9,000 kg. per hour of steam and costs 12,243 British pounds (10.823 JD) delivered to Aqaba, Jordan, including insurance. This provides the steam requirements of the Manzini paste line plus a 70% surplus for expansion, wasted steam, and other uses.

The boiler requires 220-volt, 3-phase, 50-cycle electricity and is suitable for use up to 2,000 feet above sea level at 82+% efficiency. At higher elevations, efficiency would be lowered, but the excess capacity of the present boiler above the 524 kg./hour of steam required by the Manzini line would compensate for added elevation.

(1) Sherbini, A. A. El. An Economic Study of the Establishment of a New Tomato Paste Plant in Jordan. UNSF, AMC, Amman, Jordan. October 1969.

(2) See ANNEX B

The paste line requires 185 cubic meters of water per hour and all the electrical equipment represents about 121 horsepower of energy.

Delivery time for the paste plant is 150 days from receipt of the order and financial documents. Payment must be 20% of the cost with the order and 80% by irrevocable, confirmed liberatory letter of credit to be established at the time the order is placed. The cost of a Manzini engineer will be charged to the purchase of the plant at the following conditions to aid in construction and start-up. The purchaser will provide the following:

1. A prepaid air ticket to and return from Parma, Italy, to Amman, Jordan.
2. All other travel expenses of the engineer to be reimbursed.
3. Free board and lodging.
4. Payment to Manzini of 17.2 JD for each day the engineer is away from Parma.
5. Payment to the engineer of 0.71 JD pocket money for each day he is in Jordan.

TABLE 17

The cost of a Manzini tomato paste plant FOB Italian port

Item:	Lire Thousands	JD's
Preparation Equipment	22,710	13,000
Iron scaffolding, juice extraction	815	466
Metal cabinets for electric motors, prep. I	880	503
Seed separation equipment	3,870	2,214
Juice vat with automatic controls	600	343
Juice pump	430	246
Continuous evaporator	50,400	28,800
Swept surface heat exchanger	6,155	3,530
Canning unit (Closing machine)	13,580	7.590
Sterilizer, cooler, dryer	15,355	8,675
Roller table for manual casing	180	103
Metal cabinet for electric motors II	1.065	609
Tubing	950	543
Totals	116,990	66,851

Note: 1750 lire = 1 Jordanian dinar.

TABLE 18

The cost of the paste plant, the building to house it and the land

Item:	Cost in Jordanian Dinars
Paste plant including freight	70,387
Land	3,150
Building	12,000
Office and lab equipment	2,499
Miscellaneous	1,500
Total	89,536

c. Labor Requirements

Tomato Paste

TABLE 19

Job	Men	Women	Super-visors	Total	Rate Per Day	Cost Per Day
Receiving	1			1	800	800
Dumping	2			2	700	1400
Sorting & trimming		10	1	11	800	9200
Chopping	1			1	920	920
Seed seperation(1)						
Pre-heating	1			1	920	920
Extraction and finishing	1			1	920	920
Evaporator	1		1	2	1200	2400
Heat exchanger	1				920	920
Can filling Can closing	1			1	800	800
Case packing		7		7	800	800
Labeling Case sealing		1		1	700	700
Warehousing		1		1	1200	1200
Totals	11	17	2	29		25780

(1) See seed plant

d. Production Schedule

Tomato Paste First Year

0.184 pounds product/lb. raw wgt. X 2000 No./ton = 368 No. paste per ton raw weight.

368 No. paste/ton raw fruit X 9000 tons = 3,312,000 lbs. paste produced the first year.

3,312,000 No./year/paste ÷ 45 day operatio per year = 73,600 No./day (24 hrs. operation/day).

73,600 No./shift ÷ 24 hrs/shift = 3,067 No./hour/paste production.

3067 No paste/hour ÷ 0.184 No. paste/pound/raw tomatoes = 16,668 No.'s raw produce/hour.

166,668 No./raw prod./hr. ÷ 2000 No./ton = 8.33 tons/hour line capacity.

3067 No. paste/hr. X 454 gms/lb. ÷ 1000 gms/kilo = 1390 kilos/ hour production.

16,668 lbs. raw weight/hr. X 454 gms/lb. ÷ 1000 gms.kilo = 7567 kilos/hour raw tomato input.

1390 kilos paste/hour X 8 hrs/shift X 135 shifts/year = 1,501,200 kilos product/year.

14 cases/ton raw wgt. X 8.33 tons/hr. = 117 cases/hour.

TOMATO PASTE SECOND YEAR

368 No. paste/ton raw tomatoes X 12,000 tons raw fruit = 4,416,000 lbs/paste second year.

4,416,000 No. paste/yr. ÷ 60 operating days = 73,600 No. paste/day fourth year.

73,600 No./paste/day ÷ 24 hours = 3067 No./paste/hr.

3067 No. paste/hr. ÷ 0.184 No. paste/pound raw tomatoes = 16,668 No. raw produce/hour.

4,416,000 No./paste/second year ÷ 2000 No./ton = 2208 tons paste second year.

4,416,000 No. paste X 454 gms/lbs. ÷ 1000 = 2,004,864 kilos paste second year.

TOMATO PASTE THIRD YEAR

368 No. paste/ton raw tomatoes X 15,000 tons tomatoes = 5,520,000 pounds paste third year.

5,520,000 lbs/paste ÷ 75 operating days = 73,600 No. paste/ day third year.

5,520,000 lbs/paste ÷ 2000 lbs/ton = 2760 tons paste third year.

5,520,000 lbs/paste x 454 gms/lb. ÷ 1000 = 2,506,080 kilos paste third year.

TOMATO PASTE FOURTH YEAR

368 No. paste/tons tomatoes x 20,000 tons tomatoes = 7,360,000 pounds/paste fourth year.

7,360,000 No!s/paste ÷ 100 operating/days/yr. = 73,600 No. paste/day fourth year.

7,360,000 No./paste ÷ 2000 = 3680 tons paste fourth year.

7,360,000 No. paste X 454 gms/lb. ÷ 3,341,440 kilos paste/ fourth year.

3. Canned Whole Peeled Tomatoes

a. Process Description

Scalding

Tomatoes for canning are prepared as described for paste through steps 1-3. After having been dry sorted, soaked, and spray washed the tomatoes are scalded for peeling. This may be done by conveying the tomatoes through a commercial peeler which uses hot sodium hydroxide in solution to loosen the peel, by passing the fruit through a steam atmosphere or hot water. Scalding loosens the skin so that it can be easily removed from the tomato by hand or machine. Generally scalding for 30-40 seconds in water at 212^{o}F or flowing steam will be sufficient. Over scalding should be avoided as it will soften the fruit excessively. Immediately after scalding the tomatoes are sprayed with ambient temperature water to loosen the skin and to cool the fruit so it can be handled by the peelers.

Peeling

The tomatoes exit from the scalder onto a conveyor belt which carries the tomatoes past the peelers. The fruit suitable for canning whole is selected, peeled, and placed on trays. Generally the peelers are paid a fixed amount for each tray of peeled tomatoes; so, a record must be kept as to how many trays are filled with peeled tomatoes by each peeler. This can be done by attaching a tag to the

peeler's station and punching a hole through the tag each time a tray of peeled tomatoes is removed from the peeling station and taken to the filler. Usually a very fancy whole tomato pack will be made by hand peeling. If the market is for less than fancy whole quality, a sodium hydroxide peeling machine will do an acceptable job.

Tomatoes not acceptable for peeling continue down the conveyor belt and into a chopper and pulpur where they are converted into liquid packing media to be added to the whole tomato cans.

For most of the round types of tomatoes the cores are removed. However, some of the Italian type tomatoes are peeled and canned without coring.

Filling

The peeled tomatoes may be filled by hand or by machine. Semi-automatic hand pack fillers are satisfactory for packing second quality tomatoes, but fancy whole tomatoes are usually packed by hand. Generally the can should be filled with as many tomatoes as can be put in it without crushing the fruit.

Bulk salt or salt tablets should be added to each can so as to be equal to about 0.5% of the net weight of tomatoes and juice. If bulk salt or tablets are used, the salt should be added into the bottom of the empty cans before the tomatoes are added. If placed on top of the tomatoes after they have been put in the cans, a portion of the

salt may be lost either by being blown off by steam, lost during exhausting, or by being expelled by the head-spacer just before the can is closed.

Small amounts of calcium chloride is often used to firm the tomatoes. Generally calcium not to exceed 0.026% of the net weight of the can contents will result in good but not excessive firming of the whole tomatoes. Tablets are available which contain both the sodium chloride needed for seasoning and the calcium chloride required for firming. In many countries it is necessary to so indicate on the label if calcium chloride is added to tomatoes. Various calcium salts such as calcium sulphate, calcium citrate, and mono-calcium phosphate have been used, but the most commonly used source of calcium for firming is calcium chloride.

It is generally thought that the calcium combines with the pectic substances in the middle lamella of the tomato fruit cells and forms calcium pectinate which is incoluble and which imparts firmness to the tomatoes. Regardless of the precise mechanism an abundance of scientific data and practical experience has shown that the treatment works.

Once the tomatoes and salt have been put in the cans, sufficient hot tomato juice is added to cover the peeled tomatoes. This packing media should be at a minimum of 200°F when placed in the cans. The cans should be washed with 180°F water and inverted in a can twist before they are conveyed to the filling station.

Exhausting

This involves conveying the filled unclosed cans through a steam box operating at 190° to 200°F. Large cans should be exhausted about 10 minutes but small cans need only 5-6 minute exhaust. Exhausting of small cans may be omitted if a steam flow closing machine is used. Exhausting drives out air dissolved in the juice and from the internal regions of the fruit and also heats the tomatoes thoroughly. This practice aids in development of adequate vacuum in the can after it has been closed, processed, and cooled.

Closing

The cans are conveyed directly from the exhaust box to the closing machine where the lid is double seamed on. A jet of steam is forced into the headspace of the can just before the lid is put on. When the entrapped steam condenses and the product cools a vacuum is generated in the can. Exclusion of the air and development of a vacuum of at least 5 inches of mercury will result in longer shelf-life of the product and permit shipment of the cans to areas of higher elevation and lower atmospheric pressure without swells developing.

Processing

This is easily the most important single unit operation in canning whole peeled tomatoes. Even though all other steps are done properly and processing is not adequate the entire pack will spoil.

It is essential that no delay occur between can closing and processing. Tomatoes may be processed in stationary retorts by use of steam, in continuous cookers filled with boiling water or in continuous roll-through type retorts. Only the lower product should be processed in the roll-through retort as it tends to damage the fruit.

Regardless of the method of processing the cans should be brought to a center temperature (CT) of at least 195°F for still retorts and 200°F for agitating cookers if they are water cooled. A temperature of 180°F (CT) for still retorts and 190°F for agitating retorts is satisfactory if the product is to be air cooled. When canned tomatoes are air cooled they retain the heat longer so that some of the bacterial destruction occurs during the cooling period. Generally 45 minutes in water at 212° F will be sufficient to bring a 3-3/16" diameter x 4-4/16" high can of tomatoes to the required center temperature, but this should be used only as a guide and frequent tests should be run to determine the exact time and temperature required to result in a CT of 195°F in the size of can being packed.

Cooling

The cans should be cooled as rapidly as possible after processing to about 100°F. It is important that rough handling of the canned tomatoes be avoided from the time they are processed until they are cooled as they are easily broken while hot.

Adequate cooling prior to casing is essential. Some of the cooling occurs by radiation of heat which is practically stopped by labeling and casing. The continued high temperature under such conditions causes softening, loss of normal color and flavor, and darkening of the product. Cooling must not be carried too far, however. If the cans are cold they will fail to dry and rusting will result. Cooling to about 100°F will permit the can to dry, but will not result in product damage.

Water used in cooling cans of food should be clear potable chlorinated water. Some degree of breathing occurs with all canned foods. When the can comes out of the retort the contents are hot. When the can drops into cool water the steam inside the can condenses, the product cools, and a vacuum is produced inside the can very quickly.

Since the sealing compound in the lid has not had a chance to "set" very minute amounts of cooling water may be drawn into the cans. Unless such cooling water is chlorinated, spoilage microorganisms will be drawn into the cans and spoilage will occur.

Labeling and casing is carried out as described for paste.

b. Labor Requirements

Peeled Tomatoes

TABLE 20

Job	Men	Women	Super-visors	Total	Rate Per Day	Cost Per Day
Receiving[1]					800	800
Dumping	1			1	700	700
Spray washing	1			1	700	700
Scalding	1		1	1	700	1900[3]
Peeling		27	1	28	800	2280 [3]
Chopping[2]		10		10	700	7000
Packing	1			1	920	920
Media filling	1			1	800	800
Can closing	1		1	2	800	2280 [3]
Retorting Cooling	1			1	920	920
Labeling	1			1	700	700
Case packing	1			1	800	800
Case gluing	1			1	700	700
Warehousing (Lift truck op.)	1			1	800	800
Totals	11	37	3	51		6954

(1) Handled by paste tomato receiving man

(2) Handled by paste line labor and supervisor

(3) Supervisors JD 1200/day included in cost per day.

c. Annual Production Schedule

CANNED TOMATOES FIRST YEAR

0.641 pounds canned/lb. fresh weight X 2000 lbs/ton = 1282 lbs. canned per ton fresh weight.

1904 tons raw weight/year X 1282 lbs. canned/ton = 2,400,928 lbs. canned.

2,440,928 lbs. canned/yr. ÷ 1220 tons of canned tomatoes first year.

2,440,928 lbs. canned X 454 gms/lb. ÷ 1000 + 1,108,181 kilos canned first year.

1904 tons raw tomatoes first year ÷ 100 shifts = 19.04 tons/ shift raw weight.

19.04 tons/shift ÷ 8 hrs./shift = 2.38 tons/hour first year.

2.38 tons/hr. X 55 cases product/ton = 131 cases/hour pack.

CANNED TOMATOES FOURTH YEAR

0.641 lbs. canned/lb. raw wgt. X 2000 lbs./ton = 1282 lbs. canned/lb. fresh wgt.

3808 tons/raw wgt./yr. X 1282 lbs. prod/ton = 4,874,164 lbs. product.

4,874,164 lbs/yr. prod. ÷ 2000 = 2437 tons prod./yr. fourth year.

4,874,164 lbs. X 454 gms/lb. ÷ 1000 gms/kilo = 2,212,870 kilos/product fourth year.

3808 lbs. raw wgt. ÷ 200 shifts/yr. = 19.04 tons/shift.

19.04 tons shift ÷ 8 hrs. shift = 2.38 tons/hr. fourth year.

4. Reconstituted Products Line

a. Process Description

The procedure for packing reconstituted drinks and nectars is relatively simple and the machinery inexpensive. The raw materials are purchased either as canned or frozen concentrates. Generally, two stainless stell reconstitution tanks of about 800 to 1,000 US gallons are provided. Concentrate is placed in the tank and water is added to produce the single strength concentration of the product being produced. For example, in the case of peach nectar the concentrate containers are cleaned before opening to avoid contamination of the batch. If the concentrate is in tin cans, they are washed, and if in frozen product packages the outer layer is stripped off before the product is brought to the reconstitution area. Regardless of the solids content of the concentrate, sufficient water is added to result in a finished product with 14 to 15% solids and a pH value between 3.8 and 3.9. It is a good practice to add sufficient ascorbic acid to result in 45 to 50 milligrams of vitamin C per 6 oz. serving.

A typical formula which could be used to initiate development of a formula and packing procedure is as follows:

Peach concentrate, 21 - 23° Brix ....880-885 lbs.
Sugar, sucrose, dry .....695-705 lbs.
Citric acid ..... 8-8-1/2 lbs.

Ascorbic acid (vitamin C)	2-2-1/4 lbs.
Cellulose gum or other stabilizer.	2-1/2-3-1/2 lbs.
Water	To make 700 US gallons.

Single strength juices, sauce, catsup, vegetable juice cocktail, and soup are some of the products reconstituted from tomato concentrates.

Soft drinks, supplementing the traditional tea and coffee, are popular liquids among Moslems and others who abstain from using alcoholic beverages. Pepsi-Cola locally bottled from water, sugar, and flavored syrup, has become a popular drink with such people all over the world. Without local manufacture, the freight costs of water and glass would have made these products so costly and sales volumes so low that they could be enjoyed by only a few.

Food technology has enabled fruits and vegetables, also high in water, to be concentrated in low cost growing areas for reconstitution (water add-back) closer to the consumer. The remanufacturer, can avoid the complexities and difficulties concerned with growing and primary processing and, in a like manner and without special franchise, achieve freight savings and other advantages similar to the system involving Pepsi-Cola. This system allows pear and peach nectar to be manufactured in Panama, pineapple-grapefruit drink in

the northern United States and tomato catsup to be made in Germany, even though their climates do not permit these respective crops to be grown locally.

Jordan and other Arab nations import large quantities of juices, nectars, fruit punches, etc. The capital requirements for reconsitut- a wide variety of such products is low, operations are simple and require minimal management experience. Manufacturing is non-seasonal and can be scheduled to meet demand; consequently storage costs are low.

Once a batch has been mixed in one tank, it can be further processed and canned while a second batch is being formulated in the other 100-gallon tank. It is a good idea to complete the formulation, check viscosity, pH, Brix, and vitamin C content, and make any adjustments required to bring the batch within acceptable cut-out standards. The product is then pumped through a homogenizer to ensure good mixing and to produce a smooth product with good body and texture. The product is then run through a tubular heat exchanger and pasteurized at 230°F for 30 seconds, then flashed back to ambient pressure for deaeration. The netar is filled into plain body tin cans and closed with F enameled lids or equivalent. If the lines are capable of gentle can handling,

80 pound plate with 100/25 tin coating will be satisfactory. The closed cans are held at least 3 minutes and not over 5 to ensure pasteurization of the cans and lids. They are then quickly cooled to 100 - 110°F, labeled, cased, and stored.

Generally, fruit juices, fruit juice drinks, and nectars are packed in small cans, with which it is reasonable to expect a speed of 150 cans per minute for consumer size or 6-ounce can (170 grams) Taking a 0.7 efficiency factor, we have a net of 105 can per minute or 6,300 cans per hour. If the plant runs one 8-hour shift, it will produce 50,400 cans per day or 1,050 cases per day (48 170-gram cans per case). At 100 days of operation per year of reconstituted fruit juices, juice drinks, or nectars, we could pack 105,000 cases per year with a one-shift operation. The pack of any of the products could be expanded by operating a longer single shift each day or by going to two shifts each day if the product is needed and can be marketed. This may be considered a minimum size operation for a reconstitution plant.

b. Labor Requirements[1]

Reconstitution Line

TABLE 21

Job	Men	Women	Super-visors	Total	Rate Per Day	Cost Per Day
Receiving	1			1	800	800
Operation conc. storage			1	1	1200	1200
Formulation	2			2	920	1840[2]
Homogenization Pasturization	1			1	1200	1200
Filling		1		1	800	800
Holding & cooling			1	1	1200	1200
Labeling		1		1	700	700
Casing & case sealing	1			1	700	700
Life truck operator	1			1	800	700
Warehouse men	1			1	1200	1200
Totals	7	2	2	11		10440

(1) Estimated on the basis of the fastest line speed of 135 cans per minute obtained in the third year. These values may be slightly high for the first two years.

(2) Supervisor at JD1200/day included in Cost Per Day.

c. RECONSTITUTED NECTAR FIRST YEAR

857,000 kilos packed X 1000 gms/kilo ÷ 454 gms/lb. = 1,887,665 lbs. product packed first year.

1,887,665 pounds X 16 oz/lb. = 30,202,640 ounces of nectar packed.

30,202,640 ounces nectar packed ÷ 6 oz/can = 5,033,773 cans packed/yr.

5,033,774 cans ÷ 48 cans/case = 104,870 cases first year.

5,033,774 cans/year ÷ 100 shifts = 50,338 cans per shift packed.

50,338 cans/shift ÷ 8 hrs/shift = 6292 cans per hour of operation.

6292 cans/hr. ÷ 60 min/hr. = 105 cans/minute.

RECONSTITUTED NECTAR THIRD YEAR

1,101,600 kilos nectar X 1000 gms/kilo ÷ 454 gms/lb. = 2,426,431 lbs. nectar packed/third year.

2,426,431 lbs. X 16 oz/lb. = 38,822,908 oz. nectar packed third year.

38,822,908 oz. nectar ÷ 6 oz/can = 6,470,485 cans nectar packed third year.

6,470,485 cans ÷ 48 cans/case = 134,802 cases nectar third year.

6,470,485 cans/year ÷ 100 shifts = 64,705 cans per shift.

64,705 cans/shift ÷ 8 hrs/shift = 8088 cans per hour of operation.

8088 cans/minute ÷ 60 min/hr. = 135 cans/minute.

5. Fermented Pickles and Olives Production

a. Process Description

The process for fermented green olives is relatively simple, not requiring unusual capital expenditures.

The green olives are washed thoroughly, placed in tanks, and covered with 0.5 to 2.5% sodium hydroxide (lye) solution. The lye is permitted to penetrate 2/3 of the way from the surface to the pit in about 14 hours of ambient temperature. This results in hydrolysis of the glucosides in the olive and reduces the natural bitterness of the fruit. By stopping the penetration of the lye before reaching all the way to the pit, we retain some of the glucosides which contribute to the typical flavor of the fruit. The lye is then washed off without leaching out all the fermnetable sugars. The fruit is now placed in fermentation tanks in a 2% by weight sodium chloride solution which is gradually increased until a concentration of 8% is reached at the end of the fermentation. This fermentation is carried out at 75° to 80°F. The fermentation proceeds until about 1.5% lactic acid is reached and the brine has a pH of not over 3.8. Fermentable sugars may be added if the fermentation slows or stops before the proper acid level has been attained. Once the fermentation has been completed, the olives can be held in the brine until pitted and stuffed or until they are canned.

b. Labor Requirements

Pickle or Olive Line

TABLE 22

Job	Men	Women	Super-visors	Total	Rate Per Day	Cost Per Day
Receiving	1			1	800	800
Dumping	1		1	2	700	1900
Washing	1			1	700	700
Fermenting	1			1	1200	1200
Freshening and sweetening	1			1	920	920
Packing in jars		10	1	11	800	9200(1)
Brining	1			1	920	920
Pasturization			1	1	1200	1200
Jar Closing		3		3	800	2400
Labeling		4		4	800	3200
Case packing		2		2	700	1400
Case sealing & palletizing	1			1	800	800
Lift truck drive	1			1	800	800
Warehousing	1			1	1200	1200
Totals	9	19	3	31		26640

(1) NB. Supervisor rate - JD 1200 - included in Cost Per Day.

c. Annual Production Schedule

PICKLE LINE

108 tons gross processed/year X 2000 No./ton = 216,000 lbs/season gross.

216,000 lbs/season X .8 recovery = 172,800 lbs. actually going into jars/year.

5/8 X 16 oz. net wgt/pint jar = 10 oz. pickles/pint jar.

10 oz. pickle/jar ÷ 16 oz/lb. = 0.625 lbs. actual pickle per jar.

172,800 No pickle/season ÷ 0.625 3/jar = 276,480 jars processed/year.

276,480 jars/yr. ÷ 800 op. hrs. year = 346 jars/hour line speed.

346 jars/hr. ÷ 60 min/hr. = 5.76 jars per minute line speed.

OLIVES

8 oz. net weight jars

5/8 X 8 oz. net weight = 5 oz. of olives per jar.

6 jars per minute X 60 min. per hour = 360 jars per hour.

360 jars per hour X 8 hours per day = 2880 jars per day.

2880 jars per day X 100 days = 288,000 jars/year.

Note: Pitting and stuffing of the pimiento stuffed olives would be done at the production site. Olives would be received at the processing plant in 500 No. wooden barrels.

Provision has been made for pack of fermented (non-stuffed) olives as follows.

288,000 jars X 5 oz. of olives per jar = 1,440,000 oz.

1,440,000 oz./yr. ÷ 16 = 90,000 pounds of fresh olives needed each year.

90,000 lbs. ÷ 2000 lbs./ton = 45 tons of fresh olives needed per year for 100, 8 hour shifts per year.

6. Processed Dry Products

Like the reconstituted products, packing of products such as beans in tomato cauce, red kidney and lima beans, rice puddings, etc., offer possibilities of rapid start-up with relatively low levels of sophistication involved from the food processing standpoint.

These products have many attributes in common with reconstituted fruit and vegetable products. They are nonseasonal, require relatively small capital investment and complement other products. They require more experience and management skill than reconstituted products reconstituted products but are more simple to process than fresh food crops. Products processed from fried cereals and legumes rank second to reconstituted products in order of feasibility. Other example of these products are creamed rice-raisin dessert, rice with tomato sauce and meat, wheat flour dessert puddings of different flavors, for adults and babies, bottled chocolate flavored drink, spaghetti, dips for bread and snacks, and soups.

The following dry pack items are presently offered for sale in the indicated sizes and prices in Jordan:

Dry Pack Items	Grams net Contents	Retail Price/ Fils
Red kidney beans	400	170
Lentils	400	180
Soups	300	130

The process for packing dry pack limas, beans, lentils, etc., is relatively simple. The dry beans are purchased with substantial savings on incoming freight on the dry product, the cans, shipping case, and labels. Essentially, the process involves beans held and shipped at 9 - 16% moisture content. The dry beans are washed and discolored units are discarde. They are then soaked overnight for about 14 to 20 hours in ambient temperature water. If the product does not take up moisture readily, a blanching at 180°F for 2 to 3 minutes may be necessary to soften the skin and facilitate rehydration. The soaking water should be drained off and replaced every 6 hours to eliminate souring. A blanch of 5 to 10 minutes at 180 to 200°F at the end of the soak has proven useful. As the beans leave the blancher, they are conveyed over a riffle to remove stones and a rubberized belt where imperfect beans and extraneous material are removed. The beans are then filled into the containers by use of a very accurate bean filler. Fill control is one of the most important operations in dry pack canning, as the beans absorb moisture after closing, resulting in overfilled cans if too many beans are added to the cans. The adequacy of the recommended heat process is dependent upon fill control which ensures that the drained weight is not too great. If the containers are overfilled, heat penetration into the center of the mass will be slowed, resulting in less than the required lethal heat at the cold spot in the can,

with resulting danger from spoilage and the possibility of public health hazards.

The canning brine, tomato sauce, etc., should be added at a minimum of 190°F temperature. The cans are then conveyed through an exhaust box in the case of large cans. Small cans may be closed without exhausting, if the product and packing medium has been added to the can at a temperature of 190°F and a steam-flow closing machine is used.

The cans are closed and retorted at the time-temperature combination recommended by a reputable food technologist. As an example, mature, soaked dried legumes in brine for number 401 X 411 cans with an initial temperature of 100 to 140°F require 45 minutes at 240°F, while number 603 X 700 cans require 70 minutes at 240°F to be rendered commercially sterile.[1]

Heat processing is the most important single operation in canning any food, but especially for low acid foods. Can fill, time, temperature, and proper retorting practices must be emphasized. People in charge of these operations must be trained and provided with very clear and concise procedures or the processed food will spoil and may even cause illness and death to the consumer. Recent cases of botulism related to canned soups in the US have pointed up the extreme importance of securing adequate technological help during the implementation stage of this project.

The following discussion will indicate what is considered a minimum sized dry pack line. A slow closing

1. Processes for Low Acid Canned Goods in Metal Containers, Bul. 26-L, 10th Ed. National Canners Association, Wash., D.C. p. 31, September 1966.

machine would be capable of 90 cans per minute. If we apply the reasonable efficiency factor of 0.7, we get a value of 56 cans per minute or 3,360 cans per hour. If we assume an 8-hour shift per day, the pack would be 26,880 cans per day or about 1,200 cases per day. Since this is not a seasonal pack, the number of days' operation per year is limited only by the days the same equipment would be used for seasonal packs or in the reconstitution process. The balance of days operated for dry pack versus reconstituted products would depend mainly on market availability. However, if we assume a potential plant would operate 100 days on tomatoes or other seasonal packs, and we take out 55 Fridays plus some 10 other holidays, we have available about 100 days for the dry pack and 100 days for the reconstitution pack. In 100 days of operation at 1,200 cases per day, the annual pack would be about 120,000 cases. This may be considered a minimum size practical operation for dry packs.

C. Multi-product Operation

1. Operating Schedule

The 8-year proforma operating schedule shown on Table 24 summarises increased rates of production, broadening of product lines, improvements in efficiency and the raw material and labor inputs required to accomplish the projected output.

The projected annual production in turn reflects Jordan's potential penetration of both domestic and export markets.

2. Plant Layout and Equipment Requirements

ANNEX C (back fly leaf of the Report) gives the proposed layout of the plant and a key to equipment identification. The attached warehouse, having the same dimentions are the manufacturing building, is not shown on the drawing.

Table 25 gives a proposed equipment list with job cost in US dollars and Jordan Dinars.

TABLE 24

OPERATING SCHEDULE

(Weights are in Metric Tons
-- Net of Packaging Materials)

	Operating Schedule			Production--Tons			Raw Material Required		
	Shifts	Operating							
FIRST YEAR	Per Day	Days	Shifts/Yr.	Shift	Day	Year	Shift	Day	Year
Tomato Paste	3	45	135	11.1	33.3	1500	66.7	200	9000
Nectar (70% eff)	1	100	100	8.57	8.57	857	1.30	1.30	130
SECOND YEAR									
Tomato Paste	3	60	180	11.1	11.1	2000	66.7	200	12.000
Nectar (70% eff)	1	100	100	8.57	8.57	857	1.30	1.30	130
Canned Tomatoes	1	100	100	12.2	12.2	1220	19	19	1904
THIRD YEAR									
Tomato Paste	3	75	225	11.1	33.3	2500	66.7	200	15.000
Nectar (90% eff)	1	100	100	11.0	11.0	1102	1.65	1.65	165
Fruit Drink (90% eff)	1	100	100	11.0	11.0	1102	.84	.84	84
Canned Tomatoes	2	100	200	12.2	24.4	2441	19	38	3808
FOURTH YEAR									
Tomato Paste	3	100	300	11.1	33.3	3353	66.7	200	20.118
Nectar	1	100	100	11.0	11.0	1102	1.65	1.65	165
Drink	1	100	100	11.0	11.0	1102	.84	.84	84
Canned Tomatoes	2	100	200	12.2	24.4	2441	19	38	3808
Pickles	1	100	100	1.1	1.1	108	1.2	1.2	120

FIFTH, SIXTH YEARS SAME AS FOURTH

SEVENTH YEAR	Per Day	Days	Shifts/Yr.	Shift	Day	Year	Shift	Day	Year
Tomato Paste	3	100	300	11.1	33.3	3353	66.7	200	20.118
Tom. Paste-Line 2	3	45	135	11.1	33.3	1500	66.7	200	9000
Nectar	1	100	100	11.1	11.0	1102	1.65	1.65	165
Fruit Drink	1	100	100	11.0	11.0	1102	.84	.84	84
Canned Tomatoes	2	100	200	12.2	24.4	2441	19	38	3808
Pickles	2	100	200	1.08	2.2	215	1.2	2.4	240
EIGHTH YEAR									
Tomato Paste	3	100	300	11.1	33.3	3353	66.7	200	20.118
Tom. Paste-Line 2	3	45	135	11.1	33.3	1500	66.7	200	9000
Nectar	1	100	100	11.0	11.0	1102	1.65	1.65	165
Fruit Drink	1	100	100	11.0	11.0	1102	.84	.84	84
Canned Tomatoes	2	100	200	12.2	24.4	2441	19	38	3808
Pickles	2	100	200	1.08	2.2	215	1.2	2.4	240
Olives									
Dry Pack. Prod.									

TABLE 25

EQUIPMENT COST

Items common to more than one product.

Item Number	Item Description	JD's & Cost, US.$	
		US $	JD
73	Boiler, 100 horsepower	30,000	10,714
72	Pumps, 4 each, 5 H.P.	3,000	1,071
26	Rotorts, 4 each, 4 crate	2,500	893
28	Cooling canal, 4'x4'x20' ..... (local construction)	1,500	536
--	Lift truck, 2 ton	3,000	1,071
29	Labeling machine, No.303 cans ...	1,500	536
30	Case packer, No.303 cans	1,250	446
31	Case sealer, No.303 cans	3,800	1,357
42	Labeling, machine No.202 cans ...	1,500	536
43	Case packer No.202 cans	1,250	446
44	Case sealer No.202 cans	3,800	1,357
26A	Retort controls	3,000	1,077
76	Office and laboratory equipment..	7,000	2,500
33	Frozen concentrate storage facilities	11,000	3,929
--	Miscellaneous	2,500	893
Sub-total	.....	76,600	27,362

First Year Investment for Specific Items - Tomato Paste Line

Item Number	Item Description	U.S. $ & JD's	
		US $	JD
--	Preperation Line (ITEMS 1-9)	36,336	12,977
1	Receiving platform		
2	Pre-washing dump tank		
3	Washing tank		
4	Sorting and trimming table		
5	Chopper		
7	Pre-heater		
8	Juice extractor		
9	Juice finisher		
--	Iron scaffolding for juice extraction equipment	1,304	486
--	Metal cabinet for electric motors.	1,406	503

Item Number	Item Description	US $	JD
6	Seed seperator	6,192	2,211
10	Surge tank	960	343
11	Evaporator feed pump	688	246
12	Evaporator	80,640	28,800
13	Heat exchanger	9,848	3,517
--	Canning unit	21,728	7,760
14	Can fillers and change parts		
15	Closing machines & change parts ...		
16	Sterilizer - cooler	24,928	8,903
17	Hand case packing table	288	103
--	Motor cabinet	1,704	609
--	Tubing	1,520	543
	Sub-total	167,544	67,001

Reconstitution line - Nectars first year

34	Two 1000 gal. formulation tanks w/ steam coils	2,500	893
36	Homogenizer	3,000	1,071
32	1000 gal. surge tank s/steam coils.	2,100	750
38	Pasteurizer capable of attaining 250°F product temperature with a 0.7 minute holding section.....	2,750	982
39	Surge tank (see steam-jacketed kettles)		
40	Filler for 6 oz. cans (202 x 308) .	4,100	1,464
41	Holding & cooling tunnel w/capacity for holding 3 minutes at filling & closing temperature and then cooling to 100°F	2,950	1,054
	Sub-total	17,400	6,214

Second Year Investment for Specific Items - Add Whole Peeled Tomato Line

Item Number (From Cannery Drawing)	Item Description	US $	JD
18	Dump tank	600	214
19	Spray washer with roller conveyor..	1,750	625
20	Scalder for peeling	1,100	393
21	Peeling belt	1,500	543
22	Chopper	1,000	357

Item Number (From Cannery Drawing)	Item Description	US $	JD
23	Packing table	750	268
24	Packing media filler (juice)...	2,250	804
25	Closing machine	6,750	2,411
	Sub-total	15,700	5,615

Note: Tomatoes not suitable for peeling will be chopped, and pumped to the paste line extractor and finisher, Packing media will be drawn from the paste line surge tank.

Third Year Investment for Specific Items - Add Fruit Drinks, but no Additional Investment is Required.

Fourth Year Investment for Specific Items - Add the Pickle Pack.

Item Number (From Cannery Drawing)	Item Description	US $	JD
46	Dump tank	800	286
47	Washer	1,800	643
49	Fermentation tanks, 5 each	7,500	2,679
50	Freshening tank (desalting)	800	286
51	Sweetening tank	800	286
34	Syrup preperation tank (use reconstitution tanks)	--	
52	Pickle packing table 600		214
53	Syrup filter	2,250	804
54	Exhaust box (Pasteurizer).....	1,000	357
55	Closing table	600	214
	Sub-total 16,150		5,769

- No added equipment investment in fifth, sixth and seventh years.
- Olives will be added in the eight year; will be processed on the pickle line and require no new investment.

Investment Summary

Item	Jordanian Dinars
Equipment common to all products	27,362
Tomato paste line	67,001
Reconstitution line	6,214
Whole peeled tomato line	5,615
Pickle and olive line	5,769
Total JD's	111,961

In the even a decision is made to add dry pack products to the plant the following list of equipment and current prices is offered:

Item Number	Item Description	US Dollars
Dry Pack Line		
61	Dry Cleaner.....	3,000
62	Washer	2,000
64	Four 500-gallon S.S. soak tanks	2,800
65	Blancher	3,900
66	Riffle to remove stones	1,250
67	15-20' sorting table	1,175
68	6 - Bean filler & Briner	1,975
69	Two 300-gallon brine tanks w/ heating coils or jacketed OR, 2 - 100 gallon stainless steel jacketed kettles, 90 No.pressure	1,250 1.175

Item Number	Item Description	JD's
	Dry Pack Line	
70	Exhaust box	975
71	Closing Machine.....	7,500
26	Two stationary 4 tier crate retorts	1,200
	(Does not include controls; only petcock pop-valve, pressure guage, thermometer)	
	Sub-total US. Dollars	28,200
	Sub-total JD's	10,067

D. Can Manufacture

Supplying the present tomato paste plant and later the proposed multi-product operation with cans for packaging their various products poses some problems which relate to the small size of these operations and the many sizes of cans required. Can making equipment is inflexible in the sense that once it is set-up to make a particular size of can several weeks work by skilled mechanics is required to effect a change-over to another size.

A single-line can making operation has a break-even volume of 15 to 20 million cans per year - limited to two or three sizes. Minimum equipment capacity for a viable operation is 25 - to 30 million cans per year. Capital requirement for such a plant is in excess of 100,000 dinars (1)

The current total demand for cans of all sizes in Jordan probably does not exceed 3.5 million. The existing tomato paste plant includes a semi-automated can-making operation which produces cans for internal use and for a number of small industries and farmers in Jordan (who store seeds in them). The principal sizes are kg. 1 kg. and ½ kg. paste cans and large square cans for miscellaneous uses. The large cans are hand soldered. Much of the can making equiment is very old, of obsolete design and in bad state of repair. In spite of these short comings the operation is a reasonably practical one for the present level of paste operation. The general manager estimates that the can making equipment could be up-dated and made efficient for a capital committment of JD 40,000.

The 2,000.000 cans currently being made for packing tomato paste are of undependable quality. The incidence of leakers and seepers is high, judging by store-owners' complaints. can-making labor is not specialized. In times of low production and off-season, can making is used to absorb some of the excess labor.

Cans are made from off size and scrap tin plate purchased from England and France, most of it 120 weight; 60 weight would probably suffice. Lids and bottoms are stamped out

and rubber gaskets hand fitted, followed by machine crimping. Sides often are cut, rolled and seams soldered on separate machines but the soldering is often incomplete and many cans are hand-soldered when inspection reveals solder gaps. At present only 1 kg. cans are used for paste for the army, holding 820 gms. net.

Small 100 gram cans could be made but loss of domestic and export market because of spoilage and low quality paste has eliminated this size pack. These small cans with the small circumference were difficult to crimp-seal because of the heavy weight metal. As a result, the rollers and crimping units and their shafts on the bottom and closing machines are so badly worn that no more adjustment can be made for tightening the crimp. Because of this fact, use of lighter gange metal or even purchase of ready made tops and bottoms with plastic seals could not be crimpled tight enough to prevent spoilage.

The amount of losses from unsalable merchandise attributable to defective cans is not recorded.

Can costs (1970) were provided by the Arab Co., as follows:

Size	Cost, each can
100 grams	11 fils
200	14
500	22
1 kilogram	32
5 kgm.	95

Importing cans from Lebanon is not wholly impractical (if the Syrian border is open) for the early stages of the proposed multiproduct operation. Table 27 shows cost of cans of various sizes imported from Beirut.

The attached schedule (Table 26) shows the cost of cans required for the first eight years of plant operation. The table hypothesizes a product mix for tomato paste, canned whole tomatoes, fruit nectars and drinks. Pickles and olives will be packed wholly in glass.

It is further hypothesized that the plant will purchase cans from Lebanon for the first two years, then start manufacturing 100 grm. and 200 grm. sizes.

The decision when and whether to initiate an integrated can making operation should however be based on an engineering study made after the proposed food processing operation is underway.

TABLE 26

REQUIREMENTS OF PACKAGING MATERIALS

YEAR	1		2		3		4-5-6		7-8	
	Tons	Thousand Cans	Tons	Thousand Cans	Tons	Thousand Cans	Tons	Thousand Cans	Tons	Thousand Cans
TOMATO PASTE TOTAL	1500	2360	2000	4180	2500	6000	3350	8400	4850	10220
5 Kgm.	800	160	900	180	1000	200	1300	260	1950	390
1 Kgm.	300	300	400	400	500	500	700	700	950	950
500 gm.	200	400	300	600	400	800	500	1000	750	1500
200 gm.	100	500	200	1000	300	1500	400	2000	600	3000
100 gm.	100	1000	200	2000	300	3000	450	4500	600	6000
NECTAR AND FRUIT DRINKS 800 gm.	860	4300	860	4300	2200	11000	2200	11000	2200	11000
CANNED WHOLE TOMATOES 500 gm.	0	0	1220	2440	2440	4880	2440	4880	2440	4880

SUMMARY	Thousand Cans	JD Cost	Thousand Cans	JD Cost	Thousand Cans	JD Cost	Thousand Cans	JD Cost	Thousand Cans	JD Cost
5 Kg. @ JD 100	160	16000	180	18000	200	20000	260	26000	390	39000
1 Kg. 32	300	9600	400	12809	500	16000	700	22400	950	30400
500 gm. 22	400	8800	3040	66880	5680	124960	5880	129360	6380	140360
200 gm. 11	4800	52800	5300	58300	12500	137500	13000	143000	14000	154000
100 gm. 8	1000	8000	2000	16000	3000	24000	4500	36000	6000	48000
Total Cost of Cans		95200		171980		322460		356760		411760
SHIPPING CONTAINERS		19800		33660		60000		70000		81560
BOTTLES		-		-		-		3000		6000
FREIGHT IN		2050		3900		1000		2020		2500
		118050		209540		383460		431780		501840

TABLE 27 COST OF IMPORTED CANS

SIZE	EUROPEAN DIMENSION * (MM)	APPROXIMATE U. S. EQUIVALENT	QUANTITY REQUIRED (MILLION)	CASE SIZE	PRINTING	COST FOB BEIRUT L.L.	FILS	USE
820 gr.	99.6 X 117	401 X 411	2.01	24	2 Color	.23	27	TOMATO PASTE
"	"	"	2.4	"	4 Color	.235	28	DRY PRODUCTS
		Total	4.41					
410	73.3 X 105	303 X ?	2.7	48	2 Color	.1865	22	TOMATO FRUIT
170 gr.or 6 oz.	52.6 X 95	202 X 312***	5.0	48	White plus 4 Colors	.098	11	RECON.NECTAR
4100 gr.	155 X 230	603 X 901	0.5	6	NONE	.78	91	DRY PRODUCTS
100 gr.	52.6 X 38	---	3.5	100	2 Color	.0675	8	SMALL PASTE

NOTES:

* The American dimensions are outside; the European dimentions are inside (Lip) on width and outside on height.

** Two can sizes are recommended for processed dry products; the 401 being the same size as for (Tomato Pastes; the 603 being extremely large the quantity of 2.9 Million is spent by volume, on a 5 to one ratio, or 2.4 to 0.5 Million cans. The large can price will not diminish as quantity goes to 1.5 Million.

*** Europe has adapted the American Standard for this can, so they are identical.

Truck rates Beirut to Amman :
35 cu. m. JD 70
30 cu.m. JD 50

SECTION IV

RAW MATERIAL SUPPLY

A. Contract Planting

As shown in SECTION I Jordan has the potential to raise the varieties of tomatoes most suitable for processing and to improve the quality and yield of its tomato crop by mounting an aggressive program involving improved seeds, cultural practices, use of fertilizers, insecticides and other pest control chemicals. The key to success of the proposed tomato paste, juice and whole tomato canning operation is the raw material supply. The raw material supply must be organized on a formal basis so that the processing plant has a reliable source of raw material which is not subject to the vagaries of the market.

The most widely practiced form of raw material supply organization is contract planting. Under this system the processing company contracts with individual farmers to plant specified areas of land in crops which best fit the needs of the processing company. Under the contract the farmer is obliged to sell all, or a specified amount, of his harvest to the company at an agreed upon, predetermined, price. The oompany in turn is obliged to purchase the produce and pay the farmer the agreed upon price.

Most supply contracts cover other broad aspects of the farmer - company relationship. For instance, the company may supply seed, fertilizer and other chemicals, harvest boxes and other supplies to the farmer and may also provide

financing. If the company involvement is sufficiently deep it will provide the services of a "fieldman" who acts as liason between contracting farmer and the company.

The fieldman's duties may include making recommendations and supervising planting, cultivating, use of agriculture chemicals, determining time of harvest, evaluating the quality of the produce, disposing of surplus or unacceptable quality produce, paying the farmer etc. He may or may not negotiate the contract depending on how the company is organized.

The disciplined agriculture engendered by contract planting has many benefits. It is probably the most efficient method of improving agricultural techniques and bringing about improved yields and quality. It tends to stabilize agricultural prices and increase farm income. It releaves the farmer of some of the cost of marketing his crops -- commission etc., It is essential however that the contract be honored by the farmer as well as the company - that the law of the land support the system. Farmers (U.S.) historically, have tended to take an opportunistic attitude toward planting contracts - selling on the market when it is profitable to do so, leaving the company short of supply.

In the case of tomatoes, a contract planting program will be necessary. For other vegetables the need may be less since the volume is less. For the olive processing program contracting will be more complex; will include planting, hand-picking, hand-pitting, hand stuffing and finally hand place-packing in glass jars.

B. Agriculture Supply Program

Vegetables will be supplied to the proposed plant by a combination of supply contracts and open market purchases. Table 28, 29, 30 and 31 following comprise the agriculture schedule.

Table 28 shows yield and cost (price paid to grower at processing plant). A 7% per year yield increase is used for tomatoes and 5% for cucumbers. These rates have been realized under control operations in US and other areas and are obtainable in Jordan. Depending on rate of progress, yield of vegetables in Jordan should become comparable to those in other areas. Grower's price for tomatoes is estimated to net him 25% above current costs of production based on data from Agriculture Ministry. These costs are similar but slightly below those of major producing areas. Cucumber have a short growing season, occupy land only one-third - one half as long as tomatoes and give higher return for labor.

Projected Packing Schedules are shown on Table 29 and 30.

Irrigated upland--(Wadi Duleil) provides a continuous operation and because it enjoys a longer season, can be scheduled for less contract acreage with less need for open market produce to maintain capacity. Upland is the preferred source of produce for this and other reasons. There is also less possibility of down time in the tomato plant because of rainfall.

Estimates of tonnage and dunnums needed with these sources of produce are in Table 31.

TABLE 28 **YIELDS AND COST**

Year	Tomatoes Yield Tons/Dunnum	Tomatoes Cost Per Ton F.O.B. Plant	Cucumbers Yield Tons/Dunnum	Cucumbers Cost Per Ton F.O.B. Plant
1	3.00	12.917 JD	-	-
2	3.21	12.399 JD	-	-
3	3.42	11.944 JD	-	-
4	3.63	11.543 JD	1.30	22.745 JD
5	3.84	11.185 JD	1.37	22.040 JD
6	4.05	10.864 JD	1.43	21.491 JD
7	4.26	10.525 JD	1.50	20.907 JD
8	4.47	10.313 JD	1.56	20.447 JD

Assumptions in estimating yield and F.O.B. cost.

Tomatoes: irrigated land.

A. Yield from selected contract growers estimated at 3.00 tons per dunnum increasing at rate of 7% per year.

B. Production--harvest and delivery cost estimated at 19.000 JD per dunnum plus 4.000 JD per ton. No. inflation assumed.

C. Price estimated at 1.25 times cost.

Equations--

A. $Y = .07x + 3.00$
where: Y = yield in tons per dunnum
X = year number with beginning year as 1.

B. $C = 4.000T + 19.00$
where: C = delivered cost per ton
T = tons per dunnum

C. $P = 1.25C$
where P = delivered price paid to grower

Cucumbers: irrigated land

A. Yield from selected contract growers estimated at 1.30 tons per dunnum increasing at rate of 5% per year.

B. Production--harvest and delivery cost estimated at 16.000 JD per dunnum plus 8.000 JD per ton.

C. Price paid to grower (delivered) estimated at 1.12 cost.

Equations:

A. $Y = .05X + 1.30$
where: Y = yield
X = year number with beginning year as 1.

B. $C = 8.000\ T + 16.000$
where: C = delivered cost per ton
T = tons per dunnum

C. $P = 1.12\ C$
where: P = delivered price paid to growers per ton.

TABLE 29 PACKING SCHEDULE A

Packing Schedule with Upland (Wadi Duleil) Major Produce Source

First Year	From	To
Tomato Paste	Aug. 10	Oct. 15
Nectar (70% off)	Dec. 10	Apr. 15
Second Year		
Tomato Paste	Aug. 10	Nov. 15
Nectar (70% off)	Jan. 1	May 20
Canned Tomatoes	Aug. 10	Dec. 5
Third Year		
Tomato Paste	Aug. 10	Dec. 5
Nectars (90% off)	Jan. 1	May 20
Fruit Drink (90% off)	Jun. 1	Oct.20
Canned Tomatoes	Aug. 10	Dec. 5
Years 4-5-6		
Tomato Paste	Aug. 10	Jan. 20
Nectar	Feb. 1	June 25
Drink	Jul. 1	Nov. 25
Canned Tomatoes	Aug. 10	Dec. 5
Pickles (Receive & Salt)	June 20	Sept. 25
" (Pack)	Feb. 10	June 25
Years 7-8		
Tomato Paste	Aug. 10	Dec. 5
Tomato Paste-Line 2	Sept.5	Nov. 20
Nectars	Jan. 1	May 20
Fruit Drink	June 1	Oct. 20
Canned Tomatoes	Aug. 10	Dec. 5
Pickles (Receive & Salt)	June 20	Sept.25
" (Pack)	Feb. 10	June 25

TABLE 30 PACKING SCHEDULE B

Packing Schedule with N.E. Ghor Major Produce Source

	First Pack		Second Pack		Third Pack		
First Year	From	To	From	To	From	To	
Tomato Paste	Dec.15	Feb.15	May 15	June 10	—	—	
Nectar(70% off)	Mar. 1	Jul.20	—	—	—	—	
Second Year							
Tomato Paste	Dec.15	Feb.15	May 15	June 10	—	—	
Nectar (70% off)	Mar. 1	Jul.20	—	—	—	—	
Canned Tomatoes	Dec.15	Feb.15	May 15	June 15	Sept.1	Oct.5	(1)
Third Year							
Tomato Paste	Dec.15	Feb.15	May 15	June 10	—	—	
Nectar (90% off)	Mar. 1	Jul.20	—	—	—	—	
Fruit Drink (90% off)	Aug. 5	Dec.20	—	—	—	—	
Canned Tomatoes	Dec.15	Feb.15	May 15	June 1	Sept.1	Oct.5	(1)
Year 4-5-6							
Tomato Paste	Dec.15	Feb.15	May 15	June 10	Sept.1	Oct.5	(1)
Nectar	Mar. 1	Jul.20	—	—	—	—	
Drink	Aug. 5	Dec.20	—	—	—	—	
Canned Tomatoes	Dec.15	Feb.15	May 15	June 10	Sept.1	Oct.5	(1)
Pickles (Receive)	Apr.15	Jul. 1	—	—	—	—	
" (Pack)	Mar. 1	Jul.20					
Year 7-8							
Tomato Paste	Dec.15	Feb.15	May 15	June 10	—	—	
Tom.Paste-Line 2	Dec.20	Jan.15	—	—	—	—	
Nectar	Mar. 1	Jul.20	—	—	—	—	
Fruit Drink	Aug. 5	Dec.20	—	—	—	—	
Canned Tomatoes	Dec.15	Feb.15	May 15	June 10	Sept.1	Oct.5	(1)
Pickles (Receive)	Apr.15	Jul. 1	—	—	—	—	
" (Pack)	Mar. 1	Jul.20	—	—	—	—	

(1) Processed with tomatoes purchased from Upland (Wadi Du leil)

TABLE 31 IV RAW TOMATOES FOR PROCESSING

TON AND DUNNUM REQUIREMENT

Tons and Dunnums Needed with Irrigated Upland (Wadi Duleil) Major Produce Source

	Tons Needed Process	Contract	Dunnums Needed Contract
1	9,000	9,900	3,300
2	13,904	15,294	4,765
3	13,306	20,6b7	6,049
4	23,926	26,319	7,250
5	23,926	26,319	6,b54
6	23,926	26,319	b,499
7	32,926	36,219	b,502
b	32,926	36,219	b,103

Tons Needed - With NE Ghor Major Produce Source

	Process	Contract	Buy Ghor	Buy Upland
1	9,000	11,250	900	-
2	13,904	17,3b0	1,390	-
3	1b,b06	19,339	1,934	-
4	23,926	19,33b	1,934	5,120
5	23,926	19,33b	1,934	5,120
6	23,926	19,33b	1,934	5,120
7	32,926	41,157	-	-
b	32,926	41,157	-	-

Dunnums Needed - With NE Ghor Major Source

	Contract	Buy Ghor	Buy Upland	Total
1	3,750	300	-	4,050
2	5,401	433	-	5,b34
3	5,654	565	-	6,219
4	5,327	533	1,410	7,270
5	5,036	504	1,333	6,b73
6	4,775	47b	1,264	6,517
7	9,685	-	-	9,6b5
b	9,207	-	-	9,207

Year	Tons Process	Dunnums Needed
4	120	92
5	120	bb
6	120	b3
7	2b0	160
b	240	154

Assumptions:

A. Irrigated Upland — (Wadi Duleil)

- Effective processing season for irrigated Upland tomatoes estimated at 18 weeks.
- 10% more tonnage contracted ton processed so as to start up and reach full capacity sonner.

B. North East Ghor

- "Effective" processing season, 13 weeks.
- 25% more tonnage contracted than processed so as to start up and reach full capacity sooner. Recommend buying tomatoes from open market in Ghor and irrigated upland to provide for operating nearer capacity and to obtain budget.

SECTION V

FINANCIAL ANALYSIS

A. Financing Plan

Capitalized cost of the porposed enterprise shown in detail on Table 32 is approximately JD 299,000, of which JD 142.000 is foreign exchange cost of equipment, freight and installation charges. These capital requirements will be met by four 5-year term equipment supplier loans bearing 8% annual interest on unpaid balances and guaranteed by an arm of the Jordan government thru a local bank. The loans are activated and the first interest payments and loan repayments are due one year after each line of equipment is installed.

Requirements of local funds, JD 156.700, are supplied by a 10-year, 8% mortgage loan to cover cost of constructing the factory and warehouse, secured by structures and land. Equity financing in the amount of JD 60.000 covers cost of land and some working capital. Short term bank accomodation, JD 25.000, provides the remaining working capital.

After the first year the cash flow is adequate to supply working capital as well as to service and repay debt.

B. Assumptions used in Pro-forma Profit and Loss Statement.

1. Sales.

As shown on Table 34, a combination of domestic and export sales supplies all cash inflows. Domestic

sales are projected at a level which will satisfy total demand. In the early years, export sales represent only a small share of demand in the Arab States for tomato paste and fruit nectar and drinks.

Canned tomatoes will be sold wholly to European markets, pickles and olives to the United States. The Jordan volume will represent only a very small share of the total market demand.

2. Prices

The Projection uses prices for tomato paste starting at the present, controlled level, increasing 10% in the third year and remaining unchanged thereafter. Prices forcanned tomatoes increase 8% in the third year, remain unchanged thereafter.

Reconstituted products prices decline from JD 420 to JD 340 per ton over the eight years projection, reflecting increasing competition which can be expected particularly in the export market.

All prices used are ex-factory, Amman. All transportation, insurance and duty costs will be for the account of the customer.

3. Profitability

Nectar and juice will be the most profitable items of sale particularly in the early years of the operation. Other products will not show a profit until the third year; having incurred losses of 14% and 8% respectively in the first two years.

4. Return on Investment

The discounted cash flow rate of return on the projected investment of JD 299.000 over a 10-year period is 67.8%. This unusually high rate is due principally to reconstituted products. DCFRR on the other products - tomato paste, canned whole peeled tomatoes, pickles and olives - is 15% on an investment of JD 291.000.

5. Breakeven Analysis

Using the formula:

$$\text{BREAKEVEN SALES VOLUME} = \frac{\text{Total Fixed Cost}}{1 - \frac{\text{Variable Cost}}{\text{Total Sales}}}$$

Breakeven sales for alternate years are:

Year	1	3	5	7
Sales	189.541	183.459	191.110	216.246

Table 32

FIXED CAPITAL REQUIREMENTS

	FIXED	PRE START UP EXPENSE	TOTAL
Land	26916		26.916
Site Prep.		5.200	5.200
Factory & Whs.	121.123		121.123
Equipment	111.961		111.961
Freight & Ins.		13.418	
Local Installation		10.900(1)	
Engineering		5.674	29.992
Organization Expense		3.500	3.500
Total	260.000	38.692	298,692
Dinar Cost	148.039	8.700	156.739
Foreign Exchange Cost	111.961	29.992	141.953

(1) Under terms of purchase agreement installation is provided by supplier and paid for in foreign funds.

Table 33

CAPITAL PROGRAM
PLANT AND EQUIPMENT LOANS
8% on UNPAID BALANCES

Amount of Loan Term of Loan Year	121123 10 yrs.	27346 5 yrs.	79803 5 yrs.	5885 5 yrs.	6054 5 yrs.	Ending Outstanding Balance	New Loans	Total Debt Repayment	Service on Debt
-1	0	0	0	0		148469	0	0	0
1	12115	5490	0	0		130864	79803	17605	11093
2	12115	5490	15980	0		177082	5885	33585	16853
3	12115	5490	15980	1177		148205	0	34762	14637
4	12115	5490	15980	1177		113443	6054	34762	11856
5	12115	5386	15980	1177	1211	83628	0	35973	9560
6	12115	0	15883	1177	1211	53242	0	30483	6682
7	12115	0	0	1177	1211	38739	0	14503	4242
8	12115	0	0	0	1211	25413	0	13326	3177
9	12115				1210	12088	0	13326	2111
10	12088	0	0	0	0	0	0	12088	1056

TABLE 34

SALES PROJECTION

(Computed at Ex-Factory Prices)
Jordanian Dinars

		FIRST YEAR		SECOND YEAR		THIRD YEAR		4th, 5th & 6th. YEARS		SEVENTH YEAR		EIGHTH YEAR	
		TONS	JD's	TONS	JD's	TONS	JD's	TONS	JD's	TONS	JD's	TONS	JD's
TOMATO PASTE													
PRODUCT MIX	5 Kg.	800	88000	900	99000	1000	121000	1300	157300	1950	235950	1950	235950
	1 Kg.	300	46500	400	62000	500	85000	700	119000	950	161500	950	161500
	900 g.	200	32000	300	48000	400	70000	500	87500	750	131250	750	131250
	200 g.	100	17700	200	35400	300	58500	400	78000	600	117000	600	117000
	100 g.	100	20000	200	40000	300	66000	450	99000	600	132000	600	132000
DOMESTIC		1500	204200	1545	219699	1590	254718	1590	256574	1790	287037	1790	287037
EXPORT		-	-	455	64701	910	145782	1660	284126	3060	490573	3060	490673
TOTAL		1500	204200	2000	284400	2500	400500	3350	540800	4850	777700	4850	777700
NECTAR & FRUIT DRINKS													
DOMESTIC		100	42000	150	57000	240	91200	240	87600	240	81600	240	81600
EXPORT		757	317550	707	268660	1964	746320	1964	716170	1964	661470	1964	661470
TOTAL		857	359550	857	325660	2204	837520	2204	805770	2204	743070	2204	754070
CANNED TOMATOES													
DOMESTIC		-	-	20	1790	25	3167	25	3167	25	3167	25	3167
EXPORT		-	-	1200	141600	2415	307913	2415	307913	2415	307913	2415	307913
TOTAL		-	-	1220	143390	2440	311080	2440	311080	2440	311080	2440	311080
PICKLES													
DOMESTIC		-	-	-	-	-	-	-	-	-	-	-	-
EXPORT		-	-	-	-	-	-	106	21600	215	43000	215	43000
TOTAL		-	-	-	-	-	-	106	21600	215	43000	215	43000
OLIVES													
DOMESTIC		-	-	-	-	-	-	-	-	-	-	-	-
EXPORT		-	-	-	-	-	-	-	-	-	-	240	48000
TOTAL		-	-	-	-	-	-					240	48000
TOTAL													
DOMESTIC			246200		276469		349085		374441		371794		371794
EXPORT			317550		474961		1200015		1304809		1503056		1562756
TOTAL			563750		753450		1549100		1679250		1874850		1934500

TABLE 35

PRO-FORMA PROFIT AND LOSS STATEMENT
JORDAN DINARS

	FIRST YEAR		SECOND YEAR		THIRD YEAR		Per Year 4th,5th, & 6th YR.	SEVENTH YEAR	EIGHT YEAR
GROSS SALES		563750		753450		1549100	1679250	1874650	1934550
LESS : RETURNS	5%	28188	3%	22606	1%	15491	16793	18750	19346
NET SALES		535562		730846		1533609	1662457	1856100	1915204
DIRECT MANUF. COSTS									
RAW MATERIALS	154733		210676		298070		351284	425421	424045
LABOR COSTS	5655		15797		27989		33769	41449	43396
PACKING MATERIALS AND SUPPLIES	118050		209540		383460		431780	501840	501840
POWER & FUEL	1862		3043		5461		6870	8753	8753
FACTORY OVERHEADS	2827		5529		6997		8442	10362	10849
FACTORY DEPRECIATION	7879		13199		13391		13520	13520	13520
COST OF GOODS SOLD		291026		457984		735368	845665	1001345	1002403
GROSS MARGIN (% of Sales)		244536 45%		272862 37%		798241 52%	818792 49%	854755 46%	912801 45%
INDIRECT EXPENSES									
OFFICE COSTS	19900		23300		23900		23900	28100	28100
COST OF SELLING	118600		156150		322300		350300	396000	405600
INTEREST ON PLANT & EQUIPMENT	11093		16853		14637		11856	4242	3177
EXTENSION COSTS	15400		21000		10000		7000	4250	4250
TOTAL INDIRECT COSTS		165193		219303		370637	403056	432592	441127
TOTAL COST		458219		677287		1106205	1248721	1433937	1443530
NET MARGIN		77343		53559		427404	413736 (1)	422163	471674
% of NET SALES		14%		7%		28%	25%	22%	24%

(1) 4th Year

C. Alternative Assumptions

Following Table 36 shows the effect on profits of certain short-falls in realization of projected sales revenues.

(1) Assume that sales volume and product mix are as shown on Table 33 but that the company fails to realize the projected levels of export prices. Inorder to meet competition it must reduce the price of exported products 10% on average.

(2) Assume that sales volume of reconstituted products fails to reach projected levels - is only half as large as those projected on Table 33.

TABLE 36

EFFECT OF SHORTFALLS IN PROJECTED SALES

Assumption No.1 - D C F R R 47.9% on capital of JD.299.000

Year	1	2	3	4	5	6	7	8
NET PROFIT ON NET SALES - %	9.7	-.1	18.5	15.1	15.1	15.1	12.5	14.5

Assumption No.2 - D C F R R 52.6% on capital of JD.299.000

Year	1	2	3	4	5	6	7	8
NET PROFIT ON NET SALES - %	8.0	4.6	23.2	26.5	19.7	20.0	19.3	21.6

ANNEX A

Sherbini [1]

The tomato paste plant located in Amman and visited by the MINER team was reported by Sherbini to have a capacity of 70 tons of fresh tomatoes and 10 to 12 tons of paste per day. This plant is operated on surplus fresh market tomatoes and in years of plentiful supply operates up to 100 days per year utilizing some 7,000 tons of fresh tomatoes and producing 1,000 to 1,200 tons of paste. Its mean purchase price for fresh tomatoes was estimated at 8.0 JD per ton, and the price of the paste was estimated at 145 JD per ton. In years of low tomato supplies coming to the fresh market, plant production drops by as much as 40%. Sherbini estimated the plant's direct cost at 100 JD per ton and average revenue at 120 JD per ton with a contribution above direct costs of 20 JD per ton. Sherbini concluded that the present plant has not been effective in stabilizing fresh market prices as planned. The amount of fresh fruit purchased has been too small to have much impact and the plant has had a vested interest in low fresh tomato prices.

The average yield of fresh tomatoes for all growing areas estimated at 0.926 to 1.424 tons per dunum. In normal seasons the average yield in rain-fed areas is around 1.0 tons per dunum and for irrigated land it is 3 tons per dunum. Sherbini shows clearly that there is sufficient raw tomato surplus above fresh requirement to support an additional 100 tons per day paste plant for an added 100 days per year.

1. Sherbini, A. A. El. An Economic Feasibility Study of the Establishment of a New Tomato Paste Cannery in Jordan. UNSF, Agricultural Marketing Center, FAO, UN. October 1969.

Research has shown that tomato field yield can be increased. Experimental yields of tomatoes have been as high as 4 tons per dunum on rain-fed land and 9 tons per dunum on irrigated land.

The average cost of production was estimated at 5 fils per kilogram. Marketing costs on the fresh market are 2.5 fils per kilogram for rent of containers and transportation costs plus 7% of the selling price for commission and market fees.

The Amman plant, according to Sherbini, involved an investment of 56,072 JD for processing equipment, 5,770 JD for auxiliary laboratory and office equipment, and 24,000JD for the building and site.

This plant processes 100,000 tons of fresh tomatoes each season (100 days), producing 1,700 tons of 28 to 30% paste which provides 2,073,171 cans of the 1-kilogram size. Break-even price was found to be 106 fils per 1 kilogram can. When the plant reaches full capacity the return was shown to be 6.7% of sales and 19.3% return on the investment.

The Jordanian tomato paste was found to have mold counts of 85 compared to 49 and 50% positive fields for American and Italian pastes. Color was also less red and the paste was higher in black and red specks with 13 black and 22 red specks per gram compared to 3 black and 20 red spots in American paste. The black specks represented burn-on, probably in the evaporators, as this unit had blown out and had been welded. This probably led to burn-on due to the fact that the surface sweep could not contact the full surface to keep it clean.

Mussa Samman [1]

Mussa Samman reported that the demand for tomato paste is inelastic so that an increase in supplies results in more than proportionate decreases in prices and total returns.

Demand for tomato paste was estimated as follows per year:

Army, Jordanian	350 tons
Public institutions (hospitals, hotels, etc.,)	150 "
Household consumption	250 "
Exports, mainly to Iraq	250 "
TOTAL	1,000 tons

Tomatoes were shown to constitute 75% of the total direct cost of tomato paste. Yields per dunum have gone up gradually from 0.5 tons per dunum in 1956 to 1.5 tons per dunum in 1970. The area of land devoted to tomato culture has gone up gradually also. Research has shown a potential yield of good paste varieties which is near the level of other good tomato areas.

Tin cans account for about 15 to 20% of the total direct cost of tomato paste. Establishment of one good efficient can manufacturing plant would greatly reduce can costs as plate could be purchased in larger lots and better quality plate could be used at no greater cost. The present 10 to 20% loss due to spoilage could be eliminated by use of good quality cans.

It was shown that demand for tomato paste should increase at the rate of about 8% per year. Based on the present demand of about 1,000 tons per year, the increased demand should be about 80 tons of paste per year.

Iraq imports about 9,000 tons of paste, Saudi Arabia about 10,000 tons, and Kuwait about 4,000 tons for a total of 23,000 tons annually. If Jordan could get 20% of this market or 4,600 tons

1. Mussa Samman. The Economic Feasibility of Expanding the Tomato Paste Industry in Jordan. Chief Export Development Section, Agricultural Marketing Department, Research Report 21, April 1968, Agricultural Marketing Center, Amman, Jordan.

of paste per year, production would require over 3-1/2 times the present plant capacity to supply the demand.

Samman showed that Jordan can compete on a price basis in these countries. Freight was found to be about 10 to 12 JD per ton, and in and out costs (warehousing) costs 5 to 6 JD per ton.

However, if Jordan is to export paste, the quality must be competitive. This requires good quality raw produce which in turn implies contract farming with the processor specifying varieties to be grown, cultural practices to be followed, and time of harvest.

Furthermore, improved quality requires first and foremost a quality attitude on the part of management, a well-trained quality control manager, quality measuring equipment, can testing equipment, and improved sanitation practices.

Syria is a potent competitor of Jordan and is presently leading in plant capacity. However, seasons are shorter in Syria, and Jordan therein has an advantage.

Mussa Samman proposed a new cannery with a capacity of about 2 tons per hour of fresh tomatoes and 300 kilograms of tomato paste. The plant would process daily about 16 tons of fresh tomatoes yielding 2.50 tons of paste. In a maximum season of 240 days (5 months in winter and 3 months in summer) using two shifts daily, the plant would use 7,700 tons of fresh tomatoes and produce 1,200 tons of paste.

Wadi Yabis was recommended as the location of the new plant, because the Irbid District in which Wadi Yabis is located is second in total tomato production, but first in summer production.

Less than 40 kilometers south is the Balqa District which is first in winter production; so Wadi Yabis has a potential year-round supply of tomatoes. Emerich recommended the Karak District.

Of course, conditions are greatly different in the country now as compared to when Mr. Mussa Samman made his study, so there are considerations other than technical ones.

Godston [1]

This report, done in 1966, has little relevance to the current situation. Godston does, however, make a very good case for a single, modern, efficient can manufacturing facility which would supply the can needs of all the food and non-food can users throughout Jordan. He points out that the food plants in the near future are not likely to be large enough to operate efficient can manufacturing lines individually; however, collectively they could support a good can-making operation.

One of the recommendations made by Godston was establishment of a Fruit and Vegetable Utilization Laboratory -- the personnel of which would work on better utilization of existing fruits and vegetables, improvement of existing crops, and development of new crops for processing.

1. John Godston, Feasibility of Expanding the Fruit and Vegetable Processing Industry, Phase II -- Technical Aspects. FAO Consultant in Fruit and Vegetable Processing. Research Report, December 1966.

FIGURE 1

ANNEX B

TITO MANZINI & FIGLI

MACCHINE ED IMPIANTI PER L'INDUSTRIA
DELLE CONSERVE ALIMENTARI

C.C.I.A.A. - PARMA N 1054
CASELLA POSTALE N 52

TITOMANZINI - PARMA
23156 (5 LINEE)
TELEX: 51438 MANZINIT

Ns Riferim EP/Ls
Vs Riferim

43100 PARMA
VIA TONALE

23th August 1971

QUOTATION N. 203/71

Dear Sirs,

with reference to your kind request, we are pleased to submit you our best quotation for the machines of your interest, at the following general and special conditions of sale:

DELIVERY TIME : ab. 120-150 days from receipt of L/C

PACKING : inclusive & seaworthy

CONSIGNMENT POINT: F.O.B. Italian Port

PAYMENT : 20% with order; 80% by irrevocable, confirmed liberatory Letter of Credit to be established at time of order through BANCA NAZIONALE DEL LAVORO, Parma, available against presentation of shipping documents.

ERECTION : the eventual services of one of our engineer shall be charged to you separately, at the conditions indicated in the present offer.

RESERVES : we reserve ourselves the right to revise prices and conditions of the present offer at time of official order.

MERCURIO D'ORO 1971
OSCAR DEL COMMERCIO EUROPEO

155

FIGURE 2

TITO MANZINI e FIGLI
MACCHINE ED IMPIANTI PER L'INDUSTRIA
DELLE CONSERVE ALIMENTARI

PARMA

THE PRESENT OFFER CONCERNS:

1 COMPLETE AND AUTOMATIC LINE FOR THE PRODUCTION OF TOMATO PASTE.

PROCESSING CAPACITY: ab. 200 ton. of raw tomatoes in 24 hours

OUTPUT: ab. 1.330 Kg/h of "cold break" tomato paste at 30% s.

==========

NOTE: When producing HOT BREAK tomato paste the processing capacity will diminish of ab. 20-25%, depending of the thickness of the product to be obtained.

TITO MANZINI & FIGLI
MACCHINE ED IMPIANTI PER L'INDUSTRIA
DELLE CONSERVE ALIMENTARI

PARMA

Line consisting of:

1) Automatic line for the preparation of tomato juice to be concentrated, Mod.. BR.2/T/S, consisting of:

. 1 Washing and sorting unit, Mod. A.13a/7/BG composed by:
- 1 Pre-washing tank with rotary propeller
- 1 Washing tank
- 1 Sorting table, 7 m. long, with final sloping section

See brochure n. 1300

. 1 Rack chopper, Mod. C.3
Ref.: brochure n. 1284

. 1 Pre-heating unit, Mod. PSR.8
Ref.: Note n. 1 - enclosed.

. 1 Juice extraction and refining unit, Mod. ECO.8, composed by:
- a Pulper, having screen with perforations of Ø 1,1 mm.
- a Refiner, having screen with perforations of Ø 0,7 mm.
- 1 Electric motor.

Ref.: Brochure n. 1297

TOTAL PRICE.....Lit. 22.710.000=

1 Iron SCAFFOLDING for supporting the juice extraction and refining unit, Mod. ECO.8.
Complete with platform, railings and steps.
PRICE.....Lit. 815.000=

1 Metal CABINET for the electric motors of the above line.
Ref.: Brochure n. 1305/
PRICE.....Lit. 880.000=

157

ITO MANZINI & FIGLI
MACCHINE ED IMPIANTI PER L'INDUSTRIA
DELLE CONSERVE ALIMENTARI

PARMA

B) 1 Additional unit for seed separation, consisting of:
- 1 Seed separator, Mod. G.2
  Ref.: Brochure n. 1286
- 1 "mono" PUMP for sending chopped pulps to the pre-heater, with rotary coil.

PRICE.....Lit. 3.870.000=

C) 1 Stainless steel cylindrical VAT, ab. 1.500 lt. capacity, for collecting tomato juice. Complete with diaphragm level.
Ref.: brochure
PRICE.....Lit. 600.000=

D) 1 PUMP for sending tomato juice to the continuous evaporator TITANO SR.7. Complete with electric motor, basement. Made of stainless steel in all the parts in contact with the product.
PRICE.....Lit. 430.000=

E) 1 Continuous evaporator TITANO SR.7,
Note: The water extraction pump is suitable to send the water to the washing unit.
Ref.: Brochure n. 1304
PRICE.....Lit. 50.400.000=

F) 1 Swept surface heat exchanger, ROTOTHERM Mod. SCR.26/16.
Ref.: brochure n. 1299
PRICE.....Lit. 6.155.000=

./.

158

TITO MANZINI & FIGLI
MACCHINE ED IMPIANTI PER L'INDUSTRIA
DELLE CONSERVE ALIMENTARI

PARMA

G) 1 Canning unit, suitable for cans of 100 and 200 gr., consisting of

- 2 Closing machines, Mod. AC.4/52, equipped for 200 gr. cans.

1 Additional change part set for 500 gr. cans

- 2 Seaming machines equipped for 200 gr. cans

1 Additional change part set for 500 gr. cans.

Ref.: Brochure n. 1306/70
Note n. 28 COmm.
TOTAL PRICE.....Lit. 13.580.000=

H) 1 STerilizer-cooler-dryer, Mod. NSRAL.12.20.
Ref.: brochure n. 1311
PRICE.....Lit. 15.355.000=

I) 1 Roller table, 4 m. long, for packing manually cans into cartons.
PRICE.....Lit. 180.000=

L) 1 Metal cabinet for the electric motors of the above machines.
PRICE.....Lit. 1.065.000=

M) Interconnecting tubings, complete with fittings and bends.
TOTAL PRICE.....Lit. 950.000=

TOTAL AMOUNT FOR GOODS DELIVERED F.O.B. ITALIAN PORT.....Lit. 116.990.000=

ITO MANZINI & FIGLI
MACCHINE ED IMPIANTI PER L'INDUSTRIA DELLE CONSERVE ALIMENTARI
PARMA

FIGURE 3

UTILITY REQUIREMENTS

		Steam Kg/h	Water m3/h	Installed power HP
A) 1	Juice preparatory line, Mod. BR.2/T/S.....	1000	15	36,50
B) 1	Seed separation unit			9,50
D) 1	Pump			2,00
E) 1	Continuous evaporator TITANO SR.7..	3800	150 (at 24°C)	30,00
F) 1	Pasteurizing unit ROTOTHERM.....	140		11,50
G) 1	Canning unit.....			12,00
H) 1	Sterilizer-cooler-dryer, NSRAL.12.20	300	10	19,00
		5240	185	120,50

EXCLUSIONS:

You are to provide, for your own account and at your own expenses, for the supply of steam, water and electric power up to the sockets of our machines; also to carry away condensate, water and product; to prepare all masonry works, foundations and so on, and to give the assistance of your workers to our engineer.

160

FIGURE 4

Clarke Chapman-John Thompson Ltd

Thompson Cochran Division
Lilybank Works
London Road Glasgow E1
Telephone 041-554 6311 Telex 77-352

IMD/EB

15th September, 1971.

Dr. G.R. Ammerman,
Drawer T,
Horticulture Department,
Mississippi State University,
State College, Mississippi,
U.S.A. 39762.

Dear Sirs,

re; Boiler Plant for Jordan
Our ref: E256/71.

Further to your recent enquiry passed to us by Libby, McNeill & Libby Ltd., We have much pleasure in offering the following for your consideration:-

One - MULTIPAC Series 'A' Package Boiler, capable of evaporating 20,000 lbs. of steam per hour, F. & A. 212°F., designed for a working pressure of 120 p.s.i.g. and suitable for burning 3,600 seconds oil.

All as per enclosed specification.

Price, F.O.B. Liverpool: £9,236.

Alternatively

Price, F.O. B. London: £9,336.

The foregoing prices have a validity of 60 days. Should you wish to open a Letter of Credit after this period, please contact this office to ascertain that the given prices are still valid.

Delivery: 12/14 weeks from receipt of order, subject to the boiler remaining unsold.

Freight Charges

a) Freight Aqaba, Jordan: £2,785.

Insurance: £122.

Total C.I.F. Aqaba: £12,243.

b)/

161

Dr. G.R. Ammerman.

Freight Charges cont'd.

b) Freight Beirut, Lebanon:	£2,325.
Insurance:	£116
Total C.I.F. Beirut:	£11,677.
Approximate Shipping Specification:	1 case measuring: 12' x 15'3" x 24' Cubic Capacity : 3,816 cu.ft. Gross Weight : 28 tons.
Terms:	Nett cash against shipping documents against an irrevocable Letter of Credit established within the U.K.
Conditions:	See enclosure.

The foregoing boiler is offered F.O.B. U.K. Ports as stated, and includes for a suitable packing case of dimensions as stated in the approximate shipping specification.

We have shown the extra cost for freight charges to the ports of destination as specified in the foregoing, but we point out that this is approximate only and will be renewed at the time of order being placed.

The foregoing boiler will be suitable for working at altitudes up to 2,000ft. above sea level with an electric supply of 220 volts, 3 phase, 50 cycles. If either of these requirements is not suitable, please contact us at your earliest convenience and we will amend our price accordingly.

We trust the foregoing is in line with your requirements and look forward to receiving your valued order which would have our most prompt and careful attention.

Yours faithfully,
for THOMPSON COCHRAN DIVISION.

Chief Estimator.

FIGURE 5

TOMATO CONTRACT

.....19

.....of..... State of.....

hereinafter called Seller, agrees to sell, and hereinafter called Buyer, agrees to buy, for the season of 19 ....., upon the terms and conditions expressed below and on the back hereof, the quantity, quality and variety hereinafter specified, which Seller agrees to plant, grow and harvest, upon the following described lands owned/leased by Seller in the County of ....., State of....., to wit:.....

.....

Except as hereinafter provided, all tomatoes of contract grade and quality grown on the acreage specified herein shall be delivered to Buyer by Seller at..... State of..... and title to said tomatoes shall pass to Buyer at such place. Seller agrees to not pick or permit to be picked any tomatoes until they are ripe.

Acres	Variety	Estimated Tons	Price per Ton U.S. No. 1	Price per Ton U.S. No. 2	Number Plants	Approximate Planting Date
		*				

*See paragraphs numbered 6 and 7.

If prices are not specified herein, Seller shall be notified (by mail to Seller's address shown below) prior to.....19....., of prices Buyer will pay for tomatoes delivered under the provisions of this contract. In such event, Seller shall have ten days after the receipt of said notice to cancel this contract by giving written notice thereof to Buyer. Said notice to be addressed to Buyer at.....

Payment to be made to.....on Friday for all deliveries made the preceding week ending Saturday.

1. If for good reason tomatoes grown hereunder are other than variety or varieties specified herein they shall be of variety or varieties acceptable to Buyer.

2. The tomatoes to be delivered, sold and purchased under this contract shall be U. S. No. 1 and U. S. No. 2 (as printed on the reverse side hereof) and shall at Buyer's option also meet the following additional specifications:
   (a) be whole and not over ripe or mushy,
   (b) be free from worm or worm injury which has penetrated the flesh of the tomato,
   (c) U. S. No. 2's shall be free from anthracnose (which is a disease and contains mold), molds or decay which cannot be removed in the ordinary process of trimming without loss of more than 10 per cent by weight, of the tomatoes.

Tomatoes which do not meet the above additional specifications when same are operative shall be graded culls.

3. Buyer may at its option refuse to receive or pay for any delivery:
   (a) containing less than 40 per cent of U. S. No. 1's by weight, or
   (b) containing more than 10 per cent culls by weight, or
   (c) containing dust or spray residue that cannot be removed in the ordinary process of washing in order to meet the tolerances permitted by the U. S. Food & Drug Administration, or
   (d) wherein tomatoes have been frozen or frosted, or
   (e) wherein tomatoes with worm or worm injury which has penetrated the flesh of the tomato, exceed 3 per cent, by weight, or
   (f) wherein tomatoes with anthracnose or molds and decay which cannot be removed in the ordinary process of washing without hand trimming, exceed 5 per cent, by weight, or
   (g) wherein tomatoes with defects covered by either (e) or (f) exceed 6 per cent by weight.

In the event of such refusal the Seller agrees to sort the delivery at the request of the Buyer, remove the excess percentage of U. S. No. 2's and cull tomatoes, and again submit the lot for grading.

4. It is understood that refusal to accept any load or delivery of tomatoes not complying with the terms and specifications set forth herein does not invalidate the contract. Neither shall acceptance by Buyer of any tomatoes not complying with the terms and specifications herein be construed as a waiver of Buyer's right to refuse subsequent deliveries. Also, it is understood that failure to apply all of the terms and specifications herein to the grading of deliveries hereunder shall not be construed as a waiver of Buyer's right to grade subsequent deliveries in accordance with all of the terms and specifications in this contract.

5. Seller and Buyer shall share the cost of grading and Seller shall be charged 10c per ton for each ton graded.

6. Buyer agrees to accept not to exceed 10% in excess of the estimated tonnage except as hereinafter stated; provided, however, that irrespective of the tonnage grown upon the premises named Buyer shall have the option to take the whole or any part of the excess over 10% of the estimated tonnage at the prices and on the terms set forth in this contract. In the event Seller receives written notice from Buyer that Buyer does not elect to take the whole or a part of the excess over 10% of the estimated tonnage, Seller may dispose of the excess so excluded from this contract as he sees fit. Until Seller shall have received such written notice from Buyer, Seller agrees to continue performance hereunder as though Buyer had exercised said option.

7. If for any reason Seller delivers from a lesser acreage than that specified herein, the estimated tonnage herein shall be reduced to a proportionately lesser tonnage. This paragraph shall not be construed to excuse Seller for his failure to deliver from the acreage contracted for hereunder.

(PROVISIONS CONTINUED ON REVERSE SIDE)

....., Buyer

By.....

.....Seller

By.....

Address.....

.....

Phone.....

Form A-1, 22, 25, 26-54 Comb.

163

8. If tomatoes ripen faster or are of such inferior quality so that they cannot be properly handled or processed, Buyer may limit deliveries to 2½ tons per week from each acre and said tonnage shall be delivered on not less than three different days of the calendar week. During any period of limited or suspended receipts, Seller may dispose of any tomatoes which would become overripe or lost, to others.

9. It is mutually agreed the season shall begin when enough tomatoes have ripened to permit practicable harvesting and processing procedures and Buyer shall have the option to terminate the season on ..... or any date thereafter. During the early and late part of the season Buyer may designate certain days on which [illegible] be received. Buyer shall not be obligated to receive tomatoes on Saturday, Sunday or holidays. Seller agrees to arrange either one or two days previous to the date on which Seller desires to make a delivery, and before tomatoes are picked, a definite time for the delivery of each load which is agreeable to Seller and Buyer.

10. Tomatoes are to be delivered in hampers/crates furnished by Buyer. A rental charge of ..... cents a hamper and ..... cents a crate for the season will be deducted from proceeds of early deliveries. Also, the value of the containers at ..... cents for each hamper and ..... cents for each crate received by Seller will be deducted from proceeds of early deliveries as a deposit and which will be refunded to Seller when the containers are returned in good condition, normal wear and tear excepted, provided they are returned within five days after Seller has completed delivery hereunder. Seller agrees to return all containers in such condition within such time. It is agreed the containers remain the property of Buyer and are not to be used for any purpose other than delivering tomatoes to Buyer.

11. To avoid crushing and deterioration of the tomatoes Seller agrees to fill the containers not more than level full and to stack the filled containers on delivery wagons or trucks in a manner and with the proper type and size of loading racks so the tomatoes will not be crushed and deteriorate in value. Failure to follow the provisions in this paragraph shall be considered a material breach of this contract and in the event of such breach Buyer may at its option promptly terminate the contract.

12. Buyer agrees to furnish plants and/or seed at point of delivery specified herein. Buyer agrees to notify Seller of prices for plants and seed not later than date on which prices for tomatoes hereunder are announced. Such prices shall be not higher than Buyer's approximate cost. Buyer agrees to use care in the selection of the plants and/or seed supplied to Seller but gives no warranty, express or implied, as to description, variety, quality, purity, germination, productiveness or any other matter concerning the plants and/or seed so supplied.

13. This contract is not transferable without the written consent of Buyer. It constitutes the entire agreement between the parties and no verbal statements or agreements shall alter or affect the same.

14. Buyer may terminate this contract at any time during the season at or subsequent to the time that Seller has, prior to fulfillment of all of the provisions on his part herein contained, contracted to sell or has sold or has delivered to any other person or company any tomatoes grown on the acreage herein designated.

15. If performance of this contract or Buyer's business or canning operations are hindered or prevented by act of God, action of the elements, fire, labor disturbances, failure or lack of transportation facilities, shortage of labor, material, containers or supplies, inability to obtain equipment or parts, breakdown of equipment, interruption of power or water, war, invasion, civil commotion, commandeer, enactment of legislation or issuance of governmental orders or regulations or other casualty or cause, whether similar or dissimilar, beyond either party's control, performance by either party hereunder to the extent so hindered or prevented, shall be excused.

16. Provisions on the reverse side hereof are a part of this contract.

U. S. STANDARDS FOR STRAINED TOMATO PRODUCTS

U.S. No. 1 shall consist of tomatoes which are fairly firm, ripe, well colored, and free from stems and from damage caused by badly discolored cracks, shriveling, molds, decay, sunburn, sunscald, freezing or other means.

U.S. No. 2 shall consist of tomatoes which do not meet the requirements of the foregoing grade but which are ripe and fairly well colored and which are free from serious damage from any cause.

Culls are tomatoes which do not meet the requirements of either of the foregoing grades.

DEFINITIONS OF TERMS

As used in these grades:

"Fairly firm" means that the tomato is not water soaked.

"Well colored" means that at least 90 percent of the flesh of the tomato has good red color, provided that a tomato having flesh of a lighter shade of red shall be considered as "well colored" if enough additional area of the flesh has a sufficient amount of red to be equivalent in color to that of a tomato which has 90 percent good red color.

"Fairly well colored" means that at least two-thirds of the flesh of the tomato has good red color, provided that the tomato having flesh of a lighter shade of red shall be considered as "fairly well colored" if enough additional area of the flesh has a shade of red color so that the tomato has a sufficient amount of red to be equivalent in color to that of a tomato which has two-thirds good red color.

"Damage" means any injury which appreciably affects the quality of the tomato for pulping. Any one of the following defects or any combination of defects which exceed the maximum allowed for any one defect shall be considered as damage:

(a) Molds or decay, except that molds or very slight decay which can be removed in the ordinary process of washing without hand trimming shall not be considered as damage.

(b) Sunburn or sunscald which cannot be removed in the ordinary process of trimming without a loss of more than 10 percent, by weight, of the tomato in excess of that which would occur if the tomato were perfect.

(c) Tomatoes which show an appreciable amount of shriveling.

"Serious damage" means any injury which severely affects the quality of the tomato for pulping. Any one of the following defects or any combination of defects which exceeds the maximum allowed for any one defect shall be considered as serious damage:

(a) Decay which has caused the tomato to become sour, or decay or disease, such as Anthracnose spots, Blossom-end Rot, Soil Rot, or any other decay or disease which cannot be removed in the ordinary process of trimming without a loss of more than 20 percent, by weight, of the tomato in excess of that which would occur if the tomato were perfect.

(b) Sunburn or sunscald which cannot be removed in the ordinary process of trimming without a loss of more than 20 percent, by weight of the tomato in excess of that which would occur if the tomato were perfect.

(c) Shriveling when the flesh of the Tomato is tough and rubbery.

164

Best Available Document

FIGURE 6

DAILY COST AND YIELD REPORT
TOMATOES

FORM SP 20.601 1 (4/69)

DATE

PLANT

PRODUCT Tomatoes

REPORT NO.

LABOR DATA	PEELED AND STEWED		JUICE		SAUCE		CATCHUP	
	TODAY	TO DATE	TODAY	TO DATE	TODAY	TO DATE	TODAY	TO DATE
BASIC CASES								
TOTAL DOLLARS								
ACT. COST/CASE								
EST. COST/CASE								
SHIFT HOURS								
SUCROSE LBS.								
DEXTROSE LBS.								
SUCROSE SOLIDS								
SCHEDULED SOLIDS								
% OF SCHEDULE								

					SALT DATA	TODAY	TO DATE
BASIC CASES					ACTUAL POUNDS		
TOTAL DOLLARS					SCHEDULED POUNDS		
ACT. COST/CASE					% OF SCHEDULE		
EST. COST/CASE							
SHIFT HOURS							

LOSSES DESCRIPTION	TODAY		TO DATE		LAST YEAR
	POUNDS	%	POUNDS	%	
TRANSIT SHRINK					
FLOOR SHRINK					
PROD. DUMPED					
REC. WASH					
PREP. WASH					
TRIM					
PEELING					
FLITE ELEVATOR					
PULPER					
FINISHER					
EVAP. SAUCE					
EVAP. CATCHUP					
EVAP. JUICE					
RET.CS. CATCHUP					
FILLER					
FILL VARIANCE					
R SIONE DUMP					
UNACCOUNTED FOR					
TOTAL					

WEIGHTS OPERATED AND RECOVERED	POUNDS	
	TODAY	TO DATE
TOTAL TONS OPERATED		
TONS PAID FOR		
TOTAL WEIGHT RECOVERED		

MISCELLANEOUS DATA	TODAY	TO DATE
% SOLIDS - RAW		
% SOLIDS - PASTE		

BASIS CASES/TON PAID FOR - GRADE YIELDS						LAST YEAR
BS.CS__ /__	TODAY	%	TO DATE	%	EST.	
PEELED						
STEWED						
JUICE						
SAUCE						
CATCHUP						
PASTE						
TOTAL						
% PAID FOR						
% YIELD WT. OPERATOR						
% YIELD WT. PAID FOR						

COMMENTS: YIELD CONTROL

QUALITY AUDIT

INDUSTRIAL ENGINEER

165

ANNEX C

Key to Items of Equipment on Processing Plant Drawing

TOMATO PASTE LINE ITEM IDENTIFICATION

Item Number	Item Description
1.	Receiving platform for paste and peeling tomatoes
2.	Pre-washing tank
3.	Washing tank
4.	Sorting and trimming table
5.	Chopper
6.	Seed seperator
7.	Pre-heater
8.	Extractor
9.	Finisher
10.	Surge tank
11.	Evaporator feed pump
12.	Evaporator
13.	Swept surface heat exchanger
14.	Can filler
15.	Can closing machine
16.	Sterilizer - cooler
17.	Hand case packing table

Peeled tomato and tomato juice line item identification

18.	Dump tank
19.	Spray washer
20.	Scalder
21.	Peeling table
22.	Chopper
23.	Packing table
24.	Packing media filler

25. Can closing machine

26. Retorts

27. Retort platform

28. Cooling canal

29. Labeler (303 diameter cans)

30. Case packer

31. Case sealer

Reconstitution line item identification

32. Receiving

33. Frozen concentrate storage room

34. Formulation tanks (2 each)

35. Platform

36. Homogenizer

37. Surge tank

38. Pasturizer (heat exchanger)

39. Surge tank

40. Filler

41. Holding and cooling tunnel

42. Labeler (202 diameter cans)

43. Caser (202 diameter cans)

44. Case sealer (202 diameter cans)

Pickle and olive line item identification

45. Olive and pickle receiving

46. Olive and pickle dump tank

47. Olive and pickle washer

48. Pickle and olive distribution conveyor to fermentation tanks

49. Pickle fermentation tanks

50. Pickle freshening tank (salt leaching)

51. Pickle sweetening tank

52. Pickle and olive packing table (10 hand packing stations for a 6 jar per minute line

53. Pickle and olive brine (syrup) filler

54. Exhaust box type pasturizer

55. Jar closing table (6 hand closing stations for closing 6 jars per minute)

56. Labeling, hand

47. Case packing, hand

58. Case sealing, hand

59. Olive fermentation tanks

Dry pack line item identification

60. Dry pack receiving

61. Dry cleaner

62. Washer

63. Bean and pea distribution conveyor

64. Soak tanks

65. Blancher

66. Riffle

67. Sorting table

68. Bean filler & briner

69. Brine tanks

70. Exhaust box

71. Closing machine then to retorts

72. Well & pump

73. Boiler

74. Compressors for concentrate storage freezer

75. Generator for standby electricity

168

NEX D

QUALITY CONTROL SAMPLE MANUAL
TOMATO PRODUCTS

General responsibilities of the Quality Control Staff.

The Quality Control Staff will be responsible for the following activities, but will not be limited to them:

1. Preparation and issuance of grading specifications for all products packed by the company. These specifications will be based upon the quality of the product in competition with the company's products. They will be prepared so as to result in products equal to or better than the competitor's products.

2. Preparation and issuance of container specifications. These will be based on manufacturer's recommendations and experimental packs and shelf-life studies.

3. Preparation and issuance of product formulas and packing procedures (see sample packing procedure for tomato paste in this report).

4. Approval of labels to insure that they meet all legal and technical requirements for the area in which the product is to be sold.

5. Provides adequate quality control on all products. Quality evaluation to be based on latest control procedures, equipment, and methods.

6. Investigates all trade and consumer complaints and recommends disposal of the case. Annual summaries of all complaints will be prepared and circulated to responsible staff.

   Continuously audits the quality of the product at the plant level.

   Assists production people by making daily sanitation inspections.

9. Segregates all questionable lots or product and participates in the decision making concerning such products.

10. Inspects all incoming tin plate, cans, boxes, ingredients, and supplies.

11. Conducts annual or more frequent competitive analysis wherein company products are compared to competitor's products in terms of grade, scores, flavor, etc.

12. Conducts product spoilage investigations and recommends corrective action and disposal of the product.

13. Represents the company on national and international committees concerned with quality control.

Specific responsibilities of the Quality Control Staff as regards tomato products:

1. Fill of container. Policy - It is the policy of the company that all containers will be filled so as to comply with generally accepted good practice throughout the world. For foods generally there are three criterions of fill and these are:

    a. net weight and/or volume

    b. head space in the container

    c. drained weight where applicable

    Generally packages will be filled as full as practicable without impairment of the food, the container, or the adequacy of the heat process. This condition will be satisfied if the product and packing medium occupy not less than 90% of the water capacity of the container.

    Each case of merchandise must meet the following:

    1. Average 90% of the specified fill.

    2. Over 50% of the containers in a case must be 90% full or fuller.

    3. Not over 4% of the containers in a case may be less than 88% full.

Net Weight or Net Volume - The average net weight and/or volume of the containers in a case[1] must equal the declared weight or volume on the label. All containers shipped to the United Kingdom, Germany, or the Scandinavian countries must meet or exceed the label weight. It is a good general rule that more than 50% of all containers in a case must meet declared net weight or volume. The National Bureau of Standards of the U.S. indicates the following unreasonable shortages in food packages:

[1]Case as used here means any 24 consecutively packed cans.

Label Quantity avoir. or fluid	Unreasonable shortage
Up to 8 oz.	3/16 or 0.19 oz.
From 8 to 32 oz.	1/4 or 0.25 oz.
From 32 to 64 oz.	5/16 or 0.31 oz.
From 64 to 112 oz.	3/8 or 0.38 oz.

Not over 4 cans in any single case should have shortages as great as the unreasonable shortage for the can size in question.

Drained Weight - At least 50% of all containers in a case or other lot size must meet the recommended drained weight if applicable. The recommended drained weight if not available from governmental or other sources may be stablished by filling several cans full, covering them with packing medium, processing, and determing the drained weight.

The drained weight of the containers which do not meet the recommended weight must be within the range of variability of good commercial practices. The average drained weight of all containers representative of the lot must not fall below the recommended or accepted drained weight. Not over 20% of the individual container in a lot may exceed the unreasonable shortages shown under net weight.

Sampling for Weight Control - At the beginning of a shift, 10 cans from each filling and closing line will be weighed and the gross weights recorded. An average tare weight may be used if the empty cans are found to be uniform in weight. Otherwise the cans must be opened, emptied, and weighed to determine the net weight.

Net weight: total can and contents less the weight of the empty dry can.

For a set of 10 cans one may be below the scheduled net weight, but if two are low, adjustments may be made.

After production has started, 5 cans should be checked every 30 minutes. For a 230 gram containter the weight should not fall below 228 grams, but the maximum the weight may be below schedule is 8 grams. For a 350 gram can the weight should not be below 347 grams, and the maximum a single can may be below scheduled weight is 10 grams. Other container sizes may have shortages in the proportion of these two, but the guiding principle must always be that the product is filled so as to avoid trade or consumer complaints.

When cans are taken from the line for weight determination they should also be checked to be sure the correct container is being used for the product. This inspection is especially important when the cans are checked at the beginning of the shift. Any time it is found that improper packages are being used, the line must be stopped and corrections made.

Tomato Paste Specifications and Quality Control Procedures - If tomato paste is to qualify for distribution in world trade, it should conform to the following definition:

"Tomato paste is the food prepared from one or any combination of two or all of the following optional ingredients":

1. The liquid obtained from mature red or reddish varieties.

2. The liquid obtained from the residue from preparing such tomatoes for canning, consisting of peelings and cores with or without such tomatoes or pieces thereof.

3. The liquid obtained from the residue from partial extraction of juice from such tomatoes.

   Such liquid is obtained by straining such tomatoes or residue with or without heating so as to exclude skins, seeds, and other coarse or hard substances. It is concentrated, and may be seasoned with one or more of the following:

   salt
   spice
   flavorings

   and neutralized by use of baking soda.

   It will contain not less than 25% salt free tomato solids.

   Added color may not be incorporated into the tomato paste.

Representative samples of each batch or unit of production must be checked for mold filaments. For this purpose the microscopic field must be exactly 1.382 mms. in diameter which will give a field of exactly 1.5 square mm. at 90 - 125 magnifications. The depth of the slide is such that the quantity of liquid examined is 0.15 cu. mm. An official Howard Mold Count Slide is available and is calibrated to result in the correct volume of material to be observed. An accessory micrometer disc for mold counting fits into the microscope

eyeplace and is ruled into squares, each side of which is equal to 1/6 of the diameter of the eyepiece diaphram opening. Any good binocular microscope capable of producing a microscopic field of exactly 1.382 mm. in diameter is satisfactory for mold counting.

Tomato paste may be diluted with pure water to 8.37 to 9.37% salt free solids before a count is made. At this dilution, paste should be produced with not over 30% positive fields. A field is considered positive if not more than 3 filaments exceed 1/6 of the diameter of the field. At least 25 fields on two different slides should be counted for each lot of paste. If the number of positive fields does not agree closely, a third should be counted and all the values used to obtain the average. It is good practice to send samples to other qualified mold counters periodically to be sure you are counting accurately. No technician should be permitted to attempt mold counting without thorough training by a skilled mold counter.

Total Solids - Total solids are best measured by drying the product in vacuo at 70°C, by drying at atmospheric pressure at 212°F, by calculation from the specific gravity, or by obtaining the refractive index by use of a refractometer and reading the total solids from prepared tables. Salt free solids are generally 1% less than total solids in tomato paste.

If the refractometer is used and the evaluation is made at any temperature other than 20°C, the refractive index must be corrected to 20°C by use of the proper tables of date.

Color may be evaluated by use of color instruments or by comparing the product with samples of good colored commercial paste.

Tomato Juice - Tomato juice is the unconcentrated liquid expressed from mature tomatoes of the red or reddish varieties with or without scalding followed by draining. It may or may not be homogenized and may be seasoned with salt.

Tomato juice may be scored on the following basis:

flavor	40 points
color	30 "
consistency	15 "
absence of defects	15 "
Total	100 "

Mold counts should be made as described in the discussion of tomato paste except that no dilution is permitted and the tolerance is a maximum 20% positive fields.

Each batch should be checked by taste to insure that salt was added. The quantity of salt found most acceptable is about 4 - 6 pounds per 100 gallons of tomato juice.

Fill of the container should meet the general requirements set forth above. In tomato juice excessive head space will result in impairment of flavor and color; so, the cans should be filled as full as practical. In no case should the head space be over 10/16 of an inch in larger cans and 6/16 of an inch for smaller cans.

Plain tin enameled cans or glass may be used. It is generally agreed that there is a distinct flavor difference for tomato juice packed in plain tin cans as contrasted to enameled cans or glass.

Tomato juice processing equipment should be inspected to insure that the product does not come in contact with copper as this result in Vitamin C destruction.

Adequacy of processing is a normal responsibility of the quality control staff. The method of choice for best color retention is to heat the juice to 250°F in a continuous heat exchanger, hold it at that temperature for from 0.7 to 1.0 minutes, cool it in the heat exchanger to 205°F; fill it into the cans, and close the cans. The cans are then held for at least 3 minutes to pasteurize the inside of the container and lid and is then cooled to 90-110°F. Tomato juice may be heated in the heat exchanger to temperatures other than 250°F and the holding times required to kill spores of Bacillus thermoacidurans are as follows:

Temperature of the tomato juice °F	Holding times in minutes
240	3.3
245	1.5
250	0.7
255	0.32
260	0.15
265	0.07

When the tomato juice processing line starts the quality control people should take the first 24 commercial cans through each closing machine and cool them immediately to 100°F. These cans should be held at from 85 - 110°F and observed daily for swells. Swells should appear in 3 days if significant contamination with heat and acid tolerance organisms has occurred. At the end of 5 days, half of the cans should be opened, tasted and the pH determined to test for flat sour spoilage. At the end of 14 days the remaining cans should be opened and evaluated for spoilage of any type.

Whole Peeled Tomatoes - The U.S. Standards[1] for grades of canned tomatoes state that fancy canned tomatoes are those which have good tomato flavor and color and have a drained weight of not less than 66% of the capacity of the container. The drained tomatoes must consist principally of whole or almost whole tomatoes and be practically free from defects. The U.S. Standards also describe Grade A, Whole, Grade B, Grade C, and Substandard. Details of these grades amy be found in the standards.

Grading is done on the following basis:

Drained weight	20%
Wholeness	20%
Color	30%
Absence of defects . . .	30%
Total	100%

Drained weight is expressed in terms of percent of container capacity as:

Drained weight index = Weight of drained tomatoes ÷ Capacity of the container X 100.

The drained weight of the fruit is determined by emptying the contents of the container on a circular screeen containing 2 meshes per inch made of wire of uniform diameter of 0.054 inches. The product is drained 2 minutes and is weighed. The gross weight of the screen and product after draining 2 minutes, less the weight of the dry screen is the product drained weight. The relationship of grade to drained weight is as follows:

Grade A whole	Minimum drained weight index - 50
Grade A	" " " " - 66
Grade B	" " " " - 58
Grade C	" " " " - 50
Sub-standard	" " " " - less than 50

The factor of wholeness refers to the extent to which the peeled, canned tomatoes are altered from their natural shape and contour. Whole or almost whole in the grade contex means that the contour of the tomato has not been naturally affected by coring, trimming, or other means. The fruits may be cracked or split but not to the extent that there is material loss of seed or placental tissues.

Color, which account for 30% of the grade points, is measured in terms of Munsell color discs. The discs are placed so that 33-1/3% of the area is red (Munsell 5R 2.6/13 glossy

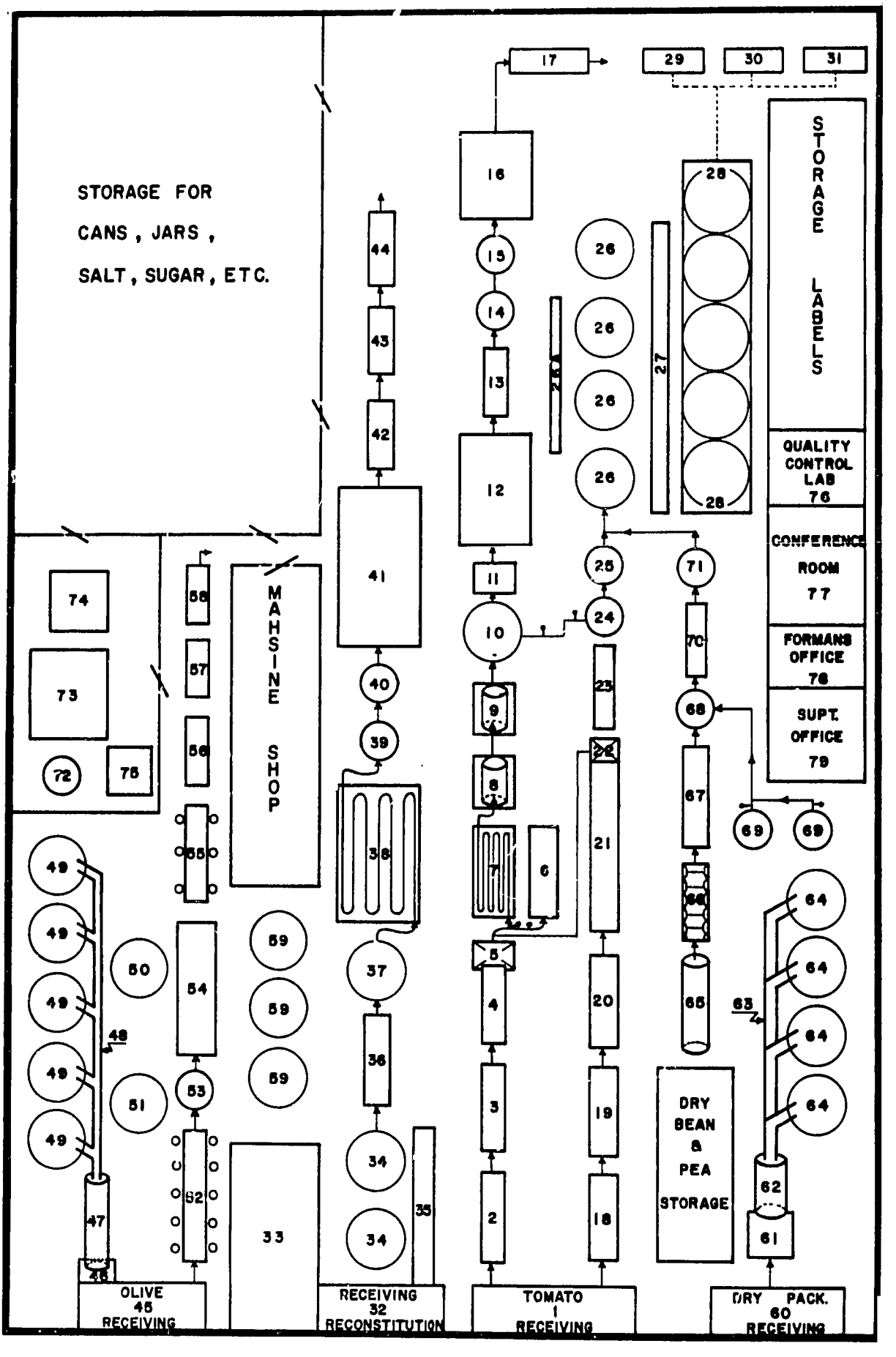
[1]United States Standards For Grades of Canned Tomatoes, Chief, Processed Products Standardization and Inspection Branch, Fruit & Veg. Div. A.M.A., USDA, Wash., D.C. 20250

finish), not over 33-1/3% is yellow (Munsell 2.5 YR 5/12 glossy finish), and the remainder of the disc is made up of black (Munsell N4 matt finish) and grey (Munsell N4 matt finish). When the disc is spun this color represents good red tomato color.

Tomatoes which have 90% of their surface equal to or better than good tomato red, not over 5% of their surface yellow, with no green, may be designated Grade A. Grade B must have at least 50% of the surface equal to or better than good tomato red. Tomatoes which grade B on color may not be designated Grade A regardless of how good they are otherwise. There are similar requirements for Grade C and Grade D.

The fourth factor grade is defects, and it accounts for 30% of the total score points for canned tomatoes. Defects refers to the freedom from objectionable core material, blemished areas, discolored portions, and harmless extraneous material. Tomatoes which are practically free from such defects may be designated Grade A, while those reasonably free from such defects are called Grade B. Details concerning the meaning of the terms "practically free" and "reasonably free" are presented in the U.S. Standards for Grades of Canned Tomatoes.

FRUIT AND VEGETABLE PROCESSING PLANT LAYOUT



17